ANSWERS

I. Multiple Choice Questions (Type-I)

1. (iii) 2. (iii) 3. (iv) 4. (i) 5. (ii) 6. (iii)
7. (i) 8. (ii) 9. (i) 10. (i) 11. (iv) 12. (i)
13. (i)

II. Multiple Choice Questions (Type-II)

14. (ii), (iv) 15. (i), (iv) 16. (i), (ii) 17. (i), (iii)
18. (ii), (iii) 19. (iii), (iv) 20. (ii), (iii) 21. (i), (iii)
22. (i), (ii) 23. (i), (iv) 24. (i), (ii) 25. (i), (iii)
26. (ii), (iii)

III. Short Answer Type

27. For the reaction

$$2Cl^-(aq) + 2H_2O\ (l) \longrightarrow 2OH^-(aq) + H_2(g) + Cl_2\ (g)$$

Value of $\Delta G^\ominus$ is + 422kJ. Using the equation $\Delta G^\ominus = -nFE^\ominus$ the value of $E^\ominus$ comes out to be –2.2V. Therefore extraction of Cl_2 from brine will require an external emf of greater than 2.2*V*.

28. As per Ellingham diagram at temperatures greater than 1073 K

ΔG (C, CO) < ΔG (Fe, FeO). Hence coke can reduce FeO to Fe.

29. $Fe_2O_3 + 3C \longrightarrow 2Fe + 3CO$

Limestone is added as flux and sulphur, silicon and phosphorus change to their oxides and pass into the slag.

30. Copper is extracted by hydrometallurgy from low grade copper ores. It is leached out using acid or bacteria. The solution containing Cu^{2+} is treated with scrap iron, Zn or H_2.

$$Cu^{2+}(aq) + H_2(g) \longrightarrow Cu(s) + 2H^+(aq)$$

$$Cu^{2+} + Fe(s) \longrightarrow Fe^{2+}(aq) + Cu(s)$$

31. Basic requirements for both processes are :

(i) The metal should form a volatile compound with an available reagent.

(ii) The volatile compound should be easily decomposable, so that recovery of metal is easy.

32. It is because at high temperature carbon and hydrogen react with metals to form carbides and hydrides respectively.

33. Two sulphide ores can be separated by adjusting proportion of oil to water or by using depressants. For example, in the case of an ore containing ZnS and PbS, the depressant NaCN is used. It forms complex with ZnS and prevents it from coming with froth but PbS remains with froth.

34. Haematite

$Fe_2O_3 + 3C \longrightarrow 2Fe + 3CO$

35. Since compound 'A' comes out before compound 'B', the compound 'B' is more readily adsorbed on column.

36. Iron oxide present as impurity in sulphide ore of copper forms slag which is iron silicate and copper is produced in the form of copper matte.

$FeO + SiO_2 \longrightarrow FeSiO_3$ 37.

Sulphides are not reduced easily but oxides are easily reduced.

38. van Arkel method is used for refining Zr and Ti. In this method crude metal is heated with iodine.

$Zr + 2I_2 \longrightarrow ZrI_4$

$ZrI_4 \xrightarrow{1800K} Zr + 2I_2$ 39. Generally two things are considered so

that proper precautions can be taken.

(i) reactivity of metal produced.

(ii) suitability of electrodes.

40. Flux is used for making the molten mass more conducting.

41. Semiconducting metal is produced by zone refining method which is based on the principle that the impurities are more soluble in melt than in the solid state of metals.

42. $3Fe_2O_3 + CO \longrightarrow 2Fe_3O_4 + CO_2$

$Fe_3O_4 + 4CO \longrightarrow 3Fe + 4CO_2$

$Fe_2O_3 + CO \longrightarrow 2FeO + CO_2$

43. (i) The metal should form a volatile compound with available reagent.

(ii) The volatile compound should be easily decomposable so that the recovery is easy.

44. $4Au\ (s) + 8CN^-(aq) + 2H_2O\ (aq) + O_2\ (g) \longrightarrow 4\ [Au\ (CN)_2]^-\ (aq) + 4OH^-\ (aq)$

$2[Au(CN)_2]^-\ (aq) + Zn(s) \longrightarrow 2Au(s) + [Zn\ (CN)_4]^{2-}\ (aq)$

In this reaction zinc acts as a reducing agent.

IV. Matching Type

45. (ii) 46. (ii) 47. (i) 48. (i) 49. (i)

V. Assertion and Reason Type

50. (i) 51. (i) 52. (ii) 53. (ii) 54. (ii)

VI. Long Answer Type

55. (a) **Hint :** Use Ellingham diagram (b)

    Hint : Oxides are easier to reduce. See Ellingham diagram.

    (c) **Hint :** Sulphide ore of copper contains iron as impurity which is removed as iron silicate (slag)

    $$\underset{}{FeO + SiO_2} \longrightarrow \underset{\text{(Slag)}}{FeSiO_3}$$

    (d) **Hint :** Carbon and hydrogen react with metals at high temperature to form carbides and hydrides respectively.

    (e) **Hint :** Ti reacts with iodine to form volatile TiI_4 which decomposes at high temperature to give extra pure titanium.