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Jars Education

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Time : 1 Hour 15 Minute

STD 11 Science Chemistry
Chapter Based Test

Total Marks : 40

SECTION A

* **Choose The Right Answer From The Given Options.[1 Marks Each]** **[5]**

1. Which metal powder suspended in oil is used as a paint for mirrors?
   (A) Fe (B) Sn (C) Ag (D) Al
2. Which of the following statements is incorrect?
   (A) Aluminium is a bright silvery-white metal.
   (B) Aluminium forms alloys with Cu, Mn, Mg, Si and Zn.
   (C) The use of aluminium and its compounds for domestic purposes is now increased considerably.
   (D) Both (a) and (b).
3. The most commonly used reducing agent is:
   (A) $AlCl_3$. (B) $PbCl_2$. (C) $SnCl_4$. (D) $SnCl_2$.
4. Elements of group 14 used in semiconductors are:
   (A) C, Si, Ge (B) Si, Ge, Sn
   (C) Si, Ge (D) B, Si, Ge
5. Which of the following statements are correct?
   (A) Fullerenes have dangling bonds.
   (B) Fullerenes are cage-like molecules.
   (C) Graphite is thermodynamically most stable allotrope of carbon.
   (D) Graphite is slippery and hard and therefore used as a dry lubricant in machines.

* **Answer The Following Questions In One Sentence.[1 Marks Each]** **[6]**

6. Give reasons:
   Aluminium wire is used to make transmission cables.
7. Which of the following is acidic and why?
   SiO_2, $Al2O_3$, PbO_2, SnO_2
8. a. Why is electron gain enthalpy of group 15 less than group 16?
   b. Nitric oxide becomes brown when released in air, why?
9. Mention the basic unit of all silicates.
10. What is inert pair effect?
11. Among tri halides of nitrogen which one is least basic and why?

SECTION B

* **Given Section consists of questions of 2 marks each.** [6]

1. Is boric acid a protic acid? Explain.
2. i. Of Bi(V) and Sb(V) which may be a stronger oxidising agent and why?
   ii. Complete the following chemical equation:

   $$Ca_3P_2 + H_2O \longrightarrow$$
3. Mention the chief reason for the anomalous behavior of boron in Group 13 of the periodic table.

SECTION C

* **Given Section consists of questions of 3 marks each.** [9]

1. a. What is used of $^{10}_{5}B$ in nuclear reactor?
   b. Name the elements with atomic number 113 and 114.
   c. Name the element having lowest melting point in group 14.
   d. Why is NH_3 liquid whereas CH_4 gas?
   e. Why does carbon form large number of compounds?
2. Describe the general trends in the following properties of the elements in Groups 13 and 14.
   Atomic size.
3. In some of the reactions thallium resembles aluminium, whereas in others it resembles with group I metals. Support this statement by giving some evidences.

SECTION D

* **Case study based questions** [4]

1. Read the passage given below and answer the following questions from 1 to 5.

   Oxidation state and trends in chemical Reactivity Due to small size of boron, the sum of its first Three ionization enthalpies is very high. This Prevents it to form +3 ions and forces it to form Only covalent compounds. But as we move from B to Al, the sum of the first three ionisation Enthalpies of Al considerably decreases, and Is therefore able to form Al^{3+} ions. In fact, Aluminium is a highly electropositive metal. However, down the group, due to poor Shielding effect of intervening d and f orbitals, The increased effective nuclear charge holds ns Electrons tightly (responsible for inert pair Effect) and thereby, restricting their Participation in bonding. As a result of this, Only p-orbital electron may be involved in Bonding. In fact in Ga, In and Tl, both +1 and +3 oxidation states are observed. The relative Stability of +1 oxidation state progressively Increases for heavier elements: A l< Ga < In< Tl. In Thallium +1 oxidation state is predominant whereas the +3 oxidation state is highly Oxidising in character. The compounds in +1 oxidation state, as expected from energy Considerations, are more ionic than those in +3 oxidation state.

   Important trends and anomalous properties of boron – certain important trends can be observed in the chemical behaviour of group 13 elements. The tri-chlorides, bromides and iodides of all these elements being covalent in nature are hydrolysed in water. Species like tetrahedral $[M(OH)_4]^-$ and octahedral $[M(H_2O)6]^{3+}$, except in boron, exist in aqueous medium. The monomeric trihalides, being electron deficient, are strong Lewis acids. Boron trifluoride easily reacts with Lewis bases such as NH_3 to complete octet around boron. It is due to the absence of d orbitals that the maximum covalence of B is

4. Since the d orbitals are available with Al and other elements, the maximum covalence can be expected beyond 4. Most of the other metal halides (e.g., $AlCl_3$) are dimerised through halogen bridging (e.g., $Al2Cl_6$). The metal species completes its octet by accepting electrons from halogen in these halogen bridged molecules.

i) Reactivity towards air Boron is unreactive in crystalline form. Aluminium forms a very thin oxide layer on The surface which protects the metal from Further attack. Amorphous boron and Aluminium metal on heating in air form B_2O_3 And Al_2O_3 respectively. With dinitrogen at high Temperature they form nitrides. The nature of these oxides varies down the Group. Boron trioxide is acidic and reacts with Basic (metallic) oxides forming metal borates. Aluminium and gallium oxides are amphoteric And those of indium and thallium are basic in Their properties.

ii) Reactivity towards acids and alkalies Boron does not react with acids and alkalies Even at moderate temperature; but aluminium Dissolves in mineral acids and aqueous alkalies And thus shows amphoteric character. Aluminium dissolves in dilute HCl and Liberates dihydrogen.

$2Al(s) + 6HCl\ (aq) \rightarrow 2Al_3^{+}\ (aq) + 6Cl^{-}\ (aq) + 3H_2\ (g)$

However, concentrated nitric acid renders Aluminium passive by forming a protective Oxide layer on the surface. Aluminium also reacts with aqueous alkali And liberates dihydrogen.

$2Al\ (s) + 2NaOH(aq) + 6H_2O(l) \rightarrow 2\ Na+ [Al(OH)_4]^{-}\ (aq) + 3H_2\ (g)$

Sodium Tetrahydroxoaluminate(III).

iii) Reactivity towards halogens These elements react with halogens to form Trihalides (except TlI3). $2E(s) + 3\ X_2\ (g) \rightarrow 2EX_3\ (s)$ (X = F, Cl, Br, I)

Borax- It is the most important compound of boron. It is a white crystalline solid of formula $Na_2B_4O_7{\cdot}10H_2O$. In fact it contains the Tetranuclear units and correct Formula; therefore, is Na2 [B4O5 (OH) 4].8H2O. Borax dissolves in water to give an alkaline Solution.

$Na_2B_4O7 + 7H_2O \rightarrow 2NaOH + 4H_3BO_3$

On heating, borax first loses water Molecules and swells up. On further heating it Turns into a transparent liquid, which solidifies Into glass like material known as borax Bead.

$Na_2B_4O_7.10H_2O \rightarrow Na^2B_4O_7 \rightarrow 2NaBO_2 + B2O_3$

Metaborate Boric Anhydride The metaborates of many transition metals Have characteristic colours and, therefore, Borax bead test can be used to identify them In the laboratory. For example, when borax is Heated in a Bunsen burner flame with CoO on A loop of platinum wire, a blue coloured Co(BO2) 2 bead is formed.

Orthoboric acid, H_3BO_3 is a white crystalline Solid, with soapy touch. It is sparingly soluble In water but highly soluble in hot water. It can Be prepared by acidifying an aqueous solution Of borax.

$Na_2B_4O_7 + 2HCl + 5H_2O \rightarrow 2NaCl + 4B(OH)_3$

It is also formed by the hydrolysis (reaction With water or dilute acid) of most boron Compounds (halides, hydrides, etc.). It has a layer structure in which planar BO_3 units are Joined by hydrogen.

i. Boron is … in crystalline form.
   a. unreactive
   b. highly reactive
   c. less reactive
   d. only (a) or (c)

ii. Orthoboric acid is …
   a. Amorphous
   b. Crystalline

c. Polyamorphous
d. None of above

iii. Aluminium and gallium oxides are ... in their properties.
a. acidic
b. Basic
c. amphoteric
d. None of above

iv. Indium and thallium are ... in their properties.
a. acidic
b. Alkali
c. amphoteric
d. basic

v. Aluminium is a highly ... metal.
a. electronegative
b. Neutral
c. electropositive
d. None of above

SECTION E

*** Given Section consists of questions of 5 marks each.** **[10]**

1. When a mixture of ammonium chloride and potassium dichromate was heated, a stable colourless gas ‘A’ is evolved which did not support combustion, but Mg continued burning in it. The gas reacted with CaC_2 in electric furnace forming a solid 'B'. Which was slowly hydrolysed by water forming a insoluble substance 'C' and a solution of substance 'D' which turns red litmus blue and gives white fumes with conc HCl to form ‘E'. Identify A to E and write chemical reactions involved.

2. **Direction:** Match Column I with Column II.

S. No.	Column I	S. No.	Column II
(a)	Diborane	(i)	Used as a flux for soldering metals
(b)	Galluim	(ii)	Crystalline form of silica
(c)	Borax	(iii)	Banana bonds
(d)	Aluminosilicate	(iv)	Low melting, high boiling, useful for measuring high temperatures
(e)	Quartz	(v)	Used as catalyst in petrochemical industries

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