# Metals and Nonmetals

## Lecture Notes on Introduction to Metals and Nonmetals

### 1. Definition and Classification

Metals and nonmetals are two broad categories of elements that have distinct physical and chemical properties.

- **Metals**: Elements that are typically shiny, malleable, ductile, and good conductors of heat and electricity. They are generally solid at room temperature (except mercury).
- **Nonmetals**: Elements that are usually not shiny, not malleable, not ductile, and poor conductors of heat and electricity. They can be solid, liquid, or gas at room temperature.

**Classification**:

- **Metals**: Examples include iron, copper, aluminum, gold, and silver.
- **Nonmetals**: Examples include hydrogen, oxygen, nitrogen, sulfur, and carbon.

### 2. Physical Properties

Physical properties of metals and nonmetals distinguish them and help in their identification and usage in various applications.

### 3. Lustre

- **Definition**: Lustre refers to the shine or glow on the surface of metals.
- **Metals**: Metals have a characteristic lustre that makes them appear shiny. This property is due to the ability of metals to reflect light.
    - Example: Gold, silver, and platinum exhibit high lustre.
- **Nonmetals**: Nonmetals typically do not have lustre and appear dull.
    - Example: Sulfur and carbon (in the form of coal) are dull.

### 4. Malleability

- **Definition**: Malleability is the ability of a metal to be hammered or pressed into thin sheets without breaking.
- **Metals**: Metals are highly malleable, which makes them suitable for applications requiring deformation without cracking.
    - Example: Gold and aluminum are highly malleable metals.
- **Nonmetals**: Nonmetals are generally not malleable and will break or shatter when hammered.
    - Example: Sulfur and phosphorus are brittle.

### 5. Ductility

- **Definition**: Ductility is the ability of a metal to be drawn into wires.

- **Metals**: Metals are ductile, which allows them to be stretched into long, thin wires without breaking.
    - Example: Copper and gold are highly ductile and used in electrical wiring.
- **Nonmetals**: Nonmetals are not ductile and cannot be drawn into wires.
    - Example: Carbon in the form of graphite is brittle and cannot be drawn into wires.

**6. Conductivity**

- **Definition**: Conductivity refers to the ability to conduct heat and electricity.
- **Metals**: Metals are excellent conductors of heat and electricity due to the presence of free-moving electrons.
    - Example: Silver and copper are among the best conductors of electricity.
- **Nonmetals**: Nonmetals are generally poor conductors of heat and electricity, with some exceptions like graphite.
    - Example: Sulfur and phosphorus are poor conductors of electricity.

**7. State at Room Temperature**

- **Metals**: Metals are generally solid at room temperature, with mercury being a notable exception (liquid at room temperature).
    - Example: Iron, aluminum, and copper are solid at room temperature.
- **Nonmetals**: Nonmetals can exist in all three states at room temperature:
    - **Solids**: Carbon, sulfur
    - **Liquids**: Bromine
    - **Gases**: Oxygen, nitrogen, hydrogen

These properties highlight the differences between metals and nonmetals and explain their varied applications in different fields such as construction, electronics, and manufacturing.