

CHEMISTRY NOTES FOR CLASS 10TH (FOR SINDH)

CHAPTER

2

**Carbon , Silicon
and their Compounds**

You will learn in this chapter about:

- ✦ Carbon and its allotropic modification, bucky ball.
- ✦ Diamond and graphite and their structures.
- ✦ Physical and chemical properties of carbon and catenation.
- ✦ Silicon, its occurrence and preparations.
- ✦ Properties and uses of silicon.
- ✦ Silica, water glass, chemical garden and silica gel.

Section - A

Multiple Choice Questions (M.C.Qs.)

Choose the correct answer for each from the given options:

1. Graphite bars are used in atomic reactors because graphite is:
(a) Soft solid (b) good conductor of electricity
(c) more reactive than diamond (d) slows down the neutrons
2. Diamond is used as abrasive because it is :
(a) hard (b) soft
(c) cubic (d) bad conductor of electricity
3. Silicon is the most abundantly found in nature as :
(a) silica (SiO_2) (b) silicon carbide (SiC)
(c) sodium silicate (d) calcium silicate
4. China clay is used in making of :
(a) glass (b) electrical insulator
(c) ceramics (d) crock eries
5. fused silica which is also known as quartz glass is used for making :
(a) concrete or cement (b) silicon carbide
(c) optical lenses and prisms (d) absorbent
6. melting point of sodium silicate is :
(a) 1100°C (b) 1090°C (c) 1410°C (d) 990°C
7. Both carbon and silicon have in their valence shells :
(a) 3 electrons (b) 4 electron (c) 5 electrons (d) 6 electrons
8. Atomic number of silicon is :
(a) 6 (b) 8 (c) 12 (d) 14

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9. Atomic number of carbon is :
(a) 6 (b) 8 (c) 12 (d) 14
10. Carbon is a pure: _____
(a) metal (b) nonmetal (c) metalloid (d) none of them
11. Silicon is a: _____
(a) metal (b) nonmetal (c) metalloid (d) none of them
12. The abundance of carbon in the earth's crust is :
(a) 12 (b) 14 (c) 16 (d) 18
13. The 2nd most abundant element in the earth's crust :
(a) Oxygen (b) Silicon (c) hydrogen (d) Aluminum
14. The first stage in the formation of coal is :
(a) anthracite (b) bitumen (c) lignite (d) peat
15. The hardest form of coal is :
(a) anthracite (b) bitumen (c) lignite (d) peat
16. The percentage of carbon content in anthracite is :
(a) 60 (b) 70 (c) 80 (d) 90
17. The formula of marble, chalk and limestone is :
(a) CaCO_3 (b) MgCO_3 (c) $\text{CaCO}_3 \cdot \text{MgCO}_3$ (d) Na_2CO_3
18. Charcoal is used to remove colours or bad tasting impurities from
(a) milk (b) water (c) food (d) ice cream
19. The crystalline forms of carbon are:
(a) 2 (b) 3 (c) 4 (d) 5
20. The existence of two or more different forms of the same element is called :
(a) isomorphism (b) polymorphism (c) allotropy (d) entropy
21. The number of carbon allotropes is:
(a) 2 (b) 3 (c) 4 (d) 5
22. Naturally hardest substance known is:
(a) anthracite (b) coal (c) diamond (d) graphite
23. The density of diamond is:
(a) 2.2 g/cm^3 (b) 3.51 g/cm^3 (c) 4.2 g/cm^3 (d) 5.51 g/cm^3
24. The refractive index of diamond is:
(a) 1.45 (b) 2.45 (c) 3.45 (d) 4.45
25. Melting point of diamond is:
(a) 3000°C (b) 3500°C (c) 4000°C (d) 4500°C
26. The density of graphite is:
(a) 2.2 g/cm^3 (b) 3.51 g/cm^3 (c) 4.2 g/cm^3 (d) 4.51 g/cm^3
27. Which one is a good conductor of electricity?
(a) Bucky ball (b) Diamond (c) graphite (d) coal
28. Graphite is mixed with oil to form high temperature:
(a) absorbent (b) nonpolluting (c) lubricant (d) desiccant
29. The structure of diamond is:
(a) tetrahedral (b) octahedral (c) layered (d) compact
30. The structure of graphite is:
(a) tetrahedral (b) octahedral (c) hexagonal (d) compact
31. An allotrope is a solid form of an element with the different molecular:
(a) formula (b) weight (c) structure (d) mass

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32. Bucky ball was discovered in:
(a) 1965 (b) 1975 (c) 1985 (d) 1995
33. in graphite how many electrons are used for bonding to other carbon atoms?
(a) 2 (b) 3 (c) 5 (d) 6
34. Graphite is:
(a) hard (b) mild (c) soft (d) stiff
35. which of the following is an allotrope of carbon?
(a) coal (b) charcoal (c) soot (d) graphite
36. The C-C bond length in diamond is
(a) 1.24 Å (b) 1.34 Å (c) 1.44 Å (d) 1.54 Å
37. The bond energy for each C-C bond in diamond is:
(a) 147 kJ/mol (b) 247 kJ/mol (c) 347 kJ/mol (d) 447 kJ/mol
38. Each layer of graphite is:
(a) two-dimensional (b) three-dimensional (c) polydimensional (d) multi-dimensional
39. the C-C bond length within a graphite layer is:
(a) 1.12 Å (b) 1.22 Å (c) 1.32 Å (d) 1.42 Å
40. two successive layers in graphite are at a distance of:
(a) 2.35 Å (b) 3.35 Å (c) 4.35 Å (d) 5.35 Å
41. Graphite conducts electricity due to :
(a) localized electron (b) delocalized electron (c) sterilized electron (d) paralyzed electron
42. coke is produced by destructure distillation of:
(a) peat (b) anthracite (c) bituminous (d) lignite
43. coke burns in air with no:
(a) residue (b) smoke (c) pollution (d) suffocation
44. coke is used for the extraction of metal from their oxides.
(a) oxidizing (b) reducing (c) drying (d) lubricating
45. Animal charcoal contains high percentage of :
(a) $\text{Ca}_3(\text{PO}_4)_2$ (b) CaSO_4 (c) CaCO_3 (d) CaCl_2
46. Carbon black is used in the tyre as:
(a) rubber (b) mortar (c) filler (d) gear
47. Charcoal heated in superheated steam is called:
(a) activated (b) deactivated (c) good (d) bad
48. Activated charcoal is used in gas masks for absorbing:
(a) light gases (b) heavy gases (c) various gases (d) poisonous gases
49. Animal charcoal is used for decolourizing brown colour sugar and petroleum:
(a) product (b) fraction (c) jelly (d) plastics
50. The tendency to form chain of similar atoms is called:
(a) catenation (b) carbonization (c) decarburization (d) aromatization
51. Silicon is present in the periodic table in group:
(a) 1st (b) 2nd (c) 3rd (d) 4th
52. Silicon is exceedingly being used for making:
(a) conductor (b) semiconductor (c) insulator (d) transistors
53. The purest and commonest crystalline form silica SiO_2 is:
(a) opal (b) onyx (c) amethyst (d) quartz
54. The most widely distributed silicate are those of:
(a) sodium (b) potassium (c) aluminium (d) calcium

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55. Kaolin is commonly called china:

(a) clay	(b) porcelain	(c) pottery	(d) white
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 56. the chemical formula of silica is:

(a) SiO_2	(b) SiO_3	(c) SiO_4	(d) SiO_5
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 57. The number of silicates present in the earth's crust are:

(a) 10	(b) 100	(c) 1000	(d) 10000
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 58. melting point of silica is:

(a) 1110°C	(b) 1210°C	(c) 1310°C	(d) 1500°C
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 59. Silicon is soluble in:

(a) HF	(b) HCl	(c) HBr	(d) HI
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 60. An important silicone is:

(a) ethyl silicone	(b) propyl silicone	(c) butyl silicone	(d) methyl silicone
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 61. Silicon are made up of long chains silicon atoms alternating with:

(a) hydrogen atoms	(b) oxygen atoms	(c) carbon atoms	(d) chlorine atoms
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 62. All of the following contain silicon dioxide except:

(a) sand	(b) quartz	(c) clay	(d) flint
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 63. $\text{Al}_2\text{SiO}_5(\text{OH})_4$ is the chemical formula of:

(a) talc	(b) mica	(c) kaolin	(d) asbestos
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 64. Water glass is silicate of:

(a) potassium	(b) sodium	(c) calcium	(d) magnesium
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 65. Silicon is made by reducing sand with:

(a) coal	(b) coke	(c) coaltar	(d) charcoal
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 66. Silicon dissolves in hot alkali solution to produce a gas:

(a) hydrogen	(b) sulphur dioxide	(c) carbon monoxide	(d) carbon dioxide
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 67. To produce a very light but stiff and strong material when plastic is combined with:

(a) silk fibre	(b) cotton fibre	(c) carbon fibre	(d) nylon fibre
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 68. The gas produce after complete combustion of all forms of carbon is:

(a) CO	(b) CO_2	(c) SO_2	(d) SO_3
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 69. Incomplete combustion of carbon produces:

(a) CO	(b) CO_2	(c) SO_2	(d) SO_3
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 70. To increase tensile strength of bronze and steel alloy, they use:

(a) silica	(b) silicon	(c) silicone	(d) silicates
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 71. How many crystalline forms of silica are present:

(a) 2	(b) 3	(c) 4	(d) 5
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 72. Fused silica has a very low coefficient of expansion hence it is heat:

(a) repellent	(b) resistant	(c) absorbent	(d) pollutant
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 73. Kieselguhr is used in making antiseptic:

(a) drugs	(b) medicine	(c) dressings	(d) solutions
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 74. In the making of dynamite, kieselguhr is used as absorbent of:

(a) nitroglycerine	(b) glycerine	(c) ethane	(d) propane
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 75. In soap industry sodium silicate is used as a:

(a) perfume	(b) stuff	(c) filler	(d) material
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 76. Eggs can be preserved for a long time by immersing them in a water glass:

(a) suspension	(b) emulsion	(c) solution	(d) dilution
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Answers of M.C.Qs.

1. (d)	12. (c)	23. (b)	34. (c)	45. (a)	56. (a)	67. (c)
2. (a)	13. (b)	24. (b)	35. (d)	46. (c)	57. (c)	68. (b)
3. (a)	14. (d)	25. (b)	36. (d)	47. (a)	58. (d)	69. (a)
4. (c)	15. (a)	26. (a)	37. (c)	48. (d)	59. (a)	70. (b)
5. (c)	16. (d)	27. (c)	38. (a)	49. (c)	60. (d)	71. (b)
6. (b)	17. (a)	28. (c)	39. (d)	50. (a)	61. (b)	72. (b)
7. (b)	18. (b)	29. (a)	40. (b)	51. (d)	62. (c)	73. (c)
8. (d)	19. (b)	30. (c)	41. (b)	52. (b)	63. (c)	74. (a)
9. (a)	20. (c)	31. (c)	42. (c)	53. (d)	64. (b)	75. (c)
10. (b)	21. (b)	32. (c)	43. (b)	54. (c)	65. (b)	76. (c)
11. (c)	22. (c)	33. (b)	44. (b)	55. (a)	66. (a)	

Section - B/C

Short / Descriptive Answer Questions

Q1. Give the introduction about carbon and silicon.

Ans. An introduction: Both carbon and silicon have four electron in their outer energy levels or valence shells, so they are placed in group IVA of the periodic table. Carbon is nonmetal while silicon is a metalloid. Both are characterized by their ability to form four covalent bonds, but their chemical properties are completely different. Carbon atoms readily form multiple covalent bonds with each other, resulting in long chains, rings. The chemistry of silicon, however, is dominated by the silicon-oxygen covalent bonds as illustrated by the giant molecules of silica and the silicones. In 1923 Berzelliuss isolated silicon as an amorphous solid. The name silicon has been derived from a Latin word *silex* which means silica (sand).

Q2. Write down the occurrence of carbon.

Ans. Occurrence of carbon: carbon is the 16th most abundant element in the earth's crust. Carbon occurs in the free as well as in combined state. In the free state carbon exists in three crystalline forms: Diamond, graphite and buckminster fullerene (bucky balls). The noncrystalline or amorphous form of carbon coal coke and charcoal. The major source of carbon is coal. In the atmosphere carbon is found combined with oxygen as carbon dioxide to the extent of 0.03%. in the earth's rocks, carbon is found as metal carbonates, calcium carbonate magnesium carbonate etc. However, the most common carbonate rock is calcium carbonate (CaCO_3) which occurs as marble, chalk and limestone. Carbon also occurs in natural gas and petroleum as hydrocarbon (a mixture of hydrogen and carbon). Carbon is also an essential constituent of all living things.

Q3. Describe the various stages in the conversion of plant materials into coal. Also write down their carbon content and energy value.

Ans. Conversion of Plant Material into coal: Coal originates from the vegetation of the carboniferous Era which was protected from complete decay by overlying water-washed earth deposits. Decomposition occurred gradually under pressure and the absence of air. Carbon dioxide methane

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and water were liberated, leaving behind a material that contained varying percentage of carbon. The amount of carbon depends on the stage of conversion of the plant materials into coal given as under:

1. **Peat:** The first stage in the formation of coal is called peat. It is soft brown spongy material made by partially plant materials. It has 59.9% carbon
2. **Lignite:** Continued decomposition of peat converts into brown coal or lignite. It has 61.8% carbon
3. **Bitumen:** Lignite on further decomposition changes into soft coal or bitumen. It has 78.7% carbon
4. **Anthracite:** Finally the bitumen changes into anthracite which is the hardest form of coal. It has 91% carbon.

Carbon Contents and Energy Values

S No	Fuels	Carbon Content (% mass)	Energy value (KJ/kg)
1.	Wood	50.0%	19800 KJ/kg
2.	Peat	59.9%	18700 KJ/kg
3.	Lignite	61.8%	20900-25700 KJ/kg
4.	Bitumen	78.7%	32100 KJ/kg
5.	Anthracite	91.0%	32600 KJ/kg

Q4. Allotropy. Discuss chief allotropic forms of carbon.

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Ans. Allotropy: The existence of an element in more than one form in the same state of matter is called allotropy. "The different forms of such an element are called allotropes. The cause of allotropy is due to different arrangements of atoms in the allotropes. All the allotropes of an element have the same chemical properties but different physical properties. There are three allotropic forms of carbon.

Main Allotropic forms of carbon:

(i) **Diamond:**

Occurrence: it is mainly found in south Africa, Brazil, Australia and India.

Properties:

1. **Hardest natural substance:** As a result of the strength and uniformity of the bonds, and the stable and rigid crystal lattice, diamond is the hardest substance known to men.
2. **Densest Form OF Carbon:** The reason of this is that the atoms of carbon are closer than in any other forms. its density is 3.51 g/cm^3
3. **Bad Conductor Of Electricity:** As there are no free electrons in Diamond, so diamond is bad conductor of electricity.
4. **Colour:** Pure diamonds is transparent. However, the colour of diamond is due some metal oxide as impurities. Diamond are blue, green, yellow, red or black.
5. **Sparkle (Brightness):** Specially cut diamonds sparkle because they have high refractive index that is, their great bending effect on light. The refractive index of diamond is 2.45
6. **Resistant to high temperature:** It is also very resistant to high temperatures and chemical attack. Its m.p. is 3500°C .
7. **Combustion:** It burns in oxygen or air when heated above 900°C to form CO_2 , but otherwise it is chemically inert and does not react with chlorine, acids or alkalis.

(ii) **Graphite:**

Occurrence: It is found in Siberia, Canada and Srilanka.

Properties:

1. **colour:** It has dark grey colour.

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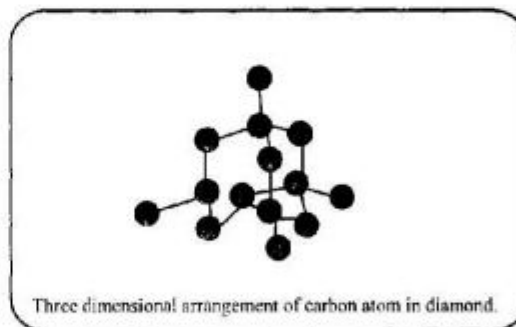
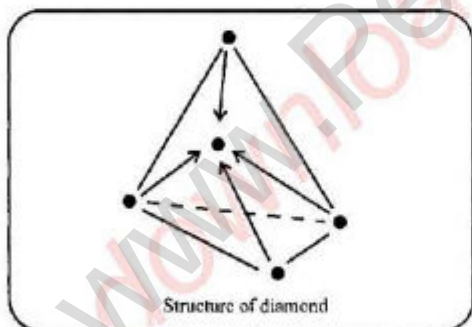
2. **Soft and Slippery:** Graphite has layered structure. The layers are arranged parallel one above the other and are held together by weak vander Waals forces only and therefore readily slide over one another, so graphite is very soft and slippery and is used as a lubricant.
3. **Density:** Graphite has an open structure, so graphite is less dense and slightly more prone to chemical attack than diamond. Its density is 2.2g/cm^3 .
4. **Good conductor:** Unlike diamond, only three of the four valence electron are held in definite bond formation. Hence graphite is good conductor of electricity due to the presence of mobile electrons in its crystal lattice.
5. **Melting Point:** Graphite has a m.p. about 3000°C .
6. **Combustion:** Graphite burns at 700°C to produce carbon dioxide gas.

(iii) **Bucky Balls (Buckminster Fullerene):** This allotropic form of carbon was discovered in 1985 by two English researchers by vaporized graphite.

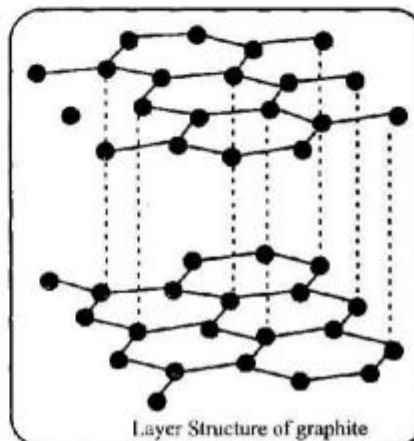
1. **Molecular Structure:** Their molecules are made up of 60 carbon atoms (C_{60}).
2. **Shape:** Their molecules are spherical in shape.
3. **Soluble in Organic Solvents:** Unlike diamond and graphite, this allotrope of carbon can be dissolved in organic solvents.

Q5. Discuss the structure of diamond and graphite.

Ans. Structure of Diamond: Diamond consists of carbon atoms in which each atom is joined to four similar atoms by covalent bonds arranged tetrahedrally. The angle between adjacent bonds is about 109.5° . diamond is therefore a giant structure of atoms, and a crystal of diamond may be regarded as a giant molecule in three dimensions. This gives it a very rigid, tough structure and in fact, diamond is the hardest naturally occurring substance known. The diamond crystal is usually octahedral in shape. The bond energy for each C-C bond is 347KJ/mol while the energy bond length is $1.54\text{\AA}$.



Structure of Graphite: Graphite crystal consist of layer of carbon atoms, and each layer is a giant structure of atoms. In fact, graphite is a giant molecule in two dimensions only. Each carbon atom is at the corner of a regular hexagon and is the same distance from three similar atoms. Only three of the valence electrons are involved in covalent bond formation. The fourth electron is delocalised, due to this graphite conducts electricity. The layer are arranged in parallel one above the other and they are far apart from one another and two successive layers are at a distance of $3.35\text{\AA}$ which are held together by weak vander Waal's forces. This makes graphite soft and flaky and suitable for use as a lubricant, or in pencil leads.



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Q6. Describe the amorphous forms of carbon and also write down their use.

Ans. Amorphous Forms of carbon: The amorphous forms of carbon are not considered as true allotropes of carbon because X-ray analysis have shown that they consist of minute crystals of graphite bound together by impurities. With the exception of coal which is mined from natural deposits, the other amorphous forms can be prepared in various ways. Some of the amorphous forms of carbon are given as under:

1. **Coal:** Coal originates from the vegetable of the carboniferous Era. The decomposition of plants and trees occurred slowly under pressure in the absence of air. Carbon dioxide, methane and water were liberated leaving behind coal. The vegetable material was converted in stages into peat, lignite, bituminous coal and anthracite. Impurities of coal include nitrogen sulphur and phosphorous.

Uses: Coal is used mainly as a fuel

2. **Coke:** Coke is prepared by destructive distillation of coal. In this process, bituminous coal is heated at 1300°C in the absence of air. Coke burns in air slowly with no smoke and leaves little residue.

Uses: (i) It is used as a fuel

(ii) It is used as a reducing agent in the extraction of metals especially iron.

3. **Charcoal:** It is produced by heating wood, bones, sugar, etc. in the absence of air. The process is called destructive distillation of wood, bones, sugar, etc.

(i) **Wood charcoal:** It is produced by burning wood in the absence of air.

Uses: • Wood charcoal absorbs gases because the molecules of the gas form a layer on its large surface area, and it is used in gas masks.

• It is mainly used as domestic fuel.

• It is also used to remove offensive odour from air and colours or bad tasting impurities from water.

(ii) **Animal charcoal:** It is formed when bones are heated without air. It contains high percentages of calcium and magnesium phosphates: $\text{Ca}_3(\text{PO}_4)_2$

Uses: • It is used in the refining of brown sugar.

• It is also used in decolourizing petroleum jelly.

Q7. Write down the physical properties of carbon.

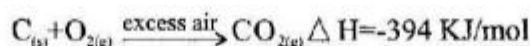
Ans. Physical Properties of Carbon:

1. All the different allotropes of carbon are black or grayish black solids except diamond which is colourless when pure.
2. The allotropes of carbon are odourless and tasteless.
3. They have high melting points above 3000°C.
4. They are insoluble in all common solvents like water, alkalis, acids, petrol, carbon disulphide, etc.

Q8. Write down the chemical properties of carbon.

Ans. Chemical properties of Carbon:

1. **Combustion:** In plentiful oxygen, carbon burns to form carbon dioxide gas.



In limited oxygen, incomplete combustion takes place and carbon monoxide gas is evolved.



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2. **Combination Reaction:** Carbon combines directly with certain element such as hydrogen, sulphur, calcium aluminium etc. at very high temperature to form addition products methane, carbon disulphide, calcium carbide and aluminium carbide respectively.



3. **As a Reducing Agent:** Iron, zinc, lead and copper are extracted from their oxides by reducing them with carbon (Usually coke, because it is cheapest). Oxide of metals above zinc in the reactivity series, such as aluminium and magnesium, are not reduced by carbon.

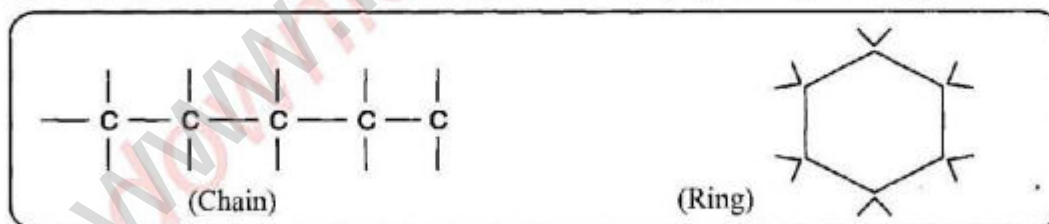


4. **Reaction Strong Oxidizing Agents:** Carbon reacts with strong oxidizing agents like hot concentrated nitric acid and sulphuric acid as a reducing agent and gets oxidized to CO_2 gas.



Q9. Define catenation.

Ans. Catenation: The tendency of carbon atoms to bond to other carbon atoms is called catenation. It is one of the unique properties of carbon which other elements do not have. Carbon forms long chain and rings and also forms compound containing chain and ring together by bonding with other carbon



atoms. The great extent of range of carbon compounds is due to catenation. The number of carbon compounds is so vast that a separate branch of chemistry called the organic chemistry has developed which deals with the carbon compounds.

Q10. Write down the uses /industrial application of carbon.

Ans. Uses of Carbon:

1. Diamonds are used in jewellery and cutting glass and metals
2. Graphite is used as lubricant, in making electrodes, and as neutron moderation.
3. Coal is used as a fuel.
4. Coke is also used as a fuel and as a reducing agent in the extraction of metal from their Oxides.
5. Charcoal is used as an absorbent in addition to a fuel.
6. Carbon fibre are incorporated into plastics to produce a very light but stiff and strong material.

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Q11. Compare the general properties of allotropes of carbon.

Ans. Allotropes of Carbon Comparison of the:

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S.No	Diamonds	Graphite	Amorphous carbon
1.	Transparent, colourless, Brilliant appearance	Opaque, grayish black Metallic luster.	Opaque, black and dull Appearance
2.	1½ times denser than graphite. Density 3.51g/cm ³	Density 2.2g/cm ³	Floats on water. Density 1.5g/cm ³ when air-free
3.	Giant structure in three dimensions	Giant layer structure weak force between layers	Probably minute crystals of impure graphite
4.	Hardest naturally occurring substance	Flaky, soft and greasy	Soft and porous
5.	Burns above 900°C	Burns above 700°C	Burns above 500°C
6.	Poor conductor	Good conductor	Moderate conductor

Q12. Write down the uses of diamond and graphite.

Ans. Uses of Diamond:

1. Because of its hardness, diamond is used industrially in drills for mining.
2. As an abrasive, it is used to sharpen very hard tools.
3. It is used for cutting glass and metals.
4. It is used as jewellery because of its refractive index and dispersion power which gives it a sparkling brilliance.
5. It is used as pivot supports in precision instrument.
6. Surgeons use diamond knives in cataract eye operations.

Uses of Graphite:

1. Graphite is an excellent dry lubricant because of its layered crystalline structure which allows one layer to slide over another.
2. As it is a good electrical conductor and is relatively inert chemically, graphite is often used as electrodes in electroplating and dry cells.
3. A nonconductor may be made conductive by coating it with graphite.
4. Graphite has a high melting point. Thus graphite lined crucibles are used for making high grade steel and other alloys.
5. A mixture of graphite and clay is used as lead in pencils, hardness is determined by the percent of clay added.
6. Graphite is also used as a black pigment in paint.
7. It is also used as a neutron moderator in atomic piles.

Uses of Bucky ball:

1. It is used as semiconductor.
2. It is used as a lubricant.

Q13. How does silicon occur in nature?

Ans. Occurrence of Silicon: Silicon is the second most abundant element in the earth's crust after oxygen. It does not occur free in nature. In the combined state, it occurs mainly as silicon dioxide and

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complex silicate. Silicon dioxide is commonly called silica. Silica is found in various forms e.g. sand, quartz, flint, opal, amethyst, onyx, agate, kieselguhr, etc. quartz is the purest crystalline form of silica. Silica occurs as complex silicate in combination with metallic oxides e.g.



There are more than one thousand silicates present in the earth's crust. The most common silicate are those of aluminium.

Q14. What are the silicates? Describe the some common natural silicates and their chemical formula and uses.

Ans. Silicates: Silicates are also very abundant in the earth, crust. They have strong silicon oxygen bonds. The most widely distributed silicates are those of aluminium.

Some Common Natural Silicates:

- Asbestos:** It is fibre-like silicate made up of chain of silicate groups with calcium and magnesium ions.
Chemical formula:- CaO, MgO, SiO_2 or $CaMgSi_4O_{12}$
Uses:- (i) Heat insulation (ii) Fire-proofing
- Feldspars:** They are silicates with aluminium ions interspersed.
Chemical formula:- $K_2O, Al_2O_3, 6SiO_2$ or $KAlSi_3O_8$
Uses:- (i) Ceramics (ii) glass (iii) Pottery (iv) abrasive
- Kaolin (China Clay):** A very pure form of aluminium silicate is called kaolin or china clay. It is white in colour.
Chemical Formula:- $Al_2O_3, SiO_2, 2H_2O$
Uses :- (i) crockery (ii) porcelain
- Mica:** It is mixture of metal silicates.
Chemical Formula:- $K_2O, Al_2O_3, 6SiO_2, 2H_2O$ or $KAl_3Si_3O_{10}$
Uses:- Electrical insulator.
- Talc (soapstone):** It is a silicate of magnesium.
Chemical Formula:- $3MgO, SiO_2, H_2O$
Uses:- Ceramics

Q15. Write down the preparation, physical and chemical properties and uses of silicon.

Ans. Preparation of silicon:

- Amorphous silicon can be prepared by heating magnesium with dry silica.



- Silicon produced by passing by $SiCl_4$ over heated sodium or potassium in an inert atmosphere.



- Industrially silicon is produced by heating SiO_2 in an electric furnace with reducing agents like carbon (coke) or magnesium.



Physical properties of silicon:

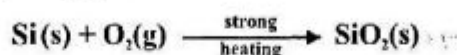
- Its melting point is 1410°C and boiling point 2600°C .

CHEMISTRY NOTES FOR CLASS 10TH (FOR SINDH)

- It is insoluble in common solvent like water but dissolve in hydrofluoric acid (HF).
- It is a poor conductor at room temperature. However, its conductivity increases with the rise in Temperature.
- Amorphous silicon has a specific gravity of 2.35. It is brown coloured and hygroscopic.
- Crystalline silicon has a specific gravity of 2.49.

Chemical properties of Silicon:

- When silicon is heated strongly in oxygen, it burns with a brilliant flame to form silicon dioxide or silica.



- Silicon reacts with alkalis to form silicate and hydrogen gas.



Uses:

- The chief use of silicon is in making silicon steels to give extra hardness.
- It is used in making silicon bronzes.
- It is used in making semi-conductors. The silicon must be very pure for it.
- It is used to make silicones, a rubber like liquid or solid.
- It is also used for making crucible, fire-bricks etc.

Q16. What are the silicones? Write down the properties, structure of methyl silicon and its uses.

Ans. **Silicones:** Groups of atoms, containing carbon and hydrogen are joined to the silicon atoms to form silicones. The silicon-oxygen chain gives the compound great stability.

Properties of Silicones:

- Thermally stable
- water repellent
- Fire resistant
- Non pollutant

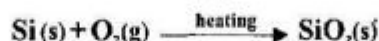
Uses of Silicones:

- Being water repellent, it is used for waterproofing materials.
- It is also used as lubricant with heat resisting properties.
- It is used in the preparation of refractory material like crucibles, fire bricks, etc

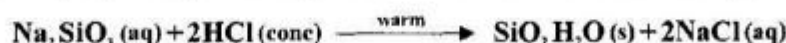
Q17. Write down the preparation, properties and uses of silica (silicon dioxide).

Ans. **1. Preparation of Silica (silicon dioxide, SiO₂):**

- Silica is prepared by heating silicon in air or oxygen.



- Hydrated silica is prepared by warming sodium silicate with concentrated hydrochloric acid.



2. Properties of silica:

- Pure silica exists in a colourless crystalline form.
- It is a compound of silicon and oxygen. (Macro molecule)
- It is a non-volatile and hard.
- Its melting point is 1500°C.
- It forms glass-like solid called Quartz glass.
- Quartz glass used in making laboratory apparatus.

CHEMISTRY NOTES FOR CLASS 10TH (FOR SINDH)

3. Uses of silica:

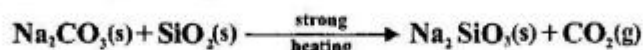
- (i) Silica is used in making mortar, cement, concrete, glass and refractory silica bricks.
- (ii) Fused silica and quartz crystals are used in making optical lenses.
- (iii) Powdered quartz is used in making silica bricks for lining furnaces.
- (iv) Kieselguhr absorbs liquids readily and is used as absorbent of nitroglycerine which is used in dynamite manufacture.

Q18. Write down the preparation and uses of sodium silicates (water glass).

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Ans. Preparation of Sodium silicate:

1. Sodium silicate is prepared by heating sand and sodium carbonate in 2:1 ratio respectively.



Uses of water glass:

1. sodium silicate is used for sizing of paper, fire proofing of wood and textile and making glue.
2. Eggs are preserved for long time by immersing them in a solution of water glass.

Q19. What is chemical garden?

Ans. Chemical Garden: It is made by dissolving some crystals of cobalt chloride, nickel sulphate, etc in a dilute solution of water glass. Leave the solution for a few days, chemical garden is seen to grow owing to the formation of coloured metallic silicates.



Q20. Write the note on silica jel.

Ans. Silica Jel: When an acid is added to a solution of water glass, a jelly like substance, jel, $(\text{SiO}_2 \cdot n\text{H}_2\text{O})$ is formed. On complete dehydration, a hard porous material silica gel is obtained.

Uses of Silica Jel:

1. being a good absorbent, it is used to absorb gases and vapours.
2. it is also used to recover valuable vapours form industrial effluent.
3. Small begs of silica jel are widely used in medicine packing to absorb moisture.

Textbook Exercise

1. Fill in the blanks :

- (i) Carbon contains 4 electrons in its valence shell and normally form covalent bonds with other elements.
- (ii) Silicon is the second most abundant element in the earth's crust after oxygen.
- (iii) The molecular formula of sand is SiO_2 .
- (iv) The hardest natural substance known is diamond.
- (v) Graphite is a good conductor of electricity.
- (vi) The formula of water glass is Na_2SiO_3 .

2. Point out of the following statement as true or false:

- (i) Amorphous form of silicon is of grey colour. (false)

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- (ii) Silicon is used in computers as semi-conductor. (true)
- (iii) The allotropes of carbon differ in their chemical properties. (false)
- (iv) Silica gel is used as an absorbent (true)
- (v) The driest and hardest type of coal which contain the highest energy value is anthracite. (true)
- (vi) Diamond is good conductor of electricity. (false)
- (vii) Graphite is used in making lead pencils. (true)
3. Choose the correct answer:
Ans: See MCQs 1 to 6.
4. (a) What is catenation? Give chief uses of carbon.
Ans: See Q.9 and 10.
- (b) Define allotropy? Discuss chief allotropic forms of carbon.
Ans: See Q.4.
- (c) what happened when the following are heated with coke. Give reactions.
- | | | |
|--------------------------------|-----------------------------------|------------------------|
| (i) sulphur | (ii) Aluminium | (iii) zinc oxide (ZnO) |
| (iv) Water as steam (H_2O) | (v) Conc. Nitric acid (HNO_3) | |
- Ans: See Q.8.
5. (a) Explain with reasons why graphite is a good conductor of electricity while diamond is not although both are the true allotropes of carbon.
Ans: See Q.5.
- (b) Discuss the structures of diamond and graphite.
Ans: See Q.5.
- (c) Compare the general properties of graphite and diamond and mention two uses each of graphite and diamond.
Ans: See Q.11 and 12.
6. Write short notes on the preparations and uses of the following:
- | | |
|-------------------|-----------------|
| (i) Charcoal | (ii) silicon |
| (iii) Water glass | (iv) silica jel |
- Ans: (i) (Q.6 (3)) (ii) (Q.15)
- (iii) (Q.18) (iv) (Q.20)
7. (a) How does silicon occur in nature?
Ans: See Q.13.
- (b) What are silicates? Describe some common silicates and their chemical formulas and uses.
Ans: See Q.14.
- (c) Give any four physical properties of silicon.
Ans: See Q.15.

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