Chemistry Worksheets Class 11 on Chapter 11 The p-Block Elements with Answers- Set 4

Q-1: Which of the following is not a silicone's property?
a) Water repellents
b) Effective electrical conductors
c) Stable towards heat
d) Non-toxic and chemically resistant

Answer: b) Effective electrical conductors
Explanation: Silicones are non-toxic, chemically resistant, good electrical insulators, stable toward heat, and water-repellent.

Q-2: Which of the following is a correct match?
a) C_{60} - Buckminsterfullerene
b) $Na_2B_4O_7.4H_2O$ - Kemite
c) Yellow bead - $Ti(BO_2)_2$
d) All of the above

Answer: d) All of the above
Q-3: Which of the following is the correct term used for the hydrides of boron?
a) Borazole
b) Borazine
c) Boranes
d) Borax

Answer: c) Boranes
Explanation: Hydrides of boron are called boranes. For example, diborane, B_2H_6.

Q-4: White fumes appear around the bottle of anhydrous $AlCl_3$ due to
a) $AlCl_3$ decomposition
b) $AlCl_3$ hydrolysis that releases H_2 gas.
c) $AlCl_3$ hydrolysis that releases Cl_2 gas
d) $AlCl_3$ hydrolysis that releases gaseous HCl

Answer: d) $AlCl_3$ hydrolysis that releases gaseous HCl
Explanation: With the help of ambient moisture, anhydrous aluminium chloride is partially hydrolysed to release HCl gas. Moist HCl has a whitish appearance.

Q-5: The percentage of lead in a lead pencil is
a) Zero
b) 20
c) 30
d) 50
Answer: a) Zero
Explanation: Lead pencils contain graphite mixed with clay or wax but not lead. Hence 0% of lead is present in lead pencils.

Q-6: How photosynthesis helps in the reduction of CO_2 from the atmosphere?
Answer: CO_2 is an acidic, colourless, and odourless gas. It provides food for plants. Through photosynthesis, green plants convert CO_2 from the atmosphere into glucose (carbohydrates).
The reaction for the same is given below:

$$6CO_2 + 6H_2O \xrightarrow[chlorophyll]{h\nu} C_6H_{12}O_6 + 6O_2$$

In this way, photosynthesis helps in the reduction of CO_2 from the atmosphere.

Q-7: Give one method of preparation of $Na_2B_4O_7$.
Answer: Borax ($Na_2B_4O_7$) is a white crystalline solid and can be prepared by boric acid. The reaction for the preparation of it is given below:
$4H_3BO_3 + Na_2CO_3 \rightarrow Na_2B_4O_7 + 6H_2O + CO_2\uparrow$
(Boric acid) (Borax)

Q-8:
a) Give the chemical composition of the glassy bead.
b) Give the colour of the bead produced when glassy beads react with CuO.

Answer:

a) Borax expands and loses water molecules when heated, producing sodium metaborate. This transparent liquid then solidifies into a glassy bead with further heating.

$Na_2B_4O_7.10H_2O \xrightarrow[loop]{Pt} Na_2B_4O_7 + 10H_2O \xrightarrow{\Delta} NaBO_2 + B_2O_3$

$NaBO_2 + B_2O_3$ is the glassy bead.

b) When the glassy bead reacts with CuO, it gives a blue bead. The chemical reaction for the same is given below:

Glassy bead + CuO → $Cu(BO_2)_2$

Blue bead

Q-9: Why do the carbon family members, other than carbon, not create pπ–pπ bonds?
Answer: Because their atomic orbitals are too large and diffuse to overlap properly, heavier members of the carbon family cannot form pπ–pπ bonds.

Q-10: Complete the following reactions.

a) $SiO_2 + 4HF \rightarrow$

b) $C(s) + H_2O(g) \xrightarrow{437-1237\ K}$

c) $2NaBH_4 + I_2 \rightarrow$

d) $4HBO_2 \xrightarrow{160^oC}$

Answer:

a) $SiO_2 + 4HF \rightarrow SiF_4 + 2H_2O$

b) $C(s) + H_2O(g) \xrightarrow{437-1237\ K} CO(g) + H_2(g)$

c) $2NaBH_4 + I_2 \rightarrow B_2H_6 + 2NaI + H_2$

d) $4HBO_2 \xrightarrow{160^oC} H_2B_4O_7 + H_2O$

Q-11: Give reasons for the following.

a) The first ionisation energy increases from Sn to Pb.

b) Diamond is a bad conductor of heat and electricity.

c) Basicity of orthoboric acid is one.

Answer:

a) The first ionisation energy increases from Sn to Pb due to lanthanide contraction and an increase of 32 units of nuclear charge in Pb over Sn.

b) Each carbon atom in a diamond is tetrahedrally bonded to the other four carbon atoms, meaning that all four of the carbon atom's electrons participate in the bonding. Therefore, no free electrons are available for conduction. Hence, a diamond is a poor conductor of heat and electricity.
c) Basicity of orthoboric acid is one because it does not lose $3H^+$ ions but accepts one lone pair of electrons from H_2O.

Q-12: Why does carbon show anomalous behaviour with the rest of the members of the family?
Answer: Carbon shows anomalous behaviour due to its smaller size, higher electronegativity, higher ionisation enthalpy and unavailability of d-orbitals.

Q-13: What might be expected of the oxidising power of the elements when we transition through the period in the p-block?
Answer: The oxidising power of the elements will increase (except the noble gases) because the electron gain enthalpy increases, showing a higher tendency to gain electrons.

Q-14: Are Al's oxidation state and covalency in $[AlCl(H_2O)_5]^{2+}$ the same?
Answer: Let Cl's oxidation state be -1, Al be x, and H_2O be zero. With the help of the oxidation number approach, we have
x+(-1)+5(0) = +2
On solving, x = +3

Al in $[AlCl(H_2O)_5]^{2+}$ has a covalency (highest number of bonds it can form) of 6 and is in the +3 oxidation state. As a result, Al's oxidation state and covalency in $[AlCl(H_2O)_5]^{2+}$ are different.

Q-15: Predict the chemical formulae of the compounds that could be created by the following pairs of elements using the periodic table:
a) Silicon and bromine
b) Sulphur and aluminium

Answer:
a) Silicon is a 14^{th} group element with a valence of 4. Bromine has a valence of 1 and is a member of the 17^{th} group (halogen family). So, $SiBr_4$ would be the formula of the chemical that was created.
b) Aluminium has a valence of 3, placing it in the 13^{th} group. Sulphur has a valence of 2 and is a member of the 16^{th} group (chalcogen family). As a result, Al_2S_3 would be the compound's formula.

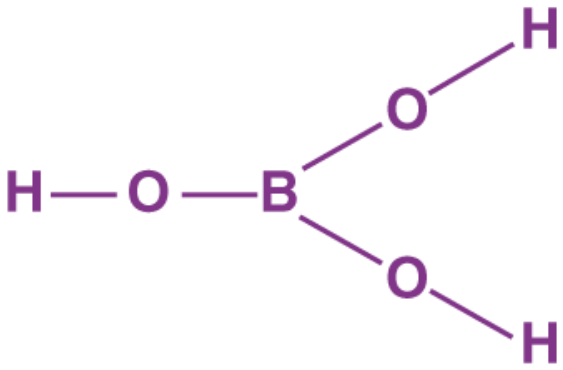
Q-16: Why does boron not form B^{3+} ions?
Answer: Boron's valence shell has three electrons. The boron does not completely lose all of its valence electrons to produce B^{3+} ions due to its tiny size and the large sum of the first three ionisation enthalpies.

Q-17: Diamond is covalent yet has a high melting point. Why?

Answer: Diamond has a three-dimensional network structure involving strong C-C bonds. Hence, diamond has a high melting point despite its covalent nature.

Q-18:
a) Give the structure of orthoboric acid and give its few physical properties.
b) Give the reaction of orthoboric acid with water.

Answer:
a) The structure of orthoboric acid is given below:



Its physical properties are:

- It is white in colour.
- It is soft.
- It has needle-like crystals having a soapy touch.

b) The reaction of orthoboric acid with water is given below:

Q-19: The first ionisation enthalpy (Δ_iH) values of the third-period elements Na, Mg and Si are respectively 496, 737 and 786 kJ/mol. Predict whether the first Δ_iH value for Al will be closer to 575 or 760 kJ/mol. Justify your answer.

Answer: It will be closer to 575 kJ/mol. The value of Al ($1s^2 2s^2 2p^6 3s^2 3p^1$) should be lower than that of Mg ($1s^2 2s^2 2p^6 3s^2$) because 3p-electrons in Al are effectively shielded by the electrons from the nucleus by 3s-electrons.

Q-20: When calcium is burned with nitrogen, it creates a white powder that, when combined with enough water, dissolves to create a gas called X and an alkaline solution. A thin layer of solid (Y) is formed on the solution's surface after exposure to air. Determine the substances (X) and (Y).

Answer: $3Ca + N_2 \xrightarrow{\Delta} Ca_3N_2$

(Calcium nitride)

(White powder)

$Ca_3N_2 + 6H_2O \rightarrow 3Ca(OH)_2 + 2NH_3$

(alkaline solution) (X)

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3\downarrow + H_2O$

(from air) (calcium carbonate)

(Y)