CBSE Test Paper-04

Class - 12 Chemistry (General Principles and Processes of Isolation of Elements)

1. Liquation method is used for the metals which have
   a. High melting points
   b. High boiling points
   c. Low boiling points
   d. Low melting points
2. Which among the following ores are not found on earth's crust?
   a. Halides
   b. Nitrides
   c. Oxides
   d. Sulphides
3. Which among the following reaction takes place in zone of heat absorption?
   a. All of these
   b. $CaCO_3 \xrightarrow{1123K} CaO + CO_2$
   c. $\mathrm{CO_2} + C \rightarrow 2CO$
   d. $C + O_2 \rightarrow CO_2$
4. $\mathrm{ZnCO_3}(s) \xrightarrow{\Delta} \mathrm{ZnO(s)} + \mathrm{CO_2}$;The reaction shows the process of
   a. Reduction
   b. Smelting
   c. Calcination
   d. Roasting
5. The sulphide ore of iron is
   a. magnetite
   b. iron pyrite
   c. cryolite
   d. haematite

6. State one limitation of Ellingham diagrams.

7. Name the process in which a particular mineral is dissolved selectively by using acids, bases or other reagents.

8. Which method is used for refining of silicon and gallium?
9. What are the main ores of iron?
10. Write the principle behind the froth floatation process. What is the role of collectors in the process.
11. Why is zinc not extracted from zinc oxide through reduction using CO?
12. Write briefly the steps to extract lead from galena. Write the chemical reactions involved.
13. Although thermodynamically feasible, in practical, magnesium metal is not used for the reduction of alumina in the metallurgy of aluminium. Why?
14. What is the chief ore of iron? Write chemical reactions taking place in the extraction of iron from its ore.
15. a. Give two important uses of the following metals:
    i. Na
    ii. Mg
    b. Give an account of the extraction of silver by the cyanide process. Describe briefly how a pure sample of silver obtained by electrorefining.

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Solutions

1. d. Low melting points
   Explanation: The low melting metal like tin is made to flow on a sloping surface. Thus it can be separated from higher melting impurities.
2. b. Nitrides
   Explanation: Nitride ores not found in earth's crust.
3. c. $CO_2 + C \rightarrow 2CO$
   Explanation: During extraction of Fe, CO_2 reduces to CO, which involves heat absorption. This reaction take place at zone of heat absorption in blast furnace.
4. c. Calcination
   Explanation: In calcination, carbonate ore is heated to a high temperature in the absence of air to decompose the carbonate and give the metal oxide and carbon dioxide.
5. b. iron pyrite
   Explanation: FeS_2 is iron pyrites which contain sulfide group.
6. Ellingham diagrams only tell us about the feasibility of a reaction. They do not tell anything about the reaction kinetics.
7. Leaching (chemical separation)
8. The refining of silicon and gallium is done by Zone refining.
9. Main ores of iron are:
   i. Haematite -Fe_2O_3
   ii. Magnetite -Fe_3O_4
10. Principle involved in froth floatation process is that the ore particles are wetted by pine oil and the gangue particles are wetted by water. Collectors enhance non-wettability of the ore- particles.
11. The standard free energy of formation $(\Delta_f G^o)$ of CO_2 from CO is higher than that of the formation of ZnO from Zn. Therefore, CO cannot be used to reduce ZnO to Zn.

12. i. **Concentration of Ore:** Galena (PbS) is concentrated with the help of froth floatation process.

ii. **Roasting:** Concentrated ore is heated strongly in presence of oxygen to form oxide.

$2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$

$PbS + 2O_2 \rightarrow PbSO_4$

iii. **Ressemerisation:**

$PbS + 2PbO \rightarrow 3Pb + SO_2$

$PbS + PbSO_4 \rightarrow 2Pb + 2SO_2$

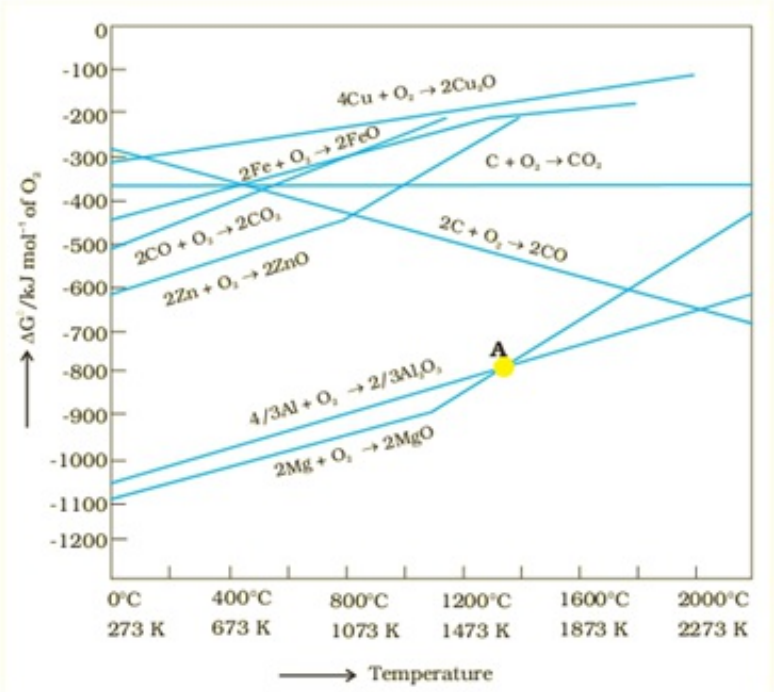
iv. **Electrolytic refining :** It is purified by electrolytic refining using $PbSiF_6$ and H_2SiF_6 as electrolyte.

Impure lead as anode and pure lead as cathode.

At anode : $\underset{\text{Impure}}{Pb} \rightarrow Pb^{2+} + 2e^-$

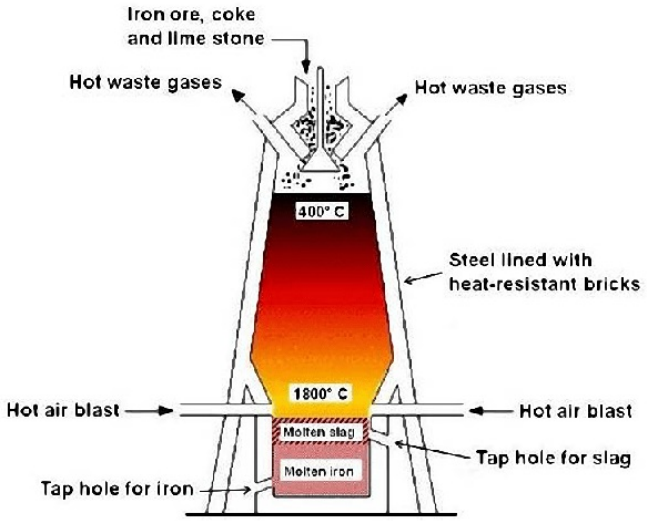
At cathode : $Pb^{2+} + 2e^- \rightarrow Pb(\text{Pure})$.

13. Temperatures below the point of intersection of Al_2O_3 and MgO curves magnesium can reduce alumina. But magnesium is a much costlier metal than aluminium and hence the process will be uneconomical.



14. Chief ore of iron is haematite (Fe_2O_3). Iron is obtained by the reduction of its ore, haematite (Fe_2O_3) in a blast furnace.

    Oxide ore, after concentration through calcinations or roasting and to decompose carbonate to oxide with limestone and coke and put into blast furnace.



Blast Furnace

    The following reaction takes place in the blast furnace:

    i. The coke combines with oxygen to form carbon dioxide.
    $C(s) + O_2(g) \rightarrow CO_2(g) + Heat$

    ii. Due to the intense heat in the furnace, limestone ($CaCO_3$) decomposes to form calcium oxide and carbon dioxide.
    $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

    iii. The carbon dioxide reacts with more coke to form carbon monoxide.
    $CO_2(g) + C(s) \rightarrow 2CO_2(g)$

    iv. The iron (III) oxide present in the ore is then reduced by carbon monoxide to form liquid iron. The molten iron is collects at the bottom of the furnace.
    $$Fe_2O_3(s) + 3CO(g) \rightarrow \underset{Liquid\ from\ metal}{2Fe(l)} + 3CO_2(g)$$

    v. Calcium oxide formed in reaction (ii) reacts with silicondioxide present in the ore to form molten calcium silicate known as slag:
    $CaO(s) + SiO_2(s) \rightarrow CaSiO_3(l)$

15. a. i. **Uses of Na**:

    - Na metal in liquid form is used as coolant in nuclear reactor as medium for heat exchange.

- For making tetraethyl lead which is used as anti-knocking agent in petrol.

ii. **Uses of Mg**:

- Used in making magnalium alloy which is used for kitchen wares.
- Also used for cathodic protection of iron.

b. **Extraction of silver:** Silver sulphide is dissolved in sodium cyanide solution to give a solution of soluble complex $Na[Ag(CN)_2]$. The solution of the complex is then treated with a more electropositive metal

$$Ag_2S + 4NaCN \rightarrow \underset{\text{soluble complex}}{2Na\,[Ag(CN)_2]} + Na_2S$$

$$2Na\,[Ag(CN)_2]\ +\ Zn \rightarrow Na_2\,[Zn(CN)_4]\ +\ 2Ag$$

Purification of silver: Ag is purified by electrolytic refining taking impure Ag as anode, pure Ag as cathode and $K[Ag(CN)_2]$ as electrolyte. The reactions at anode and cathode are given as under:

$$At\ anode: \underset{impure}{Ag} \rightarrow Ag^+ + e^-$$

$$At\ cathode: Ag^+ + e^- \rightarrow Ag\text{(Pure)}$$