

Chapter: The World of Metals and Non-metals

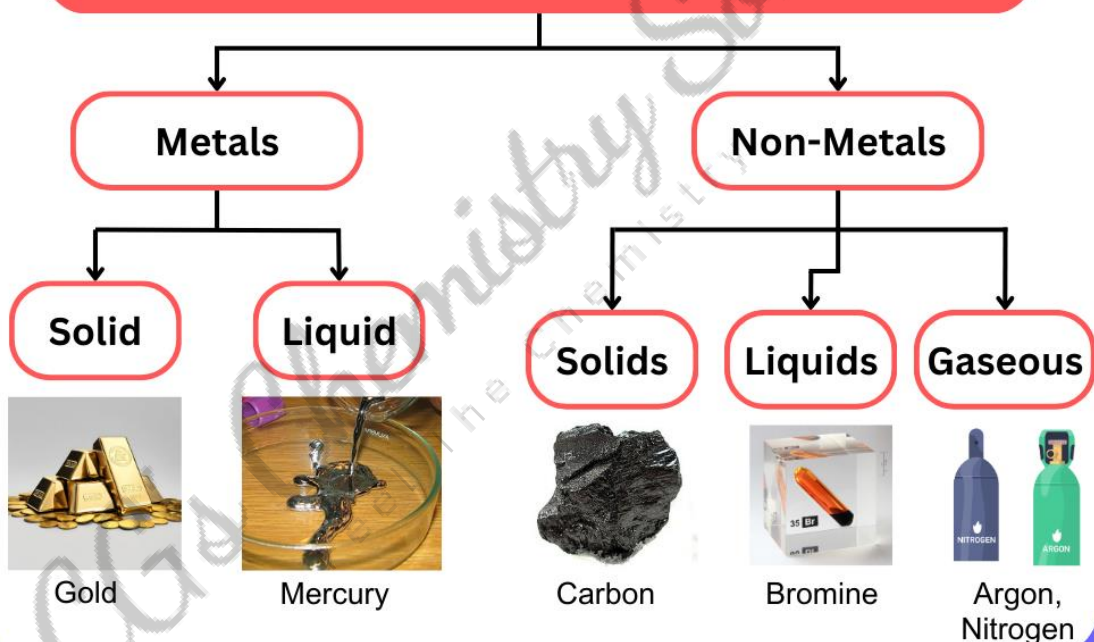
1. Introduction to Elements

- **Element:** A pure substance that cannot be broken into simpler substances by chemical means.
- All matter is made up of elements.
- There are over **118 elements** known today.

Elements are mainly classified into two categories:

- Metals
- Non-metals

DIFFERENT STATES OF METALS AND NON METALS



2. Metals

✓ Common Examples:

- Iron (Fe)
- Copper (Cu)
- Aluminium (Al)
- Gold (Au)
- Silver (Ag)



Physical Properties of Metals:

Property	Description
Lustre	Shiny appearance. E.g., gold and silver.
Hardness	Hard and strong (except sodium and potassium, which are soft).
Malleability	Can be beaten into thin sheets. E.g., aluminium foil.
Ductility	Can be drawn into wires. E.g., copper and gold wires.
Conductivity	Good conductors of heat and electricity. E.g., copper wires in circuits.
Sonorous	Produce a ringing sound when struck.
Density	Usually high (metals are heavy).
Melting Point	Generally have high melting and boiling points.
State	Solid at room temperature (except mercury which is liquid).

Chemical Properties of Metals:

Reaction	Example	Observation
With oxygen	$4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$	Forms metal oxides. Oxides are basic in nature.
With water	$2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2 \uparrow$	Reacts to form metal hydroxide and hydrogen gas.
With acids	$\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2 \uparrow$	Produces hydrogen gas.
Displacement Reaction	$\text{CuSO}_4 + \text{Zn} \rightarrow \text{ZnSO}_4 + \text{Cu}$	More reactive metal displaces a less reactive one from its compound.

3. Non-metals

Common Examples:

- Oxygen (O)
- Carbon (C)
- Sulphur (S)
- Phosphorus (P)
- Nitrogen (N)



Sulphur is a yellow non-metal

Iodine



Carbon



Red Phosphorus



Physical Properties of Non-metals:

Property	Description
Lustre	Generally dull (except iodine which is shiny).
Hardness	Brittle, break easily (non-ductile).
Malleability	Cannot be beaten into sheets.
Ductility	Cannot be drawn into wires.
Conductivity	Poor conductors of heat and electricity (except graphite).
Sonorous	Not sonorous.
Density	Usually low.
Melting Point	Usually low melting and boiling points.

Property	Description
State	Found in all three states: solid (sulphur), liquid (bromine), gas (oxygen).

Chemical Properties of Non-metals:

Reaction	Example	Observation
With oxygen	$S + O_2 \rightarrow SO_2$	Forms non-metal oxides, which are acidic in nature.
With water	Most do not react with water.	Inert with water.
With acids	Non-metals do not react with acids.	No hydrogen gas released.
Displacement	$Cl_2 + 2KI \rightarrow 2KCl + I_2$	More reactive non-metal displaces a less reactive one.

4. Differences between Metals and Non-metals

Feature	Metals	Non-metals
Lustre	Shiny	Dull
Malleability	Malleable	Non-malleable
Ductility	Ductile	Non-ductile
Conductivity	Good conductors	Poor conductors (except graphite)
Reaction with acids	Release hydrogen gas	No reaction
State	Mostly solids	Solids, liquids, or gases
Sonorous	Yes	No
Nature of oxides	Basic or amphoteric	Acidic

5. Uses of Metals

- **Iron** – used in construction, machinery, and tools.
- **Aluminium** – used in aircraft, utensils, foils.
- **Copper** – used in electrical wiring and coins.
- **Gold and Silver** – used in jewellery and coins.
- **Zinc** – used in galvanising iron to prevent rusting.

6. Uses of Non-metals

- **Oxygen** – essential for respiration and combustion.
- **Nitrogen** – used in fertilisers and food packaging.
- **Carbon** – used in fuel (coal), and graphite in pencils.
- **Sulphur** – used in medicines and sulphuric acid.
- **Chlorine** – used in water purification.

7. Alloys

- **Definition:** An alloy is a homogeneous mixture of two or more metals, or a metal and a non-metal.

- **Examples:**

- **Brass** = Copper + Zinc
- **Bronze** = Copper + Tin
- **Steel** = Iron + Carbon
- **Solder** = Lead + Tin

Alloys are made to improve properties like strength, resistance to rust, and durability.

8. Displacement Reactions (Reactivity Series Concept)

- **More reactive metals** can **displace** less reactive metals from their compounds.
- Example:
 - **Zinc + Copper Sulphate → Zinc Sulphate + Copper**
 - Here, zinc is more reactive than copper.

9. Conservation of Resources

- **Metals are non-renewable** resources.
- Should be used wisely and **recycled**.
- **Mining** of metals affects the environment (deforestation, pollution).
- Using **eco-friendly alternatives** and reducing **metal waste** helps protect nature.

Important Key Terms

- **Malleable:** Can be hammered into thin sheets.
- **Ductile:** Can be drawn into wires.
- **Sonorous:** Produces a ringing sound.
- **Lustre:** Shine on the surface.
- **Reactivity:** Tendency to undergo chemical reactions.
- **Oxides:** Compounds formed with oxygen.
- **Displacement Reaction:** A chemical reaction where a more reactive element displaces a less reactive one from a compound.

Fun Fact

- **Mercury** is the **only metal** that is **liquid at room temperature**.
- **Graphite**, a form of carbon (non-metal), conducts electricity!

Worksheet: The World of Metals and Non-metals

* SECTION A: Multiple Choice Questions (15 × 1 = 15 Marks)

- Which of the following is a good conductor of electricity?
 - Sulphur
 - Carbon
 - Copper
 - Phosphorus
- Which metal is liquid at room temperature?
 - Zinc
 - Mercury
 - Aluminium
 - Iron
- Which non-metal is used in water purification?
 - Sulphur
 - Chlorine
 - Nitrogen
 - Phosphorus
- Which of these metals is the most malleable?
 - Iron
 - Gold
 - Copper
 - Aluminium
- Which one is NOT a property of metals?
 - Ductile
 - Malleable
 - Brittle
 - Sonorous
- The property of metals to be drawn into wires is called:
 - Malleability
 - Ductility
 - Sonority
 - Conductivity
- Which of the following is a non-metal?
 - Sodium
 - Magnesium
 - Phosphorus
 - Zinc
- What happens when zinc reacts with dilute hydrochloric acid?
 - Nothing
 - Oxygen is released

- c) Zinc chloride and hydrogen gas are formed
d) Water is formed
9. Graphite is a:
a) Metal
b) Non-metal
c) Alloy
d) Metalloid
10. Non-metal oxides are generally:
a) Basic
b) Neutral
c) Acidic
d) Amphoteric
11. Which metal is used in making electrical wires?
a) Silver
b) Copper
c) Aluminium
d) Both b and c
12. The non-metal essential for combustion is:
a) Nitrogen
b) Oxygen
c) Chlorine
d) Carbon
13. An example of a displacement reaction is:
a) $\text{NaCl} + \text{H}_2\text{O} \rightarrow \text{NaOH} + \text{HCl}$
b) $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$
c) $\text{Fe} + \text{H}_2\text{O} \rightarrow \text{Fe}_2\text{O}_3$
d) $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
14. Which one is used for galvanising iron to prevent rusting?
a) Silver
b) Copper
c) Zinc
d) Lead
15. Which alloy contains iron and carbon?
a) Bronze
b) Brass
c) Steel
d) Solder



SECTION B: Fill in the Blanks ($10 \times 1 = 10$ Marks)

1. The only metal that is liquid at room temperature is _____.
2. Non-metals are generally _____ conductors of electricity.

3. A _____ is a mixture of metals or a metal and a non-metal.
4. Metals react with acids to produce _____ gas.
5. The metal used to make cooking utensils is _____.
6. _____ is the only non-metal that can conduct electricity.
7. _____ and _____ are the two soft metals that can be cut with a knife.
8. Non-metals like _____ are essential for life processes like respiration.
9. Oxides of metals are _____ in nature.
10. The metal used in the outer body of airplanes is _____.

SECTION C: True or False ($10 \times 1 = 10$ Marks)

1. Metals are sonorous.
2. Sulphur is a metal.
3. All metals are good conductors of electricity.
4. Gold is the most ductile metal.
5. Non-metals are malleable and ductile.
6. Metals react with acids to produce hydrogen gas.
7. Alloys are pure elements.
8. Graphite is a conductor of electricity.
9. Non-metals are always found in the solid state.
10. Mercury is the only non-metal that is liquid at room temperature.

SECTION D: Very Short Answer Questions ($15 \times 1 = 15$ Marks)

1. Name a metal used in electrical wires.
2. Name a non-metal used in water purification.
3. Define ductility.
4. Define malleability.
5. What is an alloy?
6. Name two non-metals.
7. Name two metals.

8. What gas is released when a metal reacts with acid?
9. Which metal is soft and can be cut with a knife?
10. What type of oxides are formed by non-metals?
11. Give one use of sulphur.
12. Write the chemical symbol of iron.
13. Which metal is used for galvanisation?
14. Name one sonorous material.
15. Which non-metal is used in making fertilisers?



SECTION E: Short Answer Questions (10 × 3 = 30 Marks)

1. List any three physical properties of metals.
2. Why are metals used for making cooking utensils?
3. What are displacement reactions? Give one example.
4. Mention three uses of non-metals.
5. Write any three differences between metals and non-metals.
6. Why is graphite an exception among non-metals?
7. What is the nature of metal oxides and non-metal oxides?
8. Write a short note on alloys with examples.
9. Explain with a reaction: metal + acid → salt + hydrogen.
10. Why is oxygen important for respiration?



SECTION F: Long Answer Questions (10 × 5 = 50 Marks)

1. Define metals and non-metals. Write 5 differences between them.
2. Explain the physical properties of metals with suitable examples.
3. What are the chemical properties of metals? Explain with reactions.
4. Describe the uses of metals in daily life.
5. List and explain the uses of five important non-metals.
6. What are alloys? Write about three commonly used alloys and their components.
7. What is reactivity? Explain the displacement reaction with an example.

8. Why should metals be conserved? How can we reduce metal wastage?
9. Describe an experiment to show reaction of zinc with hydrochloric acid.
10. Write a short note on the role of metals and non-metals in industries.



SECTION G: Case-Based Studies (5 × 5 = 25 Marks)



Case Study 1

Neha saw her mother using an aluminium pan to cook food. She noticed that the pan heated up quickly.

Questions:

- a) Why is aluminium used for making cooking utensils?
- b) What property of aluminium is shown here?
- c) Is aluminium a metal or a non-metal?
- d) Name two other metals used in utensils.
- e) What are the physical properties of metals shown in this example?



Case Study 2

Ravi conducted an experiment where he dropped zinc granules into a test tube containing copper sulphate. After some time, a brown deposit was seen.

Questions:

- a) What is this type of reaction called?
- b) What does the brown deposit indicate?
- c) Write the word equation for this reaction.
- d) Which metal is more reactive in this case?
- e) What is the principle behind displacement reactions?



Case Study 3

Priya's father is a jeweller. She noticed that gold is often mixed with copper to make jewellery stronger.

Questions:

- a) What is the mixture of gold and copper called?
- b) Why is pure gold not used alone in jewellery?
- c) What is an alloy?
- d) Give two examples of other alloys.
- e) What are the advantages of alloys?



Case Study 4

During science class, the teacher demonstrated how iron nails rust when left in water and air.

Questions:

- a) What is the process called?
 - b) Which metal was used?
 - c) How can rusting be prevented?
 - d) What is galvanisation?
 - e) Which metal is commonly used for galvanisation?
-

 Case Study 5

At a science fair, a student showed that graphite from a pencil can light up a bulb in a simple circuit.

Questions:

- a) What element is graphite made of?
 - b) Is graphite a metal or non-metal?
 - c) Why is graphite used in circuits despite being a non-metal?
 - d) Name another conductor of electricity.
 - e) What does this experiment prove about graphite?
-



Detailed solutions

✓ SECTION A: Multiple Choice Questions – Answer Key with Explanations

1. **c) Copper**
◆ *Copper is a good conductor of electricity and widely used in electrical wiring.*
2. **b) Mercury**
◆ *Mercury is the only metal that remains in liquid state at room temperature.*
3. **b) Chlorine**
◆ *Chlorine is a non-metal used for disinfecting water during purification.*
4. **b) Gold**
◆ *Gold is highly malleable and can be beaten into very thin sheets.*
5. **c) Brittle**
◆ *Brittleness is a property of non-metals, not metals.*
6. **b) Ductility**
◆ *Ductility refers to the ability of a metal to be drawn into thin wires.*
7. **c) Phosphorus**
◆ *Phosphorus is a non-metal; sodium, magnesium, and zinc are metals.*
8. **c) Zinc chloride and hydrogen gas are formed**
◆ *Zinc reacts with dilute HCl to form zinc chloride + hydrogen gas.*
9. **b) Non-metal**
◆ *Graphite is a non-metal (form of carbon) that conducts electricity.*
10. **c) Acidic**
◆ *Non-metal oxides generally form acids in water, so they are acidic.*
11. **d) Both b and c**
◆ *Copper and aluminium are both used in making wires due to high conductivity.*
12. **b) Oxygen**
◆ *Oxygen is a non-metal essential for combustion and respiration.*
13. **b) $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$**
◆ *This is a displacement reaction where zinc displaces copper.*
14. **c) Zinc**
◆ *Galvanisation is done using zinc to protect iron from rusting.*
15. **c) Steel**
◆ *Steel is an alloy made of iron and carbon.*



SECTION B: Fill in the Blanks (10 × 1 = 10 Marks)

1. **Mercury**

◆ The only metal that is liquid at room temperature is mercury.

2. **poor**

◆ Non-metals are generally poor conductors of electricity, with the exception of graphite.

3. **alloy**

◆ An alloy is a mixture of metals or a metal and a non-metal.

4. **hydrogen**

◆ Metals react with acids to produce hydrogen gas.

5. **aluminium**

◆ Aluminium is used to make cooking utensils due to its good conductivity and resistance to corrosion.

6. **graphite**

◆ Graphite is the only non-metal that can conduct electricity.

7. **sodium and potassium**

◆ These are very soft metals and can be cut with a knife.

8. **oxygen**

◆ Oxygen is essential for respiration in living organisms.

9. **basic**

◆ Oxides of metals are basic in nature (e.g., magnesium oxide).

10. **aluminium**

◆ Aluminium is light and strong, so it is used in the outer body of airplanes.



SECTION C: True or False (10 × 1 = 10 Marks)

1. **True**

◆ Metals are sonorous—they produce a ringing sound when struck.

2. **False**

◆ Sulphur is a **non-metal**, not a metal.

3. **False**

◆ Most metals are good conductors, but not **all**. For example, lead is a poor conductor.

4. **True**

◆ Gold is the most ductile metal—it can be drawn into very thin wires.

5. **False**

◆ Non-metals are generally **not** malleable or ductile; they are brittle.

6. **True**
◆ Metals react with acids to produce hydrogen gas and a salt.
7. **False**
◆ Alloys are **mixtures** of metals or metals and non-metals, not pure elements.
8. **True**
◆ Graphite, a form of carbon (non-metal), conducts electricity due to free electrons.
9. **False**
◆ Non-metals can be found in all three states: solid (sulphur), liquid (bromine), and gas (oxygen).
10. **False**
◆ Mercury is a **metal**, and it is the only metal that is liquid at room temperature.

SECTION D: Very Short Answer Questions (15 × 1 = 15 Marks)

1. **Name a metal used in electrical wires.**
➤ Copper
◆ Because it is a very good conductor of electricity.
2. **Name a non-metal used in water purification.**
➤ Chlorine
◆ Used to kill germs in drinking water.
3. **Define ductility.**
➤ The property of a metal to be drawn into thin wires.
4. **Define malleability.**
➤ The property of metals to be hammered into thin sheets without breaking.
5. **What is an alloy?**
➤ A mixture of two or more elements, at least one of which is a metal.
6. **Name two non-metals.**
➤ Oxygen and Sulphur
7. **Name two metals.**
➤ Iron and Aluminium
8. **What gas is released when a metal reacts with acid?**
➤ Hydrogen gas
9. **Which metal is soft and can be cut with a knife?**
➤ Sodium (also Potassium)
10. **What type of oxides are formed by non-metals?**
➤ Acidic oxides

11. Give one use of sulphur.

➤ Used in making medicines and firecrackers.

12. Write the chemical symbol of iron.

➤ Fe

13. Which metal is used for galvanisation?

➤ Zinc

14. Name one sonorous material.

➤ Copper

◆ It produces a ringing sound when hit.

15. Which non-metal is used in making fertilisers?

➤ Nitrogen



SECTION E: Short Answer Questions (10 × 3 = 30 Marks)

1. List any three physical properties of metals.

Answer:

Metals have several important physical properties. Three of them are:

- **Malleability:** Metals like aluminium and gold can be hammered into thin sheets without breaking.
- **Ductility:** Metals such as copper can be drawn into wires.
- **Conductivity:** Metals like silver and copper are excellent conductors of heat and electricity.

2. Why are metals used for making cooking utensils?

Answer:

Metals are used in cooking utensils because:

- They are **good conductors of heat**, which helps food cook evenly.
- They are **strong and durable**, lasting longer than other materials.
- Metals like aluminium and stainless steel do not react easily with food and are **resistant to corrosion**.

3. What are displacement reactions? Give one example.

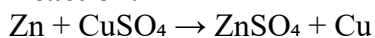
Answer:

A **displacement reaction** is a chemical reaction in which a more reactive metal displaces a less reactive metal from its compound.

Example:

Zinc + Copper Sulphate $\rightarrow$ Zinc Sulphate + Copper

Reaction:



Here, zinc (more reactive) displaces copper from copper sulphate.

4. Mention three uses of non-metals.

Answer:

- **Oxygen** is essential for breathing and combustion.
 - **Chlorine** is used to purify water.
 - **Sulphur** is used in making medicines, explosives, and rubber.
-

5. Write any three differences between metals and non-metals.

Answer:

Property	Metals	Non-metals
Appearance	Lustrous (shiny)	Dull (except iodine)
Conductivity	Good conductors	Poor conductors (except graphite)
Malleability	Malleable	Brittle

6. Why is graphite an exception among non-metals?

Answer:

Graphite is a **non-metal** but behaves like a metal in one way:

- It **conducts electricity** due to the presence of free electrons.
This makes it an exception among non-metals, which usually do not conduct electricity.
-

7. What is the nature of metal oxides and non-metal oxides?

Answer:

- **Metal oxides** are **basic** in nature. Example: Magnesium oxide (MgO) turns red litmus blue.
 - **Non-metal oxides** are **acidic** in nature. Example: Carbon dioxide (CO₂) forms carbonic acid in water.
Thus, they show different chemical behaviors in reactions.
-

8. Write a short note on alloys with examples.

Answer:

- **Alloys** are mixtures of metals with other metals or non-metals.
- They are made to improve strength, hardness, resistance to corrosion, etc.

Examples:

- **Brass** = Copper + Zinc
- **Bronze** = Copper + Tin
- **Steel** = Iron + Carbon

Alloys are widely used in machinery, buildings, tools, and even jewellery.

9. Explain with a reaction: metal + acid → salt + hydrogen.

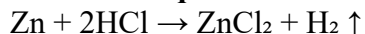
Answer:

When a metal reacts with an acid, it forms a **salt and hydrogen gas**.

Example Reaction:

Zinc + Hydrochloric Acid → Zinc Chloride + Hydrogen

Chemical Equation:



This reaction shows **effervescence** due to the release of hydrogen gas.

10. Why is oxygen important for respiration?

Answer:

- Oxygen is a **non-metal** that supports life.
- It is essential in the process of **respiration**, where it helps **release energy** from food inside the body's cells.
- Without oxygen, the **cells cannot perform their functions**, and life would not be possible.

SECTION F: Long Answer Questions (10 × 5 = 50 Marks)

1. Define metals and non-metals. Write 5 differences between them.

Answer:

- **Metals** are elements that are generally **hard, shiny, malleable, ductile, and good conductors** of heat and electricity.
Example: Iron, Copper, Aluminium
- **Non-metals** are elements that are generally **brittle, dull, and poor conductors** of heat and electricity.
Example: Sulphur, Oxygen, Phosphorus

Differences between Metals and Non-metals:

Property	Metals	Non-metals
1. Appearance	Shiny (lustrous)	Dull (except iodine)
2. Conductivity	Good conductors	Poor conductors (except graphite)
3. Malleability	Malleable (can be hammered)	Brittle (break easily)
4. Ductility	Ductile (can be drawn into wires)	Not ductile
5. State	Mostly solid (except mercury)	Can be solid, liquid, or gas

2. Explain the physical properties of metals with suitable examples.

Answer:

Metals have several physical properties that make them useful in daily life:

1. **Lustrous:** Metals have a shiny appearance (e.g., gold, silver).
2. **Malleable:** Metals can be hammered into thin sheets (e.g., aluminium foil).
3. **Ductile:** Metals can be drawn into wires (e.g., copper wires).
4. **Conductors:** Metals conduct heat and electricity well (e.g., iron, copper).
5. **Sonorous:** Metals produce a ringing sound when struck (e.g., bells made of bronze).
6. **High melting and boiling point:** Metals like iron melt at very high temperatures.

These properties make metals suitable for use in cooking utensils, machinery, wires, etc.

3. What are the chemical properties of metals? Explain with reactions.

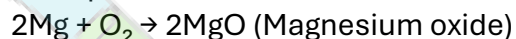
Answer:

Chemical properties of metals include:

1. Reaction with Oxygen:

Metals react with oxygen to form basic metal oxides.

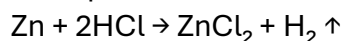
Example:



2. Reaction with Acids:

Metals react with dilute acids to form salt and hydrogen gas.

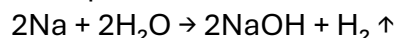
Example:



3. Reaction with Water:

Some metals react with water to form hydroxides and release hydrogen.

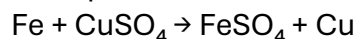
Example:



4. Displacement Reaction:

A more reactive metal displaces a less reactive metal.

Example:



These reactions help understand the reactivity of metals.

4. Describe the uses of metals in daily life.

Answer:

Metals play an important role in everyday life:

1. **Cooking utensils:** Aluminium and stainless steel are used due to heat conductivity.
2. **Electrical wires:** Copper and aluminium are good conductors.
3. **Construction:** Iron and steel are used in buildings, bridges, etc.
4. **Transport:** Metals like aluminium and iron are used in cars, trains, and airplanes.
5. **Jewellery:** Gold, silver, and platinum are used for ornaments.
6. **Tools and machines:** Made from hard metals like iron and chromium.

Thus, metals are essential in industries, homes, and infrastructure.

5. List and explain the uses of five important non-metals.

Answer:

1. **Oxygen:**
 - Essential for respiration and combustion.
2. **Chlorine:**
 - Used to disinfect drinking water and swimming pools.
3. **Sulphur:**
 - Used in making medicines, gunpowder, and rubber.
4. **Nitrogen:**
 - Used in fertilizers to improve soil fertility and in packaging to preserve food.
5. **Carbon (Graphite):**
 - Used in making pencils and as an electrode in batteries.

These uses make non-metals equally important as metals.

6. What are alloys? Write about three commonly used alloys and their components.

Answer:

- **Alloys** are mixtures of two or more elements, where at least one is a metal.

- Alloys are made to improve properties like **strength, hardness, and corrosion resistance**.

Examples of Alloys:

Alloy	Composition	Use
Steel	Iron + Carbon	Construction, tools, machines
Brass	Copper + Zinc	Musical instruments, hardware
Bronze	Copper + Tin	Statues, medals, coins

Alloys are better than pure metals in many applications.

7. What is reactivity? Explain the displacement reaction with an example.

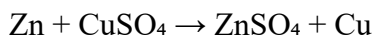
Answer:

- Reactivity** refers to how easily an element reacts with other substances.
- Metals are arranged in the **reactivity series** from most to least reactive.

Displacement Reaction Example:

A more reactive metal can displace a less reactive metal from its compound.

Reaction:



Zinc is more reactive than copper, so it replaces copper from copper sulphate.

This property is used in extracting metals and other applications.

8. Why should metals be conserved? How can we reduce metal wastage?

Answer:

Reasons to conserve metals:

- Metals are **non-renewable** natural resources.
- Extraction causes **pollution and environmental damage**.
- Some metals like copper and zinc are becoming **scarce**.

Ways to reduce metal wastage:

- Recycling** used metal products (e.g., old wires, cans).
- Using alloys** that are more durable and long-lasting.
- Avoiding wastage** during construction and manufacturing.
- Using alternative materials** where possible.

Conserving metals ensures sustainability for future generations.

9. Describe an experiment to show reaction of zinc with hydrochloric acid.

Answer:

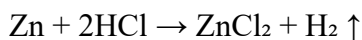
Materials:

- Test tube
- Zinc granules
- Dilute hydrochloric acid
- Test tube holder
- Matchstick

Procedure:

1. Take some zinc granules in a test tube.
2. Add dilute hydrochloric acid (HCl) to it.
3. You will see **bubbles (effervescence)**—hydrogen gas is released.
4. Bring a burning matchstick near the mouth of the test tube.
5. You will hear a '**pop**' **sound**, confirming hydrogen gas.

Reaction:



This shows how metals react with acids to produce hydrogen gas.

10. Write a short note on the role of metals and non-metals in industries.

Answer:

Metals in industries:

- **Iron and Steel:** Used in construction, tools, bridges, vehicles.
- **Aluminium:** Used in airplanes, kitchenware, packaging.
- **Copper:** Used in electrical equipment and wiring.

Non-metals in industries:

- **Oxygen:** Used in steel manufacturing and medical uses.
- **Chlorine:** Used in making plastics (like PVC).
- **Sulphur:** Used in rubber and chemical industries.
- **Nitrogen:** Used in fertilizers and food preservation.

Both metals and non-metals are vital for **technological development and economy**.



SECTION G: Case-Based Studies (5 × 5 = 25 Marks)



Case Study 1

Neha saw her mother using an aluminium pan to cook food. She noticed that the pan heated up quickly.

Questions & Answers:

a) Why is aluminium used for making cooking utensils?

👉 Aluminium is used for making cooking utensils because it is a **good conductor of heat**, meaning it allows heat to pass through it quickly. This helps cook food faster and more efficiently.

b) What property of aluminium is shown here?

👉 The property shown is **thermal conductivity** — aluminium allows heat to flow through it easily.

c) Is aluminium a metal or a non-metal?

👉 Aluminium is a **metal**.

d) Name two other metals used in utensils.

👉 Two other metals are:

- **Stainless steel** (an alloy of iron, chromium, and nickel)
- **Copper** (used in the base of some pans for better heat distribution)

e) What are the physical properties of metals shown in this example?

👉 The following physical properties are highlighted:

- **Good conductor of heat**
- **Lustrous (shiny)**
- **Malleable (can be shaped into pans)**
- **Durable and corrosion-resistant**



Case Study 2

Ravi conducted an experiment where he dropped zinc granules into a test tube containing copper sulphate. After some time, a brown deposit was seen.

Questions & Answers:

a) What is this type of reaction called?

👉 This is called a **displacement reaction** — a more reactive metal replaces a less reactive one from its salt solution.

b) What does the brown deposit indicate?

👉 The brown deposit is **copper metal**. It forms because **zinc displaces copper** from copper sulphate.

c) Write the word equation for this reaction.

☞ Zinc + Copper sulphate → Zinc sulphate + Copper
($\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$)

d) Which metal is more reactive in this case?

☞ **Zinc** is more reactive than copper. That's why it displaces copper.

e) What is the principle behind displacement reactions?

☞ A **more reactive metal** can displace a **less reactive metal** from its compound. This shows the **reactivity series** of metals in action.

Case Study 3

Priya's father is a jeweller. She noticed that gold is often mixed with copper to make jewellery stronger.

Questions & Answers:

a) What is the mixture of gold and copper called?

☞ It is an **alloy** of gold and copper.

b) Why is pure gold not used alone in jewellery?

☞ Pure gold is **very soft** and can bend or get scratched easily. Mixing it with copper makes it **harder and more durable**.

c) What is an alloy?

☞ An **alloy** is a **mixture of two or more elements**, where at least one is a metal. Alloys are made to improve the strength, hardness, or corrosion resistance of metals.

d) Give two examples of other alloys.



1. **Brass** – Copper + Zinc

2. **Steel** – Iron + Carbon

e) What are the advantages of alloys?

☞ Alloys:

- Are **stronger** than pure metals
- **Resist corrosion** better
- Have **better appearance** and **durability**
- Are **suitable for specific uses** like making jewellery, tools, machines, etc.

Case Study 4

During science class, the teacher demonstrated how iron nails rust when left in water and air.

Questions & Answers:

a) What is the process called?

👉 The process is called **rusting** — it is a chemical reaction where **iron reacts with water and oxygen** to form iron oxide (rust).

b) Which metal was used?

👉 Iron was used.

c) How can rusting be prevented?

👉 Rusting can be prevented by:

- **Painting** the metal surface
- **Oiling or greasing**
- **Galvanisation** (coating iron with zinc)
- **Using stainless steel**

d) What is galvanisation?

👉 **Galvanisation** is the process of **coating iron with a layer of zinc** to protect it from rusting.

e) Which metal is commonly used for galvanisation?

👉 **Zinc** is used for galvanisation because it prevents air and moisture from coming in contact with iron.

Case Study 5

At a science fair, a student showed that graphite from a pencil can light up a bulb in a simple circuit.

Questions & Answers:

a) What element is graphite made of?

👉 Graphite is made of **carbon**.

b) Is graphite a metal or non-metal?

👉 Graphite is a **non-metal**.

c) Why is graphite used in circuits despite being a non-metal?

👉 Unlike most non-metals, graphite can **conduct electricity** because its carbon atoms are arranged in a way that allows **free movement of electrons**.

d) Name another conductor of electricity.

👉 **Copper** is a very good conductor of electricity and is commonly used in wires.

e) What does this experiment prove about graphite?

👉 It proves that **graphite is an exception** among non-metals — it conducts electricity like metals due to its special structure.
