QB365

Important Questions - The p-block Elements

11th Standard CBSE

Chemistry Reg.No. : | | | | | | |

Time : 01:00:00 Hrs

Total Marks : 50

1) What is inert pair effect? **1**

2) What type of hybridisation of central atom is possible in $\left[GeCl_6\right]^{2-}$? **1**

3) Why the elements of the second row(first short period) show a number of difference in properties from other members of their respective families? **1**

4) AlF_3 is high melting solid but $AlCl_3$ is low melting Explain. **1**

5) Select the members of group 14 that **1**
i)forms the most acidic dioxide

6) Which allotrope of carbon is used as moderator in atomic reactors? **1**

7) What are the basic units of the larger structure of orthoboric acid? How are they bonded? **1**

8) Silicones are used for making waterproof fabrics. Give reason. **1**

9) Discuss the pattern of variation in the oxidation states of B to TI **1**

10) How does electron deficient compound BF_3 achieve electronic saturation , i.e fully ooccupied outer electron shells? **1**

11) When aqueous solution of borax is acidified with hydrochloric acid, a white crystalline solid is formed which is soapy to touch. Is this solid acidic or basic in nature? Explain. **2**

12) Give one chemical reaction to show that **2**
Tin(II) is a reducing agent whereas lead(II) is not

13) Give one chemical reaction to show that **2**
Tin(II) chloride is a reducing agent.

14) In some of the reactions, thallium resembles aluminium, whereas in others it resembles with group I metals. Support this statement by giving some evidences. **2**

15) Explain the following. **2**
Gallium has higher ionisation enthalpy than aluminium.

16) Explain the following. **2**
Aluminium forms $[AlF_6]^{3-}$ ion but boron does not form $[BF_6]^{3-}$ion.

17) Explain Silicon dioxide is treated with hydrogen fluoride. **2**

18) Explain CO is heated with ZnO **2**

19) Write balanced equation for **2**

$H_3BO_3 \xrightarrow{\Delta}$

20) Out of $PbCl_2, SnCl_2, SnCl_4$ and $PbCl_4$ which one is most commonly used as a reducing agent and why? **2**

21) Name the building block of zeolites. Why zeolites have high porosity? **5**

22) Explain the following **5**

a)PbX_2 is more stable than PbX_4

23) How is lithium aluminum hydride ($LiAlH_4$) prepared? what is its important use? **5**

24) What are the allotropes?Sketch the structure of two allotropes of carbon namely diamond and graphite.What is the impact of structure on physical properties of two allotropes? **5**

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1) **1**

In the elements of 4th, 5th and 6th period of the p-block the electrons present in the intervening d and f-orbitals do not shield the s-electrons of the valence shell effectively.As a result, ns^{-2}-electrons remain more tightly held by the nucles and hence, do not participate in bonding,. this is called **inert pair effect.**

2) **1**

3) **1**

The difference in he properties of the first member of a group from those of the other members are due to (i)this smaller size of the atom(ii)presence of one inner shell of only two electrons and (iii)absence of d-orbitals.

4) **1**

AlF_3 is high melting solid because it is ionic in nature.On the other hand, $AlCl_3$ is covalent in nature and hence is a low melting solid.

5) **1**

6) Graphite **1**

7) **1**

8) **1**

Silicones are synthetic polymers containing repeated units of R_2SiO where R is alkyl group Therefore, these are water repellants i.e. do not absorb water and are used for making waterproof fabrics.

9) **1**

Element	B	Al	Ga	In	Tl
Oxidation state	+3	+3	+3,+1	+3,+1	+1

Boron and aliminium show an oxidation state of +3 only because they do not exhibit insert pair effect due to the absence of d or f-electrons.Elements from Ga to Tl show two oxidation states, i.e +1 and +3.The tendency to show +1 oxidation state increases down the group due to the inability of ns^2 electrons of valence shell to participate in bonding which is called inert pair effect.Therefore Tl^+ is more stable than Tl^{3+}

10) **1**

BF_3 achieve it by the following ways

(i)Multiple bonding or $p\pi - p\pi$ back bonding e.g BF_3 in which a lone pair of electron present in 2p-orbits of one of the fluorine atoms may be transferred to the vacant p-orbital on the bottom atom.

(ii)Formation of complexes in which electrons are received from a donor molecule,e.g $F_3B \longleftarrow NH_3$ .Boron compounds, thus behave as Lewis acids.

11) **2**

When an aqueous solution of borax is acidified with HCl, boric acid is formed.

$Na_2B4_{Borax}O_7 + 2HCl + 5H_2O \rightarrow 2NaCl + 4H_3BO_{3Boric\ \ acid}$

Boric acid is a white crystalline solid. It is soapy to touch because of its planar layered structure. Boric acid is a weak monobasic acid. It is not a protonic acid but acts as a Lewis acid by accepting electrons from a hydroxyl ion.

$B(OH)_3 + 2HOH \rightarrow [B(OH)_4]^- + H_3O^+$

12) **2**

Both tin and lead show two oxidation states of +2 nd +4 due to inert pair effect.But the inert pair effect is more prominent in case of Pb than in Sn.In other words,+2 oxidation state of Sn is less stable than its +4 oxidation state.Therefore,Sn(II) acts as a reducing agent and gets converted into two or more stable Sn(IV) by losing two electrons.e.g it reduces Fe^{3+} to Fe^{2+} ions.

$2Fe^{3+}+Sn^{2+} \longrightarrow 2Fe^{2+}+Sn^{4+}$

In contrast,+2 oxidation state of Pb is more stable than its +4 oxidation state.In other words,Pb(II) does not lose electrons easily and hence does not act as a reducing agent.

[1]

13) **2**

Being a reducing agent, tin(II) chloride reduces mercuric chloride ($HgCl_2$) to mercurous chloride ($HgCl_2$) and ferric salts to ferrous salts.

$SnCl_2+2HgCl_2 \longrightarrow SnCl_4+Hg_2Cl_2$

$SnCl_2+2FeCl_3 \longrightarrow SnCl_4+2FeCl_2$ [1]

14) **2**

Thallium and aluminium both the elements belong to group 13. Their general electronic configurations for the valence shell is ns^2np^1 . Aluminium shows only +3 oxidation state. Like Al, thallium also shows +3 oxidation state in some compounds like Tl_2O_3, $TlCl_3$, etc. Like aluminium, thallium also forms octahedral ions like $[AlF_6]^{3-}$ and $[TlF_6]^{3-}$. Like group-I alkali metals, thallium shows +1 oxidation state due to inert pair effect in some compounds like TlCl, Tl_2O etc., like alkali metal hydroxides, TiOH is water soluble and its aqueous solution is strongly alkaline. Tl_2SO_4 also forms alums like alkali metal sulphates. Tl_2CO_3 is soluble in water like alkali metal carbonates.

15) **2**

In gallium due to poor shielding of valence electrons by the interventing 3d-electrons, the nuclear charge becomes effective, thus, atomic radius decreases and hence, the ionisation enthalpy of gallium is higher than that of aluminium.

16) **2**

Aluminium form $[AlF_6]^{3-}$ ion because of the presence of vacant d-orbitals due to which it can expand its coordination number from 4 to 6. In this complex Al undergoes sp^3d^2 hybridisation. On the other hand, boron does not form $[BF_6]^{3-}$ ion, because of the unavailability of d-orbitals as it cannot expand its coordination number beyond four. Hence, it can form $[BF_4]^-$ ion (boron in) $[BF_4]^-$ ion is sp^3 hybridised).

17) **2**

When SiO_2 reacts with HF,silicon tetrafluoride is formed which dissolves in HF to from hydrofluorosilicic acid.

$SiO_2+4HF \longrightarrow SiF_4+2H_2O$

$SiF_4+2HF \longrightarrow H_2SiF_6$ [1]

18) **2**

CO is strong reducing agent but it cannot reduce ZnO, and get converted into $CO_2\Delta_rG^0$ for conversion is always higher than that of formation of ZnO.Thus, no reaction takes place. [1]

19) **2**

$$H_3BO_3 \xrightarrow[\Delta]{370K} HBO_2 + H_2O$$

orthoboric acid Metaboric acid

$$4HBO_2 \xrightarrow[\Delta]{-H_2O} H_2B_4O_7 \xrightarrow{\Delta} 2B_2O_3 + H_2O$$

Metaboric acid Tetraboric acid Boron trioxide

20) **2**

Sn^{4+} is more stable than Sn^{2+} thus Sn^{2+} have a great tendency to get converted into Sn^{4+} by losing two electrons hence, from the given compounds $SnCl_2$ is used as reducing agent.

21) **5**

The building block of zeolites is sodalite cage. The high porosity of zeolites is because of the sodalite cage packing in a three dimensional network of channels and cavities.

22) **5**

Due to inert pair effect, Pb in +2 oxidation state is more stable than in +4 oxidation state hence PbX_2 is more stable than PbX_4

23) Lithium aluminum hydride is obtained by reacting $AlCl_3$ with LiH in the presence of dry ether. **5**

$$4LiH + AlCl_3 \longrightarrow LiAlH_4 + 3LiCl$$

Uses Lithium aluminum hydride is used as good reducing agents in many organic syntheses.

24) **5**

The phenomenon of existence of an element in two or more forms which differ in physical properties but have almost same chemical nature is known as allotropy and the different forms of the element are known as allotropes.