DPP - Daily Practice Problems

Date : | **Start Time :** | **End Time :**

CHEMISTRY CC20

SYLLABUS : General Principles and Processes of Isolation of Elements

Max. Marks : 120 **Marking Scheme :** + 4 for correct & (–1) for incorrect **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. Identity *x, y, z* for the following metallurgical process.

Metal sulphide $\xrightarrow{x}$ Metal oxide $\xrightarrow{y}$ Impure metal $\xrightarrow{z}$ Pure metal.

x, y and *z* are respectively

(a) roasting, smelting, electrolysis

(b) roasting, calcination, smelting

(c) calcination, auto-reduction, bassemerisation

(d) none of the above is correct

2. Bronze is a mixture of

(a) Pb + Sn (b) Cu + Sn

(c) Cu + Zn (d) Pb + Zn

3. Which reagent is used in Bayer's process?

(a) Na_2CO_3 (b) Carbon

(c) NaOH (d) Silica

4. Thomas slag is

(a) $Ca_3(PO_4)_2$

(b) $CaSiO_3$

(c) Mixture of (a) and (b)

(d) $FeSiO_3$

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

5. 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

6. Which of the following fluxes is used to remove acidic impurities in metallurgical process?
(a) Silica
(b) Lime stone
(c) Sodium chloride
(d) Sodium carbonate

7. A basic lining is given to a furnace by using
(a) Calcined dalomite
(b) Lime stone
(c) hae matite
(d) silica

8. Electromagnetic separation is used in the concentration of
(a) copper pyrites (b) bauxite
(c) cassiterite (d) cinnabar

9. Extraction of gold and silver involves leaching with CN^- ion. Silver is later recovered by
(a) distillation
(b) zone refining
(c) displacement with Zn
(d) liquation

10. 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) $MgCO_3 \rightarrow MgO + CO_2$

11. Δ G° 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) $CO + \frac{1}{2}O_2 \rightarrow CO_2$

12. 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

13. Among the following statements the incorrect one is
(a) Calamine and siderite are carbonates
(b) Argentite and cuprite are oxides
(c) Zinc blende and iron pyrites are sulphides
(d) Malachite and azurite are ores of copper.

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

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

Codes:
(a) I-C, II-A, III-D, IV-B (b) I-D,II-B,III-C,IV-A
(c) I-C,II-B,III-D, IV-A (d) I-D,II-A,III-C,IV-B

15. A coupled reaction is takes place as follow–
$A + B \longrightarrow C + D$, $\Delta G^\circ = +x$ kj
$D + E \longrightarrow F$ $\Delta G^\circ = -y$ kj
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) $x = (y) \times T\Delta S$

16. Aluminium is extracted from alumina (Al_2O_3) by electrolysis

RESPONSE GRID					
	5. ⓐⓑⓒⓓ	**6.** ⓐⓑⓒⓓ	**7.** ⓐⓑⓒⓓ	**8.** ⓐⓑⓒⓓ	**9.** ⓐⓑⓒⓓ
	10. ⓐⓑⓒⓓ	**11.** ⓐⓑⓒⓓ	**12.** ⓐⓑⓒⓓ	**13.** ⓐⓑⓒⓓ	**14.** ⓐⓑⓒⓓ
	15. ⓐⓑⓒⓓ				

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) $Al_2O_3 + KF + Na_3AlF_6$

17. Which of the following statements, about the advantage of roasting of sulphide ore before reduction is not true?

(a) The ΔG_f^o of the sulphide is greater than those for CS_2 and H_2S.

(b) The ΔG_f^o is negative for roasting of sulphide ore to oxide.

(c) Roasting of the sulphide to the oxide is thermodynamically feasible.

(d) Carbon and hydrogen are suitable reducing agents for reduction of metal sulphides.

18. 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)

19. The method of zone refining of metals is based on the principle of

(a) Greater solubility of the impurity in the molten state than in the solid

(b) Greater mobility of the pure metal than that of the impurity

(c) Higher melting point of the impurity than that of the pure metal

(d) Greater noble character of the solid metal than that of the impurity

20. In the cyanide extraction process of silver from argentite ore, the oxidising and reducing agents used are

(a) O_2 and CO respectively

(b) O_2 and Zn dust respectively

(c) HNO_3 and Zn dust respectively

(d) HNO_3 and CO respectively

21. The metal oxide which cannot be reduced to metal by carbon is

(a) Fe_2O_3 (b) Al_2O_3

(c) PbO (d) ZnO

22. 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) $2FeS + 3O_2 \longrightarrow 2FeO + 2SO_2$

(c) $2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$

(d) All of these

23. Which process represents the change,

$Ti + 2I_2 \rightarrow TiI_4 \rightarrow Ti + 2I_2$

(a) Cupellation

(b) Van Arkel

(c) Polling

(d) Zone Refining

24. 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

25. 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

RESPONSE GRID					
	16. ⓐⓑⓒⓓ	**17.** ⓐⓑⓒⓓ	**18.** ⓐⓑⓒⓓ	**19.** ⓐⓑⓒⓓ	**20.** ⓐⓑⓒⓓ
	21. ⓐⓑⓒⓓ	**22.** ⓐⓑⓒⓓ	**23.** ⓐⓑⓒⓓ	**24.** ⓐⓑⓒⓓ	**25.** ⓐⓑⓒⓓ

26. Which of the following reaction(s) occur in temperature range 500 – 800 K in blast furnace.

(i) $Fe_2O_3 + CO \longrightarrow 2FeO + CO_2$

(ii) $Fe_3O_4 + 4CO \longrightarrow 3Fe + 4CO_2$

(iii) $FeO + CO \longrightarrow Fe + CO_2$

(iv) $C + CO_2 \longrightarrow 2CO$

(a) (i) and (ii) (b) (i), (ii) and (iii)

(c) (iii) and (iv) (d) (iv) only

27. 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

28. 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.

29. Which of the following statements is correct ?

(a) Gangues are carefully chosen to combine with the slag present in the ore to produce easily fusible flux to carry away the impurities

(b) Slags are carefully chosen to combine with the flux present in the ore to produce easily fusible gangue to carry away the impurities

(c) Gangues are carefully chosen to combine with the flux present in the ore to produce easily fusible slag to carry away the impurities

(d) Fluxes are carefully chosen to combine with the gangue present in the ore to produce easily fusible slag to carry away the impurities

30. The value of $\Delta_f G^\circ$ for formation of Cr_2O_3 is – 540 kJmol^{-1} and that of Al_2O_3 is – 827 kJ mol^{-1}. What is the value of $\Delta_r G^\circ$ for the reaction?

$$\frac{4}{3}Al(s) + \frac{2}{3}Cr_2O_3(s) \rightarrow \frac{2}{3}Al_2O_3(s) + \frac{4}{3}Cr(s).$$

(a) – 574 kJ mol^{-1} (b) –287kJ mol^{-1}

(c) + 574 kJ mol^{-1} (d) +287kJ mol^{-1}

RESPONSE GRID	26. ⓐⓑⓒⓓ	27. ⓐⓑⓒⓓ	28. ⓐⓑⓒⓓ	29. ⓐⓑⓒⓓ	30. ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM DPP CHAPTERWISE 20 - CHEMISTRY			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	38	Qualifying Score	56
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

1. **(a)** The conversion of metal sulphide to metal oxide involves the process of **roasting** (i.e., *x* is roasting).
The metal oxides can then be converted to impure metal by reduction. Of the given choices in (a) and (b) the reduction process is that of **smelting**. (i.e., '*y*' is smelting)
The conversion of impure metal to pure metal involves a process of purification. Thus it is electrolysis.

2. **(b)**

3. **(c)**

4. **(c)**

5. **(d)**

6. **(b)**

7. **(a)** Dalomite on calcination gives CaO, MgO which provides basic lining in furnace.

8. **(c)**

9. **(c)** Zn being more reactive than Ag and Au, displaces them.

$$4Ag + 8NaCN + 2H_2O + O_2 \xrightarrow{\text{Leaching}} 4Na[Ag(CN)_2] + 4NaOH$$

Soluble Sodium dicyanoargentate (I)

Soluble cyanide compound can be treated with Zn to give metal by displacement.

$$2Na[Ag(CN)_2] + Zn \xrightarrow{\text{Displacement}} Na_2[Zn(CN)_4] + 2Ag\downarrow$$

10. **(d)** Decomposition of carbonates and hydrated oxides.

11. **(c)**

12. **(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.

13. **(b)** Cuprite is Cu_2O and Argentite is Ag_2S.

14. **(b)** Cyanide process is for gold (I-D); floatation process - pine oil (II-B); Electrolytic reduction - Al (III-C); Zone refining -Ge (IV-A).

15. **(b)** For a spontaneous reaction , ΔG° must be negative and it can be possible only in this case when $x < y$

16. **(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.

17. **(d)** The sulphide ore is roasted to oxide before reduction because the ΔG_f^o of most of the sulphides are greater than those of CS_2 and H_2S, therefore neither C nor H can reduce metal sulphide to metal. Further, the standard free energies of formation of oxide are much less than those of SO_2. Hence oxidation of metal sulphides to metal oxide is thermodynamically favourable.

18. **(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.

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

19. **(a)** Zone refining is based on the difference in solubility of impurities in molten and solid state of the metal. This method is used for obtaining metals of very high purity.

20. **(b)** The reactions involved in cyanide extraction process are :

$$\underset{\text{(argentite)}}{Ag_2S} + 4NaCN \rightarrow 2Na[Ag(CN)_2] + Na_2S$$

$$4Na_2S + \underset{\text{Oxiding agent}}{5O_2} + 2H_2O \rightarrow 2Na_2SO_4 + 4NaOH + 2S$$

$$2Na[Ag(CN)_2] + \underset{\text{(reducing agent)}}{Zn} \rightarrow Na_2[Zn(CN)_4] + 2Ag\downarrow$$

21. **(b)** Al_2O_3 cannot be reduced by carbon.

22. **(d)**

23. **(b)** The given reaction is the method named as Van Arkel for the purification of titanium

24. **(c)** Ca and K are strong reducing agents, hence their oxides cannot be reduced with carbon

25 **(b)** Zr and Ti are purified by van Arkel method.

$$Zr(s) + 2I_2(g) \longrightarrow ZrI_4(g)$$

$$ZrI_4(g) \xrightarrow[\text{filament}]{\text{On the hot}} Zr(s) + 2I_2(g)$$

26. **(c)** (iii) and (iv) reactions occur in the temperature range of 900 – 1500K in blast furnace.

27. **(d)** Zincite is ZnO.

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

$$SiO_2 + FeO \rightarrow FeSiO_3$$

29. **(d)**

30. **(b)** The two equation are:

$$\frac{4}{3}Al(s) + O_2(g) \rightarrow \frac{2}{3}Al_2O_3(s), \quad \Delta_f G^\circ = -827 kJ\ mol^{-1} \quad \ldots(1)$$

$$\frac{4}{3}Cr(s) + O_2(g) \rightarrow \frac{2}{3}Cr_2O_3(s), \quad \Delta_f G^\circ = -540 kJ\ mol^{-1} \quad \ldots(2)$$

Subtracting equation (ii) from equation (i) we have,

$$\frac{4}{3}Al(s) + \frac{2}{3}Cr_2O_3(s),$$

$$\rightarrow \frac{2}{3}Al_2O_3(s) + \frac{4}{3}Cr(s), \quad \Delta_r G^\circ = -287 kJ\ mol^{-1}$$