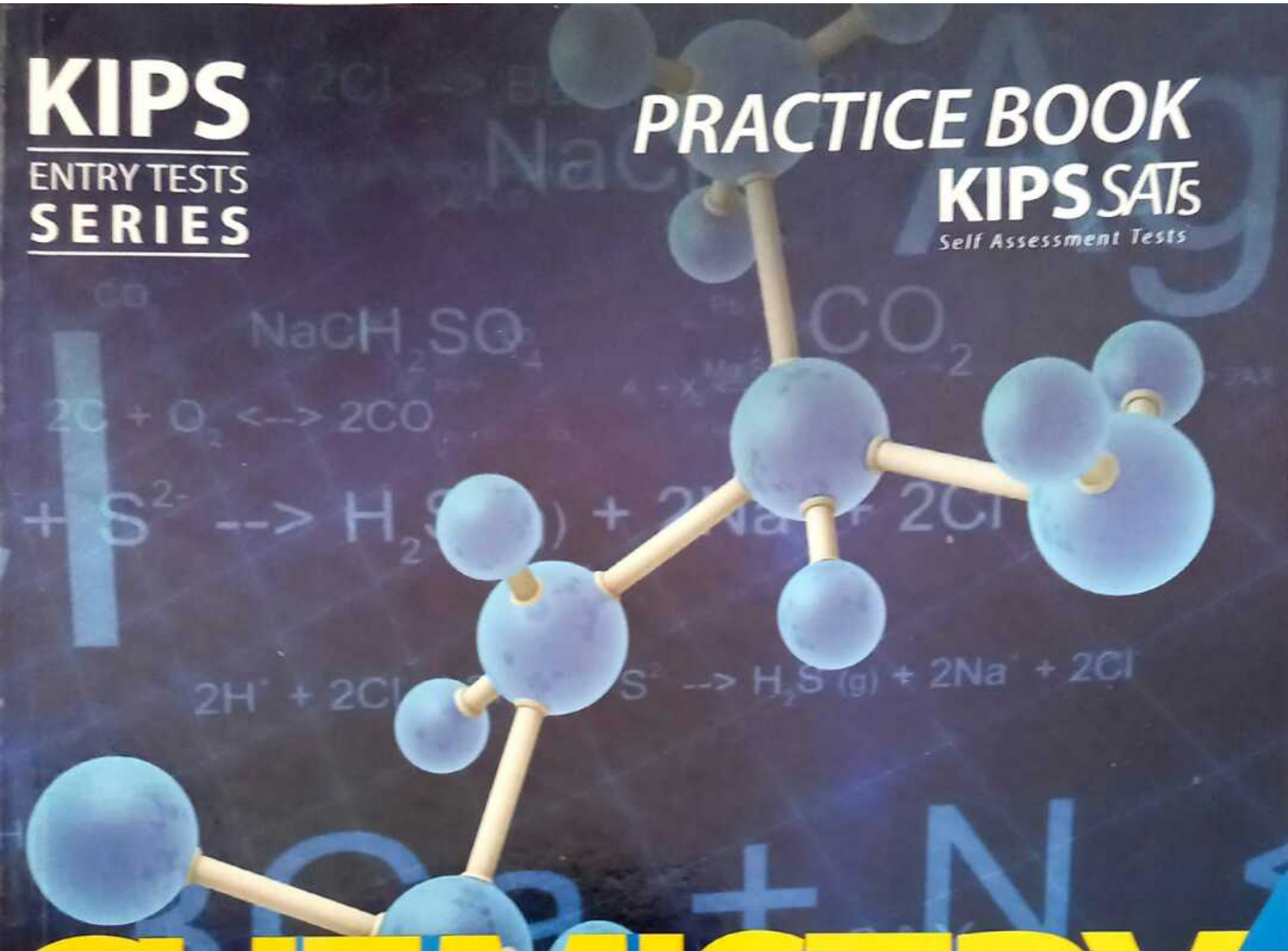
KIPS
ENTRY TESTS
SERIES

PRACTICE BOOK

KIPS SATs

Self Assessment Tests



CHEMISTRY

MDCAT

AS PER UHS SYLLABUS

- 1838 Practice MCQs
- Questions from Past Papers
- Answer Keys with Explanatory Notes
- Topic-wise Practice Exercises
- Unit-wise Self Assessment Tests
- Pre-Assessment Test (Diagnostic Test)
- Post-Assessment Test
  (Sample Paper as per Original Format)

A Kitab Dost Publication

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- **This Pre-Assessment Test is designed to help you to pinpoint the weak areas in your background. Sit aside 1 hour to take this test. Check your answers with those at the end of the test. Then evaluate yourself.**

PRE-ASSESSMENT TEST

Q.1 Which element has highest ionization energy?

A) Li
B) Be
C) B
D) Na

Q.2 The mass of one mole of electrons is

A) 1.008 mg
B) 0.55 mg
C) 0.184 mg
D) 1.637 mg

Q.3 The volume occupied by 1.4g CO at S.T.P is

A) 22.4 dm^3
B) 2.24dm^3
C) 1.12 dm^3
D) 112 cm^3

Q.4 Enthalpy change of which compound cannot be measured directly

A) CO_2
B) NO_2
C) SO_2
D) CO

Q.5 Which of the following set has all species isoelectronic

A) F^-, Cl^-, Br^-
B) Li^{+1}, Na^{+1}, k^{+1}
C) F^-, Ne, Na^+
D) H^+, H^-, H

Q.6 Which element has same isotopes like palladium

A) Nickel
B) Calcium
C) Cadmium
D) Tin

Q.7 What can affect the magnitude of equilibrium constant K_p, of a reversible gaseous reaction?

A) Temperature
B) Pressure
C) Catalyst
D) Concentration

Q.8 Which pair of mixture is called ideal solution

A) Water – ethanol
B) Chlorobenzene and bromobenzene
C) Water – ether
D) HCl and water

Q.9 The preparation of H_2SO_4 by contact process is an example of:

A) Autocatalysis
B) Homogeneous catalysis
C) Heterogeneous catalysis
D) Enzyme catalysis

Q.10 A safe and more reliable method for drying the crystal is through

A) Hot air currents
B) Folds of filter paper
C) Oven
D) Vacuum desiccator

Q.11 A method of separation of components from its solution using Distribution law is

A) Sublimation
B) Crystallisation
C) Solvent extraction
D) Distillation

Q.12 A real gas obeying Van der waal's equation will resemble the ideal gas if

A) Both 'a' and 'b' are small
B) Both 'a' and 'b' are large
C) 'a' is small and 'b' is large
D) 'a' is large and 'b' is small.

Q.13 Equal masses of methane and oxygen are mixed in empty container at 150°C The fraction of total pressure exerted by oxygen is

A) 8/9
B) 16/17
C) 1/3
D) 1/9

Q.14 Plasma is used in

A) Fluorescent bulb
B) Neon signs
C) Lasers
D) All of these

Q.15 The molecules of CO_2 in dry ice form

A) Ionic crystal
B) Covalent crystal
C) Molecular crystal
D) Any type of crystal

Q.16 Which of the following is pseudo solid

A) CaF_2
B) NaCl
C) Glass
D) Diamond

Q.17 Only London dispersion forces are present among the

A) Molecules of water in liquid state
B) Atoms of helium in gaseous state at high temperature
C) Molecules of hydrogen chloride gas
D) Molecules of solid iodine

Q.18 The order of reactivity of halogens with alkane is

A) $I_2 > Br_2 > Cl_2 > F_2$
B) $F_2 > Cl_2 > Br_2 > I_2$
C) $Cl_2 > F_2 > Br_2 > I$
D) $I_2 > F_2 > Cl_2 > Br_2$

Q.19 Quantum number values for 3p orbitals are

A) n=3 l=2
B) n=3 l=0
C) n=3 l=1
D) n=3 l=3

Q.20 When fast neutron strike the nucleus of nitrogen the particles ejected are

A) α - particles
B) β - particles
C) γ - rays
D) X – rays

Q.21 Which specie has unpaired electrons in antibonding molecular orbitals

A) O_2^{+2}
B) N_2^{-2}
C) B_2
D) O_2^{-2}

Q.22 Atomic radius can be determined by

A) X – ray diffraction
C) Optical microscope
B) Spcetrophotometer
D) Electron microscope

Q.23 For a given process the heat changes at constant pressure (q_p) and at constant volume (q_v) are related to each other as

A) $q_p = q_v$
C) $q_p > q_v$
B) $q_p < q_v$
D) $q_p = q_v/2$

Q.24 For which system does the equilibrium constant Kc has unit of $(concentration)^{-1}$

A) $N_2+3H_2 \rightleftharpoons 2NH_3$
C) $2NO_2 \rightleftharpoons N_2O_4$
B) $H_2+I_2 \rightleftharpoons 2HI$
D) $2HF \rightleftharpoons H_2+F_2$

Q.25 Solubility product of AgCl is 2.0×10^{-10} mol^2 dm^{-6}. Maximum concentration of Ag^{+1} ions in the solution is

A) 2.0×10^{-10} mol dm^{-3}
C) 1.0×10^{-10} mol dm^{-3}
B) 1.414×10^{-5} mol dm^{-3}
D) 1.0×10^{-20} mol dm^{-3}

Q.26 18g glucose is dissolved in 90g of water. The relative lowering in vapour pressure is equal to

A) $\frac{1}{5}$
C) 6
B) 5.1
D) $\frac{1}{51}$

Q.27 Which one of the following is more dilute solution

A) 5.85 % NaCl Solution
C) 6.0 % urea solution
B) 18.0 % glucose solution
D) 24.2% sucrose solution

Q.28 Stronger is the oxidizing agent, greater is the

A) Oxidation potential
C) E.M.F of cell
B) Reduction potential
D) redox potential

Q.29 Which of the following can be used in laptops?

A) Silver oxide battery
C) Nickel cadmium cell
B) Fuel cell
D) Lead accumulator

Q.30 Which is true about Zn-Cu galvanic cell?

A) Reduction occurs at anode
B) K^+ ion transfer from salt bridge to left beaker of $ZnSO_4$
C) Oxidation occurs at cathode
D) Anode is negatively charged

Q.31 Which is the unit of (K) rate constant for zero order reaction

A) s^{-1}
B) mol dm^{-3} s^{-1}
C) mol^{-1} dm^3 s^{-1}
D) mol^{-2} dm^6 s^{-1}

Q.32 Nitrates of which pair gives different products on thermal decomposition

A) Na, K
B) Mg, Ca
C) Li, Na
D) Li, Ca

Q.33 The number of grams of NaOH are present in 500 cm^3 of 0.1M NaOH

A) 40
B) 20
C) 2
D) 4

Q.34 Keeping in view the size of atom, which is in correct order

A) Mg > Sr
B) Ba > Mg
C) Lu > Ce
D) Cl > I

Q.35 Which one does not give borax bead test

A) Copper sulphate
B) Barium sulphate
C) Cobalt sulphate
D) Nickel sulphate

Q.36 Which one is not the use of silicones

A) Lubricant
B) Water repellent film
C) Rubber sheet
D) Medicine

Q.37 The most reactive allotropic form of phosphorus is

A) White
B) Red
C) Black
D) Violet

Q.38 Chemical composition of cinnabar is

A) FeS_2
B) HgS
C) PbS
D) ZnS

Q.39 Which molecule has the highest bond energy among the halogens

A) Fluorine
B) Chlorine
C) Iodine
D) Bromine

Q.40 When chlorine is passed through hot solution of caustic soda the reaction is said as

A) Displacement reaction
B) Reduction reaction
C) Disproportionation reaction
D) Double displacement reaction

Q.41 The most paramagnetic element is

A) Iron
B) Cobalt
C) Chromium
D) Manganese

Q.42 In the complex $[Cr(OH)_3(H_2O)_3]$, the coordination number is

A) 2
B) 3
C) 4
D) 6

Q.43 After digestion protein changes to:

A) Glycerol
B) Fatty acids
C) Glucose
D) Amino acids

Q.44 A great variety of the organic compounds is due to its property of carbon

A) Show tetravalency
B) Exhibit catenation
C) Show isomerism
D) Can form multiple bonds

Q.45 In 1- pentene -4- yne the carbon number 1,2,3 exhibit hybridization, respectively

A) $sp^3 - sp^2 - sp$
B) $sp^3 - sp - sp^2$
C) $sp^2 - sp - sp^3$
D) $sp^2 - sp^2 - sp^3$

Q.46 Vinyl acetylene combines with hydrochloric acid produces

A) Divinyl acetylene
B) Ethylidine dichloride
C) Chloroprene
D) 1,3,3-trichloro butane

Q.47 When benzene is heated in air with V_2O_5 at 450°C yields

A) Phenol
B) Maleic anhydride
C) Glyoxal
D) Benzoic acid

Q.48 When toluene reacts with chlorine in sunlight, the first major product is

A) Benzyl chloride
B) Benzal dichloride
C) O-chlorotoluene
D) O-chlorotoluene and P-chlorotoluene

Q.49 Which one of the following will be sulphonated readily

A) Chlorobenzene
B) Toluene
C) Nitrobenzene
D) Benzene

Q.50 Which one of the following is not a good leaving group

A) HSO_4^-
B) Cl^-
C) OH^-
D) Br^-

Q.51 When CO_2 is made to react with ethyl magnesium iodide in dry ether followed by acid hydrolysis yields

A) Propane
B) Propanal
C) Propanoic acid
D) Propanol

Q.52 The process of fermentation involves all the enzymes except

A) Diastase
B) Invertase
C) Zymase
D) Sucrase

Q.53 Ethyl chloride on reduction in the presence of Zn/HCl produces

A) n-butane
B) Ethanol
C) Ethane
D) Diethyl ether

Q.54 Which one does not exhibit aldol condensation

A) Ethanal
B) Acetone
C) Benzaldehyde
D) Butanone

Q.55 For industrial preparation of CH_3CHO catalytic promoter is

A) $PdCl_2$
B) Cu_2Cl_2
C) $CuCl_2$
D) $PbCl_2$

Q.56 The common name of propane -1,3-dioic acid is

A) Oxalic acid
B) Succinic acid
C) Malonic acid
D) Fumaric acid

Q.57 Which of the following is not a fatty acid

A) Propanoic acid
B) Acetic acid
C) Phthalic acid
D) Butanoic acid

Q.58 Industrial materials, thermal power stations are coated with

A) Polyester resins
B) Epoxy paints
C) polyamide resins
D) Polyvinyl chloride

Q.59 Which one of the following fertilizers provides the nitrogen and phosphorus to the plant

A) Urea
B) Calcium superphosphate
C) Diammonium phosphate
D) Potassium nitrate

Q.60 Chlorination of water may be harmful if the water contains

A) Ammonia
B) Dissolved oxygen
C) Carbon dioxide
D) All of these

ANSWER KEY

1	B	11	C	21	B	31	B	41	C	51	C
2	B	12	A	22	A	32	C	42	D	52	D
3	C	13	C	23	C	33	C	43	D	53	C
4	D	14	D	24	C	34	B	44	B	54	C
5	C	15	C	25	B	35	B	45	D	55	C
6	B	16	C	26	D	36	D	46	C	56	C
7	A	17	D	27	A	37	A	47	B	57	C
8	B	18	B	28	B	38	B	48	A	58	B
9	C	19	C	29	C	39	B	49	B	59	C
10	D	20	A	30	D	40	C	50	C	60	A

PRACTICE EXERCISE
CHEMISTRY

1A Topic FUNDAMENTAL CONCEPTS

PRACTICE EXERCISE

RELATIVE MASSES & ISOTOPES

Q.1 Haemoglobin molecule is how many times heavier than helium atom

A) 68000 times
B) 17000 times
C) 34000 times
D) 1700 times

Q.2 Which is a molecular ion

A) NH_4^+
B) H_3O^+
C) NH_3^+
D) SO_4^{-2}

Q.3 Which one is mono isotopic element

A) Chlorine
B) Hydrogen
C) Fluorine
D) Cadmium

Q.4 How many isotopes are present in palladium

A) Two
B) Six
C) Four
D) Nine

Q.5 Atoms having same mass number but different atomic numbers are called

A) Isotopes
B) Isobars
C) Isotones
D) Isomers

Q.6 How many unstable radioactive isotopes have been produced through artificial disintegration

A) 280
B) 40
C) 300
D) 154

Q.7 In a mass spectrometer, increasing the electric field with constant magnetic field results in

A) Increased radius 'r'
B) Increased ionization
C) Decreased radius 'r'
D) None of the above

Q.8 Molecular ions are produced in mass spectrometer. Which type of molecular ions formed more abundantly

A) Negatively charged
B) Positively charged
C) H^+ ions
D) equal positive and negative ions

Q.9 The separation of different isotopes in the mass spectrometer is done on the basis of:

A) Different amounts of positive charge on each ion

B) Different $\frac{m}{e}$ values

C) Different $\frac{e}{m}$ values

D) Velocities of the ions

Q.10 Which of the following isotopes will have maximum deflection in magnetic field during mass spectrometric analysis

A) C-12
B) C-14
C) C-13
D) Same deflection

Q.11 An element has two isotopes A–63 and A–64 with average atomic mass 63.5 amu. Relative abundance of lighter isotope is

A) 50%
B) 25%
C) 40%
D) 75%

MOLE AND AVOGADRO'S NUMBERS

Q.12 **Number of H^+ ions when 0.1 mole of sulfuric acid is completely ionized in water:**

A) $4 \times 6.022 \times 10^{23}$
B) $1 \times 6.022 \times 10^{23}$
C) $2 \times 6.022 \times 10^{23}$
D) $2 \times 6.022 \times 10^{22}$

Q.13 **How many electrons have to be removed to ionize 1.0×10^{-6} moles of Ne atoms to Ne^+ ions in a neon advertising tube**

A) $\frac{6.02\times10^{23}}{1.0\times10^{-6}}$
B) $\frac{1.0\times10^{-6}\times6.02\times10^{23}}{20.2}$
C) $1.0 \times 10^{-6} \times 6.02 \times 10^{23}$
D) $\frac{1.0\times10^{-6}\times6.02\times10^{23}}{9.65\times10^{-1}}$

Q.14 **When 0.5 moles of $Al_2(SO_4)_3$ are dissolved in water, total number of particles produced**

A) 1.2×10^{23}
B) 3.0×10^{23}
C) 1.5×10^{24}
D) 2.5×10^{23}

Q.15 **Which of the following contains 1 mole of the stated particles**

A) Chlorine molecules in 35.5 g of chlorine gas
B) Electrons in 1g of hydrogen gas
C) Hydrogen ions in $1dm^3$ of $1mol\ dm^{-3}$ aqueous sulphuric acid
D) Oxygen atoms in 22.4 dm^3 of oxygen gas at STP

Q.16 **The number of moles of CO_2 which contain 16g of oxygen**

A) 0.25
B) 1.00
C) 0.50
D) 1.50

Q.17 **The mass of one molecule of O_2 is**

A) $\frac{6.02\times10^{23}}{32}$
B) 32g
C) 0.32g
D) $\frac{32}{6.02\times10^{23}}$

Q.18 **Amount of oxygen in grams which contains 1.5×10^{22} molecules**

A) 0.08
B) 0.80
C) 80
D) 1280

Q.19 **Number of electrons in half mole of Na^+**

A) 10
B) $5.5N_A$
C) 5
D) $5N_A$

Q.20 **3×10^{-21} moles of an amino acid having molecular mass 200 g mol^{-1}, would have molecules**

A) 200
B) 1800
C) 300
D) 36000

Q.21 **The relative atomic mass of oxygen is 16amu. What is the mass of 2 mole of oxygen gas?**

A) 64g
B) 32g
C) 100g
D) 71g

Q.22 **Which of the following has maximum mass**

A) 25g of iodine
B) 25g atom of oxygen
C) 25g mole of water
D) 25g of nitrogen gas

Q.23 **Mass of one mole of chlorine gas is**

A) 32g
B) 71g
C) 35.5g
D) 46g

Q.24 Which of the following is not true for a mole?
A) It is counting unit
B) It is the gram atomic or gram formula mass of a substance
C) It contains 6.023×10^{23} particles
D) It contains different number of particles for different substances

EMPIRICAL AND MOLECULAR FORMULAE

Q.25 During combustion analysis, which one is used for absorbing carbon dioxide
A) 50 % KOH solution
B) $Mg(ClO_4)_2$
C) 5% KOH
D) Silica gel

Q.26 Absorption of CO_2 in KOH solution during combustion analysis is
A) Chemical change
B) Neither chemical nor physical change
C) Physical change
D) CO_2 absorbed in $Mg(ClO_4)_2$

Q.27 Which of the following compounds has highest percentage of oxygen by weight
A) CH_3OH
B) C_2H_5OH
C) HCOOH
D) H_2O

Q.28 Which of the following compound have empirical formula, but no molecular formula
A) H_2O
B) H_2O_2
C) C_6H_6
D) NaCl

Q.29 The sole products of combustion analysis are
A) CO_2 and NH_3
B) CO_2 and KOH
C) H_2O and $Mg(ClO_4)_2$
D) CO_2 and H_2O

Q.30 An acid with molecular mass 104 contain 34.6%C, 3.85% H and rest is O. The molecular formula of acid is
A) $C_3H_4O_4$
B) C_2H_2O
C) $C_2H_2O_4$
D) C_2HO_2

STOICHIOMETRIC CALCULATIONS

Q.31 $6Na + Fe_2O_3 \longrightarrow 3Na_2O + 2Fe$

For above reaction, if you are provided with 230g Na and 320g Fe_2O_3, then limiting reactant is
A) Na
B) Fe_2O_3
C) Na_2O
D) None of these

Q.32 Mg reacts with HCl as per the following reaction
$Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$
Given that; Mg = 21g and HCl=21g, the excess reactant is;
A) Mg
B) Both are in stoichiometric amounts
C) HCl
D) None of these

Q.33 Number of moles present in 0.6 gram of silica is (Atomic mass Si = 28, O = 16)
A) 0.01 mole
B) 0.064 mole
C) 0.044 mole
D) 0.054 mole

Q.34 What volume of oxygen is required for complete combustion of $5cm^3$ C_2H_2
A) $2cm^3$
B) $12.5cm^3$
C) $5cm^3$
D) $13.5cm^3$

Q.35 Volume occupied by 4.4g of CO_2 at STP is
A) $2.24dm^3$
B) $112cm^3$
C) $22.4dm^3$
D) $1.12\ dm^3$

Q.36 **11.207dm³ of methane at STP has _____ moles of hydrogen atoms**

A) 4 C) 2

B) 8 D) 16

Q.37 **How much Al is required to form alumina with 12g of oxygen**

A) 27g C) 13.5g

C) 54g D) 24g

Q.38 **The actual yield is always less than the theoretical yield due to**

A) Side reaction C) Reversible nature

B) mechanical loss D) All of these

Q.39 **Indicate the incorrect statement from the following**

A) A limiting reactant is consumed at the end of reaction

B) Actual yield is always greater than theoretical yield

C) Stochiometric calculation can be only done if no side reaction happens

D) The empirical formula and molecular formula of some of compounds are same

Q.40 **Which one is the molar volume of the gas at STP?**

A) $24dm^3$ C) $80dm^3$

B) $22.4dm^3$ D) $40dm^3$

Q.41 **The calculation of the efficiency of a chemical reaction can be checked by knowing the amount of**

A) The limiting reactant C) The access reagent

B) The product formed D) The substance left unused

Q.42 **When one mole of each of the following is completely burnt in oxygen, which will give the largest mass of CO_2**

A) CO C) Ethane

B) Diamond D) Methane

CONCENTRATION UNITS OF SOLUTIONS

Q.43 **When liquid solute is dissolved in liquid solvent, then the best unit of concentration is**

A) $\%\ ^{w}/_{w}$ C) $\%\ ^{v}/_{v}$

B) $\%\ ^{w}/_{v}$ D) $\%\ ^{v}/_{w}$

Q.44 **The molarity of 2% w/v NaOH solution is**

A) 2M C) 0.25M

B) 0.05M D) 0.5M

Q.45 **What is the molarity of a solution when 45g of glucose is present in $500cm^3$ of solution**

A) 5M C) 0.5M

B) 2.5M D) 4M

Q.46 **Which of the following concentration unit will change with temperature**

A) Molality C) Mole fraction

B) %w/v D) %w/w

Q.47 **In a mixture of 7g nitrogen and 8g oxygen, mole fraction of nitrogen is**

A) 0.3 C) 0.1

B) 0.25 D) 0.50

Q.48 **The mass of glucose required to prepare $1dm^3$ of 20% glucose solution is**

A) 18g C) 36g

B) 180g D) 200g

Q.49 Molarity of pure water is

A) 1M
B) 18M
C) 55.5M
D) 6M

Q.50 Solution contains 1 mole of alcohol and 4 moles of H_2O. The mole fraction of H_2O and alcohol will be

A) 4/5 and 4/1
B) 4/1 and 1/4
C) 1/5 and 4/5
D) 4/5 and 1/5

PAST PAPER QUESTIONS

Q.1 The relative abundance of the isotopes of elements can be determined by

A) X-rays
B) Mass spectrometry
C) Solvent extraction
D) Chromatography

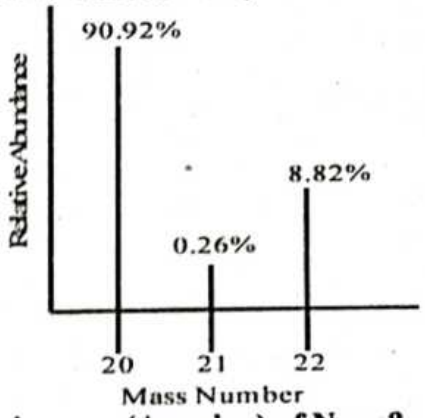
Q.2 If we know the mass of one substance, we can calculate the volume of other substance and vice versa with the help of chemical equation is called

A) Mass-mass relationship
B) Mass-mole relationship
C) Mass-volume relationship
D) Mole-volume relationship

Q.3 In the mass spectrometer ; detector or collector measures the

A) Masses of isotopes
B) Relative abundances of isotopes
C) Percentages of isotopes
D) Mass numbers of isotopes

Q.4 A sample of Neon is found to exist as ^{20}Ne, ^{21}Ne. Mass spectrum of 'Ne' is as follows



What is the relative atomic mass (A_r value) of Neon?

A) 20.18
B) 20.28
C) 20.10
D) 20.22

Q.5 With the help of spectral data given calculate the mass of Neon and encircle the best option. (Percentage of $^{20}_{10}Ne$, $^{21}_{10}Ne$ and $^{22}_{10}Ne$ are 90.92%, 0.26% and 8.82% respectively)

A) 22.18 amu
B) 21.18amu
C) 20.18amu
D) 22.20amu

Q.6 While finding the relative atomic mass, which of the following standard is used to compare the atomic mass of chlorine (35.5amu)

A) Neon-20
B) Carbon-13
C) Nucleon number
D) Carbon -12

Q.7 The average atomic mass of Boron is 10.8. It has two isotopes of masses 10 and 11 respectively. What is the percentage of isotope with the average mass of 10?

A) 80%
B) 50%
C) 60%
D) 20%

Q.8 **Which two elements are isotopes?**

A) $^{12}_{6}X$ and $^{12}_{7}Y$
B) $^{19}_{9}X$ and $^{20}_{10}Y$
C) $^{16}_{8}X$ and $^{16}_{8}Y$
D) $^{14}_{8}X$ and $^{15}_{8}Y$

Q.9 **The best standard for the calculation of relative atomic mass**

A) H-1.008
B) Carbon-13
C) Carbon -12
D) Oxygen -16

Q.10 **How many chlorine atoms are in 2 moles of Cl**

A) $2\times6.022\times10^{23}$ atoms
B) $35.5 \times 6.022\times10^{23}$ atoms
C) 2×10^{23} atoms
D) $2\times6.02\times10^{22}$ atoms

Q.11 **Choose the correct option regarding number of particles associated with one mole of a substance**

A) 6.03×10^{23}
B) 6.01×10^{-19}
C) 6.02×10^{-23}
D) 6.02×10^{23}

Q.12 **A piece of diamond embedded in a gold ring weighs 6.0 gram. How many number of moles of Carbon does it contain?**

A) 6.0 mole
B) 1.0 mole
C) 0.5 mole
D)1.5 mole

Q.13 **Iron is manufactured industrially in Blast furnace using Hematite, an ore of iron and a reducing agent Carbon monoxide.** $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ **Calculate the mass of iron ore used to manufacture 56g of iron with excess carbon monoxide. Assume that the process gives 100% yield.**

A) 160g
B) 280g
C) 112g
D) 80g

Q.14 **An organic compound has empirical formula C_3H_3O if molar mass of the compound is 110.15 molecular formula of this organic compound is**
(A, of C = 12, H = 1.008 and O = 16)

A) $C_6H_6O_2$
B) C_2H_2O
C) $C_8H_9O_3$
D) $C_6H_6O_3$

Q.15 **A polymer of simplest formula CH_2 has molar mass of 28000 $gmol^{-1}$. Its molecular formula will be**

A) 100 times that of its empirical formula
B) 200 times that of its empirical formula
C) 500 times of its empirical formula
D) 2000 times that of its empirical formula

Q.16 **An organic sample consisting of carbon, hydrogen and oxygen was subjected to combustion analysis. 0.5439 g of this compound gave 1.039g carbon dioxide, 0.6369g of water vapors. The empirical formula of this compound is**

A) CH_3O
B) $C_4H_{12}H_2O$
C) C_2H_6O
D) CH_4O

Q.17 **The formula which shows the simplest whole number ratio for the atoms of different elements in compound**

A) Ionic formula
B) Structural formula
C) Empirical formula
D) Molecular formula

Q.18 **One mole of any gas at STP occupies a volume of**

A) $22.414dm^3$
B) $22.414cm^3$
C) $23.414dm^3$
D) $20.414dm^3$

Q.19 When 8 grams (4 moles) of H_2 react with 2 moles of O_2, how many moles of water will be formed

A) Five
B) Four
C) Six
D) Three

Q.20 Hydrogen burns in chlorine to produce hydrogen chloride. The ratio of masses of reactants in chemical reaction $H_2 + Cl_2 \rightarrow 2HCl$ is

A) 2:35.5
B) 1:71
C) 1:35.5
D) 2:70

Q.21 The number of molecules in 9g of ice (H_2O) is

A) 6.02×10^{23}
B) 3.01×10^{22}
C) 6.02×10^{22}
D) 3.01×10^{23}

Q.22 How many moles of sodium are present in 0.1g of sodium?

A) 4.3×10^{-3}
B) 4.03×10^{-1}
C) 4.01×10^{-2}
D) 4.3×10^{-2}

Q.23 A researcher has prepared a sample of 1-Bromopropane from 10g of 1-propanol. After purification he had made 12g of product. Which of the following is percentage yield?

A) 60%
B) 58%
C) 90%
D) 50%

Q.24 Which one of the followings has same number of molecules as present in 11g of CO_2?

A) 4g of O_2
B) 4.5 g of H_2O
C) 4g of O
D) ¼ moles of NaCl

Q.25 Calculate the gram of H_2O formed when 8 g of CH_4 burns in excess of oxygen.

A) 21 grams
B) 19 grams
C) 18 grams
D) 15 grams

Q.26 3.0 mole of calcium will contain _____ g of calcium

A) 105gm
B) 100gm
C) 80gm
D) 120gm

Q.27 The number of moles of water in 1Kg ice are

A) 50 moles
B) 55.5 moles
C) 1000 moles
D) 100 moles

Q.28 How many moles of calcium carbonate are present in 1.75 kg of calcium carbonate? (Ar of Ca = 40, Ar of C = 12, Ar of O=16)

A) 0.0175 mol
B) 17.5 mol
C) 1.75 mol
D) 1750 mol

Q.29 During stoichiometric calculations, which of the following laws must be followed?

A) Law of conservation of mass
B) Avogadro's law
C) Law of conservation of energy
D) Dalton's law

Q.30 Mole fraction of any component is the ratio of moles of all components in a:

A) Compounds
B) Molecule
C) Solution
D) Solid

Q.31 Molarity is defined as the number of moles of solute of any substance dissolved

A) Per dm^3 of water
B) Per m^3 of water
C) In one g of water
D) In100 ml of water

Q.32 10.0 grams of glucose are dissolved in water to make 100 cm^3 of its solution, its molarity is

A) 0.55
B) 0.1
C) 10
D) 1

Q.33 **Given solution contains 16.0 g of CH_3OH, 92.0g of C_2H_5OH and 36g of water. Which statement about mole fraction of the components is true?**

A) Mole fraction of CH_3OH is highest among all components
B) Mole fraction of C_2H_5OH and H_2O is the same
C) Mole fraction of CH_3OH and C_2H_5OH is the same
D) Mole fraction of H_2O is the lowest among all

Q.34 **What mass of NaOH is present in 0.5mol of sodium hydroxide?**

A) 40gm
B) 2.5gm
C) 15gm
D) 20gm

Q.35 **Solution contains 85.5 g of sucrose $(C_{12}H_{22}O_{11})$ in 250 cm^3. What is its molarity?**

A) 0.5 M
B) 2 M
C) 0.25 M
D) 1 M

ANSWER KEY

1	B	11	A	21	A	31	A	41	B
2	C	12	D	22	C	32	A	42	C
3	C	13	C	23	B	33	A	43	C
4	B	14	C	24	D	34	B	44	D
5	B	15	B	25	A	35	A	45	C
6	C	16	D	26	A	36	C	46	B
7	A	17	C	27	D	37	C	47	D
8	B	18	B	28	D	38	D	48	D
9	B	19	D	29	C	39	B	49	C
10	A	20	B	30	A	40	B	50	D

PAST PAPER QUESTIONS

1	B	6	D	11	D	16	C	21	D	26	D	31	A
2	C	7	D	12	C	17	C	22	A	27	B	32	A
3	B	8	D	13	D	18	A	23	B	28	B	33	B
4	A	9	C	14	A	19	B	24	B	29	A	34	D
5	C	10	A	15	D	20	C	25	C	30	C	35	D

EXPLANATORY NOTES

Q.1 Haemoglobin is 68,000 times heavier than H–atom

Hb is how many times heavier than helium atom $= \frac{\text{Mass of Hb compared to H}}{\text{Molar mass of Helium}}$

$= \frac{68000}{4} = 17000$

So Hb is 17,000 times heavier than Helium atom

Q.2 Molecule containing +ve or –ve charge is called molecular ion.
After hidding charge on ion, if it look independent individual molecule then it is called as molecular ion. If +ve charge on NH_3^{+1} is hidden by thumb then NH_3 is independent molecule of ammonia so it is cationic molecular ion.

Q.3 Number of isotopes of following elements are

A) Chlorine – 2
B) Hydrogne – 3
C) Fluorine – 1
D) Cadmium – 11

Q.4 A) Two isotopes are for each Cl and Br
B) Four isotopes are for S
C) Six isotopes are for each Pd and Ca
D) Nine isotopes are for Cd

Q.5

A) Isotopes are atoms of same element having same atomic no but differnet mass number e.g. ${}^{12}_{6}C$, ${}^{13}_{7}C$, ${}^{14}_{8}C$

B) Isotones are species/ atoms having same number of neutrons e.g. ${}^{14}_{6}C$, ${}^{15}_{7}N$, ${}^{16}_{8}O$

C) Isobars are atoms having same mass number but different atomic number e.g. ${}^{40}_{18}Ar$, ${}^{40}_{19}K$

D) Isomer are compounds having same molecular formula but different physical and chemical properties e.g. n–Butane and iso–butane.

Q.6

A) 280 different isotopes occur in nature including 40 radioactive isotopes as well
B) 300 unstable radioactive isotopes produced through artificial disintegration
C) Among 280 natuarlly occuring isotope, 40 are radioactive isotopes
D) Out of 280 naturally occuring isotopes, 154 have even mass number and even atomic number

Q.7 According to following equation

$$\frac{m}{e} = \frac{H^2r^2}{2E}$$

$r \propto m$

$r \propto E$

$r \propto \frac{1}{H}$

$r \propto \frac{1}{\text{Deflection of + ve ion}}$

So, by increasing electric field "E" by keeping "H" constant. Radius of curvature will be increased.

Q.8 In mass spectrometer, vapours are bombarded with electron beam. As a result, substance to be analyzed is ionized. Hence these positively charged species are detected in mass spectrometer.

$$Ne_{(g)} \xrightarrow{e^- \text{-beam}} Ne^{+1} + 1e^-$$

Magnetic field of mass spectrometer rotate the positively charged ion in circular path.

Q.9 In magnetic field +vely charged specie are separated on basis of their m/e value because each ion has its own specific m/e value.

Q.10 According to following equation

$$m/e = \frac{H^2r^2}{2E}$$

$$r \propto m$$

$$r \propto \frac{1}{\text{deflection of } +\text{ve ion}}$$

Ion having least mass has small radius. Ion having small radius will show maximum deflection in magnetic field.

Q.11 Suppose % abundance of lighter isotope $= x$

% age abundance of heavier isotope $= 100 - x$

Average atomic mass

$$= \frac{\text{Mass of lighter isotope} \times \%\text{age abundance} + \text{Mass of heavier isotope} \times \%\text{age abundance}}{100}$$

$$63.5 = \frac{63x + 64(100 - x)}{100}$$

$$63.5 \times 100 = 63x + 6400 - 64x$$

$$6350 = 6400 - x$$

$$x = 6400 - 6350$$

$$x = 50\%$$

Q.12

$$H_2SO_4 \rightleftharpoons 2H^+ + SO_4^{-2}$$

No. of H^+ ions $= \text{No. of } H^+ \text{ in } H_2SO_4 \times \text{Mole} \times N_A$

$$= 2 \times 0.1 \times 6.022 \times 10^{23} = 2 \times 6.02 \times 10^{22}$$

Q.13 Mole of Ne atoms $= 1.0 \times 10^{-6}$ mol,

mole of electron $= ?$

$$\underset{1 \text{ mole}}{Ne} \longrightarrow \underset{}{Ne^{+1}} + \underset{1 \text{ mole}}{1e^-}$$

$$1.0 \times 10^{-6} \text{ mol} \qquad 1.0 \times 10^{-6} \text{ mol}$$

So mole of electrons produced are 1.0×10^{-6} mol

Number of electrons in given amount of Ne $= \text{No. of electron} \times N_A$

$$= 1.0 \times 10^{-6} \times 6.02 \times 10^{23}$$

Q.14 $Al_2(SO_4)_3 \xrightleftharpoons{H_2O} 2Al^{+3} + 2SO_4^{-2}$

1 mole 5mol ions

Total no. of particles = No of ions in $Al_2(SO_4)_3$ × Given mol × N_A

$= 5 \times 0.5 \times 6.02 \times 10^{23} = 1.5 \times 10^{24}$

Q.15

A) Mole of Cl_2 gas $= \frac{35.5}{71} = 0.5$ mol

B) Mole of H_2 gas $= \frac{1}{2} = 0.5$ mol

H_2	$\longrightarrow$	2 electrons
1 mol		2mol
1mol × 0.5		2mol × 0.5
0.5 mol		1 mol

So 1g of H_2 (0.5mol) contain 1 mol of electrons

C) 1 mol dm^{-3} = 1 molar

$H_2SO_4 \rightleftharpoons 2H^+ + SO_4^{-2}$

1M 2M H^+

It mean[NTT]s 1 dm^3 of H^+ contain 2 mol of H^+

D) Mole of O_2 gas $= \frac{22.414}{22.414} = 1$ mol

No. of O –atoms in given volume = No of O – atoms in O_2 × mol in O_2

$= 2 \times 1$

= 2 mol of O –atoms

Q.16 Molecular mass of O_2 =32 g/ mol

Mass of a molecule $= \frac{\text{molecular mass (g)}}{\text{Avogadro's number}} = \frac{32g}{6.02 \times 10^{23}}$

Q.17

Method –1	Method –2
Mole of $CO_2 = \frac{\text{Given mass of element}}{\text{Mass of element in compound}}$ $= \frac{16}{32} = 0.5$mol	CO_2 : O 12+32 = 44g = 1mol : 32g 0.5 mol : 16g 0.25 mol : 8g

Q.18

Mol of oxygen $= \frac{\text{Given particles}}{\text{Avogadro's number}} = \frac{1.5 \times 10^{22}}{6.02 \times 10^{23}} = 0.025$mol

Mass in grams = mole × molar mass of O_2

$= 0.025 \times 32$

$= 0.80$g

Q.19

Give mole of Na^{+1} =0.5 mol

$Na^{+1} \longrightarrow 10 - electron$

1 mol 10 mol of electron

No. of electrons in given amount of Na^{+1} = No. of elections in $Na^{+1} \times$ mole $\times N_A$

$= 10 \times 0.5 \times N_A$

$= 5N_A$

Q.20 Given mole $= 3 \times 10^{-21}$ mol

No. of molecules $= \text{Mole} \times N_A$

$= 3 \times 10^{-21} \times 6.02 \times 10^{23}$

$= 18 \times 10^{23-21}$

$= 18 \times 10^{2}$

$= 1800$

Q.21 Relative atomic mass means mass of atom on C–12.0000 scale that is 16 amu for oxygen.

Oxygen gas means molecular oxygen (O_2)

$$\text{Mole} = \frac{\text{Mass}}{\text{M.mass of oxygen gas}}$$

$$2 = \frac{\text{Mass}}{32}$$

$2 \times 32 = \text{Mass}$ 64g = Mass

Q.22 A) Mass of I_2 is 25g

B) g atom means mole of atoms

Mass of O – atoms = Mole × M. mass of O – atoms

$= 25 \times 16$

$= 400g$

C) g mol means mole

mass of H_2O = Mole × M. mass

$= 25 \times 18 = 450g$

D) mass of N_2 gas is 25g

Q.23 Relative atomic mass of Cl = 35.5 amu

Relative molecular mass of Cl_2 gas = 71 amu

If molecular mass is expressed in g, then it is called mole, so

1 mol of Cl_2 gas = 71g

Q.24 Mole is SI unit of quantity of substance so it is counting unit, its value is 6.022×10^{23}. 1 mole of different substances contain same no. of particles (6.022×10^{23}) e.g.

1 mol of Cl_2 gas = 6.02×10^{23} molecules = 71g

1 mol of CH_4 gas = 6.02×10^{23} molecules = 16g

Q.25 During combustion analysis, CO_2 is chemically absorbed in 50% KOH

$$CO_2 + 2KOH \longrightarrow K_2CO_3 + H_2O$$

While H_2O vapour are physically absorbed in $Mg(ClO_4)_2$ because $Mg(ClO_4)_2$ is hygroscopic.

Q.26 During combustion analysis, CO_2 is chemically absorbed in 50% KOH

$$CO_2 + 2KOH \longrightarrow K_2CO_3 + H_2O$$

Q.27 % age of element $= \frac{\text{Mass of element in compund}}{\text{Molar mass} \times 100}$

A) $\frac{16}{32} \times 100 = 50\%$

B) $\frac{16}{46} \times 100 = 34.7\%$

C) $\frac{32}{46} \times 100 = 69.5\%$

D) $\frac{16}{18} \times 100 = 88.8\%$

Q.28 Ionic compounds do not have molecule rather they have formula unit (Empirical formula) so these don't have molecular formula but have empirical formula

Q.29 In combustion analysis, only those compounds can be analyzed which contain C, H, O and O.

Organic compound $+ O_2 \xrightarrow{CuO} CO_2 + H_2O$

(C, H and O containing)

So sole product of combustion analysis are CO_2 and H_2O

Q.30 It can be solved theoretically but short cut is to check molecular mass of given options

A) $C_3H_4O_4 = 36 + 4 + 64 = 104\ g/mol$

B) $C_2H_2O = 24 + 2 + 16 = 42\ g/mol$

C) $C_2H_2O_4 = 24 + 2 + 64 = 90\ g/mol$

D) $C_2HO_2 = 24 + 1 + 32 = 57\ g/mol$

Q.31 To find limiting reactant, its short cut is

(i) Find no. of moles from given amount

(ii) Divide no. of moles by molar coefficient

(iii)Small ratio is considered as liming reactant while large ratio is excess reactant

$$n_{Na} = \frac{230}{23} = 10mol,\ n_{Fe_2O_3} = \frac{320}{160} = 2mol$$

$$6Na + Fe_2O_3 \longrightarrow 3Na_2O + 2Fe$$

$$\frac{10mol}{6} \quad \frac{2mol}{1}$$

Limiting reactant $\leftarrow 1.66 \qquad 2 \rightarrow$ Excess reactant

Q.32

$$n_{Mg} = \frac{21}{24} = 0.8mol,\ n_{HCl} = \frac{21}{36.5} = 0.5mol$$

$$Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_{2(g)}$$

$$\frac{0.8mol}{1} \quad \frac{0.5mol}{2}$$

Excess reactant $\leftarrow 0.8 \qquad 0.25 \rightarrow$ Limiting reactant

Q.33

$$\text{Mole} = \frac{\text{Give mass}}{\text{Molecular mass}} = \frac{0.6}{60} = \frac{6}{600}$$

$$600\overline{)600}^{\,0.01} = 0.01 \text{ mol}$$

$$\frac{600}{X}$$

Q.34

$$C_2H_2 + \frac{5}{2}O_2 \longrightarrow 2CO_2 + H_2O$$

Mole ratio between C_2H_2 and O_2 is

C_2H_2	:	O_2
1	:	2.5
$5cm_3$	:	2.5×5
	:	$=12.5\ Cm^3$

Q.35

$$\text{Mole} = \frac{\text{Given mass}}{\text{Molecular mass}} = \frac{4.4}{44} = \frac{1}{10}\text{mol}$$

$$\text{Volume (V)} = \text{Mole (n)} \times 22.414 dm^3$$

$$= \frac{1}{10} \times 22.414$$

$$= 2.2414\ dm^3$$

Q.36

$$n_{CH_4} = \frac{11.207}{22.414} = \frac{1}{2}\text{mol}$$

$$CH_4 \longrightarrow 4-H + 1-C$$

1 mol 4 mol H–atoms

$\frac{1}{2}$ mol $4 \times \frac{1}{2}$ mol

$=2$mol H–atoms

Q.37

$$n_{O_2} = \frac{12}{32} = \frac{3}{8}\text{mol}$$

$$4Al + 3O_2 \longrightarrow 2Al_2O_3$$

O_2	:	Al
3	:	4
1	:	$\frac{4}{3}$
$\frac{3}{8}$	:	$\frac{4}{3} \times \frac{3}{8}$
		$= \frac{1}{2}$

Mass of Al = Mole × Molar mass

$$= \frac{1}{2} \times 27$$

$$= 13.5g$$

Q.40 Volume occupied by 1 mole of ideal gas at STP is called molar volume. Its value is 22.414 dm^3

Q.41 Efficiency of chemical reaction is expressed in term of % age yield

$$\%\text{ age yield} = \frac{\text{Actual / experimental yield}}{\text{Thoretical / calculated yield}} \times 100$$

Actual yield is amount of product formed in chemical reaction while theoretical yield is amount of product obtained in balanced chemical equation.

Q.42

A) $CO + \frac{1}{2}O_2 \longrightarrow CO_2$

B) $C_{(D)} + O_2 \longrightarrow CO_2$

C) $C_2H_6 + \frac{7}{2}O_2 \longrightarrow 2CO_2 + 3H_2O$

D) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

1 mole of ethane give largest mol and mass of CO_2

Q.43 If solute and solvent both are liquid then best unit of concentration is % V/V

Q.44

$$\text{Molarity(M)} = \frac{\%\text{age} \times 10}{\text{M.mass of solute}}$$

$$= \frac{2 \times 10}{40} = 0.5\text{M}$$

Q.45 Volume of solution in $dm^3 = \frac{500}{1000} = 0.5 dm^3$

$$\text{molarity(M)} = \frac{\text{Mass(g)}}{\text{Molar mass of solute}} \times \frac{1}{\text{Vol. of solution}(dm^3)}$$

$$= \frac{45}{180} \times \frac{1}{0.5}$$

$$= \frac{1}{4} \times \frac{1}{0.5} = \frac{1}{2} = 0.5\text{M}$$

Q.46 Concentration unit having volume factor either in numerator or denominator is temperature dependent because volume is changed by changing temperature.

Q.47

$$n_{N_2} = \frac{7}{28} = \frac{1}{4}\text{mol},\ N_{O_2} = \frac{8}{32} = \frac{1}{4}\text{mol}$$

$$X_{N_2} = \frac{n_{N_2}}{n_t} = \frac{\frac{1}{4}}{\frac{1}{4} + \frac{1}{4}} = \frac{\frac{1}{4}}{\frac{1+1}{4}} = \frac{1}{2} = 0.5$$

Q.48

$$\%w/v = \frac{\text{Mass of solute (g)}}{\text{Volume of solution (cm}^3\text{)}} \times 100$$

$$20 = \frac{\text{Mass of solute(g)}}{1000} \times 100$$

$$20 \times 10 = \text{Mass of solute}$$

$$200\text{g} = \text{Mass of solute}$$

Q.49 Suppose 1dm^3 H_2O = 1000g

So $$n_{H_2O} = \frac{1000}{18} = 55.5\text{mol}$$

It means 55.5 mol of water is present in 1dm^3 volume of solution.

Q.50

$n_{alcohol} = 1\text{mol}$, $n_{H_2O} = 4\text{mol}$

$$X_{H_2O} = \frac{n_{H_2O}}{n_t}, \qquad X_{alcohol} = \frac{n_{alcohol}}{n_t}$$

$$= \frac{4}{5} \qquad = \frac{1}{5}$$

2A Topic STATES OF MATTER

PRACTICE EXERCISE

GASEOUS STATE + GENERAL GAS EQUATION

Q.1 Liquids have no definite shape, it is because

A) The molecules of liquid are in constant motion by sliding over each other
B) The intermolecular forces of liquids are weaker than gases
C) The liquid molecules have kinetic energy less than solids
D) All statements are correct

Q.2 A class of materials with highly variable mechanical and optical properties that solidify from the molten state without crystallization are called

A) True solids
B) Amorphous solids
C) Crystalline solids
D) All of these

Q.3 Gases deviate from ideal behavior at high pressure. Which of the following is correct for non-ideality

A) At high pressure, the gas molecules move in one direction only
B) At high pressure, the collision between the gas molecules are increased manifold
C) At high pressure, the volume of the gas becomes insignificant
D) At high pressure, the inter-molecular attractions become significant

Q.4 If both temperature and volume of a gas are doubled, the pressure

A) Cannot be predicated
B) Is reduced to ½
C) Remain unchanged
D) Is doubled

Q.5 Which one is the form of general gas equation

A) $PV = nRT$
B) $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
C) $d = \frac{PM}{RT}$
D) All of these

Q.6 Under high pressure which of the following gas show more ideality in character

A) N_2
B) NH_3
C) CO_2
D) SO_2

Q.7 Which is incorrect about ideal gas

A) No force of attraction between molecules
B) No example in nature
C) Can be liquefied easily
D) Obey gas laws at all conditions of temperature and pressure

Q.8 Volume of a gas at STP is 10 dm^3 at what temperature its volume will become 30dm^3, keeping pressure constant

A) 3°C
B) 819K
C) 819°C
D) 3K

Q.9 Which of the following pairs of gases possess equal volume at STP

A) 44g CO_2 and 44g CO
B) 16g O_2 and 32gCH_4
C) 3.01×10^{23} molecules of CO and 3.01×10^{23} gram molecules of H_2
D) 0.5 mole of NO and 16 g O_2

Q.10 Absolute zero is
A) –273 K
B) –459.67°F
C) 0°C
D) –546 K

Q.11 A gas initially at 27°C is heated upto 327°C, its average K.E will be
A) Doubled
B) 300 times
C) Four times
D) 327 times

Q.12 The correct value of general gas constant R is
A) 8.314 atm dm^3 $mol^{-1}K^{-1}$
B) 62.4 torr cm^3 $mol^{-1}K^{-1}$
C) 0.0821 $Jmol^{-1}$ K^{-1}
D) 8.314×10^7 erg $mol^{-1}K^{-1}$

Q.13 Absolute temperature of a gas is directly proportional to average _____
A) Rotational K.E
B) Vibrational K.E
C) Translational K.E
D) None of these

Q.14 An ideal gas can't be liquefied because
A) Its critical temperature is always above 0°C
B) It solidifies before becoming a liquid
C) Its molecules are smaller in size
D) Forces between its molecules are negligible

Q.15 A fire extinguisher delivers 2.2 Kg of CO_2. Volume of CO_2 at STP is
A) $12dm^3$
B) $120dm^3$
C) 1120 dm^3
D) 2400 dm^3

Q.16 When 200ml of a gas at constant pressure is heated, its volume
A) Increases
B) Decreases
C) Remains unchanged
D) First increases then decreases

Q.17 The product of PV of a gas is unit of
A) Force
B) Work
C) Entropy
D) Enthalpy

Q.18 Under what condition of temperature and pressure will a real gas behave most like an ideal gas?
A) Low temperature and low pressure
B) Low temperature and high pressure
C) Standard temperature and standard pressure
D) High temperature and low pressure

LIQUID STATE

Q.19 The strength of hydrogen bonding is
A) 20 times less than a covalent bond
B) 20 times more than a covalent bond
C) 20 times less than a ionic bond
D) 20 times more than a ionic bond

Q.20 Lower alcohols are soluble in water because
A) Intermolecular hydrogen bonding
B) Dipole induced dipoles
C) Low electro-negativity difference between C and H
D) All of the above

Q.21 Hydrogen bonding is maximum in
A) Diethyl ether
B) Benzene
C) Ethanol
D) Water

Q.22 The strongest H-bond is
A) F---H
B) N----H
C) O----H
D) O----F

Q.23 When two ice cubes are passed over each other, they unite to form one cube. This is due to

A) Covalent attraction
B) Hydrogen bond formation
C) Ionic bond formation
D) Metallic bond formation

Q.24 Propanone is miscible in water due to

A) Both are polar molecules
B) Dipole-dipole attraction between them
C) Hydrogen bonding between them
D) All of these

Q.25 Which of the following can form hydrogen bonding among its molecules more prominently

A) CH_3OH
B) $CHCl_3$
C) $CH_3 - \overset{\overset{O}{\|}}{C} - CH_3$
D) All of these

Q.26 Strong dipole-dipole forces among the liquid molecules are responsible for

A) Very high heat of vaporization
B) Very low heat of vaporization
C) Very low boiling point
D) All are correct

Q.27 Which one of the following arrangements usually represents the correct order of increasing interactions?

A) Hydrogen bonding, London forces, Dipole – Dipole
B) London force, Hydrogen bonding, Dipole – Dipole
C) London forces, Dipole – Dipole, Hydrogen bonding
D) Dipole – Dipole, London forces, Hydrogen bonding

Q.28 Evaporation is designated as a cooling process because of the reason

A) It is a surface phenomenon
B) It involves heat absorption from its surroundings
C) High energy molecules leave behind the low energy molecules and cause cooling
D) All of the above

Q.29 Vapour pressure of a liquid depends upon the following

A) Surface area and temperature only
B) Volume of the liquid
C) Humidity of the liquid in the air
D) Temperature and the inter-molecular forces

Q.30 At 1atm pressure, a liquid 1 has the boiling point less than a liquid 2, what can we predict about both the liquids

A) Liquid 1 has high vapour pressure than the liquid 2
B) Liquid 1 has the weak intermolecular forces of attraction than the liquid 2
C) Liquid 1 is more volatile than the liquid 2
D) All of the above

Q.31 The distillation of a solution under reduced pressure is called

A) Fractional distillation
B) Destructive distillation
C) Distillation
D) Vacuum distillation

Q.32 A pressure cooker reduces cooking time because

A) Large flame is used
B) Heat is uniformly distributed
C) Boiling point of water rises
D) Vapour pressure of liquid decreases

Q.33 Molar heat of vapourization of water is

A) 40.6 kJ mol^{-1}
B) 14.6 kJ mol^{-1}
C) 140.6 kJ mol^{-1}
D) Zero

Q.34 Rate of evaporation of a liquid does not depend on

A) Surface area of liquid
B) Inter molecular forces
C) External pressure
D) Temperature

Q.35 Which one of the following would cause severe burning

A) Boiling water at 100°C
B) Boiling water at 80°C
C) Steam at 101°C
D) Water at 20°C

LATTICE STRUCTURE OF CRYSTALLINE SOLIDS

Q.36 Which one of the following is a giant molecule

A) SiO_2
B) CH_4
C) CO_2
D) NH_3

Q.37 Molecular crystals are

A) Hard
B) Soft
C) Very hard
D) Always polar

Q.38 The overall structure of diamond looks

A) Face-centered cubic
B) Square planar
C) Tetragonal
D) Hexagonal

Q.39 Ice occupies more space than liquid water

A) 10%
B) 11%
C) 12%
D) 9%

Q.40 The crystals formed due to London forces of interaction are

A) Ionic
B) Covalent
C) Molecular
D) Metallic

Q.41 The number of Cl^- ions per units cell of a simple cubic lattice at the corner is / are

A) 1
B) 4
C) 3
D) 6

Q.42 Ionic solids are characterized by

A) Low melting point
B) High vapour pressure
C) Good conductivity in solid state
D) Solubility in polar solvent

Q.43 Which is incorrect about structure of iodine

A) Face-centered cubic
B) $I - I_{(g)} > I - I_{(s)}$
C) Metallic appearance
D) $I - I_{(g)} < I - I_{(s)}$ Bond length

Q.44 Overall ratio of silicon to oxygen atoms in silicon (IV) oxide is

A) 1: 4
B) 1 : 2
C) 4 : 1
D) 2 : 1

Q.45 C – C bond lengths is diamond crystal are

A) 1.54 pm
B) 154 pm
C) 109.5 pm
D) 1540 pm

Q.46 In interior of silicone (IV) oxide crystal, each silicone atom is directly connected with

A) Two O-atoms
B) Four O-atoms
C) Two O-atoms and two Si-atoms
D) Four Si-atoms

Q.47 Iodine is a molecular solid because the forces between its molecules are

A) Ionic
B) Metallic
C) Covalent
D) Vander wall's forces

Q.48 The coordination number of each ion in NaCl is

A) 4
B) 6
C) 8
D) 10

Q.49 The best conductors of electricity are

A) Ionic solids
B) Molecular solids
C) Metallic solids
D) Covalent solids

Q.50 Which of the following statement is incorrect about silica

A) Every silicon atom is bonded tetrahedrally to four oxygen atoms
B) Every oxygen atom is bonded to two silicon atoms
C) Structure of silica is considered to be essentially one molecule
D) Has very high thermal expansion

Q.51 During which process, empty spaces between particles become minimum

A) Ionization
B) Fusion
C) Condensation
D) Evaporation

Q.52 A solid may be made up of

A) Atoms
B) Molecules
C) Ions
D) a, b and c

Q.53 A malleable solid is one which can be

A) Converted into wires
B) Melted easily
C) Converted into thin sheets
D) All of above

Q.54 Which solids are called true solids

A) Metallic
B) Crystalline
C) Amorphous
D) Vitreous

Q.55 The arrangement ABC, ABC... is referred as:

A) Cubic close packing
B) Hexagonal close packing
C) Octahedral close packing
D) Tetrahedral close packing

PAST PAPER QUESTIONS

Q.1 All the collisions between the particles of gases are elastic in nature. What is meant by "Elastic Collisions"?

A) The velocity of the molecules changes
B) No change in mass during the collisions
C) No change in the kinetic energy
D) No change in potential energy during the Collisions

Q.2 Which one of the following expression represent the Avogadro law?

A) V= RnT/P (When T and n are constant)
B) V= RnT/P (When T and P are constant)
C) V= RnT/P (When P and n are constant)
D) V= RP/nT (When T, P and n are constant)

Q.3 The root mean square velocity of gases is inversely proportional to square root of their:

A) Temperature
B) Molar mass
C) Pressure
D) Volume

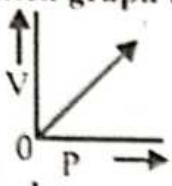
Q.4 The number of molecules in 22.4 dm^3 of H_2 gas at 0°C and 1 atm are

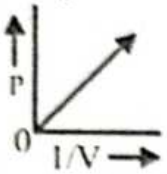
A) 60.2×10^{23}
B) 6.02×10^{23}
C) 6.02×10^{25}
D) 60.2×10^{22}

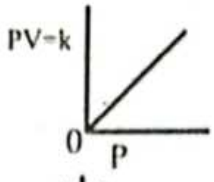
Q.5 There are four gases H_2, He, N_2 and CO_2 at 0°C. Which gas shown greater non-ideal behavior?

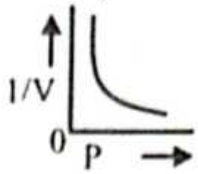
A) He
B) CO_2
C) H_2
D) N_2

Q.6 Which graph represents Boyle's law

A) 

B) 

C) 

D) 

Q.7 The coordination number of Na+ in NaCl crystal is

A) 8
B) 2
C) 4
D) 6

Q.8 Identify the value of R at STP

A) 8.314 atm dm^{-3} mol^{-1}
B) 0.0821 cal K^{-1} mol^{-1}
C) 0.0821 atm dm^3 K^{-1} mol^{-1}
D) 8.314 cal K^{-1} mol^{-1}

Q.9 In the equation $\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = RT$, 'b' represents the

A) Excluded volume
B) Excluded pressure
C) Actual volume
D) Excluded volume per mol

Q.10 Gas is enclosed in a container of 20$cm^3$with the moving piston. According to kinetic theory of gases, what is the effect on freely moving molecules of the gas if temperature is increased from 20°C to 100°C?

A) Colliding capability of molecule will become lower
B) Pressure will become one half
C) Temperature has no effect on freely moving molecules
D) Volume will be increased

Q.11 Which of the following is the correct equation to calculate relative molecular mass of a gas

A) M-mPRT/V
B) M=PV/mRT
C) M = mPR/VT
D) M= mRT/PV

Q.12 Which of the statement is applicable for both ideal and real gases molecules?

A) Have no forces of attraction
B) Collisions between the molecules is elastic
C) Molecules are in random movement
D) The actual volume of gas is negligible as compared to the volume of gas

Q.13 Correct order of boiling points of the given liquids is

A) $H_2O > HF > HCl > NH_3$
B) $HF > H_2O > HCl > NH_3$
C) $H_2O > HF > NH_3 > HCl$
D) $HF > H_2O > NH_3 > HCl$

Q.14 At 1489 mmHg, water will boil at

A) 120C°
D) 100C°
C) 110C°
D) 90C°

Q.15 Ice is less dense than water at

A) 0°C C) 4°C

B) -4°C D) 2°C

Q.16 In crystal lattice of ice, each O-atom of water molecule is attached to

A) Four H-atoms C) Two H-atoms

B) One H-atom D) Three H-atoms

Q.17 What is reason that the ice at 0^0C occupies more volume then water:

A) Empty spaces C) Intermolecular forces

B) Ionic bond D) Debye forces

Q.18 Water has maximum density at

A) –4°C C) 1°C

B) 0°C D) 4°C

Q.19 In the structure of NaCl, each sodium ion is surrounded by chloride ions

A) 4 C) 6

B) 5 D) 8

Q.20 Which one the following have highest lattice energy?

A) NaCl C) KCl

B) KBr D) LiCl

ANSWER KEY

1	A	11	A	21	D	31	D	41	A	51	C
2	B	12	D	22	A	32	C	42	D	52	D
3	D	13	C	23	B	33	A	43	D	53	C
4	C	14	D	24	A	34	C	44	B	54	B
5	D	15	C	25	A	35	C	45	B	55	A
6	A	16	A	26	A	36	A	46	B		
7	C	17	B	27	C	37	B	47	D		
8	B	18	D	28	D	38	D	48	B		
9	D	19	A	29	D	39	D	49	C		
10	B	20	A	30	D	40	C	50	D		

PAST PAPER QUESTIONS

1	C	6	B	11	D	16	A
2	B	7	D	12	C	17	A
3	B	8	C	13	C	18	D
4	B	9	D	14	A	19	C
5	B	10	D	15	A	20	D

EXPLANATORY NOTES

Q.1 Constant state of random motion in molecules of liquids and gases do not allow a definite shape.

Q.2 Amorphous solids do not have a crystalline geometry.

Q.3 Non ideal behaviour is due to intermolecular forces which become significant at high pressure as the gas molecules move closer to each other.

Q.4 $V \propto \frac{T}{P} \longrightarrow P \propto \frac{T}{V}$.

Hence increase in volume of gas is due to increase in temperature keeping "P" constant.

Q.5 General gas equation

$$PV = nRT \qquad \frac{P_1V_1}{T_1} = R$$

If n = 1

$$PV = RT \qquad \frac{P_2V_2}{T_2} = R$$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

Q.6

$$\text{Ideality} \propto \text{non-polar nature.}$$

$$\propto \frac{1}{\text{Polarity}}$$

$$\propto \frac{1}{\text{Size of molecule}}$$

Here N_2 is non-polar and lighter than CO_2 and SO_2.

Q.7 Ideal gas do not have intermolecular forces hence they cannot be iquified.

Q.8 $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$$\frac{10dm^3}{273} = \frac{30dm^3}{T_2}$$

$$T_2 = 819K$$

Q.9 Equal number of moles have equal volume for ideal gas at STP in given pairs only 0.5 mole of NO has same number of moles as 16g O_2.

Q.10 Absolute zero = –273°C

$$F = \frac{9}{5}C + 32$$

$$F = \frac{9}{5}(-273°) + 32$$

$$F = -491.4° + 32$$

$$F = -459.640°$$

Q.11 $T_1 = 27°C = 300K$
$T_2 = 327°C = 600K$
$T_1 = K.E_1$
$T_2 = 2 \times T_1$
$(K.E)_2 = 2(K.E)_1$

Q.12 $8.314 Nm\ mol^{-1}K^{-1}$
$1Nm = 10^7$ erg
Hence 8.314×10^7 erg.

Q.13 Absolute temperature measure of average translational kinetic energy
$T \propto KE_{translational}$

Q.14 Liquefaction is possible due to attractive forces. For ideal gas intermolecular forces are negligible hence they canot be liquified.

Q.15 2.2kg of $CO_2 = 2.2 \times 1000g = 2200g$

$$\text{Volume} = \frac{2200g}{44g/mole} \times 22.4dm^3$$

$= 1120\ dm^3$

Q.17 Unit of $PV = Nm^{-2}.m^3 = Nm = Joule$
Unit of work = Joule

Q.19 Hydrogen bonding is an Intermolecular forces and does not involve sharing of electrons hence it is 20 times less stronger than covalent bond.

Q.21 Ether and benzene have no hydrogen bonding. Where water has two H-bonds for molecule as compare to C_2H_5OH which has one H-bond

Q.22 Hydrogen bonding strength $\propto$ Electronegativity of bonded atom
Order of hydrogen bond strength

$$F \ldots H > O \ldots H > N \ldots H$$

Q.25 CH_3OH has OH group which allows hydrogen bonding. Acetone and chloroform have dipole-dipole forces in them.
LDF are due to temporary dipole. Dipole-Dipole forces are due to permanent dipoles. While hydrogen bonding is the strongest due to high positive charge density.

Q.28 In evaporation molecules of liquid escape from surface energy molecules as a result temperature of liquid drops. Heat start flowing from surrounding to liquid causing cooling.

Q.29 Vapour pressure $\propto$ T
$\propto$ Kinetic energy
$\propto \frac{1}{\text{Intermolecular forces}}$

Q.30 Boiling point $\propto$ Intermolecular forces
$\propto \frac{1}{\text{Vapour pressure}}$
$\propto \frac{1}{\text{Volatility}}$

Q.31 Distillation under reduced pressure is called vacuum distillation it allow boiling at low temperature.

Q.32 Boiling point $\propto$ External pressure

Q.33 ΔH_v of water = 40.6kJ/mol

Q.35 Steam contains higher potential energy because of extra heat which is absorbed by water molecules during boiling to overcome intermolecular forces.

Q.36 SiO_2 contains a network of covalently bonded S and O-atoms in which each Si is surrounded by 4 O-atoms and each O-atm is surrounded by 2 silicon atoms giving rise to giant structure.

CO_2 = Triatomic

CH_4 = Penta atomic

NH_3 = Tetra atomic

Q.37 Due to weak intermolecular forces and large empty spaces molecular solids are soft.

Q.38 Diamond is a face-centered cubical structure.

Q.39 Due to hexagonal arrangement of water molecules 9% volume is increased when water frozen to ice.

Q.40 London forces are a type of intermolecular forces and are responsible to hold non polar molecules in molecular solids.

Q.41 The unit cells that shares one Cl^{-1} ion at one corner = 8

A unit cell gets a share of one Cl^{-1} ion at one corner = $\frac{1}{8}$

A unit cell gets a total share of Cl^{-1} ion at one corner = $8 \times \frac{1}{8} = 1$

Q.42 Like dissolves like ionic solids are dissociated into ions in polar solvents and are soluble due to ion-dipole forces.

Q.43 Bond length of $I_{2(g)}$ = 266.6pm

Bond length of $I_{2(s)}$ = 271.5pm

This increase is due to the distortion caused London dispersion forces by neighbouring molecules in solid state.

Q.37 Si in sp^3 hybridized hence it allow attachment of 4 O–atoms in a tetrahedral fashion in the interior of SiO_2 crystal.

Q.48 Each Na^+ ion is surrounded by 6 Cl^- ion in NaCl crystal. Hence coordination number is 6.

Q.49 Metals have delocalized electrons that can conduct electricity readily.

Q.50 Due to strong covalent bonds SiO_2 cannot be thermally expanded readily.

3A Topic ATOMIC STRUCTURE

PRACTICE EXERCISE

PROTON, NEUTRON AND ELECTRON

Q.1 **The value of $\frac{e}{m}$ for the electron is**

A) 1.7588×10^{11} kg C^{-1}
B) 1.7588×10^{-11} Ckg^{-1}
C) 1.7588×10^{11} kgC^{-1}
D) 1.7588×10^{11} Ckg^{-1}

Q.2 **How many times the mass of neutron is greater than mass of electron**

A) $\frac{1}{1836}$
B) 1836
C) 1840
D) $\frac{1}{1840}$

Q.3 **The mass of neutron is**

A) Same as that of proton
B) Same as that of electron
C) Slightly more than that of proton
D) Slightly less than that of proton

Q.4 **The mass of proton is**

A) 9.1095×10^{-31} kg
B) 1.6726×10^{-27} kg
C) 1.602×10^{-19} kg
D) 1.6750×10^{-27} kg

Q.5 **The mass of α-particle is**

A) Slightly more than four times the mass of one proton
B) Four times the mass of one neutron
C) Slightly less than four times the mass of one neutron
D) Both A) and C)

Q.6 **What will be the effect on proton when passed through the electric field**

A) Deflection towards anode
B) Deflection towards cathode
C) Deflection perpendicular to electric field
D) Deflection downwards in electric field

NUMBER OF PROTONS, NEUTRONS AND ELECTRONS IN ATOMS AND IONS

Q.7 **Total number of neutrons in $^{68}_{31}Ga$ are**

A) 37
B) 68
C) 31
D) 99

Q.8 **The ion that is iso-electronic with Cl atom is**

A) CN^-
B) O_2^+
C) N_2^+
D) O_2^-

Q.9 **The ionic specie having more electrons than neutrons is**

A) Mg^{+2}
B) O^{2-}
C) Na^+
D) F^{-1}

Q.10 **The atomic number of an element is 26. How many electrons are present in M-Shell of this element in ground state**

A) 11
B) 15
C) 14
D) 16

Q.11 _____ is/are isoelectronic with K^+

A) P^{-3}
C) Si^{-4}
B) S^{-2}
D) All of these

Q.12 The total types of fundamental nuclear sub-atomic particles are there in an atom

A) More than 100
C) 3
B) 2
D) Equal to 100

Q.13 Isotopes are

A) Chemically similar
C) Chemically dissimilar
B) Physically dissimilar
D) Both 'A' and 'B'

Q.14 Correct representation of element with atomic number and atomic mass is

A) ${}^{A}_{Z}X$
C) ${}^{Z}_{A}X$
B) ${}^{A}X^{Z}$
D) ${}^{Z}X^{A}$

SHAPES OF s, p AND d-ORBITALS

Q.15 Quantum number which is not derived from Schrodinger wave equation

A) Principal
C) Azimuthal
B) Magnetic
D) Spin

Q.16 A nodal plane in an orbital is the plane where electron density is

A) Maximum
C) Zero
B) Infinity
D) Minimum

Q.17 The number of degenerate orbitals in a sub-shell having sausage shape are

A) 1
B) 3
C) 5
D) 7

Q.18 Quantum number values for 3p orbital are

A) $n = 3, l = 0$
C) $n = 3, l = 1$
B) $n = 2, l = 1$
D) $n = 2, l = 3$

Q.19 Maximum number of electrons that can be accommodated in p-subshell

A) 2
C) 6
B) 10
D) 14

Q.20 Which sub-shell has highest energy

A) n=5, ℓ=3, m=+1
C) n=5, ℓ=2, m=+2
B) n=4, ℓ=3, m=0
D) n=4, ℓ=0, m=+1

Q.21 Magnetic quantum number values for the d subshell are

A) 2
C) 3
B) 5
D) 7

Q.22 A p-orbital has _____ energy than the s-orbital of same principal quantum number

A) Lower
C) Higher
B) Equal
D) Variable orbit to orbit

Q.23 Which set of quantum number represents 19th electron of Cu atom

A) $n = 4, \ \ell = 0, \ m = 0, \ s = +\frac{1}{2}$
C) $n = 3, \ \ell = 2, \ m = 0, \ s = +\frac{1}{2}$
B) $n = 4, \ \ell = 1, \ m = 0, \ s = +\frac{1}{2}$
D) $n = 3, \ \ell = 0, \ m = 0, \ s = +\frac{1}{2}$

Q.24 Shapes of p orbitals

A) Circular
B) Dumb-bell
C) Sausage
D) Complicated

Q.25 An orbital which is spherically symmetrical is

A) p-orbital
B) s-orbital
C) d-orbital
D) f -orbital

Q.26 The d-orbital which is bi-lobed with collar is represented as

A) dxy
B) dz^2
C) dyz
D) dx^2-y^2

ELECTRONIC CONFIGURATION OF ATOMS AND IONS (H → Kr)

Q.27 The electronic configuration of an element is $1s^2, 2s^2, 2p_x^1, 2p_y^1, 2p_z^1$. This represents a/an

A) Ground state
B) Hybridized state
C) Excited state
D) Molecular state

Q.28 The correct electronic configuration of $_{29}Cu$ is

A) $[Ar]4s^2 3d_{xy}^2 3d_{yz}^2 3d_{xz}^2 3d_{x^2-y^2}^2 3d_{z^2}^1$
B) $[Ar]4s^1 3d_{xy}^2 3d_{yz}^2 3d_{xz}^2 3d_{x^2-y^2}^2 3d_{z^2}^1$
C) $[Ar]4s^1 3d_{xy}^2 3d_{yz}^2 3d_{xz}^2 3d_{x^2-y^2}^2 3d_{z^2}^2$
D) $[Ar]4s^1 3d_{xy}^2 3d_{yz}^2 3d_{xz}^2 3d_{x^2-y^2}^1 3d_{z^2}^1$

Q.29 Which one of the following ion has similar electronic configuration like Ar

A) Sc^{+2}
B) Cr^{+2}
C) Ti^{+4}
D) Mn^{+6}

Q.30 In electronic configuration of Cu and Cr which of following is true

A) 3-d is full filled
B) 7 electrons in s-orbitals
C) 3-d is half filled
D) 8 electrons in s-orbitals

Q.31 Which of the following violates Hund's rule

A) $1s^2, 2s^2, 2p_x^1, 2p_y^1, 2p_z^1$
B) $1s^2, 2s^1$
C) $1s^2, 2s^2, 2p_x^2, 2p_y^2, 2p_z^1$
D) $1s^2, 2s^2, 2p_x^2, 2p_y^0, 2p_z^0$

Q.32 Which one of the following represents most stable configuration of three electrons for ground state of an element in group VA

A) np_x^2, np_y^1, np_z^0
B) np_x^2, np_y^0, np_z^1
C) np_x^1, np_y^1, np_z^1
D) np_x^0, np_y^1, np_z^2

Q.33 Which one of following electronic configuration represents an element that form a simple ion with -3 charge

A) $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$
B) $1s^2, 2s^2, 2p^6, 3s^1$
C) $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$
D) $1s^2, 2s^2, 2p^1$

Q.34 A specie Z has following electronic configuration $1s^2, 2s^2, 2p_x^2, 2p_y^2, 2p_y^2, 3s^2, 3p_x^2, 3p_y^1, 3p_z^1$ What could Z be

A) Ar
B) S
C) Cl^-
D) P^{3-}

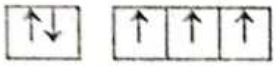
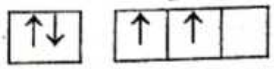
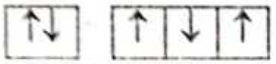
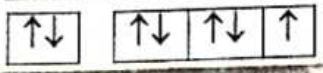
Q.35 The total number of lobes in all the orbitals of a d-subshell are

A) 2
B) 4
C) 16
D) 18

Q.36 "Two electrons in the same orbital should have opposite spins" according to

A) Aufbau's principle
B) Hund's rule
C) Pauli's exclusion rule
D) None of these

Q.37 Which of following configuration is not correct according to Hund's rule

A) 
C) 
B) 
D) 

IONIZATION ENERGY FACTORS AND TRENDS

Q.38 Ionization energy depends upon

A) Atomic/ionic radii
B) Nature of orbital
C) Shielding effect
D) All of the above

Q.39 With the increasing atomic number, ionization energy increases along a period because

A) No change in shielding effect along a period
B) Nuclear pull increases with the increase in number of protons
C) Atomic/ionic size decreases along a period
D) All of the above

Q.40 Which of the following has highest ionization energy value

A) Li
B) Be
C) H
D) He

Q.41 Greater shielding effect corresponds to_____ ionization energy value

A) Greater
B) Lesser
C) Zero
D) Variable

Q.42 Which of the following has maximum 1st ionization energy

A) B
B) C
C) N
D) Na

Q.43 Which of following has highest 2nd ionization energy

A) Na
B) Mg
C) Al
D) Si

Q.44 In given period of periodic table the family with lowest 1st ionization energy is

A) Noble gases
B) Alkaline earth metals
C) Alkali metals
D) Halogens

Q.45 Exceptionally high ionization energies of some groups is due to _____ factor

A) Atomic radius
B) Shielding effect
C) Nuclear charge
D) Nature of orbital

Q.46 The group show abnormal trends in ionization energy are

A) II A and VI A
B) II A and V A
C) III A and VI A
D) VIII A

Q.47 The group that has maximum 1st ionization energy values

A) ns^1
B) ns^2, np^5
C) ns^2
D) ns^2, np^6

ELECTRON AFFINITY

Q.48 Which of following group has maximum 1st electron affinity values in same period

A) V A
B) VII A
C) VI A
D) VIII A

Q.49 Which of the following element has lowest electron affinity

A) N C) Cl

B) O D) He

Q.50 The energy released when a electron adds to an empty or partially field orbital of an isolated gaseous atom in its valance shell to form an anion is called

A) Ionization energy C) Electron affinity

B) Electronegativity D) Electro positivity

PAST PAPERS QUESTIONS

Q.1 The charge of one gram of electron is

A) $1.7588 \times 10^{-11}C$ C) $1.7588 \times 10^{8}C$

B) $1.7588 \times 10^{11}C$ D) $1.602 \times 10^{-19}C$

Q.2 If the charge value of electron 1.7588×10^{11} coulombs Kg^{-1}, then what would be the mass of electron in grams (charge on electron is a 1.60222×10^{-19} coulombs)?

A) $9.1095 \times 10^{-31}g$ C) $9.1095 \times 10^{-28}g$

B) $91.095 \times 10^{-31}g$ D) $0.919095 \times 10^{-33}g$

Q.3 Number of neutrons in $^{66}_{30}Zn$ will be

A) 30 C) 38

B) 35 D) 36

Q.4 The charge on one proton is

A) $1.602 \times 10^{-31}C$ C) $1.602 \times 10^{-27}C$

B) $1.602 \times 10^{-19}C$ D) $1.602 \times 10^{-11}C$

Q.5 The e/m value for the canal rays is maximum for

A) Hydrogen C) Nitrogen

B) Helium D) Argon

Q.6 The nature of cathode rays in discharge tube :

A) Depends upon the nature of the gas used in discharge tube

B) Depends upon the nature of the cathode used in discharge tube

C) Is independent of the nature of the gas used in discharge tube

D) Depends upon the nature of anode in the discharge tube

Q.7 According to the number of protons, neutrons and electrons given in the table, which one of the following option is correct?

Species	Proton	Neutron	Electron
As	33	42	30
Ga	31	39	28
Ca	20	20	20

A) As^{+3}, Ga^{+3}, Ca C) $As^{+3}, Ga^{+3}, Ca^{+2}$

B) As^{+3}, Ga^{+2}, Ca D) As^{+3}, Ga, Ca^{+2}

Q.8 Modern periodic table is arranged in ascending order of?

A) Atomic mass C) mass number

B) Nucleon number D) Proton number

Q.9 Number of electrons in the outermost shell of chloride ion(Cl^-) is

A) 17 C) 1

B) 7 D) 8

Q.10 Number of electrons in $^{71}_{31}Ga^{3+}$ Will be

A) 28
B) 29
C) 30
D) 34

Q.11 Isotopic symbol of ion of Sulphur–33 is $^{33}_{16}S^{-2}$ How many number of protons and neutrons are present if number electrons are 18?

A) p = 18, n = 15
B) p = 16, n = 17
C) p = 16, n = 18
D) p = 17, n = 16

Q.12 Among the following, which contains same no. of electrons & proton but different no. of neutron:

A) Isobars
B) Isotopes
C) Isotones
D) None of the these

Q.13 Which quantum number tells us about orientation of orbitals:

A) Principal quantum number
B) Azimuthal quantum number
C) Spin quantum number
D) Magnetic quantum number

Q.14 The relative energies of 4s, 4p and 3d orbitals are in the order

A) 3d < 4p < 4s
B) 4s < 3d < 4p
C) 4p < 4s < 3d
D) 4p < 3d < 4s

Q.15 Correct order of energy in the given sub-shells is:

A) 5s > 3d > 3p > 4s
B) 5s > 3d > 4s > 3p
C) 3p > 3d > 5s > 4s
D) 3p > 3d > 4s > 5s

Q.16 There are four orbitals s, p, d and f. Which order is correct with respect to the increasing energy of the orbitals

A) 4s < 4p < 4d < 4f
B) 4p < 4s < 4f < 4d
C) 4s < 4f < 4p < 4d
D) 4f < 4s < 4d < 4p

Q.17 Maximum numbers of electron in a sub-shell is given by

A) $2(2l-1)$
B) $2(l+1)$
C) $2(2l+1)$
D) $2l+1$

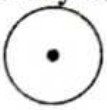
Q.18 The order of energy level in ^{19}K is?

A) 4s, 4p
B) 3p, 4s
C) 4s, 3d
D) 3s, 3d

Q.19 With increase in the value of principal quantum number 'n', the shape of the s-orbitals remain same although their sizes

A) Decrease
B) Increase
C) Remain the same
D) May or may not remain the same

Q.20 Identify the correct option associated with the shape of p-orbital:

A) 

B) 

C) 

D) 

Q.21 Which of the following element in its gaseous atomic state has electrons fully occupying first two spherically symmetrical orbitals?

A) Oxygen
B) Beryllium
C) Helium
D) Carbon

Q.22 Which one of the following pairs has the same electronic configuration as possessed by neon (Ne-10)

A) Na^+, Cl^-
B) K^+,Cl^-
C) Na^+, Mg^+
D) Na^+, F^-

Q.23 The maximum number of electrons in electronic configuration can be calculated by using formula:

A) $2l+1$
B) $2n^2+2$
C) $2n^2$
D) $2n^2+1$

Q.24 Which is the correct electronic configuration of chromium ($_{24}Cr$)?

A) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^4$
B) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^6$
C) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^5$
D) $1s^2, 2s^2, 3s^2, 3p^6, 3p^6, 4s^2, 3d^6$

Q.25 Nitrogen has the atomic mass of 7. Which of the following electronic configurations is of a Nitrogen atom in ground state?

A) $1s^2,2s^2,2px^1,2py^1,2pz^1$
B) $1s^2,2s^2,2px^2,2py^1$
C) $1s^2,2s^2,2py^2,2pz^1$
D) $1s^2,2s^2,2px^2,2pz^1$

Q.26 The ionization energy of hydrogen atom is

A) Zero
B) 13.13kJ/mole
C) 1313kJmole
D) 1313kJ/mole

Q.27 The elements for which the value of ionization energy is low can

A) Gain electrons readily
B) Lose electron less readily
C) Gain electrons with difficulty
D) Lose electron readily

Q.28 Electron affinity of the atom is the energy released when

A) Electron is added to gaseous atom
B) Covalent bond of molecule is broken
C) Electron is removed from gaseous atom
D) Covalent bond is formed between the atoms

Q.29 The shielding effect of inner electron is responsible for

A) Decreasing ionization energy
B) Increasing ionization energy
C) Having no effect on ionization energy
D) Increasing electronegativity

Q.30 Which of the following sub-shell has no degenerate orbital

A) s
B) p
C) d
D) f

ANSWER KEY

1	D	11	D	21	B	31	A	41	B
2	C	12	B	22	C	32	C	42	C
3	C	13	D	23	A	33	C	43	A
4	B	14	A	24	B	34	B	44	C
5	A	15	D	25	B	35	A	45	D
6	B	16	C	26	B	36	C	46	C
7	A	17	C	27	A	37	B	47	D
8	D	18	C	28	C	38	D	48	B
9	B	19	C	29	C	39	D	49	D
10	C	20	A	30	A	40	D	50	C

PAST PAPER QUESTIONS

1	C	6	C	11	B	16	A	21	B	26	D
2	C	7	A	12	B	17	C	22	D	27	D
3	D	8	D	13	D	18	B	23	C	28	A
4	B	9	D	14	B	19	B	24	C	29	A
5	A	10	A	15	B	20	B	25	A	30	A

EXPLANATORY NOTES

Q.1 Mass of one electron = 9.1095×10^{-31}kg

9.1095×10^{-31}kg = 1 electron

1 kg = $1/9.1095 \times 10^{-31}$ electron

1kg = 1.0978×10^{30} electron

Charge on 1kg electrons = number of electrons in 1 kg × charge on an electron

$= 1.0978 \times 10^{30} \times 1.602 \times 10^{-19}$

$= 1.758 \times 10^{11} Ckg^{-1}$

Q.5 α-prticle is He^{+2} or He-nulcei which is composed of two protons and two neutron. The mass of a neutron is slightly greater than the mass of proton therefore α-prticle slightly havier than four times the mass of a proton in the same way the mass α-prticle slightly less than four times the mass of a neutron

Q.7 Number is neutron = mass number – atomic number

$N = A - Z$

$= 68 - 31$

$N = 37$

Q.8 Isoelectronic species are those species that have same number of electorns

The Cl atom has 17 electrons while O_2^{-1} too has 17 electrons (8 + 8 + 1e)

NOTE: Number of electron in poly atomic ions = Algebraic some of Z – charge on ion

Q.9

Species	No. of $e^- = Z - q$	No. of $n = A - Z$
Mg^{+2}	$e^- = 12 - (+2) = 10$	$n = 24 - 12 = 12$
O^{-2}	$e^- = 8 - (-2) = 10$	$n = 16 - 8 = 8$
Na^+	$e^- = 11 - (+1) = 10$	$n = 23 - 11 = 12$
F^{-1}	$e^- = 9 - (-1) = 10$	$n = 19 - 9 = 10$

Q.10 "M" shell is 3rd is which includes 3s, 3p and 3d subshells. So, the number of electrons in 3s, 3p and 3d will be number of electron "M" shell. The atomic number of Fe is 26 its electronic configuration is $1s^2, 2s^2, 3p^6, \mathbf{3s^2, 3p^6}, 4s^2, \mathbf{3d^6}$

Q.11 No. of e^- = Z – charge on ion

K	P^{-3}	S^{-2}	Si^{-4}
19–(+1)	15–(–3)	16–(–2)	14–(–4)
$18e^-$	$18e^-$	$18e^-$	$18e^-$

Q.12 There are three type of fundamental sub-atomic particles out of which only two types of fundamental sub-atomic particles (Proton and neutron) are in nucleus

These are called nuclear fundamental sub-atomic particles

Q.13 Chemical properties of elements depend upon atomic number while physical proepties are said to be dependent on mass number. Isotopes which are having same atomic number do have same chemical peroeprties while they have different physical properties because of having different mass number

Q.14 The standard method to represent an element is to write mass number (A) on left top corner of symbol of element while atomic number (Z) at left bottom corner ${}^{A}_{Z}X$.

Q.15 The Schrodinger wave equation when solved for a three dimensional waves, it provides three quantum number values.
n (Shell)
l (sub-shell)
m (orbital)
These three values are associated to the position of electron in an atom while spinning of electrons does not relate to the position of electron in an atom

Q.16 The space between two shells where the finding probability of electron is zero is called nodal plane. Therefore, the electron density in the nodal plane is zero.

Q.17 The orbitals having same energy are called degenerate orbitals. The subshell of sausage shape is d-subshell and it has 5-degenerate orbitals according to the formula $(2l + 1)$

Q.18 A shell is represented by n, subshell is represented by nl and an orbital is represented by nlm. For 3p(n = 3 and $l = 1$)

Q.19 The number of electrons accommodated in a subshell is according to the formula $2(2l+1)$.
For p-subshell $l=1$
number of electrons = $2(2(1)+1) = 6$

Q.20 The energies of the sub-shells is determine by $(n + l)$ rule
A) $(n+l) = 5+3 = 8$
B) $(n+l) = 4+3 = 7$
C) $(n+l) = 5+2 = 7$
D) $(n+l) = 4+0 = 4$

Q.21 The number of "m" values for a subshell is calculated by the formula $(2l+1)$
For d-subshell, $l = 2$
Number of "m" values for d-subshell = $2(2)+1 = 5$

Q.22 The orbital of a subshell having large l-value will have high energy if different subshell are having same values of "n"

Q.23 The 19th electron of copper is filled in 4s, for which n = 4, $l = 0$, m = 0, s = +1/2
$_{29}Cu = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, \mathbf{4s^1}, 3d^{10}$

Q.26 d_{xy}, d_{yz} d_{xz} and d_{x2-y2}, all have 4 lobes each while **d_{z2} orbital is bi-lobed with a collor**

Q.27 The electronic configuration $1s^2, 2s^2, 2p_x^1\ 2p_y^1\ 2p_z^1$ is of nitrogen atom in its gram state because no electron is shifted from subshell of low energy to a subshell of high energy

Q.28 The correct electronic configuration Cu is $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^{10}$. An electron from 4s is promoted to 3d subshell to make it full filled

NOTE: Full filled subshell electronic configuration makes an atom extra stable

Q.29 $_{18}Ar = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6 = 18e^-$

$_{22}Ti = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^2 = 22e^-$

$_{22}Ti^{+4} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6 = 18e^-$

Q.30 $_{24}Cr = \mathbf{1s^2, 2s^2}, 2p^6, \mathbf{3s^2}, 3p^6, \mathbf{4s^1}, 3d^5$

$_{29}Cu = \mathbf{1s^2, 2s^2}, 2p^6, \mathbf{3s^2}, 3p^6, \mathbf{4s^1}, 3d^{10}$

Both Cr and Cu have 7 electrons in their s-subshells

Q.31 According to Hund's rule if two electrons are to be placed in 3 orbitals of p-subshell then the two electrons will be placed separately with the same spin
The two electrons should not be placed in one orbital of p-subshell

Q.32 Hund's rule must be followed while filling electrons in the p-subshell of last shell / outer most shell.

Q.33 The elements of VA have 5 electrons in their outer most shell i.e. ns^2, np^3

So, they can accommodate 3 electron in their outer most shell to form a simple ion having –3 charge

Q.34 In "Z" the last shell (3^{rd} shell) is having 6 electrons. "Z" belongs to VI-A group and it is Sulphur

Q.35

Orbitals	d_{xy}	d_{yz}	d_{xz}	$d_{x^2-y^2}$	d_{z^2}	Total number of Orbitals
Number of lobes	4	4	4	4	2	5

Q.36 The two electrons residing in an orbital must have opposite spin or must not have same spin, was stated by Pauli

Q.37 The three electrons in three degenerate orbitals of p-subshell must be placed separately with same spin rather than putting any one of them with opposite spin

Q.38 I.E $\propto$ 1/atomic or ionic radius

Large size makes nuclear grip weak on electrons

Order of ease to remove electron

$s < p < d < f$

I.E $\propto$ 1/shielding effect

Higher shielding effect makes nuclear grip weak on electrons

Q.39 I.E $\propto$ 1/atomic size

The atomic size generally decreases along the period left to right

I.E $\propto$ 1/shielding effect

The shielding effect remains almost constant along the period because number shells remains constant

I.E $\propto$ Z

Increase in Z (proton number / nuclear charge) is effective along the period left to right because shielding effect remains almost constant

Q.40 $\text{I.E} \propto \frac{1}{\text{size}}$

So, He has highest I.E value because of having smallest size

Q.41 $I.E \propto \frac{1}{\text{Shielding effect}} \propto \frac{1}{\text{No. of interveening electrons}} \propto \frac{1}{\text{No. of shells}}$

Q.42 The size of nitrogen atom is smallest an its p-subshell is half filled which makes it most stable hence making it ionization value highest among all

Q.43 Sodium contains only one electron in its outer most shell hence 2^{nd} electron is to be removed from inner shell which makes its 2^{nd} ionization energy value highest among all

Q.44 Alkali metal of the respective period has the least atomic number (proton number / nuclear charge) which results in weakest nuclear grip on outer most electrons and largest size in the respective period. This makes their ionization energy very low.

Q.45 In periods II-A group elements have full filled s-subshell and V-A group elements half-filled p-subshell electronic configuration. This mode of electronic configuration makes the elements of these group extra stable. Therefore their ionization energy values are exceptionally high.

Q.46 In periods II-A group elements have full filled s-subshell and V-A group elements half-filled p-subshell electronic configuration. This mode of electronic configuration makes the elements of these group extra stable. Therefore, their ionization energy values are exceptionally high.

This results an appearance that elements of group IIIA and VIA are showing abnormal trend while moving left to right in a period

Q.47 The full filed outer shell electronic configuration like ns^2, np^6 (noble gases) make them extra stable. Therefore, the ionization energy values of VIII-A are highest in their respective period

Q.48 The electron affinity increases up to group VII-A while move left to right in the period

NOTE: Electron affinity of VIII-A is positive

Q.49 He is a noble and its outer most shell is completely filled (duplet rule). This makes He highly stable hence it has lowest electron affinity.

4A Topic CHEMICAL BONDING

PRACTICE EXERCISE

IONIC BOND OR ELECTROVALENT BOND

Q.1 Formation of chemical bond takes place when

A) Forces of repulsion > Forces of attraction
B) Forces of repulsion = Forces of attraction
C) Forces of attraction > Forces of repulsion
D) Energy is absorbed

Q.2 The central atom which may not follow the octet rule while forming covalent bond -

A) C
B) P
C) O
D) F

Q.3 An ionic compound A^+B^- is most likely to form when:

A) Ionization energy of A is high and electron affinity of B is low
B) Ionization energy of A is low and electron affinity of B is high
C) Both the ionization energy and the electron affinity of A and B are high
D) Both the ionization energy and the electron affinity of A and B are low

Q.4 Formation of ionic bond is favoured by

A) High I. E of metal
B) Low E.A of nonmetal
C) Low lattice energy
D) Low I.E of metal

Q.5 Maximum ionic character is exhibited by

A) NaCl
B) KCl
C) CsF
D) HF

DOT AND CROSS DIAGRAM FOR COVALENT AND CO-ORDINATE BONDS

Q.6 All of the following species have dative bond except

A) OH^-
B) NH_4^+
C) BF_4^-
D) H_3O^+

Q.7 Which one shows high %age of the ionic character

A) HI
B) HCl
C) HF
D) HBr

Q.8 Co-ordinate covalent bond is present in

A) Nitride ion
B) Hydronium ion
C) Chloronium ion
D) All of these

Q.9 The percentage of co-covalent bond present in BF_4^- and NH_4^+ respectively

A) 25% and 33%
B) 33% and 25%
C) 33% each
D) 25% each

Q.10 Which of the following molecule contain six bonding electrons

A) NH_3
B) H_2O
C) CO_2
D) C_2H_4

SHAPES AND BOND ANGLES OF MOLECULES (VSEPR THEORY)

Q.11 The structure of water is:

A) Trigonal
B) Angular
C) Linear
D) Tetragonal

Q.12 The following molecules has linear structure except?

A) CS_2 C) CO_2
B) SO_2 D) $BeCl_2$

Q.13 Which of the following species has lone pair of electrons on central atom?

A) CH_4 C) PCl_5
B) NH_4^+ D) PCl_3

Q.14 Which pair has trigonal planar geometry

A) NH_3, PH_3 C) BF_3, AlH_3
B) H_2O, C_2H_2 D) CO_2, SO_2

Q.15 The electronic geometry of NH_3 is

A) Trigonal pyramidal C) Bent
B) Trigonal planner D) Tetrahedral

Q.16 The shape of NH_2^- is

A) Linear C) Angular
B) Pyramidal D) Tetrahedral

Q.17 NH_4^+ and H_3O^+ are examples of ____ and ___ system respectively

A) AB_3E, AB_2E C) AB_4, AB_3E
B) AB_2, AB_4 D) AB_4, AB_4

Q.18 Which molecular geometry is not possible for AB_4 type molecules

A) Trigonal planar C) Tetrahedral
B) Trigonal pyramidal D) Angular

COVALENT BONDING (VBT + HYBRIDIZATION)

Q.19 Limitation to valence bond theory (VBT) is that:

A) It doesn't address the shapes of the molecules
B) It doesn't involve the criteria of bond formation
C) It doesn't satisfy the concept of valency for all elements
D) None of the above

Q.20 End to end overlapping of orbitals give rise to the formation of:

A) Sigma bond C) Pi bond
B) Metallic bond D) Co-ordinate covalent bond

Q.21 Pi bonds are produced by overlapping of

A) Un-hybrid orbitals C) Hybrid orbitals
B) Hybrid and un-hybrid orbitals D) Atomic orbital and hybrid orbital

Q.22 The concept of hybridization was given to remove which of following drawback (s) of V.B.T

A) It does not explain paramagnetism of O_2
B) It does not explain odd electron system
C) It could not explain tetravalency of carbon
D) All of above

Q.23 Cl_2 molecule is formed by the overlap of

A) s-s orbital C) p-p head on overlapping of orbitals
B) s-p orbital D) p-p parallel overlapping of orbitals

Q.24 Which of the following statements is not correct?

A) Double bond is stronger than single bond C) Triple bond is shorter than double bond
B) σ bond is stronger than π bond D) σ bond is weaker than π bond

Q.25 Which of following may form π- bond

A) sp^3 C) 3pz
B) 2s D) None of these

Q.26 The correct order of bond angles is represented in

A) $CH_4 > H_2O > NF_3 > H_2S$ C) $H_2S > H_2O > CH_4 > NF_3$
B) $CH_4 > NF_3 > H_2O > H_2S$ D) $CH_4 > H_2S > H_2O > NF_3$

Q.27 Which of the following has perfect triangular structure

A) CO_2 C) PH_3
B) NO D) SO_3

Q.28 The process in which the orbitals of different energies and shape mix with each other to give equivalent hybrid orbitals is called:

A) Dissolution C) Resonance
B) Hybridization D) Ionization

Q.29 The shape of which of following molecules can be explained with concept of VSEPR theory

A) F_2 C) HCl
B) N_2 D) NH_3

Q.30 In which of following molecules central atom is not sp^3 hybridized

A) NH_4^+ C) $\bar{N}H_2$
B) NH_3 D) NO_3^-

Q.31 In ground state the unpaired electrons in carbon are

A) 1 C) 3
B) 2 D) 4

Q.32 The number of true π bonds in benzene molecule are

A) 3 C) 12
B) 6 D) None of these

BOND ENERGY, BOND LENGTH AND BOND POLARITY

Q.33 Dipole moment gives the information about:

A) % ionic character C) Bond angles
B) Geometry of the molecules D) All of the above

Q.34 Bond length depends upon

A) Hybridization on central atom C) Nature of molecule
B) Size of central atom D) All of these

Q.35 Product of charge and distance is called

A) Polarizability C) Polarizing power
B) Charge and force work D) Dipole moment

Q.36 Choose the incorrect relationship of bond energies

A) Br – Br > I – I C) Cl – Cl > F – F
B) C ≡ C > N ≡ N D) All are correct

Q.37 The S.I unit of dipole moment is

A) Debye C) pm
B) mC D) Both A and B

Q.38 Which of the following molecules has non-zero dipole moment.

A) CH_3Cl C) BF_3
B) CO_2 D) CCl_4

Q.39 Maximum dipole moment is possessed by

A) H_2O C) H_2S
B) CO D) CH_4

Q.40 The experimentally determined bond length of C—Cl is 176.7pm and C—C is 154pm what would be the radius of Cl atom

A) 22.7pm C) 99.7pm
B) 176.7pm D) 330.7pm

INTERMOLECULAR FORCES (SPECIELLY HYDROGEN BONDING)

Q.41 $CHCl_3$ exist in liquid state due to

A) Dipole-dipole and London dispersion forces
B) Dipole induced dipole forces
C) Dipole–dipole forces
D) Hydrogen bonding

Q.42 The highest boiling point among the following is for

A) NH_3 C) Br_2
B) $CHCl_3$ D) Xe

Q.43 All the metals shine when they are freshly cut. The reason is

A) The conductivity of the metal is increased
B) The process of cutting gives energy to the metal atoms
C) The electrons become less delocalized according to valance bond theory
D) The electrons are excited at higher energy levels and emit the photons when they fall back

Q.44 Which fact is not related to metals

A) Cations are surrounded by delocalized electrons
B) Can be explained with electron gas theory
C) All metals are very hard
D) Lustrous, ductile and malleable

Q.45 In NH_3, dominant Van der Waal's force among following is

A) London dispersion forces C) Dipole induced dipole forces
B) Dipole–dipole forces D) Hydrogen bonding

Q.46 When ammonia is dissolved in water, number of hydrogen bonds formed by ammonia are

A) 1 C) 2
B) 4 D) 3

INTERPRETION AND PREDICTION OF EFFECT OF DIFFERENT TYPES OF BONDING ON PHYSICAL PROPERTIES OF SUBSTANCES

Q.47 Polar molecular solid among following is

A) Solidified Xe C) P_4
B) $C_6H_{12}O_6$ D) Solid CO_2

Q.48 If the sharing of an electron pair is unequal and the atom have an electronegativity difference of 1.4 to 1.6, what is this type of sharing called

A) Ionic C) Polar covalent
B) Non-polar covalent D) Metallic

Q.49 Nature of bonding affects the properties like:

A) Solubility C) Melting, boiling points and isomerism
B) Reaction kinetics D) All of these

Q.50 Compound in which only covalent bonds are present

A) NaOH C) CaO
B) NH_4Cl D) H_2O

PAST PAPERS QUESTIONS

Q.1 Which one of the following is the correct dot and cross diagram of bonding between two chlorine atoms

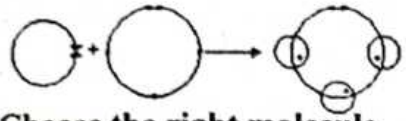
A) $:\dot{\underset{\cdot\cdot}{Cl}}\cdot + :\dot{\underset{\cdot\cdot}{Cl}}: \longrightarrow :\underset{\cdot\cdot}{\overset{\cdot\cdot}{Cl}}:$

B) $:\dot{\underset{\cdot\cdot}{Cl}}\cdot + :\dot{\underset{\cdot\cdot}{Cl}}: \longrightarrow :\underset{\cdot\cdot}{\overset{\cdot\cdot}{Cl}}: + :\underset{\cdot\cdot}{\overset{\cdot\cdot}{Cl}}:$

C) $:\dot{\underset{\cdot\cdot}{Cl}}\cdot + :\dot{\underset{\cdot\cdot}{Cl}}: \longrightarrow :\underset{\cdot\cdot}{\overset{\cdot\cdot}{Cl}}\cdot\cdot\underset{\cdot\cdot}{\overset{\cdot\cdot}{Cl}}:$

D) $:\dot{\underset{\cdot\cdot}{Cl}}\cdot + \dot{Cl} \longrightarrow :\underset{\cdot\cdot}{\overset{\cdot\cdot}{Cl}}: + Cl$

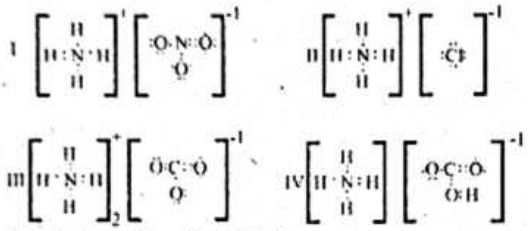
Q.2



Choose the right molecule

A) CH_3
B) CO
C) H_2O
D) NH_3

Q.3 Observe the given dot and cross structures for the following molecules or ionic species.



The co-ordinate covalent bond exists between:

A) N and C atoms in structure III and IV
B) N and one H ion in all four structure
C) N and Cl atoms of structure II
D) N and N atoms of structure I

Q.4 According to Valence shell electron pair repulsion theory, the repulsive forces between the electron pairs of central atom of a molecule are in the order

A) Lone pair bond pair> Lone pair-Lone pair
B) Bond pair> Bond pair> Lone pair-Lone pair> Lone pair-Bond pair
C) Lone pair-Bond pair> Bond pair-Bond pair> Lone pair-Lone pair.
D) Lone pair-Lone pair>Lone pair-Bond pair>Bond pair-Bond pair

Q.5 What is the exact value of angle in BF_3

A) 90°
B) 119.5°
C) 104.5°
D) 120°

Q.6 Which option show all the molecules with bond angle 109.5°.

A) $SiCl_4$, NH_4^+, CH_4
B) CH_4, CCl_4, NH_3
C) $SiCl_4$, H_2O, $BeCl_2$
D) CH_4, NH_4^+, PH_3

Q.7 The structure of Xenon trioxide is shown below,



With reference to the Valence shell electron pair repulsion theory, (VSEPR), the shape of XeO_3 is:

A) Tetrahedral
B) Bent (or angular)
C) Trigonal pyramidal
D) Trigonal planar

Q.8 **Which of the following sets constitutes of all the molecules and ions of non-planar geometry?**

A) $SO_2, C_2H_4, BF_3, NO_3^-$
B) $CH \equiv CH, H_2O, BeCl_2, H_2S$
C) $CH_4, NH_4^+, MnO_4^-, NF_3$
D) PH_4^+, NH_3, SO_3, Benzene

Q.9 **The shape of CO_2 molecule is similar to**

A) H_2S
B) $SnCl_2$
C) SO_2
D) BeF_2

Q.10 **What is the shape of ammonia NH_3 molecule?**

A) Pyramidal
B) Tetrahedral
C) Linear
D) Trigonal planar

Q.11 **The number of bonds in nitrogen molecule is**

A) One σ and one π
B) One σ and two π
C) Three σ only
D) Two σ and one π

Q.12 **When the two partially filled atomic orbital overlap in such a way that the probability of finding the electron is maximum around the line joining the two nuclei, the result is the formation of**

A) Sigma bond
B) Pi-bond
C) Hydrogen bond
D) Metallic bond

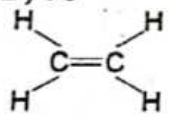
Q.13 **pi- bond is formed by sideways overlap of**

A) s-orbital
B) p-orbital
C) d-orbital
D) None of these

Q.14 **The angle between un-hybridized p-orbital and three sp^2 hybrid orbitals of each carbon atom is**

A) 120°
B) 90°
C) 109.5°
D) 180°

Q.15



Count the number of σ bonds and π bonds in the molecule

A) 1π and 5σ bonds
B) 2π and 4σ bonds
C) 3π and 3σ bonds
D) 6π and 6σ bonds

Q.16 **Which if the following molecule has largest number of shared pair electrons?**

A) NH_3
B) C_2H_4
C) CO_2
D) N_2

Q.17 **Which one of the following molecules has sp^3 hybridization?**

A) CH_4
B) C_2H_4
C) C_2H_2
D) CO_2

Q.18 **According to the Lewis Concept, ammonia is a lone pair donor, therefore easily accepts a proton to form an ammonium ion as given by an equation**

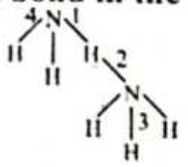
$$NH_{3(g)} + H^+_{(aq)} \rightarrow NH^+_{4(aq)}$$

A) H–N–H bond angle decrease from 180°-109.5°
B) H–N–H bond angle decrease from 107°-104.5°
C) H–N–H bond angle decrease from 107°-109.5°
D) H–N–H bond angle decrease from 109.5°-120°

Q.19 DNA molecule is double stranded , in which two chains of DNA are twisted around each other by:

A) Hydrogen bonds
B) Covalent bonds
C) Van der Waal's forces
D) Dative bonds

Q.20 Which bond in the following structure represents hydrogen bonding?



A) 1
B) 3
C) 2
D) 4

Q.21 Which of the following substances exhibits hydrogen bonding?

A) H_2S
B) NH_3
C) HI
D) SiH_4

Q.22 In 'H-F' bond Electronegativity difference is 2.0. What is the type of this bond?

A) Polar covalent bond
B) Non-polar covalent bond
C) pi (π) bond
D) Co-ordinate covalent bond

Q.23 Which of the following molecule has zero dipole moment?

A) PCl_3
B) NH_3
C) BF_3
D) H_2O

Q.24 Boiling point of water is higher than petrol , because intermolecular forces in water are :

A) Weaker than petrol
B) Same as in petrol
C) Stronger than petrol
D) Negligible

Q.25 Metallic conduction involves the relatively free movement of their---------- throughout the metallic lattice:

A) Atoms
B) Ions
C) Electrons
D) Molecules

Q.26 Which type of force is present in gasoline?

A) Dipole-dipole forces
B) Dipole-induced dipole forces
C) Hydrogen bonding
D) London dispersion forces

Q.27 Which one of the following hydrogen bond is stronger than others?

A) $N^{\delta-} - H^{\delta+} \cdots\cdots N^{\delta-} - H^{\delta+}$
B) $F^{\delta-} - H^{\delta+} \cdots\cdots F^{\delta-} - H^{\delta+}$
C) $O^{\delta-} - H^{\delta+} \cdots\cdots O^{\delta-} - H^{\delta+}$
D) $N^{\delta-} - H^{\delta+} \cdots\cdots O^{\delta-} - H^{\delta+}$

Q.28 Which one of the following has zero dipole moment:

A) NH_3
B) $CHCl_3$
C) H_2O
D) BF_3

Q.29 An inter molecular force of attraction X is relatively stronger than the other inter molecular forces, it stabilizes αhelix and β-pleated sheets of proteins. The double helical structure of DNA is also stabilized by this force of attraction. Identify X.

A) Dipole dipole attraction
B) Ionic interactions
C) Hydrogen bonding
D) van der Waal's Forces

Q.30 Among the following molecules, which one has coordinate covalent (dative) bond?

A) CCl_4
B) CO_2
C) CO
D) CH_4

ANSWER KEY

1	C	11	B	21	A	31	B	41	C
2	B	12	B	22	C	32	D	42	B
3	B	13	D	23	C	33	D	43	D
4	D	14	C	24	D	34	D	44	C
5	C	15	D	25	C	35	D	45	D
6	A	16	C	26	A	36	B	46	A
7	C	17	C	27	D	37	B	47	B
8	B	18	A	28	B	38	A	48	C
9	D	19	C	29	D	39	A	49	D
10	A	20	A	30	D	40	C	50	D

PAST PAPER QUESTIONS

1	C	6	A	11	B	16	B	21	B	26	D
2	D	7	C	12	A	17	A	22	A	27	B
3	B	8	C	13	B	18	C	23	C	28	D
4	D	9	D	14	B	19	A	24	C	29	C
5	D	10	A	15	A	20	C	25	C	30	C

EXPLANATORY NOTES

Q.1 Attractive forces should dominate to keep the atoms together.

Q.2 Phosphorous can make up to five covalent bonds as in PCl_5.

Q.3 One of the atoms should easily lose electrons while other should easily accept it.

Q.4 Metals with low ionization energy can lose electrons easily.

Q.5 Ionic character $\propto$ electronegativity difference. "Cs" has the lowest electronegativity and "F" has the highest electronegativity.

Q.6 OH^- has only one mutually shared pair of electrons.

Q.7 Ionic character $\propto$ electronegativity difference. Electronegativity of H = 2.1, electronegativity of F is highest.

Q.8 Hydronium is formed when H^+ accepts electron pair from O–atom of H_2O.

Q.9 Coordinate character % $= \frac{100}{\text{Total Number of bonds by central atoms}} \times$ No. of dative bonds.

Q.10 Bonding electrons = 2 × number of bonds.

Q.11 Water is AB_4 system with 2 lone pairs and 2 bond pairs.

Q.12 SO_2 has one lone pair $\rightarrow$ AB_3 system.

Q.13 Phosphorous have 5 v. e^- out of which three are used in bonding in PCl_3.

Q.14 Halides and hydrides of IIIA group obey AB_3 system with no lone pairs.

Q.15 It is AB_4 system.

Q.16 NH_2^- is AB_4 system with 2 lone pairs and 2 bond pairs.

Q.17 NH_4^+ has 4 bond pairs and 0 lone pair, H_3O^+ has 3 lone pairs and 1 lone pair.

Q.18

AB_4 <
- 0 L.P → Tetrahedral
- 1 L.P → Pyramedal
- 2 L.P → Bent/angular

Q.19 VBT explains shapes and bond formation.

Q.20 End to end overlapping results in maximum electron density around bond axis to form a strong bond.

Q.21 Hybrid orbitals do not allow sideways overlap.

Q.22 VBT does not explain valencies other than ground state.

Q.23 E.C of $_{17}Cl$ $1s^2, 2s^2, 2p^6, 3s^2, 3p^1{}_x, 2p_y^2, 2p_z^2$

Q.24 σ -bond is formed by head on overlap while π bond is by incomplete overlap.

Q.25 Hybrid orbitals may only form σ bond.

Q.26 B.A $CH_4 = 109.5°$, $H_2O = 104.5°$, $NF_3 = 102°$, $H_2S = 92°$.

Q.27 SO_3 has AB_3 with no lone pairs.

Q.28 Hybridization means intermixing.

Q.29 VSEPR theory explain structures of polyatomic molecules (more than 2 atoms)

Q.30 NO_3^{-1} has triangular planar geometry.

Q.31 Ground state configuration of ${}_6C = 1s^2, 2s^2, 2p^2$.

Q.32 Benzene has delocalized electronic cloud.

Q.33 Dipole moment is related to ionic character and structure of molecule.

Q.34 B.L $\propto$ p character

B.L $\propto$ atomic radius

$$\text{B.L} \propto \frac{1}{\text{Ionic character}}$$

Q.35 $\mu = q \times r$

Q.36 Atomic size of N < C. Bond energy $\propto \frac{1}{\text{atomic size}}$

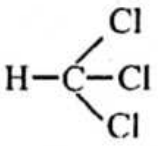
Q.37 $\mu = q \times r$, q = coulumb, r = meter

Q.38 For polyatomic molecules vector sum of all the dipole moments should be zero.

Q.39 H_2O is most polar in given options Δ electronegativity between H and O is higher among given cases.

Q.40 Bond length = $r_C + r_{Cl}$.

Q.41



Structure show ability to develop dipole -dipole forces.

Q.42 $CHCl_3$ has greater size. IMF $\propto$ Size

Q.43 Incident photons cause excitation of electrons which on de-excitation emit photons.

Q.44 Some metals are so soft they can be cut by kitchen knife (e.g. Na)

Q.45 Nitrogen can make hydrogen bonding due to high electronegativity in NH_3.

Q.46 Nitrogen atoms had only one lone pair in NH_3.

Q.47 $C_6H_{12}O_6$ is highly soluble in water like dissolve like (water is polar)

Q.48 For polar covalent bond electronegativity difference should be 0.4 $\rightarrow$ 1.7.

Q.49 Bonding effect all chemical and physical properties.

Q.50

NaOH	=	ionic compound
NH_4Cl	=	Ionic compound
CaO	=	Ionic compound
H_2O	=	Covalent compound

5A Topic CHEMICAL ENERGETICS

PRACTICE EXERCISE

CONCEPT OF ENERGY CHANGES DURING CHEMICAL REACTIONS

Q.1 Calorie is equivalent to

A) 0.4184 J
B) 40.18 J
C) 4.184 J
D) 418.4 J

Q.2 The enthalpy of formation of a compound is:

A) Positive
B) Either positive or negative
C) Negative
D) None of the above

Q.3 Thermodynamics does NOT deal with

A) Heat of reaction
B) Rate of reaction
C) Spontaneity of reaction
D) Entropy of reaction

Q.4 Which of the following is not a state function

A) Thermal energy at constant pressure
B) Enthalpy
C) Internal energy
D) Work done

Q.5 Enthalpy is an expression for the

A) Heat content
B) Internal energy
C) Rate of reaction
D) Activation energy

Q.6 Which one of the following has standard enthalpy of formation is zero

A) $Fe_{(g)}$
B) $Cu_{(s)}$
C) $C_{(l)}$
D) $Na_{(g)}$

Q.7 What is correct about heat of combustion:

A) It is positive in some cases while negative in other
B) It is applicable to gaseous substances only
C) It is always negative
D) It is always positive

Q.8 If an endothermic reaction is allowed to take place very rapidly in air, the temperature of the surrounding air will

A) Remains constant
B) Decrease
C) Increase
D) Either increase or decrease

Q.9 The exothermic process is

A) Evaporation
B) Respiration
C) Sublimation
D) Boiling

Q.10 All of the following are exothermic process except

A) Freezing of water
B) Evaporation
C) Condensation
D) Combustion

Q.11 Which of the following statement is correct

A) ΔH is positive for exothermic reaction
B) ΔH is negative for endothermic reactions
C) The heat of neutralization of strong acid with strong base is always the same
D) The enthalpy of fusion is negative

Q.12 A process, which take place on its own without any outside assistance, is termed as

A) Isothermal process
B) Non-spontaneous
C) Spontaneous
D) Adiabatic process

Q.13 The work done by expansion of gas against constant pressure is

A) $P\Delta V$ C) $-P\Delta V$

B) PV D) ΔPV

Q.14 Which one of the following is applied to calculate lattice energy indirectly?

A) Born-Haber cycle C) Bohr theory

B) Le-Chatelier principle D) All of them

ENTHALPY CHANGE OF REACTION AND BOND ENERGY

Q.15 What is not correct about ΔH_f

A) Its value gives an idea about the relative stability of reactants and the products

B) It is always negative

C) Value depends upon nature of bonds

D) Its value can be greater or less than zero

Q.16 Which of the following has positive value of enthalpy

A) Neutralization C) combustion

B) Atomization D) All of the above

Q.17 $NaOH + HCl \rightarrow NaCl + H_2O$. Enthalpy change in the above reaction is called

A) Enthalpy of reaction C) Enthalpy of formation

B) Enthalpy of neutralization D) Enthalpy of combustion

Q.18 The heat of reaction depends upon

A) Temperature of the reactants

B) Physical states of the reactants and the products

C) Both A) and B)

D) Path of the reaction and the temperature

Q.19 A state function which describes together the internal energy and product of pressure and volume is called

A) Enthalpy C) Work

B) Internal energy D) Kinetic energy

Q.20 Enthalpy of formation of one mole of ionic compound form gaseous ion under standard condition is called

A) Gibb's energy C) Bond energy

B) Lattice energy D) All of these

Q.21 Enthalpy of neutralization (ΔH_n°) per mole of H_2SO_4 / $Ba(OH)_2$ is

A) $-57.4\ kJmol^{-1}$ C) $+57.4\ kJmol^{-1}$

B) $-114.8\ kJmol^{-1}$ D) $114.8 kJmol^{-1}$

Q.22 Which of the following processes has always ΔH = –ve

A) Formation of compound C) Combustion

B) Dissolution of ionic compound D) Dilution of a solution

Q.23 The enthalpy change for the reaction $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$ is called

A) Enthalpy of formation C) Enthalpy of combustion

B) Enthalpy of reaction D) All of these

Q.24 Which equation shows lattice energy for ionic compound

A) $Na_{(s)} + \frac{1}{2}Cl_{2(g)} \rightarrow NaCl_{(s)}$ C) $Na^+_{(aq)} + Cl^-_{(aq)} \rightarrow NaCl_{(aq)}$

B) $Na_{(s)} + Cl_{(g)} \rightarrow NaCl_{(s)}$ D) $Na^+_{(g)} + Cl^-_{(g)} \rightarrow NaCl_{(s)}$

Q.25 Heat absorbed or evolved during the chemical reaction at constant pressure is

A) ΔH C) ΔE

B) ΔV D) $\Delta H+\Delta E$

Q.26 The change in enthalpy of a system when one mole of the substance is completely burnt in excess of air or oxygen is called

A) Heat of reaction C) Heat of atomization

B) Heat of formation D) Heat of combustion

Q.27 Which of the following enthalpy change always have a negative value

A) ΔH_f C) ΔH_c

B) ΔH_{sol} D) ΔH_{at}

Q.28 Neutralization of acid – base is

A) Spontaneous C) Exothermic

B) Non spontaneous D) Both A) and C)

Q.29 $\Delta H°$ represent the enthalpy change at

A) 0°C and 1 atm pressure C) 0K and 1 atm pressure

B) 25°C and 1 atm pressure D) 25°C and 2 atm pressure

Q.30 The enthalpy change ΔH of a process is given by the relation

A) $\Delta H = \Delta E + P\Delta V$ C) $\Delta H = \Delta E - \Delta nRT$

B) $\Delta H = \Delta E + W$ D) $\Delta E = \Delta H + P\Delta V$

Q.31 A system absorbs 100 kJ heat and performs 50 kJ work on the surroundings. The increase in internal energy of the system is

A) 50 kJ C) 100 kJ

B) 150 kJ D) 5000 kJ

Q.32 Which equation represents the atomization of iodine

A) $\frac{1}{2}I_{2(s)} \longrightarrow I_{(s)}$ C) $I_{2(s)} \longrightarrow 2I_{(l)}$

B) $I_{2(l)} \longrightarrow 2I_{(g)}$ D) $I_{2(g)} \longrightarrow 2I_{(g)}$

Q.33 The amount of heat which is involved during the completion of chemical reaction at 25°C and 1 atm pressure is called

A) Heat of neutralization C) Heat of combustion

B) Heat of formation D) Enthalpy of reaction

Q.34 The $\Delta H°f$ of a reaction is recorded for

A) 273 K C) 373K

B) 298K D) 473K

Q.35 Which of the following enthalpies is always negative

A) Enthalpy of solution C) Enthalpy of sublimation

B) Enthalpy of combustion D) Enthalpy of formation

Q.36 Which one of the following equation shows standard enthalpy of combustion

A) $CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$ C) $2CH_{4(g)} + 4O_{2(g)} \rightarrow 2CO_{2(g)} + 4H_2O_{(g)}$

B) $CH_{4(s)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$ D) $CH_{4(l)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$

Q.37 Enthalpy of a reaction can be measured by

A) Glass calorimeter
B) Barometer
C) Manometer
D) Thermometer

Q.38 How much heat is absorbed by 100 g of water when its temperature decreases from 25°C to 5°C? (heat capacity is 4.2 J/gK)

A) 84,000 J
B) 2000/4.2 J
C) – 2000/4.2 J
D) – 84,00 J

Q.39 Enthalpy of combustion of food, fuel and other compounds can be measured accurately by

A) Glass calorimeter
B) Thermometer
C) Bomb calorimeter
D) Manometer

Q.40 Which enthalpy of reaction can not be determined by glass calorimeter

A) Enthalpy of formation
B) Enthalpy of solution
C) Enthalpy of neutralization
D) Enthalpy of combustion

Q.41 Total heat energy (q) can be calculated in a bomb calorimeter by using following formula

A) m x s
B) s x ΔT
C) c x ΔT
D) c x s x ΔT

NUMERICAL MAGNITUDE OF LATTTICE ENERGY

Q.42 In order to determine ΔH_{latt} of ionic compound which is correct relationship

A) $\Delta H_{latt} = \Delta H_f - \Delta H_x$
B) $\Delta H_{latt} = \Delta H_a + \Delta H_v$
C) $\Delta H_{latt} = \Delta H_f + \Delta H_x$
D) $\Delta H_{latt} = \Delta H_f - \Delta H_{sol}$

Q.43 With the increase in charge to size ratio of ions, the lattice energy

A) Remains unaffected
B) Decreases
C) Increases
D) All of these are possible

HESS'S LAW TO CONSTRUCT SIMPLE ENERGY CYCLES

Q.44 Hess's law is analogous to

A) Law of heat summation
B) Law of increasing entropy
C) Law of heat exchange
D) 1st law of thermodynamics

Q.45 According to Hess's law, the enthalpy change for a reaction

A) Depends on path
B) The sum of ΔE and ΔH
C) Independent of the path
D) None of these

Q.46 One of the best applications of Hess's law to calculate the lattice energy of ionic compound is

A) Measurement of enthalpy change in a calorimeter
C) Studying of first law of thermodynamics
B) Born-Haber cycle
D) Measurement of a heat of formation of a compound

Q.47 Which of the following enthalpies of formation cannot be measured directly

A) ΔH^o_{latt} for ionic compound
B) ΔH^o_f for B_2O_3
C) ΔH^o_f for $CO_{(g)}$
D) All of these

Q.48 Born-Haber cycle is an application of

A) Hess's law
B) 1st law of thermodynamics
C) Avogadro's law
D) 1st law of thermochemistry

Q.49 The heat of combustion of ethane (C_2H_6) is –337.0 kcal at 25°C. The heat of the reaction when 3g of ethane is burnt completely is

A) –3.37 kcal
B) –33.7 kcal
C) +3.37 kcal
D) 33.7 kcal

Q.50 **The standard enthalpy changes of formation of carbon dioxide and water are -394 KJmol^{-1} and -286kJ mol^{-1} respectively, if the standard enthalpy change of combustion of propyne, C_3H_4 is -1938 KJ mol^{-1}. What is its standard enthalpy change of formation?**

A) +1258 kJ mol^{-1}
B) -184 kJ mol^{-1}
C) +180 kJ mol^{-1}
D) -680 kJ mol^{-1}

PAST PAPERS QUESTIONS

Q.1 **A spontaneous process is**

A) Unidirectional and irreversible
B) Irreversible and real
C) Unidirectional and real
D) All of above

Q.2 **ΔH will be given a negative sign in**

A) Exothermic reactions
B) Decomposition reactions
C) Dissociation reactions
D) Endothermic reactions

Q.3 **Reactants have high energy than products in**

A) Endothermic reactions
B) Photochemical reactions
C) Exothermic reactions
D) Non-spontaneous reactions

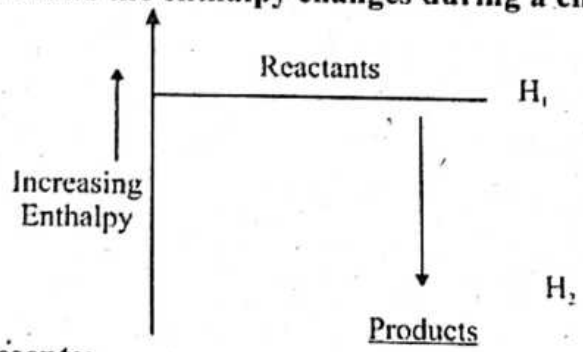
Q.4 **Reaction of water with quick lime result in the rise in the temperature of the system. Using the concentration change, indicate the nature of the reaction?**

A) Third order reaction
B) Non spontaneous reaction
C) Endothermic reaction
D) Exothermic reaction

Q.5 **Which of the following enthalpy change is always exothermic?**

A) Enthalpy of solution
B) Enthalpy of combustion
C) Enthalpy of formation
D) Enthalpy of atomization

Q.6 **The given diagram shows the enthalpy changes during a chemical reaction.**



This diagram represents:

A) An endothermic reaction
B) A non-spontaneous process
C) An exothermic reaction
D) An isothermic process

Q.7 **Heat of formation of MgO is given below. $Mg+1/2O_{2(g)} \rightarrow MgO_{(s)}$ $\Delta H = -692k$ jmol^{-1} This equation shows that:**

A) The product is very stable
B) The reaction is endothermic
C) The product is highly unstable
D) The reactants are very stable

Q.8 **When one mole of gaseous hydrogen ions are dissolved in water to form infinitely dilute solution, amount of heat liberated is**

A) -1075kJ/mol
B) -1891kJ/mol
C) -499kJ/mol
D) -1562kJ/mol

Q.9 **In standard enthalpy of atomization heat of surrounding**

A) Remains same
B) Decreases
C) Increases
D) Increases then decreases

Q.10 **Heat of formation (ΔH°_f) for CO_2 is**

A) -390 kJ/mole
B) -394 kJ/mole
C) +394 kJ/mole
D) -294 kJ/mole

Q.11 $2H_2 + O_2 \longrightarrow 2H_2O \quad \Delta H = 205.5\,kJmol^{-1}$ **what will be the enthalpy change in the above reaction**

A) 205.5 kJ mol^{-1}
B) Zero kJ mol^{-1}
C) - 205.5 kJ mol^{-1}
D) 1 kJ mol^{-1}

Q.12 **The equation that represents standard enthalpy of atomization of hydrogen is (2015)**

A) $\frac{1}{2}H_2O_{(l)} \longrightarrow H_{2(g)} + \frac{1}{2}O_{(g)} \quad +218kJmol^{-1}$

B) $\frac{1}{2}H_2O_{(l)} \longrightarrow H_{2(g)} + \frac{1}{2}O_{(g)} \quad -218kJmol^{-1}$

C) $\frac{1}{2}H_{2(g)} \longrightarrow H_{(g)} \quad +218kJmol^{-1}$

D) $\frac{1}{2}H_{2(g)} \longrightarrow H_{(g)} \quad -218kJmol^{-1}$

Q.13 $\frac{1}{2}H_{2(g)} \rightarrow H_{(g)} \quad \Delta H = 218KJmol^{-1}$

In this reaction ΔH will be called

A) Enthalpy of atomization
B) Enthalpy of decomposition
C) Enthalpy of formation
D) Enthalpy of the dissociation

Q.14 $Mg + \frac{1}{2}O_2 \longrightarrow MgO_{(s)} + -692KJmol^{-1}$ **at STP.**

Enthalpy of the above reaction will be called:

A) ΔH°_{at}
B) ΔH°_{a}
C) ΔH°_{sol}
D) ΔH°_{f}

Q.15 **Determinate the value of Enthalpy of formation of NH_4Cl:**

A) -788 $kJmol^{-1}$
B) -314.55 $kJmol^{-1}$
C) -692 $kJmol^{-1}$
D) None of these

Q.16 **Enthalpy is measured at _____**

A) 300 K and 2 atm
B) 300 K and 1 atm
C) 298 K and 1 atm
D) 295 K and 1 atm

Q.17 **Which enthalpy change is relevant in the following process?**

$Na_{(s)} \rightarrow Na_{(g)} \quad \Delta H = +$

A) Enthalpy of fusion
B) Enthalpy of atomization
C) Enthalpy of vaporization
D) Enthalpy of formation

Q.18 **When two moles of H_2 and one mole of O_2 react to form H_2O 484KJ heat is evolved what is ΔHf for one mole of H_2O**

A) $-484KJmol^{-1}$
B) $-121KJmol^{-1}$
C) $-242KJmol^{-1}$
D) $+242KJmol^{-1}$

Q.19 **For a given reaction** $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$ **the change in enthalpy under standard conditions is called?**

A) Standard enthalpy change of solution
B) Standard enthalpy of neutralization
C) Standard enthalpy change of hydration
D) Standard enthalpy change of formation

Q.20 **50.0 cm^3 of 1.0 mol dm^{-3} hydrochloric acid reacts with 50.0 cm^3 of 1.0 mol dm^{-3} sodium hydroxide. The temperature rises to 6.5°C. Calculate the enthalpy of neutralization. Specific heat capacity of water is 4.18 Jg^{-1} $°C^{-1}$**

A) $-54.0\,KJmol^{-1}$
C) $+54.0\,KJmol^{-1}$
B) $+58.8\,KJmol^{-1}$
D) $-58.8\,KJmol^{-1}$

Q.21 **Which of the equations shows the same "twice" the enthalpy change of neutralization as the following equatio**

$$HCl + NaOH \rightarrow NaCl + H_2O$$

A) $H_2SO_4 + Mg(OH)_2 \rightarrow MgSO_4 + 2H_2O$
B) $MgCO_3 + 2HCl \rightarrow MgCl_2 + CO_2 + H_2O$
C) $NH_4Cl + NaOH \rightarrow NaCl + H_2O + NH_3$
D) $KOH + HCl \rightarrow KCl + H_2O$

Q.22 **Lattice energy of an ionic crystal is the enthalpy of:**

A) Combustion
C) Dissociation
B) Dissolution
D) Formation

Q.23 **Combustion of graphite to form CO_2, can be done by two ways. Reactions are given as follow**

$C + O_2 \longrightarrow CO_2$ $\quad \Delta H = -393.7\,kJmol^{-1}$
$C + \frac{1}{2}O_2 \longrightarrow CO$ $\quad \Delta H_1 = ?$
$CO + \frac{1}{2}O_2 \longrightarrow CO_2$ $\quad \Delta H_2 = -283\,kJmol^{-1}$

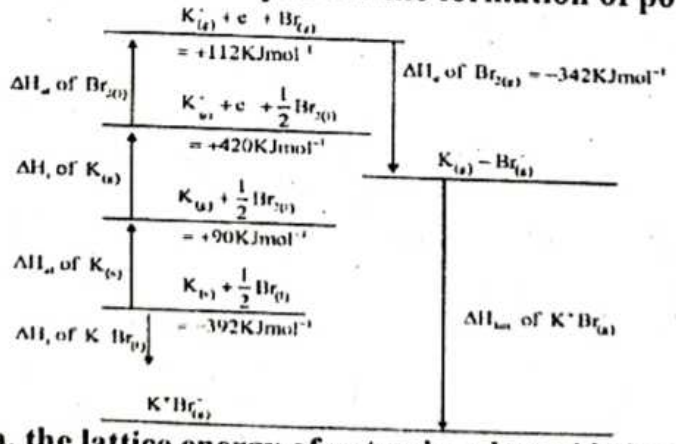
A) – 676 kJ mol^{-1}
C) + 110 kJ mol^{-1}
B) – 110 kJ mol^{-1}
D) 676 kJ mol^{-1}

Q.24 **Calculate the lattice energy of sodium chloride on the basis of Born-Haber cycle when**

$\Delta H_f[NaCl] = -411\,KJmol^{-1}$, $\Delta H_{at}[Na] = +107\,KJmol^{-1}$, $\Delta H_{at}[Cl] = +122\,KJmol^{-1}$,
$\Delta H_{ii}[Na] = +496\,KJmol^{-1}$, $\Delta H_{eat}[NaCl] = -349\,KJmol^{-1}$

A) 376 kJ/mole
C) -376 kJ/mole
B) +787 kJ/mole
D) -787 kJ/mole

Q.25 **The given diagram is a Born-Haber cycle for the formation of potassium bromide.**



Using the given data, the lattice energy of potassium bromide is calculated to be

A) –672kJmol^{-1}
C) –672KCalmol^{-1}
B)–787 kJmol^{-1}
D) +672 Jmol^{-1}

ANSWER KEY

1	C	11	C	21	A	31	A	41	C
2	B	12	C	22	B	32	A	42	A
3	B	13	C	23	D	33	D	43	C
4	D	14	A	24	D	34	B	44	A
5	A	15	B	25	A	35	B	45	C
6	B	16	B	26	D	36	A	46	C
7	C	17	B	27	C	37	A	47	D
8	B	18	C	28	D	38	D	48	A
9	B	19	A	29	B	39	C	49	B
10	B	20	B	30	A	40	D	50	B

PAST PAPER QUESTIONS

1	D	6	C	11	C	16	C	21	A
2	A	7	A	12	C	17	B	22	D
3	C	8	A	13	A	18	C	23	B
4	D	9	B	14	D	19	B	24	D
5	B	10	B	15	C	20	A	25	A

EXPLANATORY NOTES

Q.1 1 Cal = 4.184J

Q.2 $Mg_{(s)} + \frac{1}{2}O_{2(g)} \longrightarrow MgO_{(s)} \quad \Delta H°f = -692kJ/mol$

$\frac{1}{2}N_{2(g)} + O_{2(g)} \longrightarrow NO_{2(g)} \quad \Delta H°f = 33.18kJ/mol$

Q.3 Thermodynamics is study of heat change during a reaction not rate of reaction.

Q.4 As work done is not property of system so not a state function.

Q.6 All the elements in their natural physical state has enthalpy of formation as zero.

Q.7 As combustion produce het is always negative.

$C_{(s)} + \frac{1}{2}O_2 \longrightarrow CO_{2(g)} \quad \Delta H°C = -393.7kJ/mol$

Q.8 Endothermic reaction absorb heat. Heat is taken from surrounding. So, temperature of surrounding air decreases.

Q.9 Respiration involve exothermic process.

Q.10 In evaporation molecule absorb energy and leave the surface of liquid.

Q.11 As per definition strong acid produce 1 mol of H^+ and strong base produce 1 mol of OH^- to form 1 mol of H_2O.

Q.12 Definition

Q.13 Work done by the system is considered negative.

Q.14 By using Born Haber cycle an application of Hess's law we can calculate lattice energies.

Q.15 Enthalpy of formation may be negative or positive.

$Mg_{(s)} + \frac{1}{2}O_2 \longrightarrow MgO_{(s)} \quad \Delta H°f = -692kJ/mol$

$\frac{1}{2}N_{2(g)} + O_{2(g)} \longrightarrow NO_{2(g)} \quad \Delta H°f = 33.18kJ/mol$

Q.16 In atomization molecule is split up into atoms by breaking down the bond as it.

Q.17 Neutralization reaction and enthalpy change is called enthalpy of neutralization.

Q.18 Definition

Q.19 Definition $\Delta H = \Delta E + P\Delta V$

Q.20 Definition $Na^+_{(g)} + Cl^-_{(g)} \longrightarrow NaCl_{(s)} \quad \Delta H°f = -787kJ/mol$

Q.21 $H_2SO_4 + Ba(OH)_2 \longrightarrow BaSO_4 + 2H_2O$

$2H^+ + 2OH^- \longrightarrow 2H_2O \quad q_n = -114.8kJ$

$1H^+ + 1OH^- \longrightarrow 1H_2O \quad \Delta H°n = -57.4kJ/mol$

Q.23 In this reaction 1 mol of CO_2 is formed and 1 mol of C is burnt at the same time can be named as enthalpy of reaction.

Q.25 $\Delta H = q_p$

Q.26 Definition

Q.29 Standard condition

Q.31

$\Delta E = q - w$

$= 100 - 50$ Work done on the surrounding by system is negative.

$= 50kJ$

Q.32 One mole of gaseous atom is formed from the elements under standard condition.

Q.36 1 mol of substance burnt in excess of oxygen enthalpy change is called enthalpy of combustion.

Q.38

$q = m \times s \times \Delta T$

$= 100 \times 4.2 \times 20$

$= 8400$

$= -8400J$

As heat released during reaction is absorbed by H_2O.

Q.43 Smaller the size of ion
Greater the charge on the ion
} → High charge density

Higher the charge density ⟶ Higher the lattice energy

Q.45 Enthalpy change is same, whether the reaction proceeds in direction or indirect way.

Q.49 $C_2H_6 + \frac{1}{2}O_2 \longrightarrow 2CO_3 + 3H_2O \Rightarrow \quad \Delta H = -337kcal$

30g of C_2H_6 produces heat $\Rightarrow$ –337kcal

3g of C_2H_6 produces heat $\Rightarrow$ –33.7kcal

Q.50 $C + O_2 \longrightarrow O_2 \qquad \Delta H = -394$ _____ (i)

$H_2 + \frac{1}{2}O_2 \longrightarrow H_2O \qquad \Delta H = -286$ _____ (ii)

$C_3H_4 + 4O_2 \longrightarrow 3CO_2 + 2H_2O \qquad \Delta H = -1938$ _____ (iii)

Required $3C + 2H_2 \longrightarrow C_3H_4 \qquad \Delta H = ?$

Multiply equation (i) with (iii), equation (ii) with (ii)

Reverse equation (iii) and adding them

$3C + 3O_2 \longrightarrow 3CO_2 \qquad \Delta H = -1182$

$2H_2 + O_2 \longrightarrow 2H_2O \qquad \Delta H = -572$

$3CO_2 + 2H_2O \longrightarrow C_3H_4 + 4O_2 \qquad \Delta H = +1938$

$3C + 2H_2 \longrightarrow C_3H_4 \qquad \Delta H = -184$

6A Topic ELECTROCHEMISTRY

PRACTICE EXERCISE

REDOX PROCESSES + BALANCING CHEMICAL EQUATION BY REDOX METHOD

Q.1 **The oxidation state of carbon-atom in glucose is**

A) +4
B) +6
C) -4
D) None of these

Q.2 **The element on the reactant side which has been reduced is**

$$HI + H_2SO_4 \rightarrow I_2 + SO_2 + H_2O$$

A) H
B) S
C) I
D) O

Q.3 **A redox reaction is**

$$MnO_{2(s)} + 4H^+ \longrightarrow Mn^{+2}_{(aq)} + 2H_2O$$

A) $2e^-$ are added on LHS
B) $2e^-$ are added on LHS
C) $2e^-$ are added on RHS
D) $2e^-$ are added on RHS

Q.4 **In which of the following changes there is a transfer of the five electrons**

A) $MnO_4^{2-} \rightarrow MnO_2$
B) $MnO_4^{1-} \rightarrow Mn^{+2}$
C) $CrO_4^{2-} \rightarrow Cr^{+3}$
D) $Cr_2O_7^{-2} \rightarrow 2Cr^{+2}$

Q.5 **In the reaction $H_2S + Cl_2 \rightarrow 2HCl + S$ H_2S acts as**

A) Reducing agent
B) Oxidizing agent
C) Nitrating agent
D) Sulphonating agent

Q.6 **In which of the following substance done Sulphur exhibit its highest oxidation state**

A) S_8
B) SO_2Cl_2
C) SO_2
D) $Na_2S_2O_3$

Q.7 **What is the oxidation state of oxygen is KO_2**

A) $-\frac{1}{2}$
B) -1
C) -2
D) -3

Q.8 **Apparent charge on an atom of an element in a molecule or ion is called oxidation number. It may be**

A) Positive
B) Negative
C) Zero or fraction
D) All of these

Q.9 **Apparent charge on atom in molecule is**

A) Valency
B) Oxidation number
C) Coordination number
D) Charge number

Q.10 **The oxidation number of oxygen atom in OF_2 and H_2O_2**

A) $-2, -1$
B) $-1, +2$
C) $+2, -1$
D) $+2, +1$

Q.11 **$8H^+ + MnO_4^- \longrightarrow Mn^{2+} + 4H_2O$, which one is correct about given equation**

A) $5e^-$ in R.H.S
B) $3e^-$ in R.H.S
C) $5e^-$ in L.H.S
D) $3e^-$ in L.H.S

Q.12 In which of the following reactions, occur at cathode

A) $Cu^{2+} + 2e^- \rightarrow Cu$

B) $Hg + \frac{1}{2}O_2 \rightarrow HgO$

C) $Cu + 2e^- \rightarrow Cu^{2+}$

D) $Mg + \frac{1}{2}O_2 \rightarrow MgO$

Q.13 In which of the following changes there is a transfer of five electrons

A) $MnO_4^{2-} \longrightarrow MnO_2$

B) $CrO_4^{2-} \longrightarrow Cr^{+3}$

C) $MnO_4^- \longrightarrow Mn^{+2}$

D) $Cr_2O_7^{2-} \longrightarrow 2Cr^{+3}$

STANDARD ELECTRODE (REDOX) POTENTIAL

Q.14 Cell potential depends upon

A) Temperature
B) Nature of electrolyte
C) Concentration of ions
D) All of these

Q.15 When an element is in contact with 1M aqueous solution of its own ions, at 298K then potential is called?

A) Standard reduction potential
B) Reduction potential
C) Standard electrode potential
D) Both "A" and "C"

Q.16 The electric current obtained form galvanic cell is a result of electrons being pushed forced form the negative electrode, through an external wire, to positive electrode. The force with which these electrons move through the wire is called

A) Electromotive force
B) Cell potential
C) Electrode potential
D) Both A) and B)

Q.17 Which is incorrect about standard electrode potential

A) It is the difference of potential of a cell, consisting of particular electrode and the SHE
B) The potential set up, when an electrode is in contact with one molar solution of its ions at standard conditions
C) The electrode potential of a single electrode can be measured directly
D) All of these

STANDARD HYDROGEN ELECTRODE

Q.18 Which is not true about SHE

A) Finely divided platinum black is used as electrode
B) Temperature is kept 25°C
C) One molar solution of H_2SO_4 is used as electrolyte
D) Electrode potential of any element can be calculated by comparison method

Q.19 The oxidation reaction that takes place in the SHE is

A) $H_{2(gas)} \longrightarrow 2H^+_{(aq)} + 2e^-$

B) $2H^+_{(aq)} + 2e^- \longrightarrow H_{2(gas)}$

C) $2H_2O_{(l)} \longrightarrow 2H_{2(g)} + O_{2(g)}$

D) $2H_2O_{(l)} + 2e^- \longrightarrow OH^-_{(aq)} + H_{2(g)}$

Q.20 The working condition/s for SHE

A) 1atm pressure
B) 298K temperature
C) 1M H^+ solution
D) All of these

Q.21 The potential of SHE is taken as zero which is a _____ value

A) Reference
B) Exact
C) Arbitrary
D) Experimental

Q.22 The electrochemical series is based on

A) pH scale
B) Hydrogen scale
C) Redox scale
D) Arrhenius scale

Q.23 Electrochemical series is useful in:

A) Prediction of the feasibility of a chemical reaction
B) Calculation of voltage
C) Comparison of the relative tendencies of the metals and non-metals to get oxidized or reduced
D) All of the above

Q.24 Four metals A, B, C and D are having standard electrode potentials as -3.05, -1.66, -0.4 and 0.8 V respectively. Which one will be the best reducing agent:

A) A
B) C
C) B
D) D

Q.25 The oxidation potential of Mg and Al are +2.37V and 1.66V, respectively. The Mg in chemical reaction:

A) Will be replaced by Al
B) Would not be able to replace Al
C) Will replace Al
D) None of the above

Q.26 The ability of elements to act as reducing agent ____ down to electrochemical series

A) Increases
B) Remains constant
C) Decreases
D) Depends upon the reaction conditions

Q.27 Halogens are placed at lower level of electrochemical series, this indicates that

A) Halogens are good reducing agents
B) Halogens are good oxidizing agents but bad reducing agents
C) Halogens are good oxidizing agents as well as good reducing agents
D) All the above statements are correct

Q.28 Li has least reduction potential in electrochemical series. Which element has highest E^{0}_{red}

A) N
B) O
C) F
D) Cl

Q.29 The value of oxidation potential would be positive if it is

A) Below SHE
B) Equal to SHE
C) Above SHE
D) Both A and B

Q.30 Greater the value of the standard reduction potential of the given specie:

A) Greater is its tendency to accept electrons to undergo reduction
C) Greater is its tendency to accept electron to undergo oxidation
B) Greater is its tendency to lose electrons to undergo reduction
D) Greater is its tendency to lose electrons to undergo oxidation

Q.31 In the following cell representation

$$Zn_{(s)}\left|Zn^{2+}_{(aq)}(1M)\right\|Cu^{2+}_{(aq)}(1M)\left|Cu_{(s)}\right.$$

The line || in the representation shows

A) Salt bridge
B) Electrode
C) Molar concentration
D) Phase boundary

METHODS USED TO MEASURE THE STANDARD ELECTRODE POTENTIALS

Q.32 SHE acts as anode when connected with Cu electrode but cathode with Zn electrode because

A) Zn has less reduction potential than hydrogen and Cu more
B) Zn has high oxidizing potential than hydrogen and Cu more
C) Zn is above in electrochemical series than hydrogen and Cu below
D) All the above are possible reasons

Q.33 In a galvanic cell, the electrode occupying a lower position in the electrochemical series:
A) Will act as Cathode
B) Reduction will take place on it
C) Oxidation will take place on it
D) Both "A" and "B"

Q.34 In Zn / Zn^{+2} (1 M) // Cu^{+2} (1 M) / Cu galvanic cell, which one is incorrect statement
A) Zn is negatively charged
B) Zn will be oxidized
C) Cu is negatively charged
D) Cu^{2+} will be reduced

Q.35 The reaction taking place at anode and cathode are respectively
A) Oxidation and reduction
B) Reduction and oxidation
C) Reduction and hydrolysis
D) Oxidation and hydrolysis

Q.36 In electrochemical series, metal will be easily oxidized if
A) $E^{\circ}_{red} = 0.521$ V
B) $E^{\circ}_{red} = -1.66$ V
C) $E^{\circ}_{red} = 1.08$ V
D) $E^{\circ}_{red} = -0.76$ V

Q.37 If a salt bridge is removed from two half cells
A) Reaction will stop
B) emf drop to zero
C) emf is decreased
D) Electrodes will reversed

STANDARD CELL POTENETIAL

Q.38 The cathode has the reduction potential
A) Less than anode
B) More than anode
C) The same as anode
D) Always zero

Q.39 Al / Al^{+3} || Zn^{+2} / Zn galvanic cell, the negative terminal
A) Al
B) H_2
C) Zn
D) KCl

Q.40 E°_{red} values of metals are W= –3.06 V, X = +2.07 V , Y = –1.85 V , Z = +1.14 V indicate the least reactive metal
A) W
B) Y
C) X
D) Z

Q.41 If the sum of E° values of the two half cells is negative, then:
A) The reaction will be feasible
B) The reaction may or may not be feasible
C) The reaction will not be feasible
D) No prediction can be made

Q.42 The cell will function best if its calculated emf is
A) Small +ve
B) Large +ve
C) Small –ve
D) Large –ve

Q.43 Which of the following metal will liberate hydrogen gas when react with steam
A) Cu
B) Ag
C) Au
D) Mg

Q.44 The overall positive value for the reaction potential predicts that process is energetically
A) Not feasible
B) Feasible
C) Impossible
D) No indication

CONSTRUCTION OF REDOX EQUATION USING THE HALF-EQUATIONS

Q.45 Two half-cell reaction are
$2H^{+} / H_2$, $E^{\circ}_{red} = 0.00$ V
Ag^{+1} / Ag , $E^{\circ}_{red} = +0.80$ V
E°_{cell} of cell is
A) 0.080 V
B) 0.00 V
C) –0.80 V
D) –1.66 V

Q.46 **Overall reaction of fuel cell is $2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$, here the reaction taking place at cathode is**

A) $O_{2(g)} + 2H_2O_{(l)} + 4e^- \longrightarrow 4OH^-_{(aq)}$
C) $2H_2O_{(l)} \longrightarrow H_{2(g)} + 2OH^-_{(aq)}$
B) $H_{2(g)} + 2OH^-_{(aq)} \longrightarrow 2H_2O_{(l)} + 2e^-$
D) $4OH^-_{(aq)} \longrightarrow O_{2(g)} + 2H_2O_{(l)} + 4e^-$

ADVANTAGES OF FUEL CELL

Q.47 **Fuel cells are mostly used in space air crafts as the source of**

A) Power only
C) Drinking water
B) Drinking water and power
D) Fuel and drinking water

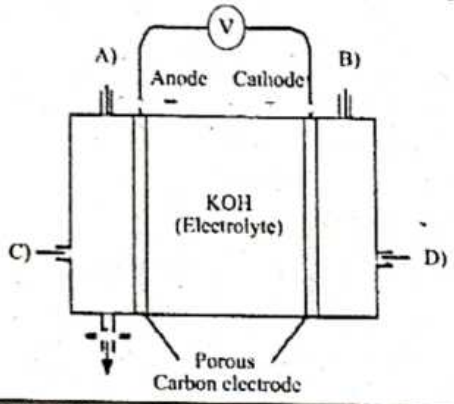
Q.48 **Fuel cells are very efficient. They convert about _____ of fuels bond into electricity**

A) 50%
C) 75%
B) 60%
D) 100%

Q.49 **The electrolyte used in fuel cell is**

A) NaCl solid
C) KCl solid
B) Na_2SO_4 solution
D) KOH solution

Q.50 **In the given diagram of fuel cell, hydrogen intake is represented by**



PREDICTION AND IDENTIFICATION OF PRODUCTS OF ELECTROLYSIS

Q.51 **The electrolysis product of molten NaCl at electrodes**

A) Na and Cl_2
C) H_2 and Cl_2
B) Na and NaOH
D) H_2, Cl_2 and NaOH

Q.52 **During the electrolysis of aqueous KNO_3, H_2 is produced at cathode instead of potassium due to**

A) Reduction potential of "K" is greater than hydrogen
B) Hydrogen is more reactive than potassium
C) Reduction potential of potassium is less than hydrogen
D) All of the above are possible reasons

Q.53 **The cathodic reaction in the electrolysis of dil H_2SO_4 with Pt electrodes**

A) reduction
C) Both oxidation and reduction
B) Oxidation
D) Neither oxidation nor reduction

Q.54 **The product produced at the cathode when aqueous sodium chloride is electrolyzed**

A) H_2
C) Cl_2
B) O_2
D) Na

Q.55 **For the purification of copper, impure copper is made the_____:**

A) Cathode
C) Solution
B) Anode
D) Both A & B

PAST PAPERS

Q.1 The reaction which is responsible for the production of electricity in the voltaic cell is

A) Hydrolysis
B) Reduction
C) Oxidation
D) Redox

Q.2 In all oxidation reactions, atoms of an element in a chemical species lose electrons and increases their

A) Oxidation states
B) Reduction states
C) Electrode
D) Negative charges

Q.3 In $MgCl_2$, the oxidation state of Cl is

A) Zero
B) +2
C) -2
D) -1

Q.4 Which one of the following behave as a redox reaction?

A) $NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl$
B) $2Cl^- \rightarrow Cl_2 + 2e^-$
C) $2Na + Cl_2 \rightarrow 2NaCl$
D) $Na^+ + 1e^- \rightarrow Na$

Q.5 In SO_4^{-2} the oxidation number of sulphur is

A) –8
B) +8
C) –6
D) +6

Q.6 Study the following redox reaction:

$$10Cl^- + 16H^+ + 2MnO_4^- \longrightarrow 5Cl_2 + 2Mn^{+2} + 8H_2O$$

Which statement is true about this reaction?

A) Manganese is oxidized from +7 to +2.
B) Chloride ions are reduced from -1 to zero
C) Chlorine is reduced from zero to -1
D) Manganese is reduced from +7 to +2

Q.7 In NO_3^- the oxidation number of N is

A) +5
B) +2
C) +3
D) –3

Q.8 The oxidation state of carbon in $C_2O_4^{-2}$ is

A) +4
B) +3
C) –4
D) +2

Q.9 The value of oxidation number of chlorine in $HClO_3$ is

A) +7
B) –1
C) +5
D) +3

Q.10 In votaic cell a salt bridge is used in order to

A) Pass the electric current
B) Prevent the flow of ions
C) Mix solutions of two half cells
D) Allow movement of ions between two cells

Q.11 The potential difference of an electrochemical cell is measured by

A) Galvanometer
B) Voltmeter
C) Calorimeter
D) Ammeter

Q.12 In an electrochemical series, elements are arranged on the basis of:

A) pH scale
B) pOH scale
C) pKa scale
D) Hydrogen scale

Q.13 The E° value of standard copper half-cell is +0.34V, measured when it is connected with SHE i.e. Standard hydrogen electrode. In this case the half reaction taking place at SHE is

A) $2H^+_{(aq)} + 2e^- \longrightarrow H_{2(g)}$

B) $2H^+_{(aq)} + 2e^- \longrightarrow 2H_{(g)}$

C) $H_{2(g)} \longrightarrow 2H^+_{(aq)} + 2e^-$

D) $H_{2(g)} \longrightarrow 2H_{(g)} + 2e^-$

Q.14 The standard electrode potential of hydrogen is arbitrarily taken at 298k is _

A) 1.00volt

B) 0.00 volt

C) 0.10 volt

D) 10.0 volt

$Mg^{2+} + 2e^- \rightarrow Mg$	$E^\circ = -2.37V$
$Zn^{2+} + 2e^- \rightarrow Zn$	$E^\circ = -0.76V$
$2H^+ + 2e^- \rightarrow H_2$	$E^\circ = 0.000V$
$Cu^{2+} + 2e^- \rightarrow Cu$	$E^\circ = +0.34V$
$Cl_2 + 2e^- \rightarrow 2Cl^-$	$E^\circ = +1.36V$
$Au^{3+} + 3e^- \rightarrow Au$	$E^\circ = +1.50V$

Keeping in view the values of standard reduction potential given above, which one of the following would you select as a feasible redox chemical reaction?

A) $2Au + 6H^+ \rightarrow 2Au^{3+} + 3H_2$

B) $Mg + 2H^+ \rightarrow Mg^{2+} + H_2$

C) $2Cl^- + I_2 \rightarrow Cl_2 + 2I^-$

D) $Cu + Zn^{2+} \rightarrow Cu^{2+} + Zn$

Q.15 Coinage metals Cu, Ag and Au are the least reactive because they have

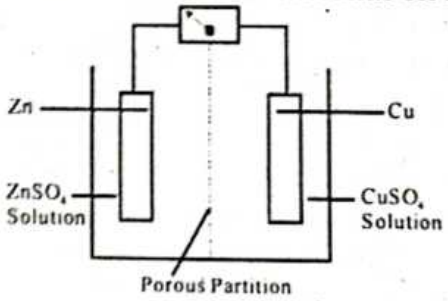
A) Negative reduction potential

B) Positive reduction potential

C) Negative oxidation potential

D) Positive oxidation potential

Q.16 In the figure given below, the electron flow in external circuit is from



A) Zinc to copper electrode

B) Copper to zinc electrode

C) Right to left

D) porous partition to zinc electrode

Q.17 Study the following facts

$Zn \longrightarrow Zn^{+2} + 2e^- \quad E^\circ = +0.76V$

$Cu \longrightarrow Cu^{+2} + 2e^- \quad E^\circ = -0.34V$

A) $Cu + Zn^{+2} \longrightarrow Cu^{+2} + Zn$

B) $Cu^{+2} + Zn^{+2} \longrightarrow Cu + Zn$

C) $Cu^{+2} + Zn \longrightarrow Cu + Zn^{+2}$

D) $Cu^{+2} + Zn^{+2} \longrightarrow Cu + Zn^{+2}$

Q.18 Keeping in mind the electrode potential, which one of the following reactions is feasible?

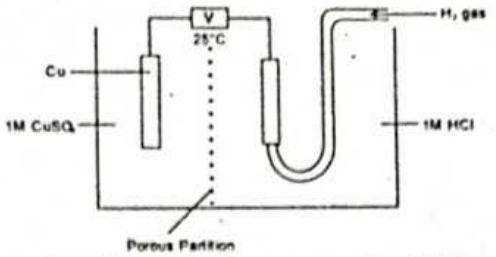
A) $Zn^{+2} + Cu \longrightarrow Cu^{+2} + Zn$

B) $Zn + MgSO_4 \longrightarrow ZnSO_4 + Mg$

C) $Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$

D) $Cd + MgSO_4 \longrightarrow CdSO_4 + Mg$

Q.19



The diagram shows a galvanic cell. The current will flow from

A) Hydrogen electrode to copper electrode
B) Copper electrode to hydrogen electrode
C) Hydrogen electrode to HCl solution
D) $CuSO_4$ solution to hydrogen electrode

Q.20 Stronger is the oxidizing agent, stronger is the

A) emf of cell
B) Reduction potential
C) Oxidation potential
D) Redox potential

Q.21 Which of the following metal does not liberate hydrogen on reaction with acid?

A) Mg
B) Zn
C) Pt
D) Ca

Q.22 Which one of the following elements is the strongest reducing agent?

A) Chlorine
B) Magnesium
C) Sodium
D) Aluminium

Q.23 Rusting of iron metal Fe occurs when Fe gets converted into Fe_2O_3. What happen with Fe?

A) Fe is neutralized
B) Fe is reduced
C) Fe is sublimed
D) Fe is oxidized

Q.24 During space flights, astronauts obtained water from

A) Nickel cadmium cells
B) Fuel Cell
C) Lead accumulator
D) Alkaline battery

Q.25 The electrolyte used in fuel cell is

A) KOH
B) $NaNO_3$
C) NaCl(aq)
D) Molten NaCl

ANSWER KEY

1	D	11	C	21	C	31	A	41	C	51	A
2	B	12	A	22	B	32	A	42	B	52	C
3	A	13	C	23	D	33	D	43	D	53	A
4	B	14	D	24	A	34	C	44	B	54	A
5	A	15	C	25	C	35	A	45	A	55	B
6	B	16	D	26	C	36	B	46	A		
7	A	17	C	27	B	37	B	47	B		
8	D	18	C	28	C	38	B	48	C		
9	B	19	A	29	C	39	A	49	D		
10	C	20	D	30	A	40	C	50	C		

PAST PAPER QUESTIONS

1	D	6	D	11	B	16	B	21	C
2	A	7	A	12	D	17	A	22	C
3	D	8	B	13	C	18	C	23	D
4	C	9	C	14	B	19	A	24	B
5	D	10	D	15	B	20	B	25	A

EXPLANATORY NOTES

Q.1 Net charge on carbon in glucose is zero.

$C_6H_{12}O_6$

$6x+12+(-2)6=0$ Let x be net oxidation state of carbon.

$6x=0$

$x=0$

Q.2 Oxidation state of S in H_2SO_4 = +6

Oxidation state of S in SO_2 = +4

Hence sulphur is reduced.

Q.3 $MnO_2+4H^+ \longrightarrow Mn^{+2}+2H_2O$

+4 +2

In order to balance charge 2 electrons have to be added on L.H.S.

$MnO_2+4H^++2e^- \longrightarrow Mn^{+2}+2H_2O$

Q.4

Reaction	Change in O.S	T.O.E
$MnO_4^{-2} \longrightarrow MnO_2$	$+6 \longrightarrow +4$	2
$MnO_4^{-1} \longrightarrow Mn^{+2}$	$+7 \longrightarrow +2$	5
$CrO_4^{-2} \longrightarrow Cr^{+3}$	$+6 \longrightarrow +3$	3
$CrO_4^{-2} \longrightarrow Cr^{+3}$	$2(+6 \longrightarrow +3)$	3×2

Q.5 $H_2S \longrightarrow S$ oxidation state of S changes from –2 to 0. Hence t is oxidized by Cl_2 making H_2S reducing agent at Cl_2 is reduced to Cl^- substance oxidation state (x).

Q.6

S_8 O

SO_2Cl_2 $x+(-2)_2+(-1)_2=0$

$x-4-2=0$

$x=+6$

SO_2 $x+(-2)_2=0$

$x=4$

$Na_2S_2O_3$ $(+1)_2+2x+(-2)_3=0$

$+2+2x+6=0$

$2x-4=0$

$2x=+4$

$x=2$

Q.7 Let x be oxidation state of "O" KO_2

$$+1+2x=0$$

$$2x=-1$$

$$x=-\frac{1}{2}$$

Q.8 Oxidation state may be zero, fractional, positive or negative.

Q.14 As reduction potential of electrodes changes by change in

i) Temperature
ii) Concentration of ions
iii) Nature of electrolyte

Hence cell potential also changes.

$E^{\circ}_{cell} = E^{\circ}_{oxidation} + E^{\circ}_{reduction}$

Q.15 Standard electrode potential is measured at 298K for electrode in 1M aqueous solution of its ions.

Q.16 emf or cell potential is the force to drive electron in a circuit.

Q.17 Electrode potential is measured by comparing it with SHE.

Q.18 Conditions for SHE

i) Pt electrode coated with finely divided Pt black
ii) T = 25°C = 298k
iii) 1M = H^+ ions
iv) P = 1 atm

As one molar H_2SO_4 = 2M H^+ hence it is not correct.

Q.19 In SHE H_2 gas is oxidized to H^+ ions by loss of electron $H_{2(g)} \longrightarrow 2H^+ + 2e^-$

Q.20 Conditions for SHE

i) Pt electrode coated with finely divided Pt black
ii) T = 25°C = 298k
iii) 1M = H^+ ions
iv) P = 1 atm

Q.21 SHE itself is a reference electrode hence its E°_{red} is take zero Arbitrary i.e. without any other reference.

Q.22 ECS shows E°_{red} value in ascending order and E°_{red} is measured by comparing with SHE i.e. H-scale.

Q.25 Metal with higher oxidation potential has lower reduction potential hence

E°_{red} of Mg = –2.37V

E°_{red} of Al = –1.66V

Metal with lower E°_{red} can replace the metal with higher E°_{red}. Hence Mg will replace Al.

Q.26 In ECs E°_{red} increases down the series. Reducing strength $\propto \frac{1}{E^{\circ}_{red}}$. Hence ability of element to act as reducing agent decreases.

Q.27 E^*_{red} increases down the ECS and oxidizing strength $\propto E^*_{red}$. As the halogens are placed towards bottom of the series this indication their higher E^*_{red} values and hence these are good oxidizing agent.

Q.28 Fluorine is very strong oxidizing agent and is at the bottom of ECS. Indicating its highest E^*_{red}.

Q.29 In ECS elements above SHE have negative E^*_{red}, $E^*_{ox} = -E^*_{red}$ hence elements with negative E^*_{red} have positive E^*_{ox}.

Q.30 Reduction potential is the ability to get reduced hence greater E^*_{red} means greater tendency to accept electrons to undergo reduction.

Q.31 Shows salt bridge in galvanic cell.

Q.33 Low position in ECS $\longrightarrow$ higher E^*_{red}.

$E^*_{red} \propto$ Tendency to get reduced

Cathode $\longrightarrow$ Electrode at which reduction takes place.

Q.34 Zn = anode = oxidized = negative electrode
Cu = cathode = reduced = positive electrode

Q.35 Reaction at anode = Oxidation
Reaction at cathode = Reduction

Q.36 Tendency to get oxidized $\propto \frac{1}{E^*_{red}}$.

Q.37 Salt bridge maintain the electrical neutrality between two half cells preventing net charge accumulation which will occur if salt bridge is removed and hence emf will drop to zero.

Q.38 At cathode reduction takes place hence it has greater E^*_{red} than anode.

Q.39 $Al \xrightarrow{\text{oxidation}} Al^{+3} + 3e^-$, as Al is oxidized hence it acts as anode and will get negative charge while zinc will act as cathode and is reduced.

Q.40 Reactivity of metal $\propto \frac{1}{E^*_{red}}$

Q.41 Reaction is feasible when E^*_{cell} is positive otherwise it is not feasible

Q.42 If emf is positive the cell reaction will be feasible and cell will work at its best otherwise not.

Q.43 Metals with negative E^*_{red} can easily lose electrons hence reducing $H^+ \longrightarrow H_{2(g)}$ liberating H_2 from steam and aqueous acids. Here Mg has negative E^*_{red}.

Q.45 $E^*_{cell} = E^*_{red\ of\ cathode} + E^*_{ox\ of\ anode}$

E^*_{red} of anode < E^*_{red} of cathode

Here SHE = anode E^*_{ox} of SHE = 0.00V

$E^*_{cell} = +0.80 + 0.00 = 0.80V$

Q.46 In fuel cell oxygen is reduced to OH^- at cathode

$$O_{2(g)} + 2H_2O_{(l)} + 4e^- \longrightarrow 4OH^-_{(aq)}$$

Q.47 As the net reaction of fuel cell indicates production of H_2O.

$$2H_2 + O_2 \longrightarrow 2H_2O$$

This provides power and clean drinking water.

Q.48 75% of bond energy of fuel is converted into electricity.

Q.50 H_2 is oxidized and hence work as reducing agent at anode. Hence H_2 is injected from bottom left (labelled C).

Q.51 For molten NaCl

At anode

$$2Cl^- \longrightarrow Cl_2 + 2e^-$$

At cathode

$$2Na^+ + 2e^- \longrightarrow 2Na$$

Net reaction

$$2NaCl \longrightarrow 2Na + Cl_2$$

Q.52 Reduction potential of potassium is less than hydrogen. H^+ will be reduced instead of K^+ at cathode and hydrogen gas is produced.

Q.53 Electrolysis of dilute H_2SO_4.

At anode: O_2 is produced (Oxidation)

At cathode: H_2 is produced (Reduction)

Q.54 For aqueous solution of NaCl at cathode.

H_2O is reduced to H_2 as its E°_{red} is higher than Na^+.

$$2H_2O + 2e^- \longrightarrow H_2 + 2OH^-$$

7A Topic CHEMICAL EQUILIBRIUM

PRACTICE EXERCISE

RATES OF FORWARD AND REVERSE REACTIONS AND DYNAMIC QUILIBRIUM

Q.1 **At equilibrium, the concentration of reactants and products are**

A) Constant
B) Maximum
C) Different
D) Equal

Q.2 **Statement, which describe a reversible reaction**

A) Both forward and reverse reaction does not occur simultaneously
B) Both forward and reverse reaction occur simultaneously but under different conditions
C) Both forward and reverse reaction occur simultaneously at the same time under same condition
D) Forward and reverse reaction takes place at different time and different conditions

THE LE-CHATELIER'S PRINCIPLE

Q.3 **In the reaction $A_{2(g)} + 4B_{2(g)} \rightleftharpoons 2AB_{4(g)}$ such that ΔH is negative, the formation of $AB_{4(g)}$ will be favoured at**

A) Low temperature and high pressure
B) High temperature and low pressure
C) Low temperature and low pressure
D) High temperature and high pressure

Q.4 $N_2 + 3H_2 \rightleftharpoons 2NH_3$ $\quad \Delta H = -41.02 kJ/mol$

Forward reaction is favoured by

A) Adding NH_3 at equilibrium
B) Decreasing temperature
C) Adding catalyst
D) Decreasing concentration of H_2

Q.5 **In a given system, water and ice are in equilibrium, if the pressure is applied to the system then**

A) More ice is formed
B) Amount of ice and water will remain the same
C) More ice is melted
D) Both A) and B)

Q.6 **In a reaction $CO_{(g)} + 2H_{2(g)} \rightleftharpoons CH_3OH_{(g)}$, $\Delta H° = -92 kJ/mol$. Concentration of hydrogen, carbon monoxide and methanol become constant at equilibrium, what will happen**

A) Reaction become faster
B) Equilibrium state disturbs
C) Reaction become slow
D) Equilibrium state remains undisturbed

Q.7 **If Kc value is small then equilibrium position will shift**

A) Towards left
B) Remains unchanged
C) Towards right
D) It is always constant value

Q.8 **The value of Kc for H_2O at 25°C is**

A) 1×10^{-14} moldm^{-3}
B) 14 moldm^{-3}
C) 1.86×10^{-16} moldm^{-3}
D) 1.0×10^{-7} moldm^{-3}

Q.9 **The equilibrium expression for a reaction is** $Kc = \frac{X^2}{V(a-X)}$, **what is true for this reaction.**

A) Increase of pressure favoured forward reaction
B) Decrease of pressure favoured forward reaction
C) Decrease of pressure favoured backward reaction
D) Increase in volume favoured backward reaction

Q.10 **For the reaction $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$. The equilibrium constant changes with**

A) Total pressure
B) Concentration of H_2 and I_2
C) Catalyst
D) Temperature

Q.11 **If the temperature is increased of following reaction, then will go in**

$$N_2 + 3H_2 \rightleftharpoons 2NH_3 \qquad \Delta H = -Ve$$

A) Forward direction
B) Remain constant
C) Reverse direction
D) Cannot be predicted

EQUILIBRIUM CONSTANT EXPRESSIONS OF DIFFERENT REACTIONS

Q.12 **Correct relationship b/w K_c and K_p can be written as**

A) $K_p = K_c (R)^{\Delta n}$
B) $K_c = K_p (RT)^{\Delta n}$
C) $K_p = K_c (RT)^{\Delta n}$
D) $K_p = K_c (R/N)^{\Delta n}$

Q.13 **For the given reaction $PCl_5 \rightleftharpoons PCl_3 + Cl_2$**

A) $K_p > K_c$
B) $K_p < K_c$
C) $K_p = K_c$
D) $K_p = K_c = 0$

Q.14 **For the reaction $H_2 + I_2 \rightleftharpoons 2HI$. Equilibrium concentration of H_2, I_2 and HI are 8,3 and 24mol/dm^3 respectively. K_c of the reaction is**

A) 24
B) 26
C) 1
D) 9

Q.15 **In which case, Kp is less than Kc**

A) $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$
B) $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$
C) $H_{2(g)} + Cl_{2(g)} \rightleftharpoons 2HCl_{(g)}$
D) All of these

Q.16 **For a homogeneous reaction**

$$4NH_3 + 5O_2 \rightleftharpoons 4NO + 6H_2O$$

The units of equilibrium constant (Kc) is

A) Conc.$^{+2}$
B) Conc.$^{-1}$
C) Conc.$^{+1}$
D) No units

Q.17 **For the following reaction in the gaseous phase**

$$CO + \frac{1}{2}O_2 \rightleftharpoons CO_2, \frac{Kc}{Kp} \text{ is}$$

A) $(RT)^{\frac{1}{2}}$
B) RT
C) $(RT)^{-\frac{1}{2}}$
D) RT^{-1}

CALCULATE VALUE OF K_c

Q.18 **One mole of HI was sealed in a tube heated at 440°C till equilibrium is reached, HI was found to be 50% dissociated, K_c for the reaction is**

A) 1
B) 0.5
C) 0.25
D) 0.625

Q.19 **For what value of K_c almost forward reaction is complete**

A) $K_c = 10^{-30}$
B) $K_c = 1$
C) $K_c = 10^{30}$
D) $K_c = 0$

Q.20 **1 mole of ethyl alcohol was treated with one mole of acetic acid at 25°C. $\frac{2}{3}$rd of acid changes into ester at equilibrium. The equilibrium constant of the reaction will be**

A) 1
B) 3
C) 2
D) 4

CALCULATE THE QUANTITIES PRESENT AT EQUILIBRIUM

Q.21 At equilibrium concentration of SO_2 is 2M, O_2 is 2M and SO_3 is 4M. $2SO_2 + O_2 \rightleftharpoons 2SO_3$. What will be the Kc value of given reaction

A) 0.2
B) 4
C) 2
D) 8

CONDITIONS USED IN HABER PROCESS

Q.22 In Haber process, equilibrium mixture contains _____ NH_3 by volume

A) 20%
B) 55%
C) 70%
D) 35%

Q.23 Catalyst used in Haber process for manufacturing of NH_3 is

A) Fe(MgO, Al_2O, SiO_2)
B) MgO
C) Al_2O_3
D) SiO_2

LOWRY BRONSTED ACID AND BASE CONCEPT

Q.24 Which of the following is strongest conjugate base

A) CH_3COO^-
B) OH^-
C) Cl^-
D) $C_2H_5O^-$

Q.25 $HA + H_2O \rightleftharpoons A^- + H_3O^+$

Conjugate base in above reaction is

A) HA
B) H_2O
C) A^-
D) H_3O^+

Q.26 The reaction involving $H_2PO_4^{-1}$ are given below

(i) $H_3PO_4 + H_2O \rightleftharpoons H_3O^+ + HPO_4^{-1}$

(ii) $H_2PO_4^{-1} + H_2O \rightleftharpoons HPO_4^{-2} + H_3O^+$

(iii) $H_2PO_4^{-1} + OH^- \rightleftharpoons H_3PO_4 + O^{-2}$

In which of above does $H_2PO_4^{-1}$ act as an acid

A) (i) only
B) (i) and (ii)
C) (ii) only
D) (iii) only

Q.27 The conjugate base of $H_2PO_4^{-1}$ is

A) H_3PO_4
B) HPO_4^{-2}
C) PO_4^{-3}
D) HPO_4^{-1}

Q.28 Which of the following is a base according to lowery Bronsted concept?

A) I^{-1}
B) HCl
C) H_3O^+
D) NH_4^{+1}

Q.29 According to the Lowery Bronsted concept, correct order of relative strength of bases follows the order

A) $Cl^- > CH_3COO^- > OH^-$
B) $OH^- > CH_3COO^- > Cl^-$
C) $Cl^- > OH^- > CH_3COO^-$
D) $OH^- > Cl^- > CH_3COO^-$

pH, pOH, Ka, pKa, Kb, pKb and Kw

Q.30 pKa value of three acid. A, B, C are 4.3, 3.3 and 5.5 respectively, which represent correct order of strength

A) A > B > C
B) C > A > B
C) B > A > C
D) C > B > A

Q.31 Select the pKa values of strongest acid from following
A) 1
B) 2.0
C) 3.0
D) 4.5

Q.32 Which is correct statement
A) pKa × pKb = 14
B) pKa + pKb = Kw
C) Ka × Kb = pKw
D) Ka ×Kb = Kw

Q.33 The K_w of water at 25°C is given by
A) 10^{-7}
B) 10^{-10}
C) 10^{-12}
D) 10^{-14}

Q.34 At 90°C, pure water has $[H_3O^+]$ is 10^{-6} mol/dm³. What is the value of K_w at 90°C
A) 10^{-8}
B) 10^{-6}
C) 10^{-12}
D) 10^{-14}

Q.35 With increase in temperature, ionic product of H_2O
A) Decreases
B) Remains same
C) Increases
D) May increase or decrease

Q.36 The pH of neutral water is 6.8 then the temperature of H_2O is
A) 25°C
B) More than 25°C
C) Less than 25°C
D) Not predicted

Q.37 The value of K_w in an acidic aqueous solution at 298 K is
A) $>10^{-14}$
B) 10^{14}
C) $< 10^{-14}$
D) 10^{-14}

Q.38 Which statement is incorrect
A) pH and $[OH^-]$ are inversely related to each other
B) pOH and $[OH^-]$ are inversely related to each other
C) pH and $[OH^-]$ are directly related to each other
D) pOH means potential of hydroxyl ion concentration

Q.39 Which of the following is not correct
A) $pH = \frac{1}{\log[H^+]}$
B) $pH = \log\frac{1}{[H^+]}$
C) $[H^+] = 10 - pH$
D) $pH = -\log[H^+]$

Q.40 H^+ concentration of a solution is 1 mol/dm³, its pH is
A) 0.1
B) 1.5
C) 1.0
D) 0.0

Q.41 What will be the pH of 1.0 mol dm^{-3} of H_2X, which is only 50% dissociated
A) 1
B) 0
C) 2
D) Less than 0

Q.42 What is the pH of 0.1M solution of weak acid having ionization constant (Ka) is 10^{-7}
A) 7
B) 6
C) 4
D) 5

Q.43 The pH of 1M MOH solution which is only 10% dissociated
A) 10
B) 13
C) 3
D) 1

BUFFER SOLUTIONS

Q.44 Basic buffer solution is

A) HF / NaF
B) $(COOH)_2$ / $(COONa)_2$
C) H_2CO_3 / Na_2CO_3
D) NH_4OH/NH_4Cl

Q.45 Buffer action can be explained by except

A) Common ion effect
B) Le-Chatelier's principle
C) Law of mass action
D) Solubility product

Q.46 pH of monoprotic acid is 3.0 at 25°C. The hydrogen ion concentration in the solution would be

A) 0.001
B) 0.01
C) 0.0001
D) 10^{-5}

Q.47 A basic buffer solution can be prepared by mixing

A) Strong acid and its salt with weak base
B) Strong base and its salt with weak acid
C) Weak base and its salt with strong acid
D) Weak acid and its salt with strong base

Q.48 The pH of ideal buffer is

A) 10
B) 7
C) Less than 7
D) 0

Q.49 pH of 10^{-3} mole dm^{-3} of H_2SO_4

A) 3
B) 2.7
C) 4
D) 1.7

Q.50 A certain buffer solution contains equal conc. of $\bar{X}$ and HX.Ka for HX is 10^{-8}. The pH of buffer is

A) 3
B) 11
C) 8
D) 14

Q.51 Which Henderson equation is not correct?

A) $pH = pKa + \log\frac{[salt]}{[acid]}$
B) $pH = pKa - \log\frac{[salt]}{[acid]}$
C) $pH = pKa - \log\frac{[acid]}{[salt]}$
D) $Pka = pH - \log\frac{[salt]}{[acid]}$

Q.52 For acidic buffer, pH < pKa if

A) [salt] = [acid]
B) [salt] < [acid]
C) [salt] > [acid]
D) [salt] > [base]

SOLUBILITY PRODUCT

Q.53 If ionic product is equal to K_{sp} then the solution is

A) Unsaturated
B) Ideal
C) Supersaturated
D) Saturated

Q.54 The solubility product is only applicable for those substance whose molar concentrations is

A) Equal to 0.1M
B) Equal to 1
C) Equal to or Less than 0.01
D) Greater than 0.1

Q.55 In a saturated solution of AgCl, the molar concentration of Ag^+ and Cl^- is 1.0×10^{-5} M each. What is the value of Ksp

A) 1.0×10^{-5}
B) 0.1×10^{-5}
C) 1.0×10^{-15}
D) 1.0×10^{-10}

Q.56 The solubility product of AgCl is $2.0 \times 10^{-10} mol^2\ dm^{-6}$. The maximum concentration of Ag^+ ions in the solution is

A) 1.41×10^{-5} mol.dm^{-3}
B) 1.41×10^{-10} mol.dm^{-3}
C) 2.0×10^{-10} mol.dm^{-3}
D) 4.0×10^{-20} mol.dm^{-3}

Q.57 The molar solubility of sparingly soluble salt AB_3 is "S" mol/dm^3, the corresponding solubility product K_{sp} is given in term of K_{sp} by the reaction.

A) $S = \left(\frac{K_{sp}}{128}\right)^{\frac{1}{4}}$

C) $S = \left(27K_{sp}\right)^{\frac{1}{3}}$

B) $S = \left(\frac{K_{sp}}{27}\right)^{\frac{1}{4}}$

D) $S = \left(\frac{K_{sp}}{81}\right)^{\frac{1}{4}}$

COMMON ION EFFECT

Q.58 When HCl gas is passed through saturated solution of rock salt, the solubility of NaCl

A) Increases
C) Decreases
B) May increase or decrease
D) None of these

Q.59 An excess of silver nitrate is added to the aqueous barium chloride and the precipitate is removed by filtration. What are the main ions in the filtrate

A) Ag^+ and NO_3^- only
C) Ag^+ and NO_3^- and Ba^{+2}only
B) NO_3^- and Ba^{+2}only
D) Cl^- and NO_3^- and Ba^{+2}only

Q.60 Ionization of $KClO_3$ is suppressed by

A) Increasing temperature
C) Adding $NaNO_3$
B) Adding KCl
D) Decreasing temperature

PAST PAPERS QUESTIONS

Q.1 Formation of NH_3 is reversible and exothermic process, what will happen on cooling?

A) More reactant will form
C) More H_2 will be formed
B) More N_2 will be formed
D) More product (NH_3) will be formed

Q.2 During the manufacture of nitric acid, nitric oxide is oxidized to nitrogen dioxide. This reaction is given as

$$2NO_{(g)} + O_{2(g)} \rightleftharpoons 2NO_{2(g)} \quad \Delta H = -114 kJ/mol$$

According to Le Chatelier's Principle

A) Reaction must not be temperature dependent
B) Reaction must be carried out at room temperature
C) Reaction must be carried out at low temperature
D) Reaction must be carried out at high temperature

Q.3 For an equilibrium reaction;

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ **the forward reaction is exothermic, increase in temperature shifts the equilibrium position towards left because,**

A) the concentrations of SO_3, SO_2 and O_2 increase as the temperature increases
B) the concentrations of SO_2 and O_2 increase and concentration of SO_3 decreases as the temperature increases
C) the concentrations of SO_2 and O_2 decrease and concentration of SO_3 increases as the temperature increases
D) the concentrations of SO_2 and O_2 increase and concentration of SO_3 stays same as the temperature increases

Q.4 Which of the following factors effect a reversible chemical reaction in accordance with the Le-Chatelier principle?

A) Pressure
C) Temperature
B) Concentration
D) Pressure, concentration and temperature

Q.5 Which one of the following factors does not affect the equilibrium position?

A) Catalyst
B) Temperature
C) Concentration of reactants and product
D) Pressure

Q.6 Units of Kc for the following reaction is: $H_2 + I_2 \rightarrow 2HI$

A) mol^2dm^{-6}
B) $moldm^{-3}$
C) no unit
D) $mol^{-2}dm^6$

Q.7 For which of the following equilibrium reaction, K_c has no units?

A) $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$
C) $SO_{2(g)} + 2O_{2(g)} \rightleftharpoons 2SO_{3(g)}$
C) $CO_{(s)} + H_2O_{(g)} \rightleftharpoons CO_{2(g)} + H_{2(g)}$
D) $2NO_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$

Q.8 The Kc Unit for the reaction $N_{2(g)}+3H_{2(g)} \rightarrow 2NH_{3(g)}$ are

A) $mole^{-1}dm^{+6}$
C) $mole^{-2}dm^{+3}$
B) $mole^{-2}dm^{+6}$
D) $mole^{-1}dm^{+3}$

Q.9 The value of equilibrium constant (K_c) for the reaction $2HF_{(g)} \rightleftharpoons H_{2(g)} + F_{2(g)}$ is 10^{-13} at 2000°C calculate the value of K_p for this reaction

A) 2×10^{-13}
C) 186×10^{-13}
B) 10^{-13}
D) 3.48×10^{-9}

Q.10 The chemical substance, when dissolved in water, gives "H^+" is called:

A) Neutral
C) Base
B) Acid
D) Amphoteric

Q.11 According to Lowry – Bronsted acid & base concept, H_2O is

A) Base
C) A salt
B) An amphoteric species
D) An acid

Q.12 If Ka for an acid is higher , the stronger is the acid , relate the strength of acid with pKa

A) Higher pKa , weaker the acid
B) Lower pKa , stronger the acid
C) pKa has no relation with the strength of an acid
D) Both A and B

Q.13 The K_a values of HCl, CH_3COOH, HF and H_2SO_4 are 10^{+7}, 1.85×10^{-5}, 6.7×10^{-5} and 10^{+2} respectively. The decreasing order of acidic strength is:

A) $HCl > H_2SO_4 > HF > CH_3COOH$
C) $CH_3COOH > HF > H_2SO_4 > HCl$
B) $HCl > HF > H_2SO_4 > CH_3COOH$
D) $HCl > CH_3COOH > HF > H_2SO_4$

Q.14 What will be the pH of a solution of NaOH with a concentration of 10^{-3} M?

A) 3
C) 11
B) 14
D) 7

Q.15 Human blood maintains its pH between

A) 6.50 – 7.00
C) 7.50 – 7.55
B) 7.20 – 7.25
D) 7.35 – 7.40

Q.16 Which one of the following bases has highest Kb value?

A) NH_4OH
C) NaOH
B) $Ca(OH)_2$
D) CH_3NH_2

Q.17 What is the pH of 0.1M of HCl?

A) 1
B) 0.01
C) 0.1
D) –1

Q.18 What is the correct relation between pH and pKa?

A) $pH = pKa + \log\left[\frac{Acid}{Base}\right]$
B) $pH = pKa - \log\left[\frac{Acid}{Base}\right]$
C) $pH = pKa - \log\left[\frac{Base}{Acid}\right]$
D) $pKa = pH + \log\left[\frac{Base}{Acid}\right]$

Q.19 The pH of 10^{-2} M aqueous solution of sodium hydroxide is

A) 12
B) 13
C) 14
D) 10

Q.20 The Pka values of CH_3COOH is 4.74, the pH of equimolar solution of acetic acid and sodium acetate is

A) 13.0
B) 4.79
C) 7.2
D) 4.74

Q.21 The product of the concentrations of each ion in saturated solution of a sparingly soluble salt at 298K raised to the power of their relative concentrations is

A) Ksp
B) Ka
C) Kb
D) Kw

Q.22 Which one of the following is the correct representation for K_{sp}?

$$AgCl \rightleftharpoons Ag^{+} + Cl^{-}$$

A) $K_{sp} = \frac{[AgCl]}{[Ag^{+1}][Cl^{-1}]}$
B) $K_{sp} = [Ag^{+1}][Cl^{-1}]$
C) $K_{sp} = \frac{[Ag^{+1}][Cl^{-1}]}{[AgCl]}$
D) $K_{sp} = [AgCl]$

Q.23 Value of K_{sp} for $PbSO_4$ system at 25°C is equal to

A) 1.6×10^{-5} mol^2dm^{-6}
B) 1.6×10^{-6} $mol^2\ dm^{-6}$
C) 1.6×10^{-8} mol^2dm^{-6}
D) 1.6×10^{-7} mol^2dm^{-6}

Q.24 $Ca(OH)_2$ is sparingly soluble having solubility value 6.5×10^{-6}. What will be its solubility

A) 2.75×10^{-2}
B) 2.75×10^{2}
C) 1.17×10^{-2}
D) 3.63×10^{3}

Q.25 Precipitation occurs when the product of ionic concentration is?

A) Greater than Ksp
B) Equal to Ksp
C) Less than Ksp
D) Equal to unity

ANSWER KEY

1	A	11	C	21	C	31	A	41	B	51	B
2	C	12	C	22	D	32	D	42	C	52	B
3	A	13	A	23	A	33	D	43	B	53	D
4	B	14	A	24	D	34	C	44	D	54	C
5	C	15	B	25	C	35	C	45	D	55	D
6	D	16	C	26	C	36	B	46	A	56	A
7	A	17	A	27	B	37	D	47	C	57	B
8	A	18	A	28	A	38	C	48	B	58	C
9	B	19	C	29	B	39	A	49	B	59	C
10	D	20	D	30	C	40	D	50	C	60	B

PAST PAPER QUESTIONS

1	D	6	C	11	B	16	C	21	A
2	C	7	C	12	D	17	A	22	B
3	B	8	B	13	A	18	B	23	C
4	D	9	B	14	C	19	A	24	C
5	A	10	B	15	D	20	D	25	A

EXPLANATORY NOTES

Q.1 At dynamic equilibrium

(i) Rate of forward reaction (R_f) = Rate of backward reaction (R_b)

(ii) Concentration of reactant and product becomes constants

It means at equilibrium, concentration of reactant and product does not change with time no matter how much long reaction proceed

Q.2 In dynamic equilibrium, both forward and reverse reaction takes place simultaneously and $R_f = R_b$

Q.3

$$A_{2(g)} + 4B_{2(g)} \rightleftharpoons 2AB_{4(g)} \qquad \Delta H = -Ve$$

5mole 2mole

5 volume 2 volume

According to Le-Chatelier principle, for exothermic reaction

$$\text{Yield} \propto \frac{1}{\text{Temperature}}$$

And increase in pressure move reaction in direction in which volume in less. Because reactant have more volume than product so increase in pressure favours forward reaction

Q.4 According to Le-Chatelier principle, for exothermic reaction

$$\text{Yield} \propto \frac{1}{\text{Temperature}}$$

Q.5 Ice $\rightleftharpoons$ liquid water

According to Le-Chatelier principle, increase in pressure move reaction in direction in which volume is less. Ice has 9% more volume than liquid water. So, increase in pressure will convert ice (more volume) into liquid water (less volume). So, by increasing pressure ice starts to melt

Q.6 Equilibrium state / position is changed by changing

(i) Concentration

(ii) Pressure

(iii) Volume

(iv) Temperature

If concentration are constant then equilibrium position / state remains constant

Q.7 $K_c < \frac{[\text{Product}]}{[\text{Reactant}]} (Qc)$

If K_c is small, it means product are more and reactant are less. If product are more then reaction move in reverse direction and equilibrium shift to left side

Q.8 Value of K_c for H_2O at 25°C is 1.86×10^{-16} moldm^{-3}

Q.9 If volume factor is in denominator of K_c expression, it means mole (volume) of product are more than mole (volume) of reactant. So, less pressure favours the forward reaction because according to Le-Chatelier principle increases in pressure move reaction in direction in which volume is less.

Q.10 $K_c = \frac{K_f}{K_r}$

Equilibrium constant (Kc) is ratio of K_f and K_r. its value is only changed by change in temperature. Change in temperature (ΔT) changes both equilibrium constant (K_c) as well as equilibrium state / position (Q_c)

Q.11 For exothermic reaction

$$\text{Yield} \propto \frac{1}{\text{Temperature}}$$

If temperature is increased then yield of product become less. It means reaction move in reverse direction

Q.12 $K_p = K_c(RT)^{\Delta n}$, $K_p = K_x(RT/V)^{\Delta n}$, $K_p = K_n\left(\frac{P}{N}\right)^{\Delta n}$

Q.13

If $\Delta n = +Ve$ then $K_p > K_c$

If $\Delta n = -Ve$ then $K_p < K_c$

If $\Delta n = 0$ then $K_p = K_c$

and

$$\Delta n = n_P - n_R$$

for $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

$$\Delta n = 2 - 1$$

$$\Delta n = 1$$

Because Δn is +Ve so $K_p > K_c$

Q.14

$$K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{(24)^2}{(8)(3)}$$

$$= \frac{24 \times 24}{24} = 24$$

Q.15 $2SO_2 + O_2 \rightleftharpoons 2SO_3$

$\Delta n = n_P - n_R$

$\Delta n = 2 - 3$

$\Delta n = -1$

Because Δn is –Ve so $K_P < K_c$

Q.16

$$\Delta n = n_P - n_R$$

$$= 10 - 9$$

$$\Delta n = +1$$

for unit of k_c

$$k_c = (\text{conc})^{\Delta n}$$

$$kc = (\text{conc})^{+1}$$

Q.17

$$\Delta n = n_P - n_R$$

$$= 1 - \frac{3}{2}$$

$$= -\frac{1}{2}$$

$$K_p = K_c(RT)^{\Delta n}$$

$$K_p = K_c(RT)^{-\frac{1}{2}}$$

$$K_p = \frac{K_c}{(RT)^{\frac{1}{2}}}$$

$$(RT)^{\frac{1}{2}} = \frac{K_c}{K_p}$$

Q.18 $2HI \rightleftharpoons H_2 + I_2$

1	0	0
$1-\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$

$$Kc = \frac{[H_2][I_2]}{[HI]^2} = \frac{\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)}{\left(\frac{1}{2}\right)^2}$$

$$\frac{1}{4} \times \frac{4}{1} = 1$$

Q.19 If the Kc value is very high reaction is more favourable in forward direction.

Q.20

$$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$$

1	1	0	0
$1-\frac{2}{3}$	$1-\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$
$\frac{1}{3}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{2}{3}$

$$Kc = \frac{[CH_3COOC_2H_5][H_2O]}{[CH_3COOH][C_2H_5OH]}$$

$$Kc = \frac{\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)}{\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)} = 4$$

Q.21 $Kc = \dfrac{[SO_3]^2}{[SO_2]^2[O_2]} = \dfrac{(4)^2}{(2)^2(2)}$

$= \dfrac{16}{8} = 2$

Q.24 Conjugate base of very weak acid is very strong.
Ethanol is weaker acid and its conjugate base $C_2H_5O^-$ is stronger.

Q.25 The species which left behind after removal of 1 proton from an acid is called conjugate base. So, A^- is conjugate base of acid HA.

Q.26 According to Lowry Bronsted concept an acid is proton donor.

$H_2PO_4^{-1} + H_2O \rightleftharpoons HPO_4^{-2} + H_3O^+$

$H_2PO_4^{-1}$ acts as an acid and H_2O acts as a base in above reaction.

Q.27 $H_2PO_4^{-1} + H_2O \rightleftharpoons HPO_4^{2-} + H_3O^+$

After removal of 1 proton from $H_2PO_4^{-1}$, the species HPO_4^{2-} is formed which is conjugate base.

Q.28 According to Lowry Bronsted concept base is proton acceptor.

Q.29 The conjugate base of very weak acid is very strong.
OH^- is the conjugate base of H_2O, CH_3COO^- is conjugate base of CH_3COOH and Cl^- is conjugate base of HCl.

Q.30 Acidic strength is inversely proportional to the pKa value of an acid.
Smaller the value of pKa stronger is the acid and vice versa.

Q.31 Smaller the value of pKa stronger is the acid and vice versa.

Q.32 According to Lowry Bronsted concept of acid and base $K_a \times K_b = K_w$.

Q.33 $K_w = [H^+][OH^-]$
$= (10^{-7})(10^{-7}) = 10^{-14}$

Q.34 At 90°C, pure water has $[H^+] = 10^{-6}$ and $[OH^-] = 10^{-6}$ so, $K_w = 10^{-12}$

Q.35 By increasing the temperature ionization of water increases. Therefore, ionic product of water increases.

Q.36 pH of water decreases by increasing the temperature because ionization of water increases.

Q.37 In case of addition of small amount of acid $[H^+] > [OH^-]$ while in case of addition of few drops of base $[OH^-] > [H^+]$
During both of these additions, the value of K_w will remain same i.e. 10^{-14} at 298K.

Q.38 pH and $[OH^-]$ are inversely related to each other.

Q.40 $pH = -\log [H^+]$
$= -\log (1) = 0$

Q.41

$HX_2 \rightleftharpoons 2H^+ + X^{2-}$

$1M \longrightarrow 2M$

50% dissociated $= \dfrac{50}{100} \times 2 = 1$

$pH = -\log [H^+]$
$= -\log (1) = 0$

Q.42

$$[H^+] = \sqrt{[HA] \times Ka}$$

$$[H^+] = \sqrt{0.1 \times 10^{-7}}$$

$$[H^+] = \sqrt{10^{-8}} = 10^{-4}$$

$$pH = -\log[H^+]$$

$$pH = -\log 10^{-4}$$

$$= 4 \log 10$$

$$= 4(1) = 4$$

Q.43

$$MOH \rightleftharpoons M^+ + OH^-$$

$$1M \longrightarrow 1M$$

$$10\% \text{ dissociated} = \frac{10}{100} \times 1 = 10^{-1}$$

$pOH = \log [OH^-]$

$pOH = -\log 10^{-1} = 1 \log 10 = 1$

$pH + pOH = 14$

$pH = 14 - pOH$

$pH = 14 - 1 = 13$

Q.44 Basic buffer is the mixture of weak base and salt of it with strong acid.
NH_4OH is weak base and NH_4Cl is salt of strong acid (HCl).

Q.45 There is no role of solubility product in buffer action.

Q.46 For monoprotic acid $[H^+] = 10^{-pH}$
$[H^+] = 10^{-3} = 0.001$

Q.47 NH_4OH is weak base and NH_4Cl is salt of strong acid (HCl). It is an example of basic buffer.

Q.48 If the pH of buffer is 7 then it is called neutral buffer which is ideal.

Q.49

$$H_2SO_4 \longrightarrow 2H^+ + SO_4^{2-}$$

$$1M \longrightarrow 2M$$

$$10^{-3}M \longrightarrow 2 \times 10^{-3}M$$

$$pH = -\log[H^+]$$

$$= -\log 2 \times 10^{-3}$$

$$= -\log 2 - \log 10^{-3}$$

$$= -0.3 + 3 \log 10$$

$$= -0.3 + 3(1) = 2.7$$

Q.50 $pKa = -\log K_a$

$pKa = -\log 10^{-8}$

$pKa = 8 \log 10$

$= 8(1) = 8$

$$pH = pKa + \log\left[\frac{Salt}{Acid}\right]$$

$$pH = 8 + \log\frac{1}{1}$$

$$pH = 8 + 0 = 8$$

If concentration of salt and acid is equal then buffer solution has pH = pKa.

Q.52 If concentration of salt is less than concentration of acid then pH will be less than pKa.

Q.53 According to solubility product

i) If ionic product = K_{sp}, then solution is saturated

ii) If ionic product < K_{sp}, then solution is unsaturated

iii) If ionic product > K_{sp}, then solution is supersaturated

Q.54 The solubility product is applicable for sparingly soluble salt whose concentration is equal to or less than $0.01 mol dm^{-3}$.

Q.55

$$AgCl \rightleftharpoons Ag^{+} + Cl^{-}$$

$$K_{sp} = [Ag^{+}][Cl^{-}]$$

$$(1\times10^{-5})\times(1\times10^{-5})$$

$$= 1\times10^{-10}$$

Q.56 For compound having two ions $K_{sp} = S^2$

$$2\times10^{-10} = S^2$$

$$\sqrt{2\times10^{-10}} = S$$

$$S = 1.41\times10^{-5}$$

Q.57 For compound having the four ions $K_{sp} = 27S^4$.

$$\frac{K_{sp}}{27} = S^4$$

$$S = \left(\frac{K_{sp}}{27}\right)^4$$

Q.58

$$NaCl \rightleftharpoons Na^{+} + Cl^{-}$$

$$HCl \rightleftharpoons H^{+} + Cl^{-}$$

Due to common ion effect solubility of NaCl decreases.

Q.59 $2AgNO_3 + BaCl_2 \longrightarrow 2AgCl + Ba^{+2} + NO_3^{-}$

If $AgNO_3$ is in excess then filterate contains Ba^{+2}, NO_3^{-} and Ag^{+}.

Q.60

$$KClO_3 \rightleftharpoons K^{+} + ClO_3^{-}$$

$$KCl \rightleftharpoons K^{+} + Cl^{-}$$

The solubility of less soluble salt $KClO_3$ in water is suppressed by addition of more soluble salt KCl by common ion effect.

8A Topic REACTION KINETICS

PRACTICE EXERCISE

USE OF DIFFERENT TERMS

Q.1 Which one of the following is correct about following reaction if iron is not 100% pure

$$2Fe + 3H_2O + O_2 \longrightarrow Fe_2O_3.3H_2O$$

A) Very fast reaction
B) Moderately reaction
C) Very slow reaction
D) Not predicted

Q.2 Which of the following reactions are usually slow

A) Neutralization of acids and bases
B) Organic substitution reaction
C) Explosive reaction of O_2 and H_2
D) Photochemical reactions

Q.3 Activation energy of a reaction

A) Includes the average kinetic energy of the reactants
B) Is in addition to the average K.E. of the reactants
C) Is in addition to the average K.E. of the products
D) Required for effective collisions

Q.4 E_a appears as a potential energy hill between _____ for carrying out the reaction

A) Among the reactants
B) Reactants and the products
C) Among the products
D) None of the above

Q.5 The 2nd order reaction becomes 1st order when

A) One of the reactants is limiting
B) One of the reactants is in large excess
C) None of the reactants is in large excess
D) Both reactants in large excess

Q.6 Oxidation of $SO_{2(g)}$ in the presence of $NO_{(g)}$ catalyst is an example of

A) Homogeneous catalysis
B) Auto catalysis
C) Heterogeneous catalysis
D) Negative catalysis

Q.7 The specific rate constant of a chemical reaction is the rate of the reaction when the concentration of the reactant is

A) Less than unity
B) Greater than unity
C) Equal to unity
D) Equal to the concentration of 2nd order reaction

Q.8 The half-life time for a 1st order decomposition of a substance dissolved in CCl_4 is 2.5 hours at 30°C. The amount of substance left after 10 hours if the initial weight of the substance is 160g

A) 5g
B) 15g
C) 10g
D) 20g

Q.9 For a chemical reaction to occur

A) The vessel shall be open
B) Reacting molecules should have less energy than Ea at time of collision
C) Reacting molecules must be properly oriented and energy more than or equal to Ea
D) The reacting molecules must not collide with each other

Q.10 The unit of rate constant of second order reaction is

A) mol dm^{-3} sec^{-1}
B) mol^{-2} dm^{+6}
C) sec^{-1}
D) $mole^{-1}$ dm^{+3} sec^{-1}

Q.11 If the energy of the activated complex lies close to energy of reactants, it means that reaction is

A) Slow
B) Endothermic
C) Exothermic
D) Exothermic and fast

Q.12 Hydrolysis of ethyl acetate into acetic acid and ethanol in the presence of mineral acid is

A) Fractional order reaction
B) 1st order reaction
C) Pseudo 1st order reaction
D) 2nd order reaction

Q.13 The activation energy for a simple chemical reaction $A \longrightarrow B$ is E_a in forward direction. The activation energy for reverse reaction

A) Can be less than or more than E_a
B) Is negative of E_a
C) Is always double of E_a
D) Is always less than E_a

Q.14 For a reaction $A + 2B \longrightarrow C$, rate is given by $Rate = k[A][B]$, hence the order of the reaction is

A) 3
B) 1
C) 2
D) 0

Q.15 For a chemical reaction $A \longrightarrow B$, the rate of reaction doubles when the concentration of A is increased four times. The order of reaction for A is

A) Zero
B) Two
C) One
D) Half

Q.16 In first order reaction, the concentration of the reactant is reduced to 25% in one hour. The half-life period of reaction is

A) 120 min
B) 30 min
C) 60 min
D) 15 min

Q.17 If E_f and E_r are activation energies of forward and reverse reaction. The reaction is known to be exothermic then

A) $E_f > E_r$
B) $E_f < E_r$
C) $E_f >>> E_r$
D) $E_f = E_r$

Q.18 For an endothermic reaction $A \longrightarrow B$, an activation energy of forward reaction is 15 kcal mol^{-1} and enthalpy change of reaction is 5 kcal mol^{-1}. The activation energy for reverse reaction $B \longrightarrow A$ is

A) 10 kcal mol^{-1}
B) 15 kcal mol^{-1}
C) 20 kcal mol^{-1}
D) zero

Q.19 The increase in reaction rate as a result of increase in temperature from 10K to 100K is

A) 512
B) 400
C) 614
D) 112

Q.20 What will be order of reaction if doubling the concentration of reactant increases the rate by factor 4 and tripling the concentration of reactant by a factor of 9

A) 1
B) 3
C) 2
D) 0

Q.21 When the concentration of reactant in the reaction is increased by 8 times, the rate increased only by 2 times. The order of reaction is

A) 1
B) $\frac{1}{2}$
C) $\frac{1}{3}$
D) 2

Q.22 Which one is the assumption of collision theory of reaction rate

A) During a chemical reaction the particles must collide
B) Reaction between the colliding particles can only take place if upon collision they possess the activation energy
C) Only those collisions are effective which take place in proper orientation
D) All statements are correct

Q.23 By increasing the concentration of reactants, the rate of reaction_____

A) Decreases
B) Remains constant
C) Increases
D) Not predicted

Q.24 Select the correct rate law from given data

[A] moles dm^{-3}	[B] moles dm^{-3}	Rate of reaction (moles dm^{-3} sec^{-1})
0.1	0.1	2×10^{-5}
0.2	0.1	4×10^{-5}
0.1	0.2	4×10^{-5}
0.2	0.2	8×10^{-5}

A) Rate = $k[A][B]$
B) Rate = $k[A]^{\circ}[B]^2$
C) Rate = $k[A]^2[B]$
D) Rate = $k[A][B]^2$

ENZYMES AS BIOLOGICAL CATALYSTS

Q.25 A catalyst can

A) Accelerate the reaction rate
B) Retard the reaction rate
C) Chemically un-consumed at the end of the reaction
D) All of the above

Q.26 Which of the following statements regarding a catalyst is not true

A) A catalyst does not alter the equilibrium in a reversible reaction
B) A catalyst can initiate the reaction which is not thermodynamically feasible
C) Catalytic reactions are very specific in nature
D) A catalyst remains unchanged in composition and quantity

Q.27 When potential energy of the transition state is very high, then which one of the following results is applicable?

A) Low activation energy and fast reaction
B) High activation energy and fast reaction
C) Low activation energy and slow reaction
D) High activation energy and slow reaction

Q.28 Which of the following best explains the effects of a catalyst on the rate of a reversible reaction?

A) It decreases the rate of the reverse reaction
B) It increases the kinetic energy of the reacting mole molecules
C) It moves the equilibrium position to the right
D) It provides a new reaction path with a lower activation energy

Q.29 The rate of catalyzed reaction is independent of the concentration of

A) Reactants
B) Products
C) Catalyst
D) None of these

Q.30 What is the correct relation between rate and activation energy

A) Rate $\propto$ Ea
B) Rate $\propto \frac{1}{Ea}$
C) Rate = Ea
D) All of them

Q.31 Oxidation of $SO_{2(g)}$ in the presence of $V_2O_{5(s)}$ is an example of

A) Homogeneous catalysis
B) Auto catalysis
C) Heterogeneous catalysis
D) Negative catalysis

Q.32 The complex protein molecules which catalyze the organic reactions in living cells are known as _____

A) Negative catalysts
B) Co-enzymes
C) Catalyst for catalysts
D) Enzyme catalysts

Q.33 Concentrated sugar solution under goes hydrolysis into glucose and fructose by an enzyme_____

A) Zymase
B) Maltase
C) Invertase
D) None of these

Q.34 Which of the followings is correct about enzyme catalysts

A) These are in pure crystalline state
B) The activity of enzyme catalyst is inhibited by poison
C) Enzyme Catalytic reaction have maximum rate at optimum temperature
D) All of these

CONSTRUCT AND USE RATE EQUATIONS FOR ZERO, 1ST AND 2ND ORDER REACTIONS

Q.35 In the reaction A + B ⟶ Product

The doubling of [A], increases the reaction rate four times but the doubling of [B] has no effect on rate. The rate expression is

A) Rate = $K[A]^2[B]^0$
B) Rate = $K[A]^2[B]^2$
C) Rate = $K[A]$
D) Rate = $K[A][B]$

Q.36 The rate law of a reaction is, rate $= k[A]^2[B]$. On doubling the concentration of both A and B, the rate of reaction increases _____ time

A) 4
B) 8
C) 9
D) 2

Q.37 For the reaction A + B ⟶ C + D, doubling the concentration of both the reactants increases the reaction rate by 8 times and doubling the initial concentration of only B simply doubles the reaction rate. The rate law for the reaction is

A) Rate $= k[A][B]^2$
B) $R = k[A]^{1/2}[B]^2$
C) Rate $= k[A][B]$
D) Rate $= k[A]^2[B]$

Q.38 The rate of reaction $2X + Y \longrightarrow$ Products.

Rate $= k[X]^2[Y]$ of X in large excess, the order of reaction is

A) 3rd
B) 1st
C) 2nd
D) 0th

HALF-LIFE OF 1ST ORDER REACTION

Q.39 For the 1st order decomposition reaction $2N_2O_{5(g)} \rightarrow 2N_2O_{4(g)} + O_{2(g)}$ the half-life is given as
A) 0.693/k
B) log2/k
C) 0.693/2k
D) ln2/k

Q.40 The half-life period of zero order reaction is equal to
A) $\frac{0.693}{K}$
B) $\frac{1}{Ka}$
C) $\frac{a}{2K}$
D) $\frac{1.5}{Ka^2}$

Q.41 For which of the reaction, half-life is inversely proportional to the initial concentration of the reactants
A) Zero order
B) 2nd order
C) 1st order
D) 3rd order

Q.42 If 'a' is the initial concentration of the reactant then half-life period of the reaction of n^{th} order is directly proportional to
A) a^{n-1}
B) a^n
C) a^{1-n}
D) a^{n-1}

Q.43 For the first order reaction, half-life is 14 sec. The time requires for the initial concentration to reduce to $\frac{1}{8}^{th}$ of its value is
A) 28s
B) $(14)^2$ s
C) 42s
D) $(14)^3$ s

Q.44 For the reaction $N_2O_5 \longrightarrow 2NO_2 + \frac{1}{2}O_2$, $t_{\frac{1}{2}} = 24$min. Starting with 10g of N_2O_5 how many grams of N_2O_5 will remain after a period of 72 min
A) 0.063g
B) 1.77g
C) 0.50g
D) 1.25g

CALCULATION OF RATE CONSTANT

Q.45 The equation for the rate constant is $k = Ae^{-E_a/RT}$ A chemical reaction will proceed more rapidly if there is a decrease in
A) k
B) E_a
C) A
D) T

Q.46 The rate constant of reaction is 3×10^{-3}moldm^{-3}sec^{-1}. The order of reaction is
A) 1
B) 3
C) 2
D) 0

DETERMINATION OF RATE OF REACTION

Q.47 The rate of reaction involving ions can be studied by
A) Spectrometric method
B) Optical rotation method
C) Dilatometric method
D) Electrical conductivity method

Q.48 Which method for rate determination is useful for those reaction, which involve small volume change in solutions
A) Refractometric method
B) Optical rotation method
C) Dilatometric method
D) Spectrometric method

Q.49 Which method for rate determination is applicable to reactions in solutions, where there are changes in refractive indexes of the substance taking part in the chemical reaction

A) Dilatometric method
B) Refractometric method
C) Optical rotation method
D) Spectrometric method

Q.50 The angle through which plane polarized light is rotated by the reacting mixture is measured by _____

A) Refractometric method
B) Dilatometric method
C) Spectrometric method
D) Optical rotation method

PAST PAPERS QUESTIONS

Q.1 In some reactions a product formed acts as a catalyst. This phenomenon is called

A) Negative catalysis
B) Activation of catalyst
C) Heterogeneous catalysis
D) Autocatalysis

Q.2 The reaction rate in forward direction decreases with the passage of time because

A) Concentration of reactants decreases
B) Concentration of product decreases
C) The order of reaction changes
D) Temperature of the system changes

Q.3 For the reaction $2NO + O_2 \rightleftharpoons 2NO_2$, the rate equation for the forward reaction is

A) Rate = k $[NO][O_2]$
B) Rate = k $[NO_2]^2[O_2]$
C) Rate = k $[NO_2]^2$
D) Rate = k $[NO_2]$

Q.4 Choose the type of catalysis in the following reaction

$$2SO_{2(g)} \overset{NO_{(g)}}{\rightleftharpoons} 2SO_{3(g)}$$

A) Homogeneous catalysis
B) Heterogeneous catalysis
C) Biological catalysis
D) Gas catalysis

Q.5 What is the measure of activation energy is an endothermic reaction?

A) The energy of activation of backward reaction is less than that of forward reaction.
B) The energy of activation of forward-backward reaction is same.
C) The energy of activation of backward reaction is more than that of forward reaction.
D) The energy of activation of forward reaction is less than that of backward reaction.

Q.6 If energy of activated complex is close to energy of reactants, it means that the reaction is

A) Fast
B) Slow
C) Moderate
D) Very slow

Q.7 According to the collision theory of bimolecular reactions in gas phase , minimum amount of energy required for an effective collision is known as

A) Heat of reaction
B) Has no effect on the reaction
C) Rate of reaction
D) Energy of activation

Q.8 If the energy of activation of a chemical reaction is very low, the rate of that chemical reaction is observed to be very high because?

A) Concentration of the reactants becomes irrelevant
B) Number of efficient or fruit collisions increase
C) Reaction proceeds without any transition state
D) Molecules of the reactants move slowly

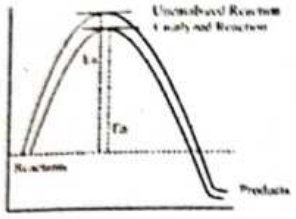
Q.9 The influence of temperature on reaction rate is predicted by

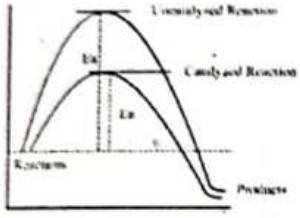
A) Free energy charge
B) Arrhenius equation
C) Wander Waal's equation
D) Kinetic equation

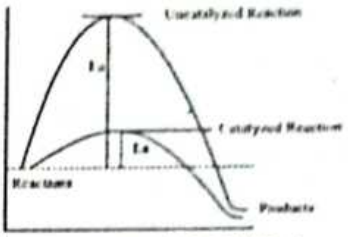
Q.10 **For which change of temperature, the rate of reaction become approximately double**
A) 293K
B) 20°C
C) 283K
D) 10°C

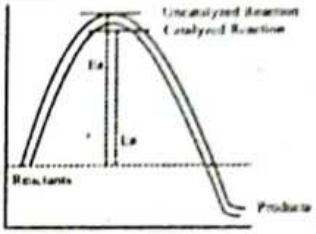
Q.11 **It is experimentally found that catalyst is used to**
A) Lower the activation energy
B) Increase the activation energy
C) Lower the pH
D) Decrease the temperature of other reactants

Q.12 **Which one of the following graphs is representation for more rapid catalyzed reaction?**

A)


B)


C)


D)


Q.13 **Role of a catalyst in a chemical reaction is to**
A) Increase rate of a reaction
B) Decrease yield of a reaction
C) Decrease rate of a reaction
D) Increase yield of product

Q.14 **Glucose is converted into ethanol by the enzyme present in the yeast**
A) Urease
B) Invertase
C) Zymase
D) Sucrase

Q.15 **In zero order reaction, the rate is independent of**
A) Concentration of the product
B) Temperature of the reaction
C) Concentration of the reactant
D) Surface area of the product

Q.16 **$2A + B \rightarrow$ Product**
If the reactant 'B' is in excess, the order of reaction with respect to 'A' in given rate law Rate = $k[A]^2[B]$ is
A) 2nd order reaction
B) 1st order reaction
C) Pseudo 1st order reaction
D) 3rd order reaction

Q.17 **The rate constant 'k' is 0.693 min^{-1}. The half-life for the 1st order reaction will be**
A) 1 min
B) 2 min
C) 0.693 min
D) 4 min

Q.18 **Unit of K in first order Reaction is**
A) s^{-1}
B) moles dm^{-3} s^{-1}
C) moles dm^{-3}
D) mol^{-1} dm^3

Q.19 **Rate of first order reaction depends on**
A) Concentration of one reactant
B) Concentration of three reactants
C) Concentration of two reactants
D) Independence of the initial concentration

Q.20 The decomposition of phosphorus pentachloride in the presence of moisture takes place by the following mechanism.

$PCl_{5\,(s)} + H_2O_{(l)} \rightarrow POCl_{3\,(l)} + 2HCl_{(aq)}$ (Slow Step)

$POCl_{3\,(l)} + 3H_2O_{(l)} \rightarrow H_3PO_{4\,(l)} + 3HCl_{(aq)}$ (Fast Step)

$PCl_{5\,(s)} + 4H_2O_{(l)} \rightarrow H_3PO_{4\,(l)} + 5HCl_{(aq)}$

The rate equation for this reaction will be:

A) $Rate = k[PCl_5][H_2O]^4$

B) $Rate = k[PCl_5][H_2O]$

C) $Rate = [PCl_5][H_2O]$

D) $Rate = k[POCl_3][H_2O]^3$

Q.21 The unit of rate constant is same as that of rate of reaction in

A) First order reaction

B) Second order reaction

C) Zero order reaction

D) Third order reaction

Q.22 Rates of photo-chemical reactions do not change with the change in concentration of reactants. What is the order of such reactions?

A) Second order reactions

B) First order reactions

C) Pseudo first order reactions

D) Zero order reactions

Q.23 The half-life of N_2O_5 at 45°C is 24 minutes. How long will it take for sample of N_2O_5 to decay to 25% of its original concentration?

A) 24 minutes

B) 72 minutes

C) 120 minutes

D) 48 minutes

Q.24 When the change in concentration is 6×10^{-4} moldm^{-3} and time for that change is 10 seconds, the rate of reaction will be

A) 6×10^{-3} moldm^{-3} sec^{-1}

B) 6×10^{-4} moldm^{-3} sec^{-1}

C) 6×10^{-2} moldm^{-3}sec^{-1}

D) 6×10^{-5} moldm^{-3}sec^{-1}

Q.25 For the first order reaction, half-life is related to the expression $Kt_{1/2}=0.693$ Half-life is the

A) Time taken for the concentration of the product to the increase to half of its original value.

B) Time taken for the concentration of the reactant, to fall to half of its products value.

C) Time taken for the concentration of the reactant to fall to half of its original value

D) Time taken for the concentration of the reactant to fall to quarter of its original value

Q.26 The rate of reaction involving ions can be studied by method

A) Dilatometric

B) Refractrometric

C) Electrical conductivity

D) Optical rotation

Q.27 If the reactants or product of a chemical reaction can absorb ultraviolet, visible or infra-red radiation then the rate of a chemical reaction can best be measured by which one of the following methods?

A) Chemical method

B) Spectrometry

C) Graphical method

D) Differential method

Q.28 If concentration time graph of a reactant indicates a constant half-life, then the order reaction with respect the reactant is

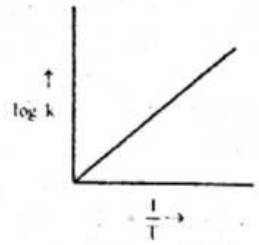
A) First order

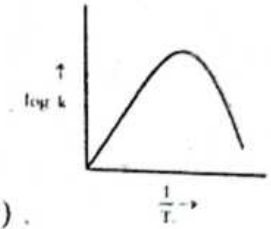
B) Second order

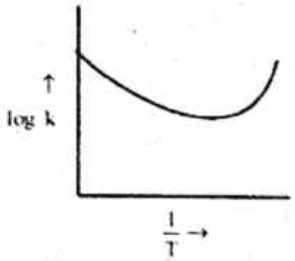
C) Zero order

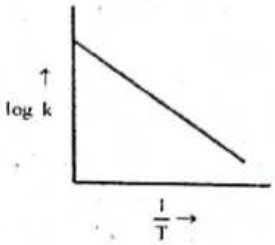
D) Half order

Q.29 By considering Arrhenius equation, the graph between, '$\frac{1}{T}$' and 'log k' gives a curve of the type

A) 

C) 

B) 

D) 

Q.30 On increasing the temperature of the rection from 20°C to 30°C, the rate of rection will become

A) Half
B) Double
C) Triple
D) Ten times

ANSWER KEY

1	C	11	D	21	C	31	C	41	B
2	B	12	C	22	D	32	D	42	C
3	D	13	A	23	C	33	C	43	D
4	B	14	C	24	A	34	D	44	D
5	B	15	D	25	D	35	A	45	B
6	A	16	B	26	D	36	B	46	D
7	C	17	B	27	D	37	D	47	D
8	C	18	A	28	D	38	B	48	C
9	C	19	A	29	B	39	A	49	B
10	D	20	C	30	B	40	C	50	D

PAST PAPER QUESTIONS

1	D	6	A	11	A	16	A	21	C	26	C
2	A	7	D	12	C	17	A	22	D	27	B
3	B	8	B	13	A	18	A	23	D	28	A
4	A	9	B	14	C	19	A	24	D	29	D
5	A	10	D	15	C	20	B	25	C	30	B

EXPLANATORY NOTES

Q.1 It is ruesting of iron so it is very slow process

Q.2 Orgnanic subsitution reactions involve covalent bond therefore these are slow reaction for example hydrolysis of ester.

Q.3 The amount of energy required for effective collisions is called activation energy.

Q.4 Potential of activated complex is higher than that of reactant and product

Q.6 Reactants SO_2, O_2 and catalyst NO are in same phase (gaseious phase). Therefore, it is homogenous catalysis

Q.7 $A+B \longrightarrow Product$

$Rate = k[A][B]$

When concentration of reactants is unity then rate constant is equal to rate of reaction

Q.8 $$\text{Number of half-life} = \frac{\text{Total time}}{\text{Half-life}}$$

$$\frac{10}{2.5} = 4$$

$$160g \rightarrow 80g \rightarrow 40g \rightarrow 20g \rightarrow 10g$$

After 4 half-life 10g left behind

Q.9 For chemical reaciton to condition are necessary

(i) Proper orientation (ii) Activation energy

Q.11 For exothermic reaciton activation of energy of forward reaction is less than activation energy of backward reaction

Q.12 In hydrolysis of ester water is in large excess therefore it is pseudo 1st order reaciton

Q.13 If exothermic reaciton activation of energy of forward reaction is less than activation energy of backward reaction.

If reaction is endothermic, activaiton energy of forward reaciton is greater than that of reverse reaction

Q.14 $Rate = k[A][B]$ the sum of the exponents of concentration terms in given rate law equation is two

Q.15

$$Rate = [A]^n$$

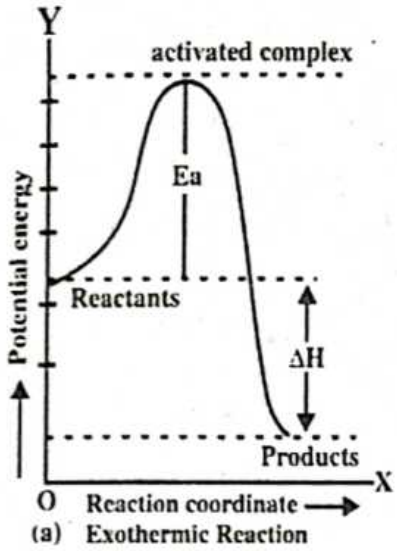
$$2 = [4]^n,\ 2 = 2^{2n},\ 1 = 2n,\ n = \frac{1}{2}$$

Q.16 After two half-life concentration of reactant is reduced to 25%.

$$\text{Half-life} = \frac{\text{Total time}}{\text{No. of half-life}}$$

$$t_{\frac{1}{2}} = \frac{60\text{min}}{2} = 30\text{min}$$

Q.17



(a) Exothermic Reaction

Q.18 $Ea_r = Ea_f - \Delta H$

$= 15 - (+5) = 10$

Q.19 Temperature increases from 10 k to 100 k is 90 k which is 9 interval of 10 k

$\text{Rate increases} = (2)^{\text{No of interval of 10k}}$

$\text{Rate increases} = (2)^9 = 512$

Q.20 For 2nd order reaction

$\text{Rate} = k[A]^2$

$\text{Rate} = k[2]^2 = 4$

$\text{Rate} = k[3]^2 = 9$

Q.21

$\text{Rate} = [A]^n$

$2 = [8]^n,\ 2 = 2^{3n},\ 1 = 3n,\ n = \frac{1}{3}$

Q.23 By increasing the concentration of reactants, number of effective collisions increases so rate of reaction increases

Q.24 Rate is directly proportional to concentration of A and concentration of B so it is 2nd order reaciton

Q.26 Catalyst can initiate the reaciton which is thermodynamically feasible

Q.27 Activation energy is directly proportional to potential energy of activated complex and rate of reaciton is inversely proportional to the activation energy

Q.28 Catalyst change the mechanism of reaction and decreases the activaiton energy which increases the rate of reaction.

Q.30 Rate of reaction increases by decreasing the activation energy

Q.31 The reactants SO_2 and O_2 are in gaseous phase while catalyst V_2O_5 is in solid phase. Therefore it is the example of heterogeneous catalysis

Q.33 $C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Invertase}} C_6H_{12}O_6 + C_6H_{12}O_6$

Q.35 Rate of reaciton is directly proportional to the square of concentration of A and is independent to concentration of B

Q.36

$$\text{Rate} = k[A]^2[B]$$

$$\text{Rate} = (2)^2(2), = 4\times2=8$$

Q.37 It is overall 3rd order reaction. With respect to A, it is 2nd order reaction with respect to B is 1st order

Q.38 X is large excess, so rate of reaction is independent to the concentration of X and is directly proportional to the concentration of Y. It is 1st order reaciton with respect to Y.

Q.39 $\left[t_{1/2}\right]_1 = \dfrac{0.693}{k}$

Q.40 For zero order reaction half-life period is directly proportional to the initial concentration of reactant

Q.41

$$\left[t_{1/2}\right]_n \propto \frac{1}{a^{n-1}}$$

$$\left[t_{1/2}\right]_2 \propto \frac{1}{a^{2-1}}$$

$$\left[t_{1/2}\right]_2 \propto \frac{1}{a}$$

Q.42

$$\left[t_{1/2}\right]_n \propto \frac{1}{a^{n-1}}$$

$$\left[t_{1/2}\right]_n \propto a^{-(n-1)}$$

$$\left[t_{1/2}\right]_n \propto a^{1-n}$$

Q.43 After three half-life concentraiton of reactant is reduced to $\frac{1}{8}$th

Total time = half-life × Number of half-life

= 14sec × 3 = $(14)^3$sec

Q.44 $\text{Number of Half-life} = \dfrac{\text{Total time}}{\text{Half-life}} = \dfrac{72}{24} = 3$

$10 \rightarrow 5 \rightarrow 2.5 \rightarrow 1.25$

After three half-life 1.25g of N_2O_5 is left behind

Q.45 Rate of reaction is inversely proportional to the activation energy

Q.46 The unit of rate constant in given statement is $moldm^{-3}sec^{-1}$ which shows it is zero order reaction.

1B Topic PERIODS

PRACTICE EXERCISE

INTRODUCTION

Q.1 In a same period, an element X belongs to II-A group and another element Y belongs to V-A group, marks the incorrect statement

A) X is greater in atomic/ionic size comparatively to Y
B) Y has more free electrons as compared to X
C) Y is a good conductor as compared to X
D) X is surely a metal while Y might be a non-metal or a metalloid

Q.2 Total number of elements is 2^{nd} period are

A) 8
B) 18
C) 32
D) 2

Q.3 For which element, are the group number and period number the same

A) Li
B) Be
C) B
D) Mg

Q.4 Modern periodic table has been divided in _____blocks

A) 2
B) 8
C) 4
D) 7

Q.5 The period number in the periodic table represents

A) Number of valance electron
B) Number of shells
C) Atomic number
D) Atomic mass

Q.6 An element has electronic configuration $1s^2, 2s^2, 2p^2$. It belongs to

A) Group II-A
B) Group VII-A
C) Group IV-A
D) Group VI-A

Q.7 How many elements are there in period 6

A) 32
B) 10
C) 14
D) 18

Q.8 Which of the following has both members from the same period of periodic table

A) Cl, Br
B) Na, Ca
C) Na, Cl
D) Ca, Cl

Q.9 Third and fourth periods of periodic table consist of _____ and _____ respectively

A) Eight and eighteen elements
B) Eighteen and thirty two elements
C) Eight and eight elements
D) Eighteen and eighteen elements

Q.10 Which one of the following is not a periodic property

A) Melting point of elements
B) Ionization energy of elements
C) Boiling point of elements
D) Coordination number of ions

Q.11 Which of the following property remains constant along the period?

A) Atomic number
B) Shielding effect
C) Ionization energy
D) Metallic character

ATOMIC RADIUS

Q.12 Which of the following represent elements in order of decreasing atomic size?

A) F, Cl, Br
B) S, P, Si
C) Li, Be, B
D) Be, Mg, Ca

Q.13 Which of the following will remain constant along the period
A) Atomic size
B) Shell number
C) Atomic number
D) Ionization energy

Q.14 The correct order of atomic radii is
A) F < K < Na < Li
B) Li < Na < K < F
C) F < Li < Na < K
D) Na < K < Li < F

Q.15 The correct atomic size order is
A) Li > Mg
B) Be > Al
C) B > Si
D) Ba > Na

Q.16 Shielding effect across a third period
A) Increases
B) first increase then decrease
C) Decreases
D) Remains same

Q.17 Increase in atomic size down the group is due to
A) Addition of shells
B) Inert pair effect
C) Shielding effect
D) Both A) and C)

Q.18 Atomic radius of fluorine is only larger than _____ in its period
A) Li
B) N
C) O
D) Ne

IONIC RADIUS

Q.19 Which one of the following is smallest in size?
A) Na^+
B) F^-
C) O^{2-}
D) N^{3-}

Q.20 Consider the iso-electronic species,K^+,S^{2-},Cl^- and Ca^{2+}, the radii of the ion decrease as
A) $Ca^{+2} > Cl^- > K^+ > S^{2-}$
B) $Cl^- > K^+ > S^{2-} > Ca^{2+}$
C) $K^+ > Cl^- > Ca^{2+} > S^{2-}$
D) $S^{2-} > Cl^- > K^+ > Ca^{2+}$

Q.21 The radius of fluorine atom is 72pm and that of the fluoride ion (F^-) is _____
A) 72pm
B) 133pm
C) 44pm
D) 36pm

Q.22 One of the following species is iso-electronic with Ca^{2+}. Which is that
A) Sr^{2+}
B) Ar
C) Na
D) Mg^{2+}

Q.23 The size of which of the following species is largest after gaining one electron
A) Na^+
B) F
C) O^{-1}
D) N^{-2}

Q.24 The radii of H, H^+ and H^- are in the order of
A) $H^+ > H > H^-$
B) $H^- > H > H^+$
C) $H > H^- > H^+$
D) $H > H^+ > H$

Q.25 After losing an electron radius of Na is reduced to
A) 95pm
B) 157pm
C) 181pm
D) 62pm

Q.26 Which statement is correct
A) Loss of valence electron may lead to loss of valence shell
B) Radius of isoelectronic ions decreases left to right in 3rd period
C) Anionic radius increase with magnitude of negative charge
D) All of these

Q.27 Which ion is largest in size in 2nd period

A) Cl^- C) N^{-3}
B) F^- D) Be^{+2}

MELTING POINT

Q.28 Melting points of group IIA elements are considerably higher than those of group IA elements because

A) Size of IIA is greater than IA C) I.E of IIA is higher than IA
B) I.E of IIA is less than IA D) IIA provide more binding electron

Q.29 The correct melting point order is

A) Al > Si C) P > Si
B) Na > Mg D) S > Cl

Q.30 The lowest melting point among these four elements is of

A) Be C) Ca
B) Mg D) Sr

Q.31 The highest melting point among these elements is of

A) Nitrogen C) Fluorine
B) Oxygen D) Neon

Q.32 Generally the melting point decreases from VA to VIII A along the period but with exception of

A) Phosphorous C) Chlorine
B) Sulphur D) Argon

Q.33 Among the given elements of period 3, the greatest value of melting point is observed in case of

A) Mg C) Si
B) Al D) P

Q.34 Correct order of melting point of group II A elements

A) Be > Mg > Ca C) Ca >Be > Mg
B) Mg > Be > Ca D) Be > Ca > Mg

Q.35 Melting point of IA and IIA decreases down the group due to _____.

A) Strong electronegativity C) Increment in size
B) Strong attractive forces D) High ionization energy

BOILING POINT

Q.36 In which group melting and boiling point decreases down the group

A) IA C) VIIA
B) VIIIA D) VA

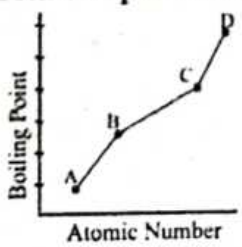
Q.37 The element which has boiling point less than 0°C is

A) Beryllium C) Carbon
B) Boron D) Nitrogen

Q.38 Across the short period the melting and boiling point increase upto

A) IIIA group C) IVA group
B) VA group D) VIA group

Q.39 In the following graph boiling points of halogens are given, select the option of that halogen which is liquid at room temperature



IONIZATION ENERGY

Q.40 Ionization energy depends upon
A) Atomic/ionic radii
B) Electron to proton ratio
C) Shielding effect
D) All of these

Q.41 With the increasing atomic number, ionization energy increases along a period because
A) No change in shielding effect along a period
B) Nuclear pull increases with the increase in number of protons
C) Atomic/ionic size decreases along a period
D) All of the above

Q.42 If the ionization energy of unknown element 'Z' is very low then, the element 'Z' is
A) Non-metal
B) Metal
C) Metalloid
D) Semi-metal

Q.43 The ionization energy of an element is
A) The energy released when an electron is added to an atom of the element
B) The same as the electron affinity of element
C) Equal in magnitude but of opposite sign to the electron affinity of the element
D) The energy required to remove the outermost electron of an atom of the element

Q.44 Ionization energy depends upon
A) Nuclear charge
B) Atomic size
C) Shielding effect
D) I.E depends upon all of the above and nature of orbital

Q.45 The 1st ionization energy of metal is lower and 2nd ionization energy is very high, it indicate that group number is
A) IA
B) IIIA
C) IIA
D) IVA

Q.46 The greater 1st ionization energy would be associated with which of the following configuration
A) $1s^2\ 2s^2\ 2p^6\ 3s^1$
B) $1s^2\ 2s^2\ 2p^5$
C) $1s^2\ 2s^2\ 2p^3$
D) $1s^2\ 2s^2\ 2p^6$

Q.47 Which one of the following series is arranged in order of increasing value
A) The first ionization energies of: Oxygen, Fluorine, Neon
B) The radii of: H^- ion, H atom, H^+ ion
C) The electro negativities of: Chlorine, Bromine, Iodine
D) The boiling points of: Iodine, Bromine, Chlorine

Q.48 In the periodic table, the ionization energy of elements decreases from top to bottom because of
A) Increase in atomic size
B) Decrease in shielding effect
C) Decrease in electronegativity
D) Increase in density

Q.49 In the following, the element with the highest ionization energy is
A) $[Ne]\ 3s^2\ 3p^1$
B) $[Ne]\ 3s^2\ 3p^3$
C) $[Ne]\ 3s^2\ 3p^2$
D) $[Ne]\ 3s^2\ 3p^4$

Q.50 The unit of ionization energy is
A) Joule
B) KJ/mol
C) Calorie
D) KJ

ELECTRONEGATIVITY

Q.51 Which of the following is NOT true about electronegativity

A) Metal has EN value less than 2
B) With increase in O.S, EN decreases
C) It has no unit
D) It determines the polarity of molecule

Q.52 The power of an atom to attract shared pair of electrons towards itself in a molecule is called

A) Electron Affinity
B) Ionization Potential
C) Electronegativity
D) Hydration Energy

Q.53 Which one of the following elements has greater electronegativity value

A) N
B) O
C) Br
D) C

Q.54 Which of the following periodic properties has no unit

A) Electron Affinity
B) Ionization Potential
C) Electronegativity
D) Hydration Energy

Q.55 Which of the following elements has greater electronegativity

A) As
B) S
C) Si
D) P

ELECTRON AFFINITY

Q.56 Which of the following element has greater negative first electron affinity (EA_1)

A) C
B) B
C) Li
D)Be

Q.57 Which of the following group of elements have positive 1st electron affinity

A) IA
B) IIA
C) VIA
D) VIIA

Q.58 Which of the following halogens has comparatively smaller first electron affinity

A) F
B) Br
C) I
D) Cl

ELECTRICAL CONDUCTIVITY

Q.59 Which of the following is incorrect information

A) Metals have free electrons in the valance shell
B) Electrical conductivity increases with the decrease of temperature
C) Metalloids are poor conductors of electricity
D) Non-metals have atomic conductance usually less than 10^{-10} ohm^{-1}

Q.60 Which of the following group of elements have extra ordinary high value of electrical conductivity

A) IA
B) IIA
C) IB
D) VIIA

OXIDATION STATES

Q.61 The maximum oxidation state of S is in

A) H_2S
B) S_2Cl_2
C) SO_2
D) H_2SO_4

Q.62 Which of the following transition element does not have oxidation number according to the group number

A) Mn(VII)
B) Cu(I)
C) Zn(II)
D) Cr(V)

Q.63 In which of the following compounds, central atom has +8 oxidation states

A) Na_4XeO_6
B) $K_2Cr_2O_7$
C) $H_2S_2O_7$
D) $KMnO_4$

HYDRATION ENERGY

Q.64 Which of the following possesses maximum hydration energy

A) Na^{+}
B) Mg^{+2}
C) K^{+}
D) Ca^{+2}

Q.65 Identify the incorrect statement about hydration energy

A) $Li^{+} > K^{+}$
B) $Mg^{+2} > Ca^{+2}$
C) $Al^{+3} > Ca^{+2}$
D) $Cl^{-} > F^{-}$

HALIDES

Q.66 Halides in which halogen atoms act as a bridge between two atoms of the other element are called

A) Covalent halides
B) Polymeric halides
C) Electronegative halides
D) Polymeric hydrides

Q.67 The most ionic halide is

A) NaCl
B) $MgCl_2$
C) $AlCl_3$
D) $SiCl_4$

Q.68 Order of decreasing ionic character of halides is

A) Chloride > Fluoride > Bromide > Iodide
B) Fluoride > Chloride> Bromide > Iodide
C) Iodide > Chloride> Bromide > Fluoride
D) Iodide > Bromide > Chloride > Fluoride

OXIDES

Q.69 Amphoteric oxides are those, which possess _____ properties

A) Acidic
B) Acidic and basic
C) Basic
D) Neutral and acidic

Q.70 Which of the following is amphoteric oxide

A) K_2O
B) CO_2
C) SO_3
D) Al_2O_3

PAST PAPERS QUESTIONS

Q.1 Which one remains same along a period?

A) Atomic radius
B) Melting point
C) Number of shells (orbits)
D) Electrical conductivity

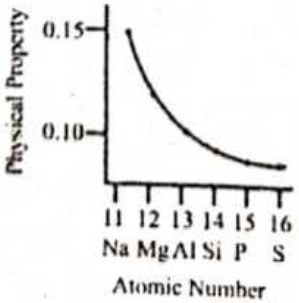
Q.2 Along a period, atomic radius decreases. This gradual decrease in radius is due to

A) Increase in number of shells
B) Increase in number of protons in the nucleus
C) Melting and boiling points first decrease then increase
D) Melting and boiling points first increase then decrease

Q.3 Keeping in view the size of atoms, which order is correct?

A) N > C
B) P > Si
C) Ar > Cl
D) Li > Be

Q.4 Following graph shows a physical property along the period 3 elements. Which physical property is



A) Electron affinity
B) Non-metallic character
C) Atomic radius
D) Melting point up to group IVA

Q.5 **Down the group acid-base behavior of metallic oxides of group2 elements changes to**

A) More basic
B) Less basic
C) No change
D) More acidic

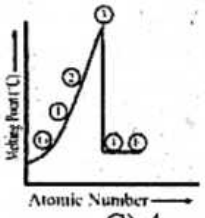
Q.6 **Which one of the following will have the smallest radius?**

A) Al^{+3}
B) Si^{+4}
C) Mg^{+2}
D) Na^{+1}

Q.7 **In the 3rd period of the periodic table which of following property is decreasing consistently?**

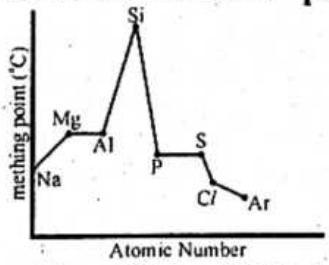
A) Electrical conductivity
B) Melting point
C) Ionization energy
D) Atomic radius

Q.8 **The diagram below is a plot of melting points of elements of second period against their atomic numbers. Lithium and fluorine are placed at the extreme ends of the plot. On the basis of melting points where would you place carbon among the empty slots on the plot?**



A) 1
B) 2
C) 4
D) 3

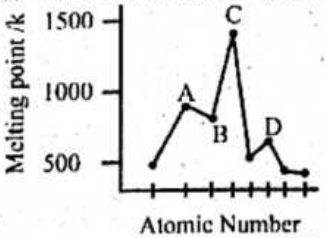
Q.9 **The trends in melting points of the elements of 3rd period are depicted in figure below**



The sharp decreases observed from 'Si' to 'P' is due to

A) Decrease in atomic radius from 'Si' to 'P'
B) Change in bonding and structure of two elements
C) Different densities of two elements
D) Increase in electron density from 'Si' to 'P'

Q.10 **The following sketch shows the melting point of eight elements with consecutive atomic numbers. Which element is silicon?**



A) A
B) B
C) C
D) D

Q.11 **In period 2 and period 3 maximum melting point shown by elements**

A) Lithium and sodium
B) Neon and argon
C) Carbon and silicon
D) Nitrogen and phosphorous

Q.12 The following sketch show the variation in a physical property of third period elements against their number:



What physical property is plotted in this sketch?

A) Ionic radius
B) Ionization energy
C) Melting point
D) Atomic radius

Q.13 What is the trend of melting and boiling points of the elements of short periods as we move from left to right in a periodic table?

A) Melting and boiling points decrease gradually
B) Melting and boiling points first decrease then increase
C) Melting and boiling points increase gradually
D) Melting and boiling points first increase then decrease

Q.14 Energy required to remove an electron from gaseous neutral atom is

A) Electron affinity
B) Ionization energy
C) Lattice energy
D) Crystal energy

Q.15 The elements for which the value of ionization energy is low can

A) Gain electrons readily
B) Lose electron less readily
C) Gain electrons with difficulty
D) Lose electron readily

Q.16 More the ionization energy of an element

A) More the electro positivity
B) More the reducing power
C) Less the metallic character
D) Bigger the atomic radius

Q.17 Arrange the following elements according to the trends of ionization energies C, N, Ne, B

A) Ne < N < C < B
B) B < N < C < Ne
C) B < C < N < Ne
D) Ne < B < C < N

Q.18 In the second period of elements, although oxygen lies next to nitrogen yet its ionization first energy is lower than that of nitrogen because?

A) In oxygen, there exists repulsion between pair of electrons present in the same orbital of valence shell
B) Oxygen is paramagnetic in character.
C) Nuclear charge of oxygen is greater than nitrogen.
D) Oxygen has higher electron affinity.

Q.19 Ionization energy decrease down the group from top to bottom due to:

A) Decrease in atomic size
B) Increase in atomic mass
C) Increase in shielding effect of the intervening electrons
D) Increase in proton number

Q.20 The ionization energy of potassium is less than sodium due to

A) Decrease in shielding effect
B) Increase in nuclear charge
C) Decrease in electron affinity
D) Increase in atomic radius

Q.21 Which element has the highest electron affinity among halogens?

A) F
B) Cl
C) I
D) Br

Q.22 **Which one of the following properties decreases across the third period of elements in the periodic table?**

A) Electronegatively
B) Ionization energy
C) Ability to act as reducing agent
D) Melting and boiling points

Q.23 **The hydration energy of Mg^{2+} is less than**

A) Na^{+1}
B) Li^{+1}
C) Ca^{2+}
D) Al^{3+}

Q.24 **Which of the following oxide is most acidic oxides?**

A) Al_2O_3
B) Na_2O_3
C) Cl_2O_7
D) CaO

Q.25 **Which of the following compound have Ionic Bond?**

A) MgO
B) CO_2
C) SiO_2
D) Al_2Cl_6

ANSWER KEY

1	C	11	B	21	B	31	A	41	D	51	B	61	D
2	A	12	C	22	A	32	B	42	B	52	C	62	D
3	B	13	C	23	B	33	C	43	D	53	B	63	A
4	C	14	D	24	A	34	D	44	D	54	C	64	B
5	B	15	D	25	D	35	C	45	A	55	B	65	D
6	C	16	D	26	C	36	A	46	D	56	A	66	B
7	A	17	D	27	D	37	D	47	A	57	B	67	A
8	C	18	B	28	D	38	C	48	A	58	C	68	B
9	A	19	A	29	D	39	C	49	B	59	B	69	B
10	D	20	B	30	B	40	D	50	B	60	C	70	D

PAST PAPER QUESTIONS

1	C	6	B	11	C	16	C	21	B
2	B	7	D	12	C	17	C	22	C
3	D	8	D	13	D	18	A	23	D
4	C	9	B	14	B	19	C	24	C
5	A	10	C	15	D	20	D	25	A

EXPLANATORY NOTES

Q.1 Group (IIA) is alkaline earth metals while group (VA) is nitrogen family (Non-metals). So, IIA group are metals having large atomic size and free electrons (conductor) while VA are non-metals having small atomic size and no free electrons (insulator)

Q.2

Period No.	No. of elements
1	2 ⟶ shortest period
2	8 ⟶ short period
3	8
4	18 ⟶ long period
5	18
6	32 ⟶ longest period
7	23 ⟶ (Incomplete period)

Q.3 Period No. = No. of shell
Group No. = No. of valence electrons

A) $_3Li$ $1s^2\ 2s^1$ — Group No = 1, Period No = 2

B) $_4Be$ $1s^2\ 2s^2$ — Group No = 2, Period No = 2

C) $_5B$ $1s^2\ 2s^2\ 2p^1$ — Group No = 3, Period No = 2

D) $_{12}Mg$ $1s^2\ 2s^2\ 2p^6\ 3s^2$ — Group No = 2, Period No = 3

Q.4 Modern periodic table has been divided into four blocks (s, p, d and f) on basis of electronic configuration.

Q.5

A) No. of valence electron = Group no.
B) No. of shells = Period no.
C) Atomic no. represents no. of protons in atom
D) Atomic mass = No. of P^+ + no. of neutron

Q.6 Electronic configuration is $1s^2, 2s^2, 2p^2$.
Group No = No. of valence electrons
This element contain 4-valence electrons so it belongs to IVA group.

Q.7 6^{th} period of periodic table is the longest period that contain 32-elements

Q.8 Period number = number of shells
$_{11}Na$ $1s^2\ 2s^2\ 2p^6\ 3s^1$
$_{17}Cl$ $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

Q.10 The repetition of properties at regular interval in periodic table is called periodicity of properties. Coordination no is not periodic property because it has no repetition in group and periodic table.

Q.11 Shielding effect ∝ No. of shells

In period, all elements have same no. of shells (period No. = No. of shells). So, shielding effect remains constant.

Q.12 Atomic size decreases from left to right in period due to increase in effective nuclear charge so from Li to B atomic size decreases

Q.13 Shell no and shielding effect remain constant along period because.

Period No. = Shell No.

Shielding effect ∝ No. of shell

Q.14 F is on the extreme right side of periodic table so has smallest size while Li, Na and K are alkali metals having large size. Their size increases down the group so correct order of atomic size is F < Li < Na < K

Q.15 Ba is at the bottom of group (IIA) so having largest size while Na is at top of group (IA) so having smaller size so Ba > Na

Q.17 Atomic size increases down the group due to

(i) Increase in no. of shell

(ii) Increase in shielding effect

(iii)Decrease in effective nuclear charge

Q.18 Atomic size decreases from left to right in period due to increase in effective nuclear charge (Zeff) so correct order of atomic size is Li > N > O > F > Ne

Q.19 $\text{Ionic radius} \propto \frac{1}{\text{Magnitude of + ve charge on cation}}$

Ionic radius ∝ Magnitude of –ve charge on anion

So, order of ionic radius is $N^{-3} > O^{-2} > F^{-1} > Na^{+1}$

Q.20 $\text{Ionic radius} \propto \frac{1}{\text{Magnitude of + ve charge on cation}}$ If number of shells are constant.

Ionic radius ∝ magnitude of –ve charge on anion

So, order of ionic radius is $S^{-2} > Cl^{-1} > K^{+1} > Ca^{+2}$

Q.22 Atomic No = No. of electrons

$_{20}Ca$ = 20 electrons

Ca^{+2} = 20 – 2 = 18 electrons

$_{18}Ar$ = 18 electrons

Q.23

$$\underset{(2,8)}{Na^{+1}} + 1e^- \longrightarrow \underset{(2,8,1)}{Na}$$

Na^{+1} after gaining one electron has three no. of shells while all other ions have two shell after gaining electron. So atomic / Ionic radius ∝ no. of shell

Q.25 Atomic/ Positive ion — Ionic radius (pm)

Na	187
Na^{+1}	95

Q.26 A) For example, in alkali metals, loss of one electron lead to loss of valence shell

$$\underset{(2,8,1)}{Na} \longrightarrow \underset{(2,8)}{Na^{+1}} + 1e^-$$

B) Radius of iso-electronic species decreases from left to right in period because

(i) No. of shell / shielding effect remains same

(ii) In crease in effective nuclear charge

C) Anionic radius ∝ magnitude of –ve charge on anion

Q.28 Melting / boiling point of metals (IA & IIA) depends on

(i) No. of binding electrons

(ii) Metallic structure

Binding energy ∝ no. of binding electrons

Binding energy ∝ melting and boiling point

Group (IIA) provide two electrons per atom for binding so have highest melting and boiling point than IA.

Q.29 Melting point ∝ Atomicity

Sulphur has 8-atomicity so large atomic size and high melting point than Cl_2 which has 2-atomicity, small size and low melting point

Q.30 Generally, in group (IIA), melting point decreases down the group so order of melting point Be > Ca > Sr > Ba > Mg

Abnormally, Mg has lowest melting point because of its hexagonal structure. It contains empty spaces so, less binding energy and less melting point

Q.31 London dispersion forces ∝ Size ∝ polarizability

LDF ∝ melting point

Among given options, nitrogen has large size, large polarizability and large LDF and high melting point.

Q.32 In 3rd period, melting point decreases from left to right in period but sulphur (S_8) shows exception due to high atomicity than phosphorus (P_4)

Period-3 $P < S > Cl > Ar$

Q.33 In 3rd period, Si has highest melting point because in its crystal it provides four electron per atom for binding, so high binding energy and highest melting point

Q.35 In IA and IIA group, melting point decreases due to increases in size, less binding energy.

Q.36 In IA and II A group, melting point decreases down the group due to

(i) Increase in size

(ii) Decreases in binding energy

Q.37 N_2 exist as independent individual non-polar small molecule so has least inter – molecular forces (IMF) and lowest boiling point (boiling point of $N_2 = -196°C$).

Size $\propto$ Polarizability $\propto$ London Dispersion Forces

London Dispersion Forces $\propto$ boiling point

While others have giant structure, high binding energy and high boiling point

Q.38 In 2nd and 3rd period, melting point / boiling point increases up to IVA (giant structure and high binding energy) and then decreases from VA to VIIIA (Independent, individual non-polar small molecule and less intermolecular forces)

Q.39 A and B are gases due to small size, C is liquid due to relatively large size while D is solid due to largest size

Size $\propto$ Polarizability $\propto$ London Dispersion Forces

Q.40 Ionization energy $\propto \frac{1}{\text{atomic size}}$

$\propto \frac{1}{\text{shielding effect}}$

$\propto \frac{1}{\text{Electron to proton ratio}}$

Q.42 If ionization energy (I.E) is low $\rightarrow$ Metals

If ionization energy (I.E) is intermediate $\rightarrow$ Semi-metals

If ionization energy (I.E) is high $\rightarrow$ Non-metals

Q.45 If there is large gap between 1st and 2nd ionization energy (I.E). It contains one valence electron and it belong to IA group.

Q.46 $1s^2, 2s^2, 2p^6$

It is configuration of noble gas (stable configuration) so it has very high 1st I.E.

Q.47 Ionization energy increases from left to right in period due to increase in effective nuclear charge (Z_{eff}) so order of ionization energy is ${}_8O < {}_9F < {}_{10}Ne$

Q.48 Ionization energy decreases from top to bottom in group due to

(i) Increase in atomic size

(ii) Increase in shielding effect

(iii) Decrease in effective nuclear charge (Z_{eff})

Q.49 ${}_{10}[Ne]\ 3s^2, 3p^3$

This element has half filled (stable) p-orbital. So,

stability of orbital $\propto$ ionization energy

Q.50 Unit of Ionization energy is kJ/mol or ev/mol.

Q.51 With the increase of OS of elements, EN increases as it is observed along the period.

Q.53

Elements	Electronegativity value
N	3.0
O	3.5
Br	2.8
C	2.8

Q.55 Sulphur has greater electronegativity. Electronegativity also depends on valance electrons, greater is the number of valance electrons greater is the electronegativity.

Elements	Electronegativity value
As	2.0
S	2.5
Si	1.8
P	2.1

Q.56 Electron affinity of carbon is greater than that of other elements as shown in the tabular form

Elements	Electron affinity (kJ mol^{-1})
C	–123
B	–83
Li	–1.6
Be	240

Q.57 IIA group elements have positive 1^{st} electron affinity value

Q.58

Elements	Electron affinity (kJ mol^{-1})
F	–322
Br	–325
I	–295
Cl	–349

Q.59 The electrical conductance decreases with the increase of temperature

Q.60 IB (Coinage metals) are good electrical conductors

Q.61 In H_2SO_4 , the oxidation state of S is +6 which is maximum and equal to the group number VIA

Q.62 Cr belongs to VIB so, its maximum oxidation state is VI

Q.63 In the compound sodium perxenate Xe has +8 oxidation state

Q.64

Q.65

Ions	Hydration energy $kJmol^{-1}$
F	–457
Cl^-	–384
Li^+	–499
K^+	–305
Mg^{+3}	–1891
Al^{+3}	–4613

2B Topic GROUP

PRACTICE EXERCISE

REACTIONS OF GROUP-II ELEMENTS + THERMAL DECOMPOSITION AND SOLUBILITY OF COMPOUNDS

Q.1 Which of the following property of IIA group decreases down to the group?

A) Atomic radii
B) Reactivity with H_2O
C) Basicity of hydroxides
D) Ionization energy

Q.2 In alkaline earth metal, the oxidation states more than two are never encountered because

A) The removal of third electron involves breaking up of noble gas configuration and the energy needed for this purpose is very high
B) They have only two electrons in the outermost shell
C) The s-orbital can accommodate only two electrons
D) All are correct

Q.3 Be^{2+} has a strong tendency to form covalent bonds in its compounds due to the reason that

A) It has high charge density
B) It has low polarizing power
C) It has low charge density
D) It has low ionization energy

Q.4 The solubility of noble gases in water increases with increasing atomic number. This is because the

A) Bigger atoms are less polarized by water
B) Bigger atoms have low I.E
C) Bigger atoms are more polarized by water
D) Bigger atoms have high I.E

Q.5 All noble gases are

A) Mono-atomic
B) Tri-atomic
C) Di-atomic
D) Poly atomic

Q.6 An element having high ionization energy and tends to be chemically in-active would most likely to be a/an:

A) Alkali metal
B) Noble gas
C) Transition element
D) Halogens

Q.7 The substance with the lowest of any known boiling point is

A) Helium
B) Neon
C) Argon
D) Krypton

Q.8 Beryllium and barium do not form oxide with oxygen

A) Normal oxide
B) Acidic oxide
C) Basic oxide
D) Amphoteric oxide

Q.9 Which one of the following doesn't react with water even at red hot temperature

A) Be
B) Ca
C) Mg
D) Ba

Q.10 Which of the following hydroxide is more soluble in water?

A) LiOH
B) $Mg(OH)_2$
C) $Sr(OH)_2$
D) $Ba(OH)_2$

Q.11 Milk of magnesia is

A) Suspension of $Ca(OH)_2$
B) Solid $Mg(OH)_2$
C) Suspension of $Mg(OH)_2$ in water
D) Suspension of $Ca(OH)_2$ and $Mg(OH)_2$

Q.12 Saturated solution of $Ca(OH)_2$ is called

A) Milk of lime
B) Quick lime
C) Lime water
D) White wash

Q.13 Slaked lime is not used in the manufacture of

A) Fire bricks
B) Acetylene
C) Medicine
D) Bleaching powder

Q.14 The amphoteric oxide is

A) CaO
B) Na_2O
C) BeO
D) BaO

Q.15 Which of the following is less soluble in water

A) $Be(OH)_2$
B) $Mg(OH)_2$
C) $Ca(OH)_2$
D) $Sr(OH)_2$

Q.16 Which one of the following is applied on walls as white wash

A) Lime water
B) Milk of magnesia
C) Milk of lime
D) Lime stone

Q.17 When carbon dioxide is passed through _____ it turns milky

A) Quick lime
B) Milk of Magnesia
C) Milk of lime
D) Lime water

Q.18 Which is not true about beryllium

A) Least reactive metal in the group
B) Loses silvery appearance instantly
C) Never oxidized completely
D) Not highly corroded at ordinary temperature

PROPERTIES OF HALOGENS AND THEIR COMPOUNDS

Q.19 Demerits of water purification by chlorination is/are:

A) Formation of chloroform with organic matter in water which is liver carcinogen
B) Risk of bladder and rectal cancer
C) Eye irritation due to the formation of chloramines
D) All of the above

Q.20 Melting and boiling points of halogens increase down the group due to:

A) Increasing atomic mass
B) Non polar character
C) Increasing polarizability
D) Decreasing polarizability

Q.21 Which of the following group of periodic table possess the elements of all the three physical states of matter?

A) IVA
B) VA
C) VIIA
D) VIIIA

Q.22 Why bleaching powder is always preserved in sealed plastic bags?

A) It is hygroscopic
B) It decomposed
C) Chlorine gas escapes
D) Calcium change in calcium hydroxide

Q.23 The colour of fluorine gas is

A) Greenish yellow
B) Red brown
C) Greyish black
D) Pale yellow

Q.24 Mark the correct order regarding the oxidizing power of halogens

A) $I_2 > Br_2 > F_2 > Cl_2$
B) $I_2 < Br_2 < Cl_2 < F_2$
C) $Br_2 > F_2 > I_2 > Cl_2$
D) None of the above

Q.25 Which halogen is solid at room temperature

A) F_2 C) Cl_2
B) Br_2 D) I_2

Q.26 The correct formula of bleaching powder is

A) $Ca(OH)_2$ C) $COCl_2$
B) $Ca(OCl)Cl$ D) $CaSO_4.2H_2O$

Q.27 The colour of chlorine gas is

A) Pale yellow C) Greenish yellow
B) Reddish brown D) Greyish black

Q.28 Which of the halogen has highest electronegativity?

A) Fluorine C) Chlorine
B) Bromine D) Iodine

Q.29 Which of the following statements is incorrect about halogens

A) All are non-metals
B) All the halogens have electronic configuration ns^2p^5
C) They have high electron affinity and ionization energy
D) All the halogens react with noble gases to form their halides

Q.30 With the increase of atomic number of halogens, they

A) Lose the outermost electrons less readily C) Become less denser
B) Gain electrons less readily D) Become lighter in colour

Q.31 Bleaching powder is an example of

A) Normal salt C) Double salt
B) Mixed salt D) Complex

Q.32 Which statement is true for halogens

A) Have large standard electrode potentials
B) Have high electronegativity values
C) Their electron affinity values are large and negative
D) All of these

Q.33 Which halogen shows only single restricted oxidation state

A) Fluorine C) Chlorine
B) Bromine D) Iodine

Q.34 Bleaching action of bleaching powder is due to

A) Chloride ion C) Chlorate ion
B) Hypochlorite ion D) Per-chlorate ion

REACTION OF CHLORINE

Q.35 A reaction in which an atom, ion or molecule is oxidized and reduced simultaneously is called

A) Disproportionation reaction C) Neutralization reaction
B) Self oxidation-reduction reaction D) Both "A" and "C"

Q.36 The oxidation state of chlorine in NaClO is

A) −1 C) −1/2
B) +1 D) 0

Q.37 Which of the following is formed when, NaOH reacts with Cl_2 in cold state

A) $NaClO_4$ C) $NaClO_3$
B) NaClO D) $NaClO_2$

Q.38 **Consider the following reaction**

$$3Cl_2 + 6NaOH \longrightarrow NaClO_3 + 5NaCl + 3H_2O$$

This reaction is

A) Displacement reaction
B) Disproportionation reaction
C) Double displacement reaction
D) Reduction reaction

Q.39 **The chemical formula of sodium hypochlorite is**

A) NaClO
B) $NaClO_3$
C) $NaClO_2$
D) $NaClO_4$

Q.40 **For the reaction, $3NaClO \longrightarrow 2NaCl + NaClO_3$**

The temperature required is

A) 5°C
B) 15°C
C) 30°C
D) 70°C

COMPARISION OF OXIDIZING POWER OF HALOGNS

Q.41 **Which of the following is not possible**

A) $F_2 + 2Cl^- \longrightarrow Cl_2 + 2F^-$
B) $Br_2 + 2I^- \longrightarrow 2Br^- + I_2$
C) $Cl_2 + 2I^- \longrightarrow 2Cl- + I_2$
D) $2F^- + I_2 \longrightarrow 2I^- + F_2$

Q.42 **Identify the weakest oxidizing agent**

A) F_2
B) Cl_2
C) Br_2
D) I_2

Q.43 **Fluorine is good oxidizing agent because of**

A) High Bond energy
B) Low electronegativity
C) High Reduction potential
D) Low ionization energy

Q.44 **Identify the halogen which cannot oxidize any other halogen**

A) F_2
B) Cl_2
C) Br_2
D) I_2

Q.45 **Reduction potential of fluorine**

A) 2.87V
B) 1.36V
C) 1.07V
D) 0.59V

PAST PAPES QUESTIONS

Q.1 **Oxidation number of particular element can be directly or indirectly inferred from its:**

A) Physical state
B) Atomic size
C) Group number
D) Atomic mass

Q.2 **Alkaline earth metal hydroxides decompose on heating. Which of the following reactions is a correct representation of this decomposition?**

A) $M(OH)_{2(s)} \longrightarrow MO_{(s)} + H_2O_{(l)}$
B) $MOH_{(s)} \longrightarrow M_2O_{(s)} + H_2O_{(l)}$
C) $2MOH_{(s)} \longrightarrow 2MO_{(s)} + H_2(g)$
D) $4MOH_{(s)} \longrightarrow 4M_{(s)} + H_2O_{(l)} + O_{2(s)}$

Q.3 **Alkaline earth metal oxides react with water to give hydroxides. The solubility of alkaline earth metal oxides in water increases as we move from top to bottom in a group, which of the following alkaline earth metal oxides is least soluble in water?**

A) BaO
B) SrO
C) MgO
D) CaO

Q.4 **Melting points of group II-A elements are higher than those of group I-A because:**
A) Atoms of II-A elements have smaller size
B) II-A elements are more reactive
C) Atoms of II-A elements provide two binding electrons
D) I-A elements have smaller atomic radius

Q.5 **Among the following, which one is least reactive metal**
A) Mg
B) Ca
C) Na
D) Be

Q.6 **Which alkaline earth metal makes peroxides?**
A) Ba
B) Mg
C) Be
D) Ca

Q.7 **The strongest acid among the following is**
A) HF
B) HCl
C) HBr
D) HI

Q.8 **On the basis of oxidizing power of halogens, which reaction is possible?**
A) $I_2 + 2Cl^- \longrightarrow Cl_2 + 2I^-$
B) $Br_2 + 2I^- \longrightarrow I_2 + 2Br^-$
C) $Cl_2 + 2F^- \longrightarrow F_2 + 2Cl^-$
D) $I_2 + 2Br^- \longrightarrow Br_2 + 2I^-$

Q.9 **Which halogen molecule 'X_2' has lowest dissociation energy?**
A) Cl_2
B) Br_2
C) I_2
D) F_2

Q.10 **Halogens are being used as fire extinguisher, mild antiseptic, CFCs and many other organic chemicals the following halogen is used to kill to bacteria in drinking water.**
A) Chlorine
B) Iodine
C) Bromine
D) Fluorine

Q.11 **Which of the following element is not present in halogens?**
A) Cl
B) Fe
C) I
D) F

Q.12 $2NaOH_{(aq)} + Cl_{2(g)} \rightarrow NaCl + NaClO + H_2O$ **proceed at**
A) 500°C
B) 200°C
C) -10°C
D) 15°C

Q.13 $6NaOH_{(aq)} + 3Cl_{2(g)} \longrightarrow 5NaCl_{(aq)} + NaClO_{3(aq)} + 3H_2O$

In above disproportionation reaction the oxidation state of chlorine is converted from zero to -------- and -------.
A) –1, +1
B) –1, +3
C) –1, +5
D) +1, +5

Q.14 **Aqueous solutions of Iodine and Sodium hydroxide were mixed in a round bottom flask at 70°C. Following chemical reaction was carried out.**
$3I_2 + 6NaOH \rightarrow NaIO_3 + NaI + H_2O$

This reaction is termed as
A) Free radical reaction
B) Substitution reaction
C) Precipitation reaction
D) Redox reaction

Q.15 **In the third period of elements, there lies element "X" which is metallic in nature and it can reduce chlorine gas rapidly. To which group of elements does "X" belong?**
A) IIA
B) IVA
C) VIIA
D) IA

ANSWER KEY

1	D	11	C	21	C	31	B	41	D
2	A	12	C	22	C	32	D	42	D
3	A	13	C	23	D	33	A	43	C
4	C	14	C	24	B	34	B	44	D
5	A	15	A	25	D	35	D	45	A
6	B	16	C	26	B	36	B		
7	A	17	D	27	C	37	B		
8	B	18	C	28	A	38	C		
9	A	19	D	29	D	39	A		
10	D	20	C	30	B	40	D		

PAST PAPER QUESTIONS

1	C	6	A	11	B
2	A	7	D	12	D
3	C	8	B	13	C
4	C	9	C	14	D
5	D	10	A	15	D

EXPLANATORY NOTES

Q.1 In IIA group, ionization energy decreases down the group due to
(i) Increase in atomic size
(ii) Increase in shielding effect
(iii)Decrease in effective nuclear charge (Z_{eff})

Q.2 Alkaline earth metals have two valence electrons. After losing two valence electrons, outermost shell is lost and size of ion is decreased. Due to decrease in size, nuclear force increases. Hence, it is difficult to remove 3rd electron from penultimate shell (Inner to valence shell). In addition, it is difficult to remove 3rd electron from stable configuration.

Q.3 A small size cation (High charge density) had high polarizing power. So Be^{+2} essentially pulls electronic cloud from large size anion, such that electrons are effectively shared. This gives covalent character to Be^{+2} compounds e.g. $BeCl_2$.

Q.4 Noble gases are partially soluble in water. Their solubility increases down the group. It is because with increase in size, polarizability increases and with increase in polarizability. Debye forces are increased and hence solubility increases.

Q.5 Molecule having only one atom are called mono-atomic molecules. Molecule of noble gases contain only one atom. So, these are mono-atomic molecules.

Q.6 According to following relationship

$$\text{Ionization energy} \propto \frac{1}{\text{Atomic size}} \propto \text{Effective nuclear charge}(Z_{eff})$$

Noble gases have small size, high nuclear charge and stable configuration. So, these have highest ionization energy

Q.7 Boiling point is the measurement of intermolecular forces (IMF). So according to following relationship

London dispersion forces (LDF) ∝ Size ∝ polarizability

London dispersion forces (LDF) ∝ boiling point

So, Helium (He) He has small size, small polarizability, small IMF and hence less boiling point.

Helium (He) has lowest boiling point in periodic table

Q.8 $Be + O_2 \xrightarrow{800°C} \underset{\text{(Normal oxide)}}{BeO}$ (Amphoteric oxide)

$Ba + O_2 \xrightarrow{500°C-600°C} \underset{\text{(peroxide)}}{BaO_2}$ (Basic oxide)

Normal oxide has –2 oxidation state while peroxide has – 1 oxidation state

Q.9 Be is only alkaline earth metal which does not react with water even at red hot temperature because Be has least metallic character (tendency to loose electron) due to high charge density.

Q.10 Basicity of hydroxide of alkaline earth metal increases down the group due to decrease in lattice energy. Lattice energy become small if size of cation and anion are not comparable

Q.11

A) Suspension of $Ca(OH)_2$ is called milk of lime and is used as white wash

B) Suspension of $Mg(OH)_2$ in water is called milk of magnesia and is used for treatment of acidity in stomach

Q.12 Saturated solution of $Ca(OH)_2$ in water is called lime water and is used as a test for CO_2

Q.13 Aqueous solution of $Ca(OH)_2$ is called slaked lime. It produces acetylene as

$Ca(OH)_2 \xrightarrow{\Delta} CaO + H_2O$

$CaO + 3C \xrightarrow{2800°C} CaC_2 + CO$

$CaC_2 + H_2O \longrightarrow C_2H_2 + Ca(OH)_2$

It produces bleaching powder as

$Ca(OH)_2 + Cl_2 \longrightarrow Ca(OCl)Cl + H_2O$

Q.14 Less electropositive metals form amphoteric oxide. Be is less electropositive metal. So, it form amphoteric oxide

Q.15 $Be(OH)_2$ is least soluble in water due to high lattice energy because Be^{+2} and OH^{-1} have approximately comparable sizes

Q.16

A) Saturated solution of $Ca(OH)_2$ in water is called lime water used to test CO_2

B) Suspension of $Mg(OH)_2$ in water is called milk of magnesia used for treatment of acidity in stomach

C) Suspension of $Ca(OH)_2$ in water is called milk of lime used as white wash

D) Lime stone is $CaCO_3$

Q.17 $CO_2 + Ca(OH)_2 \longrightarrow CaCO_3 + H_2O$

Solution become milky because $CaCO_3$ is insoluble in water

Q.18 Be is resistant to complete oxidation and stable in air at ordinary temperature but oxidizes completely at about 800°C

$2Be + O_2 \xrightarrow{800°C} 2BeO$

Q.19 During chlorination of H_2O, following reaction occur

$Cl_2 + H_2O \longrightarrow HOCl + HCl$

A) $HOCl + \text{Humic acid} \longrightarrow CHCl_3$ (liver carcinogenic)

B) Chlorinated water causes bladder and rectal cancer

C) $3HOCl + NH_3 \longrightarrow 3H_2O + NCl_3$ (chloramine are eye irritant)

Q.20 Size of X_2 increases down the group

London dispersion forces (LDF) $\propto$ Size $\propto$ polarizability

Boiling point $\propto$ London dispersion forces (LDF)

So, order of m.pt/b.pt of X_2 is $I_2 > Br_2 > Cl_2 > F_2$

Q.21 F_2 and Cl_2 are gases due to very small size. Br_2 is liquid due to appreciable size while I_2 is solid due to very large size

Q.22 Bleaching powder contain 35–40% available chlorine. So it is preserved in sealed plastic bags in order to avoid escaping of chlorine gas.

Q.23 Colour of following X_2 is

Pale yellow – F_2

Greenish yellow – Cl_2

Reddish brown – Br_2

Greyish black – I_2

Q.24 According to following relation

Oxidizing power $\propto E^{\circ}_{red}$

F_2 is strongest oxidizing agent because it has large positive reduction potential $\left(E^{\circ}_{red}\right)$ while I_2 is weak oxidizing agent because it has lower value of reduction potential $\left(E^{\circ}_{red}\right)$

Q.26 Calcium oxychloride or calcium hypochlorite chloride Ca(OCl)Cl is bleaching powder

Q.28 Order of electronegativity of halogen (X) is F > C > Br > I

F has high charge density as compared to I. So, F has high electronegativity than I

Q.29 Halogens do not react with noble gases because noble gases are inert gases

Q.31 Mixed salt contains fixed proportion of two salts often sharing a common cation or common anion. It contains calcium hypochlorite $Ca(OCl)_2$ and calcium chloride $(CaCl_2)$

Q.32

A) Order of electrode potential $\left(E^{\circ}_{red}\right)$ values of "X_2"

$F_2 > Cl_2 > Br_2 > I_2$

B) Order of electronegativity values of "X"

F > Cl > Br > I

C) Order of electron affinity values of "X"

Cl > Br > F > I

Q.33 Fluorine remains restricted to –1 oxidation state because it can't utilize d-orbitals in bonding because d-subshell is not there in its last shell.

Q.34 Ca(OCl)Cl is oxidizing agent and perform bleaching action. It is due to hypochlorite ion (OCl^{-1}) in water

Q.36 Na = +1, Cl = X, O = –2

+1 + X – 2 = 0

X – 1 = 0

X = 1

So, –1 is oxidation state of Cl

Q.37 $2NaOH_{(aq)} + Cl_{2(g)} \xrightarrow[\text{cold}]{15^{\circ}C} NaCl + NaClO_{(aq)} + H_2O$

In this reaction, Cl_2 is oxidized from $0 \longrightarrow 1$ and reduced to $0 \longrightarrow -1$

Q.38 Reaction in which one specie is simultaneously oxidized and reduced is called disproportionation reaction

Q.39

$NaClO \longrightarrow$ Sodium hypochlorite

$NaClO_2 \longrightarrow$ Sodium chlorite

$NaClO_3 \longrightarrow$ Sodium chlorate

$NaClO_4 \longrightarrow$ Sodium perchlorate

3B Topic TRANSITION ELEMENTS

PRACTICE EXERCISE

ELECTRONIC CONFIGURATION

Q.1 Which one possesses maximum number of unpaired electrons

A) Mn^{2+}
B) Cu^{2+}
C) Fe^{3+}
D) Both A) and C)

Q.2 The location of transition elements is in between

A) Lanthanides and actinides
B) Chalcogens and halogens
C) s and p block elements
D) d and f block elements

Q.3 The correct electronic configuration of 'Cr' is

A) [Ar] $3d^4 4s^2$
B) [Ar] $3d^5 4s^0$
C) [Ar] $3d^4 4s^2$
D) [Ar] $3d^5 4s^1$

Q.4 Which pair of elements has abnormal electronic configuration

A) Ti, V
B) Cr, Mn
C) Cr, Cu
D) Ni, Co

Q.5 The general electronic configuration of 3d series of transition elements is

A) [Ar]$(n-1)d^{1-10}ns^{1-2}$
B) [Ar] $(n-1)d^{1-2}ns^{1-2}$
C) [Ar] $(n-1)d^{1-10}ns^2$
D) [Ar] $(n-2)d^{1-2}ns^{12}$

Q.6 Which of the following is a typical transition metal?

A) Sc
B) Cd
C) Y
D) Co

Q.7 Correct electronic configuration of Mn

A) [Ar] $3d^3 4s^2$
B) [Ar] $3d4s^2$
C) [Ar] $3d^4 4s^2$
D) [Ar] $3d^5 4s^2$

Q.8 Which of the followings has a complete d-subshell in atomic as well as cationic state

A) Sc
B) Ti
C) Mn
D) Zn

Q.9 The element which gains electronic configuration of a noble gas at +3 oxidation state

A) V
B) Sc
C) Ti
D) Cr

Q.10 At which oxidation state Cu achieves electronic configuration of Zn^{+2}

A) 0
B) +1
C) +2
D) +3

VARIABLE OXIDATION STATES

Q.11 Zinc does not show variable oxidation state, because

A) Its d-subshell is incomplete
B) It is relatively soft metal
C) Its d-subshell is complete
D) It has two electrons in outermost shell

Q.12 Which complex shows zero oxidation state of the transition metal

A) $[Fe(CO)_5]$
B) $K_3[Fe(CN)_6]$
C) $K_2[Fe(CN)_6]$
D) $[Cu(NH_3)_4]SO_4$

Q.13 The oxidation state of transition elements is usually

A) Variable
B) Constant
C) Single
D) Infinite

Q.14 The oxidation number of central metal atom in $[Ni(CO)_4]$ is
A) 0 C) 4
B) 2 D) 6

Q.15 In complex compounds, the oxidation number is written in
A) English C) Greek
B) Roman number D) Latin

Q.16 The oxidation number of Mn in $[MnO_4]^{-2}$ is
A) +7 C) -7
B) +6 D) -6

Q.17 The algebraic sum of the charges present on the central atom ion and the total charge on the ligands is called
A) Coordination number C) Coordination sphere
B) Oxidation number D) Charge on coordination sphere

Q.18 The higher oxidation state of manganese is
A) +7 C) –7
B) +6 D) +4

Q.19 Which two pairs show same oxidation state of iron
A) Fe_2O_3, FeO C) $FeCl_3$, $FeSO_4$
B) $K_3[Fe(CN)_6]$, $K_4[Fe(CN)_6]$ D) $Fe_2(SO_4)_3$, Fe_2O_3

Q.20 Which of the following shows only +2 oxidation state
A) Sc C) Zn
B) Cu D) Co

Q.21 Which electronic configuration can have possibility of +7 oxidation state
A) $[Ar]3d^5, 4s^2$ C) $[Ar]3d^6, 4s^2$
B) $[Ar]3d^5, 4s^1$ D) $[Ar]3d^{10}, 4s^2$

USE AS A CATALYST

Q.22 The catalytic ability of transition metals come from
A) Vacant d-orbitals C) Vacant p-subshell
B) Variable valance D) High charge density of cations

Q.23 Which transition metals serves as catalyst for oxidation of alkanes
A) Zn C) Cu
B) Hg D) As

Q.24 Catalyst used for ammonia synthesis is
A) Cu C) Co
B) Zn D) Fe

Q.25 $TiCl_4$ is used as catalyst for manufacture of
A) Sulphuric acid C) Plastics
B) Ethanol D) Tetraethyl lead

FORMATION OF COMPLEXES AND THEIR NOMENCLATURE

Q.26 While assigning the name of a complex compounds, the correct order is
A) Cation, Coordination Sphere, Anion C) Coordination Sphere, Cation, Anion
B) Cation, Anion, Coordination Sphere D) Anion, Coordination Sphere, Cation

Q.27 The ability of transition elements to form complexes is due to:
A) Small size of metal ion C) Highly charged metal ion
B) Availability of empty d orbitals D) All of these

Q.28 When $K_4[Fe(CN)_6]$ is dissolved in a solution of salt, then it produces
A) Simple ions only C) Complex ions only
B) Complex ions and simple ions D) Weak acid HCN

Q.29 **During the formation of complex compound the Ligands bind with central metal ion / atom by**
A) Covalent bonds
B) Ionic bonds
C) Co-ordinate covalent bond
D) All of these

Q.30 **Which one complex is more stable**
A) $[Cu(H_2O)_6]^{2+}$
B) $[CuCl_4]^{2-}$
C) $[Pt(C_2O_4)_2]^{2-}$
D) All have same stability

Q.31 **What is the nature of co-ordination sphere**
A) Aninoic in nature
B) Cationic in nature
C) Neutral in nature
D) All are possible

Q.32 **The geometry of $[Fe(CO)_5]$ is**
A) Pyramidal
B) Octahedral
C) Square planar
D) Bi pyramidal

Q.33 **When light is exposed to transition element, then electrons jump from lower orbitals to higher orbitals in**
A) Orbitals of s-subshell
B) Orbitals of p-subshell
C) Orbitals of d-subshell
D) Both A) and B)

Q.34 **$K_2[Cu(CN)_4]$ which one is correct**
A) Potassium tetra cyano cupperate
B) Ligand is positively charged
C) Co-ordination number is 2
D) Central atom is present in anionic sphere

Q.35 **The specie which donates electrons to central metal atom in co-ordination sphere is called**
A) Anion
B) Ligand
C) Cation
D) Acid

Q.36 **The species which donate two electron pairs in a coordination compound is called**
A) Ligand
B) Poly-dentate ligand
C) Mono-dentate ligand
D) Bi-dentate ligand

Q.37 **The compound or complex ion which has a ring in its structure**
A) Polydentate ligand
B) Monodentate ligand
C) Chelate
D) Hydrate

Q.38 **The IUPAC name of $Na_3[Co(NO_2)_6]$ is**
A) Sodium hexanitroso cobaltate (III)
B) Sodium hexanitro cobalt (III)
C) Sodium cobaltinitrite (III)
D) Sodium hexanitro cobaltate (III)

Q.39 **Which one of the following is correct geometry of complex $[MnCl_4]^{-2}$**
A) Square planner
B) Tetrahedral
C) Trigonal bipyramidal
D) Octahedral

Q.40 **The number of d electrons of Cr in $[Cr(H_2O)_6]^{3+}$ ion is**
A) 2
B) 4
C) 3
D) 5

Q.41 **Which is not true about $[Pt(C_2O_4)_2]^{-2}$**
A) It is a chelate
B) Ligands are bidentate
C) It is less stable than normal complex
D) It has dicyclic structure

Q.42 **Correct formula of triamminotrinitrocobalt (III)**
A) $[Co(NH_3)_3(NO_2)_3]$
B) $[Co(NO)_3(NH_3)_3]$
C) $Co[(NH_3)_3(NO_2)_3]$
D) $[Co(NO_2)_3(NH_3)_3]$

Q.43 **Which has same charge on central metal atom as the co-ordination sphere**
A) $K_4[Fe(CN)_6]$
B) $[Cu(NH_3)_4]SO_4$
C) $[Co(NO_2)_3(NH_3)_3]$
D) $[MnCl_4]^{-2}$

COLOUR OF TRANSITION METAL COMPLEXES

Q.44 Which of the following compound is expected to be colored

A) Ag_2SO_4 C) $ZnCl_2$
B) MgF_2 D) CuF_2

Q.45 The colour of transition metal complexes is due to:

A) d-d transitions of electrons C) Paramagnetic nature of transition elements
B) Ionization D) Loss of s-electrons

Q.46 Which of the following transition metal forms colourless compounds

A) Ti C) Cr
B) Cu D) Zn

Q.47 Sc^{3+} has $3d^0$ configuration, its colour will be

A) Colourless C) Purple
B) Blue D) Green

Q.48 Number of electrons involved in d-d transition of $[Ti(H_2O)]^{+3}$

A) 1 C) 3
B) 2 D) 4

Q.49 Ti^{+3} shows minimum absorption (maximum transmittance) at ____ P ____ wavelength

A) Yellow, Green C) Red, Yellow
B) Blue, Green D) Red, Blue

Q.50 d-d transition cannot be shows by

A) Cu^{+1} C) Sc^{+3}
B) Zn^{+2} D) All of the above

GEOMETRY AND ISOMERISM OF COMPLEX IONS WITH COORDINATION NUMBER 4 AND 6

Q.51 Which of the following compound can form tetrahedral as well as square planar isomers

A) $[Pt(NH_3)_3Cl]$ C) $[Pt(NH_3)_2Cl_2]$
B) $[Co(NH_3)_4Cl_2]$ D) $[PtCl_4]$

Q.52 The hybridization of central transition atom in tetrahedral complex is

A) sp C) dsp^2
B) sp^3 D) d^2sp^2

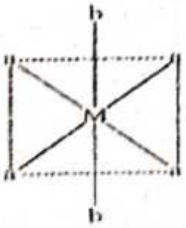
Q.53 The co-ordination number in octahedral complex is

A) 2 C) 6
B) 4 D) 8

Q.54 The transition compounds usually show

A) Metamerism **C) Stereoisomerism**
B) Tautomerism D) Chain isomerism

Q.55



The above arrangement represents

A) Cis-from C) Both cis and tans
B) Trans-form D) None of these

PAST PAPERS QUESTIONS

Q.1 The paramagnetic character of substances is due to the presence of
A) Bond pairs of electrons
B) Lone pairs of electron
C) Unpaired electrons in the atom or molecule
D) Paired electrons in the valence shell of atoms

Q.2 Which pair of transition elements shows abnormal electronic configuration?
A) Sc and Zn
B) Cu and Sc
C) Zn and Cu
D) Cu and Cr

Q.3 Electronic configuration of manganese (Mn) is
A) Mn(Ar) 3d: ↑ ↑ ↑ ↑ ↑ 4s: ↑↓
B) Mn(Ar) 3d: ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ 4s: ↑
C) Mn(Ar) 3d: ↑↓ ↑↓ ↑ ↑ ↑ 4s: ↑↓
D) Mn(Ar) 3d: ↑↓ ↑↓ ↑↓ ↑ ↑ 4s: ↑

Q.4 Electronic configuration of Gold $[Au_{79}]$ is
A) $[Xe]4f^{14}, 5d^{10}, 6s^1$
B) $[Xe]4f^{10}, 5d^{10}, 6s^2$
C) $[Xe]4f^{14}, 5d^9, 6s^2$
D) $[Xe]4f^{14}, 5d^{10}, 6s^2$

Q.5 The anomalous electronic configuration shown by chromium and copper among 3-d series of elements is due to:
A) Colour of ions of these metals
B) Variable oxidation states of metals
C) Stability associated with this configuration
D) Complex formation tendency of metals

Q.6 Which element of 3-d series of periodic table shows the electronic configuration of $3d^8, 4s^2$?
A) Copper
B) Cobalt
C) Zinc
D) Nickel

Q.7 Scandium has atomic number 21; which one will be its electronic configuration?
A) $1s^2, 2s^2, 2p^6, 3s^2, 3s^6, 3d^3$
B) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 4p^1$
C) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^1$
D) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 4p^2$

Q.8 Which of the following is the electronic configuration of Cr?
A) $[Ar]3d^5 4s^2$
B) $[Ar]3d^6 4s^0$
C) $[Ar]3d^4 4s^2$
D) $[Ar]3d^5 4s^1$

Q.9 Copper is a typical transition metal. Its atomic number is 29. In which oxidation state does it have partially filled orbital in d-subshell?
A) Cu
B) Cu^-
C) Cu^{2+}
D) Cu^+

Q.10 Valence electronic configuration Cu^{2+} is ^{29}Cu
A) $5d^6$
B) $3d^8$
C) $3d^9$
D) $3d^7$

Q.11 The total number of transition element is
A) 58
B) 30
C) 48
D) 25

Q.12 Oxidation state of 'Mn' in $KMnO_4$, K_2MnO_4, MnO_2 and $MnSO_4$ is in the order
A) +7, +6, +2, +4
B) +6, +7, +2, +4
C) +7, +6, +4, +2
D) +4, +6, +7, +2

Q.13 Which one pair has the same oxidation state of 'Fe'?

A) $FeSO_4$ and $FeCl_3$
B) $FeSO_4$ and $FeCl_2$
C) $FeCl_2$ and $FeCl_3$
D) $Fe_2(SO_4)_3$ and $FeSO_4$

Q.14 Identify the element that has maximum oxidation states:

A) Zinc
B) Chromium
C) Vanadium
D) Manganese

Q.15 The geometry of complexes depends upon type of ---------taking place in the valence shell of central metal atom:

A) Protonation
B) Hybridization
C) Deprotonation
D) Dissociation

Q.16 Tick the correct statement

A) Chelates are more stable than ordinary complexes
B) Ordinary complexes are more stable than chelates
C) Monodentate ligand form chelate
D) Chelates have no ring structure

Q.17 Oxidation state of 'Fe' in $K_3[Fe(CN)_6]$ is

A) +2
B) -3
C) -6
D) +3

Q.18 Ligands having two lone pair of electrons for donations to the central transition metal ions are known as

A) monodentate ligand
B) bidentate ligand
C) hexadentate ligand
D) polydentate ligand

Q.19 The shape of $[Co(NH_3)_6]^{3+}$ complex is

A) Square planar
B) Linear
C) Tetrahedral
D) Octahedral

Q.20 What are the coordination number of Fe and Cu in the following compounds $K_4[Fe(CN)_6]$,$[Cu(NH_3)]SO_4$ respectively

A) –6,–4
B) +6,–4
C) –6, +4(–6,–4)
D) +6, +4

Q.21 $\left[Ti(H_2O)_6\right]^{+3}$ transmits

A) Yellow and red light
B) Yellow and blue light
C) Red and white light
D) Red and blue light

Q.22 Violet color of $\left[Ti(H_2O)_6\right]^{+}$ ion is due to the .

A) Central metal ion
B) Complex ion
C) Water molecule
D) Outer anion

Q.23 The color of transition metal complexes is due to transition of electron between

A) p to d orbitals
B) p to p orbitals
C) d to d orbitals
D) d to p orbitals

Q.24 Potassium dichromate is used as an oxidizing agent in redox titrations. During reaction Cr(VI) is reduced to Cr(III). The color change during this transition is

A) Green to colorless
B) Pink to colorless
C) Colorless to pink
D) Orange to green

Q.25 The octahedral geometry of complexes $\left[Co(NH_3)_6\right]^{3+}$ has hybridization

A) sp^3d
B) sp^3d^2
C) spd^4
D) sp^2d^3

ANSWER KEY

1	D	11	C	21	A	31	D	41	C	51	C
2	C	12	A	22	C	32	D	42	D	52	B
3	D	13	A	23	C	33	C	43	B	53	C
4	C	14	A	24	D	34	D	44	D	54	C
5	A	15	B	25	C	35	B	45	A	55	B
6	D	16	B	26	A	36	D	46	D		
7	D	17	D	27	B	37	C	47	A		
8	D	18	A	28	B	38	D	48	A		
9	B	19	D	29	C	39	B	49	D		
10	B	20	C	30	C	40	C	50	D		

PAST PAPER QUESTIONS

1	C	6	D	11	A	16	A	21	D
2	D	7	C	12	C	17	D	22	A
3	A	8	D	13	B	18	B	23	C
4	A	9	C	14	D	19	D	24	D
5	C	10	C	15	B	20	D	25	B

EXPLANATORY NOTES

Q.1 A)

$_{25}Mn^{+2}$ $_{18}[Ar]$ ☐ 1 1 1 1 1

4s 3d

B)

$_{29}Cu^{+2}$ $_{18}[Ar]$ ☐ 1 ⇅ ⇅ ⇅ ⇅ ⇅

4s 3d

C)

$_{26}Fe^{+3}$ $_{18}[Ar]$ ☐ 1 1 1 1 1

4s 3d

Q.2 Transition element are those elements which lie between s and p – block elements and their properties are also between s and p – block elements.

Q.3 In 3d series (1st series of transition elements), two elements "Cr" and "Cu" have different electronic configuration.

$_{24}Cr$ $[Ar]\ 3d^{5}\ 4s^{1}$

$_{29}Cu$ $[Ar]\ 3d^{10}\ 4s^{1}$

Q.5 d – block (outer) transition elements are those in which d – subshell of penultimate shell (inner to valence shell) is in process of completion. So general electronic configuration of 3d series is $(n-1)\ d^{1-10}\ ns^{1-2}$.

Q.6 Typical transition elements show general properties (colour, paramagnetism, alloy formation etc.) of transition elements while non-typical transition element don't show general properties of transition elements. Group No. IIIB (Sc, Y, La) and IIB (Zn, Cd, Hg) are non-typical transition elements while group No. (IVB, VB, VIB, VIIB, VIIIB and IB) are typical transition elements.

Q.7 Electronic configuration of Mn is $_{25}Mn$ $_{18}[Ar]\ 4s^{2}\ 3d^{5}$.

Q.8

(A) $_{21}Sc$ $_{18}[Ar]\ 4s^{2}\ 3d^{1}$

Sc^{+3} $_{18}[Ar]\ 4s^{0}\ 3d^{0}$

(B) $_{21}Ti$ $_{18}[Ar]\ 4s^{2}\ 3d^{2}$

Ti^{+3} $_{18}[Ar]\ 4s^{0}\ 3d^{1}$

(C) $_{25}Mn$ $_{18}[Ar]\ 4s^{2}\ 3d^{5}$

Mn^{+2} $_{18}[Ar]\ 4s^{0}\ 3d^{5}$

(D) $_{30}Zn$ $_{18}[Ar]\ 4s^{2}\ 3d^{10}$

Zn^{+2} $_{18}[Ar]\ 4s^{0}\ 3d^{10}$

Q.9

$_{21}Sc$ $_{18}[Ar]\ 4s^{2}\ 3d^{1}$

$_{21}Sc^{+3}$ $_{18}[Ar]\ 4s^{0}\ 3d^{0}$

Scandium in +3 state has same electronic configuration as $_{18}Ar$.

$_{18}Ar\ 1s^{2}2s^{2}2p^{6}3s^{2}3p^{6}$

Q.10

Cu^{+1} $_{18}[Ar]\ 4s^{0}\ 3d^{10}$

Zn^{+2} $_{18}[Ar]\ 4s^{0}\ 3d^{10}$

Q.12

A) $\left[\overset{0}{Fe}(CO)_5\right]$

B) $K_3\left[\overset{+3}{Fe}(CN)_6\right]$

C) $K_2\left[\overset{+4}{Fe}(CN)_6\right]$

D) $\left[\overset{+2}{Cu}(NH_3)_4\right]SO_4$

Q.13 Transition elements show variable state because in addition to 4s – electrons, 3d –electrons also take part in bonding.

Q.14 $\left[\overset{0}{Ni}(\overset{0}{CO})_4\right]^{0}$

Oxidation state on CO = 0

Overall coordination sphere has zero charge. So Ni has zero oxidation state.

Q.16 Oxidation no of Mn = ?

Oxidation no of O = –2

Overall charge on coordination sphere = –2

Mn + 4(–2) = –2

Mn – 8 = –2

Mn = 8 –2

Mn = +6

Q.18 Mn belongs to group (VIIB) of periodic table. So, its maximum oxidation state should be +7. Because maximum oxidation state may be equal to group no of element.

Q.19

Oxidation state of Fe in $Fe_2(SO_4)_3$	Oxidation state of Fe in Fe_2O_3
Charge on sulphate ion = –2 2Fe +3(–2) = 0 2Fe – 6 = 0 2Fe = + 6 Fe = +3	Charge on oxygen = –2 2Fe +3(–2) = 0 2Fe – 6 = 0 2Fe = +6 Fe = +3

Q.20 "Zn" is non-typical transition element it does not show variable oxidation state. So it shows only +2 oxidation state.

Q.21 $[Ar]\ 2d^{5}\ 4s^{2}$ is electronic configuration of Mn. It shows maximum +7 oxidation state because it belongs to group VIIB of periodic table.

Q.22 Catalytic property of transition elements is due to
(i) Vacant d–orbitals
(ii) Formation of interstitial compounds which absorb and activate the reacting substance.
(iii) Variable oxidation state due to which these form intermediate compounds which help in formation of desired product.

Q.23 "Cu" is used as catalyst in oxidation of lower alkanes.

$$CH_4 + [O] \xrightarrow[200\ atom]{Cu/400^\circ C} CH_3 - OH\ .$$

Q.24 Finely divided "Fe" is used as a catalyst in Haber process. $Cr_2O_3 + MgO + SiO_2$ is used as promoter.

$$N_2 + 3H_2 \underset{450^\circ C/200\ atom}{\overset{Fe/MgO/Cr_2O_3/SiO_2}{\rightleftharpoons}} 2NH_3$$

Q.25 For high quality polyethylene (plastic), $(C_2H_5)_3Al + TiCl_4$ is used as catalyst.

$$n(CH_2 = CH_2) \xrightarrow[traces\ of\ O_2(0.1\%)400^\circ C/100\ atom]{(C_2H_5)_3Al+TiCl_4} [CH_2 - CH_2]_n$$

Q.27 Transition metals can form complexes because these have vacant d–orbital in which ligands can donate electron pairs.

Q.28 $$K_4[Fe(CN)_6] \xrightarrow{Ionization} 4K^+ + [Fe(CN)_6]^{-4}$$

Q.29 In coordination compounds, ligands are Lewis bases and central metal atom are Lewis acid so these form coordinate covalent bond.

Q.30 Complexes formed by poly-dentate ligands are called chelates. Oxalate ion $(C_2O_4^{-2})$ is poly-dentate ligand so it will form chelates. These are stable compounds due to ring structure.

Q.31

A) Anionic coordination sphere $K_4[Fe(CN)_6]$
B) Cationic coordination sphere $[Cu(NH_3)_4]SO_4$
C) Neutral coordination sphere $[Fe(CO)_5]$

Q.32 There are five carbonyl (CO) ligands attached with central atom (Fe), so coordination no is 5. If coordination no. is 5 then geometry is Trigonal bipyramidal.

Q.33 When d-orbitals are involved in bonding, they split into two energy levels (lower and higher). Electrons present in low energy level absorb a part of visible light and jump to higher energy level. This is called d-d transition. Due to this transition, metal ion show colour.

Q.34 In $K_2[Cu(CN)_4]$, potassium is cation while $[Cu(CN)_4]^{-4}$ is anion, so central metal atom "Cu" is present in anionic coordination sphere.

Q.36 Ligands which donate two electron pairs to central metal atom is called bidentate ligand e.g. $C_2O_4^{-2}$, N_2H_4, SO_4^{-2} etc.

Q.38 In writing IUPAC nomenclature of coordination sphere, following way is used

$$\left[\begin{pmatrix}\text{Neutral ligand}\\ \text{alphabetically}\end{pmatrix} \rightarrow \begin{pmatrix}-\text{ve ligand}\\ \text{alphabetically}\end{pmatrix} \rightarrow \begin{pmatrix}\text{Cationic ligand}\\ \text{alphabetically}\end{pmatrix} \rightarrow \begin{matrix}\text{Central}\\ \text{metal atom}\end{matrix} (\text{oxi.state})\right]$$

and if central metal atom is in anionic coordination sphere then suffix "ate" is used at end of name of metal.

Q.39 In $[MnCl_4]^{-2}$, four chloro group are attached with central metal atom. So, coordination no is 4. If coordination no is 4 then sp^3 hybridization (except NO_2^{-1}, Cl^{-1}, CO, NH_3) is present on central atom. So tetrahedral geometry.

Q.40 $\left[\overset{+3}{Cr}(H_2O)_6^0\right]^{+3}$

$_{24}Cr$ $_{18}[Ar]$ $\underset{4s}{\square}$ $\underset{3d}{|1|1|1|1|1|}$

$_{24}Cr^{+3}$ $_{18}[Ar]$ $\underset{4s}{\square}$ $\underset{3d}{|1|1|1| | |}$

Q.41 In $[Pt(C_2O_4)_2]^{-2}$, $C_2O_4^{-2}$ is polydentate (bi–dentate) ligand, so it is chelate and stable due to ring structure.

Q.42 In writing formula of complex, following way is used.

$$\left[\begin{pmatrix}\text{Central metal}\\ \text{atom}\end{pmatrix}\rightarrow\begin{pmatrix}\text{–ve ligand}\\ \text{alphabetically}\end{pmatrix}\rightarrow\begin{pmatrix}\text{Neutral ligand}\\ \text{alphabetically}\end{pmatrix}\rightarrow\begin{pmatrix}\text{Cationic ligand}\\ \text{alphabetically}\end{pmatrix}\right]$$

Q.43

A) $\overset{+4}{K_4}\left[\overset{+2}{Fe}(\overset{-6}{CN})_6\right]^{-4}$

B) $\left[\overset{+2}{Cu}(NH_3)_4^0\right]^{+2}SO_4^{-2}$

C) $\left[\overset{+3}{Co}(\overset{-3}{NO_2})_3(\overset{0}{NH})_3\right]^0$

D) $\left[\overset{+2}{Mn}\overset{-4}{Cl_4}\right]^{-2}$

Q.44 Copper in +2 state contain one unpaired electron so it show d-d transition and certain colour.

Cu^{+2} $_{18}[Ar]$ $\underset{4s}{\square}$ $\underset{3d}{|1|\uparrow\downarrow|\uparrow\downarrow|\uparrow\downarrow|\uparrow\downarrow|}$

Q.46 Following ions of 3d-series contain no unpaired electrons. So, these don't show d-d transition and certain colour

Sc^{+3}, Ti^{+4}, V^{+5}, Cu^{+1} and Zn^{+2}

Q.47 $_{21}Sc$ $_{18}[Ar]\,4s^2\,3d^1$

Sc^{+3} $_{18}[Ar]\,4s^0\,3d^0$

Q.48

$\left[\overset{+3}{Ti}(H_2O)_6^0\right]^{+3}$

$_{22}Ti$ $[Ar]\,4s^2\,3d^2$

$_{22}\overset{+3}{Ti}$ $_{18}[Ar]4s^0\,3d^1$

Q.49 In $[Ti(H_2O)_6]^{+3}$, yellow light is absorbed while most of the red and blue lights are transmitted, therefore the solution of $[Ti(H_2O)_6]^{+3}$ ions looks violet in colour.

4B Topic COMPOUNDS OF NITROGEN AND SULPHUR

PRACTICE EXERCISE

NITROGENOUS FERTILIZERS

Q.1 **Inorganic compounds of nitrogen are not commonly found as minerals because**
A) Nitrogen is an inert element
B) It is present in air as major constituent
C) Its minerals are unstable
D) None of the above

Q.2 **Compounds of nitrogen are mostly**
A) Ionic
B) Polar
C) Covalent
D) All varieties are possible

Q.3 **The most electronegative element among the following is**
A) Sb
B) As
C) N
D) P

Q.4 **N_2 is relatively inactive element because**
A) It has low atomic radius
B) Its electronegativity is fairly high
C) It has stable electronic configuration
D) The bond dissociation energy of nitrogen is fairly high

Q.5 **N_2 act as inert gas at**
A) Furnace temperature
B) 3000°C
C) Room temperature
D) Electric spark

Q.6 **Nitrogen is found in combined state in**
A) Air
B) Protein
C) Plants
D) Both C) and D)

Q.7 **Nitrogen is present in air**
A) 78% by volume
B) 78% by weight
C) 87% by volume
D) 87% by weight

Q.8 **During the manufacture of ammonia by Haber's process, a high yield is favoured by high pressure and low temperature. However, in practice, a high temperature of 450°C is employed because**
A) At low temperatures, reaction rates are too slow
B) At low temperature ammonia liquefies
C) At low temperature, the catalyst is inactive
D) At low temperature, the reacting gases would not react

Q.9 **Which of the following is the most suitable catalyst for ammonia synthesis?**
A) Pt
B) $ZnO + Cr_2O_3$
C) Fe in fused mixture of $Al_2O_3 + SiO_2 + MgO$
D) All of the above

Q.10 **Which equation correctly describe preparation of NH_3 by Haber's process**
A) $N_2 + H_2 \xrightarrow{Fe} 2NH_3$
B) $2N_2 + 3H_2 \xrightarrow{Al_2O_3} NH_3$
C) $N_2 + 3H_2 \rightleftharpoons[Fe] 2NH_3$
D) $N_2 + 3[H] \xrightarrow{MgO} 2NH_3$

Q.11 **Optimum temperature for preparation of NH_3 by Haber's process is**
A) 400°C
B) 273°C
C) 673°C
D) 300°C

Q.12 In Haber's process at equilibrium percentage ratio
A) 65% NH_3 + 35% of N_2 and H_2
B) 13% NH_3 + 87% of N_2 and H_2
C) 35% NH_3 + 65% of N_2 and H_2
D) 50% NH_3 + 50% of N_2 and H_2

Q.13 The nitrogen present in some fertilizers helps plants
A) To fight against diseases
B) To produce sugars
C) To produce fats
D) To produce proteins

Q.14 Which one is not role of nitrogen in plant growth?
A) It imparts green color to the leave
B) It is the main constituent of proteins
C) It is responsible for intensive root system development
D) All of above are the function of nitrogen

Q.15 Why do farmers and gardeners often treat soil with ammonium sulphate
A) To kill harmful insects
B) To reduce the acidity of the soil
C) To increase the nitrogen contents of the soil
D) To increase the oxygen contents of the soil

Q.16 For plants to grow well they need soils which contain compounds of
A) Nitrogen
B) Phosphorous
C) Potassium
D) All of them

Q.17 Which of the following fertilizer provides to soil 75% nutrients
A) Urea
B) Calcium superphosphate
C) Diammonium phosphate
D) Potassium nitrate

Q.18 The fertility of the soil is improved by
A) Rotation of the crops
B) Adding manure and growing legumes
C) Adding lime to the acid salts
D) All

Q.19 Which of the following is incorrect statement about nitrogen importance?
A) It enhances plant growth
B) It is involved in the synthesis of protein and nucleic acids
C) It accelerates fruits and flowers growth
D) It is involved in the chlorophyll synthesis

Q.20 The fertilizers, which provide 82% nitrogen to plants is
A) Urea
B) Ammonium nitrate
C) Liquid Ammonia
D) Ammonium chloride

Q.21 Addition of urea to the soil is _____ reaction.
A) Endothermic
B) Both 'A' and 'B'
C) Exothermic
D) No heat energy is involved

Q.22 The percentage of nitrogen in urea is
A) 36%
B) 56%
C) 46%
D) 66%

Q.23 Which one of the following is an inorganic fertilizer?
A) Manure
B) Ammonium nitrate
C) Urea
D) All of these

Q.24 Which fertilizer is used in liquid state
A) NH_4NO_3
B) Urea
C) DAP
D) NH_3

Q.25 Which of the following is not the property of good fertilizer
A) It is soluble in water
B) It is cheap to be prepared
C) It alters pH of the soil
D) It is not injurious to plants

Q.26 Micro-nutrients per acre are required in quantity ranging from
A) 4g – 40g
B) 6g – 200g
C) 6kg –200kg
D) 4kg – 40kg

Q.27 $(NH_4)_2HPO_4$ is chemical formula of
A) Ammonium phosphate
B) Ammonium super phosphate
C) Diammonium hydrogen phosphate
D) Nitrogen phosphate

Q.28 Which a fertilizer makes the soil acidic in nature
A) Urea
B) Calcium nitrate
C) Magnesium nitrate
D) Potassium nitrate

Q.29 Which of the following potassium fertilizers are more useful for horticultural crops, tobacco & potatoes?
A) KCl
B) K_2SO_4
C) KNO_3
D) $KMnO_4$

Q.30 Which fertilizer is more volatile
A) $(NH_2)_2CO$
B) NH_4NO_3
C) NH_3
D) $(NH_4)_2HPO_4$

Q.31 Advantages of prilling of fertilizer
A) Dust free
B) Easy to handle
C) Easy to spread
D) All of these

Q.32 Maximum plant nutrient are present in
A) NH_3
B) $(NH_2)_2CO$
C) $(NH_4)_2HPO_4$
D) NH_4NO_3

PRESENCE OF SULPHUR DIOXIDE IN ATOMISPEHRE

Q.33 Acid rain is caused due to the absorption of
A) Oxides of C
B) Oxides of S
C) Oxides of N
D) All of the above

Q.34 Acid rain
A) Retards the growth of trees
B) Effects big marble constructions
C) Results in loss of flora and fauna
D) All of these

Q.35 Acid rain is NOT responsible for
A) Decrease in the pH of natural rain
B) Damages the buildings
C) Leaching metals like Al, Hg and Pb from soil
D) Increasing the percentage of CO_2 in the atmosphere

Q.36 SO_2 is produced by volcanoes is
A) 1–6%
B) 67%
C) 37%
D) 50%

Q.37 Temporary acid rain is due to
A) HCl
B) H_2SO_4
C) HNO_3
D) H_2CO_3

MANUFACTURING OF SULPHURIC ACID BY CONTACT METHOD

Q.38 SO_2 is purified from impurities
A) To manufacture pure H_2SO_4
B) To get maximum yield of SO_3
C) To avoid poisoning of V_2O_5
D) All of the above

Q.39 Which of the following is not part of purifying unit in contacts process
A) Dust Remover
B) Testing box
C) Scrubber
D) Absorption tower

Q.40 In Contact process for the manufacture of sulfuric acid, the most important reaction occurs in the catalyst chamber. Which set of the reactants and the catalyst are correct

A) Sulfur, air and Pt
B) Sulfur, oxygen and V_2O_5
C) Sulfur dioxide, air and V_2O_5
D) Sulfur dioxide air and steam

Q.41 The catalyst V_2O_5 used in contact process is employed during

A) Absorbing sulfuric acid in water
B) Burning molten sulfur with air
C) Oxidizing SO_2 to SO_3
D) None of the above

Q.42 When we mix SO_3 with conc. H_2SO_4 in contact process, the product obtained is

A) Sulphuric acid
B) Pyrosulphuric acid
C) HNO_3
D) carbonic acid

Q.43 Sulphuric acid is king of chemicals, in its reactions it generally not act as

A) An acid
B) A reducing agent
C) Dehydrating agent
D) Oxidizing agent

Q.44 Which one of the following is anhydride of sulphuric acid

A) Sulphur (II) oxide
B) Sulphur (IV) oxide
C) Sulphur (VI) oxide
D) Sulphur (III) oxide

Q.45 Specific gravity of H_2SO_4 at 18°C is

A) 1.83
B) 1.74
C) 2.74
D) 3.83

Q.46 Pure H_2SO_4 freezes at

A) 0°C
B) 283.5K
C) 273K
D) 32°F

Q.47 The oxidation number of sulphur is +6 in all of the following except.

A) SO_2
B) H_2SO_4
C) SO_3
D) $H_2S_2O_7$

Q.48 Basicity of H_2SO_4 is

A) 0
B) 2
C) 1
D) 3

Q.49 In contact process for H_2SO_4 preparation SO_2 is cooled by passing through

A) Cu–Pipes
B) Pb–Pipes
C) Al–Pipes
D) Fe–Pipes

Q.50 Arsenic oxide absorber is

A) $Fe(OH)_2$
B) $Fe(OH)_3$
C) V_2O_5
D) H_2SO_4

SULPHURIC ACID AS DEHYDRATING AGENT AND OXIDIZING AGENT

Q.51 When sulphuric acid is treated with ethanol, sulphuric acid behaves like

A) An acid
B) An oxidizing agent
C) A dehydrating agent
D) As sulphonating agent

Q.52 When a sugar is treated with conc. H_2SO_4 the sugar becomes black due to

A) Decolonization
B) Hydrolysis
C) Dehydration
D) Hydration

Q.53 Which gas cannot be dried by H_2SO_4

A) NH_3
B) SO_2
C) O_2
D) CO_2

Q.54 Papers is charred by concentrated sulphuric acid the residue left behind is
A) H_2O C) O_2
B) C D) CO_2

Q.55 Which product is not obtained when oxalic acid is treated with concentrated sulphuric acid
A) H_2O C) CO
B) C D) CO_2

PAST PAPERS QUESTIONS

Q.1 Urea is produced by reaction of liquid ammonia with
A) C C) CO_2
B) CO D) CaO

Q.2 The nature of an aqueous solution of ammonia (NH_3) is
A) Amphoteric C) Neutral
B) Basic D) Acidic

Q.3 About 80% of ammonia is used for the production of
A) Explosives C) Nylon
B) Fertilizers D) polymers

Q.4 Urea is the most widely used nitrogen fertilizer in Pakistan. Its composition is
A) NH_2CO C) $N_2H_4CO_2$
B) $N_2H_5CO_2$ D) N_2H_4CO

Q.5 What is the percentage of nitrogen in NH_4NO_3?
A) 65% C) 20%
B) 35% D) 58%

Q.6 The %age of nitrogen is ammonium nitrate is
A) 46% C) 33%
B) 82% D) 13%

Q.7 Liquid ammonia has become an important fertilizer for direct application to soil. It contains ------ nitrogen
A) 46% C) 14%
B) 82% D) 17%

Q.8 Which of the following fertilizer contain 75% plant nutrients?
A) $Ca(H_2PO_4)_3$ C) $(NH_4)_2HPO_4$
B) $(NH_2)_2CO$ D) NH_4NO_3

Q.9 Which one of the following is correct equation of 1st ionization of sulphuric acid.
A) $H_2SO_{4(aq)} + H_2O_{(l)} \longrightarrow 2H^+ + SO_4^{-2}$ C) $H_2SO_{4(aq)} + H_2O_{(l)} \longrightarrow H^+ + HSO_4^{-1}$
B) $H_2SO_{4(aq)} + H_2O_{(l)} \rightleftharpoons 2H^+ + SO_4^{-2}$ D) $H_2SO_{4(aq)} + H_2O_{(l)} \longrightarrow H_3O^+ + SO_4^{-2}$

Q.10 Which one of the following is anhydride of sulphuric acid?
A) Sulphur (II) oxide C) Iron pyrite
B) Sulphur (IV) oxide D) Sulphur (VI) oxide

Q.11 In contact process the catalyst used for conversion of SO_2 to SO_3 is
A) Magnesium oxide C) Aluminium oxide
B) Silicon dioxide D) Vanadium pentaoxide

Q.12 **In contact process for manufacturing sulphuric acid, sulphur trioxide (SO_3) is not absorbed because**

A) The reaction does not go to completion
B) The reaction is highly exothermic
C) The reaction is quite slow
D) SO_3 is insoluble in water

Q.13 **Which one of the following product is obtained when sulphur trioxide is absorbed in concentrated sulphuric acid**

A) Oleum
B) Aqua regia
C) Hydrogen sulphide
D) Sulphate ion

Q.14 **During Contact process of H_2SO_4 synthesis, the following reaction occurs**

$$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad \Delta H = -96 KJmol^{-1}$$

Which step is used to increase the yield of SO_3?

A) Temperature is raised to very high degree
B) SO_3 formed is removed quickly
C) Both temperature and pressure are kept very low
D) An excess of air is used to drive the equilibrium to right side

Q.15 **SO_3 formed in Contact process is absorbed in _____ % H_2SO_4**

A) 90
B) 80
C) 98
D) 89

Q.16 **Among the following, which is a catalyst in contact proses**

A) V_2O_5
B) H_2SO_4
C) NH_4Cl
D) NaOH

Q.17 **In contact process, optimum temperature lies between_____**

A) 200-300^{0}C
B) 300-400^{0}C
C) 400-500^{0}C
D) 300-500^{0}C

Q.18 **In contact process, to which substance adequate quantities of water is added to convert it to sulphuric acid?**

A) $H_2S_2O_7$
B) HSO_4^-
C) SO_3
D) SO_2

Q.19 **In contact process arsenic impurities act as poison for**

A) $Fe(OH)_3$
B) Fe_2O_3
C) V_2O_5
D) $H_2S_2O_7$

Q.20 **$2HBr + H_2SO_4 \rightarrow Br_2 + SO_4 + 2H_2O$ in the above reaction H_2SO_4 is acting as a**

A) Oxidizing agent
B) Reducing agent
C) Catalyst
D) Base

ANSWER KEY

1	A	11	A	21	C	31	D	41	C	51	C
2	C	12	C	22	C	32	C	42	B	52	C
3	C	13	D	23	B	33	D	43	B	53	A
4	D	14	C	24	D	34	D	44	D	54	B
5	C	15	C	25	C	35	D	45	A	55	B
6	D	16	D	26	B	36	B	46	B		
7	A	17	C	27	C	37	A	47	A		
8	A	18	D	28	A	38	C	48	B		
9	C	19	C	29	C	39	D	49	B		
10	C	20	C	30	C	40	C	50	B		

PAST PAPER QUESTIONS

1	C	6	C	11	D	16	A
2	B	7	B	12	B	17	C
3	B	8	C	13	A	18	A
4	D	9	C	14	D	19	C
5	B	10	D	15	C	20	A

EXPLANATORY NOTES

Q.1 Nitrogen is an inert gas due to very high bond energy (941 kJ/mol). So, it does react immediately and mostly does not exist as minerals.

Q.2 Nitrogen is non-metal and mostly form compounds with non-metals. It form oxides, hydrides, halides and oxy-acids. Bond formed non-metal to non-metal is covalent. So, compounds of N_2 are mostly covalent.

Q.3 Nitrogen is at top of group (VA) and have smallest size and high charge density. So, it is most electro-negative element of group (VA).

Q.4 N_2 is inert gas because it has very high bond energy (941kJ/mol). It has highest bond energy due to high bond order = 3 and smallest size of atoms.

$$\text{Bond energy} \propto \text{Bond order} \propto \frac{1}{\text{Size of bonded atoms}}$$

Q.5 N_2 is inert gas at room temperature due to high bond order and smallest size of bonded atoms. But N_2 react at very high temperature (electric arc)

$$N_2 + O_2 \xrightarrow{3000^\circ C} 2NO$$

Q.6 N_2 is in free state in air (78% N_2) but in combined state, it is present in form of proteins, urea, amino acids and plants.

Q.8 According to Le-Chatelier principle, decrease in temperature favours forward reaction in exothermic reaction. But actually rate of reaction become low because

Rate of reaction $\propto$ Temperature

So in actual practice, optimum temperature (450°C) is used so that rate become high.

Q.9 In ammonia synthesis (Haber process), finely divided Fe is used as catalyst while fused mixture of $Al_2O_3 + SiO_2 + MgO$ is used as promoter / activator.

Q.11 Optimum condition in ammonia synthesis are

(i) Pressure 200 – 300 atm

(ii) Temperature 673K(400°C)

(iii) Catalyst – finely divided pieces of Fe

(iv) Promoter-MgO, Al_2O_3 and SiO_2

Q.12 In ammonia synthesis, equilibrium mixture contains about 35% by volume of NH_3 and rest (65% by volume) is N_2 and H_2.

Q.13 Importance of nitrogen is. It

(i) Accelerate growth of stem and leaves

(ii) Helps in synthesis of proteins

(iii) Gives green colour to leaves

(iv) Increases yield and quality of plants

While Phosphorous and potassium increases resistance to diseases.

Q.15 $(NH_4)_2SO_4$ contain 21% nitrogen, so it enhances nitrogen contents of soil

Q.16 For proper growth of plants, N, P and K are of prime importance

Q.17 Diammonium phosphate contain 16% nitrogen and 48% P_2O_5 and it contains 75% plant nutrients

Q.18 Lime is added to neutralize acidic soil. It control pH of soil and increase readily soluble phosphorous. By adding manures, plant get essential nutrients required for growth of plants

Q.20 A) Urea $\longrightarrow$ 46% nitrogen

B) Ammonium nitrate $\longrightarrow$ 33.5% nitrogen

C) Liquid ammonia $\longrightarrow$ 82% nitrogen

D) Ammonium chloride $\longrightarrow$ 26% nitrogen

Q.23 Manure and urea are organic fertilizers while ammonium nitrate is inorganic fertilizer

Q.25 Good fertilizer does not change pH of soil

Q.26 Requirement of micronutrient varies from 6g to 200g per acre while requirement of macronutrient varies from 5kg to 200kg per acre

Q.28 All nitrogeneous fertilizers make soil acidic except $Ca(NO_3)_2$, $NaNO_3$, KNO_3 and $Mg(NO_3)_2$

Q.29 Potassium fertilizers are especially used for tobacco, coffee, potato and corn. KNO_3 is used as potassium fertilizers while others are not used as potassium fertilizers

Q.31 Prills of fertilizers are free of dust, easy to handle and easy to spread in the field

Q.32 $(NH_4)_2HPO_4$ contain 75% plant nutrients

Q.33 $CO_2 + H_2O \longrightarrow H_2CO_3$

$$SO_2 + \frac{1}{2}O_2 + H_2O \xrightarrow[\text{metal oxide}]{\text{Hydrocarbons, smoke}} H_2SO_4$$

$$2NO_2 + H_2O + \frac{1}{2}O_2 \longrightarrow 2HNO_3$$

These acids after mixing with rain water causes acidic rain

Q.35 During acidic rain, CO_2 is absorbed by water so CO_2 relatively become less in atmosphere

Q.36 Most of SO_2 is produced by volcanoes (67%). It is one of the major and natural source of SO_2

Q.37 In some countries, due to release of HCl by volcanic eruption there is temporary acid rain

Q.38 In contact process, SO_2 contain As_2O_3 as poison (impurities) this poison is removed in arsenic purifier by $Fe(OH)_3$ to avoid poisoning of V_2O_5 (catalyst)

Q.39 In contact process, purifying unit contain 6 parts

(i) Dust remover

(ii) Cooling pipes

(iii) Scrubbers

(iv) Drying tower

(v) Arsenic purifier

(vi) Testing box

Q.40 $2SO_2 + O_2 \xrightarrow{V_2O_5} 2SO_3$

Q.42 SO_3 is dissolved in 98% H_2SO_4 to form $H_2S_2O_4$ (oleum) / pyrosulphuric acid

$SO_3 + H_2SO_4 \longrightarrow H_2S_2O_7$

(98%)

Q.43 H_2SO_4 never acts as reducing agent

Q.44 $H_2SO_4 \xrightarrow{-H_2O} SO_3$

SO_3 is anhydride of H_2SO_4

Q.47 A) $\overset{+4}{S}O_2$ C) $\overset{+6}{S}O_3$

B) $H_2\overset{+6}{S}O_4$ D) $H_2\overset{+6}{S}_2O_7$

Q.48 Number of replaceable H^+ in acid is called basicity of acid. H_2SO_4 have two replaceable H^+ so its basicity is 2

$H_2SO_4 + H_2O \longrightarrow HSO_4^{-1} + H_3O^+$

$HSO_4^{-1} + 2H_2O \longrightarrow SO_4^{-2} + 2H_3O^+$

Q.49 In contact process, SO_2 is passed through lead pipes to cool them to 100°C

1C Topic FUNDAMENTAL PRINCIPLES

PRACTICE EXERCISE

ORGANIC COMPOUNDS

Q.1 **_____ organic compound/s can be classified as acyclic**

A) Isobutane
B) Isopentyne
C) Isobutylene
D) All of these

Q.2 **Compounds containing ring of three or more than three carbon atom and resembling _____ compounds are called alicyclic**

A) Aliphatic
B) Benzene
C) Aromatic
D) Heterocyclic

Q.3 **Alicyclic hydrocarbons will not follow _____ general formula**

A) C_nH_{2n}
B) C_nH_{2n+2}
C) C_nH_{2n-2}
D) C_nH_{2n-4}

Q.4 **_____ cannot be classified as cyclic organic compound**

A) Phenol
B) Pyridine
C) Naphthalene
D) Neopentane

Q.5 **Benzene, derivatives of benzene and compounds having two are more isolated or fused benzene rings are classified as**

A) Aromatic
B) Aliphatic
C) Alicyclic
D) Acyclic

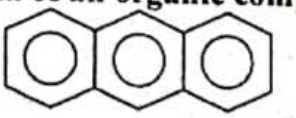
Q.6 **Cyclohexane can be classified as**

A) Carbocyclic
B) Alicyclic
C) Aromatic
D) Both A and C

Q.7 **How many secondary carbon atoms are present in Methylcylopropane**

A) 1
B) 2
C) 3
D) 0

Q.8 **Skeletal formula of an organic compound is given below**



Name of this compound is

A) Naphthalene
B) Anthracene
C) Pyrene
D) Biphenyl methane

Q.9 **Which of the following is not heterocyclic compound**

A) Naphthalene
B) Pyridine
C) Furan
D) Pyrrole

Q.10 **The aliphatic compounds are of two types**

A) Straight chain and cyclic
B) Straight chain and branched
C) Branched chain and alicyclic
D) Homocyclic and alicyclic

Q.11 **Which is not present as heteroatom in heterocyclic compounds**

A) Sulphur
B) Oxygen
C) Nitrogen
D) Chlorine

Q.12 **Which compounds is alicyclic in nature**

A) Cyclobutane
B) n-Butane
C) Iso-butane
D) Toluene

ALKANES AND ALKENES OF LOWER MASSES (CRACKING)

Q.13 Gasoline obtained by fractional distillation can be augmented by

A) Cracking
B) Reforming
C) Destructive distillation
D) Fermentation

Q.14 Select incorrect option regarding cracking

A) Need excess supply oxygen gas
C) Can be used to obtain high quality of fuel
B) Used to obtained high volatile fractions
D) Can be used to obtained low unsaturated hydrocarbons

Q.15 Select the true option regarding

$C_{16}H_{34} \xrightarrow[700°C]{Heat} C_7H_{16} + 3C_2H_4 + C_3H_6$

A) Catenation
B) Cracking
C) Reforming
D) Distillation

Q.16 The phenomenon of cracking is also referred to as

A) Bond fusion
B) Bond condensation
C) Bond fission
D) None of these

Q.17 Which is the incorrect statement for cracking of hydrocarbons

A) It gives smaller alkenes
B) It involves in breaking of C – C bond
C) It increases gasoline reserves
D) It produces CO_2 and water

Q.18 The catalyst which is used for cracking of gasoline is

A) $TiCl_4$
B) Fe_2O_3
C) $Al_2O_3 + SiO_2$
D) Pd/C

Q.19 When long chain alkanes are cracked from C – C bonds, the changes to

A) Two smaller alkane molecules
B) Two smaller alkene molecules
C) Alkane and alkene molecules
D) Alkene and alkynes molecules

Q.20 Approximately _____ of gasoline is prepared by cracking of petroleum

A) 10%
B) 20%
C) 30%
D) 50%

Q.21 A type of cracking in which higher hydrocarbons are heated at high temperature of 700°C to break them down into lower alkenes and alkanes is

A) Thermal cracking
B) Steam cracking
C) Catalytic cracking
D) Hydro-cracking

Q.22 In steam cracking higher hydrocarbons are heated for short duration to about _____ temperature.

A) Room temperature
B) 100°C
C) 700°C
D) 900°C

Q.23 Which is not the application of cracking

A) Increases production of petrol
B) Used to produce certain solvent phenol ethanol and acetone
C) Use to form drugs, fertilizer, plastic and detergents
D) Increases percentage of alkanes

Q.24 Octane number 100 is given by

A) n-Octane
B) n-Heptane
C) 2,2,4-Trimethyl pentane
D) 2,2,4-Trimetyl octane

NUCLEOPHILES, ELECTROPHILES AND FREE RADICALS

Q.25 Which type of hybridization is present in primary carbonium ion CH_3^+

A) sp^3 C) sp^2
B) sp D) dsp^2

Q.26 Which one is not nucleophile

A) NH_2^- C) H_2O
B) BF_3 D) CH_3^-

Q.27 Which of the following will not form by homolytic fission of CH_3Cl

A) CH_3^* C) H^*
B) CH_3^+ D) Cl^*

ISOMERISM

Q.28 The isomerism in which the com pounds differ with respect to functional group but have same molecular formula is called:

A) Metamerism C) Functional group isomerism
B) Position isomerism D) Chain isomerism

Q.29 The compounds having the same structural formula but differ with respect to the positions of the identical groups in space are said to exhibit:

A) Skeletal isomerism C) Cis-trans isomerism
B) Geometric isomerism D) Both B) and C)

Q.30 Ether shows the phenomenon of:

A) Position isomerism C) Functional group isomerism
B) Metamerism D) Cis trans isomerism

Q.31 Which of the following structures will not display geometrical isomerism?

A) $CH_3 - CBr = CBrCH_3$ C) $CH_3CH = CHCl$
B) $CH_3 - CH = CH - CH_3$ **D) $CH_3 - CH = CBr_2$**

Q.32 Which of the following compounds does not exhibit positional isomerism

A) Alkynes C) Nitroalkanes
B) Carboxylic acid D) Alcohol

Q.33 Total number of possible chain isomers of butylalcohol among alcohols are

A) Four C) Five
B) Three D) Six

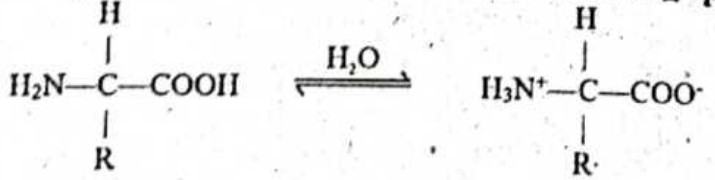
Q.34 Alkanes do not show geometrical isomerism due to

A) Asymmetry C) Resonance
B) Rotation around single bond D) Restricted rotation around doubled bond

Q.35 How many esters are possible for $C_4H_8O_2$

A) 2 C) 3
B) 4 D) 5

Q.36 The type of isomerism shown in the following species is



A) Functional group isomerism C) Tautomerism
B) Metamerism D) Cis-trans isomerism

Q.37 Which class of compound cannot show positional isomerism

A) Alkanes C) Alkene
B) Alkynes D) Alcohol

FUNCTIONAL GROUPS & NOMANCLATURE

Q.38 **Choose the correct name according to IUPAC nomenclature**

A) 2–Ethyl–3–methyl pentane
B) 3-Methyl cyclohexane
C) 3–Ethyl–2–methyl pentane
D) 3–Ethyl–4–methyl pentane

Q.39 **Which one is thioether**

A) R – O – R
B) R – S – R
C) R – Se – R
D) R – Te – R

Q.40 **Glycols and glycerols can be differentiated on the hasis of**

A) Number of carbon atom
B) Position of hydroxyl group
C) Number of hydroxyl group
D) All of these

Q.41 **The name of the compound $HC \equiv C - CH_2 - CH = CH_2$**

A) 1-Penten-4-yne
B) 2-Penten-3-yne
C) 4-Penten-1-yne
D) None of these

Q.42 **Which of the following is functional group of amino functional group**

A) $-NH_2$
B) $-C \equiv N$
C) $\diagdown C = NH \diagup$
D) $-\overset{\overset{O}{\|}}{C}-NH_2$

Q.43 **Select from the following the one which is alcohol**

A) $CH_3–CH_2–OH$
B) $CH_3–O–CH_3$
C) CH_3COOH
D) $CH_3–CH_2–Br$

Q.44 **Which one is the functional group of carboxylic acid (R = alkyl radical)**

A) $R-\overset{\overset{O}{\|}}{C}-H$
B) $R-\overset{\overset{O}{\|}}{C}-OH$
C) $R-\overset{\overset{O}{\|}}{C}-OR$
D) $R – O – R$

Q.45 **Which one of the following class of compounds has been incorrectly matched with their general formulae**

A) Phenol …… Ar –OH
B) Carboxylic acid ……. RCOOH
C) Ketone ……. R – COR
D) Aldehyde ……. ROR

Q.46 **What is the IUPAC name of this structure**

$$CH_3-CH_2-\underset{\displaystyle CH_3-\underset{|}{CH}-CH_3}{\underset{|}{CH}}-CH_2-CH_2-CH_3$$

A) 3–Ethyl 2–methyl hexane
B) 4–Ethyl 5–methyl hexane
C) Iso propyl hexane
D) 3–Iso propyl hexane

Q.47 **The correct name of 3,5,5-Trimethylhexane is**

A) 3–Ethyl 2–methyl pentane
B) 2,2,4-Trimethylhexane
C) 2,3–Dimethylpentane
D) 2,3,4-Trimethylhexane

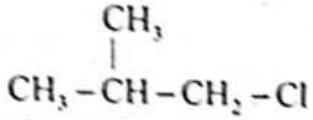
Q.48 **Which suffix is used for carboxylic acid**

A) – al
B) – ol
C) – oic
D) – ene

Q.49 Which one is not dicarboxylic acid

A) Phthalic acid
B) Adipic acid
C) Benzoic Acid
D) Oxalic acid

Q.50 The IUPAC name of given compound is



A) 1–Chloro-2–methylbutane
B) 1–Chloro-2-methylpropane
C) Iso-butyl chloride
D) 2-Chloro-2-methyl propane

PAST PAPERS QUESTIONS

Q.1 The given three hydrocarbons are



Benzene Naphthalene Anthracene

A) Alicyclic hydrocarbons
B) Aromatic hydrocarbons
C) Acyclic Hydrocarbons
D) Heterocyclic hydrocarbons

Q.2 Cyclobutane structure is categorized under

A) Aromatic compounds
B) Alicyclic compounds
C) Aliphatic compounds
D) Heterocyclic compounds

Q.3 In the following organic compound carbon atoms in all of them undergo both sp^3 and sp^2 hybridization except X, which has all sp^3 hybrid orbitals, identify X

A) 1-butanol
B) 2-chloro - 2- butane
C) Trans to butene
D) Butanoic acid

Q.4 A gasoline of higher octane number can be obtained by

A) Oxidative cleavage
B) Steam cracking
C) Thermal cracking
D) Catalytic cracking

Q.5 Which one of the followings is used as typical catalyst for catalytic cracking?

A) Mixture of SiO_2 and Ni
B) Mixture of Pt and Cu
C) Mixture of Fe and MgO
D) Mixture of SiO_2 and Al_2O_3

Q.6 What should be the temperature and pressure respectively for catalytic cracking:

A) 500^0C, 2 atm
B) 900^0C, 2 atm
C) 500^0C, 4 atm
D) 900^0C, 4 atm

Q.7 Alkenes can be prepared on industrial scale by the following reaction using high temperature and a suitable catalyst. What type of reaction is this?

$$C_{16}H_{34} \rightarrow C_7H_{16} + 3CH_2 = CH_2 + CH_3 - CH = CH_2$$

A) Cracking
B) Reforming
C) Displacement
D) Double Displacement

Q.8 The compound with an atom which has an unshared pair of electron is called

A) Nucleophile
B) Protophile
C) Electrophile
D) None of these

Q.9 In the following, which one is free radical

A) Cl^-
B) Cl^+
C) Cl_2
D) $Cl^{\cdot}$

Q.10 Select a nucleophile from the following examples

A) NH_4^+
B) NO_2
C) NH_3
D) NO^+_2

Q.11 Which one of these is NOT a nucleophile?

A) NH_3^-
B) H_2O
C) BF_3
D) CH^-

Q.12 Among the following, which one is nucleophile

A) H^+
B) OH^-
C) Ca^{2+}
D) None of these

Q.13 Which one is not nucleophile?

A) BH_3
B) $-NH_2$
C) NH_3
D) –OR

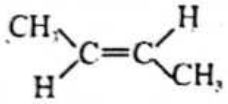
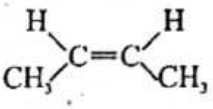
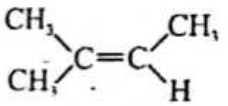
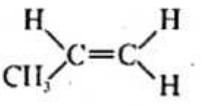
Q.14 Homolysis of a covalent bond yields a very reactive species with incomplete octet in its valence shell. What is this species?

A) A complex ion
B) A free radical
C) An electrophile
D) A nucleophile

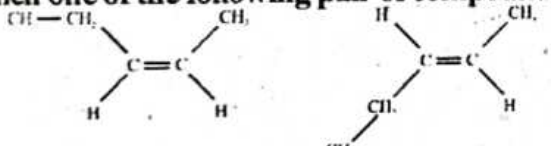
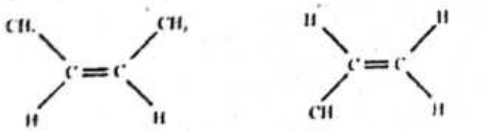
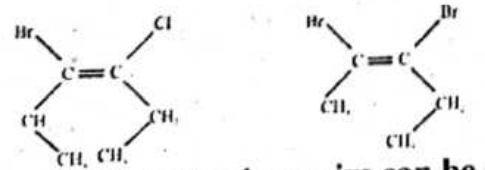
Q.15 1-chloroproane and 2-chloropropane are isomers of each other. The type of isomerism

A) Cis-trans isomerism
B) Positional isomerism
C) Chain isomerism
D) Functional group isomerism

Q.16 The cis-isomerism is shown by

A) 
C) 
B) 
D) 

Q.17 Which one of the following pair of compound is cis and trans isomersm of each other?

A) 
B) 
C) 
D) 

Q.18 Which one of the following pairs can be a cis-trans isomer to each other?

A) $CHCl = CCl_2$ and $CH_2 = CH_2$
B) $CHCl = CH_2$ and $CH_2 = CHCl$
C) CH_3-$CH=CH$-CH_3 and H_3C-$CH=CH$-CH_3
D) CH_3-CH_3 and $CH_2 = CH_2$

Q.19 The type of structural isomerism which arises due to the difference in the nature of carbon chain or carbon skeleton is

A) Chain isomerism
B) Position isomerism
C) Cis-Trans isomerism
D) Optical isomerism

Q.20 Name the compound, which shows geometric isomerism:

A) 1-bromo-2-chloropropene
B) 2-pentene
C) 2,3-dimethylpropen
D) Both A & B

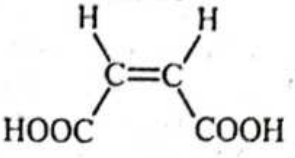
Q.21 Butane molecule can have maximum no of isomers

A) 2
B) 4
C) 5
D) 3

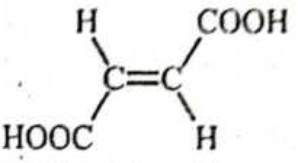
Q.22 Which of the following molecule shows cis – trans isomers?

A) C_2HCl_3
B) C_2H_4
C) $C_2H_2Cl_4$
D) $C_2H_2Br_2$

Q.23 Maleic acid and Fumaric acid, both have chemical formula $C_4H_4O_4$. The structure of these acids is shown below:



Maleic acid



Fumaric acid

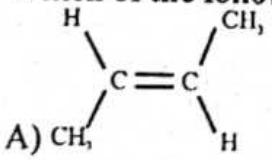
Maleic acid and Fumaric acid are:

A) Position isomers
B) Cis-trans isomers
C) Metamers
D) Structural isomers

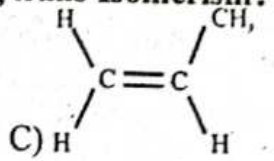
Q.24 Diethyl ether and n-butanol are

A) Position isomerism
C) Chain isomerism
C) Functional isomerism
D) Tautomerism

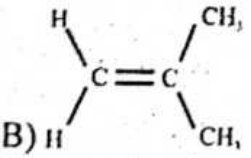
Q.25 Which of the following structure is showing trans-Isomerism?



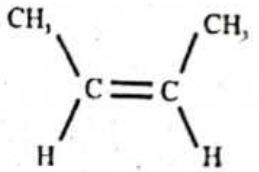
A)



C)

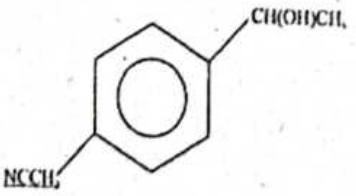


B)



D)

Q.26 The names of functional groups in the following compound X are;

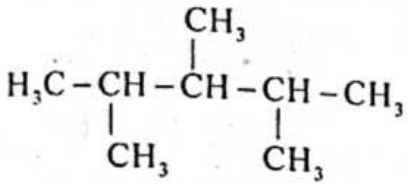


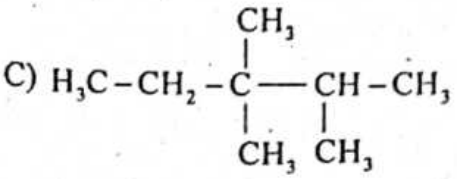
A) Primary alcohol, nitrile and benzene ring
B) Secondary alcohol, nitrile and aryl ring
C) Secondary alcohol, nitrile and phenol ring
D) Secondary alcohol, amine and benzene ring

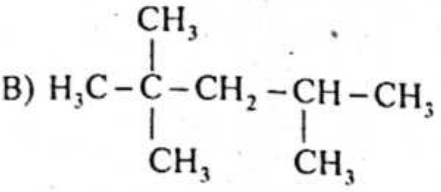
Q.27 Which one of the following is a ketone?

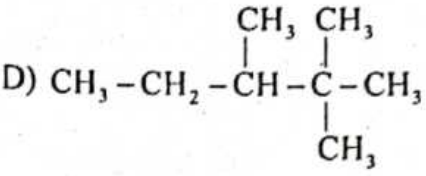
A) $CH_3—O—CH_2—CH_3$
B) $CH_3—CO—CH_2—CH_3$
C) $CH_3COCOOH$
D) $CH_3—CH_2CHO$

Q.28 The structural formula of 2,3,4 trimethylpentane is

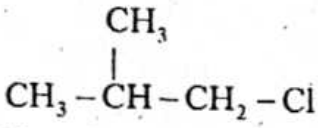
A) 

C) 

B) 

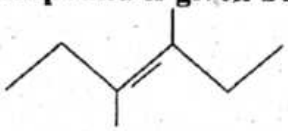
D) 

Q.29 The IUPAC name of the given compound is



A) 1–Chloro-2-methylpropane
B) 1-Chloro-2-methylbutane
C) Isobutyl chloride
D) 2-Methyl-3-chloropropane

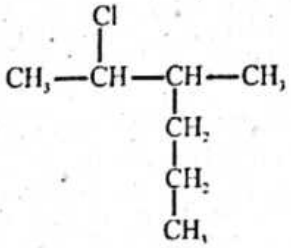
Q.30 Skeletal formula of an organic compound is given below:



It is a hydrocarbon. IUPAC name of the compound is:

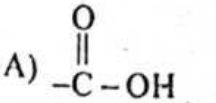
A) 3,3 dimethyl 3-hexene
B) 3,4 dimethyl 3-hexene
C) 3-hexene
D) 2,3 dimethyl 1-hexene

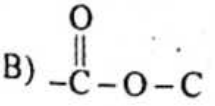
Q.31 Which one of the followings is the best name according to IUPAC system for the formula given below?

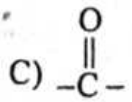


A) 4-methyl-6-chloro heptane
B) 2-chloro-4n propyl hexane
C) 2-chloro-3-methyl hexane
D) 2-chloro-4-n propyl pentane

Q.32 Which one is a functional group of carboxylic acid

A) 

B) 

C) 

D) None of these

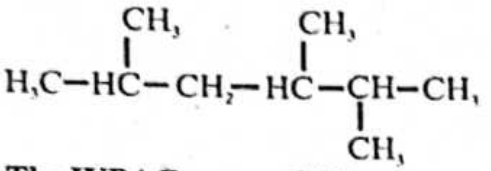
Q.33 Select one which is alcohol

A) $CH_3–O–CH_3$
B) CH_3COOH
C) $CH_3–CH_2–OH$
D) $CH_3–CH_2–Br$

Q.34 IUPAC name of Divinyl acetylene is

A) 1,5- hexadiene-3-ene
B) 3-Hexane-1,5-diyne
C) 1,5- hexadiene-3-yne
D) 3-Hexyne-1,5-diene

Q.35 Have a critical look at the given structure



The IUPAC name of this compound is

A)2-Methyl-4-isopropylpentane
B) 2,3,5-Trimethylhexane
C) 2,4,5-Trimethylhexane
D) 2-Isobutyl-3-methylbutane

ANSWER KEY

1	D	11	B	21	A	31	D	41	A
2	A	12	A	22	D	32	B	42	A
3	B	13	A	23	D	33	A	43	A
4	D	14	A	24	C	34	B	44	B
5	A	15	B	25	C	35	C	45	D
6	D	16	C	26	B	36	C	46	A
7	B	17	D	27	B	37	A	47	B
8	B	18	C	28	C	38	C	48	C
9	A	19	C	29	D	39	B	49	C
10	B	20	D	30	B	40	D	50	B

PAST PAPER QUESTIONS

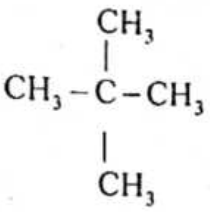
1	B	6	A	11	C	16	C	21	A	26	B	31	C
2	B	7	A	12	B	17	A	22	D	27	B	32	A
3	A	8	A	13	A	18	C	23	B	28	A	33	C
4	D	9	D	14	B	19	A	24	C	29	A	34	C
5	D	10	C	15	B	20	D	25	A	30	B	35	A

EXPLANATORY NOTES

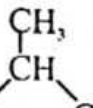
Q.1 Isobutane, isopentane and isobutylene are open chain acyclic compounds

Q.3 C_nH_{2n+2} is valid only in case of saturated open chain hydrocarbons

Q.4 The formula of neopentane is following



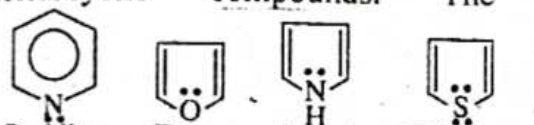
This is open chain saturated hydrocarbon



Q.7 In methyl cyclopropane there are one primary carbon, one tertiary carbon and two secondary carbon atoms are present

Q.8 Naphthalene, anthracene and pyrene are fused ring aromatic compounds while biphenyl methane is isolated ring aromatic compound. The given formula is of anthracene

Q.9 The compounds which contain at least one atom other than carbon in the ring are heterocyclic compounds. The following are heterocyclic compound



Pyridine Furan Pyrrole Thiophene

Q.10 Aliphatic or open chain compounds are further classified as straight chain and branched compounds

Q.11 In heterocyclic compounds only that heteroatom is possible which as valancy of two or more. Therefore chlorine cannot be a heteroatom because it forms only one bond in order to complete its octet.

Q.12 A) Alicyclic, B) Branched hydrocarbon, C) Straight chain hydrocarbon and D) Aromatic compound

Q.14 Break down of higher hydrocarbons (alkanes) into lower hydrocarbons (alkenes and alkanes) by heating in the absence of air is called cracking.

Q.15 Break down of higher hydrocarbons (alkanes) into lower hydrocarbons (alkenes and alkanes) by heating in the absence of air observed in the given reaction which is indicating the process of cracking.

Q.16 Cracking is also known as pyrolysis means breaking up of bonds. Therefore, in cracking bond fission is necessary for the break down of higher hydrocarbons into lower hydrocarbons.

Q.17 Cracking takes place by heating high hydrocarbon in the absence of air. Therefore, without oxygen formation of carbon dioxide and water is not possible.

Q.18 $C_{16}H_{34} \xrightarrow[500°C]{Al_2O_3+SiO_2} C_8H_{18} + C_8H_{16}$

Hexadecane n-Octane Octene

Q.19 When C – C bond of alkane is broken is changes to alkane and alkene.

Q.20 The fractional distillation of petroleum gives us 20% gasoline while approximately 50% of gasoline is prepared by cracking of petroleum.

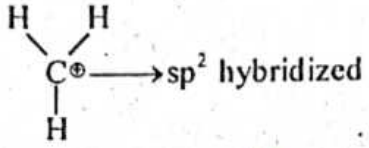
Q.22 Break down of higher hydrocarbons in vapour phases mixed with steam into lower hydrocarbons by heating for short duration to about 900°C and then cooled rapidly is called steam cracking.

Q.23

(i) Used to produce gasoline.
(ii) Increases production of petrol.
(iii) Used to produce, propene, butane and benzene.
(iv) Used to form drugs, fertilizer, plastic, synthetic fibers and detergents.
(v) About 50% of petrol is synthesized.
Used to produce certain solvents, phenol, ethanol and acetone.

Q.25 Carbon of methyl carbocation is sp^2 – hybridized because this carbon is attached to three groups.

In $\dot{C}H_3$ free radical, carbon is sp^2 hybridized.



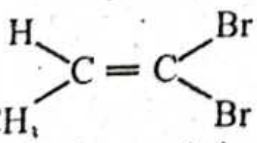
Q.28

Type	Reason of isomerism	Functional groups	Example
Chain or skeletal isomerism	Difference in nature of carbon chains	Same	n-pentane, iso-pentane and neo-pentane
Position isomerism	Difference in position of same functional group on the carbon chain	Same	1-butene and 2- butene
Functional group isomerism	Same molecular formula, but different functional groups	Different	propanal and propanone
Metamerism	Unequal distribution of carbon atoms (R) on either side of functional group	Same	diethyl ether and methyl n-propyl ether

Q.29 The compounds having structural formula but differ with respect to the position in space is known as cis-trans isomerism or geometric isomerism.

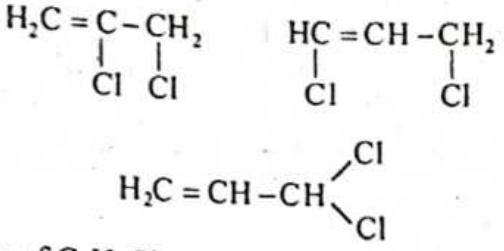
Q.30 Ethers show phenomenon of metamerism

Q.31

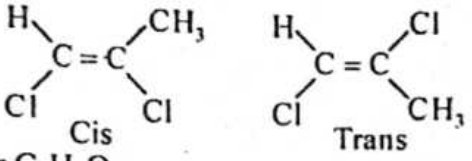


1st carbon contains two similar bromine atoms so it does not shows geometrical isomerism.

Q.33 Structural isomer of $C_3H_4Cl_2$ are

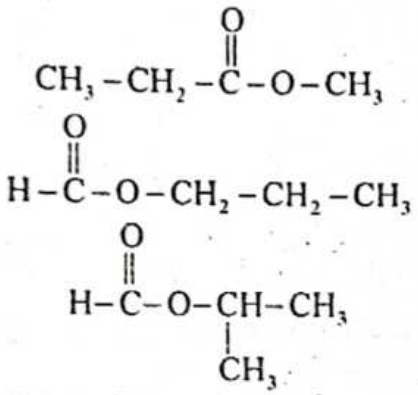


Geometrical isomer of C_3H_4Cl are



Cis Trans

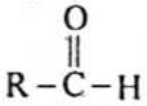
Q.35 Three esters are possible for $C_4H_8O_2$



Q.36 The compounds which differ with respect to position of H-atom within the same molecule. These isomers are usually rapidly interconvertable with each other.

Q.43 Alcohol has –OH group as functional group

Q.45 In aldehyde group, carbonyl carbon is linked with one H and one R group



Q.46 Select that chain which has greater number of branches on it

Q.50 Numbering of chain will start from halogen side

2C Topic HYDROCARBONS

PRACTICE EXERCISE

CHEMISTRY OF ALKANES

COMBUSTION

Q.1 **The combustion of one mole of C_2H_6 will produce how many moles of H_2O**

A) 1
B) 3
C) 2
D) 5

Q.2 $CH_4 + \_\_\_\_\_ \xrightarrow{\text{flame}} CO_2 + 2H_2O$:

A) H_2
B) O_2
C) CO
D) C

Q.3 **Complete combustion of an alkane produces H_2O and:**

A) C only
B) CO_2 only
C) CO only
D) All of these

Q.4 **The complete combustion of two moles of _____ requires seven moles of oxygen gas.**

A) Methane
B) Cyclopropane
C) Ethane
D) n-Propane

THE MECHANISM OF FREE RADICAL SUBSTITUTION REACTION

Q.5 **The extent of halogenation of alkanes depends upon the factors:**

A) Intensity of UV light
B) Temperature
C) Concentration of X_2 used
D) Both A) and B)

Q.6 **Propagation of free radical mechanism takes place by the**

A) Reaction of free radical with free radical
B) Formation of two free radicals
C) Consumption as well as production of another free radical
D) Reaction between two molecules

Q.7 **The termination step in chlorination of methane in presence of diffused sun light is**

A) $Cl_2 \longrightarrow 2C\dot{l}$
B) $Cl_2\dot{C}H + C\dot{l} \longrightarrow HCCl_3$
C) $CH_4 + C\dot{l} \longrightarrow \dot{C}H_3 + HCl$
D) $H_3\dot{C} + Cl_2 \longrightarrow H_3CCl + C\dot{l}$

Q.8 **Select the correct option when methane and chlorine gas are made to react with each other in equal proportion volume in presence of sun light:**

A) $CH_3Cl + HCl$
B) $CH_2Cl_2 + 2CH_3Cl$
C) $CHCl_3 + Cl_2$
D) $CCl_4 + Cl_2$

Q.9 **If excess of methane is treated with chlorine gas then the major possible hydrocarbons derivative would be:**

A) Dichloromethane
B) Tetrachloromethane
C) Chloromethane
D) Trichloromethane

Q.10 The most probable products are _____ when Cl_2 is supplied in very high excess to react with CH_4:

A) $CH_3Cl+HCl$
B) CH_2Cl_2+2HCl
C) $CHCl_3+3HCl$
D) CCl_4+4HCl

Q.11 Halogenation of alkane is believed to proceed through

A) Free radical substitution mechanism
B) Electrophilic substitution mechanism
C) Nucleophilic addition mechanism
D) Nucleophilic substitution mechanism

CHEMISTRY OF ALKENES

PREPARATION OF ALKENES

Q.12 The ease of dehydration of alcohols to produce alkenes is of the order:

A) Tertiary > Secondary > Primary
B) Secondary < Primary < Tertiary
C) Primary > Secondary > Tertiary
D) Tertiary < Secondary < Primary

Q.13 Dehydration of alcohols with conc. H_2SO_4 at 180°C gives:

A) Ethers
B) Alkenes
C) Esters
D) Alkyl halides

Q.14 Elimination of a halogen atom together with a hydrogen atom from an alkyl halide produces:

A) Alkanes
B) Alkynes
C) Alkenes
D) Alcohols

Q.15 Dehydrohalogenation of RX occurs in the presence of

A) An alcoholic base
B) An alcoholic salt
C) An alcoholic acid
D) An alcoholic Grignard reagent

Q.16 Ethanol with conc. H_2SO_4 at 140°C forms diethyl ether because:

A) It involves low temperature
B) It gets dehydrated
C) It gets dehydrogenated
D) Both A) and B)

Q.17 Which of the following is not used for the dehydration of alcohols?

A) P_4O_{10}
B) H_2SO_4
C) HNO_3
D) H_3PO_4

REACTIONS OF ALKENES

Q.18 What type of reaction that occurs between ethene and hydrogen?

A) Addition
B) Dehydration
C) Neutralization
D) Oxidation

Q.19 Which of the following will decolorize bromine water?

A) 1-Pentene
B) 2-Methyl-1-butene
C) Pentane
D) Both "A" and "B"

Q.20 Which of the following test can be used for distinguishing an alkane and an alkene

A) Bromine water test
B) Ozonolysis
C) Hydroxylation
D) Both "A" and "C"

Q.21 Hydroxylation of alkenes produce
A) Diols
B) Geminal diols
C) Vicinal diols
D) Mono-ols

Q.22 The preparation of vegetable ghee involves
A) Halogenation
B) Hydroxylation
C) Hydrogenation
D) Dehydrogen

Q.23 The test for unsaturation of organic compounds is carried out by treating alkenes with 1% dilute alkaline $KMnO_4$ solution. The colour of $KMnO_4$ is discharged with the formation of
A) Ethylene glycol
B) Glyoxal
C) Vicinal glycol
D) Oxalic acid

Q.24 In which addition reaction Markownikov's rule is not obeyed:
A) $CH_3CH = CH_2 + HCl \rightarrow$
B) $CH_3CH = CH_2 + HBr \rightarrow$
C) $CH_3CH_2CH = CH_2 + HI \rightarrow$
D) $CH_3CH = CHCH_3 + HBr \rightarrow$

Q.25 In addition of HCl to $CH_3CH = CH_2$, which one will be added first:
A) Cl^+
B) H^+
C) Cl^{-1}
D) $H^\bullet$

Q.26 The heat of hydrogenation of 1,3-hexadiene is
A) -239 kJ mol^{-1}
B) -120 kJ/mole
C) -208 kJ mol^{-1}
D) -231 KJ/mole

Q.27 Baeyer's reagent is used in the laboratory for
A) Reduction
B) Detection of double bond
C) Oxidation
D) Detection of glucose

CHEMISTRY OF BENZENE

STRUCTURE OF BENZENE

Q.28 CCC and CCH bond angles in benzene are _____ and _____ respectively
A) 109.5°, 109.5°
B) 120°, 109.5°
C) 120°, 120°
D) 109.5°, 120°

Q.29 Which one of the following statement is not correct about benzene?
A) On hydrogenation, 208 kJ/mole is liberated
B) C-H bond length in benzene is 1.09 A°
C) Molecular mass of benzene is 78.108
D) Resonance energy of benzene is 150.5 kcal/mole

Q.30 Total number of hybrid orbitals of all the carbon atoms in benzene are:
A) 3
B) 12
C) 6
D) 18

Q.31 The heat of hydrogenation of benzene is
A) –119.5kJ/mole
B) –293kJ/mole
C) –358.5kJ/mole
D) –208kJ/mole

Q.32 The C–C bond length in benzene molecule is
A) 1.54 A°
B) 1.397 A°
C) 1.34 A°
D) 1.09 A°

Q.33 How many π electrons are there in benzene to form delocalized electronic cloud?
A) 3
B) 8
C) 4
D) 6

ELECTROPHILIC SUBSTITUTION REACTIONS AND THE MECHANISM

Q.34 What is required other than anhydrous $AlCl_3$, when toluene is prepared by Friedal craft reaction?

A) C_6H_6
B) $C_6H_5C_2H_5$
C) $C_6H_6 + CH_3Cl$
D) C_6H_5Cl and CH_3Cl

Q.35 Benzene undergoes _____ readily

A) Substitution reaction
B) Oxidation reaction
C) Addition reaction
D) Elimination reaction

Q.36 Which of the following is produced by the action of CH_3Cl on benzene in presence of $AlCl_3$ followed by oxidation in the presence of acidified $KMnO_4$ give

A) Toluene
B) m-Xylene
C) o-Xylene
D) Benzoic acid

Q.37 Benzene reacts with benzoyl chloride in the presence of $AlCl_3$ to give

A) Benzaldehyde
B) Acetophenone
C) Benzyl chloride
D) Benzophenone

Q.38 Benzene on treatment with n-propyl chloride in the presence of $AlCl_3$ gives

A) Xylene
B) n-Propyl benzene
C) Iso propyl benzene
D) Toluene

HYDROGENATION OF BENZENE

Q.39



A) H_2
B) $2H_2$
C) $3H_2$
D) $4H_2$

Q.40 An organic compound X on reduction by consuming 3-molecules of hydrogen gas to product Y. Y is a cyclic saturated hydrocarbon, X is:

A) Vinyl acetylene
B) Divinyl acetylene
C) Benzene
D) Cyclohexane as catalyst

Q.41 The conversion of benzene into cyclohexane is _____

A) Exothermic process
B) Endothermic process
C) Isothermic process
D) Both A and B

Q.42 The conversion of benzene to cyclohexane is an example of:

A) Addition reaction
B) Elimination reaction
C) Substitution reaction
D) Polymerization

SIDE CHAIN OXIDATION OF ALKYL BENZENE

Q.43 X is decolourized when alkyl benzene are readily oxidized to benzoic acid, X is

A) Aqueous $KMnO_4$ or $K_2Cr_2O_7$
B) Alcoholic $KMnO_4$ or $K_2Cr_2O_7$
C) Cold dilute alkaline $KMnO_4$ or $K_2Cr_2O_7$
D) Acidified $KMnO_4$ or $K_2Cr_2O_7$

Q.44 **Benzoic acid is the only oxidation product along with formation H_2O and CO_2, of an organic compound A, when A is treated with acidified potassium dichromate, A is**

A) Ethyl benzene
B) Aniline
C) Benzoyl halide
D) Benzophenone

Q.45 **Benzoic acid is the main product when _____ is oxidized by acidified $K_2Cr_2O_7$**

A) $C_6H_5CH_3$
B) $C_6H_5CH_2CH_3$
C) $C_6H_5CH_2CH_2CH_3$
D) All of these

Q.46 **The oxidation of toluene by acidified $KMnO_4$ produces**

A) Phenol
B) Benzyl alcohol
C) Benzaldehyde
D) Benzoic acid

BENZENE RING BY 2,4 DIRECTING AND 3,5 DIRECTING GROUPS

Q.47 **Most reactive compound among the following:**

A) Benzene
B) Nitrobenzene
C) Benzoic acid
D) Ethyl benzene

Q.48 **Which one of the following is least reactive**

A) Benzene
B) Chlorobenzene
C) Toluene
D) Nitrobenzene

Q.49 **Which group deactivates the benzene ring?**

A) $-NH_2$
B) $-OR$
C) $-CHO$
D) $-OH$

Q.50 $X \xrightarrow[FeCl_3]{Cl_2} Y \xrightarrow{HNO_3+H_2SO_4} Z$, **Z in this reaction is possibly**

A) Benzene
B) 3-Chloronitrobenzene
C) Chlorobenzene
D) 2-Chloronitrobenzene

PAST PAPERS QUESTIONS

Q.1 **Which one of the following reactions shows combustion of a saturated hydrocarbon?**

A) $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$
B) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
C) $CH_4 + \frac{1}{2}O_2 \xrightarrow[400°C,200atm]{Cu} CH_3OH$
D) $C_2H_2 + \frac{5}{2}O_2 \longrightarrow 2CO_2 + H_2O$

Q.2 **Catalytic Oxidation of alkanes result in formation of _____:**

A) Carboxylic acid
B) Aldehyde
C) Ketone
D) Alcohol

Q.3 **Which of the options show all possible products of combustion of Butene?**

A) $CO+CO_2+H_2O$
B) $C+CO+CO_2$
C) CO_2+H_2O
D) $C+CO+CO_2+H_2O$

Q.4 **Reaction mechanism of alkanes with halogens is known as**

A) Addition
B) Free radical substitution
C) Elimination
D) Propagation

Q.5 **Ordre of reactivity of halogen toward alkance is**

A) $F_2>I_2>Br_2>Cl_2$
B) $F_2>Br_2>Cl_2>I_2$
C) $F_2>Cl_2>Br_2>I_2$
D) $F_2>Cl_2>I_2>Br_2$

Q.6 Which compound is obtained by the elimination of bromopropane?

A) Butene
B) Ethene
C) Propene
D) Propane

Q.7 Hydrogenation of unsaturated oils is done by using

A) Finally divided nickel
B) Vanadium pentaoxide
C) Finally divided iron
D) Copper

Q.8 Ethene on polymerization, give the product polyethene, this reaction may be called as

A) Addition
B) Condensation
C) Substitution
D) Pyrolysis

Q.9 In the reaction of ethene with bromine the intermediate formed is

A) CH_2-CH_2 with Br^+ bridge
C) $\overline{C}H_2-CH_2$, Br
B) CH_2-CH_2, Br
D) CH_2-CHBr

Q.10 What is the product formed when propene reacts with HBr?

A) $CH_3-CH_2-CH_2Br$
C) $CH_2(Br)-CH(Br)-CH_3$
B) $BrCH_2-CH=CHBr$
D) $CH_3-CH(Br)-CH_3$

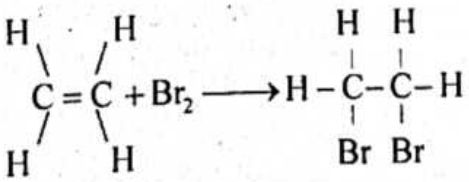
Q.11 Addition of unsymmetrical reagent to an unsymmetrical alkene is governed by

A) Cannizzaro's Reaction
B) Krichoff Rule
C) Aldol condensation
D) Markownikov's Rule

Q.12 Order of reactivity of alkenes with hydrogen halide is

A) HBr > HI > HCl
B) HI > HBr > HF
C) HF > HI > HCl
D) HI > HBr > HCl

Q.13 Bromination of alkene is shown in the following reaction. This reaction is used for



A) identification of primary and secondary alcohols
B) Detection of double bond
C) Detection of aldehydes
D) Detection of ketones

Q.14 Treatment of ethene with cold sulphuric acid followed by reaction with boiling water yields:

A) Ethyne
B) Ethanal
C) Ethane
D) Ethanol

Q.15 Alkenes undergo:
A) Nucleophilic substitution
B) Electrophilic Addition
C) Nucleophilic addition
D) Electrophilic substitution

Q.16 Acetone can be obtained by ozonolysis
A) 2-Batyne
B) iso-butene
C) 2-Butene
D) 1-butene

Q.17 When hydrogen atom is removed from benzene, group left is called:
A) Alkyl group
B) Benzyl group
C) Phenyl group
D) Methyl group

Q.18 The ratio of σ and π bond is benzene is
A) 4:1
B) 1:3
C) 1:4
D) 3:1

Q.19 The introduction of NO_2 group in the benzene ring is called nitration. The nitration of benzene takes place when it is heated with a 1:1 mixture of ---------at 50-55^{0}C
A) Conc. HNO_3 and Conc. H_2SO_4
B) Conc. HNO_3 and Conc. Acetic acid
C) Conc. HNO_3 and Conc. HCl
D) Conc. HNO_3 and Conc. H_3PO_4

Q.20 The substitution of –H group by –NO_2 group in benzene is called
A) Nitration
B) Sulphonation
C) Ammonolysis
D) Reduction of benzene

Q.21 Which one of the following is a powerful electrophile used to attack on the electrons of benzene ring?
A) $FeCl_2$
B) $FeCl_4^-$
C) Cl^+
D) Cl_2

Q.22 The reaction of benzene with bromine in the presence of $FeBr_3$ follows the mechanism of _____ reaction
A) Electrophilic addition
B) Nucleophilic substitution
C) Electrophilic substitution
D) Nucleophilic addition

Q.23 For halogenation of benzene, which reagent is used
A) H_2SO_4
B) $AlCl_3$
C) HNO_3
D) HCl

Q.24 Chlorination and Bromination mostly uses_____
A) Radiowaves
B) Visible light
C) Infrared radiation
D) U.V light

Q.25 Which one of the following acts as a electrophile in the electrophilic substitution of benzene with bromine
A) Br^+
B) Fe^{+3}
C) $FeCl_4^-$
D) Fe^{+2}

Q.26 Benzene in presence of $AlCl_3$ gives acetophenone when reacts with
A) Acetyl chloride
B) Ethyl benzene
C) Acetic acid
D) Ethanoic acid

Q.27 The introduction of R - C(=O) group in benzene is called
A) Acylation
B) Carbonyl reduction
C) Alkylation
D) Formylation

Q.28 The introduction of an alkyl group in benzene takes place in the presence of $AlCl_3$ and:

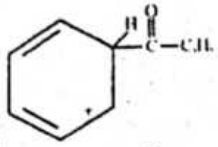
A) $R-\overset{O}{\overset{\|}{C}}-OH$

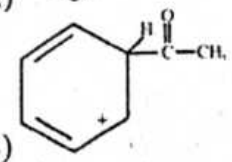
B) $R-Cl$

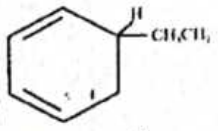
C) $R-\overset{O}{\overset{\|}{C}}-Cl$

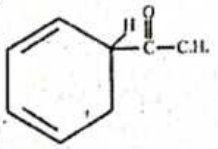
D) $R-\overset{O}{\overset{\|}{C}}-O-$

Q.29 Intermediate product formed when propanoyl chloride reacts with benzene is

A) 

B) 

C) 

D) 

Q.30 When benzene reacts with Acetyl chloride (CH_3COCl) in the presence of $AlCl_3$ acetophenone is formed. The electrophile in this reaction will be

A) CH_3C^+O

B) $AlCl_3$

C) C^+H_3

D) CH_3COCl

Q.31 In Friedal Craft's Chlorination of Benzene, Iron III chloride acts as a catalyst, which is the initial reaction in the generation of an electrophile?

A) $Cl_2 + FeCl_3 \rightarrow Cl^+ + FeCl_3^-$

B) $Cl_2 + FeCl_3 \rightarrow 2Cl^+ + FeCl_2^-$

C) $Cl_2 + FeCl_3 \rightarrow Cl^- + FeCl_4^+$

D) $Cl_2 + FeCl_3 \rightarrow Cl^+ + FeCl_4^-$

Q.32 Which of the following species are 3,5(meta) directing groups when second group is introduced into the benzene ring

I = $-NH_2$ II = $-CHO$ III = $-COOH$ IV = $-CH_3$

A) II, III and IV

B) II and III

C) I and IV

D) I, II and IV

Q.33 Which derivative of benzene shows maximum reactivity in electrophilic substitution reactions?

A) Benzaldehyde

B) Benzoic acid

C) Methyl benzene

D) Nitrobenzene

Q.34 Which of the following compound react slower than benzene in electrophilic substitution reaction

A) Nitrobenzene

B) Aniline

C) Phenol

D) Toulene

Q.35 Which catalyst is used in oxidation of benzene ring?

A) $FeBr_3$

B) $Fe+Al_2O_3$

C) V_2O_5

D) Raney Ni

ANSWER KEY

1	B	11	A	21	C	31	D	41	A
2	B	12	A	22	C	32	B	42	A
3	B	13	B	23	C	33	D	43	D
4	C	14	C	24	D	34	C	44	A
5	C	15	A	25	B	35	A	45	D
6	C	16	D	26	A	36	D	46	D
7	B	17	C	27	B	37	D	47	D
8	A	18	A	28	C	38	B	48	D
9	C	19	D	29	D	39	C	49	C
10	D	20	D	30	D	40	C	50	D

PAST PAPER QUESTIONS

1	B	6	C	11	D	16	B	21	C	26	A	31	D
2	A	7	A	12	D	17	C	22	C	27	A	32	B
3	D	8	A	13	B	18	D	23	B	28	B	33	C
4	B	9	A	14	D	19	A	24	D	29	D	34	A
5	C	10	D	15	B	20	A	25	A	30	A	35	C

EXPLANATORY NOTES

Q.1 $2C_2H_6 + 5O_2 \longrightarrow 2CO_2 + 6H_2O$

$C_2H_6 + 2.5O_2 \longrightarrow CO_2 + 3H_2O$

Q.2 $CH_4 + O_2 \xrightarrow{\text{flame}} CO_2 + 2H_2O$

Q.3 In case of incomplete combustion C, CO and H_2O may be formed while for complete combustion only CO_2 and H_2O are formed.

$3CH_4 + 6O_2 \longrightarrow 3CO_2 + 6H_2O$

Q.4 $2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$

Q.5

$CH_4 + X_2 \longrightarrow CH_3X + HX$

$CH_4 + 2X_2 \longrightarrow CH_2X_2 + 2HX$

$CH_4 + 3X_2 \longrightarrow CHX_3 + 3HX$

$CH_4 + 4X_2 \longrightarrow CX_4 + 4HX$

A) and B) control rate of reaction.

Q.6 Propagation step involves

i) Attack of free radical on molecule
ii) Homolytic fission in molecule
iii) Bond formation
iv) Formation of new molecule
v) Formation of new free radical

$R^\circ + Cl_2 \longrightarrow R - Cl + Cl^\circ$

$Cl^\circ + R - H \longrightarrow HCl + R^\circ$

Q.7 Termination step in free radical substitution mechanism involves

i) Attack of free radical on other free radical
ii) Bond formation
iii) Formation of a molecule

$Cl^\circ + Cl^\circ \longrightarrow Cl_2$

$R^\circ + X^\circ \longrightarrow R - X$

$R^\circ + R^\circ \longrightarrow R - R$

Q.9 $CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl$

$2CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl + CH_4$

$3CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl + 2CH_4$

$4CH_4 + Cl_2 \longrightarrow CH_4Cl + HCl + 3CH_4$

A) CH_4 and Cl_2 are in 1:2 by volume or moles
B) CH_4 and Cl_2 are in 1:3 by volume or moles
C) CH_4 and Cl_2 are in 1:4 by volume or moles

Q.11 The initiation propagation and termination of halogenation of alkane involves free radicals.

Initiation step $Cl_2 \longrightarrow 2Cl^{\circ}$

Propagation step $Cl^{\circ} + CH_4 \longrightarrow HCl + CH_3^{\cdot}$

Termination step $CH_3^{\cdot} + Cl^{\circ} \longrightarrow CH_3Cl$

Q.12 The dehydration of alcohols is an elimination reaction which involves C – O cleavage.
Ease of dehydration $\propto$ Ease of C – O cleavage $\propto$ number of β - carbon in alcohol.
3 β – C in tertiary alcohol, 2 β–C in secondary alcohol and 1 β–C in primary alcohol.
Ease of dehydration $\propto$ Ease of C – O cleavage $\propto$ Size of R in alcohol

Q.13 Concentration H_2SO_4 180°C causes β-elimination reaction

$$C_2H_5OH \xrightarrow[180^{\circ}C]{\text{conc } H_2SO_4} H_2C = CH_2 + H_2O$$

But concentration H_2SO_4 causes condensation elimination reaction at 140°C.

$$2C_2H_5OH \xrightarrow[140^{\circ}C]{\text{conc } H_2SO_4} C_2H_5 - O - C_2H_5$$

Q.14 This is β-elimination reaction which involves removal of X from α–C and removal of β–H from β–C.

$$-\overset{H}{\underset{|}{C}}-\overset{X}{\underset{|}{C}}- + KOH \xrightarrow{\text{alcohol}} -C=C- + KX + H_2O$$

Dehalogenation is removal of X from α–C and β–H from β–C.

Q.15 In alcoholic medium OH becomes a base strong base hence it attacks on β–H instead of replacing X from RX. Therefore, alkene is produce from RX by β-elimination reaction.

$$OH^- + -\overset{H}{\underset{|}{C}}-\overset{X}{\underset{|}{C}}- + KOH \xrightarrow{\text{alcohol}} -C=C- + KX + H_2O$$

Q.16 At low temperature (140°C) ethanol is dehydrated by condensation elimination reaction but at high temperature (180°C) ethanol gets dehydrated by β-elimination reaction.

Q.17 Dehydration of alcohols need dehydrating agents like concentrated H_2SO_4, P_2O_3 or P_4O_{10}, H_3PO_4 and Al_2O_3.
HNO_3 is not a dehydration agent at all.

Q.18 Ethene is an unsaturated hydrocarbon. So, it becomes saturated reduced by the addition of hydrogen gas.

$$C_2H_4 + H_2 \xrightarrow[\Delta]{Ni} C_2H_6$$

Q.19 Bromine water ($Br_{2(aq)}$) is reddish brown in colour. It is used to detect unsaturation in hydrocarbon when any unsaturated hydrocarbon (1-Pentene / 2-Methyl-1-pentene) come across it. Bromine water is decolourized.

Q.20 Alkane is saturated hydrocarbon while alkene is an unsaturated one. The presence of unsaturation is detected by bromine water test and hydroxylation (using Baeyer's reagent). Ozonolysis is used to locate position of double bond.

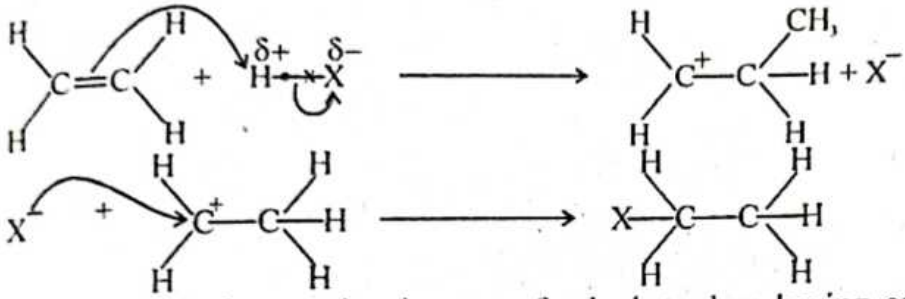
Q.21

$$-C=C- + 2KMnO_4 - H_2O \xrightarrow{\text{cold}} -\underset{|}{\overset{OH}{C}} - \underset{|}{\overset{OH}{C}} - + 2MnO_2 + 2KOH$$

Q.22 Vegetable ghee is prepared from vegetable oil which is tri-ester of unsaturated fatty acids with glycerol.
The unsaturation can be vanished by hydrogenation in presence of Ni at high temperature.

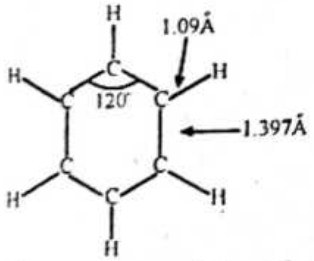
Q.24 Markownikove's rule is obeyed by unsymmetrical alkenes. Symmetrical alkanes like $CH_3CH = CHCH_3$ having no binding to obey the rule because both doubly bonded carbon atoms have same number of hydrogen atom.

Q.25 In case of alkenes, the addition is started by the attack of electrophile.



Q.26 The heat of hydrogenation in case of a hydrocarbon having only one double bond is 119.5kJ/mole. It will become twice i.e. 239kJ/mole. If the hydrocarbon is having 2 isolated double bonds like 1-3-hexadiene.
Note: If double bonds are at alternate position then the value of heat of hydrogenation will be slightly less than twice.

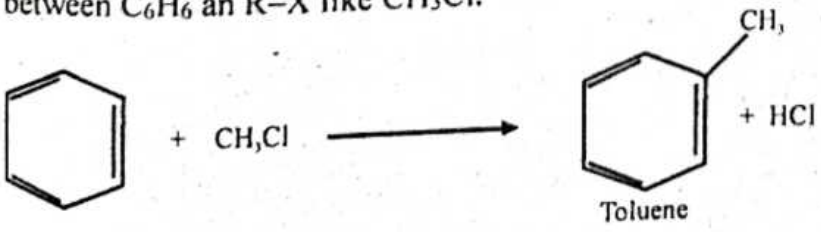
Q.28



Q.30 Benzene consists of six sp^2-hybridized carbon atoms each sp^2-carbon atoms has $3sp^2$ hybrid orbital therefore the total number of hybrid orbitals in benzene would be 18.

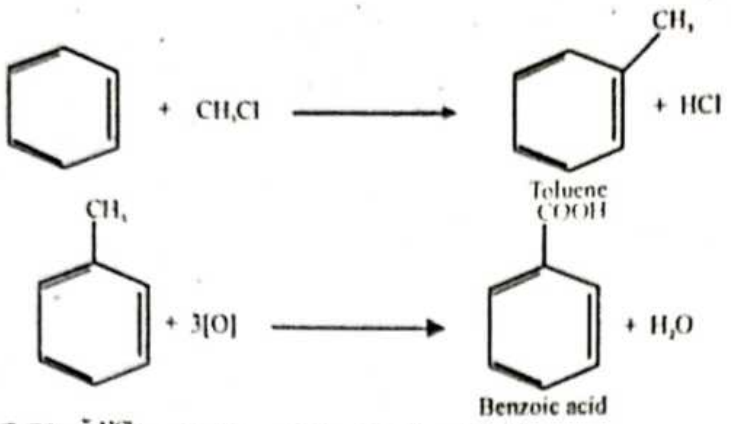
Q.33 In benzene all six carbon atoms are sp^2-hybridized, so each carbon atom is having one half filled un-hybrid orbital that involved in partially overlapped with adjacent un-hybrid orbitals of p to form π–electrons cloud of 6 electron clouds.

Q.34 In Friedal Craft's reaction $AlCl_3$ is a catalyst. It acceleration the speed of reaction between C_6H_6 an R–X like CH_3Cl.



Toluene

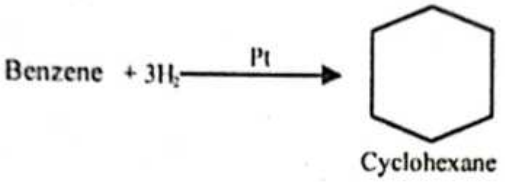
Q.36



Q.37 $C_6H_6 + C_6H_5COCl \xrightarrow{AlCl_3} C_6H_5 - CO - C_6H_5 + HCl$

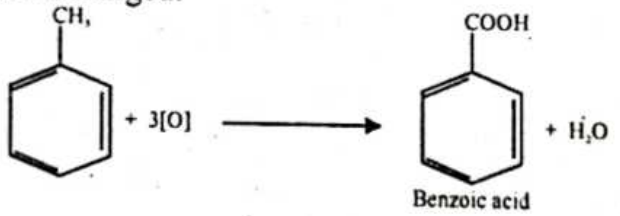
Q.38 $C_6H_6 + CH_3CH_2CH_2 - Cl \xrightarrow{AlCl_3} C_6H_5 - C_3H_7 + HCl$

Q.40

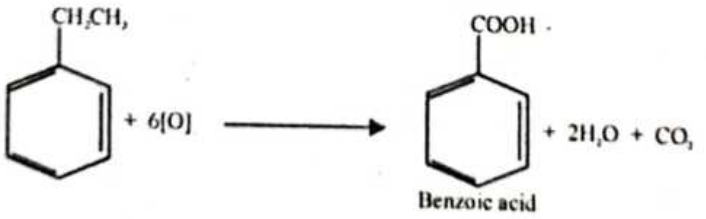


Q.41 The conversion of benzene to cyclohexane is hydrogenation. This process of hydrogenation is an exothermic by 208kJ/mol.

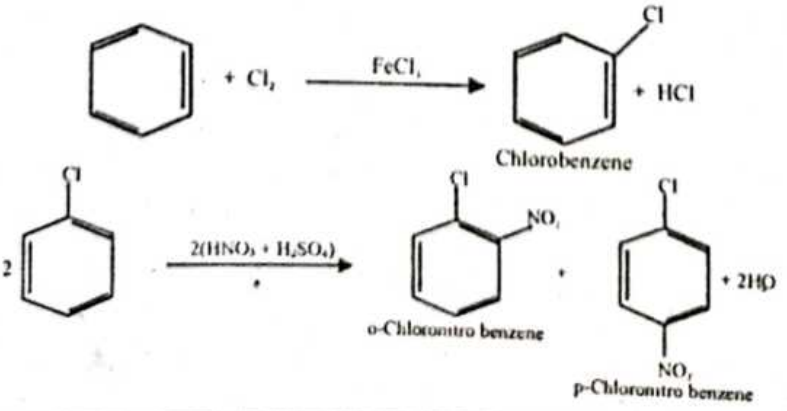
Q.43 Alkyl benzene are oxidized to benzoic acid by nascent oxygen which is produce by reacting purple coloured $KMnO_4$ with H_2SO_4 or orange red coloured $K_2Cr_2O_7$ during this production colour is discharged.



Q.44



Q.50



3C Topic ALKYL HALIDES

PRACTICE EXERCISE

IMPORTANCE OF HALOGENOALKANES

Q.1 Which of the following is alkyl halide

A) CH_3Cl
B) CH_2Cl_2
C) $C_2H_4Cl_2$
D) All of these

Q.2 Which one is monohaloalkane

A) CH_2Cl_2
B) $CHCl_3$
C) $CH_3 — CH_3 — CH_2 — Cl$
D) CCl_4

Q.3 Which one is used in containers and pipe work for reactive and corrosive chemicals.

A) Silicone polymers
B) Teflon
C) Steel
D) None of these

Q.4 Dichlorodifluoromethane (CCl_2F_2) acts as aerosol propellant and refrigerant due to its inertness which is explained by

A) C–F bond energy is large
B) Fluorine is highly electronegative
C) C – F bond has low polarity
D) Fluorine compounds are non-flammable

Q.5 PTFE is used as non-stick coating for pans and other cookware due to

A) Its non-reactive and non-toxic nature
B) Strong (C–F) bonds present in it
C) Its non-flammability
D) All are the reasons

Q.6 Freon-12 is commonly known as

A) Refrigerant
B) Insecticides
C) A solvent
D) A fire extinguisher

REACTIONS OF ALKYL HALIDES + SN REACTIONS AND MECHANISMS

Q.7 Elimination bimolecular reactions involve:

A) 1st order kinetics
B) Zero order kinetics
C) 2^{nd} order kinetics
D) None of these

Q.8 Which one among the following is not a good leaving group?

A) HSO_4^-
B) OH^-
C) Cl^-
D) Br^-

Q.9 Alkyl halides are considered to be very reactive compounds towards nucleophile because

A) They have an electrophilic carbon
B) They have an electrophilic carbon and a good leaving group
C) They have an electrophilic carbon and a bad leaving group
D) They have a nucleophilic carbon and a good leaving group

Q.10 Which of the following is correct about S_N2 reactions:

A) Breakage of C—X and formation C—Nu bonds are simultaneous
B) Inversion of the configuration of the alkyl halide molecule
C) 2nd order kinetics
D) All of these

Q.11 Which of the following is correct about S_N1 reactions:

A) Retention of the configuration of the alkyl halide molecule
B) Unimolecular reactions
C) Reaction rate is a function of the [alkyl halide]
D) All of these

Q.12 β-elimination reactions are due to:
A) Attack of the incoming nucleophile on alpha hydrogen
B) Attack of the incoming nucleophile on beta hydrogen
C) Attack of the incoming nucleophile on beta carbon
D) Attack of incoming nucleophiles on electrophilic carbon

Q.13 Tertiary alkyl halides give
A) S_N1 and E1 reaction
B) S_N2 and E1 reaction
C) S_N2 and E2 reaction
D) None of the above

Q.14 Order of S_N1 reaction
A) 1
B) 2
C) 1.5
D) 3

Q.15 Which statement is incorrect about reactivity of alkyl halides with respect to nucleophile
A) Greater the bond energy of R-X, lesser the reactivity
B) Greater the bond polarity of R-X, lesser the reactivity
C) Greater the bond energy of R-X, smaller the stability
D) Greater E.N difference of R- X, greater the stability

Q.16 Which statement is incorrect about nucleophilic substitution reaction
A) Incoming nucleophile must be stronger than the leaving one
B) Leaving nucleophile must be stronger than incoming nucleophile
C) Tertiary alkyl halides generally give S_N1 reactions
D) S_N2 is a single step mechanism

Q.17 In β -Elimination the resulting product is?
A) Alcohol
B) Alkyl halide
C) Alkane
D) Alkene

Q.18 Which compound is most reactive through SN_2 mechanism
A) CH_3–Cl
B) CH_3–CH_2–Cl
C) CH_3–CH_2–CH_2–Cl
D) All have same reactivity

Q.19 Thioalcohol is prepared when alkyl halide is reacted with
A) $\bar{O}H$
B) NO_2^-
C) $\bar{S}H$
D) I^-

Q.20 Whether an alkyl halide follows SN1 or SN2 mechanism depends on
A) Steric hindrance
B) Inductive effect
C) Stability of carbocation
D) All of these

Q.21 Neo-pentyl bromide refers to follow which mechanism during substitution reactions
A) SN1
B) Both A and C
C) SN2
D) It does not show SN reactions

Q.22 The rate of E_2 reaction depends on
A) Concentration of substrate
B) Concentration of nucleophile
C) Concentration of both substrate and nucleophile
D) Polarity of solvent

Q.23 During SN2 mechanism of alkyl halides C – X bond undergoes
A) Homolytic cleavage
B) Heterolytic cleavage
C) Sometimes homolytic, sometimes heterolytic
D) C–X bond is not cleaved in SN2 reactions

Q.24 **If an nucleophile is the attacking reagent which one would be the most reactive one**
A) R – F
B) R – Br
C) R – Cl
D) R – I

Q.25 **CH_3 – Cl can show which of the following reaction with easiness**
A) SN_2
B) E_2
C) SN_1
D) Both A) and B)

Q.26 **Which of the following is true about R – I**
A) They are most reactive alkyl halide for a given alkyl group
B) They show maximum boiling point for a given alkyl group
C) Cannot be prepared directly by reaction of alkanes with I_2
D) All are true

Q.27 **Which of the following reactions is not shown by R – X**
A) Substitution reactions
B) Elimination reactions
C) Reduction
D) It shows all of above mentioned reactions

Q.28 **Most common reactions shown by alkyl halides are**
A) Substitution
B) Reduction
C) Elimination
D) Polymerization

Q.29 **2° alkyl halides show both SN_1 and SN_2 reactions depending upon**
A) Nature of functional group
B) Nature of solvent
C) Temperature
D) All of these

Q.30 **Ammonia reacts with excess of alkyl halide to form**
A) 1°- amine
B) 3°-amine
C) 2°-amine
D) Mixture of 1°, 2° and 3° amines

Q.31 **The main factor which decides the reactivity of (R – X) is**
A) C°–X bond strength
B) Both C – X bond strength and polarity
C) C – X bond polarity
D) Boiling point of the given R– X

Q.32 **Higher polarizable nucleophiles favour**
A) Substitution reactions
B) Elimination reactions
C) Favour both substitution and elimination reactions equally
D) Cannot be predicted

Q.33 $CH_3 - Cl \xrightarrow[KOH]{Alc} A$ **. "A" product is**
A) $CH_3 - OH$
B) CH_4
C) $CH_3 - O - CH_3$
D) No reaction will occur

Q.34 **High temperature favours elimination reactions over substitution reactions due to**
A) More reorganization of bonds in E-reactions
B) Weak polarizability of electrons rich specie
C) Attack on β-hydrogen instead of α- carbon
D) Formation of unsaturated product

Q.35 **Which among CH_3X, $R - CH_2 - X$, R_2CHX, R_3CX is most reactive towards SN2 reaction**
A) R_3CX
B) R_2CHX
C) RCH_2X
D) CH_3X

Q.36 Consider the following haloalkanes

1. CH_3F 2. CH_3Br
3. CH_3Cl 4. CH_3I

The increasing order of reactivity in SN reactions is

A) 4 < 3 < 2 < 1 C) 1 < 3 < 2 < 4
B) 1 < 2 < 3 < 4 D) 1 < 2 < 4 < 3

Q.37 3°-Alkyl halides are practically inert to SN_2 mechanism because of

A) Insolubility C) Instability
B) Inductive effect D) Steric hindrance

Q.38 The organic chloro compound which shows complete stereo chemical inversion during S_N2 reaction is

A) $(C_2H_5)_2CHCl$ C) $(CH_3)_3CCl$
B) $(CH_3)_2CHCl$ D) $CH_3 - Cl$

Q.39 Second step of which of the following pair of reaction is same

A) E_1 + SN1 C) E_2 + SN1
B) SN1 + SN2 D) None of these

Q.40 Which of the following is the most stable carbocation

A) Secondary C) Primary
B) Tertiary D) All have same stability

Q.41 Which reagent is a good nucleophile?

A) NH_3 C) HBr
B) Br_2 D) BH_3

Q.42 $CH_3 - CH_2 - OH + Alc.NH_3 \longrightarrow$

A) $CH_3CH_2-NH_2$ C) CH_3-CH_2-H
B) CH_2-CH_2 D) $CH_3-CH_2-CH_3$

Q.43 Which C–X bond has highest bond energy per mole

A) C–Br C) C–F
B) C–Cl D) C–I

Q.44 Which alkyl halide out of the following may follow both S_N1 and S_N2 mechanism

A) CH_3-X C) $(CH_3)_3C-X$
B) $(CH_3)_2CH-X$ D) $(CH_3)_3C-CH_2-X$

Q.45 Rate of E_1 reaction depends upon

A) Concentration of nucleophile
B) Concentration of substrate as well as alkyl halide
C) Concentration of substrate only
D) None of these

Q.46 In β-elimination reaction, nucleophile attacks on

A) α-hydrogen C) α-carbon
B) β-hydrogen D) β-carbon

Q.47 An alkyl halide may be converted to alcohol by

A) Addition C) Addition
B) Substitution D) Elimination

Q.48 **Neutral nucleophile among the following is**

A) CN^-
B) Cl^-
C) $:NH_3$
D) $C_2H_5O^-$

Q.49 **100% inversion of configuration take place during**

A) S_N1
B) S_N2
C) E_1
D) E_2

Q.50 **$CH_3CH_2–Br+CN^- \longrightarrow ?$**

A) $CH_3CH_2–Br$
B) $CH_3CH_2–CN$
C) $CH_2 = CH_2$
D) No reaction take place

PAST PAPERS QUESTIONS

Q.1 **CFC's are organic compounds, which are derivatives of saturated hydrocarbons. They have high bond dissociation values therefore they are inert and non-toxic for the living organisms. The word CFS's stands for;**

A) Carboflourochlorines
B) Chlorofluorocarbons
C) Chlorofluorcarbides
D) Chlorofluoridecarbons

Q.2 **Organic compound carbon tetra chloride is used as**

A) Lubricant
B) Oxidant
C) Solvent
D) Plastic

Q.3 **The suspected liver carcinogenic which also has a negative reproduction and developmental effects in human is**

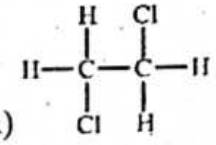
A) Iodoform
B) Chloroform
C) Bromoform
D) Tropoform

Q.4 **The IUPAC name of halothane is**

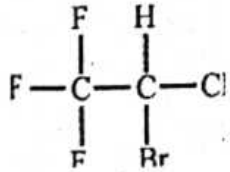
A) 1- Bromo-1-chloro-2,2,2- trifluoroethane
B) 1,1,1-Trifluoro-2 bromo-2-chloroethane
C) 2-Bromo-2-chloro-1,1,1-trifluoroethane
D) 2-Chloro-2- bromo -1,1,1- trifluoroethane

Q.5 **Which one of the followings is Halothane?**

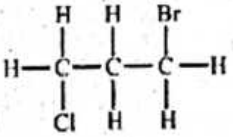
A)



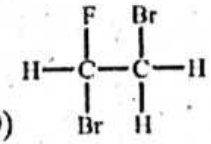
B)



C)



D)



Q.6 **The non-stick lining of pans is _____**

A) Difluoroethene
B) Chlorofluoroethene
C) Chloroethene
D) Tetrafluoroethene

Q.7 **Halothane is a halo derivative of**

A) Ethane
B) Methane
C) Ethanol
D) Methanol

Q.8 Which one of the following is the structure of Teflon?

A) $(-CF_2-CCl_2-)n$
B) $(-CF_2-CH_2-)n$
C) $(-CH_2-CH_2-)n$
D) $(-CF_2-CF_2-)n$

Q.9 Which halide ion has the capacity to act as both very good nucleophile and good leaving group in nucleophilic substitution reactions?

A) I^-
B) F^-
C) Br^+
D) Cl^-

Q.10 Which product is obtained by the hydrolysis of 1 – chlorobutane with the aqueous sodium hydroxide?

A) 1-butanol
B) 1-butene
C) 1-butanal
D) Butanone

Q.11 During S_N2 reaction, configuration of alkyl halide molecule is

A) Remains same
C) Gets inverted
B) Depends upon carbon atom
D) Depends upon electronegativity of halide

Q.12 The alkaline hydrolysis of bromoethane shown below gives alcohol as the product

$$CH_3-CH_2-Br \longrightarrow CH_2CH_2OH$$

The reagent and the condition used in this reaction may be

A) H_2O at room temperature
B) Ethanol, heat
C) KOH is alcohol
D) Dilute $NaOH_{(aq)}$, warm

Q.13 In substitution reaction, secondary halogenoalkane give/show

A) S_N1 mechanism
B) S_N2 mechanism
C) Both E_1 and E_2
D) Both S_N1 and S_N2

Q.14 The order of reactivity of alkyl halides towards nucleophile is

A) RI > RBr > RF > RCl
B) RF > RBr > RCl > RI
C) RI > RBr > RCl > RF
D) RF > RCl > RBr > RI

Q.15 If halogenalkanes are mixed with an excess of ethanoic ammonia and heated under pressure amine are formed. Which amine is formed in the following reaction?

$$CH_3CH_2Br + NH_3 \longrightarrow Amine$$

A) $CH_3—CH_2—NH—CH_2—CH_3$
B) $CH_3—CH_2—NH_2$
C) $CH_3—CH_2—CH_2—NH_2$
D) $H_2N—CH_2—CH_2—NH_2$

Q.16 The average bond energy of C-Br is

A) 228 $KJmol^{-1}$
B) 200$KJmol^{-1}$
C) 250$KJmol^{-1}$
D) 290$KJmol^{-1}$

Q.17 During the S_N1 reaction, the fast reaction involves

A) Breakage of covalent bond
B) Formation of carbocation
C) Transition state
D) Attack of nucleophile

Q.18 Which is an intermediate compound in S_N1

A) Ethoxide ion
B) Alkyl halide
C) Alkene
D) Carbocation

Q.19 Among the alkyl halides, which always follows S_N2 mechanism

A) Primary alkyl halides
B) Secondary alkyl halides
C) Tertiary alkyl halide
D) Both A & B

Q.20 What is the order of increasing reactivity of alkyl halides?

A) Fluoroalkane > chloroalkane > bromoalkane > iodoalkane
B) Fluoroalkane < chloroalkane < bromoalkane < iodoalkane
C) Fluoroalkane < chloroalkane > bromoalkane > iodoalkane
D) Fluoroalkane < chloroalkane < bromoalkane < iodoalkane

Q.21 Which type of alkyl halides gives SN_2 mechanism?

A) Secondary alkyl halides
B) Vinyl halides
C) Tertiary alkyl halides
D) Primary alkyl halides

Q.22 When purely alcoholic solution of sodium/potassium hydroxide and halogen alkane are refluxed an alkene is formed :

CH_3-CH_2-Br (in presence of alcoholic KOH)→ CH_2=CH_2

What is the mechanism of the reaction

A) Elimination
B) Debromination
C) Dehydration
D) Nucleophilic substitution

Q.23 Consider the reaction given below:



which statement is true?

A) Reagent for I is KOH in alcohol
B) Reaction II is elimination
C) Reagent for II is KOH in aqueous medium
D) Reaction I is debromination

Q.24 Consider the reaction given below:

$$CH_3 - CH_2Br \xrightarrow[alcohol]{KOH} H_2C = CH_2 + HBr$$

Mechanism followed by the reaction is

A) E2
B) E1
C) S_N1
D) S_N2

Q.25 In elimination reaction, alcoholic KOH is used. OH^- in this case will act as

A) Electrophile
B) Base
C) Leaving group
D) Acid

Q.26 In elimination reaction, alcoholic KOH is used. OH^- in this case will act as

A) Electrophile
B) Base
C) Leaving group
D) Acid

Q.27 In elimination reaction, _____ is used

A) Acidic $K_2Cr_2O_7$
B) $CuCl_2$
C) Acidic NaOH
D) Alcoholic KOH

Q.28 In the reaction sequence

$$H_3C - CH_2 - CH_2 - Br + AlcKOH \longrightarrow C \xrightarrow[H_2O]{H_2SO_4} D$$

Product D will be

A) Mixture of methanol and ethanol
B) 2-propanol
C) 1-Propanol
D) Propanoic acid

Q.29 In the reaction sequence given here

$H_3C-CH_3 + Br_2 \xrightarrow{hv} A \xrightarrow{AlcKOH} B$ **The end product is an unsaturated hydrocarbon. Identify the nature of reaction in the two steps.**

A) Step I is a nucleophilic substitution and step II is elimination
B) Step I is addition and step II is nucleophilic substitution
C) Step I is free radical substitution and step II nucleophilic substitution
D) Step I is free radical substitution and step II is elimination

ANSWER KEY

1	A	11	D	21	C	31	A	41	A
2	C	12	B	22	C	32	A	42	A
3	B	13	A	23	B	33	D	43	C
4	A	14	A	24	D	34	C	44	B
5	D	15	C	25	A	35	D	45	A
6	A	16	B	26	D	36	B	46	A
7	C	17	D	27	D	37	D	47	B
8	B	18	A	28	A	38	D	48	C
9	B	19	C	29	B	39	D	49	B
10	D	20	D	30	D	40	B	50	B

PAST PAPER QUESTIONS

1	B	6	D	11	C	16	D	21	D	26	B
2	C	7	A	12	D	17	D	22	A	27	D
3	B	8	D	13	D	18	D	23	B	28	B
4	C	9	A	14	C	19	A	24	A	29	D
5	B	10	A	15	B	20	B	25	B		

EXPLANATORY NOTES

Q.1 Alkyl halides are monohalo alkanes only $C_nH_{2n+1}X$

Q.2 Monohalo alkanes have only one halogen attached to hydrocarbon chain and follow general formula $C_nH_{2n+1}X$.

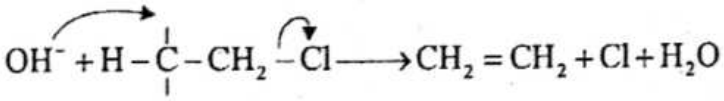
Q.3 Teflon due to high proportion of fluorine does not react to most corrosive substances (Fluoro compounds are inert due to restriction of fluorine to octet and high C – F bond energy).

Q.4 High C – F bond energy does not allow CFCs to react in air.

Q.5 PTFE (Teflon) is an inert, non-toxic compound which does not catch fire due to strong C – F bonds.

Q.6 Freon–12 (CCl_2F_2) is a chlorofluoro carbon used as refrigerant and aerosol propellent.

Q.7 A bimolecular reaction involves 2 molecules in rate determing step.



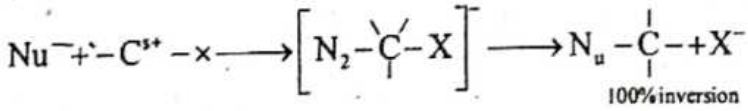
$R = K\,[C_2H_5Cl]\,[OH^-]$

Order = 1+1 = 2

Q.8 OH^- is very strong nucleophile and due to its high charge to size ratio it is strongly attached to carbon and hence a poor leaving group.

Q.9 Electrophilic α-carbon of alkyl group makes it a good substrate for nucleophile attach which is aided by good leaving groups.

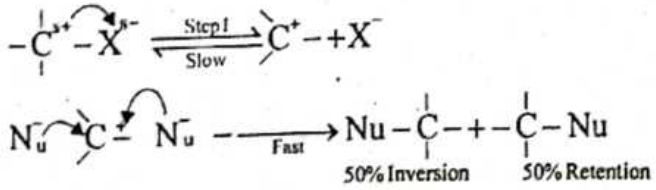
Q.10



$R = k\,[Nu^-]\,[R–X]$

Order = 1 + 1 = 2

Q.11 **SN1→Unimolecular nucleophilic substitution**



$R = k\left[-\overset{|}{\underset{|}{C}}-X\right]$

Order = 1

Q.12 β-Elimination involves attack of strong base (e.g. OH^-) on β-hydrogen.

Q.13 Tertiary alkyl halides can be ionized relatively easily due to stable carbocation hence giving S_N1 and E_1 mechanism in both first and the rate determing step involves ionization of $R - X$ to R^+.

Q.14 S_N1 is unimolecular

$R = K[R - X]$

Order = 1

Q.15

Reactivity of $R-X$ $\propto$ C–X bond polarity

$\propto$ C–X bond length

$\propto \frac{1}{\text{C–X bond energy}}$

$\propto \frac{1}{\text{Stability}}$

So greater stability means higher B.E

Q.16 SN reactions are favoured by a good leaving and stronger incoming group.

R $\propto$ Strength of incoming Nu^-

$\propto \frac{1}{\text{Strength of leaving } Nu^-}$

Q.17 β-Elimination reaction produces alkenes from alcohol or alkyl halides.

$$R - CH_2 - CH_2 - X \xrightarrow{\text{Koltaic}} R - CH_2 = CH_2 + HX$$

$$R - CH_2 - CH_2 - OH \xrightarrow[180°C]{\text{conc } H_2SO_4} R - CH_2 = CH_2 + H_2O$$

(Alkene)

Q.18 Reactivity through S_N2 mechanism

$$\propto \frac{1}{\text{Size of R}}$$

Hence the order

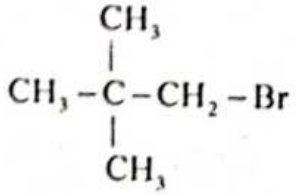
$CH_3X > C_2H_5 - X > C_3H_7X$

Q.19 Thioalcohol = $R - SH$

$$R - Br + SH^- \longrightarrow R - SH + Br^-$$

Q.20 Greater steric hinderance, greater stability of R^+ and greater inductive effect favours S_N1.

Q.21 Neo-pentyl bromide is a primary alkyl halide, and primary alkyl halides favours S_N2.



Q.22 E_2 is bimolecular reaction.

$$R = K[R-X][OH^-]$$

Order = 1 + 1 = 2

Q.23 In heterolytic cleavage one of the atoms leaves with both of the shared electrons in S_N2 mechanism leaving X^- gets both electron.

Q.24 Reactivity of $R-X \propto \frac{1}{C-X \text{ bond energy}}$

Reactivity order

$R-I > R-Br > R-Cl > R-R$

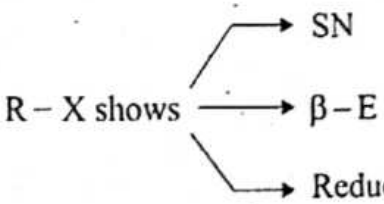
Q.25 $CH_3 - Cl$ does not offer steric hindrance to attacking group also its carbocation is unstable hence attack and removal occur simultaneously giving S_N2.

Q.26 (i) Due to low bond energy reactivity is highest.

(ii) Greater polarizability of "I" increases boiling point.

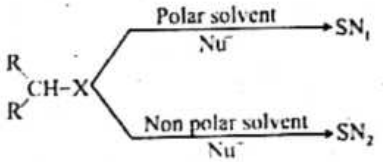
(iii) R – I are highly reactive so cannot be prepared directly.

Q.27



Q.28 $R^{\delta+}X^{\delta-}$ are good substrate for nucleophile attack of α-carbon giving mostly SN reaction.

Q.29



In polar solvent formation of carbocation is favoured which allows S_N1 mechanism.

Q.30 When R – X is excess, these are enough R – X molecules to react with NH_3 and make 1°, 2° and 3° amines.

Q.31 C – X bond has to be broken in order to another Nv^- to replace X^-. So bond energy is major factor.

Q.32 Higher polarizable nucleophile gives off electron easily to electrophilic carbon favouring substitution while it does not favour elimination as it is weak base.

Q.33 KOH in alcoholic medium favour β-elimination, as $CH_3 - Cl$ lack β-hydrogen so no reaction may occur.

Q.34 C – H bond energy is higher so attack on B – H is favoured at higher temperature.

Q.35 Reactivity order towards S_N2 $CH_3X > RCH_2X > R_2CHX > R_3CX$ increase in R – groups increases steric hindrance.

Q.36 Reactivity of $R-X \propto \frac{1}{\text{B.E of } C-X}$

Bond energy order

$C-F > C-Cl > C-Br > C-I$

Hence reactivity order

$CH_3F < CH_3Cl < CH_3Br < CH_3I$

Q.37 Three bulky R-groups in tertiary R – X produce high hindrance to attacking nucleophile making only S_N1 possible instead of S_N2.

Q.38 CH_3Cl gives only S_N2 reaction giving complete inversion.

Q.39 First step is same in S_N1 and E_2 i.e. ionization to form carbocation. While 2nd step is different in all S_N1, S_N2, E_1 and E_2.

Q.40 Order of stability of carbocations

Tertiary > Secondary > Primary

Stability of $R^+ \propto$ Number of β-hydrogens

Q.41 NH_3 has a lone pair to donate which makes it a good nucleophile.

Q.42 $CH_3-CH_2-Br + Alc.NH_3 \xrightarrow{S_N2} CH_3CH_2-NH_2 + H_2O$

Q.43 Bond energy $\propto \frac{1}{B.L}$

Order of B.E $C-F > C-Cl > C-Br > C-I$

Q.44 Secondary alkyl halides can give both S_N1 and S_N2.

Q.45 For E_1 reaction R = K[R–X] unimolecular mechanism.

Q.46 In β-elimination reaction nucleophile is a base e.g. OH^- hence attack occurs on β-hydrogen.

Q.47 $R-X + OH^-_{(aq)} \xrightarrow{SN} R-OH + X^-$

X^- is substituted by OH^-

Q.48 NH_3 has no net charge.

Q.49

$$Nu^- + -C^{\delta+}-x \longrightarrow \left[N_2-\overset{\backslash\ /}{C}-X\right]^- \longrightarrow N_u-\underset{\text{100\% inversion}}{\overset{|}{C}}-+X^-$$

$R = k\,[Nu^-]\,[R–X]$

Order = 1 + 1 = 2

Q.50 $CH_3-CH_2-Br + CN^- \xrightarrow{S_N2} CH_3-CH_2-CN + Br^-$

4C Topic ALCOHOLS AND PHENOLS

PRACTICE EXERCISE

ALCOHOLS

ALCOHOLS: PRIMARY, SECONDARY AND TERTIARY

Q.1 Which of the following can be used for alcohol denaturing

A) Methanol
B) Pyridine
C) Acetone
D) All of these

Q.2 Absolute alcohol is

A) 100% C_2H_5OH
B) 95% C_2H_5OH
C) 100% CH_3OH
D) 15% C_2H_5OH

Q.3 The carbon to which functional group in alcohols is attached is

A) ∝-Carbon
B) Saturated carbon
C) β-Carbon
D) Both A and C

Q.4 Alcohol in which hydroxyl is attached to carbon which is further attached to two alkyl groups is

A) Primary alcohol
B) Secondary alcohol
C) Tertiary alcohol
D) None of these

Q.5 Alcohol in which – OH group is attach to carbon which is further attached to only one alkyl group is

A) Primary alcohol
B) Secondary alcohol
C) Tertiary alcohol
D) Aromatic alcohol

Q.6 Isobutyl alcohol and isopentyl alcohol are

A) Primary alcohols
B) Secondary alcohols
C) Tertiary alcohol
D) All

Q.7 Identify a tertiary alcohol

A) 2–Pentanol
B) 2,2–Dimethyl –1 – propanol
C) 2 – Methyl – 2 – butanol
D) 3– Methyl – 2– butanol

PREPARATION OF ETHANOL

Q.8 Dehydration of alcohols with conc. H_2SO_4 at 180°C gives:

A) Ethers
B) Alkenes
C) Esters
D) Alkyl halides

Q.9 Among alkenes which one produces t°-butyl alcohol on acid hydration

A) $(CH_3)_2 – C = CH_2$
B) $CH_3 – CH_2 – CH = CH_2$
C) $CH_3 – CH = CH – CH_3$
D) $CH_3 – CH = CH_2$

Q.10 During hydration of alkenes to form alcohols, alkenes are first dissolved in

A) Water
B) Dilute H_2SO_4
C) Concentration H_2SO_4
D) Both B and C can be used

Q.11 The addition of water to an alkene in the presence of catalytic amount of strong acid lead to the formation of

A) Alkoxy alkanes
B) Hydroxy alkane
C) Haloalkanes
D) Alkanoic acid

Q.12

$$CH_2 = CH_2 + H_3PO_4 \longrightarrow CH_3 — CH_2 — OPO_3H_2 \xrightarrow{H2O} CH_3 — CH_2 — OH + H_3PO_4$$

The compound in the centre of above series of reaction is called

A) Alkyl hydrogen sulphate
B) Alkyl phosphate
C) Alkyl phosphoric acid
D) Alkyl dihydrogen phosphate

REACTIONS OF ALCOHOLS

Q.13 Primary alcohols upon oxidation with acidified dichromate gives:
A) Aldehydes
B) Branched alkenes
C) Ketones
D) All of these

Q.14 Tertiary alcohols with acidified dichromate gives:
A) Aldehydes
B) Alkenes
C) Ketones
D) Alkynes

Q.15 Which of the following reacts with aqueous alkaline iodine:
A) 1-Propanol
B) Methanol
C) Ethanol
D) 2-Methyl-2-propanol

Q.16 When alcohols react with Na metal, the alkoxide ion thus formed is a strong
A) Electrophile
B) Acid
C) Nucleophile
D) Free radical

Q.17 An organic compound X is prepared by the oxidation of ethanol. This X reacts with ethanol to produce an ester, what is X likely to be:
A) Methanoic acid
B) Propanoic acid
C) Ethanoic acid
D) Butanoic acid

Q.18 Which inorganic reagent may be used to distinguish between phenol and methanol
A) Alkaline aqueous I_2
B) Aqueous $NaHCO_3$
C) $K_2Cr_2O_7$ in dil. H_2SO_4
D) Na metal

Q.19 $K_2Cr_2O_7/H_2SO_4$ generates
A) O_2
B) [O]
C) H_2
D) [H]

Q.20 Esterification takes place when an alcohol reacts with
A) Organic acid
B) Both organic and inorganic acids
C) Inorganic acid
D) Ethers

Q.21 During preparation of ester, the bridge oxygen is from
A) Alcohol
B) Ether alcohol or acid
C) Acid
D) Catalyst

Q.22 Which of the following is incorrect
A) 1° alcohol oxidizes to form aldehyde which is further oxidized to carboxylic acid
B) 2° alcohol oxidizes to form ketone, which is further oxidized to carboxylic acid
C) 3° alcohol is not oxidized in presence of $K_2Cr_2O_7/H_2SO_4$
D) All are correct statements

Q.23 Alcohols react with Na metal to produce
A) R–ONa
B) H_2 gas
C) Both A and B
D) No reaction takes place

Q.24 When an alcohol reacts with PX_5, the order or reactivity of alcohol is
A) 1° > 2° > 3°
B) 1° > 2° > 3°
C) 3° > 2° > 1°
D) Both B and C are correct

Q.25 When alcohols are oxidized the nature of products depends on
A) Nature of alcohol only
B) Reaction conditions only
C) Both A and B
D) It does not depend on any of A and B

Q.26 There are four alcohols P, Q, R and S with 3,2,1 and zero ∝-hydrogens which will not respond to $Na_2Cr_2O_7/H_2SO_4$
A) P
B) R
C) Q
D) S

Q.27 Alkanol + [o] $\xrightarrow{K_2Cr_2O_7+H_2SO_4}$ A $\xrightarrow{\cdot}$ B

The correct products are

A) $A = C_nH_{2n}O$, $B = C_nH_{2n}O_2$

B) $A = C_nH_{2n}O_2$, $B = C_nH_{2n}O$

C) $A = C_nH_{2n+2}O$, $B = C_nH_{2n}O_2$

D) $A = C_nH_{2n}O$, $B = C_nH_{2n+2}O$

Q.28 **When ethanol reacts with sodium metal than**

A) C—O bond breaks

B) O—H bond breaks

C) C—C bond breaks

D) C—H bond breaks

Q.29 **The number of moles of diol are required to produce one mole of hydrogen gas.**

A) 1

B) 2

C) 3

D) 4

Q.30 **Rasberry flavoured compound is produced by a condensation process. The process may be**

A) Addition

B) Elimination

C) Evaporation

D) Esterification

Q.31 **The one of the functional group isomer of alkoxy alkane reacts with alkanoic acid to produce**

A) Alkyl alkanoate

B) Alkoxy alkanoate

C) Alkane alkanoic acid

D) Alkyl alkoxy alkane

Q.32 **In esterification reaction, which one of the following bonds of alcohol undergo cleavage**

A) C — H

B) O — H

C) C — O

D) C — C

Q.33 **Excess alcohol at low temperature in presence of conc. of H_2SO_4 produce**

A) Ether

B) Ester

C) Organic acid

D) Alkene

Q.34 **Compound which gives most stable carbonium ion on dehydration is**

A) $(CH_3)_2-CH-CH_2-OH$

B) $CH_3(CH_2)_4OH$

C) $(CH_3)_3C-OH$

D) $CH_3CH(OH)CH_2CH_3$

Q.35 **Order of easiness of dehydration of alcohol is**

A) $3^\circ > 2^\circ > 1^\circ$

B) $2^\circ > 3^\circ > 1^\circ$

C) $1^\circ > 2^\circ > 3^\circ$

D) All are correct

Q.36 **After dehydration of 2-Butanol, the major product will be**

A) 1-Butene

B) Both are produced in equal amount

C) 2-Butene

D) 1-Butyne

Q.37 **$ROH + PCl_5 \longrightarrow RCl + POCl_3 + HCl$**

The type of above reaction is

A) Electrophilic substitution

B) Nucleophilic substitution

C) Addition

D) Elimination

PHENOLS

REACTIONS OF PHENOL

Q.38 Phenol reacts with aqueous bromine and decolorizes aqueous bromine forming the white precipitates of:
A) 2, 4-Dibromophenol
B) 2, 4, 6-Tribromophenol
C) 2-Bromophenol
D) 3-Bromophenol

Q.39 Picric acid can be prepared from phenol by
A) Halogenation
B) Oxidation
C) Nitration
D) Sulphonation

Q.40 Which one can be used as test for phenol
A) $C_6H_5OH + CH_3COCl$ in the presence of aq. NaOH
B) $C_6H_5OH + HCHO$ in the presence of NaOH
C) $C_6H_5\bar{O}Na^+ + CH_3CH_2Br$
D) $C_6H_5OH + Br_2$ (excess)

Q.41 Phenol on treatment with dil. HNO_3 at low temperature give
A) o-Nitrophenol
B) p-Nitrophenol
C) m-Nitrophenol
D) Mixture of o-Nitrophenol

Q.42 Phenol + $Br_{2(aq)} \rightarrow$?
A) o and p- Bromophenol
B) No reaction takes place
C) 2,4,6-Tribromophenol
D) Both A and C are produced

Q.43 Phenol can be distinguished from alcohol by
A) Tollen's reagent
B) $NaHCO_3$
C) $Br_{2(aq)}$
D) HCl

Q.44 The reaction of carbolic acid with aqueous bromine can be used as _____ from alcohols
A) Identification test
B) Distinguish test
C) Confirmatory test
D) Tollen's test

Q.45 The reaction of carbolic acid with caustic soda is used to produce colorless product. The molecular formula of the product is
A) C_6H_6O
B) C_6H_4OH
C) C_7H_6O
D) C_6H_5O

Q.46 Phenol and ethanol can be distinguish by all except
A) Iodoform test
B) Aq. Br_2
C) Na–metal
D) Lucas-reagent

Q.47 The reaction of phenol in which ring is involved except
A) Nitration
B) Sulphonation
C) Esterification
D) Bromination

RELATIVE ACIDITY OF WATER, ETHANOL AND PHENOL

Q.48 What is correct order for acidity of water, phenol and ethanol
A) $C_6H_5OH > H_2O > C_2H_5OH$
B) $C_6H_5OH > C_2H_5OH > H_2O$
C) $H_2O > C_2H_5OH > C_6H_5OH$
D) $H_2O > C_6H_5OH > C_2H_5OH$

Q.49 Conjugation between unshared electron pair on oxygen and aromatic ring in phenoxide ion results in
A) Shorter C – O bond distance
B) Stronger acidic character
C) Stable base
D) All of these

Q.50 The alcohol more acidic in nature is
A) Methanol
B) Ethanol
C) Propanol
D) Butanol

PAST PAPERS QUESTIONS

Q.1 Which of the following is secondary alcohol?

A) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{|}}-OH$

C) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH}{|}}-CH_2-OH$

B) $CH_3-CH_2-CH_2-OH$

D) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH}{|}}-CH_2-\underset{\displaystyle OH}{\overset{\displaystyle CH_3}{\overset{|}{C}}}-CH_3$

Q.2 The following structure is of

$$R-\overset{\displaystyle H}{\overset{|}{C}}-OH \quad (R)$$

A) Secondary alcohol
B) Primary alcohol
C) Tertiary alcohol
D) Carboxylic acid

Q.3 Primary, secondary and tertiary alcohols can be identified and distinguished by
A) Lucas test
B) Iodoform test
C) Bayer's test
D) Silver mirror test

Q.4 $(CH_3)_3C-OH$. Which one of the following is proper classification of the above formula?
A) Primary
B) Secondary
C) Tertiary
D) Polyhydric

Q.5 Alcohol in which carbon atom bonded to –OH group is further attached with three alkyl group is
A) Aromatic alcohol
B) Secondary alcohol
C) Primary alcohol
D) Tertiary alcohol

Q.6 Which one the following compounds is known as tertiary alcohol?
A) 2-Methyl-1-propanol
B) 2-Propanol
C) 2-Methyl-2-propanol
D) 1-Propanol

Q.7 Which enzyme is involved in fermentation of glucose
A) Zymase
B) Urease
C) Invertase
D) Diastase

Q.8 The dehydration of ethyl alcohol with concentrated H_2SO_4 at 140°C gives
A) Ethene
B) Diethyl ether
C) Alcohol
D) Carboxylic acid

Q.9 To produce absolute alcohol (100%) from rectified spirit (95.6% alcohol), the remaining 4.4% water must be removed by a drying agent such as
A) Calcium oxide
B) Calcium chloride
C) Calcium carbonate
D) Carbon monoxide

Q.10 $C_2H_5-SO_4H \xrightarrow[Warm]{H_2O} C_2H_5-OH + H_2SO_4$ choose the correct type for this reaction from the following?
A) Reduction
B) Oxidation
C) Hydroxylation
D) Hydration

Q.11 **Which of the following reactions is used for the production of alcohols on industrial scale?**

A) Hydrohalogenation of alkenes
B) Hydration of alkenes
C) Hydroxylation of alkenes
D) Hydrogenation of alkenes

Q.12 **Industrially water gas is converted into methanol by using catalyst(NUMS RC 2019)**

A) $CuO + ZnO$
B) $Al_2O_3 + ZnO$
C) $CuO + Cr_2O_3$
D) $ZnO + Cr_2O_3$

Q.13 **Ethanol reacts with ammonia to form ethyl amine. The catalyst used for this reaction is**

A) $ZnCl_2$
B) C_5H_5N
C) ThO_2
D) Cr_2O_3

Q.14 **An alcohol is converted into an aldehyde with same number of carbon atoms in the presence of K_2CrO_4/H_2SO_4. the alcohol is**

A) $CH_2C(CH)_2OH$
B) $(CH_3)_3COH$
C) $CH_3CH_2CH_2OH$
D) $(CH_3)_2CHOH$

Q.15 **Ethanol can be converted in to ethanoic acid by**

A) Oxidation
B) Fermentation
C) Hydration
D) Hydrogenation

Q.16 **Consider the following reaction**

$$C_2H_5OH + PCl_5 \rightarrow ?$$

What product (s) may be formed?

A) C_2H_5Cl, $POCl_3$ and HCl
B) C_2H_5Cl only
C) C_2H_5Cl and HCl
D) C_2H_5Cl and $POCl_3$

Q.17 **Which one of the following groups is indicated when HCl is formed by reaction of ethanol with phosphorus pentachloride?**

A) Amino group
B) Hydroxyl group
C) Halide group
D) Hydride group

Q.18 $CH_3-CH_2-OH+PCl_5 \longrightarrow CH_3-CH_2Cl+POCl_3+HCl$ **formation of HCl is test for the presence of ___ in a compound**

A) Alkyl group
B) Hydroxyl group
C) Saturated alkyl group
D) Acid H^+ ion

Q.19 **Which one of the following alcohol is indicated by formation of yellow crystals in iodoform tests?**

A) Methanol
B) Ethanol
C) Butanol
D) Proponal

Q.20 **How will you distinguish between methanol and ethanol?**

A) By lucas test
B) By silver mirror test
C) By oxidation
D) By iodoform test

Q.21 **Which one of the following is an appropriate indication of positive iodoform test?**

A) Formation of H_2O
B) Release of H_2 gas
C) Brick red precipitate
D) Yellow crystal

Q.22 **Distinction between ethanol and phenol can be ascertained by**

A) Lucas test
B) Tollen's test
C) Benedict's test
D) Reaction with bromine

Q.23 When ethanol is warmed with ethanoic acid in the presence of strong acid catalyst, an ester ethyl ethanoate is formed

$$CH_3CH_2OH + CH_3CO_2H \longrightarrow CH_3CO_2CH_2CH_3$$

During this reaction

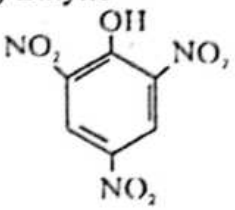
A) Alcohol is reduced
B) O–H bond in ethanoic acid is broken
C) O–H bond in ethanol is broken
D) Acid is oxidized

Q.24 $C_2H_5OH + CH_3\text{-}COOH \xrightleftharpoons{H_2SO_4}$ **? what will be the exact product**

A) Diethyl ether
B) Methyl propyl ether
C) Ethyl acetate
D) Butyl alcohol

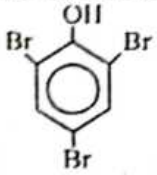
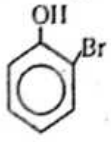
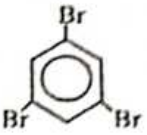
Q.25 Dehydration of ethanol at 180°C in the presence of conc-H_2SO_4 gives

A) Ethene
B) Ethyne
C) Ethane
D) Ether

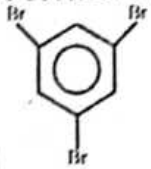
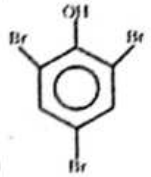
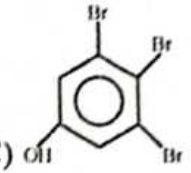
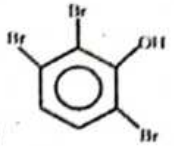
Q.26  **is named as**

A) Nitro phenol
B) Benzoic acid
C) Malonic acid
D) Picric acid

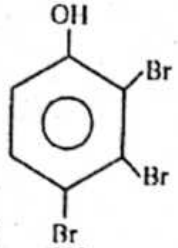
Q.27 Aqueous phenol decolorizes bromine water to form a white precipitate. What is the structure of the white precipitate formed?

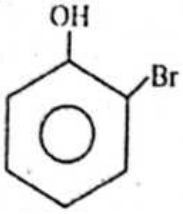
A) 
B) 
C) 
D) 

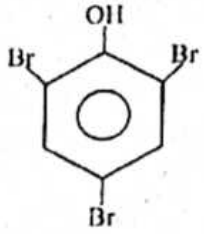
Q.28 The formula of 2, 4, 6-Tribromophenol is

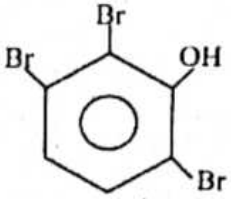
A) 
B) 
C) 
D) 

Q.29 Which one of the following is an appropriate structure of product of bromination of phenol?

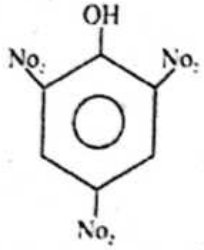
A) 

B) 

C) 

D) 

Q.30



Which one of the following is an appropriate name of above compound?

A) 1,3,6 trinitrophenol
B) m-nitrophenol
C) Tartaric acid
D) Picric acid

Q.31 At 25^{0}C with phenol 2-4 Dinitrophenol is formed by the reaction of:

A) (HNO_3+H_2SO_4) with benzene
B) (HNO_3+H_2SO_4) with phenol
C) NaOH with Benzene sulphonic acid
D) Sodium phenoxide with HCl

Q.32 Dissociation constant of phenol is

A) 1.2×10^{-10}
B) 1.3×10^{10}
C) 1.2×10^{10}
D) 1.3×10^{-10}

Q.33 The phenoxide ion is more stable than ethoxide ion as

A) Lone pair on oxygen atom overlaps with the delocalized π-bonding system in benzene
B) Oxygen atom is directly bonded with benzene ring in phenoxide ion
C) The negative charge is localized on oxygen atom of phenoxide ion
D) The negative charge is delocalized on oxygen atom of ethoxide ion

Q.34 The acidity of phenol is due to its_____:

A) Nature of Benzene
B) Double bond in benzene ring
C) Nature of phenoxide
D) Hydroxyl group

Q.35 Phenol react with CH_3COCl to give

A) Acid
B) Aldehyde
C) Ester
D) Ketone

Q.36 Methanol is prepared from CO and H_2. The catalyst used for this reaction is.

A) $ZnO + CoO_2$
B) $ZnO + CuO$
C) $ZnO + Cr_2O_3$
D) $ZnO + Ag_2O$

Q.37 Which one of the following was used as one of the earliest antiseptic and disinfectant?

A) Phenol
B) Ether
C) Ethanol
D) Methanol

Q.38 Which one of the following is NOT able to denature the ethanol?

A) Methanol
B) Lactic acid
C) Pyridine
D) Acetone

Q.39 Reaction of alcohol with hydrogen chloride yields_____:

A) Ketone
B) Carboxylic
C) Aldehyde
D) Ester

Q.40 Sodium phenoxide on treating with hydrochloric acid yields:

A) Benzene
B) Benzoic
C) Phenol
D) Benzaldehyde

ANSWER KEY

1	D	11	B	21	A	31	A	41	D
2	A	12	D	22	D	32	B	42	C
3	A	13	A	23	C	33	A	43	C
4	B	14	B	24	C	34	C	44	D
5	A	15	C	25	A	35	A	45	A
6	A	16	C	26	D	36	C	46	C
7	C	17	C	27	A	37	B	47	C
8	B	18	C	28	B	38	B	48	A
9	A	19	B	29	A	39	C	49	D
10	C	20	A	30	D	40	D	50	A

PAST PAPER QUESTIONS

1	A	6	C	11	B	16	A	21	D	26	D	31	B	36	C
2	A	7	A	12	D	17	B	22	D	27	A	32	D	37	A
3	A	8	A	13	C	18	B	23	C	28	B	33	A	38	B
4	C	9	A	14	C	19	B	24	C	29	C	34	C	39	C
5	D	10	D	15	A	20	D	25	A	30	D	35	C	40	C

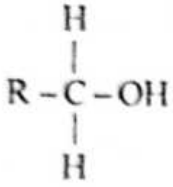
EXPLANATORY NOTES

Q.1 Denatured alcohol is poisonous to user methanol, acetone and pyridine all are poisonous compounds.

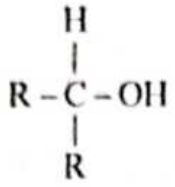
Q.2 Absolute alcohol is pure ethanol.

Q.3 $-\overset{\gamma}{C}-\overset{\beta}{C}-\overset{\alpha}{C}-F.G$

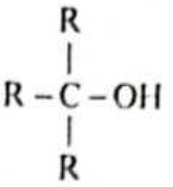
Q.4



Primary alcohol

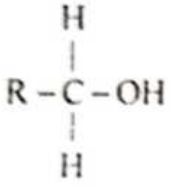


Secondary alcohol

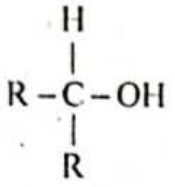


Tertiary alcohol

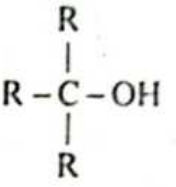
Q.5



Primary alcohol

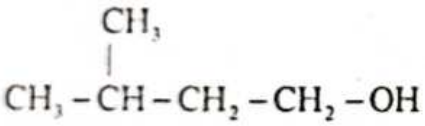


Secondary alcohol

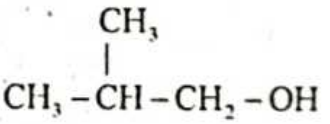


Tertiary alcohol

Q.6



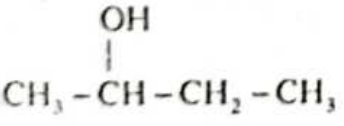
Iso-pentyl alcohol



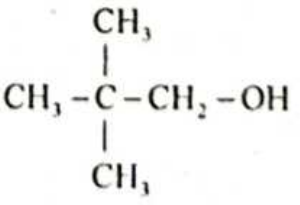
Iso-butyl alcohol

in both –OH is attached to primary carbon.

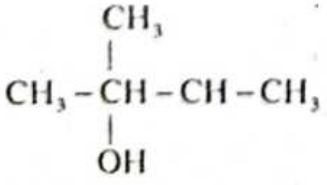
Q.7



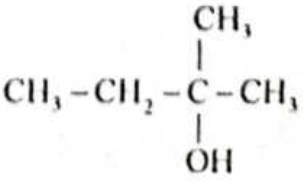
2-Pentanol
(2°-alcohol)



2,2-Dimethyl-1-propanol



3-Methyl-2-Butanol



2-Methyl-2-Butanol

Q.8 $CH_3-CH_2-OH \underset{180^\circ}{\overset{\text{conc } H_2SO_4}{\rightleftharpoons}} CH_2=CH_2+H_2O$

At high temperature β-elimination is promoted.

Q.9

$$CH_3-\underset{\displaystyle CH_3}{\overset{|}{C}}=CH_2+H_2O \xrightarrow[\text{Markownikoff's}]{\text{conc } H_2SO_4} CH_3-\underset{\displaystyle OH}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_3$$

Q.10 $CH_2=CH_2+H_2SO_4 \rightleftharpoons CH_3-CH_2-SO_4H \overset{H_2O}{\rightleftharpoons} CH_3-CH_2-OH+H_2SO_4$

Q.11 Hydroxy alkane = Alcohol

Q.12 In $CH_3–CH_2–OPO_3H_2$. Dihydrogen phosphate is attached to an alkyl group.

Q.13

$$R-CH_2-OH+[O] \xrightarrow{K_2Cr_2O_7,\ H_2SO_4} R-\underset{\displaystyle H}{\overset{\displaystyle O}{\overset{\|}{\underset{|}{C}}}}+H_2O$$

Alcohol Aldehyde

Q.14 Tertiary alcohol do not undergo oxidation instead they undergo β-elimination to give alkenes.

Q.15 The only primary alcohol to give iodoform test is ethanol.

Q.16 $R–O^-$ is an electron efficient specie hence a strong nucleophile.

Q.17

$$CH_3-CH_2-OH \xrightarrow{\text{oxidation}} \underset{\text{Ethanol}}{CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-H} \xrightarrow{\text{oxidation}} \underset{\text{ethanoic acid}}{CH_3COOH}$$

(X)

$$\underset{\text{(X)}}{CH_3COOH}+C_2H_5OH \overset{H_2SO_4}{\rightleftharpoons} \underset{\text{ester}}{CH_3-C-OC_2H_5}+H_2O$$

(X) = Ethanoic acid

Q.18 Methanol gets oxidized by acidified $K_2Cr_2O_7$ but phenol does not.

Q.19 $K_2Cr_2O_7+4H_2SO_4 \longrightarrow K_2SO_4+Cr(SO_4)_3+4H_2O+3[O]$ esterification.

Q.20 $RCOOH + R'OH \overset{H_2SO_4}{\rightleftharpoons} RCOOR' + H_2O$

Organic acid Alcohol Ester

Q.21 –OH group of acid is replaced by RO^- of alcohol giving SN reaction. So, bridge oxygen comes from alcohol.

Q.22

$$R-CH_2-OH \xrightarrow[-H_2O]{\text{oxidation}} R-\overset{\overset{O}{\|}}{C}-H \xrightarrow{\text{oxidation}} \underset{\text{acid}}{RCOOH}$$

$$R-\underset{\underset{R'}{|}}{CH}-OH \xrightarrow[-H_2O]{\text{oxidation}} \underset{\text{ketone}}{\overset{R}{\overset{R'}{C=O}}} \xrightarrow{(O)} RCOOH + R'COOH$$

Tertiary Alcohol are not oxidized

Q.23 $2ROH + 2Na \longrightarrow 2R-ONa + H_2$

Q.24 Reaction of alcohol with PX_5 is nucleophilic substitution reaction in which OH^- is replaced by X^- and C–O bond is broken hence the order $3° > 2° > 1°$.

Q.25

Primary alcohhols $\xrightarrow{\text{oxidation}}$ Aldehyde

Secondary alcohols $\xrightarrow{\text{oxidation}}$ Ketones

Tertiary alcohols $\longrightarrow$ No oxidation

Q.26 Zero α-hydrogen means "S" is tertiary alcohol, hence it does not undergo oxidation.

Q.27 Alkanol $\xrightarrow{\text{oxidation}}$ Aldehyde $\xrightarrow{\text{oxidation}}$ Carboxylic acid

A: $C_nH_{2n}O$ B: $C_nH_{2n}O_2$

Q.28 $2C_2H_5OH + 2Na \longrightarrow C_2H_5ONa + H_2$

It is replaced by Na^+ by breaking O–H bond.

Q.29 $HO-CH_2-CH_2-OH \xrightarrow{2Na} NaO-CH_2-CH_2-ONa + H_2$

Q.30 Esters give off particular flavours.

Isobutyl formate = Raspberry flavour.

Iso-Butyl alcohol + Formic acid $\underset{\text{Esterification}}{\rightleftharpoons}$ Isobutyl formate.

Q.31 Functional group of alkoxy alkanes (ethers) is alkano (alcohol) which reacts with alkanoic acids (carboxylic acids) to give esters (alkoxy alkanoate).

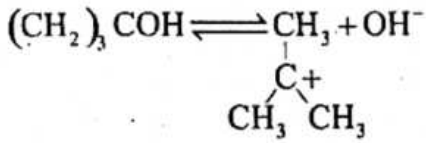
Q.32

$$R-\overset{\overset{O}{\|}}{C}H-OH + HO-R' \underset{}{\overset{\text{Conc } H_2SO_4}{\rightleftharpoons}} R-\overset{\overset{O}{\|}}{C}-OR' + H_2O$$

Reaction shows breakage of O–H bond in alcohol

Q.33 Low temperature favours formation of ethers by dehydration of alcohols, while high temperature favours β-elimination to form alkenes.

Q.34 Tertiary carbocation > Secondary carbocation > Primary carbocation



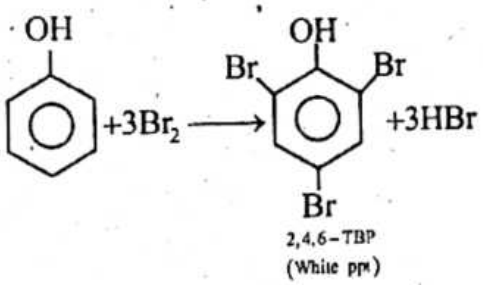
Q.35 Ease of dehydration ∝ Number of β-hydrogens, tertiary alcohols have greater β-hydrogens.

Q.36 Formation of alkene with greater alkyl substituents at C = C is more favoured during dehydration.

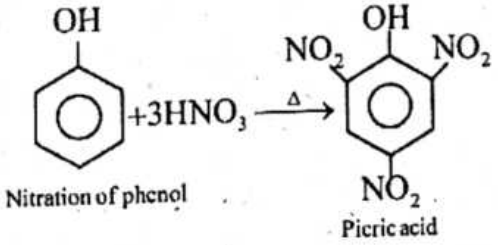


Q.37 OH^- is replaced by Cl^-, hence reaction is nucleophilic substitution.

Q.38

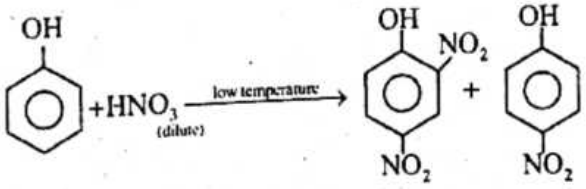


Q.39

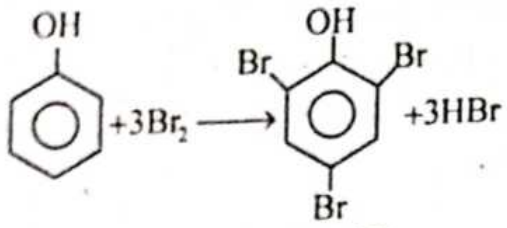


Q.40 Phenol can be tested by bromine water test, as it gives white ppt of 2,4,6-Tribromophenol.

Q.41



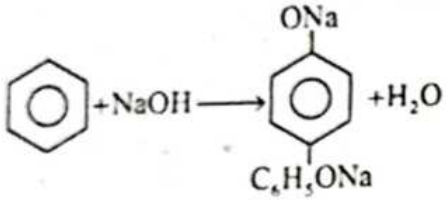
Q.42



Q.43 Both alcohols and phenol do not give Tollen's test, $NaHCO_3$ test and reaction with HCl. However, phenol reacts with Br_2, to give white ppt but alcohol does not.

Q.44 Phenol can be tested by bromine water test, as it gives white ppt of 2,4,6-Tribromophenol.

Q.45



Q.46

Test	Phenol	Ethanol
Iodoform	×	✓
Br_2 water	✓	×
Na-Metal	✓	✓
Lucas-test	×	✓

Hence, Na-metal cannot distinguish between phenol and ethanol.

Q.47 Esterification is due to OH group and not the ring.

Q.48 Phenol is more acidic due to resonance in phenoxide, then comes water and alcohol is least acidic due to unstable alkoxide ion.

Q.49 Conjugation between O^- and benzene ring gives C–O bond a double bond characters that leads to

i) Shorter bond length

ii) Resonance give stability to phenoxide

iii) Stability of conjugate base $\propto$ Acidic strength

Q.50 Alcohol that gives stable alkoxide ion are more acidic stability order of $R-O^-$.

$$CH_3O^- > C_2H_5-O^- > C_3H_7O^- > C_4H_4O^-$$

5C Topic ALDEHYDES AND KETONES

PRACTICE EXERCISE

STRUCTURE OF ALDEHYDE AND KETONES

Q.1 The clear fact for the structural difference between aldehyde and ketone is

A) A ketone has one R group attached on carbonyl group

B) An aldehyde has two R groups attached on carbonyl group

C) An aldehyde has one R and a ketone has two R groups attached to carbonyl group

D) Both "A" and "C"

Q.2 General formula of aldehyde is

A) $C_nH_{2n}O$ C) C_nH_{2n}

B) $C_nH_{2n}OH$ D) C_nH_{2n+2}

Q.3 Which of the following is true regarding an aldehyde?

A) Contains carbonyl carbon within carbon chain

B) Contains carbonyl oxygen within carbon chain

C) Contains carbonyl group within carbon chain

D) Contains carbonyl carbon at terminal of carbon chain

Q.4 Which of the following is true regarding ketones?

A) Contain carbonyl oxygen within carbon chain

B) Contain carbonyl carbon at terminal of carbon chain

C) Contain carbonyl group at terminal of carbon chain

D) Contain carbonyl carbon which is attached to two carbon atoms

Q.5 Select the incorrect option regarding formaldehyde and acetone

A) Both have same molecular geometry

B) Both contains sp^2-hybridized carbon atom

C) Both belong to carbonyl compounds

D) Both have same general molecular formula

Q.6 The incorrect statement regarding carbonyl compounds is

A) Both have general formula $C_nH_{2n}O$ C) Both have general formula RCOR

B) Both have general formula R–COH D) Both B) and C)

Q.7 Select the correct option R my be an H atom or an alkyl group in cases of

A) Ketone C) Both A) and B)

B) Aldehyde D) None of these

Q.8 Carbonyl group is bonded to _____ in ketones

A) sp^2-hybridized oxygen atom C) Only one hydrogen atom

B) Only one carbon atom D) At least two carbon atoms

Q.9 In carbonyl compounds carbonyl carbon is bonded to _____

A) Oxygen atom through single bond C) Oxygen atom through peptide bond

B) Oxygen atom through pi-bond D) Oxygen atom through a double bond

Q.10 Which of the following is correct statement regarding carbonyl compounds

A) Carbonyl carbon contain no lone pair C) Carbonyl oxygen contains two lone pair

B) Carbonyl group contains two lone pairs D) All of these

Q.11 The planar trigonal geometry is associated with

A) Formaldehyde C) Crotanaldehyde

B) Acetaldehyde D) Butyraldehyde

Q.12 **For a ketone** $R-\overset{\overset{O}{\|}}{C}-R$ **R cannot be**

A) Same Alkyl
B) Aryl and Alkyl
C) Alkyl and H
D) Different alkyl

Q.13 **Which of the following is unsymmetrical ketone**

A) $(CH_3)_2CO$
B) $C_2H_5OC_2H_5$
C) $C_3H_7COCH_2CH_2CH_3$
D) $C_2H_5CO(CH_2)_2CH_3$

Q.14 **Which one is aldehyde**

A) Benzaldehyde
B) Ethanal
C) Crotonaldehyde
D) All of these

PREPARATION OF ALDEHYDES AND KETONES

Q.15 **Which of the following can be used for the oxidative preparation of aldehydes from alcohols**

A) Pt-asbestos
B) $Na_2Cr_2O_7$ and H_2SO_4
C) FeO and Mo_2O_3
D) All of these

Q.16 **Which of the following compound is oxidized to get methyl ethyl ketone**

A) 2-Propanol
B) 2-Butanol
C) 1-Butanol
D) Tertiary butyl alcohol

Q.17 **Formation of acetaldehyde by ethanol is known as**

A) Reduction
B) Oxidation
C) Substitution
D) Elimination

Q.18 **Formaldehyde is prepared by passing _____ and air over platinized asbestos catalyst at 300°C**

A) Formalin vapour
B) Ethanol vapour
C) Acetone vapour
D) Methanol vapour

Q.19 **Air oxidation of methanol vapour is achieved on passing over _____ at 300°C to get formalin**

A) Platinized asbestos
B) Nickel
C) Copper
D) Both A) and B)

Q.20 **Acidified sodium dichromate oxidizes ethanol to ethanal by producing**

A) Molecular oxygen
B) Nascent oxygen
C) Ozone
D) Dichromate ions

Q.21 **Methanol vapours can be oxidized to methanal with molecular oxygen by using**

A) FeO and Mo_2O_3 catalyst at 500°C
B) Silver catalyst at 500°C
C) Platinized asbestos at 300°C
D) All of these

Q.22 **Which of the following is true regarding oxidation of an ethanol to an ethanal**

A) $-CH_3$ is oxidized to CH_2–OH
B) $>CH_2$ is oxidized to –CHO group
C) –OH is oxidized to –CO group
D) $-CH_2OH$ is oxidized to –CHO

Q.23 **During the oxidation of all the primary alcohols, ____ is oxidized to aldehydic group**

A) –OH
B) $-CH_3$
C) $-CH_2-OH$
D) None of these

Q.24 $H-\boxed{CH_2OH} \xrightarrow[[O]]{Na_2Cr_2O_7/H_2SO_4} H-\boxed{X}$ **X is**

A) An aldehyde group
B) A hydroxyl group
C) A carbonyl group
D) A carbonyl group

Q.25 Acetaldehyde is purified by which method when prepared by alcohol in laboratory
A) Solidification
B) Re-distillation
C) Chromatography
D) Steam distillation

Q.26 Isobutyl alcohol on oxidation converts to a carbonyl compound A. A is
A) Butanone
B) 2-Methyl propanal
C) Butanal
D) All of the above

REACTION OF ALDEHYDES AND KETONES

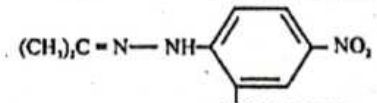
Q.27 Formation of yellow or orange/red precipitates with 2, 4-DNPH refers to the identification of
A) Aldehydes
B) Pure alcohols only
C) Ketones
D) Both A) and C)

Q.28 The reduction of a ketone using $NaBH_4$ gives:
A) Primary alcohol
B) Tertiary alcohol
C) Secondary alcohol
D) Phenol

Q.29 Addition of HCN to acetaldehyde in the presence of dilute mineral acid and sodium cyanide forms
A) Formaldehyde cyanohydrin
B) Acetone cyanohydrins
C) Acetaldehyde cyanohydrin
D) Butanone cyanohydrin

Q.30 What will be the product in following reaction?
$CH_3CH = CHCH_2COCH_3 \xrightarrow{NaBH_4} ?$
A) $CH_3CH_2CH_2CH_2COCH_3$
B) $CH_3CH_2CH_2CH_2CH(OH)CH_3$
C) $CH_3CH = CHCH_2CH(OH)CH_3$
D) All of these

Q.31 Which of the following has maximum reactivity in nucleophilic addition reactions?
A) Formaldehyde
B) Acetaldehyde
C) Propanone
D) All of these

Q.32 $X + 2,4\text{–DNPH} \xrightarrow[-H_2O]{H^+}$  **, the X will be?**
A) CH_3COCH_3
B) CH_3CHO
C) HCHO
D) $C_2H_5OCH_3$

Q.33 Formation of cyanohydrin form an aldehyde is an example of
A) Nucleophilic substitution
B) Nucleophilic addition
C) Electrophilic addition
D) Electrophilic substitution

Q.34 Reducing agent which attack carbonyl compound in $NaBH_4$ is
A) $\dot{H}$
B) H^+
C) H^-
D) H_2

Q.35 Catalytic reduction of acetone will produce
A) Methyl alcohol
B) Ethyl alcohol
C) Isopropyl alcohol
D) Neopentyl alcohol

Q.36 In the oxidation of unsymmetrical ketones using strong oxidizing agents like conc. HNO_3, which carbon atom is preferentially attacked:
A) Carbon atom with the maximum number of hydrogen atoms
B) Carbon atoms with the least number of hydrogen atoms
C) Alpha carbon
D) Beta carbon

Q.37 For which one of the following pairs of compounds can be distinguished by means of Tollen's tests.

A) HCHO and CH_3CHO
B) CH_3CHO and CH_3COCH_3
C) CH_3COCH_3 and $CH_3COCH_2CH_3$
D) CH_3COOH and CH_3COCH_3

Q.38 Which substance does not oxidize easily

A) CH_3CH_2CHO
B) CH_3CHO
C) HCHO
D) CH_3COCH_3

Q.39 Which one of the following set of compounds oxidize aldehydes as well as ketones

A) $CuSO_4$ + NaOH + Citric acid
B) $CuSO_4$ + NaOH + Tartaric acid
C) $AgNO_3 + NH_4OH$
D) $K_2Cr_2O_7$ + Conc. H_2SO_4

Q.40 An aldehyde when boiled with Fehling solution gives brick red precipitate, red colour is due to

A) Ag
B) Cuprous oxide
C) Cupric oxide
D) Sodium carboxylate

Q.41 Strongest reducing agent that can reduce the Tollen's reagent is

A) HCHO
B) CH_3CHO
C) 

D) CH_3COCH_3

Q.42 Haloform test is given by:

A) Acetaldehyde
B) Propanone
C) Methyl group ketones
D) All of these

Q.43 An aldehyde reacts with mixture to give cyanohydrin

A) HCl + HCN
B) HCl + H_2SO_4
C) NaCN + HCl
D) $NaHSO_3$ + HCl

Q.44 Which of the following ion is rich source of hydride ions

A) Boric anhydride
B) Tetrahydridoborate ions
C) Orthoborate ion
D) Tetraborate ion

Q.45 Protonation of alkoxide of _____ produces secondary alcohol if reduced by hydride ion source

A) Ethanal
B) Propionaldehyde
C) Acetone
D) Methanol

Q.46 Which of the following carbonyl compound can gives aliphatic, saturated alcohol using $NaBH_4$

A) Acetophenone
B) 2-Butene, 2-ol
C) Benzaldehyde
D) 3-Methyl 2-pentanone

Q.47 Mixture of air and methanol can form a compound that reacts with Fehling's solution if mixture is passed over copper heated at

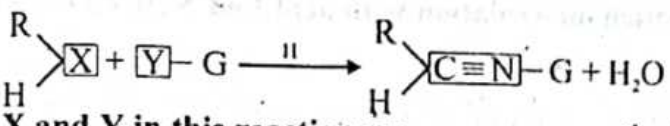
A) 500°C
B) 100°C
C) 300°C
D) 25°C

Q.48 Acetaldehyde gives which salt by reacting with ammonical silver nitrate

A) Sodium acetate
B) No salt formed
C) Ammonium acetate
D) Silver chloride

Q.49 Which of the following pair cannot be distinguished by haloform test

A) Ketons from methyl ketons
B) Methanol from alkanols
C) Acetaldehyde from aldehydes
D) 2-Propanol from 1-propanol

Q.50 

X and Y in this reaction are _____ respectively

A) $-NH_2$ and $-CHO$
B) $> C = O$ and $-NH_2$
C) $-CHO$ and $-NH_2$
D) $-CH_2OH$ and $-NH_2$

Q.51 Formalin is _____% solution of formaldehyde in water

A) 10%
B) 40%
C) 20%
D) 60%

Q.52 Which of the following carbonyl compounds shows rapid reaction with sodium nitroprusside

A) Formaldehyde
B) Benzaldehyde
C) Acetaldehyde
D) Acetone

Q.53 Cannizzaro's reaction is not given by

A) Formaldehyde
B) Benzaldehyde
C) Acetaldehyde
D) Trimethyl acetaldehyde

Q.54 Which of the following do not give aldol condensation reactions

A) Formaldehyde
B) Diemthyl ketone
C) Acetaldehyde
D) Propionaldehyde

Q.55 Dry distillation of calcium acetate results in the formation of

A) Formaldehyde
B) Methane
C) Acetaldehyde
D) Acetone

Q.56 Which of the following will not give addition reaction with $NaHSO_3$

A) HCHO
B) CH_3-CH_2-CHO
C) CH_3CHO
D) CH_3CH_2-OH

Q.57 Which one exhibits aldol condensation

A) HCHO
B) Cl_3CCHO
C) C_6H_5CHO
D) CH_3COCH_3

Q.58 For aldol condensation the conditions necessary

A) α-C
B) Basic medium
C) α -H
D) All of these

Q.59 Which of the following does not give aldol condensation

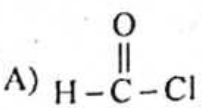
A) Methanal
B) Propanone
C) Ethanal
D) 2-pentanone

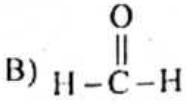
Q.60 Which of the following compound can be used for the separation of ethanal from the mixture of ethanal and ethanol

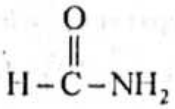
A) $NaHSO_3$
B) NH_2NH_2
C) HCN
D) 2,4-DNPH

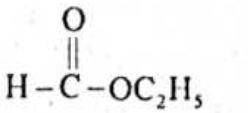
PAST PAPERS QUESTIONS

Q.1 Which of the following compounds belong to homologous series of aldehydes

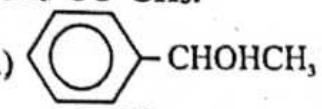
A) 

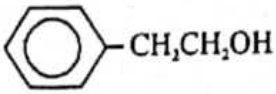
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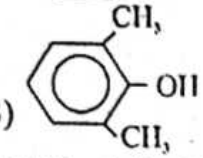
C) 

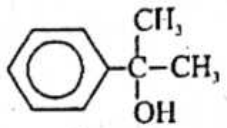
D) 

Q.2 What is the structure of alcohol which on oxidation with acidified $Na_2Cr_2O_7$ gives C_6H_5-CO-CH_3.

A) 

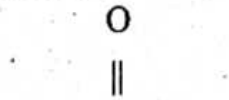
C) 

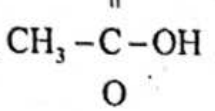
B) 

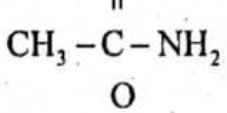
D) 

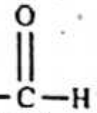
Q.3 Which of the following is the structure of a ketone?

A) 

C) 

B) 

D) 

Q.4 

Which one of the following is IUPAC name of the above given structure?

A) Proopanaldehyde
C) Acetaldehyde
B) Methanone
D) Methanal

Q.5 Hybridization of carbon in –CHO group is

A) sp
C) sp^2
B) sp^3
D) dsp

Q.6 Dry distillation of mixture of calcium salts of acetic acid and formic acid results into formation of

A) Acetaldehyde
C) Calcium acetate
B) Formaldehyde
D) Sodium acetate

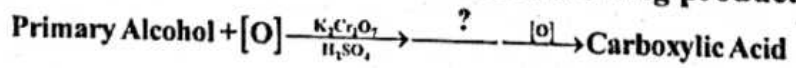
Q.7 $Na_2Cr_2O_7$, what the product will be, when secondary alcohols are oxidized in same conditions?

A) Alkenes
C) Alkyl halides
B) Alkynes
D) Ketones

Q.8 A student mixed ethyl alcohol with small amount of sodium dichromate and added it to the hot solution of dilute sulphuric acid. A vigorous reaction took place. He distilled the product formed immediately. What was the product?

A) Acetone
C) Dimethyl ether
B) Acetic acid
D) Acetaldehyde

Q.9 In the reaction, "?" represents which one of the following products:



A) Ketone
C) Formic acid
B) Aldehyde
D) Ether

Q.10 2-propanal on Oxidation gives _____:

A) Aldehyde
B) Ketone
C) Carboxylic Acid
D) Alcohol

Q.11 Why is it necessary to distill aldehyde formed from oxidation of primary alcohol through acidified per dichromate (VI) solution or acidified sodium dichromate (VI) solution?

A) Aldehyde formed is unstable and decompose back to original precursor i.e. primary alcohol
B) Aldehyde formed may react with primary alcohol, the original reactant
C) Aldehyde may be oxidized further to a ketone
D) Aldehyde formed may be oxidized further to carboxylic acid

Q.12 Ketones can be made by oxidation of

A) Primary Alcohols
B) Tertiary Alcohols
C) Secondary Alcohols
D) Aldehydes

Q.13 Select the reagent X from the following choices for this conversation;

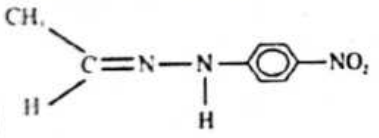
$$CH_3CH(OH)CH(CH_3)_2 \xrightarrow{\text{Reagent X}} CH_3COCH(CH_3)_2$$

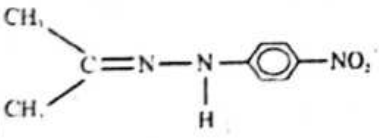
A) Acidified Phosphoric acid
B) Acidified Potassium dichromate (VI)
C) Acidified Potassium hydroxide
D) Acidified Oxalic acid

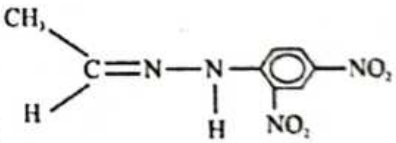
Q.14 Which mechanism of reaction is shown by carbonyl compounds?

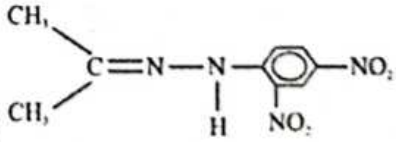
A) Electrophilic substitution
B) Electrophilic addition
C) Free radical substitution
D) Nucleophilic addition

Q.15 The structure of formula of the product of reaction of acetone with 2, 4-dinitrophenyl hydrazine is

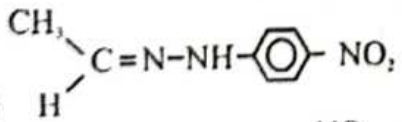
A) 

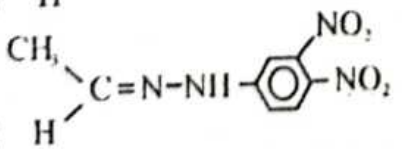
B) 

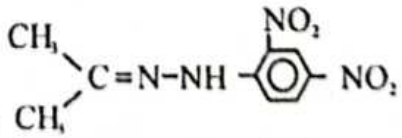
C) 

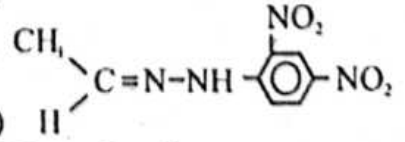
D) 

Q.16 When acetaldehyde reacts with 2,4–dinitrophenylhydrazine (2,4-DNPH), which one of the following products is formed

A) 

B) 

C) 

D) 

Q.17 $R-CH=N-NH-C_6H_3(NO_2)_2$ It is a general formula of

A) 2,4 Dinitrophenyl hydrazine
B) 1,3 Dinitrophenyl hydrazone
C) Phenyl hydrazone
D) 2,4 Dinitrophenyl hydrazine

Q.18 Which one of the following test is given by both aldehyde and ketone?

A) Silver mirror test
B) Fehling's solution test
C) 2,4 DNPH test
D) Benedict's solution test

Q.19 **The reaction of aldehydes and ketones with ammonia derivative G-NH_2 to form compounds containing the group $\backslash C = N - G$ and water is known as _____reaction.**

A) Nucleophilic addition
B)Nucleophilic substitution
C) Electrophilic addition
D) Addition Elimination

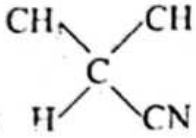
Q.20 **Both aldehyde and ketones give _____:**

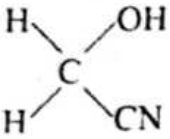
A) Tollen's Test
B) 2,4-DNPH test
C) Benedict's solution test
D) Sodium nitroprusside test

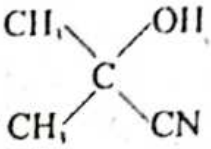
Q.21 $HCHO + HCN \longrightarrow H_2C(OH) - CN$ **in the above reaction nucleophile is**

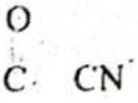
A) CN^-
B) Cl^-
C) HCl
D) OH^-

Q.22 **Formaldehyde reacts with HCN (NaCN + HCl) to give a compound**

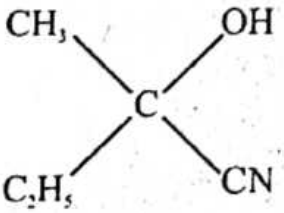
A) 

B) 

C) 

D) 

Q.23 **For the reaction:**

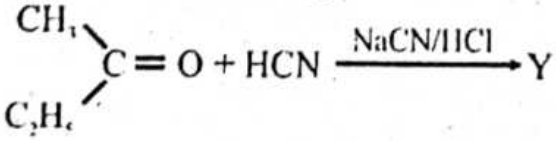
$? + HCN \xrightarrow{Base}$ 

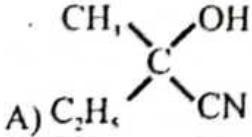
A) $C_2H_5COCH_3$
B) $C_2H_5CH(CH_3)OH$
C) CH_3COCH_3
D) $C_2H_5CH_2CHO$

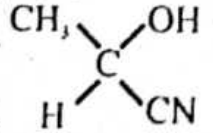
Q.24 **Ethanal reacts with HCN to form cyanohydrin. It is an example of**

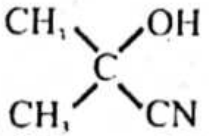
A) Nucleophilic addition
B) Electrophilic addition
C) Electrophilic substitution
D) Nucleophilic substitution

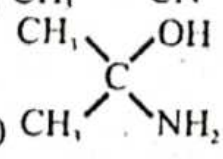
Q.25 **What will be the product of the reaction given below?**



A) 

B) 

C) 

D) 

Q.26 Both aldehydes and ketones are planer to the neighborhoods of carbonyl $\left(\overset{\backslash}{\underset{/}{C}}=O\right)$ group. Which one of the following bonds is distorted towards the oxygen atoms?

A) π bond of C and O
B) Sigma bond of C and H
C) Sigma bond of C and O
D) Sigma bond of C and C

Q.27 Which type of reaction takes place when a carbonyl compound is treated with a mixture of NaCN and an acid?

A) Electrophilic addition reaction
B) Displacement reaction
C) Nucleophilic addition reaction
D) Substitution reaction

Q.28 Carbonyl group undergo

A) Electrophilic addition reaction
B) Electrophilic substitution reaction
C) Nucleophilic addition reaction
D) Nucleophilic substitution reaction

Q.29 Which reagent is responsible for the conversion of ketone to secondary alcohol:

A) $NaAlH_4$
B) $NaBH_4$
C) Al
D) Red P

Q.30 Which of the following compounds will give a secondary alcohol after reaction with $NaBH_4$?

A) CH_3COCH_3
B) CH_3CH_2COOH
C) CH_3CH_2CHO
D) CH_3COOCH_3

Q.31 Brick red precipitate are formed when aldehyde reacts with

A) Sodium borohydride
B) Sodium bisulphate
C) Fehling solution
D) Formaldehyde

Q.32 Consider the following reaction:

$$R\text{-}CHO + 2[Ag(NH_3))_2]OH \longrightarrow RCOONH_4 + 2Ag + 2NH_3 + H_2O$$

this reaction represents which of the following tests

A) Fehling test
B) Ninhydrin test
C) Benedict test
D) Tollen's test

Q.33 To distinguish aldehyde from ketone which solution is used

A) Alkaline solution
B) Fehling's solution
C) A solution containing $K_2Cr_2O_7$
D) A solution containing acid only

Q.34 Which one of the following reagents is used to distinguish between aldehydes and ketones?

A) Tollen's reagent
B) 2,4-DNPH
C) Bromine
D) Alkaline iodine

Q.35 Which of the following will give a positive test with Tollen's reagent?

A) Tertiary Alcohols
B) Aldehydes
C) Ketones
D) Carboxylic Acids

Q.36 Identification test for functional groups of organic compounds are associated with specific observations. Tollen's reagent is ammonical silver nitrate solution, which is used for the identification of a functional group X with an observation O. Identify X and O.

A) X = Aldehyde O = Red precipitate
B) X = Aldehyde O = Silver mirror
C) X = Ketone O = Silver mirror
D) X = Ketone O = Grey precipitate

Q.37 Iodoform test will not be positive with

A) $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_2-CH_3$

B) $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$

C) C_2H_5OH

D) $CH_3-\overset{\overset{O}{\|}}{C}-H$

Q.38 Which group gives a yellow precipitate of triiodomethane when warmed with alkaline aqueous iodine?

A) An amide group, $CH_3-\overset{\overset{O}{\|}}{C}-NH_2$

B) Ethyl ketone group, $C_2H_5-\overset{\overset{O}{\|}}{C}-NH_2$

C) A primary alcohol group as in propanol, $CH_3CH_2CH_2OH$

D) Methyl ketone group, $CH_3-\overset{\overset{O}{\|}}{C}-$

Q.39 Identify the compound, which give iodoform test:

A) Methanol
B) Methyl ketone
C) 3- Hexanol
D) Propionaldehyde

Q.40 Which of the following compounds will produce a yellow precipitate with I_2 dissolved in $NaOH_{(aq)}$?

A) $HCOOCH_2CH_2$
B) CH_3OH
C) $CH_3CH_2CO\ CH_3$
D) CH_3CH_2CHO

ANSWER KEY

1	C	11	A	21	D	31	A	41	A	51	B
2	A	12	C	22	D	32	A	42	D	52	D
3	D	13	D	23	C	33	B	43	C	53	C
4	D	14	D	24	A	34	C	44	B	54	A
5	A	15	D	25	B	35	C	45	C	55	D
6	D	16	B	26	B	36	B	46	D	56	D
7	B	17	B	27	D	37	B	47	C	57	D
8	D	18	D	28	C	38	D	48	C	58	D
9	D	19	D	29	C	39	D	49	B	59	A
10	D	20	B	30	C	40	B	50	B	60	A

PAST PAPERS QUESTIONS

1	B	6	A	11	D	16	D	21	A	26	A	31	C	36	B
2	A	7	D	12	C	17	D	22	B	27	C	32	D	37	A
3	B	8	D	13	B	18	C	23	A	28	C	33	B	38	D
4	D	9	B	14	D	19	D	24	A	29	B	34	A	39	B
5	C	10	B	15	D	20	B	25	A	30	A	35	B	40	C

EXPLANATORY NOTES

Q.1 The structural formula of aldehyde is $R-\overset{\overset{O}{\|}}{C}-H$ and that of ketone is $R-\overset{\overset{O}{\|}}{C}-R$

Q.2 General formula of saturated aliphatic aldehydes is $C_nH_{2n}O$ so answer is **A**

Q.3 $H-\overset{\overset{O}{\|}}{C}-H$, $H_3C-\overset{\overset{O}{\|}}{C}-H$, $H_3C-CH_2-\overset{\overset{O}{\|}}{C}-H$

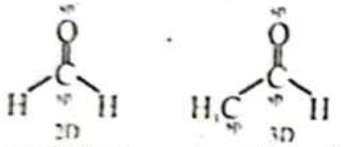
in the all the given examples of aldehydes, the carbonyl carbon is at position 1 or at the terminal of carbon chain

Q.4

$CH_3-\overset{\overset{O}{\|}}{C}-CH_3$, $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$, $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_2-CH_3$

In all the given examples of ketones, the carbonyl carbon is within carbon chain

Q.5



Formaldehyde Acetaldehyde

In formaldehyde both the carbonyl carbon and carbonyl oxygen atoms are sp^2 hybridized while in acetaldehyde one carbon atom is sp^3 hybridized

So, formaldehyde is planar trigonal while acetaldehyde is planar trigonal at C#1 and tetrahedral at C#2. Therefore both formaldehyde and acetaldehyde don't have same molecular geometry

Q.6 Carbonyl compounds include aldehyde and ketones. Aldehydes have structural formula $R-\overset{\overset{O}{\|}}{C}-H$ while ketones have $R-\overset{\overset{O}{\|}}{C}-R$ or $R-\overset{\overset{O}{\|}}{C}-R'$. Therefore both aldehydes and ketones don't have same general structural formula.

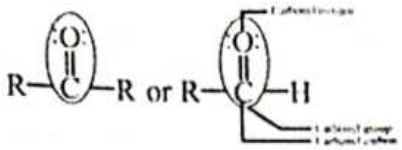
Q.7 In aldehydes the structural formula is $R-\overset{\overset{O}{\|}}{C}-H$ in which R can be a hydrogen atom is true for $H-\overset{\overset{O}{\|}}{C}-H$ while R is an alkyl group and its true for $H_3C-\overset{\overset{O}{\|}}{C}-H$ or $H_3C-CH_2-\overset{\overset{O}{\|}}{C}-H$.

Q.8 The general structure is formula of ketone is $R-\overset{\overset{O}{\|}}{C}-R$. The carbonyl group $>C=O$ is bonded to two alkyl groups means to C atoms

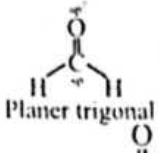
Q.9 Mostly in saturated and aliphatic carbonyl compounds the carbonyl carbon is bonded to one or two sp^3 hybridized carbon atoms through single bond (sigma bond) while it is also attached to sp^2 hybridized oxygen atom through a double bond

$CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ $CH_2-\overset{\overset{O}{\|}}{C}-H$

Q.10



Q.11



Q.12 In case of ketones the structural formula is $R-\overset{O}{\overset{\|}{C}}-R$. If R will be a H-atom then it will be an aldehyde

Q.13 The unsymmetrical ketones have two different alkyl groups on either side of carbonyl group like $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-CH_3$

Q.14 All compounds have –CHO group. Therefore all the compounds are aldehydes

Q.15

$$2CH_3OH+O_2 \xrightarrow[500^\circ C]{FeO,Mo_2O_3} 2HCHO+2H_2O$$

$$2CH_3OH+O_2 \xrightarrow[300^\circ C]{Pt\text{-}Asbestos} 2HCHO+2H_2O$$

$$CH_3-CH_2-OH+[O] \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} CH_3CHO+H_2O$$

FeO, Mo_2O_3 and Pt-asbestos are catalysts used for air oxidation of alcohols to aldehydes while $Na_2Cr_2O_7 + H_2SO_4$ combination is used for the production of nascent oxygen which is used to oxidize alcohols to carbonyl compounds.

Q.16 Methyl ethyl ketone is a 4-C ketone. So, it requires a 4-C secondary alcohols

$$H_3C-CH_2-\overset{OH}{\overset{|}{C}}H-CH_3+[O] \xrightarrow[H_2SO_4]{Na_2Cr_2O} CH_3-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$$

Q.17

$$CH_3-CH_2-OH+[O] \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} CH_3-CHO$$

This reaction is involving oxidation of ethanol

Q.18

$$2CH_3OH_{(g)}+O_{2(g)} \xrightarrow[300^\circ C]{Pt\text{-}Asbestos} 2HCHO_{(g)}+2H_2O_{(g)}$$

Q.19

$$2CH_3OH+O_2 \xrightarrow[300^\circ C]{Pt\{\cdot\}Asbestos\ or\ Cu} 2HCHO+2H_2O$$

Q.20

$$Na_2Cr_2O_7+4H_2SO_4 \longrightarrow Na_2SO_4+Cr_2(SO_4)_3+4H_2O+3[O]$$

$$3C_2H_5OH+3[O] \longrightarrow 3CH_3CHO+3H_2O$$

Q.21

$$2HCHO+O_2 \xrightarrow[500^\circ C]{FeO,Mo_2O_3\ or\ Ag^+} 2HCHO+2H_2O$$

$$2HCHO+O_2 \xrightarrow[300^\circ C]{Pt\text{-}Asbestos} 2HCHO+2H_2O$$

Q.22

$$H_3C-\boxed{CH_2-OH}+[O] \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} H_3C-\boxed{CHO}+H_2O$$

Q.23

$$R-\boxed{\overset{\alpha}{C}H_2-OH}+[O] \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} H_3C-\boxed{CHO}+H_2O$$

Primary alcohol — Aldehyde group

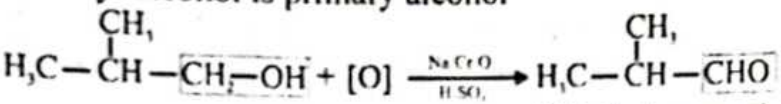
Q.24

$$H-\boxed{\overset{\alpha}{C}H_2-OH}+[O] \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} H-\boxed{CHO}+H_2O$$

Aldehyde group

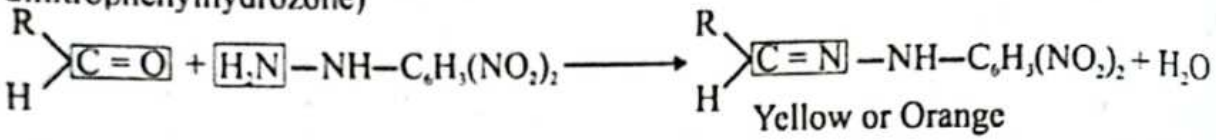
Q.25 During the oxidation of ethanol to get a acetaldehyde, acetaldehyde is immediately distilled off to avoid its oxidation. This distillate (mixture of ethanol, water and acetaldehyde) is then condensed. To get pure acetaldehyde, it is redistilled

Q.26 Isobutyl alcohol is primary alcohol

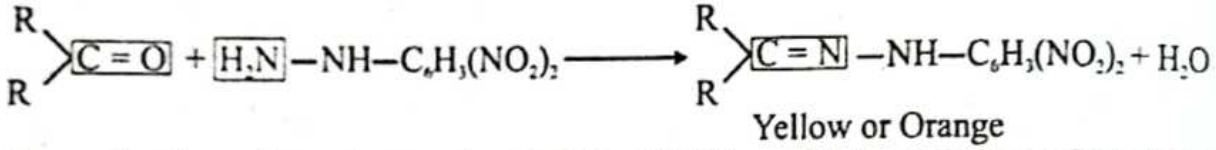


2-Methyl propanal

Q.27 The aldehydes and ketones give yellow or orange colour crystals (2,4-dinitrophenylhydrozone)

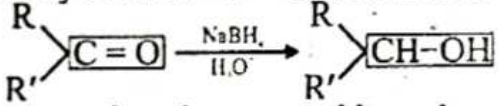


Yellow or Orange



Yellow or Orange

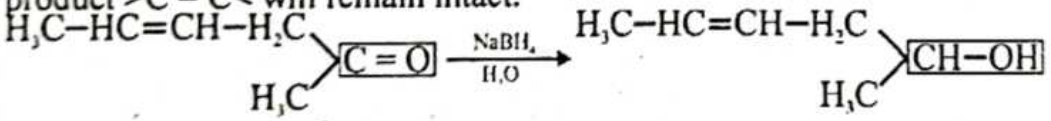
Q.28 The reduction of any ketone by $NaBH_4$, $LiAlH_4$ or H_2 (in presence of Ni / Pt / Pd catalyst) produces secondary alcohol > C = O is reduced to > CH – OH



Q.29 When HCN is added to any carbonyl compound it produces an adduct which contain both –CN group and –OH group attached to one carbon, called cyanohydrin.

$$R-CHO + HCN \xrightarrow[HCl]{NaCN} R-CH(OH)(CN)$$

Q.30 $NaBH_4$ can reduce >C = O group to >CH–OH group but cannot reduce >C=C<. So, in product >C = C< will remain intact.



Q.31

$$\text{Reactivity of carbonyl compound} \propto \frac{1}{\#\text{ of R groups}}$$

$$\text{Reactivity of carbonyl compound} \propto \frac{1}{\text{Size of R groups}}$$

$$\text{Reactivity of carbonyl compound} \propto \frac{1}{\#\text{ of C-atoms}}$$

Reactivity order:

Aldehyde > Ketone

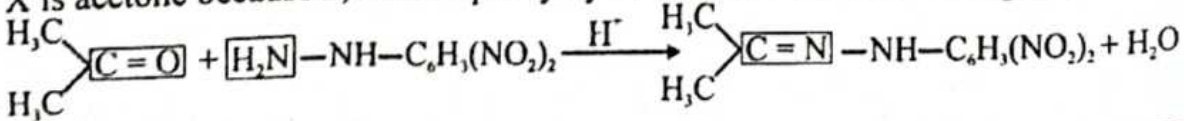
Small aldehyde > large aldehyde

Small ketone >large ketone

Unsymetrical ketone > symmetrical ketone

Aliphatic aldehyde / ketone > aromatic aldehyde / ketone

Q.32 X is acetone because 2,4 dinitrophenylhydrazone contains two $-CH_3$ groups.



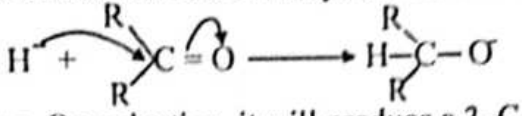
Q.33 The formation of cyanohydrin is achieved by addition of HCN to carbonyl compounds. As this addition is initiated by the attack of $-CN^-$ to carbonyl carbon of carbonyl compound. Therefore, it is a nucleophilic addition reaction.

Q.34

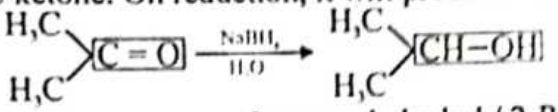
$$NaBH_4 \longrightarrow Na^+ + BH_4^-$$

$$BH_4^- \longrightarrow BH_3 + H^-$$

H^- is reducing agent because it reduces carbonyl carbon of carbonyl compound.



Q.35 Acetone is a 3–C ketone. On reduction, it will produce a 3–C secondary alcohol.



Isopropyl alcohol / 2-Propanol

Q.36 In case of unsymmetrical methyl ketones, the carbonyl group remains with the $-CH_3$ group while the carbon of other alkyl group will be oxidized to –COOH.

Q.37 All the aliphatic aldehydes gives positive test (silver mirror formation on the inner side of test tube) while ketones don't. So, any aliphatic aldehyde can be distinguished from ketones by Tollen's test.

Q.38

$$\text{Reactivity of carbonyl compound} \propto \frac{1}{\text{\# of R groups}}$$

$$\text{Reactivity of carbonyl compound} \propto \frac{1}{\text{Size of R groups}}$$

$$\text{Reactivity of carbonyl compound} \propto \frac{1}{\text{\# of C-atoms}}$$

Reactivity order:

Aldehyde > Ketone

Small aldehyde > large aldehyde

Small ketone >large ketone

Unsymetrical ketone > symmetrical ketone

Aliphatic aldehyde / ketone > aromatic aldehyde / ketone

Q.39 A, B, C are mild oxidizing agent, so they can oxidize aldehydes only (due to high reactivity than ketone) but not ketones but the combination of $K_2Cr_2O_7$ and H_2SO_4 produces nascent oxygen which is very strong oxidizing agent. So, it can oxidize both aldehydes and ketones.

Q.40 Fehling's solution is alkaline solution containing cupric tartarate complex ion. This cupric ion reduced to brick red coloured cuprous oxide (Cu_2O) by an aliphatic aldehyde.

Q.41 Aliphatic aldehydes are reactive than aromatic aldehydes and ketones so, a small aliphatic aldehyde can reduce Tollen's reagent

Q.42 Ethanol out of all primary alcohols, 2-alkanols out of all secondary alcohols, acetaldehyde out of all aldehydes and methyl ketone out of all ketones gives haloforms test

Q.43 Any carbonyl compound needs HCN to produce cyanohydrin. HCN if obtained *in situ* by reacting NaCl with HCl

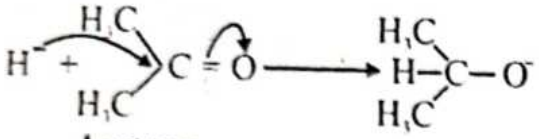
$$NaCN + HCl \longrightarrow NaCl + HCl$$

Q.44

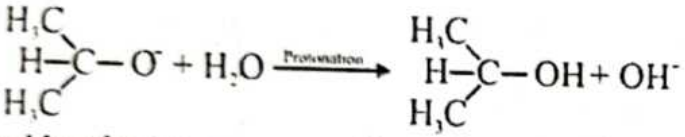
$$NaBH_4 \longrightarrow Na^+ + BH_4^-$$

$$BH_4^- \longrightarrow BH_3 + H^-$$

Q.45

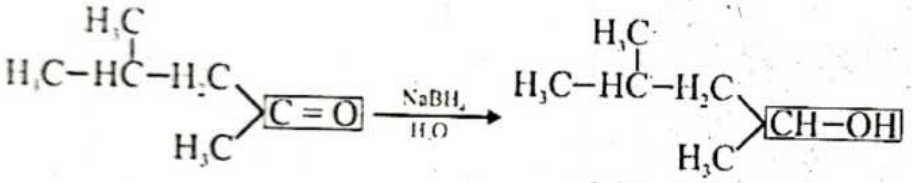


Acetone



Alkoxide of acetone Secondary alcohol

Q.46



3-Methyl-2-pentanone

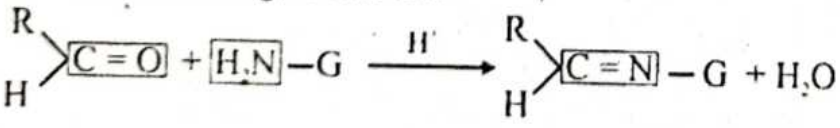
Q.47 $2HCHO + O_2 \xrightarrow[300\,^\circ C]{Cu} 3CH_3OH + 2H_2O$

Q.48 $CH_3CHO + 2\left[Ag(NH_3)_2\right]OH \longrightarrow CH_3COONH_4 + 2Ag + 2NH_3 + H_2O$

Q.49 Ethanol out of all primary alcohols, 2-alkanols out of all secondary alcohols, acetaldehyde out of all aldehydes and methyl ketone out of all ketones gives haloforms test

Methanol cannot give this test

Q.50



6C Topic CARBOXYLIC ACIDS

PRACTICE EXERCISE

PHYSICAL PROPERTIES OF CARBOXYLIC ACIDS

Q.1 General formula for carboxylic acid is

A) $C_nH_{2n}O_3$
B) $C_nH_{2n}O_2$
C) $C_nH_nO_2$
D) $C_nH_{2n}O$

Q.2 Which of the following is an unsaturated carboxylic acid

A) Malonic acid
B) Succinic acid
C) Oxalic acid
D) Maleic acid

Q.3 Acetic acid exists as dimer in benzene due to

A) Presence of hydrogen at α-carbon
B) Presence of carboxylic group
C) Condensation reaction
D) Hydrogen bonding

Q.4 An acid with unpleasant smell

A) Formic acid
B) Propionic acid
C) Acetic acid
D) Butyric acid

Q.5 Glacial acetic acid at low temperature is a

A) Semi solid
B) Viscous liquid
C) Ice like solid
D) Dilute liquids

REACTIONS OF CARBOXYLIC ACIDS

Q.6 Which of the following is unsaturated aliphatic organic acid

A) Maleic acid
B) Phthalic acid
C) Terephthalic acid
D) Adipic acid

Q.7 Which one is carboxylic acid

A) Carbolic acid
B) Carbonic Acid
C) Picric Acid
D) Palmitic acid

Q.8 Organic acid which cannot obtained by hydrolysis of fats

A) Succinic acid
B) Butyric acid
C) Acetic acid
D) Propionic acid

Q.9 By oxidation of which compound carboxylic acid cannot be obtained.

A) 2-Methyl-2-propanol
B) 2-Butanol
C) 1-Butanol
D) 3-Propanol

Q.10 A compound is oxidized to x, by further oxidation of x if resulting compound is butyric acid, starting compound can be:

A) Butanol
B) Butanone
C) Butanoic acid
D) All of these

Q.11 Alkane nitriles on boiling with which type of acid gives organic acids

A) Organic
B) Alcohol
C) Phenol
D) Mineral acids

Q.12 Metallic cyanides give alkyl cyanides in the presence of

A) Acid
B) Base
C) Water
D) Alcohol

Q.13 Gas released by basic hydrolysis of alkane nitriles

A) NO_2
B) CO_2
C) NH_3
D) H_2

Q.14 Oxidation of 2-Pentanone by strong oxidizing agents gives

A) Methanoic acid, Ethanoic acid
B) Ethanoic acid, Butanoic acid
C) Propanoic acid, Ethanoic acid
D) Butanoic acid, Methanoic acid

Q.15 Acetic acid (ethanoic acid) can be prepared from ethanol under

A) Oxidizing condition
B) Redox condition
C) Reducing condition
D) 7.0 pH condition

Q.16 Ethanoic acid is synthesized from ethanol involves the use of

A) Acidified potassium dichromate
B) Both "A" and "C"
C) Ammonical silver nitrate
D) Fehling's solution

Q.17 If ethanoic acid is to be prepared by hydrolysis of alkane nitriles, which of the following can be the reagent to be hydrolyzed

A) CH_3CN
B) HCN
C) CH_3CH_2CN
D) NaCN + HCl

Q.18 Hydrolysis of CH_3CH_2CN will synthesize

A) Ethanoic acid
B) Methanoic acid
C) Propanoic acid
D) Glutamic acid

Q.19 Alkane nitriles can be prepared by treating alkyl halide with

A) Alcohol
B) Potassium cyanide
C) Alcoholic potassium cyanide
D) Water

Q.20 Ethanoic acid can be prepared by hydrolysis of

A) Methyl chloride
B) Ethanol
C) Ethane nitrile
D) Ethyl chloride

Q.21 Propanoic acid is produced from _____ on acidic hydrolysis

A) 1-propanol
B) n-propyl cyanide
C) Isopropyl cyanide
D) Ethyl cyanide

Q.22 $CH_3CN + H_2O \xrightarrow{H^+} A \xrightarrow[H_2O]{H^+} CH_3COOH$ **. Predict "A" among the following**

A) $CH_3CH_2NH_2$

B) $NH_2-\overset{\overset{O}{\|}}{C}-NH_2$

C) $CH_3-\overset{\overset{O}{\|}}{C}-NH_2$

D) $CH_3-\overset{\overset{O}{\|}}{C}-OH$

Q.23 Hydrolysis of ethane nitrile in presence of HCl produces carboxylic acid. Identify the by product produced during reaction

A) NH_4NO_3
B) NH_4Cl
C) $(NH_4)_2SO_4$
D) All of these

Q.24 Potassium carbonate is decomposed by acetic acid and release a gas, the nature of gas is

A) Basic
B) Acidic
C) Neutral
D) Unpredictable

Q.25 Which group of carboxylic acids is active for reaction with alkali metal carbonates

A) H-atom
B) Hydroxyl group
C) Carbonyl group
D) Carboxylic group

Q.26 Which reaction can be used in artificial juices formation with carboxylic acids

A) Hydration
B) Hydrolysis
C) Esterification
D) Salt formation

Q.27 The addition of ethyl alcohol in protonated acetic acid is

A) Electrophilic substitution
B) Nucleophilic substitution
C) Nucleophilic addition
D) Oxidation

Q.28 Benzyl alcohol and acetic acid give a compound with _____ fragrance

A) Banana
B) Apricot
C) Pineapple
D) Jasmine.

Q.29 Ammonium acetate converts to acetamide by

A) Cooling
B) Dehydration
C) Heating
D) Both B and C

Q.30 Which of the following represent acid amide

A) CH_3COONH_4
B) CH_3CN
C) CH_3COCl
D) CH_3CONH_2

Q.31 Which sequence of groups replace OH of carboxylic acid to halides, esters and amides respectively

A) OH, X, NH_2
B) NH_2, H, X
C) X, OR, NH_2
D) X, OR, NO_2

Q.32 Which gas release during acid halide formation with the help of thionyl chloride and carboxylic acid

A) CO_2
B) SO_2
C) NO
D) SO_3

Q.33 Which of the following can be the reagent to produce acetyl chloride from ethanoic acid

A) $SOCl_2$
B) NaCl
C) PCl_5
D) Both "A" and "C"

Q.34 During the formation of an acid amide from ethanoic acid, what actually happens

A) Displacement of the –H from the acid by –Cl
B) Displacement of the –OH from the acid by $-NH_2$
C) Attachment of $-NH_2$ with the carbonyl oxygen
D) Displacement of the –H from the acid by $-NH_2$

Q.35 Carboxylic acids react with active metals (Na, K, Ca and Mg) to form their salt and

A) H_2O
B) H_2O and CO_2
C) CO_2 only
D) H_2 gas

Q.36 Which pair can be used as a reactant for the preparation of acetyl chloride

A) CH_3COOH, HCl
B) CH_3COOH, $SOCl_2$
C) CH_3COOH, PCl_5
D) Both "B" and "C"

Q.37 For producing a carboxylic acid derivative. The addition of nucleophile to carboxyl group is always followed by displacement of

A) –COOH group
B) H atom
C) –OH group
D) OR

Q.38 Which statement is incorrect about formation of ester

A) When carboxylic acids are heated with alcohols, esters are formed
B) Esters have fruity smell
C) Esters are used as artificial flavours
D) Ester are formed in the presence of NaOH

Q.39 Which ester is used as orange flavour

A) Amyl acetate
B) Benzyl acetate
C) Octal acetate
D) Isobutyl formate

Q.40 Esters are

A) Acidic
B) Basic
C) Neutral
D) None of these

Q.41 The work of concentrated H_2SO_4 in esterification process is as

A) Dehydrating agent and catalyst
B) Dehydrating agent
C) Hydrolyzing agent
D) Catalyst

Q.42 Acetyl chloride is soluble in which solvent

A) Water
B) Acetone
C) Ether
D) Both 'A' and 'B'

Q.43 Which of the following is not an example of electrophilic substitution reaction

A) Reaction of CH_3COOH with Na
B) Reaction of CH_3COOH with Na_2CO_3
C) Reaction of CH_3COOH with $NaHCO_3$
D) Reaction of CH_3COOH with PCl_5

Q.44 Identify reversible reaction among the following

A) Esterification
B) Acid Amide formation
C) Acid Halide formation
D) Acid anhydride formation

Q.45 During formation of acid halide, –OH of carboxylic acid is replaced by

A) $-NH_2$
B) –OR
C) $(CO)_2O<$
D) –X

Q.46 Ethyl butyrate is an ester formed by combination of _____ and butyric acid

A) Ethyl alcohol
B) Butyl alcohol
C) Propyl alcohol
D) Methyl alcohol

Q.47 By product produced during hydrolysis of alkane nitrile in basic medium is

A) NH_3
B) NH_4Cl
C) $(NH_4)_2SO_4$
D) NH_4NO_3

Q.48 Which of the following bond undergoes cleavage when carboxylic acid reacts with Na

A) C–O
B) O–H
C) C–C
D) H–H

Q.49 $2CH_3COOH + xCa \longrightarrow Ca(OCOCH_3)_2 + H_2O$. Calculate value of "x".

A) 1
B) 2
C) 3
D) 4

STRENGTH OF ORGANIC ACIDS RELATIVE TO CHLORO-SUBSTITUTED ACIDS

Q.50 Strongest acid among following is

A) CH_3CH_2COOH
B) CH_3CCl_2COOH
C) $CH_3CHClCOOH$
D) CH_3COOH

Q.51 The stronger acid among the following is.

A) Cl_3CCOOH
B) $Cl_2CHCOOH$
C) $ClCH_2COOH$
D) CH_3COOH

Q.52 The strength of the organic acids and chloro substituted acids is measured by pK_a scale such that smaller value of pK_a corresponds to

A) Stronger acid
B) Mild acid
C) Weaker acid
D) Very weak acid

Q.53 Identify strongest acid among the following

A) α-chlorocarboxylic acid
B) β- chlorocarboxylic acid
C) γ-chlorocarboxylic acid
D) Carboxylic acid

RELATIVE ACIDIC STRENGTH OF CARBOXYLIC ACIDS, PHENOLS AND ALCOHOLS

Q.54 Organic acids (Carboxylic acids) are considered as

A) Strong acids
B) Mild acids
C) Weak acids
D) Mineral acids

Q.55 Identify strongest conjugate base among the following

A) OH^-
B) ^-OR
C) $RCOO^-$
D) PhO^-

PAST PAPERS QUESTIONS

Q.1 In $^4CH_3-^3\underset{\underset{CH_3}{|}}{CH}-^2\underset{\underset{CH_3}{|}}{CH}-^1COOH$ which one is α–carbon atom?

A) 1
B) 3
C) 2
D) 4

Q.2 The dilute solution of _____ is called vinegar

A) Formic acid
B) Benzoic acid
C) Acetic acid
D) Oxalic acid

Q.3 Which of the following is not a fatty acid?

A) Phenyl acetic acid
B) Palmitic acid
C) Stearic acid
D) Oleic acid

Q.4 Which one of the following compounds can exist in the form of cyclic dimers?

A) Benzene
B) Ozonide
C) Acetals
D) A carboxylic acid

Q.5 Consider the following reaction

$CH_3COOH + Mg(metal) \rightarrow$?What product will form

A) Magnesium formate
B) Magnesium acetate
C) Magnesium ion
D) Carboxylate ion

Q.6 The formation of ester from acetic acid in presence of acid and ethanol is a

A) Nucleophilic addition reaction
B) Electrophonic substitution reaction
C) Nucleophilic substation reaction
D) Electrophonic addition reaction

Q.7 Organic compound 'X' and 'Y' both can react with Na-metal to evolve hydrogen gas. 'X' and 'Y' if react with each other form an organic compound 'Z' which gives fruity smell. What types of compounds 'X' , 'Y' and 'Z' are?

	X	Y	Z
A)	Alcohol	Ester	Acetic Acid
B)	Alcohol	Ester	Mineral Acid
C)	Alcohol	Acetic Acid	Ester
D)	Alcohol	Mineral Acid	Ester

Q.8 $CH_3COOH + CH_3CH_2OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$

Which one of the following will act as a catalyst in above reaction?

A) HNO_3
B) H_2SO_4
C) Acidified potassium dichromate
D) $SOCl_2$

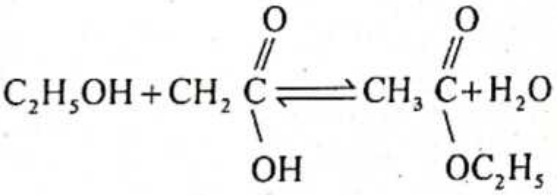
Q.9 Which one of the following reaction of carboxylic acid is reversible?

A) Esterification
B) Salt formation
C) Reaction with PCl_5
D) Reaction with $SOCl_2$

Q.10 During esterification, the bond from alcohol that breaks is between

A) Carbon and Oxygen
B) Oxygen and hydrogen
C) Carbon and carbon
D) None of these

Q.11



Which of the following catalyst is used in the above reaction?

A) Pt
B) Pumice stone
C) Ni
D) Conc. H_2SO_4

Q.12 Which product is formed by the reaction of carboxylic acid with alcohol?

A) Ester
B) Alkane
C) Aldehyde
D) Ether

Q.13 Which one of the following compounds act as catalyst when alcohols react with carboxylic acids

A) Pt
B) Conc. H_2SO_4
C) Ni
D) Conc. HNO_3

Q.14 What will be the outcome of reaction of methanol with ethanoic acid in the presence of concentrated sulphuric acid?

A) Propanone is formed
B) Propanoic acid formed
C) Methyl ethanoate is formed
D) Propanol is formed

Q.15 $CH_3COOH + PCl_5 \rightarrow$ the products of above reaction are

A) $CH_3COCl + POCl_2 + HCl$
B) $CH_3COCl + POCl_3 + HCl$
C) $CH_3Cl + POCl_3 + HCl$
D) $CH_3COCl + POCl_3 + H_2$

Q.16 $CH_3COOH + PCl_5 \rightarrow ?$
Which one of the following options shows the products of above reaction?
A) $POCl_2+CH_3COCl_2+HCl$
B) $POCl_3+CH_3COCl_2+H_2$
C) $CH_3COCl+POCl_2+HCl$
D) $POCl_3+CH_3COCl+HCl$

Q.17 **Identify the product X in the following reaction:**
$$CH_3COOH + PCl_5 \xrightarrow{Yields} X + POCl_3 + HCl$$
A) CH_3COCl
B) CH_3COCl_2
C) $CH_3COCH_2Cl_2$
D) CH_2COCl_2

Q.18 **Which balance chemical equation show the formation of ethanoyl chloride using thionyl chloride?**
A) $CH_3CH_2COOH + 2SOCl \rightarrow CH_3CH_2COCl + SO_2 + HCl$
B) $CH_3COOH + SOCl_2 \rightarrow CH_3COCl + SO_2 + HCl$
C) $HCOOH + SOCl_2 \rightarrow HCOCl + SO_2 + HCl$
D) $CH_3CH_2COOH + 2SOCl \rightarrow CH_3CH_2COCl + SO_3 + HCl$

Q.19 **Which of the following reagent is required for preparation of acyl chloride (CH_3COCl) from ethanoic acid?**
A) HCl
B) CH_3Cl
C) PCl_5
D) $POCl_3$

Q.20 **Acetyl chloride (Ethanoyl chloride) is used in the synthesis of organic compounds. It is prepared by treating acetic acid with**
A) $SOCl_2$
B) CH_3Cl
C) HCl
D) $ClNH_2$

Q.21 **The –NH-CO group is called**
A) Amide group
B) Protein linkage
C) Amino group
D) Peptide linkage

Q.22 **When ethanoyl chloride reacts with methylamine an amide is formed. What is the structure of it amide formed?**
A) $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-NH_2$
B) $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-NHCH_3$
C) $CH_3-\overset{O}{\overset{\|}{C}}-NH_2$
D) $CH_3-\overset{O}{\overset{\|}{C}}-NHCH_3$

Q.23
$$CH_3-\overset{O}{\overset{\|}{C}}-OH+NH_3 \xrightarrow{Heat} ?$$
The final products formed are
A) $CH_3-\overset{O}{\overset{\|}{C}}-NH_2+CO_2$
B) $CH_3-\overset{O}{\overset{\|}{C}}-NH_2+H_2$
C) $CH_3-\overset{O}{\overset{\|}{C}}-NH_2+H_2O$
D) $CH_3-\overset{O}{\overset{\|}{C}}-NH_2+HCl$

Q.24 Carboxylic acids are rather hard to reduce, which powerful reducing agent can be used to convert them to the corresponding primary alcohol

A) $H_2SO_4 / HgSO_4$
B) V_2O_5
C) $LiAlH_4$
D) $K_2Cr_2O_7/H_2SO_4$

Q.25 Carboxylic acids can be reduced into corresponding alcohols. Which of the following reagent can be used for this purpose?

A) $K_2Cr_2O_4$
B) H_2SO_4
C) $LiAlH_4$
D) $KMnO_4$

Q.26 Reagent used to reduce a carboxylic acid to an alkance is

A) Ni/H_2
B) P/HI
C) $NaBH_4$
D) $LiAlH_4$

Q.27 'Ka' values of few organic acids are given.

Acid	Ka
CH_3COOH	1.85×10^{-5}
CCl_3COOH	2.3×10^{-2}
$CHCl_2COOH$	5.0×10^{-3}
$CH_2ClCOOH$	1.3×10^{-3}

The order of the acid strength is

A) $CCl_3COOH > CHCl_2COOH > CH_2ClCOOH > CH_3COOH$
B) $CH_3COOH > CHCl_2COOH > CCl_3COOH > CH_2ClCOOH$
C) $CHCl_2COOH > CH_3COOH > CCl_3COOH > CH_2ClCOOH$
D) $CCl_3COOH > CH_3COOH > CHCl_2COOH > CH_2ClCOOH$

Q.28 Select the correct acidic strength order of chlorosubstituted acids

A) $CH_3COOH > ClCH_2COOH > Cl_2CHOOH > Cl_3CCOOH$
B) $CH_3COH > Cl_2CHCOOH > Cl_3CCOOH > ClCl_2COOH$
C) $Cl_3CCOOH > Cl_2CHCOOH > ClCH_2COOH > CH_3COOH$
D) $Cl_3CCOOH > CH_3COOH > Cl_2CHCOOH > ClCH_2COOH$

Q.29 Which one will be act as a strong acid

A) Dichloroethanoic acid
B) Trichloethanoic acid
C) Ethanoic acid
D) Chloroethanoic acid

Q.30 Which of the following compounds in the form of aqueous solution will produce CO_2 on reaction with sodium carbonate

A) $CH_3COOC_2H_5$
B) $C_2H_5COOCH_3$
C) $C_2H_5COOC_2H_5$
D) $C_2H_5CO\text{-}OH$

Q.31 Relative acidic strength of alcohol , phenol , water and carboxylic acids is

A) Carboxylic acid > Alcohol > Phenol > Water
B) Carboxylic acid > Phenol > Water > Alcohol
C) Phenol > Carboxylic acid > Alcohol > Water
D) Water > Phenol > Alcohol > Carboxylic acid

Q.32 An organic acid 'z' reacts separately with sodium bicarbonate, sodium hydroxide and sodium carbonate. Which one of the following represent the structure of 'z'

A) $HCOOC_2H_5$
B) $CH_3 - CH = CH_2$
C) CH_3CH_2OH
D) $H_3C - CH_2 - COOH$

Q.33 Ethanol, ethanoic acid and phenol all contain acidic functional groups, the order of the acidic strength is Ethanoic acid> phenol>ethanol
This is mainly due to
A) Electron releasing (donating) effect of ethanoic acid is greater than that of ethanol
B) Electron releasing (donating) effect of phenol is greater than that of ethanol
C) Electron with drawing effect of phenol is greater than that of ethanol
D) Electron with drawing effect of ethanoic acid is greater than that of phenol

Q.34 When $CH_3–CH_2–OH$ is oxidized in the presence of $K_2Cr_2O_7$ and H_2SO_4, the product formed is

A) $CH_3-\overset{\overset{O}{\|}}{C}-OH$

C) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$

B) $H-\overset{\overset{O}{\|}}{C}-OH$

D) $CH_3-\overset{\overset{O}{\|}}{C}-OCH_3$

Q.35 Compounds having — C ≡ N group are called
A) Cyano compounds
B) Nitro compounds
C) Carbon nitrogen molecules
D) Nitriles

ANSWER KEY

1	B	11	D	21	D	31	C	41	A	51	A
2	D	12	D	22	C	32	B	42	D	52	A
3	D	13	C	23	B	33	D	43	D	53	A
4	D	14	C	24	B	34	B	44	A	54	C
5	C	15	A	25	A	35	D	45	D	55	B
6	A	16	A	26	C	36	D	46	A		
7	D	17	A	27	B	37	C	47	A		
8	A	18	C	28	D	38	D	48	B		
9	A	19	C	29	D	39	C	49	A		
10	A	20	C	30	D	40	C	50	B		

PAST PAPERS QUESTIONS

1	C	6	C	11	D	16	D	21	A	26	B	31	B
2	C	7	C	12	A	17	A	22	D	27	A	32	D
3	A	8	B	13	B	18	B	23	C	28	C	33	D
4	D	9	A	14	C	19	C	24	C	29	B	34	A
5	B	10	B	15	B	20	A	25	C	30	D	35	D

EXPLANATORY NOTES

Q.1

$$\begin{matrix} CH-COOH \\ \| \\ CH-COOH \end{matrix}$$

have double bond and have open chain structure

Q.2 Carbolic acid = Phenol
Carbonic acid = H_2CO_3
Picric acid = 2,4,6 – Trinitrophenol
Palmitic acid = Carboxylic acid

Q.3 Aliphatic monocarboxylic acid is called fatty acid. Fats on hydrolysis give saturated fatty acids. Succinic acid is a dicarboxylic acid so it is not a fatly acid

Q.4 2–Methyl –2– propanol is tertiary alcohol. So it cannot be oxidized to carboxylic acid because it does not contain α-H. Under same conditions it show elimination and give alkene

Q.5

$$CH_3-CH_2-CH_2-CH_2-OH \xrightarrow{[O]} CH_3-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-H \xrightarrow{[O]} CH_3CH_2CH_2COOH$$

Q.6 $RCN + H_2O \xrightarrow[HCl]{\text{Mineral acid}} RCOOH + NH_4Cl$

Q.7 $R-X + KCN \xrightarrow{\text{alcohol}} R-CN + KX$

Q.8 $RCN + H_2O \xrightarrow[NaOH]{OH^-} RCOOH + NH_3$, $CH_3-CN + H_2O \xrightarrow{H^+} CH_3COOH + NH_4^+$

Q.9

$$CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-CH_3 \xrightarrow[KMnO_4]{[O]} CH_3COOH + C_2H_5COOH$$

Q.10

$$C_2H_5-OH \xrightarrow{\text{Oxidation}} CH_3-\overset{O}{\overset{\|}{C}}-OH$$

Q.11 Strong oxidizing agent is required to oxidize alcohol

Q.12

$$CH_3CN \xrightarrow[H^+]{H_2O} CH_3-\overset{O}{\overset{\|}{C}}-NH_2 \xrightarrow[H^+]{H_2O} CH_3COOH$$

Q.13 $CH_3CH_2CN \xrightarrow[H^+]{H_2O} CH_3CH_2COOH$

Q.14 $R-X + KCN \xrightarrow{\text{alcoholic}} R-CN + KX$

Q.15 $CH_3-CN + H_2O \xrightarrow{H^+} CH_3COOH + NH_4^+$

Q.16 $C_2H_5-CN \xrightarrow[H+]{H_2O} CH_3CH_2COOH$

Q.17

$$CH_3-CN + H_2O \xrightarrow[H_2O]{H^+} CH_3-\overset{O}{\overset{\|}{C}}-NH_2 \xrightarrow[H_2O]{H^+} CH_3COOH$$

Q.18 During acidic hydrolysis if acid is
$HCl \longrightarrow NH_4Cl$ salt is produced, $HNO_3 \longrightarrow NH_4NO_3$ salt is produced, $H_2SO_4 \longrightarrow (NH_4)_2SO_4$ salt is produced

Q.19 $K_2CO_3 + 2CH_3COOH \longrightarrow 2CH_3COOK + CO_2 + H_2O$
CO_2 is evolved which is acidic in nature

Q.20 Reaction with carboxylic acid and carbonates are example of E^+– substitution
$Na + CH_3COOH \longrightarrow CH_3COONa + \frac{1}{2}H_2$, So, O – H bond break

Q.21 Artificial flavours are derived from esters

Q.22 Esterification is an example of Nucleophilic substitution reaction. In which O – H bond of alcohol breaks while C – O of carboxylic acid break

Q.23 $CH_3COOH + C_6H_5CH_2OH \overset{H^+}{\rightleftharpoons} CH_3COOCH_2C_6H_5 + H_2O$

Q.24 $CH_3COONH_4 \xrightarrow{\Delta} CH_3 - CO - NH_2 + H_2O$, It is a heating and dehydration reaction

Q.25 $CH_3 - CO - NH_2 \longrightarrow$ acid amide

Q.26 Acid halides $(-OH\,by - X)$, Esters $(-OH\,by - OR)$, Amides $(-OH\,by - NH)$

Q.27 $CH_3COOH + SOCl_2 \longrightarrow CH_3COCl + H_2O + SO_2$

Q.28 $CH_3COOH + SOCl_2 \longrightarrow CH_3COCl + H_2O + SO_2$
$CH_3COOH + PCl_5 \longrightarrow CH_3COCl + POCl_3 + HCl$

Q.29 –OH replaced by $-NH_2$

Q.30 $RCOOH$ + active metal $\longrightarrow$ Salt + H_2

Q.31 $CH_3COOH + SOCl_2 \longrightarrow CH_3COCl + H_2O + SO_2$
$CH_3COOH + PCl_5 \longrightarrow CH_3COCl + POCl_3 + HCl$
$3CH_3COOH + PCl_3 \longrightarrow 3CH_3COCl + H_3PO_3$

Q.32 For Nucleophilic substitution reaction of carboxylic acid
$\longrightarrow$ C – O bond breaks
$\longrightarrow$ –OH replace by –OR

Q.33 Esters formation are catalyzed by acids

Q.35 Esters are neutral species because aqueous solution of esters have no effect on litmus paper

Q.36 Mineral acid act as catalyst and dehydrating agent during esterification

Q.37 Acetyl chloride is polar and will dissolve more in polar solvent

Q.38 $CH_3COOH + PCl_5 \longrightarrow CH_3 - CO - Cl + POCl_3 + HCl$, In this reaction C – O bond of carboxylic acid break so it is Nu substitution reaction

Q.39 $CH_3COOH + C_6H_5CH_2OH \overset{H^+}{\rightleftharpoons} CH_3COOCH_2C_6H_5 + H_2O$

Q.40 In halide formation –OH is replaced by –X

Q.41

$$C_2H_5 - OH + HO - CO - CH_2 - CH_2 - CH_3 \longrightarrow C_2H_5 - O - CO - CH_2 - CH_2 - CH_3 + H_2O$$

Ethyl Butyrate

Q.42 $R{-}CN + H_2O \xrightarrow{OH^-} RCOOH + NH_3$

Q.43

$CH_3COOH + Na \longrightarrow CH_3COONa + \frac{1}{2}H_2$, O – H bond of carboxylic acid break os it is electrophilic substitution reaction

Q.44

$$2CH_3COOH + Ca \longrightarrow Ca\begin{matrix}OCOCH_3\\OCOCH_3\end{matrix} + H_2O$$

Q.45 Halogens are electron withdrawing group. Greater the number of halogens, more the electron withdrawing effect, strong will be acid

Q.46 Acidity $\propto$ no of halogen atom

Q.47 $pK_a \propto \frac{1}{\text{acidity}}$

Q.48 Closer the halogen to functional group carbon, greater the acidity

Q.49 Carboxylic are weak acid

Q.50

$OH^{-1} + H^+ \longrightarrow H - OH$

$\bar{O}R + H^+ \longrightarrow R - OH$

$RCOO^- + H^+ \longrightarrow RCOOH$

$PhO^- + H^+ \longrightarrow PhOH$

Among these conjugate acids, alcohol is the weakest acid. If acid is weakest, strongest will be conjugate base

7C Topic AMINO ACIDS

PRACTICE EXERCISE

THE GENERAL STRUCTURE OF AMINO ACIDS FOUND IN PROTEINS

Q.1 Amino acids contain

A) $-NO_2$ and $-COOH$
B) $-NH_2$ and $-COOH$
C) $-NH_2$ and $-OH$
D) $-OH$ and $-COOH$

Q.2 Side chain in the structure of α-amino acid is represented by

A) COOH
B) R
C) NH_2
D) H

Q.3 Which of the following is α-amino acid

A) $CH_3-CH(NH_2)-CH_2-COOH$
B) $CH_3-CH(NH_2)-CH_2-CH_2-COOH$
C) $CH_3-CH(NH_2)-COOH$
D) All of these

Q.4 α-carbon of nature occurring amino acid is always _____ hybridized

A) sp
B) sp^2
C) sp^3
D) dsp^2

Q.5 The number of α-amino acid on the basis of side chains primarily involved in protein synthesis are

A) 5
B) 20
C) 10
D) 30

Q.6 Which of the following species is different for different α-amino acids

A) COOH
B) R
C) NH_2
D) H

Q.7 Amino acids that can-not be synthesized in our body are called

A) Essential amino acid
B) Non-essential amino acid
C) Complete amino acids
D) All of these

Q.8 Which of the following is non-essential amino acids

A) Lysine
B) Valine
C) Histidine
D) Proline

Q.9 Amino acids are the building blocks of

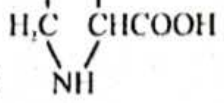
A) Fats
B) Proteins
C) Carbohydrates
D) Starch

Q.10 The structure of valine is

A) $CH_2(NH_2)-COOH$

B) $CH_3-CH(NH_2)-COOH$

C) $CH_3-CH(CH_3)-CH(NH_2)-COOH$

D) 

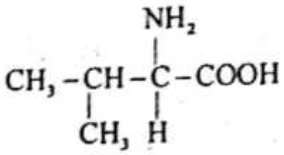
Q.11 Glycine is different than all other naturally occurring α – amino acids due to

A) Having α - hydrogen atom
B) Neutral in nature
C) It is not optically active amino acid
D) Both "A" and "C"

Q.12 Incorrect statement about α-amino acids is
A) The zwitter ionic structure is also called internal salt
B) All α – amino acids exist largely in dipolar ionic forms
C) $-NH_2$ group always present on α, β or γ carbon etc in naturally occurring amino acids
D) Every amino acid contains at least one amino group and one carboxylic group

Q.13 The unique properties of each amino acid are determined by its particular
A) Amino group
B) Number of bonds to other amino acids
C) R – group
D) Presence of hydrogen

Q.14 Number of chiral centers in



A) 2
B) 3
C) 1
D) 4

Q.15 The cyclic neutral amino acid is
A) Histidine
B) Lysine
C) Proline
D) Glycine

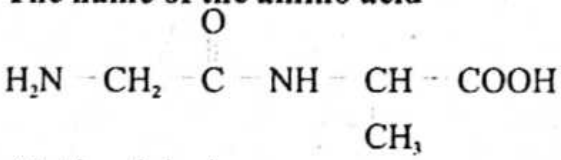
Q.16 Which of the following can be prepared by our body
A) Valine
B) Lysine
C) Glycine
D) Histidine

Q.17 Amino acid which have methyl group attached to α-carbon
A) Alanine
B)Aspartic acid
C) Lysine
D) Histidine

Q.18 Which one is not amino acid
A) Aspartic acid
B) Picric acid
C) Glutamic acid
D) Valine

Q.19 The IUPAC name of alanine is
A) 2-Aminobutanoic acid
B) 2-Aminopropanoic acid
C) 2-Ethanoic acid
D) 2-Aminopropionic acid

Q.20 The name of the amino acid



A) Alanylglycine
B) Glycylalanine
C) Lysylglycine
D) Glycylvaline

AMINO ACIDS ON THE BASIS OF NATURE OF R GROUP

Q.21 Which of the following amino acid has polar R group
A) Glutamic acid
B) Glycine
C) Valine
D) Alanine

Q.22 Which of the following amino acid has non- polar R group
A) Glutamic acid
B) Histidine
C) Threonine
D) Alanine

Q.23 The pair of amino acids that has more number of carboxyl groups as compared to amino groups
A) Histidine and lysine
B) Proline and glycine
C) Histidine and alanine
D) Aspartic acid and glutamic acid

Q.24 The amino acids which contain non-polar alkyl group
A) Lysine
B) Histidine
C) Alanine
D) Aspartic acid

Q.25 Which of the following doesn't contain primary amino?
A) Lysine
B) Valine
C) Proline
D) Aspartic acid

Q.26 Which of the following is not an aliphatic amino acid?
A) Glycine
B) Valine
C) Alanine
D) Histidine

Q.27 Which of the following has same number of oxygen and nitrogen atoms
A) Proline
B) Valine
C) Glutamic acid
D) Lysine

Q.28 Which of the following has more number of COOH group than nitrogen atoms
A) Proline
B) Valine
C) Glutamic acid
D) Lysine

Q.29 Which of the following amino acid is essential as well as basic
A) Alanine
B) Proline
C) Aspartic acid
D) Arginine

Q.30 Which of the following is neutral but non-essential amino acid
A) Alanine
B) Isoleucine
C) Methionine
D) Phenylalanine

ZWITTER ION + ACID BASE PROEPRTIES OF AMINO ACIDS

Q.31 The internal salt of alanine has structure

A) $R-\underset{\underset{NH_2}{|}}{\overset{\overset{H}{|}}{C}}-COONa$

C) $CH_3-\underset{\underset{NH_3^+}{|}}{\overset{\overset{H}{|}}{C}}-COO^-$

B) $CH_3-\underset{\underset{NH_3^+}{|}}{\overset{\overset{H}{|}}{C}}-COOH$

D) $H-\underset{\underset{NH_3^+}{|}}{\overset{\overset{H}{|}}{C}}-COO^-$

Q.32 There are three peptide bonds present in a molecule of a
A) Tripeptide
B) Pentapeptide
C) Tetrapeptide
D) Dipeptide

Q.33 Aspartic acid is an amino acid but its nature is
A) Acidic
B) Neutral
C) Basic
D) Amphoteric

Q.34 Alanine is an amino acid but its nature is
A) Acidic
B) Neutral
C) Basic
D) Highly basic

Q.35 In the formation of Zwitter ion, the proton from the carboxyl group goes and gets attached to the
A) Carbonyl carbon
B) Amino group nitrogen
C) Alkyl group carbon
D) Carbonyl group oxygen

Q.36 The acidic character of amino acids is due to
A) Amino group
B) Carbonyl group
C) Carboxylate ion
D) Carboxyl group

Q.37 Which of the following compound exist as dipolar ion?

A) Carbohydrate
B) Amino acid
C) Long chain fatty acid
D) α-halocarboxyl compounds

Q.38 Which of the following contain two acidic $-NH_3^+$ groups in aqueous media

A) Lysine
B) Valine
C) Proline
D) Alanine

Q.39 Which of the following pair is incorrect?

	Name	Nature	Lyric
A)	Glutamic acid	Acidic	Gla
B)	Glycine	Neutral	Gly
C)	**Alanine**	**Acidic**	**Ala**
D)	Proline	Neutral	Pro

Q.40 Which of the following statement is correct about Zwitter ion?

A) α-amino acid cannot form zwitter ion
B) γ-amino acid can form zwitter ion
C) Most but not all α-amino acids exist largely in dipolar ionic form
D) β-amino acid cannot form dipolar ionic structure

Q.41 Formation of internal salt from amino acid is an example of

A) Tautomerism
B) Metamerism
C) Chain isomerism
D) Functional group isomerism

Q.42 When NaOH is added to an amino then internal salt will

A) Accept proton
B) Loses proton
C) Neither accept nor donate
D) Loses its electron pair

PEPTIDES AND PROTEINS

Q.43 There are three peptide bonds present in a molecule of a

A) Tripeptide
B) Pentapeptide
C) Tetrapeptide
D) Dipeptide

Q.44 Peptides are formed from

A) Aliphatic amines
B) Carboxylates
C) α-amino acids
D) Aromatic amines

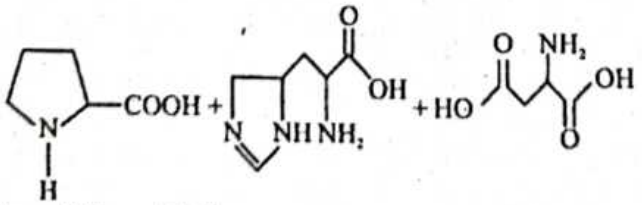
Q.45 A polypeptide having molecular mass upto

A) 15,000
B) 10,000
C) 50,000
D) 1000

Q.46 A peptide having molecular mass more than 10,000 is called

A) Amino acid
B) Glycoprotein
C) Protein
D) Complex protein

Q.47



Gives rise to a tri peptide called as:

A) Pro-His-Asp
B) Val-His-Pro
C) His-Pro-Lys
D) Pro-His-Gla

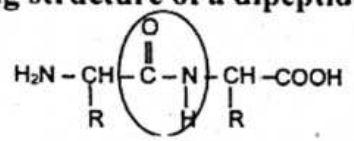
Q.48 A polypeptide chain have mass exactly 10,000 amu it will be called:

A) Polypeptide
B) Can be called both polypeptide and protein
C) Protein
D) It is a border line case

Q.49 Formation of dipeptide by amino acid is an example of reaction

A) Condensation
B) Addition
C) Reduction
D) Combustion

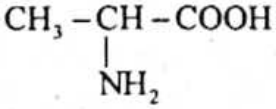
Q.50 In the following structure of a dipeptide, the encircled group is

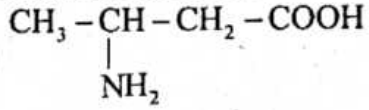


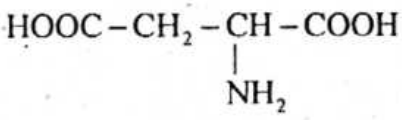
A) Peptide linkage
B) Amine linkage
C) Ether linkage
D) Ester linkage

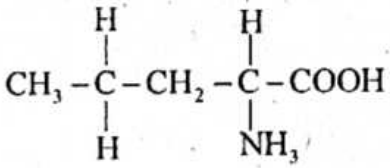
PAST PAPERS QUESTIONS

Q.1 Aspartic acid is an acidic amino acid which has chemical formula

A) 

C) 

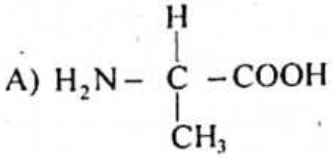
B) 

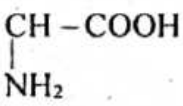
D) 

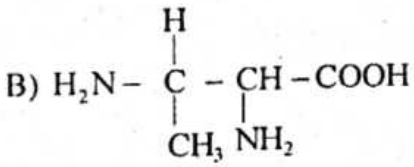
Q.2 Organic compound containing both amino and carboxyl group is known as

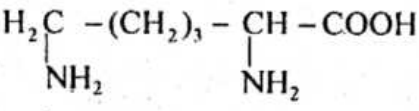
A) Amino acid
B) Fatty acid
C) Saccharide
D) Amide

Q.3 Alanine is an amino acid which shows neutral effect on litmus paper, the formula of alanine may be

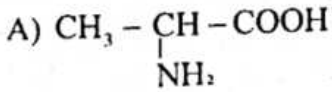
A) 

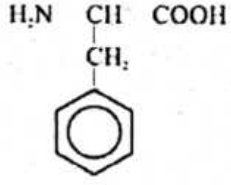
C) 

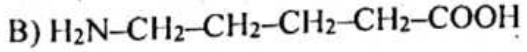
B) 

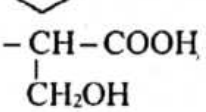
D) 

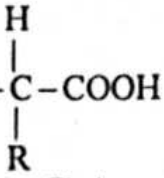
Q.4 Which of the following structures is not an α-amino acid?

A) 

C) 

B) 

D) 

Q.5 **What is the name of amino acid,**  **where 'R' is CH_3 group?**

A) Glycine
B) Lysine
C) Aspartic acid
D) Alanine

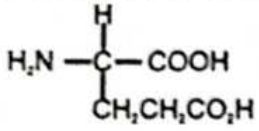
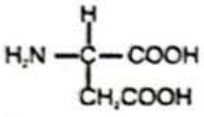
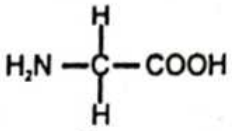
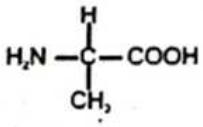
Q.6 **α-amino acids are compounds having carboxylic acid as well as amino functional groups attached to**

A) Any H-atom in the molecule
B) Same carbon atom
C) Alternate carbon atoms
D) Neighboring carbon atoms

Q.7 **The amino acids which largely exist in dipolar ionic form are**

A) Acidic amino acids
B) Basic amino acids
C) Beta amino acids
D) Alpha amino acids

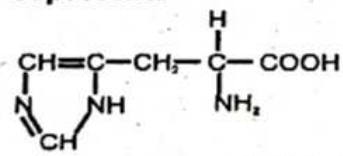
Q.8 **Which one of the following is glumatic acid**

A) 
B) 
C) 
D) 

Q.9 **Indicate the cyclic amino acid from the following**

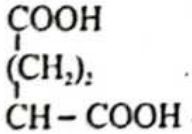
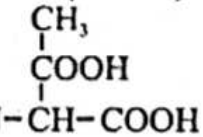
A) Cysteine
B) Serine
C) Methionine
D) Proline

Q.10 **The structure shown below represents**

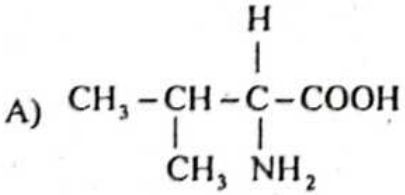
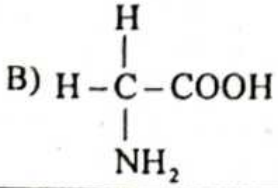
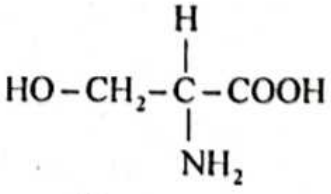
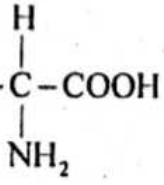


A) Proline
B) Histidine
C) Glycine
D) Lysine

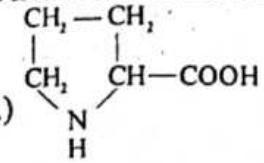
Q.11 **Which one of the following structures shows the correct formula of glutamic acid?**

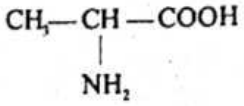
A) $H_2N–CH_2–COOH$
B) 
C) $H_2N–CH(COOH)–COOH$
D) 

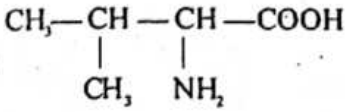
Q.12 **The structural formula for alanine is**

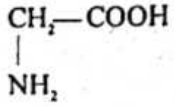
A) 
B) 
C) 
D) 

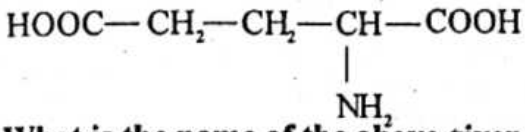
Q.13 Which one of the following is structural formula of proline?

A) 

C) 

B) 

D) 

Q.14 

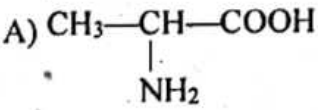
What is the name of the above given structural formula?

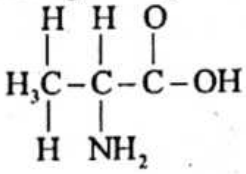
A) Aspartic acid
B) Asparagine
C) Adipic acid
D) Glutamic acid

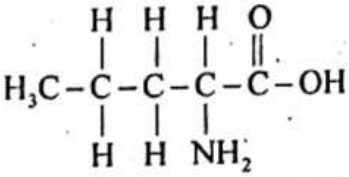
Q.15 Which one of the following is simplest amino acid?

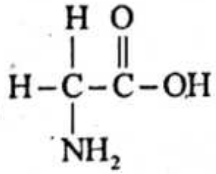
A) Lysine
B) Leucine
C) Alanine
D) Glycine

Q.16 Among the following, choose the correct option regarding the structure of Alanine:

A) 

C) 

B) 

D) 

Q.17 The nature of amino acid lysine is

A) Neutral
B) Acidic
C) Basic
D) Amphoteric

Q.18 Which of the following has an amino R group

A) Lysine
B) Valine
C) Proline
D) Alanine

Q.19 At intermediate value of pH, amino acids form zwitter ions containing

A) $-(N^+)H_3$ and COO^-
B) $-NH_2$ and COO^+
C) $-(N^+)H_2$ and COOH
D) $-NH_2$ and COOH

Q.20 In basic conditions, amino acid exists in which of the following forms?

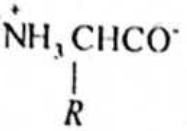
A) $H_3N^+ - CH_2 - COOH$

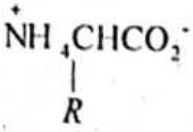
B) NH_2-CH_4-COOH

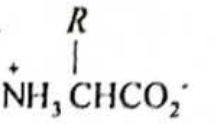
C) $H_3N^+ - CH_2 - COO^-$

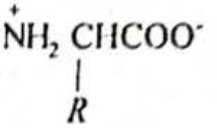
D) $H_2N - CH_2 - COO^-$

Q.21 The formula of 'zwitterion' is represented by

A) 

B) 

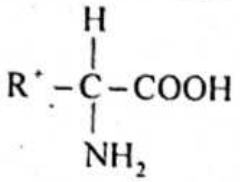
C) 

D) 

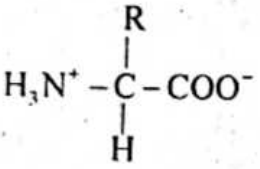
Q.22 At low pH or in acidic condition amino acid exist as

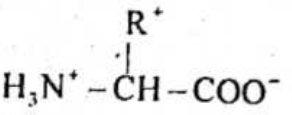
A) Anion
B) Cation
C) Zwitter ion
D) Neutral Specie

Q.23 Select the correct zwitter ionic structure of an amino acid?

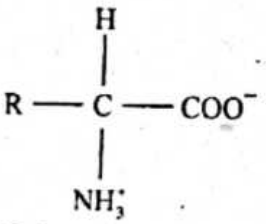
A) 

C) $H_2N^+ - CH_2 - COO^-$

B) 

D) 

Q.24



Select the best option indicating the name of the above structure

A) Cation
B) Neutral amino acid
C) Internal salt
D) Anion

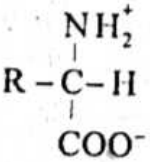
Q.25 When acid is added to an amino acid, which one of the following will act as a base?

A) NH_3^+
B) COO^-
C) H^+
D) R group

Q.26 Acidic character of amino acid is due to

A) $-NH_2$
B) $-N^+H_3$
C) $-COOH$
D) $-COO^-$

Q.27 In aqueous solution amino acids exist in an ionic form as shown below



This ionic form of amino acid is known as

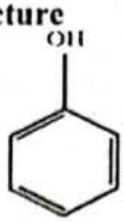
A) Cation
B) Amphoteric ion
C) Zwitterion
D) Anion

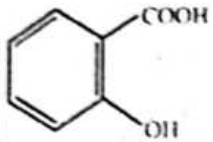
Q.28 **The nature of lysine is**

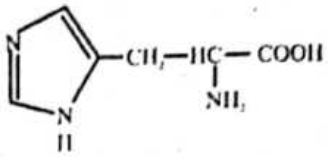
A) Acid
B) Neutral
C) Basic
D) Leadenly acid

Q.29 **An organic compound reacts with NaOH and also gives esterification reaction. The compound gives violet color when treated with Ninhydrin solution. Based on these observation, the compound may have a structure**

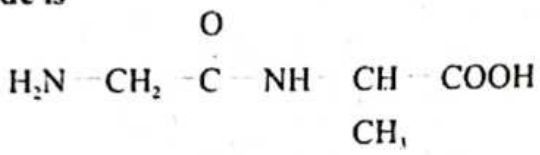
A) H_2C-CH_2-COOH

C) 

B) 

D) 

Q.30 **Structure of dipeptide is**



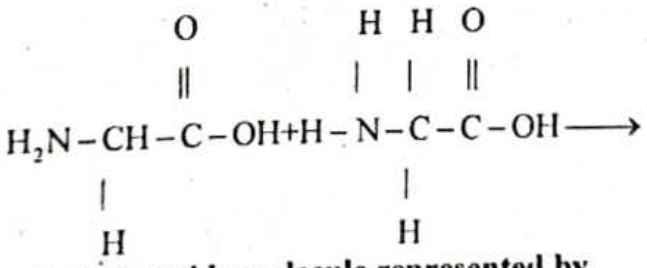
This is called

A) Glycyl glycine
B) Glycyl alanine
C) Alaninyl alanine
D) Alaninyl glycine

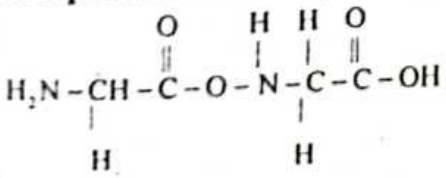
Q.31 **Two or more amino acids condensed to form protein by a peptide linkage which is present between two atoms**

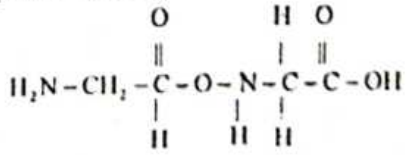
A) C and C
B) C and N
C) O and C
D) C and H

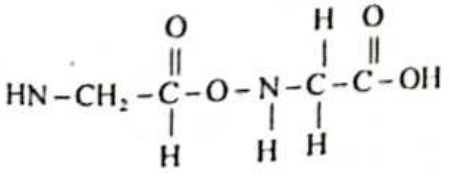
Q.32 **The reaction:**

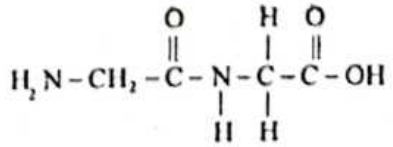


Gives a product called dipeptide molecule represented by

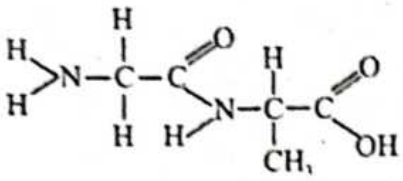
A) 

C) 

B) 

D) 

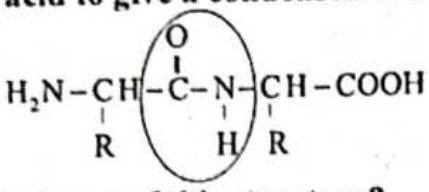
Q.33



This structure is

A) Gly –Ala (dipeptide)
B) Asp-Gly (Dipeptide)
C) Gly-Val (dipeptide)
D) Asp-Val (dipeptide)

Q.34 Amino acids react with each other such that –COOH group of one amino acid reacts with the another among acid to give a condensed structure as shown below



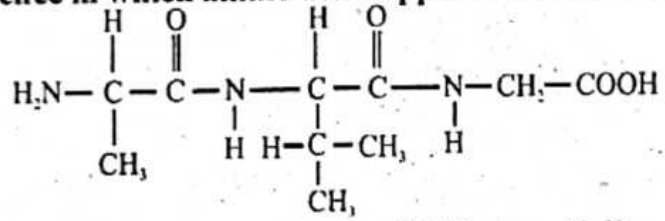
What is the name of circled part of this structure?

A) Peptide linkage
B) Ester linkage
C) Azide linkage
D) Carbide linkage

Q.35 Amino acids are bi-functional compounds, with a general formula $NH_2CH(R)CO_2H$. A tripeptide is formed between Alanine (ala), Glycine (gly) and lysine (lys). There is no repetition of amino acid in this tri-peptide, suggest how many tri-peptides are possible?

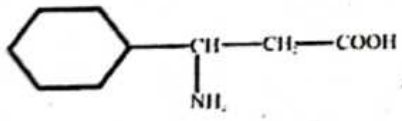
A) 3
B) 12
C) 9
D) 6

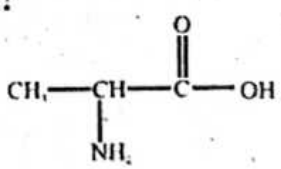
Q.36 Identify the sequence in which amino acids appear in the following tripeptide chain.



A) Glycine-Alanine-Valine
B) Alanine-Glycine-Valine
C) Glycine- Valine-Alanine
D) Alanine- Valine-Glycine

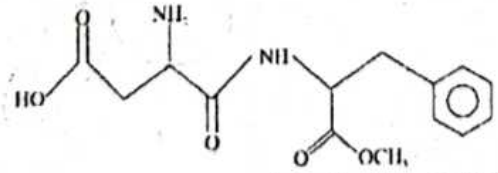
Q.37 Which of the following is an alpha amino acid?

a) 

c) 

B) $CH_3NH_2CHCH_2COOH$
D) $CH_3–CO–NH–CH_2–COOH$

Q.38 The skeletal formula of dipeptide formed between aspartic acid and phenylalanine is given below



How many functional groups are present in its formula?

A) 1
B) 2
C) 4
D) 3

Q.39 The amino acids which are not prepared by human body are called

A) Essential amino acids
B) Non-essential amino acids
C) Alpha amino acids
D) Beta amino acids

Q.40 IUPAC name of alanine is

A) 2-Aminopropanoic acid
B) 2-Aminobutane-1,4-diolc acid
C) 2-Aminoethanoic acid
D) 2-Aminobutanoic acid

ANSWER KEY

1	B	11	C	21	A	31	C	41	A
2	B	12	C	22	D	32	C	42	B
3	C	13	C	23	D	33	A	43	C
4	C	14	C	24	C	34	B	44	C
5	B	15	C	25	C	35	B	45	B
6	B	16	C	26	D	36	D	46	C
7	A	17	A	27	B	37	B	47	A
8	D	18	B	28	C	38	A	48	A
9	B	19	B	29	D	39	C	49	A
10	C	20	C	30	A	40	D	50	A

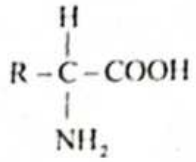
PAST PAPERS QUESTIONS

1	B	6	B	11	B	16	A	21	C	26	B	31	B	36	D
2	A	7	D	12	D	17	C	22	B	27	C	32	D	37	C
3	A	8	A	13	A	18	A	23	B	28	C	33	A	38	C
4	B	9	D	14	D	19	A	24	C	29	D	34	A	39	A
5	D	10	B	15	D	20	D	25	B	30	B	35	D	40	A

EXPLANATORY NOTES

Q.1 The compounds containing both amino group and carboxyl group are called amino acids.

Q.2 General structure of α-amino acid



R may or may not be an alkyl group and is referred to as side chain.

Q.3 In α-amino acid amino group ($-NH_2$) is attached to α-carbon

Q.4 In amino acids α-carbon is attached to $-COOH$, $-NH_2$ and $-H$ along with any side chain. Therefore, α-carbon is bonded with four groups and is sp^3 hybridized.

Q.5 There are twenty different α-amino acid on the bases of side chains primarily involved in protein synthesis

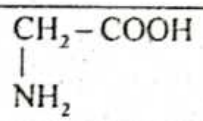
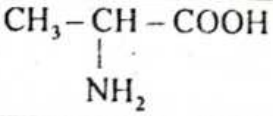
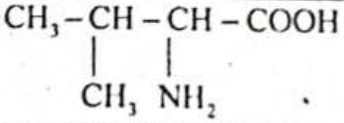
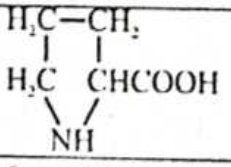
Q.6 See the explanation of Q.2

Q.7 Those that cannot be synthesized in our body are called essential amino acid.

Q.8 Those that can be synthesized in our body are called non-essential amino acid. Proline is one of its example.

Q.9 The amino acids are very important because they are the building blocks of proteins. Proteins are very important for us.

Q.10

Glycine	
Alanine	
Valine	
Proline	

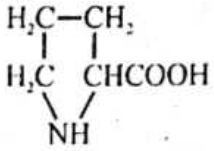
Q.11 Glycine is neutral and the simplest α-amino acid in which α-carbon is bonded with two hydrogen atoms. Therefore, it is not chiral and optically active.

Q.12 α-amino acid have always amino group attached to α-carbon

Q.13 Different amino acids which are present in body are different due to presence of different side chain (R group).

Q.14 This is structural formula of valine. Here only α-carbon is chiral. Chiral carbon is a carbon having four different groups attached to it.

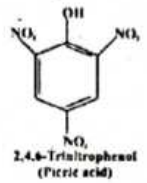
Q.15 The structure of proline is following which is cyclic



Q.16 Glycine is non-essential, neutral amino acid which our body can synthesis.

Q.17 The structure of alanine is $CH_3-CH(NH_2)-COOH$

Q.18 Picric acid is a substituted phenol



Q.19 The structure of alanine is $CH_3-CH(NH_2)-COOH$

Q.20

(i) Identify the amino acids from their sides chains

(ii) Start naming from the amino terminal

(iii) Place suffix-yl at the end of 1st amino acid followed by full name of 2nd amino acid

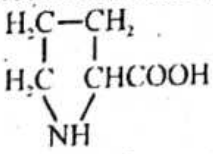
Q.21 Amino acids with polar R group are Serine, Cysteine, Asparagine Tyrosine, Threonine, Glutamine, Aspartic acid, Glutamic acid, Histidine, Lysine and Arginine. They are eleven in number.

Q.22 Amino acids with non-polar R group are nine out of twenty other than the mentioned in the above explanation.

Q.23 Acidic amino acid have more COOH than NH2 groups. Aspartic acid and glutamic acid is an example of acidic amino acid

Q.24 Alanine have methyl group which is non-polar as an alkyl group attached to α-carbon

Q.25 In structure of proline the amino group is secondary which is attached to two carbon atoms



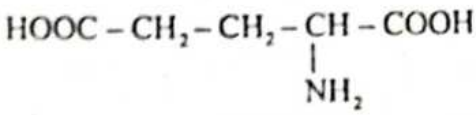
Q.26 Histidine is an example of aromatic amino acid

Q.27 The structure of glycine is

$CH_2(NH_2)-(CH_2)_3-CH(NH_2)-COOH$

There are two amino group and one carboxyl group and it is a basic amino acids. Here the number of oxygen and nitrogen atoms are two in each case.

Q.28



There are two COOH group and only one nitrogen atom in the structure of glutamic acid molecule.

Q.29 All basic amino acids are essential amino acids

Q.30 Isoleucine, methionine and phenylalanine are neutral and essential amino acids while alanine is neutral but non-essential amino acid

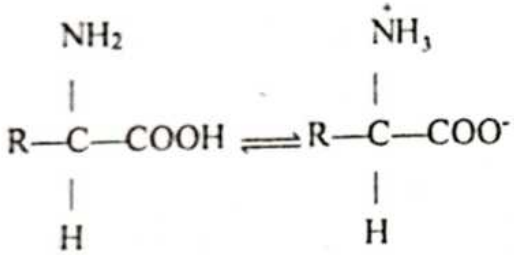
Q.31 Alanine has R group attached to α-carbon

Q.32 Tetrapeptide molecule have three peptide bonds

Q.33 Aspartic acid have more COOH group than NH_2 so it is acidic amino acid

Q.34 Alanine have same number of COOH group and amino group so it is neutral

Q.35



Neutral structure Zwitter ionic structure

Q.36 Carboxyl group is proton donating so it is acid

Q.37 Only α-amino acid can form zwitter ion by transferring proton from COOH group to NH_2 group

Q.38 Lysine have two amino group

Q.39 Alanine is neutral amino acid

Q.40 Only α-amino acid form zwitter ion

Q.41 Formation of zwitter ion involves transfer of proton so it is tautomerism

Q.42 When an alkali is added to an amino acid, NH_3^+ group releases the proton and therefore, the acidic character is due to this group.

Q.44 Peptide are formed by α-amino acid

Q.45 A peptide having molecular mass upto 10,000 is called a polypeptide
A peptide having a molecular mass more than 10,000 is called a protein

Q.46 A peptide having molecular mass upto 10,000 is called a polypeptide
A peptide having a molecular mass more than 10,000 is called a protein

Q.47 The tri-peptide has three amino acids Proline, histidine and aspartic acid

Q.48 A peptide having molecular mass upto or equal to 10, 000 is called a polypeptide
A peptide having a molecular mass more than 10,000 is called a protein

Q.49 Peptides are the compounds formed by the condensation of two or more same or different α – amino acids. The condensation occurs between amino acids with the elimination of water.

Q.50 – CO – NH – linkage is called a peptide linkage.

8C Topic MACROMOLECULES

PRACTICE EXERCISE

ADDITION POLYMERIZATION

Q.1 Polymer of chloroethylene is

A) Teflon
B) Polystyrene
C) PVC
D) Nylon

Q.2 Which one is not synthetic polymer

A) Plastics
B) Neoprene
C) Synthetic fiber
D) Graphite

Q.3 An example of chain growth polymer is

A) Bakelite
B) Terylene
C) Nylon
D) Polyethene

Q.4 Which one of the following is synthetic polymer

A) Protein
B) Starch
C) Nucleic acid
D) Polystyrene

Q.5 All are the uses of PVC except

A) Used in floor covering
B) Manufacturing in gramophone recorders
C) Manufacturing pipe
D) Used in textile fiber

Q.6 The formula of styrene is

A) $CH_2 = CH$ with C_6H_5 attached

B) $CH_2 = CHOH$

C) $CH_2 = CH$ with Cl attached

D) $CH_2 = CH$ with COOH attached

Q.7 Addition polymerization is a _____ reaction

A) Free radical
B) Thermochemical
C) Homolytic
D) All are correct

Q.8 Which of the following is used as a starting material in addition polymerization process

A) Carboxylic anhydride
B) Alkyl peroxide
C) Benzoyl peroxide
D) Benzyl phenoxide

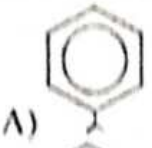
Q.9 What are the conditions for the preparation of polyethylene

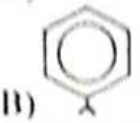
	Temperature	Pressure	Catalysts	Additive
A)	127K	100atm	$Al(C_2H_5)+TiCl_4$	$1\%O_2$
B)	673K	76000 torr	Aluminium triethyl + titanium tetrachloride	$0.1\%O_2$
C)	400°C	1atm	$Al(C_2H_5)_3 + TiCl_4$	$0.1\%O_2$
D)	500K	100atm	Triethyl aluminium + titanium tetrachloride	1%

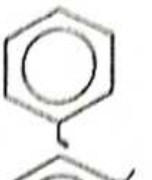
Q.10 What is the condition for manufacturing of PVC?

A) 52°C and 630 torr
B) 325 k and 132.3 psi
C) 52K and 9 atm
D) 650K and 6840 torr

Q.11 Skeletal formula of styrene is

A) 

B) 

C) 

D) 

Q.12 Which of the following is not the use of PVC

A) Making of pipe joint
B) Making of gramophones
C) Making of plastic pipes
D) Making of floor coverings

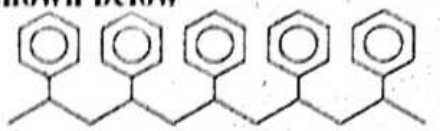
Q.13 Ziegler-Nata ($Al(C_2H_5)_3+TiCl_4$) catalyst is used in preparation of

A) Polyethene
B) Polyesters
C) Nylon, 6-6
D) Polystyrene

Q.14 The monomer used for the manufacture of PVC is obtained by addition of

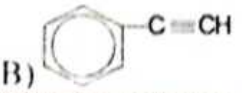
A) Cl_2 to ethylene
B) HCl to ethylene
C) HCl to acetylene
D) Cl_2 to ethane

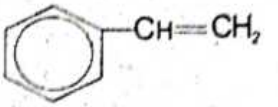
Q.15 An addition polymer is shown below

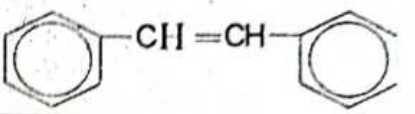


What is the structure of the monomer

A) 

B) 

C) 

D) 

CONDENSATION POLYMERIZATION

Q.16 Choose the polymer which is obtained by condensation polymerization

A) Polyvinyl chloride
B) Polystyrene
C) Polyvinyl acetate
D) Polyester

Q.17 Terylene is an example of

A) Teflon
B) Polyamide
C) Polyethene
D) Polyester

Q.18 The compound used in the manufacture of terylene

A) Ethylene
B) Ethylene glycol
C) Vinyl chloride
D) Adipic acid

Q.19 Polyamide is an example of

A) Addition polymer
B) Condensation polymer
C) Inorganic polymer
D) Natural polymer

Q.20 The polymerization in which by product is formed

A) PVC
B) Polyethylene
C) Polysterene
D) Terylene

Q.21 Which of the following is not true about condensation polymerization

A) Polymerization occur at both side of chain
B) Small molecules like H_2O, alcohol and phenols are produced as byproducts
C) It occurs in bi-functional molecules
D) Only PVC is condensation polymer

Q.22 Which of the following is not used as a functional group for condensation polymerization
A) Esters
B) Diols
C) Di-carboxylic acid
D) C=C

Q.23 Which of the following is not used in clothing industry
A) Polyesters
B) Acrylic resins
C) Polyamide
D) Polyethene

Q.24 Which of the following is not a property of Nylon-6, 6
A) Strength
B) Brittle
C) Elasticity
D) Abrasion resistance

Q.25 Which of the following is not made of polyamides
A) Nylon
B) Wool
C) Artificial silk
D) Natural silk

Q.26 Which of the following is not correct regarding terylene
A) Contains ether linkage
B) Contains ester linkage
C) Contains benzene ring
D) Used in clothing

Q.27 $\left[NH(CH_2)_6NHCO(CH_2)_4CO\right]_n$ **is formula of**
A) Nylon-6,6
B) Nylon-6,4
C) Nylon-2,2
D) Nylon-4,2

Q.28 Polyvinyl chloride consisting on 1000 repeating units has molecular mass
A) 63000
B) 6300
C) 630000
D) 6300000

STRUCTURE OF PROTEINS

Q.29 Zigzag and regular coiling of polypeptide linkage forms
A) Primary structure
B) Tertiary structure
C) Secondary structure
D) Quaternary structure

Q.30 The hydrogen bond in secondary structure of protein is present between
A) O – H
B) C – H
C) N – H
D) F – H

Q.31 Primary structure of proteins shows
A) Folding
B) Coiling
C) Sequence of amino acids
D) It is due to hydrogen bonding

Q.32 Which of the following statement is false about protein
A) Peptide bond is a covalent bond
B) It is a polyamide
C) It contain different sequence of amino acids in different proteins
D) Primary structure is due to hydrogen bonding

Q.33 Which one of the following structure of protein is the direct consequence of hydrogen bonding
A) Primary
B) Secondary
C) Tertiary
D) Quaternary

Q.34 Primary structure of protein arises due to which force
A) Hydrogen bonding
B) Amide linkage
C) Covalent bond
D) Dipole-Dipole forces

Q.35 Secondary structure of protein includes
A) α-helix
B) β-sheets
C) Both A) and B)
D) 3-dimensioal folding

Q.36 Which is true about primary structure
A) Result of replication
B) Result of duplication
C) Result of termination
D) Result of translation

Q.37 Which is not present in an α-helix
A) H-Bond
B) Covalent bond
C) Disulphide linkage
D) Amino acids

Q.38 Which carbon of amino acids bond to nitrogen of another in peptide linkage
A) α-Carbon
B) Side chain carbon
C) β Carbon
D) Carbonyl carbon

STRUCTURE AND FUNCTION OF NUCLEIC ACID (DNA)

Q.39 Which statement is correct about DNA
A) These help in protein synthesis
B) Hydrogen bonding is absent in DNA
C) These help in genetic transmission
D) Ribose sugar is present in DNA

Q.40 The incorrect statement about DNA is
A) It is double stranded
B) It contains thiamine
C) It contains H-Bonding
D) It helps in protein synthesis

Q.41 Duplication of DNA is also called
A) Replication
B) Translation
C) Transcription
D) Nucleolysis

Q.42 DNA is a/an _____
A) Addition polymer
B) Condensation polymer
C) Synthetic polymer
D) Inorganic polymer

Q.43 DNA is directly responsible for product of
A) Protein
B) Lipid
C) Carbohydrate
D) RNA

Q.44 A nucleoside does not contain
A) Sugar group
B) Nitrogenous bases
C) Phosphate group
D) It contains all of these

Q.45 Which of the following element is not present in nucleoside
A) N
B) C
C) O
D) P

Q.46 Which of the following is the property associated to DNA only
A) Hydrogen bonding
B) Replication
C) Presence of purine bases
D) All of these

Q.47 The nucleic acid base which can form 3 hydrogen bonds
A) Cytosine
B) Guanine
C) Both A) and B)
D) Thymine and adenine

Q.48 DNA contains
A) Ribose sugar and thymine
B) Ribose sugar and uracil
C) Deoxyribose sugar and thymine
D) Deoxyribose sugar and uracil

Q.49 Which part is responsible for hydrogen bonding in DNA
A) Nitrogeneous bases
B) Ribose sugar
C) Phosphate group
D) Hydroxide group

Q.50 Which of the following contain 5-membered heterocyclic ring fused with a 6-membered ring
A) Adenine
B) Cytosine
C) Uracil
D) Thymine

PAST PAPERS QUESTIONS

Q.1 **PVC is an example of**
A) Addition polymer
B) Biopolymer
C) Condensation polymer
D) Thermosetting polymer

Q.2 **Polyvinyl chloride is an example of**
A) Condensation polymer
B) Biopolymer
C) Addition polymer
D) Thermosetting polymer

Q.3 **Polystyrene is an addition polymer. Which one of the following structure represent the monomer of polystyrene?**
A) $CH_2=CH_2$
B) $CH_2=CH-CH_3$
C) $CH_2=CH-Cl$
D) $CH_2=CH-C_6H_5$

Q.4 **Which one of the following polymer is a polystyrene**
A) $\left(CH_2-\underset{\displaystyle C_6H_5}{\underset{|}{CH}}\right)_n$
B) $\left(CH_2-CH_2\right)_n$
C) $\left(CF_2-CF_2\right)_n$
D) $\left(CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}\right)_n$

Q.5 **Identify the monomers of Polyvinyl chloride**
A) Vinyl acetate
B) Butyl maleate
C) Styrene
D) Vinyl chloride

Q.6 **Among the following, which compound is formed by addition polymerization**
A) Polystyrene
B) Polyester
C) Nylon
D) Both A & B

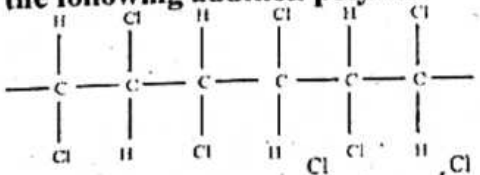
Q.7 **Which is the structure of polyvinyl chloride (polychloroethene)?**
A) -[H_2C-CH-Cl]-
B) [H_2C=CH-Cl]
C) -[CCl_2-CCl_2]-
D) -[HCCl-CH-Cl]-

Q.8 **Disposable cups are made of a polymer polystyrene. Polystyrene is:**
A) A condensation polymer
B) A polyamide
C) An addition polymer
D) A polyester

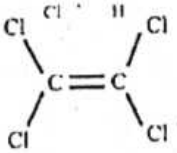
Q.9 **Which of the following compound is additional polymer?**
A) Nylon
B) Polyvinyl chloride
C) Carbohydrate
D) Polyester

Q.10 **Which of the following is addition polymer?**
A) Polyester
B) Acrylic resins
C) Epoxy resins
D) Polyamides

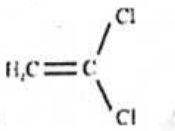
Q.11 **Identify the monomer in the following addition polymer**



A) $H_2C=CH-Cl$



B) ClCH=CHCl



Q.12 The catalyst used for the preparation of acrylonitrile is
A) Al_2O_3 and NH_4Cl
B) Cu_2Cl_2 and NH_4Cl
C) Cu_2Cl_2 and NH_4OH
D) Al_2O_3 and Cu_2Cl_2

Q.13 When hexanedioic acid is heated with hexamethylenediamine the compound formed is
A) Polypeptide
B) Addition polymer
C) Ester
D) Nylon 6, 6

Q.14 Terylene, a polyester is an example of
A) Biopolymer
B) Condensation polymer
C) Lipids
D) Addition polymer

Q.15 Adipic acid and hexamethylene diamine, both of which have _____carbon atoms
A) Seven
B) Eight
C) Six
D) Four

Q.16 Polyvinyl acetate (PVA) is colourless and non-toxic resin used as an adhesive and as a binder for making
A) Emulsion paints
B) Toys
C) Gramophone recorders
D) Compact discs

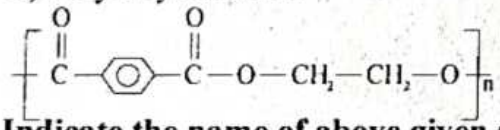
Q.17 Which one of the following is an example of condensation polymer?
A) Polyvinylchloride
B) Polystyrene
C) Polyethene
D) Polyamide

Q.18 Polyamide is formed due to the condensation of hexane-dioic acid with
A) Hexane–1,5–diamine
B) Hexane–1,6–diamine
C) Hexane–1,4–diamine
D) Hexane–2,5–diamine

Q.19 Which one of the following is an example of co-polymer?
A) Polyamide
B) Polystyrene
C) Polyvinyl acetate
D) Polyvinyl chloride

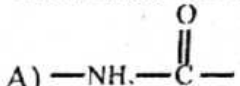
Q.20 Which one of the following polymer is called as Nylon 6,6?
A) Polyester
B) Polyvinylchloride
C) Polyamide
D) Polyvinylacetate

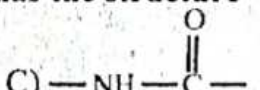
Q.21

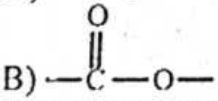


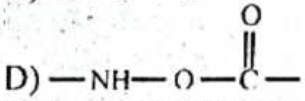
Indicate the name of above given structure
A) Nylon 6,6
B) Adipic acid
C) PVA
D) Polyester

Q.22 The amide linkage, present in Nylon-6,6 has the structure

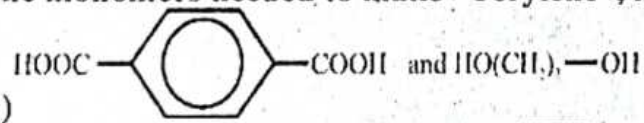
A) 

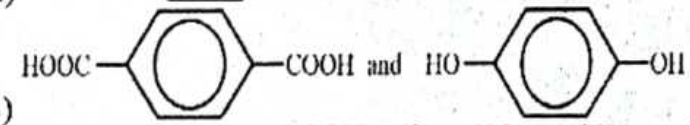
C) 

B) 

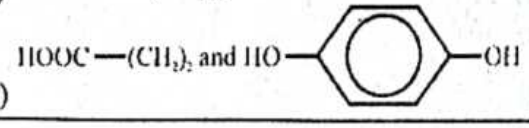
D) 

Q.23 The monomers needed to make "Terylene", i.e. a polyester are

A) 

B) 

C) $HOOC-(CH_2)_2-COOH$ and $-HO-(CH_2)_2-OH$

D) 

Q.24 Nylon-6,6 is also called
A) Polystyrene
B) Polyester
C) Polyamide
D) Polyvinyl alcohol

Q.25 Nylon is a condensation that is used as a textile fiber with high strength and elasticity. The repeating functional group in nylon is
A) Ester
B) Amine
C) Carboxylic acid
D) Amide

Q.26 Collagen and albumin are
A) Derived proteins
B) Simple proteins
C) Polyamide
D) Polysaccharide

Q.27 A polymer in which the number of amino acid residue is greater than 100 or the molecular mass is greater than 10,000 is called
A) Protein
B) Dipeptide
C) Polypeptide
D) Tripeptide

Q.28 Haemoglobin is a
A) Genetic protein
B) Building protein
C) Transport protein
D) Structural protein

Q.29 Phosphoprotein comes under the type of proteins
A) Simple protein
B) Conjugated
C) Derived protein
D) Both A & B

Q.30 Which of the following bond is responsible for joining the amino acids in proteins?
A) Metallic Bond
B) Peptide Bond
C) Di sulfide bond
D) Ionic Bond

Q.31 The proteins which give an amino acid and non-protein group on hydrolysis are known as
A) Derived protein
C) Albumins
B) Conjugated simple protein
D)Conjugated protein

Q.32 Both ribose and deoxyribose are monosaccharides containing _____ carbon atoms.
A) Four
B) Six
C) Five
D) Seven

Q.33 Which one of the following base is not present in RNA?
A) Cytosine
B) Adenine
C) Thymine
D) Guanine

Q.34 Out of these which nitrogen base is NOT present in DNA?
A) Adenine
B) Guanine
C) Uracil
D) Thymine

Q.35 Which one of the following nitrogen base is NOT present in DNA?
A) Adenine
B) Guanine
C) Uracil
D) Cytosine

Q.36 Which one of the followings is the main function of DNA?
A) Making of proteins
C) Breaking of ribose sugar
B) Making of amino acids
D) Carries genetic information

Q.37 The stability in the following structure in due to the
A) Disulfide bridges
B) Presence of unpaired electron in the structure
C) Weak vander Waal's forces
D) Hydrogen bonding between NH group of one peptide with another peptide



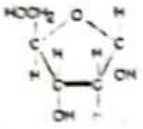
Q.38 According to Watson and Crick's model of DNA, the DNA molecule consists of a double helix. What type of forces are responsible to keep two strands of DNA together?

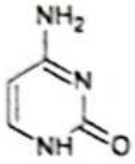
A) Hydrogen bonding
B) Ionic bonding
C) Van der Waal's forces
D) Dipole-induces dipole forces

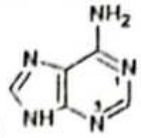
Q.39 The sugar unit in DNA molecule is

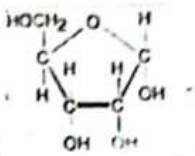
A) Ribose
B) 3-Deoxyribose
C) 2-Deoxyribose
D) 2-Deoxyribose

Q.40 Which one of the given structures represents Deoxyribose sugar?

A) 

B) 

C) 

D) 

ANSWER KEY

1	C	11	C	21	D	31	C	41	A
2	D	12	A	22	D	32	D	42	B
3	D	13	A	23	D	33	B	43	D
4	D	14	C	24	B	34	C	44	C
5	D	15	C	25	C	35	C	45	D
6	A	16	D	26	A	36	D	46	B
7	D	17	D	27	A	37	C	47	C
8	C	18	B	28	A	38	D	48	C
9	B	19	B	29	C	39	C	49	A
10	B	20	D	30	A	40	D	50	A

PAST PAPERS QUESTIONS

1	A	6	A	11	B	16	A	21	D	26	B	31	D	36	D
2	C	7	A	12	B	17	D	22	C	27	A	32	C	37	D
3	D	8	C	13	D	18	B	23	A	28	C	33	C	38	A
4	A	9	B	14	B	19	A	24	C	29	B	34	C	39	C
5	D	10	B	15	C	20	C	25	D	30	B	35	C	40	A

EXPLANATORY NOTES

Q.1 Poly chloroethylene in short is called PVC.

Q.2 Graphite is allotrope of carbon and occurs naturally.

Q.3 Addition polymer is also called chain growth polymer.

Q.4 Proteins, Nuclei acids and starch all exist in living organisms naturally.

Q.5 PVC is a plastic and cannot be used in textile.

Q.7 Addition polymerization is a thermochemical reaction which follows formation of face radicals by homolytic fission.

Q.8 Organic peroxides are used to initiate addition polymerization.

Q.9

$$\text{ethene} \xrightarrow[400^\circ C/100atm, 0.1\%O_2]{Al(C_2H_5)_3 + TiCl_4} \text{polyethene}$$

Q.10 Convert 52°C into kelvin and 9atm into Psi.

Q.12 Pipe joints are commonly made up acrylic resins.

Q.13 High quality polyethylene required Z – N catalyst.

Q.14

$$HC \equiv CH + HCl \longrightarrow CH_2 = \underset{\displaystyle Cl}{\underset{|}{CH}} \xrightarrow{\text{Polymerization}} PVC$$

Q.15 Structure shows polystyrene.

Q.16 Polyester is a condensation polymer.

Q.17 Terylene contains ester linkage.

Q.18 Terylene is made of terephthalic acid and ethylene glycose.

Q.19 Amide linkage is a result of condensation between $-NH_2$ and $-COOH$ groups.

Q.20 Terylene is a condensation polymer.

Q.21 PVC is addition polymer.

Q.22 C = C gives addition.

Q.23 Polyethene is a plastic.

Q.24 Nylon 6,6 is flexible and does not break easily.

Q.25 Artificial silk is made of polyester.

Q.26 Terylene is example of polyesters.

Q.27 Both adipic acid and hexamethylene diamine have 6 carbons each.

Q.28 Mol. Mass = Mol. Mass of repeat unit × DP

$= 63 \times 1000$

$= 63000$

Q.29 Regular coiling gives α-helix.

Q.30

$$>C=\overset{\delta-}{O}---\overset{\delta+}{H}-NH$$

Q.31 Primary structure is order of A.A in a predetermined sequence.

Q.32 Primary structure involves covalent bonding.

Q.33 α-Helix and β-sheets are due to hydrogen bonding.

Q.34 Amino acids are joined in primary structure by covalent bond,.

Q.35

$$2°\text{Structure} \begin{cases} \rightarrow \alpha-\text{helix} \\ \rightarrow \beta-\text{sheets} \end{cases}$$

Q.36 Formation of polypeptide chain from RNA is called translation.

Q.37 2° structure is due to hydrogen bonding.

Q.38 Peptide linkage is between –COOH and $-NH_2$ groups.

Q.39 DNA stores and transfers genetic information.

Q.40 $DNA \xrightarrow{\text{transcription}} RNA \xrightarrow{\text{translation}} \text{Protein}$.

Q.41 DNA duplicates to form copies this called replication.

Q.42 DNA contains phospho-ester linkages.

Q.43 $DNA \xrightarrow{\text{transcription}} RNA \xrightarrow{\text{translation}} \text{Protein}$.

Q.44 Ribose sugar + Nitrogeneous base = Nucleotide.

Q.45 Nucleoside does not have phosphate group.

Q.46 DNA can replicate RNA cannot.

Q.47 There is triple hydrogen bonding between guanine and cytosine.

Q.48 DNA = deoxyribonucleic acid

Sugar = 2-Deoxy ribose

Bases = G, A, T, C

Q.49 Hydrogen bonding occurs between nitrogeneous bases.

Q.50 Purines heterodicyclic = Adenine and Guanine

9C ENVIRONMENTAL CHEMISTRY

Topic » PRACTICE EXERCISE

AIR POLLUTANTS

Q.1 Ozone (O_3) is _____ around us

A) Primary pollutant
B) Not pollutant
C) Secondary pollutant
D) None of these

Q.2 The combustion of coal is one of the source of SO_2 in air because coal contains

A) 1–20% sulphur
B) 1–2% sulphur
C) 1–5% sulphur
D) 1–9% Sulphur

Q.3 The residence time of NO in the atmosphere

A) 3 years
B) 4 days
C) 3 days
D) 2 days

Q.4 Which one of the followings is not a pollutant

A) CO_2
B) CO
C) NO_2
D) SO_2

Q.5 Which one of the following is secondary pollutant of atmosphere

A) CO_2
B) SO_3
C) NO_2
D) H_2SO_4

Q.6 Major sources of NOx pollutants are

A) UV coming from sun
B) Combustion of coal and oil
C) Extensive use of CFC's
D) Detergents

Q.7 Paddy fields produce a significant amount of _____ in the atmosphere as a pollutant

A) CO
B) CH_4
C) CO_2
D) SO_x

Q.8 Which is the most toxic gas?

A) CO_2
B) SO_2
C) NO_2
D) CO

Q.9 Which of the following are the major source of hydrocarbons pollutant

A) Petroleum
B) Coal
C) Automobiles
D) Wood

Q.10 Which property of CO given below is incorrect

A) It is a colourless gas
B) It has pungent odour
C) It is highly toxic gas
D) It is soluble in water

Q.11 What is the effect of CO inhalation

A) Sore throat
B) Eye irritation
C) Nose irritation
D) Suffocation

Q.12 A person is affected with CO gas how can we save him / her by adverse effect of this poisonous gas

A) Drink dilute solution of CH_3COOH
B) Supply pure O_2 for breathing
C) Give more water for drinking
D) All are correct

Q.13 The percentage of SO_2 produced by volcanoes eruption is

A) 62%
B) 65%
C) 63%
D) 67%

Q.14 Natural source of CH_4 is the anaerobic decomposition of organic matter $2CH_2O \xrightarrow{X} CO_2 + CH_4$. Here X is of

A) Smoke
B) Bacteria
C) Metal oxide
D) All of these

Q.15 NO_X and SO_Z are transformed by reaction with O_2 and water into

A) HNO_2, H_2SO_3
B) HNO_3, H_2SO_4
C) HNO_2, H_2SO_4
D) $HNO_3 + H_2SO_3$

Q.16 Paddy fields produce a significant amount of _____ in the atmosphere as a pollutant

A) CO
B) CH_4
C) CO_2
D) SO_x

Q.17 Select the pair which is not air pollutant

A) CO_2, H_2
B) SO_2, H_2S
C) SO_2, O_3,
D) CO, NO

Q.18 Per–oxyacetyl nitrate (PAN) is an irritant to human beings and if affects

A) Eyes
B) Stomach
C) Ears
D) Nose

Q.19 CO is a pollutant and its major source is

A) Absence of methane in atmosphere
B) Fuel burning
C) Forest fires
D) Incomplete combustion of CO_2

CHEMISTRY AND CAUSES OF ACID RAIN

Q.20 SO_2 and SO_3 through various reactions in the atmosphere form

A) Acid rain
B) Acid deposition
C) Sulphate aerosols
D) All of these

Q.21 In some countries there is temporary acid rain, is due to

A) Release of HCl by volcanic eruption
B) Release of NO by volcanic eruption
C) Release of SO_2 by volcanic eruption
D) Release of CH_4 by volcanic eruption

Q.22 Acid rain

A) Has pH 5.6
B) Is controlled by basic rain
C) Effects big marble constructions
D) Is produced in thermosphere

Q.23 Which one of the following is not affect of acid rain

A) It decreases the pH of natural rain
B) It damages the buildings
C) It leaches metals like aluminium mercury and lead from soil
D) It increase the percentage of CO_2 in the atmosphere

Q.24 The source of acid rain

A) Acidic oxides
B) Basic oxides
C) Amphoteric oxides
D) Neutral oxides

Q.25 Acid which must be present in the natural rain in different extent

A) H_2SO_4
B) H_2CO_3
C) HNO_3
D) HCl

Q.26 The pH of normal rain is less than 7 is due to
A) CO_2 C) SO_2
B) NO_2 D) All of these

Q.27 Which of the following is not the demerits of acid rain
A) Damages buildings C) Skin cancer
B) Leach nutrients D) Make soil acidic

Q.28 Acid rain does not cause
A) Leach nutrient C) Increased pH of soil
B) Can damage building material D) Reduce forest growth

Q.29 The metal leached by acid rain of soil and causes suffocation in gills of fishes
A) Calcium C) Aluminium
B) Magnesium D) Iron

Q.30 Acid deposition
(i) Involves both wet and dry deposition
(ii) Makes soils acidic i.e. increase the in pH of soil
(iii) Has pH less than 5
(iv) Is due to C, N, S oxides
A) I, II, III C) II, III, IV
B) I, II, III, IV D) I, III, IV

Q.31 The pH range of acid rain is
A) 7–6.5 C) 6.5–6
B) 6–5.6 **D) Less than 5**

Q.32 One of the followings is not the effect of acid rain
A) It increases the plant capability to resist against cold disease
B) It decreases the pH of natural rain
C) It causes leaching of metals
D) It deprives trees from nutrients

Q.33 SO_2 and NO_2 cause pollution by increasing
A) Alkalinity C) Acidity
B) Buffer action D) Neutrality

Q.34 Which of the following is not a source of SO_2:
A) Decomposition of organic matter C) Volcanoes
B) Combustion of crude oil D) Exhaust of auto mobile

OZONE AND CHLORFLUOROCARBONS (CFC's)

Q.35 The amount of ozone is less in the regions near to:
A) Tropical regions C) North pole
B) South pole D) Equator

Q.36 The main cause of ozone depletion is:
A) Acid rain C) Global warming
B) Use of CFCs D) Burning of solid waste

Q.37 The function of the ozone layer:
A) Filtering UV radiations in the sunlight C) Increasing vitamin D contents in the sunlight
B) Increasing photosynthesis in plant D) Decreasing global warming

Q.38 The high thickness of ozone layer is observed in
A) 25 to 50 km
B) 3 km only
C) 25 to 28 km
D) 1 km only

Q.39 The normal amount of overhead ozone is
A) 300 DU
B) 400 DU
C) 350 DU
D) 450 DU

Q.40 A single chloride free radical can destroy upto _____w_____ ozone molecules.
A) 100
B) 100,000
C) 10,000
D) 100,0000

Q.41 Chlorofluro carbons (CFCs) decomposes in the stratosphere into some free radicals. Which is possibly not responsible for depletion process of ozone
A) $CFCl_2^{\bullet}$
B) $Cl^{\bullet}$
C) $ClO^{\bullet}$
D) $O^{\bullet}$

Q.42 All of the following statements about ozone layer are correct except
A) It depletes every year during Sep-Nov
B) It ranges from 25–28 Km high in stratosphere
C) It's normal overhead amount is 250 DU
D) It is an allotropic form of oxygen

Q.43 Chloroflurocarbons plays and effective role in removing O_3 in the
A) Troposphere
B) Polar region
C) Stratosphere
D) Equator

Q.44 Ozone hole is very dangerous. It is
A) The formation of complex of O_3 with hydrocarbon
B) The depletion in total amount of O_3 stratosphere region
C) The decomposition of O_2 to O_3 in sunlight
D) The increase in concentration of O_3 in tropical region

Q.45 O_3 is produced in most of tropical region by reaction
$O_2 \rightarrow O + O$ and $O_2 + O \rightarrow O_3$ **It is**
A) Photochemical reaction
B) Addition oxidation reaction
C) Redox reaction
D) Oxidation reaction

Q.46 Ozone is a
A) Low boiling point gas
B) High boiling point liquid
C) Low boiling point liquid
D) High boiling point gas

Q.47 Ozone concentration is measured in
A) Debye units
B) Dupent units
C) Debackle units
D) Dobson units

Q.48 Ozone layer filters most of the harmful _____ rays present in the sunlight
A) Ultra violet
B) X-rays
C) Infrared
D) Cosmic rays

Q.49 Which of the following is not the true fact about ozone
A) Damages eyes
B) It is produced in tropical region
C) Concentration of O_3 is more in region close to equators
D) It is disinfectant

Q.50 CFC's destroys O_3 is stratosphere. Which of the following is not a source of CFC's
A) Refrigerator
B) Volatile hydrocarbons
C) Air fresheners
D) Air conditioners

PAST PAPERS QUESTIONS

Q.1 Peroxyacetylene is an irritant to human beings and it effects

A) Ears
B) Eyes
C) Nose
D) Stomach

Q.2 Anaerobic decomposition of organic matter i.e. glucose by bacteria in water sediments produce

A) Propane
B) Methane
C) Ethane
D) Butane

Q.3 _____ is an eye irritant.

A) Peroxyacetyl nitrate
B) Peroxyacetyl nitrite
C) Paramethoxy aniline
D) Peroxyacetyl aniline

Q.4 Which one of the following pollutants can cause death of a person by binding with haemoglobin in red blood cells?

A) Chlorofluorocarbons
B) Oxides of sulphur
C) Carbon monoxide
D) Oxides of nitrogen

Q.5 The gas which is mainly produced in landfills from the waste is

A) CH_4
B) CO_2
C) SO_2
D) Cl_2

Q.6 Which of the following is secondary pollutant?

A) CO
B) PAN
C) SO_2
D) NO_2

Q.7 The unpolluted rain water is slightly acidic due to reaction of rain water with

A) Sulphur dioxide
B) Carbon dioxide
C) Oxides of nitrogen
D) Hydrocarbons present in air

Q.8 The biggest source of acid rain is the oxides of

A) N
B) S
C) O
D) C

Q.9 Which agent is responsible for the acid rain_____

A) O_2
B) $Ca(SO_4)$
C) NO_2
D) HNO_3 & H_2SO_4

Q.10 Which of these pollutants is produced by during of coal and causes acid rain

A) CO_2
B) NO
C) SO_2
D) CO

Q.11 Which of the following are all harmful effects of acid rain?

A)
- Causes thunder storms
- Causes global warming
- Damages building and statues

B)
- Affects aquatic life
- Causes global waring
- Damages buildings and statues

C)
- Affects aquatic life
- Leaches nutrients from the soil
- Damages buildings and statues

D)
- Causes thunder storms
- Leaches nutrients from soil
- Damages buildings and statues

Q.12 Ozone concentration is measured in

A) Debye units
B) Dupent units
C) Debackle units
D) Dobson units

Q.13 _____ is the major source of acid deposition in the atmosphere

A) SiO_2
B) CO_2
C) SO_2
D) Al_2O_3

Q.14 The energy from the ultraviolet light is sufficient to break the _____ bond in CCl_2F_2

A) Cl – Cl
B) C – Cl
C) Cl – F
D) C – F

Q.15 Which of the following would react with ozone in the atmosphere?

A) $F^{\bullet}$
B) $O^{\bullet}$
C) O_2
D) $Cl^{\bullet}$

Q.16 Which of following compounds is responsible for the depletion of ozone layer?

A) Carbon tetrachloride
B) Methane
C) Hydroflorocarbons
D) Choroflorocarbons

Q.17 Chlorofluorocarbons (CFCs) are important compounds which are used as refrigerants but these are also responsible for Ozone layer depletion. If a Chlorofluorocarbon $CFCl_3$ is present in stratosphere, which of it's reaction intermediates are actually responsible for the breakdown of Ozone molecule?

A) $Cl^{\cdot}$ and $ClO^{\cdot}$
B) $CFCl_2^{\cdot}$ and $CFCl_3$
C) $CFCl_2^{\cdot}$ and $Cl^{\cdot}$
D) $CFCl_2^{\cdot}$ and $ClO^{\cdot}$

Q.18 A single chloride free radical can destroy ozone molecule upto

A) 100,000
B) 100,0000
C)10,000
D) 1000

Q.19 Chlorofluorocarbon cause depletion of ozone layer in the stratosphere since they can produce

A) Atomic oxygen on reaction with ozone
B) Strongly oxidizing fluorine gas
C) Chlorine free radical by fission of C–Cl bond
D) Fluoride ion by C–F by bond breakage

Q.20 The yellowish brown color in photochemical smog is due to the presence of

A) SO_2 (sulphur dioxide)
B) CO (carbon monoxide)
C) CO_2 (carbon dioxide)
D) NO_2 (nitrogen dioxide)

ANSWER KEY

1	C	11	D	21	A	31	D	41	D
2	D	12	B	22	C	32	A	42	C
3	B	13	D	23	D	33	C	43	C
4	A	14	B	24	A	34	D	44	B
5	D	15	B	25	A	35	D	45	A
6	B	16	B	26	A	36	B	46	A
7	B	17	A	27	C	37	A	47	D
8	D	18	A	28	C	38	C	48	A
9	C	19	B	29	C	39	C	49	C
10	B	20	D	30	D	40	B	50	B

PAST PAPERS QUESTIONS

1	B	6	B	11	C	16	D
2	B	7	B	12	D	17	A
3	A	8	B	13	C	18	A
4	C	9	D	14	B	19	C
5	A	10	C	15	D	20	D

EXPLANATORY NOTES

Q.1 Because it produced by reaction of two primary pollutants i.e. NOx and VOCs.

Q.2 Coal is formed by carbonization of wood which contain sulphur.

Q.3 Greater the residence time more adverse the pollutant i.e. residence time of NO_2 is 3 days.

Q.4 CO_2 is one of the component of air. It is not harmful to human upto normal concentration and used by the plants for photosynthesis.

Q.5 Coal and oil are fossil fuels formed by the decomposition of plants and animals which contain nitrogen as essential constituent.

Q.7 Paddy fields contain large amount of water due to which anaerobic decomposition of organic matter take place.

$$2CH_2O \xrightarrow{\text{Bacteria}} CO_2 + CH_4$$

Q.9 Fossil fuels are major source of hydrocarbon fuel.

Q.10 It is colourless and odourless gas.

Q.11 It binds hemoglobin in the blood and reduce the oxygen required for normal respiration.

Q.12 It restore the hemoglobin ability to carry oxygen.

Q.14 Natural source of CH_4 is the anaerobic decomposition of organic matter required bacteria.

Q.15

$$NO_2 + H_2O \longrightarrow HNO_3$$
$$SO_3 + H_2O \longrightarrow H_2SO_4$$

Q.18 PAN is a secondary pollutant.

Q.19 Incomplete combustion of fossil fuel produce CO.

Q.20 $SO_2 + \frac{1}{2}O_2 + H_2O \longrightarrow H_2SO_4$

Q.22 Marble contain $CaCO_3$ which react with acid rain.

$$H_2SO_4 + CaCO_3 \longrightarrow CaSO_4 + CO_2 + H_2O$$

Q.23 $2HNO_3 + CaCO_3 \longrightarrow Ca(NO_3)_2 + CO_2 + H_2O$

Q.24 Oxides of non-metals are acidic in nature i.e. CO_2, SO_2, NO_2.

Q.25 Formed in air $H_2O + CO_2 \longrightarrow H_2CO_3$

Q.26 Because air contain H_2O vapours and CO_2 which react to form H_2CO_3.

Q.31 Due to formation of H_2SO_4, HNO_3 and H_2CO_3.

Q.33 By the reaction with rain water.

Q.34 SO_2 formed H_2SO_4 not SO_2.

Q.36 CFCs produce $\dot{C}l$ free radical in UV radiation which react with ozone and deplete it.

Q.38 Otherwise these rays cause various heath problem i.e. damages eyes, decreases elasticity of lungs etc.

Q.39 As we move away from earth density of O_2 decrease which form O_3 in stratosphere.

Q.40

$$CFCs \xrightarrow{hv} \dot{C}FCl_2 + \dot{C}l$$

$$\dot{C}l + O_3 \longrightarrow Cl\dot{O} + O_2$$

$$\dot{C}lO + O_3 \longrightarrow \dot{C}l + 2O_2$$

Q.42 Normal amount of O_3 in stratosphere 350DU.

Q.43 25 to 28km O_3 layer is thick.

Q.44 It allows harmful UV rays enter in the earth and cause heath problems like sink cancer in humans and animals.

SELF ASSESSMENT TEST CHEMISTRY

UNIT 1 FUNDAMENTAL CONCEPTS

SELF ASSESSMENT TEST

Q.1 Which of the following is pure substance

A) Distilled water
B) $NaCl_{(aq)}$
C) Sea water
D) Brass

Q.2 1 amu = ?

A) 1.661×10^{-27}g
B) 1.661×10^{-24}kg
C) 1.661×10^{-19}kg
D) 1.66×10^{-21}mg

Q.3 Naturally occurring isotopes of silver are

A) Two
B) Sixteen
C) Four
D) Forty seven

Q.4 Mass of an atom of C is

A) $\frac{12}{N_A}$g
B) $12\times1.661\times10^{-24}$g
C) 12amu
D) All of these

Q.5 1gram molecule refers to amount in grams

A) Equivalent to 1 mole of an atom
B) Equivalent to 1 mole of a molecule
C) Equivalent to 1 mole of an ionic species
D) Of an ionic compound

Q.6 1gram formula refers to:

A) Amount in grams equivalent to 1 mole of a atom
B) Amount in grams equivalent to 1 mole of a covalent compound
C) Amount in grams equivalent to 1 mole of a ionic compound
D) Amount in grams equivalent to 1 mole of an ion

Q.7 One mole of SO_2 contains

A) 6.022×10^{23} atoms of oxygen
B) 6.022×10^{23} atoms of sulfur
C) 18.1×10^{23} molecules of SO_2
D) 4 g molecule of SO_2

Q.8 The mass of 1 mole of magnesium atoms is 24g. What is the mass of one magnesium atom in grams

A) 6.02×10^{23}
B) 3.99×10^{-23}
C) 6.02×10^{-23}
D) 3.99×10^{23}

Q.9 The approximate number of molecules present in 3g of H_2O is

A) 3×10^{23}
B) $3\times6.01\times10^{23}$
C) 1×10^{23}
D) 2×10^{23}

Q.10 The largest number of molecules are present in

A) 3.6 of H_2O
B) 2.8 g of CO
C) 4.6 g of C_2H_5OH
D) 5.4 g of N_2O_5

Q.11 40g of calcium is

A) 1 gram of Ca
B) 1 gram atom of Ca
C) 1 atom of Ca
D) 1 gram ion of Ca

Q.12 How many atoms of carbon are present in 34.2g of sucrose

A) 6.02×10^{22}
B) 7.2×10^{23}
C) 3.6×10^{23}
D) 1.2×10^{22}

Q.13 If a ring is made up of 6g diamond, then number of atoms present in it are

A) 6.02×10^{23}
B) 3.01×10^{23}
C) 1.5×10^{23}
D) 7.5×10^{22}

Q.14 Moles of protons in 20g of SO_3

A) 10
B) 40
C) 20
D) 80

Q.15 The mass of 10^{-3} moles of $MgSO_4$ is

A) 0.12g
B) 1.12g
C) 2.12g
D) 4.12g

Q.16 Which of the following contains same number of atoms as 12g of Mg

A) 12g Carbon
B) 5g Neon
C) 10g Neon
D) 3g Carbon

Q.17 Equal volumes of CO and N_2 are taken in identical conditions, The correct relationship between masses of two gases is

A) $CO < N_2$
B) $N_2 < CO$
C) $CO = N_2$
D) All of these

Q.18 The largest number of molecules are present in

A) 44g CO_2
B) 36g H_2O
C) 98g H_2SO_4
D) 180g of $C_6H_{12}O_6$

Q.19 The Avogadro's number of atom or molecules or formula units of a substance is called its

A) Molecular weight
B) Molecular mass
C) Mole
D) None of these

Q.20 Which of the following quantity is not 1mole

A) 1g atom of an element
B) 1 atomic mass unit
C) 1g formula of an ionic compound
D) 1g molecule of covalent compound

Q.21 18.02g of H_2O

A) 1 mole of hydrogen atoms
B) ½ mole of oxygen atoms
C) 6.022×10^{23} moles of H_2O
D) 6.022×10^{23} molecules of H_2O

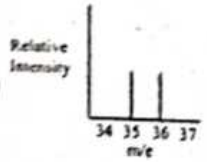
Q.22 A unit which represents 6.02×10^{23} particles is called

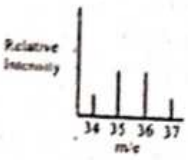
A) Mole
B) 1 gram ionic mass
C) 1 gram molecule nitrogen
D) All of these

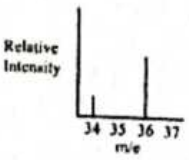
Q.23 Mass spectrometry is used to determine the

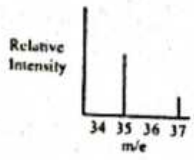
A) Number of isotopes of an element
B) Relative abundance of isotopes
C) Relative isotopic masses
D) All of these

Q.24 The relative atomic mass of chlorine is 35.5. Which one of the following is the mass spectrum of chlorine

A) 

B) 

C) 

D) 

Q.25 The height of the peak in the mass spectrum shows
A) Number of isotopes
B) Mass number
C) Relative abundance
D) Number of protons

Q.26 The element showing 100% abundance in mass spectrum is
A) Chlorine
B) Arsenic
C) Bromine
D) Hydrogen

Q.27 An element X has two isotopes X–35 and X–37 with average atomic mass 35.5 amu. Relative abundance of both isotopes is respectively
A) 25%, 75%
B) 40% and 60%
C) 50% both
D) 75%, 25%

Q.28 % of nitrogen in urea (NH_2CONH_2)
A) 82.35%
B) 35%
C) 46.6%
D) 55.56%

Q.29 A compound contains 50% sulphur and 50% oxygen by mass. The empirical formula of the compound is
A) S_2O_3
B) SO_3
C) SO_2
D) SO

Q.30 Empirical formula of vitamin C (Ascorbic acid) is
A) $C_3H_4O_3$
B) $C_4H_8O_7$
C) $C_3H_6O_3$
D) $C_6H_{12}O_6$

Q.31 If empirical formula of a compound is CH_2 and its molecular mass is 56amu. What will be its molecular formula
A) CH_2
B) C_3H_6
C) C_2H_4
D) C_4H_8

Q.32 Molecules formula = n × (empirical formula), which statement is correct about 'n'
A) It can never be unity
B) It may be negative
C) It can never by zero
D) Not predictable

Q.33 Styrene has empirical formula CH, and there is 92.2%C and 7.75% hydrogen. If molar mass is 104g mol^{-1}, what will be integral multiple (n) to get molecular formula
A) 2
B) 6
C) 4
D) 8

Q.34 Combustion analysis is performed for the determination of
A) Molar mass of the compound
B) Structural formula of the substance
C) Empirical formula of the compound
D) Mass of halogens present in organic compounds

Q.35 The stoichiometric calculations for a chemical reaction results in
A) Actual yield
B) Percentage yield
C) Theoretical yield
D) Exprimental yield

Q.36 5604 cm^3 of H_2 gas at STP contains atoms of hydrogen
A) 6.02×10^{23}
B) 3.01×10^{23}
C) 2.6×10^{22}
D) 1.50×10^{23}

Q.37 Gram atoms of hydrogen in 5.5g H_2
A) 5.50
B) 2.25
C) 5.45
D) 2.20

Q.38 4g of an unknown gas occupies 5.6dm^3 volume, at S.T.P the gas is
A) SO_2
B) O_2
C) CH_4
D) H_2S

Q.39 **10 moles of HCl is added to excess to magnesium and forms 4 moles of hydrogen gas percentage yield is**

A) 40% C) 80%

B) 60% D) 100%

Q.40 **Which of the following is a limitation of balanced chemical equation**

A) Conditions and rate of reactions

C) Physical state and mechanism

B) Reactants and products and their coefficients

D) Both A) and B)

Q.41 **How much oxygen is required to react 16g of S to form SO_2**

A) 32g C) 24g

B) 16g D) 64g

Q.42 **Theoretical yield is always less than the actual yield because**

A) Some product is lot in the experiment

B) Reversible reaction may occur

C) Errors are made in weighing the reactants or the products

D) The given statement is not correct

Q.43 **The actual yield of a product is 8g, then experimental yield will be _____ while reaction is 80% efficient**

A) 8g C) 10g

B) 12g D) 14g

Q.44 **4 moles of hydrogen react with 5 moles of oxygen to form water, identify the excess reagent**

A) Hydrogen C) Water

B) Oxygen D) All of these

Q.45 **If 15g of sulphur are burnt, what volume of SO_2 is produced at STP?**

A) 10.51dm^3 C) 30dm^3

B) 20dm^3 D) 100dm^3

Q.46 **If you have 3.5 moles of hydrogen and 5 moles of nitrogen to produce ammonia. How much ammonia is produced**

A) 34.08g C) 17.04g

B) 39.6g D) None of these

Q.47 **Which of the following conditions of temperature and pressure are the standard conditions (STP)**

A) 0°C and 1 atm pressure C) 32°F and 760 torr

B) 273k and 14.7 PSI D) All of these

Q.48 **Which one is experimental equation**

A) Rate equation C) Stoichiomeric equation

B) Rate expression D) Both A) and B)

Q.49 **Number of molecules of sugar in 1dm^3 of 1M sugar solution is:**

A) 6.02×10^{23} C) 6.02×10^{20}

B) $3.42 \times 6.02 \times 10^{22}$ D) 1.80×10^{23}

Q.50 **A solution of glucose is 10%. The volume in which 1g mole of it will be dissolved is**

A) 1 dm^3 C) 1.8 dm^3

B) 200 dm^3 D) 180 dm^3

Q.51 **How many grams of NaOH are present in 250 cm^3 of its 0.2M solution**

A) 4 g C) 0.4 g

B) 10 g D) 2 g

Q.52 In a solution, 7.8 g of benzene (C_6H_4) and 46g of toluene ($C_6H_5CH_3$) is present. The mole fraction of toluene is

A) $\frac{1}{3}$ C) $\frac{2}{3}$

B) $\frac{1}{5}$ D) $\frac{5}{6}$

Q.53 Which concentration unit is best applicable to a solution having more than two components

A) %v/v C) Mole fraction

B) Molarity D) %w/w

Q.54 41g of calcium nitrate was used to create 1.25M solution, volume of solution will be

A) $0.2cm^3$ C) $5dm^3$

B) $20dm^3$ D) $2dm^3$

Q.55 A solution is made by mixing 250g hexane and 50g octanol, mass percent of octanol is

A) 20% C) 83.3%

B) 16.66% D) 50%

Q.56 What is the mass of water in 15% NaCl solution by mass

A) 15g C) 85g

B) 30g D) 100g

Q.57 In a mixture of 7g of N_2 and 8g of O_2 the mole fraction of O_2 is

A) 1 C) 0.5

B) 0.1 D) 0.2

Q.58 The sum of the mole fractions of the two components of a solution is always

A) More than one C) Exactly one

B) Less than one D) Not fixed

Q.59 A solution contains A, B and C components. The mole fraction of A and C are 0.25 and 0.35 respectively, the mole fraction of B will be

A) 0.005 C) 0.05

B) 0.0025 D) 0.40

Q.60 %w/v of 3M aqueous solution of limestone is

A) 3% C) 30%

B) 60% D) 90%

ANSWER KEY

1	A	11	B	21	D	31	D	41	B	51	D
2	D	12	B	22	D	32	C	42	D	52	D
3	A	13	B	23	D	33	D	43	C	53	C
4	D	14	A	24	D	34	C	44	A	54	C
5	B	15	A	25	C	35	C	45	A	55	B
6	C	16	C	26	B	36	B	46	B	56	C
7	B	17	C	27	D	37	A	47	D	57	C
8	D	18	B	28	C	38	C	48	D	58	C
9	C	19	C	29	C	39	A	49	A	59	D
10	A	20	B	30	A	40	D	50	C	60	C

2 UNIT STATES OF MATTER

SELF ASSESSMENT TEST

Q.1 Gases exert pressure on the walls of the container because the gas molecules

A) Collide with each other
B) Have definite volume
C) Collide with walls of container
D) Obey the gas laws

Q.2 Which one of the following is absolute zero

A) 0 K
B) 273 K
C) 20 K
D) –273K

Q.3 Crystalline solids are classified on the basis of bonding into _____ types

A) Two
B) Seven
C) Five
D) Four

Q.4 The number of molecules in 0.0112m^3 of methane at 0°C and pressure of 760mm Hg is

A) 6.02×10^{20}
B) 3.01×10^{12}
C) 6.02×10^{23}
D) 3.01×10^{23}

Q.5 Which of the following will have same number of molecules at STP

A) 280 cm^3 of CO_2 and 280 cm^3 of N_2O
B) 44g of CO_2 and 11.2 dm^3 CO
C) 11.2 dm^3 of O_2 and 32 g of O_2
D) 28g of N_2 and 5.6 dm^3 of oxygen

Q.6 The graph between pressure and inverse of volume at constant temperature and number of moles

A) Straight line parallel to x-axis
B) Straight line parallel to y-axis
C) Straight line passing through the origin
D) None of them

Q.7 In a closed vessel of 1000 cm^3, H_2 gas is heated from 27°C To 127°C. Which statement is not correct?

A) The rate of collision increases
B) Pressure of gas increases
C) The energy of gas molecules increases
D) The number of moles of gas increases

Q.8 The molecules of gas show more deviation from ideal behaviour at low temperature, because

A) Kinetic energies are increased
B) Densities of the gases increased
C) Collisions become less frequent
D) Attractive force dominate at low temperature

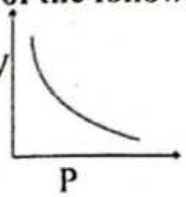
Q.9 The gas laws are best applicable under the conditions

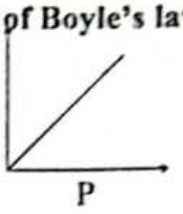
A) High P, Low T
B) High T, and polar gas
C) Low P, High T
D) High P and larger molecular size

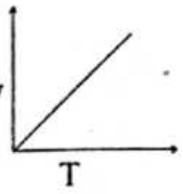
Q.10 The root mean square velocity is expressed as

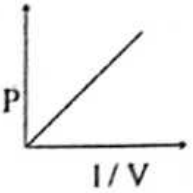
A) $\left(\frac{3}{2}RT\right)^{\frac{1}{2}}$
B) $\left(\frac{2RT}{M}\right)^{\frac{1}{2}}$
C) $\left(\frac{3RT}{M}\right)^{\frac{1}{2}}$
D) $\left(\frac{8RT}{\pi M}\right)^{\frac{1}{2}}$

Q.11 Which of the following is graphical explanation of Boyle's law

A) 

C) 

B) 

D) 

Q.12 At constant pressure, volume of a given mass of a gas is directly proportional to

A) Temperature
B) Pressure
C) Number of moles
D) Absolute temperature

Q.13 Absolute zero is unattainable temperature, current attempts have resulted in the lowest temperature of

A) 10^{-1} K
B) 10^{-5} K
C) 10^{-2} K
D) 10^{-7} K

Q.14 If temperature is increasing continuously then constant 'k' in PV = k will

A) Increase
B) Constant
C) Decrease
D) Unpredictable

Q.15 What will happen to density of an ideal gas, if both temperature and pressure are doubled

A) Increase two times
B) Decrease four times
C) Increase four times
D) Remain Same

Q.16 100 m^3 of a gas at 3atm and 27°C is transferred into a container having volume 300m^3 and temperature 327°C. Pressure in new container will be

A) 2 atm
B) 3 atm
C) 4 atm
D) 6 atm

Q.17 Value of general gas constant 'R' depends upon

A) Nature of gas
B) Units of P and T
C) Mass of gas
D) Units of P and V

Q.18 Which of the following molecules have maximum root mean square velocity at 25°C

A) CO_2
B) NH_3
C) H_2S
D) SO_2

Q.19 Which of the following gas show maximum ideal behavior

A) NH_3
B) N_2
C) CO_2
D) SO_2

Q.20 Which mathematical relationship doesn't correctly represent behavior of an ideal gas

A) $P \propto CT$
B) $P \propto \frac{1}{d}$
C) $PM \propto dT$
D) Both A) and B)

Q.21 The density of methane at 2atm pressure at 27°C is

A) 26 gdm^{-3}
B) 0.26 gdm^{-3}
C) 1.3 gdm^{-3}
D) 0.13 gdm^{-3}

Q.22 The correct mathematical form of Avogadro's law is

A) $P_1V_1=P_2V_2$

B) $\frac{V_1}{T_1}=\frac{V_2}{T_2}$

C) $\frac{V_1}{V_2}=\frac{n_1}{n_2}$

D) $\frac{P_1}{P_2}=\frac{n_1}{n_2}$

Q.23 When one is most real at STP

A) NH_3
B) H_2
C) He
D) Ar

Q.24 The deviation of a gas form ideal behavior is maximum at

A) –10°C and 5.0 atm
B) –10°C and 2 atm
C) 100°C and 2.0 atm
D) 0°C and 2 atm

Q.25 If absolute temperature is doubled and the pressure is increased to 4 times, the volume of gas is

A) Half
B) Double
C) Four times
D) Unchanged

Q.26 The average K.E. of the gas molecules is

A) Inversely proportional to its absolute temperature
B) Directly proportional to its absolute temperature
C) Equal to the square of its absolute temperature
D) Directly proportional to the square root of its absolute temperature

Q.27 The compressibility factor (Z) for an ideal gas is

A) Zero
B) Greater than 1
C) Less than 1
D) Equal to one

Q.28 If we increase or decrease the amount of heat to a liquid, its boiling point will

A) Increase
B) Decrease
C) Remain constant
D) Increase or decrease accordingly

Q.29 Which is the correct order of boiling points

A) $H_2O > HF > NH_3 > CH_4$
B) $H_2O > NH_3 > HF > CH_4$
C) $H_2O > HF > CH_4 > NH_3$
D) $H_2O > NH_3 > CH_4 > HF$

Q.30 Evaporation of water depends upon the following

A) Surface area and intermolecular forces
B) Speed of the air above the liquid surface
C) Humidity in air
D) All of these

Q.31 110°C boiling point of water corresponds to the external pressure

A) Between 760 to 1200 torr
B) 765 torr
C) Between 200 to 760 torr
D) Any value of pressure

Q.32 The boiling point of compound is mostly raised by

A) Dipole induced dipole interaction
B) London dispersion forces
C) Inter-molecular Hydrogen bonding
D) Intra-molecular Hydrogen bonding

Q.33 Which has greater enthalpy of vapourization

A) F_2
B) Br_2
C) Cl_2
D) I_2

Q.34 Identify incorrect statement about evaporation

A) Continuous
B) Cooling
C) Exothermic
D) Surface Phenomenon

Q.35 **Maximum vapour pressure is shown by**
A) 1dm^3 water
B) 50 cm^3 ethanol
C) 1dm^3 ethanol
D) Both B) and C)

Q.36 **Evaporation occurs at**
A) 25°C
B) 40°C
C) 0°C
D) All temperatures

Q.37 **Which one is the most accurate method for the measurement of vapour pressure**
A) Barometric method
B) Manometric method
C) Dilatometric method
D) Optical rotation method

Q.38 **The vapour pressure of methanol at 40°C is less than**
A) Water
B) Ether
C) Glycerin
D) Acetic acid

Q.39 **Ionic crystals are characterized by**
A) Low melting point
B) High vapour pressure
C) Solubility in polar solvents
D) Good conductivity in solid state

Q.40 **NaCl crystal is**
A) Cubic
B) Hexagonal
C) Tetragonal
D) Triclinic

Q.41 **Which element exists as discrete small molecule in the solid state**
A) Aluminium
B) Sodium chloride
C) Iodine
D) Diamond

Q.42 **Ice floats on the liquid water because**
A) Density of water is maximum at 4°C
B) Water freezes at 0°C and is less dense than liquid water
C) Ice occupies less volume than water at 0°C
D) Both B) and C)

Q.43 **Number of tetrahedral carbon atoms in unit cell of diamond is**
A) 1
B) 2
C) 3
D) 4

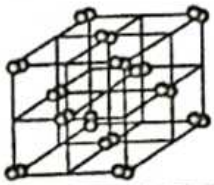
Q.44 **The number of Cl^{-1} ions per unit cell of NaCl are**
A) 6
B) 4
C) 2
D) 8

Q.45 **The crystal of diamond is**
A) Ionic
B) Molecular
C) Covalent
D) Metallic

Q.46 **One unit cell of NaCl contains ion pairs**
A) Two
B) Four
C) Six
D) Eight

Q.47 **Which is not a property of silica**
A) High surface activity
B) Refractory
C) Insulator
D) High thermal expansion

Q.48 **Silicon (IV) oxide crystal is an example of**
A) Ionic crystal
B) Covalent crystal
C) Metallic crystal
D) Molecular crystal



Q.49 **Carbon atom in diamond is**
A) sp hybridized
B) sp^3 hybridized
C) sp^2 hybridized
D) dsp^2 hybridized

Q.50 The given crystal lattice is for

A) Sodium chloride
B) Diamond
C) Ice
D) Iodine

Q.51 The volume of ice on freezing 200cm^3 of water will be

A) 109cm^3
B) 209cm^3
C) 218cm^3
D) 200cm^3

Q.52 I – I bond distance difference between $I_{2(g)}$ and $I_{2(s)}$ is

A) 271.5 pm
B) 4.9 pm
C) 266.6 pm
D) 9.6 pm

Q.53 Which one of the following contains maximum hydrogen bonding

A) H_2O
B) NH_3
C) HF
D) C_2H_5OH

Q.54 Ammonia shows the maximum boiling point because of

A) Lone pair of electrons present on nitrogen
B) Very small size of nitrogen
C) Pyramidal structure of ammonia
D) Enhanced electronegativity character of nitrogen

Q.55 The boiling point of H_2O is 100°C while that of C_2H_5 OH is 78.37°C. The reason is that

A) H_2O molecules are small sized
B) The bond angles at oxygen atom are different.
C) C_2H_5 group is electron donating
D) The number of hydrogen bonds per H_2O molecule are greater than C_2H_5OH

Q.56 Which of the following in liquid has lowest boiling point

A) CH_3COOH
B) H_2O
C) CH_3OH
D) C_2H_5OH

Q.57 In which of the following of the pairs, Debye forces exist

A) Water and ethanol
B) Methane and ethane
C) Argon and water
D) Water and Na^+ ion

Q.58 Kerosene oil is liquid at room temperature due to

A) Debye forces
B) Hydrogen bonding
C) London dispersion forces
D) Dipole - dipole forces

Q.59 The heat of vaporization of H_2O, C_2H_5OH and CS_2 are 40.6 kJ/mol, 38.6kJ/mol and 28.6kJ/mol respectively. The order of decreasing intermolecular forces in these liquids is

A) $H_2O > C_2H_5OH > CS_2$
B) $CS_2 > C_2H_5OH > H_2O$
C) $H_2O > CS_2 > C_2H_5OH$
D) $CS_2 > H_2O > C_2H_5OH$

Q.60 The different substances are given along with their boiling points in the following table

Substance	Boiling Point	Substance	Boiling Point
HF	19.9°C	C_2H_5OH	78.37°C
NH_3	-33.34°C	$C_2H_5OC_2H_5$	34.6°

Select the substance having weakest intermolecular forces

A) HF
B) NH_3
C) C_2H_5OH
D) $C_2H_5OC_2H_5$

ANSWER KEY

1	C	11	D	21	C	31	A	41	C	51	C
2	A	12	D	22	C	32	C	42	B	52	B
3	D	13	B	23	A	33	D	43	D	53	A
4	D	14	A	24	A	34	C	44	B	54	D
5	A	15	D	25	A	35	D	45	C	55	D
6	C	16	A	26	B	36	D	46	B	56	C
7	D	17	D	27	D	37	B	47	D	57	C
8	D	18	B	28	C	38	B	48	B	58	C
9	C	19	B	29	A	39	C	49	B	59	A
10	C	20	B	30	D	40	A	50	D	60	B

UNIT 3 ATOMIC STRUCTURE CHEMICAL BONDING

SELF ASSESSMENT TEST

Q.1 Charge on 1kg of electrons is

A) 9.1095×10^{-31}C
B) 1.602×10^{-19}C
C) 1.7588×10^{11}C
D) 1

Q.2 The mass of neutron is

A) 1.675×10^{-27} kg
B) 1.0087amu
C) 1.675×10^{-24}g
D) All of these

Q.3 The e/m value of He^{+1} ion in comparison to e/m value of electron is

A) 7344 times lesser
B) 1836 times lesser
C) 1836 times greater
D) 7344 times greater

Q.4 What will be the effect on electron when passed through the electric field

A) Deflection towards anode
B) Deflection towards cathode
C) Deflection perpendicular to electric field
D) Deflection downwards in electric field

Q.5 X specie carry +3 charge and number of electron and neutrons are 10 and 14 respectively. What is the atomic mass of X

A) 24
B) 27
C) 21
D) 17

Q.6 Which of the followings set of ions is isoelectronic

A) Sc^{+3}, Ca^{+2}, S^{-2}
B) H^-, H and H^+
C) F^-, Ne and Na
D) Li^+, Na^+ K^+

Q.7 Which of the following particles would on losing an electron has its outermost p-orbital as half filled

A) N atom
B) O^+ ion
C) P^{-1} ion
D) S^{+1} ion

Q.8 Isotopes differ in

A) Properties with respect to their mass number
B) Properties with respect to their proton number
C) Properties of with respect to their atomic number
D) With respect to chemical properties

Q.9 Which property is same for two nuclides $^{40}_{18}Ar$ and $^{40}_{19}K$

A) Number of electrons
B) Number of nucleons
C) Number of neutrons
D) Number of protons

Q.10 The correct set of four quantum numbers for the valence electron of potassium (Z = 19) is

A) n = 4, l = 0, m = 0 and s = +1/2
B) n = 4, l = 1, m = 1 and s = +1/2
C) n = 4, l = 1, m = 0 and s = +1/2
D) n = 3, l = 0, m = 0 and s = +1/2

Q.11 Identify the correct order of decreasing energy

A) 3s > 2s > 1s
B) 2s > 3s > 1s
C) 1s > 2s > 3s
D) 1s > 3s > 2s

Q.12 Correct number of degenerate orbitals

A) p = 6, d = 10, f = 14
B) p = 1, d = 2, f = 3
C) p = 3, d = 5, f = 7
D) p = 3, d = 7, f = 5

Q.13 The maximum number of electrons in subshell can be calculated by using formula

A) $2\ell + 1$
B) $2n^2$
C) $2(2l+1)$
D) $n + l$

Q.14 The incorrect statement about d-orbitals

A) It is not present in first two principle energy levels
B) They are associated with only transition elements
C) They are five degenerate orbitals in d-subshell
D) d-orbitals can filled before p-orbitals in the same principle energy level

Q.15 Valence electron of K has _____ value for spin quantum number with _____ spin

A) $+\frac{1}{2}$, clockwise
B) $+\frac{1}{2}$, anticlockwise
C) $-\frac{1}{2}$, clockwise
D) $-\frac{1}{2}$, anticlockwise

Q.16 Fourth shell can accommodate 32 electrons how many electron can be placed in 5th shell

A) 32
B) 40
C) 46
D) 50

Q.17 The correct set of quantum numbers is

A) $n=2,\ \ell=2,\ m=0,\ s=+\frac{1}{2}$
B) $n=2,\ \ell=1,\ m=0,\ s=+\frac{1}{2}$
C) $n=2,\ \ell=1,\ m=-2,\ s=+\frac{1}{2}$
D) $n=2,\ \ell=1,\ m=-2,\ s=0$

Q.18 The place between two orbitals where probability for finding the electron is zero known as

A) Anti orbital
B) Atomic hole
C) Nodal plane
D) Orbital

Q.19 The shapes of s orbitals is circular and their size:

A) Increases with the increase in principal quantum number
B) Decreases with the increase in principal quantum number
C) Remains the same with the change in principal quantum number
D) Increase with the increase in Azimuthal quantum number value

Q.20 The electronic configuration of P(15) is

A) $1s^2,2s^2,2p^6,3s^2,3p_x^1,3p_y^2,3p_z^0$
B) $1s^2,2s^2,2p^6,3s^2,3p_x^0,3p_y^1,3p_z^2$
C) $1s^2,2s^2,2p^6,3s^2,3p_x^1,3p_y^1,3p_z^1$
D) $1s^2,2s^2,2p^6,3s^2,3p_x^2,3p_y^1,3p_z^0$

Q.21 The number of d-electrons in Fe^{+2} (Z = 26) is not equal to

A) p electrons in Ne (Z = 10)
B) d electrons in Fe (Z = 26)
C) s electrons in Mg (Z = 12)
D) p electrons in Ar (Z = 18)

Q.22 The rule for filling electrons in subshells of atoms is

A) Aufbau's principle
B) Hund's rule
C) Pauli exclusion principle
D) All of these

Q.23 When 6d orbital is completed the entering electron goes into

A) 7f
B) 7p
C) 7s
D) 7d

Q.24 Number of orbitals required to place all electrons of an element with atomic number 30

A) 13 C) 9

B) 15 D) Can't be predicted

Q.25 Which of the following has 5 unpaired electron in d sub-shell

A) $_{25}Mn^{+2}$ C) $_{24}Cr^{+1}$

B) $_{26}Fe^{+3}$ D) All of these

Q.26 2nd ionization energy of Mg is higher than the first because

A) Metallic character of Mg^{+1} is less than that of Mg

B) Nuclear pull for Mg^{+1} electrons is more than that for the Mg atom

C) Size of Mg^{+1} is greater than Mg^{+2}

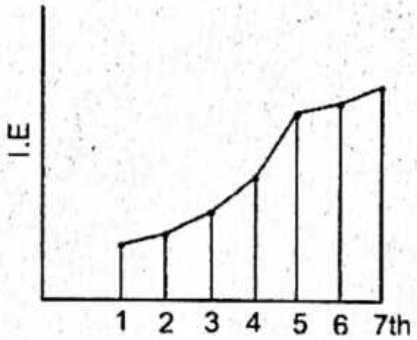
D) Nature of orbital of Mg^{+1} is different from Mg

Q.27 Arrange following according to correct trend of 1st ionization energies: Na, Mg, Al, P, S

A) Na < Mg < Al < P < S C) Na < Al < Mg < S < P

B) Na < Mg < Al < S < P D) Na < Al < Mg < P < S

Q.28 Following graph represents successive ionization energies of an element. Choose the valency of element.



A) 4 C) 5

B) 6 D) 7

Q.29 Second electron affinity value is always with positive sign. It is due to repulsion of second incoming electron with

A) Cation C) Anion

B) Atom D) Molecule

Q.30 Which one of the following has maximum electron affinity

A) F C) Cl

B) Br D) I

Q.31 Octet rule is followed by central atom in

A) CCl_4 C) SF_6

B) BF_3 D) PCl_5

Q.32 Orbital around single nucleus is called

A) Atomic orbital C) Molecular orbital

B) Pi orbital D) Sigma orbital

Q.33 Ionic compounds are obtained by the combination of elements of groups

A) 3 and 5 C) 2 and 5

B) 1 and 7 D) 4 and 8

Q.34 Which of the following molecule has non-directional bond(s)

A) NH_3 C) H_2O

B) NaCl D) None of these

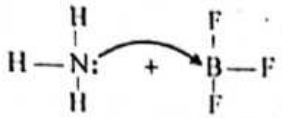
Q.35 **The bond formed between the atoms having electronegativity difference 1.70 is**
A) 50% ionic
B) 50% covalent
C) More than 50% ionic
D) Both A and B

Q.36 **In a double bond connecting 2 atoms there is a sharing of**
A) 1 electron
B) 2 electrons
C) 3 electrons
D) Two electron pairs

Q.37 **In BF_3 molecule, the B atom makes use of**
A) 2s orbital
B) sp^2-hybrid orbitals
C) 2p orbital
D) 3s orbital

Q.38 **Which of following molecules has all types of bonds except metallic bond**
A) AlF_3
B) PH_4Cl
C) NH_4^+
D) NaCl

Q.39 **Which information is incorrect for compound formed from given structure**



A) N carries positive charge
B) B carries negative charge
C) N and B will not complete their octet
D) NH_3 is donor while BF_3 is accepter

Q.40 **The shape of H_3O^+ is**
A) Tetrahedral
B) Angular
C) Pyramidal
D) Trigonal planar

Q.41 **Total number of valence electrons of nitrogen atom in ammonium ion is**
A) 6
B) 10
C) 8
D) 16

Q.42 **Which one of the following is linear molecule**
A) SO_2
B) H_2S
C) C_2H_4
D) HCN

Q.43 **The molecular geometry of H_2O is**
A) Tetrahedral
B) Bent
C) Linear
D) Both A and B

Q.44 **Lateral overlapping is expected in**
A) Sigma bond
B) Metallic bond
C) Pi bond
D) Ionic bond

Q.45 **Total number of sigma electrons in one molecule of HC ≡ CH**
A) 3
B) 4
C) 6
D) 8

Q.46 **An organic molecule formed by chemical combination of two carbon atoms and four hydrogen atoms have**
A) 6 σ, 0 π
B) 1 σ, 5 π
C) 5 σ, 1 π
D) 4 σ, 2 π

Q.47 **In sp^3 hybridized orbital, the s character is:**
A) 25%
B) 75%
C) 50%
D) 100%

Q.48 **Which of the following molecule is not planer**
A) Benzene
B) Boron trichloride
C) Ethene
D) Phosphorous trichloride

Q.49 **On the basis of s– character which of following overlap results in a practically strongest bond**

A) $sp^2 - sp^2$ C) sp – sp

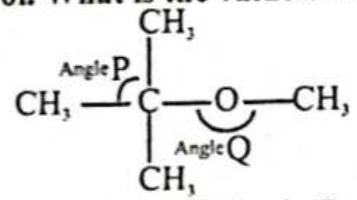
B) $sp^3 - sp^3$ D) All have same

Q.50 **The carbon number 2 in the structure $^1CH_2 = {}^2CH - {}^3CH = {}^4CH_2$ shows a type of hybridization**

A) sp^3 C) sp^2

B) sp D) dsp^2

Q.51 **MTBE is a constituent of petrol. What is the value of angle Q in the molecule MTBE**



A) Angle Q = 90° C) Angle Q = 105°

B) Angle Q = 180° D) Angle Q = 360°

Q.52 **Which of following molecule has strongest hydrogen bond**

A) CH_3OH C) HF

B) H_2O D) NH_3

Q.53 **Molecule in which the distance between two carbon atom is largest is**

A) Ethane C) Ethyne

B) Ethene D) Benzene

Q.54 **Which of the following is weakest bond**

A) H – H C) C – C

B) N – N D) F – F

Q.55 **The nature of bonds and molecule of CO_2 is ____and ____ respectively.**

A) Polar, Polar C) Polar, Non-Polar

B) Non-Polar, Non-Polar D) Non-Polar, Polar

Q.56 **The carbon-hydrogen bond length is shortest in**

A) Ethane C) Ethene

B) Ethyne D) Methane

Q.57 **Following information are true for which of the following group**

(i) Have LDF due to non-polar nature

(ii) All exist in gaseous state at ordinary temperature

(iii) Size and polarizability increase down the group

(iv) Boiling point increases down the group

A) IIA C) VIIA

B) VA D) VIIIA

Q.58 **From the following, select one which can conduct electricity in solid as will as in liquid state**

A) Magnesium oxide C) Phosphorous

B) Zinc D) Silicon dioxide

Q.59 **Intermolecular forces present in ionic compounds are due to**

A) Metallic bonds C) Hydrogen bonds

B) Electrostatic attractions D) Electron pair bonds

Q.60 **Debye forces present in**

A) HCl and H_2O C) Na^+ and H_2O

B) Cl_2 and HCl D) Solid I_2

ANSWER KEY

1	C	11	A	21	D	31	A	41	C	51	C
2	D	12	C	22	A	32	A	42	D	52	C
3	A	13	C	23	B	33	B	43	B	53	A
4	A	14	B	24	B	34	B	44	C	54	D
5	B	15	B	25	D	35	D	45	C	55	C
6	A	16	A	26	B	36	D	46	C	56	B
7	C	17	B	27	C	37	C	47	A	57	D
8	A	18	C	28	A	38	B	48	D	58	B
9	B	19	A	29	C	39	C	49	C	59	B
10	A	20	C	30	C	40	C	50	C	60	B

4 UNIT CHEMICAL ENERGETICS ELECTROCHEMISTRY

SELF ASSESSMENT TEST

Q.1 **One Joule is equivalent to**

A) 4.184 cal.
C) 0.4184cal.
B) $\frac{1}{2}$cal.
D) $\frac{1}{4.184}$cal.

Q.2 **The enthalpies of all elements in their standard states are**

A) Unity
C) Always –ve
B) Always +ve
D) Zero

Q.3 **_____ is not a state function**

A) Enthalpy
C) Internal energy
B) Temperature
D) Heat

Q.4 **No work is done at constant**

A) P
C) V
B) T
D) None

Q.5 **For an endothermic reaction, enthalpy of reactants**

A) Is smaller than that of the products
B) Is greater than that of the products
C) Is equal to that of the products
D) Must be greater or smaller than that of the products

Q.6 **Most of the reactions which give stable products are**

A) Endothermic
C) Exothermic
B) Isothermal
D) Non of these

Q.7 **Decomposition of H_2O is**

A) Endothermic reaction
C) Nuclear reaction
B) Exothermic reaction
D) Zero nuclear reaction

Q.8 **What type of reaction constitute a limiting case between spontaneous and non-spontaneous reaction**

A) Irreversible reactions
C) Reversible reactions
B) Nuclear reactions
D) Thermal reactions

Q.9 **In an endothermic reaction**

A) $E_R > E_P$
C) $E_R < E_P$
B) $E_R = E_P$
D) None of these

Q.10 **In an exothermic reaction the heat energy is _____ while in endothermic reaction it is _____**

A) Released, released
C) Released, absorbed
B) Absorbed, released
D) Absorbed, absorbed

Q.11 **Whenever a reaction is endothermic, then it means that**

A) Heat is transferred from surrounding to the system
C) Heat is transferred system to the surrounding
B) Heat content of the products is less than that of reactants
D) Het content of the reactants is greater than the products

Q.12 **Enthalpy of neutralization of strong acids and strong bases have same values because**

A) Neutralization leads to the formation of salt and water
B) Strong acids and bases are ionic substances
C) Acids always give rise to H^+ and bases always furnish OH^{-1} ions
D) The net change involves the combination of H^+ and OH^{-1} ions to form water

Q.13 The measurement of enthalpy change at standard conditions means that we should manage the measurement at

A) 24°C at 1 atm
B) 0°C at 1 atm
C) 25°C at 1 atm
D) 100°C1 atm

Q.14 The enthalpy change for the reaction $C_2H_2 + \frac{5}{2}O_2 \longrightarrow 2CO_2 + H_2O$ is known as enthalpy of

A) Formation of CO_2
B) Combustion of C_2H_2
C) Fusion of C_2H_2
D) Vaporization of C_2H_2

Q.15 $BaCl_{2(aq)} + H_2SO_{4(aq)} \rightarrow BaSO_{4(s)} + HCl_{(aq)}$ $\Delta H = -22.4$kJ/mole, the heat change represented by above equation is called

A) Heat of formation of $BaSO_4$
B) Heat of reaction of $BaSO_4$
C) Heat of dissociation of $BaSO_4$
D) Sum of all the above heats

Q.16 The enthalpy of atomization of $H_{2(g)}$ is 218 kJ/mole, the enthalpy of formation of $H_{2(g)}$ from gaseous atoms

$\frac{1}{2}H_{2(g)} \longrightarrow H_{(g)}$ $\Delta H^{\circ}_{at} = 218$kJ mol^{-1}

A) -218 kJ/mole
B) –109 kJ/mole
C) – 436 kJ/mole
D) +218 kJ/mole

Q.17 An enthalpy change which is always exothermic

A) ΔH°_{at}
B) $\Delta H^{\circ}_{solution}$
C) ΔH°_{n}
D) ΔH°_{f}

Q.18 The enthalpy change for the reaction, $C_2H_2 + 5/2O_2 \rightarrow 2CO_2 + H_2O$ is known as enthalpy of

A) Formation of CO_2
B) Fusion of C_2H_2
C) Combustion of C_2H_2
D) Vaporization of C_2H_2

Q.19 Which of the following gases have the highest heat of combustion

A) Methane
B) Ethane
C) Ethylene
D) Acetylene

Q.20 Which one of the following pairs has maximum enthalpy of neutralization

A) HCl + NaOH
B) HCl + NH_4OH
C) KOH + CH_3COOH
D) NH_4OH + CH3COOH

Q.21 ΔH of a system can be calculated by which of following relationship

A) $q = m \times s \times \Delta T$
B) $q = m \times v \times \Delta T$
C) $q = \Delta E$
D) $q = pv$

Q.22 Bomb calorimeter is used to determine the

A) ΔH°_{s}
B) ΔH°_{i}
C) ΔH°_{c}
D) ΔH°_{n}

Q.23 What is the unit of molar heat capacity

A) Jmol^{-1}k^{-1}
B) Jg^{-1}K^{-1}
C) g^{-1}K^{-1}
D) g^{-2} K^{-2}

Q.24 Which is true about lattice energy of an ionic compound

A) Cannot be determined directly
B) Can be obtained by means of Born Haber cycle
C) Is helpful in discussing bonding and properties of ionic compounds
D) All of above

Q.25 The enthalpy of formation of an ionic compound is -392 kJ / mol. Total energy changes (ΔH_x) involved in the formation of gaseous ions from normal physical state is 280 kJ/mol. The enthalpy of lattice($\Delta H_{lat.}$) is

A) -112 kJ /mol
B) - 672 kJ / mol
C) + 672 kJ/mol
D) + 224 kJ / mol

Q.26 Choose from the followings the correct statement about Born Haber cycle

A) Born Haber cycle is different from Hess's law
B) The energy changes in a cyclic process is not zero
C) The lattice energy of crystalline substances can be calculated easily
D) None of these

Q.27 Standard heat of formation of Al_2O_3 cannot determined directly because

A) It reacts with CO_2
B) Protective layer of Al_2O_3
C) it does not catch fire
D) Al and O_2 do not react

Q.28 Heat of combustion of graphite at 25°C is -393.51 kJ mol^{-1} and that of diamond is -395.41 kJ mol^{-1}. What is the enthalpy for the conversion of graphite into diamond at same temperature

A) –1.5kJ mol^{-1}
B) –2.7 kJ mol^{-1}
C) +1.2kJ mol^{-1}
D) +1.9 kJ mol^{-1}

Q.29 Using the hypothetical information given in the table below,

Reactions	ΔH
$K_{(s)} + \frac{1}{2}Br_{2(l)} \longrightarrow KBr_{(s)}$	$-400 kJmol^{-1}$
$K_{(s)} \longrightarrow K_{(g)}$	$+100 kJmol^{-1}$
$K_{(g)} \longrightarrow K^+_{(g)} + e^-$	$+400 kJmol^{-1}$
$\frac{1}{2}Br_{2(l)} \longrightarrow Br_{(g)}$	$+100 kJmol^{-1}$
$Br_{(g)} + e^- \longrightarrow Br^-_{(g)}$	$-350 kJmol^{-1}$

Calculate the lattice energy of formation of potassium bromide.

A) $+672 kJmol^{-1}$
B) $+650 kJmol^{-1}$
C) $-672 kJmol^{-1}$
D) $-650 kJmol^{-1}$

Q.30 By applying Hess's law we can calculate

A) ΔH
B) ΔP
C) ΔT
D) ΔV

Q.31 Which change in oxidation state takes place in nitrogen?

$$Cu + HNO_3 \rightarrow Cu(NO_3) + NO_2 + H_2O$$

A) +5 to –2
B) +5 to 0
C) +5 to +4
D) 0 to –4

Q.32 The +1oxidation state of 'P' is found in

A) H_3PO_3
B) H_3PO_4
C) H_3PO_2
D) $H_3P_2O_7$

Q.33 The oxidation number of phosphorous in the compounds $|PCl_4|^+$ and $|PCl_6|^-$ are respectively

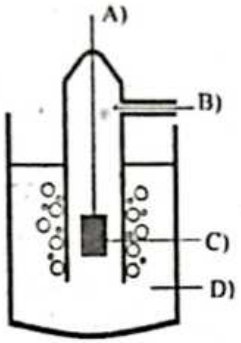
A) +1 and –1
B) +2 and –6
C) +5 and +3
D) +5 and +5

Q.34 **The value of reduction potential of elements is independent upon**
A) Change in temperature
B) Change in concentration
C) Change in pressure
D) All of these

Q.35 **The potential set up when an electrode is in contact with one molar solution of its own ion at 298K. This potential is represented by**
A) ΔE
B) ΔE°
C) E°
D) E

Q.36 **SHE is used as a**
A) Scale
B) Reference electrode
C) Electrolyte
D) All of these

Q.37 **In diagram of standard hydrogen electrode, which labelled part represents one molar solution of HCl**



Q.38 **The reduction potential of aluminum is – 1.66V. The oxidation potential of Al will be**
A) –1.66V
B) +1.66V
C) 0.0V
D) –3.32V

Q.39 **Which is correct statement for the element present at the top of electrochemical series**
A) It has greater tendency to get oxidized
B) It can easily replace H_2 from dilute acid
C) It has large positive reduction potential value
D) It can reduce the metal lower in electrochemical series

Q.40 **The ability of elements to act as reducing agent _____ down to electrochemical series**
A) Increases
B) Remains constant
C) Decreases
D) Depends upon the reaction conditions

Q.41 **For the cell $Cu^{+2}_{(aq)} + Zn_{(s)} \longrightarrow Cu_{(s)} + Zn^{+2}_{(aq)}$ when $E^\circ_{Zn/Zn^{+2}} = +0.76V$ and $E^\circ_{Cu^{+2}/Cu} = +0.34V$ then cell voltage is**
A) 0.10 V
B) 1.10 V
C) 10.1 V
D) 0.55 V

Q.42 **The reaction taking place at cathode is**
A) Oxidation
B) Neutralization
C) Reduction
D) Hydrolysis

Q.43 **The two half cells of the galvanic cell are connected with each other through a salt bridge which**
A) Carries the electrons from one half cell to the other
B) Carries the ions from one half cell to the other
C) Indicates the value of the e.m.f. of cell
D) Carries out the electrolysis

Q.44 Given standard reduction potential for

$Fe^{+2}+2e^- \rightarrow Fe$ –0.440V

$Fe^{+3}+3e^- \rightarrow Fe$ –0.036V

The standard electrode potential for

$Fe^{+3}+e^- \rightarrow Fe^{+2}$ is

A) –0.476 C) 0.404

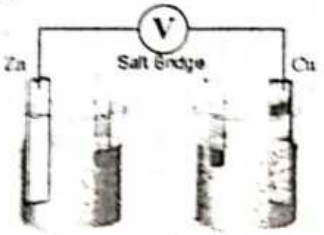
B) +0.476 D) –0.404

Q.45 The reduction potential of Cu = +0.34V and Zn = -0.76V. When these two are coupled the emf of cell is

A) -0.42V C) -1.10V

B) +0.42V D) +1.10V

Q.46 For the given cell which of the following statement is true



A) Zn acts as cathode

B) Cu acts as anode

C) Electrons flow from Zn to Cu through external circuit

D) Electrons flow from Cu to Zn through external circuit

Q.47 Which of the following reaction is not feasible

A) $CuSO_4+Fe \longrightarrow$ C) $Mg+2HCl \longrightarrow$

B) $MgSO_4+Zn \longrightarrow$ D) $2H_{2(g)}+O_{2(g)} \longrightarrow$

Q.48 In the following cell representation

$$Zn_{(s)}\left|Zn^{2+}_{(aq)}(1M)\right\|Cu^{2+}_{(aq)}(1M)\left|Cu_{(s)}\right.$$

The line | in the representation shows

A) Electrode C) Phase boundary

B) Salt bridge D) Molar concentration

Q.49 Not correct about fuel cell

A) light and portable

B) Enviromental friendly

C) Hydrogen diffuses through porous cathode

D) Electons flow through external circuit form anode to cathode

Q.50 Cell reaction which can be used in the fuel cell

A) $2NH_{3(g)}+3/2O_{2(g)} \longrightarrow N_{2(g)}+3H_2O_{(\ell)}$

B) $N_2H_{4(\ell)}+O_{2(g)} \longrightarrow N_{2(g)}+2H_2O_{(\ell)}$

C) $CH_{4(g)}+2O_{2(g)} \longrightarrow CO_{2(g)}+2H_2O_{(l)}$

D) All of these

Q.51 The cell in which electrical energy is converted into chemical energy is

A) Galvanic cell C) Voltaic cell

B) Electrolytic cell D) All of these

Q.52 **On electrolysis of aqueous solution of Na_2SO_4 using graphite electrode, the product produced at anode is**

A) SO_2 C) H_2

B) O_2 D) Na

Q.53 **When there is more than one anion present in the electrolyte, the order of increasing discharge ability is**

A) $NO_3^- < Cl^{-1} < Br^{-1} < I^{-1} < OH^{-1}$ C) $Cl^{-1} < NO_3^- < Br^{-1} < I^{-1} < OH^{-1}$

B) $OH^{-1} < NO_3^- < Cl^{-1} < Br^{-1} < I^{-1}$ D) $I^{-1} < Cl^{-1} < NO_3^- < Br^{-1} < OH^{-1}$

Q.54 **Which one is irreversible cell**

A) Dry cell C) Fuel battery

B) Lead storage battery D) All of them

Q.55 **Which one of the following is the reduction reaction**

A) $Br_2 \rightarrow 2Br^-$ C) $Zn \rightarrow Zn^{-2}$

B) $Fe^{+2} \rightarrow Fe^{+3}$ D) $Sn^{+2} \rightarrow Sn^{+4}$

Q.56 **Which of the following is not a constant quantity**

A) Single electrode potential C) Standard cell potential

B) Standard electrode potential D) Standard reduction potential

Q.57 **The electrode potential of standard hydrogen electrode is chosen as**

A) 0 V C) –1 V

B) 1 V D) 2 V

Q.58 **Which can replace hydrogen from dilute acids?**

A) Au C) Pt

B) Zn D) None of these

Q.59 **The standard reduction potential values of three metallic cations X, Y and Z are 0.52, –3.03 and –1.18 respectively. The order of reducing power of the corresponding metal is**

A) Y > Z > X C) X > Y > Z

B) Z > Y > X D) Z > X > Y

Q.60 **The difference in electrolysis of concentrated and dilute NaCl is**

A) Formation of ions in the solution C) Product produced at anode

B) Reaction taking place at cathode D) Product produced at cathode

ANSWER KEY

1	D	11	A	21	A	31	C	41	B	51	B
2	D	12	D	22	C	32	C	42	C	52	B
3	D	13	C	23	A	33	D	43	C	53	A
4	C	14	B	24	D	34	C	44	C	54	A
5	A	15	B	25	B	35	C	45	D	55	A
6	C	16	C	26	C	36	B	46	C	56	A
7	A	17	C	27	B	37	D	47	B	57	A
8	C	18	C	28	D	38	B	48	C	58	B
9	C	19	D	29	D	39	C	49	D	59	A
10	C	20	A	30	A	40	C	50	D	60	C

5 UNIT CHEMICAL EQUILIBRIUM REACTION KINETICS

SELF ASSESSMENT TEST

Q.1 For a reversible reaction, $A \longrightarrow B$, which expression describe rate of forward reaction

A) $\frac{d[A]}{dt}$

B) $\frac{d[B]}{dt}$

C) $-\frac{d[A]}{dt}$

D) $-\frac{d[B]}{dt}$

Q.2 Consider the reaction $PCl_{5\,(g)} \rightleftharpoons PCl_{3\,(g)} + Cl_{2\,(g)}$ in a closed container at equilibrium. At a fixed temperature, what will be the effect of adding more PCl_5 on the equilibrium constant

A) It increases

B) It remains unaffected

C) It decreases

D) Can't be predicted without K_P

Q.3 In $2HI \rightleftharpoons H_2 + I_2$, $\Delta H > 0$ the forward reaction is affected by change in

A) Catalyst

B) Volume

C) Temperature

D) Pressure

Q.4 The reaction quotient (Q) for the reaction $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ is given by $Q = \frac{[NH_3]^2}{[N_2][H_2]^3}$, the reaction will proceed from right to left is

A) $Q = 0$

B) $Q < Kc$

C) $Q = Kc$

D) $Q > Kc$

Q.5 Which value of Kc indicate maximum yield of products

A) $Kc = 10^2$

B) $Kc = 10^{-2}$

C) $Kc = 1$

D) $Kc = 10^{-3}$

Q.6 The equilibrium constant for the reaction $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$ is 4.4×10^{-4} at 2000K temperature. In the presence of catalyst, equilibrium is attained ten times faster. Therefore, the equilibrium constant in presence of catalyst at 2000K is

A) 4.4×10^{-4}

B) 4.4×10^{-3}

C) 4.4×10^{-5}

D) Difficult to compute

Q.7 Ratio of K_p/K_c for the reaction $CO_{(g)} + \frac{1}{2}O_{2(g)} \rightleftharpoons CO_{2(g)}$ is

A) 1

B) RT

C) $(RT)^{\frac{1}{2}}$

D) $(RT)^{-\frac{1}{2}}$

Q.8 What is the equilibrium expression for the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$

A) $Kc = \frac{[NH_3]}{[N_2][H_2]}$

B) $Kc = \frac{[N_2][H_2]^3}{[NH_3]^2}$

C) $Kc = \frac{[2NH_3]}{[N_2]+[3H_2]}$

D) $Kc = \frac{[NH_3]^2}{[N_2][H_2]^3}$

Q.9 For the reaction $CO_{(g)} + Cl_{2(g)} \rightleftharpoons COCl_{2(g)}$, then $\frac{Kp}{Kc}$ is equal to

A) $\frac{1}{RT}$
B) $\sqrt{RT}$
C) RT
D) 0.1

Q.10 For reaction $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ unit of Kp is

A) atm
B) atm^{-2}
C) atm^{-1}
D) atm^{2}

Q.11 $2A + B \rightleftharpoons C$. At equilibrium 0.20 mole of A, 0.45 mole of B and 0.15 mole of C are present, Calculate K_c

A) 8.3
B) 4.0
C) 5.0
D) 6.0

Q.12 4 moles of A are mixed with 4 moles of B. At equilibrium for the reaction $A + B \rightleftharpoons C + D$, 2 moles of C and D are formed, the equilibrium constant for reaction will be

A) $\frac{1}{4}$
B) $\frac{1}{2}$
C) 4
D) 1

Q.13 $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ is of equilibrium, the concentration of $PCl_{3(g)}$ is doubled the concentration of $Cl_{2(g)}$ would become

A) Half of its initial value
B) ¼ of its initial value
C) Four times of its initial value
D) Two times of its initial value

Q.14 The most suitable temperature for preparing ammonia gas is

A) 250°C
B) 450°C
C) 350°C
D) 550°C

Q.15 Which one is correct about conjugate acid-base concept?

A) Conjugate base of a very weak acid is relatively very strong
B) Conjugate base of a very weak acid is relatively very weak
C) Conjugate base of a very strong acid is relatively very weak
D) Both A and C

Q.16 What is the conjugate base of OH^-

A) O_2
B) O^{-1}
C) H_2O
D) O^{-2}

Q.17 Ostwald's dilution law is applicable for

A) Weak electrolyte
B) Strong electrolyte
C) Both A) and B)
D) None of these

Q.18 If pKa of an acid is 5, then pKb of its conjugate base will be ____ at 25°C.

A) 10
B) 8
C) 9
D)5

Q.19 The units of ionic product of H_2O is

A) Mol dm^{-3}
B) Mol^2dm^{-6}
C) $Mol^{-1}dm^{-3}$
D) $Mol^{-2}dm^{-6}$

Q.20 Which is correct relation at 100°C

A) $pH + pOH < 14$ C) $pKa + PKb < 14$

B) $[H^+][OH^-] > 10^{-14}$ D) All of these

Q.21 pH of 10^{-4} molar solution of HX acid in water is

A) –4 C) Between 3 and 4

B) 4 D) 7

Q.22 What will be the pH of 1.0 mol dm^{-3} of NH_4OH, which is 1% dissociated

A) 2 C) 0

B) 12 D) 2.7

Q.23 Which one of the following has the lowest pH values

A) 0.1M HCl C) 0.1M KOH

B) 0.01M HCl D) 0.01M KOH

Q.24 Which one is best buffer those have

A) $pH = pK_a$ C) $pOH < pK_b$

B) $pH > pK_a$ D) $pK_a = 0$

Q.25 An acidic buffer solution can be prepared by mixing

A) Weak acid and its salt with strong base C) Strong acid and its salt with weak base

B) Weak base and its salt with strong acid D) Strong base and its salt with strong acid

Q.26 pH of buffer solution is 4.74, pKa of acid is 4.74. What is ratio between concentration of salt and acid

A) 10 C) 1

B) 0.1 D) 0.3

Q.27 If the concentration of salt is greater than the acid in buffer solution, then the

A) $pH = pK_a$ C) $pH > pK_a$

B) $pH = pK_b$ D) $pH < pK_b$

Q.28 Expression of solubility product constant (Ksp) for following sparingly soluble salt is

$AxBy \rightleftharpoons xA^{+y} + yB^{-x}$

A) $[A^{-y}]^x[B^{-x}]^y$ C) $[A^{-y}]^x[B^{-x}]^y$

B) $[A^y]^y[B^{-x}]^x$ D) $[x^A]^y[y^{-B}]^x$

Q.29 The solubility of $Fe(OH)_3$ is 'x' mole per dm^3. Its K_{sp} would be

A) $9x^3$ C) $3x^4$

B) $27x^4$ D) $9x^4$

Q.30 Which one increases by common ion effect except?

A) Crystallization C) Association of ions

B) Solubility D) All of these

Q.31 $AgNO_{3(aq)} + NaCl_{(aq)} \longrightarrow AgCl + NaNO_3$ which one is correct about given reaction

A) It is very slow reaction C) It proceed at moderate rate

B) It is very fast reaction D) Black participate

Q.32 The unit of rate constant is the same as that of the rate of reaction in

A) 1st order reaction C) 2nd order reaction

B) Zero order reaction D) 3rd order reaction

Q.33 The rate of reaction is doubled for every 10°C rise in temperature. The increase in reaction rate as a result of temperature rise from 10 °C to 100 °C is

A) 112 C) 512

B) 400 D) 614

Q.34 The mathematical relation between the rate of reaction and the concentrations of the reactants is known as the

A) Order of reaction
B) Arrhenius equation
C) Half-life period
D) Rate law equation

Q.35 If 75% of any given amount of radioactive element disintegrates in 60 min. The half-life of radioactive element is

A) 20 min
B) 30 min
C) 45 min
D) 25 min

Q.36 The energy of activated complex is

A) Less than reactants
B) Greater than products
C) Greater than reactants
D) Both B and C

Q.37 The rate of reaction depends upon

A) Molar concentration
B) Equivalent mass
C) Atomic mass
D) None of these

Q.38 For a first-order reaction, the half-life period is independent of

A) Initial concentration
B) First power of final concentration
C) Cube root of initial concentration
D) Square root of final concentration

Q.39 If the rate of the reaction is equal to the rate constant, the order of the reaction is

A) 3
B) 1
C) 0
D) 2

Q.40 Which of the following is incorrect about order of reaction

A) It is calculated experimentally
B) It is sum of powers of concentration in rate law expression
C) The order of reaction cannot be fractional
D) There is not necessarily a connection between order and stoichiometry of a reaction

Q.41 For the reaction A+B+C $\longrightarrow$ Product, Rate $= K[A]^{\frac{1}{2}}[B]^{\frac{1}{3}}[C]$. The order of reaction is

A) 3
B) $\frac{5}{6}$
C) 1
D) $\frac{11}{6}$

Q.42 The half-life period of a first order reaction is 15 minutes. The amount of substance left after one hour will be

A) ½
B) ⅛
C) ¼
D) 1/16

Q.43 For an exothermic reaction, an activation energy of forward reaction 70kJmol^{-1} and the enthalpy change of reaction is 30 kJ mol^{-1}. The activation energy for reverse reaction is

A) 70 kJ mol^{-1}
B) 40 kJ mol^{-1}
C) 30 kJ mol^{-1}
D) 100 kJ mol^{-1}

Q.44 According to the Arrhenius equation a straight line is to be obtained by plotting the logarithm of the rate constant against

A) T
B) $\frac{1}{T}$
C) Log T
D) Log $\frac{1}{T}$

Q.45 Select the correct rate law from given data

[A] moles dm^{-3}	[B] moles dm^{-3}	Rate of reaction (moles dm^{-3} sec^{-1})
0.1	0.1	1×10^{-4}
0.2	0.1	2×10^{-4}
0.3	0.1	3×10^{-4}
0.3	0.2	12×10^{-4}

A) Rate = k[A][B]
B) Rate = $k[A]^0[B]^2$
C) Rate = $k[A]^2[B]$
D) Rate = $k[A][B]^2$

Q.46 Mixture of H_2 and Cl_2 will react twice as fast, if partial pressure of H_2 or Cl_2 is
A) Decreased from 1 to 0.5 atm
B) Increase from 0.5 to 1 atm
C) increased from 0.5 to 2 atm
D) Decreased from 2 to 1 atm

Q.47 Select the suitable catalyst for given reaction

$HCOOH \longrightarrow H_2O + CO_2$

A) Cu
B) Al_2O_3
C) SiO_2
D) NO

Q.48 When the rate of reaction is retarded by adding a substance, then it is said to be a
A) Poison
B) Inhibitor
C) Auto catalyst
D) Activator

Q.49 Which of the followings enzyme is used as a catalyst in the hydrolysis of urea
A) Invertase
B) Zymase
C) Sucrase
D) Urease

Q.50 Glucose is converted into ethanol by the enzyme _____ present in the yeast
A) Maltase
B) Zymase
C) Invertase
D) All of these

Q.51 The rate of reaction, $A + B + C \longrightarrow$ Products is given by Rate = $k[A][B]^0[C]$. If A is in excess, the order of reaction would be
A) 0
B) 2
C) 1
D) 3

Q.52 A reaction is first order with respect to A and second order with respect to B. The rate equation is
A) Rate = $k[A][B]^2$
B) Rate = $k[A]^2[B]$
C) Rate = $k[A][B]$
D) Rate = $k[A]$

Q.53 If the half-life for a particular reaction is found to be constant and independent of initial concentration of reactant then reaction is of
A) 1st order
B) 3rd order
C) 2nd order
D) Zero order

Q.54 What is the half-life period of the given reaction when initial concentration of HI is 0.050M and rate constant "k" is 0.080 $dm^3mol^{-1}sec^{-1}$ $\left(2HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)}\right)$
A) 150 sec
B) 1000 sec
C) 125 sec
D) 250 sec

Q.55 What will be the half life period of 1st order reaction, if value of rate constant "k" is 0.3465 min^{-1}
A) 0.5 mint
B) 1.0 mint
C) 2.0 mint
D) 1.5 mint

Q.56 $2A + 2B \longrightarrow D + E$ **for the reaction following the mechanism has been proposed**

$A + 2B \longrightarrow 2C + D$ **(slow)**

$A + 2C \longrightarrow E$ **(fast)**

Select the correct law equation

A) $\text{Rate} = k[A]^2[B]^2$

B) $\text{Rate} = k[A][B]^2$

C) $\text{Rate} = k[A]^2[B]^2[C]$

D) $\text{Rate} = k[A][B]$

Q.57 What will be the rate constant for 2nd order reaction, when rate of reaction is 4 moles dm^{-3} sec^{-1} and concentration of A is equal to concentration of B which is 0.1 moles dm^{-3}

A) 400 mol^{-1} $dm^{+3}sec^{-1}$

B) 4000 sec^{-1}

C) 40000 mol^{-1} $dm^{+3}sec^{-1}$

D) 4000 mol^{-1} $dm^{+3}sec^{-1}$

Q.58 Which method for the rate determination is applicable if a reactant or a product absorbs UV/ visible or IR radiation

A) Spectrometric method

B) Optical rotation method

C) Dilatometric method

D) Refractometric method

Q.59 What will be rate of reaction, when change in concentration of substance is 3×10^{-3} moles dm^{-3} in 10 sec

A) 3×10^{-3} mol dm^{-3} sec^{-1}

B) 3×10^{-4} mol dm^{-3} sec^{-1}

C) 3×10^{-2} mol dm^{-3} sec^{-1}

D) 3×10^{2} mol dm^{-3} sec^{-1}

Q.60 The unit of rate constant of 1st order reaction is

A) $Moldm^3sec^{-1}$

B) sec^{-1}

C) $Mol^{-1}dm^{+3}sec^{-1}$

D) $Mol^{-2}dm^{+6}sec^{-1}$

ANSWER KEY

1	C	11	A	21	B	31	B	41	D	51	C
2	B	12	A	22	B	32	B	42	D	52	A
3	C	13	A	23	A	33	C	43	D	53	A
4	D	14	B	24	A	34	D	44	B	54	D
5	A	15	D	25	A	35	B	45	D	55	C
6	A	16	D	26	C	36	D	46	B	56	B
7	D	17	A	27	C	37	A	47	A	57	D
8	D	18	C	28	A	38	A	48	B	58	A
9	A	19	B	29	B	39	C	49	D	59	B
10	A	20	D	30	A	40	C	50	B	60	B

6 UNIT PERIODS GROUPS

SELF ASSESSMENT TEST

Q.1 Elements in the same vertical group of the periodic table have same

A) Number of valence electrons
B) Atomic mass
C) Atomic number
D) Atomic volume

Q.2 Which of the following sets of elements belongs to third period?

A) Cl, Br, Ar
B) S, Al, Ne
C) Mg, Cl, Ar
D) Ca, Si, Cl

Q.3 Keeping in view the size of an atom, which statement is correct

A) Mg > Sr
B) Ne > Ar
C) Rb < Cs
D) Cl > I

Q.4 Which of the following correctly relates the correct order of atomic sizes

A) Be > F > C > Ne
B) Ne > Be > C > F
C) Be < C < F < Ne
D) Ne < F < C < Be

Q.5 The radius of iso-electronic cations _____ along the period

A) Decreases
B) Increases
C) Remains constant
D) Unpredictable

Q.6 The element that possesses the shortest atomic radius

A) Lithium
B) Carbon
C) Nitrogen
D) Oxygen

Q.7 What is reason for decrease of atomic radius in a period?

A) Increase in number of group
B) No effect of shielding
C) Increases in effective nuclear charge
D) All contribute

Q.8 Shielding effect across the period

A) Increases
B) Can not be predicted
C) Decreases
D) Remains constant

Q.9 Mark the incorrect order of ionic radii

A) $Mg^{+2} > Be^{+2}$
B) $F^- > Cl^-$
C) $K^+ > Na^+$
D) $Li^+ > Be^{+2}$

Q.10 Which of the following cation has smallest size

A) Al^{+3}
B) Mg^{+2}
C) Ca^{+2}
D) Na^{+1}

Q.11 Which of the following is a favourable factor for cation formation

A) High electron affinity
B) High electronegativity
C) Small atomic size
D) Low ionization potential

Q.12 The addition of an electron in valence shell of an isolated gaseous atom to form uni-negative ion is _____ process

A) Exothermic only
B) Enthalpy change is zero
C) Endothermic only
D) Exothermic or endothermic

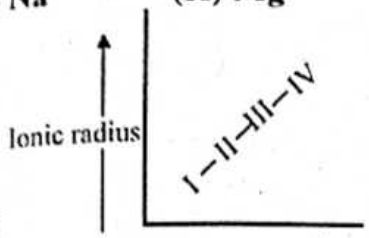
Q.13 Mark the correct statement

A) Na+ is smaller than Na atom
B) Cl^- is smaller than Cl atom
C) Na+ is larger than Na atom
D) Cl^- and Cl are of equal size

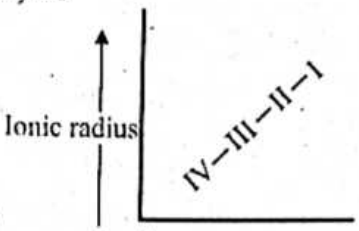
Q.14 Isoelectronic species contain same number of e^- which among the following is the correct order for ionic radius

(I) Na^{+1} (II) Mg^{+2} (III) Al^{+3} (IV) Si^{+4}

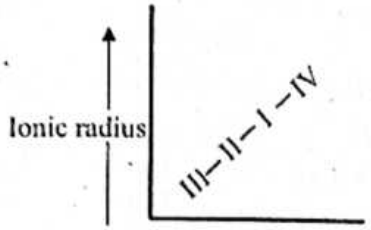
A)



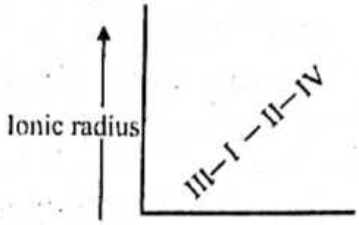
C)



B)



D)



Q.15 Which one of the following has lowest melting point

A) Be C) Ca

B) Ba D) Mg

Q.16 Which of the following information is obtained from melting point and boiling point of an element?

A) Strength between molecules C) Physical state at room temperature

B) Strength between atoms D) All of these above

Q.17 The highest melting point is associated with which of following?

A) Coke C) Diamond

B) Graphite D) Charcoal

Q.18 Melting point of group I-A down the group

A) Increases C) Decreases

B) Remains constant D) Not regular

Q.19 Mark the correct order with respect to the melting/boiling points

A) Na > K C) I > Br

B) Kr > Ne D) All of the above are correct

Q.20 Among halogens, the highest boiling point is of

A) Fluorine C) Chlorine

B) Bromine D) Iodine

Q.21 For the molecular forms of the given elements: P , S, Cl , Ar
The correct decreasing order for their melting and boiling points is

A) Ar > P > Cl > S C) S > P > Cl > Ar

B) Cl > P > S > Ar D) P > S > Cl > Ar

Q.22 The ionization energy of boron is less than that of beryllium because

A) Atomic size of B > Be C) Atomic size of B < Be

B) Shielding effect of B < Be D) Removal of e^- from p-subshell

Q.23 2^{nd} ionization energy of Mg is higher than the first because

A) Metallic character of Mg^{+1} is less than that of Mg

B) Nuclear pull for Mg^{+1} electrons is more than that for the Mg atom

C) Size of Mg is less than Mg^{+1}

D) All of the above

Q.24 The maximum first ionization energy is possessed by
A) Mg
B) Al
C) Si
D) Cl

Q.25 Which one of the following has highest ionization energy
A) Fluorine
B) Nitrogen
C) Oxygen
D) Helium

Q.26 Amongst the following elements whose configurations are given below, the one having the highest ionization energy is
A) $[Ne]3s^2\ 4p^4$
B) $[Ne]3s^2\ 3p^1$
C) $[Ne]3s^2\ 3p^2$
D) $[Ne]3s^2\ 3p^3$

Q.27 The first ionization energy of magnesium is 738kJ/mol and the 2nd I.E of magnesium will be
A) Equal to 738kJ/mol
B) Higher than 738kJ/mol
C) Less than 738kJ/mol
D) Equal to 738cal/mol

Q.28 Incorrect 1st ionization energy order is
A) N > O
B) F > Ne
C) Be > B
D) He > H

Q.29 The ionization energy of nitrogen is more than that of oxygen because of
A) The greater attraction of the electrons by the nucleus
B) The extra stability of the half-filled p-orbitals
C) The smaller size of nitrogen
D) High nuclear charge

Q.30 Which of the following configurations is associated with largest difference between 2nd and 3rd ionization energy
A) $1s^2\ 2s^2\ 2p^2$
B) $1s^2\ 2s^2\ 2p^6\ 3s^1$
C) $1s^2\ 2s^2\ 2p^6\ 3s^2$
D) $1s^2\ 2s^2\ 2p^1$

Q.31 Which of the following configurations corresponds to alkaline earth metals
A) $[Ar]\ 3d^{10}, 4s^2$
B) $[Ar]4s^2$
C) $[Ne]3d^2, 3p^2$
D) $[Ar]3d^{10}, 4s^1$

Q.32 Which of the following is the strongest alkali?
A) NaOH
B) $Ca(OH)_2$
C) CsOH
D) KOH

Q.33 The reactivity of oxides of alkaline earth metals _____ down to the group
A) Increase
B) Decrease
C) Unpredictable
D) Remains constant

Q.34 Which of the following alkaline earth metal is very least reactive
A) Mg
B) Ba
C) Be
D) Ca

Q.35 The milk of magnesia is used for the treatment of
A) Acidity
B) Rancidity
C) Basicity
D) Jaundice

Q.36 The solubility of alkaline earth metal hydroxide increases down the group due to
A) Decrease in lattice energy
B) Increase in lattice energy
C) Increase in charge to size ratio of cations
D) Constant charge to size ratio of cations in the group

Q.37 **Soda-lime is a mixture of**
A) $Ca(OH)_2 + H_2O$
B) CaO + NaOH
C) $Mg(OH)_2 + Ca(OH)_2$
D) MgO + NaOH

Q.38 **Correct order of solubility in water for alkaline earth metal oxides is**
A) MgO < CaO < SrO < BaO
B) CaO < MgO < BaO < SrO
C) MgO < BaO < CaO < SrO
D) SrO < CaO < BaO < MgO

Q.39 **Which of the following produces water not only reacting with caustic soda but also with oil of vitriol**
A) CaO
B) BeO
C) BaO
D) MgO

Q.40 **The minor product formed by burning of magnesium ribbon in pure air will be**
A) MgO
B) MgS
C) Mg_3N_2
D) None of these

Q.41 **For alkaline earth metals the correct order of reaction with cold water is**
A) Mg > Be
B) Sr > Ba
C) Ca > Sr
D) Be > Ba

Q.42 **The substituent of chlorine in water disinfection:**
A) Ozone
B) Chloramines
C) Hypochlorous acid
D) All of the above

Q.43 **Bleaching powder is a strong**
A) Reducing agent
C) Acid
B) Oxidizing agent
D) Base

Q.44 **Which of the following halogen shows metallic luster?**
A) Fluorine
B) Chlorine
C) Iodine
D) Astatine

Q.45 **The oxidizing property of halogen _____ down to the group**
A) Increases
B) Decreases
C) Unpredictable
D) Remains constant

Q.46 **Among the halogens, the radioactive element is**
A) Fluorine
B) Astatine
C) Chlorine
D) Iodine

Q.47 **Which of the halogen can displace other three elements form their respective compounds**
A) Fluorine
B) Iodine
C) Chlorine
D) Bromine

Q.48 **_____ causes burns on skin that heal slowly**
A) Fluorine
B) Chlorine
C) Bromine
D) Iodine

Q.49 **Correct order of increase in colour intensity of halogens is**
A) $F_2 < Cl_2 > Br_2 < I_2$
B) $F_2 < I_2 < Cl_2 < Br_2$
C) $F_2 < Br_2 < Cl_2 < I_2$
D) $I_2 < Br_2 < Cl_2 < F_2$

Q.50 **The halogen having the highest bond energy is**
A) F_2
B) Br_2
C) Cl_2
D) I_2

Q.51 **Which of the following is not a property of bleaching powder**
A) Mixed salt
B) Reducing agent
C) Oxidizing agent
D) Bleaching agent

Q.52 **Bleaching powder is not used for**

A) The preparation of Cl_2 and O_2
B) Sterilization of water
C) Making unshrinkable wool
D) Manufacture of methane

Q.53 **For the reaction, $Cl_2 + 2NaOH \longrightarrow NaClO + NaCl + H_2O$**

The oxidation state of chlorine changes from zero to _____ and _____ respectively

A) −1 , −1
B) +5 , +1
C) −1 , +5
D) +1 , −1

Q.54 **On reaction of chlorine with hot NaOH solution, the least chance are the formation of**

A) NaCl
B) NaClO
C) $NaClO_2$
D) $NaClO_3$

Q.55 **For the reaction, $3Cl_2 + 6NaOH \longrightarrow NaClO_3 + 5NaCl + 3H_2O$**

Chlorine is

A) Oxidized
B) Reduced
C) Both oxidized and reduced
D) Neither oxidized nor reduced

Q.56 **For the equation $^{226}Ra \longrightarrow X + {}^{4}He$, X is**

A) Ne
B) Xe
C) Ar
D) Rn

Q.57 **Noble gas used to fill fluorescent tubes is**

A) He and Ne
B) Ar and Kr
C) Ne and Ar
D) Kr and Xe

Q.58 **A mixture of _____ and _____ is used for breathing by the sea divers**

A) 20% Rn and 80% O_2
B) 20% He and 80% O_2
C) 80% Rn and 20% O_2
D) 80% He and 20% O_2

Q.59 **Which one of the following noble gas is used for providing and inert atmosphere for welding**

A) Helium
B) Argon
C) Neon
D) Krypton

Q.60 **Pick up the wrong pairing**

A) Making advertising sings — Neon
B) Filling fluorescent tubes — Argon
C) Cooling medium for nuclear reactors — Helium
D) Used in high voltage indicators — Krypton

ANSWER KEY

1	A	11	D	21	C	31	B	41	A	51	B
2	D	12	A	22	D	32	C	42	A	52	D
3	C	13	A	23	B	33	A	43	B	53	D
4	D	14	C	24	D	34	C	44	C	54	C
5	A	15	D	25	D	35	A	45	B	55	C
6	D	16	D	26	D	36	A	46	B	56	D
7	D	17	C	27	B	37	B	47	A	57	B
8	D	18	C	28	B	38	A	48	C	58	D
9	B	19	D	29	B	39	B	49	A	59	A
10	A	20	D	30	C	40	C	50	C	60	D

UNIT 7 TRANSITION ELEMENTS COMPOUNDS OF N AND S

SELF ASSESSMENT TEST

Q.1 The elements in which d orbitals are in the process of completion are

A) Outer transition elements
B) Normal elements
C) Inner transition elements
D) Representative elements

Q.2 The first transition series ends on the element

A) Scandium
B) Calcium
C) Zinc
D) Mercury

Q.3 Cr and Cu have half-filled s-orbitals why

A) They belong to p-block elements
B) They belong to 4d- series
C) They give stablity to d-orbitals
D) They all diamagnetic

Q.4 Which of the following pairs show resemblance in their valance shell electronic .configuration

A) Sc, Y
B) Zn, V
C) Mn, Mo
D) Pt, Au

Q.5 Which of the following has the maximum number of unpaired electrons

A) Ni^{2+}
B) Ti^{3+}
C) V^{3+}
D) Fe^{2+}

Q.6 Cu belongs to

A) 3d series
B) 4d series
C) 5d series
D) 6d series

Q.7 Variable oxidation state of transition elements is due to:

A) Involvement of unpaired d-electrons in addition to s electrons in bond formation
B) d-d transitions
C) Paramagnetic nature
D) Loss of s electrons

Q.8 Which one is the oxidation states of Mn?

A) +2 and +3
B) +4 and +5
C) +6 and +7
D) All of these

Q.9 The lowest oxidation state of Fe is in which of the following compounds

A) Mohr's state
B) Fe_2O
C) $Fe(CO)_5$
D) $K_4[Fe(CN)_6]$

Q.10 Which one of the following transition element shows only single restricted oxidation state

A) Mn
B) Zn
C) Co
D) Ni

Q.11 The oxidation number of central metal atom in $K_3[Fe(CN)_6]$ is

A) 0
B) +2
C) +3
D) +4

Q.12 The oxidation state of Cr in CrO_2Cl_2 is

A) 2
B) 3
C) 4
D) 6

Q.13 Which of the following transition element used as a catalyst in Haber's process

A) Fe
B) Cr_2O_3
C) Al_2O_3
D) All of these

Q.14 The catalytic activity of transition elements is usually due to two main reasons, which are

A) They have several different oxidation state and they provide a site at which reaction taken place

B) They forms compound and show colours

C) They have Variable oxidation states and show colours

D) None of these

Q.15 Which economical catalyst is used in preparation of sulphuric acid

A) Pt C) Ni

B) V_2O_5 D) All of these

Q.16 For d^2sp^3 hybridization, the expected shape is

A) Tetrahedral C) Trigonal bipyramidal

B) Square planar D) Octahedral

Q.17 Co-ordination number of the transition element in $[Pt\ Cl\ NO_2\ (NH_3)_4]^{2-}$ is

A) +2 C) +6

B) +4 D) +8

Q.18 The central atom along with ligands is called

A) Complex ion C) Coordination sphere

B) Ligand D) Complex compound

Q.19 Ethylenediamine is a

A) Monodentate Ligand C) Hexadentate ligand

B) Bidentate Ligand D) Tridentate ligand

Q.20 Geometry of the complex compounds usually depends upon

A) Nature of ligand

B) Types of hybridization in the elements of ligands

C) Hybridization of central metal

D) Both A) and C)

Q.21 Which one of the following is a neutral mono dentate ligand

A) N_2H_4 C) OH^-

B) CO D) $C_2O_4^{2-}$

Q.22 Transition metals form complexes very readily, the reason is

A) Smaller cations C) Greater charge density of cations

B) Vacant d-orbitals D) All of them

Q.23 The IUPAC name of $[Co(NH_3)_4Cl_2]Cl$ is

A) Tetraamminedichloro cobalt (I) chloride

B) Dichloro tetraamine cobalt (II) chloride

C) Tetraamminedichloro cobalt (III) chloride

D) Dichloro tetraamine cobalt (III) chloride

Q.24 The tendency of 3d metal ions to form stable complexes is due to

A) Strong electronegative nature C) Variable valency

B) Very low ionization energies D) High charge/radius ratio and vacant d orbitals

Q.25 The aqueous solution containing which one of the following ions will be colourless

A) Sc^{3+} C) Fe^{+2}

B) Fe^{+3} D) Mn^{+2}

Q.26 The colour of the $[Ti(H_2O)_6]^{3+}$ is

A) Red C) Pink

B) Orange D) Violet

Q.27 **From the following which ion gives colourless complex**
A) Mn^{2+} C) Cu^{2+}
B) Cu^{1+} D) Fe^{3+}

Q.28 **In $[Ti(H_2O)_6]^{3+}$, yellow light is absorbed the solution of $[Ti(H_2O)_6]^{3+}$ ion look violet in colour. The transmitted lights are _____**
A) Blue, red C) Violet, yellow
B) Green, red D) Violet, red

Q.29 **All of the following give colorless complex except**
A) Zn^{+2} C) Ti^{+4}
B) Sc^{+3} D) Mn^{+2}

Q.30 **Transition compounds are mostly coloured due to**
A) s-d transition C) p-d transition
B) d-d transition D) d-f transition

Q.31 **N_2 is inert under ordinary circumstances. The important factor is**
A) Presence of triple bond in N_2 C) Smaller molecular size of N_2
B) High electronegativity of nitrogen D) Low boiling point of nitrogen

Q.32 **Nitrogen is gas while other elements of same group are**
A) Solid and liquid C) Solid
B) Gas and liquid D) Gas and solid

Q.33 **The bond energy of N_2 molecule is**
A) 149 kJ/mol C) 941 kJ/mol
B) 349 kJ/mol D) 121 kJ/mol

Q.34 **In Haber's process, the increase in pressure will shift equilibrium towards**
A) Left C) Not affected
B) Any direction D) Right

Q.35 **In Haber's process maximum ammonia can be achieved by reducing temperature, but on contrary we maintain high temperature of 400°C because**
A) At low temperature rate of reaction cannot be controlled
B) The amount of products is less at low temperature
C) Rate of reaction is slow at low temperature
D) Reaction is stopped at low temperature

Q.36 **In Haber's process the equilibrium mixture contain_____ ammonia**
A) 35% C) 41%
B) 40% D) 45%

Q.37 **Percentage of nitrogen in NH_3 is**
A) 87.5% C) 82%
B) 33.5% D) 21%

Q.38 **Which of the following is NOT a use of nitrogeneous fertilizer**
A) Impart green colour to leaves C) Enhance the yield
B) Enhance the quality of plant D) Produce resistance against disease

Q.39 **Which of the following fertilizer is injected about 6-inches under the surface of soil**
A) NH_3 C) NH_2CONH_2
B) NH_4NO_3 D) $(NH_4)_2PO_4$

Q.40 **Which of the following step is not involved in NH_4NO_3 manufacturing**
A) Prilling C) Evaporation
B) Neutralization of HNO_3 with NH_3 D) Dehydration

Q.41 The manufacturing of nitrogenous fertilizer's from ammonia is oftenly the result of
A) Addition Reaction
B) Substitution Reaction
C) Acid-base Reaction
D) Decomposition reaction

Q.42 Which one of the following statement is correct for urea
A) It is a synthetic fertilizer
B) It is a natural fertilizer
C) It provides micronutrients to plants
D) It is an inorganic water soluble compound

Q.43 The nitrogenous fertilizer which is organic in nature
A) NH_4NO_3
B) NH_3
C) $(NH_4)_2PO_4$
D) NH_2CONH_2

Q.44 Maximum ammonia is used for the
A) Explosives formation
B) Fertilizer itself
C) Manufacturing of fertilizer
D) manufacturing of Nylon

Q.45 The cooling of molten urea by air in the tower is called
A) Prilling
B) Condensation
C) Evaporation
D) Crystallization

Q.46 Which of the following fertilizers is not useful for paddy rice?
A) Urea
B) Ammonium sulphate
C) DAP
D) Ammonium nitrate

Q.47 Which one of the following set of raw material is most suitable for manufacture of urea?
A) CH_4, N_2 and CO_2
B) H_2, CO_2 and H_2O
C) H_2, N_2 and CO
D) H_2O, N_2 and H_2

Q.48 Which three elements are needed for the healthy growth of plants
A) N, S, P
B) N, K, C
C) N, Ca, P
D) N, K, P

Q.49 In KNO_3 % of potash and nitrogen is
A) 50% and 20%
B) 13% and 44%
C) 44% and 13%
D) 20% and 44%

Q.50 The pH of unpolluted rain water is 5.6. The decrease in pH is due to presence of
A) NO_2
B) SO_3
C) CO_2
D) HCl

Q.51 Most of the SO_2 present in air from natural source is due to
A) Volcanoes
B) Combustion of coal
C) Organic matter
D) Burning of crude oil

Q.52 Acid rain is caused by increase in the atmospheric concentration of
A) Ozone and dust
B) SO_2 and CO
C) SO_z and NO_x
D) CO and CO_2

Q.53 The anhydride of sulphuric acid responsible for acid rain is
A) Pyrosulphuric acid
B) Sulphur (IV) oxide
C) Sulphurous acid
D) Sulphur (VI) oxide

Q.54 Which of the following occurs in Contact process
A) SO_2 is dissolved in water
B) SO_3 is dissolved in water
C) Sulfur trioxide is dissolved in dil. Sulfuric acid
D) Sulfur trioxide is dissolved in conc. Sulfuric acid

Q.55 **Sulfuric acid is not prepared by dissolving SO_3 in water because**
A) It doesn't dissolve in water
B) The reaction is too exothermic and difficult to control
C) It forms oleum instead of sulfuric acid
D) None of the above

Q.56 **Oleum is prepared by**
A) Absorbing SO_3 into water
B) Absorbing SO_3 into sulfuric acid
C) Absorbing SO_2 into water
D) Absorbing SO_2 into sulfuric acid

Q.57 **In contact process SO_3 manufacturing is favour at low temperature but in actual practice the reaction is carried out at 400-600°C the reason is that**
A) At high temperature reaction will be slow
B) Rate of forward reaction is low
C) Equilibrium will established later
D) Separation is easy at high temperature

Q.58 **Arsenic oxide can be removed during contact process by using freshly prepared**
A) $Al(OH)_3$
B) $Fe(OH)_3$
C) $Fe(OH)_2$
D) $Ca(OH)_2$

Q.59 **Pure sulphuric acid is _____ but the addition of water makes it a _____**
A) Nonconductor, non-conductor
B) Good conductor, non-conductor
C) Non-conductor, good conductor
D) Conductor, good conductor

Q.60 **The formula for oleum is**
A) H_2SO_3
B) $H_2S_2O_7$
C) H_2SO_4
D) SO_3

ANSWER KEY

1	A	11	C	21	B	31	A	41	C	51	A
2	C	12	D	22	D	32	C	42	A	52	C
3	C	13	A	23	C	33	C	43	D	53	D
4	A	14	A	24	D	34	D	44	C	54	D
5	D	15	B	25	A	35	C	45	A	55	B
6	A	16	D	26	D	36	A	46	D	56	B
7	A	17	C	27	B	37	C	47	A	57	B
8	D	18	C	28	A	38	D	48	D	58	B
9	C	19	B	29	D	39	A	49	C	59	C
10	B	20	D	30	B	40	D	50	C	60	B

UNIT 8 FUNDAMENTAL PRINCIPLES HYDROCARBONS

SELF ASSESSMENT TEST

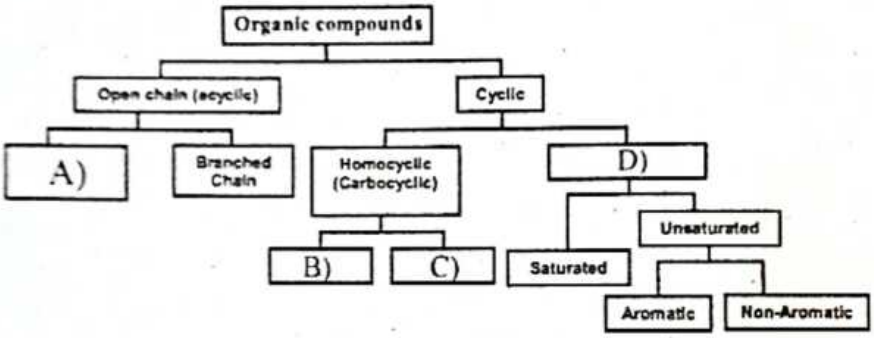
Q.1 **Which of the following option is not true regarding thiophene**

A) Helerocyclic
B) Alicyclic
C) Aromatic
D) Monocyclic

Q.2 **_____ is heterocyclic compound**

A) Toluene
B) Phenol
C) Furan
D) Anthracene

Q.3 **In the given mind map of classification of organic compound alicyclic compound out of the option A), B), C) and D) is**



Q.4 **Maximum number of hydrogen atoms are in**

A) Cyclobutane
B) Cyclopentane
C) Cyclohexane
D) Benzene

Q.5 **Which is not true about the compound 1,3-Cyclohexadiene**

A) Non-benzenoid
B) Non-aromatic
C) Carbocyclic
D) Heterocyclic

Q.6 **Benzene is _____ compound**

A) Heterocyclic
B) Aliphatic
C) Alicyclic
D) Aromatic

Q.7 **In t-butyl alcohol the tertiary carbon is bonded to**

A) Two hydrogen atoms
B) One hydrogen atoms
C) Three hydrogen atoms
D) No hydrogen atoms

Q.8 **Break down of higher hydrocarbons (alkanes) into lower hydrocarbons (alkenes and alkanes) by heating in the absence of air is called**

A) Reforming
B) Distillation
C) Cracking
D) Crystallization

Q.9 **Which type of cracking is useful in the production of better quality gasoline**

A) Thermal cracking
B) Steam cracking
C) Catalytic cracking
D) Hydro-cracking

Q.10 **The fractional distillation of petroleum gives us _____ gasoline**

A) 10%
B) 20%
C) 30%
D) 50%

Q.11 **Breaking down of higher hydrocarbons into lower hydrocarbons in the presence of catalyst at lower temperature is**

A) Thermal cracking
B) Steam cracking
C) Catalytic cracking
D) Hydro-cracking

Q.12 The higher hydrocarbons are used in cracking are mostly consisted of

A) Propene
B) Butane
C) Benzene
D) Kerosene

Q.13 Which of the following statements is incorrect about cracking of petroleum

(i) Both heat and air is required.
(ii) Lower alkenes are obtained in all types of cracking
(iii) Higher hydrocarbons in vapour phase are mixed with air in steam cracking
(iv) High octane petrol is obtained in thermal cracking

A) (i) and (ii)
B) (ii) and (iii)
C) (i), (iii) and (iv)
D) (i), (ii), (iii) and (iv)

Q.14 Select nucleophile from the following

A) NO_2
B) NO_2^+
C) NH_3
D) NH_4^+

Q.15 Select the incorrect statement

A) An ion with a positively charged carbon atom is called a carbocation.
B) When organic compounds react, their bonds can split in either of two ways, by heterolytic or homolytic fission.
C) Negative ions and compounds in which an atom has an unshared pair of electrons are electrophilic in nature
D) A reagent which attacks a region where the electron density is high is called an electrophile

Q.16 Most stable carbocation is

A) Tertiary
B) Secondary
C) Primary
D) Methyl

Q.17 Which one of the following is called free radical

A) Cl^+
B) $Cl^\bullet$
C) Cl^-
D) Cl_2

Q.18 Which type of isomerism is shown by the following compounds:
$CH_3CH_2-O-CH_2CH_3$ and $CH_3CH_2CH_2-OCH_3$

A) Chain isomerism
B) Metamerism
C) Position isomerism
D) Functional group isomerism

Q.19 The structures of three compounds are shown:
I-$CH_3CH_2-O-CH_3$ and II-$CH_3CH_2CH_2-OH$ and III-$CH_3CH(OH)CH_3$
Which compounds are isomers of each other?

A) 1st and 2nd only
B) 1st and 3rd only
C) 2nd and 3rd only
D) All are isomers of one another

Q.20 Chain isomerism is also called:

A) Metamerism
B) Tautomerism
C) Skeletal isomerism
D) All of these

Q.21 Diethyl ketone and Methyl n-propyl ketone are:

A) Metameric isomers
B) Positional isomers
C) Cis trans isomers
D) None of these

Q.22 Which statement is incorrect about cis-trans isomerism

A) Two carbon atoms with double bond cannot rotate freely
B) Two compounds that possess the same structural formula but differ with respect to the positions of identical groups in space.
C) In cis form, similar groups lie on same side of double bond
D) Two groups attached to same carbon atom must be same

Q.23 1-chloropropene and 2-chloropropene show isomerism

A) cis-trans
B) Position isomerism
C) Functional group isomerism
D) Chain isomerism

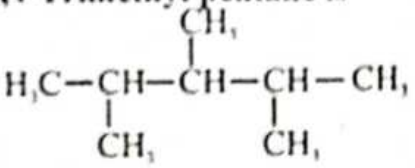
Q.24 Which statement about the members of a homologous series is correct:

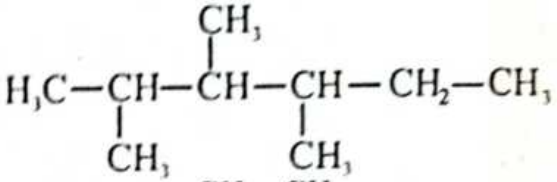
A) They have the same empirical formula
B) They have same melting points
C) They have the same number of carbon atoms per molecule
D) They do not undergo similar reactions

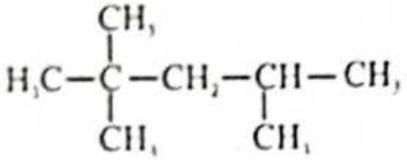
Q.25 The IUPAC name of $CH_3 - CH(C_2H_5) - CH_2 - C(CH_3)_2 - CH_3$

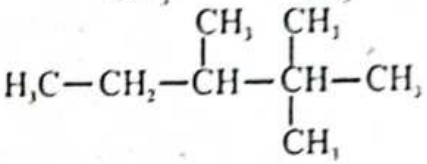
A) 2,2-Dimethyl 4-ethyl pentane
B) Nonane
C) 2,2-Dimethyl heptane
D) 2,2, 4-Trimethyl hexane

Q.26 2,3,4-Trimethyl pentane is

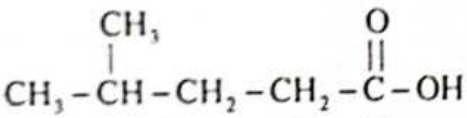
A) 

C) 

B) 

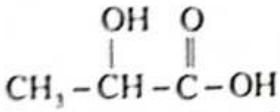
D) 

Q.27 Which one of the following names is correct for the structure



A) 2–Methyl pentanoic acid
B) 4–Methyl pentanoic acid
C) Methyl pentanoic acid
D) 4, 4-Dimethyl butanoic acid

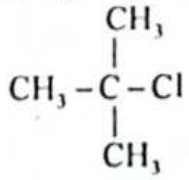
Q.28 Which one of the following is the name of given structure

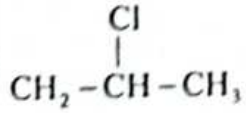


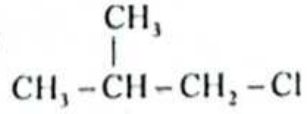
A) Maleic acid
B) Malonic acid
C) Lactic acid
D) Propanal

Q.29 Which one of the following structures is secondary alkyl halide

A) $CH_3–CH_2–Cl$

C) 

B) 

D) 

Q.30 While selecting longest possible chains among the organic compounds for nomenclature, when two or more chains compete each other, which one is selected:

A) Chain with less substituents
B) Chain near to double bond
C) Chain with greater number of substituents
D) Chain near to triple bond

Q.31 Incomplete combustion (occurs in limited supply of air) results in formation of H_2O and

A) CO
B) C
C) CO_2
D) C and CO

Q.32 The standard amount of heat released when 1 mole of CH_4 is burnt in excess of air is

A) 891kJ/mole
B) 1336.5kJ/mole
C) 445
D) 1782kJ/mole

Q.33 When one mole of _____ is burnt completely in excess of oxygen, produces 2 moles of water

A) Propane
B) Benzene
C) Acetylene
D) Methane

Q.34 The order of reactivity of halogens with alkanes is in the order of

A) $I_2 > F_2 > Cl_2 > Br_2$
B) $I_2 > Br_2 > Cl_2 > F_2$
C) $I_2 > Cl_2 > Br_2 > F$
D) $I_2 < Br_2 < Cl_2 < F_2$

Q.35 Select the option that represents propagation step during bromination of alkane in presence of sun light

A) $R-R+Br_2 \longrightarrow R-CH_2-Br+HBr$
B) $R-\dot{C}H_2+Br_2 \longrightarrow R-CH_2Br+\dot{B}r$
C) $\dot{B}r+\dot{B}r \longrightarrow \dot{B}r_2$
D) $\dot{R}+\dot{R} \longrightarrow R-R$

Q.36 The direct substitution is not possible with _____ is treated when alkane in presence of sun light

A) Cl_2
B) Br_2
C) I_2
D) F_2

Q.37 The dehydrating agents that can be used for alcohol dehydration:

A) Conc. H_2SO_4
B) Al_2O_3
C) H_3PO_4 and P_4O_{10}
D) All of these

Q.38 The alcohol which can be easily dehydrated is:

A) $(CH_3)_2CHOH$
B) $(CH_3)_3COH$
C) CH_3CH_2OH
D) Alcohols do not show dehydration

Q.39 2-Bromobutane reacts with alcoholic KOH to give:

A) 1-Butene
B) 2-Butene
C) 1-Butanol
D) 2-Butanol

Q.40 One mole of a hydrocarbon X reacts completely with one mole of hydrogen gas in the presence of a heated catalyst. What could be the formula of X?

A) C_2H_6
B) C_5H_{10}
C) C_3H_8
D) C_7H_{16}

Q.41 Baeyer's reagent is

A) 1% Cold alkaline $KMnO_4$
B) $(R)_3Al$ and $TiCl_4$
C) 1% hot acidified potassium dichromate
D) Liquid ammonia

Q.42 Alkenes undergo

A) Addition polymerization
B) Addition elimination polymerization
C) Condensation polymerization
D) Both "B" and "C"

Q.43 Which of the following set cannot be used for dehydration of alcohols

A) $AlCl_3$, P_2O_3
B) H_2SO_4 , P_2O_5
C) H_2SO_4, H_3PO_4
D) $CaCl_2$, Silica gel

Q.44 The oxidative cleavage of double bond in 2-pentene in the presence of hot alkaline $KMnO_4$ produces

A) Formic acid
B) Formic acid and acetic acid
C) Acetic acid
D) Acetic acid and propanoic acid

Q.45 Polymerization of ethene to polyethene takes place in the presence of

A) $(C_2H_5)_4Pb$
B) $Al(C_2H_5)_3$ and $TiCl_4$
C) $(CH_3)_4Pb$ and $TiCl_4$
D) Zn/HCl

Q.46 Ethene gas is absorbed by conc. H_2SO_4 to form an intermediate, which when hydrolysed with boiling water forms

A) Methyl alcohol
B) Ethyl alcohol
C) Formic acid
D) Methyl hydrogen sulphate

Q.47 Raney nickel is prepared from ——— by treating with caustic soda

A) Ni-Cu alloy
B) Ni-Al alloy
C) Ni-Fe alloy
D) Ni-Mg alloy

Q.48 The resonance energy of benzene is

A) 136 kcal/mole
B) 150.5 kJ/mole
C) -160.5 kJ/mole
D) Both (A) and (C)

Q.49 The C–C bond length in benzene is

A) Less than alkyne
B) Less than alkene
C) More than alkane
D) Less than alkane

Q.50 Total number of sigma bonds in benzene molecule are:

A) 6
B) 3
C) 12
D) 9

Q.51 According to modern concept benzene has

A) Three double bond
B) Delocalized π electron charge
C) Two double bonds
D) One double bond

Q.52 The reaction in which there is an introduction of _____ in benzene is classified in acylation:

A) $-CH_3$
B) H_3C-CO
C) –HCO
D) –COOH

Q.53 Replacement of hydrogen of benzene by alkyl group in the presence of alkyl halide and aluminum chloride is known as

A) Dow's process
B) Friedel and Craft alkylation
C) Friedel and Craft acylation
D) Clemmenson reduction

Q.54 In the nitration of benzene with conc. HNO_3 + conc. H_2SO_4, the active species involved is known as

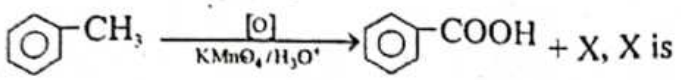
A) Nitrite ion
B) Nitrosonium ion
C) Nitrate ion
D) Nitronium ion

Q.55 Which of the following can be used as catalyst for the saturation of benzene?

A) Ag
B) $AlCl_3$
C) Pt/H_3O^+
D) P_2O_5

Q.56 Benzene can be converted into cyclohexane ring by

A) Reduction
B) Oxidation
C) Unsaturation
D) Neutralization

Q.57  + X, X is

A) H_2O

B) $H_2O + CO_2$

C) $H_2O + CO + CO_2$

D) $H_2O + C + CO + CO_2$

Q.58 **Ethyl benzene undergoes _____when acidified $KMnO_4$ is made to react to form benzoic acid:**

A) Reduction

B) Hydroxylation

C) Oxidation

D) Hydrogenation

Q.59 **The Friedel craft reaction will be slowest for**

A) Benzene

B) Nitrobenzene

C) Toluene

D) Phenol

Q.60 **The major product of nitration of benzoic acid?**

A) 3-Nitrobenzoic acid

B) 2-Nitrobenzoic acid

C) 4-Nitrobenzoic acid

D) 2,4-Dinitrobenzoic acid

ANSWER KEY

1	B	11	C	21	A	31	D	41	A	51	B
2	C	12	D	22	D	32	A	42	A	52	B
3	B	13	C	23	B	33	D	43	D	53	B
4	C	14	C	24	A	34	D	44	A	54	D
5	D	15	C	25	D	35	B	45	B	55	C
6	D	16	A	26	A	36	C	46	B	56	A
7	D	17	B	27	B	37	D	47	B	57	A
8	C	18	B	28	C	38	B	48	B	58	C
9	C	19	D	29	B	39	B	49	D	59	B
10	B	20	C	30	C	40	B	50	C	60	A

9 UNIT

ALKYL HALIDES , ALDEHYDES & KETONES ALCOHOLS AND PHENOLS

SELF ASSESSMENT TEST

Q.1 **$CH_3 - CH(Cl)CH_3$ is called as**

A) Iso-propyl chloride
B) 2-Chloropropane
C) 2°-Alkyl halide
D) All are correct

Q.2 **Halogens present in halothanes are**

A) F, I, Br
B) F, Cl, Br
C) F, At
D) Cl , I

Q.3 **Which of the following statement is incorrect**

A) Halothane is the only inhalational anesthetic having bromine atom
B) CFC's destroy ozone layer in troposphere
C) Carbon tetrachloride is used as fire extinguisher
D) Both A and C are incorrect

Q.4 **Which one of the following species is not an electrophile?**

A) NH_3
B) H^+
C) Br^+
D) BF_3

Q.5 **The alkyl halide molecule on which the nucleophile attacks is called:**

A) Electrophile
B) Substrate
C) Leaving group
D) Electrophilic centre

Q.6 **Primary alkyl halides give**

A) E2 and S_N2 reactions
B) Either E1 or E2 reactions
C) E1 and S_N1 reactions
D) S_N2 and E1 reactions

Q.7 **Most stable carbonium ion is**

A) $(CH_3)_3 - C - {}^+CH_2$
B) $(CH_3)_3 - C^+$
C) ${}^+CH_3$
D) $CH_3 - {}^+CH - CH_3$

Q.8 **If an electrophile is the attacking reagent which one is most reactive?**

A) R - I
B) R - Br
C) R - Cl
D) R - F

Q.9 **SN1 reactions are favoured in which solvent?**

A) Non polar
B) Slightly polar
C) Polar
D) All solvents

Q.10 **Which pair of reactant give the primary alkyl amine as a product**

A) $C_2H_5Br + CH_3\bar{O}$
B) $C_2H_5Br + 2[H]$
C) $C_2H_5Br + C\bar{N}$
D) $C_2H_5Br + NH_3$

Q.11 **Which one among the following is good leaving group**

A) $O\bar{H}$
B) $C\bar{\ell}$
C) $\bar{F}$
D) I^-

Q.12 In SN reactions, the correct order of reactivity of alkyl halide is

A) $1° > 2° > 3°$
B) $2° > 1° > 3°$
C) $3° > 2° > 1°$
D) $1° > 3° > 2$

Q.13 C – X bond is strongest in

A) $CH_3 - F$
B) $CH_3 - Br$
C) $CH_3 - Cl$
D) $CH_3 - I$

Q.14 Among halide (X^-) ions, the poor leaving group is

A) F^-
B) Br^-
C) Cl^-
D) I^-

Q.15 Which of the following mechanism is most likely to be affected by nature of leaving group

A) $SN_2 + SN_1$
B) $SN_1 + E_1$
C) $E_2 + E_1$
D) $SN_2 + E_2$

Q.16 The reactivity order of alkyl halides for Dehydrohalogenation reaction is

A) R – Cl > R – Br > R – F > R – I
B) R – I > R – Br > R – Cl > R – F
C) R – F > R – Cl > R – Br > R–I
D) R – Br > R – Cl > R – I > R – F

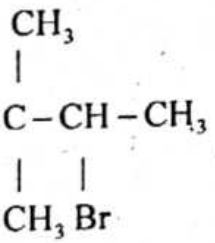
Q.17 2-Bromopropane on reaction with alcoholic KOH gives

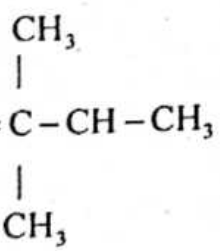
A) 2-Propanol
B) 1-Propene
C) Propane
D) 1-Propanol

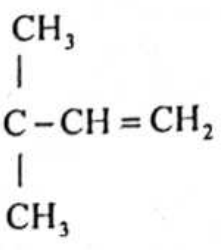
Q.18 Rate= K [R – X][BASE]

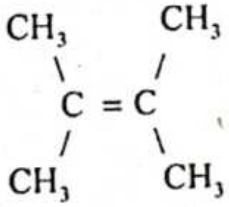
This rate law is consistent with which of following mechanism

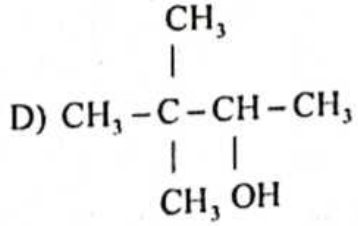
A) SN1
B) E1
C) SN2
D) E2

Q.19  **undergoes E mechanism to produce.**

A) 

B) 

C) 

D) 

Q.20 Alkaline hydrolysis of CH_3–Cl follows which mechanism and what will be the product

A) SN1, $CH_3 - OH$
B) SN2, CH_3–OH
C) SN_2, CH_3–CH_2–OH
D) E2, CH_3–OH

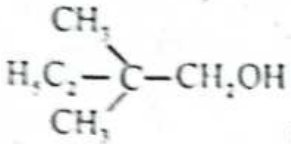
Q.21 Which one is not a characteristics of alcohols

A) They have higher boiling point than corresponding alkanes
B) Higher members are colourless and odourless
C) They are lighter than water
D) Their solubility in water decreases with increase in molecular weight

Q.22 Neo-pentyl alcohol is a type of alcohol

A) Primary alcohol
B) Secondary alcohol
C) Tertiary alcohol
D) Aromatic alcohol

Q.23



In above structure the number of primary carbon and primary hydrogen atoms are

A) 4,13
B) 3,8
C) 4,11
D) 5,13

Q.24 The hydration of ethene in the presence of conc. H_2SO_4 or conc. H_3PO_4 produces

A) Ethanol
B) Ethane
C) Ethanal
D) Ethyne

Q.25 Acid catalyzed hydration of alkenes except ethene leads to the formation of

A) Mixture of 2°and 1° Alcohol
B) 2° or 3° Alcohol
C) Mixture of 1° and 3° Alcohol
D) 1° Alcohol

Q.26 Ethyl hydrogen sulphate undergoes _____ to form ethanol

A) Hydration
B) Both A and B
C) Hydrolysis
D) Oxidation

Q.27 For the reaction $H_3C-CH_2-OH \xrightarrow[180^\circ C]{H^+} H_2C=CH_2+H_2O$, The type of bonds that break are

A) C – H and C – H
B) C – O and C – O
C) C – H and H – O
D) C – H and C – O

Q.28 2-Propanol upon oxidation with acidified dichromate gives:

A) Acetaldehyde
B) 2-Methylpropene
C) Acetone
D) All of these

Q.29 When ethanol reacts with PCl_5 then products formed are:

A) C_2H_5Cl and H_3PO_3
B) C_2H_5Cl, $POCl_3$ and HCl
C) C_2H_5Cl and HCl
D) C_2H_5Cl only

Q.30 When an unknown primary alcohol gives yellow precipitates of iodoform, it is most likely to be:

A) Methanol
B) 1-Propanol
C) Ethanol
D) 1-Butanol

Q.31 Which of the following is used as a catalyst for esterification:

A) Dil.H_2SO_4
B) Dilute alkali
C) Conc. H_2SO_4
D) Conc. alkali

Q.32 Distinction between methanol and ethanol can be performed by

A) Lucas test
B) Iodoform test
C) Fehling's test
D) 2, 4 –DNPH

Q.33 $(CH_3)_3CCH_2OH \xrightarrow[180°C]{Conc.\ H_2SO_4} X$

The "X" compound in the above reaction

A) Isobutylene
B) Isopropylene
C) 2–Methyl–but–1–ene
D) It's not an alkene

Q.34 **Tertiary butyl alcohol do not undergo dehydrogenation because**

A) It does not contain α-hydrogen
B) It contain only one –OH group
C) It contain electron donating groups
D) Stearic hindrance of alkyl groups

Q.35 **Catalytic dehydration of a 1° alcohol gives**

A) Ketone
B) 2°-Alcohol
C) Aldehyde
D) Alkene

Q.36 **Reaction of Phenol with bromine in polar solvent (H_2O) give**

A) 2, 4, 6-Tribromophenol
B) p - Bromophenol
C) o- Bromophenol
D) Mixture of o – Bromophenol and p - Bromophenol

Q.37 **The reaction of phenol with sodium hydroxide is**

A) SN reaction
B) Neutralization reaction
C) Elimination
D) Addition reaction

Q.38 **Which of the following is more acidic in nature**

A) Carbolic acid
B) Picric acid
C) Benzoic acid
D) Acetic acid

Q.39 **The statement which explains the acidic behaviour of phenol**

A) Its phenoxide ion become stable due to resonance
B) Phenol on treatment with Na metal produces H_2 gas
C) Its aqueous solution has pH around 5 or 6
D) All of these

Q.40 **Alcohol as compared to water is**

A) More acidic
B) Less acidic
C) Neutral
D) Less basic

Q.41 **Symmetrical structure of a ketone refers to:**

A) Uneven number of carbon atoms on either side of the carbonyl group
B) Same number of carbon atoms on either side of the carbonyl group
C) Just 1 carbon more on the right of the carbonyl group
D) Just 1 carbon more on the left of the carbonyl group

Q.42 **Which of the following is true regarding two different carbonyl compounds having molecular formula C_3H_6O (not belonging to alkenol)**

A) Both contain only sp^3-hybridized carbon atom
B) Both contain sp^3-hybridized oxygen atom
C) Both contain at least one sp^3 hybridized carbon atom
D) Both belong to carboxylic acids

Q.43 **The general formula for an alkanone is**

A) $C_nH_{2n}O_2$
B) $C_nH_{2n+1}OH$
C) $C_nH_{2n+1}O$
D) $C_nH_{2n}O$

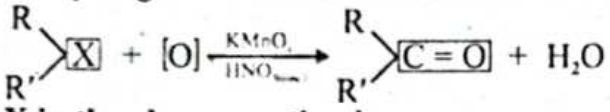
Q.44 **The alcohol which cannot be used to prepare an aldehyde by oxidation**

A) Ethyl alcohol
B) Methyl alcohol
C) Isopropyl alcohol
D) Neopentyl alcohol

Q.45 During the oxidation of alcohol to get a carbonyl compound, which of the following is not true statement about the reaction

A) Oxygen is added to ethanol
B) Hydrogen is removed from ethanol
C) Oxidizing agent is used
D) Hybridization of alpha carbon changes

Q.46



X in the above reaction is

A) CH_2-OH
B) $-CHO$
C) $-CH_3$
D) $>CH-OH$

Q.47 An alcohol giving positive 2, 4-DNPH test implies that

A) It is 100% pure
B) It may contain some contents of aldehydes and ketones
C) It is ethanol
D) Alcohol contain some contents of carboxylic acid

Q.48 Reduction of an aldehyde using $NaBH_4$ gives:

A) Primary alcohol
B) Tertiary alcohol
C) Secondary alcohol
D) Phenol

Q.49 Acidified hydrolysis of cyanohydrins forms:

A) Carboxylic acids
B) Hydroxyl-carboxylic acids
C) Alcohols
D) Aldols and ketols

Q.50 Acetaldehyde can react with

A) Electrophiles only
B) Nucleophiles only
C) Electrophiles and nucleophiles
D) Free radicals only

Q.51 Which of the following ketones will produce propanoic acid only after oxidation by acidified potassium dichromate:

A) Ethyl n-propyl ketone
B) Ethyl methyl ketone
C) Dimethyl ketone
D) Diethyl ketone

Q.52 All of the followings react with Fehling solution except

A) $CH_3(CH_2)_2CHO$
B) $CH_3(CH_2)_2COCH_3$
C) HCHO
D) CH_3CHO

Q.53 A compound which give both haloform and Tollen's test is

A) Methanal
B) Acetaldehyde
C) Methyl ketone
D) Acetone

Q.54 High quality mirrors are manufactured by using

A) 2,4-DNPH
B) Cupric tartrate
C) Cupric citrate
D) Diammine silver (I) hydroxide

Q.55 Unsymmetrical ketones on oxidation with strong oxidizing agent produces _____ carboxylic acids.

A) Same
B) Different
C) Maybe same or different
D) Ketones cannot be oxidized

Q.56 Which of the following is not a mild oxidizing agent

A) Tollen's reagent
B) Fehling's solution
C) Benedict's solution
D) Acidified potassium dichromate

Q.57 **CHX_3 will be given by all the carbonyl compounds (aldehydes and ketones) containing at least one:**

A) Ethyl group
B) Isopropyl group
C) Methyl group
D) Both "B" and "C" are correct

Q.58 **Which of the following will not give iodoform test?**

A) Ethanol
B) Ethanal
C) 3–Pentanone
D) 2–Pentanone

Q.59 **Benzaldehyde will not give which of the following test**

A) Iodoform
B) Silver mirror
C) Fehling's solution
D) 2,4 DNPH

Q.60 **_____ on reduction generates methoxide ion as an intermediate**

A) Acetaldehyde
B) Methanal
C) Acetone
D) Methanol

ANSWER KEY

1	D	11	D	21	C	31	C	41	B	51	A
2	B	12	C	22	A	32	B	42	C	52	B
3	B	13	A	23	C	33	D	43	D	53	B
4	A	14	A	24	A	34	A	44	C	54	D
5	B	15	B	25	B	35	D	45	A	55	C
6	A	16	B	26	C	36	A	46	D	56	D
7	B	17	B	27	D	37	B	47	B	57	C
8	D	18	D	28	C	38	B	48	A	58	C
9	C	19	B	29	B	39	D	49	A	59	C
10	D	20	B	30	C	40	B	50	C	60	B

10 UNIT CARBOXYLIC ACIDS AMINO ACIDS

SELF ASSESSMENT TEST

Q.1 Which of the following is not carboxylic acid?

A) $C_nH_{2n+1}COOH$
B) $C_nH_{2n}O_2$
C) $C_nH_{2n+1}OH$
D) RCOOH

Q.2 Pentanoic acid is

A) Maleic acid
B) Adipic acid
C) Glutamic acid
D) valeric acid

Q.3 Which one is not fatty acid

A) Palmitic acid
B) Phthalic acid
C) Stearic acid
D) Oleic acid

Q.4 Isobutyric acid also written as

A) 2-Propanoic acid
B) 2-Ethylpropanoic acid
C) 2-Methylpropanoic acid
D) Ethanedioic acid

Q.5 Which of the following compound cannot be oxidized to carboxylic acid by mild oxidizing agent:

A) Ethanol
B) Ethanal
C) Propanone
D) Propionaldehyde

Q.6 Hybridization of functional carbon, changes from _____ to _____when converting to carboxylic from formyl

A) $sp \rightarrow sp$
B) $sp \rightarrow sp^3$
C) $sp \rightarrow sp^2$
D) $sp^2 \rightarrow sp^2$

Q.7 Ethyl cyanide boiled with HCl in the presence of water gives

A) Methanoic acid
B) Ethanoic acid
C) Propanoic Acid
D) Butanoic acid

Q.8 A molecule is oxidized to simple aliphatic carboxylic acid if the molecule gives silver mirror but do not behave as an acid, identify the molecule

A) Butanol
B) Ethanol
C) Propanoic acid
D) Propanal

Q.9 Hydrolysis of alkane nitriles for preparing carboxylic acids requires

A) Acidic conditions
B) Any of the above
C) Alkaline conditions
D) Both are simultaneously necessary

Q.10 IUPAC name of CH_3CN is

A) Ethane nitrile
B) Methyl cyanide
C) Propane nitrile
D) Ethyl cyanide

Q.11 $R-X+KCN \xrightarrow{\text{alcohol}} R-CN+KX$ **is an example of**

A) Electrophilic substitution reaction
B) Nucleophilic substitution reaction
C) Condensation reaction
D) Elimination reaction

Q.12 Carboxylic acid decomposes bicarbonates with

A) Effervescence
B) Hydrogen
C) Esterification
D) Reaction don't proceed

Q.13 Ethyl alcohol reacts with which to give a product having pineapple flavor:

A) Acetic acid
B) Formic acid
C) Valeric acid
D) Butyric acid

Q.14 Which one is benzyl acetate

A) $C_6H_5CH_2COOH_3$
B) $CH_3COOCH_2C_6H_5$
C) $C_6H_5COOC_6H_5$
D) $CH_3(OH_2)_2COOC_2H_5$

Q.15 Esterification is a reaction

A) Condensation
B) Elimination
C) Neutralization
D) All

Q.16 Which of the following do not give acetamide when react with ammonia

A) Carboxylic acid
B) Acid anhydride
C) Acid Chloride
D) Alkyl nitrite

Q.17 Which one don't convert acid to acid halide

A) Cl_2
B) PCl_5
C) $SOCl_2$
D) PCl_3

Q.18 During the formation of an ester from acetic acid, what actually happens

A) Displacement of the H^+ from the acid by Cl
B) Displacement of the OH^{-1} from the acid by OCH_3
C) Attachment of OCH_3 with the carbonyl oxygen
D) Displacement of the H^+ from the acid by OCH_3

Q.19 Carboxylic acid react with ammonia to form which salt

A) Acid amide
B) Ammonium acetate
C) Acetic anhydride
D) Acetyl chloride

Q.20 Which of the following formula is more reactive for hydrolysis

A) –COOR
B) –COOH
C) $-CONH_2$
D) –COCl

Q.21 $2CH_3COOH + Na_2CO_3 \longrightarrow X + CO_2 + H_2O$. **Identify "X" among the following**

A) Sodium carboxylate
B) Sodium ethanoate
C) Sodium formate
D) Sodium propanoate

Q.22 $CH_3COONH_4 \xrightarrow{heat} CH_3CONH_2 + H_2O$

Above reaction is an example of

A) Dehydration
B) Hydrolysis
C) Polymerization
D) Condensation

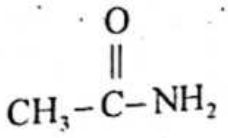
Q.23 Ester used for banana flavouring is

A) Amyl acetate
B) Isobutyl formate
C) Ethyl butyrate
D) Octyl acetate

Q.24 Which of the following metal does not react with carboxylic acid

A) Na
B) K
C) Ca
D) Cu

Q.25 IUPAC name of



A) Acetamide
B) Ethanamide
C) Ethanal amine
D) Ethanal imide

Q.26 Pure organic acids are much

A) Weaker than chloro substituted acids
B) Same strength as chloro substituted acids
C) Stronger than chloro substituted acids
D) None of these

Q.27 Here the strongest acid is

A) CH_3COOH
B) CH_3CH_2COOH
C) $Cl–CH_2–COOH$
D) $Br–CH_2–COOH$

Q.28 Carboxylic acid when dissolved in H_2O produces H_3O^+ and _____

A) Alkanoate ion
B) Alkoxide ion
C) Phenoxide ion
D) Hydroxy ion

Q.29 Which of the following can react with $NaHCO_3$

A) Ethanoic acid
B) Phenol
C) Ethanol
D) Water

Q.30 Which of the following does not contain COOH group

A) Succinic acid
B) Adipic acid
C) Lactic acid
D) Carbolic acid

Q.31 The organic compounds containing both the amino and the carboxyl group are called

A) Carboxylic acids
B) Mineral acids
C) Amino acids
D) Polybasic acids

Q.32 The amino group in amino acids can be attached to any carbon other than

A) Alpha carbon
B) Gamma carbon
C) Beta carbon
D) Carbonyl carbon

Q.33 The amino acids that are not created within our body and required to be taken up through our diet are

A) Essential amino acids
B) Basic amino acids
C) Non essential amino acids
D) Acidic amino acids

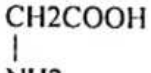
Q.34 Which of the following amino acid is present in humans but is not involved in protein synthesis?

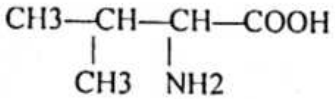
A) Histidine
B) γ-Aminobutyric acid
C) Proline
D) Cysteine

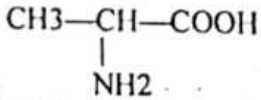
Q.35 Which of the following was first isolated from cheese?

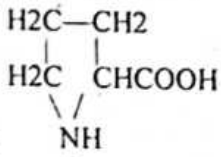
A) Tryosine
B) Butyric acid
C) Glycine
D) Histidine

Q.36 Correct formula of proline is

A)


B)


C)


D)


Q.37 2-amino acetic acid is IUPAC name of

A) Alanine
B) Glycine
C) Lysine
D) Aspartic acid

Q.38 α-amino acids are compounds having carboxylic group as well as amino group attached to

A) Any hydrogen atom in molecule
B) Same carbon atom
C) Alternate carbon atom
D) Neighbouring carbon atom

Q.39 The α-amino acid which contains an aromatic side chain is

A) Proline
B) Tyrosine
C) Valine
D) Lysine

Q.40 Which of the following can be obtained by introduction of amino group to one of the carbon of succinic acid

A) Aspartic acid
B) Lysine
C) Glutamic acid
D) Alanine

Q.41 Which of the following is not present in histidine?

A) p° amine group
B) Imine group
C) s° amine group
D) Vinyl group

Q.42 Which of the following contain hydroxyl group.

A) Serine
B) Valine
C) Histidine
D) Proline

Q.43 Total number of methylene group present in alanine is

A) 2
B) 3
C) 4
D) 0

Q.44 The number of amino acids in a pentapeptide are

A) 1
B) 3
C) 2
D) 5

Q.45 Amino acid which contains π-bond in its side chain

A) Histidine
B) Alanine
C) Lysine
D) Glycine

Q.46 Histidine is an amino acid but its nature is

A) Acidic
B) Neutral
C) Basic
D) Highly acidic

Q.47 All alpha amino acids exist largely in aqueous form in the form of a dipolar structure called

A) Zwitter ion
B) Carbo-cation
C) Anion
D) Complex ion

Q.48 The dipolar structure of α-amino acids is also called

A) Internal salt
B) Double salt
C) Carboxylate salt
D) Basic salt

Q.49 The basic character of amino acids (in aqueous solution) is largely due to

A) Amino group
B) Carbonyl group
C) Carboxylate ion
D) Carbonyl oxygen

Q.50 In which media zwitter ion can exist?

A) Alcoholic HCl
B) Aqueous HCl
C) Equimolar alkaline HCl
D) $NaNO_3$+HCl

Q.51 Which of the following amino acid is aromatic and basic amino acid?

A) Lysine
B) Histidine
C) Arginine
D) Tyrosine

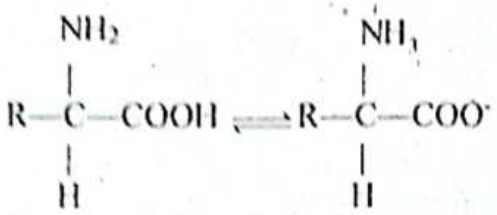
Q.52 Which of the following pair is correct?

	Name	Nature	Type
A)	Lysine	Acidic	Essential
B)	Proline	Neutral	Essential
C)	Valine	Neutral	Essential
D)	Alanine	Basic	Non-essential

Q.53 In excess of acid how many H^+ ions can be accommodated by histidine ideally

A) 1
B) 3
C) 2
D) 4

Q.54



Above mentioned reaction cannot be called as

A) Neutralization reaction
B) Rearrangement
C) Tautomerism
D) Disprotonation

Q.55 **Amino acid which is cyclic and have more amino group than COOH**

A) Histidine
B) Lysine
C) Proline
D) Glycine

Q.56 **Building blocks of proteins are**

A) Carboxylic acids
B) Mineral acids
C) Amino acids
D) Fatty acids

Q.57 **A nanopeptide contains _____ peptide linkages**

A) 10
B) 8
C) 4
D) 9

Q.58 **Proteins are macro molecules that mostly contain**

A) Single type of monomer
B) Single type of amino-acids
C) Single type of C-C bonds
D) Single type of chain length between two consecutive peptide bonds

Q.59 **–CO–NH– linkage is known as**

A) Peptide
B) Ether
C) Amide
D) Ester

Q.60 **Protein is _____ polymer**

A) Condensation
B) Homopolymer
C) Addition
D) Thermoplastics

ANSWER KEY

1	C	11	B	21	B	31	C	41	D	51	B
2	D	12	A	22	A	32	D	42	A	52	C
3	B	13	D	23	A	33	A	43	D	53	B
4	C	14	B	24	D	34	B	44	D	54	D
5	A	15	A	25	B	35	A	45	A	55	A
6	D	16	D	26	A	36	D	46	C	56	C
7	C	17	A	27	C	37	B	47	A	57	B
8	D	18	B	28	A	38	B	48	A	58	D
9	B	19	B	29	A	39	B	49	C	59	A
10	A	20	D	30	D	40	A	50	C	60	A

11 UNIT MACROMOLECULES ENVIRONMENTAL CHEMISTRY

SELF ASSESSMENT TEST

Q.1 **The incorrect statement about addition polymerization**

A) Empirical formula of monomer and polymer are same
B) It proceeds in the presence of sunlight
C) The product have high saturation than reactant
D) It follow free radical mechanism

Q.2 **Polyvinyl chloride is a polymer of vinyl chloride. It usually follows**

A) Free radical mechanism
B) Base catalyzed mechanism
C) Acid catalyzed mechanism
D) Ion catalyzed mechanism

Q.3

$$n\,CH_2=\underset{\displaystyle Cl}{\underset{|}{CH}} \xrightarrow{?} \left\{CH_2-\underset{\displaystyle Cl}{\underset{|}{CH}}\right\}_n$$

What conditions are required for the preparation of PVC

A) 52°C and 9 atm
B) 25°C and 1 atm
C) 100°C and 2 atm
D) 25°C and 9 atm

Q.4 **Which of the following is used for the manufacturing of plastic bottles or containers**

A) PVC
B) Polystyrene
C) Polyethene
D) Polyesters

Q.5 **Empirical formula of polystyrene**

A) CH
B) $\left\{\underset{\displaystyle C_6H_5}{\underset{|}{CH}}-CH_2\right\}_n$
C) $C_6H_5C_2H_3$
D) C_8H_8

Q.6 **Which can be used as a monomer in polymerization reaction**

A) Vinyl benzene
B) Ethylene
C) Vinyl chloride
D) All of these

Q.7 **Peroxides initiates the polymerization via**

A) Hydrocarbon combustion
B) Isomeric saponification
C) Ion formation
D) Free radical formation

Q.8 **Polyester resins are used in**

A) Plastic
B) Food container
C) Floor covering
D) Clothing and water tanks

Q.9 **Example of step growth polymerization**

A) Polyamide
B) PVC
C) Polythene
D) Polystyrene

Q.10 **Hexamethylene diamine and adipic acid condense to form Nylon 6,6. Any one of the both of the monomers contains how many number of C-atoms**

A) 3
B) 5
C) 4
D) 6

Q.11 **Which of the following is not used as a packing material**

A) Polyethene
B) Terylene
C) PVC
D) Polystyrene

Q.12 **Which of the following is not used for manufacturing of Nylon**

A) Esters
B) Adipic acid
C) Di-carboxylic acids
D) Di-amine

Q.13 The helical structure of secondary protein is due to
A) London force
B) Covalent bond
C) Dipole force
D) Hydrogen bond

Q.14 Which of the following is a bi product of Nylon-6, 6
A) NH_3
B) HCl
C) H_2O
D) CH_3OH

Q.15 Which nitrogenous base is absent in RNA
A) Adenine
B) Cytosine
C) Guanine
D) Thymine

Q.16 Which of followings is prepared by using an aliphatic dicarboxylic acid monomers
A) PVA
B) Nylon-6,6
C) Polyester
D) polythene terephthalate

Q.17 Gly-Ala-val is formed by _____ process
A) Addition
B) Substitution
C) Condensation
D) Elimination

Q.18 Polyethene, polystyrene and PVC are examples of
A) Natural polymer
B) Inorganic polymer
C) Addition polymer
D) Condensation polymer

Q.19 Peptide linkage is chemically
A) Amide linkage
B) Ether linkage
C) Glyosidic linkage
D) Ester linkage

Q.20 In an α-Helix of secondary structure of protein, the hydrogen bond exits between
A) Carbonyl carbon and nitrogen of amine
B) Carbonyl oxygen and hydrogen of amine
C) α-hydrogen and carbonyl group
D) All are possible

Q.21 The groups responsible for hydrogen bonding in proteins are
A) >C=O, H–N<
B) CHO, H_2N
C) –OH, H–N<
D) COOH, H_2N

Q.22 Number of hydrogen bonding between adenine – thymine and guanine – cytosine are respectively
A) 2 and 3
B) 3 and 1
C) 3 and 2
D) 3 and 4

Q.23 Not true for majority of proteins
A) Compact
B) Convoluted
C) Precisely positioned atoms
D) Contain four structural levels

Q.24 The nitrogenous base not present in DNA
A) Thymine
B) Guanine
C) Uracil
D) Adenine

Q.25 Purine base among the following
A) Adenine
B) Uracil
C) Cytosine
D) Thiamine

Q.26 Which pair has triple hydrogen bond
A) A, T
B) T, U
C) A, G
D) G, C

Q.27 Chief role of DNA is
A) To carry genetic information
B) To facilitate biosynthesis of proteins
C) To start biochemical reactions
D) To form chromosomes

Q.28 Major differentiating factor of DNA and RNA is
A) Phosphate group
B) Nitrogenous bases
C) Sugar
D) Both B) and C)

Q.29 In biological system the DNA can undergoes
A) Translation
B) Mutation
C) Replication
D) All of these

Q.30 The key to the ability of DNA to store and pass the genetic information is
A) Absence of thymine
B) Presence of phosphate
C) Presence of hydrogen bonding
D) Presence of double helical structure

Q.31 The harmful substances pollute the atmosphere
They damage I-Environment II- Human health III-Quality of life
A) I, II only
B) I-III only
C) II, III only
D) I, II, III

Q.32 Which of the following is primary pollutant
A) Ozone
B) Aldehydes
C) Hydrocarbon
D) HF

Q.33 Which is incorrect information about carbon monoxide
A) It is colourless and highly toxic gas
B) It is vital for photosynthesis process
C) It is three times lighter than air
D) It is slightly soluble in water

Q.34 NOx in atmosphere are majorly produced naturally by
A) Photochemical reaction
B) Oxidation of nitrogen compounds
C) Bacterial action
D) Volcanoes

Q.35 Factor responsible to increase the temperature of stratosphere is
A) CO_2
B) O_3
C) CH_4
D) CFC's

Q.36 Which of the following air pollutant is known as silent killer
A) NO_2
B) CO_2
C) CO
D) NO

Q.37 The major source of pollution due to carbon monoxide is
A) Exhaust from automobiles
B) Forests fires
C) Volcanic eruptions
D) Industrial processes

Q.38 The residence time of NO_2 in atmosphere is
A) 30 minutes
B) 3 days
C) 1 day
D) 4 days

Q.39 A primary pollutant
A) Corrodes the metals only
B) Is waste product from chimneys of industry
C) Causes cancer
D) Concentration cannot be controlled

Q.40 Oxides of sulphur and nitrogen are important pollutants of
A) Water
B) Soil
C) Air
D) Both A) and B)

Q.41 75% of total carbon monoxide in the atmosphere is due to
A) Forest fires
B) Agricultural products
C) Industries
D) Fuel burning in vehicles

Q.42 Due to photochemical reaction, NOx are converted to

A) HNO_3 C) N_2O_5

B) NO_2 D) N_2O

Q.43 The green house effect is caused by

A) CO C) NO

B) CO_2 D) NO_2

Q.44 Which of the following is primary pollutant

A) PAN C) CO

B) HNO_3 D) H_2SO_4

Q.45 Which of the following is not generally regarded as a pollutant

A) CO C) N_2

B) O_3 D) Hydrocarbons

Q.46 What is the percentage of sulphur in coal

A) 1-5 % C) 1-9 %

B) 1-20 % D) 1-15 %

Q.47 Sulphur oxides have which of the following harmful effects

(i) Are irritating and suffocating **(ii) Form sulphate aerosols**

(iii) Headache and fatigue **(iv) Major source of acid rain**

A) I, IV only C) I, II, III

B) I, II, IV D) II, III only

Q.48 One of the following is not the effect of acid rain. What is that

A) It increases the %age of CO_2 in atmosphere

B) It leaches metal like Al, Hg and Pb

C) It damages building material

D) It decreases the pH of rain water

Q.49 In some countries due to release of _____ by volcanic eruption there is temporary acid rain

A) H_2SO_4 C) HNO_3

B) HCl D) H_2CO_3

Q.50 For acid deposition one of the reaction is

$SO_2 + \frac{1}{2}O_2 + H_2O \xrightarrow{X} H_2SO_4$ **here "X" is**

A) Hydrocarbon C) Metal oxides

B) Smoke D) All of these

Q.51 Which statement is not true about O_3

A) It is a gas and act as pollutant

B) It is measured in DU and its concentration is 350 DU.

C) It gained importance in 1980s

D) It absorbs infrared radiations

Q.52 Ozone is depleted as $\dot{Cl} + O_3 \rightarrow Cl\dot{O} + O_2$. Which of the following is not a source of $\dot{Cl}$

A) Freon C) Teflon

B) CCl_4 D) CF_2Cl_2

Q.53 Under normal condition concentration of O_3 in stratosphere remains constant but still hole is created due to

A) Rate of formation of O_3 is less than rate of dissociation
B) O_3 being unstable dissociate to O_2
C) Excessive use of pollutants like CFC's
D) O_3 is polar and reactive

Q.54 Depletion of ozone layer causes

A) Blood cancer
B) Lungs cancer
C) Bone cancer
D) Skin cancer

Q.55 CFC's play an important role in removing O_3 in

A) Troposphere
B) Polar region
C) Stratosphere
D) Equators

Q.56 Ozone is pollutant for human beings when it present in

A) Troposphere
B) Mesosphere
C) Stratosphere
D) Thermosphere

Q.57 The amount of ozone in expressed in Dobson units (DU) the normal amount of overhead ozone is

A) 300
B) 250
C) 350
D) 150

Q.58 If ozone is present in troposphere then it causes

A) Lungs problems
B) Eyes problems
C) Coughing
D) All of these

Q.59 Ozone hole was observed at

A) Africa
B) Europe
C) Antarctica
D) America

Q.60 Maximum concentration of ozone is present in stratosphere layer in the range of

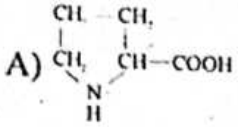
A) 10–15 Km
B) 20–25 Km
C) 15–20 Km
D) 25–28 Km

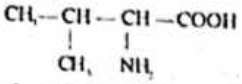
ANSWER KEY

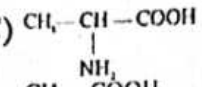
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3	A	13	D	23	D	33	B	43	B	53	C
4	B	14	C	24	C	34	C	44	C	54	D
5	A	15	D	25	A	35	B	45	C	55	C
6	D	16	B	26	D	36	C	46	C	56	A
7	D	17	C	27	A	37	A	47	B	57	C
8	D	18	C	28	D	38	B	48	A	58	D
9	A	19	A	29	D	39	B	49	B	59	C
10	D	20	B	30	D	40	C	50	D	60	D

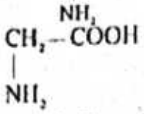
POST-ASSESSMENT TEST

Q.1 Which one of the following is structural formula of proline

A) 

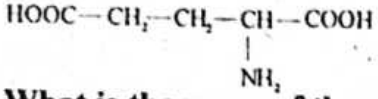
B) 

C) 

D) 

Q.2 In the formation of Zwitter ion which one of the following donates the proton?

A) COOH
B) NH_2
C) CH_2COO^-
D) OH^-

Q.3 

What is the name of the above given structural formula?

A) Aspartic acid
B) Asparagine
C) Adipic acid
D) Glutamic acid

Q.4 Which one of the following is simplest amino acid?

A) Lysine
B) Leucine
C) Alanine
D) Glycine

Q.5 Which one of the following polymer is called as Nylon 6,6?

A) Polyester
B) Polyvinylchloride
C) Polyamide
D) Polyvinylacetate

Q.6 Which one of the following is an exact composition of a carbohydrates?

A) Carbon and hydrogen
B) Carbon and oxygen
C) Carbon, hydrogen and oxygen
D) Hydrogen and oxygen

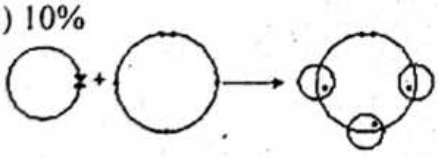
Q.7 Which one of the following nitrogen base is NOT present in DNA?

A) Adenine
B) Guanine
C) Uracil
D) Cytosine

Q.8 In the woody parts of trees, the %age of cellulose is:

A) 50%
B) 10%
C) 30%
D) 100%

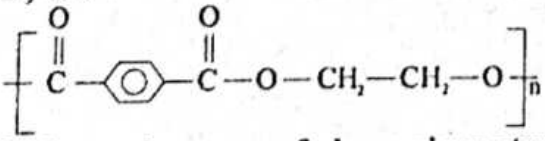
Q.9



Choose the right molecule:

A) CH_3
B) CO
C) H_2O
D) NH_3

Q.10



Indicate the name of above given structure:

A) Nylon 6,6
B) Adipic acid
C) PVA
D) Polyester

Q.11 In laboratory experiment an unknown compound was added in test tube containing iodine, the colour became intense blue. What could be the unknown compound?

A) Cellulose
B) Raffinose
C) Ribose
D) Starch

Q.12 Ozone concentration is measured in:

A) Debye units
B) Dupent units
C) Debackle units
D) Dobson units

Q.13 The gas which is mainly produced in landfills from the waste is:

A) CH_4
B) CO_2
C) SO_2
D) Cl_2

Q.14 The substance for the separation of isotopes is firstly converted into the:

A) Neutral state
B) Free state
C) Vapour state
D) Charged state

Q.15 The number of moles of CO_2 which contain 8.00gm of oxygen is:

A) 0.75
B) 1.50
C) 0.25
D) 1.00

Q.16 London dispersion forces are the only forces present among the:

A) Molecules of H_2O in liquid state
B) Molecules of HCl gas
C) Atoms of helium in gaseous state at high temperature
D) Molecules of solid chlorine

Q.17 Electrical conductivity of graphite is greater in one direction than in other due to:

A) Isomorphism
B) Cleavage plane
C) Anisotropy
D) Symmetry

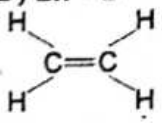
Q.18 Number of neutrons in $^{66}_{30}Zn$ will be:

A) 30
B) 35
C) 38
D) 36

Q.19 The maximum number of electrons in electronic configuration can be calculated by using formula:

A) $2l+1$
B) $2n^2+2$
C) $2n^2$
D) $2n^2+1$

Q.20



Count the number of σ bonds and π bonds in the molecule:

A) 1π and 5σ bonds
B) 2π and 4σ bonds
C) 3π and 3σ bonds
D) 6π and 6σ bonds

Q.21 $\frac{1}{2}H_{2(g)} \rightarrow H_{(g)}\ \Delta H = 218 KJmol^{-1}$

In this reaction ΔH will be called:

A) Enthalpy of atomization
B) Enthalpy of decomposition
C) Enthalpy of formation
D) Enthalpy of the dissociation

Q.22 $Mg + \frac{1}{2}O_2 \longrightarrow MgO_{(s)} + -692KJmol^{-1}$ **at STP.**

Enthalpy of the above reaction will be called:

A) $= \Delta H^{\circ}_{at}$
B) ΔH°_{n}
C) ΔH°_{sol}
D) ΔH°_{f}

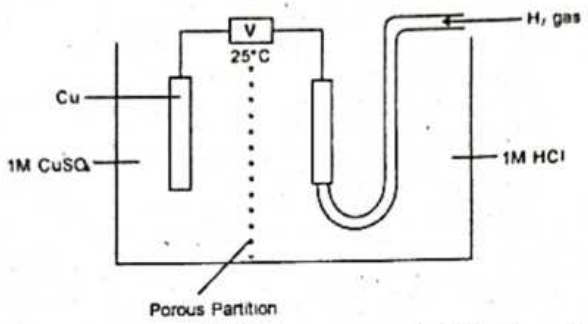
Q.23 Freezing point is also defined as that temperature at which it's solid and liquid phases have the same:

A) Concentration
B) Ratio between the particles
C) Vapor pressure
D) Attraction between the phases

Q.24 What mass of NaOH is present in 0.5mol of sodium hydroxide?

A) 40gm
B) 2.5gm
C) 15gm
D) 20gm

Q.25



The diagram shows a galvanic cell. The current will flow from:

A) Hydrogen electrode to copper electrode
B) Copper electrode to hydrogen electrode
C) Hydrogen electrode to HCl solution
D) $CuSO_4$ solution to hydrogen electrode

Q.26 Study the following redox reaction:

$$10Cl^- + 16H^+ + 2MnO_4^- \longrightarrow 5Cl_2 + 2Mn^{+2} + 8H_2O$$

Which statement is true about this reaction?

A) Manganese is oxidized from +7 to +2.
B) Chloride ions are reduced from -1 to zero
C) Chlorine is reduced from zero to -1
D) Manganese is reduced from +7 to +2

Q.27 Human blood maintains its pH between:

A) 6.50 – 7.00
B) 7.20 – 7.25
C) 7.50 – 7.55
D) 7.35 – 7.40

Q.28 Value of K_{sp} for $PbSO_4$ system at 25°C is equal to:

A) 1.6×10^{-5} mol^2dm^{-6}
B) 1.6×10^{-6} mol^2 dm^{-6}
C) 1.6×10^{-8} mol^2dm^{-6}
D) 1.6×10^{-7} mol^2dm^{-6}

Q.29 $2A + B \rightarrow$ Product

If the reactant 'B' is in excess, the order of reaction with respect to 'A' in given rate law Rate = $k[A]^2[B]$ is:

A) 2nd order reaction
B) 1st order reaction
C) Pseudo 1st order reaction
D) 3rd order reaction

Q.30 The rate constant 'k' is 0.693 min^{-1}. The half life for the 1st order reaction will be:

A) 1 min
B) 2 min
C) 0.693 min
D) 4 min

Q.31 Melting points of group II-A elements are higher than those of group I-A because:

A) Atoms of II-A elements have smaller size
B) II-A elements are more reactive
C) Atoms of II-A elements provide two binding electrons
D) I-A elements have smaller atomic radius

Q.32 The ionic radius of fluoride ion is:

A) 72 pm
B) 95 pm
C) 136 pm
D) 157 pm

Q.33 $2NaOH_{(aq)} + Cl_{2(g)} \longrightarrow NaCl + NaClO + H_2O$ **proceed at:**

A) 500°C
B) 200°C
C) -10°C
D) 15°C

Q.34 Which halogen molecule 'X_2' has lowest dissociation energy?

A) Cl_2
B) Br_2
C) I_2
D) F_2

Q.35 The anomalous electronic configuration shown by chromium and copper among 3-d series of elements is due to:

A) Colour of ions of these metals
B) Variable oxidation states of metals
C) Stability associated with this configuration
D) Complex formation tendency of metals

Q.36 Which element of 3-d series of periodic table shows the electronic configuration of $3d^8, 4s^2$?

A) Copper
B) Cobalt
C) Zinc
D) Nickel

Q.37 The %age of nitrogen is ammonium nitrate is:

A) 46%
B) 82%
C) 33%
D) 13%

Q.38 Which one of the following is anhydride of sulphuric acid?

A) Sulphur (II) oxide
B) Sulphur (IV) oxide
C) Iron pyrite
D) Sulphur (VI) oxide

Q.39 During Contact process of H_2SO_4 synthesis, the following reaction occurs:

$$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad \Delta H = -96KJmol^{-1}$$

Which step is used to increase the yield of SO_3?

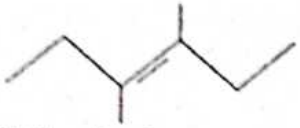
A) Temperature is raised to very high degree
B) SO_3 formed is removed quickly
C) Both temperature and pressure are kept very low
D) An excess of air is used to drive the equilibrium to right side

Q.40 Synthesis of ammonia by Haber's Process is a reversible reaction. What should be done to increase the yield of ammonia in the following reaction?

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} \quad \Delta H = -92KJmol^{-1}$$

A) Pressure should be decreased
B) Ammonia should remain in the reaction mixture
C) Pressure should be increased
D) Concentration of nitrogen should be decreased

Q.41 Skeletal formula of an organic compound is given below:



It is a hydrocarbon. IUPAC name of the compound is:

A) 3,3 dimethyl 3-hexene
B) 3,4 dimethyl 3-hexene
C) 3-hexene
D) 2,3 dimethyl 1-hexene

Q.42 Which one of the following pairs can be a cis-trans isomer to each other?

A) $CHCl = CCl_2$ and $CH_2 = CH_2$
B) $CHCl = CH_2$ and $CH_2 = CHCl$
C) $CH_3\text{-}CH=CH\text{-}CH_3$ and $H_3C\text{-}CH=CH\text{-}CH_3$
D) $CH_3\text{-}CH_3$ and $CH_2 = CH_2$

Q.43 Which one of the following reactions shows combustion of a saturated hydrocarbon?

A) $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$
B) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
C) $CH_4 + \frac{1}{2}O_2 \xrightarrow[400°C,200atm]{Cu} CH_3OH$
D) $C_2H_2 + \frac{5}{2}O_2 \longrightarrow 2CO_2 + H_2O$

Q.44 Consider the reaction given below:

$$CH_3 - CH_2Br \xrightarrow[\text{alcohol}]{KOH} H_2C = CH_2 + HBr$$

Mechanism followed by the reaction is:

A) E2
B) E1
C) S_N1
D) S_N2

Q.45 The average bond energy of C-Br is:

A) 228 $KJmol^{-1}$
B) 200$KJmol^{-1}$
C) 250$KJmol^{-1}$
D) 290$KJmol^{-1}$

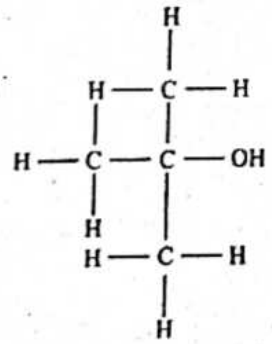
Q.46 Which one of these is NOT a nucleophile?

A) NH_3^-
B) H_2O
C) BF_3
D) CH^-

Q.47 Which one of the following is an appropriate indication of positive iodoform test?

A) Formation of H_2O
B) Release of H_2 gas
C) Brick red precipitate
D) Yellow crystal

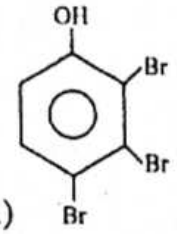
Q.48

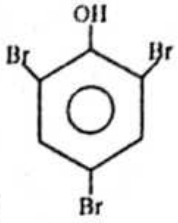


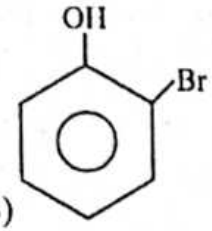
Which one of the following is proper classification of the above formula?

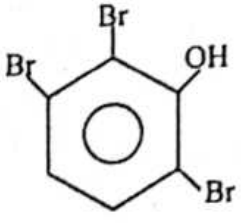
A) Primary
B) Secondary
C) Tertiary
D) Polyhydric

Q.49 Which one of the following is an appropriate structure of product of bromination of phenol?

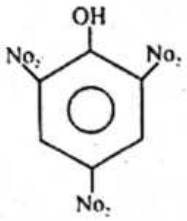
A) 

C) 

B) 

D) 

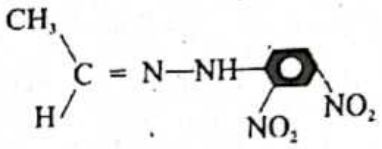
Q.50



Which one of the following is an appropriate name of above compound?

A) 1,3,6 trinitrophenol
B) m-nitrophenol
C) Tartaric acid
D) Picric acid

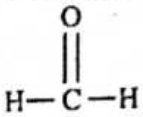
Q.51



It is a general formula of:

A) 2,4 dinitrophenyl hydrazine
B) 1,3 dinitrophenyl hydrazone
C) Phenyl hydrazone
D) 2,4 dinitrophenyl hydrazone

Q.52 Which one of the following is IUPAC name of the given structure?



A) Proopanaldehyde
B) Methanone
C) Acetaldehyde
D) Methanal

Q.53 Which one of the following test is given by both aldehyde and ketone?

A) Silver mirror test
B) Fehling's solution test
C) 2,4 DNPH test
D) Benedict's solution test

Q.54 $CH_3COOH+CH_3CH_2OH \rightleftharpoons CH_3COOC_2H_5+H_2O$

Which one of the following will act as a catalyst in above reaction?

A) HNO_3
B) H_2SO_4
C) Acidified potassium dichromate
D) $SOCl_2$

Q.55 $CH_3COOH + PCl_5 \rightarrow ?$

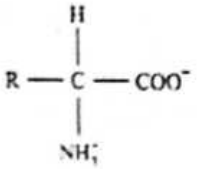
Which one of the following options shows the products of above reaction?

A) $POCl_2+CH_3COCl_2+HCl$
C) $CH_3COCl+POCl_2+HCl$
B) $POCl_3+CH_3COCl_2+H_2$
D) $POCl_3+CH_3COCl+HCl$

Q.56 Which one of the following reaction of carboxylic acid is reversible?

A) Esterification
C) Reaction with PCl_5
B) Salt formation
D) Reaction with $SOCl_2$

Q.57



Select the best option indicating the name of the above structure:

A) Cation
C) Internal salt
B) Neutral amino acid
D) Anion

Q.58 When acid is added to an amino acid, which one of the following will act as a base?

A) NH_3^+
C) H^+
B) COO^-
D) R group

ANSWER KEY

1	A	11	D	21	A	31	C	41	B	51	D
2	A	12	D	22	D	32	C	42	C	52	D
3	D	13	A	23	C	33	D	43	B	53	C
4	D	14	C	24	D	34	C	44	A	54	B
5	C	15	C	25	A	35	C	45	D	55	D
6	C	16	C	26	D	36	D	46	C	56	A
7	C	17	C	27	D	37	C	47	D	57	C
8	A	18	D	28	C	38	D	48	C	58	B
9	D	19	C	29	A	39	D	49	C		
10	D	20	A	30	A	40	C	50	D		

EXPLANATORY NOTES

Q.1 Proline is the only cyclic non aromatic α-amino acid.

Q.2 –COOH group is acidic.

Q.3 Glutamic acid

Q.4 Glycine has "H" as side chain.

Q.5 Nylon 6,6 has a wide linkages between –COOH and NH_2 groups of adipic acid and Hexamethylene diammine.

Q.6 Carbohydrate = hydrated carbons.
General formula = $C_x(H_2O)_y$

Q.7 Uracil present in RNA tyamine in DNA.

Q.8 In the woody parts of trees, the %age of cellulose is 50%.

Q.9 Ammonia has a lone pair in nitrogen.

Q.10
$$-\overset{\overset{O}{\|}}{C}-O-C-$$
Ester linkage

Q.11 Amylose makes complex with iodine.

Q.12 Ozone concentration is measured in Dobson units.

Q.13 Microorganism decompose organic matter to methane.

Q.14 Before anything else atoms need to be separated from each other.

Q.15

CO_2	O_2
1 mole	32g
$\frac{1}{4}$	$\frac{32}{4}=8$
0.25 mole	8g

Q.16 H_2O, HCl and Cl_2 also contain covalent bond.

Q.17 Anisotropy is change in properties with direction.

Q.18 $A = N + Z$
$66 = N + 30$
$N = 66 - 30 = 36$

Q.19 The maximum number of electrons in shell can be calculated by using formula $2n^2$.

Q.20 Single bonds are σ bonds, double bond = $1\sigma + 1\pi$.

Q.21 Amount of energy required for formation of 1 mole gaseous atoms is enthalpy of atomization.

Q.22 1 mole MgO solid formed from standard state Mg and O_2.

Q.23 Vapour pressure depends on temperature. At external pressure both liquid and solid are at same temperature.

Q.24 $n = \frac{\text{mass}}{\text{molar mass}}$
Mass = n × molar mass
Mass = 0.5 × 40 = 20g

Q.25 Current in galvanic cell flows from electrode with lower $E°_{red}$ to higher.
$E°_{red}$ of H_2 = 0 volts
$E°_{red}$ of Cu = 0.34 volts

Q.26 Oxidation state of Mn in MnO_4^{-1} = +7

Q.27 The pH of human blood is 7.38.

Q.28 Value of Ksp for $PbSO_4$ at 25°C is 1.6×10^{-8} mol^2dm^{-6}.

Q.29 The exponent of molar concentration in rate equation shows order w.r.t that reactant.

Q.30

$$\left(t_{\frac{1}{2}}\right)_1 = \frac{0.693}{k}$$

$$= \frac{0.693}{0.693} = 1\,min$$

Q.31 Valence shell of IIA contains 2 electrons for bonding.

Q.32 Ionic radius of fluoride ion is 136 pm.

Q.33 NaClO is formed at low temperature of 15°C.

Q.34

F_2	155 kJ/mol
Cl_2	242kJ/mol
Br_2	193kJ/mol
I_2	151kJ/mol

Q.35 Stability order

Complete > half > any other

Q.36 Atomic number of Ni = 28

Q.37 NH_4NO_3

$$\% \text{ of } N = \frac{28}{80}\times100 = 35\%$$

By approximation 33%

Q.38

$$H_2SO_4 \xrightarrow{-H_2O} SO_3$$

sulphur (VI) oxide

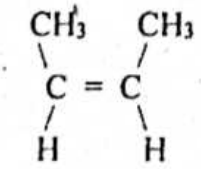
Q.39 Increase in reactant derives reaction to forward.

Q.40 $n_p < n_R$

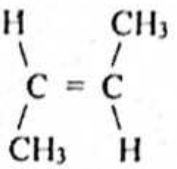
Increase in pressure derives forward reaction.

Q.41 3,4-Trimethyl-3-hexene

Q.42

(1) 

Cis 2-Butene

(2) 

Trans 2-Butene

Q.43 Combustion of saturated hydrocarbon gives CO_2 and H_2O.

C_2H_4 = ethene
C_2H_2 = ethyne
] Unsaturated

Q.44 Primary alkyl halides show E_2 mechanism.

Q.45 Average bond energy of C–Br is 290kJmol^{-1}.

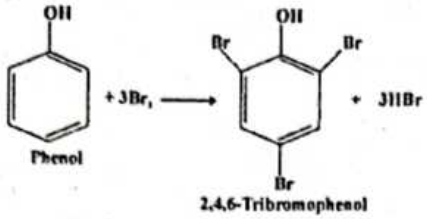
Q.46 Nucleophile has at least one lone pair.

BF_3 is deficient of electrons.

Q.47 Iodoform is a yellow solid.

Q.48 Tertiary carbon has no hydrogen. (Tertiary butyl alcohol)

Q.49 –OH is ortho para director.



Q.50 2,4,6-Trinitrophenol is also called picric acid.

Q.51 2,4 dinitrophenyl hydrazone.

Q.52 The IUPAC name of formaldehyde is methanal.

Q.53 2,4, DNPH can be added in both aldehyde and ketones while Tollen's, Fehling and benedict's reagents are mild oxidizing agents and react with aldehyde only.

Q.54 Esterification is acid catalyzed. H_2SO_4 used as a catalyst.

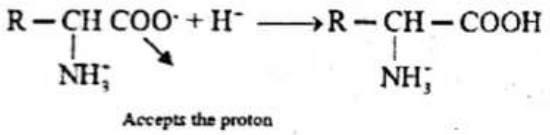
Q.55 $CH_3COOH + PCl_5 \rightarrow CH_3COCl + HCl + POCl_3$

Q.56 Esterification is reversible reaction.

$$CH_3COOH + CH_3CH_2OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$$

Q.57 Zwitter ion is also called internal salt.

Q.58 When acid is added to amino acid, the carboxylate ion accepts the proton and therefore basic character is due to this group.



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