

Tips & Tricks

- ✍ Pitch blende is the source of *Ra*, *U* and *Th*.
- ✍ Nitrate is least likely to be found in mineral.
- ✍ Oxygen is the most abundant element (45.2%)
- ✍ Aluminium is the most abundant metal (8.3%)
- ✍ Silicon is the second most common element in the universe (27.2%)
- ✍ First five elements comprise almost 92% by weight
- ✍ First ten elements make up over 99.5% of the earth crust.
- ✍ Other very abundant elements are nitrogen (78% of the atmosphere) and hydrogen which occurs as water in the ocean.
- ✍ Diamond consists only of carbon.
- ✍ Removal of unwanted earthy and silicious impurity from the ore is called ore dressing or concentration.
- ✍ *Refractory materials* : These are the substances which can withstand very high temperature without melting or becoming soft.
- ✍ Noble metals like *Au*, *Ag* etc. are obtained by cyanide or amalgamation process.
- ✍ Active metals like *Li*, *Na*, *K* (alkali metals), *Cs*, *Mg*, *Sr*, *Ba* (alkaline earth metals) etc. are obtained by the electrolysis of their chloride, oxides or hydroxide.
- ✍ Heavy metals like *Cu*, *Zn*, *Fe*, *Pb*, *Sn* etc. are obtained by roasting and smelting process.
- ✍ Gravity separation is employed for the concentration of oxide ores.
- ✍ Slag is used in road making as well as in the manufacture of cement and fertilizers.

Ordinary Thinking

Objective Questions

Occurrence

- The most abundant element on earth crust is
[MP PMT 1972, 80, 84; DPMT 1986]
(a) Hydrogen (b) Oxygen
(c) Silicon (d) Carbon
- Naturally occurring substances from which a metal can be profitably (or economically) extracted are called
[CPMT 1982; MP PET 1996]
(a) Minerals (b) Ores
(c) Gangue (d) Salts
- Titanium containing mineral found in our country is
[NCERT 1984; RPET 1999]
(a) Bauxite (b) Dolomite
(c) Chalcopyrites (d) Elmanite
- Silicon is main constituent of
[DPMT 1985]
(a) Alloys (b) Rocks
(c) Animals (d) Vegetables
- Ore pitch blende is main source of
[DPMT 1985; RPET 1999]

- (a) *Ra* (b) *Ce*
(c) *Th* (d) *Mg*
- Which of ore is metalloid [MP PMT 1987]
(a) *As* (b) *Na*
(c) *Au* (d) *Fe*
- A mineral is called an ore if [MP PMT 1990]
(a) Metal present in mineral is precious
(b) Metal can be extracted from it
(c) Metal can be extracted profitably from it
(d) Metal cannot be extracted from it
- The highest quantity present in the atmosphere is of [NCERT 1971, 79; CPMT 1972]
(a) Oxygen (b) Hydrogen
(c) Nitrogen (d) Ozone
- Which of the following statement is correct
(a) Bauxite is an ore of aluminium
(b) Magnetite is an ore of manganese
(c) Haematite is an ore of mercury
(d) Pyrites is an ore of phosphorus
- Carnallite is a mineral of [CBSE PMT 1988; DPMT 1983; AMU 1999]
(a) *Ca* (b) *Na*
(c) *Mg* (d) *Zn*
- The salt which is least likely to be found in minerals is [DPMT 1984]
(a) Chloride (b) Sulphate
(c) Sulphide (d) Nitrate
- Metal which can be extracted from all the three dolomite, magnesite and carnallite is [MP PET 1985]
(a) *Na* (b) *K*
(c) *Mg* (d) *Ca*
- Cinnabar is an ore of [DPMT 1982, 84; CBSE PMT 1991; MNR 1986; CPMT 1973, 76, 78, 79, 86, 89, 94; UPSEAT 1999]
(a) *Hg* (b) *Cu*
(c) *Pb* (d) *Zn*
- Metallurgy is the process of [MP PET 2001]
(a) Concentrating the ore
(b) Roasting the ore
(c) Extracting the metal from the ore
(d) Adding carbon to the ore in blast furnace
- What is believed to be the second most common element in the universe [MP PET 2000]
(a) Helium (b) Hydrogen
(c) Nitrogen (d) Silicon
- Which of the following substances consists of only one element [MP PET 1999, 2000]
(a) Marble (b) Sand
(c) Diamond (d) Glass
- Which of the following minerals is not an ore of aluminium
(a) Bauxite (b) Gypsum
(c) Cryolite (d) Corundum
- An example of halide ore is [MP PMT 1993]
(a) Galena (b) Bauxite
(c) Cinnabar (d) Cryolite
- Which of the following is not an ore [IIT 1982]
(a) Bauxite (b) Malachite
(c) Zinc blende (d) Pig iron
- "Chile saltpetre" is an ore of [CPMT 1982]
(a) Iodine (b) Sodium

- (c) Bromine (d) Magnesium
21. Which of the following metal is not found in free state
(a) *Na* (b) *Au*
(c) *Ag* (d) *Pb*
22. Which of the following ore is used for industrial extraction of aluminium in India [MP PET 1989]
(a) Corundum (b) Keolin
(c) Cryolite (d) Bauxite
23. Bauxite is an oxide ore of [BHU 1979; AFMC 1980; Kurukshetra CEE 1998; RPET 1999; CPMT 1976, 2001, 02]
(a) Barium (b) Boron
(c) Bismuth (d) Aluminium
24. Cryolite is [AMU 1983]
(a) Magnesium silicate
(b) Sodium borofluoride
(c) Sodium aluminium fluoride
(d) Magnesium silicate
25. Composition of bauxite is
(a) Al_2O_3 (b) $Al_2O_3 \cdot H_2O$
(c) $Al_2O_3 \cdot 2H_2O$ (d) $Al_2O_3 \cdot 3H_2O$
26. Main ore of aluminium is [CPMT 1989, 91, 2001; RPMT 1997; RPET 1999]
[CPMT 2002, MP PMT 1999]
(a) Bauxite (b) Corundum
(c) Cryolite (d) Magnetite
27. Corundum is [CPMT 1975, 76; DPMT 1983]
(a) SrO_2 (b) Al_2O_3
(c) $CaCl_2$ (d) Cu_2Cl_2
28. Which is not a mineral of aluminium [BHU 1974, 79; MNR 1984; DPMT 2002]
(a) Anhydrite (b) Bauxite
(c) Corundum (d) Diaspore
29. Which of the following mineral does not contain *Al* [IIT (Screening) 1992]
(a) Cryolite (b) Mica
(c) Feldspar (d) Fluorspar
30. An important oxide ore of iron is [MP PET/PMT 1998; MP PET 1990; MP PMT 1994, 96]
(a) Haematite (b) Siderite
(c) Pyrites (d) Malachite
31. Which ore is used for the manufacture of iron [CPMT 1973, 79; RPET 2000]
(a) Cryolite (b) Bauxite
(c) Haematite (d) Chalcopyrites
32. Formula of magnetite is [CPMT 1991]
(a) Fe_2O_3 (b) FeS_2
(c) $FeCO_3$ (d) Fe_3O_4
33. Which of the following is ferrous alloy [DPMT 1982, 84; CPMT 1989]
(a) Invar (b) Solder
(c) Magnalium (d) Type metal
34. Which of the following ores does not represent the ore of iron [CPMT 1989; AIIMS 2002]
(a) Haematite (b) Magnetite
(c) Cassiterite (d) Limonite
35. The formula of haematite is [MNR 1994]
(a) Fe_3O_4 (b) Fe_2O_3
(c) $FeCO_3$ (d) FeS_2
36. Which metal is not silvery white
(a) *Ni* (b) *Cu*
(c) *Na* (d) *Sn*
37. Azurite is an ore of
(a) *Ag* (b) *Cu*
(c) *Pt* (d) *Au*
38. Copper can be extracted from [NCERT 1973; IIT 1978; J & K 2005]
(a) Kupfernickel (b) Dolomite
(c) Galena (d) Malachite
39. Which of the following ore is called malachite [CPMT 1989, 93]
(a) Cu_2S (b) $CuCO_3 \cdot Cu(OH)_2$
(c) Cu_2O (d) $CuCO_3$
40. Argentite is a mineral of [CPMT 1978; MP PMT/PET 1988]
(a) Copper (b) Silver
(c) Platinum (d) Gold
41. Which one of the following is an ore of silver [CPMT 1983; MP PET 1989; CBSE PMT 1993]
(a) Argentite (b) Stibnite
(c) Haematite (d) Bauxite
42. Calamine is [BHU 1980, 85; CPMT 1990; MNR 1995; UPSEAT 1999]
(a) $ZnSO_4$ (b) ZnO
(c) $Zn(NO_3)_2$ (d) $ZnCO_3$
43. Important ore of zinc is [CPMT 1973, 78, 80]
(a) Calamine (b) Cryolite
(c) Gibbsite (d) Malachite
44. Which of the following statement is incorrect [CPMT 1985]
(a) Silver glance mainly contains silver sulphide
(b) Gold is found in native state
(c) Zinc blende mainly contain zinc chloride
(d) Copper pyrites also contain Fe_2S_3
45. Commercially important ore of lead from which it is extracted is [DPMT 1982, 90]
(a) Siderite (b) Haematite
(c) Galena (d) None of these
46. Which of the following is not an ore of lead [MP PMT 1993]
(a) Galena (b) Anglesite
(c) Calamine (d) Cerrusite
47. Galena is
(a) PbO (b) $PbCO_3$
(c) PbS (d) $PbCl_2$
48. An example of an oxide ore is [MP PET 1996]
(a) Bauxite (b) Malachite
(c) Zinc blende (d) Felspar
49. Cryolite is an ore of [MP PMT 1996; BHU 2002; DPMT 1996]
(a) Iron (b) Silver
(c) Zinc (d) Aluminium
50. Cassiterite is an ore of [CBSE PMT 1999; DPMT 1996]
(a) *Mn* (b) *Ni*
(c) *Sb* (d) *Sn*

51. Which one of the following is the most abundant element in the universe [NDA 1999]
(a) Nitrogen (b) Hydrogen
(c) Oxygen (d) Silicon
52. Among the following statements, the incorrect one is [IIT 1997]
(a) Calamine and siderite are carbonates
(b) Argentite and cuprite are oxides
(c) Zinc blende and pyrites are sulphides
(d) Malachite and azurite are ores of copper
53. Which one of the following ores is a chloride [EAMCET 1997; CPMT 2001]
(a) Horn silver (b) Zincite
(c) Bauxite (d) Felspar
54. Aluminium is most abundant in earth crust yet it is obtained from bauxite because [CPMT 1997]
(a) Bauxite is available in larger quantity
(b) Of easy extraction of aluminium from it
(c) Bauxite contains maximum aluminium
(d) Bauxite is less impure
55. An ore of potassium is [JIPMER 2001]
(a) Bauxite (b) Solomite
(c) Carnallite (d) Cryolite
56. The molecular formula of cryolite is [AFMC 1999; MP PET 2002]
(a) Fe_3O_4 (b) Na_3AlF_6
(c) $Na_2Al_2O_3$ (d) All of these
57. All ores are minerals, while all minerals are not ores because [Orissa JEE 2002]
(a) The metal can't be extracted economically from all the minerals
(b) Minerals are complex compounds
(c) The minerals are obtained from mines
(d) All of these are correct
58. Corundum is an ore of [Kerala (Med.) 2002]
(a) Copper (b) Boron
(c) Aluminium (d) Sodium
59. Which one of the following is correct [MP PET/PMT 2002]
(a) A mineral cannot be an ore
(b) An ore cannot be a mineral
(c) All minerals are ores
(d) All ores are minerals
60. Which ore contains both iron and copper? [IIT-JEE (Screening) 2005]
(a) Cuprite (b) Chalcocite
(c) Chalcopyrite (d) Malachite
61. Formula of Felspar is [MHCET 2004]
(a) $K_2O \cdot Al_2O_3 \cdot 6SiO_2$
(b) $K_2O_3 \cdot Al_2O_3 \cdot 6Si_2O_2 \cdot 2H_2O$
(c) $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$
(d) $3MgO \cdot 4SiO_2 \cdot H_2O$
62. Chile saltpetre is [MP PET 2004]
(a) $NaNO_3$ (b) KNO_3
(c) Na_2SO_4 (d) $Na_2S_2O_3$
63. Which of the following is not an ore of magnesium [CPMT 2004; DCE 2004]
(a) Magnesite (b) Dolomite
(c) Gypsum (d) Carnallite
64. Which of the following is not a mineral of iron? [Kerala PMT 2004]
(a) Magnetite (b) Siderite
(c) Smithsonite (d) Limonite
(e) Haematite
65. The ore carnallite is represented by structure: [EAMCET 1987; MP PET 1986, 04; AFMC 2000 Pb. PMT 2004]
(a) $Na_2Al_2O_3$ (b) Na_3AlF_6
(c) $KCl \cdot MgCl_2 \cdot 6H_2O$ (d) Fe_3O_4
66. Which of the following metal is sometimes found native in nature [CPMT 1973, 7]
(a) Al (b) Cu
(c) Fe (d) Mg
67. The most abundant metal in the earth crust is [BHU 1979, 81; MP PMT 1997; CPMT 1988, 2001; CBSE PMT 2000]
(a) Na (b) Mg
(c) Al (d) Fe
68. Indicate the mineral from which copper is manufactured [NCERT 1973]
(a) Galena (b) Cuprite
(c) Sphalerite (d) Chalcopyrite
69. The principal ores of silver are argentite, horn silver and pyrargyrite. Their formula respectively are
(a) Ag_2S , $AgCl$ and $AgSbS_2$
(b) $AgCl$, $AgSbS_2$ and Ag_2S
(c) $AgSbS_2$, Ag_2S and $AgCl$
(d) $AgCl$, Ag_2S and $AgSbS_2$
70. The most important ore of tin is [AFMC 2005]
(a) Cassiterite (b) Cryolite
(c) Cerussite (d) None of these
71. Important ore of Mg is [BCECE 2005]
(a) Gypsum (b) Carnallite
(c) Magnatide (d) Carnolite
72. Which of the following is a carbonate ore [AIIMS 2005]
(a) Pyrolusite (b) Malachite
(c) Diaspore (d) Cassiterite

Concentration

1. Sulphide ores are generally concentrated by [CPMT 1980, 82; EAMCET 1980; MNR 1981; DPMT 1982; KCET 1993]
(a) Froth floatation process (b) Magnetic separation
(c) Gravity separation (d) By hand picking
2. Froth floatation process is used for the concentration of [NCERT 1984; CPMT 1982, 87; MP PMT 1989; BHU 1997; EAMCET 1983; AMU 1984; DPMT 1989; AFMC 2000; MNR 1981; KCET 2000; MP PET 2001; Pb. PMT 2002]
(a) Oxide ores (b) Sulphide ores
(c) Chloride ores (d) Amalgams
3. A process used for the concentration of ore is [MP PMT 1990; MP PET 2003]
(a) Froth floatation (b) Roasting
(c) Electrolysis (d) Bessemerization
4. Magnetic separation is used for increasing concentration of the following [MP PET 1990]
(a) Horn silver (b) Calcite
(c) Haematite (d) Magnesite
5. The substance added in water in the froth floatation process is [EAMCET 1980]

- (a) Soap powder (b) Pine oil
(c) Coconut oil (d) None of the above
6. For which one of the metal, froth floatation method is used for concentration [MP PMT 2001]
(a) Horn silver (b) Bauxite
(c) Cinnabar (d) Haematite
7. Cyanide process is used in the extraction of [DCE 2002, 03]
(a) Au (b) Ag
(c) both (a) and (b) (d) Cu
8. Cassiterite is concentrated by [EAMCET 1998]
(a) Levigation
(b) Electromagnetic separation
(c) Floatation
(d) Liquifaction
9. Froth floatation process for the concentration of ores is an illustration of the practical application of [NCERT 1984]
(a) Adsorption (b) Absorption
(c) Coagulation (d) Sedimentation
10. Iron ore is concentrated by [MP PMT 1991]
(a) Froth floatation (b) Electrolysis
(c) Roasting (d) Magnetic treatment
11. An ore of tin containing $FeCrO_4$ is concentrated by [SCRA 1991]
(a) Magnetic separation (b) Froth floatation
(c) Electrostatic method (d) Gravity separation
12. One of the following metals forms a volatile compound and this property is taken advantage for its extraction. This metal is [NCERT 1984]
(a) Iron (b) Nickel
(c) Cobalt (d) Tungsten
13. Bauxite ore is concentrated by [MP PET 1994; KCET 1999; UPSEAT 2001]
(a) Froth floatation
(b) Electromagnetic separation
(c) Chemical separation
(d) Hydraulic separation
14. In extraction of copper, we use [CPMT 1980; MP PMT 1986]
(a) Cu_2S (b) Pyrites
(c) Silver argentocyanide (d) $CuFeS_2$
15. Which metal is most difficult to be extracted from its oxide
(a) Cs (b) Ag
(c) Zn (d) Mg
16. Copper pyrites are concentrated by [MNR 1995; UPSEAT 1999; AMU 1999; MP PMT 2003]
(a) Electromagnetic method (b) Gravity method
(c) Froth floatation process (d) All the above methods
17. In the metallurgy of zinc, flux is not used because
(a) Zinc ore has no impurities
(b) Zinc is volatile hence easily separated
(c) Zinc reacts with flux
(d) Flux is volatile
18. Ores like magnetite or tungstates in tin ores are concentrated by
(a) Froth floatation (b) Magnetic separation
(c) Gravity separation (d) Electrostatic separation
19. Froth–floatation method is successful in separating impurities from ores because [Kerala CET 2005]
(a) The pure ore is lighter than water containing additives like pine oil, cresylic acid etc.
(b) The pure ore is soluble in water containing additives like pine oil, cresylic acid etc.
(c) The impurities are soluble in water containing additives like pine oil, cresylic acid etc.
(d) The pure ore is not as easily wetted by water as by pine oil, cresylic acid etc
20. An ore like zinc blende is concentrated by [MP PMT 1997]
(a) Froth floatation (b) Magnetic separation
(c) Leaching (d) Washing with water
21. The method of concentrating the ore which makes use of the difference in density between ore and impurities is called [Pune CET 1998]
(a) Levigation (b) Leaching
(c) Magnetic separation (d) Liquifaction
22. Which of the following ore is best concentrated by froth–floatation method [AIEEE 2004]
(a) Galena (b) Cassiterite
(c) Magnetite (d) Malachite

Roasting & Calcination

1. Refractory materials are generally used in furnaces because [MNR 1980; MP PMT 1986]
(a) They possess great structural strength
(b) They can withstand high temperature
(c) They are chemically inert
(d) They do not require replacement
2. Main function of roasting is [MP PET/PMT 1988]
(a) To remove volatile substances
(b) Oxidation
(c) Reduction
(d) Slag formation
3. Roasting is generally done in case of the following [MP PMT 1985]
(a) Oxide ores (b) Silicate ores
(c) Sulphide ores (d) Carbonate ores
4. Heating of pyrites in air for oxidation of sulphur is called [CPMT 1973, 75, 78, 79, 94; DPMT 1982, 84, 86; MP PMT 2000, 01, 02]
(a) Roasting (b) Calcination
(c) Smelting (d) Slagging
5. Which is not basic flux [CPMT 1986]
(a) $CaCO_3$ (b) Lime
(c) SiO_2 (d) CaO
6. A substance which reacts with gangue to form fusible material is called [MP PMT 1990; Kurukshetra CEE 1998]
(a) Flux (b) Catalyst
(c) Ore (d) Slag
7. When lime stone is heated strongly, it gives off CO_2 . In metallurgy this process is known as [MP PET/PMT 1988]
(a) Calcination (b) Roasting
(c) Smelting (d) Ore dressing
8. Electric furnaces are lined with magnesia because
(a) It is not affected by acids
(b) It gives oxygen on heating
(c) It melts at very high temperature

- (d) It has no effect of electricity
9. Purpose of smelting of an ore is [MP PMT 1990, 2001; Kurukshetra CEE 1998; RPMT 2000]
- (a) To oxidise it
(b) To reduce it
(c) To remove vaporisable impurities
(d) To obtain an alloy
10. Smelting is done in [DPMT 1979]
- (a) Blast furnace (b) Muffle furnace
(c) Open-hearth furnace (d) Electric furnace
11. In order to bring initial chemical change in the ore, the process of heating of ore below its melting point is known as
- (a) Reduction (b) Smelting
(c) Calcination (d) Roasting
12. Matte contains mainly [KCET 2000]
- (a) Cu_2S and FeS (b) CuS and Fe_2S_3
(c) Fe (d) Cu_2S
13. The substance which is mixed with the ore for removal of impurities is termed as [MP PMT 1985, 87, 90; CPMT 1996; JIPMER 2002]
- (a) Slag (b) Gangue
(c) Flux (d) Catalyst
14. The cheap and having high melting point compound used in furnace is [CPMT 1975]
- (a) PbO (b) CaO
(c) HgO (d) ZnO
15. Which of the following substance can be used for drying gases [EAMCET 1997; MP PET 1999]
- (a) $CaCO_3$ (b) Na_2CO_3
(c) $NaHCO_3$ (d) CaO
16. Which one of the furnaces among the following can produce the highest temperature
- (a) Muffle furnace (b) Blast furnace
(c) Reverberatory furnace (d) Electric furnace
17. The process of heating the ore strongly in excess of air so that the volatile impurities are removed and the ore is changed to oxide is known as [AMU 1985; NCERT 1990]
- (a) Calcination (b) Roasting
(c) Froth floatation (d) Leaching
18. The role of calcination in metallurgical operations is [AMU 1984]
- (a) To remove moisture
(b) To decompose carbonate
(c) To drive off organic matter
(d) To achieve all the above
19. Calcination is the process of heating the ore [CPMT 1982]
- (a) In a blast furnace (b) In absence of air
(c) In presence of air (d) None of these
20. Smelting is termed to the process in which [MP PMT 1987]
- (a) The ore is heated in the absence of air
(b) Ore is cold
(c) The ore is heated in the presence of air
(d) Ore is melted
21. The metallurgical process in which a metal is obtained in a fused state is called [IIT 1978; MP PET 1997]
- (a) Smelting (b) Roasting
(c) Calcination (d) Froth floatation
22. Which of the following processes involves smelting [NCERT 1983]
- (a) $ZnCO_3 \rightarrow ZnO + CO_2$
(b) $Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$
(c) $2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$
(d) $Al_2O_3 \cdot 2H_2O \rightarrow Al_2O_3 + 2H_2O$
23. Reverberatory furnace is employed in the metallurgical process mainly for [MP PMT 1994]
- (a) Reduction of oxide ores
(b) Smelting of sulphide ores
(c) Conversion of chloride to sulphate
(d) Getting magnetic materials
24. In metallurgy, flux is a substance used to convert [EAMCET 1988]
- (a) Infusible impurities to fusible material
(b) Soluble impurities to insoluble impurities
(c) Fusible impurities to infusible impurities
(d) Mineral into silicate
25. In the manufacture of iron lime stone added to the blast furnace, the calcium ion ends in the form of [MP PMT 1989; CPMT 1989; KCET 1993; IIT 1982; MADT Bihar 1995]
- (a) Slag (b) Gangue
(c) Calcium metal (d) $CaCO_3$
26. Flux added in the extraction of iron is
- (a) Silica (b) Felspar
(c) Limestone (d) Flint
27. The smelting of iron in the blast furnace involves all the following process except
- (a) Oxidation (b) Reduction
(c) Decomposition (d) Sublimation
28. In the manufacture of iron from haematite, the function of lime stone is as [CPMT 1988; MP PET 1991, 93, 95]
- (a) A reducing agent (b) Flux
(c) Slag (d) Gangue
29. The slag obtained during the extraction of copper from copper pyrites is composed mainly of [MNR 1993; MP PMT 1997; UPSEAT 2000, 01; IIT-JEE Screening 2001]
- (a) $CaSiO_3$ (b) $FeSiO_3$
(c) $CuSiO_3$ (d) SiO_2
30. Complex is formed in the extraction of [MP PET 1989]
- (a) Na (b) Cu
(c) Ag (d) Fe
31. Which of the following metal is extracted by amalgamation process
- (a) Tin (b) Silver
(c) Copper (d) Zinc
32. The reaction $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$ in the metallurgical process of zinc is called [MP PET 1994]
- (a) Calcination (b) Cupellation
(c) Smelting (d) Roasting
33. Calcination is used in metallurgy for removal of [AFMC 1995]
- (a) Water and sulphide (b) Water and CO_2
(c) CO_2 and H_2S (d) H_2O and H_2S
34. Which of the following is slag [CPMT 1994]
- (a) CaO (b) $CaSO_4$

- (c) $CaSiO_3$ (d) SiO_2
35. The impurities associated with minerals used in metallurgy are collectively called [MP PMT 1995; RPMT 1999]
(a) Slag (b) Flux
(c) Gangue (d) Ore
36. When a metal is to be extracted from its ore, if the gangue associated with the ore is silica, then [MP PET 1996]
(a) An acidic flux is needed
(b) A basic flux is needed
(c) Both acidic and basic flux are needed
(d) Neither of them is needed
37. Which statement is correct
(a) Gangues are carefully chosen to combine with the slag present in the ore to produce easily fusible flux to carry away the impurities
(b) Slags are carefully chosen to combine with the flux present in the ore to produce easily fusible gangue to carry away the impurities
(c) Gangues are carefully chosen to combine with the flux present in the ore to produce easily fusible slag to carry away the impurities
(d) Fluxes are carefully chosen to combine with the gangue present in the ore to produce easily fusible slag to carry away the impurities
38. Roasting of copper pyrites ores is for the following purposes
(a) To burn off sulphur, arsenic, antimony etc. as oxides and convert all the iron and copper to their oxides
(b) To burn off arsenic, antimony etc. as oxides and burn off sulphur so that enough of it remains to combine with all the copper
(c) To burn off sulphur partially to leave enough to combine with arsenic, antimony etc. and to convert all the iron and copper to oxides
(d) To melt arsenic and antimony sulphides etc. and remove them by liquation and to burn off sulphur partially to leave enough to combine with copper and iron
39. In the modern blast furnaces, the charge consists of a mixture of
(a) Calcined iron oxides + lime + anthracite coal
(b) Calcined iron oxides + limestone + coke
(c) Hydrated iron oxides + dolomite + coke
(d) Iron pyrites + lime + bituminous coal
40. Roasting involves
(a) Only volatilisation of volatile impurities
(b) Only volatilisation of volatile impurities and decomposition of the ore
(c) Volatilisation of volatile impurities and decomposition and oxidation of the ore
(d) Oxidation and reduction of the ore and slag formation
41. Which of the following ores is subjected to roasting during metallurgical operations for getting the metal oxide
(a) Horn silver (b) Zinc blende
(c) Malachite (d) Limonite
42. A metal obtained directly by roasting of its sulphide ore is [Pune CET 1998]
(a) Cu (b) Pb
(c) Hg (d) Zn
43. In blast furnace, the highest temperature is in [KCET 1998]
(a) Reduction zone (b) Slag zone
(c) Fusion zone (d) Combustion zone
44. The process of roasting of an ore is carried out in the [BHU 1999]
(a) Absence of air (b) Presence of air
(c) Limited supply of air (d) None of these
45. Flux is used to remove [AIIMS 1999]
(a) Acidic impurities (b) Basic impurities
(c) All impurities from ores (d) Both (a) and (b)
46. During extraction of Fe ; slag obtained is [CPMT 2000]
(a) FeO (b) $FeSiO_3$
(c) $MgSiO_3$ (d) $CaSiO_3$
47. The final step for the extraction of copper from copper pyrite in Bessemer converter involves the reaction [CPMT 2000]
(a) $4Cu_2O + FeS \rightarrow 8Cu + FeSO_4$
(b) $Cu_2S + 2Cu_2O \rightarrow 6Cu + SO_2$
(c) $2Cu_2O + FeS \rightarrow 4Cu + Fe + SO_2$
(d) $Cu_2S + 2FeO \rightarrow 2Cu + 2FeCO + SO_2$
48. Flux is used to remove [KCET (Med.) 2000; PCET 2004]
(a) Silica
(b) Metal oxide
(c) All impurities from ores
(d) Silica and undesirable metal oxide
49. Roasting is done in [AFMC 2001]
(a) Blast furnace (b) Open hearth furnace
(c) Electric furnace (d) None of these
50. Which of the following fluxes is used to remove acidic impurities in metallurgical process [KCET (Med.) 2001]
(a) Silica (b) Lime stone
(c) Sodium chloride (d) Sodium carbonate
51. Refractory metals are used in construction of furnaces because
(a) They can withstand high temperature
(b) They are chemically inert
(c) Their melting point is high
(d) None of these
52. CN^- solution used in extraction of which metal [RPMT 2002]
(a) Ag (b) Ti
(c) Zn (d) Sn
53. In a line kiln, to get higher yield of CO_2 , the measure that can be taken is [KCET 2003]
(a) To remove CaO
(b) To add more $CaCO_3$
(c) To maintain high temperature
(d) To pump out CO_2
54. Which metal is used as a reducing agent in smelting [MP PET 2003]
(a) C (b) Al
(c) Zn (d) None of these
55. Inner layer of blast furnace is made of [MP PMT 1990]
(a) Graphite bricks (b) Silica bricks
(c) Fire-clay bricks (d) Basic bricks
56. Blast furnace is employed in the smelting of oxide ore with coke and flux in the metallurgy of
(a) Iron (b) Copper
(c) Lead (d) All the above
57. How is limestone used in Fe extraction [Orissa JEE 2004]
(a) Oxidation of Fe ore (b) Reduction of Fe ore
(c) Formation of slag (d) Purification of Fe formed
58. Heating mixture of Cu_2O and Cu_2S will give

[AIEEE 2005]

- (a) $Cu + SO_2$ (b) $Cu + SO_3$
(c) $CuO + CuS$ (d) Cu_2SO_3

59. Heating of ore in presence of air to remove sulphur impurities is called [AFMC 2005]

- (a) Calcination (b) Roasting
(c) Smelting (d) None of these

60. The important step in the extraction of metal from carbonate ore is

- (a) Calcination (b) Roasting
(c) Electro-reduction (d) Cupellation

Reduction to free Metal

1. Electrometallurgical process is used to extract

[MNR 1985, 89; UPSEAT 2000; MP PMT 2001]

- (a) Fe (b) Pb
(c) Na (d) Ag

2. General method for the extraction of metal from oxide ore is

[CPMT 1983; MP PET 2002]

- (a) Carbon reduction (b) Reduction by aluminium
(c) Reduction by hydrogen (d) Electrolytic reduction

3. Function of the flux added during smelting is

- (a) To make ore porous
(b) To remove gangue
(c) To make reduction easier
(d) To precipitate slag

4. Alumino-thermic process is used for the extraction of metals, whose oxides are

- (a) Fusible
(b) Not easily reduced by carbon
(c) Not easily reduced by hydrogen
(d) Strongly basic

5. In blast furnace iron oxide is reduced by

[MP PMT 1989; KCET 2005]

- (a) Silica (b) CO
(c) Carbon (d) Lime stone

6. Furnaces are lined with calcium oxide because

- (a) It gives off oxygen on heating
(b) It gives strong light on heating
(c) It is refractory and basic
(d) It is not affected by acids

7. The substance used in the thermite process of reducing metal ores is [MP PET 1993; CPMT 2000, 01]

- (a) Aluminium (b) Thorium
(c) Heated Pt gauge (d) Carbon

8. The electrolytic method of reduction is employed for the preparation of metals that

[MP PMT 1991; NCERT 1984; CPMT 1988; KCET 2002]

- (a) Are weakly electropositive
(b) Are moderately electropositive
(c) Are strongly electropositive
(d) Form oxides

9. Which of the following metals cannot be extracted by carbon reduction process [AMU 1982]

- (a) Pb (b) Al
(c) Hg (d) Zn

10. Carbon reduction process is used for the extraction of

- (a) Hg (b) Zn
(c) Cr (d) Fe

11. Among the following groups of oxides, the group containing oxides that cannot be reduced by carbon to give the respective metals is [NCERT 1984]

- (a) Cu_2O, K_2O (b) Fe_2O_3, ZnO
(c) CaO, K_2O (d) PbO, Fe_3O_4

12. Which one of the following metals is extracted by thermal reduction process? [EAMCET 1986]

- (a) Copper (b) Iron
(c) Aluminium (d) Magnesium

13. Chemical reduction is not suitable for converting

[MP PET 1994]

- (a) Bauxite into aluminium (b) Cuprite into copper
(c) Haematite into iron (d) Zinc oxide into zinc

14. In alumino-thermite process, aluminium is used as

[IIT 1983; DPMT 1980; MP PMT 1987;

MP PET/PMT 1988; NCERT 1983; UPSEAT 2003]

- (a) Oxidising agent (b) Flux
(c) Reducing agent (d) Solder

15. Which metal is extracted by electrolytic reduction method

[CPMT 1984; MP PET 1997]

- (a) Cu (b) Al
(c) Fe (d) Ag

16. Alumina

- (a) Is a good conductor of electricity
(b) Is a bad conductor of electricity
(c) Melts at $200^\circ C$
(d) Is an electrovalent compound

17. Aluminium is prepared in large quantities by

[KCET 1991, 92]

- (a) Heating cryolite in a limited quantity of air
(b) Reducing aluminium oxide with coke
(c) Reducing aluminium oxide with sodium
(d) Electrolysing aluminium oxide dissolved in fused electrolyte

18. Alumina is

- (a) $Al(OH)_3$ (b) $AlCl_3$
(c) AlN (d) Al_2O_3

19. Which one of the following is used in the extraction of aluminium by electrolytic process [CPMT 1978]

- (a) Al_2O_3 (b) $Al(OH)_3$
(c) $AlCl_3$ (d) $Al_2(SO_4)_3$

20. Which technique is used in the manufacture of aluminium from bauxite [NCERT 1983]

- (a) Reduction with magnesium
(b) Reduction with coke
(c) Electrolytic reduction
(d) Reduction with iron

21. Which of the following processes does not involve a catalyst

[KCET 1991]

- (a) Haber's process (b) Thermite process
(c) Ostwald process (d) Contact process

22. Thermite process is used to extract metals

[KCET 1989]

- (a) When their oxides can't be reduced by carbon
(b) When their carbonates do not yield oxides by thermal decomposition
(c) When their sulphides can't be converted into oxides by roasting
(d) When their melting points are very high

23. Iron is obtained on a large scale from Fe_2O_3 by

[CPMT 1973, 78, 79; Orissa JEE 2005]

- (a) Reduction with Al
(b) Reduction with CO

- (c) Reduction with H_2
(d) Reduction with sodium
24. After partial roasting, the sulphide of copper is reduced by [MP PMT 1993]
(a) Reduction by carbon (b) Electrolysis
(c) Self-reduction (d) Cyanide process
25. High purity copper metal is obtained by [MP PMT 1991]
(a) Carbon reduction (b) Hydrogen reduction
(c) Electrolytic reduction (d) Thermite reduction
26. In the metallurgical extraction of zinc from ZnO the reducing agent used is [MP PET 1994]
(a) Carbon monoxide (b) Sulphur dioxide
(c) Carbon dioxide (d) Nitric oxide
27. In order to refine "blister copper" it is melted in a furnace and is stirred with green logs of wood. The purpose is [MP PET 1996]
(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
28. Aluminium is produced on a large scale by electrolysis of alumina, dissolved in fused cryolite and a little fluorspar. These two electrolytes, *cryolite* and *fluorspar* are respectively
(a) Na_3AlF_6 and CaF_2
(b) AlF_3 and KF
(c) Al_2C_6 and KCl
(d) $KCl.MgCl_2.6H_2O$ and MgF_2
29. Electrometallurgy is used for
(a) Transition metals
(b) Most reactive metals
(c) Noble metals
(d) Soft metals
30. The metal extracted by electrolysis of its fused salt is [MP PET/PMT 1998]
(a) Iron (b) Lead
(c) Sodium (d) Copper
31. Alumino-thermic process is used for metallurgy of [CPMT 1996]
(a) Pb (b) Ag
(c) Al (d) None of these
32. Which metal can't be obtained from electrolysis [CPMT 1997; RPET 1999]
(a) Cu (b) Mg
(c) Cr (d) Ni
33. To obtain chromium from chromic oxide (Cr_2O_3), the method used is [JIPMER 2001]
(a) Alumino-thermic process
(b) Electrolytic reduction
(c) Carbon reduction
(d) Carbon monoxide reduction
34. The substance used in the thermite process of reducing metal ores is [CPMT 2000; KCET 2001; UPSEAT 2001]
(a) Aluminium (b) Thorium
(c) Heated platinum gauze
(d) Carbon
35. Heating with carbon in absence of air is known as [DCE 2002]
(a) Reduction (b) Carbon-reduction
(c) Smelting (d) Roasting

Refining of crude metal

1. In electrolytic refining of metals, electrolysis of an aqueous solution of its complex salt is done with impure metal as anode and an strip of pure metal as cathode. This method cannot be used for the refining of the metal [MP PMT 1989]
(a) Silver (b) Copper
(c) Aluminium (d) Zinc
2. Which method of purification is represented by the equation

$$\underset{\text{Impure}}{Ti} + 2I_2 \xrightarrow{500\text{ K}} TiI_4 \xrightarrow{1675\text{ K}} \underset{\text{Pure}}{Ti} + 2I_2$$
 [AIIMS 1983]
(a) Cupellation (b) Poling
(c) Van Arkel (d) Zone refining
3. Cupellation process is used in the metallurgy of [CPMT 1983; MP PET 1994; MP PMT 2000, 02]
(a) Copper (b) Silver
(c) Aluminium (d) Iron
4. Metals are [MADT Bihar 1983]
(a) Electropositive (b) Electronegative
(c) Acceptor of electrons (d) None of these
5. The cyanide process is used for obtaining [DPMT 1982; CPMT 1976, 84, 90; MNR 1995; MP PET/PMT 1998; AIEEE 2002]
(a) Na (b) Ag
(c) Cu (d) Zn
6. In electrolytic refining, the impure metal is made is used to make
(a) Cathode (b) Anode
(c) Electrolytic bath (d) None of these
7. Of the following, which cannot be obtained by electrolysis of the aqueous solution of their salts [IIT 1990]
(a) Ag (b) Mg and Al
(c) Cu (d) Cr
8. Van Arkel method of purification of metals involves converting the metal to a [BHU 1990]
(a) Volatile stable compound
(b) Volatile unstable compound
(c) Non volatile stable compound
(d) None of the above
9. Zone refining is a method to obtain [KCET 1993]
(a) Very high temperature (b) Ultra pure Al
(c) Ultra pure metals (d) Ultra pure oxides
10. Which one of the following is manufactured by the electrolysis of fused sodium chloride [CPMT 1979, 83, 91]
(a) $NaOH$ (b) $NaClO$
(c) Na (d) $NaClO_3$
11. A metal which is refined by poling is [RPET 2000]

- (a) Sodium (b) Blister copper
(c) Zinc (d) Silver
12. Silver obtained from argentiferrous lead containing lead impurity is purified by [CPMT 1981; MP PMT 1990; EAMCET 1998]
(a) Distillation (b) Froth floatation
(c) Cupellation (d) Treatment of KCN
13. If the impurity in a metal has a greater affinity for oxygen and is more easily oxidised than the metal, then the purification of metal may be carried out by [MP PMT 1997]
(a) Poling (b) Zone refining
(c) Electrolytic refining (d) Cupellation
14. Electric refining is used for refining of [DPMT 1996]
(a) Lead (b) Copper
(c) Iron (d) Sodium
15. Zone refining is used for the purification of [Pune CET 1998]
(a) Cu (b) Au
(c) Ge (d) Ag
16. Mond's process is used for preparing [MNR 1983]
(a) Ni (b) H_2SO_4
(c) NH_3 (d) HNO_3
(e) $NaHCO_3$
17. Gold is extracted by hydrometallurgical process based on its property [KCET 2005]
(a) Of being electropositive
(b) Of being less reactive
(c) To form complexes which are water soluble
(d) To form salts which are water soluble
7. Zone refining is a technique used primarily for which one of the following process
(a) Alloying (b) Tempering
(c) Sintering (d) Purification
8. Method used for obtaining highly pure silicon used as a semiconductor material is [CBSE PMT 1994]
(a) Oxidation (b) Electrochemical
(c) Crystallization (d) Zone refining
9. Which is correct [MADT Bihar 1995]
(a) Galena : Mg_2CO_3
(b) Cassiterite : $CaCO_3 \cdot MgCO_3$
(c) Dolomite : SnO_2
(d) Magnesite : $MgCO_3$
10. 'Lapis-Lazuli' is a blue coloured precious stone. It is mineral of the class [NCERT 1980; AIIMS 1980; BHU 1978, 80]
(a) Sodium-alumino silicate (b) Zinc cobaltate
(c) Basic copper carbonate (d) Prussian blue

Assertion & Reason

For AIIMS Aspirants

Read the assertion and reason carefully to mark the correct option out of the options given below :

- (a) If both assertion and reason are true and the reason is the correct explanation of the assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) If assertion is true but reason is false.
(d) If the assertion and reason both are false.
(e) If assertion is false but reason is true.

1. Assertion : $Al(OH)_3$ is amphoteric in nature
Reason : $Al-O$ and $O-H$ bonds can be broken with equal ease in $Al(OH)_3$ [IIT 1998]
2. Assertion : Iron is found in the free state in nature [AIIMS 2001]
Reason : Iron is highly reactive element
3. Assertion : Zinc is used and copper is not used in the recovery of Ag from the complex $[Ag(CN)_2]^-$.
Reason : Zinc is a powerful reducing agent than copper.
4. Assertion : Coke and flux are used in smelting.
Reason : The phenomenon in which ore is mixed with suitable flux and coke is heated to fusion is known as smelting.
5. Assertion : Leaching is a process of reduction.
Reason : Leaching involves treatment of the ore with a suitable reagent so as to make it soluble while impurities remains insoluble. [BHU 2004]
6. Assertion : Ethyl xanthate is used as a collector in froth floatation process.
Reason : Collectors depress the floatation property of one of the components of the ore and thus help in the separation of different minerals present in the same ore.
7. Assertion : Levigation is used for the separation of oxide ores from impurities.
Reason : Ore particles are removed by washing in a current of water.

Critical Thinking

Objective Questions

1. Black Jack is an ore of [PCET 2004]
(a) Cr (b) Sn
(c) Zn (d) Ni
2. Froth floatation process is used for concentration of [MNR 1987; IIT 1989; UPSEAT 2000, 02]
(a) Chalcopyrite (b) Bauxite
(c) Haematite (d) Calamine
3. The process of ore dressing is carried out to [MP PMT 1994]
(a) Remove the siliceous materials
(b) Add flux to the mineral
(c) Convert the ore to oxide
(d) Remove the poisonous impurities
4. Wolframite ore is separated from tinstone ore by the process of
(a) Roasting (b) Electromagnetic
(c) Smelting (d) Calcination
5. Which process of reduction of mineral to the metal is suited for the extraction of copper from its ores with low copper content
(a) Metal displacement (b) Auto reduction
(c) Chemical reduction (d) Electrolytic reduction
6. Pb and Sn are extracted from their chief ore by [IIT-JEE Screening 2004]
(a) Carbon reduction and self reduction.
(b) Self reduction and carbon reduction.
(c) Electrolysis and self reduction.
(d) Self reduction and electrolysis.

8. Assertion : In Hall and Heroult's process, Al is extracted by electrolysis of a fused mixture of alumina, cryolite and fluorspar.
Reason : Addition of cryolite and fluorspar lowers the fusion temperature and increases the conductivity of the electrolyte.
9. Assertion : $AgNO_3$ is called lunar caustic.
Reason : In contact with organic matter (skin, cloth paper, etc.) $AgNO_3$ is reduced to metallic silver.
10. Assertion : Wolframite impurities are separated from cassiterite by electromagnetic separation.
Reason : Cassiterite being magnetic is attracted by the magnet and forms a separate heap.
11. Assertion : Lead, tin and bismuth are purified by liquation method.
Reason : Lead, tin and bismuth have low m.p. as compared to impurities.
12. Assertion : Gold is recovered from its solution containing aurocyanide complex by adding zinc dust.
Reason : Zinc is more electropositive than gold.

Answers

Occurrence

1	b	2	b	3	d	4	b	5	ac
6	a	7	c	8	c	9	a	10	c
11	d	12	c	13	a	14	c	15	d
16	c	17	b	18	d	19	d	20	b
21	a	22	d	23	d	24	c	25	c
26	a	27	b	28	a	29	d	30	a
31	c	32	d	33	a	34	c	35	b
36	b	37	b	38	d	39	b	40	b
41	a	42	d	43	a	44	c	45	c
46	c	47	c	48	a	49	d	50	d
51	b	52	b	53	a	54	a	55	c
56	b	57	a	58	c	59	d	60	c
61	a	62	a	63	c	64	c	65	c
66	b	67	c	68	d	69	a	70	a
71	b	72	b						

Concentration

1	a	2	b	3	a	4	c	5	b
6	c	7	c	8	b	9	a	10	d
11	a	12	b	13	c	14	d	15	c
16	c	17	b	18	b	19	d	20	a
21	a	22	a						

Roasting & Calcination

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

Reduction to free Metal

1	c	2	a	3	b	4	b	5	b
6	c	7	a	8	c	9	b	10	d
11	c	12	b	13	a	14	c	15	b
16	b	17	d	18	d	19	a	20	c
21	b	22	a	23	b	24	c	25	c
26	a	27	d	28	a	29	b	30	c
31	d	32	b	33	a	34	a	35	b

Refining of crude Metal

1	d	2	c	3	b	4	a	5	b
6	b	7	b	8	a	9	c	10	c
11	b	12	c	13	d	14	b	15	c
16	a	17	c						

Critical Thinking Questions

1	c	2	a	3	a	4	b	5	b
6	b	7	d	8	d	9	d	10	a

Assertion & Reason

1	c	2	e	3	a	4	b	5	c
6	c	7	c	8	a	9	b	10	c
11	a	12	a						

AS Answers and Solutions

Occurrence

1. (b)

Element	% abundance by weight
<i>O</i>	46.6
<i>Si</i>	27.7
<i>Al</i>	8.3
<i>Fe</i>	5.1
<i>Ca</i>	3.6
6. (a) $As \rightarrow$ Metalloid $Na, Au, Fe \rightarrow$ Metals
8. (c) $N_2 = 78\%$; $O_2 = 21\%$
9. (a) Bauxite $Al_2O_3 \cdot 2H_2O$
10. (c) Carnallite $KCl \cdot MgCl_2 \cdot 6H_2O$
12. (c) Dolomite $MgCO_3 \cdot CaCO_3$
 Magnesite $MgCO_3$
 Carnallite $KCl \cdot MgCl_2 \cdot 6H_2O$
16. (c) Diamond made up of carbon only.
17. (b)

$\left. \begin{array}{l} \text{Bauxite } (Al_2O_3) \\ \text{Cryolite } (Na_3AlF_6) \\ \text{Corundum } (Al_2O_3) \end{array} \right\}$	Minerals of Al
Gypsum $(CaSO_4 \cdot 2H_2O)$	
18. (d) Cryolite $(Na_3AlF_6) \rightarrow$ Halide ore

$\left. \begin{array}{l} \text{Galena } (PbS) \\ \text{Cinnabar } (HgS) \end{array} \right\}$	Sulphide ore
Bauxite $Al_2O_3 \cdot 2H_2O \rightarrow$ Oxide ore	
19. (d) Pig iron \rightarrow It is the most impure form of iron and contains highest proportion of carbon (2.5 – 4%)
 Malachite $\rightarrow Cu(OH)_2 \cdot CuCO_3$
 Zinc blende $\rightarrow ZnS$
 Bauxite $\rightarrow Al_2O_3 \cdot 2H_2O$
20. (b) Chile salt petre $\rightarrow NaNO_3$
21. (a) Na is alkali metal highly reactive. Hence present in combined state.
24. (c) Na_3AlF_6 Sodium hexafluoro aluminate (III)
28. (a) Bauxite $(Al_2O_3 \cdot 2H_2O)$
 Corundum (Al_2O_3)
 Diaspore $(Al_2O_3 \cdot H_2O)$
29. (d) Fluorspar (CaF_2) , Cryolite (Na_3AlF_6) ,
 Feldspar $(KAlSi_3O_8)$, Mica $(K_2O \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot 2H_2O)$
30. (a) Haematite Fe_2O_3
33. (a) Invar $Fe = 64\%$ and $Ni = 36\%$
34. (c) Cassiterite (SnO_2) , Magnetite (Fe_3O_4) ,
 Haematite (Fe_2O_3) , Limonite $(Fe_2O_3 \cdot 3H_2O)$.
36. (b) Copper is a reddish brown metal
37. (b) Azurite $Cu(OH)_2 \cdot 2CuCO_3$
38. (d) Malachite $(Cu(OH)_2 \cdot CuCO_3)$
40. (b) Argentite or silver glance (Ag_2S)
44. (c) Zinc blende is ZnS not $ZnCl_2$
46. (c) Galena (PbS) , Anglesite $(PbSO_4)$,
 Calamine $(ZnCO_3)$, Cerrussite $(PbCO_3)$
52. (b) Cuprite (Cu_2O) and Argentite (Ag_2S)
53. (a) Horn silver $(AgCl)$
55. (c) Carnallite is $KCl \cdot MgCl_2 \cdot 6H_2O$
56. (b) Cryolite is an ore of Al containing Na_3AlF_6 .
58. (c) Corundum (Al_2O_3) is an ore of Al.
59. (d) All minerals are not suitable for the extraction of metals commercially. Thus all ores are minerals, but all minerals are not ores.
60. (c) Among cuprite $[Cu_2O]$, Chalcocite $[Cu_2S]$, Chalcopyrite $[CuFeS_2]$ & Malachite $[Cu(OH)_2 \cdot CuCO_3]$, only Chalcopyrite is an ore which contains both Fe and Cu
61. (a) Felspar is $K_2O \cdot Al_2O_3 \cdot 6SiO_2$
62. (a) Chile salt petre is $NaNO_3$ While KNO_3 is Indian salt petre. Na_2SO_4 is Glauber salt and $Na_2S_2O_3$ is known as Hypo.
63. (c) Gypsum $(CaSO_4 \cdot 2H_2O)$ is an ore of calcium.
 Dolomite $(CaCO_3 \cdot MgCO_3)$, Magnesite $(MgCO_3)$ and Carnallite $(KCl \cdot MgCl_2 \cdot 6H_2O)$ are the ores of Magnesium.
64. (c) Magnetite (Fe_3O_4) , Siderite $(FeCO_3)$, Limonite $(Fe_2O_3 \cdot 3H_2O)$ and Haematite (Fe_2O_3) are ores of Iron. Only Smithsonite is not an ore of Iron.