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General Principles and Processes of Isolation of Elements

MCQs with One Correct Answer

1. Calcination is used in metallurgy for removal of
   (a) moisture (b) water and CO_2
   (c) CO_2 and H_2S (d) H_2O and H_2S
2. Hydro-metallurgical process of extraction of metals is based on
   (a) complex formation (b) hydrolysis
   (c) dehydration (d) dehydrogenation
3. The method of zone refining of metals is based on the principle of
   (a) greater solubility of the impurities in the molten state than in the solid
   (b) greater mobility of the pure metal than that of the impurite
   (c) higher melting point of the impurities than that of the pure metal
   (d) greater noble character of the solid metal than that of the impurities
4. In froth flotation process many chemicals (frother , collector, activator, and depressant) are used. Which of the following is a frother:
   (a) $CuSO_4$
   (b) NaCN + alkali
   (c) Pine oil
   (d) Potassium xanthate.
5. Thomas slag is
   (a) calcium silicate
   (b) calcium phosphate
   (c) tricalcium phosphate and calcium silicate
   (d) calcium ammonium phosphate
6. 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
7. Calcination is the process in which
   (a) ore is heated above its melting point to expel H_2O or CO_2 or SO_2
   (b) ore is heated below its melting point to expel volatile impurities
   (c) ore is heated above its melting point to remove S, As and Sb as SO_2 ,As_2O_3 and Sb_2O_3 respectively
   (d) ore is heated below its melting point to expel H_2O or CO_2
8. A sulphide ore is generally roasted to the oxide before reduction, because
   (a) the enthalpy of formation of CO_2 is more than that of CS_2
   (b) a metal sulphide is generally more stable than the metal oxide
   (c) no reducing agent is found suitable for reducing a sulphide ore
   (d) a sulphide ore cannot be reduced at all

9. Nickel is purified by thermal decomposition of its
(a) hydride (b) chloride
(c) azide (d) carbonyl

10. The process of converting hydrated alumina into anhydrous alumina is called
(a) roasting (b) smelting
(c) dressing (d) calcination

11. The reduction of metal oxides is sometimes done by aluminium in the
(a) Bayer reaction
(b) Zilch reaction
(c) Goldschmidt reaction
(d) Silberschmidt reaction

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

13. Composition of azurite mineral is
(a) $CuCO_3CuO$
(b) $Cu(HCO_3)_2.Cu(OH)_2$
(c) $2CuCO_3.Cu(OH)_2$
(d) $CuCO_3.2Cu(OH)_2$

14. Cassiterite is concentrated by
(a) levigation
(b) electromagnetic separation
(c) floatation
(d) liquefaction

15. One of the ores of lead is known as lead pyromorphite. What is approximate composition?
(a) $Pb_3O_4.PbCl_2$ (b) $PbSO_4.Pb(OH)_2$
(c) $3Pb_3(PO_4)_2.PbCl_2$ (d) $PbCO_3.Pb(OH)_2$

16. Consider the following statements –
(A) In the Aluminothermite process, aluminium acts as reducing agent.
(B) The process of extraction of gold involves the formation of $[Au(CN)_2]^-$ and $[Zn(CN)_4]^{2-}$.
(C) In the extractive metallurgy of zinc, partial fusion of ZnO with coke is called sintering and reduction of ore to the molten metal is called smelting.
(D) Extractive metallurgy of silver from its ore argentine involves complex formation and displacement by more electropositive metal.
Choose the correct options –
(a) A and B (b) B and C
(c) A, B and C (d) A, B, C and D

17. Carbon cannot be used in the reduction of Al_2O_3 because
(a) the enthalpy of formation of CO_2 is more than that of Al_2O_3
(b) pure carbon is not easily available
(c) the enthalpy of formation of Al_2O_3 is very high
(d) it is an expensive proposition

18. Which of the following process is generally used for the extraction of tin and lead from their chief ores ?
(a) carbon reduction and self-reduction
(b) self reduction and carbon-reduction
(c) electrolysis and self-reduction
(d) self-reduction and electrolysis

19. In order to refine "blister copper" it is melted in a furnace and is stirred with green logs of wood. The purpose is
(a) to expel the dissolved gases in blister copper.
(b) to bring the impurities to surface and oxidize them.
(c) to increase the carbon content of copper.
(d) to reduce the metallic oxide impurities with hydrocarbon gases liberated from the wood.

20. Muffle furnace is used in the metallurgy of
(a) Zn (b) Sn
(c) Pb (d) Cu

ANSWER KEY																			
1	(b)	**3**	(a)	**5**	(c)	**7**	(d)	**9**	(d)	**11**	(c)	**13**	(c)	**15**	(c)	**17**	(c)	**19**	(d)
2	(a)	**4**	(c)	**6**	(b)	**8**	(a)	**10**	(d)	**12**	(a)	**14**	(b)	**16**	(d)	**18**	(a)	**20**	(a)

Hints & Solutions

CHAPTER 20

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1. **(b)** Calcination is used for removal of volatile impurities and decompose carbonates into their respective oxides.

$$\underset{\text{Bauxite}}{Al_2O_3 \cdot 2H_2O} \xrightarrow{\Delta} \underset{\text{Alumina}}{Al_2O_3} + 2H_2O$$

$$\underset{\text{Limestone}}{CaCO_3} \xrightarrow{\Delta} \underset{\text{Calcium oxide}}{CaO} + CO_2$$

2. **(a)** For example, Ag_2S is converted into $Na[Ag(CN)_2]$. When Zn is added, Ag is displaced.

3. **(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.

4. **(c)** Froth reduces the surface tension of water and the solution forms froth.

5. **(c)** Tricalcium phosphate and calcium silicate is Thomas slag

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

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

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

7. **(d)** Calcination is a process of heating a substance to a high temperature but below the melting or fusion point, causing loss of moisture, reduction or oxidation and dissociation into simpler substances.

8. **(a)** The more stable CO_2 has higher enthalpy of formation than CS_2

9. **(d)** Ni is purified by Mond's process by decomposition of $Ni(CO)_4$.

10. **(d)** $Al_2O_3.2H_2O \rightarrow Al_2O_3 + 2H_2O$ is calcination.

11. **(c)** Fe_2O_3 (3 parts) + Al powder (1 part) is known as thermite

$$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 3\,Fe$$

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

13. **(c)** Azurite is a basic carbonate ore of copper. $2CuCO_3.Cu(OH)_2$

14. **(b)** Cassiterite contains the magnetic impurities of $FeSO_4$ and thus concentrated by electromagnetic separation.

15. **(c)** Lead pyromorphite is a phosphate ore. It can be represented as $3Pb_3(PO_4)_2.PbCl_2$.

16. **(d)** (A) $Cr_2O_3 + 2Al \longrightarrow \overset{+3}{Al_2O_3} + 2Cr$

(B) $Au + 2CN^- + H_2O + \frac{1}{2}O_2 \longrightarrow [Au(CN)_2]^- + 2OH^-$

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

(C) Statement is true

(D) $Ag_2S + 4NaCN \xrightarrow{O_2} 2Na[Ag(CN)_2] + Na_2S$

$2Na[Ag(CN)_2] + Zn \longrightarrow Na_2[Zn(CN)_4] + 2Ag$

17. **(c)** The enthalpy of formation of Al_2O_3 is very high and therefore, it cannot be reduced by carbon. It is reduced by electrolytic method.

18. **(a)** Generally tin is obtained by carbon reduction and lead by self-reduction.

$SnO_2 \longrightarrow Sn + CO_2$ (carbon reduction)

$2PbO + PbS \longrightarrow 3Pb + SO_2$ (self-reduction)

19. **(d)** $2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$

$3Cu_2O + \underset{\substack{\text{(From green}\\ \text{logs of wood)}}}{CH_4} \longrightarrow 6Cu + 2H_2O + CO$

20. **(a)** It is used in metallurgy of Zn.