METALLURGY

PROBLEMS BASED ON GIVEN TOPICS

- Types of ores
- Principal steps in the recovery of a metal form its ore
- Concentration or dressing of ore
  - Gravity separation or levigation
  - Magnetis separation
  - Froth floatation of oil floatation
  - Chemical method of separation leaching
- Conversion of concentrated ore into its oxide
  - Calcination
  - Roasting
- Different reduction processes
  - Carbon reduction
  - Self reduction
  - Thermite reduction (or Goldschmidt-Thermite process)
  - Metal replacement method (Hydrometallurgy)
  - Electrolytic reduction
  - Thermal decomposition method
- Purification or refining of metal
  - Thermal refining
  - Electrorefining
- Thermodynamics of rection process
- Alloy and amalgams
  - Classification of alloys
  - Characteristic of allys
  - Preparation of allys
  - Amalgam
- Different types of furnances used in metallurgy
- Extraction of silver
  - Refining of Ag
- Extraction of Gold by Cyanide process
  - Refining Au
- Extraction of tin
  - Refining of Sn
- Extraction of Magnesium
  - Electrolytic reduction
  - Carbon reduction process
  - Other processes
- Extraction of Aluminium
  - Beneficiation of bauxide
  - Electrolytic reduction of pure Al_2O_3
  - Electrorefining of aluminium
- Extraction of lead
  - Carbon reduction
  - Self reduction process
  - Refining of lead
- Extraction of copper
  - Refining of blister copper
- Extraction of zinc
- Extraction of iron
  - Purification of iron or preparation of wrought iron
  - Steel making

CHAPTER 3

Metallurgy

EXERCISE # I

❑ **Only one correct answer :**

1. Which of the following is not sulfide ore ?
(*a*) Zinc blende (*b*) Galena
(*c*) Cinnabar (*d*) Baryte

2. Which of the following is carbonate ore ?
(*a*) Siderite (*b*) Magnesite
(*c*) Dolomite (*d*) All

3. The salt which is least abundant as mineral is ?
(*a*) Halide
(*b*) Nitrate
(*c*) Carbonate
(*d*) sulfide

4. Which ore does not have water of crystallisation ?
(*a*) Diaspore (*b*) Bauxite
(*c*) Gibbsite (*d*) Pyrolusite

5. Which of the following is not halide ore ?
(*a*) Cryolite
(*b*) Fluorospar
(*c*) Horn silver
(*d*) Limonite

6. Sulphides ore is common in between :
(*a*) Ag, Cu, Pb (*b*) Ag, Cu, Sn
(*c*) Ag, Mg, Pb (*d*) Al, Cu, Pb

7. $BO \xrightarrow[400^{\circ}C]{\Delta} \frac{1}{2} O_2 \uparrow + B$

$ACl_2 + BCl_2 \longrightarrow ACl_4 + B.$

If ACl_2 is the reducing agent. B is the metal, then ore of A & B would be :
(*a*) Siderite, Cinnabar
(*b*) Casseterite, Cinnabar
(*c*) Hornsilver, Tinstone
(*d*) None

8. During leaching of alumina from Bauxite the leaching reagent used would be :
(*a*) Concentrated solution of $Ba(OH)_2$
(*b*) Concentrated solution of NaOH or 40% KOH
(*c*) Concentrated HCl
(*d*) Concentrated H_2SO_4

9. The leaching of alumina from Bauxite is done by :
(*a*) 473-523 K & 35-36 bar pressure
(*b*) 300 K & 5-6 bar pressure
(*c*) 1000 K & 1 bar pressure
(*d*) None

10. In the metallurgy of silver and gold, the metal is leached with the reagent :
(*a*) NaOH (*b*) $NaNH_2$
(*c*) NaCN (*d*) Zn metal

11. Which of the following ore is best concentrated by Froth floatation method ?
(*a*) Galena
(*b*) Casseterite
(*c*) Magnetite
(*d*) Malachite green

12. Gravity separation is primarily used for separation of impurities from which ore
(*a*) Cassiterite (SnO_2)
(*b*) Haematite (Fe_2O_3)
(*c*) Chromite ($FeCr_2O_4$)
(*d*) All

13. The metal that can't be obtained by electrolysis of an aqueous solution of its salt is :
(*a*) Cu (*b*) Cr
(*c*) Ag (*d*) Ca

14. Which metallurgical process describe best the extraction of Mn from Mn_3O_4 by the use of aluminium.

(*a*) Hydrometallurgy

(*b*) Electrometallurgy

(*c*) Pyrometallurgy

(*d*) Amalgamation

15. The main impurity present in red bauxite is :

(*a*) CuO (*b*) ZnO

(*c*) Fe_2O_3 (*d*) SiO_2

16. The main impurities present in white bauxite is :

(*a*) Fe_2O_3 (*b*) TiO_2

(*c*) SiO_2 (*d*) FeO

17. Heating pyrites in air for oxidation of sulphur is called :

(*a*) Smelting (*b*) Roasting

(*c*) Calcination (*d*) Slagging

18. The process of converting hydrated ore into anhydrous ore is called :

(*a*) Roasting (*b*) Smelting

(*c*) Dressing (*d*) Calcination

19. Copper matte consists

(*a*) Mixture of $Cu_2S + FeS$

(*b*) Mixture of $Cu_2S + FeO$

(*c*) Metallic copper with 98-99 % purity

(*d*) Metallic copper with 1-2 % purity

20. Zincite is example of

(*a*) Oxide ore (*b*) Halide ore

(*c*) sulphide ore (*d*) Corbonate ore

21. Which method is based on the principle that impurties are more soluble in molten metal than in solid state.

(*a*) Vapour phase refining

(*b*) Zone refining

(*c*) Poling

(*d*) Levigation

22. Auto reduction is applicable for which of metals ?

(*a*) Al, Fe (*b*) Cu, Sn

(*c*) Cu, Hg (*d*) Ag, Au

23. During self reduction of Cu_2S in the Ist step when O_2 is added then.

(*a*) Oxidation state of Cu^{+1} converted into Cu^{2+}

(*b*) Oxidation state of S^{2-} converted ento SO_2

(*c*) Oxidation state of Cu^{+1} & S^{2-} both undergoes change

(*d*) Oxidation state of Cu^{+1} & S^{2-} both remains unchanged

24. Slag formed by reaction between impurities and flux. If flux is basic then impuriteis must be

(*a*) Acidic in nature eg. SiO_2

(*b*) Acidic in nature eg. CaO

(*c*) Basic in nature eg. MgO

(*d*) Basic in nature eg. P_4O_{10}

25. Carbon reduction method is not applicable for extraction of

(*a*) Tin from SnO_2 (*b*) Iron from Fe_2O_3

(*c*) Al from Al_2O_3 (*d*) Pb from PbO

26. In which reaction aluminium acts as reducing agent:

(*a*) Baeyer's process

(*b*) Serpeck's process

(*c*) Thermite process

(*d*) Hall's process

27. Thermite reduction is not used for commerical extraction of respective metal from which of the following oxide :

(*a*) Mn_3O_4 (*b*) TiO_2

(*c*) Fe_2O_3 (*d*) Cr_2O_3

28. Spiegel (or spiegeleisen), used in the manufacture of steel by the Bessemer process, is an alloy of :

(*a*) Iron , chromium and carbon

(*b*) Iron , nickel and carbon

(*c*) Iron , tungsten and carbon

(*d*) Iron, Manganese and carbon

29. Which of the following statement is incorrect regarding thermite welding.

(*a*) Al is used as reducing agent

(*b*) Fe is obtained in the form of molten metal

(*c*) This process is used for rail rod joining

(*d*) Fe_2O_3 + Al taken are in the ratio (5 : 4)

30. $Zr + 2I_2 \xrightarrow{\Delta} ZrI_4\ ZrI_4 \xrightarrow{\Delta} Zr + I_2$

The name of this method is :

(*a*) Van Arkel method (*b*) Zone refinig

(*c*) Poling (*d*) Cupellation

31. In Mond's process during extraction of nickel, the reagent added which gives complex is X & the complex formed if is Y, then X & Y are respectively:

(*a*) CN^-, $Ni(CN)_4^{2-}$ (*b*) CO, $Ni(CO)_4$

(*c*) CN^-, $[Ni(CN)_6]^{4-}$ (*d*) CO, $Ni(CO)_5$

32. Froth floatation is based on the following principle:

(*a*) Differences in wetting ability of ore particles in oil and impurity particles in water.

(*b*) Difference in specific gravity of ore particles and impurity particles in water.

(*c*) Difference in magnetic property of ore particles and impurity particles in water.

(*d*) All

33. Zinc blende and chalcopyrites are concentrated by :

(*a*) Leaching

(*b*) Levigation

(*c*) Froth floatation

(*d*) Magnetic separation

34. The oxidation state of metal in cuprite and fool's gold are respectively :

(*a*) +1 , +1 (*b*) +2, +2

(*c*) +1, +2 (*d*) +2 , +1

35. Oxidation state of Fe in Haematite and Magnetite respectively :

(*a*) II ; III (*b*) II ; (II + III)

(*c*) III ; III (*d*) III ; (II + III)

36. Observe the following partial roasting process,

$CuFeS_2 + O_2 \longrightarrow A + FeO + SO_2$; A is :-

(*a*) Cu_2O (*b*) CuO

(*c*) Cu_2S (*d*) CuS

37. Steps which are involved in the extraction of Cu from its low grade ore.

(*a*) Leaching by NaCN

(*b*) Metal displacement by Ag

(*c*) Leaching with acid

(*d*) Metal displacement by iron

38. Out of following oxides, unstable oxide at temperature 200ºC is

(*a*) CaO (*b*) Al_2O_3

(*c*) HgO (*d*) Fe_2O_3

39. Ti is prepared by the following method .

$$\underset{\text{Ti}}{\text{Impure metal}} + X_2 \xrightarrow{\Delta} TiX_4 \xrightarrow[\text{at high temp.}]{\text{Heating}} Ti + 2X_2\uparrow;\ X_2$$

is :

(*a*) Cl_2 (*b*) Fe

(*c*) Br_2 (*d*) I_2

40. Which alkaline earth metals are present in Dolomite.

(*a*) Na, Mg (*b*) K, Ca

(*c*) Be, Ba (*d*) Ca, Mg

41. Zinc blende $\xrightarrow{\text{Roasting}}$ Metal oxide + Gas. (Suffocating odour)

What is the oxidation state of S in zinc blende and gas ?

(*a*) –2, +4 (*b*) –2, +6

(*c*) 0, +6 (*d*) 0, +4

42. Ellingham diagram normally describes

(*a*) Variation of ΔG^o vs temperature for fromation of oxide $2xM(s) + O_2(g) \longrightarrow 2M_xO(s)$

(*b*) Variation of ΔH^o vs temperature for formation and oxide $2xM(s) + O_2(g) \longrightarrow 2M_xO(s)$

(*c*) Variation of ΔS^o vs temperature for formation of oxide $2xM(s) + O_2(g) \longrightarrow 2M_xO(s)$

(*d*) None

43. In Ellingham diagram there is sudden increase in slope at particular point for every metals which depicts

(*a*) Phase change e.g., solid $\longrightarrow$ Liq. ; Liq $\longrightarrow$ gas

(*b*) The metals oxide decomposition temperature

(*c*) Metal oxide boiling point

(*d*) Metal oxide fusion point

44. Which reaction is most spontaneous ?

(*a*) $Zn^{2+} + 2e \longrightarrow Zn$

(*b*) $Ag^+ + e^- \longrightarrow Ag$

(*c*) $Mg \longrightarrow Mg^{2+} + 2e^-$

(*d*) $Li^{+1} + e \longrightarrow Li$

45. The oxide of which metal having least thermal stability.

(*a*) Hg (*b*) Fe

(*c*) Al (*d*) Mg

46. For which reaction $\Delta S = 0$.

(*a*) $C(s) + O_2(g) \longrightarrow CO_2(g)$

(*b*) $Ca(s) + \frac{1}{2}O_2(g) \longrightarrow CaO(s)$

(*c*) $2Al(s) + \frac{3}{2}O_2(g) \longrightarrow Al_2O_3$

(*d*) $C(s) + \frac{1}{2}O_2 \longrightarrow CO(g)$

47. From Ellingham diagram in Blast furnace at 673 K, best reducing agent is :

(*a*) Coke

(*b*) CO

(*c*) Mixture of (C+CO)

(*d*) Can't be predicted

48. Sphalerite ore is used for extraction of which metal?

(*a*) Fe (*b*) Cu

(*c*) Zn (*d*) Al

49. Distillation is a method of refining of metals. For which metal it is applicable.

(*a*) Low boiling point metals e.g., Pb, Sn

(*b*) High boiling poing metal e.g., Zn, Hg

(*c*) Low boiling point metal e.g., Zn, Hg

(*d*) High boiling point metal e.g., Pb, Sn

50. In the metallurgy of aluminium the electrolyte is :

(*a*) Fused matrix of Al_2O_3 with Na_3AlF_6 and CaF_2

(*b*) Al_2O_3 only

(*c*) Na_3AlF_6

(*d*) CaF_2

51. Impurity has more tendency to be oxidised by atmospheric O_2 than ore particles. This concept is applicable for :

(*a*) Poling

(*b*) Cupellation process

(*c*) Zone refining

(*d*) Electrolytic refining

52. In cupellation process :

(*a*) Lead impurities are separated from Ag

(*b*) Silver impurities are separated from Pb

(*c*) Cu impurities are separated from Sn

(*d*) Sn impurities are separated from Cu

53. Boiling point order :

(*a*) Cd > Zn > Fe (*b*) Fe > Zn > Cd

(*c*) Zn > Fe > Cd (*d*) Zn > Cd > Fe

54. In liquation metal can be separated from impurities. Here metal and impurities are of

(*a*) Higher melting point and lower metling point respectively

(*b*) Higher boiling point and lower boiling point respectively

(*c*) Lower metling point and higher melting point respectively

(*d*) Lower boiling point and higher boiling point respectively

55. In zone refining impurities get concentrated

(*a*) In solidified zone (*b*) Molten zone

(*c*) Freezing zone (*d*) None

56. The chemical process in the production of steel from haematite ore involve :-

(*a*) reduction

(*b*) oxidation

(*c*) reduction followed by oxidation

(*d*) oxidation followed by reduction

57. The temperature T_1 and T_2 for Mond process

$$Ni + 4CO \xrightarrow{T_1} Ni(CO)_4 ;$$

$$Ni(CO)_4 \xrightarrow{T_2} Ni + 4CO$$

(*a*) 330 - 350 K ; 600 - 630 K

(*b*) 330 - 350 K ; 450 - 470 K

(*c*) 450 - 470 K ; 600 - 630 K

(*d*) 600 - 630 K ; 330 - 350 K

58. In which of the following process roasting followed by self reduction takes place :

(*a*) $Cu_2S \longrightarrow Cu$ (*b*) $PbS \longrightarrow PbO$

(*c*) $CaCO_3 \longrightarrow Ca$ (*d*) None

59. The pyrometallurgy requires
(*a*) Electric current (*b*) Low temperature
(*c*) High temperature (*d*) Atmospheric O_2

60. Which is correctly matched ?
(*a*) Anthracite – Ore of iron
(*b*) Fluorospor – Mineral of aluminium
(*c*) Cementite – A carbide of iron in steel
(*d*) Pyrolusite – An ore of Mg

61. At 1100ºC which of the following reaction is thermodynamically most feasible.
(*a*) $TiO_2 + C \longrightarrow Ti + CO_2$
(*b*) $CO_2 + C \longrightarrow 2CO$
(*c*) $Al_2O_3 + 3C \longrightarrow 2Al + 3CO$
(*d*) $Cr_2O_3 + 3C \longrightarrow 2Cr + 3CO$

62. In Parke's process, 2 layers are developed. Correct options is :-
(*a*) Upper layer consists of Pb
(*b*) Upper layer consists of alloy of Zn-Ag
(*c*) Upper layer consists of Zn
0(*d*)Upper layer consists of Ag-Pb-alloy

63. Lower layer consists of
(*a*) Molten zinc
(*b*) Molten silver
(*c*) Molten lead
(*d*) Molten mixture of (Zn + Ag)

64. In Baeyer's process Fe_2O_3 does not react with NaOH, but SiO_2 does along with Al_2O_3 becuase.
(*a*) Because Fe_2O_3 is basic oxide whereas SiO_2 is acidic oxides and Al_2O_3 is amphoteric oxide
(*b*) Al_2O_3 and SiO_2 are basic oxides whereas Fe_2O_3 is acidic oxide
(*c*) Fe_2O_3 is basic oxides whereas SiO_2 and Al_2O_3 are example of acidic oxide
(*d*) Al_2O_3 , Fe_2O_3 are example of basic oxide whereas SiO_2 is example of acidic oxide

65. In froth floatation method sodium ethyl xanthate is used as collector. Actually it
(*a*) Helps sulfide ore to collect in water medium
(*b*) Helps sulfide ore to collect on air bubble
(*c*) Dissolves impurities in water
(*d*) Dissolves impurities in air

66. White bauxite is purified by.
(*a*) Baeyer's process (*b*) Hoop's process
(*c*) Serpeck's process (*d*) Hall's process

67. Red bauxite is purified by.
(*a*) Baeyer's process (*b*) Hall's process
(*c*) Both A and B (*d*) Hoop's process

68. Aluminium is purified by.
(*a*) Baeyer's process (*b*) Hall's process
(*c*) Serpeck's process (*d*) Hoop's process

69. The correct position of metal (from top to bottom) is electrochemical series.
(*a*) Li > K > Mg > Al
(*b*) Na > Mg > K > Li
(*c*) Li > K > Ca > Na
(*d*) Mn>Mg>Al>Ka

70. In electrolytic reduction of Al_2O_3, the ratio of Al_2O_3, Cryolite and fluorspar will be
(*a*) 1 : 1 :1 (*b*) 3 : 1 : 2
(*c*) 1 : 5 : 1 (*d*) 1 : 3 : 1

71. In Golds mith process Fe_2O_3 and Al mixture are in the ratio
(*a*) 1 : 2 (*b*) 5 : 1
(*c*) 3 : 2 (*d*) 3 : 1

72. Ignition mixture which is used for thermite process consists of
(*a*) KCl + BaO (*b*) $KClO_3$ + BaO
(*c*) $KClO_3 + BaO_2$ (*d*) KCl + BaO_2

73. At approximate what temperature, zinc and carbon have equal affinity for oxygen
(*a*) 500°C (*b*) 1000°C
(*c*) 1200°C (*d*) 1500°C

74. In Castner's process for extraction of sodium the elctrolyte is
(A fused NaOH (*b*) NaOH + $CaCl_2$
(*c*) fused NaCl (*d*) fused NaCl +$CaCl_2$

75. In Down's process for extraction of sodium the elctrolyte is
(*a*) fused NaOH
(*b*) NaOH + $CaCl_2$
(*c*) fused NaCl
(*d*) fused NaCl +$CaCl_2$

76. Which of the following options are incorrect ?

(A Si can't reduce MgO at all.

(*b*) Al can't reduce ZrO_2 but Mg can reduce ZrO_2

(*c*) Al can reduce Cr_2O_3 as well as TiO_2

(*d*) H_2 does not act as strong reducing agent at high temperature

77. Sodium cloride is added during electrolysis of fused anhydrous magnesium chloride

(*a*) To increase melting point of $MgCl_2$ from 500°C to 800°C

(*b*) To reduced melting point of $MgCl_2$ from 700°C to 400°C

(*c*) To increase melting point of $MgCl_2$ from 600°C to 900°C

(*d*) To reduced melting point of $MgCl_2$ from 900°C to 600°C

78. The point at which line of $M + O_2 \rightarrow MO$ cuts the zero free energy line depicts

(*a*) decomposition temperature of oxide

(*b*) decomposition temperature of metal

(*c*) fusion point of metal

(*d*) fusion point of slag

79. The elements which are at lowest line in Elingham diagram has

(*a*) very low tendency to combine with O_2

(*b*) very high tendency to combine with O_2

(*c*) Oxide which are very unstable

(*d*) None

80. In Polling, basic impurities associated with metal

(*a*) gets reduced to form volatile elemental form

(*b*) gets oxidised to form slag which is immescible with molten metal

(*c*) gets oxidised to form volatile oxide which is removed as scum

(*d*) gets reduced to form solidified element which is crystallised out of molten metal

81. In Distillation process, zinc is seperated from Cd at temperature T_1 and zinc is separated from Pb and Fe at temperaure T_2 . T_1 and T_2 are respectively

(*a*) 767°C and 920°C (*b*) 667°C and 940°C

(*c*) 657°C and 800°C (*d*) 957°C and 750°C

82. Which of the following option are correct?

(*a*) $Ca + \frac{1}{2} O_2 \rightarrow CaO$ line sharply increases at temperature at 1440°C

(*b*) $Mg + \frac{1}{2} O_2 \rightarrow MgO$ line sharply increases at temperature at 1440°C

(*c*) $Hg + \frac{1}{2} O_2 \rightarrow HgO$ line sharply increases at temperature at 1440°C

(D All

83. Carnalite on electrolysis gives

(*a*) Ca and Cl_2 (*b*) Al and Cl_2

(*c*) Na & CO_2 (*d*) Mg and Cl_2

84. In which of the following extraction, no reducing agent is used

(*a*) Iron from Haematite

(*b*) Tin from Casseterite

(*c*) Mercury from Cinnabar

(*d*) Zinc from zincblende

85. Railway wagon axles are made by heating iron rods embeded in charcoal powder. This process is known as -

(*a*) Sherardising (*b*) Anealing

(*c*) Tempering (*d*) Case hardening

86. Which of the following options is incorrect -

(*a*) Reduction potential of alkali metal cation is much lower than that of H^+

(*b*) Magnesia and quick lime are used as acidic flux

(*c*) TiI_4 is volatile stable compound

(*d*) In Park's process, silver impurity is removed from lead metal

87. At 1100°C which of the following reactions is thermodynamically most favoured

(*a*) $TiO_2 + C \rightarrow Ti + CO_2$

(*b*) $Al_2O_3 + 3C \rightarrow 2Al + 3CO$

(*c*) $Cr_2O_3 + 3C \rightarrow 2Cr + 3CO$

(*d*) $CO_2 + C \rightarrow 2CO$

88. In the extraction of copper from its sulphide ore, the metal is formed by reduction of Cu_2O with

(*a*) FeS (*b*) CO

(*c*) Cu_2S (*d*) SO_2

89. Refractory materials are generally used in furnance because -

(*a*) they are chemically inert

(*b*) they can withstand high temperature

(*c*) they do not contain impurities

(*d*) they decrease melting point of ore

90. Addition of high proportions of manganese makes still useful in making rails of rail roads, because manganese -

(*a*) gives hardness to steel

(*b*) help the formation of oxide of iron

(*c*) can remove oxygen and sulphur

(*d*) can show highest oxidation state of +7

91. Silica is added to roasted copper ores during extraction copper to remove -

(*a*) Cuprous sulphide (*b*) Cuprous oxide

(*c*) Ferrous oxide (*d*) Ferrous sulphide

92. Blister copper is refined by stirring molten impure metal with green logs to wood because such wood liberates hydrocarbon gases. This proces is called and the metal contain impurities of -

(*a*) Cupellation, CuO (*b*) Polling, CuO

(*c*) Cupellation, Cu_2O (*d*) Polling, Cu_2O

93. The process which does not use a catalyst is -

(*a*) Contact process (*b*) Thermite process

(*c*) Ostwald's process (*d*) Haber's process

94. Spelter may be purified by -

(*a*) Polling

(*b*) Heating with iodine

(*c*) Electrolysis process

(*d*) Fractional distillation

95. ΔG° vs T plot in Ellingham diagram slopes downward for which of the following reactions

(*a*) $2Mg + O_2 \rightarrow 2MgO$

(*b*) $2CO + O_2 \rightarrow 2CO_2$

(*c*) $2Zn + O_2 \rightarrow 2ZnO$

(*d*) $2C + O_2 \rightarrow 2CO$

96. Iron obtained from blast furnance is

(*a*) wrought iron (*b*) cast iron

(*c*) pig iron (*d*) steel

97. High temperature (>1000°C) electrolytic reduction is necessary for extraction of

(*a*) Mg (*b*) Cu

(*c*) Pb (*d*) Al

98. From the Ellingham graph on carbon, which of the following statement is false?

(*a*) CO_2 is more stable than CO at less than 983 K

(*b*) CO reduces Fe_2O_3 to Fe at less than 983 K

(*c*) CO is less stable than CO_2 at more than 983 K

(*d*) CO redues Fe_2O_3 to Fe in the reduction zone of blast furnace

99. Coke powder is spreaded over the molten electrolyte in electrolytic reduction of Al_2O_3 due to :

(*a*) prevent the heat radiation from the surface

(*b*) prevent the corrosion of graphite anode

(*c*) prevent oxidation of molten aluminium by air

(*d*) both (*a*) & (*b*)

100. Which of the following reaction cannot occur in blast furnace during extraction of iron.

(*a*) $CaO + SiO_2 \rightarrow CaSiO_3$

(*b*) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

(*c*) $FeO \rightarrow Fe + \frac{1}{2} O_2$

(*d*) $P_2O_5 + 5C \rightarrow \frac{1}{2} P_4 + 5CO$

EXERCISE # II

❑ **One or More Than One Correct Answer :**

1. In which ore iron (Fe) can have (+2) oxidation state :

(*a*) Haematite (Fe_2O_3)

(*b*) Iron pyrite (Fool's gold) FeS_2

(*c*) Siderite ($FeCO_3$)

(*d*) Copper pyrite ($CuFeS_2$)

2. Which of the following ores having potassium ?

(*a*) Carnalite (*b*) Indian salt Petre

(*c*) Gypsum (*d*) Cryolite

3. Which of the following ores have copper ?

(*a*) Chalcopyrite (*b*) Azurite

(*c*) Malachite green (*d*) Limonite

4. Which of the following changes is obsered when ore is heated for calcination ?

(*a*) $Fe_2O_3.3H_2O \longrightarrow Fe_2O_3 + 3H_2O$

(*b*) $Al_2O_3.2H_2O \longrightarrow Al_2O_3 + 2H_2O$

(*c*) $PbCO_3 \longrightarrow PbO + CO_2$

(*d*) $ZnCO_3 \longrightarrow ZnO + CO_2$

5. Magnetic substance which are present in casseterite for Sn extraction.

(*a*) $FeWO_4$ (*b*) SnO_2

(*c*) $MnWO_4$ (*d*) Fe_3O_4

6. Which of the two metal form cyano complex during its extraction?

(*a*) Zn (*b*) Ag

(*c*) Au (*d*) Cu

7. Electrolytic reduction is applicable for

(*a*) Al from Al_2O_3(Molten)

(*b*) Ag from Ag_2S

(*c*) Na from NaOH

(*d*) Cu from $CuFeS_2$

8. In zone refining method some elements are formed in ultrapure form. The elements can be :

(*a*) Si (*b*) Ge

(*c*) Ga (*d*) Fe

9. Which of the following options are correct ?

(*a*) Carbon cannot be used to produce magnesium by chemical reduction of MgO because magnesiumreacts with carbon to form carbide

(*b*) In froath floatation method activator can enhance the frothering tendency of sulphide ore

(*c*) CO is preferential reducing agent in iron extraction from haematite ore

(*d*) Na, K, Li are situated at the top of electrochemical series.

10. For aluminium extraction when electrolysis of molten mass Al_2O_3 is carried out then which statement are correct?

(*a*) Lining of carbon acts as cathode and graphite anode is used

(*b*) During electrolysis, the oxygen liberated reacts with carbon of anode to give CO and CO_2

(*c*) This process is called Hall-Heroult process

(*d*) CaF_2 reduces the melting point of the mixture and increases electrical conductivity

11. Mercury can't form amalgam with :

(*a*) Fe (*b*) Ag

(*c*) Au (*d*) Pt

12. The method used in metallurgy to refine the impure metal is :

(*a*) Chromatographic separation

(*b*) Vapour phase refining

(*c*) Zone refining

(*d*) Distillation

13. Tin can be refined by

(*a*) Poling

(*b*) Liquation

(*c*) Distillation

(*d*) Zone refining

14. $4Au + 8CN^- + 2H_2O + O_2\ (g) \longrightarrow 4[Au(CN)_2]^-(aq) + 4OH^-(aq)$

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

Which of the following options are correct ?

(*a*) Both the reactions are the example of nonredox reaction

(*b*) Both are examples of redox reactions

(*c*) In I^{st} reaction O_2 acts as oxidising agent

(*d*) In II^{nd} reaction Zn acts as reducing agent

15. CO can't be used as reducing agent

(*a*) To prepare/extract Zn metal from ZnO

(*b*) To Prepare Al metal from Al_2O_3

(*c*) To prepare Fe metal from Fe_2O_3

(*d*) To prepare Pb metal from PbS

16. In Ellingham diagram

(*a*) The elements in the higher line can reduce oxide of elements in the lower line

(*b*) The elements in the lower line can reduce oxide of elemetns in higher line

(*c*) Reduction of metals oxide is easier if the metals formed is in liqid state at the temperature of reduction

(*d*) Reduction of metals oxide can take place of room temperture.

17. In Ellingham diagram Fe_2O_3 can be redcued by which of following elements.

(*a*) Ca (*b*) Mg

(*c*) Hg (*d*) Al

18. Pick the correct statement(s) for aluminothermite process :-

(*a*) Reaction in endothermic

(*b*) It is used for welding of rail tracks

(*c*) To start the reaction a Mg ribbon is ignited

(*d*) Al is used as reductant

19. Which of the following statement is / are correct :-

(*a*) Combination Lime stone and wolframite is non magnetic in nature

(*b*) No external reducing agent is required for extraction of Hg from HgO.

(*c*) Poling method is mainly used when impure metal oxide having oxide as impurity

(*d*) For Cu extraction in bessemer converter process, oxidation and reduction reaction takes place.

20. Which of the following statements are not correct?

(*a*) Copper is extracted by self reduction method

(*b*) Cast iron is the purest form of iron

(*c*) The composition of malachite ore is $Ca(OH)_2 . CaCO_3$

(*d*) Cupellation process is used for refining of Ag and Au

21. Select the statement which is correct.

(*a*) Elingham diagram M $\rightarrow$MO curves have ngative slope.

(*b*) MgO can be reduced by carbon at very high temperature (~800°C)

(*c*) In blast furnace carbon does not reduce iron oxides

(*d*) Iron scraps will be advisable and advantageous w.r.t Zn scraps for reducing leached copper ore

22. Find the number of ores which can be concentrated by magnetic separation method.

(*a*) Galena (*b*) Copper pyrites

(*c*) Haematite (*d*) Siderite

23. Which of the following are the steps / reactions involved in extraction of iron :-

(*a*) $3FeO_3 + CO \rightarrow 2FeO_3 + CO_2$

(*b*) $Fe_3O_4 + CO \rightarrow 3FeO_3 + CO_2$

(*c*) $FeO + CO \rightarrow Fe + CO_2$

(*d*) Calcium silicate is produced as slag

24. Which of the following statements are correct :-

(*a*) Anhydros $MgCl_2$ can not be prepared by heating $MgCl_2.6H_2O$

(*b*) Anhydros $CaCl_2$ is used in drying gases and organic compounds but not NH_3 or ethyl alcohol due to formation of $CaCl_2.8NH_3$ and $CaCl_2 .4C_2H_5OH$

(*c*) Leblanc process is used for preparation of both Na_2CO_3 and H_2CO_3 but not solvay process.

(*d*) KOH is preferably used compared to NaOH for absorption to NaOH for absorption of CO_2 because $KHCO_3$ formed is soluble where as $NaHCO_3$ is sparingly soluble and therefore choke the tubes of apparants used.

25. Which of the following reactions are example of thermite reduction ?

(*a*) A thermite reaction may start, if a ship (having aluminium parts) is hit by a missile

(*b*) $Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$

(*c*) $Al_2O_3 + 3Mg \xrightarrow{\Delta} 3MgO + 2Al$

(*d*) $Cr_2O_3 + 2Al \xrightarrow{\Delta} 2Cr + Al_2O_3$

26. Blister copper is :-

(*a*) Impure copper

(*b*) Obtained by self reduction process in Bessemer converter

(*c*) pure 100% Cu

(*d*) 50% Copper

27. Select correct option :-

(*a*) $Al_2O_3 + 2Fe \rightarrow Fe_2O_3 + 2Al \quad \Delta H = +ve$

(*b*) $FeO \xrightarrow[\text{reduction}]{Cu} Fe_3O_4 \xrightarrow[\text{reduction}]{CO}$

$Fe_2O_3 \xrightarrow[\text{reduction}]{CO} 2Fe$

(*c*) Out of two metal oxide FeO and CaO ; CaO more easily combine with SiO_2

(*d*) Impurities present in molten cast iron are possibly oxidised to Fe_2O_3

28. Which of the following statements are incorrect ?

(*a*) During metallurgy of zinc, spelter is obtained by reduction process of ZnO

(*b*) Pig iron is obtained from blast furnance.

(*c*) Liquation is only valid for purification of Bi not for Sn and Pb.

(*d*) Pitch blende is ore of U

29. Which of the following is an example of amphoteric oxide ?

(*a*) Al_2O_3 (*b*) PbO

(*c*) ZnO (*d*) FeO

30. The compound with different metals as

(*a*) Dolomite (*b*) Carnalite

(*c*) Copper pyrite (*d*) Azurite

31. Choose incorrect statement.

(*a*) Mg is liquid at less than 1500ºC and gas at above 1500ºC

(*b*) Si can't reduce MgO at all

(*c*) The equation of line in Ellingham diagram is given by $\Delta G = \Delta H - T\Delta S$

(*d*) The preferable temperature for Mg to be used as a reducing agent for SiO_2 is 2200ºC

32. When copper is purified by electrolytic refining of the blister copper, the correct statement :

(*a*) Pure Cu is deposited at cathode

(*b*) Impurities settle as anode mud.

(*c*) Acidified $CuSO_4$ is used as electrolyte

(*d*) Pure Cu is deposited at anode

33. Which of the following metals can be extraced by electrolytic reuction

(*a*) Na (*b*) Mg

(*c*) Ca (*d*) Ag

34. Which of the following diagram are not related to the extraction of Mg from sea water ?

(*a*) Sea water $\xrightarrow{Na_2CO_3}$ $MgCO_3$ $\xrightarrow{\text{Calcination}}$ MgO $\xrightarrow[\text{Reduction}]{\text{Carbon}}$ Mg)

(*b*) Sea water $\xrightarrow[\text{water}]{\text{lime}}$ $Mg(OH)_2$ $\xrightarrow{HCl(aq.)}$ $MgCl_2.6H_2O$ $\xrightarrow[\text{With excess of dry HCl(g)}]{\Delta}$ $MgCl_2$ anhyd. $\xrightarrow[\text{in molted condition}]{\text{Electrolysis}}$ Mg

(*c*) Sea water $\xrightarrow{\text{drying}}$ Sea salt $\xrightarrow{\text{Electrolysis}}$ Mg

(*d*) Sea water $\xrightarrow{Ca(OH)_2}$ $Mg(OH)_2$ $\xrightarrow{HCl(aq.)}$ $MgCl_2$ solution $\xrightarrow[\text{in aq. solution}]{\text{Electrolysis}}$ Mg

35. "In electrolysis M^{n+}(aq.), metal ions are discharged at negative electrodes (cathodes) and deposited there" above method of extraction is not possible for :

(*a*) Sodium (*b*) Aluminium (*c*) Silver (*d*) Carbon

36. The reduction processes employed to prepare lead metal can be

(*a*) Carbon reduction

(*b*) self reduction

(*c*) Aluminothermic reduction

(*d*) Electrolytic reduction

37. The reduction process employe to prepare iron metal can be

(*a*) Carbon reduction

(*b*) self reduction

(*c*) Aluminothermic reduction

(*d*) Electrolytic reduction

38. The metallurgy/reduction process involved for extraction for Cu can be

(*a*) Electrometallurgy

(*b*) Pyrometallurgy with carbon reduction

(*c*) Pyrometallurgy with Auto reduction

(*d*) Hydrometallurgy

39. In Elingham Diagram, Fe_2O_3 can be reduced by which of the following elements

(*a*) Ca (*b*) Mg

(*c*) Ag (*d*) Al

40. The position of element from (top to bottom) in electrochemical series

(*a*) Zn > Cr > Fe > Sn > Pb

(*b*) H > Cu > Hg

(*c*) Hg > Ag > Au

(*d*) Al > Mn > Zn > Cr

41. In Cupellation

(*a*) Ag impurity is removed from Pb metal

(*b*) Pb impurity is removed from Ag metal

(*c*) Zn impurity is removed from Ag metal

(*d*) Zn impurity is removed from Pb metal

42. Which of the following option are correct

(*a*) In electrolytic refining of Au, $AuCl_3$ solution is used as electrolyte

(*b*) In electrolytic refining of Ni, $Ni(NO_3)_2$ solution is used as electrolyte

(*c*) In electrolytic refining of Ag, $AgNO_3 + HNO_3$ solution is used as electrolyte

(*d*) In electrolytic refining of Zn, $ZnSO_4 + H_2SO_4$ solution is used as electrolyte

43. Which of the following statements are correct :-

(*a*) 24 carat Gold consists of 100 % Au

(*b*) 14 carat Gold consists of 54 % Au

(*c*) Stainless steel have Cr : 12-14%

(*d*) Amalgamation is carried out in Iron container

44. Which of the following statements are correct :-

(*a*) The metallic impurities having higher oxidation potential than that of metal to be refined are separated in the form of anode mud.

(*b*) Cathode is made of large slab of impure metal in electrolytic refining

(*c*) Anode is made of thin strip of pure metal in electrolytic refining

(*d*) Spinels are mineral of Al with molecular formula $MgO.Al_2O_3$

44. Which of the following can not be obtained by electrolytic reduction of there compounds in aqueous solution.

(*a*) Barium (*b*) Cadmium

(*c*) Potassium (*d*) Nickel

45. Which of the following are true or false electrolytic extraction of aluminium -

(*a*) anode material contains graphite

(*b*) cathode made of carbon

(*c*) cathode reacts with O_2 released to form CO_2

(*d*) anode reacts with O_2 released to form CO_2

46. Which of the following employ downward movement of ore -

(*a*) Gravity separation (*b*) Froath floatation

(*c*) Bessemer converter (*d*) Blast furnance

47. Metal which can be extracted by smelting process

(*a*) Pb (*b*) Fe

(*c*) Zn (*d*) Mg

48. Which of the following reactions are actually employed for commercial extraction of metal -

(*a*) $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$

(*b*) $2Na[Au(CN)_2] + Zn \rightarrow Na_2[Zn(CN)_4] + 2Au$

(*c*) $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$

(*d*) $Cu_2S + Pb \rightarrow Cu + PbS$

49. In the manufacturing of metallic sodium by fused salt electrolysis method (Down's process), small amount of $CaCl_2$ is added. The purpose is -
(*a*) To improve electrical conductance of electrolyte
(*b*) To stabilise metallic sodium
(*c*) To increase the temperature of elctrolysis
(*d*) To decrease the melting point of NaCl

50. Collectors are the substances which help in attachment of an ore particle to air bubble in froth. The example of collectors are
(*a*) Sodium pyrophosphate
(*b*) Sodium nitropruside
(*c*) Sodium ethyl xanthate
(*d*) Sodium lauryl sulphate

51. B_4C is used -
(*a*) to extract boron
(*b*) for making bullet-proof clothing
(*c*) as an abrassive for polishing
(*d*) as lubricants

52. Elingham diagram can be drawn for which of the following
(*a*) Sulphide (*b*) Oxide
(*c*) Halides (*d*) Nitrates

53. Choose correct options -
(*a*) Reduction of metal oxide will be easier if the metal formed is in the liquid state at the temperature of reduction
(*b*) Reduction of metal oxide will be easier if the metal formed is in the solid state at the temperature of reduction
(*c*) Aluminium can reduce MgO above 1350°C
(*d*) Aluminium can not reduce MgO above 1500°C

54. Choose correct options -
(*a*) Reduction of metal oxide take place at room temperature only
(*b*) A particular metal oxide can be reduced by many reducing agent , but temperature for reduction is same for all reducing agent
(*c*) On increasing temperature metal oxide stability decreases
(*d*) A metal oxide can be reduced by many reducing agent but temperature for reduction is different for all reductants

55. If at a temperature there is sudden rise in slope in Elingham diagram , that temperature can indicate-
(*a*) Melting point of metal oxide
(*b*) Boiling point of metal oxide
(*c*) Melting point of metal
(*d*) Boiling point of metal

56. Which alloy has Cu and Zn as constituent metals -
(*a*) Brass (*b*) Dutch metal
(*c*) Bronze (*d*) Bell metal

57. Correct statements are -
(*a*) Black zack is ZnS
(*b*) Ruby copper is Cu_2O
(*c*) Parke's process is based on distribution principle
(*d*) Stellite is an alloy having highest % of cobalt metal among all metals present in it

58. The crude metal zinc which is called spelter contains impurities like -
(*a*) Ag (*b*) Fe
(*c*) Cd (*d*) Pb

59. Which alloy has Cu and Sn as constituent metals -
(*a*) Brass (*b*) Dutch metal
(*c*) Bronzene (*d*) Bell metal

60. Pitch blende is not the sorce of
(*a*) Ba (*b*) U
(*c*) Ge (*d*) Tl

EXERCISE # III

❑ **Linked Comprehension Type :**

Paragraph for Q.1 to Q.3

According to Lux concept of acids and bases, an acid is an acceptor of oxide ions and a base is a donor of oxide ion. This concept is very much applicable in the fields of ceramic and metallurgy.

1. CaO acts as flux for impurities like SiO_2 to form slag $CaSiO_3$. Here :-
(*a*) CaO acts as base because it is donor of oxide ion.
(*b*) CaO acts as base because it acceptor of oxide ion.
(*c*) SiO_2 acts as acid because it is donor of oxide ion.
(*d*) SiO_2 acts as acid because it is acceptor of oxide ion.

2. $6SiO_2 + 2Ca_3(PO_4)_2 \rightarrow 6CaSiO_3 + P_4O_{10}$. Here
(a) SiO_2 and P_4O_{10} acts as acid
(b) SiO_2 and P_4O_{10} acts as base
(c) $Ca_3(PO_4)_2$ and $CaSiO_3$ acts as acid
(d) $Ca_3(PO_4)_2$ and $CaSiO_3$ acts as extremly strong base

3. $CaO + SiO_2 \rightarrow CaSiO_3$
$FeO + SiO_2 \rightarrow FeSiO_3$
$MgO + SiO_2 \rightarrow MgSiO_3$
$CaSiO_3$, $FeSiO_3$ $MgSiO_3$ all are :-
(a) Flux
(b) Gangue particle
(c) Slag
(d) Lewis acid

Paragraph for Q.4 to Q.6

When mixture of metal in the liquid state solidify three types of alloys are formed :

(i) Alloys in which the metals crystallise separately.
(ii) Alloys in which the metals form solid solutions.
(iii) Alloys in which the metals form the intermetallic compound.

4. Alnico ; Duralumin and Magnelium are alloy of :-
(a) Zn metal (b) Cu metal
(c) Al (d) As

5. Copper based alloy is :-
(a) Brass (b) Bronze
(c) Bell metal (d) All

6. Which of the following alloy having copper and zinc metal along with other metal :-
(a) German silver
(b) Gun metal
(c) (a) and (b)
(d) None

Paragraph for Q.7 to Q.9

Iron is extracted from its oxide and carbonate ores by reduction with coke in blast furnace. The process is carried out in two steps.

(i) Preliminary roasting or calcination : The ore is calcine with a little coal in heaps regulating the temperature and air supply in order to burn the organic metal and drive of most of the moisture , carbondioxide, sulphur, arsenic. Ferrous oxide is converted into ferric oxide. The roasted mass contains ferric oxide Fe_2O_3.

(ii) Smelting and reduction in blast furnace : The roasted ore is mixed with coke and limestone (flux) and charged into the blast furnace when the ferric oxide is reduced to metallic iron.

7. Top most zone in blast furnace, at 1070 K / 800°C which reaction can not take place :-
(*a*) $3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$
(*b*) $Fe_3O_4 + CO \rightarrow 3FeO + CO_2$
(c) $CaCO_3 \rightarrow CaO + CO_2$
(d) $FeO + C \rightarrow Fe + CO$

8. The slag formed in blast furnace is :-
(a) SiO_2 (b) $CaSiO_3$
(c) $CaCO_3$ (d) P_4O_{10}

9. At temperature zone 1300°C to 1900°C which reaction can not take place :-
(a) $FeO + C \rightarrow Fe + CO$
(b) $C + O_2 \rightarrow CO_2$
(c) $C + CO_2 \rightarrow 2CO$
(d) $3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$

Paragraph for Q.10 to Q.13

Steel is produced from pig iron by first resoning mechanically all the impurities in the pig iron. e.g. e, Si, Mn, S, P by oxidation and then adding the current among of carbon. The operation is carried out in Bessemer converter or in a Siemens-Martin open hearth furnace.

10. The two types of bessemer process are :
(a) The oxidation bessemer process and reduction bessemer process
(b) The redox bessemer process and non-redox bessemer process
(c) The acidic bessemer process and basic bessemer process
(d) The neutral bessemer process and amphoteric bessemer process

11. In acid bessemer process the slag obtained can be:-

(a) $MnSiO_3$

(b) $FeSiO_3$

(c) $Ca_3(PO_4)_2$

(d) both (a) and (b)

12. In basic bessemer process the slag obtained is called Thomas slag which is used as fertiliser. The Thomas slag is actually.

(a) $MnSiO_3$

(b) $FeSiO_3$

(c) $Ca_3(PO_4)_2$

(d) $CaSiO_3$

13. Which of the following statements are correct :

(a) Silica bricks are used as lining in acidic bessemer converter :-

(b) Calcined dolomite or magnesite is used as lining in basic bessemer converter

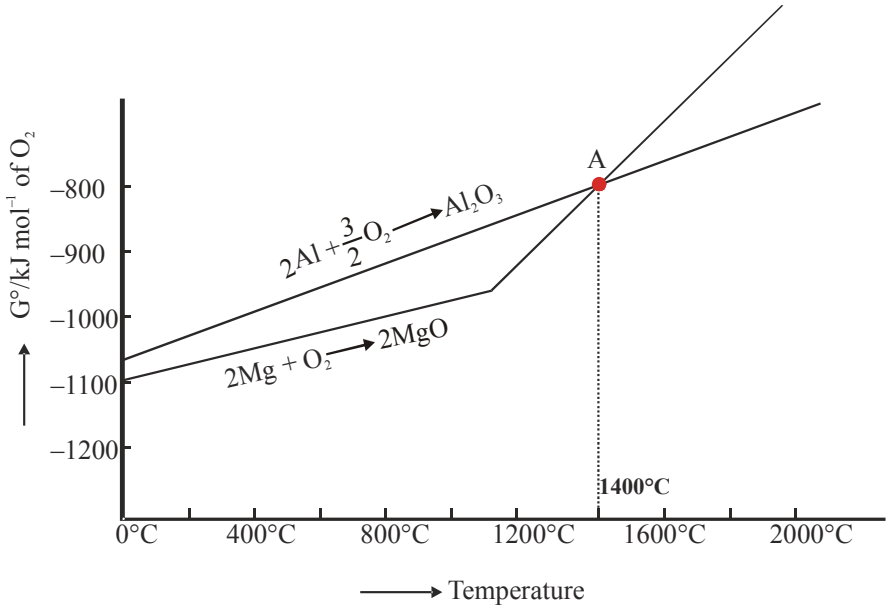
(c) In acidic bessemer , the interaction between the slag which is iron phosphate and the carbon containing iron continuously regenerates iron phosphide according to the reaction.

$2P_2O_5 + 6Fe + 3O_2 \rightarrow 2Fe_3(PO_4)_2$

$Fe_3(PO_4)_2 + 2Fe_3C + 3Fe \rightleftharpoons 2Fe_3P + 6FeO + 2CO$

(d) All

Paragraph for Q.14 to Q.16



14. The two equations are

$\frac{4}{3}Al + O_2 \rightarrow \frac{2}{3}Al_2O_3$.....(i)

$2Mg + O_2 \rightarrow 2MgO$.....(ii)

A is the point of intersection of the Al_2O_3 and MgO curves. Which of the following option is correct.

(a) Below temperature 1400°C, $\frac{2}{3}Al_2O_3 + 2Mg \rightarrow 2MgO + \frac{4}{3}Al$ reaction is thermodynamically feasible.

(b) Above temperature 1400°C, $\frac{4}{3}Al + 2MgO \rightarrow \frac{2}{3}Al_2O_3 + 2Mg$ reaction is thermodynamically feasible.

(c) At temperature 1400°C, $\Delta G° = 0$ for the reaction $\frac{2}{3}Al_2O_3 + 2Mg \rightarrow 2MgO + \frac{4}{3}Al$

(d) All

15. Al metal can't be used for reduction of MgO because :-

(a) This reaction is nonspontaneous

(b) This reaction is economical

(c) This reaction is noneconomical

(d) None

16. Al_2O_3, MgO are examples of

(a) amphoteric , amphoteric oxide

(b) amphoteric , basic oxide

(c) basic , amphoteric oxide

(d) basic , basic oxide

Paragraph for Q.17 & Q.18

Zinc ore (X) $\xrightarrow{\text{calcination}}$ Solid(S) + Gas - 1

Zinc ore (Y) $\xrightarrow{\text{roasting}}$ Solid(S) + Gas - 2

Solid (S) $\xrightarrow[\text{At 1673 K}]{\Delta \text{ with C}}$ Metal (M) + Gas - 3

Gas - 3 $\xrightarrow[\text{with } O_2]{\text{combustion}}$ Gas - 1

17. Which substance produces colourless, odourless gas with dil. H_2SO_4 -

(I) Ore(X) (II) Ore (Y)

(III) Metal(M) (IV) Solid(S)

(*a*) I, III (*b*) I, II, III

(*c*) II, III (*d*) I, IV

18. Which step is not involved in the extraction of pure metal from ore-(Y)

(*a*) Froath flotation

(*b*) Smelting

(*c*) Self reduction

(*d*) Distillation

Paragraph for Q.19 & Q.20

(I) $FeCr_2O_4 + NaOH + air \rightarrow a + Fe_2O_3$

(II) (*a*) + (*b*) $\rightarrow Na_2Cr_2O_7$

(III) $Na_2Cr_2O_7 + X \xrightarrow{\Delta} Cr_2O_3$

(IV) $Cr_2O_3 + Y \xrightarrow{\Delta} Cr$

19. Compound A and B are -

(*a*) Na_2CrO_4 , H_2SO_4

(*b*) $Na_2Cr_2O_7$, HCl

(*c*) Na_2CrO_5 , H_2SO_4

(*d*) None

20. X and Y are

(*a*) C and Al

(*b*) Al and C

(*c*) C in both

(*d*) Al in both

Matrix Match Type :

21. Match the column-I with column-II :-

Column - I : (Property)	**Column - II : (Element/ Compound)**
(*a*) Explosive	(P) Cu
(*b*) Self-reduction	(Q) Fe_3O_4
(*c*) Ferrimagnetic material	(R) $Cu(CH_3COO)_2.Cu(OH)_2$
(*d*) Verdigris	(S) $Pb(NO_3)_2$

22.

Column - I : (Process)	**Column - II : (Compounds formed during reaction)**
(*a*) Mac-Arther forest cyanide process	(P) $[Ag(CN)_2]^{-1}$
(*b*) Mond process	(Q) TiI_4
(*c*) Van-Arkel method	(R) $Ni(CO)_4$
(*d*) Blast Furnace	(S) $CaSiO_3$(slag)

23.

Column - I : (Process involved)	**Column - II : (Pure metal extracted)**
(*a*) Bessemerisation	(P) Cr
(*b*) Electrolytic refining using aqueous salt as an electrolyte	(Q) Au
(*c*) Extracted by the formation of soluble complex	(R) Ag
(*d*) Reaction which involves Mg ribbon and $(BaO_2 + KClO_3)$ mixture to generate ignition temperature	(S) Fe
	(T) Cu

24. **Column - I** **Column - II**

(Elements) **(Characterstic feature of elements and their oxide)**

(*a*) Mg (P) Highest value of $|\Delta G|$ range for oxide formation for these elements

(*b*) Al (Q) Lowest value of $|\Delta G|$ range for oxide formation for these elements

(*c*) Fe (R) Can reduce at least one of metal oxides of given elements

(*d*) Hg (S) Strongest reducing agent among these

(T) Its metal oxides has lowest thermal stability among oxide of these metal

25. **Column - I** **Column - II**

Chemical changing metallurgy **Purpose of metallurgy of specified metal**

(*a*) $M_2O_3 + C + \text{Electrical energy} \longrightarrow M + CO / CO_2$ (P) Purification of copper

(*b*) $(M + CO + Fe) + CO \xrightarrow[50°C]{\Delta} Fe(s)$ (Q) Benefication of bauxite

$+ CO(s) + [\text{vapoures of carbonyl complex of M}]$

(*c*) $(Fe_2O_3.MgO)_g + OH^-(aq.) \longrightarrow Fe_2O_3 + [M(OH)_4]^{-1}$ sol. (R) Extraction of metal from alumina

(*d*) Fe.M.Ag.Au + Electrical oxidation (S) Separation of nickel from impurities

$$\xrightarrow[\text{of metal (M)}]{\text{in aq. solution}} \begin{matrix} Fe^{2+}(aq.) + Ag(s) \\ + Ml^{2+}(aq.) + Au(s) \end{matrix}$$

26. Match the column :-

Column - I	**Column - II**
(Process involved)	**(Pure metal extracted)**
(*a*) Poling	(P) Sn
(*b*) Cupellation	(Q) Ag
(*c*) Zone refining	(R) Cu
(*d*) Parke's process	(S) Ge
(T) Pb	

27. Match the column :-

Column - I **Column - II**

(Elements) **(Correct information regarding extraction process)**

(*a*) Ni (P) A solution of lead silicofluoride $PbSiF_6$ containing 8-10% of H_2SiF_6 is used as electrolyte for

(*b*) Pb (Q) Complex formation reaction is involved in extraction of

(*c*) Cu (R) Self reduction

(*d*) Hg (S) Carbon monoxide is used for extraction of metal

(T) d-block element

28. **Column - I** **Column - II**

(Metal extracted from its ore) **(Process involved for extraction of metal)**

(*a*) Zinc from $ZnCO_3$ (P) Calcination

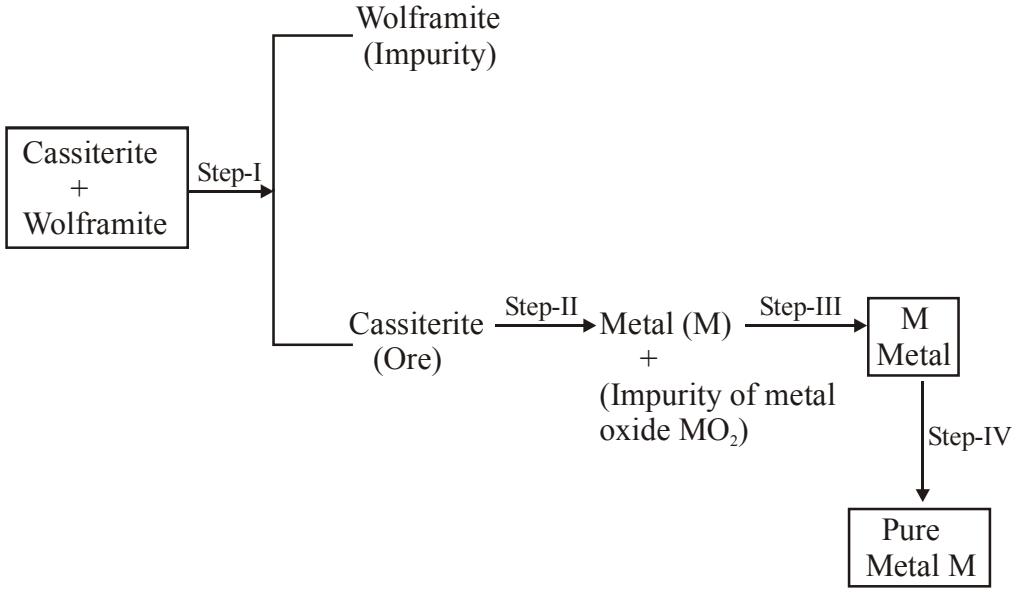
(*b*) Lead from PbS (Q) Removal of iron

(*c*) Cu from $CuFeS_2$ (R) Froath floatation process

(*d*) Tin from cassiterite (S) Poling

(T) Gravity separation

29. Consider following extraction process and match Column-I with Column-II :



Column - I **Column - II**

(*a*) Magnetic seperation (P) Step-I

(*b*) Liquation (Q) Step-II

(*c*) Poling (R) Step-III

(*d*) Carbon reduction (S) Step-IV

30 Match the column :-

Column - I **Column - II**

(*a*) Downs cell (P) Fused $MgCl_2$

(*b*) Dow sea water process (Q) Fused $Al_2O_3 + Na_3AlF_6$

(*c*) Hall - Heroult (R) Fused KHF_2

(*d*) Moissan process (S) Fused 40 % NaCl and 60% $CaCl_2$

31 Match the column :-

Column - I **Column - II**

Ore **Process for benefactions**

(*a*) ZnS (P) Magnetic separation

(*b*) $FeCr_2O_4$ (Q) Froath floatation

(*c*) SnO_2 (R) Gravity separation

(*d*) $Cu_2S.Fe_2S_3$ (S) Roasting

32 Match the column :-

Column - I **Conversion**	**Column - II** **Process involved**
(*a*) $Cu_2S \rightarrow Cu_2O$	(P) Roasting
(*b*) $CaCO \rightarrow CaO$	(Q) Calcination
(*c*) $ZnS \rightarrow Zn$	(R) Carbon reduction
(*d*) $PbS \rightarrow Pb$	(S) Self reduction

33. Match the column :-

Column - I **Definition**	**Column - II** **Term**
(*a*) Naturally occuring chemical substance in the earth's crust obtainable by mining	(P) Metallurgy
(*b*) Substance from which metal can be extracted economically and conventionally	(Q) Gangue
(*c*) Undesired earthy substance contaminated with desired earthy substance ore	(R) Ore
(*d*) Scientific and technological process used for isolation of metal	(S) Mineral

34. Chemical changing metallurgy :-

Column - I **Phenomenon**	**Column - II** **Term**
(*a*) Calcium phosphate	(P) Blister copper
(*b*) Hard steel is heated to bright redness and then allowed to cool very slowly	(Q) Pig iron
(*c*) Many impurities C/Si/P/S	(R) Thomas slag
(*d*) SO_2 evolution take place and pores are developed	(S) Anealing

35. Match the column:-

Column - I **Different types of iron**	**Column - II** **Features**
(*a*) Cast iron	(P) Purest form of iron with C % $\rightarrow$ 0.1 - 0.15%
(*b*) Wrought iron	(Q) Molten iron from blast furnance having more than 4% carbon
(*c*) Steel	(R) Carbon % varies from 0.15 - 1.5%
(*d*) Pig iron	(S) Carbon % varies from 2 - 4%

EXERCISE # IV

❑ **Integer Type :**

1. If a mixture of ores consist of :

(i) Zinc blend (ii) Argentie (iii) Haematite (iv) Chromite (v) Dolomite

(vi) $FeWO_4$ (vii) Cassiterite

Then find out number of ores which are collected in container when allowed to move towards magnetic roller.

2. Calcination of how many ore produce CO_2.

(*a*) Limonite (*b*) Siderite

(*c*) Malachite (*d*) Cerrusite

(*e*) Azurite (*f*) Dolomite

3. Of the following metal that can not be obtained by electrolysis of the aqueous solution of their salts using inert electrode :

Ag ; Cu ; Cr ; Mg ; Al ; Na ; Ba ; Ca

4. Find the number of compounds which are added to acidic impurities to form slag.

(*a*) SiO_2 ; MgO ; CaO ; $CaCO_3$; $MgCO_3$; P_2O_5 ; B_2O_3

5. How many metals are commercially obtained by auto reduction.

Fe ; Na ; Mg ; Mg ; Ca ; Pb ; Sn ; Cu ; Hg ; Au

6. How many metals are commercially obtained by carbon reduction of their oxide .

Fe ; Al ; Mg ; Ca ; Sn ; Pb ; Zn

7. How many metals can be commercially extracted by hydrometallurgy i.e., displacement reaction takes place in aqueous solution.

Au ; Ag ; In ; Zn ; Pb ; Al ; Cu

8. How many statements are correct?

(i) Graphite rod is used as anode but not diamond because moblie electrons are present in graphite layer which helps in electrical conductivity.

(ii) If the impurity in a metal has greater affinity for oxygen then the purification of metal may be carried out by cupellation.

(iii) Fe and Pt can't form alloy with Hg.

(iv) During roasting of sulfide ore at high temperature oxide is formed and at low temperature sulphate is formed.

(v) During Sn/Pb/iron metallurgy $CaSiO_3$ is formed as slag.

(vi) Wolframite is ferro magnetic, therefore attracted by magnet.

(vii) Magnetic siderite, chromite, Wolframite are of Fe(II) but limonite, Haematite are of Fe(III).

(viii) Bauxite is considered as oxide as well as hydroxide of Al.

(ix) In cyanide extraction process of silver from argentite ore the oxidising and reduing agent used as O_2 and Zn.

9. How many of the following terms are associated for purificaton of iron.

(a) Puddling process

(b) Thomas slag

(c) Cupellation

(d) Bessemerisation

(e) Amalgamation

10. Find the number of ores in which any metal is present in +1 oxidation state.

Copper pyrite, Chalcocite, Chile Salt petre, Cryolite, Cuprite, Sylvine

11. Find the number substance which contain metal is in its elemental form mainly.

Blister copper, Pig iron, Wrought iron, Steel, Copper matte, Alumina, Spelter

12. Find the number of ores which can be roasted or calcined followed by reduction with carbon to give respective metal.

$Fe_2O_3 . 3H_2O$; ZnS ; $ZnCO_3$; PbS (low grade)

13. Find the number of impurities which are deposited as anode mud in the electrorefining of copper.

Antimony ; Selenium ; Tellurium ; Silver ; Gold ; Platinum

14. Find the number of ores which can be concentrated by magnetic separation.

Galena ; Copper pyrites ; Haematite ; Siderite

15. Find the number of ores in which roasting process is used in metallurgy of corresponding metal.

Galena ; Haematite ; Calamine ; Zinc Blende ; Cinnaber, Horn Silver ; Lime stone.

16. Find the number of steps in the following used during the extraction of spelter from zinc blend.

Poling ; Electrorefining ; Roasting ; Froath floatation ; Smelting ; Magnetic separation

17. The number of following pairs is correctly matched:

(i) Van Arkel method - Zirconium

(ii) Amalgamation - Lead

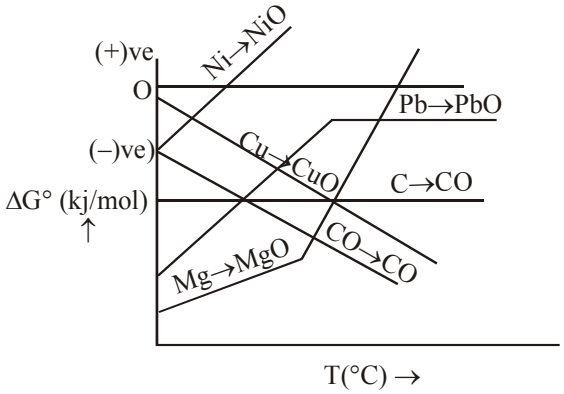
(iii) Distillation method - Zinc

(iv) Poling process - Copper

(v) Mond process - Titanium

(vi) Van Arkel method - Zirconium

18. Find the number of curves which are wrongly presented in the Ellingham diagram.



19. Find the number of following reactions which are involved in roasting process :

(i) $CaCO_3 . MgCO_3 \xrightarrow{\Delta} CaO + MgO + CO_2$

(ii) $2Cu_2S + 3O_2 \xrightarrow{\Delta} 2Cu_2O + 2SO_2$

(iii) $S_8 + 8O_2 \xrightarrow{\Delta} 8SO_2$

(iv) $P_4 + 5O_2 \xrightarrow{\Delta} P_4O_{10}$

(v) $4As + 3O_2 \xrightarrow{\Delta} 2As_2O_3$

(vi) $2ZnS + 3O_2 \xrightarrow{\Delta} 2ZnO + 2SO_2$

20. How many reactions can show slag formaton process from the given reaction ?

(i) $SiO_2 + CaO \longrightarrow CaSiO_3$

(ii) $MgCO_3 + SiO_2 \longrightarrow MgSiO_3 + CO_2$

(iii) $FeO + SiO_2 \longrightarrow FeSiO_3$

(iv) $Cr_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Cr$

(v) $CaO + P_2O_5 \longrightarrow Ca_3(PO_4)_2$

21. How many elements can be purified by liquation method ?

Sn ; Pb ; Bi ; Zn ; Cd ; Fe

22. How many elements can be purified by Zone refining method ?

Ge ; Si ; Ga ; Se ; Te ; Tl ;

22. How many elements can be purified by distillation?

Zn ; Pb ; Cd ; Hg ; Mg ; Na ; Ka

23. Find out the number of layers developed in Hoop's process which is used for electrolytic refining of aluminium.

24. Find the number of unstable oxide out of the following oxide which undergo decomposition below 200°C.

CaO ; Al_2O_3 ; MgO ; Fe_2O_3

25. Find the number of oxide out the of the following oxide which undergo decomposition below 400°C.

CaO ; Al_2O_3 ; MgO ; Fe_2O_3 ; Ag_2O and HgO

26. What is the coordination number of aluminium in mineral Cryolite

27. How many water of crystallisation present in the ore Carnalite.

28. In iron metallurgy for preparation pig iron from Haematite ore the number of reducing agent involed.

29. Find out number of ores which are examples of oxy salt ore but not oxide ore ?

Epsom salt ; Glauber salt ; Gypsum ; Anglesite ; Rutile ; Cuprite ; Plaster of paris

30. Find the number of ores in which atleast one metal is in +3 oxidation state :-

Bauxite ; Diaspore ; Gibbsite ; Limonite ; Cryolite; Haematite ; Magnetite ; Chromite

31. Find the number of ores in which atleast one metal is in +2 oxidation state :-

Baryte ; Fluorspar ; Chromite ; Magnetite ; Iron pyrite ; Copper pyrite ; Carnalite

32. % of silver in German silver -

33. Number of metals present in Alnico alloy -

34. Number of metals present in Devardas alloy -

35. For how many elements amalgamation process is applicable for purification of metals -

Ag ; Au ; Cu ; Zn

36. For the reaction $Al_2O_3 . 2H_2O + xNaOH + H_2O \rightarrow xNa[Al(OH)_4]$

The value of x

37. Find the total number of acidic refracories out of the following compounds.

CaO ; Quartz ; Dolomite ; Bone ash ; Magnesite.

38. Among the following number of compound that would require electrolysis process to get their respective metal is .

Al_2O_3, $MgCl_2$, Fe_2O_3

39. Find out the number of layers developed in Park's process which is used for purification of lead metal..

40. How many statements are correct

(i) Steel are Brittle

(ii) Cast iorn is soft

(iii) Pewter is an Alloy of Pb and Sn

EXCERCISE # V(A) (JEE-MAIN)

1. Aluminium is extracted by the electrolysis of :- **[AIEEE - 2002]**

(*a*) Bauxite

(*b*) Alumina

(*c*) Alumina mixed with molten cryolite

(*d*) Molten cryolite

2. Pyrolusite is a / an :- **[AIEEE - 2002]**

(*a*) Oxide ore (*b*) Sulphide ore

(*c*) Carbide ore (*d*) Not an ore

3. Which one of the following ores is best concentrated by froth - flotation method :- **[AIEEE - 2004]**

(*a*) Galena (*b*) Cassiterite

(*c*) Magnetite (*d*) Malachite

4. Which one of the following factors is of no significance for roasting sulphide ores to the oxides and not subjecting the sulphide ores to carbon redction directly ? **[AIEEE - 2008]**

(*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 CS_2

(*d*) CO_2 is more volatile than CS_2

5. Which method of purification is represented by the following equation :- **[AIEEE - 2012]**

$$Ti(s) + 2I_2(g) \xrightarrow{523\ K} TiI_4(g) \xrightarrow{1700\ K} Ti(s) + 2I_2(s)$$

(*a*) Van Arkel

(*b*) Zone refining

(*c*) Cupellation

(*d*) Poling

6. The substance used as froth stablisers in froth - floatation process is :- **[Jee-Mains -2012(online)]**

(*a*) Copper sulphat

(*b*) Aniline

(*c*) Sodium cyanide

(*d*) Potassium ethyl xanthante

7. Which of the oxide groups among the following cannot be reduced by carbon :- **[Jee-Mains - 2012(online)]**

(*a*) Fe_2O_3 , ZnO (*b*) PbO , Fe_2O_3

(*c*) Cu_2O , SnO_2 (*d*) CaO, K_2O

8. In Goldschmidt alumino thermic process which of the following reducing agents is used :- **[Jee-Mains - 2013(online)]**

(*a*) Calcium (*b*) Coke

(*c*) Sodium (*d*) Al-power

9. Calcination is the process in which :-

(1) Ore is heated strongly below its melting point in the presence of excess of air and is used for the conversion of carbonates and hydrated oxide ores to their respective oxides.

(2) Ore is heated strongly below its melting point in the absence or limited supply of air and is used for conversion of sulphide ores to their respective oxides.

(3) Ore is heated strongly below its melting point either in the limited or absence of air and is used to converte carbonates and hydrated oxide ores to their respective oxides.

(4) Ore is heated strongly above its melting point in the limited supply of air to convert sulphide ores to their respective oxides.

10. The metal that cannot be obtained by electrolysis of an aqueous solution of its salts is :- **[Jee-Mains - 2014]**

(*a*) Cu (*b*) Cr

(*c*) Ag (*d*) Ca

11. The form of iron obtained from blast furnace is :- **[Jee-Mains - 2014(On line)]**

(*a*) Steel (*b*) Wrought iron

(*c*) Cast Iron (*d*) Pig iron

12. In the context of the Hall-Heroult process for the extraction of Al, which of the following statements is false? **[Jee-Mains - 2015]**

(*a*) Al^{3+} is reduced at the cathode to form Al

(*b*) Na_3AlF_6 serves as the electrolyte

(*c*) CO and CO_2 are produced in the process

(*d*) Al_2O_3 is mixed with CaF_2 which lowers the melting point of the mixture and brings conductivity.

EXCERCISE # V(B) (ADVANCED)

1. In extractive metallurgy of zinc partial fsion of ZnO with coke is called ..... and reduction of the ore to the molten metal is called ..... **[Jee'88]**

2. Carnallite does not contain :-

(*a*) K

(*b*) Ca

(*c*) Mg

(*d*) Cl

3. During initial treatment, preferential wetting of ore by oil and gangue by water takes place in :-

(*a*) Levigation (gravity separation)

(*b*) Froth floatation

(*c*) Leaching

(*d*) Bessemerisation

4. Which of the following is true for calcination of metal ore ?

(*a*) It makes the ore more porous

(*b*) The ores is heated to a temperature when fusion just begins

(*c*) Hydrated salts lose their water of crystallisation

(*d*) Sulphur in sulphides is oxidised to SO_2

(*e*) Heating with carbon leads to better calcination

5. In the commercial electrochemical process for aluminium extraction, the electrolyte used as :- **[Jee-1999]**

(*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 AlO(OH) and $Al(OH)_3$

6. The chemical process in the production of steel from haematite ore involve :- **[2000 Qualifying]**

(*a*) reduction

(*b*) oxidation

(*c*) reduction followed by oxidation

(*d*) oxidation followed by reduction

7. Electrolytic reduction of alumina to aluminium by Hall - Heroult process is carried out :- **[2000 Qualifying]**

(*a*) in the presence of NaCl

(*b*) in the presence of fluorite

(*c*) in the presence of cryolite which forms a melt with lower melting temperature

(*d*) in the presence of cryolite which forms a melt with higher melting temperature

8. The chemical composition of "slag" formed during the smelting process in the extraction of copper is :- **[2001 Qualifing]**

(*a*) $Cu_2O + FeS$ (*b*) $FeSiO_3$

(*c*) $CuFeS_2$ (*d*) $Cu_2S + FeO$

9. Which of the following process is used in extractive metallurgy of magnesium ? **[2002 Qualifing]**

(*a*) Fused salt electrolysis

(*b*) Self reduction

(*c*) Aqueous solution electrolysis

(*d*) Thermite reduction

10. In the process of extraction of gold, **[2003 Qualifing]**

$$\text{Roasted gold ore} + CN^- + H_2O \xrightarrow{O_2} [X] + OH^-[X] + Zn \longrightarrow [Y] + Au$$

Identity the complexes [X] and [Y] :-

(*a*) $X = [Au(CN^-)_2]^-$, $Y = [Zn(CN)_4]^{2-}$

(*b*) $X = [Au(CN)_4]^{3-}$, $Y = [Zn(CN)_4]^{2-}$

(*c*) $X = [Au(CN)_2]^-$, $Y = [Zn(CN)_6]^{4-}$

(*d*) $X = [Au(CN)_4]^-$, $Y = [Zn(CN)_4]^{2-}$

11. The methods chiefly used for the extraction of lead and tin from their ores are respectively :- **[JEE - 2004]**

(*a*) self reduction and carbon reduction

(*b*) self reduction and electrolytic reduction

(*c*) carbon reduction and self reduction

(*d*) cyanide process and carbon reduction

12. Which ore contains both iron and copper ?
[JEE - 2004]

(*a*) Cuprite (*b*) Chalcocite
(*c*) Chalcopyrite (*d*) Malachite

13. Extraction for zinc from zinc blende is achieved by:- **[JEE - 2007]**

(*a*) electrolytic reduction
(*b*) roasting followed by reduction with carbon
(*c*) roasting followed by reduction with another metal
(*d*) roasting followed by self-reduction

14. Native silver metal forms a water soluble complex with a dilute aqueous solution of NaCN in the presence of :- **[JEE-2008]**

(*a*) Nitrogen (*b*) Oxygen
(*c*) Carbon dioxide (*d*) Argon

Passage for Q. 15 to 16

Copper is the most nobel of the first row transition metals and occurs in small deposits in several countries. Ores of copper include chalcanthite ($CuSO_4 . 5H_2O$), atacamite ($Cu_2Cl(OH)_3$), cuprite (Cu_2O), copper glance (Cu_2S) and malachite ($Cu_2(OH)_2CO_3$). However, 80% of the world copper production comes from the ore chalcopyrite ($CuFeS_2$). The extraction of copper from chalcopyrite involves partial roasting , removal of iron and self-reduction. **[JEE-2010]**

15. Partial roasting of chalcopyrite produces :-

(*a*) Cu_2S and FeO
(*b*) Cu_2O and FeO
(*c*) CuS and Fe_2O_3
(*d*) Cu_2O and Fe_2O_3

16. Iron is removed from chalcopyrite as :-

(*a*) FeO
(*b*) FeS
(*c*) Fe_2O_3
(*d*) $FeSiO_3$

17. In self-reduction, the reducing species is :-

(*a*) S (*b*) O^{2-}
(*c*) S^{2-} (*d*) SO_2

18. Match the extraction processes listed in column I with metals listed in column II :- **[JEE-2006]**

Column-I	Column-II
(*a*) Self reduction	(P) Lead
(*b*) Carbon reduction	(Q) Silver
(*c*) Complex formation and displacement by metal	(R) Copper
(*d*) Decomposition of iodide	(S) Boron

19. Match the conversions in column I with the type(s) of reaction(s) given in column II. Indicate your answer by barking the appropriate bubbles of the 4 × 4 matric given in the ORS :- **[JEE-2008]**

Column-I	Column-II
(*a*) $PbS \rightarrow PbO$	(P) Roasting
(*b*) $CaCO_3 \rightarrow CaO$	(Q) Calcination
(*c*) $ZnS \rightarrow Zn$	(R) Carbon reduction
(*d*) $Cu_2S \rightarrow Cu$	(S) Self reduction

20. In extractive metallurgy of zinc partial fusion of ZnO with coke is called ..... and reduction of the ore the molten metal is called ..... (smelting, calcining, roasting, sintering) :- **[JEE-1988]**

21. Extraction of metal from the ore cassiterite involves:- **[JEE2011]**

(*a*) carbon reduction of an oxide ore
(*b*) self-reduction of a sulphide ore
(*c*) removal of copper impurity
(*d*) removal of iron impurity

22. Oxidation states of the metal in the minerals haematite and magnetite, respectively, are:- **[JEE-2011]**

(*a*) II, III in haematite and III in magnetite
(*b*) II, III in haematite and II in magnetite
(*c*) II in haematite and II, III in magnetite
(*d*) III in haematite and II, III in magnetite

23. In the cyanide extraction process of silver from argentite ore, the oxidizing and reducing agents used are :- **[JEE-2012]**

(*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

24. Sulphide ores are common for the metals :- **[JEE-2013]**

(*a*) Ag, Cu and Pb (*b*) Ag, Cu and Sn

(*c*) Ag, Mg and Pb (*d*) Al, Cu and Pb

25. The carbon - based reduction method is NOT used for the extraction of :- **[JEE-2013]**

(*a*) Tin from SnO_2

(*b*) Iron from Fe_2O_3

(*c*) Aluminium from Al_2O_3

(*d*) Magnesium from $MgCO_3 . CaCO_3$

26. Upon heating with Cu_2S, the reagent(s) that give copper metal is / are :- **[JEE-2014]**

(*a*) $CuFeS_2$ (*b*) CuO

(*c*) Cu_2O (*d*) $CuSO_4$

27. Copper is purified by electrolytic refining of blister copper. The correct statement (s) about this process is (are) :- **[JEE-Adv.2015]**

(*a*) Impure Cu strip is used as cathode

(*b*) Acidified aqueous Cu_2SO_4 is used as electrolyte

(*c*) Pure Cu deposite at cathode

(*d*) Impurities settle as anode - mud

28. Match the anionic species given in column I that are present in the ore(s) given in column II :- **[JEE-Adv. 2015]**

Column-I	**Column-II**
(*a*) Carbonate	(P) Siderite
(*b*) Sulphide	(Q) Malachite
(*c*) Hydroxide	(R) Bauxite
(*d*) Oxide	(S) Calamine
	(T) Argentite

■■

CH-3 METALLURGY

EXERCISE # I

1. (*d*)	**2.** (*d*)	**3.** (*b*)	**4.** (*d*)	**5.** (*d*)	**6.** (*a*)	**7.** (*b*)	**8.** (*b*)	**9.** (*a*)	**10.** (*c*)
11. (*a*)	**12.** (*d*)	**13.** (*d*)	**14.** (*c*)	**15.** (*c*)	**16.** (*c*)	**17.** (*b*)	**18.** (*d*)	**19.** (*b*)	**20.** (*a*)
21. (*b*)	**22.** (*c*)	**23.** ( )	**24.** (*a*)	**25.** (*c*)	**26.** (*c*)	**27.** (*c*)	**28.** (*d*)	**29.** (*d*)	**30.** (*a*)
31. (*b*)	**32.** (*a*)	**33.** (*c*)	**34.** (*c*)	**35.** (*b*)	**36.** (*c*)	**37.** (*c*)	**38.** (*c*)	**39.** (*d*)	**40.** (*d*)
41. (*a*)	**42.** (*a*)	**43.** (*a*)	**44.** (*c*)	**45.** (*a*)	**46.** (*a*)	**47.** (*b*)	**48.** (*c*)	**49.** (*c*)	**50.** (*a*)
51. (*b*)	**52.** (*a*)	**53.** (*b*)	**54.** (*c*)	**55.** (*b*)	**56.** (*b*)	**57.** (*b*)	**58.** (*a*)	**59.** (*c*)	**60.** (*c*)
61. (*b*)	**62.** (*b*)	**63.** (*c*)	**64.** (*a*)	**65.** (*b*)	**66.** (*c*)	**67.** (*c*)	**68.** (*d*)	**69.** (*c*)	**70.** (*d*)
71. (*d*)	**72.** (*c*)	**73.** (*b*)	**74.** (*a*)	**75.** (*d*)	**76.** (*a*)	**77.** (*b*)	**78.** (*a*)	**79.** (*b*)	**80.** (*c*)
81. (*a*)	**82.** (*d*)	**83.** (*d*)	**84.** (*c*)	**85.** (*d*)	**86.** (*c*)	**87.** (*d*)	**88.** (*c*)	**89.** (*b*)	**90.** (*a*)
91. (*c*)	**92.** (*d*)	**93.** (*b*)	**94.** (*d*)	**95.** (*d*)	**96.** (*c*)	**97.** (*d*)	**98.** (*c*)	**99.** (*d*)	**100.** (*c*)

EXERCISE # II

1. (*b,c,d*)	**2.** (*a,b*)	**3.** (*a,v,c*)	**4.** (*a,b,c*)	**5.** (*a,c*)
6. (*b,c*)	**7.** (*a,c*)	**8.** (*a,b,c*)	**9.** (*a,b,c,d*)	**10.** (*a,b,c,d*)
11. (*a,d*)	**12.** (*a,b,c,d*)	**13.** (*a,b*)	**14.** (*b,c,d*)	**15.** (*a,b,d*)
16. (*b,c*)	**17.** (*a,b,d*)	**18.** (*b,c,d*)	**19.** (*b,c,d*)	**20.** (*b,c*)
21. (*a*)	**22.** (*c,d*)	**23.** (*a,b,c,d*)	**24.** (*a,b,c,d*)	**25.** (*a,b,d*)
26. (*a,b*)	**27.** (*a,c,d*)	**28.** (*a,c,d*)	**29.** (*a,b,c*)	**30.** (*a,b,c*)
31. (*a,b*)	**32.** (*a,b,c*)	**33.** (*a,b,c*)	**34.** (*a,c,d*)	**35.** (*a,b*)
36. (*a,b*)	**37.** (*a,c*)	**38.** (*b,d*)	**39.** (*a,b,d*)	**40.** (*a,b,c,d*)
41. (*b*)	**42.** (*a,b,c,d*)	**43.** (*a,b,c,d*)	**44.** (*a,b,c,d*)	**44.** (*a,c*)
45. (*a,b,d*)	**46.** (*a,d*)	**47.** (*a,b,c*)	**48.** (*b,c*)	**49.** (*a,d*)
50. (*c,d*)	**51.** (*a,b,c*)	**52.** (*a,b,c*)	**53.** (*a,c*)	**54.** (*c,d*)
55. (*c,d*)	**56.** (*a,b*)	**57.** (*a,b,c*)	**58.** (*b,c*)	**59.** (*a,b,c*)
60. (*a,c,d*)				

EXERCISE # III

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

Matrix Match Type :

	(*a*)	(*b*)	(*c*)	(*d*)		(*a*)	(*b*)	(*c*)	(*d*)
21.	S	P	Q	R	**22.**	P	R	Q	S
23.	S,T	R,T	Q,R	P,S	**24.**	P, Q, S	R	R	Q,T
25.	R	S	Q	P	**26.**	P,R	Q	S,T	Q
27.	Q,S,T	P,R	Q,R,T	R,T	**28.**	P,T	R	Q,R,S	Q,S,T
29.	P	S	R	Q	**30.**	S	P	Q	R
31.	Q,S	P	P,R	Q,S	**32.**	P	Q	P,R	P,R,S
33.	S	R	Q	P	**34.**	R	S	Q	P
35.	S	P	R	Q					

EXERCISE # IV

1. (3) **2.** (5) **3.** (5) **4.** (4) **5.** (3) **6.** (4) **7.** (3) **8.** (9) **9.** (3) **10.** (6)
11. (5) **12.** (4) **13.** (6) **14.** (2) **15.** (4) **16.** (4) **17.** (4) **18.** (4) **19.** (6) **20.** (4)
21. (3) **22.** (3) **22.** (2) **23.** (3) **24.** (0) **25.** (2) **26.** (6) **27.** (6) **28.** (2) **29.** (5)
30. (8) **31.** (7) **32.** (0) **33.** (3) **34.** (3) **35.** (2) **36.** (2) **37.** (1) **38.** (2) **39.** (2)
40. (1)

EXERCISE # V(*a*) JEE-MAIN

1. (3) **2.** (1) **3.** (1) **4.** (3) **5.** (1) **6.** (2) **7.** (4) **8.** (4) **9.**(3) **10.**(4)
11. (4) **12.** (2)

EXERCISE # V(*b*) JEE-ADVANCED

1.Smelting, Sintering

2. (*b*) **3.** (*b*) **4.** *(a,c)* **5.** (*c*) **6.** (*c*) **7.** (*c*) **8.** (*b*) **9.** (*a*) **10.** (*a*)
11. (*a*) **12.** (*c*) **13.** (*b*) **14.** (*b*) **15.** (*a*) **16.** (*d*) **17.** (*c*)
18. (*a*) → (P,R) ; (*b*) → (P) ; (*c*) → (Q) ; (*d*) → (S) **19.** (*a*) → (P) ; (*b*) → (Q) ; (*c*) → (P,R) ; (*d*) → (S)
20.Sintering, Smelting **21.** (*a,c,d*) **22.** (*d*) **23.** (*b*) **24.** (*a*) **25.** (*c,d*)
26. (*a,c,d*) **27.** ( ) **28.** (*a*) → (P,Q,S) **;** (*b*) → (T) **;** (*c*) → (Q,R) **;** (*d*) → (R)