PHYSICAL / INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 57

Total Marks : 42

Max. Time : 42 min.

Topic : Metallurgy

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.8	(3 marks 3 min.)	[24, 24]
Comprehension ('–1' negative marking) Q.9 to Q.11	(3 marks 3 min.)	[9, 9]

Revision Question

Comprehension ('–1' negative marking) Q.12 to Q.14	(3 marks 3 min.)	[9, 9]

1. In froth floatation process for the purification of ores, the particles of ore float because :

(A) their surface is not easily wetted by water (B) they are light

(C) they are insoluble (D) they bear electrostatic charge

2. The purpose of adding Na_3AlF_6 to Al_2O_3 during electrolysis is

(A) To decrease metling point of Al_2O_3 (B) To increase conductivity of electrolyte

(C) To provide reducing condition in the bath (D) A & B

3. Match List–I with List–II and select the correct answer using codes given below in the list :

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

(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

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

	List I		**List II**
A	van Arkel method	**1.**	Manufacture of caustic soda
B	Solvay process	**2.**	Purification of titanium
C	Cupellation	**3.**	Manufacture of Na_2CO_3
D	Poling	**4.**	Purification of copper
		5.	Refining of silver

	A	B	C	D		A	B	C	D
(A)	2	1	3	4	(B)	4	3	2	5
(C)	2	3	5	4	(D)	5	1	3	4

5. Match **List-I** with **List-II** and select the correct answer using the codes given below the lists.

	List-I (Metals)		**List-II (Process/methods involved in extraction process)**
(a)	Au	1.	Self reduction
(b)	Al	2.	Liquation
(c)	Pb	3.	Electrolysis
(d)	Sn	4.	Bayer's process

	(a)	**(b)**	**(c)**	**(d)**		**(a)**	**(b)**	**(c)**	**(d)**
(A)	3	1	2	4	(B)	3	4	1	2
(C)	1	2	4	3	(D)	3	2	4	1

6. In the Hoop's process of aluminium extraction , the fused materials remain in three different layers. These layers remain separated even in electrolytic reduction, because :

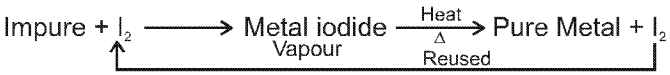
(A) upper layer is attracted by cathode and lower layer is attracted by anode

(B) cell has the arrangement for separating the layers

(C) all the layers have different densities

(D) all the layers are at different temperature

7. In steel making the impurities are removed by
(A) Oxidation
(B) reduction
(C) Converted into high melting compounds by addition of some elements
(D) Gasification

8. 

The above method of purification is :
(A) Van – arkel process for Zr, Hg etc
(B) Distillation for Zn, Cd, Hg etc
(C) Electro refining for W, Ag, Au, etc
(D) Zone refining of germanium gallium, silicon etc.

Comperhension # (Q.9 to Q.11)

The choice of reducing agent for metal oxide is decided by thermodynamic principle of metallurgy. ΔG must be negative. Ellingham diagram is a plot of $\Delta_f G^\circ$ Vs T for the formation of oxides of varous elements. All the plots slope upwards when temeprature increases. Each plot is a straight line except when some change in phase takes place. A metal will reduce the oxide of other metals which lie above it in this diagram.

9. ΔG° vs T plot in the Ellingham's diagram slopes downward for the reaction

(A) $Mg + \frac{1}{2}O_2 \longrightarrow MgO$
(B) $2Ag + \frac{1}{2}O_2 \longrightarrow Ag_2O$
(C) $C + \frac{1}{2}O_2 \longrightarrow CO$
(D) $CO + \frac{1}{2}O_2 \longrightarrow CO_2$

10. Free energies of formation ($\Delta_f G^\circ$) of MgO(s) and CO(g) at 1273 K are – 941 and – 439 kJ mol^{-1} respectively. At this temperature the nature of the reaction :

$MgO(s) + C(s) \longrightarrow Mg(s) + CO(g)$ is

(A) reversible
(B) spontaneous
(C) non-spontaneous
(D) highly spontaneous

11. Why is zinc not extracted from zinc oxide through reduction using CO ?
(A) Out of C and CO, C is always a better reducing agent.
(B) The line for $\Delta_f G^\circ$ (CO, CO_2) in the Ellingham diagram is always higher than the line for $\Delta_f G^\circ$ (ZnO, Zn) at the temperature employed.
(C) The line for $\Delta_f G^\circ$ (CO, CO_2) in the Ellingham diagram is always lower than the line for $\Delta_f G^\circ$ (ZnO, Zn) at the temperature employed.
(D) None of these.

Revision Question

Comprehension # (Q.12 to Q.14)

Suppose Bohr theory is applicable to a negative particle of mass $2m_e$ and charge $2e^-$ revolving around the nucleus of charge Ze, Let r_1, v_1 and E_1 be the radius of the orbit, speed of the particle in the orbit and energy of the particle in the orbit respectively. The value for these variable for electron revolving in the corresponding Bohr's orbit are r, v and E respectively.

12. Which of the following expression regarding the ratio of radii is correct ?

(A) $\frac{r_1}{r} = 2$
(B) $\frac{r_1}{r} = \frac{1}{2}$
(C) $\frac{r_1}{r} = 4$
(D) $\frac{r_1}{r} = \frac{1}{4}$

13. Which of the following expressions regarding the ratio of speeds are correct ?

(A) $\frac{v_1}{v} = 2$
(B) $\frac{v_1}{v} = \frac{1}{2}$
(C) $\frac{v_1}{v} = 4.$
(D) $\frac{v_1}{v} = \frac{1}{4}$

14. Which of the following expressions regarding the ratio of energies is correct ?

(A) $\frac{E_1}{E} = 4$
(B) $\frac{E_1}{E} = \frac{1}{4}$
(C) $\frac{E_1}{E} = 8$
(D) $\frac{E_1}{E} = \frac{1}{8}$

Answer Key

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1.	(A)	**2.**	(D)	**3.**	(B)	**4.**	(C)	**5.**	(B)
6.	(C)	**7.**	(A)	**8.**	(A)	**9.**	(C)	**10.**	(C)
11.	(B)	**12.**	(D)	**13.**	(A)	**14.**	(C)		

Hints & Solutions

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2. (D) Al_2O_3 is a poor conductor of electricity and having very high melting point. so to increase the conductivity Na_3AlF_6 is added and to decreases the melting point Na_3AlF_6 and CaF_2, are added so that melting point of electrolyte comes to around 930°C.

5. In the Bayer's process pure aluminium oxide is obtained from the bauxite ore. A low melting metal like tin can be refined by liquation method. Electrolysis is used in the refining of gold.

7. (A) In steel making. pure O_2 is purged into molten iron, where all impurities like C,S, Si, Mn converted into oxides then forming as slag, which is removed after wards.

8. (a) $\rightarrow$ van – Arkel method for Zr – Hg
$\rightarrow$ Based on volatile nature of halides of methods.

9. for $C(s) + \frac{1}{2}O_2(g) \longrightarrow CO(g)$ $\Delta S = +ve$

10. $\Delta G = -439 - (-941) = +502$ KJ/mol^{-1} so reaction will non-spontaneous

12. Force of attraction = $\frac{KZe \times 2e}{r_1^2} = \frac{2KZe^2}{r_1^2}$; Force of repulsion = $\frac{mv^2}{r_1} = \frac{2m_e \times v^2}{r_1}$

$$\therefore \quad \frac{2KZe^2}{r_1^2} = \frac{2m_e \times v^2}{r_1}$$

$$\text{or} \quad r_1 = \frac{KZe^2}{m_e v^2} = \frac{KZe^2}{m_e \times v^2} = \frac{KZe^2}{m_e \times \frac{n^2h^2}{4\pi m^2 r_1^2}} \qquad \left[\because mvr = \frac{nh}{2\pi} \text{ or } v = \frac{nh}{2\pi mr}\right]$$

$$\text{or} \quad r_1 = \frac{KZe^2 \times 4\pi^2 \times 4m_e^2 \times r_1^2}{m_e \times n^2h^2} \qquad \text{or} \qquad r_1 = \frac{n^2h^2}{4\pi^2 m_e KZe^2 \times 4} = \frac{r}{4}$$

$$\text{or} \quad \frac{r_1}{r} = \frac{1}{4}$$

13. $$v_1 = \frac{nh}{2\pi mr} = \frac{nh}{2\pi \times 2m_e \times r_1} = \frac{nh}{2\pi \times 2m_e \times \frac{r}{4}} = 2 \times \frac{nh}{2\pi m_e r} = 2 \times v \qquad \text{or} \qquad \frac{V_1}{v} = 2.$$

14. $$TE = -\frac{1}{2}KE = -\frac{1}{2}mv^2 = -\frac{1}{2} \times 2m_e \times \frac{n^2h^2}{\pi^2 \times m_e^2 \times r^2} = -\frac{1}{2} \times 2m_e \times \frac{n^2h^2}{\pi^2 \times m_e^2 \times \frac{n^4h^4}{4^2\pi^4 m_e^2 K^2 Z^2 e^4}}$$

$$TE = -\frac{16 \times \pi^2 \times K^2 \times e^4 \times z^2 \times m_e}{n^2h^2}$$

$$TE = \left[-\frac{2 \times \pi^2 \times K^2 \times e^4 \times z^2 \times m_e}{n^2h^2}\right] \times 8$$

$$E_1 = E \times 8 \qquad \text{or} \qquad \frac{E_1}{E} = 8.$$