PHYSICAL / INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 59

Total Marks : 33

Max. Time : 34 min.

Topic : Metallurgy

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks 3 min.)	[12, 12]
Comprehension ('–1' negative marking) Q.5 to Q.7	(3 marks 3 min.)	[9, 9]
Assertion and Reason (no negative marking) Q.8	(3 marks 3 min.)	[3, 3]

Integer Answer Type

Subjective Questions ('–1' negative marking) Q.9 to Q.11	(4 marks 5 min.)	[12, 15]

1(a)._ Leaching the silver and gold metal with CN^- :

(A) is oxidation reaction
(B) is complexation reaction
(C) is reduction reaction
(D) is both (A) and (B)

1(b)._ Leaching of low grade copper ores is carried out by :

(A) sulphuric acid (B) sodium hydroxide (C) sodium sulphate (D) sodium nitrate

2(a)._ Which of the following reactions represents Goldschmidt aluminothermite process?

(A) $2Al + HCl \longrightarrow 2AlCl_3 + 3H_2$
(B) $Al_2O_3 + 2NaOH + 2H_2O \longrightarrow 2NaAlO_2 + 3H_2O$
(C) $2Al + N_2 \longrightarrow 2AlN$
(D) $2Al + Cr_2O_3 \longrightarrow 2Cr + Al_2O_3$

2(b)._ Calcium is extracted by the electrolysis of :

(A) fused mixture of $CaCl_2$ and CaF_2
(B) fused mixture of $CaCl_2$ and NaF
(C) aqueous solution of $CaCl_2$
(D) aqueous solution of $Ca_3(PO_4)_2$ solution

3(a)._ The materials which are added along with the calcined iron ore into the blast furnance in the extraction of iron from haematite ore are :

(A) coke and silica
(B) coke and lime stone
(C) lime stone and silica
(D) coke and borax

3(b). Match the method of concentration of the ore in column I with the ore in column II and select the correct alternate.

	Column I		Column II
(1)	Leaching.	(p)	Copper pyrite.
(2)	Calcination.	(q)	Magnesite.
(3)	Froth floatation.	(r)	Bauxite.
(4)	Magnetic separation.	(s)	Chromite.

	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
(A)	(s)	(q)	(p)	(r)	(B)	(r)	(q)	(p)	(s)
(C)	(p)	(q)	(r)	(s)	(D)	(q)	(r)	(p)	(s)

4(a). In which of the following pair of metals, both are commercially extracted from their respective ores by self reduction method ?

(A) Zn, Cu (B) Pb, Cu (C) Sn, Zn (D) Al, Ag

4(b)._ Which of the following is obtained by zone refining method?

(A) Highly pure ore
(B) Highly pure aluminium
(C) Ultra pure oxide
(D) Ultra pure metals used as semi-conductors

Comprehension # (Q.5 to Q.7)

Read the following comprehension carefully and answer the questions :

Main ore of lead is galena. This is mined and separated from other minerals by froth flotation. There are two methods of extracting the lead.

(i) First method involves the roasting of ore followed by reduction with coke or CO.

(ii) Second method involves the partial roasting of ore followed by self reduction.

5. Partial roasting of galena gives :

(A) only PbS (B) only PbO (C) PbS + PbO (D) PbO + Pb

6. In self reduction process, the species which bring about the reduction is :

(A) O_2 (B) S^{2-} (C) O^{2-} (D) H_2S

7. Which of the following statements is incorrect about the extraction of lead from galena ?

(A) Galena is a sulphide ore and therefore, it is concentrated by froth flotation process.

(B) Self reduction takes place in absence of air.

(C) Complete roasting of galena gives PbO which is then reduced by coke or CO to give metallic lead.

(D) $FeSiO_3$ is obtained as slag.

8. **Statement-1 :** Dow's process is the extraction of magnesium from sea water.

Statement-2 : Hydrated magnesium chloride is made anhydrous by heating in a current of dry HCl gas.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(C) Statement-1 is True, Statement-2 is False.

(D) Statement-1 is False, Statement-2 is True.

Integer Answer Type

This section contains 4 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.

9. How many water of crystallisation is present in the ore carnallite ?

10. The number of reducing agents involved in the extraction of iron (as pig iron) using blast furnace from ore haematite is(are).

11. Among the following metals how many metals are extracted by self-reduction method from their respective ores. Hg, Zn, Cu, Al, Mg, Pb, Fe, Sn.

12. The number of different metals present in the ore copper pyrites is :

Answer Key

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

Hints & Solutions

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1. **(a)** $Ag/Au + 8CN^-(aq) + 2H_2O(aq) + O_2(g) \longrightarrow [Ag/Au(CN)_2]^-(aq) + 4OH^-(aq)$.

(b) $2Cu_2O$ (cuprite) $+ 4H_2SO_4(aq) + O_2(g) \longrightarrow 4CuSO_4(aq) + 4H_2O(\ell)$

$CuSO_4(aq) + Fe(s) \longrightarrow FeSO_4(aq) + Cu(s)\downarrow$

3 **(a)** (B) is correct statement.

(b) (A) Bauxite is leached with NaOH (concentrated) to form soluble $Na[Al(OH)_4]$ complex and insoluble impurities are filtered off.

(B) Carbonate and hydroxide ores are heated in absence of air below their melting point to convert in to their oxides in reverberatory furnace. This is called calcination. So magnesite, $MgCO_3$ is subjected to calcination.

(C) This method is commonly used for the concentration of the low grade sulphide ores like galena, PbS (ore of Pb) ; copper iron pyrites $Cu_2S.Fe_2S_3$ or $CuFeS_2$ (ore of copper) ; zinc blende, ZnS (ore of zinc) etc., and is based on the fact that gangue and ore particles have different degree of wettability with water and pine oil; the gangue particles are preferentially wetted by water while the ore particles are wetted by oil.

(D)Chromite ore ($FeO.Cr_2O_3$) having magnetic properties is separated from non–magnetic silicious impurities by magnetic separator.

4. **(a)** (i) Extraction of tin (carbon reduction) :

$SnO_2 + C \rightarrow SnO + CO\uparrow$

(ii) Extraction of zinc (carbon reduction) :

$PbS + 2O_2 \longrightarrow PbSO_4$; $PbS + 3O_2 \longrightarrow 2PbO + 2SO_2$

$PbS + 2PbO \longrightarrow 3Pb + SO_2$; $PbS + PbSO_4 \longrightarrow 2Pb + 2SO_2$

(iv) Extraction of copper (self reduction) :

$2CuFeS_2 + 4O_2 \longrightarrow Cu_2S + 2FeO + 3SO_2$

$Cu_2S + FeO + SiO_2 \longrightarrow FeSiO_3$ (fusible slag) $+ Cu_2S$ (matte)

$2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$; $2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$

(v) Extraction of aluminium (electrolytic reduction, Hall-Heroult process) :

The purified Al_2O_3 is mixed with Na_3AlF_6 (cryolite) or CaF_2 (fluorspar)) which lowers the melting point of the mixture and brings conductivity. The fused matrix is electrolysed.

Cathode : $Al^{3+}(melt) + 3e^- \longrightarrow Al(l)$

Anode : $C(s) + O^{2-}(melt) \longrightarrow CO(g) + 2e^-$

$C(s) + 2O^{2-}(melt) \longrightarrow CO_2(g) + 4e^-$

(vi) Extraction of lead (leaching and displacement method) :

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

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

(b) Ge, Si and Ga used as semi-conductors are refined by the zone refining method.

5. $3PbS + O_2$ (air) $\longrightarrow PbS + 2PbO$

10. At 500 – 800 K (lower temperature range in the blast furnace)

$$3\,Fe_2O_3 + CO \longrightarrow 2\,Fe_3O_4 + CO_2$$
$$Fe_3O_4 + CO \longrightarrow 3Fe + 4\,CO_2$$
$$Fe_2O_3 + CO \longrightarrow 2FeO + CO_2$$

At 900 – 1500 K (higher temperature range in the blast furnace):

$$C + CO_2 \longrightarrow 2\,CO\,; \qquad FeO + CO \longrightarrow Fe + CO_2$$

11.

$$2HgS + 3\,O_2 \longrightarrow 2HgO + 2SO_2\,;\ 2HgO + HgS \longrightarrow 3Hg + SO_2$$
$$Cu_2S + 3O_2 \longrightarrow 3Cu_2O + 2\,SO_2\,;\ 2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$$
$$2PbS + 3O_2 \longrightarrow 2PbO + 2\,SO_2\,;\ 2PbO + PbS \longrightarrow 3Pb + SO_2$$

12. Copper pyrites ($CuFeS_2$) contains copper and iron.