

Chapter 3

Metals and Non-metals

Intext Questions

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Question 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?

Solution:

- a) Metal which exists in liquid state at room temperature – Mercury
- b) Metal which can be easily cut with a knife - Sodium
- c) Metal which is the best conductor of heat - Silver
- d) Metals that are poor conductors of heat - Mercury and lead

Question 2: Explain the meanings of malleable and ductile.

Solution:

Malleable: a property by which any substance can be beaten into thin sheets is called malleable. For example- metals

Ductile: a property by which any substance can be drawn into thin wires is called ductile. For example- metals

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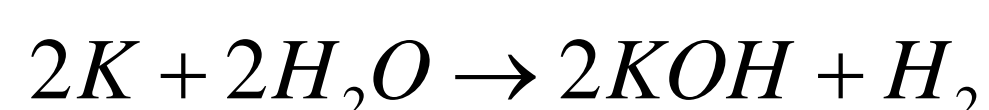
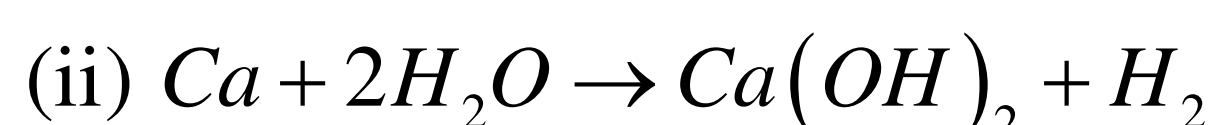
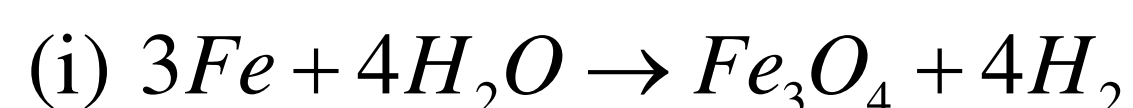
Question 1: Why sodium is kept immersed in kerosene oil?

Solution: Sodium is very reactive metal. It can combine with air & water. Thus, it can catch fire if kept in open. In order to prevent accidental fires and accidents, sodium is stored in kerosene oil.

Question 2: Write equations for the reactions of

- a) Iron with steam
- b) Calcium and potassium with water

Solution:



Question 3: Samples of four metals A, B, c and D were taken and added to the following solution one by one. The results obtained have been tabulated as follows.

Metal	Iron sulphate	Copper sulphate	Zinc sulphate	Silver nitrate
A.	No reaction	Displacement		
B.	Displacement		No reaction	
C.	No reaction	No reaction	No reaction	Displacement
D.	No reaction	No reaction	No reaction	No reaction

Use the Table above to answer the following questions about metals A, B, C and D.

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

Solution:

Ans. 3

From above table, we can conclude:

- A is less reactive than iron
- A is more reactive than copper
- B is more reactive than iron
- B is less reactive than zinc
- C is less reactive than iron
- C is less reactive than copper
- C is less reactive than zinc
- C is more reactive than silver
- D is less reactive than iron, copper, zinc, and silver

B is the most reactive metal

Order of reactivity:

$\text{Zn} > \text{B} > \text{Fe} > \text{A} > \text{Cu} > \text{C} > \text{Ag} > \text{D}$

If B is added to a copper sulphate solution, then it would displace copper.

The metals can be arranged in the order of decreasing reactivity as follows:

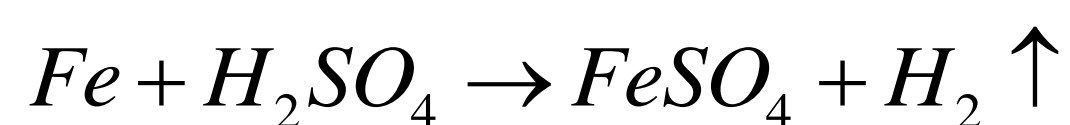
$\text{B} > \text{A} > \text{C} > \text{D}$

Question 4: Which gas is produced when dilute hydrochloric acid is added to a reactive metal? Write the chemical reaction when iron reacts with dilute H_2SO_4 .

Solution:

Hydrogen gas is evolved when dilute hydrochloric acid is added to a reactive metal.

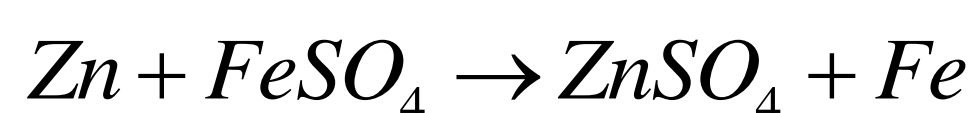
When iron reacts with dilute H_2SO_4 , iron sulphate with the evolution of hydrogen gas is formed.



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

Solution:

Zinc is more reactive than iron. Thus, when zinc is added to a solution of iron sulphate, then it displaces iron from the solution.



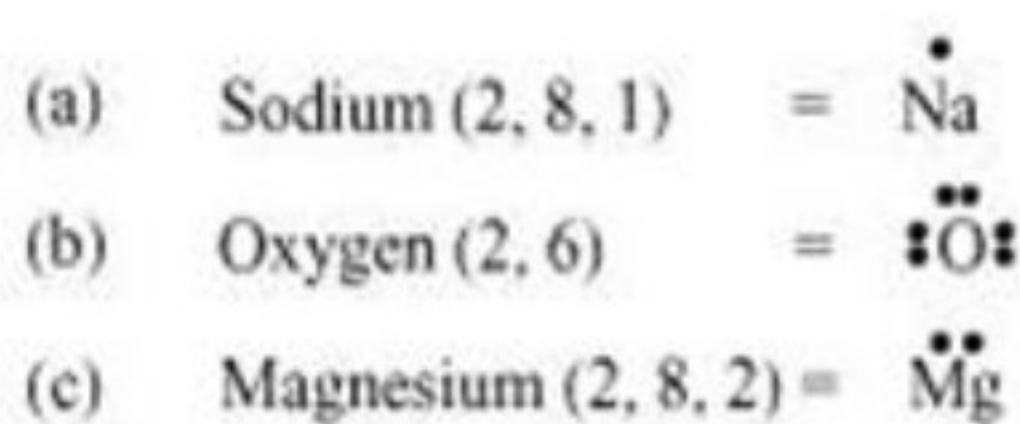
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Question 1:

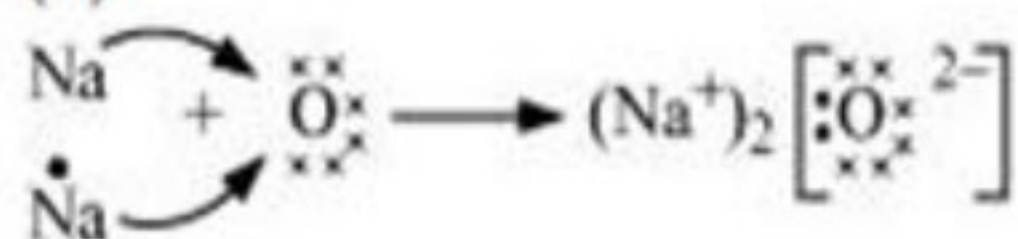
- Write the electron-dot structures for sodium, oxygen and magnesium,
- Show the formation of Na_2O and MgO by the transfer of electrons.
- What are the ions present in these compounds?

Solution:

- (i) Electron-dot structure:



(ii)



- (iii) Ions present in $Na_2O = Na^+ + O^{2-}$



Question 2: Why do ionic compounds have high melting points?

Solution: Ionic compounds have strong electrostatic forces of attraction between them. Thus, it requires a lot of energy to overcome these forces. That is why ionic compounds have high melting points

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Question 1: Define the following terms:

- 1) Mineral
- 2) Ore
- 3) Gangue

Solution:

- (i) Mineral: Most of the elements occurs in nature as in combined state as minerals.
- (ii) Ore: Minerals from which metals can be extracted profitably are known as ores.
- (iii) Gangue: The impurities (sand, soil, etc.) present in the ore are called gangue.

Question 2: Name two metals which are found in nature in the Free State.

Solution: Gold & silver are found in Free State.

Question 3: What chemical process is used for obtaining a metal from its oxide?

Solution: Reduction is used for obtaining a metal from its oxide. In this process, metal oxides are reduced by using suitable reducing agents such as carbon or by highly reactive metals to displace the metals from their oxides.

For example-



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Question 1: Metallic oxides of zinc, magnesium and copper were heated with the following metals.

Metal	Zinc	Magnesium	Copper
Zinc oxide	-	-	-
Magnesium oxide	-	-	-
Copper oxide	-	-	-

In which cases will you find displacement reactions taking place?

Solution:

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

Question 2: Which metals do not corrode easily?

Solution: Less reactive metals are less likely to get corroded.

Question 3: What are alloys?

Solution: Alloys are homogeneous mixtures of two or more elements. For example, steel is an alloy of iron and carbon.

Exercise

Question 1: Which of the following pairs will give displacement reactions?

- (a) NaCl solution and copper metal
- (b) MgCl_2 solution and aluminium metal
- (C) FeSO_4 solution and silver metal
- (d) AgNO_3 solution and copper metal.

Solution: (d) AgNO_3 solution and copper metal

Question 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 coating of zinc
- (d) All of the above

Solution: (c) Applying a coating of zinc

Question 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

Solution: (a) Calcium

Question 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.

Solution: (c) Food cans are coated with tin and not with zinc because zinc is more reactive than tin.

Question 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 these tests in distinguishing between metals and non-metals.

Solution:

- (a) With the hammer, we can beat the sample and If it can be beaten into thin sheets, then it is a metal otherwise a non-metal. Similarly, we can use the battery, bulb, wires, and a switch to set up a circuit with the sample. If the sample conducts electricity, then it is a metal otherwise a non-metal.
- (b) The above tests are based on the physical properties. No chemical reactions are involved in these tests.

Question 6: What are amphoteric oxides? Give two examples of amphoteric oxides.

Solution: Those oxides that behave as both acidic and basic oxides are called amphoteric oxides. Examples: aluminium oxide (Al_2O_3), zinc oxide (ZnO)

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

Solution: Metals that are more reactive than hydrogen displace it from dilute acids. For example sodium and potassium Metals that are less reactive than hydrogen do not displace it. For example copper and silver

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

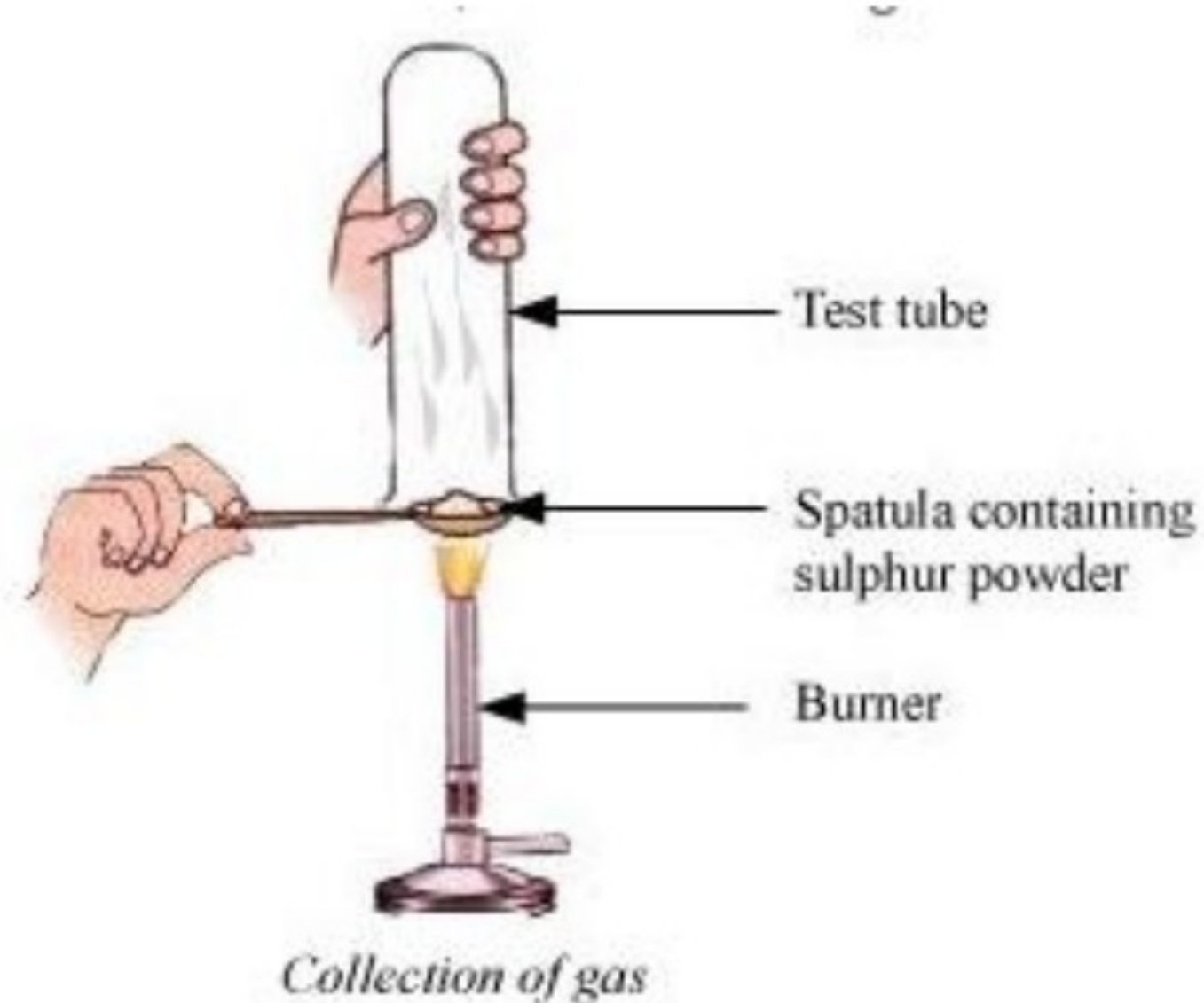
Solution: In the electrolytic refining of a metal M:

Anode - Impure metal M

Cathode - Thin strip of pure metal M

Electrolyte - Solution of salt of the metal M

Question 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 figure below.



(a) What will be the action of gas on

- (i) Dry litmus paper?
- (ii) Moist litmus paper?

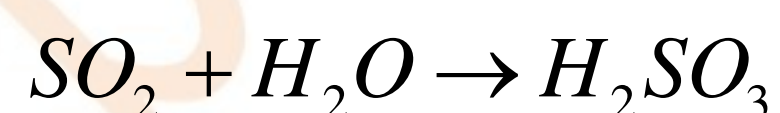
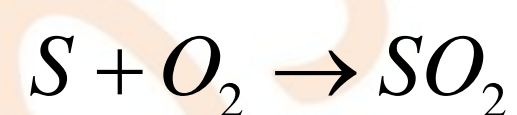
(b) Write a balanced chemical equation for the reaction taking place

Solution:

(a)

- (i) There will be no action on dry litmus paper.
- (ii) Since the gas is sulphur dioxide, it turns moist blue litmus paper to red because sulphur dioxide reacts with moisture to form sulphurous acid.

(b)



Question 10: State two ways to prevent the rusting of iron?

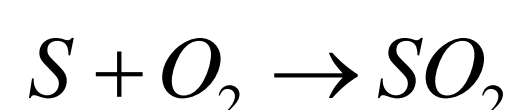
Solution: Two ways to prevent the rusting of iron are:

(i) **Oiling or painting:** By applying oil, grease, or paint, the surface becomes water proof and the moisture and oxygen present in the air cannot come into direct contact with iron.

(ii) **Galvanisation:** An iron article is coated with a layer of zinc metal, which prevents the iron to come in contact with oxygen and moisture.

Question 11: What types of oxides are formed when non-metals combine with oxygen?

Solution: Non-metals combine with oxygen to form acidic oxides.



Question 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.

Solution:

- (a) Platinum, gold, and silver are used to make jewellery because they are very lustrous. Also, they are very less reactive and do not corrode easily.
- (b) Sodium, potassium, and lithium are very reactive metals and react very vigorously with air as well as water. Therefore, they are kept immersed in kerosene oil in order to prevent their contact with air and moisture
- (c) Though aluminium is a highly reactive metal, it is resistant to corrosion. This is because aluminium reacts with oxygen present in air to form a thin layer of aluminium oxide. This oxide layer is very stable and prevents further reaction of aluminium with oxygen. Thus, it is used to make cooking utensils.
- (d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction because metals can be easily extracted from their oxides rather than from their carbonates and sulphides.

Question 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.

Solution: Copper reacts with moist carbon dioxide in air to form copper carbonate. Because of this, copper vessel loses its shiny brown surface & forms a green layer of copper carbonate. The citric acid present in the lemon neutralises the basis copper carbonate and dissolves the layer. Thus, tarnished copper vessels are cleaned with lemon or tamarind juice.

Question 14: Differentiate between metal and non-metal on the basis of their chemical properties.

Solution:

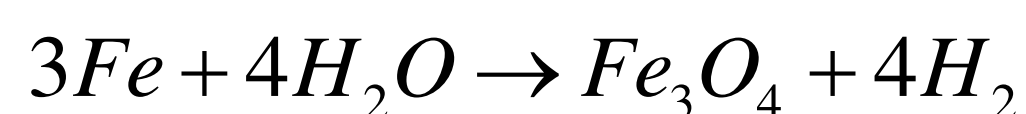
Ans. 14Metal	Non-metal
Metals are electropositive.	Non-metal are electronegative.
They react with oxygen to form basic oxides.	They react with oxygen to form acidic or neutral oxides.
They react with water to form oxides and hydroxides.	They do not react with water
They react with dilute acids to form a salt and evolve hydrogen gas.	They do not react with dilute acids.
They act as reducing agents	They act as oxidising agents.

Question 15: A man went door to door posing as a goldsmith lie 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?

Solution: He must have dipped the gold metal in the solution of aqua regia — 3:1 mixture of conc. HCl and conc. HNO₃. Aqua regia is a fuming, highly corrosive liquid. It dissolves gold in it. After dipping the gold ornaments in aqua regia, the outer layer of gold gets dissolved and the inner shiny layer appears. That is why the weight of gold ornament reduced

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

Solution: Copper does not react with cold water, hot water, or steam. On the other hand, iron reacts with steam. If the hot water tanks are made of steel, then iron would react vigorously with the steam formed from hot water. . thus, steel cannot be used for this purpose.



steam