Chemistry

Fsc MLT

1ST SEMESTER

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Units of Measurement in Chemistry

- **Why Units Are Important:**
- Chemistry involves **quantitative study** — we measure mass, volume, temperature, energy, and length.
- To ensure **accuracy and uniformity**, scientists use **standardized units** worldwide.
- A **unit** is a definite magnitude of a quantity used as a standard of measurement.
- **Main Systems Used:**
- **Metric System (SI System)** – used universally in science.
- **Imperial System** – older British system, still used in some countries like the USA.

The Metric (SI) System

- **Definition:**
  The **Systeme International d'Unités (SI)** is the **modern form of the metric system**, adopted globally in scientific work.

Base SI Units Commonly Used in Chemistry

Quantity	Unit	Symbol	Example
Length	meter	m	Measuring wavelength of light
Mass	kilogram	kg	Measuring mass of a substance
Time	second	s	Measuring rate of reaction
Temperature	Kelvin	K	Measuring absolute temperature
Amount of substance	mole	mol	Chemical quantity of atoms or molecules
Electric current	ampere	A	Used in electrochemistry
Luminous intensity	candela	cd	Light intensity (less used in chemistry)

Derived SI Units

- **Volume:** cubic meter (m^3) or liter (L)
- **Density:** kg/m^3 or g/cm^3
- **Pressure:** pascal ($Pa = N/m^2$)
- **Energy:** joule (J)

Metric Prefixes

Prefix	Symbol	Multiplier
kilo	k	×1000
centi	c	×1/100
milli	m	×1/1000
micro	μ	×1/1,000,000

Imperial System

- **Definition:**
  A **non-SI system** once widely used in the UK and USA for trade and daily use.
  Chemists sometimes need conversions when reading old data or American references.

Common Imperial Units

Quantity	Unit	Conversion to Metric
Length	inch (in), foot (ft), yard (yd), mile	1 inch = 2.54 cm
Mass	ounce (oz), pound (lb)	1 lb = 0.454 kg
Volume	pint, gallon	1 gallon = 3.785 L
Temperature	Fahrenheit (°F)	0°C = 32°F

Temperature Scales and Conversions

- **Temperature:**
  Indicates the degree of hotness or coldness; essential for chemical reactions and gas laws.

Temperature Scales and Conversions

Scale	Symbol	Freezing Point of Water	Boiling Point of Water
Celsius	°C	0°C	100°C
Fahrenheit	°F	32°F	212°F
Kelvin (SI unit)	K	273 K	373 K

Conversion Formulas:

- **Celsius → Fahrenheit:**

$$^\circ F = \frac{(^\circ C \times 9)}{5} + 32$$

- **Fahrenheit → Celsius:**

$$^\circ C = \frac{(^\circ F - 32) \times 5}{9}$$

- **Celsius → Kelvin:**

$$K = ^\circ C + 273$$

- **Kelvin → Celsius:**

$$^\circ C = K - 273$$

Examples:

- 25°C = (25 × 9/5) + 32 = **77°F**
- 100°F = (100 − 32) × 5/9 = **37.8°C**

Measurement of Chemical Quantities

- **1. Measurement of Mass (Weight):**
- Measured using **analytical balance**.
- SI unit: **kilogram (kg)** or **gram (g)**.
- **Used in:** Calculating molar mass, chemical equations, and reagent quantities.
- **2. Measurement of Volume:**
- Measured using **pipette, burette, graduated cylinder, or volumetric flask**.
- Unit: **liter (L)** or **milliliter (mL)**.
- **1 L = 1000 mL = 1000 cm^3**.
- Important in **solutions and titrations.**

Measurement of Chemical Quantities

- **3. Measurement of Heat & Energy:**
- Units: **Joule (J)** or **Calorie (cal)**.
- **1 cal = 4.18 J.**
- Used in **thermochemistry** to measure enthalpy and energy changes.
- **4. Measurement of Length:**
- Units: **meter (m), centimeter (cm), nanometer (nm)**.
- Used to measure **atomic radii, bond lengths, and wavelengths**.
  - $1\ \text{nm} = 1 \times 10^{-9}\ \text{m}$.

Summary

Quantity	SI Unit	Imperial Unit	Common Use in Chemistry
Length	meter (m)	inch, foot	Atomic & molecular sizes
Mass	kilogram (kg)	pound (lb)	Molar mass, reagents
Volume	liter (L)	gallon	Solution preparation
Temperature	Kelvin (K)	Fahrenheit (°F)	Reaction temperature
Energy	joule (J)	calorie (cal)	Heat of reaction


ANY
QUESTIONS?


THANK YOU