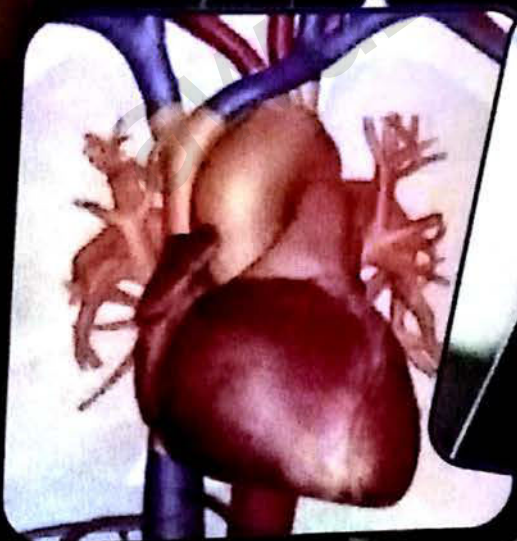


General Science 10



According to the New Syllabus of all Boards of
Khyber Pakhtunkhwa

CLASSIC NOTES

GENERAL SCIENCE

(NEW EDITION)
FOR CLASS 10

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NEW CLASSIC PUBLISHERS

Nowshera Cantt. Ph: 0923 563093

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First Edition : 2018-19
Name of Book : General Science-10
Publisher : New Classic Publishers
Nowshera
Composing at : Saleem Composing Centre
No. of copies : 2200

Price: 115

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Unit 6

Electricity in Everyday Life

SECTION A (MCQs)

- (A) Select the correct answers for the following questions:
- ✓ Opposite charges _____ each other.
(a) Attract (b) Repel
(c) Cancel (d) None of them
 - ✓ An object that is negatively charged has:
(a) Gained protons (b) Lost protons
(c) Gained electrons (d) Lost electrons
 - ✓ The term "electricity" in referring to static electricity, Means:
(a) An imbalance of protons
(b) An equal number of atoms
(c) An imbalance of electrons
(d) An imbalance of neutrons
 - ✓ Which one rod will become positively charged when rubbed with silk?
(a) Glass rod (b) Carbon rod
(c) Silver rod (d) Ebonite rod
 - ✓ If an ebonite rod and a glass rod are brought together after being rubbed with fur, which of the following will happen?
(a) They will remain stationary
(b) They will attract each other
(c) They will repel each other
(d) None of them
 - ✓ You are walking on a carpet and gain a positive charge. When you touch a neutral doorknob:

- (a) The electrons flow from the doorknob to your hand and you feel a shock.
 (b) The electrons flow from your hand to the doorknob and you feel a shock
 ✓ (c) The electrons do not flow and you feel no shock.
 (d) The electrons do not flow but you still feel a shock.
7. **Why does lightning hit buildings and homes?**
 ✓ (a) They are the closest point to thunder clouds.
 (b) They are good insulators.
 (c) Lightning clouds tend to form over buildings
 (d) None of these.
8. **Electrostatic is used.**
 ✓ (a) In pollution control (b) In electro painting
 (c) In automobiles
 (d) To protect from lightening
9. **Which one phenomenon is not related to static electricity?**
 ✓ (a) Both unlike and like charges attract
 (b) Like charges repel
 (c) Opposite charges attract
 (d) Neutral objects are attracted to charged objects
10. **The path on which current flow is called _____.**
 ✓ (a) Resistance (b) Resistor
 (c) Circuit (d) None of these

ADDITIONAL MCQs

1. **The energy due to the position of a body is called as:**
 (a) Nuclear energy (b) Chemical energy
 (c) Kinetic energy (d) Potential energy ✓
2. **When a piece of rubber is stretched, the energy stored in it is called as:**
 (a) Kinetic energy (b) Elastic energy ✓
 (c) Potential energy (d) Chemical energy

3. **Energy obtained from a chemical reaction is called as:**
 ✓ (a) Chemical energy (b) Electrical energy
 (c) Heat energy (d) Nuclear energy
4. **Energy obtained by our body from food is:**
 (a) Electrical energy (b) Heat energy
 ✓ (c) Chemical energy (d) Kinetic energy
5. **Energy due to the movement of molecules of body is called as:**
 ✓ (a) Heat energy (b) Kinetic energy
 (c) Potential energy (d) Chemical energy
6. **The biggest source of heat energy is:**
 (a) Moon (b) Stars
 ✓ (c) Galaxy (d) Sun
7. **Energy released due to the burning of fuel is:**
 (a) Electrical (b) Chemical
 ✓ (c) Heat (d) Nuclear
8. **The process which can not balance in plants without sunlight is:**
 (a) Respiration (b) Photosynthesis
 ✓ (c) Assimilation (d) Digestion
9. **Energy of moving charges is:**
 (a) Nuclear energy (c) Chemical energy ✓
 (c) Chemical energy (d) Potential energy
10. **Energy obtained from the nucleus of an atom is called as:**
 ✓ (a) Nuclear energy (b) Electrical energy
 (c) Chemical energy (d) Potential energy
11. **It is used as a fuel in nuclear fission:**
 ✓ (a) Uranium (b) Lithium
 (c) Helium (d) Aluminium
12. **Energy obtained from sun is:**
 ✓ (a) Solar energy (b) Wind energy
 (c) Tidal energy (d) Geothermal energy

13. The amount of solar energy falling vertically on atmosphere is:
 ✓ (a) 1.1 kilowatt per square meter
 (b) 1.2 kilowatt per square meter
 (c) 1.3 kilowatt per square meter
 (d) 1.4 kilowatt per square meter
14. Solar energy can be used for producing electricity from:
 ✓ (a) Two ways (b) Three ways
 (c) Four ways (d) Five ways
15. Wind mill consists of four wings on a huge pole:
 ✓ (a) 60ft (b) 70ft
 (c) 80ft (d) 90ft
16. Some hot stones are found under the surface of the earth:
 (a) 5km (b) 10km ✓
 (c) 15km (d) 20km
17. Fuel from biogas is of types:
 ✓ (a) Two (b) Three
 (c) Four (d) Five
18. It is obtained from the alcoholic fermentation of biomass:
 (a) Ethane gas (b) Methane gas ✓
 (c) Naphthalene gas (d) Ethanole (alcohol)
19. Substitute of gasoline is:
 ✓ (a) Methane (b) Ethane
 (c) Ehanole (d) Nephthalenic
20. Substitute of natural gas is:
 ✓ (a) Ethane (b) Nephthalene
 (c) Methane (d) Ehtanole
- =====

SECTION B (SHORT ANSWERS)

Write short answers of the following questions:

Q. 1. Why a metallic chain is hanging from the rear side of a petrol supply tanker.

Ans. In large vehicles which transport inflammable chemicals, fire and explosion may occur in them due to building up of very large static charges on their bodies.

These charges are built up due to friction. To avoid these hazards, hanging metallic straps, called static straps are connected to the rear sides of vehicles. These straps touch the ground thereby providing a conducting path for the flow of static charges towards the ground. In this way Static straps prevent the accumulation of static charges on the bodies of the vehicles. These also help in reducing radio interference and electric shocks.

Q. 2. Define Electrostatic Induction.

Ans. Electrostatic Induction

Electrostatic induction is the mechanism of charging a conductor without any physical contact with a charged body. When a charged body is brought near an uncharged conducting body, the side of uncharged body close to charged body becomes oppositely charged while its other side gains similarly charge as that of the charged body.

The phenomenon of redistribution of charges on the surface or inside a neutral conducting body due to the presence of a charged body in its proximity is called electrostatic induction. In the neutral body the redistribution of charge persists till the charged body is kept in its proximity. When the charged body is moved away from the neutral body, it attains its original charge distribution.

Q. 3. Describe fuse and its importance.

Ans. Fuse and its Importance

Fuse is a thin and small piece of metallic wire of low melting point. It is connected in the live wire, often as a cartridge. If a fault develops and current exceeds the limits, then fuse overheats and melts thereby breaks the circuit before the circuit catches fire. Fuse is connected in series along the main supply line so that entire current passes through the fuse.

Q. 4. What is meant by circuit, closed circuit and open circuit?

Ans. Electric Circuit

The path for the flow of electric current is called electric circuit. When switch is off or power supply is disconnected and no current flows in the circuit, then it is called open circuit. While if switch is on and current flows in the circuit then it is called closed circuit.

Q. 5. What is a circuit breaker? Describe its importance.

Ans. Circuit Breaker and its Importance

A circuit breaker is modified form of fuse. It is in the form of a switch that automatically turns off circuit when the current exceeds the specified value. It can be reset by turning the switch on or by pressing a button.

Q. 6. What is meant by current electricity? Describe its types.

Ans. Current Electricity

Electricity which is produced due to flow of charges (electrons or ions) through conducting material is called current electricity or electric current. Current electricity is of two types i.e. direct current and alternating current.

Types of Current Electricity:

- (i) **Direct Current:** This type of current flows in one direction only.

- (ii) **Alternative Current:** It regularly changes its direction.

Q.7. Why do your hair stand on ends when you pull apart your cap?

Ans. We know that like charges repel each other. When we pull apart our cap, all the hair acquire the same charge so the repel each other. As a result the hair stand on ends.

Q.8. How does a lightning rod protect a building from a lightning strike?

Ans. Lightning always follows the shortest way to the ground. So, if it strikes a lightning rod on a building, it goes down along the wire to the earth. In this way lightning rod protects the building from a lightning strike.

Q.9. Define static charges. Why are they called static?

Ans. Static Charges: The charges produced on objects by rubbing them together or by pressing and pulling them, apart, are called static charges.

Why they are called static charges. As these charges are confined to the rubbed area of objects and unable to move to the other areas of the same objects so that is why they are called static charges.

Q.10. What is meant by polarization of charge?

Ans. Polarization of Charge:

In most neutral atoms or molecules, the center of positive charge coincides with the center of negative charge. However, in the presence of a charged object, these centers may shift slightly, resulting in positive charge on one side of the molecule and negative charge on the other side. This effect is known as, polarization. Polarization of charges within individual molecules produces an induced charge on the surface of the insulator as, shown in the figure 6.2. This effect

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explains why a comb that has, been moved through hair, attracts bits of neutral paper.

ADDITIONAL SHORT ANSWERS

Q. 1. Define energy?

Ans. The ability of a body to do work is called energy.

Q. 2. Write names of different kinds of energy.

Ans. Kinetic energy, potential energy, elastic energy, chemical energy, heat energy, light energy, electrical energy and nuclear energy.

Q. 3. On which factor the kinetic energy of moving body depends upon?

Ans. Kinetic energy of a moving body depends upon its mass and speed.

Q. 4. Define elastic potential energy?

Ans. Energy stored in a body by pressing or stretching the body is called the elastic potential energy.

Q. 5. What is meant by the energy of light?

Ans. Type of energy from which we can see things is called as light energy.

Q. 6. On which the diet-needs of living organisms depend upon?

Ans. Diet needs of all living organisms of the earth directly or indirectly depends upon the food prepared by plants.

Q. 7. Electrical energy is used at a wide range. Why?

Ans. The reason is that it can be transferred from one place to another and can be converted into other forms of energy.

Q. 8. What is meant by nuclear fission reaction?

Ans. The process in which the nucleus of a heavy atom is divided into two parts and energy is released is called as nuclear fission reaction.

Q. 9. What is meant by nuclear fusion reaction?

Ans. The process in which some small nucleus form heavy nucleus is called as nuclear fusion.

Q. 10. Define "law of conservation of energy"?

Ans. Energy can not be created nor be destroyed but can be converted from one form to another, the quantity remains the same in this process and it is called the law of conservation of energy.

Q. 11. In which major form the energy is used?

Ans. The energy is used in the form of electrical energy in major form.

Q. 12. Write names of conventional methods of electricity production.

Ans. Hydro electric power, thermal power and nuclear power are conventional methods of producing electricity.

Q. 13. What is meant by hydro electric power?

Ans. Producing of electricity from flowing water is called as hydroelectric power.

Q. 14. Write the method of electricity production from hydro-electric power.

Ans. In this method water is stored in a high lake or reservoir. Gravitational energy is stored in the water at high level. When water falls down its potential energy converts into kinetic energy. Tunnels are used to keep the water down. Turbine works from energy of flowing water which runs the generator. In this way electricity is produced.

Q. 15. What is meant by thermal power?

Ans. Production of electricity by burning the fossil fuels is called the thermal power.

Q. 16. How the electricity is produced through thermal power?

Ans. Heat is produced by burning the fossil fuels. This heat converts the water into steam which runs, the turbine and electricity is produced.

Q. 17. What is the source of nuclear energy?

Ans. The source of nuclear energy is nucleus of atom.

Q. 18. What are the non-conventional methods of electricity production?

Ans. Solar power, wind power, tidal power and geothermal power are the non-conventional methods of electricity production.

Q. 19. In what ways the solar energy can be used for the production of electricity?

Ans. Solar energy can be used for the production of electricity in two ways.

(i) Method of solar panel

(ii) Method of solar cells

SECTION C - DETAILED ANSWERS

Write detail answers of the following questions.

Q. 1. What are the basic characteristics of static charges?

Ans. Characteristics of Static Charges

(i) **Conservation of charges:** Ordinarily objects are electrically neutral and contain equal number of negative charge particles (electrons) and positive charge particles (protons). When one body rubbed against another, charge is not created in the process. The electrified state is due to transfer of charge (electrons) from one body to the other. Therefore, one body gains some amount of negative charge while the other gains an equal amount of positive charge. In other words electric charge is always conserved. For example, when a glass rod is rubbed with silk, the silk obtains a negative charge that is equal in magnitude to the positive charge on the glass rod.

(ii) **Attraction:** One of the characteristics of static charges is that they make certain materials to attract each other. For example, when you rub a glass rod with silk cloth or an

ebonite rod with a woolen cloth, static charge is developed and these rods are able to attract small particles. Similarly another every day example of attraction due to static charges is that of a plastic comb which when moved in dry hair, gathers static charges and starts attracting small pieces of paper.

(iii) **Repulsion:** Static charges also produce the ability of repulsion in objects. For example, when you comb your hair on a dry day or after using hair drier, negative charges builds up on the comb while positive charge on the hair. You know that like charges repel each other. As all the hair acquire the same charge so they repel each other. As a result the phenomenon of "flyaway of hair" occurs.

The force of attraction or repulsion between charged bodies is inversely proportional to the square of distance between them.

Q. 2. Describe the effects of static charges.

Ans. Effects of static charges

(i) **Electrostatic Sparks**

The production of electrostatic spark is a common effect of static charges. A spark is produced due to heating up of air present between two highly charged bodies. If there are more positive charges on one object and equally negative charges on the surface of another object, then the attraction between the charges may be great enough. This condition can lead the electrons to jump the gap between these highly charged objects.

Once a few electrons start to move across the gap, they heat up the air and more electrons will jump across the gap quickly.

This heats up the air even more. The air gets so hot that for a very short period of time it glows and produces a spark which is known as an electrostatic spark. The same phenomenon is seen during thunderstorms when electrostatic

sparks are produced on a much larger scale resulting in lightning.

Q. 3. What is meant by resistance? How resistors are connected in a circuit?

Ans. Resistance:

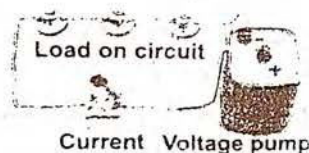
The opposition offered by a conductor to the flow of current is called resistance.

Resistors: The electrical appliances which are connected in a circuit, act as resistors.

The basic function of a resistor is to control the magnitude of current flowing in a circuit. Resistors in a circuit can be connected in a series or in parallel.

(a) Resistors in Series

In a series circuit, there is only one path for the flow of current and same amount of current flows through all the resistors. The total voltage across the circuit is equal to the sum of voltages across all the resistors.

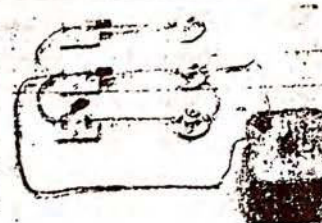


The total resistance is equal to the sum of resistances of all the resistors. An example of series circuit is a string of decoration lights. If any one of the bulb is missing or burnt out, no current will flow and none of lights will work.

(b) Resistors in Parallel

In a parallel circuit, there is two or more paths for the flow of current and different amounts of current flows through each resistor. The voltage of the circuit is equal to the voltage across each resistor

An example of parallel circuit is wiring system of a house. If one of the appliances stops working, current still flows through other appliances. However, in case of short circuit, the voltage drops almost to zero and the circuit stops working.



Q. 4. Describe the practical applications of static electricity.

Ans. Practical Applications of Static Electricity

Static electricity has many applications, e.g. photocopiers, inkjet printers, laser printers, high voltage generators, electrostatic painting, electrostatic precipitators etc. However, electrostatic painting and electrostatic precipitators are discussed here in detail.

Electrostatic or Electro painting: The principle of electrostatic is applied to paint uniformly the surfaces of metallic bodies such as refrigerator, metallic furniture, metallic boxes, automobiles etc.

The surface of metallic body is earthed. The paint particles when emerge out of the nozzle of the spray machine, they acquire positive charge due to friction. When these positively charged particles reach near the metallic body,

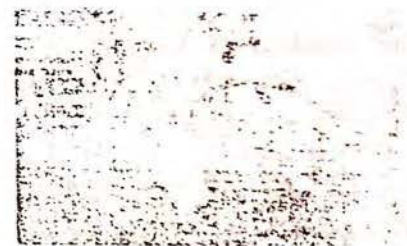


Fig. Electro Painting

induce negative charge it. Thus due force of attraction between opposite charges a uniform coat of paint is formed on the surface of metallic body.

Q. 5. Write about practical uses of current electricity in household appliances?

Ans. Application of Current Electricity in Household Appliance

Most of practical applications of electricity deal with the current electricity. A variety of home appliances operate on it. We utilize electric current for different purposes e.g., lighting, heating, cooling, washing etc. at home. In all these situations electric current is converted into other forms of energies according to the need.

1. When an electric current passes through the filament of a bulb, it heats up as much as that it emits light. Here electric current is converted into heat and light energies. Electric room heater, electric iron, immersion rod, electric kettle etc. are such appliances which contain a high resistance metallic heating coils. When these appliances are switched on, the electric current is converted into heat energy in these coils. Similarly in clothes drier, hair drier, toaster, oven etc. electric current is converted into heat and mechanical energy.

2. In summer season we use electric fan, air cooler and air conditioner for cooling purpose. When electric current flows, their blades start rotating hence electric current is converted into mechanical energy. Similarly, in washing machine and electric motor, electric current is converted into mechanical energy. Other household appliances like refrigerator, television, computer etc. need electric current for their operation. In other words, current electricity has become necessity of our life.

3. Similarly in washing machines and electric motor, electric current is converted into mechanical energy.

4. Other household appliances like refrigerator, television, computer etc. need electric current for their operation. In other words, current electricity has become necessity of our life.

Q. 6. What safety measures should be adopted to avoid hazards of electricity?

Ans. Electric safety measures

To avoid the hazards of electricity in homes and in your surroundings, the following safety measures should be adopted.

1. Don't touch switches unnecessarily.
2. Never use electrical equipment in or close to water.
3. Never play near broken plugs or in areas with many electrical wires and appliances.
4. Never pull out a plug by pulling its cable.
5. Never touch any torn or taped cables or switches, keep them away from heat and water.
6. Avoid touching electrical appliances with any metallic object.
7. Never go near a declined power line.
8. Avoid climbing electric poles, transmission towers or fences around power stations.
9. Avoid climbing trees or poles that are near power lines.
10. Always contact an electrician or relevant expert in case of any fault in circuit or in an electrical appliance.

Q. 7. Write a note on energy generation from renewable resources.

Ans. Energy Generation from renewable Energy Resources

Energy is the basic need of our life. We utilize energy for different purposes e.g. for operating industries, running automobiles, stoves, heating, lighting, cooling etc. For these purposes one form of energy is converted into other form according to the need. In this regard, different sources are utilized e.g. coal, petroleum products, natural gas, electricity etc. Today a large amount of energy in the world, is obtained from coal petroleum products and natural gas. However, these

resources are gradually decreasing and ultimately will be depleted because these are not renewable. Moreover, these resources are not environment friendly, cause global warming and ozone layer depletion. This is the reason that today man is struggling to utilize maximum renewable energy resources like sunlight, flowing water, wind etc. These resources do not deplete on consumption. Such energy resources which do not deplete on consumption are called renewable energy resources.

There are a number of renewable energy resources such as sunlight, wind, flowing water, rain, tides, waves, biomass, geothermal heat etc. However, a few of them are described below.

1. Sunlight. The major renewable energy resource is sunlight. Large amount of energy in the form of light and heat receiving from sunlight is called solar energy. This energy is vital for human beings, animals and plants on the earth. In past, large spherical mirrors and lenses were used to concentrate sunlight and convert into heat energy. However, today solar cells are used to convert solar energy into heat and electrical energy.

Solar cell is a device that directly converts solar energy into electric energy. A single solar cell produces a small voltage. A number of solar cells are connected in series to generate large amount of voltage. This connection of solar cells is called a solar panel. Solar panels are installed according to need of electric energy.

Today, due to load shedding the use of solar panels has been started in offices and homes for lighting and other needs. Similarly solar panels are used in artificial satellites to meet their electrical need. Solar energy is utilized in different fields of agriculture. Moreover, today where conventional electric facility is not available, tube wells are operated by solar panels to irrigate agricultural lands.

2. Flowing Water: Flowing water is a very useful renewable energy resource of hydro energy. In ancient times, man used water mills to convert hydro energy into mechanical energy for milling grains and crushing sugar cane. Today, in most of the countries of the world hydro energy is utilized for generation of electricity. For this purpose water is stored in dams, from where it is passed through tunnels where it turns huge turbines whose rotating shafts connected to generators that generate electricity. It is then supplied to homes, offices, industries and other areas through cables.

3. Wind: Man has been using wind as a source of energy for centuries. In past people were utilizing wind energy for navigation of sail boats and sail ships. Similarly they used wind mills for milling grains and drawing water from wells.

Winds blow from regions of high pressure towards regions of low pressure. Sea winds are stronger than land winds. In windy regions, wind mills convert wind energy into mechanical energy for operating tube wells and flour mills. In Pakistan, wind energy can be utilized in coastal areas and high mountainous areas like Chitral, Gilgit and Swat. Now-a-days, wind energy is used for operating turbines which generate electricity.

4. Biomass: Biomass is a renewable energy source. It consists of organic materials like animal manure, sawdust of timber mills, plants and trees residues, crop residue and used tires. Energy from biomass can be obtained by using all these materials as a fuel either by direct burning or fermentation. In direct burning the solid waste are fed into a furnace producing heat which is used to boil the water and run the turbines and generators for generating electric energy. While in fermentation, biomass is enclosed in a tank and decomposes it by bacterial action. As a result methane gas is produced which is then utilized for different energy purposes.

ADDITIONAL QUESTIONS

Q.1. What are the careers in Electrical Technology?

Ans. Careers in Electrical Technology

Following are some of the careers one can choose in electrical technology.

Electrician: An electrician is responsible for the overall installation, maintenance and repair of electrical connections in a home, industry or any other building. An electrician connects wires to circuits and their components.

Line Worker: A line worker installs and maintains lines and cables that carry electricity from the distribution point to the homes, industries and other setups. Apart from this they also work in power grid stations.

Electrical Installers: These persons are expert in installing various electrical appliances used in domestic as well as industrial setups. They also install and maintain main switch boards and power grids.

Power Plant Operators: Power plant operators work in electricity producing companies where they are responsible for operating and maintenance of power plants.

Q.2. What are the problems related to electric charger? Describe some solutions to them.

Ans. Problems Related to Electrostatic Charge and their Solutions

There are many problems related to electrostatic charge; here we discuss only two of them and their solutions.

Lightning and use of Lightning Rods

Lightning is a natural phenomenon which happens when electrons travel between two objects having different and large amount of static charges. Lightning can occur between or within clouds or between clouds and the earth. Electrons heat the air present between the charges so much that causes

lightning. The heat also makes the air move away from the charge very fast. The air expands. When this occurs, a very loud sound, called the thunder, is produced. Lightning can be dangerous. It can strike trees, buildings, people and animals.

Lightning rods are used to protect the buildings from the hazard of lightning. Lightning rod is a metal rod attached to the roof of a house or a building. Its lower end is connected to a copper or aluminum wire which goes down to the earth and is grounded.

As lightning always follows the shortest way to the ground. So if it strikes a lightning rod on a building, it goes down along the wire to the earth. Thus in this way lightning rod protects the building from the hazard of lightning.

Q.3. Define electricity and its importance.

Ans. Electricity: It is the common form of energy which, we use in our houses and working places everyday.

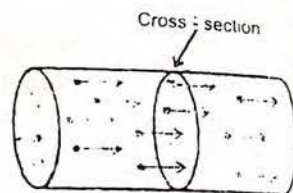
Importance of electricity:

- (i) Electricity has facilitated our life we just turn on the switch and electricity start the work.
- (ii) Electricity causes the electric fans, motors and electric appliances to move.
- (iii) Electricity produces light in electric, energy-savers, bulb, tubes and television.
- (iv) It is converted in to sound in loudspeaker and is converted in to heat electric heater.

Q.4. Define electric current and explain it?

Ans. Definition:

The amount of charge which passes through the cross section in one second is called electric current.



Explanation:

Electric current is the flow of charges and charges are the free electrons. These free electrons are found in conductors. The current also flows in some conductors due to the motion of positive and negative ions but energy is required for the flow of these charges which causes the changes in circuit.

Formula: If charge Q passes through any cross section in time t seconds then the current I can be written as,

$$I = \frac{Q}{t}$$

Unit of current: Unit of current in system international is ampere which is denoted by (A):

$$1 \text{ million ampere} = 1 \text{ mA} = 10^{-3} \text{ A}$$

$$1 \text{ micro ampere} = 1 \text{ A} = 10^{-6} \text{ A}$$

Measurement of current: Current can be measured by connecting an ammeter in series with the circuit.

Q.5. Element of bulb is made like tight spring. Why?

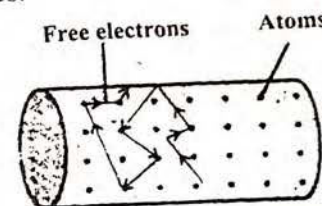
Ans. Element of bulb is made like tight spring so that the heat does not waste in the air.

Q.6. What is conventional current? Explain it with an example.

Ans. Conventional current:

Electric current is a result of flow of positive charges. These charges travel from positive terminal to the negative terminal. It is called the conventional current. It is the oldest theory about current we know charged particles are electrons in

metal conductors which pass negative charge. Electrons move from the negative terminal of the battery. Thus in fact current is the result of flow of negative charges.

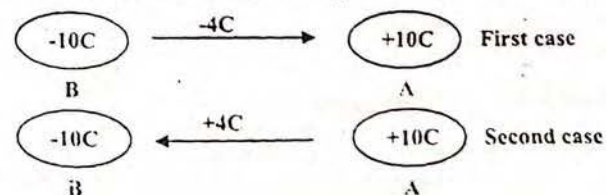


Explanation: Electrons do not flow through conductor like a stream but their motion is different. A number of free electrons move here and there among the atoms of the conductor. This movement is called the random motion without battery. A number of electrons which pass from left to right and from right to left from any cross section, the rate will be zero of electrons.

When one end of conductor is connected to the positive terminal and other to the negative terminal, electrons experience force. As a result, electrons drift from negative to positive terminal and carry the negative charge with them.

"The amount of positive charge flowing in one direction is equivalent to the same amount of charge flowing in the opposite direction."

Example: Suppose a body A carries +10C charge and body B carries -10C. Each other through a wire for a small duration and then put them apart. If -4C charge is transferred from the body B to A during this interval, then what should be the charge on bodies A and B after they are separated again.



Let us see

$$\text{Charge on A} = +10C + (-4C) = +6C$$

$$\text{Charge on B} = -10C + (+4C) = -6C$$

In both cases the result remains the same.

Note: The word current is used for conventional current. For the direction of flow of electrons the word electronic current is used.

MODEL PAPER NO. 1

SECTION A (MCQs)

- (i) Amount of charge passing through any cross section in one second is called:
 - (a) Electric
 - (b) Current
 - (c) Voltage
 - (d) Electric current ✓
- (ii) The unit of electric current is:
 - ✓ (a) Volt
 - (b) Ammeter
 - (c) Voltage
 - (d) Wire
- (iii) Which should always be placed in the way of:
 - (a) Wires
 - (b) Live wires ✓
 - (c) Series
 - (d) Opposite side
- (iv) The instrument that measures current is called:
 - ✓ (a) Voltmeter
 - (b) Circuit breaker
 - ✓ (c) Ammeter
 - (d) Switch
- (v) The potential of a neutral wire is:
 - ✓ (a) Zero
 - (b) +2020 volts
 - (c) -220 volts
 - (d) Changing
- (vi) The SI unit of resistance is:
 - (a) Current
 - (b) Resistance
 - (c) Potential difference
 - (d) Ohm ✓

(vii) The device used for turning a circuit on or off is:

- ✓ (a) Switch
- (b) Fuse
- (c) Circuit breaker
- (d) Earth wire

(viii) The way on which current flows is called:

- (a) Resistance
- (b) Resistant
- (c) Circuit
- (d) Current ✓

(ix) AC current changes its direction _____ times in one second:

- ✓ (a) 100
- (b) 110
- (c) 130
- (d) 150

(x) The instrument transferring solar energy into heat energy is called:

- (a) Converter
- (b) Solar cell ✓
- (c) Batteries
- (d) USP

(xi) Which type of rod will be charged positive when rubbed with wool cloth.

- ✓ (a) Carbon
- (b) Silver
- ✓ (c) Glass
- (d) Ebonite

(xii) The branch of physics which deals the study of static charges is:

- (a) Electrostatic
- (b) Electronic ✓
- (c) Optics
- (d) Kinematics

(xiii) Some charges _____ each other:

- (a) Attract
- (b) Repel ✓
- (c) Cancel
- (d) None of these

(xiv) An object that is positively charged has:

- ✓ (a) Gained protons
- (b) Lost protons
- (c) Gained electrons
- (d) Lost electrons

(xv) An object that is negatively charged has:

- (a) Gained protons
- (b) Lost protons ✓
- (c) Gained electrons
- (d) Lost electrons

SECTION B

Q.2. Answer any nine parts. Each part carries four marks.

- (i) What is meant by current electricity? Describe its types.
- (ii) Why does hair stand when you pull a part of your cap?
- (iii) Define static charges. Why they are called static charges.
- (iv) Why a metallic chain is hanging from the rear side of a petrol supply tanker?
- (v) Write a note on Biomass.
- (vi) Differentiate between A.C and D.C current.
- (vii) What are the basic characteristics of static charges?
- (viii) What is meant by resistance? How resistors are connected in a circuit?
- (ix) Describe the practical applications of static electricity.
- (x) What is meant by charging of a capacitor?
- (xi) Define electric current. What is conventional current?
- (xii) What is meant by semi conductor?

SECTION C

Note: Attempt any three questions. All questions carry equal marks.

3. Define circuit, closed circuit and open circuit.
 4. Describe the effects of static charges.
 5. Write note on the following:
(a) Practical applications of static electricity
 6. Write a note on energy generation from renewable resources.
- =====

Unit 7

Chemical Reactions and their Practical Application

SECTION A (MCQs)

Select the correct answers of the following questions.

1. Which of these shows that a chemical reaction has taken place?
(a) Change in state (b) Evolution of a gas
(c) Change in color (d) All of these ✓
2. What is rust?
(a) Sodium Oxide (b) Iron oxide ✓
(c) Copper Oxide (d) Silver Oxide.
3. In glucose metabolism the pyruvate molecules may be fermented into:
(a) Ethanol (b) Carbonic acid
(c) Lactic acid (d) None of the above ✓
4. A chemical reaction involves:
(a) Only breaking of bonds
(b) Only formation of bonds
(c) Both breaking and formation of bonds ✓
(d) None of these
5. Which among the following is not a chemical change?
(a) Melting of ice (b) Soap making ✓
(c) Rusting of iron
(d) Fermentation of substances
6. Formation of water needs:
(a) Hydrogen (b) Oxygen
(c) A spark (d) All of them ✓
7. Re-treading is used for the recycling of:
(a) Car batteries (b) Motor oils

- ✓ (c) Tyres (d) Metals
8. Chemical name of Vitamin C is:
- ✓ (a) Ascorbic acid (b) Magnesium silicate
- (c) Acetylsalicylic acid (d) Sodium bicarbonate

ADDITIONAL MCQ'S

- A chemical reaction takes place when occurs a
 - Electricity
 - Chemical change ✓
 - Chemical bond
 - Chemical sound
- The substances which take part in chemical reactions are called:
 - Reactants
 - Reactors
 - Resistance
 - Rebuilt
- The new substances formed by chemical reaction are called:
 - Reactants
 - Reactions
 - Products
 - Resistance
- Rusting of iron is an example of:
 - Chemical change
 - Chemical reaction ✓
 - Mixing of oxygen
 - Mixing of iron
- $\text{Fe} + \text{O}_2 \longrightarrow$
 - Fe_2O_3
 - Fe_3O_2 ✓
 - FO_2e_3
 - none of these
- $6\text{CO}_2 + 6\text{H}_2\text{O} \longrightarrow$
 - C_6HO_2
 - $\text{C}_6\text{H}_{12}\text{O}_6$
 - 6O_2
 - $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
- $\text{CH}_4 + 2\text{O}_2 \longrightarrow$
 - CO_2
 - $2\text{H}_2\text{O}$
 - Energy
 - $\text{CO}_2 + 2\text{H}_2\text{O} + \text{Energy}$ ✓
- Chemical name of vitamin B₉ is:
 - Acetic acid
 - Sodium acid ✓
 - Folic acid
 - None of these

- Chemical name of vitamin D is:
 - Ascorbic acid
 - Ergocalciferol ✓
 - Folic acid
 - Acetic acid
- Different chemical compounds have scientific names of based on:
 - Chemical name
 - Chemical structure
 - Physical name
 - Physical structure
- Soaps are chemically:
 - Sodium
 - Potassium
 - Both a and b
 - None of these
- In order to separate glycerine from soap _____ is added to soap mixture.
 - Soda
 - Oil
 - Sodium chloride
 - Sodium nitrate
- Fermentation process was first studied by:
 - William Richard
 - Mills
 - Louis Pasteur
 - None of these
- Plants need _____ for their growth and development.
 - Mineral nutrition
 - Air
 - Sunlight
 - All of these ✓
- The pieces of tree are put in solution of NaOH and Na₂ to remove:
 - Colour
 - Salt
 - Lignin
 - None of these
- The reactants of water are:
 - Hydrogen
 - Oxygen
 - Spark
 - All of these ✓
- What is meant by rust?
 - Sodium oxide
 - Iron oxide ✓
 - Copper oxide
 - Silver oxide
- Sunlight is the major source of:
 - Electricity
 - Energy ✓
 - Current
 - Tides

19. Ethanal is formed from glucose by the action of
✓ (a) Bacteria (b) Virus
(c) Fungi (d) Mushroom
20. Chemical name of vitamin D is:
✓ (a) Ergocalciferol (b) Ascorbic acid
(c) Folic acid (d) Acetic acid
21. Chemical name of vinegar is:
(a) Ergocalciferol (b) Ascorbic acid
(c) Folic acid (d) Acetic acid ✓
22. Which of these shows that a chemical reaction has taken place?
(a) Change in state (b) Evolution of gas
(c) Change in colour (d) All of these ✓
23. Dyes are molecules which absorb and reflect
(a) Rust (b) Colour ✓
(c) Gas (d) Light
24. The nitrogen fixation process breaks apart free nitrogen and combines _____ with other substances to form compounds:
(a) Oxygen atoms (b) Nitrogen atoms ✓
(c) Hydrogen atoms (d) None of these
25. Chemicals are added to food for their:
(a) Tastes (b) Preservation
(c) Both a and b (d) None of these
26. Soaps containing sodium salts are formed by heating oil with
(a) Aqueous sodium hydroxide solution
(b) Castic soda ✓ (c) Both a, b
(d) None of these
27. The reaction acids and bases to form water and salts is called:
(a) Saponification (b) Neutralization ✓
(c) Product (d) None of these

28. Food label provides information about the food items present in a:
(a) Label (b) Container ✓
(c) Compound (d) None of these
29. Green plants manufacture their own food is:
(a) Neutralization (b) Photosynthesis ✓
(c) Both a, b (d) None of these
30. A process in which one or more substances are converted into one or more different substances is called:
(a) Mechanical change (b) Physical change
✓ (c) Chemical change (d) None of these

SECTION B (SHORT ANSWERS)

Write short answers of the following questions:

1. Recognize those characteristics which indicate that a chemical reaction has taken place.

Ans. **Indications of a Chemical Reaction**

When a chemical reaction takes place, different types of changes occur. One or more of the following observations may indicate that a chemical reaction has taken place.

A change in colour is seen.

A solid (precipitate) forms on mixing liquids.

A gas evolves on mixing two substances

A change of temperature may occur.

2. **How iron gets rusted?**

Ans. **Rusting of Iron:**

Rusting occurs because the iron (Fe) reacts with oxygen (O_2) in the atmosphere. Chemical bonds are formed and broken to finally make iron oxide (Fe_2O_3) which is called rust.

3. Write the common names of four chemical compounds along with their scientific names.

Ans. Table: 7.1 Names of edible chemical compounds.

Common Name	Chemical Name
Vitamin B9	Folic acid
Vinegar	Acetic acid
Vitamin C	Ascorbic acid
Baking soda	Sodium bicarbonate
Vitamin D	Ergocalciferol
Aspirin	Acetylsalicylic acid
Margarine	Partially saturated fatty acid

4. Define saponification reaction.

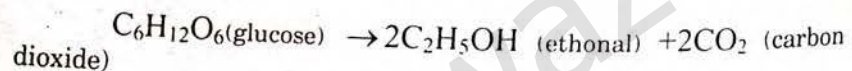
Ans. Saponification: When vegetable oils or animals fats are treated with sodium hydroxide, soaps are formed along with glycerin. This process is called saponification.

5. What do you mean by fermentation process?

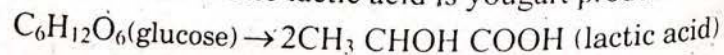
Ans. Fermentation Process:

During glucose metabolism yeast and certain bacteria can be employed in the formation of ethanol and carbon dioxide. Ethanol fermentation is used in the production of beer, wine and bread.

This process can be represented by the following chemical equation.



The pyruvate molecules from glucose metabolism also may be fermented into lactic acid. Lactic acid fermentation is used to convert lactose into lactic acid is yougart production.



ADDITIONAL SHORT ANSWERS

- Q.1. What are the harms of hazardous wastes?

Ans. Hazardous wastes can be potentially harmful to both the health of humans and animals as well as to the environment.

- Q.2. Where are minerals found?

Ans. Minerals are found embedded in rocks and combined with other elements.

- Q.3. What are dyes?

Ans. Dyes are molecules which absorb and reflect light at specific wavelengths to give human eyes the sense of colour.

- Q.4. Why chemicals are added to food?

Ans. Chemicals are added to food for their preservation and processing, enhancing their appeal and adding nutritive value in them.

- Q.5. Describe saponification.

Ans. Soaps containing sodium salts are formed by heating oil with aqueous sodium hydroxide solution in a reaction human as saponification.

- Q.6. Define neutralization.

Ans. The reaction of acids and bases to form water and salts is called neutralization.

- Q.7. Why food is labled?

Ans. Food label provides information about the food items present in a container.

- Q.8. Define photosynthesis?

Ans. Photosynthesis is the process by which green plants manufacture their own food.

- Q.9. Define reactants.

Ans. The starting substances used in the chemical reaction are collectively called reactants.

DETAILED QUESTIONS/ANSWERS

Write detailed answers of the following questions.

1. What do you mean by the term scientific nomenclature? Explain it with examples.

Ans. **Scientific Nomenclature and Common Consumer Products**

Different chemical compounds have scientific names based upon their chemical structure. Chemical nomenclature or scientific nomenclature is the term given to the naming of chemical compounds. Often, these names are complicated, long and understandable only to those who have background knowledge of chemistry. Commonly used chemical compounds may have several names. For example, Baking soda is white substance usually available in powder form. It is one of the important edible items used in every kitchen. Chemical name of this compound is sodium bicarbonate (NaHCO_3). Generally chemists use common chemical names more when it comes to mentioning certain ingredients in everyday consumer products.

Table: Names of edible chemical compounds.

Common Name	Chemical Name
Vitamin B9	Folic acid
Vinegar	Acetic acid
Vitamin C	Ascorbic acid
Baking soda	Sodium bicarbonate
Aspirin	Acetylsalicylic acid
Margarine	Partially saturated fatty acid

Names of chemical compounds and their use in cosmetics

Chemical name	Use in cosmetics
Lead	Used as a constituent in over 650 cosmetic products, including sunscreens, foundation, nail colors, lipsticks and whitening toothpaste.
Triclosan	Used in antibacterial soaps, deodorants and toothpastes.
Phthalates	Found in nail polish and in synthetic fragrance.
Ethylene Oxide	It is used in shampoos and body washes.
1,3-butadiene	This chemical is used in Shaving creams, sprays sunscreens and foundations, and as anti-fungal.

2. How soap is prepared from oil and sodium hydroxide?

Ans. **Preparation of soap from oil and Sodium Hydroxide**

Soaps are chemically sodium or potassium salts of long chain fatty acids, such as stearic, oleic or palmitic acid. These acids are present in vegetable oils or animals fats. When vegetable oils or animals fats are treated with sodium hydroxide, soaps are formed along with glycerin. This process is called saponification. Let's study this process in some detail.

The mixture of fat or vegetable oil and caustic soda (NaOH) is put in a steel tank fitted with steam coils. The tank has an outlet at the bottom. Steam is passed through the mixture. The heat of the steam first melts the fat. Sodium hydroxide then combines with fat or oil to form soap.

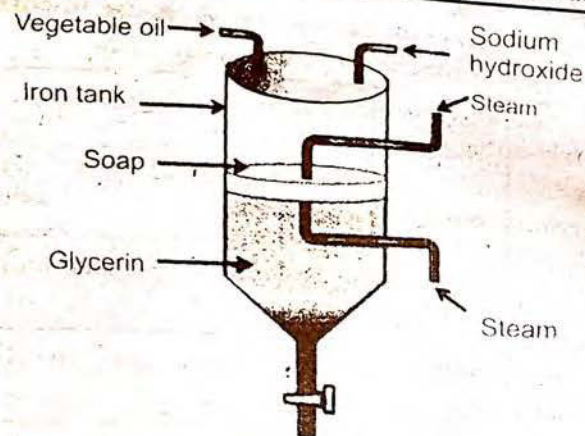


Fig. Soap Preparation Tank

In order to separate glycerin from soap sodium chloride is added to the soap mixture. Glycerin dissolves in sodium chloride solution. Being heavier than the soap, the glycerin solution settles down at the bottom. The soap floats at the surface. The glycerin solution is removed by opening the tap at the bottom of the tank. Thus, soap is separated from the solution mixture. Soap produced for commercial purposes contain synthetic lathering agents, artificial colors, and a range of chemicals. The molecules that are found in soap play a large role in the lathering process. In fact, soap molecule is actually made up of two parts, those that are attracted to water and others that are attracted to oil. When soap molecules and water are combined with friction, lathering usually occurs.

3. Relate chemical reactions to familiar processes encountered in everyday life.

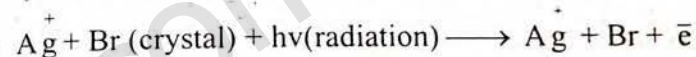
Ans. Chemical Reactions in Technological Products and Processes

Chemical industries have an important role to play in the development of a country. It is the use of various chemical reactions which have resulted in the production of some of the

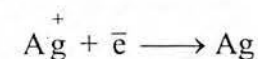
vital products used in our daily life. Pharmaceuticals, sugar, fertilizers, synthetic fibers, cement, glass, paints, steel etc are some of the examples in this regard. In the following section you will study some of the important technological products and processes.

(a) Reactions in Film Processing

The photographic film on which image is to be produced is made up of silver halide salts, for example, silver bromide (AgBr). This compound is in the form of crystals. When light of a particular wavelength hits silver bromide crystals, chemical reaction starts and results in the formation of a free silver ion along with a free bromine atom.



The free silver ion can then combine with the electron to produce a silver atom.



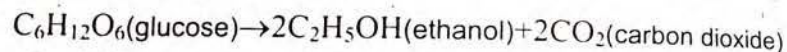
In this process the free silver atoms produce a "latent image". This latent image is further refined in the development process. When an exposed film is placed in a developer solution, the grains containing silver ions are reduced much faster than those that do not. The more ions present in a given grain (i.e., the greater the exposure of that grain), the faster the reaction with developer and the darker the image at that site in the film.

Once the developed image is obtained, a large amount of unexposed and undeveloped silver halide remains in the emulsion. If that silver halide is not removed before the image is exposed to radiation capable of producing a latent image, the image will continue to darken. The process of removing the residual silver halide from the image is called "fixing" which is done by washing with Sodium thiosulfate before final print is obtained.

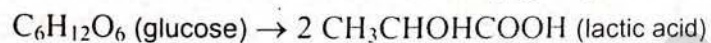
(b) Reactions in Food Processing

Chemical reactions have an important role in the food processing industry. Processed food means a food transformed in a way suitable for better consumption and use. Sometime raw food items are not suitable for consumption. In food processing technique, food is fortified by the addition of vitamins and minerals. This improves its nutritional value. Sometimes addition of artificial flavors makes the food more tasty for consumption. A common example of food processing is the fermentation process which was first studied by Louis Pasteur. He demonstrated that during glucose metabolism yeast and certain bacteria can be employed in the formation of ethanol and carbon dioxide. Ethanol fermentation is used in the production of beer, wine and bread.

This process can be represented by the following chemical equation:



The pyruvate molecules from glucose metabolism also may be fermented into lactic acid. Lactic acid fermentation is used to convert lactose into lactic acid in yogurt production.

**(c) Fabric and Hair Dyeing**

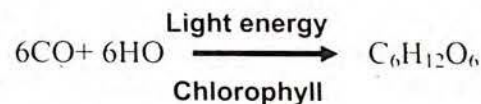
Different colours and shades are employed in the process of dyeing fabrics to make them attractive and beautiful. Technically dyes are molecules which absorb and reflect light at specific wavelengths to give human eyes the sense of color.

One simple way of dyeing is to add dye in water and dissolve it completely. Now immerse the fabric within the dye solution for some period of time. Dye being a chemical sticks and forms chemical bonds with fabric. The chemical nature of the dye and the material to be dyed both have role in the dyeing process.

Human hairs have natural colour and shades. From black to brown different types of colours are present. Although hair are mainly composed of a protein called keratin, the natural colour of hair depends on the ratio and quantities of two other proteins, pheomelanin and eumelanin. Pheomelanin controls the expression of golden blond, ginger, and red colors while eumelanin is responsible for brown to black hair shades. If one of these two proteins is lacking, hair colour turns white/grey. Hair dye provide every one with an option to gets hair dyed as per his or her desire.

AGRICULTURE

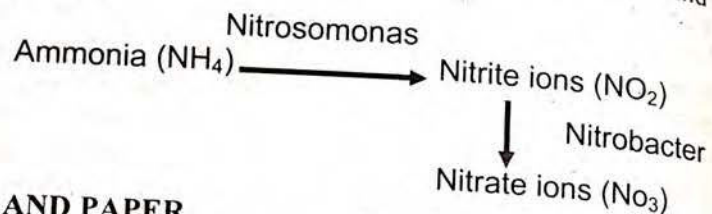
You have already studied the process of photosynthesis in the pervious section. Recall the chemical equation of the process. You will see plants convert six molecules of carbon dioxide and six molecules of water into one sugar molecule which provides the essential energy for different types of life activities and in the process releases six oxygen molecules into the atmosphere.



Plants need mineral nutrition for their growth and development. One of the essential element needed for this purpose is nitrogen. Plants are unable to consume free nitrogen present in the air. However, it is because of some vital chemical reactions which are helped by nitrogen-fixing bacteria that live in soil and in the roots of leguminous plants which ensure its availability to the plants in the form suitable for consumption.

These bacteria fix free nitrogen by using hydrogen ions found in the soil and form ammonia which is later converted to nitrite ions by the action of bacteria like *nitrosomonas*. Nitrite is then converted to nitrate ions by *nitrobacter*, another kind of

bacterium. Plants can use nitrate for their growth and development.



PULP AND PAPER

Paper is one of the useful products obtained from trees. It has multidimensional usage. In the field of publishing it has a vital role in the production of books, note books, play cards, dairies and other related items. In the packaging industry card boards and brown paper are also obtained from the paper industry. Chemicals and chemical reactions play an important role in the production of paper from its raw material.

Bark of the tree is first removed from the tree trunks and it is cut into small pieces. Then these pieces are put in solution of NaOH and Na₂S to remove lignin.

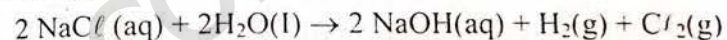
This material is heated in a pressure cooker where after sometime the pressure is suddenly released. This sudden release of pressure causes the wood pieces to fly apart into fibres. The material which is known as pulp is washed again treated with more NaOH in the presence of oxygen to remove any left over lignin. The fibres are bonded together and chemicals are added to make the paper water resistant and to give colour to the paper. From this material water is squeezed out and the pulp is rolled and dried. These rolls are further processed and paper is produced which is ready to be used for different purposes.

MINERAL PROCESSING

Mineral is defined as any naturally occurring homogenous inorganic substance distributed in the earth crust. Chemical reactions are employed in the refinement and

production of various useful products from minerals. For example gypsum or calcium sulphate dihydrate (CaSO₄·2H₂O) when ground into fine powder and this powder is heated at temperature between 150°C to 165°C, water content present in the gypsum is removed and hemi-hydrate plaster (CaSO₄·1/2H₂O), which is commonly known as the 'Plaster of Paris' is produced. This again changes into gypsum on adding water into it.

Sodium chloride commonly known as table salt occurs naturally as a mineral, also called rock salt. It can be processed into useful products with the help of chemical reactions. For example, chlorine and sodium hydroxide are manufactured by electrolysis of sodium chloride solution as shown in the following chemical reaction.



Sodium Chloride + Water $\rightleftharpoons$ Sodium Hydroxide + Hydrogen + Chlorine

4. List the methods of chemical disposal and briefly describe each method.

Ans. Industrialization has brought economic development but it also gives environment pollution.

Consumption of chemicals and their products by the large industrial units and households have resulted in the generation of chemical wastes which pose great threats to the human health and environment. These wastes are known as hazardous wastes. Technically a chemical waste is regarded as hazardous waste if it is ignitable, corrosive, reactive and toxic. Hazardous waste is a serious threat if it is not properly managed or disposed. In Pakistan different types of industries produce large quantities of chemical waste which need proper management and disposal mechanism. Let's study various aspects of chemical disposal in Pakistan.

Methods of disposal of wastes in Pakistan

Like any other country in the world chemical industries in Pakistan generate large amounts of hazardous wastes. Unfortunately there is no proper mechanism and infra structure for the disposal of chemical wastes in Pakistan. The necessary infrastructure for the treatment, recycling and waste disposal facilities in the country are still in the developmental stage. In most cases hazardous wastes produced by the chemical industries are given to contractors who are least bothered about the safety precautions to be taken while dealing with such materials. So often these contractors release hazardous wastes in nearby water bodies, residential areas or cultivable lands from where these wastes manage their way to the food chain.

- (i) Reducing the use of hazardous materials: The hazardous wastes should be minimized in different chemical industries.
- (ii) Reuse and recycle: The hazardous wastes should be recycled and reused if possible. This could ensure the safe disposal of the waste as well as it will be cost effective.

5. Describe how old tyres can be recycled and reused.**Ans. Recycling of old tyres:**

The good thing about plastic is that it can be recycled and reused again and again. On the recycling center different types of plastic are separated from the pile. It is then processed for recycling. Recycled plastic could be used in the manufacturing of various daily use items. In this way recycling and reuse of plastic makes it sure that the waste plastic is not thrown in open spaces or in drainage lines.

6. Explain the impacts and safety consequences of chemical disposal in Pakistan.**Ans. Impacts and Safety Consequences of Chemical Disposal**

Industrial chemicals have a profound role to play in the production of various useful products like soaps, detergents, fertilizers, pesticides, paints, varnishes, plastic etc. However, the processing and production of these products have been associated with the release of harmful chemicals which have become a source for serious diseases. Improper disposal of these chemicals are also contributing to the creation of different environmental problems like different types of pollution, improper storage and management of chemical wastes and accidents during the transport and distribution of chemicals affecting a particular ecosystem etc. Agriculture has a key role in Pakistan's economy. Use of fertilizers, pesticides, insecticides and herbicides is common practice in our farmlands. Most of the time these practices are not properly used and managed. In this way these are contributing in producing health and environmental concerns.

Development demands that proper planning must be done for safe disposal of these harmful wastes. In the following section you will study about the disposal mechanism of some of these wastes.

ADDITIONAL QUESTIONS

Q.1. Write a note on disposal of wastes in land based disposal areas.

Ans. Disposal of wastes in land based disposal areas

One of the easiest way for the disposal of hazardous wastes is to throw them in a landfill, waste pile, injection well or other land based disposal areas. However, this disposal method must be supported by proper precautions and necessary regulations which can help protect the people living adjacent to it. And this method must ensure that the environment and natural resources of that locality are safe and protected.

Q.2. How tanneries and textile industries affect environment.

Ans. In tanneries and textile industries different types of chemicals are used in various processes. These chemicals include bleaching agents, toxic and inflammable solvents, acids and alkalis. These chemicals are not treated properly and most often these are discharged in the nearby water bodies or in open land. As a result the people living in such localities are becoming victim of several dangerous diseases including cancer.

Q.3. How does chemical reactions occur in everyday life and what are their practical applications?

Ans. Chemical Reaction:

When a chemical change occurs, a chemical reaction is said to have taken place. In chemical reactions atoms combine with each other forming new substances. The substances which take part in chemical reactions are called reactants. The new substances formed as a result of a chemical reaction are called products. Generally, the chemical properties of the reactants and products are different from each other.

An example of a chemical reaction is rusting of iron. Rusting occurs because the iron (Fe) reacts with oxygen (O_2) in the atmosphere. Chemical bonds are formed and broken to finally make iron oxide (Fe_2O_3) which is rust.

In physical change only the physical state of matter is changed, for example, melting of ice. These changes are temporary and can be easily reversed. The substances retain the properties during a physical change. Thus, no new thing is formed in this type of change. On the other hand, a chemical change is permanent and it cannot be reversed easily. In a chemical change new things are formed which have chemical properties different from the original substances, for example, pure hydrogen gas (H_2) and pure oxygen gas react violently in the presence of spark to form water. This chemical reaction is exothermic and it will release energy.

Q.4. Describe some chemical reactions in everyday life?

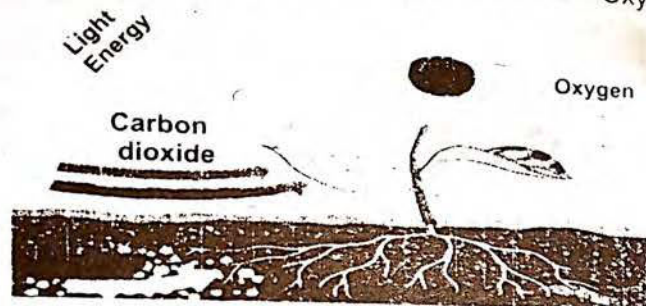
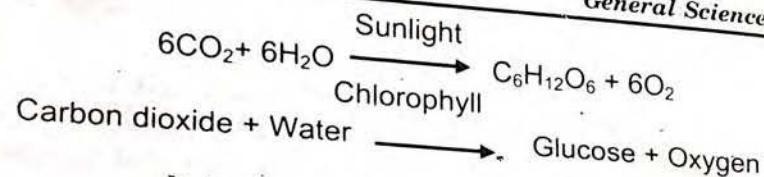
Ans. Some Chemical Reactions in Everyday Life:

Different things that are being used by us in our day today activities are products of chemical reactions. For example; toothpaste, soap, shampoo, washing powder etc. are all results of chemical reactions. Following are some of the significant examples of chemical reactions, which we encounter in everyday life.

(i) **Photosynthesis**

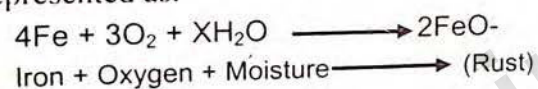
You are familiar with the term photosynthesis. It is the process by which green plants manufacture their own food. Water and carbon dioxide act as raw materials in the process. The chlorophyll pigment, present in the leaves, traps energy from sunlight. Chemical reactions take place whereby raw materials are converted into glucose and oxygen gas.

The overall equation of the process of photosynthesis is given below.



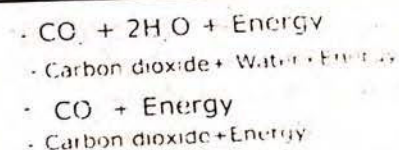
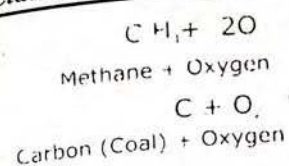
(ii) Rusting of Iron:

You might have seen a layer of rust over unpainted iron surfaces. This layer gradually leads to disintegration of iron. In rusting process iron combines with oxygen in the presence of atmospheric moisture resulting in formation of iron oxide (Fe_2O_3) which is rust. The chemical reaction of the process can be simply represented as:



(iii) Burning of Coal/Natural Gas

Coal and natural gas are fossil fuels and are important means of energy. Coal mainly contains carbon and natural gas contains methane. The chemical reaction of burning of carbon in coal and methane in natural gas involves combustion process where carbon and methane react with oxygen to release energy used for domestic and industrial consumption. These chemical reactions are shown below.



Q.5. Write down some careers related to chemical reaction in technological process.

Ans.

1. Careers Related to Chemical Reactions in Technological Processes:

Knowledge of chemical reactions and chemical processes open a door of opportunities for growth in career. Following are some of the careers related to chemical reactions in technological processes.

2. Film Developer

Film developers create photographic prints from raw film using chemicals, highly technical instruments and, in some cases, photographic processing machines.

3. Food processors

Food processors work to turn raw goods into finished products for grocers, wholesalers, restaurants, and institutional food services.

4. Textile dyeing technician

As a textile dyeing technician you would create dyes to colour fibres, yarns and fabrics.

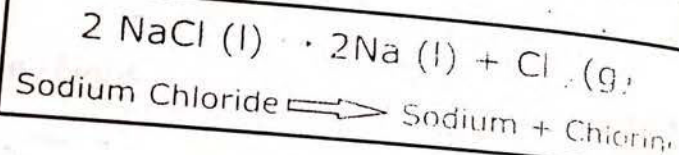
5. Agriculture

A degree in agriculture provides you with the knowledge and skills to manage agricultural businesses. Jobs include:

Agricultural consultant, Farm manager, Fish farm manager, Soil scientist etc.

6. Mineral Processing Operators

Mineral processing operators use equipment to process mineral ores until the final form or a concentrate is produced. Sodium metal and chlorine gas results from the electrolysis of molten sodium chloride. This chemical reaction can be shown as:



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MODEL PAPER NO. 2

SECTION A (MCQs)

Q.1. Choose the correct option.

(i) The reactants of water are:

(Kohat board 2018)

- (a) Hydrogen
- (b) Oxygen
- (c) Spark
- (d) All of these ✓

(ii) What is meant by rust?

(Kohat Board 2018, Mardan Board 2018)

- (a) Sodium oxide
- (b) Iron oxide ✓
- (c) Copper oxide
- (d) Silver oxide

(iii) Sunlight is the major source of:

(Mardan board 2018)

- (a) Electricity
- (b) Energy ✓
- (c) Current
- (d) Tides

(iv) Ethanol is formed from glucose by the action of:

(Mardan Board 2018)

- ✓ (a) Bacteria
- (b) Virus
- (c) Fungi
- (d) Mushroom

(v) Chemical name of vitamin D is:

(Mardan Board 2018)

- ✓ (a) Ergocalciferol
- (b) Ascorbic acid
- (c) Folic acid
- (d) Acetic acid

(vi) Chemical name of vinegar is:

- (a) Ergocalciferol
- (b) Ascorbic acid ✓
- (c) Folic acid
- (d) Ascorbic acid

(vii) Which of these shows that a chemical reaction has taken place?

- (a) Change in state
- (b) Evolution of gas
- (c) Change in color
- (d) All of these ✓

- (viii) **Dyes are molecules which absorb and reflect:**
 (a) Rust (b) Colour
 (c) Gas (d) Light ✓
- (ix) **The nitrogen fixation process breaks apart free nitrogen and combines _____ with other substances to form compounds:**
 (a) Oxygen atoms (b) Nitrogen atoms ✓
 (c) Hydrogen atoms (d) None of these
- (x) **Chemicals are added to food for their:**
 (a) Taste (b) Preservation
 ✓ (c) Both a and b (d) None of these
- (xi) **Soaps containing sodium salts are formed by heating oil with**
 ✓ (a) Aqueous sodium hydroxide solution
 (b) Castic soda
 (c) Both a, b
 (d) None of these
- (xii) **The reaction of acids and bases to form water and salts is called:**
 (a) Saponification (b) Neutralization ✓
 (c) Product (d) None of these
- (xiii) **Food label provides information about the food items present in a _____.**
 (a) Label (b) Container ✓
 (c) Compound (d) None of these
- (xiv) **Green plants make their own food is called:**
 (a) Neutralization (b) Photosynthesis ✓
 (c) Both a and b (d) None of these

- (xv) **A process in which one or more substances are converted into one or more different substances is called:**
 (a) Mechanical change (b) Physical change ✓
 (c) Chemical change (d) None of these

SECTION B

Q.2. Answer any nine questions.

- What is the easiest way for disposal of hazardous wastes?
- Which metals are used in packing?
- What is meant by recycling?
- Describe photosynthesis.
- Name some chemical reactions in our day life.
- Describe indications of a chemical reaction.
- Describe briefly scientific nomenclature and common consumer products.
- How soap is prepared?
- What is silver bromide?
- What is rock salt and describe its uses.
- Describe careers related to chemical reactions in technological process.
- Describe briefly the methods of disposal of wastes in Pakistan.

SECTION C

Note: Answer any three questions.

- Describe effective disposal methods of wastes.
- Describe impacts of chemical disposal.
- What are minerals and how they are processed?
- Describe saponification.

Unit 8

Biotechnology

SECTION A (MCQs)

Select the correct answers in the following questions.

1. The normal human chromosome diploid number is:
 (a) 23 (b) 24 ✓
 (c) 46 (d) 48
2. In meiosis, crossing over occurs in:
 (a) Metaphase I (b) Prophase I ✓
 (c) Metaphase II (d) Prophase II
3. Each section of information necessary for the synthesis of a single polypeptide is:
 (a) Chromosome (b) DNA
 ✓ (c) Gene (d) Protein
4. A highly coiled, condensed form of chromatin formed in the cell nucleus during meiosis and mitosis is:
 ✓ (a) - Chromosome (b) Spindle fibers
 (c) DNA (d) Centromere
5. A double helical molecule, consisting of two strands of four different nucleotides containing a genetic information is:
 (a) Chromosome (b) DNA ✓
 (c) Gene (d) Aster
6. Proteins are synthesized in:
 (a) Lysosome (b) Mitochondrion
 ✓ (c) Plasmid (d) Ribosomes

7. A process of cell division where each of the two daughter cells receives a complete set of chromosomes is called:
 (a) Cytokinesis (b) Amitosis
 ✓ (c) Mitosis (d) Meiosis
8. A specialized protein that binds to DNA and organize its structure in the nucleus
 (a) Chromosome (b) Histone
 ✓ (c) Hormone (d) Enzyme
9. Chromosomes can be counted best at the stage of:
 ✓ (a) Metaphase (b) Anaphase
 (c) Telophase (d) Prophase
10. The stage in which daughter chromosomes move toward the poles of the spindle is:
 (a) Anaphase (b) Metaphase
 (c) Prophase (d) Telophase ✓
11. Which of the following cellular structures always disappears during mitosis and meiosis?
 ✓ (a) Plasma membrane
 (b) Nucleolus and nuclear envelope
 (c) Plastids
 (d) None of these
12. During meiosis I, the number of chromosomes is:
 ✓ (a) Halved (b) Tripled
 (c) Doubled (d) Quadrupled
13. The diploid chromosome number for the house fly is 12. The haploid number of chromosomes found in their gametes would be:
 ✓ (a) 1 (b) 3
 (c) 6 (d) 12

14. Which of the following is NOT a function of cell division?

- (a) Growth of multicellular organisms
- ✓ (b) Repair of multicellular organisms
- (c) Reproduction of single-celled organisms
- (d) Aerobic cellular respiration of multicellular organisms

15. Which of the following statements about mitosis is NOT correct?

- (a) Mitosis is cell division that produces two daughter cells.
- (b) Each daughter cell formed by mitosis has the same number of chromosomes as the parent cell
- (c) The parent cell and the daughter cells are genetically identical,
- ✓ (d) During mitosis, the centromeres divide and the sister chromatids stay together.

16. Which of the following is the correct sequence of phases of mitosis?

- (a) Anaphase, prophase, metaphase, telophase
- (b) Prophase, anaphase, metaphase, telophase
- ✓ (c) Prophase, metaphase, anaphase, telophase
- (d) Prophase, metaphase, telophase, anaphase

17. Which of the following statements is NOT correct when cells undergo meiosis?

- (a) Meiosis ensures that the chromosome number remains constant generation after generation.
- (b) Meiosis ensures that each generation has a different genetic makeup than the previous one.

(c) Meiosis ensures that each newly formed daughter cell receives the same number and kinds of chromosomes.

✓ (d) Meiosis results in four daughter cells.

18. **Thalassemia is due to**

- (a) Abnormal blood
- ✓ (b) Abnormal haemoglobin
- (c) Abnormal white blood cell
- (d) Abnormal platelets in the blood

ADDITIONAL MCQs

SECTION A

1. The field of science dealing with heredity and variations is called:

- ✓ (a) Genetics
- (b) Biology
- (c) Biotechnology
- (d) None of these

2. The use of living microorganisms or biological process for the welfare of man is called:

- (a) Genetics
- (b) Biology
- ✓ (c) Biotechnology
- (d) None of these

3. Citric acid is produced by the action of bacteria or _____.

- (a) Bacteria
- (b) Fungi
- ✓ (c) Both a, b
- (d) None of these

4. Nucleus is found in the _____ of animal cell.

- (a) Upper part
- (b) Back
- ✓ (c) Center
- (d) Bone

5. Generally a cell has _____ nucleus.

- (a) One
- (b) Two

- ✓ (c) Three (d) Four
6. Nuclear material is enclosed in a nuclear _____.
- ✓ (a) Nucleoplasm (b) Nucleous
(c) Chromosomes (d) Membrane
7. The nuclear membrane has several opening called:
(a) Nuclear opening (b) Nuclear pores ✓
(c) Nuclear chain (d) Both a, b
8. Different types of proteins and ribonucleic acids between the nucleus and cytoplasm are exchanged through _____
(a) Nuclear chair (b) Back
✓ (c) Pores (d) None of these
9. The cells are divided into prokaryotic and _____.
(a) Membrane (b) Cytoplasm
(c) Eukaryotic (d) Algae
10. During cell division, the chromatin is converted into thick, uncoiled thread like structures are called:
(a) Cytoplasm (b) Chromosomes ✓
(c) Protoplasm (d) None of these
11. Chromosomes carry genetic information in the form of:
(a) Nuclear (b) Chromosomes
(c) Protoplasm (d) Genes ✓
12. Each chromosome is composed of:
(a) DNA (b) protein
(c) protoplasm (d) both a and b
13. Nucleus is the site of storage of hereditary material in the form of:
(a) Genes (b) Proteins

- (c) RNA (d) All of these ✓
14. RNA and ribosomes are responsible of:
(a) Heridity (b) Protein synthesis ✓
(c) Chromatin (d) None of these
15. When cell divides, chromatin network breaks into chromosomes which are then equally transmitted into _____.
(a) RNA (b) DNA
✓ (c) Offsprings (d) Genes
16. DNA is composed of chemical units known as:
✓ (a) Nucleotides (b) Somonotides
(c) Strands (d) Genes
17. Reproduction is essential for continuity of _____.
(a) Race (b) Life ✓
(c) Relationship (d) Growth
18. Cell division provides basis for:
(a) Growth (b) Reproduction
(c) Heredity (d) All of these ✓
19. Mitosis is also called _____ cell division.
✓ (a) Somatic (b) Single
(c) Double (d) None of these
20. During metaphase the centromere of each chromosome _____.
(a) Collects (b) Divides ✓
(c) Interacts (d) None of these
- =====

SECTION B (SHORT ANSWERS)

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Q.1. Write short answers of the following questions:
Ans. What is role of nuclear pores in the nucleus?
Ans. Role of nuclear pores in the nucleus:

The nuclear pores provide or passage for exchange of materials like different types of proteins and ribonucleic acids between the nucleus and cytoplasm.

Q.2. List down four major functions of nucleus?
Ans. Functions of Nucleus:

Following are some of the important functions of the nucleus:

1. Nucleus is the site of storage of hereditary material in the form of genes. It also stores different types of proteins and RNA in the nucleolus.
2. Messenger RNA (mRNA) and ribosomes are formed in the nucleus which are responsible for protein synthesis.
3. It is a site for the exchange of hereditary molecules (DNA and RNA) between the nucleus and the rest of the cell.
4. When cell divides, chromatin network breaks into chromosomes which are then equally transmitted into offsprings.
3. Write the role of RNA as a carrier of information?

Ans. RNA as a carrier of information

DNA is not directly involved in protein synthesis and is just the store house of genetic information that is transferred to RNA. There are three types of RNA i.e. messenger RNA or mRNA, transfer RNA or tRNA and ribosomal RNA or rRNA. Each has its own specific role in protein synthesis. The messenger RNA (mRNA) carries information from the DNA

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according to which protein is synthesized. The transport of amino acids to the site of protein synthesis is carried out by the transfer RNA (tRNA).

Ribosomal RNA (rRNA) in the ribosome cooperates with tRNAs to translate mRNAs into peptides. Genetic information from the DNA to mRNA and then to cytoplasm takes place in two steps i.e. transcription and translation.

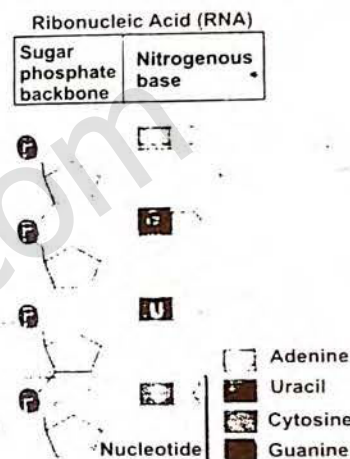
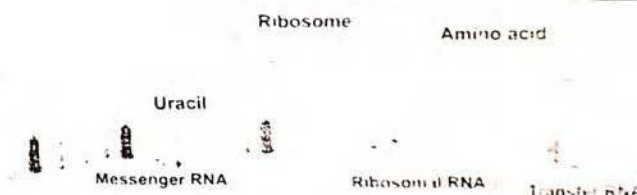


Fig. Structure of RNA



Structure of Nucleus

4. Name the four types of nitrogenous bases found in the DNA molecule.

Ans. (i) Thymine (ii) Adenine (iii) Cytosine (iv) Guanine

5. **Define interphase.**

Ans. **Interphase:** The resting phase between any two mitotic division is called interphase. During this phase nucleus and cytoplasm become active. The nucleus prepares itself for division.

6. **Briefly write about the-significance of mitosis.**

Ans. **Mitosis:** Mitosis is a cell division by which each of the daughter cells receive exactly the same number and the same kind of chromosomes as in the parent cell.

7. **What do you mean by genetic disorders?**

Ans. **Genetic Disorders:** Genetic disorders are those diseases which are transmitted from parents to offsprings.

=====

ADDITIONAL SHORT ANSWERS

Q.1. Define heredity.

Ans. Genetic traits are transmitted to the next generation by the process of reproduction and this characteristic of living organism is known as heredity.

Q.2. Describe the structure of cytoplasm.

Ans. Cytoplasm consists of about 9 percent water and the remaining 10 percent are the fundamental molecules of life such as insoluble waste products and storage products.

Q.3. Define genes.

Ans. Genes are the heredity material which are composed of nucleic acids. These acids are also the messenger substances that convey information from the genes to the rest of the cell.

Q.4. Describe DNA.

Ans. DNA has a specific sequence of nitrogenous bases, which carries information in the form of genes that can be transferred from generation to generation.

Q.5. What is the function of cell division?

Ans. Cell division is the responsible of growth and development of an organism and at the same time it helps in the production of gametes and in the continuity of a species generation after generation.

Q.6. Define mitosis.

Ans. Mitosis is a cell division by which each of the daughter cells receive exactly the same number and the same kind of chromosomes as in the present cell.

Q.7. What are genetic diseases?

Ans. Genetic diseases are those disorders which are transmitted from parents to the offsprings.

Q.8. Describe thalassemia.

Ans. In thalassemia the body makes abnormal form of haemoglobin, the protein in red blood cells that carries oxygen.

Q.9. Define biotechnology.

Ans. Biotechnology can be broadly defined as using living organisms or their products for commercial purposes.

Q.10. What is a clone?

Ans. A clone is an animal who is genetically identical to its donor "parent".

Q.11. Describe the role of biotechnology and genetic engineering in the field of pharmaceuticals.

Ans. Microorganisms are used as living factories for the production of life saving antibiotics including penicillin, from the fungus penicillium, and

streptomycin from the bacterium streptomycetes. Human insulin for diabetics is now being produced using biotechnology.

Genetically engineered vaccines are being developed to protect fish and livestock against pathogens and parasites.

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SECTION C - DETAILED ANSWERS

Write detail answers of the following questions.

1. Describe the structure and function of nucleus.

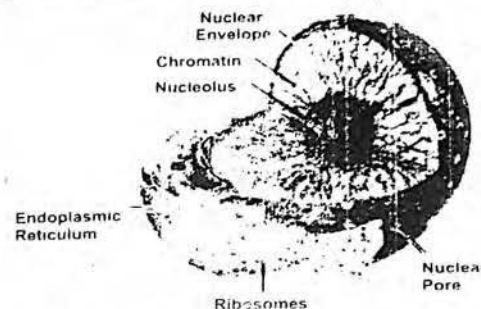
Ans. Nucleus: Nucleus is a spherical structure found in the center of animal and young plant cell.

Structure of Nucleus

A nucleus consists of a nuclear membrane, nucleoplasm, nucleolus and chromosomes. Nucleoplasm, (also known as karyoplasm) is the matrix present inside the nucleus.

Nuclear Membrane:

Nuclear material is enclosed in a nuclear membrane which is double-layered membrane. The outer layer of this membrane is connected to the endoplasmic reticulum. A fluid-filled space is present between the two layers of a nuclear membrane. The nuclear membrane has several openings called nuclear pores. These pores provide a passage for exchange of materials like different types of proteins and ribonucleic acids between the nucleus and cytoplasm.



2. Describe the importance of hereditary material found in nucleus.

Ans.

Genetic information in the cell is present in the nucleus. DNA is composed of chemical units known as nucleotides. Each nucleotides are composed of smaller parts: a 5 carbon sugar, a phosphate group, and nitrogen – containing base. Both phosphate group and nitrogenous base are covalently bonded to the sugar.

DNA has equal numbers of adenine and thymine ($A=T$) and equal numbers of guanine and cytosine bases ($C=G$). These relationships show that $A+G = T+C$. These relationships hold in determining how genetic information is encoded in DNA and passed from one generation to the next.

3. Identify the relationships among nucleic acids (DNA and RNA), genes and chromosomes.

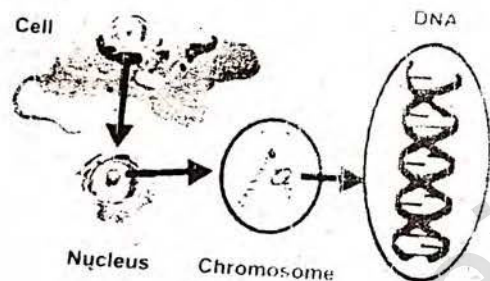
Ans. Nucleic Acids, Genes and Chromosomes

Nucleic acids are a major class of organic compounds required to maintain life. Genes are the heredity material and are composed of nucleic acids. Nucleic acids are also the messenger substances that convey information from the genes to the rest of the cell.

Nucleic acid molecules are long polymers of smaller building-block units called nucleotides which are composed of still smaller parts; a 5-carbon sugar, a phosphate group, and a nitrogen-containing base.

Nitrogenous bases are of four types namely, adenine, guanine, thymine and cytosine. Both the phosphate group and the nitrogenous base are covalently bonded to the sugar molecule.

DNA is a polynucleotide chain. The most important fact about DNA is that it has a specific sequence of nitrogenous bases, which carries information in the form of genes that can be transferred from generation to generation. This genetic information is needed to produce countless number of proteins from various combinations of twenty amino acids. The four different types of bases can be arranged in any linear order along a strand of DNA. Each sequence of bases represents a unique set of genetic instructions.



4. Describe the molecular basis of heredity.

Ans. **Nature of Hereditary Material**

A typical cell consists of: cell wall (in case of plant cell), cell membrane, cytoplasm with organelles and the nucleus.

Molecular Basis of Heredity: Genetic information in the cell is present in the nucleus. In order to know the nature of

this information present in the DNA we have to see the chemical nature of DNA.

Chemical composition of DNA: DNA is composed of chemical units known as nucleotides. Each nucleotide is composed of smaller parts; a 5-carbon sugar, a phosphate group, and a nitrogen-containing base. Both phosphate group and nitrogenous base are covalently bonded to the sugar.

5. Give an overview of the process of DNA replication.

Ans. **Mitosis (Somatic Cell Division)**

Mitosis may be defined as the regular process of cell division by which each of the daughter cells receive exactly the same number and the same kind of chromosomes that a parent cell contains.

Mitosis is a common method. It occurs in the body cells of all animals and plants. As Mitosis occurs in the body (or soma) therefore, it is also called somatic cell division.

Mitosis is completed in six steps.

1. **Interphase:**

The resting phase between any two mitotic division is called interphase. During this phase nucleus and cytoplasm become active. The nucleus prepares itself for division.

2. **Prophase:**

During prophase the centrosome divides into two halves and each half is surrounded by fine fibers called astral rays. This constitutes an aster. Now the two asters start moving away from each other and finally reach the opposite sides of the nucleus. Between the two asters appear fine fibres. These fibres form a spindle, which is broad in the middle to form the equator and narrow towards the asters which are now known as poles.

During this whole process the chromatin material of the nucleus is converted into chromosomes. The nucleolus and the

nuclear membrane disappear and the chromosomes attach themselves to the spindle fibres.

3. Metaphase:

During metaphase the centromere of each chromosome divides. The daughter chromosomes or chromatids so formed are attached to the half spindle fibers and arrange themselves on equator forming equatorial plate.

4. Anaphase:

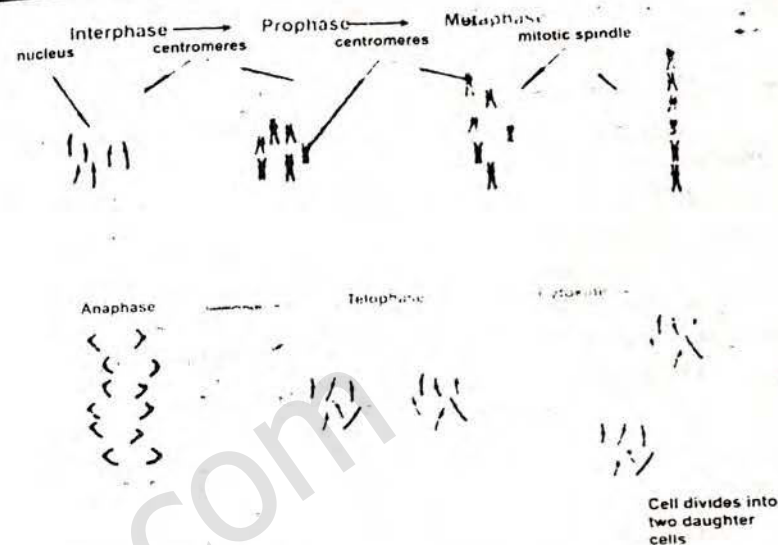
During anaphase the chromatids separate. At the same time the spindle fibers contract which results in the movement of chromatids towards their respective poles.

5. Telophase:

During Telophase the chromatids reach the poles where they meet each other to form a chromatin network. In each network nucleolus reappears. Nuclear membrane is reformed around each chromatin network. Thus two daughter nuclei are formed. Each daughter nucleus contains the same number of chromosomes as in the parent cell. The spindle fibres and astral rays disappear.

6. Cytokinesis:

Division of cytoplasm is called Cytokinesis. After the formation of two daughter nuclei, a constriction appears in the middle of cytoplasm in the region of equator. This constriction is called cleavage furrow. This cleavage furrow deepens and divides the parent cell into two daughter cells. When the division of the cell is completed, two daughter cells are formed. These two daughter cells are the exact copies of the parent cell. The daughter cells pass into the interphase. During interphase they grow to their normal size.



Significance of Mitosis

Mitosis plays an important role in growth of an organism and keeps the number of chromosomes constant. The hereditary characters are equally transmitted into the daughter cells. It also helps in healing of wounds and formation of new cells.

Q.6. Describe the process of mitosis in detail.

Ans. Meiosis

The term "Meiosis" means reduction. In this type of cell division, the number of chromosomes is reduced to half. This process occurs in the reproductive organs (testes or ovaries). In animals, meiosis produces gametes while in plants it produces spores. During meiosis four daughter cells are formed from one parent cell. Meiosis is completed in two steps, Meiosis I and Meiosis II.

(i) **Meiosis I or Reduction Division**

This stage is divided into the following sub phases.

(a) **Prophase-I:**

During this phase coiling and condensation of chromosomes take place. The homologous chromosomes form pairs and this process is called synapsis. Later on crossing over between the homologous chromosomes takes place during which the chromatids exchange their parts. Nuclear membrane disappear and spindle fibres are formed. Chromosomes are attached to the spindle fibres.

(b) **Metaphase-I:**

During metaphase-I the chromosomes arrange themselves on the equator. These chromosomes are attached to the spindle fibres by the centromere.

(c) **Anaphase-I:**

During anaphase-I contraction of spindle fibres occurs. The chromosomes start movement from the equator towards the poles. Reduction of chromosomes occurs at this stage as one from each pair of chromosomes move to each pole.

(d) **Telophase-I:**

During Telophase-I these chromosomes reach the poles. Chromosomes form a chromatin network. Nuclear membrane appears around the network. A new nucleolus appears. Thus two daughter nuclei are formed.



Then a groove is formed in the cell membrane. This groove becomes deeper and deeper and divides the cell into two daughter cells. The spindle fibres and the astral rays disappear. The centriole persists in each daughter cell. In this way two daughter cells are formed.

(ii) **Meiosis II:**

Meiosis II is just like mitosis. Meiosis II is completed through the following steps.

1. Prophase II
 2. Metaphase II
 3. Anaphase II
 4. Telophase II
- After the first cell division, each of the resulting cells contains a pair of sister chromatids—one

maternal chromatid and the other paternal. Unlike mitosis, meiosis does not end after one division; it continues with a second cell division. In this division, the sister chromatids are separated producing four haploid cells.

SIGNIFICANCE OF MEIOSIS

Meiosis is very significant because;

1. In meiosis gametes are formed which are the sexual units of reproduction.
2. Meiosis maintains constant number of chromosomes in the organism by the union of haploid cells during sexual reproduction.
3. Meiosis causes exchange of genes, thus genetic variation occurs among the species.

Q.7. Explain thalassemia and Down's syndrome as common genetic disorders.

Ans. (a) Thalassemia

Thalassemia is a blood disorder which is hereditary in nature. In this disorder the body makes an abnormal form of haemoglobin (the protein in red blood cells that carries oxygen). The disorder results in excessive destruction of red blood cells which leads to anaemia.

Thalassemia occurs when there is a defect in a gene that controls the production of haemoglobin. Untreated thalassemia leads to heart failure and liver problems, and makes a person vulnerable to infections. Frequent blood transfusions can help control some symptoms. However it may result in accumulation of iron, which can damage heart, liver, and endocrine system.

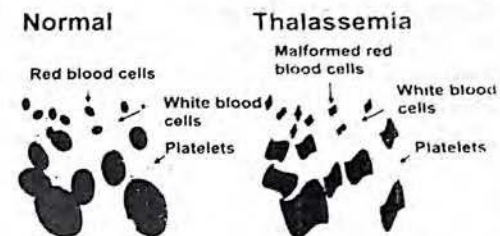


Fig: Comparison of normal and malformed red blood cells.

Thalassemia is caused by mutations in the DNA of cells that make haemoglobin.

(b) Down's Syndrome

In human being there are 23 pairs of chromosome. Each chromosomal pair is numbered from 1 to 23. Down's Syndrome disorder is concerned with chromosome number 21 where instead of a pair there are enough healthy red three chromosomes. So an extra blood cells. Red blood chromosome is present.

This disorder is commonly known as Mongolism as the facial features of these people look like Mongols. Down syndrome includes characteristic facial features, short stature, heart defects, susceptibility to respiratory infection and mental retardation.

Q.8. Analyze the role of genetic engineering and biotechnology in the fields of agriculture and food processing.

Ans. Genetic Engineering and Bio-Technology:

Genetic engineering is a technique which is used for the transfer of genes from one organism to another. It allows genetic information to be transferred between organisms belonging to the same or different species.

Biotechnology has been practiced by human society since the beginning of recorded history in such activities as baking bread, brewing alcoholic beverages, or breeding food crops or domestic animals. Biotechnology is "the commercial application of living organisms or their products which involves the deliberate manipulation of their DNA molecules". Biotechnology deals with different technologies such as gene manipulation and gene transfer, DNA typing and cloning of plants and animals.

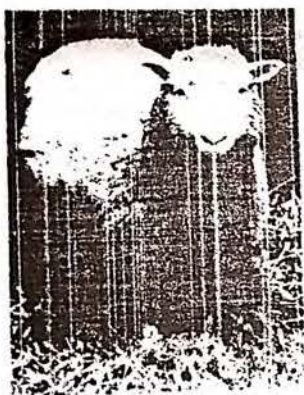


Fig: Dolly: The First cloned sheep.

Cloning

Cloning is the production of multiple identical offsprings. A clone is an animal who is genetically identical to its donor "parent". Cloning can be achieved using cells derived from a microscopic embryo, a fetus, or from an adult animal.

Cloning from adult animals was introduced to the public in 1997 when scientists announced the birth of Dolly, the first animal cloned in this way. Since Dolly, several scientists have cloned other animals including cows and mice.

Dolly is the result of cloning of only one parent. Scientists transferred genetic material from the nucleus of an adult sheep's udder cell to an egg whose nucleus had been

removed. There have now been hundreds of clones produced from skin cells taken from adult sheep, cattle, goats, and mice.

Transgenic Animals and Plants

Genes or genetic material can be transferred naturally, or by a number of genetic engineering techniques from one organism to another. A transgenic organism (plant or animal) is one that carries a foreign gene that has been deliberately inserted into its DNA. This inserted gene can create proteins which are useful for the mankind.

Transgenic animals are created to study human diseases and to develop and identify the drug useful to treat these diseases. Gene transfer is done in animals to increase the milk production and to produce useful proteins.

ADDITIONAL QUESTIONS

Q.1. Describe the application of biotechnology and genetic engineering.

Ans. Application of Biotechnology and Genetic Engineering

Biotechnology and genetic engineering have wide range of applications in the present world.

The two significant features of genetic engineering are:

1. production of beneficial proteins and enzymes in surplus
2. quantities + creation of genetically modified organisms with useful characters

Some of the applications of biotechnology and genetic engineering in present world are as follows.

Q.2. Describe the role of biotechnology and genetic engineering in the field of agriculture.

Ans. Biotechnology and Genetic Engineering in the field of Agriculture

Agricultural biotechnology is the area of biotechnology involving applications to agriculture. Agricultural biotechnology has been practiced for a long time, as people have sought to improve agriculturally important plants by selective breeding. An example of traditional agricultural biotechnology is the development of disease-resistant wheat varieties by cross-breeding different wheat types.

Today, this technology has reached a stage where scientists can take one or more specific genes from nearly any organism including plants, animals, bacteria or viruses, and to introduce those genes into plants to get the required characteristics in those plants.

Q.3. Describe the role of biotechnology and genetic engineering in the field of live stock and dairy products.

Ans. Biotechnology and Genetic Engineering in the field of Live Stock and dairy products

Biotechnology is being used to speed up breeding programmes for livestock and fish and to extend the range of useful traits. Animal feeds and feeding practices are being changed by biotechnology to improve animal nutrition and to reduce environmental wastes.

Biotechnology is used in the diagnosis of various diseases. It is also being used in the production of vaccines which help animals to fight against several diseases. Biotechnology has made possible the production of enzymes, single-cell proteins and antibiotic feed additives. These products have been widely used to improve the availability of

nutrients from feeds and the productivity of livestock and aquaculture.

Gene-based technologies are used to improve animal nutrition. This is done either through modifying the feeds to make them more digestible or through modifying the digestive and metabolic systems of animals to enable them to make better use of the available feeds.

One example of commercial success is the use of somatotropin, a hormone that results in increased milk production and accelerated growth in dairy cows.

Q.4. Describe the role of biotechnology and genetic engineering in the field of food processing.

Ans. Biotechnology and Genetic Engineering in the field of food processing

Biotechnology has found its role in food processing techniques. This has helped us to convert relatively bulky, perishable and typically inedible raw materials into more useful and edible foods and drinks. Food is also processed in order to improve its quality and safety.

Collecting DNA samples

Blood is an excellent source of DNA. It is collected from the white blood cells (mature red blood cells do not contain DNA). DNA can also be obtained from hair follicles, or from any other cellular tissue.

Q.5. Describe the role of biotechnology and genetic engineering in the field of pharmaceuticals.

Ans. Biotechnology and Genetic Engineering in the Field of Pharmaceuticals

Micro-organisms have been used for decades as living factories for the production of life-saving antibiotics including penicillin, from the fungus *Penicillium*, and streptomycin from

the bacterium *Streptomyces*. Human insulin for diabetics is now being produced using biotechnology.

Genetically engineered vaccines are being developed to protect fish and livestock against pathogens and parasites.

Q.6. Describe the structure of nucleus.

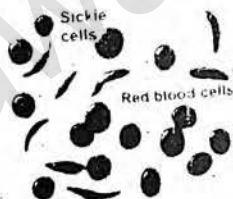
Ans. Nucleus

Nucleus is a spherical structure found in the center of animal cell and young plant cell but it occupies a peripheral position in a mature plant cell. Nucleus is the most prominent organelle in the cell which constitutes about 10 percent of the cell's volume. Nucleus is separated from the cytoplasm by the nuclear membrane. Generally a cell has only one nucleus (uninucleate). However, in some cells the nucleus is absent (enucleate), for example, red blood cells. Whereas some cells consist of two or more nuclei (multinucleate), for example, slime moulds.

Q.7. Describe disease sickle cell anaemia.

Ans. Sickle cell anaemia

Both males and females are equally affected by this disease. The direct effect of the disease is that the red cells produced have abnormal haemoglobin molecules. The molecules tend to link together and crystallize, especially when oxygen content of the blood is lower than usual. The shape of the cells become sickle-like, which are rapidly destroyed by the body. The cell count is rapidly decreased, causing anaemia and general weakness of the body. This disease is the most common inherited among people of Africa.



Q.8. What is the mechanism of genetic engineering.

Ans. Mechanism of Genetic Engineering

In genetic engineering, the genes of choice of an organism are cut off by restriction enzymes and inserted into the cells of another organism of the same or different species. For the transfer of gene, a vector usually a plasmid, is used which is small circular DNA molecule carrying genes found in bacterium. The gene, once transplanted inside the bacterium, begins to express itself and start producing the protein specified by the gene for example Insulin.



Q.9. Describe the structure of DNA.

Ans. Structure of DNA

Watson and Crick proposed a model to explain the structure of DNA. According to this model each DNA molecule is composed of two strands that wind around each other. The sugar phosphate chain is located on outer side while the nitrogenous bases project towards the center.

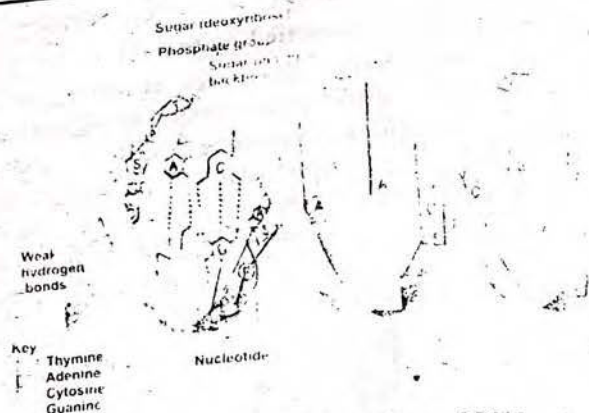


Fig: Ladder like structure of DNA.

Nitrogenous bases of two strands are held together by hydrogen bonds. An Adenine on the chain always pairs with Thymine on the other chain, while Guanine always pairs with Cytosine. This relationship is known as complementary, that is strands of the DNA molecule are complementary to each other and run in opposite directions.

Unit 9

Water Resources

SECTION A (MCQs)

Select the correct answers in the following questions.

1. The largest bodies of water on Earth are:
 - ✓ (a) Sea (b) Rivers
 - (c) Oceans (d) Underground water
2. About 30% world fresh water is in the form of
 - (a) Solid (b) Liquid ✓
 - (c) Gas (d) Water vapours
3. Glaciers are predominantly present in which one of the following regions?
 - (a) Europe (b) Antarctica ✓
 - (c) Africa (d) Asia
4. Sea water is basically _____ in nature.
 - (a) Acidic (b) Saline ✓
 - (c) Neutral (d) Fresh
5. The concept of sustainable development encourages:
 - (a) Form of growth that meets current basic needs
 - (b) Preservation of the resources for the need of future generation
 - (c) A change in all respects of life
 - ✓ (d) Growth to meet current needs, preservation for the needs of future and change in all respects of life
6. How many percent of the world water is suitable for human use?
 - ✓ (a) 25% (b) 10%

- (c) Less than 1% (d) 40%
7. **Water that is safe to drink is called**
 (a) Tap Water (b) Potable water
 ✓ (c) Distilled water (d) Non-potable water
8. **Which human activities need the most water?**
 (a) Personal hygiene (b) Cooking
 ✓ (c) Irrigation (d) Drinking
9. **How much of the global water supply is found in oceans?**
 (a) Less than 28% (b) About 75% ✓
 (c) About 87% (d) About 97%
10. **What is the process by which water enters the small pore spaces between particles in soil or rocks?**
 (a) Transpiration (b) Infiltration
 (c) Precipitation (d) Sublimation
11. **Which of the following statements about the water table is false?**
 (a) The water table changes when discharge is not balanced by recharge.
 ✓ (b) The water table is generally flat.
 (c) The water table is above the land surface in lakes.
 (d) The water table is depressed near high volume pumping wells.
12. **The boundary between the saturated zone and the unsaturated zone is called:**
 ✓ (a) Water table (b) Aquifer
 (c) Aquilude (d) Sedimentation zone
13. **Which one of the following is used in disinfecting water?**
 (a) Bromine (b) Chlorine ✓

- (c) Iodine (d) Fluorine
14. **Which of the following can contaminate an aquifer?**
 (a) Land pollution (b) Air pollution
 (c) Extraction machines (d) All of these ✓

ADDITIONAL MCQs

1. **The percent earth's surface is covered with water is:**
 (a) 70% (b) 71% ✓
 (c) 72% (d) 73%
2. **The percent fresh water of the world in liquid form is:**
 ✓ (a) 30% (b) 40%
 (c) 25% (d) 45%
3. **The largest body of water on Earth is:**
 (a) Atlantic ocean (b) Indian ocean
 ✓ (c) Pacific ocean (d) Arctic ocean
4. **The average depth of Baikle is:**
 (a) 1000 meters (b) 844.4 meters
 ✓ (c) 744.4 meters (d) 800 meters
5. **Lake Baikle is located in:**
 (a) Sindh region (b) Siberian region ✓
 (c) Green land (d) Canada
6. **Rivers are main source of:**
 (a) Fishing (b) Boating
 ✓ (c) Irrigation (d) Bathing
7. **Most of the glaciers are present in region:**
 (a) Polar (b) Greenland
 (c) Antaretica (d) All of these ✓

8. Siachen Glacier is located in:
(a) Southern areas (b) Eastern areas
✓ (c) Northern areas (d) None of these
9. One of the most useful sources of water is:
(a) Fresh water (b) Underground water ✓
(c) Ocean water (d) Spring water
10. The water containing less than 1000 milligrams per liter salts is called:
(a) Spring water (b) Fresh water ✓
(c) Stream water (d) Canal water
11. Underground water accounts for approximately _____ percent of the total fresh water.
(a) 10% (b) 20%
✓ (c) 30% (d) 40%
12. Monsoon rains constitute about _____ of the total annual rainfall.
(a) 50% (b) 60%
✓ (c) 70% (d) 80%
13. Indus plain in Pakistan extends from Himalyan foothills to _____.
✓ (a) Arabian sea (b) Indian ocean
(c) Pacific ocean (d) Atlantic ocean
14. The biggest tributary of River Indus is _____.
(a) River Chenab (b) River Jhelum
(c) River Ravi (d) River Kabul ✓
15. In Pakistan water resources are used in:
(a) Domestic activities (b) Industries
(c) Irrigation (d) All of these ✓

16. Pakistan has a total area of _____ million hectares.
✓ (a) 79.6 (b) 89.6
(c) 59.6 (d) 69.6
17. _____ percent of total area is under cultivation.
(a) 23% (b) 25%
(c) 27% (d) 29% ✓
18. Water continuously circulates through:
(a) Irrigation (b) Evaporation
✓ (c) Hydrological cycle (d) Reclamation
19. Globally climate change has resulted in _____.
(a) Heavy rains (b) Extreme hot
(c) Dry conditions (d) All of these ✓
20. Forests play an important role in the regulation and maintenance of:
✓ (a) Water cycle (b) Rain
(c) Floods (d) Clouds
- =====

SECTION B (SHORT ANSWERS)

Write short answers of the following questions:

Q.1. Enlist various forms of water available in the Earth.

Ans. Earth water (i) ocean (ii) seas (iii) lakes (iv) rivers (v) springs (vi) glaciers (vii) ground water.

Q.2. What do you mean by underground water?

Ans. The water found underground which is in the cracks and crevices in soil, sand and rocks. This water is usually used for domestic consumption and industrial uses.

Availability of ground water depends on water table of the area.

Q.3. What do you mean by fresh water?

Ans. The water containing less than 1000 milligrams per liter salts is called fresh water. The amount of fresh water is 3% which can be used for drinking purposes and domestic consumption. Fresh water is present in lakes, streams, springs and glaciers.

Q.4. What do you mean by potable water?

Ans. Potable water: The water which is considered safe and fit for consumption both humans and animals is called potable water.

Q.5. Enlist major pressures on water resources.

Ans. Pressures on water resources:

- (i) pollution (ii) climate change
- (iii) urban growth (iv) landscape change
- (i) **Pollution:** Human activities are a major reason for the pollution of water. Water pollution is brought by industrial wastes, municipal wastes, fertilizers, pesticides etc. these wastes when go in rivers, make water polluted.

Q.6. Give three main measures for sustainable development of water resources of Pakistan.

Ans. Pakistan needs a sound water conservation plan for avoiding water crisis, famine and any possible ecological disaster to happen. Following are some of the important measures for sustainable development of water resources of Pakistan.

1. Improving planning, management and community participation in the utilization of local water systems.
2. For effective utilization of water resource there must be a regular programme for cleaning canals and waterways.

3. A huge amount of water is lost due to seepage from canals lining. Proper lining of the canal system could reduce these losses.
4. Efficient irrigation techniques can reduce water loss. For example drip irrigation delivers water directly to the roots of crops and save precious water.
5. Steps for the conservation of environment and to check and control those factors which are contributing to its degradation.
6. Establishment and maintenance of proper sanitation system for ensuring less contamination of local water bodies.
7. Maintaining a proper check on the extraction of ground water.
8. Storage of flood water during monsoon season by construction of small dams especially in the barrani areas.
9. Launching public campaign emphasizing conservation of water at all levels.
10. Lastly construction of mega dams could store huge amount of flood water and could provide water for irrigation too.

Q.7. Give a brief account of climate change on water resources.

Ans. Climate change

Globally climate change has resulted in heavy rains causing floods and extreme hot and dry conditions. Although these two conditions are opposite to each other, a quick glance at the water cycle shows that during water cycle water evaporates from the sea and land and returns to the earth as rainfall and snow. Global warming and rise in temperature has resulted in higher rates of evaporation and warm air holding

intense rainstorms, bringing large amount of water which flows down into the rivers and streams. The soil remains dry and it increases the risk of drought. One clear evidence of climate change is the shrinking and melting of glaciers which have already been noticed in many parts of the world.

ADDITIONAL SHORT ANSWERS

Q.1. Write the names of form of water present on Earth.

Ans. Water vapors; rivers, lakes ice caps, glaciers, soil moisture and aquifers.

Q.2. What are the largest bodies of water on Earth?

Ans. Pacific ocean, Atlantic ocean, Indian ocean, Antarctic ocean and Arctic ocean.

Q.3. Define lake?

Ans. Lake is a small standing water body which is generally field with a stream (source) and has an out let for draining water.

Q.4. Describe Baikal Lake.

Ans. Baikal is the deepest and oldest lake in the world. It is the second most voluminous lake in the world. It's average depth is 774.4 meters. It is estimated that it contains 20% of world's fresh water. It is located in Siberian region near the city of "Irkutsh".

It nourishes 1700 species of plants and animals and 1100 out of them are not found anywhere else in the world.

Q.5. Which is the longest glacier in Pakistan?

Ans. Siachen is the longest glacier in Pakistan. It is a major source of water. It is located towards north of Pakistan and extends toward China and India.

Q.6. On what the availability of ground water depends?

Ans. Availability of ground water depends on the water table of the area which is defined as the upper level of an underground surface which the soil or rocks are permanently saturated with water. The water table has between the zone of saturation and zone of aeration.

Q.7. What is meant by aquifer?

Ans. An aquifer is an underground layer of water bearing permeable rocks or unconsolidated materials (gravel, sand, or slit) from which ground water can be extracted using a water well.

Q.8. What is meant by hydrogeology?

Ans. The study of water flow in aquifers and characterization of aquifers is called hydrogeology.

Q.9. On what the availability of ground water depends upon?

Ans. The availability of ground water depends upon the seasons and the quantity of rainfall recorded in a year.

Q.10. Define fresh water?

Ans. Fresh water can be defined as the water which containing less than 1000 milligrams per liter salts. The fresh water is stored in the soil, the atmosphere, biological organisms, lakes, streams and springs.

Q.11. Describe the utilization of water in Pakistan.

Ans. Water is used in domestic activities (drinking, washing, cooking), industries, and irrigation.

Q.12. What are the methods of reclamation and conservation of water?

Ans. Following are the methods of reclamation and conservation of water:

(i) Recycling

- (ii) Collection of rainwater
- (iii) Using efficient irrigation techniques (drip irrigation, overhead irrigation)
- (iv) Necessary repairs of canals, leaking and damages pipes.
- (v) Closing the taps and showers after necessary uses.

Q.13. What is meant by sewage?

Ans. Sewage is sent for primary treatment in which water is separated from large particles after which it enters sedimentation tanks. Solid particles settle at the bottom and waste water is separated.

Q.14. How water is polluted?

Ans. Water pollution is brought about by industrial wastes, municipal wastes, agricultural wastes, fertilizers and pesticides etc. When these wastes are dumped into rivers, they make water polluted.

SECTION C - DETAILED ANSWERS

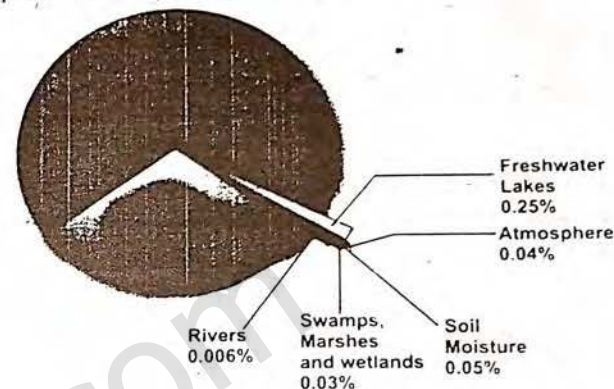
Write in detail answers of the following questions:

1. Identify the amount of fresh water available on Earth with an emphasis on Pakistan.

Ans. Amount of Fresh Water available on Earth

Freshwater can be defined as the water which containing less than 1000 milligrams per liter salts. As you have studied, in the pervious section, 97% of the global water supply is saline in nature and is found in the oceans. The remaining 3% is 'freshwater' which can be used for drinking purposes and domestic consumption. Of the total freshwater available on Earth about 69% is held by the glaciers and permanent ice sheets of arctic region. Underground water

accounts for approximately 30% of the total freshwater supply. Fresh water is also present in lakes, streams, springs etc. Minute amounts of freshwater are also stored in the soil, the atmosphere and in biological organisms.



Freshwater Resources of Pakistan

Allah has gifted Pakistan with plenty of fresh water resources in the form of surface water, rainfall, and groundwater. Rivers and fresh water lakes constitute the surface water resources of Pakistan. Pakistan river system is mainly based on the flows of the Indus River and its tributaries. Five major tributaries join Indus on the eastern side are Jhelum, Chenab, Ravi, Beas and Sutlej; besides, three minor tributaries are the Soan, Harow, and Siran, which drain in mountainous areas. A number of small tributaries also join the Indus towards its western side. The biggest of such tributaries is River Kabul.

Monsoon rains constitute about 70 per cent of the annual rainfall that occurs in the months of June to September. These rains in most instances bring floods which damages our infrastructure, agriculture and overall economy of the people of Pakistan. If properly managed this rain water could be utilized for various productive activities. Unfortunately, we have not been able to utilize this precious resource and every year huge

amount of flood water drains into the Arabian sea without giving any benefit.

Pakistan has a rich source of groundwater resources. Indus Plain in Pakistan extends from Himalayan foothills to Arabian Sea upto about 1,600 Km. This plain has rich alluvial deposits and is blessed with extensive unconfined aquifers. These aquifers are used for extracting fresh water for domestic consumption and it is also a useful source of irrigation.

2. **The level of agricultural production is directly related to the availability and effective use of water as a major input. Justify the statement.**

Ans. The agricultural production is directly related to water.

The agricultural sector of Pakistan is largest consumer of water. Pakistan has a total area of 79.6 million hectares. Out of this about 27 percent of the area is currently under cultivation. Almost, 80 percent of the current cropped area is irrigated with the help of canals. Pakistan has one of the largest canal system in the world and so has one of the highest proportions of irrigated cropped area in the world. Apart from these Pakistan has built several water reservoirs and dams. These reservoirs are not only producing energy but these have a key role in managing the irrigation system of Pakistan.

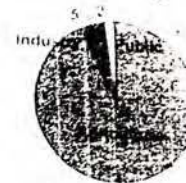
3. **Describe the existing ways of utilization of water resources in Pakistan.**

Ans. **Ways of utilization of Water Resources in Pakistan**

Allah has gifted Pakistan with abundant water resources. Rivers flow down from the Himalayan and Karakoram range. Melting water from mountainous glaciers adds to the flow of rivers.

Domestic use:

1. In Pakistan water resources are used in three broad categories. Firstly, water is being used in figure utilization of water the domestic activities which include water being by different sectors, used for drinking, cooking, bathing, washing etc.



2. **Industrial use:**

Water has an important role to play in industrial and manufacturing sector, for example, industries related to metals production, wood and paper products, chemicals etc consume large quantities of water. In industries water is used in processing, washing, diluting, cooling, or transporting a product.

3. **Agricultural use:**

27% of the total area is currently under cultivation. Almost, 80% of the cropped area is irrigated with the help of canals. Pakistan has also built several reservoirs and dams which are still un-sufficient to meet the needs. It is necessary to build more dams.

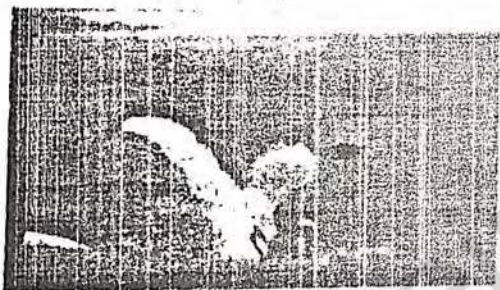
4. **Explain the issues and problems Pakistan is facing in utilizing the water resources effectively for its people.**

Ans. **Issues and Problems of water resource utilization in Pakistan**

Pakistan water resources heavily depend on winter snowfall and monsoon rains. This weather phenomenon is limited to certain areas and the rest of the country receives very little rainfall and people living in such areas have little or no access to surface water. Summer season brings along with it melting of ice and monsoon rains. Water from these sources is fed into our river system. As water flows down, it seeps into

ground and makes its way to aquifers where it stays and is available for extraction. Currently, Pakistan water resources are declining and are being degraded because of various types of problems. These include over-exploitation of groundwater, misuse and wastage of surface water and vulnerability of water resources to different kinds of pollution.

In order to increase agricultural yield and feed the ever increasing population, groundwater is either pumped extensively or too much water is diverted from the rivers for irrigation purposes. Consequently these practices results in the formation of salinity and degradation of fertile land. All these factors can lead to the problem of food scarcity in the long run. Pakistan has one of the largest irrigation system in the world. Overall the available infrastructure of canal system has resulted in loss of about two-third of water due to poor transmission and seepage. This in turn has resulted in the problem of water logging and salinity.



Lack of access to clean drinking water is one of the leading cause of different types of diseases, for example, diarrhea, typhoid, cholera, malaria, dysentery etc. Hydropower is the cheapest source of energy. Pakistan's topography has the capacity where large dams can be built and every year a huge amount of water can be saved. The water stored in the dams is not only used for the agricultural purposes but also to provide electricity. In addition to this, dams provide an effective barrier

to floods. Pakistan is an agricultural country and water is the key for its survival. A big investment in the repair of existing dams and large scale construction of new water reservoirs is the first step in conserving water resources of Pakistan.

5. Explain the methods of reclamation of water.

Ans. Methods for Reclamation and Conservation of Water

In today's water scarce environment reclamation and conservation strategy gain attention and is a well-established practice in many areas of the world. Historically water is being recycled for billions of years and every water molecule has been used countless times before it has reached us. Water continuously circulates through hydrological cycle, from the sea, to air and land, and back to the sea.

Reclamation:

The term reclamation of water means to reclaim usable water from waste waters and to use this water for irrigation and for other purposes. Reclamation strategies are initiated at places where abundant waste water is generated. There are a number of methods for the reclamation of water from waste water. One such strategy is given below:

Primary treatment:

Sewage is sent for primary treatment in which water is separated from large particles after which it enters sedimentation tanks. Solid particles settle at the bottom and waste water is separated.

After primary treatment waste water is sent for secondary treatment. Here bacteria are added to the waste water so that to ingest organic wastes.

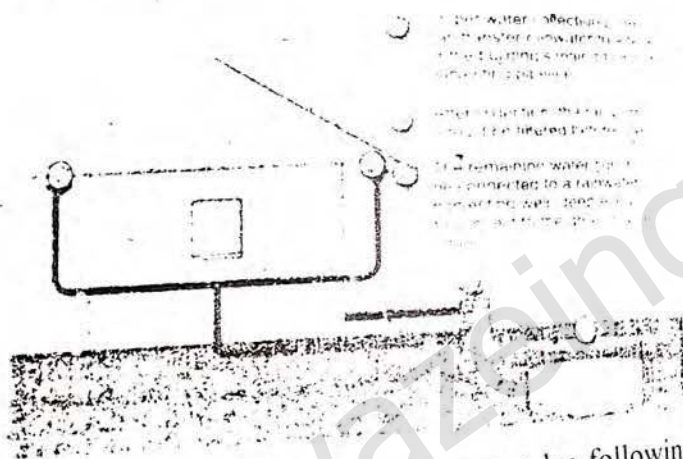
Filtration:

In tertiary treatment waste water is filtered and is disinfected with chlorine, and any leftover salt is removed.

For recycled water to become drinkable, tertiary-treated water undergoes advanced water treatment technology. Water is then disinfected by ultra violet light (UV) or hydrogen peroxide. Finally it is added to groundwater or surface water reservoirs where it stays for several months to be further purified by natural processes.

Using water wisely:

However, one of the best strategy in the natural resource management is to use the resource wisely and make strategies for its conservation so that the coming generations have the chance to take equal benefits from the resource too. Water being a key resource need serious efforts both at the individual and at the government level. Following are some of the measures which can be followed to achieve this objective.



⇒ We can save some precious water by following some simple measures like closing the tap while cleaning your teeth.

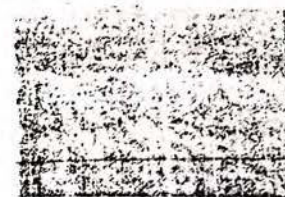


Fig. Overhead Irrigation System

⇒ **Use of water:** In our homes, make it sure that taps and showers are closed and do necessary repairs for leaking and damaged water pipes.

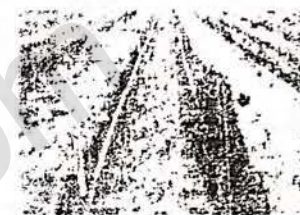


Fig. Drip Irrigation

⇒ Rain water can be collected and can be used for gardening and washing. In the field of agriculture water can be saved by the use of efficient irrigation techniques for example, drip irrigation and overhead irrigation.

Storing of Rain Water: One of the useful practice to recharge the underground water is to dug recharge pits for storing rainwater and stop runoff water. These give ample time to the land to recharge ground water supply.

Planting Trees: Increase in the vegetation cover and planting more trees can stop run off water.

Reservoirs: Storing surplus water in large water reservoirs during rainfall season can make water available for use in the dry spells for irrigation purposes on one hand and control flooding during the rainy season on the other hand.

6. Write an essay on conservation of water.

Ans. Threats to Water Resources

Although water is present in large quantities throughout the world, the sources of usable and drinkable water are limited. Water resources are being under threat due to unwise and unplanned human activities like growing trends of urbanization, over population, worldwide competition for controlling water resources and increasing pollution.

Conservation of water: Allah has gifted Pakistan with plenty of fresh water resources in the form of surface water, rainfall and ground water. Rivers and fresh water lakes constitute the surface water resources of Pakistan. Pakistan has a rich surface of ground water. Unfortunately, we have not been able to utilize this precious resource and every year huge amount of water in the shape of floods drains into the Arabian sea without giving any benefit.

Better management: Pakistan is an agricultural country and water is the key for its survival. A big investment in the repair of existing dams and large scale of new water reservoirs is the first step in concerning water resources of Pakistan.

Cementing canals: The canals should be cemented so that the may not leak.

Modern techniques of irrigation: Modern techniques of irrigation should be adopted for example, drip irrigation and over head irrigation.

Storing surplus water: Storing surplus water in large water reservoirs during rainfall season.

7. Explain how water resources are being threatened by urbanization and deforestation.

Ans. Effect of urbanization on water:

The process of urbanization has resulted in the haphazard development of residential and industrial areas in large cities. These areas are the main source of point-source pollution. Urbanization trends generally suggest more economic activities and development. Development of roads, infrastructure and other human activities put stress on precious natural resources including water resource of that area.

Domestic wastewater combined with untreated industrial waste pose a serious threat. Ill managed sanitation system and sewage treatment is the threat to water bodies. Often the nearby water bodies are used for releasing untreated water from urban areas and industries. Rivers in developing countries are more like open sewers than rivers. Garbage collection and disposal facilities are lacking in most cases. So one can see polythene bags and other solid wastes in streams and rivers. In these conditions fish population has almost become non-existent.

Effect of deforestation:

Yet another problem is deforestation or cutting of forest. Trees are cut to clear land for agriculture, for the establishment of industrial zones, infra structure and for the development of residential areas. Once the land is exposed it is open for all types of environmental hazards. Exposed land is vulnerable to the process of erosion which results in the loss of soil nutrients and consequently fertility of the land is lost.

Forests also play an important role in the regulation and maintenance of water cycle. Roots of the trees not only hold precious soil but allow more water to be absorbed by the soil and moves this water to the underground water reservoirs.

8. Describe the implications of growing demand of water in the world.

Ans. Implication of growing water demand in the world

Water used for human consumption is limited in quantity. Only 1% of the total amount of water present on planet Earth can be utilized. Due to this reason competition for water resources is growing and its effects are evident from the rising tensions between different countries and nations in different parts of the world.

Water is vital for our survival and its scarcity affects every sphere of life i.e. social, political, economic and it even threatens the health of the ecological system. Water scarcity has already lead to growing pressure on freshwater resources in many places around the world. According to one of the estimates approximately 2 billion people are currently living in areas faced with water stress and its scarcity.

For the last many decades there has been a sharp rise in human population and this trend in human population growth has been a major contributor to water scarcity. Population growth limits the amount of water available per person. Growth in populations means mounting demand and competition for water in the field of agriculture, domestic, industrial, and municipal uses.

Population growth demands more food and more water is needed to produce that food. In agriculture sector water is mainly used for irrigation.

ADDITIONAL QUESTIONS

- Q.1. How Pakistan is facing climatic changes?

Ans. Pakistan is among the list of those countries which can be severely affected by the climatic changes. In the backdrop of this scenario water resources of the country would be vulnerable to harmful effects of climatic changes. So it is essential that proper water management strategy should be devised to tackle the challenges of water problems.

- Q.2. Write water treatment steps in the treatment plant.

Ans. Water treatment:

In a treatment plant, the first step is pre-chlorination for algae control and arresting biological growth. Second step is aeration along with pre-chlorination for removal of dissolved iron and manganese. Water is passed on for further chemical treatment using alum, caustic soda, ferrous sulphate. These chemicals help in neutralizing water and in the precipitation of metallic ions and particulate matter. Finally the treated waters proceeds for final filtration process. This filtration is done in stone/gravel filter beds or activated carbon. After this water is processed for final disinfection. This is done by an oxidant such as chlorine. After final disinfection, the treated water is pumped for distribution to different parts of the city.

- Q.3. Write a short note on lakes especially about "Lake Bakal".

Ans. Lakes

Lake can be defined as a small standing water body which is generally filled with a stream (source) and has an outlet for draining water. Lakes must have a constant source of water, otherwise continuous draining of water may result in the drying up of lake. Lakes are generally regarded as a source of fresh water.



Not only the deepest lake in the world but also the oldest fresh water lake. Baikal, is the second most voluminous lake in the world. Its average depth is 744.4 meters. It is estimated that it contains 20% of world's fresh water. Known as "Pearl of Siberia" lake Baikal is located in Siberian region near the city of "Irkutsh".

Another unique fact about the lake is that it nourishes 1700 species of plants and animals and 1100 out of them are not found anywhere else in the world.

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Unit 10

Environmental Problems and Management

SECTION A (MCQs)

Select the correct answers in the following questions:

1. All of the following are layers of earth's atmosphere EXCEPT:
(a) Troposphere (b) Lithosphere ✓
(c) Stratosphere (d) Thermosphere
2. Which one of the following causes acid rain?
(a) Hydrocarbons (b) Methane
(c) Halogens (d) Sulphur dioxide ✓
3. Ultraviolet radiations from sun that reach the earth cause:
(a) Respiratory disorder (b) Typhoid fever
✓ (c) Skin cancer (d) Bronchitis
4. The source of all of the following pollutants is vehicle exhaust EXCEPT:
(a) Carbon mono-oxide (b) Carbon dioxide
✓ (c) CFCs (d) Nitrogen oxide
5. Which of the following is not a greenhouse gas?
✓ (a) Oxygen (b) Carbon dioxide
(c) Chlorofluorocarbons (d) Methane
6. Which one of the following can cause stone cancer?
✓ (a) Carbon dioxide (b) Sulphur dioxide
(c) Carbon monoxide (d) Ozone

7. **Ozone layer is present in:**
(a) Troposphere (b) Mesosphere
✓ (c) Stratosphere (d) Thermosphere
8. **The ultraviolet radiations in stratosphere are absorbed by:**
(a) Oxygen (b) Ozone ✓
(c) Sulphur dioxide (d) Argon
9. **Most hazardous metal pollutant in the automobile exhaust is:**
✓ (a) Lead (b) Mercury
(c) Cadmium (d) Argon
10. **Which of the following gases contribute to the greenhouse effect on earth?**
(a) Carbon dioxide (b) Methane ✓
(c) Chlorofluorocarbons (d) All of these
11. **Which of these is NOT an expected effect of climate change?**
✓ (a) Sea levels rising
(b) Flooding in coastal cities
(c) Expanding glaciers
(d) Extreme weather
12. **Based on general knowledge which natural hazard has caused the greatest number of deaths in a single event?**
(a) Earthquakes (b) Floods
(c) Volcanic eruptions (d) Hurricanes ✓
13. **Which of the following measures an earthquake's intensity?**
✓ (a) Richter scale
(b) Modified Mercalli scale

- (c) Centigrade scale
(d) Moment magnitude scale
14. **Which of the following is an air pollutant?**
(a) Nitrogen (b) Carbon dioxide ✓
(c) Carbon monoxide (d) Oxygen
15. **Which of the following is a non-point source of water pollution?**
(a) Factories
(b) Sewage treatment plants
(c) Urban and suburban lands
✓ (d) None of these
16. **Taj Mahal is said to be suffering from "Marble Cancer" What is Marble Cancer?**
✓ (a) Acidic Rain which corrodes marble.
(b) Large number of Fungus in Taj Mahal marbles
(c) Yellowing of the marble on account of Soot particles
(d) Smokes entering Taj Mahal from adjoining industries
17. **Water pollution is primarily caused by:**
(a) Forest fires (b) Volcanic eruptions
(c) Biological decay (d) Human activities ✓
- =====

ADDITIONAL MCQs

1. Development and prosperity of the modern age has resulted in improving the quality of:
(a) Mechanical advancement
(b) Biotechnology advancement
✓ (c) Life style and living standard
(d) None of these
2. In a region sustainable development depends on:
(a) Life style (b) Environment ✓
(c) Industries (d) Water
3. Land degradation occur due to:
(a) Land erosion (b) Logging
(c) Salinity of agricultural land
✓ (d) All of these
4. Layer of ozone occurs above the Earth's surface:
✓ (a) 10-45 km (b) 5-10 km
(c) 45-60 km (d) 60-70 km
5. The depletion of ozone became known to us in:
(a) 1975 (b) 1985 ✓
(c) 1995 (d) 2005
6. With the depletion of ozone layer, higher levels of _____ radiations reach Earth to:
(a) CFCs (b) Ultrasound rays
✓ (c) Ultraviolet radiations
(d) None of these
7. When a CFCs drifts up into the stratosphere it releases active:
(a) Nitrogen (b) Oxygen

- (c) CO₂ (d) Chlorine ✓
8. CFCs are used as coolants in:
(a) Air-conditioners (b) Refrigerators
(c) Both a, b (d) None of these
9. Ultraviolet radiations on the Earth causes:
(a) Skin cancer (b) Eye cataracts
(c) Weak immunity (d) All of these ✓
10. Green house effect in the atmosphere cause:
✓ (a) Global warming (b) Damage to crops
(c) Cancer (d) Solar radiation
11. The global warming produces harmful effects such as:
(a) Melting of polar ice
(b) Rising of sea level
(c) Change in rainfall pattern
✓ (d) All of these
12. Acid rain is due to
✓ (a) Air pollution (b) Water pollution
(c) Land pollution (d) Noise pollution
13. The major reason for desertification is:
(a) Excessive use of water
(b) Excessive use of wood
✓ (c) Excessive use of land for agriculture
(d) Excessive use of water for agriculture
14. When acid rainfalls on buildings, it slowly dissolves the:
✓ (a) Lime stones (b) Mortar
(c) Both a, b (d) None of these

15. Excessive use of land for agriculture leads to:
 (a) Unfit for further crops
 (b) Loss of soil fertility
 (c) Change into deserts
 ✓ (d) All of these
16. In the absence of greenhouse effect the temperature of Earth would have gone:
 (a) Up (b) Low ✓
 (c) Same (d) All of these
17. Hazardous wastes include use chemicals like:
 (a) Pesticides (b) Cleaning fluids
 ✓ (c) Both (a) and (b) (d) None of these
18. The region in the world where earthquakes frequently is:
 (a) America (b) India
 ✓ (c) Japan (d) Turkey
19. Richter scale is used to measure the strength of:
 (a) Flood (b) Air
 ✓ (c) Earthquake (d) Moisture
20. International environmental law was established in:
 (a) 1962 (b) 1972 ✓
 (c) 1982 (d) 1992

SECTION B (SHORT ANSWERS)

Write short answers of the following questions:

Q.1. Give a brief overview of the nature of ozone layer found in the atmosphere.

Ans. Nature of ozone layer:

About 10-45 kilometres above the Earth's surface, there occurs a layer of ozone encircling our planet. This layer is

present in the stratosphere part of the atmosphere. It shields the Earth from most of ultraviolet radiations coming from sun. Ozone layer is capable of absorbing 97-99% of the harmful ultraviolet radiations that are emitted by sun.

2. Define the term desertification.

Ans. Desertification: Desertification is a process where by a productive land either through climatic variations or through unwise utilization by humans gets degraded and changes into desert.

Q.3. List some measures to control the green house effect.

Ans. Measures to control green house effect:

- Use of fossil fuels should be reduced by using alternate means like electricity, solar energy etc.
- Forest areas should be increased reduce carbon dioxide in the atmosphere.
- Manufacture and use of CFCs should be eliminated completely.

Q.4. What are natural disasters and in which forms these are exhibited?

Ans. Natural Disasters: Planet Earth at times tremendous changes which occur deep inside it or on its surface. Such changes are called natural disasters.

Forms of natural disasters:

- | | |
|----------------------------|--------------------|
| (i) Floods | (ii) Droughts |
| (iii) Volcanic eruptions | (iv) Earthquakes |
| (v) Cyclones or Hurricanes | |
| (vi) Avalanches | (vii) Forest fires |

Q.5. Enlist the names of different layers of atmosphere.

Ans. Different Layers:

- | | |
|-------------------|-------------|
| (i) Troposphere | 8 to 16 km |
| (ii) Stratosphere | 16 to 50 km |

(iii) Mesosphere 50 to 80 km

(iv) Thermosphere 80 to 500 km

Q.6. Define climate.

Ans. Climate:

The average amount of sunlight, altitude, distance from the sea, vegetation cover available wind, rainfall pattern, topography of the area for the period of many years is called climate.

Q.7. Write five major effects on environment by human activities.

- Ans.** (i) Deforestation for agriculture and settlements
 (ii) Land erosion (iii) Desertation
 (iv) Changing in climate
 (v) Melting of glaciers
 (vi) Depletion of ozone layer

ADDITIONAL SHORT ANSWERS

Q.1. What is ozone layer and how it is affected?

Ans. Ozone layer is present in the stratosphere. It presents the harmful UV (ultra violet) radiation from entering the earth surface.

Q.2. What is global warming? Describe its effect.

Ans. Global warming is an increase in earth's temperature due to the effect of the greenhouse gases mainly carbon dioxide, methane and some other gases.

Q.3. What is greenhouse effect?

Ans. Greenhouse effect is the rise in temperature that the Earth experiences because certain gases in the atmosphere trap energy from the sun. Without these

gases, heat would escape back into space and Earth's average temperature would be lower.

Q.4. What are natural disasters?

Ans. Natural disasters are changes which are so great that they may cause damage to the shape of the land or to the lives of people and other living things.

Q.5. What is global warming?

Ans. Global warming is an increase in earth's temperature due to the effect of the greenhouse gases.

Q.6. What is the effect of global warming?

Ans. Global warming can result in melting of glaciers, flooding, climate change, droughts, diseases and increase in hurricanes frequency.

Q.7. Describe acid rain?

Ans. Acid rain is rain that has a larger amount of acid in it than what is normal.

Q.8. Define desertification.

Ans. Desertification is defined as 'land degradation resulting from various factors including climate variations and human activities'.

Q.9. Describe the cause of climatic change.

Ans. Climatic change on the global scale is either due to the amount of heat that is let into the system, or the amount of heat that is let out of the system.

Q.10. Describe natural disasters.

Ans. Natural disasters are changes which are so great that they may cause damages to the shape of land or to the lives of people and other living things.

Q.11. Describe earthquake.

Ans. An earthquake is a violent shaking of the ground. When tectonic plates move against each other, giant shock

waves move upwards towards the surface causing earthquake.

Q.12. Describe storm.

Ans. A storm is any disturbed state of an environment specially affecting its surface and resulting severe weather.

Q.13. How environment is to be protected.

Ans. International cooperation in the form of treaties, agreements and resolutions created by intergovernmental organizations as well as national laws and regulations are being used to protect the environment.

Q.14. Define pollution.

Ans. Pollution is the addition of unwanted and harmful materials into the environment of living things that bring undesirable changes in standard quality of an environment.

Q.15. Write a short note on watching television.

Ans. Watching television in moderation can be a good activity as television can be an excellent educator and entertainer but despite its advantages, watching too much television can be harmful too.

Q.16. Describe overuses of computers.

Ans. Overuses of computers cause some physical effects in the form of eye strain, vision abnormalities, pain in hand and fingers joints, headache and backache.

SECTION C - DETAILED ANSWERS

Write in detailed answers of the following questions:

Q.1. What are the main causes of ozone depletion? List some of the major effects of ozone depletion on the living organisms.

Ans. Causes of ozone depletion.

The loss of ozone is caused by commercially important compounds called chlorofluro carbons (CFCs) of which the most important is Freon. When a CFC drifts up into the stratosphere it releases active chlorine which reacts with the ozone molecules of ozone shield. A single atom of chlorine destroys about 100,000 molecules of ozone. CFCs are used as coolants in air conditioners and refrigerators, as foam for insulation and packaging and as medical sterilizers.

With the depletion of ozone layer, higher levels of ultraviolet radiations reach the surface of the Earth. This causes skin cancer, eye cataracts, weak immunity and damage to crops.

2. Describe global warming and its consequences.

Ans. Global Warming

The greenhouse effect in the atmosphere cause global warming. The carbon dioxide in the atmosphere allows solar radiations to pass through, but does not permit heat to radiate back into the space. Instead, the heat is reflected back to the Earth's surface which heats up the atmosphere of the Earth. During the past several decades greenhouse gases have accumulated to such an extent that the earth's temperature has increased by 0.8°C as a result of this phenomenon.

The global warming produces harmful effects such as melting of polar ice resulting in rising of sea level, changes in the rainfall pattern, migration and extinction of some animals

and increasing the frequency and duration of droughts and hurricanes.

Greenhouse effect and in turn global warming can be controlled by preventing the release of larger quantities of greenhouse gases by reducing the tremendous use of fossil fuel and wood for burning. Use of fossil fuels can also be reduced by using alternate means like electricity, solar energy etc.

3. **How acid rain is caused? What impacts this rain can have on the life of living organisms of a particular region?**

Ans. Acid Rain

Acid rain is one of the most dangerous forms of air pollution. It is a widespread phenomenon which affects the living and non living things equally. For years it can remain in an area undetected and for this reason it is called as unseen plague. Technically, acid rain is rain that has a larger amount of acid in it than normal rain.

4. **What do you mean by Climate change? Describe some of its effects.**

Ans. Climate Change

Different regions of the world are characterized by different set of climatic conditions. These conditions sustain themselves over a period of many years. On the basis of these average weather conditions we can say that a certain area has a particular type of climate. Climate of an area depends upon the amount of sunlight it receives, some geographic factors like altitude, distance from the sea, vegetation cover available, wind, rainfall pattern, topography of the area etc. In recent past there has been a constant accumulation of greenhouse gases in the atmosphere which has resulted in global warming. At the same time greenhouse effect keeps the temperature of the Earth suitable for many life forms.

In the absence of greenhouse effect the temperature of Earth would have gone low enough to make life difficult. Global temperatures in the past one hundred years have been increasing more rapidly than the historic record shows and this increase has been attributed to increasing amounts of the greenhouse gases which are trapping heat. At the global level climatic change has made significant effects on the environment.

In addition to a rise in average global temperature, there have been other changes that indicate that climate indeed is changing. These include, shortening of winter, fast shrinking of Earth's ice cover, killing of coral reefs due to warming sea water, increase in mosquito-borne diseases, rising sea levels, increased precipitation (rainfall etc.) in most areas and extreme weather becoming more common.

5. **Describe natural disasters caused by El-Nino and La-Nina.**

Ans. Natural Disasters: Natural disasters are changes which are so great that they may cause damage to the shape of land or to the lives of people and other living things.

Natural disasters may be in the form of volcanic eruptions, earthquakes, cyclones, floods etc.

El Nino and La Nina:

A phenomenon in which a change in temperature between the ocean and atmosphere takes place in the east-central Equatorial Pacific region is called as El Nino-Southern Oscillation (ENSO) cycle.

El Nino and La Nina are two phases of this cycle. La Nina is the cold phase and El Nino is the warm phase of ENSO cycle. ENSO cycles make profound impacts on ocean and all those processes associated with oceans. Apart from this ENSO cycle also affects global weather conditions.

ENSO cycle lasts for 9 to-12 months and is repeated after every three to five years. The warm phase occurs more frequently than cold phase. El Nino or the warm phase effect climatic conditions around the world.

Impacts of El Nino and La Nina:

El Nino results in an increase in the average ocean surface water temperature in the region and causes climatic change around the world. It also causes torrential rains across the west coast of North America and South America and warm water reduces the fish population.

Strong rains and damages caused by flooding were noticed from 1965-1966, 1982-1983, and 1997-1998. California to Mexico to Chile were the worst affected regions. La Nina is responsible for the opposite effects on climate as El Nino. For example, a major La Nina event in 1988 caused significant drought across North America.

6. Identify the legislation or laws on environmental problems.

Ans. International Laws and Environmental Issues

We as citizens of the world live in an environment where we share with each other different natural resources. With growing trends of industrialization and development, economic prosperity has brought with itself certain environmental concerns. Environmental problems and issues whether these are local, regional, or global in nature, need to be addressed with the cooperation of people and governments.

At the international level there has been an increasing demand for addressing the environmental issues backed by strong legislation because these are closely linked and affect sustainable development.

It was in these circumstances that international environmental law as a separate area of public international law was introduced in Stockholm Conference on Environment

in 1972. Since Stockholm Conference the need for legislation in the field of environment has increased gradually.

At present the environmental issues in focus are destruction of tropical rain forests, ozone layer depletion and global warming, international trade in endangered species, protection of wetlands, transboundary nuclear air pollution, dumping of hazardous wastes, groundwater depletion, oil spills etc.

At international level cooperation has fostered by treaties, resolutions and agreements finalized by inter-governmental organizations. At home countries are having national laws and regulations to protect the environment.

Generally, the scope of environmental laws can be summarized into two categories. Firstly pollution control and remediation and secondly conservation of natural resources.

Following is the list of some of the important international laws pertaining to environmental issues.

- Convention on Biological Diversity
- Convention on International Trade in Endangered Species
- Framework Convention on Climate Change
- Law of the Sea (LOS)
- Stockholm Convention on Persistent Organic Pollutants

7. Describe the control strategies that can be used for treating air pollutants.

Ans. Methods to reduce Air Pollution

Air pollution can be minimized by adopting the following measures:

- (i) We can cut down the burning of fossil fuel by the using alternative means like biomass energy, solar energy etc.

- (ii) In the field of agriculture use of pesticides can be reduced by using new varieties of plants which are pest resistant.



Fig. Biological control in action

- (iii) Lead free petrol can be used in vehicles,
- (iv) Deforestation should be checked and more plants should be grown.
- (v) Emission from industries should be controlled and treated before releasing them into the atmosphere and by following strict laws.
- (vi) Use of refrigerators, air conditioners, air fresheners etc. may be reduced to reduce the amount of CFCs emissions.

8. Describe the harmful effects of the excessive use of Television on individual's health.

Ans. Protection at Individual Level

Progress and development in the field of technology has made possible for us to get maximum benefit from the tools and gadgets of modern age. These devices have become very much part and parcel of our daily life. On one hand these devices are useful and productive. On the other hand they are one of the biggest source of entertainment for us.

Apart from the positive aspects of these modern gadgets and tools, these are putting certain negative impacts on their users, especially in case if these are used indiscriminately. In the following section you will study some of devices and

machines which have transformed the life of the present day human being but their excessive use can be harmful for individual health.

Watching Television in moderation is a good activity. However, watching too much television is harmful. It is common that children are glued to television and they spend maximum time watching their favorite programs. Recent research suggests that children who spend more than 4 hours continuously per day watching TV are more likely to be overweight. In much older people it can lead to obesity and heart diseases.

When you watch television your thinking mechanism stops and your focus is to listen and watch the programs being aired. In this situation you watch news, analysis, reports, documentaries being prepared by different persons with diverse view points. This situation often creates an environment where you can be easily misinformed and manipulated leading you to make an opinion that is not yours but is based on the analysis and research of those who produced such programs.



Fig. Physical activities help in healthy development of the body

Watching too much television often leads to behavioural changes as seen in young children who watch aggressive cartoons, movies etc become violent and develop a destructive nature.

Our social development is also affected due to the time we decide to spend watching too much television. It is better to play different sports in the playground instead of watching them on television.

Television even influences your spending habits. Often different types of advertisements project wrong information and viewers often believe whatever is expressed in glamorous way. So it is desirable to watch television in moderation and use your thinking and analytical abilities before making opinions and choices.

ADDITIONAL QUESTIONS

Q.1. Describe the causes of desertification.

Ans. Desertification

Desertification is a process whereby a productive land either through climatic variations or through unwise utilization by humans gets degraded and changes into desert. Sometimes a particular area experiences high and sustained temperatures lasting for months with infrequent and irregular rainfall which leads to dry conditions and drought. The overall impact of such sustained harsh conditions result in failure of vegetation to grow and sustain itself. If such conditions in such an area are being aggravated by overgrazing and deforestation, the situation becomes worst and desertification occurs.

Yet another major reason for desertification is the excessive use of land for agricultural activities. In order to feed the growing population, farmers use land excessively for better yields.

Q.2. What are hazardous wastes?

Ans. Hazardous Wastes

Different types of industries and household activities use chemicals for various purposes. Among these some chemicals are harmless and are disposed safely in the environment. However, there are some chemicals which when released in the environment have the potential to be harmful and dangerous for living organisms and the environment as a whole. Such types of chemicals are known as hazardous wastes. These wastes can occur in liquid, solid, or gaseous forms.

Industrial sector releases certain solid wastes which are non-biodegradable i.e. these do not break down by biological processes and remain on land as such for a longer period of time. Such material include polythene bags, plastics etc. If these items are burnt in open they pose more serious threats.

Hazardous wastes include used chemicals like pesticides, cleaning fluids or the by-products of certain manufacturing processes. Some of the more serious wastes are nuclear wastes from nuclear reactors which have long term harmful effects on the health of living organisms. Dichlorodiphenyl-trichloroethane (DOT) is yet another hazardous waste which has serious implications on human health.

Q.3. How air is polluted?

Ans. Air Pollution

Air pollution is dangerous to human health, harms plants and animals, damages materials from fabric to stone work. There are large number of pollutants which are the cause of air pollution. Air pollution may result from the incomplete burning of fuels such as coal, oil, petrol and wood. Air pollution due to human activities includes exhausted fumes from automobiles, chimney fumes emitted from the factories burning of garbage and other wastes and the use of

chlorofluorocarbons (CFCs) etc. The harmful gaseous pollutants are sulphur dioxide, nitrogen oxides, carbon monoxide, carbon dioxide and lead. At high concentration these gases have a damaging effect on both plants and animals. Generally these pollutants cause photochemical smog, acid deposition, greenhouse effect and ozone shield destruction. You have already studied in detail about acid rain, greenhouse effect and ozone layer depletion.

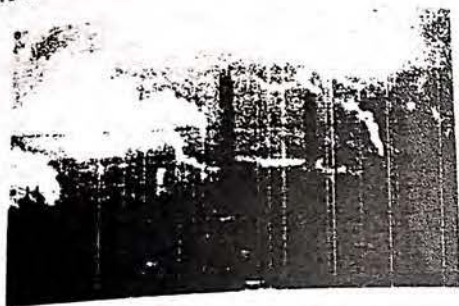


Fig: Air Pollution in city.

One of the more common effect of air pollution is photochemical smog, a mixture of smoke and fog. It is produced when sunlight and ozone in the atmosphere act on oxides of nitrogen and unburnt hydrocarbons released from automobile exhausts. Smog is irritating to eyes and lungs and also damages plants.

Q.4. How water is polluted?

Ans. Water Pollution:

Industries pollute water by adding chemicals like acids, alkalis, salts, pesticides, detergents, phenols and other compounds into it. This polluted water is highly toxic that may either kill the microorganisms that purify water or inhibit their growth.

Chlorinated organic compounds such as dioxins are released from paper and pulp mills. Leather tanneries are

important source for earning precious foreign exchange. However, these produce a significant amount of solid waste in the form of sludge, hair and hide. The waste water discharged from these factories contains chromium, acids, sulfides and chlorides.

Petrochemical industries discharge wastes that contain phenols, and benzene, suspended solids, oils and grease. Water discharged from mines and stainless steel production release metals, such as copper, nickel, and chromium. High concentrations of these metals can be harmful to human health.

Q.5. Describe harmful effects of excessive use of mobiles.

Ans. Harmful Effects of Excessive Use of Mobiles

In today's world one could not think of life without a cellular or mobile phone. It has become one of the fundamental means of communication in the world. It provides an easy and efficient way to get in touch with our family and friends. Every one of us spends a considerable amount of time using mobile phone. Despite its usefulness using too much mobile phones can put negative effects on our health.

There are an estimated six billions subscriptions of mobiles worldwide and the number is increasing every day.



Mobile Phone Side Effects



Fatigue



Headaches



Loss of sleep



Memory loss



Ringing ears



Joint pains

Fig: Mobile phones have some serious effects on the body.

In a mobile phone there is a small transmitter and a receiver system. This system sends and receives calls in the form of radio waves. Adults and especially children can suffer the long-term effects of radiation waves on the brain. Mobile phone used in excess can have serious implications on our health especially in youth. The high frequency radio waves emitting from the mobile put negative effects on our stress levels and cause sleep disorders.

We notice a greasy oil residue on mobile phone especially on its screen. This is a breeding surface for many germs. While managing text messages and e-mails frequently at rapid speed can cause pain and inflammation in the joints of hand bones. If you hold the phone between your neck and shoulders while talking during work it can cause back pain. Focusing more closely on the mobile screen for text messaging and other tasks can harm your vision.

Though in the field of communication technology cell phone has revolutionized communication in the 21st century but its excessive use is harmful for our health. So care should be taken while using mobile phone technology.

Q.6. Describe the harmful effects of excessive use of computer.

Ans. Harmful effects of excessive use of computer

We are living in the age of computers where most of our daily tasks in one way or the other are dependent on computers. As an electronic machine computer quickly organizes, analyzes and presents the information supplied to it. Computer has a significant role to play in almost every field of life, e.g., education, entertainment, communication etc. With the advent of internet facility computer usage has increased many fold and people from all age groups frequently use computers for using internet. This has brought excessive use of computer at home or at workplace. Though working on

computer can be enjoyable sometimes it can also have unseen effects on your health:



Excessive use of computer can cause some serious health problems, for example, headache and backache, pain in hand and fingers joints, vision abnormalities and eye strains. The implications for growing children are even more serious. For example, sitting for longer periods can delay physical as well as mental development of the child. Sitting in room with no social interaction with the society can hinder the interpersonal skills of the child. Many children get addicted to this habit and it becomes difficult for them to get away from the computer which in turn affects their education.

So it must be in our mind that technology has a useful role to play in our lives. But at the same time excessive use of even useful tools and machines can bring undesirable effects on our health and physical well being.

Q.7. Describe the methods to reduce water pollution?

Ans. Methods to reduce water pollution

Water pollution can be reduced by adopting the following measures.

- (i) Sewage treatment plants can be built to help degrade organic wastes.
- (ii) Human and animal wastes need to be disposed off properly.
- (iii) Use of pesticides can be reduced by alternative means e.g. introducing friendly insects to protect

crops from pathogens. This is called biological control.

- (iv) Industrial and domestic wastes should be treated properly before releasing them in water bodies. For this purpose waste treatment plants are used.
- (v) Unnecessary use of fertilizers and pesticides must be avoided.
- =====

Unit 11

Science Technology and Development

SECTION A (MCQs)

Select the correct answers on the following questions:

1. The Laser light is:
✓ (a) Monochromatic (b) Coloured
(c) Chromatic (d) None of these
2. The device that uses strong magnetic field and radio waves is:
✓ (a) X-ray (b) C.T. scan
(c) MRI (d) Laser
3. Artificial satellites are the objects which revolve round the:
(a) Sun (b) Earth ✓
(c) Star (d) Moon
4. C.T. scan can take cross sectional images of the body by using:
✓ (a) X-rays (b) Laser beam
(c) Ultrasonic waves (d) Radioactivity
5. Laser used for communication is in the form of:
(a) Heat (b) Light
(c) Electricity (d) Sound ✓
6. Ultrasonic sound has the frequency:
(a) 5k Hz to 10 kHz (b) 10Hzkto 15k Hz
(c) 15k Hz to 20k Hz (d) Above 20k Hz ✓

7. The light that travels along the fiber is made up of:
 - (a) Binary code
 - (b) Single code
 - ✓ (c) Tertiary code
 - (d) All of these
8. Identify an input device in the following:
 - (a) Monitor
 - (b) Speaker
 - (c) Printer
 - (d) Mouse ✓
9. Electrocardiography is a technique of recording bio-electric currents generated by:
 - (a) Brain
 - (b) Heart ✓
 - (c) Spinal cord
 - (d) kidneys
10. A magnetic resonance imaging scan produces cross-sectional images of the body using:
 - (a) Ultrasound waves
 - (b) Strong magnetic field and radio waves
 - ✓ (c) X-rays
 - (d) Infrared rays
11. Atherosclerosis causes fatty plaques to be deposited in:
 - (a) Bones
 - (b) Muscles fibers
 - ✓ (c) Blood vessels
 - (d) Skin
12. Identify the out put device in the following:
 - ✓ (a) Mouse
 - (b) Keyboard
 - (c) Microphone
 - (d) Printer
13. A fax machine scans a document and changes the dark and light parts into:
 - (a) Ultrasound waves
 - (b) Radio wave
 - ✓ (c) Electrical signals
 - (d) Infra red rays
14. In radio the transmitter receives the message, encodes it into a:
 - (a) Ultrasound waves
 - (b) Radio waves
 - ✓ (c) Electrical signals
 - (d) Sine wave

ADDITIONAL MCQs

1. Sky lab broke in air in:
 - (a) 1976
 - (b) 1977
 - (c) 1978
 - (d) 1979 ✓
2. Russia sent space station (Mir) in space in:
 - (a) 1982
 - (b) 1984
 - ✓ (c) 1986
 - (d) 1988
3. Size of mirror of Hubble space telescope:
 - (a) 2.2 meter
 - (b) 2.3 meter
 - ✓ (c) 2.4 meter
 - (d) 2.5 meter
4. Weight of Hubble space telescope is:
 - (a) 10 ton
 - (b) 11 ton
 - ✓ (c) 12 ton
 - (d) 13 ton
5. A form of space craft is:
 - (a) Mir
 - (b) Sky lab
 - ✓ (c) Space shuttle
 - (d) Hubble space
6. Armstrong and Aldrin Apollo landed on moon on:
 - (a) 20 July 1966
 - (b) 20 July 1967
 - (c) 20 July 1968
 - (d) 20 July 1969 ✓
7. Branch which study the environment for a longtime:
 - (a) Biology
 - (b) Metrology ✓
 - (c) Cymatology
 - (d) Physiology
8. Spaco headquarter is at:
 - (a) Abbotabad
 - (b) Islamabad
 - ✓ (c) Islamabad
 - (d) Karachi
9. Pakistan sent his 1st rocket in space in:
 - (a) 4 June 1962
 - (b) 5 June 1962 ✓
 - (c) 6 June 1962
 - (d) 7 June 1962

10. 1st rocket of Pakistan is:
✓ (a) Skua (b) Rabbar
(c) Mir (d) Sky lab
11. How many Skua named rockets were sent in space in 1973:
✓ (a) Two (b) Three
(c) Four (d) Five
12. Pakistan atomic energy research council made in:
✓ (a) 1955 (b) 1956
(c) 1957 (d) 1958
13. Pakistan institute of information technology and nuclear sciences made pinstech in:
(a) 1960 (b) 1965
(c) 1970 (d) 1975 ✓
14. The artificial satellites are used to:
(a) Relay messages (b) Pictures
(c) Waves (d) All of these ✓
15. A radio wave is an electromagnetic wave which is transmitted by
✓ (a) An antenna (b) Screne
(c) Membrane (d) None of these
16. Computers provide a wide range of communication methods like:
(a) Email (b) Social networks
(c) Web and teleconferencing
✓ (d) All of these
17. PWI (Pakistan watching institute was established in
(a) 1980 (b) 1985
(c) 1990 (d) 1995 ✓

18. Urigagrain belongs to:
(a) America (b) China
(c) Russia (d) Germany ✓
19. Pakistan became atomic power in:
(a) 26 May 1998 (b) 27 May 1998
✓ (c) 28 May 1998 (d) 29 May 1998
20. The first T.V relay station called Telstar was released in space in:
(a) 1952 (b) 1962 ✓
(c) 1972 (d) 1982

SECTION B (SHORT ANSWERS)

Write short answers of the following questions:

Q.1. What are the similarities and differences between MRI and CT scan?

Ans. Similarities:

The scanner works in both MRI and CT scan.

Differences: MRI : MRI scan does not use x-rays as in CT scan. MRI is used to examine the brain, spinal cord, joints, abdomen and pelvis.

CT scan: It is a special type of x-rays tests that produces section images of the body using x rays and the images are generated in the computer. Such images generally help doctors to diagnose a certain abnormal condition developing in the body.

It is used to collect graphical information which can be used to assess the general health of the brain, neck, spine, chest, abdomen, pelvis and sinuses.

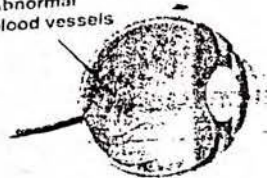
Q.2. How laser is used in different scientific processes.

Ans. Applications of Lasers

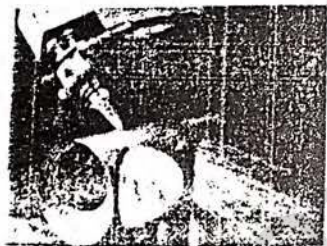
Lasers have been used in a number of areas of scientific research, and have opened a new field of scientific research. Lasers are widely used in many ways. Some of these are described below:

1. Lasers are being used in telecommunications in space and in open-air communications.

Abnormal blood vessels



2. Lasers are used for microsurgery of different body organs.
3. Lasers are used for bar-code scanners and also in printers for getting superior quality computer printouts.



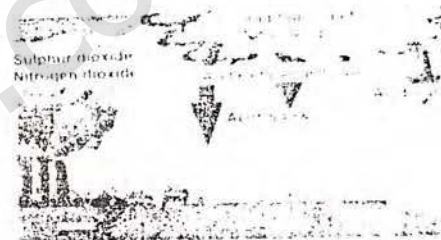
4. Lasers are used in various industries for different activities like boring and cutting metals and for cutting several layers of fabrics in the textile industry.

5. Laser beam can be used to generate three dimensional image of an object in a process called holography.
6. Lasers are used in different types of weapons like tanks, missiles and bombers to locate the exact position of the enemy.



Q.3. Describe the causes of acid rain.

Ans. Causes of acid rain:



Acid rain is caused by smoke and gases that are given off by factories and automobiles that run on fossil fuels especially coal. When these fuels are burnt to produce energy, the sulphur that is present in the fuel combines with oxygen and becomes sulphur dioxide; at the same time some of the nitrogen in the air converts into nitrogen oxide. Sulphur dioxide and nitrogen oxides in the atmosphere dissolve in rainwater to form sulphuric acid and nitric acid respectively. Rain containing these acids is known as acid rain.

Effects of acid rain: Acid rain can also damage buildings and historic monuments, especially those made of rocks such as limestone and marble containing large amounts

of calcium carbonate. Acids in the rain react with calcium compounds inter acid rain stones to create gypsum, which then flakes off. This phenomenon related to acid rain is termed as stone cancer.

When this acid rain falls on buildings, it slowly dissolves the limestones and mortar. When it falls on plants, it damages their leaves and retards their growth. Falling on the earth, acid rain dissolves aluminum salts in the soil and washes them into rivers and lakes. These salts in higher concentration are poisonous to fish and other marine life.

Q.4. Why optical fiber is better than copper cable for telecommunication.

Ans. Optical fibers are thinner than electric copper cable. They carry more signals than copper cables. They are not affected by electrical interference. They are not flammable and electric current does not pass through it. There is no danger of fire accident.

Q.5. What is the importance of artificial satellite in telecommunication?

Ans. Artificial satellites

Artificial satellites move around the earth. These satellites are used to relay messages e.g. Speech, conversation, pictures etc, transmitted over electromagnetic waves from one place to far off places on the earth surface which enable us to view live events, matches etc.

Q.6. How has mobile phone changed the life style of the people of Pakistan?

Ans. (i) Cellular or mobile phone has revolutionized the lives of Pakistani people. In Pakistan mobile phone users are increasing with every passing day.

(ii) We can hear and watch the speakers, lecturers and scholars sitting in our homes.

(iii) We can also enjoy games on mobile phones.

Q.7. Differentiate between EEC and ECG.

Ans. EEG: The EEG (electroencephalogram) is a diagnostic procedure in which electrical activity of brain is recorded.

ECG: An electrocardiogram (ECG) is an electrical recording of the heart and issued in the investigation of heart diseases.

Q.8. Why MRI is safer than CT scan?

Ans. MRI is safer than CT scan because it can distinguish both normal and diseased state of a soft tissue. It provides the information about brain cancer hemorrhage, obstruction in brain artery and pressure on medulla oblongata.

Q.9. According to your opinion which technology has effected the human life a lot. Introduce the technology in few lines.

Ans. All the technologies have effected the lives of human. But biotechnology has played a vital role in the lives of human.

Biotechnology is defined as the use of living microorganism or biological process for industrial, agricultural or medical processes for the welfare of man.

ADDITIONAL SHORT ANSWERS

(i) Which space probes collect the samples of soil and rocks from the surface of Mars?

Ans. America sent two probes which collected solid and rocks named viking-1 and viking-2.

(ii) **What is Hubble telescope?**

Ans. Hubble is the largest space telescope launched in space in April 24, 1990. Size of its mirror is 2.5 meter and its weight is 11 ton.

(iii) **Write some benefits of artificial satellites?**

Ans. (i) Scientists can make correct prediction of climate.
(ii) Helps in telecommunication sector.
(iii) Scientists have come to know about different galaxies, stars planets with the help of satellites.
(iv) These satellites help in the study of cosmic rays.

(iv) **What are the basic objection of SUPARCO?**

Ans. Basic objection of SUPARCO are space research, study of ozone, pollution of atmosphere, study of radio waves, exploration of natural minerals, establishment of ground stations and launching of space rockets and satellites into space.

(v) **Where the nuclear power plant of Pakistan are situated?**

Ans. Nuclear power plant of Pakistan are situated in Karachi and chashma. Total production capacity of Karachi is 137 mega watt, and production of chashma nuclear power plant (CHASNUPP) is 300 mega watt.

SECTION C - DETAILED ANSWERS

Write in detailed answers of the following questions:

Q. 1. What are ultrasound waves? Why these waves are less harmful than X-rays.

Ans. Ultrasound waves are longitudinal mechanical waves with frequency above the audible range. So these waves have a greater penetrating power.

Why these are less harmful?

Ultrasonic are widely used waves which are harmless and produce no after effects like x-rays or nuclear radiations. They are longitudinal mechanical waves with frequency above the audible range so these waves have greater penetrating power.

Q. 2. How CT scan has helped in providing better way of diagnosis and treatment of diseases?

Ans. Computerized tomography scans are generally used to collect graphical information which can be used to assess the general health of the brain, neck, spine, chest, abdomen, pelvis and sinuses.

Computerised tomography
(CT Scan) of the brain

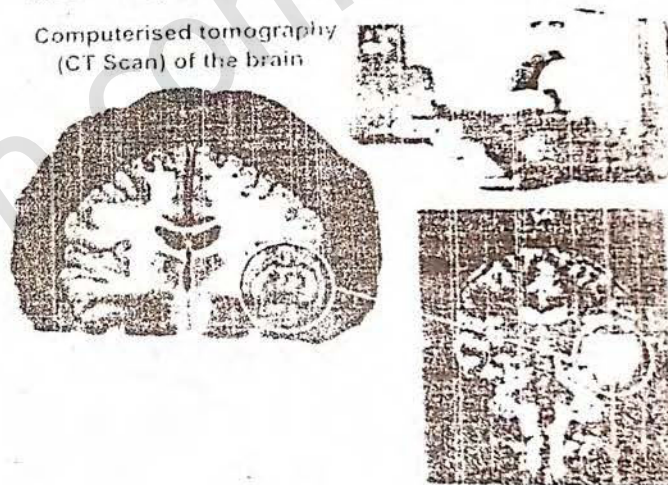


Fig. CT Scan

One of the advantages of CT scan over other diagnostic procedures is that it is useful in the examination of the soft body tissues like liver, stomach, and some other abdominal organs. It is also being used for the examination of brain to look for a mass, stroke, area of bleeding, or blood vessel abnormality. CT scans are also used as a confirmatory procedure for checking the already known results using X-rays

and ultrasound test. CT scan can also be used to see the spread of a cancer in the body.

Q. 3. Describe the principle of Lasers and its uses in different fields with examples.

Ans. Lasers

Laser stands for "light amplification by stimulated emission of radiation." Laser is a device / source that produce an intense monochromatic and unidirectional coherent beam of visible light. It operates by the principle of stimulated emission of a photon by an atom in excited state.

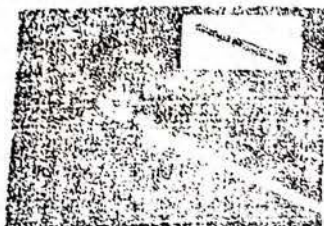


Fig: Laser

The light beam produced by most lasers is pencil-sized, and maintains its size and direction over very large distances.

A laser consists of two fundamental parts: An amplifying medium which can be solid, liquid or a gas. It is composed of atoms, molecules, ions or electrons whose energy levels are used to increase the power of a light wave during its propagation.

A pumping system: Its function is to excite the amplifying medium which in turn creates a condition for light amplification. For this purpose it supplies critical energy. Pumping systems can be optical, (the sun, flash lamps, tungsten-filament lamps, diode or other lasers), electrical (electric current in semiconductors, gas discharge tubes) or even chemical.

The different components that make up a basic laser are illustrated in the diagram below.

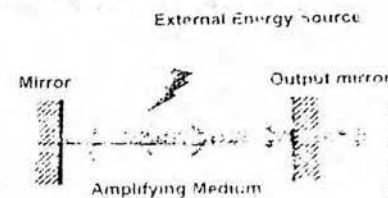


Fig: Components of Laser.

The fundamental parts of laser amplify light. This is known as a laser amplification. Most of the lasers use a cavity or an optical resonator. Technically, the whole device is known as a laser oscillator which uses reflecting mirrors to amplify the light source considerably by bouncing it back and forth within the cavity.

Uses:

Many useful inventions use lasers. For example, DVD and CD players, bar code readers etc. Metal workers use lasers to cut and weld metal. Likewise workers in clothing factories use lasers to cut through hundreds of layers of fabric at once.

Q. 4. Describe the functions and uses of ECG.

Ans. ECG (Electrocardiogram)

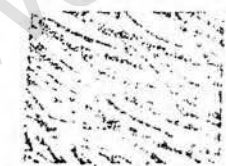
An electrocardiogram (ECG) is an electrical recording of the heart and is used in the investigation of heart disease. An electrocardiographic lead is a recording electrode or a pair of recording electrodes at a specified location on the body. In clinical practices, twelve leads are usually used in the diagnostic ECG, although there is no limitation to the number of leads. The leads are usually placed on the elbows and stifles.

The electrocardiography is a technique of recording the bio-electric currents generated by the heart.

The graphical display of this recording is called electrocardiogram. The ECG, refers in general to both electrocardiogram and electrocardiography. For more than one hundred years, the ECG has been used to reveal the condition of the heart and to diagnose cardiac illnesses. This has been possible because the cardiac muscle cells generate bio-currents which can be detected inside the body or on its surface using some special electrodes. Unlike the bio-currents generated by some other muscles, the currents generated by the heart muscles are periodic, that is, they consist of a repeated sequence of characteristic waveforms which correspond to a heartbeat.



Cardiac cells at rest are considered as polarized, having no electrical activity. The cell membrane of cardiac muscle cell separates different concentrations of ions such as sodium, potassium, and calcium. This is called the resting potential. Electrical impulses are generated automatically by specialized cardiac cells. Once an electrical cell generates an electrical impulse and ions cross the cell membrane, the resting potential turns into action potential also known as depolarization.



Cardiac muscle cells

Q. 5. Describe the functions and uses of EEG

Ans. EEG

The electroencephalogram (EEG) electrical activity of the brain is discs called electrodes on the scalp. The recorded waves form pattern show the electrical activity reflected from the cortex of the brain. Cortex is the largest part of the brain which is concerned with the higher functions of the brain such as thought and action.

Brain is composed of nerve cells or neuron which produces electrical signals known as action potentials. From one nerve cell to other, action potential moves through a gap called as synapse with the help of special chemicals known as neurotransmitters.



Usages: For taking reading of the electrical activity of the brain electrodes are placed on the scalp at specific positions. Each electrode site is labeled with a letter referring to the area of brain underlying the electrode .e.g. T-Temporal lobe and F-Frontal lobe and a number. Even numbers denote

the right side of the head and odd numbers the left side of the head.

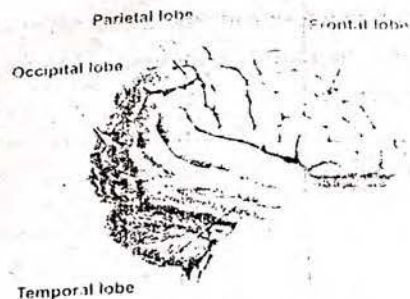


Fig: Different lobes of brain

There is a great variety of electrodes that can be used. Majority are small discs of stainless steel, tin, gold or silver covered with a silver chloride coating. These normally have a lead attached.

Sometimes, an elastic cap fitted with electrodes is used instead. The electrodes are connected with wires to an instrument that amplifies the brain waves and records them on computer equipment.

The technician may ask the patient from time to time to open and close eyes, perform a few simple calculations, read a paragraph, to look at a picture or a flashing light, breathe deeply for a few minutes.



Video is frequently recorded during the EEG. Body motions are captured by a video camera while the EEG simultaneously records brain waves. This combined recording may help doctor diagnose and treat a medical problem.

Q. 6. Describe the main components of a computer.

Ans. Computer

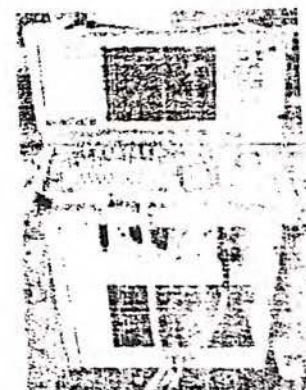
A computer is an electronic device which can solve complicated problems. It processes data, entered into it and gives out the result rapidly. There are three basic kinds of computers i.e. digital computers, analog computers and hybrid computers.



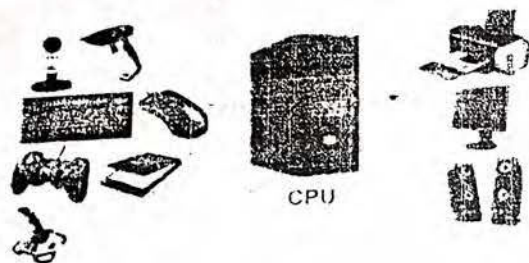
Analog computer



Digital computer



Hybrid



Input devices

Output devices

Digital computers are programmable so these can run variety of applications using software. Analog computers work with the physical characteristics like pressure, temperature, weight etc. Sometimes the properties of digital and analog computers are combined in a computer and such computer is called hybrid computer.

The use and importance of computer is rapidly increasing day by day. It is because of high speed processing, the reliability of handling the supplied information with accuracy, large memory and the capability of arriving at an end result. These properties have made computer to be an important tool for getting easy solutions to variety of problems we face on our daily life.

A set of computers connected through a network is called a computer network. For example, internet is a computer network. Computers connected by a network can mutually exchange information. The interconnected computers can serve as a common database.

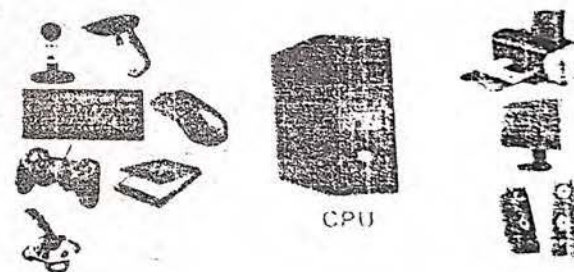
Basic elements of a computer system: A computer system is composed of different components which work in a coordinated fashion for the accomplishment of a certain task. Overall, a computer has hardware and a software component.

The hardware components of the computer are the parts which can be touched and are visible to eyes. The software components consist programmes and applications that directs the hardware components for effective functioning. A computer has the following major parts:

- (i) Central processing Units (CPU)
- (ii) Memory or storage
- (iii) Input Units
- (iv) Output Units

The set of instructions given to a computer is called program. We enter data through input devices. An input device is any hardware component that allows a user to enter data and instructions into a computer. Input devices are mouse, keyboard, microphone, digital camera, scanners etc.

An output device is any piece of computer hardware equipment used to communicate the results of data processing carried out by a computer to the user. Output devices are monitor, printers, computer speakers etc.



Input devices

Output devices

Fig: Different devices of computers

Electronic data is stored into the memory, from where it is processed as and where instructed. Central processing unit

(CPU) executes the instructions sequentially. The instructions modify data stored in memory or obtained from an input device. Processed data may be stored back in memory or sent to an output device, such as monitor. The results can be viewed on the TV screen or can be printed by the printer for permanent record.

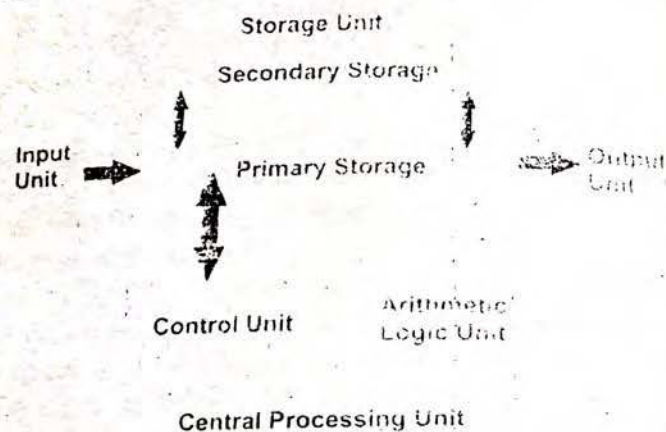


Fig: Flow chart showing working of a computer

There are two types of storage memory used in a computer system, primary storage and secondary storage. Primary storage is of two types; Read only Memory (ROM) and Random Access Memory (RAM). ROM is a permanent memory supplied by the manufacturer and contains all the necessary codes and instructions. RAM is a temporary memory. Secondary storage are in the form of USB (Universal serial bus), memory cards, etc. These devices give backup storage and also increases the data storage capacity.

Computer has a vital role to play in almost every field of life. In the field of education, computer provides an efficient mechanism for storage and access to information. It also preserves data for future use. Online education has made the dream of distance learning a reality. Computers help in audio-

visual representation of information, thus making the process of learning interactive and interesting.

Computers are extremely important in today's business. Ordering products, shipping information, price checks in retail stores etc. is done using computers. Many businesses use accounting software and ledgering systems to ensure the accuracy of their financial status.

Computers provide a wide range of communication methods like email, social networks, chat, web and teleconferencing etc.

With the advent of Internet, we are now enjoying the benefits of high technology media which is not only faster but also wide spread in range. In manufacturing industry computers are widely used to design and manufacture products.

Q. 7. Explain the contribution SUPARCO has made in the development of our country and list their future plans.

Ans. Contribution of SUPARCO

This research center sent several satellites for weather research. First satellite Badar-I was sent into space in 1990 after which Badar-II was sent. Pakistan has its own communication satellite, responsible for communication all over the country. Pakistan has its own surveillance satellite, which can check each and every movement in the region. It also has monsoon watch program. Weather satellite successfully predicts the information about rain, storms, hurricanes etc.

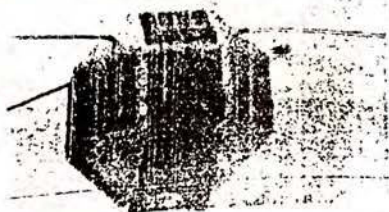


Fig: Bader -1 satellite of Pakistan.

Future Plans of SUPARCO

VSD: Pakistan's National Satellite Development Programme (NSDP) is one of the major tasks entrusted to SUPARCO. It includes the development of the following.

- Development of effective communication Satellite
- Pakistan Remote Sensing Satellite (PRSS-1)
- Human Resource Development in the area of space exploration

In the field of Applications Programmes following fields have been focused for further studies.

- Remote Sensing Applications
- Space and Atmospheric Sciences
- Tele-Medicine

Q. 8. Write a note on the working of a telephone.

Ans. Working of Telephone

Telephone has two main parts.

1. Receiver

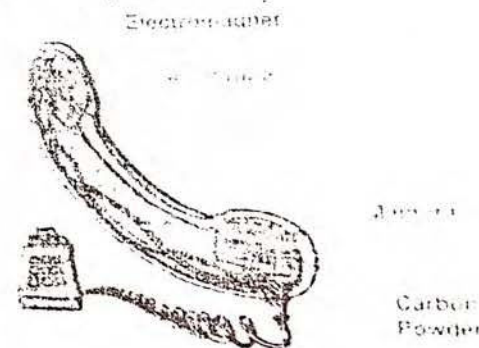
The receiver turns the incoming signals into sound. As the signals pass through the electromagnet, it attracts the thin metal membrane. The changes in the amplitude of the signals will vary the attraction, and thus causing the membrane to vibrate accordingly. Such vibration is transmitted in the air as sound waves. Therefore we can hear the sound.

2. Speaker

Most telephones use carbon powder speaker transmitter, a device to turn the sound wave into electric signals. The carbon powder is present in a case. When you speak, the sound vibrates the plastic membrane and presses the carbon powder.

The resistance of the powder drop when it is under pressure. Therefore, the sound vibration changes the electric current correspondingly.

When we speak on telephone, the sound energy changes into electrical signals. These signals travel along telephone cable and telephone receiver on other end of the lines changes the electrical signals again into sound. In the latest technology, sound signals are first converted into electrical signals which are then converted into light signals with the help of electronic circuits. These light signals travel along optical fibers. Advantage of this technology is that several thousand calls can be transmitted through a single optical fiber at the same time and there will be no interference effect of electric or magnetic fields on the light signal.



Q. 9. What is the role of information technology in our society? How it has revolutionized the human life?

Ans. Information Technology (IT)

The rapid advancements in electronics have provided new tools such as television, computer, internet, telephone, satellites etc. Our society is changing due to developments in information technology. While watching TV or reading a newspaper or magazine, it is impossible to miss coverage on seemingly diverse topic related to information technology, internet, World Wide Web (WWW), digital TV, online learning, corporate restructuring, wireless communication, medicine and so on. IT is based on the hardware and software of a computer and the telecommunication infrastructure. Computers have been used for information processing for many years.

Computers are becoming more and more powerful both in terms of their computational speeds and also for their capacities for storing data. Computer technology is the most useful technology ever developed. IT is the combination of computer Technology and communications.

Rapid changes are taking place in information technology all over the world. The methods used in sending information instantly over long distances are called telecommunications. The devices are television, computer, radio, telephones, fax machines etc. Let's study some devices in detail.

ADDITIONAL QUESTIONS

Q.1. Write notes on Fax Machine and Radio.

Ans. Fax Machine

Fax machine is used to send contents of the documents to other destinations without changing the physical version of the document. Fax is a short of facsimile, which means exact

reproduction of a document print or picture. A fax machine scans a document and changes the dark and light parts into electrical signals. These signals travel along telephone cable to the receiving fax machine, which reproduces the original document. The original document is scanned with a fax machine (or a telecopier), which processes the contents (text or images) as a single fixed graphic image, converting it into a bitmap, and then transmitting it through the telephone system in the form of audio-frequency tones. The receiving fax machine interprets the tones and reconstructs the image, printing a paper copy.

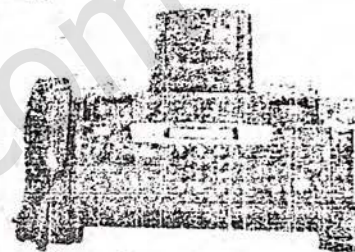


Fig. Fax Machine

Radio

Radio is a source of information and entertainment even in the presence of other useful present day gadgets. A radio works with the help of radio transmitter and a radio receiver. Radio transmitter transmits sound in the form of radio waves which are received by the radio receiver.

A radio wave is an electromagnetic wave which is transmitted by an antenna. Radio waves launched from a transmitting antenna move outward and without being influenced by the surrounding atmospheric conditions like rain, snow etc. Radio waves can easily penetrate non-metallic objects. They travel best in free spaces and require no material medium for their transmission.

Q.2. Describe Pakistan's space programme.

Ans. Pakistan Space Programme

Due to the revolution in space exploration and importance of the role of satellite in various fields, Pakistan, although a developing country also realized the importance of space and space exploration, therefore established an organization named "SUPARCO" in 1962.

SUPARCO means "Pakistan Space and Upper Atmosphere Research Commission". It is responsible for the execution of the space science and technology programmes in the country.

Functions of SUPARCO

Functions of the SUPARCO are:

- (i) Keeping in view the objectives of the commission it prepares and submit proposals, schemes or projects to the Government of Pakistan for getting necessary approvals.
- (ii) The commission is entrusted with the responsibility of carrying out research and application programs approved by the Government of Pakistan.
- (iii) On the directives of the Government the commission conducts investigations and surveys mainly related to space and upper atmosphere.
- (iv) The commission prepares and submits quarterly progress reports and its annual budget to the Government Of Pakistan for approval.

The commission consists of the following divisions

(a) Remote sensing and application Division (RSA):

This center is for dissemination of satellite remote sensing data products. It also works on geographic information system technology for exploring earth resources, surveying, mapping and environmental monitoring.

(b) Environmental and space science Division (E & SS):

It carries out research in environmental pollution studies astronomy etc. and atmospheric science.

(c) Ionosphere Research Division (IR)

It is also concerned with research studies about ionosphere and its effects.

(d) Satellite communications Division (SC)

Receive the data from the satellite.

On 16th July 1990, Pakistan launched its first experimental satellite BADR-1



Q.3. Describe the working of television.

Ans. Working of television.

Working of a television is based on three basic things i.e. the **TV camera** that turns a picture and sound into a Figure Television, signal; the **TV transmitter** that sends the signal through the air; and the **TV receiver** (the TV set in your home) that captures the signal and turns it back into picture and sound. TV creates moving pictures by repeatedly capturing still pictures and presenting these to your eyes so quickly that they seem to be moving.

A television program is produced by focusing a television camera on a scene. The camera changes light from the scene into an electric signal, called the video signal. The video signals from the cameras are processed in a control room. Audio signals from microphones placed in or near the

scene also flow to the control room, where they are amplified and combined. The signals are then sent to the transmitter.

The transmitter amplifies the video and audio signals and uses the electronic signals to modulate, or vary, carrier waves. The carrier waves are combined, and then sent to the transmitting antenna. In the antenna, the oscillations of the carrier waves generate electromagnetic waves of energy that radiate horizontally throughout the atmosphere. These waves excite weak electric currents in all television-receiving antennas within range. These currents have the characteristics of the original picture and sound currents. The currents flow from the antenna attached to the television into the television receiver, where they are electronically separated into audio and video signals. These signals are amplified and sent to the picture tube and the speakers, where they produce the picture and sound portions of the program.

Q.4. What are optical fibers? Describe their advantages and uses?

Ans. Optical fibers:

Optical fibres are thinner and lighter than electric cables. They carry more signals than electric cables. They are not affected by electrical interference.

LED Optical Fiber

approx

Fig: Principle of optical fiber system.

As compared to copper wire optical cable are less expensive and these can be drawn to smaller diameter. Optical

fibers provide a high data transmission rates and higher carrying capacity. Data travels with maximum protection and offers very less losses. Optic fibers are small in size and light in weight. Optic fibers are non flammable and as electric current does not pass through it there is no danger of fire accidents.

Speed: Fiber can carry information so fast that you can transmit three television episodes in one second.

Bandwidth: Taken in bulk, it would take 33 tons of copper to transmit the same amount of information handled by 1/4 pound of optical fiber.

Resistance: Fiber optic cables offer greater resistance to electromagnetic noise such as radios, motors or other nearby cables. Because optical fibers carry beams of light, they are free of electrical noise and interference.

Capacity: Fiber optics have a greater capacity for information which means smaller cables can be used.

Uses:

1. Surgeons and physicians often examine the internal organs of the body by obtaining their images on a screen with the help of optical fibres.
2. Optical fibres are used in telephone and other telecommunication systems.
3. These are used in the night vision devices, photo-electronics and automobile panel lighting.

Q.5. What are x-rays? Describe their functions.

Ans. X-Rays

X-rays are electromagnetic radiations, lying between ultraviolet radiations and gamma rays in the spectrum. Their wavelength range is 10^{-11} m to 10^{-8} m. These were discovered by Wilhelm Konrad Rontgen in 1895. X-rays are produced in an apparatus called X-ray tube as shown in the figure. An X-

ray tube consists of a vacuum tube fitted with cathode and anode which are connected with a high voltage battery. A heavy metal (usually tungsten) is embedded at the anode. When cathode is heated by supplying the current, it emits high energy electrons. These energetic electrons when strike the target at anode, an intense beam of X-rays is produced.

Functions of X-rays

Some of the important functions of X-rays are below:

1. X-rays penetrate several centimeters into solid materials on which they are incident.
2. They cast shadows of the obstacles placed in their path of propagation.
3. They cause florescence in many substances.
4. By passing through solid, liquid or gas, they ionize the atoms.
5. They affect the photographic plates.

Uses of X-rays

Some of the important uses of X-rays are as under:

1. **Medical Use:** X-rays are used for the diagnostic radiography of bones, chest, kidneys, teeth, etc. to reveal the fractures of bones or abnormality of an organ. X-rays are also used for therapeutic purposes in the treatment of tumors.
2. **Industrial Use:** X-rays are used to test cracks in structural materials. They are also used to analyze the composition of alloys, structures of rubber and plastics.
3. **Safety Use:** X-rays are used to look for weapons and bombs in sealed cases at airports.
4. **Scientific Use:** X-rays are used to study the crystalline structures of solids.

Q.6. How ultrasound waves are produced? Describe their applications.

Ans. Production of Ultrasound Waves

Ultrasound is one of the widely used tools for disease diagnosis and examination of several body parts. The main part of the ultrasound imaging equipment is the transducer. During diagnosis the transducer remain in contact with the surface of the body of the patient. When electrical pulses are supplied to ultrasound machine, the ultrasonic sound is focused by the transducer into small beams which can strike the internal organs. After striking the echo pulse is returned and signals are picked by the transducer and are converted back into electric pulses that are then processed by the system and images are formed.

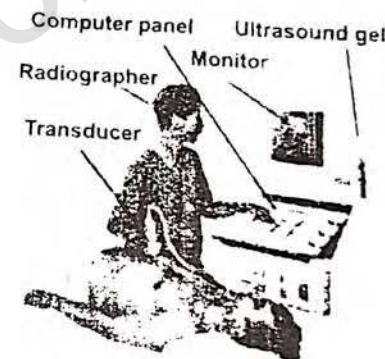


Fig: Ultrasound in diagnosis of diseases.

Application of ultrasonic waves

- (i) Ultrasonic waves are widely used as diagnostic, therapeutic, and surgical tools in medicine and industries.
- (ii) Ultrasonic waves are also used to obtain cross-sectional pictures of patient's organs in hospital.
- (iii) Ultrasonic guidance devices are used for the blind.

- (iv) These waves are used to kill bacteria and microorganisms in liquids.
- (v) Ultrasonic scans are preferred to x-rays as ultrasound is much safer than x-rays. Ultrasounds are considered best to examine the soft fleshy parts of the body.

Q.7. Write notes on MRI and angiography.

Ans. MRI (Magnetic Resonance Imaging)

Magnetic resonance imaging (MRI) scanners are used to produce two-dimensional and three-dimensional internal images of the body. These scanners work in a similar way like that of CT scan. However, MRI scan does not use X-rays as in CT scan, rather it uses a strong magnetic field and radio waves to produce very clear and detailed images of inside of the body on a computer.

Commonly MRI is used to examine the brain, spinal cord, joints, abdomen, and pelvis. Apart from this; a special kind of MRI called magnetic resonance angiography (MRA) is used to examine the blood vessels.

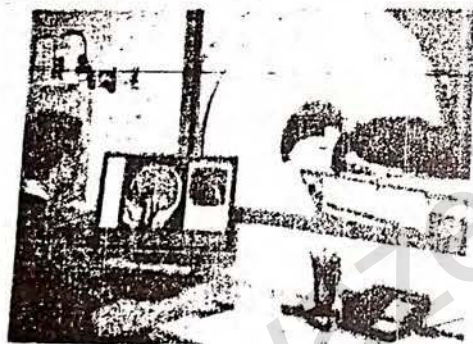


Fig. MRI Scan

A head coil is placed around the patient's head while examining the MRI of brain. With the help of this head coil diverse images of brain are captured for diagnostic purposes. MRI scans are also used for the diagnosis of medical problems

related to hearing, general weakness, blurred vision, seizures etc.

Angiography: Angiography is a diagnostic procedure which detects the general conditions of the blood vessels. It gives an information showing whether blood vessels are narrow, irregular or blocked. It also gives an overview of the blood flow condition in the blood vessels and also detect the development of clumps of new vessels and other abnormal patterns like tumours and injuries. Angiography is also a useful procedure for investigating the narrowing or blockage of the coronary arteries supplying blood to the heart, so that necessary treatment like balloon angioplasty or coronary artery bypass operation can be done.

It detects the presence of abnormal arteries in and around the brain. A general look into the procedure shows that it is a special form of x-ray examination which shows the problem of the blood flow in arteries and veins. A special dye is injected into the blood stream which detects any disease like atherosclerosis which causes fatty plaques to be deposited in the lining and narrows the vessel. It is also useful in the detection of blood clots.

Q.8. Write a note on mobile as call:

Ans. Mobile or Cell phone:

Cellular or mobile phone has revolutionized the communication technology worldwide. It is one of the booming industries in the world. In Pakistan mobile phone users are increasing with every passing day. Mobile phone is a type of short-wave analog or digital telecommunication in which a user has a wireless connectivity from a mobile phone to a nearby transmitter. Each of the transmitters has its own specific area of coverage which is technically called as a cell.

When the mobile phone user moves from an area to another area of coverage, the signals are passed on to the loca

cell transmitter operating in that specific area. When you speak into a mobile phone, the sound waves strike the microphone in the handset which converts sound waves into electrical signals. In a mobile phone there is a microchip which converts these electric signals into radio waves which are beamed out from the antenna of the mobile. These radio waves travel through the air at the speed of light until it is received by cell phone mast which pass them to its base station. From the base station, the calls are transferred to their destination. This is how a call is made from one mobile to another mobile.

When call is from one mobile phone network to another mobile phone network or to a landline number, the radio waves travel to and are received by the main telephone network before they are routed onward to the desired destination.

