8. Metallurgy
Extra Questions

1) Alloy of sodium with mercury

Ans – sodium amalgam Na (Hg)

2) Molecular formula of the common are of aluminum

Ans - $Al_2O_3.H_2O$

3) A metal which does not react with cold water but reacts with steam

Ans – Aluminum

4) Two highly reactive metals

Ans – sodium & potassium

5) Two non – metals which are lustrous

Ans – Iodine & diamond

6) State true or false

In electroplating a metal is coated with another metal using electrolysis

Ans – True

7) Ionic compounds are soluble in kerosene

Ans – False

8) Ionic compounds in the solid state conduct electricity

Ans – False

9) Electrolysis method is used to obtain pure metals from impure metals

Ans – True

10) Diamond is the softest natural substance

Ans – False

11) Silver amalgam is mainly used by dentists

Ans – True

12) Corrosion is degradation of a material due to reaction with its environment.

Ans – True

13) Aqua regia is a mixture of conc. HCL & conc HNO_3 in the ratio of 1:3

Ans – False

14) Corrosion of metal can be stopped by detaching surface of copper or brass vessel

Ans – True

15) Due to corrosion a greenish layer forms on the surface of copper or brass vessel

Ans – True

16) Find the correlation

Brass : copper & zinc :: Bronze:……..

Ans – Copper & Tin

17) Tinning: Tin :: Galvanizing :……..

Ans – Zinc

18) Why is Sodium metal always placed in kerosene?

Ans – (1) Sodium reacts so vigorously with atmospheric oxygen that it catches fire if kept in the open.

(2) It does not react with kerosene and sinks in it. Hence , to protect sodium and to prevent accidental fires it is always kept in kerosene.

19) In the extraction of aluminium write the anode reaction in electrolytic reduction of alumina.

Ans – $Al_2O_3 \rightarrow 2Al^{3+} + 3O^{2-}$

At Anode $2O^{2-} \rightarrow O_{2(g)} + 4e^-$

20) when zinc granules are added to copper sulphate solution, the blue colour solution turns colourless. Why?

Ans – (1) Zinc is more reactive than copper.

(2) When zinc granules are added to copper sulphate Solution , they displace copper from the copper sulphate solution to form zinc sulphate solution . As Zinc Sulphate is colourless , the blue coloured solution of copper sulphate disappears

21. What is ionic bond?

Ans – The cation & anion being oppositely charged, there is an electrostatic force of attraction between them, this force of attraction between cation & anion is called as the ionic bond.

22) Covalent bond

Ans – The bond formed between combining atoms by shearing of one or more pair of electrons is called covalent bond.

23) Ionic compound

Ans – The compounds formed two units namely cation & anion are called ionic compounds.

24) Covalent compound.

Ans – The chemical compound formed by mutually sharing of one or more pair of electrons between the two combining atoms is called covalent compound.

25) Metallurgy

Ans – The science & technology regarding the extraction of metals from ores & their purification for the use is called metallurgy.

26) complete the following reaction

1) $N_{2(g)} + 3H_{2(g)} \xrightarrow[\text{high pressure}]{\text{Proper temp}}$ _____

Ans –

1) $N_{2(g)} + 3H_{2(g)} \xrightarrow[\text{high pressure}]{\text{Proper temp}} 2NH_{3(g)}$

ammonia

2) $2\,C_{(s)} + O_{2(g)} \xrightarrow{\text{Partial combustion}}$ _____

Ans - $2\,C_{(s)} + O_{2(g)} \xrightarrow{\text{Partial combustion}} 2CO_{(g)}$ Neutral carbon monoxide

27) Complete the following reaction

1) $Zn_{(s)} + H_2O_{(g)} \rightarrow -$

Ans - $Zn_{(s)} + H_2O_{(g)} \rightarrow ZnO_{(s)} + H_{2(g)}$

2) $C_{(s)} + O_{2(g)} \xrightarrow[\text{combustion}]{\text{complete}} \text{——}$

Ans - $C_{(s)} + O_{2(g)} \xrightarrow[\text{combustion}]{\text{complete}} CO_{2(g)}$ (acidic oxide)

28) Explain the term Metallurgy

Ans – The science & technology regarding the extraction of metals from ores & their purification for the use is called metallurgy

most metals being reactive do not occur in nature in free state but are found in combined state as their salts such as oxide carbonates, sulphides & nitrates. However, the most unreactive metals that are not affected by air, water & other natural factors like silver, gold, platinum, generally occur in free state.

The compounds of metals that occur in nature along with the impurities are called minerals

The process of extraction of metal in pure state from the ores is also a part of metallurgy

29) Leaching

Ans – The first step in the extraction of the metal aluminum, gold & silver form their ores is a method of leaching.

In this method the ore is soaked in a certain solution for a long time. The ore dissolves in that solution due to a specific chemical reaction.

The gangue, however, does not react & therefore does not dissolve in that solution. So it can be separated.

ex. cone of bauxite the aluminum ore, is done by leaching method.

30) Alloying

Ans – The homogenous mixture formed by making a metal with other metals or non – metals in certain proportion is called an alloy. Majority of the metallic substances used presenting are in the form of alloy. The main intention behind this is to decrease the intensity of corrosion of metals.

For ex bronze is an alloy formed from 90% copper & 10% tin.

Stainless steel is an alloy made from 74% iron 18% chromium & 8% carbon.

31) Anodization

Ans – Anodization is the process in which a thin & strong layer of copper & aluminum oxides are coated by means of electrolysis.

In this method metals like copper, aluminum are coated with a thin strong layer of their oxides by means of electrolysis.

For this the copper or aluminum articles is used as anode. As this oxide layer is strong & uniform all over the surface, it is used for prevention of the corrosion of the metal. prevention of the corrosion of the metal.

For ex, when aluminum is anodized, the thin layer of aluminum oxide is formed.

32) How does a metal react with water?

Ans – Sodium & potassium metal react rapidly & vigorously with water & liberates hydrogen gas

$$2\,Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq)} + H_{2(g)} + Heat$$

$$2K_{(s)} + 2H_2O_{(l)} \rightarrow 2KOH_{(aq)} + H_{2(aq)} + Heat$$

On the other hand, calcium reacts with water slowly & less rigorously. The hydrogen gas released in this reaction collects on the surface of the metal in the form of bubbles & the metal floats on water.

$$2\,Ca_{(s)} + 2H_2O\,(l) \rightarrow 2Ca(OH)_{2(aq)} + H_{2(g)}$$

The metals; aluminum, iron and zinc do not react with Cold water, but they react with steam to form their oxides. Hydrogen gas is released in this reaction

$2Al\,(s) + 3H_2O_{(g)} \rightarrow Al_2O_{3(s)} + 3H_{2(g)}$

$2Fe_{(s)} + 4H_2O_{(g)} \rightarrow Fe_3O_{4(s)} + 4H_{2(g)}$

$Zn_{(s)} + H_2O_{(g)} \rightarrow ZnO_{(s)} + H_{2(g)}$

33) How do metals react with oxygen?

Ans - Metals combine with oxygen on heating in air & metals oxides are formed sodium &potassium are very reactive metals, sodium metal combines with oxygen in the air even at room temperature& forms sodium oxide

$4Na_{(s)} + O_{2(g)} \rightarrow 2Na_2O\,(s)$

metal + oxygen → metal oxide

on exposure to air sodium readily catches fire. Therefore to prevent accident in the laboratory or elsewhere it is kept in kerosene. oxides of some metals are soluble in water. They react with water to form alkali

$Na_2O\,(s) + H_2O\,(l) \rightarrow 2NaOH\,(aq)$

34) How does a metal react with nitric acid?

Ans – Nitrates salts of metals are formed on reaction of metal with nitric acid. Various oxides of nitrogen (Na_2O, NO, NO_2) are also formed in accordance with the concentration of nitric acid.

$Cu(s) + 4HNO_{3(aq)} \rightarrow Cu(NO_3)_{2(aq)} + 2NO_{2(g)} + 2H_2O$

$3Cu(s) + 8HNO_{3(aq)} \rightarrow Cu(NO_3)_{2(aq)} + 2NO_{(g)} + 4H_2O_{(l)}$

35) Write the chemical equation for the following events

i) Stems is passed over aluminum

Ans – When steam is passed over aluminum hydrogen gas is evolved & aluminum oxide is formed

$2Al_{(s)} + 3H_2O_{(g)} \rightarrow Al_2O_{3_{(s)}} + 3H_{2_{(g)}} \uparrow$

ii) sodium reacts with oxygen sodium react with oxygen in air at room temperature to form sodium oxide

$4Na + O_2 \rightarrow 2Na_2O$

36) Write the chemical equation

i) Reaction of hot iron with steam

Ans – Hot iron react with steam to form their oxides (iron oxide) & hydrogen gas released in this reaction.

$3Fe_{(s)} + 4H_2O_{(g)} \rightarrow Fe_3O_{4_{(s)}} + 4H_{2_{(g)}}$

Iron Steam Iron oxide Hydrogen

ii) Zinc carbonate is heated strongly in a limited supply of air

Ans - $ZnCO_3 \xrightarrow{heat} ZnO + Co_{2_{(g)}} \uparrow$

Zinc carbonate Zinc oxide Carbon dioxide

37) What is ionic compound state the properties of ionic compound

Ans – The compound formed from two units namely cation & anion are called ionic compounds

properties of ionic compounds

The attractive force between the positively & negatively charged ions is strong. Therefore the ionic compounds exits in solid state & hard.

The ionic compounds are brittle & can be between into pieces by applying pressure.

The intermolecular force of attraction is high to overcome it. Therefore the melting & boiling points of ionic compounds are high.

Ionic compounds are water soluble. Ionic compounds are however, insoluble in solvents unlike water a new attractive force cannot be established in these solvents.

The ionic compounds cannot conduct electricity when in solid state but fused (molten) state or conduct electricity.

38) Why do pure gold & platinum always glitter

Ans – Along with other properties such as malleability, ductility & hardness, metals have a property called luster.

metals have the quality of reflecting light from its surface after or before being polished.

gold & platinum are one of the most lustrous metals, paired along with their noble (non – reactive) chemical nature.

They are good raw materials for decorations & jewels as they have a good shelf life. & are more malleable than other metals

so pure gold & platinum always glitter without oxidation.

39) How sodium & magnesium metal extracted?

Ans – The metals high up in reactivity series are very reactive e.g. sodium & magnesium these metals are obtained by electrolytic reduction.

sodium & magnesium are obtained by electrolysis of molten chlorides.

The metals are deposited at the cathode (-ve charged electrode) where as chlorine is liberated at the anode (+ve charged electrode)

The electrode reactions during the electrolysis of molten chloride to get metallic sodium as shown below

cathode reaction :$Na^+ + e^- \rightarrow Na$

Anode reaction :$2Cl^- \rightarrow Cl_2 + 2e^-$

The electrode reactions during the electrolysis of molten magnesium chlorine to get metallic magnesium are shown below

cathode - $mg^2 + 2e^- \rightarrow mg$

anode - $2cl^- \rightarrow cl_2 + 2e^-$

40) Explain the following term

i) minerals

The naturally occurring compounds of metals along with other impurities are known minerals.

For e.g. Talc & granite are minerals

ii) Gangue

ores contain metal compounds with some of the imp impurities like soil, sand, rocky material. etc. these impurities are called gangue.

iii) ores

The minerals from which metals are extracted profitably & conveniently are called are for e.g. Bauxite ($Al_2O_3.H_2O$)

iv) concentration of ore

The process of separating gangue from the other are is called concentration of ores

v) Roasting

The process of heating an ore to a high temperature in excess of air & converting it into its oxide is called roasting

41) Explain the different methods to prevent corrosion of metals.

Ans – one simple way to prevent corrosion is to use a corrosion resistant metal such as aluminum or stainless steel.

The application of preventing of paint coating is a cost effective way of preventing corrosion. paint coating acts as a barrier to prevent the transfer of electrochemical charge form the corrosive solution to the metal underneath.

Corrosion is caused by a chemical reaction between the metal & gases in the surrounding environment. By taking measures

to control the environment, these unwanted reactions can be minimized.

corrosion of metal is prevented by coating with something which does not allow moisture & oxygen to react with it.

corrosion of metal can be prevented if the contact between & air is cut off

42) Describe the Hall's method of concentration of bauxite.

Ans – Bauxite is the main ore of aluminum. silica (SiO_2)

ferric oxide (Fe_2O_3) & titanium oxide (TiO_2) are the impurities is done by leaching process using Hall's method.

In these methods finally the concentrated alumina is obtained by calcinations.

In Hall's process the ore is powered & then leached by heating with aqueous sodium carbonate in the digester to form water soluble aluminate. Then the insoluble impurities are filtered out.

The filtrate is warmed & neutralized by passing carbon dioxide gas through it. This results in the precipitation of aluminum hydroxide

$$Al_2O_3.2H_2O_{(s)} + Na_2CO_{3(aq)} \rightarrow 2NaAlO_{2(aa)} + CO_2 \uparrow + 2H_2O_{(l)}$$

$$2NaAlO_{2(aq)} + 3H_2O + CO_{2(g)} \rightarrow 2Al(OH)_3 \downarrow + Na_2CO_3$$

The precipitate of $Al(OH)_3$ obtained in Hall's process is filtered, washed, dried & then calaned by heating at 1000^0C to obtain aluminia

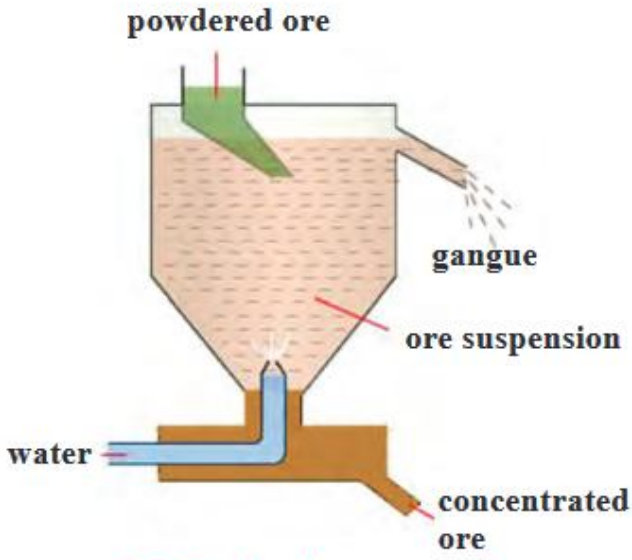
$2Al(OH)_3 \rightarrow 2Al_2O_3 + 3H_2O$

43) Explain hydraulic separation method

Ans – The hydraulic separation method is based on the working of a mill. These are a tapering vessel similar to that used in a grinding mill. It opens in a tank – like container that is tapering on the lower side.

The tank has on outlet for water on the upper finely ground are released in the tank. A forceful jet of water is introduced in the tank from the lower side .gangue particles are lighter and therefore they flow out along with the water jet from the outlet on the upper side of the tank and get collected separately.

At the sometime the heavy particles of the are collected at the bottom from the lower side of the tank. In short this method is based on the low of gravitation, where in particles of the same size separated by their weight with the help of water.



8.9 Hydraulic separation

44) Explain magnetic separation method

Ans – This method requires an electromagnetic machine. The main parts of this machine are two types of iron rollers and the conveyor belt moving continuously around them.

One of the rollers is non-magnetic while the other is electromagnetic. The conveyor belt moving around the rollers is made up of leather or brass.

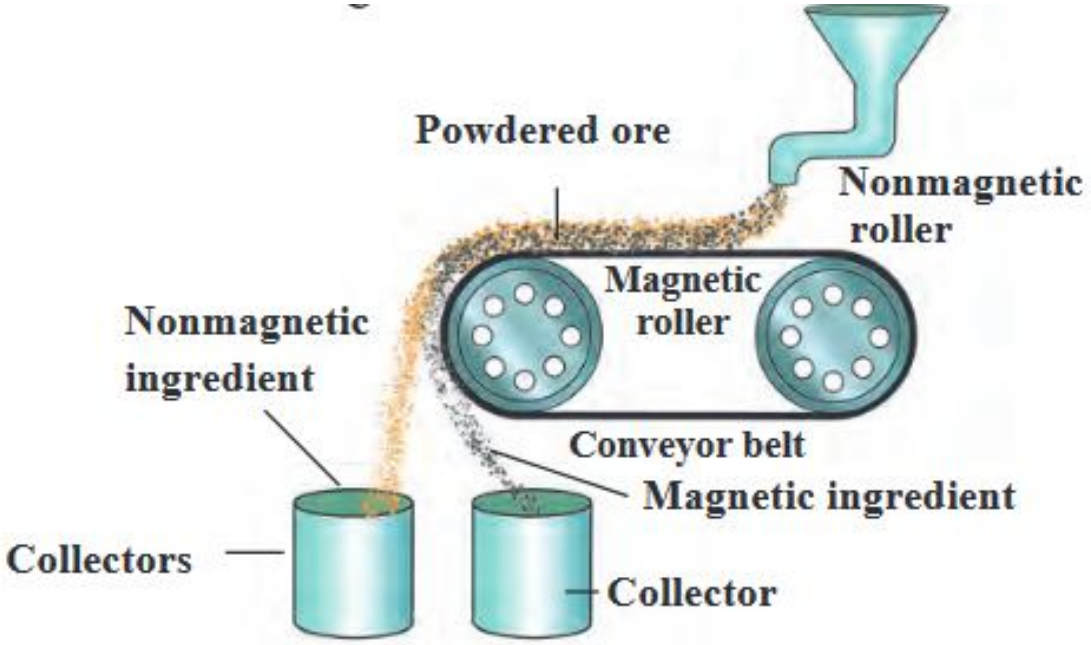
The powdered ore is poured on the conveyor belt near the magnetic roller. Two collector vessels are placed below the magnetic roller.

The particles of the nonmagnetic part in the ore not attracted towards the magnetic roller.

Therefore they are carried further along the belt and fall in the collector vessel places is away from the magnetic roller. At The same time the particles of the magnetic ingredients of the ore stick to the collector vessel near the magnetic rollers.

In this way the magnetic and nonmagnetic ingredients in the ore can be separated depending on their magnetic nature

For e.g. cassiterite is a tin ore . it contains mainly the nonmagnetic ingredient stannic oxide (SnO_2) and te magnetic ingredient ferrous tungstate ($FeWO_4$) .These are separated by the electromagnetic method



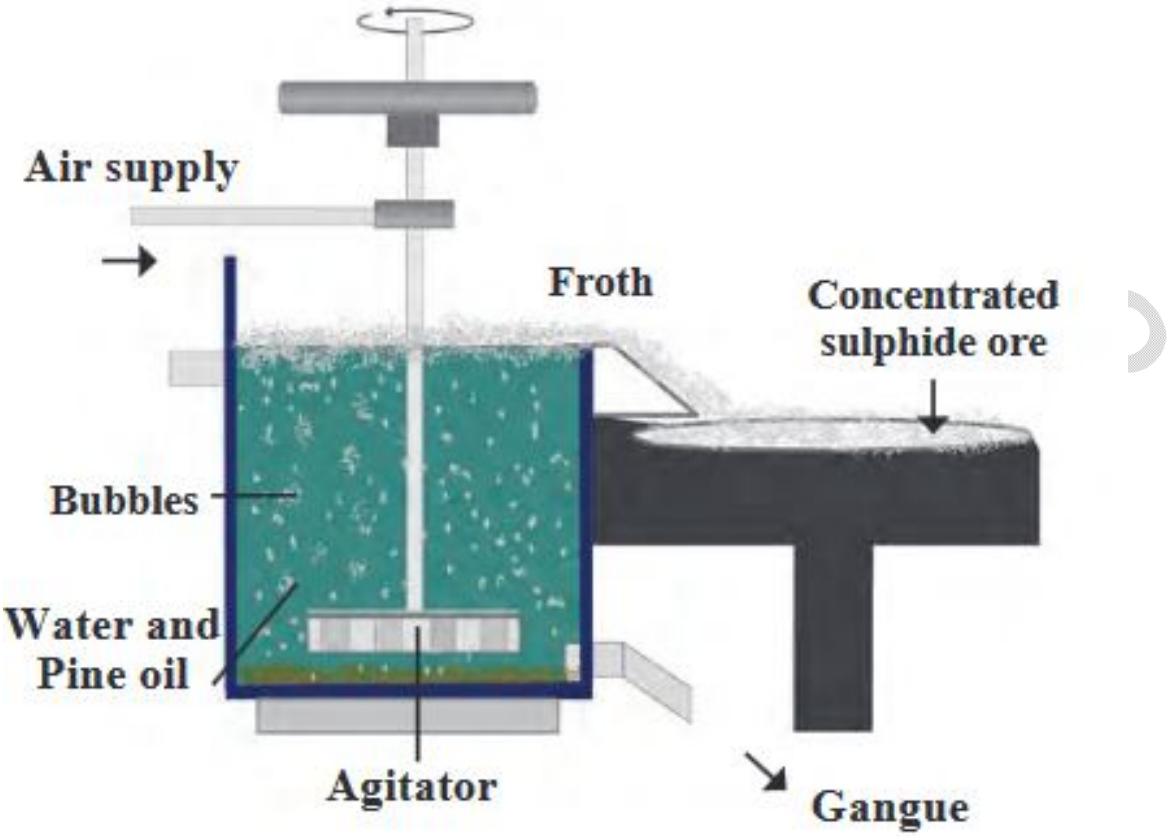
8.10 Magnetic separation

45) Explain froth floatation method.

Ans – The forth floatation method is based on the two opposite properties, Hydrophilic and hydrophobic, of the particles. Here the particles of metal sulphides due two their hydrophobic property, get wetted mainly with oil, while due to the hydrophilic property the gangues particles get wetted with water. By using these properties certain ores are concentrated by froth flotation method.

In this method the finely ground ore is put into a big tank containing ample amount of water. certain vegetable oil such as pine oil eucalyptus oil ,is added in the water for the formation of froth pressurized air is blown through the water . there is an agitator rotating around its axis in the centre of the flotation tank the agitator is use as per requirement bubbles are formed due to blown air . due to agitation a foam is formed from oil, water and air, bubble together, due to

agitating. this foam rises to the surface of water & floats that is why this method is called froth flotation method.

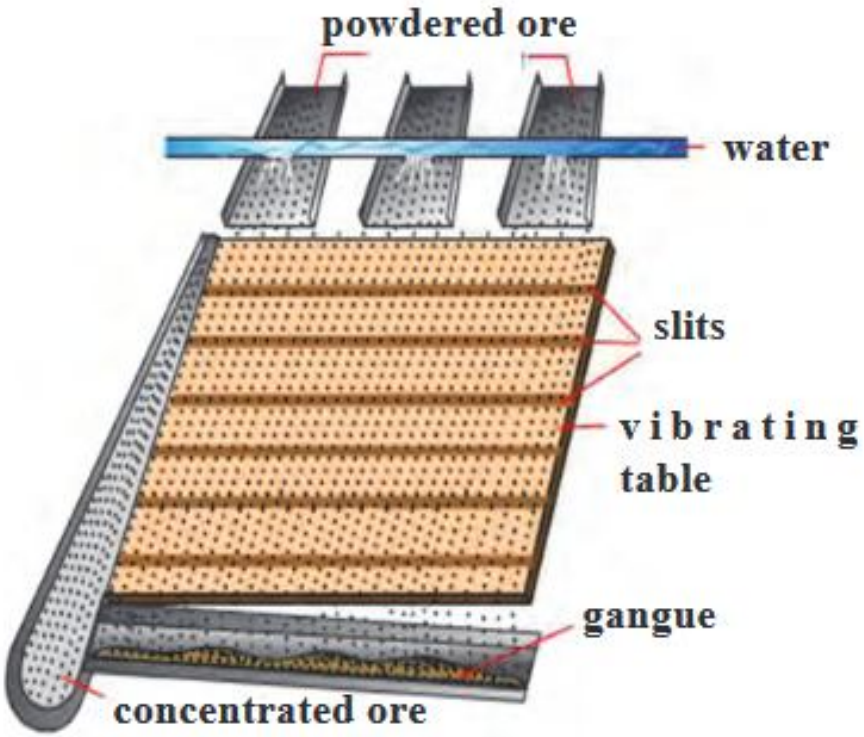


8.11 Froth floatation method

46) Explain wilfley table method.

Ans – In this method of separation the wilfley method is made by fixing narrow and thin wooden riffles an inclined surface. The table is kept vibrating continuously. powdered ore obtained from lumps of the are using ball mill is poured on the table and a stream of water is also released from the upper side As a result the lighter gangue particles are carried away along with the flowing water, while the heavier particles in which proportion of minerals is more and proportion of

gangue is less are blocked by the wooden riffles and get collected on the slits between them.



8.8 Wilfley table method

47) Explain the Extraction of moderately reactive metals

Ans – The metals in the middle of the reactivity series such as iron, zinc, lead, copper ore moderately reactive. Usually, they occur in the form of their sulphide salts or carbonate. It is easier to obtain metals form their oxides rather than sulphides or carbonates. Therefore the supplies ores are strongly heated in air to transform them into oxides. This process in called roasting. Carbonate ores are strongly heated in a limited supply of air to transform them into oxides. This process is called calcination. The following reactions occur during roasting and calcination of zinc ore.

Roasting $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2 \uparrow$

Calcinations $ZnCO_3 \rightarrow ZnO + CO_2 \uparrow$

The zinc oxide so obtained is reduced to zinc by using suitable reductant such as carbon

$ZnO + C \rightarrow Zn + CO \uparrow$

48) Write these method of preventing rusting of iron

Ans – The rusting of iron can be prevented by painting, oiling, greasing or varnishing its surface.

Galvanization is another method of protecting iron from rusting by coating iron with a thin layer of zinc

corrosion of iron is prevented by coating iron with noncorrosive substance like carbon This process is termed as alloying

49) Distance between

i) Metals and Non – metals

Metals	Non – metals
1) Metals have a lustre	1) Nonmetals have no lustre
2) They are generally good conductors of heat and electricity	2) They are bad conductors of heat and electricity
3) They are generally solids at room temp	3) They are generally gases and solids at room temp
4) Metals form basic oxides	4) Nonmetals form acidic or natural oxides

50) Roasting and Calcination

Roasting	Calcination
1) In this process the ore is heated strongly in the presence of air	1) In this process, the ore is heated strongly in the limited supply of air
2) In this process sulphides are is converted into metal oxide	2) In this process carbonate are is converted into metal oxide
3) During this process SO_2 is given out	3) During this process Co_2 is given out