DPP-06

SOLUTIONS

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1. SnO_2 is reduced to metallic Sn on smelting oxide with anthracite, limestone and sand. The function of sand is to acts as a flux and removes basic impurities such as slag.

Sand eliminates fundamental impurities such as slag.

$$\underset{\text{Acidic flux}}{SiO_2} + \underset{\text{Basic gangue}}{FeO} \rightarrow \underset{\text{Slag}}{FeSiO_3}$$

Thus, the functions of sand are represented by both (a) and (b). Hence, option C is correct

2. Extraction of silver from its ore involving NaCN air and an active metal is known as the Mc Arthur-Forrest method.

It is the technique for separating silver and gold from their ores using a weak solution of potassium or sodium cyanide. The Scottish chemist's John S. MacArthur, Robert W. Forrest, and William Forrest developed the procedure in 1887.

3. An alloy is a term used to describe a mixture of metals or a metal combined with another element.

Zn and Pb, Fe and Hg, C and Pt do not form alloys. Only Fe and Cr form the alloy.

4. Cupellation is used to separate noble metals like gold and silver. This process is carried out at a high temperature, so the impurities form oxides and slag. Since noble metals are inert, they do not get oxidised as easily as the impurities.

5. Silver and gold are extracted by the cyanide process (Mac Arthur - Forrest process). After the preliminary crushing and concentration by froth floatation process, the ore (crushed auriferous rocks in the case of gold) is leached with dilute (0.4-7%) solution of sodium cyanide made alkaline by adding lime kept agitated by a current of air. Silver (or gold) pass into solution as argentocyanide (or aurocyanide).

It is based on the fact that gold/silver dissolves in dilute solution of sodium cyanide in presence of atmospheric oxygen with the formation of complex cyanide.

Reaction:

$$Ag_2S + 4NaCN \rightarrow 2Na[Ag(CN)_2] + Na_2S$$

Silver is obtained by reaction with Zn :

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

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6. Self reduction basically means the species which will undergo the reduction itself and so acts as a reducing agent.

$2PbS(s) + 3O_2(g) \rightarrow 2PbO(s) + 2SO_2(g)$

Lead Sulfide Oxygen Lead oxide Sulfur dioxide

$\underset{\text{Lead sulfide}}{PbS(s)} + \underset{\text{Lead oxide}}{2PbO(s)} \rightarrow 3\ \underset{\text{Lead}}{Pb(s)} + \underset{\text{Sulfur dioxide}}{SO_2(g)}$ (self - reduction)

This Carbon reduction basically involves the reduction of substances, usually the metal oxides by the use of Carbon as a reducing agent.

$\underset{\text{Tin oxide}}{SnO_2(s)} + \underset{\text{Carbon}}{C(s)} \xrightarrow{\Delta} \underset{\text{Tin}}{Sn(s)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$

$\underset{\text{Tin oxide}}{SnO_2(s)} + \underset{\text{Carbon monoxide}}{2CO(s)} \rightarrow \underset{\text{Tin}}{Sn(s)} + \underset{\text{Carbon dioxide}}{2CO_2(g)}$

So the correct option is (B): self reduction and carbon reduction respectively.

7. The electrolysis of a concentrated solution of NaCl gives (I) Cl_2, (II) NaOH(aq) and (III) H_2 (g)

$2NaCl(aq) + 2H_2O \rightarrow 2NaOH(aq) + H_2(g) + Cl_2$ (g)

8.

Roasting	Calcination
One is heated in the presence of excess of oxygen or air.	one is heated in the absence or limited supply of oxygen or air
This method is employed for sulphide ores.	This method is employed for carbonate ores.
Sulphur dioxide is produced along with metal oxide.	Carbon dioxide is produced along with metal oxide.
Example: For the ores ZnS (sphalerite) and Cu_2 S (chalcocite), balanced equations for the roasting are: $2ZnS + 3O2 --> 2Zno + 2SO2$ $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$	Example: $ZnCO3 --> ZnO + CO2$
Roasting is the process in which the ore is heated below its melting point in presence of air to oxidise the impurities. Ex: carbon, sulphur etc removed as their gaseous oxides.	Calcination is the process of heating the ore below its melting point in absence of air to remove volatile impurities like arsenic etc

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9. Lead obtained contains impurities like Cu, Sb, Sn, As, Ag, Au, etc. which make it hard. During electrolytic refining of lead, the electrolyte ($PbSiF_6 + H_2SiF_6$) is mixed with a little gelatin. Gelatin is added for smooth and uniform deposition of lead in this process.

The ore used commercially for extraction of lead is galena. Depending upon the impurity content, lead can be extracted from galena by one of the following two processes:

(a) Carbon reduction (when the impurity content is high enough)

$$PbS \xrightarrow[-SO_2]{\text{Roasted in air}} PbO \xrightarrow[-CO_2]{\text{Heated with C}} Pb$$

(b) Self-reduction (when the impurity content is low)

$$PbS \xrightarrow[-SO_2]{\text{Roasted in air}} PbO \xrightarrow[-CO_2]{\text{Heated with PbS}} Pb + SO_2$$

10. (P) Smelting is a process of applying heat to an ore, to extract a base metal. It is a form of extractive metallurgy. It is used to extract many metals from their ores, including silver, iron, copper, and other base metals.

(Q) Mond process for refining of Nickel is based on the principle that nickel is heated in the presence of carbon monoxide to form nickel tetracarbonyl, wh. is a volatile copound.

$$Ni + 4CO \xrightarrow{330-350\ K} \underset{\text{(Nickel tetracabonyl)}}{Ni(CO)_4}$$

Now, the obtained nickel tetracarbonyl is decomposed by subjecting it to a higher temperature $(450 - 470\ K)$ to obtain pure nickel metal.

$$\underset{\text{(Nickel tetracabonyl)}}{Ni(CO)_4} \xrightarrow{450-470\ K} \underset{\text{(Pure nickel)}}{Ni} + 4CO$$

(R) The Bayer process is the principal industrial means of refining bauxite to produce alumina (aluminium oxide) and was developed by Carl Josef Bayer. Bauxite, the most important ore of aluminium, contains only $30 - 60\%$ aluminium oxide (Al_2O_3), the rest being a mixture of silica, various iron oxides, and titanium dioxide.

(S) Cyanide process is used for the extraction of Au and Ag

(T) Copper is extracted from copper pyrites by froth flotation process.

Froth flotation method is used to separate particles based on the differences in the ability of air bubbles to selectively attach to specific mineral surfaces in a mineral-water slurry. Copper is extracted from its principle ore Copper pyrites $CuFeS_2$. The ore is concentrated by froth flotation process.