

4

Materials: Metal and Non-Metals

TOPICS COVERED

4.1 Physical Properties : Metals and Non-metals

4.2 Chemical Properties : Metals and Non-metals

4.3 Displacement Reactions, Metals and Non-metals : Uses

IMPORTANT POINTS TO REMEMBER

- A substance which is lustrous, sonorous, ductile and is a good conductor of heat and electricity is called a **metal**.
- A substance which is non-lustrous, non-sonorous, non-ductile and is a bad conductor of heat and electricity is called **non-metal**.
- Metals react with oxygen to form metallic oxides. **Metallic oxides** are basic in nature.
- Non-metals also react with oxygen to make oxides. **Oxides** of non-metals are acidic in nature.
- Some metals react vigorously with water, while some other do not react at all.
- Usually, non-metals do not react with water. But some non-metals react vigorously with air.
- Usually, metals react with acids and produce a gas which burns with a pop sound.
- Usually, non-metals do not react with acids.
- Metals react with sodium hydroxide to produce hydrogen gas.
- Non-metals' reaction with sodium hydroxide is much complex.
- When a metal displaces another metal from a compound; this is called **displacement reaction**.
- When iron nails are kept in copper sulphate solution, the blue colour of copper sulphate solution disappears and the solution becomes green. This happens because iron displaces copper from copper sulphate solution and forms iron sulphate.
- Metals are used for making machines and tools. Iron is used for making ships, bridges, railway lines, etc. Copper is used for making electric wires. Aluminium is used for making utensils. Gold and silver are used for making ornaments.
- Oxygen is used by all living beings for respiration. Carbon dioxide is used by plants for photosynthesis. Chlorine is used for water purification. Iodine solution is used as antiseptic and applied on wounds. Coal (carbon) is an important fuel.

4.1 PHYSICAL PROPERTIES: METALS AND NON-METALS

Metals

Elements which have characteristics like lustre, malleability, ductility, good thermal and electrical conductivity are called metals. Example: iron, aluminium, copper, silver, gold etc.

There are about 118 elements known as far out of which 92 are metals, 22 are non metals and the rest are metalloids.

Physical Properties of Metals

Physical State: Metals are generally solid at room temperature, except *mercury* which is a liquid at room temperature.

Hardness: Metals are generally hard, except *sodium* and *potassium* which can be easily cut with a knife.

Lustre: Metals have a shiny appearance. This property is called lustre.

Malleability: The property of a metal to be beaten into sheets is called malleability. Gold is the most malleable metal.

Ductility: The property of a metal to be drawn into thin wires is called ductility. Gold is the most ductile metal.

Thermal Conductivity: Metals are generally good conductors of heat. *Silver* is the best conductor of heat followed by copper. *Lead* and *Mercury* are exceptional metals that offers good resistance to heat.

Electrical Conductivity: Metals are generally good conductors of electricity. Silver is the best conductor of electricity.

Sonorous: Metals, when hit by a hard surface, produce a ringing sound. This property is called sonority. Metals are sonorous.

Density: Metals have high density as they are heavy and dense.

Melting and Boiling Points: Metals have generally high melting and boiling points, except *gallium* and *caesium* which have low melting points. They can melt when kept on the palm of our hand.

Non-metals

Elements which do not show characteristics like lustre, malleability, ductility good thermal and electrical conductivity are called non-metals. *Example:* Oxygen, Sulphur, Phosphorous, Carbon, etc.

Physical Properties of Non-metals

Physical State: Non-metals exists as solids, liquids or gases at room temperature.

Example:

Solid	Liquid	Gas
Sulphur Phosphorous Carbon	Bromine	Oxygen Nitrogen Hydrogen

Hardness: Non-metals are usually soft, except *Diamond* which is the hardest substance known.

Lustre: Non-metals are non-lustrous.

Malleability: Non-metals are non-malleable.

Ductility: Non-metals are non-ductile.

Thermal and Electrical Conductivity: Non-metals are poor conductors of heat and electricity, except *graphite* which is a good conductor of heat.

Sonorous: Non-metals are non-sonorous.

Density: Non-metals have low density.

Melting and Boiling Point: Non-metals usually have low melting and boiling points.

Metalloids

Elements which show characteristics of both metals as well as non-metals are called metalloids. *Example:* Germanium, Boron, Silicon etc.

Exercise 4.1

I. Very Short Answer Type Questions (1 Mark)

1. What are metals?
 2. Which property of metals makes them suitable for use in jewellery?
 3. Name the property of metals by the virtue of which they can be hammered into thin sheets.
 4. Name the property of metals by the virtue of which they can be drawn into thin wires.
 5. Name a solid metal.
 6. Name a metal which is liquid at room temperature.
 7. Name a gaseous non-metal.
 8. Name a metal which starts melting when kept on the palm of your hand.
 9. Name a non-metal which is liquid at room temperature.
 10. Give one word for the following:
 - (a) Elements which show characteristics like lustre, malleability etc. _____
 - (b) Elements which do not show characteristics like lustre, ductility etc. _____
 - (c) A metal which is a liquid at room temperature. _____
 - (d) A non-metal which is a liquid at room temperature. _____
 - (e) A metal which is best conductor of heat. _____
 - (f) A metal which can be easily cut with a knife. _____

(NCERT Exemplar)

 - (g) A non-metal that is the hardest substance known. _____
 - (h) A non-metal that is a good conductor of electricity. _____
 - (i) A non-metal which is lustrous. _____
 - (j) A metal that is stored in kerosene. _____
 11. Fill in the blanks:
 - (a) The property of a metal to be hammered into thin sheets is called _____.
 - (b) The property of a metal to have a shiny appearance is called _____.
 - (c) The property of a metal to be drawn into thin wires is called _____.
 - (d) The ability of a metal to produce ringing sound when struck with a hard object is called _____.
-

- (e) _____ is a soft metal.
- (f) _____ is a metal while _____ is a non-metal.
- (g) _____ metal is the best conductor of heat while _____ is the metal that offers resistance to heat.
- (h) The ability of a non-metal to be broken down into pieces is called _____.
- (i) The most malleable metal is _____.
- (j) _____ metal is used for making jewellery.

II. Short Answer Type Questions-1 (2 Marks)

12. Gold is used in making jewellery. Why?
13. Why is copper metal used in making electrical wires?
14. Why is copper used in making kitchen utensils?
15. Temple bells are made up of copper. Why?
16. Wires cannot be drawn from wood. Why?
17. Graphite is used for making electrodes in electric cells. Why?
18. Iron is used for construction of bridges. Why?
19. Oxygen is not brittle. Why?
20. What are non-metals? Give examples.
21. Aluminium is used for making foils. Why?

III. Short Answer Type Questions-2 (3 Marks)

22. Write three differences between metals and non-metals, on the basis of their physical properties.
23. A substance 'X' is lustrous and is the best conductor of heat and electricity. It is also used in making jewellery.
 - (a) Name the substance 'X'.
 - (b) Give its two characteristics.
 - (c) What happens when it reacts with water?
24. A substance 'X' is soft, cannot be drawn into wires, can be broken into pieces, is used in making electrodes in electric cells.
 - (a) Name the substance 'X'.
 - (b) Write its characteristics.
 - (c) Give one more use of 'X'.
25. Write any three properties of non-metals.
26. Write three characteristics of metals.

IV. Long Answer Type Questions (5 Marks)

27. Distinguish between metals and non-metals on the basis of their physical properties.

ANSWERS

- | | | |
|---|-----------------|--------------|
| 1. Elements which are have lustrous, malleable, ductile, thermal and electrical conductivity are called metals. | 3. Malleability | 4. Ductility |
| 2. Malleability and Ductility | 5. Iron | 6. Mercury |
| | 7. Oxygen | 8. Gallium |
| | 9. Bromine | |
-

10. (a) Metals (b) Non-metals
 (c) Mercury (d) Bromine
 (e) Silver
 (f) Sodium/Potassium
 (g) Diamond (h) Graphite
 (i) Iodine (j) Sodium
11. (a) malleability (b) lustre
 (c) ductility (d) sonority
 (e) Sodium/Potassium
 (f) Iron, Carbon
 (g) Silver, Mercury/Lead
 (h) brittleness (i) Gold
 (j) Gold
12. It is malleable and ductile. It is least reactive.
13. It is ductile and a good conductor of electricity.
14. Copper is a good conductor of heat. It does not react with water.
15. Copper is sonorous. When hit with a hard object, it makes a ringing sound.
16. Wood is not ductile nor a good conductor of electricity.
17. Graphite is a good conductor of electricity.
18. Iron has high tensile strength.
19. It is not a solid but exists as a gas at room temperature.
20. Elements which are not lustrous, malleable, ductile are poor thermal and electrical conductors are called non-metals.
21. It is malleable and a good conductor of heat.

22.

Metals	Non-metals
<ul style="list-style-type: none"> Generally hard solids. 	<ul style="list-style-type: none"> Generally soft and may exist as solid, liquid or a gas.
<ul style="list-style-type: none"> Malleable and ductile. 	<ul style="list-style-type: none"> Non-malleable, and ductile.
<ul style="list-style-type: none"> High melting and boiling points 	<ul style="list-style-type: none"> Low melting and boiling points.

23. (a) Gold/Silver
 (b) (i) It is lustrous.
 (ii) It is malleable and ductile.
 (c) It shows no reaction. It is least reactive.
24. (a) Graphite
 (b) (i) It is soft and lubricant.
 (ii) It is a good conductor of electricity.
 (c) It is used as a lubricant in machines.
25. (i) Non-metals are usually soft except, Diamond which is the hardest substance known.
 (ii) They are non-lustrous.
 (iii) They are non-malleable.
26. (i) Metals are generally hard, except sodium and potassium which can be easily cut with a knife.
 (ii) They have a shiny appearance i.e., lustrous.
 (iii) They can be beaten into sheets, malleable. Gold is the most malleable metal.

27.

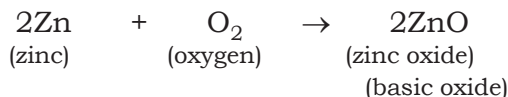
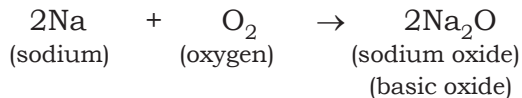
Metals	Non-metals
Generally solids and hard	Generally soft may exist as solids, liquids or gases
Good conductors of heat.	Poor conductors of heat.
They are lustrous	They are non-lustrous.
Good conductors of electricity.	Poor conductors of electricity.
High Tensile strength.	Low Tensile strength.
They are malleable	Non-malleable
They are ductile	Non-ductile
They are sonorous	Non sonorous
They have high melting and boiling point	Low melting and boiling point
They have high density	Low density

4.2 CHEMICAL PROPERTIES : METALS AND NON-METALS

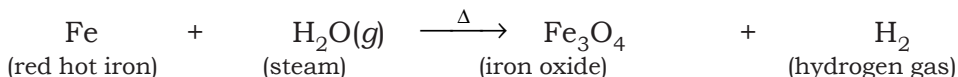
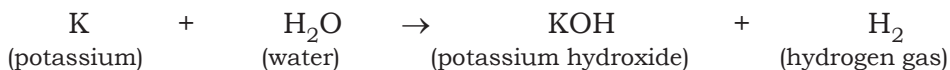
Chemical Properties of Metals

Metals show similar chemical properties with oxygen, water, acids, bases etc.

Reaction with Oxygen: Metals react with oxygen to form metallic oxides which are basic in nature, i.e. they turn blue litmus solution red. For example,

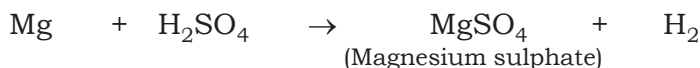


Reaction with Water: Metals react with water to form metal hydroxides or metal oxide and hydrogen gas. For example,

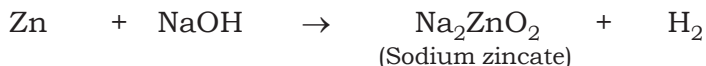


Copper does not react even with steam, silver and gold metals are very unreactive and do not get affected by water at all.

Reaction with Acids: Metals react with acids to form respective salt and hydrogen gas.

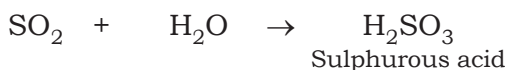
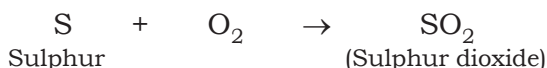


Reaction with Bases: Metals react with bases to form metal salts and hydrogen gas.



Chemical Properties of Non-Metals

Reaction with Oxygen: Non-metals react with oxygen to form non-metallic oxides, which are acidic in nature. For example,



Reaction with Water: Non-metals do not react with water or steam.

Reaction with Acids: Non-metals do not react with acids.

Reaction with Bases: Non-metals generally do not react with bases. Only some non-metals react and these reactions are complex, with no evolution of H₂ gas.

Exercise 4.2

I. Very Short Answer Type Questions (1 Mark)

1. Give one word for the following:

- (a) Metals react with oxygen to form _____
- (b) Iron reacts with hydrochloric acid to form a gas called _____
- (c) Sodium reacts with oxygen to form _____
- (d) Zinc metal burns in air only on strong heating to form _____
- (e) The nature of magnesium oxide is _____
- (f) The nature of sulphur dioxide is _____
- (g) Sulphur dioxide dissolves the water to form _____
- (h) Carbon dioxide dissolves in water to form an acid called _____
- (i) Nitrogen reacts with oxygen to form _____
- (j) The gas liberated when metals react with acids is _____
- (k) Metal that is stored in kerosene is _____

2. Fill in the blanks:

- (a) Metals react with oxygen to form _____ which are _____ in nature.
- (b) Metals react with water to form _____ or _____ and _____ gas.
- (c) Metals react with acid to form _____ and _____ gas.
- (d) Metals react with bases to form _____ and _____ gas.
- (e) Most metals combine with _____ to form metal oxides.
- (f) _____ catches fire if left in open.
- (g) Generally _____ do not react with acids.
- (h) _____ do not react with water.

II. Short Answer Type Questions-1 (2 Marks)

- 3. Why do gold ornaments look new even after several years?
- 4. What happens when non-metals react with oxygen? Give one example.
- 5. How is sulphurous acid formed? Write the chemical equation involved.
- 6. What is carbonic acid? Give its application.
- 7. What happens when metals react with water? Give an example.
- 8. What happens when metals react with acids? Give an example.
- 9. Why is sodium stored in kerosene oil? (NCERT)
- 10. What happens when metals react with oxygen? Give one example.
- 11. A doctor prescribed a tablet to a person suffering from iron deficiency. The tablet does not look like iron. Explain. (NCERT Exemplar)

III. Short Answer Type Questions-2 (3 Marks)

- 12. Show, that metals react with oxygen to form basic oxides with the help of an activity.
 - 13. Complete the equations:
(a) $\text{Na} + \text{O}_2 \rightarrow$ (b) $\text{Zn} + \text{O}_2 \rightarrow$ (c) $\text{SO}_2 + \text{H}_2\text{O} \rightarrow$
 - 14. State any two chemical properties to prove that copper is a metal.
-

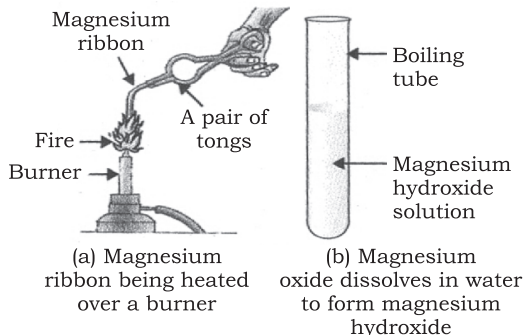
IV. Long Answer Type Questions (5 Marks)

15. With the help of an activity, show that sulphur on reacting with oxygen forms an acidic oxide.
16. Complete the equations and write the name of the products formed.
- (a) $\text{Al} + \text{HCl} \rightarrow \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$
- (b) $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$
- (c) $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$
- (d) $\text{Na} + \text{H}_2\text{O} \rightarrow \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$
- (e) $\text{Mg} + \text{HCl} \rightarrow \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$
17. Write word equation and chemical equation for the following:
- (a) Reaction of zinc with sulphuric acid.
- (b) Reaction of magnesium with hydrochloric acid.
- (c) Reaction of calcium metal with water.
- (d) Reaction of iron with steam.
- (e) Reaction of magnesium with oxygen.

ANSWERS

1. (a) metallic oxides (b) hydrogen
(c) sodium oxide (d) zinc oxide
(e) basic (f) acidic
(g) sulphurous acid (h) carbonic acid
(i) nitrogen oxide (j) hydrogen
(k) sodium
2. (a) metal oxides, basic
(b) metal hydroxide/metal oxide and hydrogen
(c) salt, hydrogen (d) salt, hydrogen
(e) oxygen
(f) sodium potassium metal
(g) non-metals (h) Non-metals
3. Gold is very unreactive, it does not react with air, water, acids etc.
4. Non-metallic oxides are formed. For e.g.,
$$\underset{\text{carbon}}{\text{C}} + \text{O}_2 \rightarrow \underset{\text{carbon dioxide}}{\text{CO}_2}$$
5. When Sulphur dioxide is mixed with water, sulphurous acid is formed.
$$\text{SO}_2 + \text{H}_2\text{O} \rightarrow \underset{\text{sulphurous acid}}{\text{H}_2\text{SO}_3}$$
6. When carbon dioxide is mixed with water, carbonic acid is formed. For example in soda water it is formed as follows.
$$\text{CO}_2 + \text{H}_2\text{O} \rightarrow \underset{\text{carbonic acid}}{\text{H}_2\text{SO}_3}$$
- This reaction is responsible for the effervescence seen in the soda water and thus, use as a soda water.
7. Metal hydroxides or metal oxides along with hydrogen gas is formed, For e.g.,
$$\text{Na} + \text{H}_2\text{O} \rightarrow \underset{\text{sodium hydroxide}}{\text{NaOH}} + \underset{\text{hydrogen}}{\text{H}_2}$$
8. Salt and hydrogen gas is formed.
$$\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2 \uparrow$$
9. Sodium is a very reactive metal. If let open in air, it catches fire. To prevent it from catching fire, it is kept immersed in kerosene oil.
10. Metallic oxides are formed, For e.g.,
$$\underset{\text{sodium}}{\text{Na}} + \text{O}_2 \rightarrow \underset{\text{sodium oxide}}{\text{Na}_2\text{O}}$$
11. Iron is a metal and tablet is not made up of iron metal. It is made from the salt of iron and hence does not look like iron.
12. *Aim:* To synthesize a non-metallic oxide and test its solution using litmus paper.
Materials needed: Sulphur, a long-handled spoon or a deflagrating spoon, burner, water, gas jar with a lid, and blue litmus paper.
- (i) Take a small piece of magnesium ribbon and clean it by rubbing its surface with sand paper.
- (ii) Hold the magnesium ribbon at one end with the pair of tongs and bring its other end over the flame of a bunsen burner till it catches fire.

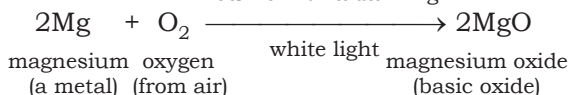
- (iii) Put the powder formed in the boiling tube, add a little water and shake. Now, add some red litmus solution to the boiling tube and observe the change in colour.



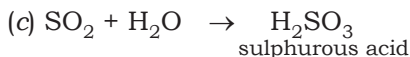
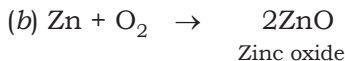
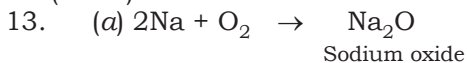
Metals are basic in nature

Observation:

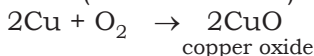
- (i) When magnesium burns in air, it combines with oxygen to form magnesium oxide (white powdery substance).
burns with a dazzling



- (ii) Magnesium oxide dissolves in water partially to form magnesium hydroxide (basic) solution.



14. (a) Copper reacts with oxygen to form copper oxide (basic in nature).



- (b) Copper reacts with nitric acid to form the salt, $\text{Cu}(\text{NO}_3)_2$ and nitrous oxide gas. Here, hydrogen is not evolved as HNO_3 is a strong oxidising agent.

15. **Aim:** To show that sulphur on reacting with oxygen forms an acidic oxide.

Materials needed: Sulphur, a long-handled spoon or a Deflagrating spoon, burner, water, gas jar with a lid and blue litmus paper.

Method:

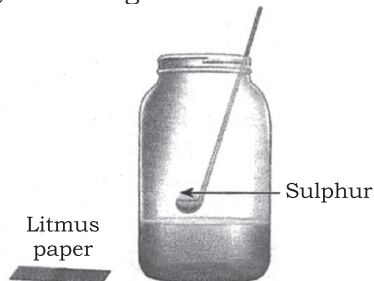
- (i) Take small amount of sulphur in the long-handled spoon/deflagrating spoon and heat it over the flame of a burner.

- (ii) When sulphur starts burning, lower the spoon into the gas jar. Cover the jar partly with the lid while the sulphur is still burning.

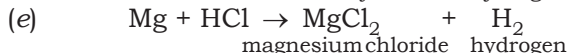
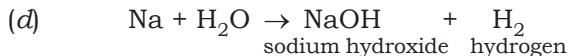
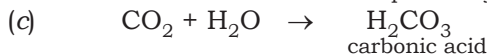
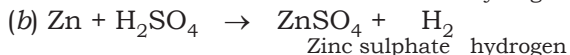
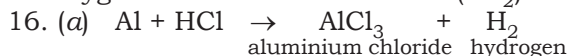
- (iii) The jar will be filled with sulphur dioxide gas. Remove the spoon and cover the gas jar with a lid.

- (iv) Add 20 mL water to the gas jar and test this solution with blue litmus paper.

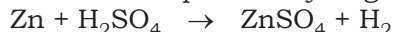
Observation: Blue litmus paper turns red, indicating that the solution is acidic.



Conclusion: Water dissolves the gas (sulphur dioxide) to form an acid (sulphurous acid), which turns blue litmus red. Thus, sulphur reacts with oxygen to form an acidic oxide (SO_2).

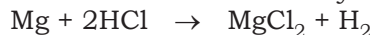


17. (a) zinc + sulphuric acid
→ zinc sulphate + hydrogen



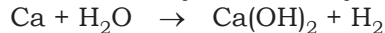
- (b) magnesium + hydrochloric acid
→ magnesium chloride

+ hydrogen



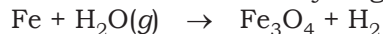
- (c) calcium + water

→ calcium hydroxide + hydrogen



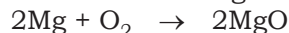
- (d) iron + steam → iron oxide

+ hydrogen



- (e) magnesium + oxygen

→ magnesium oxide

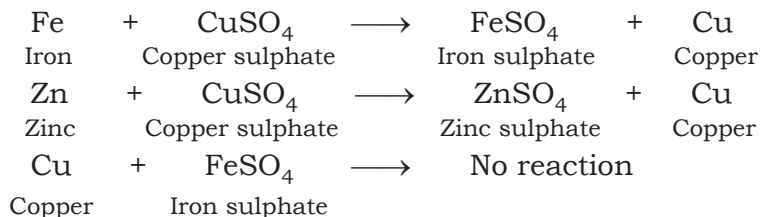


4.3 DISPLACEMENT REACTION, METALS AND NON-METALS : USES

Displacement Reaction: A reaction in which a more reactive metal displaces a less reactive metal from its salt solution is called a displacement reaction.

On the basis of displacement reactions, reactivity series of metals was formulated.

Reactivity Series of Metals: Examples of Displacement Reactions:



A less reactive metal cannot displace a more reactive metal from its salt solution.

Uses of Metals

Iron: Used for making heavy machines, building materials, ships, in automobile industry, railway tracks etc.

Copper: Electrical wires, cables, coils, cooking utensils.

Aluminium: Parts of machinery, automobiles, sheets, rods, door, window frames, packaging tin cans, foils.

Zinc: Used in galvanisation, for making alloys.

Mercury: Thermometers, amalgams (alloy of mercury for dental fillings).

Lead: Car batteries, pigments, paints.

Gold, Silver: Jewellery, ornaments, statues.

Uses of Non-metals

Diamond: A form of carbon used in making jewellery, cutting, drilling tools used by eye surgeons.

Graphite: Used in pencils, lubricants, electrodes.

Hydrogen: Synthesis of ammonia, welding, torches.

Sulphur: Vulcanisation of rubber, manufacture of sulphuric acid, dyes, gun-powder.

Phosphorus: Making matchsticks, fireworks, and fertilisers.

Nitrogen: For manufacture of ammonia, as fertilisers, packaging food items (acts as an antioxidant), liquid nitrogen is used for refrigerating cells for medical research.

Oxygen: It is stored in cylinders, which are used by mountaineers and deep-sea divers as breathing equipment. It is used with acetylene for oxyacetylene torches that are used for welding and cutting metals.

Chlorine: Used as a bleaching agent, disinfectant for water purification.

Metals	Symbol
Potassium	K
Sodium	Na
Calcium	Ca
Magnesium	Mg
Aluminium	Al
Zinc	Zn
Iron	Fe
Tin	Sn
Lead	Pb
Hydrogen	H
Copper	Cu
Mercury	Hg
Silver	Ag
Gold	Au
Platinum	Pt

Exercise 4.3

I. Very Short Answer Type Questions (1 Mark)

1. Give one word for the following:

- (a) A metal more reactive than copper _____
- (b) A metal less reactive than iron _____
- (c) A least reactive metal _____
- (d) A metal used in jewellery _____
- (e) A metal used in construction of ships _____
- (f) A non-metal used in pencils _____
- (g) A non-metal used in jewellery _____
- (h) A non-metal which is essential for our life _____
- (i) A non-metal used to disinfect water _____
- (j) A non-metal used as an antiseptic _____

2. Fill in the blanks:

- (a) A more reactive metal displaces a _____ reactive metal from its salt solution.
- (b) A reaction in which a more reactive metal displaces a less reactive metals called _____.
- (c) _____ is more reactive than copper.
- (d) _____ is the hardest substance known.
- (e) Alloy of mercury is called _____.
- (f) _____ non-metal is used in the growth of plants.
- (g) A purple coloured solution is used as an antiseptic. It is a tincture _____.
- (h) _____ is used to disinfect water.
- (i) _____ is used as an antioxidant in chips packet to keep the chips fresh.
- (j) _____ is used in packaging of food items.

II. Short Answer Type Questions-1 (2 Marks)

- 3. Why is copper used in making electrical wires?
- 4. Why is gold and silver used in making jewellery?
- 5. Why do doctors use diamond as a tool in eye surgery?
- 6. Why is graphite used in machines?
- 7. What happens when iron nails are dipped in copper sulphate solution?
- 8. What is a displacement reaction? Give one example.

III. Short Answer Type Questions-2 (3 Marks)

9. Complete the equation:

- (a) $\text{Fe} + \text{CuSO}_4 \rightarrow \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$
- (b) $\text{Zn} + \text{FeSO}_4 \rightarrow \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$
- (c) $\text{Cu} + \text{AgNO}_3 \rightarrow \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$

10. Write word equation and chemical equation for the following reaction:

- (a) Reaction of iron nails with copper sulphate solution.
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- (b) Reaction of zinc rod with iron sulphate solution.
 (c) Reaction of aluminium with zinc sulphate solution.
11. A metal 'M' is used in making ships, bridges etc. It also conducts heat and is a good conductor of electricity.
 (a) Name the metal 'M'.
 (b) Write its reaction with copper sulphate.
 (c) Give its one more use.
12. A metal 'X' is used in making thermometers.
 (a) Name the metal 'X'.
 (b) Why is it used in making thermometers?
 (c) Mention one more use of this metal.
13. What happens when
 (a) Dilute sulphuric acid is poured on a copper plate.
 (b) Iron nails are placed in copper sulphate solution.
 Write word equation of the reaction involved. (NCERT)
14. Saloni took a piece of burning charcoal and collected the gas evolved in a test tube:
 (a) How will she find the nature of the gas.
 (b) Write down word equation of all the reactions taking place in the process. (NCERT)

IV. Long Answer Type Questions (5 Marks)

15. What happens when iron nails are dipped in copper sulphate solution? Write the chemical equation involved.
16. You are asked to dip iron nails in copper sulphate solution. Record your observation and answer the following questions:
 (a) What is the initial colour of copper sulphate solution?
 (b) What is the colour of the solution after iron nails were dipped into it?
 (c) Why do the iron nails become reddish brown in colour?
 (d) What type of reaction is it?
 (e) Write the chemical equation involved.
17. Give two uses each of the following:
 (a) Aluminium (b) Oxygen (c) Nitrogen
18. With the help of an activity, show that iron is more reactive than copper. (NCERT Exemplar)
19. One day Reeta went to a jewellery shop with her mother. Her mother gave an old gold jewellery to the goldsmith to polish. Next day, when they bought the jewellery back, they found that there was a slight loss in its weight. Can you suggest a reason for the loss in weight. (NCERT)

ANSWERS

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|-------------|-----------------|--------------|------------------|
| 1. (a) Iron | (b) Copper | (g) Diamond | (h) Oxygen |
| (c) Gold | (d) Gold/Silver | (i) Chlorine | (j) Iodine |
| (e) Iron | (f) Graphite | 2. (a) less | (b) displacement |
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- (c) Iron (d) Diamond
 (e) amalgam (f) Nitrogen
 (g) Iodine (h) Chlorine
 (i) Nitrogen (j) Aluminium
3. Copper is a malleable and ductile metal. It is a good conductor of electricity.
4. Gold and silver are malleable and ductile. They are the least reactive metals and does not get affected by air, water etc.
5. Diamond is the hardest substance known.
6. Graphite acts as a lubricant and thus used in machinery for lubricating its parts.
7. Iron displaces copper from its salt solution and copper metals gets deposited.

$$\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$$
8. A reaction in which a more reactive metal displaces a less reactive metal from its salt solution is called displacement reaction. For e.g.,

$$\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$$
 On the basis of displacement reactions, reactivity series of metals was formulated.
9. (a) $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$
 (b) $\text{Zn} + \text{FeSO}_4 \rightarrow \text{ZnSO}_4 + \text{Fe}$
 (c) $\text{Cu} + \text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{Ag}$
10. (a) Iron + Copper sulphate

$$\rightarrow \text{Iron sulphate} + \text{Copper}$$

$$\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$$

 (b) Zinc + Iron sulphate

$$\rightarrow \text{Zinc sulphate} + \text{Iron}$$

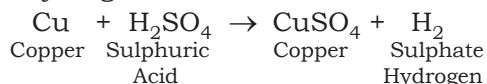
$$\text{Zn} + \text{FeSO}_4 \rightarrow \text{ZnSO}_4 + \text{Fe}$$

 (c) Aluminium + Zinc sulphate

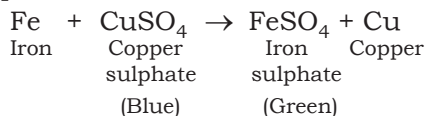
$$\rightarrow \text{Aluminium sulphate} + \text{Zinc}$$

$$2\text{Al} + 3\text{ZnSO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{Zn}$$
11. (a) M-Iron
 (b) $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$
 (c) It is used in making railway tracks
12. (a) X-Mercury
 (b) It is a liquid, it is a poor conductor of heat and has a high coefficient of expansion.
 (c) It is used for making amalgams (an alloy of mercury for dental fillings)

13. (a) Copper reacts with dilute sulphuric acid to form copper sulphate and hydrogen.



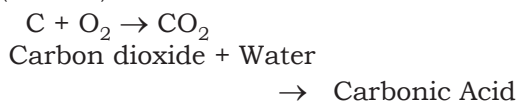
- (b) The blue colour of copper sulphate changes to light green due to the formation of iron sulphate and a reddish brown layer of copper is deposited on iron nails.



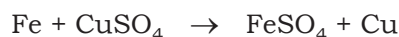
14. (a) When charcoal is burnt in air, it produces *Carbon dioxide* Gas. It is then dissolved in water to form *Carbonic acid*.

A red litmus paper is minimised in the solution. It turns red indicating that carbon dioxide is a non-metallic oxide which is *basic* in nature.

- (b) Carbon + Oxygen \rightarrow Carbon dioxide (Charcoal)



15. The blue coloured solution changes to light green and a reddish brown layer is observed on iron nails.



16. (a) Blue (b) Light green
 (c) Copper has been displaced by iron and it has got deposited over the iron metal.
 (d) Displacement Reaction
 (e) $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$

17. *Aluminium:* (i) Used to make parts of machinery, automobiles, sheets, rods, doors, window frames.

(ii) Packaging tin cans, foils.

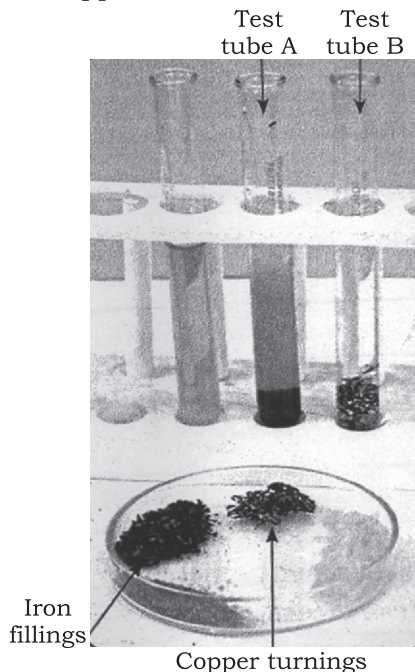
Oxygen: (i) It is stored in cylinders, which are used by mountaineers and deep-sea divers as breathing equipment.

(ii) It is used with acetylene for making oxyacetylene torches that are used for welding and cutting of metals.

Nitrogen: (i) For manufacture of ammonia and fertilisers.

(ii) Liquid nitrogen is used for refrigerating cells for medical research.

18. *Aim:* To prove that iron is more reactive than copper.



Materials needed: Iron fillings, copper turnings, copper sulphate solution, iron sulphate solution, test tubes, and two droppers.

Method:

- (a) Take some iron fillings in a test tube labelled A, and add some copper sulphate solution with the help of a dropper.
- (b) Take some copper turnings in a test tube labelled B and add some iron sulphate solution with the help of another dropper

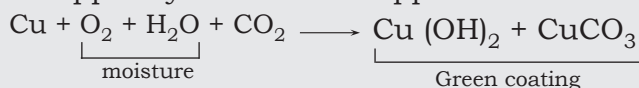
Observation: In test tube A, iron fillings turn brown due to the deposition of copper and the solution turns pale green due to the formation of iron sulphate solution. No reaction is observed in test tube B.

Conclusion: Iron is more reactive than copper as it displaces copper from copper sulphate solution.

19. There was a slight loss in its weight because it was dissolved in aquaregia. Aquaregia is the only reagent in which gold dissolves. It is a mixture of concentrated nitric acid and hydrochloric acid in the ratio of 1 : 3 respectively.

Did You Know?

- Silver foils used for decorating sweets are made by gently hammering small pieces of silver, since it is a highly malleable metal.
- When copper or brass, vessels are exposed to moist air, they acquire a green coating commonly called basic copper carbonate. It is a combination of two salts i.e. copper hydroxide and copper carbonate.



HOTS & VALUE BASED QUESTIONS

1. Name a lustrous non-metal. **(HOTS)**
2. With the help of an activity, show that metals and graphite (a non-metal) are good conductor of electricity. **(HOTS)**
3. Which metal is used in making thermometers? Why? **(HOTS)**
4. Why does calcium metal start floating in water? **(HOTS)**
5. Can we store lemon pickle in an aluminium container? **(HOTS)**

6. A metal 'M' has shining appearance but does not react with water nor with dilute hydrochloric acid. Name the metal 'M'. Give its uses. **(HOTS)**
7. A metal 'X' is burnt in air. A white dazzling light is produced along with the formation of a compound 'Y'. **(HOTS)**
 (a) Name 'X' and 'Y'
 (b) Write one chemical property of 'X'
 (c) What happens when 'Y' is mixed with water? Write the chemical equation involved.
8. With the help of an activity, show that metallic oxides are basic in nature. **(HOTS)**
9. Two test tubes 'A' and 'B' are given to you. They both contain blue coloured solutions. You are asked to put iron nails in test tube A and silver filings in test tube B. **(HOTS)**
 Now answer the following questions:
 (a) What is observed in test tube A? Write the chemical equation.
 (b) What is observed in test tube B? Write the chemical equation.
 (c) What do you infer from this activity?
10. One day Mohan went to market with his father and they saw two idol statues, one made up of copper and other of silver coating over iron metal. Mohan father decides to take the silver coated article, rather than the copper statue. He also explained Mohan that copper statue will deteriorate after sometime, while the silver coated statue does not.
 Now answer the following questions.
 (a) Write the chemical equations for the reaction responsible for green coating over copper statue.
 (b) What values are associated with Mohan's father? **(VBQ)**
11. In the evening, Rajiv plays guitar for poor children of his colony. He even teaches some children how to play guitar, free of cost.
 (a) Name the property because of which strings of guitar are made up of metal.
 (b) What are the values possessed by Rajiv? **(VBQ)**

ANSWERS

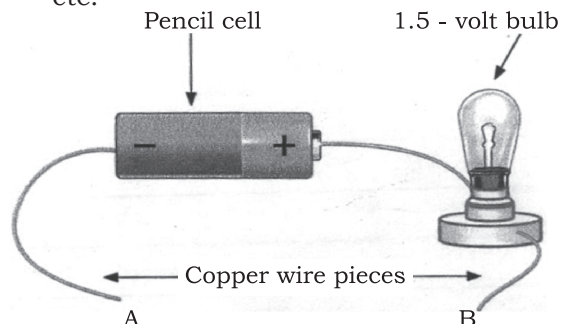
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| <p>1. Iodine</p> <p>2. <i>Aim:</i> To show that metals and graphite are good conductors of electricity.
 <i>Materials needed:</i> Small samples of easily available metals (e.g., aluminium wire, iron wire, copper wire, etc.) and non-metals (e.g., graphite and charcoal), pieces of copper wire, a pencil cell, and a 1.5-volt bulb.
 <i>Method:</i>
 (a) Set up the apparatus as shown in the figure.</p> | <p>(b) Connect the two free ends (A and B) of the copper wire to the objects, one by one.
 <i>Observation:</i> The bulb glows when metals and graphite are connected to the free ends of the copper wire.
 <i>Conclusion:</i> Metals and graphite are good conductors of electricity.</p> <p>3. Mercury is used in thermometers since it is a liquid, and a poor conductor of heat, it has a high coefficient of expansion and thus it expands easily.</p> |
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4. Calcium metal sticks to hydrogen gas, and rises along with hydrogen to the surface of water. Hence it starts floating.



5. Lemon contains citric acid and metals reacts with acid to form salt and hydrogen gas. So, aluminium will react with the acid present in lemon and form toxic substances. Hence, lemon pickles cannot be stored in an aluminium container.

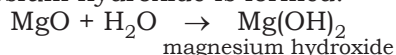
6. Metal M is copper. It is used for a making utensils, boilers etc.



7. (a) X-Magnesium (Mg)
Y-Magnesium oxide (MgO)

- (b) Magnesium reacts with hydro-chloric acid to form magnesium chloride and hydrogen.

- (c) When 'Y', i.e. MgO is dissolved in water, magnesium hydroxide is formed.



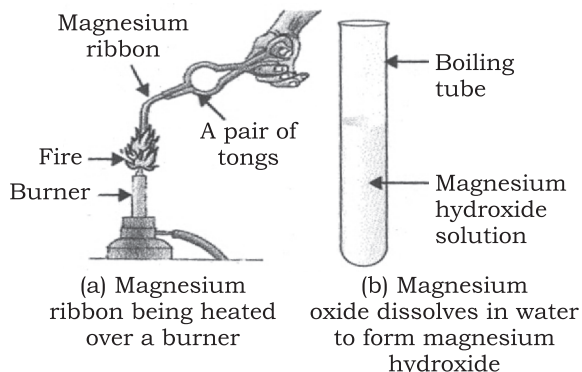
8. Aim: To show that metal react with oxygen to form basic oxides.

Materials needed: A magnesium ribbon, sand paper, pair of tongs, a Bunsen burner, boiling tube, water and red litmus solution.

Method:

- (i) Take a small piece of magnesium ribbon and clean it by rubbing its surface with sand paper.
- (ii) Hold the magnesium ribbon at one end with the pair of tongs and bring its other end over the flame of a bunsen burner till it catches fire.
- (iii) Put the powder formed in the boiling tube, add a little water and shake. Now,

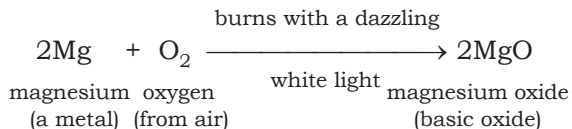
add some red litmus solution to the boiling tube and observe the change in colour.



Metals are basic in nature.

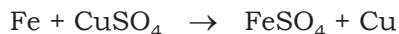
Observation:

- (i) When magnesium burns in air, it combines with oxygen to form magnesium oxide (white powdery substance).

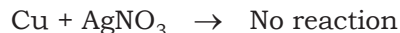


- (ii) Magnesium oxide dissolves in water partially to form magnesium hydroxide (basic) solution.

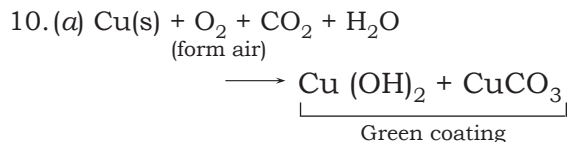
9. (a) The blue-coloured solution of test tube A changes to light green and a reddish brown layer is observed on iron nails.



- (b) No reaction



- (c) A more reactive metal displaces a less reactive metal from its salt solution.



- (b) Mohan's father has knowledge of chemistry and scientific bent of mind.

11. (a) Sonority

- (b) Scientific awareness, kindness, gentleness.