L7

Measurement

Measurement is the process of quantifying physical quantities by comparing them to standard units. Precise measurement allows us to study, analyze, and communicate findings about natural phenomena. The SI system (International System of Units) is the most widely used standard for measurements worldwide.

SI Units

The **SI Unit** (International System of Units) is the standardized system of measurement used worldwide in science and engineering. It defines seven **base units** that correspond to fundamental physical quantities, from which all other units (derived units) are constructed.

seven SI base units:

1. **Meter (m)** – Unit of Length
2. **Kilogram (kg)** – Unit of Mass
3. **Second (s)** – Unit of Time
4. **Ampere (A)** – Unit of Electric Current
5. **Kelvin (K)** – Unit of Temperature
6. **Mole (mol)** – Unit of Amount of Substance
7. **Candela (cd)** – Unit of Luminous Intensity

Length

- **SI Unit**: Meter (m)
- **Definition**: Length is the distance between two points.
- **Common Conversions**:
    - 1 kilometer (km) = 1,000 meters (m)
    - 1 meter (m) = 100 centimeters (cm) = 1,000 millimeters (mm)

Example: If a track is 2 km long, it can be converted to meters as $2\,\text{km} \times 1{,}000 = 2{,}000\,\text{m}$.

Time

- **SI Unit**: Second (s)
- **Definition**: Time is the duration of an event or interval between two occurrences.
- **Common Conversions**:
    - 1 minute (min) = 60 seconds (s)
    - 1 hour (hr) = 60 minutes = 3,600 seconds
    - 1 day = 24 hours = 86,400 seconds

Example: To convert 3 hours to seconds:
3 hours×3,600 s/hr=10,800 s

Mass

- **SI Unit**: Kilogram (kg)
- **Definition**: Mass is the measure of the amount of matter in an object.
- **Common Conversions**:
    - 1 gram (g) = 0.001 kilograms (kg)
    - 1 milligram (mg) = 0.000001 kilograms (kg)

Example: To convert 500 grams to kilograms:

500 g×0.001=0.5 kg.

Density

- **SI Unit**: Kilogram per cubic meter (kg/m³)
- **Definition**: Density is mass per unit volume, showing how much mass is contained in a specific volume of a substance.
- **Formula**: Density=$\frac{mass}{volume}$
- **Common Conversions**:
    - 1 g/cm³ = 1,000 kg/m³
    - 1 kg/L = 1,000 kg/m³

Example: If a material has a mass of 300 kg and occupies a volume of 0.15 m³, its density is:

Density=$\frac{mass}{volume}$=$\frac{300kg}{0.15m^3}$=2,000 kg/m³

practice problems

Convert the following measurements into their respective SI units:

1. Length: 13 Kilometers, 2345 millimeter
2. Mass: 2300 grams,123400 milligram
3. Time: 5 hours 30 minutes 59 second, 50 minutes.
4. Calculate the mass of an object with a density of 800 kg/m³ and a volume of 0.002 m³.
5. Calculate the volume of an object with a density of 800 kg/m³ and a mass of 1.6 kg.