

Chapter – 3

Metals and Non- Metals

In Text Questions-Pg-40

Q. 1 Give an example of a metal which:

- (i) Is a liquid at room temperature
- (ii) Can be easily cut with a knife
- (iii) Is the best conductor of heat
- (iv) Is a poor conductor of heat

Answer:

- (i) Mercury is liquid at room temperature.
- (ii) Sodium can be easily cut with a knife.
- (iii) Silver is the best conductor of heat.
- (iv) Lead is a poor conductor of heat.

Q. 2 Explain the meanings of malleable and ductile.

Answer: (a) Metals can be beaten into thin sheets, hence they are called malleable.

(b) Metals can be turned into thin wires by stretching, hence they are called ductile.

In Text Questions-Pg-46

Q. 1 Why sodium is kept immersed in kerosene oil?

Answer: Sodium is very reactive metal which react with the atmospheric moisture when kept in the open and produces fire as

well. So, it is always kept immersed in kerosene oil to prevent its reaction with air and to prevent accidental fires.

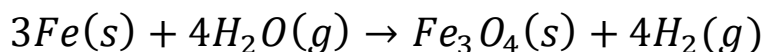
Q. 2 Write equations for the reactions of:

(i) Iron with steam

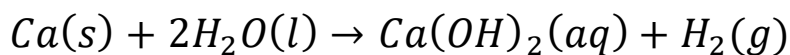
(ii) Calcium with water

(iii) Potassium with water

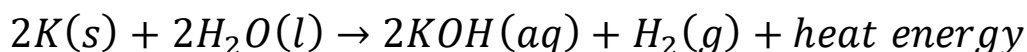
Answer: (i) Equation for the reaction of iron with steam is given below:



(ii) Equation for the reaction of calcium with water is as follows:



(iii) Equation for the reaction of potassium with water can be written as:



Q. 3 Samples of four metals A, B, C and D were taken and added to the solutions given in the following table, one by one. The results obtained are as follows:

Metal	Iron (II) Sulphate	Copper (II) Sulphate	Zinc Sulphate	Silver nitrate
A	No reaction	Displacement	No reaction	No reaction
B	Displacement	No reaction	No reaction	No reaction
C	No reaction	No reaction	No reaction	Displacement
D	No reaction	No reaction	No reaction	No reaction

Use the above table to answer the following questions about metals A, B, C and D:

- (i) Which is the most reactive metal?
- (ii) What would you observe when metal B is added to a solution of copper (II) sulphate?
- (iii) Arrange the metals A, B, C and D in the order of decreasing reactivity.

Answer: (i) Metal B gives the displacement reaction with the iron (II) sulphate, hence it is the most reactive metal.

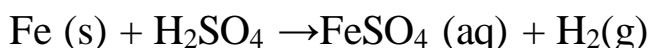
(ii) When metal B is added to copper (II) sulphate solution, it displaces the copper.

(iii) Metal B is the most reactive metal whereas metal D is the least reactive metal as it cannot displace any metal from its salt solution. Hence, the decreasing order of reactivity of the metals is:

B > A > C > D.

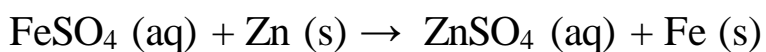
Q. 4 Which gas is produced when dilute hydrochloric acid is added to a reactive metal? Write the chemical reaction when iron reacts with dilute sulphuric acid.

Answer: Hydrogen gas is produced when dilute hydrochloric acid is added to a reactive metal. The chemical equation for reaction when iron reacts with dilute sulphuric acid is as follows.



Q. 5 What would you observe when zinc is added to a solution of iron (II) sulphate? Write the chemical reaction that takes place.

Answer: When zinc is added to iron (II) sulphate solution, zinc displaces iron from iron (II) sulphate solution. This is because zinc is more reactive than the iron. The reaction can be shown as follows:



In Text Questions-Pg-49

(i) Write the electron-dot structures for sodium, oxygen and magnesium.

(ii) Show the formation of Na_2O and MgO by the transfer of electrons.

(iii) What are the ions present in these compounds?

Answer:

(i) The electron-dot structure of sodium (Na):



The electron-dot structure of oxygen(O):

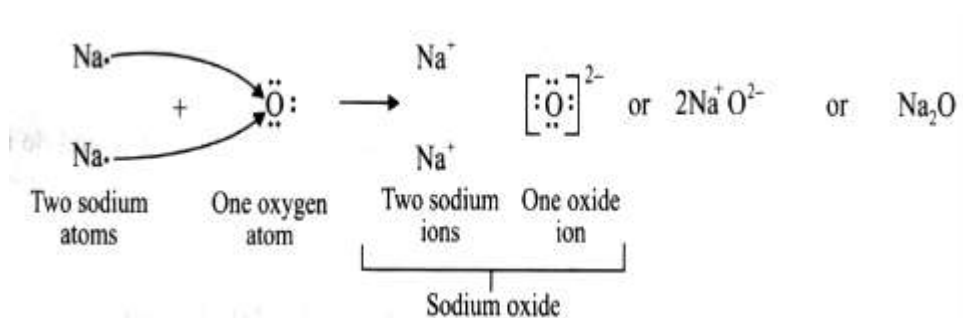


The electron-dot structure of magnesium(Mg):



(ii) (a) Formation of Na_2O

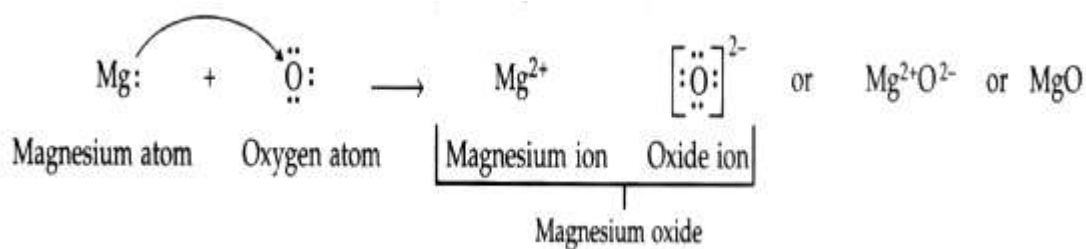
Na_2O is sodium oxide. Sodium atom has one electron in its outermost shell whereas oxygen atom has six electrons in its outermost shell. In the formation of sodium oxide, two sodium atoms transfer their two outermost electrons to an oxygen atom. Thus, sodium atoms form two sodium ions (2Na^+) by losing two electrons while oxygen atom forms an oxide ion (O^{2-}) by gaining two electrons.



Sodium ions and oxide ion, being oppositely charged, attract each other and are held together by strong electrostatic forces of attraction to form the ionic sodium oxide compound $2Na^+O^{2-}$ or Na_2O .

(b) Formation of MgO

MgO is magnesium oxide. Magnesium atom has two electrons in its outermost shell whereas oxygen atom has six electrons in its outermost shell. In the formation of magnesium oxide, magnesium atom transfers its two outermost electrons to an oxygen atom. Thus, magnesium atom forms magnesium ion (Mg^{2+}) by losing two electrons while oxygen atom forms an oxide ion (O^{2-}) by gaining two electrons.



ion and oxide ion, being oppositely charged, attract each other and are held together by strong electrostatic forces of attraction to form the ionic magnesium oxide compound $Mg^{2+}O^{2-}$ or MgO .

(iii) (a) The ions present in sodium oxide (Na_2O) compound are sodium ions (Na^+) and oxide ions (O^{2-}).

(b) The ions present in magnesium oxide (MgO) compound are magnesium ions (Mg^{2+}) and oxide ions (O^{2-}).

Q. 2 Why do ionic compounds have high melting points?

Answer: In ionic compounds, oppositely charged ions are held together by strong electrostatic force of attraction. This is because a considerable amount of energy is required to break this force of attraction. That's why ionic compounds have high melting points.

In Text Questions-Pg-53

Q. 1 Define the terms: (i) mineral (ii) ore, and (iii) gangue.

Answer:

(i) Mineral: The elements or compounds, which occur naturally in the earth's crust, are known as minerals

(ii) Ore: Minerals from which the metals can be extracted profitably are called ores.

(iii) Gangue: Ores mined from the earth are usually contaminated with large amounts of impurities such as soil, sand, etc., called gangue.

Q. 2 Name two metals which are found in nature in the free state.

Answer: Gold and Platinum are found in nature in the free state.

Q. 3 What chemical process is used for obtaining a metal from its oxide?

Answer: A metal can be extracted from its oxide by the process of reduction.

In Text Questions-Pg-55

Zinc oxide, magnesium oxide and copper oxide were heated, turn by turn, with zinc, magnesium and copper metals as shown in the following table:

Metal	Zinc	Magnesium	Copper
Zinc oxide			
Magnesium oxide			
Copper oxide			

In which cases will you find displacement reactions taking place?

Answer: When a more reactive metal displaces a less reactive metal from its oxide, a displacement reaction takes place. In the given metals, magnesium is the most reactive metal whereas copper is the least reactive metal.

Metal	Zinc	Magnesium	Copper
Zinc oxide	No reaction	Displacement	No reaction
Magnesium oxide	No reaction	No reaction	No reaction
Copper oxide	Displacement	Displacement	No reaction

Q. 2 Which metals do not corrode easily?

Answer: Metals which are at the bottom of the reactivity series are highly unreactive. They are not affected by air, moisture or ordinary chemicals. Therefore, they do not corrode easily. Gold and platinum do not corrode easily.

Q. 3 What are alloys?

Answer: Alloys are a homogeneous mixture of two or more metals or a metal and a non-metal. It is prepared by first melting the primary

metal, and then, dissolving the other elements in it. It is then cooled to room temperature. For example, brass is an alloy of copper and zinc.

Exercise-Pg-56

Q. 4 Which of the following pairs will give displacement reactions?

- A. NaCl solution and copper metal
- B. MgCl₂ solution and aluminium metal
- C. FeSO₄ solution and silver metal
- D. AgNO₃ solution and copper metal

Answer: Copper metal is more reactive than silver metal (Ag), so a displacement reaction will take place between AgNO₃ solution and Copper metal.

Q. 2 Which of the following methods is suitable for preventing an iron frying pan from rusting?

- A. Applying grease
- B. Applying paint
- C. Applying a coat of zinc
- D. All of the above

Answer: The most suitable method for preventing an iron frying pan from rusting is applying a coat of zinc. This is called galvanization. Grease and paint are also used for prevent rusting from iron. However, in case of iron frying pan, grease and paint cannot be applied because when fan will be heated and washed again and again, the coating of grease and paint would get destroyed.

Q. 3 An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be:

- A. calcium
- B. carbon
- C. silicon
- D. iron

Answer: The element is likely to be calcium. When calcium reacts with oxygen to give an ionic compound, calcium oxide, having a high melting point. This calcium oxide compound is soluble in water. When carbon reacts with oxygen, carbon dioxide is formed which is a gas. Silicon reacts with oxygen to form a compound silicon dioxide which has high melting point but insoluble in water. Similarly, iron reacts with oxygen to form iron (III) oxide compound which has a high melting point but 'insoluble in water

Q. 4 Food cans are coated with tin and not with zinc because:

- A. zinc is costlier than tin
- B. zinc has a higher melting point than tin
- C. zinc is more reactive than tin
- D. zinc is less reactive than tin.

Answer: Food cans are coated with tin and not with zinc because zinc is more reactive than tin. Hence, being more reactive, zinc may react with acidic food and form toxic products which may be harmful for our health.

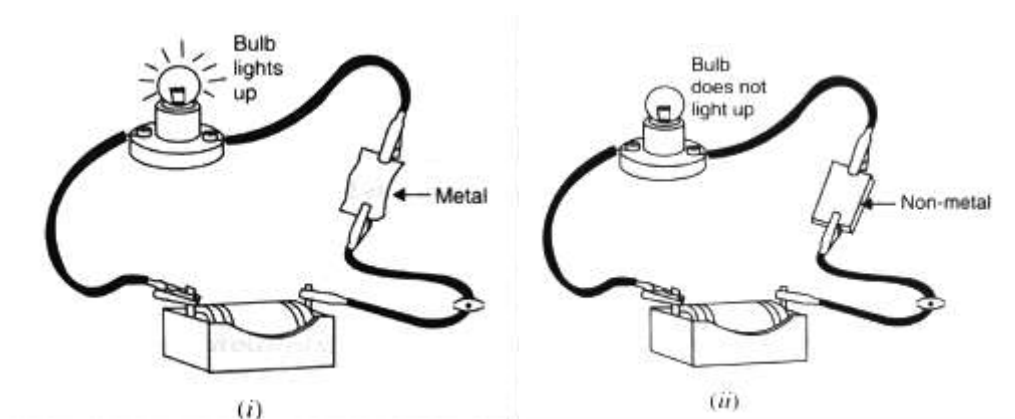
Q. 5 You are given a hammer, a battery, a bulb, wires and a switch.

(a) How could you use them to distinguish between samples of metals and non-metals?

(b) Assess the usefulness of metals based on properties shown by these tests.

Answer: (a) (i) Metals are malleable because they can change into a thin sheet on hammering whereas non-metals are brittle as they are broken into pieces on hammering. When we beat the samples, if sample turns into a thin sheet, then it is a metal otherwise it is a non-metal.

(ii) We can use battery, bulb, wires and switch to set up an electric sample. Now place the given samples to be tested in the circuit between the terminals one by one. The sample which allows the current to pass through it making the bulb to light up, will be a metal. On the other hand, the sample which does not allow the current to pass through it and hence does not make the bulb to light up, will be a non-metal.



(b) Metals are malleable as they can turn into thin sheets. The metal sheets can be used for various purposes such as iron sheets are used for making buckets, roofing material and boxes.

Metals are good conductor of electricity. Therefore, the metal wires are used as electric wires for various purposes.

Q. 6 What are amphoteric oxides? Give two examples of amphoteric oxides.

Answer: Those oxides which act as both basic and acidic oxides are called amphoteric oxides. Aluminium oxide and zinc oxide show the properties of both basic as well as acidic oxides.

Q. 7 Name two metals which will displace hydrogen from dilute acids, and two metals which will not.

Answer: Zinc and iron will displace hydrogen from dilute acids because they are more reactive than hydrogen. While copper and silver cannot displace hydrogen from dilute acids because they are less reactive than hydrogen.

Q. 8 In the electrolytic refining of a metal M, what would you take as the anode, the cathode, and the electrolyte?

Answer: In the electrolytic refining of metal M:

Anode- The impure metal M is made the anode.

Cathode- a thin strip of pure metal M is made the cathode.

Electrolyte- A solution of salt of the metal M is used as an electrolyte.

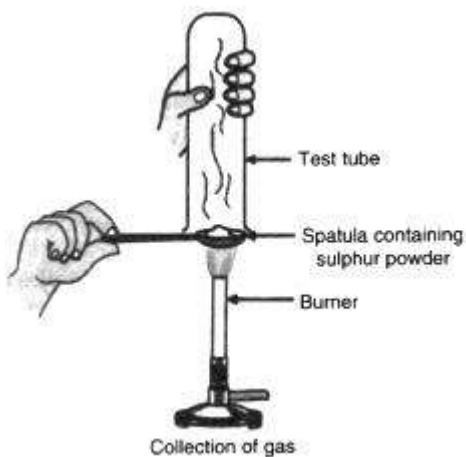
Q. 9 Pratyush took sulphur powder on a spatula and heated it. He collected the gas evolved by inverting a test tube over it as shown in the figure here.

(a) What will be the action of gas on:

(i) Dry litmus paper?

(ii) Moist litmus paper?

(b) Write a balanced chemical equation for the reaction taking place.

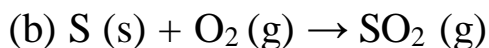


Answer:

(a) When sulphur is burnt in air, then sulphur dioxide (SO₂) gas is formed.

(i) There will be no action on dry litmus paper.

(ii) Sulphur dioxide gas turns moist blue litmus paper to red.



Q. 10 State two ways to prevent the rusting of iron.

Answer: (i) Rusting of iron can be prevented by galvanization. In this process, iron articles are coated with a thin layer of zinc metal which prevent the iron to come in contact with air and moisture. Hence, rusting is prevented.

(ii) Rusting of iron can be prevented by applying oil, grease, or paint. These are applied all over the surface of iron object to keep the air and moisture away.

Q. 11 What type of oxides are formed when non-metals combine with oxygen?

Answer: When non-metals combine with oxygen, then neutral or acidic oxides are formed.

Q. 12 Give reasons:

- (a) Platinum, gold and silver are used to make jewellery
- (b) Sodium, potassium and lithium are stored under oil.
- (c) Aluminium is a highly reactive metal, yet it is used to make utensils for cooking.
- (d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction.

Answer: (a) Platinum, gold and silver are used to make jewellery because they are very lustrous. Also they are less reactive and do not corrode easily.

(b) Sodium, potassium and lithium are very reactive metal which react with the atmospheric moisture when kept in the open and produce fire as well. So, these are always kept immersed in kerosene oil to prevent their reaction with air and to prevent accidental fires.

(c) Although aluminium is a highly reactive metal, it is resistant to corrosion. This is because when aluminium metal react with oxygen present in air to form a protective layer of aluminium oxide on its surface. This oxide layer is very stable and makes the aluminium metal resistant to the action of air and water. Also, it is light in weight and good conductor of heat, hence it is used for making cooking utensils.

(d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction because it is much easier to obtain metals from its oxide as compared to its sulphides and carbonates.

Q. 13 You must have seen tarnished copper vessels being cleaned with lemon or tamarind juice. Explain why these sour substances are effective in cleaning the vessels.

Answer: Tarnished copper vessels are cleaned with lemon or tamarind juice as the acids contained in them dissolves the coating of copper

oxide or basic copper carbonate present on the surface of the vessels and makes them shining red-brown again.

Q. 14 Differentiate between metals and non-metals on the basis of their chemical properties.

Answer: Differences between metals and non-metals on the basis of their chemical properties:

Metals	Non-metals
metals react with oxygen to form basic oxides. $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$	Non-metals form acidic or neutral oxides.
metals react with water and form metal oxide and hydrogen gas. $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2 \uparrow$	Non-metals do not react with dilute acids.
$2\text{Na} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2 \uparrow$	Non-metals do not react with dilute acids.
metals form ionic chlorides with chlorine.	Non-metals form covalent chloride with chlorine.

Q. 15 A man went from door to door posing as a goldsmith. He promised to bring back the glitter of old and dull gold ornaments. An unsuspecting lady gave a set of gold bangles to him which he dipped in a particular solution. The bangles sparkled like new but their weight was reduced drastically. The lady was upset but after a futile argument the man beat a hasty retreat. Can you play the detective to find out the nature of the solution he had used?

Answer: The solution used by the goldsmith was aqua-regia solution which contains concentrated nitric acid and concentrated hydrochloric acid in the ratio 1:3. When the gold bangles were dipped into this solution, considerable amount of gold was dissolved in it. Thus the weight of the bangle was reduced.

Q. 16 Give reasons why copper is used to make hot water tanks and not steel (an alloy of iron).

Answer: Copper is used to make hot water tanks because it is resistant to corrosion and is a good conductor of heat than steel.