Chemistry Question Bank

Chapter: The p-Block Elements.

General p block & Group 14 elements

Question 1

What are the general characteristics of p-block elements?

Ans.

The p-block elements have relatively little in common except that their outer elections are in p orbital's. This contrasts with the considerable similarities in properties of the elements of the s-block and also between those of the d-block. The p-block is more notable for trends.

The general electronic configuration of these elements is $ns^2 np^{1-6}$.

Depending upon the number of valence electrons, the elements of the p-block exhibit variable oxidation states.

Question 2

Why the p-block elements are also known as representative elements?

Ans.

Each group in the p-block has its own characteristic properties and hence they are called as representative elements.

Question 3

Which elements of the p-block are most abundant in the earth crust?

Ans.

The three p-block elements oxygen, silicon and aluminum are most abundant in earth's crust.

Question 4

Name the elements of p-block which occur in free state in nature.

Ans.

Carbon and sulphur are the two p-block elements that occur in free state.

Question 5

What are the p-block elements?

Ans.

The elements belonging to groups 13 to 18 of the periodic table are the p-block elements. They are also called as representative elements or normal elements. The chemistry of p-block elements plays an important role in our daily life.

Question 6

What is the use of studying p-Block elements?

Ans.

The p-block contains several elements of great social and economic importance as well as chemical interest. Examples include the use of aluminium as a structural material, the importance of silicon and germanium as semiconductors, and the use of sulphur, phosphorus and nitrogen in fertilizers.

Question 7

What is inert pair effect?

Ans.

The reluctance of s-electron pair, of heavier elements, to take part in bond formation is known as inert pair effect. This is due to poor shielding effect of intervening *d* and *f* orbitals, the increased effective nuclear charge holds *ns* electrons tightly and thereby, restricting their participation in bonding. As a result of this, only *p*-orbital electron may be involved in bonding.

Question 8

How many groups belongs to p-block elements?

Ans.

Six groups belongs to p-block.

Group 14 elements

Question 9

Give reasons for the solid carbon dioxide being known as dry ice.

Ans.

Since solid CO_2 is a snow -like substance which directly changes to the gaseous state without changing into liquid state and hence it is known as dry ice.

Question 10

Why the melting point of diamond is very high?

Ans.

Diamond is a three dimensional substance in which all the carbon atoms are bonded rigidly by tetrahedrally. Therefore, a large amount of energy is required to break down these bonds.

Question 11

C and Si are always tetravalent but Ge, Sn, Pb show divalency.

Ans.

Ge, Sn and Pb show divalency due to inert pair effect, Pb^{2+} is more stable than Pb^{4+}.

Question 12

Gallium has higher I.E. than Aluminium. Explain.

Ans.

It is due to poor shielding effect of d-electrons in Ga, effective nuclear charge increases as compared to Al, therefore, I.E of Ga is higher than Al. Secondly, Ga is smaller than Al.

Question 13

Give the differences in structures of the following pair of compounds CO_2 and SiO_2.

Ans.

CO_2 is linear molecule and exists as monomer. It is gas while SiO_2 is solid at room temperature due to three dimensional networks in which each Si atom is covalently bonded to four oxygen atoms tetrahedrally. In CO_2, 'C' is sp hybridized while in SiO_2, 'Si' is sp^3 hybridised.

Question 14

PbO_2 is stronger oxidizing agent than SnO_2.

Ans.

PbO_2 is stronger oxidizing agent than SnO_2 because Pb^{2+} is more stable than Pb^{4+} (due to inert pair effect) whereas Sn^{4+} is more stable than Sn^{2+}.

Question 15

Give a comparative account of the chemistry of carbon and silicon with regard to their property of catenation.

Ans.

Carbon shows property of catenation to more extent than silicon due to small size and tendency to form p∏-p∏ multiple bonds with itself; bond length of C-C is more than of Si-Si.
C-C > Si-Si

Question 16

Carbon dioxide is non polar while water is polar. What conclusion do you draw about their structures from these?

Ans.

CO_2 is linear, bond moments are equal and opposite, so net dipole moment is zero whereas Water is a bent molecule, and has a net dipole moment.

Question 17

What are the differences between diamond and graphite?

Ans.

Difference between diamond and graphite:
(a) Diamond crystallizes in the cubic system but graphite crystallizes in the hexagonal system.
(b) Diamond is clear and transparent, but graphite is black and opaque.
(c) Diamond is hardest mineral known but graphite is one of the softest .
(d) Diamond is the good abrasive, but graphite is soft and is a very good lubricant.
(e) Diamond is an excellent electrical insulator, but graphite is a conductor of electricity.
(f) Diamond is an excellent thermal conductor, but some forms of graphite are used for thermal insulation.

Question 18

What are the similarities between graphite and diamond?

Ans.

Both graphite and diamond are forms of carbon. As such, they are said to be allotropes of carbon. Both occur naturally. Both are mined for industrial purposes, though larger diamonds are sought and used for other things. Both are produced in the earth in geothermal processes. Both can be made artificially. Both are normally solids and highly stable. And they are both difficult to burn, even in an oxygen environment.

Question 19

What allotrope of carbon has a three-dimensional solid structure?

Ans.

Diamond has a three dimensional solid structure.

Question 20

Graphite conducts electricity. Explain.

Ans.

Graphite has layers structure. There are weak van der Waalâ€™s forces between the layers. Graphite conducts electricity, due to the presence of delocalized pi bond electrons above and below the planes of the carbon atoms. These electrons are free to move, so are able to conduct electricity.

Question 21

Why diamond is a good abrasive?

Ans.

Diamond has a solid three dimensional structure. Each carbon atom is present at the same distance to each of its neighboring carbon atoms. In this rigid network atoms cannot move. This makes diamond hard. Eventually, diamond is the hardest known natural mineral. This makes it an excellent abrasive and makes it hold polish and luster extremely well. No known naturally occurring substance can cut (or even scratch) a diamond.

Question 22

Why graphite is soft but diamond is hard in nature?

Ans.

Graphite has layers structure. There are weak van der Waal's forces between the layers. So, the layers can slide over one another. Therefore, graphite is soft. In diamond each carbon atom is the same distance to each of its neighboring carbon atoms. In this rigid network atoms cannot move.

Question 23

Which is the most stable allotrope of carbon?

Ans.

Graphite is the most stable allotrope of carbon.

Question 24

What are fullerenes?

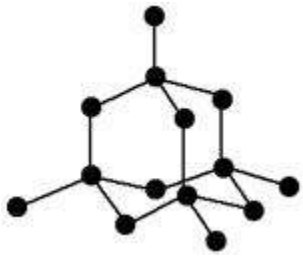
Ans.

The Buckminster fullerenes, or fullerenes or buckyballs, were discovered in 1985.

Question 25

Draw the structure of diamond.

Ans.



Question 26

What are allotropes of carbon?

Ans.

There are many allotropes of carbon, some are:

(a) Amorphous Carbon

(b) Diamond

(c) Graphite

(d) Buckyballs

Question 27

What is an allotrope?

Ans.

An allotrope is a variation of a substance consisting of only one type of atom. It is a new molecular configuration, with different properties.

Question 28

What are the applications of silicon compounds?

Ans.

Applications of Silicon Compound

a. Ferro-silicon and calcium silicate are used as alloying elements in the development of steel or cast iron.

b. Silicon carbide possess a diamond like crystalline structure. Due to its hardness it is used as an abrasive.

c. $CaSiO_3$ is used as a component of cement.

Question 29

What are the common properties of silica?

Ans.

Properties:-

a) It is insoluble in water.

b) It reacts with alkalies to form respective silicates.

$SiO_2 + 2NaOH \rightarrow Na_2Sio3 + H_2O$

c) At high temperatures, it reacts with metal oxides and gives silicates.

$SiO_2 + Na_2O \rightarrow Na_2Sio3$

$SiO_2 + CaO \rightarrow CaSio_3$

d) When silica is heated with carbon in an electric furnace, it is reduced to carborundam, SiC.

$SiO_2 + 3C \rightarrow SiC + 2CO$

e) When heated to 1600°C, silica melts to form quartz glass.

Question 30

Give the use of silica?

Ans.

Uses of silica:

a) Silica is used as a building material. It is used in making of cement, bricks, etc.

b) Bricks made from a mixture of powdered sand, clay and lime are used for lining the furnace used in the manufacture of steel.

c) It is used as an acid flux in metallurgy.

d) Colored crystalline silica are used as gems.

e) Few transparent varieties of quartz are used for the manufacture of lenses, optical instruments.

f) Quartz glass used for making special glassware suitable for working with u.v radiation as quartz is transparent.

Question 31

Discuss any two methods to prepare silica.

Ans.

Silica can be prepared by the following methods:

a) On burning silicon in air or oxygen, it produces silicon dioxide or silica.

$Si + O_2 \rightarrow SiO_2$

b) Silica is formed when the Orthosilicic acid is hydrolysed. The orthosilic acid is formed on hydration of silicon tetrafluoride or tetrachloride.

$3SiF_4 + 4H_2O \rightarrow H_4SiO_4 + 2H_2SiF_6$

$SiCl_4 + 4H_2O \rightarrow H_4SiO_4 + 4HCl$

$H_4SiO_4 \rightarrow SiO_2 + H_2O$

Question 32

What is silica?

Ans.

Silica is the common constituent of earth's crust. It has molecular formula SiO_2.

Silica is found in nature in different forms. It may occur as crystals or in amorphous forms. The examples of the crystalline allotropes of silica are quartz, tridymite, and cristobalite

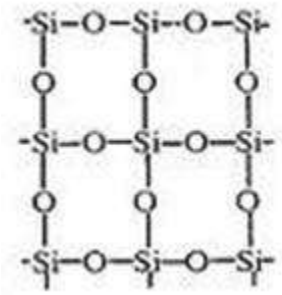
The purest form of silica is quartz. Sand is the crushed form of quartz and sandstone is sand particles with iron oxide bound to them. Certain gems are also crystalline forms of silica.

Question 33

Draw the structure of silica.

Ans.

Structure of Silica



Question 34

Give any two uses of the silicones.

Ans.

Chemically silicones are inert, water repellant, heat resistant and good insulators.

The important uses of silicones are:

1) These are used in making electrical insulations.

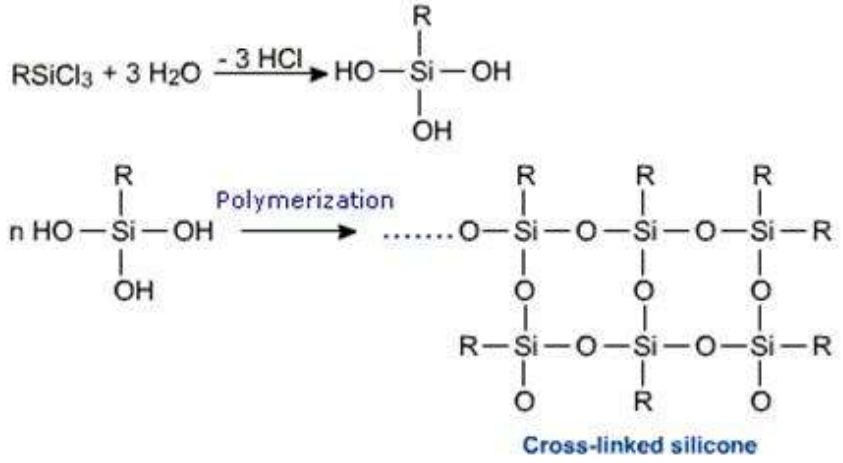
2) These are used in making heat resistant containers.

Question 35

How is the cross linked polymer of the silicones synthesized?

Ans.

The hydrolysis of monotrichloro silanes $RSiCl_3$ gives cross-linked polymers. By regulating the conditions, the condensation can be stopped at any stage and the chains or rings of desired lengths can be obtained.

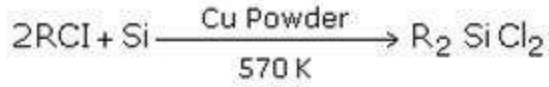


Question 36

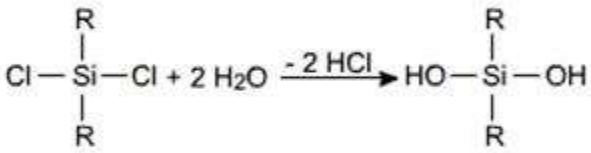
Discuss the methods for preparation of silicones.

Ans.

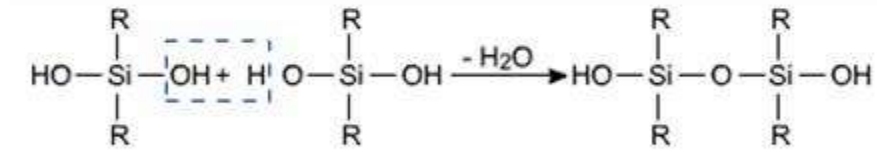
Silicones are prepared through alkyl derivatives chlorosilanes. These derivatives are obtained by reaction of alkyl halides with silicon in the presence of catalyst metallic copper.

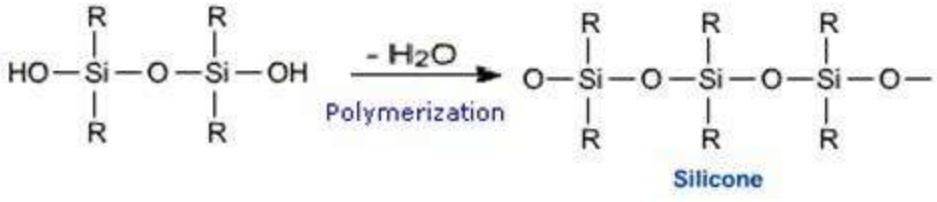


These derivatives are then hydrolyzed to form the respective silicones:



Further reaction leads to the polymeric silicones





Question 37

What are silicones?

Ans.

Silicones are polymeric compounds containing Si-O-Si linkages. These compounds have the general formula $(R_2SiO)_n$ (R may be alkyl or phenyl group). Silicones may be linear cyclic or cross-linked in structure. These have very high thermal stability and are called high temperature polymers.

Question 38

What are the uses of silicon?

Ans.

Silicon is used in the manufacture of electronic devices such as transistors, integrated circuits and computer chips. Silicon is the basic material of most products in the semiconductor industry. It is used as a base material for many sensors and other micro-mechanical systems. Silicon is also the basic component of most solar cells. Silicon is used as fuel in many high-energy explosives.

Question 39

Write a brief note on silicon.

Ans.

Silicon is the most common metalloid. It is represented as Si and have atomic number 14. It is the second most abundant element after oxygen in earth crust.

Pure silicon is used in the semiconductor industry. It is used in photovoltaic and electronic applications.

Question 40

Draw the structure of Graphite.

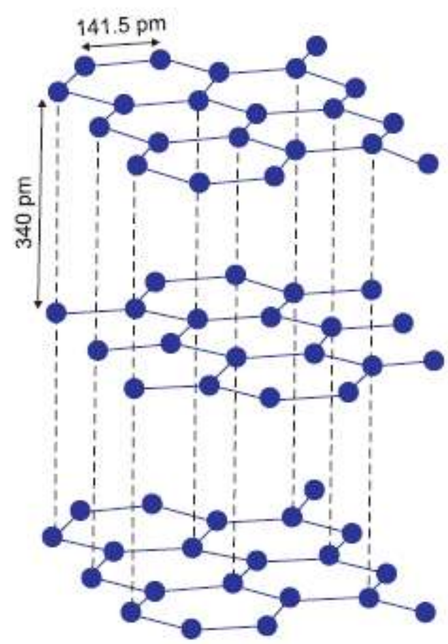


Fig *The structure of graphite*

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