Daily Tutorial Sheet 1	JEE Advanced (Archive)

1. During roasting, in excess supply of air, in a reverberatory furnance the following reaction occurs.

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

$PbS + 2O_2 \longrightarrow PbSO_4$

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

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

2.

(A)	Silver	**(S)**	Amalgamation
(B)	Calcium	**(P)**	Fused salt electrolysis
(C)	Zinc	**(Q)**	Carbon reduction
(D)	Iron	**(R)**	Carbon monoxide reduction
(E)	Copper	**(T)**	Self reduction

3.(C) Aluminium (Al) reduced Fe_2O_3 or Cr_2O_3 and so Al acts as a reducing agent.

$Fe_2O_3 + 2Al \longrightarrow 2Fe + Al_2O_3$

4. **(i)** Metals generally occur as oxides, carbonates, sulphides which can be calcinated or roasted.

(ii) Zone refining method is based on the difference in solubility of impurities in molten and solid states of the metal. This method can be used for those metals which can be readily melted and can be easily crystallized out from the melt, e.g. Ge, Si, etc.

5.(D) Aluminium (Al) is more electropositive than hydrogen. Thus, aluminium oxide will not be reduced by hydrogen.

6. Sodium chloride is added to prevent hydrolysis of magnesium chloride and also to provide conductivity to the electrolyte. It also lowers the fusion temperature of anhydrous $MgCl_2$.

7. Chalocite (Cu_2S) being a sulphate ore, has to be roasted (heated in excess of air) and not calcinated, so as to convert it to its oxide (Cu_2O).

8. Following reactions occurs during recovery of lead (Pb) from galena (PbS).

$2PbS + 3O_2 \longrightarrow 2PbO + 2SO_2\uparrow$

$PbS + 2PbO \longrightarrow 3Pb + SO_2\uparrow$

9.(BD) The reduction potentials of both Mg and Al are less than that of water. Thus, the ions of both Mg and Al in aqueous solution cannot be reduced and in such a case water will be reduced.

$2H_2O + 2e^- \longrightarrow H_2 + 2OH^-$.

10.(B) Argentite (Ag_2S) is a sulphide ore and not an oxide.

11.(B) FeS, which is present as impurity in the ore, is oxidised to FeO when ore is smelted with coke (C) and silica (SiO_2). The oxide (FeO) formed then reacts with silica (SiO_2) to form ferrous silicate (Fusible) which is removed as a slag.

$\underset{\text{(impurity)}}{2FeS} + 3O_2 \longrightarrow \underset{\text{(oxide)}}{2FeO} + 2SO_2\uparrow$; $FeO + \underset{\text{(silica)}}{SiO_2} \longrightarrow \underset{\text{(slag)}}{FeSiO_3}$

12.(A) $MgCl_2 \longrightarrow Mg^{2+} + 2Cl^-$ (Fused, anhydrous)

$Mg^{2+} + 2e^- \longrightarrow Mg$ (cathode)

$2Cl^- \longrightarrow Cl_2 \uparrow + 2e^-$ (anode)

13.(C) Chalcopyrite is $CuFeS_2$ i.e. it contains both Cu and Fe.

Cuprite is Cu_2O ; it contains only Cu.

Chalcocite is Cu_2S ; it contains only Cu

Malachite is $Cu(OH)_2 \cdot CuCO_3$; it contains only Cu.

14. **(A) → P, R**

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

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

$2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$

$Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$

(B) → P

$PbO + C \longrightarrow Pb + CO$; $PbO + CO \longrightarrow Pb + CO_2$

(C) → Q

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

$2Na[Ag(CN)_2] + Zn \longrightarrow \underset{\text{Soluble}}{Na_2[Zn(CN)_4]} + \underset{\text{ppt.}}{2Ag}$

(D) → S

NaCl ⇓ fused

cathode ← $Na^+ + Cl^-$ → anode

$Na^+ + e^- \longrightarrow Na$ $\qquad$ $Cl^- \longrightarrow Cl + 1e^-$

$2Cl \longrightarrow Cl_2$

15.(B) Extraction of Zn from ZnS is achieved by roasting followed by reduction with carbon (smelting). This method is different from self reduction.

$2ZnS + 3O_2 \longrightarrow 2ZnO + 2SO_2$; $\qquad$ $ZnS + 2O_2 \longrightarrow ZnSO_4$

$2ZnSO_4 \longrightarrow 2ZnO + 2SO_2 + O_2$; $\qquad$ $ZnO + C \longrightarrow Zn + CO$