16. **(A) → P ; (B) → Q ; (C) → P, R ; (D) → P, S**

Sulphides of Cu, Pb, when roasted in air are converted partially into their oxides. On further roasting in the absence of air, self reduction takes place.

Calcination is used when concentrated ore is in the form of hydroxide or carbonate, volatile matter is burnt away.

$CaCO_3 \longrightarrow CaO + CO_2$; $2ZnS + 3O_2 \xrightarrow{\Delta} 2ZnO + 2SO_2$(Roasting)

Reduction with carbon : $ZnO + C \xrightarrow{\Delta} Zn + CO$

17.(ACD) Tin is extracted from cassiterite ore. It is reduced by carbon.

$SnO_2 + 2C \longrightarrow Sn + 2CO$

Crude metal contains impurities of Fe, W and Cu.

18.(B) Silver ore is oxidised by using oxygen from air as follows :

$4Ag + 8NaCN + 2H_2O + O_2(air) \longrightarrow \underset{\text{Sodium argentocyanide}}{4Na[Ag(CN)_2]} + 4NaOH$ $\quad Ag(0) \xrightarrow{\text{Oxidation}} Ag(+1)$

Silver is precipitated from the solution by addition of Zn powder in a finely divided condition.

$2Na[Ag(CN)_2] + Zn \longrightarrow \underset{\text{Sodium zinccyanide}}{Na_2[Zn(CN)_4]} + 2Ag$ $\quad Ag(+1) \xrightarrow{\text{Reduction}} Ag(0)$

19.(A) Sulphide ore of Ag → Silver glance (Ag_2S) : Cu → Copper pyrites ($CuFeS_2$) and Pb → Galena (PbS).

20.(CD) Al_2O_3 and $MgCO_3 \cdot CaCO_3$ are reduced by electrolytic reduction method.

21.(BCD) **(A)** $CuFeS_2 + Cu_2S \xrightarrow{\Delta}$ No reaction **(B)** $2CuO \xrightarrow{\Delta} Cu_2O + \frac{1}{2}O_2$

(C) $2Cu_2O + Cu_2S \xrightarrow{\Delta} 6Cu + SO_2$

(D) $CuSO_4 \xrightarrow{\Delta} CuO + SO_2 + \frac{1}{2}O_2$

Both CuO and $CuSO_4$ upon heating produces Cu_2O and CuO respectively and further Cu_2O and CuO on heating with Cu_2S gives Cu.

22.(BCD) **(A)** Impure copper is made the anode and a thin sheet of pure copper is made the cathode, while copper sulphate solution acidified with sulphuric acid is taken as the electrolyte. Pure copper deposits at cathode and impurities settle as anode-mud.

At anode : $Cu(s) \longrightarrow Cu^{2+}(aq) + 2e^-$

At cathode : $Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$

23. **(A) → (P, Q and S)**

Carbonate ores are

(P) Siderite : $FeCO_3$

(Q) Malachite : $CuCO_3 \cdot Cu(OH)_2$

(S) Calamine : $ZnCO_3$

(B) → (T)

Sulphide ore is Argentite : Ag_2S

(C) → (Q and R)

Hydroxide ion is present in

(Q) Malachite : $CuCO_3 \cdot Cu(OH)_2$

(R) Bauxite : $Al_2O_3 \cdot 2H_2O$

(D) → (R)

Oxide ore is bauxite only.

24.(ABC) **(A)** In the extraction of copper from copper pyrites $(CuFeS_2)$, after crushing, concentration of ore is done by froth floatation process.

(B) Iron is removed as slag $FeO + SiO_2 \longrightarrow \underset{\text{Slag}}{FeSiO_3}$

(C) Auto-reduction $2Cu_2O + Cu_2S \longrightarrow \underset{\text{Blister copper}}{6Cu} + SO_2$

(D) Blister copper is finally purified by electrolytic refining.

25.(6.47) $2PbS + 3O_2 \longrightarrow 2PbO + 2SO_2$

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

3moles of O_2 produce 3 moles of lead.

96 kg of oxygen produced 621 kg of lead.

1 kg of oxygen produced $\frac{621}{96} = 6.468 = 6.47\,kg$

26.(B) Calamine $\rightarrow ZnCO_3$ Malachite $\rightarrow CuCO_3 \cdot Cu(OH)_2$

Magnetite $\rightarrow Fe_3O_4$ Cryolite $\rightarrow Na_3AlF_6$

27.(ACD) $Au \xrightarrow[O_2(Q)\ +H_2O]{NaCN} \underset{(R)}{Na[Au(CN)_2]} \xrightarrow[(T)]{Zn} Au\downarrow + \underset{(Z)}{Na_2[Zn(CN)_4]}$