

## Chapter 6

## General Principles and Processes of Isolation of Elements

## Solutions

## SECTION - A

## Objective Type Questions

**(Occurrence of metals and thermodynamical principles of metallurgy)**

1. A substance which reacts with gangue to form fusible material is called  
 (1) Flux (2) Catalyst (3) Ore (4) Slag

**Sol.** Answer (1)Flux is a substance used to react with impurities to form fusible substance. For example, SiO<sub>2</sub>, CaO etc.

2. Cyanide process is used for the extraction of  
 (1) Au (2) Cu (3) Zn (4) Fe

**Sol.** Answer (1)

Cyanide process is used for the extraction of Au and Ag



3. Calcination is the process in which  
 (1) Heating the ore in presence of air (2) Heating the ore in absence of air  
 (3) Heating in vacuum (4) Heating of ore in presence of N<sub>2</sub>

**Sol.** Answer (2)

Calcination process is heating of hydrated oxides, carbonate to convert them into oxides, in the absence of oxygen



4. Which of the following is not a concentration technique?  
 (1) Levigation (2) Froth-flotation (3) Leaching (4) Calcination

**Sol.** Answer (4)

Calcination is not a method of concentration of ore. It is used for the conversion of carbonate, hydroxides, hydrated oxides into corresponding oxide.

5. The ores that are concentrated by Froth flotation method are  
 (1) Carbonate (2) Sulphides (3) Oxides (4) Phosphates

**Sol.** Answer (2)

Froth flotation process is used for the concentration of sulphide ores.

6. In blast furnace, iron oxide is reduced by  
 (1) Silica (2) CO (3) H<sub>2</sub>S (4) Lime stone

**Sol.** Answer (2)

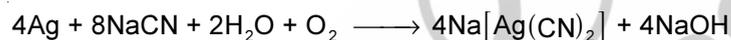
In blast furnace iron oxide is reduced by carbon monoxide



7. The silver complex formed during cyanide process is  
 (1) Na<sub>2</sub>[Ag(CN)] (2) Na[AgCN] (3) Na<sub>2</sub>[Ag(CN)<sub>2</sub>] (4) Na[Ag(CN)<sub>2</sub>]

**Sol.** Answer (4)

During cyanide process Na[Ag(CN)<sub>2</sub>] is formed



8. Zincite and calamine respectively are  
 (1) Oxide and carbonate ore of Zn (2) Carbonate and oxide ore of Zn  
 (3) Oxide and sulphate ore of Zn (4) Sulphate and sulphite ore of Zn

**Sol.** Answer (1)

Zincite  $\longrightarrow$  ZnO (zinc Oxide)

Calamine  $\longrightarrow$  ZnCO<sub>3</sub> (zinc Carbonate)

9. Which of the following is chalcopryrite?  
 (1) CuFeS<sub>2</sub> (2) FeS<sub>2</sub> (3) KMgCl<sub>3</sub>·6H<sub>2</sub>O (4) Al<sub>2</sub>O<sub>3</sub>·2H<sub>2</sub>O

**Sol.** Answer (1)

CuFeS<sub>2</sub> is called chalcopryrites. Also known as copper pyrites and Fool's gold.

10. The alloy used in dental filling contains  
 (1) Ag and Sn (2) Ag and Sb (3) Hg, Ag and Sn (4) Hg, Ag and Sb

**Sol.** Answer (3)

In dental filling, the alloy used consist of (50%) Hg, Ag (22.23%) and Sn (~ 14%).

11. What is the slag formed from P<sub>2</sub>O<sub>5</sub> impurity in metallurgy of iron?  
 (1) Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> (2) CaSiO<sub>3</sub> (3) Fe<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> (4) FeSiO<sub>3</sub>

**Sol.** Answer (1)

In the metallurgy of iron, slag formed  $P_2O_5$  is  $Ca_3(PO_4)_2$



12. Which of the following oxide is thermally least stable?

- (1)  $CaO$                                       (2)  $Al_2O_3$                                       (3)  $Fe_2O_3$                                       (4)  $Ag_2O$

**Sol.** Answer (4)

Due to small size of  $Ag^{2+}$ , it has very small size. This small size of  $Ag^{2+}$  gives  $Ag_2O$  more covalent character than  $CaO$ ,  $Al_2O_3$  and  $Fe_2O_3$ . Since covalent oxides are thermally stable than ionic oxides,  $Ag_2O$  is thermally least stable.

13. Thomas slag is

- (1) Calcium silicate                              (2) Anode mud                                      (3)  $FeSiO_3$                                       (4) Calcium phosphate

**Sol.** Answer (4)

Thomas slag is  $Ca_3(PO_4)_2$ , a by-product of steel industry.

**(Electrochemical principles of metallurgy)**

14. Which of the following metal can be extracted without using reducing agent?

- (1) Sn                                      (2) Pb                                      (3) Fe                                      (4) Both (1) & (2)

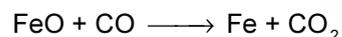
**Sol.** Answer (2)

Oxides of less reactive metals like Pb can undergo auto reduction and the metal can be extracted without using reducing agent.

15. Which of the following metal is extracted by using coke and carbon monoxide as reducing agent?

- (1) Na                                      (2) Cu                                      (3) Fe                                      (4) Al

**Sol.** Answer (3)



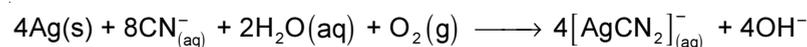
Fe can be extracted by using coke and carbon monoxide.

16. Which of the following metal is extracted by the use of cyanide solution?

- (1) Pb                                      (2) Zn                                      (3) Mn                                      (4) Ag

**Sol.** Answer (4)

Ag can be extracted by using solution of cyanide ion



17. Electrolytic reduction method is used for extraction of

- (1) Highly electronegative elements                                      (2) Transition metals  
(3) Highly electropositive elements                                      (4) Metalloids

**Sol.** Answer (3)

Electrolytic reduction method is used for extraction of highly electropositive elements because they are highly reactive and very difficult to extract from other processes.

18. Which of the following metals cannot be extracted by carbon reduction process?

- (1) Pb                                      (2) Al                                      (3) Hg                                      (4) Zn

**Sol.** Answer (2)

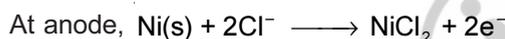
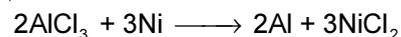
Aluminium cannot be extracted by carbon reduction process because reduction of oxides of aluminium with carbon requires a very high temperature of about 2000°C as shown in Ellingham diagram.

19. What will happen, if anode is made of nickel instead of graphite in the extraction of aluminium from  $\text{AlCl}_3$ ?

- (1) Nickel will be affected by high temperature                      (2) Nickel will combine with  $\text{Cl}_2$   
(3) Nickel is insulator    (4) All of these

**Sol.** Answer (2)

Nickel combines with  $\text{Cl}_2$



20. When molten  $\text{NaCl}$  is electrolysed by using inert electrode, the product obtained at cathode is

- (1) Na                                      (2)  $\text{Cl}_2$                                       (3)  $\text{H}_2$                                       (4) Na-Hg amalgam

**Sol.** Answer (1)

When molten  $\text{NaCl}$  is used in electrolysis, the product obtained at cathode is sodium (Na)

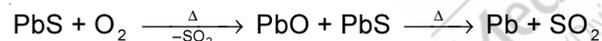


21. Which of the following give respective metal by self reduction?

- (1) Galena  $\text{PbS}$                                       (2)  $\text{HgS}$                                       (3)  $\text{ZnS}$                                       (4) Both (1) & (2)

**Sol.** Answer (4)

Both  $\text{PbS}$  and  $\text{HgS}$  on roasting undergo auto reduction to give respective metal



22. Which of the following statement is incorrect?

- (1)  $\text{Al}_2\text{O}_3$  cannot be reduced into Al by  $\text{Cr}_2\text{O}_3$                       (2) Ca is stronger reducing agent than Mg  
(3) At 673 K, CO is poor reducing agent than carbon                      (4) All of these

**Sol.** Answer (3)

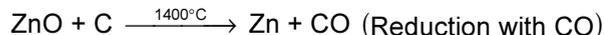
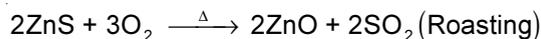
At higher temperature  $\text{Al}_2\text{O}_3$  can be reduced by Cr.

23. By which process zinc is extracted from zinc blende?

- (1) Electrolytic reduction    (2) Roasting followed by reduction with carbon  
(3) Calcination followed by reduction with carbon                      (4) Roasting followed by self reduction

Sol. Answer (2)

Roasting followed by reduction with carbon



**(Refining)**

24. Which of the following is not a refining process?

- (1) Mond's process      (2) Van-Arkel process      (3) Poling      (4) Leaching

Sol. Answer (4)

Leaching is a method of extraction of metal. Mond's process, Van-Arkel process and poling are used for refining of metals.

25. From gold amalgam, gold may be recovered by

- (1) Distillation      (2) Oxidation  
(3) Electrolytic refining      (4) Dissolving in  $\text{HNO}_3$

Sol. Answer (1)

From gold amalgam, gold may be recovered by distillation process since Hg is as metal with low BP, it will boil first and will separate out from gold.

## SECTION - B

### Previous Years Questions

1. Which one is malachite from the following?

[NEET-2019]

- (1)  $\text{CuFeS}_2$       (2)  $\text{Cu(OH)}_2$       (3)  $\text{Fe}_3\text{O}_4$       (4)  $\text{CuCO}_3 \cdot \text{Cu(OH)}_2$

Sol. Answer (4)

Malachite :  $\text{CuCO}_3 \cdot \text{Cu(OH)}_2$  (Green colour)

2. Considering Ellingham diagram, which of the following metals can be used to reduce alumina? [NEET-2018]

- (1) Fe      (2) Zn      (3) Cu      (4) Mg

Sol. Answer (4)

The metal which is more reactive than 'Al' can reduce alumina i.e. 'Mg' should be the correct option.

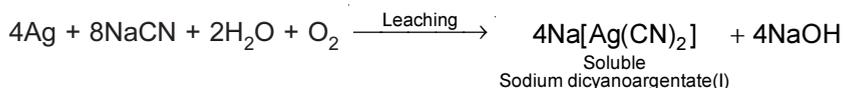
3. Extraction of gold and silver involves leaching with  $\text{CN}^-$  ion. Silver is later recovered by [NEET-2017]

- (1) Liquefaction      (2) Distillation  
(3) Zone refining      (4) Displacement with Zn

Sol. Answer (4)

Zn being more reactive than Ag and Au, displaces them.

From Native ore,



4. Match items of **Column I** with the items of **Column II** and assign the correct option:

[NEET-2016]

Column I		Column II	
(a)	Cyanide process	(i)	Ultrapure Ge
(b)	Froth floatation process	(ii)	Dressing of ZnS
(c)	Electrolytic reduction	(iii)	Extraction of Al
(d)	Zone refining	(iv)	Extraction of Au
		(v)	Purification of Ni

- (1) a(iii), b(iv), c(v), d(i)      (2) a(iv), b(ii), c(iii), d(i)      (3) a(ii), b(iii), c(i), d(v)      (4) a(i), b(ii), c(iii), d(iv)

**Sol.** Answer (2)5. Aluminium is extracted from alumina ( $\text{Al}_2\text{O}_3$ ) by electrolysis of a molten mixture of [AIPMT (Prelims)-2012]

- (1)  $\text{Al}_2\text{O}_3 + \text{Na}_3\text{AlF}_6 + \text{CaF}_2$       (2)  $\text{Al}_2\text{O}_3 + \text{KF} + \text{Na}_3\text{AlF}_6$   
 (3)  $\text{Al}_2\text{O}_3 + \text{HF} + \text{NaAlF}_4$       (4)  $\text{Al}_2\text{O}_3 + \text{CaF}_2 + \text{NaAlF}_4$

**Sol.** Answer (1)

During extraction of aluminium by electrolysis, a molten mixture of  $\text{Al}_2\text{O}_3$ ,  $\text{Na}_3\text{AlF}_6$ ,  $\text{CaF}_2$  is used.  $\text{CaF}_2$  is used as flux and  $\text{Na}_3\text{AlF}_6$  is the main electrolyte.

The overall reaction is  $2\text{Al}_2\text{O}_3 + 3\text{C} \longrightarrow 4\text{Al} + 3\text{CO}_2$

6. In the extraction of copper from its sulphide ore, the metal is finally obtained by the reduction of cuprous oxide with

[AIPMT (Prelims)-2012]

- (1) Iron sulphide ( $\text{FeS}$ )      (2) Carbon monoxide ( $\text{CO}$ )  
 (3) Copper (I) sulphide ( $\text{Cu}_2\text{S}$ )      (4) Sulphur dioxide ( $\text{SO}_2$ )

**Sol.** Answer (3)

In the final step of extraction of copper,  $\text{Cu}_2\text{O}$  is reduced with the help of  $\text{Cu}_2\text{S}$ .



7. Identify the alloy containing a non-metal as a constituent in it

[AIPMT (Prelims)-2012]

- (1) Bell metal      (2) Bronze      (3) Invar      (4) Steel

**Sol.** Answer (4)

8. Which one of the following is a mineral of iron ?

[AIPMT (Prelims)-2012]

- (1) Pyrolusite      (2) Magnetite      (3) Malachite      (4) Cassiterite

**Sol.** Answer (2)

Magnetite ( $\text{Fe}_3\text{O}_4$ ) is a mineral of iron.

9. Which of the following pairs of metals is purified by Van Arkel method?

[AIPMT (Prelims)-2011]

- (1) Ni and Fe      (2) Ga and In      (3) Zr and Ti      (4) Ag and Au

**Sol.** Answer (3)

Van Arkel method is used to collect ultra pure titanium and zirconium by using  $\text{I}_2$  as specific reagent.

10. Which of the following elements is present as the impurity to the maximum extent in the pig iron?

[AIPMT (Prelims)-2011]

- (1) Phosphorus                      (2) Manganese                      (3) Carbon                      (4) Silicon

**Sol.** Answer (3)

Carbon is the major impurity in the pig iron. Pig iron contains about 4% carbon.

11. The following reactions take place in the blast furnace in the preparation of impure iron. Identify the reaction pertaining to the formation of the slag [AIPMT (Mains)-2011]

- (1)  $\text{CaO(s)} + \text{SiO}_2\text{(s)} \rightarrow \text{CaSiO}_3\text{(s)}$                       (2)  $2\text{C(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{CO(g)}$   
 (3)  $\text{Fe}_2\text{O}_3\text{(s)} + 3\text{CO(g)} \rightarrow 2\text{Fe(l)} + 3\text{CO}_2\text{(g)}$                       (4)  $\text{CaCO}_3\text{(s)} \rightarrow \text{CaO(s)} + \text{CO}_2\text{(g)}$

**Sol.** Answer (1)

In the blast furnace during the extraction of iron  $\text{SiO}_2$  is present as impurity and  $\text{CaO}$  is used as flux to remove  $\text{SiO}_2$  in the form of  $\text{CaSiO}_3$  (slag).

12. Match List-I (substances) with List-II (process) employed in the manufacture of the substances and select the correct option

**List - I (Substances)**

- a. Sulphuric acid  
 b. Steel  
 c. Sodium hydroxide  
 d. Ammonia

**List - II (Processes)**

- (i) Haber's process  
 (ii) Bessemer's process  
 (iii) Leblanc process  
 (iv) Contact process

- (1) a(i), b(iv), c(ii), d(iii)      (2) a(i), b(ii), c(iii), d(iv)      (3) a(iv), b(iii), c(ii), d(i)      (4) a(iv), b(ii), c(iii), d(i)

[AIPMT (Mains)-2010]

**Sol.** Answer (4)

13. Which of the following statements, about the advantage of roasting sulphide ore before reduction is not true?

[AIPMT (Prelims)-2007]

- (1) Roasting of the sulphide to the oxide is thermodynamically feasible  
 (2) Carbon and hydrogen are suitable reducing agents for metal sulphides  
 (3) The  $\Delta_f G^\circ$  of the sulphide is greater than those for  $\text{CS}_2$  and  $\text{H}_2\text{S}$   
 (4) The  $\Delta_f G^\circ$  is negative for roasting of sulphide ore to oxide

**Sol.** Answer (2)

14. Sulphides ores of metals are usually concentrated by Froth Floatation process. Which one of the following sulphides ores offers an exception and is concentrated by chemical leaching ? [AIPMT (Prelims)-2007]

- (1) Sphalerite                      (2) Argentite                      (3) Galena                      (4) Copper pyrite

**Sol.** Answer (2)

15. The mass of carbon anode consumed (giving only carbondioxide) in the production of 270 kg of aluminium metal from bauxite by the Hall process is (Atomic mass Al= 27) [AIPMT (Prelims)-2005]

- (1) 180 kg                      (2) 270 kg                      (3) 540 kg                      (4) 90 kg

**Sol.** Answer (4)

16. In which of the following process fused sodium chloride is electrolysed for extraction of sodium?  
 (1) Castner process (2) Cyanide process (3) Down's process (4) Both (2) & (3)

**Sol.** Answer (3)

Na is extracted by the electrolysis of fused sodium chloride by Down's process in which Na is collected at cathode.

17. Which of the following does not contain aluminium?  
 (1) Cryolite (2) Fluorspar (3) Feldspar (4) Mica

**Sol.** Answer (2)

Fluorspar is  $\text{CaF}_2$ . Also known as fluorite and does not contain aluminium.

18. Which of the following does not contain Mg?  
 (1) Magnetite (2) Asbestos (3) Magnesite (4) Carnalite

**Sol.** Answer (1)

Magnetite is  $\text{Fe}_3\text{O}_4$ , an ore of iron and it does not contain magnesium.

19. Carborundum is  
 (1)  $\text{CaC}_2$  (2)  $\text{CaCO}_3$  (3)  $\text{Fe}_3\text{C}$  (4) SiC

**Sol.** Answer (4)

Carborundum is SiC, silicon carbide. It is a very hard substance which is used as abrasive.

20. Bessemer converter is used for manufacture of  
 (1) Steel (2) Wrought iron (3) Pig iron (4) Cast iron

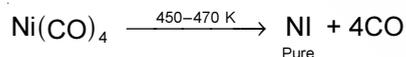
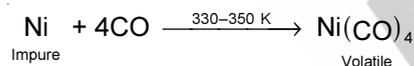
**Sol.** Answer (1)

Steel is commonly prepared in Bessemer converter. Steel contains 0.1 to 1.7% carbon.

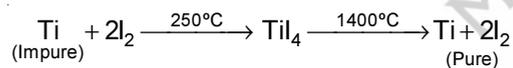
21. Mond's process is used for  
 (1) Ni (2) Al (3) Fe (4) Cu

**Sol.** Answer (1)

Mond's process is used for refining of Ni



22. Which process of purification is represented by following scheme?



- (1) Poling (2) Electro refining (3) Zone refining (4) van Arkel process

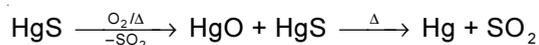
**Sol.** Answer (4)

In Van Arkel process titanium and zirconium are purified by using  $\text{I}_2$  as specific reagent.

23. Which of the following sulphides when heated strongly in air gives the corresponding metal?  
 (1) CuS (2)  $\text{Fe}_2\text{S}_3$  (3) FeS (4) HgS

**Sol.** Answer (4)

HgS undergo auto reduction and gives the Hg metal on strong heating.



24. Most important ore of tin is

- (1) Cassiterite                      (2) Cryolite                      (3) Malachite                      (4) All of these

**Sol.** Answer (1)

The most important ore of tin is cassiterite ( $\text{SnO}_2$ ).

25. Heating of ore in presence of air to remove sulphur impurities is called

- (1) Calcination                      (2) Roasting                      (3) Smelting                      (4) None of these

**Sol.** Answer (2)

Heating of sulphide ore in presence of air to get corresponding oxide is called roasting



26. Sodium is extracted from

- (1)  $\text{NaCl(aq)}$                       (2)  $\text{NaCl(l)}$                       (3)  $\text{NaOH(aq)}$                       (4)  $\text{NaNO}_3(\text{aq})$

**Sol.** Answer (2)

Sodium is extracted by electrolysis of molten  $\text{NaCl}$ . Na metal is collected at cathode and gives  $\text{Cl}_2$  at anode.

27. Among the metals, the one that cannot be obtained by reduction of its metal oxide

- (1) Cr                      (2) Fe                      (3) Mn                      (4) Mg

**Sol.** Answer (4)

In Ellingham diagram, the slope of  $\text{Mg} \rightarrow \text{MgO}$  lies well below the slope of  $\text{C} \rightarrow \text{CO}$ . A very high temperature is required for the reduction of Mg. Therefore, Mg cannot be obtained by its reduction.

28. Which of the following is used as depressant in the separation of mixture of  $\text{PbS}$  and  $\text{ZnS}$ ?

- (1)  $\text{NaCN}$                       (2)  $\text{NaCl}$                       (3)  $\text{AgCl}$                       (4) All of these

**Sol.** Answer (1)

During the concentration of sulphide ores using froth floatation process,  $\text{NaCN}$  is used to separate  $\text{PbS}$  and  $\text{ZnS}$ .  $\text{NaCN}$  reacts with  $\text{ZnS}$  and forms  $\text{Na}_2[\text{Zn}(\text{CN})_4]$  therefore, acts as depressants.

29. Which contains both iron and copper?

- (1) Cuprite                      (2) Chalcocite                      (3) Chalcopyrite                      (4) Malachite

**Sol.** Answer (3)

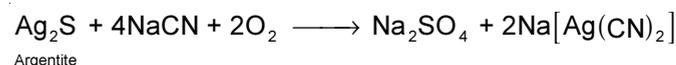
Chalcopyrite contains both Cu and Fe. Chalcopyrite is  $\text{CuFeS}_2$ .

30. To dissolve argentite ore which of the following is used?

- (1)  $\text{Na}[\text{Ag}(\text{CN})_2]$                       (2)  $\text{NaCN}$                       (3)  $\text{NaCl}$                       (4)  $\text{HCl}$

**Sol.** Answer (2)

Argentite is dissolved using  $\text{NaCN}$



31. Iron obtained from blast furnace is

- (1) Wrought iron                      (2) Cast iron                      (3) Pig iron                      (4) Steel

**Sol.** Answer (3)

Iron obtained from blast furnace is pig iron. It contains about 4% carbon with many other impurities like S, P,  $\text{S}_8$ , Mn etc.

32. Elements used as semiconductor are purified by  
(1) Van Arkel method      (2) Mond process      (3) Distillation      (4) Zone refining

**Sol.** Answer (4)

Semiconductor like Si, Ge, Ga etc can be purified by using zone refining method.

33. Which of the following oxide is least stable?  
(1)  $\text{CO}_2$       (2)  $\text{CO}$       (3)  $\text{MgO}$       (4)  $\text{HgO}$

**Sol.** Answer (4)

$\text{HgO}$  is least stable oxide because +1 oxidation state of Hg is more stable.

34. The inner layer of a blast furnace is made of  
(1) Graphite bricks      (2) Silica bricks      (3) Basic bricks      (4) Fireclay bricks

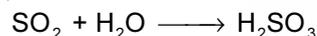
**Sol.** Answer (4)

The inner layer of blast furnace is made up of fire clay bricks which can withstand high temperature.

35. Roasting of sulphides gives the gas X as a by- product. This is a colorless gas with choking smell of burnt sulphur and causes great damage to respiratory organs as a result of acid rain. Its aqueous solution is acidic acts as a reducing agent and its acid is known only in solution. The gas X is  
(1)  $\text{SO}_2$       (2)  $\text{CO}_2$       (3)  $\text{SO}_3$       (4)  $\text{H}_2\text{S}$

**Sol.** Answer (1)

Sulphur dioxide is a colourless gas which can cause damage to respiratory organs. Its aqueous solution is acidic



$\text{H}_2\text{SO}_3$  is sulphurous acid and it is known only in solution.

36. Which of the following mineral contains calcium as well as magnesium?  
(1) Tridymite      (2) Aragonite      (3) Dolomite      (4) Carnalite

**Sol.** Answer (3)

Dolomite is  $\text{CaCO}_3 \cdot \text{MgCO}_3$  which contains Ca as well as Mg.

## SECTION - C

### Assertion - Reason Type Questions

1. A : Cuprite is concentrated by froth floatation process.  
R : Cuprite is the sulphide ore.

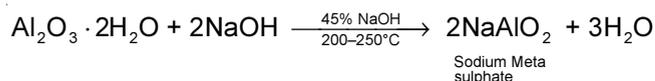
**Sol.** Answer (4)

Assertion is incorrect because sulphide ores are concentrated by froath floatation process and cuprite is not a sulphide ore, Hence reason is also false.

2. A : Bauxite is purified by leaching process.  
R : Aluminium oxide reacts with  $\text{NaOH}$  to form soluble sodium meta aluminate.

**Sol.** Answer (1)

Bauxite ( $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ ) is purified by leaching process. In this process bauxite is treated with  $\text{NaOH}$  to form sodium meta aluminate



Hence, both Assertion and Reason are true.

3. A : Calamine and Dolomite are the carbonate ores.  
R : Calamine is  $\text{ZnCO}_3$  whereas Dolomite is  $\text{MgCO}_3 \cdot \text{ZnCO}_3$ .

**Sol.** Answer (3)

Calamine is  $\text{ZnCO}_3$  whereas Dolomite is  $\text{CaCO}_3 \cdot \text{MgCO}_3$ . Therefore, Assertion is true but reason is false.

4. A : Roasting process is involved in the metallurgy of Cu from Malachite ore.  
R : Roasting is the process of heating the ore in absence of air.

**Sol.** Answer (4)

Roasting process is used for sulphide ores. Malachite is  $\text{CaCO}_3 \cdot \text{Cu}(\text{OH})_2$  which can be converted into oxide by calcination process. Roasting is done in presence of air. Therefore, both Assertion and Reason are false.

5. A : Metallurgy of Ag from Argentite is known as hydro-metallurgy.  
R : Argentite is  $\text{Ag}_2\text{S}$ .

**Sol.** Answer (2)

In the extraction of Ag from argentite, leaching is done with the help of NaCN and Zn dust. This process is called hydrometallurgy. Argentite is  $\text{Ag}_2\text{S}$  but this reason is not the correct explanation of Assertion.

6. A : In the manufacturing of iron from haematite, silicon dioxide is added as flux.  
R : Lime stone is also used as acidic flux in many case.

**Sol.** Answer (4)

In the metallurgy of Iron CaO is used as flux and  $\text{SiO}_2$  is present as impurity. Limestone is not used as acidic flux.

Hence, both Assertion and Reason are false.

7. A : Ultrapure metals are obtained by zone refining.  
R : Van arkel method is used for purification of titanium.

**Sol.** Answer (2)

Zone refining method is used for purification of semiconductors and this method gives metals of very high purity. Van Arkel method is used for purification titanium. Hence, Reason and Assertion are true but Reason is not the correct explanation.

8. A : Wrought iron is purest form of iron with respect to other forms.  
R : It has less than 0.5% carbon.

**Sol.** Answer (1)

The percentage of impurities in wrought iron is minimum and it contains less than 5% carbon. Therefore, both Assertion and Reason are true.

9. A : Magnesium oxide is used for the lining in steel making furnace.  
R : Magnesium oxides acts as flux.

**Sol.** Answer (1)

In the steel industry, MgO is used for lining the surface of furnace. MgO is a basic oxide and reacts with  $\text{SiO}_2$  which is present in the iron ore as impurity to form slag. Hence MgO acts as a flux. Therefore, both Assertion and Reason are true.

10. A : Aluminium metal is used as a reducing agent for the extraction of metals.

R : Aluminium has great affinity for oxygen.

**Sol.** Answer (1)

Aluminium metal has great affinity for oxygen and it readily combines with oxygen. This property of aluminium makes it a suitable reducing agent for the extraction of other metals. Hence, both assertion and reason are true.

11. A : Zinc but not copper is used for recovery of Ag from the complex  $[\text{Ag}(\text{CN})_2]^-$ .

R : Zinc is more powerful reducing agent in comparison to copper.

**Sol.** Answer (1)

During the extraction of Ag, Zn is used for the reduction. Cu is a less electropositive metal and less reactive than Zn. Due to high electropositive nature of Zn, zinc dust is used for the recovery of Ag from the complex  $[\text{Ag}(\text{CN})_2]^-$ .

12. A : Hydrometallurgy is used for extraction of Ag and Au.

R : Hydrometallurgy is different from pyrometallurgy.

**Sol.** Answer (2)

Hydrometallurgy is used for the extraction of Ag and Au in which they are treated with NaCN solution. This process is known as leaching. Pyrometallurgy is thermal treatment of minerals and is different from hydrometallurgy.

Therefore Reason is not the correct explanation of Assertion.

13. A : Pure silver is obtained by electrolysis of  $\text{AgNO}_3$  solution.

R : In electrolysis impure silver is taken as cathode and pure silver is taken as anode.

**Sol.** Answer (3)

Pure silver can be obtained by electrolysis of  $\text{AgNO}_3$  solution. During its electrolysis, pure silver is taken as cathode so the impure silver from the anode dissolves and pure silver is deposited at cathode made up of pure silver.

Hence Assertion is true, Reason is false.

14. A : Carbon is used in blast furnace for reduction of  $\text{Fe}_2\text{O}_3$ .

R : This process is called smelting.

**Sol.** Answer (2)

Carbon is used as a reducing agent in the blast furnace for the reduction of  $\text{Fe}_2\text{O}_3$  to obtain Fe. This process of reduction is known as smelting. Reason is true but not the correct explanation of Assertion.

15. A : In Hall's process Aluminium is purified.

R :  $\text{Al}_2\text{O}_3$  (aq) is used in Hall's process.

**Sol.** Answer (4)

Hall's process is a method of extraction of aluminium not of purification, Also in Hall's process molten  $\text{Al}_2\text{O}_3$  is used. Therefore, both Assertion and Reason are false.

