CBSE Test Paper-02

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

1. Metal halides are found in lakes and seas because
   a. They are lighter than water
   b. They are insoluble in water
   c. They are soluble in water
   d. They are heavier than water
2. Pyrometallurgy is the process of
   a. Reduction of the oxide to the metal with the help of heat
   b. Magnetic separation of impurities
   c. Concentration of ore
   d. Oxidation of pure metal
3. The impurity that is added externally to remove the impurity already present in the ore is known as
   a. Flux
   b. Matrix
   c. Slag
   d. Gangue
4. Extraction of Al from bauxite is done by
   a. Mond's process
   b. Van – Arkel – de Boer process
   c. Cyanide process
   d. Hall – Heroult process
5. Cinnabar is an ore of
   a. Copper
   b. Zinc
   c. Mercury
   d. Lead
6. Give the name of principal ore of Copper.
7. What is the role of graphite in the electrometallurgy of aluminium?

8. What is cast iron?

9. What is the principle of separation of metal ions in qualitative analysis?

10. How is 'cast iron' different from 'pig iron"?

11. Give the chemical formula of:
    i. Chile salt petre
    ii. Iron pyrites
    iii. Dolomite.
12. i. Write the names of any two principal ores of zinc.
    ii. Write uses of zinc.

13. Explain the magnetic separation process.

14. Explain the role of each of the following in the extraction of metals from their ores:
    i. CO in the extraction of nickel.
    ii. Zinc in the extraction of silver.
    iii. Silica in the extraction of copper.
15. Explain:
    i. Zone refining
    ii. Column chromatography

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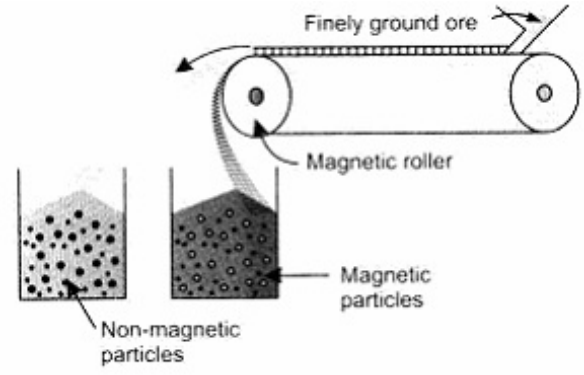
Solutions

1. a. They are soluble in water
   Explanation: Metal halides found in sea or lakes, since they get dissolved in rain water and collected in the sea or lakes.
2. a. Reduction of the oxide to the metal with the help of heat
   Explanation: It is branch of science and technology concerned with the use of high temperatures to extract and purify metals.
3. a. Flux
   Explanation: Flux is externally added substance to an ore, which combines with impurities in the ore to form Slag which can be easily separated.
4. d. Hall – Heroult process
   Explanation: Hall-Heroult process is used for extraction of Al from bauxite. It is usually carried out at a temperature of 980 °C.
5. c. Mercury
   Explanation: HgS is brick red form of sulphide ore of Hg from which it can be profitably extracted. It resembles quartz in symmetry.
6. Principal ore of copper is copper pyrites $CuFeS_2$
7. The graphite electrode is useful for the reduction of Al_2O_3 in aluminium. The overall reaction is given as:
   $2A1_2O_3 + 3C \rightarrow 4A1 + 3CO_2$
8. Iron obtained by melting pig iron with scrap iron and coke using hot air blast is cast iron. It has slightly lower carbon content about 3% and is extremely hard and brittle.
9. If ionic product exceeds K_{SP}, compound of metal is precipitate.
10. The iron obtained from blast furnaces is known as pig iron. It contains around 4% carbon and many impurities such as S, P, Si, Mn in smaller amounts. Cast iron is

obtained by melting pig iron and coke using a hot air blast. It contains a lower amount of carbon (3%) than pig iron. Unlike pig iron, cast iron is extremely hard and brittle.

11. i. Chile salt petre: $NaNO_3$
    ii. Iron pyrites : FeS_2
    iii. Dolomite : $CaCO_3 \cdot MgCO_3$
12. i. The principal ores of zinc are:
        a. Zinc blande: ZnS
        b. Calamine: $ZnCO_3$
    ii. Uses of Zinc:
        a. It is used for galvanising iron.
        b. It is main constituent of alloys like brass, german silver etc.
        c. Zinc dust is used as a reducing agent in the manufacture of dyestuff, paints etc.
13. This is based on differences in magnetic properties of the ore components. If either the ore or the gangue is capable of being attracted by a magnetic field then such separations are carried out. The ground ore is carried on a conveyer belt which passes over a magnetic roller.



14. i. CO is used for the extraction of nickel by converting it to nickel tetracarbonyl $(Ni(CO)_4)$. $Ni(CO)_4$ vapour undergoes thermal decomposition at higher temperature to give pure nickel. $\underset{\text{Impure nickel}}{Ni} + CO(g) \xrightarrow{525K} Ni(CO)_4(g)$
    $\xrightarrow{450-470K} \underset{\text{Nickel pure}}{Ni} + 4CO(g)$
    ii. Zinc is used to recover silver from a solution containing sodium dicyanoargentate

(I) because zinc is more electropositive than silver.

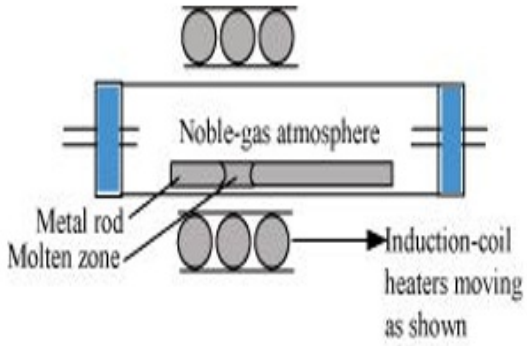
$$\underset{From\ silver\ ore}{Ag(s)} + 2NaCN(aq) \rightarrow \underset{Sodium\ dicyanido\ \text{arg}entate}{Na[Ag(CN)_2]} + Na^+$$

$$2Na[Ag(CN)_2](aq) + Zn(s) \rightarrow \underset{Sodium\ tetracyanidozincate(II)}{Na_2[Zn(CN)_4]} + \underset{Pure\ silve}{2Ag(s)}$$

iii. During the extraction of copper, silica is added to remove iron (present as FeO) as slag.

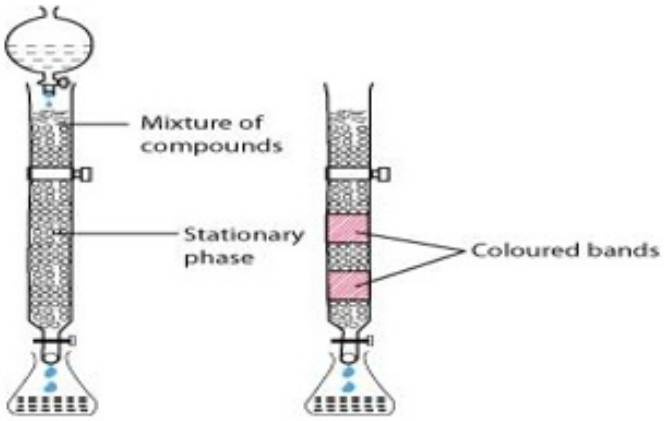
$FeO + SiO_2 \rightarrow FeSiO_3$ (Slag)

15. i. Zone refining:



This method is based on the principle that the impurities are more soluble in the molten state of metal (the melt) than in the solid state. In the process of zone refining, a circular mobile heater is fixed at one end of a rod of impure metal. As the heater moves, the molten zone of the rod also moves with it. As a result, pure metal crystallizes out of the melt and the impurities pass onto the adjacent molten zone. This process is repeated several times, which leads to the segregation of impurities at one end of the rod. Then, the end with the impurities is cut off. Silicon, boron, gallium, indium etc. can be purified by this process.

ii. Column chromatography:



Column chromatography is a technique used to separate different components of

a mixture. It is a very useful technique used for the purification of elements available in minute quantities. It is also used to remove the impurities that are not very different in chemical properties from the element to be purified. Chromatography is based on the principle that different components of a mixture are differently adsorbed on an adsorbent. In chromatography, there are two phases: mobile phase and stationary phase. The stationary phase is immobile and immiscible. Al_2O_3 column is usually used as the stationary phase in column chromatography. The mobile phase may be a gas, liquid, or supercritical fluid in which the sample extract is dissolved. Then, the mobile phase is forced to move through the stationary phase. The component that is more strongly adsorbed on the column takes a longer time to travel through it than the component that is weakly adsorbed. The adsorbed components are then removed (eluted) using a suitable solvent (eluant).