DPP - Daily Practice Problems

Chapter-wise Sheets

Date : Start Time : End Time :

CHEMISTRY CC20

SYLLABUS : General Principles and Processes of Isolation of Elements

Max. Marks : 180 **Marking Scheme :** + 4 for correct & (–1) for incorrect **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. Bronze is a mixture of
(a) Pb + Sn (b) Cu + Sn
(c) Cu + Zn (d) Pb + Zn

2. Which of the following pair is incorrectly matched ?
(a) Magnetite – Fe_3O_4 (b) Copper glance – Cu_2S
(c) Calamine – $ZnCO_3$ (d) Zincite – ZnS

3. Which of the following factors is of ***no significance*** for roasting sulphide ores to the oxides and not subjecting the sulphide ores to carbon reduction directly?
(a) Metal sulphides are thermodynamically more stable than CS_2
(b) CO_2 is thermodynamically more stable than CS_2
(c) Metal sulphides are less stable than the corresponding oxides
(d) CO_2 is more volatile than CS_2

4. Aluminothermic process is used for the extraction of metals , whose oxides are
(a) fusible
(b) not easily reduced by carbon
(c) not easily reduced by hydrogen
(d) strongly basic.

5. Which reagent is used in Bayer's process?
(a) Na_2CO_3 (b) Carbon
(c) NaOH (d) Silica

6. Which of the following reaction takes place in blast furnace during extraction of copper ?
(a) $2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$
(b) $2FeS + 3O_2 \longrightarrow 2Fe\bullet + 2SO_2$
(c) $2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$
(d) All of these

RESPONSE GRID					
1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ	6. ⓐⓑⓒⓓ

Space for Rough Work

7. When an aqueous solution of sodium chloride is electrolysed using platinum electrodes, the ion discharged at the electrodes are
(a) sodium and hydrogen (b) sodium and chloride
(c) hydrogen and chloride (d) hydroxyl and chloride

8. Which of the following elements is present as the impurity to the maximum extent in the pig iron?
(a) Manganese (b) Carbon
(c) Silicon (d) Phosphorus

9. Thomas slag is
(a) $Ca_3(PO_4)_2$
(b) $CaSiO_3$
(c) Mixture of (a) and (b)
(d) $FeSiO_3$

10. Brine is electrolysed by using inert electrodes. The reaction at anode is _____.
(a) $Cl^-(aq) \longrightarrow \frac{1}{2}Cl_2(g) + e^-$; $E^\circ_{Cell} = 1.36V$
(b) $2H_2O(l) \longrightarrow O_2(g) + 4H^+ + 4e^-$; $E^\circ_{Cell} = 1.23V$
(c) $Na^+(aq) + e^- \longrightarrow Na(s)$; $E^\circ_{Cell} = 2.71V$
(d) $H^+(aq) + e^- \longrightarrow \frac{1}{2}H_2(g)$; $E^\circ_{Cell} = 0.00V$

11. Pb and Sn are extracted from their chief ore by
(a) carbon reduction and self reduction.
(b) self reduction and carbon reduction.
(c) electrolysis and self reduction.
(d) self reduction and electrolysis.

12. In the commercial electrochemical process for aluminium extraction the electrolyte used is
(a) $Al(OH)_3$ in NaOH solution
(b) An aqueous solution of $Al_2(SO_4)_3$
(c) A molten mixture of Al_2O_3 and Na_3AlF_6
(d) A molten mixture of Al_2O_3 and $Al(OH)_3$

13. Aluminium is extracted from alumina (Al_2O_3) by electrolysis of a molten mixture of
(a) $Al_2O_3 + HF + NaAlF_4$
(b) $Al_2O_3 + CaF_2 + NaAlF_4$
(c) $Al_2O_3 + Na_3AlF_6 + CaF_2$
(d) $Al_2O_3 + KF + Na_3AlF_6$

14. A coupled reaction is takes place as follow–
$A + B \longrightarrow C + D$, $\Delta G^\circ = +xkJ$
$D + E \longrightarrow F$ $\Delta G^\circ = -ykJ$
for the spontaneity of reaction $A + B + E \longrightarrow C + F$, which of the following is correct?
(a) $2x = y$ (b) $x < y$
(c) $x > y$ (d) $x = (y) \times T\Delta S$

15. The most electropositive metals are isolated from their ores by
(a) high temperature reduction with carbon
(b) self reduction
(c) thermal decomposition
(d) electrolysis of fused ionic salts

16. Which of the following pairs of metals is purified by van Arkel method?
(a) Ga and In (b) Zr and Ti
(c) Ag and Au (d) Ni and Fe

17. Match list I with list II and select the correct answer using the codes given below the lists:

List I	List II
A. Cyanide process	I. Ultrapure Ge
B. Floatation process	II. Pinoil
C. Electrolytic reduction	III. Extraction of Al
D. Zone refining	IV. Extraction of Au

(a) A-III; B-I; C-IV; D-II (b) A-IV; B-II; C-III; D-I
(c) A-III; B-II; C-IV; D-I (d) A-IV; B-I; C-III; D-II

18. Blister copper is
(a) Impure Cu (b) Cu alloy
(c) Pure Cu (d) Cu having 1% impurity

19. Electrometallurgical process is used to extract
(a) Fe (b) Pb
(c) Na (d) Ag

RESPONSE GRID					
	7. (a)(b)(c)(d)	8. (a)(b)(c)(d)	9. (a)(b)(c)(d)	10. (a)(b)(c)(d)	11. (a)(b)(c)(d)
	12. (a)(b)(c)(d)	13. (a)(b)(c)(d)	14. (a)(b)(c)(d)	15. (a)(b)(c)(d)	16. (a)(b)(c)(d)
	17. (a)(b)(c)(d)	18. (a)(b)(c)(d)	19. (a)(b)(c)(d)		

Space for Rough Work

20. Sulphide ores of metals are usually concentrated by froth flotation process. Which one of the following sulphide ores offer an exception and concentrated by chemical leaching?
(a) Galena (b) Copper pyrite
(c) Sphalerite (d) Argentite

21. Which of the following reactions is an example for calcination process ?
(a) $2Ag+2HCl+(O)\rightarrow 2AgCl+H_2O$
(b) $2Zn+O_2\rightarrow 2ZnO$
(c) $2ZnS+3O_2\rightarrow 2ZnO+2SO_2$
(d) $MgCO_3\rightarrow MgO+CO_2$

22. In the metallurgy of Zn, Zn dust obtained from roasting and reduction of zinc sulphide contains some ZnO. It is removed by
(a) absorbance of ultraviolet light- and reemission of white light
(b) shock cooling by contact with a shower of molten lead.
(c) X-raymethod
(d) smelting.

23. The electrolytic reduction technique is used in the extraction of
(a) highly electronegative elements
(b) highly electropositive elements
(c) metalloids
(d) transition metals.

24. Which of the following metal is leached by cyanide process
(a) Ag (b) Na (c) Al (d) Cu

25. ΔG° vs T plot in the Ellingham's diagram slopes downward for the reaction
(a) $Mg+\frac{1}{2}O_2\rightarrow MgO$ (b) $2Ag+\frac{1}{2}O_2\rightarrow Ag_2O$
(c) $C+\frac{1}{2}O_2\rightarrow CO$ (d) $CO+\frac{1}{2}O_2\rightarrow CO_2$

26. Process followed before reduction of carbonate ore is
(a) calcination (b) roasting
(c) liquation (d) polling

27. Which of the following metal is used in the manufacture of dye-stuffs and paints ?
(a) Copper (b) Zinc
(c) Aluminium (d) Magnesium

28. Silver containing lead as an impurity is removed by
(a) poling (b) cupellation
(c) lavigation (d) distillation

29. Among the following groups of oxides, the group containing oxides that cannot be reduced by carbon to give the respective metals is
(a) Cu_2O, SnO_2 (b) Fe_2O_3, ZnO
(c) CaO, K_2O (d) PbO, Fe_3O_4

30. Which of the following condition favours the reduction of a metal oxide to metal?
(a) ΔH = +ve, $T\Delta S$ = + ve at low temperature
(b) ΔH = +ve, $T\Delta S$ = – ve at any temperature
(c) ΔH = –ve, $T\Delta S$ = – ve at high temperature
(d) ΔH = –ve, $T\Delta S$ = + ve at any temperature

31. Match the columns.

Column-I	Column-II
(A) Blisterred Cu	I. Aluminium
(B) Blast furnace	II. $2Cu_2O+Cu_2S\rightarrow 6Cu+SO_2$
(C) Reverberatory furnace	III. Iron
(D) Hall-Heroult process	IV. $FeO+SiO_2\rightarrow FeSiO_3$
	V. $2Cu_2S+3O_2\rightarrow 2Cu_2O+2SO_2$

(a) A – II; B – III; C – IV; D – I
(b) A – I; B – II; C – III; D – V
(c) A – V; B – IV; C – III; D – II
(d) A – IV; B – V; C – III; D – II

RESPONSE GRID					
	20. ⓐⓑⓒⓓ	**21.** ⓐⓑⓒⓓ	**22.** ⓐⓑⓒⓓ	**23.** ⓐⓑⓒⓓ	**24.** ⓐⓑⓒⓓ
	25. ⓐⓑⓒⓓ	**26.** ⓐⓑⓒⓓ	**27.** ⓐⓑⓒⓓ	**28.** ⓐⓑⓒⓓ	**29.** ⓐⓑⓒⓓ
	30. ⓐⓑⓒⓓ	**31.** ⓐⓑⓒⓓ			

Space for Rough Work

32. In the extraction of copper from its sulphide ore, the metal is finally obtained by the reduction of cuprous oxide with :
(a) Copper (I) sulphide (Cu_2S)
(b) Sulphur dioxide (SO_2)
(c) Iron sulphide (FeS)
(d) Carbon monoxide (CO)

33. In electro-refining of metal the impure metal is made the anode and a strip of pure metal, the cathode, during the electrolysis of an aqueous solution of a complex metal salt. This method cannot be used for refining of
(a) silver (b) copper
(c) aluminium (d) sodium

34. According to Ellingham diagram, the oxidation reaction of carbon to carbon monoxide may be used to reduce which one of the following oxides at the lowest temperature ?
(a) Al_2O_3 (b) Cu_2O
(c) MgO (d) ZnO

35. Hematite is the ore of
(a) Pb (b) Cu
(c) Fe (d) Au

36. Which of the following is chalcopyrite?
(a) $CuFeS_2$ (b) FeS_2
(c) $KMgCl_3.6H_2O$ (d) $Al_2O_3.2H_2O$

37. Main function of roasting is
(a) to remove volatile substances
(b) oxidation
(c) reduction
(d) slag formation

38. Method used for obtaining highly pure silicon used as a semiconductor material, is
(a) Oxidation (b) Electrochemical
(c) Crystallization (d) Zone refining

39. After partial roasting the sulphide of copper is reduced by
(a) cyanide process (b) electrolysis
(c) reduction with carbon (d) self reduction

40. Cast iron is
(a) made by melting pig iron with scrap iron and coke using hot air blast
(b) having slightly lower carbon content (about 3%) as compared to pig iron
(c) extremely hard and brittle
(d) All of the above statements are true

41. The following reactions take place in the blast furnace in the preparation of impure iron. Identify the reaction pertaining to the formation of the slag.
(a) $Fe_2O_3(s) + 3\,CO(g) \rightarrow 2\,Fe(l) + 3\,CO_2(g)$
(b) $CaCO_3(s) \dashrightarrow CaO(s) + CO_2(g)$
(c) $CaO(s) + SiO_2(s) \dashrightarrow CaSiO_3(s)$
(d) $2C(s) + O_2(g) \dashrightarrow 2\,CO(g)$

42. Before introducing FeO in blast furnace, it is converted to Fe_2O_3 by roasting so that
(a) it may not be removed as slag with silica
(b) it may not evaporate in the furnace
(c) presence of it may increase the m.pt. of charge
(d) None of these.

43. When a metal is to be extracted from its ore and the gangue associated with the ore is silica, then
(a) an acidic flux is needed
(b) a basic flux is needed
(c) both acidic and basic fluxes are needed
(d) Neither of them is needed

44. $Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$
In which process of metallurgy of copper, above equation is involved?
(a) Roasting (b) Self reduction
(c) Refining (d) Purification

45. When the sample of copper with zinc impurity is to be purified by electrolysis, the appropriate electrodes are

	Cathode	**Anode**
(a)	pure zinc	pure copper
(b)	impure sample	pure copper
(c)	impure zinc	impure sample
(d)	pure copper	impure sample.

RESPONSE GRID					
	32. ⓐⓑⓒⓓ	**33.** ⓐⓑⓒⓓ	**34.** ⓐⓑⓒⓓ	**35.** ⓐⓑⓒⓓ	**36.** ⓐⓑⓒⓓ
	37. ⓐⓑⓒⓓ	**38.** ⓐⓑⓒⓓ	**39.** ⓐⓑⓒⓓ	**40.** ⓐⓑⓒⓓ	**41.** ⓐⓑⓒⓓ
	42. ⓐⓑⓒⓓ	**43.** ⓐⓑⓒⓓ	**44.** ⓐⓑⓒⓓ	**45.** ⓐⓑⓒⓓ	

Space for Rough Work

1. **(b)**
2. **(d)** Zincite is ZnO.
3. **(c)** The reduction of metal sulphides by carbon reduction process is not spontaneous because ΔG for such a process is positive. The reduction of metal oxide by carbon reduction process is spontaneous as ΔG for such a process is negative. From this we find that on thermodynamic considerations CO_2 is more stable than CS_2 and the metal sulphides are more stable than corresponding oxides.
   In view of above the factor listed in choice (c) is incorrect and so is of no significance.
4. **(b)** When reduction by carbon is not satisfactory in case of metals having high m.pt., aluminothermic process is used.
5. **(c)**
6. **(d)**
7. **(c)** $NaCl \rightleftharpoons Na^+ + Cl^-$

   $H_2O \rightleftharpoons H^+ + OH^-$ ($H^+ \xrightarrow{+e^-}$)

   $\frac{1}{2}H_2 \leftarrow H;\ Cl^- \rightarrow Cl \rightarrow \frac{1}{2}Cl_2 + e^-$

   (At cathode) (At anode)

   Reduction potential of H is more than Na.
8. **(b)** Pig iron or cast iron contains 3 – 5% carbon and varying amounts of Mn, Si, P and S which makes the iron hard and brittle.
9. **(c)**
10. **(a)**
11. **(b)** PbO and $PbSO_4$ get reduced by PbS itself which is already present in mixture so because the reduction took place by itself, hence is known as self reduction.

    $2PbO + PbS \xrightarrow{\Delta} 3Pb + SO_2 \uparrow$

    $PbSO_4 + PbS \xrightarrow{\Delta} 2Pb + 2SO_2 \uparrow$
12. **(c)**
13. **(c)** Fused alumina (Al_2O_3) is a bad conductor of electricity. Therefore, cryolite (Na_3AlF_6) and fluorspar (CaF_2) are added to purified alumina which not only make alumina a good conductor of electricity but also reduce the melting point of the mixture to around 1140 K.
14. **(b)** For a spontaneous reaction , $\Delta G^\bullet$ must be negative and it can be possible only in this case when $x < y$
15. **(d)** Most electropositive metals are obtained by electrolysis of their fused ionic salts.
16. **(b)** Zr and Ti are purified by van Arkel method.

    $Zr(s) + 2I_2(g) \xrightarrow{870K} ZrI_4(g)$

    $ZrI_4(g) \xrightarrow[\text{Tugsten filament}]{2075K} Zr(s) + 2I_2(g)$

    $Ti(s) + 2I_2(s) \xrightarrow{523K} TiI_4(g)$

    $\downarrow 1700K$

    $Ti(s) + 2I_2(g)$

    Pure titanium
17. **(b)** Cyanide process is for gold (A-IV); floatation process - pine oil (B-II); Electrolytic reduction - Al (C-III); Zone refining -Ge (D-I).
18. **(d)** Blister-Copper contains 1 – 2 % impurities. It is obtained after Bessemerisation of crude copper.
19. **(c)** Because Na is very reactive and cannot be extracted by means of the reduction by C, CO etc. So it is extracted by electrolysis.
20. **(d)** Leaching is the selective dissolution of the desired mineral leaving behind the impurities in a suitable dissolving agent, e.g. Argentitie or Silver glance, Ag_2S is an ore of silver. Silver is extracted from argentite by the mac-Arthur and Forest process (leaching process).

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

    $4Au + 8KCN + 2H_2O + O_2 \rightarrow 4K[Au(CN)_2] + 4KOH$
21. **(d)** Decomposition of carbonates and hydrated oxides.
22. **(d)**
23. **(b)** Highly electropositive elements are obtained by electrolytic reduction.
24. **(a)** Ag is leached by cyanide process.
25. **(c)**
26. **(a)** Calcination is heating ore in absence of air to remove moisture and volatile impurities. Carbonate ores decomposed to corresponding oxides as a result of calcination.
27. **(b)** Zinc dust is used as a reducing agent in the manufacture of dye-stuffs, paints etc.
28. **(b)** Silver containing lead is purified by cupellation.
29. **(c)** Ca and K are strong reducing agents, hence their oxides cannot be reduced with carbon.
30. **(d)**
31. **(a)**

32. **(a)** Cuprous oxide formed during roasting of cuprous sulphide is mixed with few amount of cuprous sulphide and heated in a reverberatory furnace to get metallic copper.

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

33. **(d)** Na reacts vigorously with water (exothermic process)

34. **(b)** In the graph of $\Delta_r G^\circ$ vs T for formation of oxides, the Cu_2O line is almost at the top. So, it is quite easy to reduce oxide ores of copper directly to the metal by heating with coke both the lines of C, CO and C, CO_2 are at much lower temperature (500 - 600 K).

$$Cu_2O + C \longrightarrow 2Cu + CO$$

35. **(c)** Hematite is Fe_2O_3. Thus it is the ore of iron (Fe).

36. **(a)** Chalcopyrite : $CuFeS_2$
Fool's gold : FeS_2
Carnalite : $KMgCl_3.6H_2O$
Bauxite : $Al_2O_3.2H_2O$

37. **(a)** To remove moisture and non-metallic impurities like S, P and As are oxidised and are removed as volatile substances.

$$S_8 + 8O_2 \rightarrow 8SO_2 \uparrow ; \; P_4 + 5O_2 \rightarrow P_4O_{10} \uparrow$$

$$4As + 3O_2 \rightarrow 2As_2O_3 \uparrow$$

38. **(d)** Si obtained by reduction of $SiCl_4$ with H_2 is further purified by zone refining method to get Si of very high purity. Silicon is purified by zone-refining process because the impurities present in it are more soluble in the liquid phase than in the solid phase.

39. **(d)** $2CuO + CuS \rightarrow 3Cu + SO_2$ (Self - reduction)

40. **(d)** Cast iron is different from pig iron and is made by melting pig iron with scrap iron and coke using hot air blast. It has slightly lower carbon content (about 3%) and is extremely hard and brittle.

41. **(c)** In blast furnace at about 1270 K, calcium carbonate is almost completely decomposed to give CaO which acts as a flux and combines with SiO_2 present as impurity (gangue) in the ore to form calcium silicate (fusible slag)

$CaO(s)$ (basic flux) + SiO_2 (s) (acidic flux) $\longrightarrow$ $CaSiO_3$ (s) (slag)

42. **(a)** FeO is capable forming slag with SiO_2

$$SiO_2 + FeO \rightarrow FeSiO_3$$

43. **(b)** Since silica is acidic impurity the flux must be basic.

$$CaO + SiO_2 \rightarrow CaSiO_3$$

44. **(b)** This process is also called autoreduction process or air reduction process. The sulphide ores of less electropositive metals are heated in air to convert part of the ore into oxide or sulphate which then react with the remaining sulphide ore to give the metal and sulphur dioxide.

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

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

45. **(d)** Pure metal always deposits at cathode.