



Chapter 6

Metals and Non-metals

Chapter Objectives

In this chapter, you will learn about:

- ◆ Differences between the properties of metals and non-metals
- ◆ Some important metals and non-metals
- ◆ Corrosion of iron and ways to prevent it
- ◆ Uses of different metals and non-metals
- ◆ Metalloids and their properties

We have read in the previous class that elements are a pure form of matter. What are elements made of? What are the impure forms of matter? What do you think are metals?

INTRODUCTION

Chemistry plays a very important role in improving the quality of human life. Many materials, such as metals, medicines, textiles, soaps and glass, that we use daily are developed through the application of chemistry. Metals have been used by people since ancient times. Gold and silver found in the free state were beaten into useful decorative shapes at around 4000–6000 BCE. These metals were known in the **Stone Age**. One of the first useful metal to be made was bronze. Bronze was used extensively for making tools and weapons in Asia and Africa from 4500 BCE which began the **Bronze age**. By 2000 BCE, iron was extracted from its ore by heating. This period was known as **Iron Age**.

Materials like sand and lime were in use from that time. People also knew how to extract dyes from flowers and other plant parts. Later, people learned the usage of materials around them by using the methods and principles of chemistry to build shelters, make medicines and invent advanced means of transportation, etc., to make life more comfortable. Now, if you look around in your house, many things like toothpaste, detergent, soaps, clothes, medicines are all gifts of chemistry.

On the basis of their properties and nature, the elements can be classified into metals, non-metals and **metalloids**.

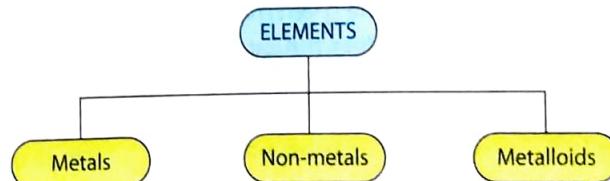


Fig. 6.1 Classification of elements

In this chapter, you will learn about the properties and uses of metals and non-metals and their compounds.

Teaching Tip: The chapter can also be introduced by asking questions about the periodic table.

METALS AND NON-METALS

Aluminium and iron are the most abundant metals in the Earth's crust. The most abundant non-metal in the Earth's crust is oxygen followed by silicon. Some metals occur free in nature. For example, gold, silver and platinum are found in the free state in the Earth's crust. Many metals are

reactive and combine with non-metals to form oxides, hydroxides, carbonates, sulphides, etc.

Metals and non-metals show different properties. There are some exceptions as well. Let us see the comparison of general properties of metals and non-metals in the Table 6.1, and understand the properties and the exceptions that exist among them.

Table 6.1 Comparison of general properties of metals and non-metals

Property	Metals	Non-metals
Physical state	Most metals are solid at room temperature, except mercury which is a liquid.	Non-metals are either solids or gases at room temperature except bromine, which is a liquid.
Strength	Most of the metals are hard and strong, except sodium and potassium that are soft and can be cut with a knife.	Most non-metals are not very strong, except diamond which is an allotrope of carbon and is the hardest substance known.
Lustre	All metals have lustre. For example, copper, gold, etc.	All non-metals are dull except iodine and graphite.
Malleability	All metals are highly malleable except zinc, antimony and arsenic.	They are non-malleable and brittle, except crystals of iodine.
Ductility	Metals are ductile except zinc, arsenic and antimony.	They are non-ductile and break on stretching.
Conductivity	Metals are good conductors of heat and electricity. Examples are copper, aluminium, etc.	They are bad conductors of heat and electricity except graphite.
Sonority	Sonorous	Non-sonorous
Melting and boiling points	Metals have high melting and boiling points. Tungsten has the highest melting point.	They have low melting and boiling points.
Tensile strength	Metals are highly tensile. Some examples of metals with high tensile strength are iron, copper, aluminium, etc.	Low tensile strength except carbon fibres.

ACTION TIME - 1

Aim: To examine the properties of metals and non-metals.

Materials required: iron nail, a piece of coal, aluminium wire, copper wire, pencil lead, hammer

Procedure: Take the given materials one by one and complete the table. You can take more objects and add rows to complete the table.

Object	Beaten to sheet with hammer	Produces sound on dropping	Has lustre	Metal/Non-metal
Iron nail				
Coal piece				
Aluminium wire				
Copper wire				
Pencil lead				

ACTION TIME 2

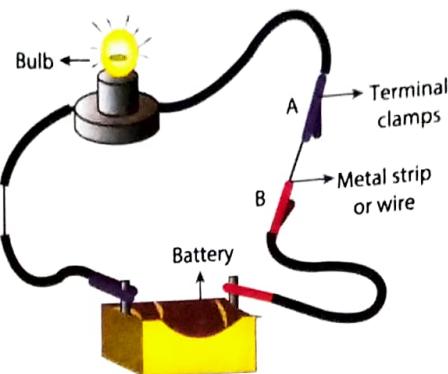
Aim: To check electrical conductivity of different materials.

Materials required: wires, a dry cell or battery, torch bulb, metal crocodile clips, wooden stick, safety pin, plastic spoon, metal key, a cardboard strip, a plastic ruler, a metal ruler

Procedure: Set up an electric circuit using the wires, metal clips, torch bulb, etc., as shown in the figure.

Now, use the different materials, in place of the metal strip, and check whether electricity flows through them or not.

(Hint: If the bulb glows, it means that object is a good conductor of electricity.)



Object	Bulb glows/ does not glow	Conductor	Non-conductor	Metal/Non- metal
Wooden stick				
Safety pin				
Plastic spoon				
Metal key				
Plastic ruler				
Metal ruler				
Cardboard strip				

Conclusion: The substances that conduct electricity are metals and the substances that do not conduct electricity are non-metals.

(Note: The activity must be performed under teacher's supervision.)

Uses of Some Common Metals

Silver

Silver is a bright and shiny metal. It is chemically unreactive. When silver reacts with sulphur and oxygen in the air, it changes to blackish or grayish in colour. This is due to the **oxidation** of metal.

- Silver is used in making ornaments and silverware.
- Silver paste is used to make solar panels.
- It is also used for making mirrors.



a. Silver coins



b. Silver ornaments

Fig. 6.2 Some of the uses of silver

- It is used in making electric circuits because it is a good conductor of heat and electricity.
- Silver is used in bandages and dressings to prevent infections.
- Silver is used in electroplating metal articles to prevent **corrosion**.
- Silver is also used in making silver coins.

Gold

Gold is a precious metal. It is extremely malleable, and conducts electricity.



a. Jewellery



b. Orthodontic

Fig. 6.3 Some of the uses of gold

- The primary use of gold is to make ornamental objects, jewellery and coins.
- Gold is used in the manufacture of electronic equipments because it is corrosion-resistant and is a good conductor of electricity.
- Gold alloys are used for dental fillings, crowns, bridges and orthodontic **appliance** because it is chemically inert, non-allergic and easy for dentists to work on.
- Iron is very common in many different tools, surgical equipment, and appliances.
- Iron-based compounds are very useful in many ways. Iron chloride is used in treating sewage system. It is also used in dyes for clothes, colouring agent for paints, manufacturing printed circuit boards, and an additive in animal feed.
- Ferrous sulphate is used to treat anaemia or iron deficiency.
- Iron hydroxide nano particles are employed for waste water purification.

Platinum

Platinum is a shiny, silvery-white metal. It is resistant to corrosion. Just like gold, platinum is also a very precious metal. It is chemically inactive and resistant to heat.

- Platinum is widely used for making jewellery.
- It is also used in making optical fibres and LCDs, turbine blades, spark plugs, **pacemakers** and dental fillings.
- Platinum-based compounds are used as chemotherapy drugs to treat cancers.
- Platinum is also used in electronics industry for manufacturing computer hard disks and **thermocouples**.
- Platinum is used in the chemical industry as a catalyst for the production of nitric acid, silicone and benzene.

Iron

Iron is the most common metal on the surface of the Earth. It has been used since ancient times. Iron gets rusted in the presence of moist air. It is malleable and ductile. Iron has many uses in industry, and is also present in the blood in the human body.

- Iron is used in manufacturing machine tools, automobiles, hulls of large ships, machine parts and even building parts.

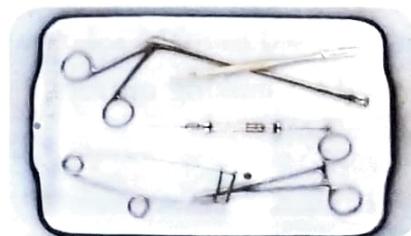
Appliance: A device or equipment designed to perform a specific task
Thermocouples: A kind of thermometer



a. Building construction



b. Bridge construction



a. Surgical equipment

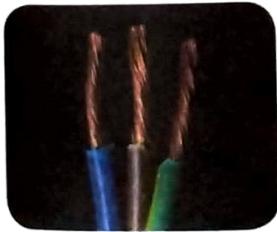
Fig. 6.4 Different uses of iron

Iron is used in buildings, bridges, skyscrapers, other types of constructions.

Copper

Copper is a reddish-brown metal. It is highly ductile, malleable and a good conductor of heat and electricity. Some of the uses of copper are given here:

- Copper does not corrode. Hence, it is used in pipes, electrical cables, saucepans and radiators.
- Copper can be joined easily by soldering or brazing. This property makes copper useful for pipework and for making sealed copper vessels.
- Copper is used in manufacturing military applications.
- Copper and its alloys, such as brass, are used for making jewellery and ornaments.
- Copper is used in manufacturing electrical equipments such as wiring and motors, in construction and in industrial machinery.
- Copper sulphate is used widely as an agricultural poison and as an algaecide in water purification.
- Copper compounds, such as Fehling's solution, are used in chemical tests for sugar detection.



a. Electrical wiring



b. Saucepans



c. Jewellery



d. Copper coins

Fig. 6.5 Some of the uses of copper

Skyscraper: A very tall building of many stories | **Tinge:** Colour slightly

Algaecide: Used to prevent the growth of algae

Zinc

Zinc is a silvery-white metal with a blue tinge. It tarnishes in air. It is not very malleable or ductile. It is brittle. Some of the uses of zinc are:

- Zinc is used to galvanise other metals, such as iron and steel, to prevent rusting.



a. Batteries



b. Nuts and bolts

Fig. 6.6 Some of the uses of zinc

INFO HUB

Galvanisation is the process of deposition of a thin layer of zinc over the surface of iron and steel objects.

- Zinc oxide is widely used in manufacturing paints, rubber, cosmetics, pharmaceuticals, plastics, inks, soaps, batteries, textiles and electrical equipment.
- Zinc is important for health. It is a necessary element for the proper growth and development of humans, animals and plants.
- Zinc is used to make the negative electrode of dry cells.
- Zinc is used to make alloys like brass and German silver.

Tin

Tin is a silvery-white metal. It is lightweight, ductile, malleable, durable and a soft metal.



Fig. 6.7 Tin-plated containers

- Tin is typically used in alloying with other metals (that is, alloying tin with copper to form bronze).
- Tin is used for making an alloy, solder, which is used in joining electric circuits, pipes, etc.
- Tin is used for coating lead, zinc and steel to prevent corrosion. Tin-plated steel containers are used for food preservation.

Aluminium

Aluminium is a silvery-white, lightweight metal. It is one of the most abundant metal found in the Earth's crust. It is soft, malleable and a good conductor of heat and electricity.

- Aluminium is used in making a variety of products including cans, foils, kitchen utensils, window frames and airplane parts.
- Aluminium is a good conductor of heat and is often used in the manufacture of cookers, boilers and cookware.
- It is used in door knobs, doors and kitchen utensils.
- It is used in making furniture. Some sports equipments like golf club head and tennis rackets are also made by using aluminium.
- One of the most popular uses of aluminium is in packaging. Trays, foils, bottle caps and cans are usually made of aluminium. It is also used for thermos, utensil lids and storage boxes.
- Aluminium is lightweight hence, it is ideal for use in power lines and electricity.
- Aluminium is also used in construction. The metal is used in skylights, building bridges, shutters, ladders, railings, doors, wiring, sheets, pipes, and so on.



a. Utensil b. Food wrap/foil

Fig. 6.8 Some uses of aluminium

Lead

Lead is a dull, silvery grey, lustrous metal. It is very soft, highly malleable, ductile and a relatively poor conductor of electricity. It is very resistant to corrosion but **tarnishes** upon exposure to air.

- Lead is a major constituent of the lead-acid battery used in car batteries.
- It is used as colouring element in ceramic glazes.
- It is mainly used in glass of computer and television screens.
- Lead is used in the construction industry for roofing, **cladding**, gutters and **glazing** bars for stained glass.
- Lead is used to make statues and sculptures.

INFO HUB

The English words plumbing, plumber, plumb, and plumb-bob are derived from the Latin word for lead, that is, *Plumbum*.

Subject Connect

Magnesium

Magnesium is a silvery-white metal. It has low density and is a strong metal. This metal burns with a characteristic brilliant-white light.

- Magnesium and its alloys are used in products that benefit from being lightweight, such as car seats, luggage, laptops, cameras and power tools.
- It is also added to the molten iron and steel, to remove sulphur during the making of iron and steel. The process is called **desulphurisation**.

- Magnesium is used in making alloys. These alloys are used in making parts of aircraft, spacecraft, car engine casting missile construction, etc.
- Magnesium hydroxide is added to plastics to make them **fire-retardant**.
- Magnesium oxide is used in making heat-resistant bricks for fireplaces and furnaces.
- It is also added to cattle feed and fertilisers.
- Magnesium hydroxide (milk of magnesia), magnesium sulphate (Epsom salts), chloride and citrate are all used in medicine.
- Magnesium is an essential element both in plant and animal life.

Mercury

Mercury is a dense, silvery-white, poisonous metal with a mirror-like appearance. It is the only metal which is liquid at room temperature. Mercury readily forms alloys (called amalgams) with other metals such as silver, gold and tin.

- Mercury is useful in recovering gold, silver, and platinum from its ores.
- Mercury amalgams are also used in dental fillings.
- Mercury is used in barometers and manometers for measuring the pressure of

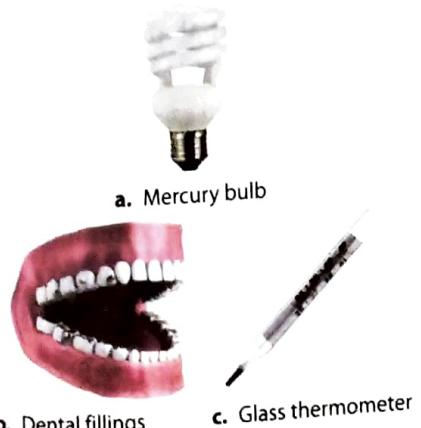


Fig. 6.9 Different uses of mercury

gases and liquids because of its density and fluidity.

- Mercury is widely used in making advertising signs, mercury switches and other electrical appliances.
- It is also used in mercury vapour lamps. These lamps are used for street lighting, as **sunlamps** and as UV lights.

Uses of Some Common Non-Metals

We find the uses of some non-metals in our day-to-day lives. Some uses of non-metals are described below.

Oxygen

Oxygen is necessary to sustain life. It is a colourless, odourless and tasteless gas with the molecular formula O_2 .

Oxygen makes up 21% of the atmosphere by volume.

- Oxygen from the air is essential for respiration, hence, oxygen supplementation is used in medicine.
- Scuba divers** and submariners use artificially delivered oxygen.
- Low pressure pure oxygen is used as breathing gas in space suits.
- Oxygen is essential for all combustion (burning) process.



Fig. 6.10 Oxygen cylinders used by scuba divers and some patients in hospital

Carbon

There are a number of pure forms of carbon including graphite, diamond, **fullerenes** and **graphene**. Diamond is a colourless, transparent, crystalline solid, a good conductor of electricity and the hardest known material. Graphite is black and shiny but soft. The nano-forms, fullerenes and graphene, appear as black or dark brown, soot-like powders. Carbon is commonly used as a fuel.

- **Graphite:** It is used as a **lubricant** in making pencil tips, dry cells and electrodes. It is also used as fuel in power plants to produce electricity.
- **Diamond:** These are used in making jewellery, cutting glass and for drilling and grinding purposes in different industries.
- **Charcoal:** It is obtained by burning of wood in the limited supply of oxygen. It is used as fuel and decolourising agent in industries. Charcoal along with coke (obtained from coal) is used for metal **smelting**.
- Carbon black is used as the black pigment in printing ink.
- Carbon can form alloys with iron, the most common being carbon steel.

Nitrogen

Nitrogen makes up 78% of the air by volume. It is a colourless, odourless and tasteless gas with the molecular formula N_2 . Nitrogen is also present in every living thing on the planet.

- Nitrogen is used to produce nitric acid and ammonia. Ammonia is used for making fertilisers.
- Liquid nitrogen is used as a refrigerant.
- Nitrogen is used in controlling pollution.

- Nitrogen gas is used in food packages and to fill the tyres of aircraft and cars.

INFO HUB

Nitrogen gas is not reactive; it is used in the food processing industry and food packets to prevent its spoilage.

Iodine

Iodine is a bluish-black, lustrous solid under standard conditions. It can sublime into a violet-pink gas. It is slightly soluble in water but dissolves easily in chloroform, carbon tetrachloride, or carbon disulphide to form bright purple solutions. It also exhibits some properties of metal.



a. Salt



b. Tincture of iodine

Fig. 6.11 Some uses of iodine

- Iodine and its compounds are used industrially in the production of acetic acid.
- Iodine is an essential part of nutrition and medicines. Iodide is added in small amounts to table salt, to avoid iodine deficiency which affects the thyroid gland.
- Iodine is used to treat conjunctivitis. It also helps to prevent goitre and many other health problems.
- Potassium iodide is used in photography, and the free element is added to laundry starch solutions.

Fullerenes: A form of carbon having a large molecule | **Graphene:** A one-atom-thick planar sheet of carbon atom. It is the basic structural element of graphic and fullerenes | **Lubricant:** A substance used for lubricating on engine or its parts | **Smelting:** Process of extracting metals from ores, involving heating and melting

Tincture of iodine is a solution of iodine, alcohol and water containing potassium iodide. It is widely used as a disinfectant and antiseptic.

Sulphur

Elemental sulphur is a bright yellow crystalline solid at room temperature.

- Sulphur is used in the **vulcanisation** of black rubber. It is also used in black gunpowder.
- Sulphur is used in manufacturing insecticides.
- Sulphur is used in the production of sulphuric acid.



Fig. 6.12 Sulphur is used to make insecticides

- 'Dusting sulphur' (powdered elemental sulphur) is used in pesticides, insecticides and fungicides.
- Sulphur is used for curing skin diseases.

INFO HUB

Vulcanisation is the process of adding sulphur to rubber to make it stiff and hard.

such as the smell of household bleach. In nature, chlorine is widely distributed over the Earth in the form of the salt (sodium chloride) in sea water.

- The most important use of chlorine is as a water purifier.
- Chlorine is used in manufacturing hydrochloric acid.
- It is used to treat drinking water and swimming pool water.
- Chlorine is also used to make consumer products from paper to paints, and from textiles to insecticides.

Hydrogen

It is a colourless, odourless, tasteless, non-toxic, non-metallic gas with the molecular formula H_2 . It is one of the lightest gas. It is highly inflammable and burns with blue flame.

- It is used in the manufacture of fertilisers.
- It is used in the preparation of vegetable *ghee*.
- It is used in the preparation of ammonia (NH_3) and methanol (CH_3OH).
- It is used as rocket fuel.
- It is seen as a future fuel for automobiles.
- It is used in the preparation of oxy-hydrogen flame, which is used in **welding** because it produces of high temperature.
- Hydrogen is used in filling weather balloons used in weather forecasting.



Fig. 6.13 Hydrogen used as a rocket fuel

Welding: Joining metal parts together by heating | **Vulcanisation:** a process of treating rubber or rubber-like materials with sulphur to improve elasticity and strength, or to harden them

Quick Check 1

Name the following:

1. The hardest non-metal:
2. A metal that can be cut with a knife:
3. A non-metal that is liquid at room temperature:
4. The non-metal necessary for breathing:
5. The non-metal used in the making of pesticides and insecticides:
6. Metal whose layer is deposited over iron during galvanisation:
7. It is used in vulcanisation of rubber:
8. It is used as a rocket fuel:
9. It is used to make pencil lead:
10. A non-metal that is a good conductor of electricity:

powdery coating, called rust, on them. Rust is hydrated iron (III) oxide that is represented as $[Fe_2O_3 \cdot xH_2O]$. The green powdery deposit on copper and bronze is also due to corrosion.

Effects of Corrosion

- It eats away the metal surface and deteriorates its quality.
- It makes the metal objects such as iron rods and machinery weak and dysfunctional, and prone to breakage.



Fig. 6.15 Machine parts covered with rust

CORROSION OF METALS

Most metals react with oxygen and water and form a coating on them losing some of their properties such as lustre and even strength. This process in which metals react with air and water and form a coating of another substance on them is called **corrosion**.

The most common example of corrosion is the formation of rust on iron objects.

Rusting is a process in which objects made of iron react with air and moisture and form a reddish-brown



Fig. 6.14 A screw covered with rust

Factors Affecting Corrosion

The rate of corrosion of a metal is increased by the exposure of the metal to air and water. Let us understand the process of rusting and the factors responsible for it by performing an activity (Action Time 3).

From the activity, we learn that, the conditions necessary for rusting are:

- Presence of air
- Presence of moisture
- Presence of a metal surface or an object

Ways to Prevent Rusting

There are different ways by which rusting can be prevented. Some of them are discussed here.

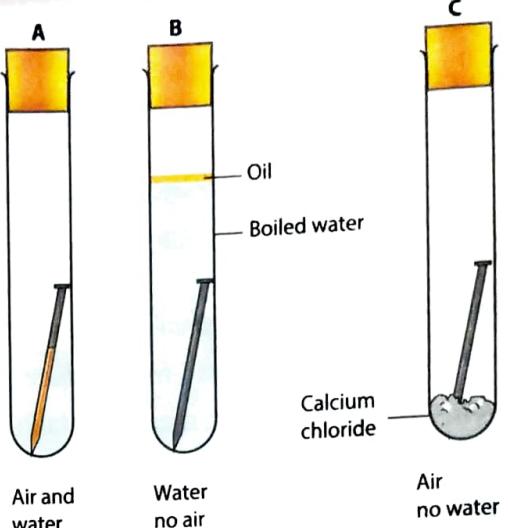
ACTION TIME 3

Aim: To show that air and moisture are necessary for rusting of iron.

Materials required: three iron nails, three test tubes, oil or wax, water, anhydrous calcium chloride, three corks

Procedure:

1. Take three test tubes. Place one nail in each of them and label them as A, B and C.
2. In test tube A, add water until the nail submerges half way. In test tube B, add boiled water until the nail submerges completely with a layer of oil or wax above it. In test tube C, put some anhydrous calcium chloride (and no water).
3. Leave the set up for a few days and observe closely.



Observations: The iron nail in test tube A starts to deposit a reddish-brown powdery substance called rust, whereas the iron nails in test tubes B and C do not.

Conclusion: Iron nail in test tube A starts rusting as water and air are in contact with the nail. The nails B and C do not rust. This shows that air and water (moisture) both are necessary for the process of rusting to take place.

Galvanisation

The process of coating the metal surface, iron or copper, with a layer of zinc is called galvanisation. In this process, the metal object is dipped in the molten zinc so that the object gets a coating of zinc on it. As zinc is less reactive than iron or copper, it prevents them from getting corroded or rusted.



Fig. 6.16 A galvanised metal bin

Painting and oiling

Applying paint or oil is an easier way to prevent metal objects from rusting. The layer of paint

cuts off the contact between the metal surface and air or moisture, thus preventing corrosion or rusting.



Fig. 6.17 Metals are painted to prevent rusting

Electroplating

A layer of less reactive metals, such as nickel and chromium, is plated on the reactive metal object by a process called electrolysis. Plating of iron or copper objects with zinc, tin or chromium by electrolysis is called electroplating.



Fig. 6.18 An electroplated metal object

METALLOIDS

The **metalloids** (also called as semi-metals) are the elements with properties intermediate between metals and non-metals. It means metalloids show properties of both metals and non-metals.

- They are solid at room temperature.
- Some metalloids are good conductors of electricity under the right conditions, for example, silicon and germanium. Silicon is also used as a semi-conductor.
- They can form alloys with other metals. For example, brass and steel.

Silicon appears lustrous, but is not malleable or ductile. It is rather brittle. (a characteristic of some non-metals.)

Uses of Some Metalloids

- Silicon is a semi-conductor used as a chip in computers and many other electronic devices. It is also used in the manufacturing of glass. Silicones, packaging materials are also made of silicon.

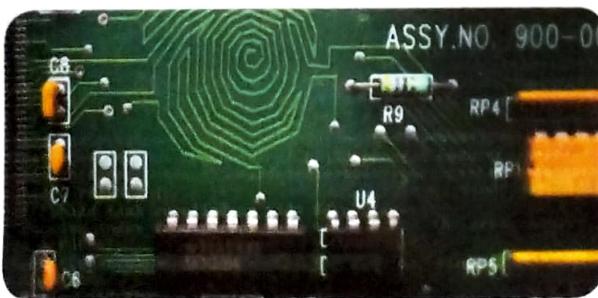


Fig. 6.19 Silicon is used in computer chips

- Tungsten is used to make filaments of bulbs as they have a very high melting point. It is also

used in many other electrical fittings such as wires and sheets.

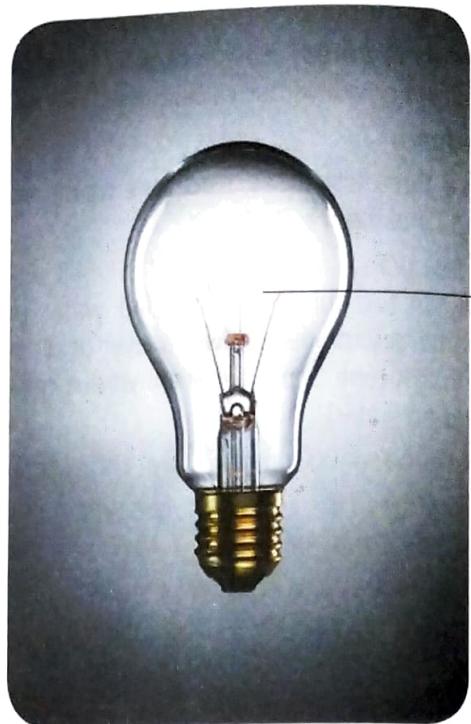


Fig. 6.20 Tungsten is used to make filaments of bulbs

- Germanium is used in transistors, cameras and optic fibres. It is also used in manufacture of plastics.
- Antimony is used in making batteries, cables, sheaths, bullets, and many musical instruments.

Quick Check 2

Fill in the blanks.

1. The chemical formula of rust is
2. is the process in which tin is plated on iron objects.
3. and from the atmosphere are the main cause of rusting.
4. show properties of both metals and non-metals.
5. The reddish-brown powdery substance formed on iron objects is called

KEY TERMS

- Metalloids:** The elements that possess the properties of both metals and non-metals
- Malleability:** The property by which elements can be beaten into sheets
- Ductility:** The property by which elements can be drawn into wires
- Corrosion:** The process by which a metal reacts with water and oxygen, and gets degraded
- Pacemaker:** A device for stimulating the heart muscles and regulating their contraction
- Tarnishes:** Cause to lose lustre as a result of exposure to air or moisture
- Fire-retardant:** A substance that confers the property of halting the spread of fire

QUICK NOTES

- * On the basis of their properties and nature, the elements can be classified into metals, non-metals and metalloids.
- * Most metals are malleable, ductile, sonorous and also good conductors of electricity.
- * Most non-metals are non-malleable, non-sonorous, and insulators.
- * Galvanisation is the process of deposition of a thin layer of zinc over the surface of iron and steel objects.
- * The process in which metals react with air and water and form a coating of another substance on them is called corrosion.
- * Conditions necessary for rusting are the presence of air, presence of moisture and presence of a metal surface or object.
- * Corrosion can be prevented by painting, galvanisation, electroplating and oiling.

RUN-THROUGH

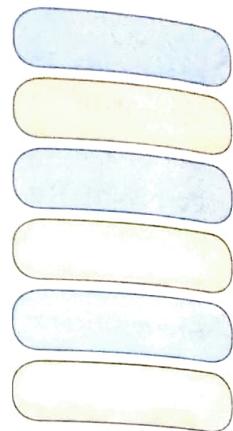
I. Very Short Answer Questions.

A. Tick (✓) the correct answer.

1. Which of the following is malleable?
a. Aluminium b. Oxygen c. Coal d. Graphite
2. Which of the following is used to make vulcanised rubber?
a. Nitrogen b. Gold c. Sulphur d. Silicon
3. Which of the following is not used to make ornaments?
a. Mercury b. Gold c. Silver d. Platinum
4. Which method cannot prevent rusting?
a. Electroplating b. Galvanisation c. Painting d. Boiling
5. Which metal is used as a filament in bulbs?
a. Copper b. Silver c. Tungsten d. Chromium
6. Which metal can be cut with a knife?
a. Potassium b. Diamond c. Mercury d. Gold

B. State whether the following statements are True or False.

1. All the metals are non-conductors of electricity.
2. Bromine is a non-metal that is liquid at room temperature.
3. Tungsten is used in the filaments of bulbs.
4. Sodium and potassium can be cut with a knife.
5. Diamond is the hardest substance.
6. Most non-metals are good conductors of electricity.

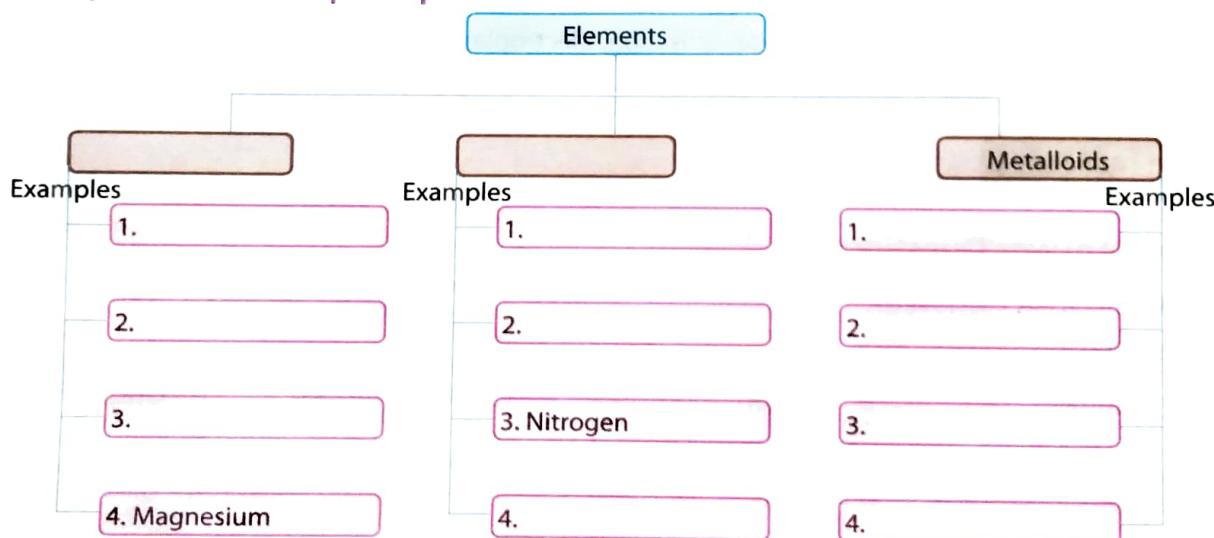


C. Match the following:

Column A
1. Diamond
2. Galvanisation
3. Tungsten
4. Chromium
5. Mercury

Column B
a. Filament in bulbs
b. Thermometer
c. Electroplating
d. Corrosion
e. Hardest substance

D. Complete the concept map.



II. Short Answer Questions.

A. Give reasons for the following statements.

1. Tungsten is used in filaments.
2. Mercury is used in thermometers.
3. Platinum, gold and silver are used to make jewellery.
4. Iron objects are electroplated.
5. Most metal objects are painted.

B. Answer the following questions.

1. How are elements classified?
2. Which non-metal is used in vulcanisation of rubber?
3. Define metalloids.
4. Define electroplating. Why is it used?
5. State the differences between malleability and ductility.
6. What is galvanisation?

III. Long Answer Questions.

1. Give a comparative account between metals and non-metals with examples.
2. How can you examine that metals conduct electricity? Explain with the help of an activity and diagram(s)?
3. What are metalloids? Explain the uses of some metalloids.
4. Name some metals and explain their uses.
5. What do you understand by corrosion? Explain the ways to prevent it.
6. Explain an activity to show that air and water are necessary for rusting.

IV. Challenge

1. How is stainless steel made?
2. Why are metals good conductors of electricity?
3. Which is the hardest known material on the Earth. Is it a metal or a non-metal?
4. Why don't we use pure gold for making ornaments?

V. Enrichment

A. Alloys:

Steel, aluminium, titanium and their alloys are the metals that are used in aircraft manufacturing. Aluminium alloys have lower density values compared to steel alloys (around one third), with good corrosion resistance properties, good thermal and electric conductivity, technological effectiveness and high corrosion-resistance. Aluminium loses its strength at high temperatures. Therefore, it is not used in the skin surface of an aircraft.

However, steel alloys have a greater tensile strength, as well as higher levels of elasticity. As a result, steel is used in the parts of aircraft for which strength is very important, such as in the design of landing gears as well as the skin surface of the aircraft.

Titanium is also used in the design of aircraft structures as it is a lightweight, strong and corrosion-resistant metal. This material is employed in the manufacture of some of the engine components, together with specifically designed heat-resistant alloys, such as Nickel-based super alloys.



Aircraft manufacturing unit assembling a plane.

Life Connect

Tensile strength: The resistance of a material to breaking under tension

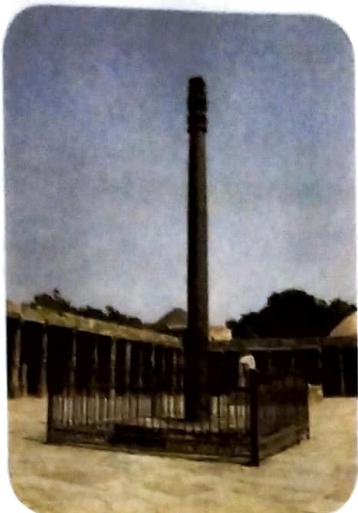
- B. **Activity:** Identify some metals and non-metals that are used in your daily life. Find out the property which makes them useful to you.

Name of the Metal	Use	Property Used
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Name of the Non-metal	Use	Property Used
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

SCIENTIFIC QUEST

The Iron pillar located at Qutub Minar, New Delhi does not get rusted. Find out the reason for the same. Make a report and share with your class.



Subject Connect

ENJOY SCIENCE

Identify four words related to metals and non-metals in the given word search.

→

A	C	O	R	R	O	S	I	O	N
R	K	M	X	V	B	L	K	V	R
T	I	A	L	L	O	Y	O	N	T
M	E	T	A	L	L	U	R	G	Y
K	B	E	M	Z	M	C	E	G	L
L	R	R	A	Y	X	T	S	M	V
V	V	I	T	X	K	U	A	B	B
S	L	A	R	F	U	X	O	F	X
Q	M	L	O	K	L	Z	W	D	Z
S	T	S	P	P	O	L	D	Y	D

PICTURE SURVEY

Look at the pictures and name the element from which they are made. Also write whether the element is a metal or a non-metal.

a.



Name of the element

Metal/Non-metal

Life Connect

c.



Name of the element

Metal/Non-metal

e.



Name of the element

Metal/Non-metal

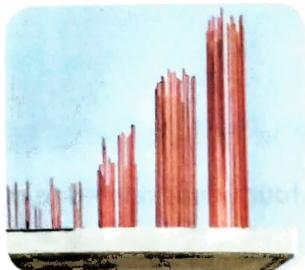
b.



Name of the element

Metal/Non-metal

d.



(rods in buildings)

Name of the element

Metal/Non-metal

f.



Name of the element

Metal/Non-metal

PICTURE SURVEY

Look at the pictures and name the element from which they are made. Also write whether the element is a metal or a non-metal.

a.



Name of the element

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Life Connect

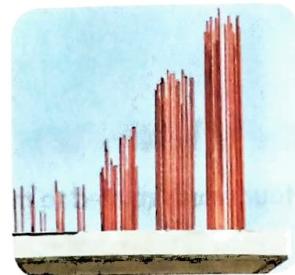
c.



Name of the element

Metal/Non-metal

d.



(rods in buildings)

Name of the element

Metal/Non-metal

e.



Name of the element

Metal/Non-metal

f.



Name of the element

Metal/Non-metal