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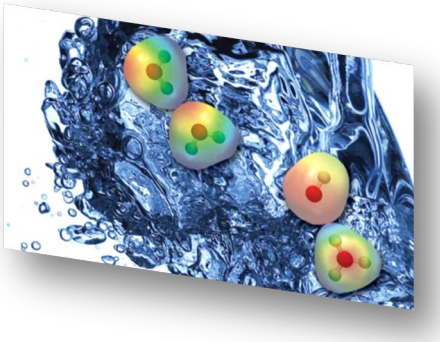
ABDULLAH MOHAMMED

Physics & Chimestry

Chapter 1
Matter, Energy and Measurements



Lecture 2

General Chemistry

- **OUTLINE**

✓ The States of Matter

✓ Density and Specific Gravity.

✓ Energy

✓ Heat

D: Time

- The base unit (SI) is the second.

$$60\ s = 1\ min$$
$$60\ min = 1h$$

E: Temperature

1. The **Celsius** scale is based on the properties of water.
   - 0^oC is the freezing point of water.
   - 100^oC is the boiling point of water.
2. The **Kelvin** is the SI unit of temperature.
   - There are no negative Kelvin temperatures.

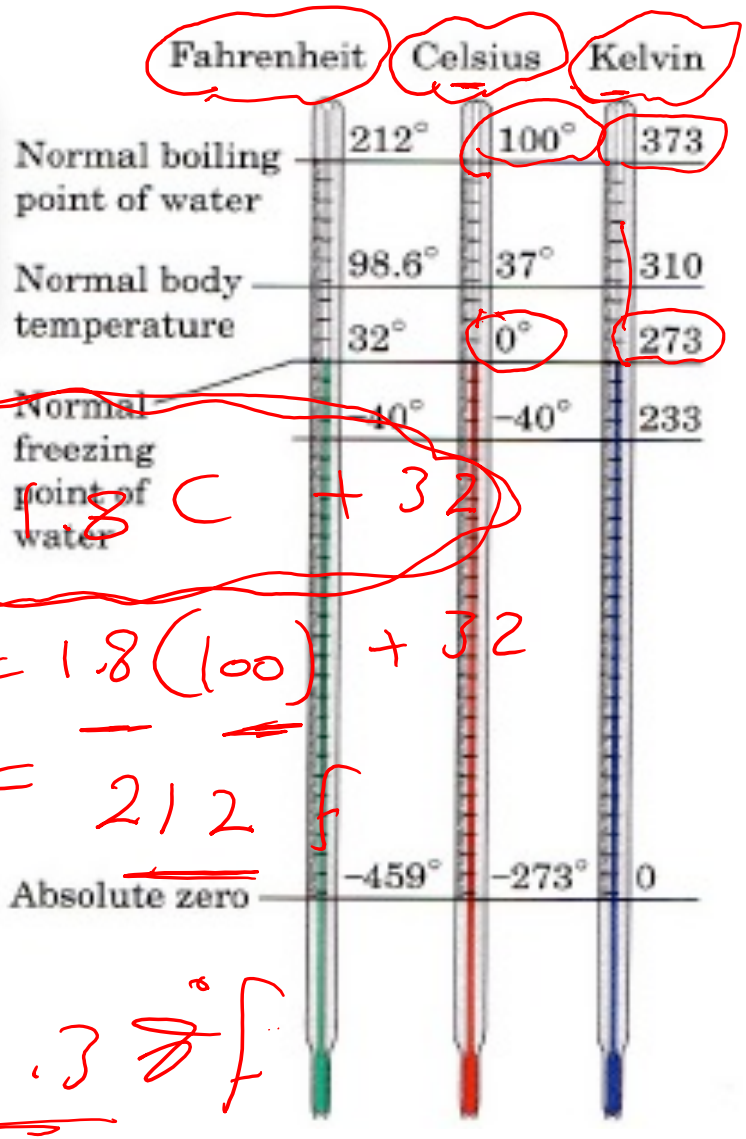
$$K = {}^oC + 273.15$$

The **Fahrenheit** scale is not used in scientific measurements

$$°F = 9/5(°C) + 32$$
$$°C = 5/9(°F - 32)$$

A person with hypothermia has a body temperature of 29.1°C. What is the body temperature in °F?

$$°F = 9/5(29.1°C) + 32$$
$$= 52.4 + 32$$
$$= 84.4°F$$



Unit conversions: The Factor-Label Method

length	Mass	Volume
1 in. = 2.54 cm	1 oz = 28.35 g	1 qt = 0.946 L
1 m 39.37 in.	1 lb = 453.6 g	1 gal = 3.785 L
1 mile = 1.609 km	1 kg = 2.205 lb	1 L = 33.81 fl oz
	1 g = 15.43 grams	1 fl oz = 29.57 ml
		1 L = 1.057 qt

- Example 1.2 The distance between Rome and Milan 358 miles. How many km separate the two cities?

1 mile = 1.60 km

- Solution:

$$358\ miles \times \frac{1.609\ km}{1\ mile} = 576\ km$$

- Example: The label on a container of olive oil says 1.844 gal. How many ml does the container hold?
- solution

$$1.844\ gal \times \frac{3.785\ L}{1\ gal} \times \frac{1000\ ml}{1\ L} = 6980\ ml$$

- Example: Calculate the number of kilometers in 8.55 miles.
- Solution:

$$8.55\ mile \times \frac{1.609\ km}{1\ mile} = 13.76\ km$$

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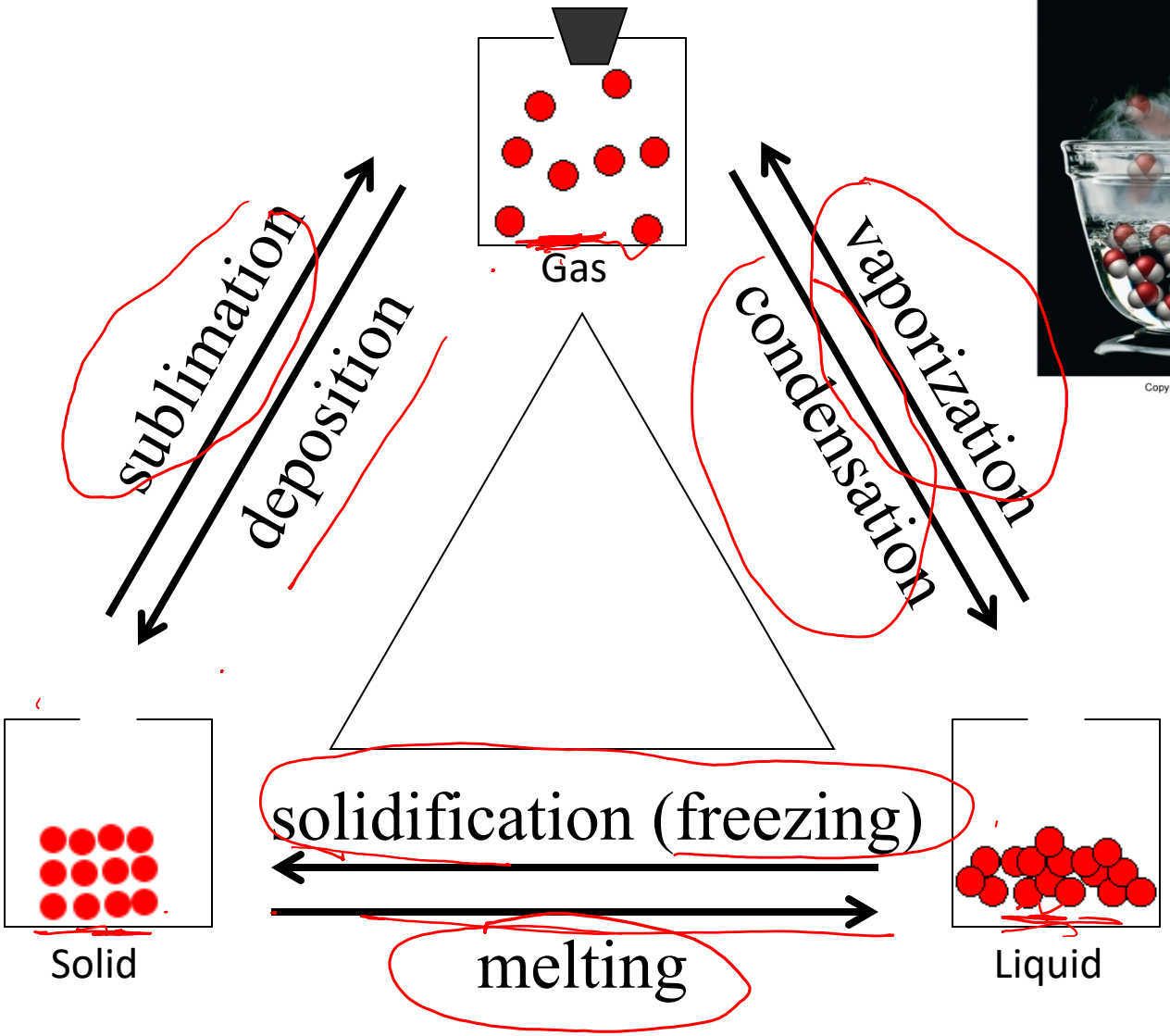
1.6 The States of Matter



Specific Heat

Specific heat: the amount of heat necessary to raise the temperature of 1 g of a substance by 1°C.

Substance	Specific Heat (cal/g •°C)	Substance	Specific Heat (cal/g •°C)
Water	1.00	Wood	0.42
Ice	0.48	Glass	0.22
Steam	0.48	Rock	0.20
Iron	0.11	Ethanol	0.59
Aluminum	0.22	Methanol	0.61
Copper	0.092	Ether	0.56
Lead	0.038	Acetone	0.52

Specific Heat

The amount of heat change when matter is heated or cooled is given by the following equation

Amount of heat = specific heat x mass x change in temperature

$$= SH \times m \times (T_2 - T_1)$$

$$Q = SH \cdot m \cdot (T_2 - T_1)$$

$$= 1\ \text{kg} \quad (18 - 15)$$

$$= 1\ \text{kg} \quad (16 - 15)$$

Example: how many calories are required to heat 352 g of water from 23°C to 95°C?

Solution

Amount of heat = specific heat x mass x change in temperature

$$= SH \times m \times (T_2 - T_1)$$

$$\text{Amount of heat} = \frac{1.00 \text{ cal}}{\text{g} \cdot °\text{C}} \times 352 \text{ g} \times (95 - 23)°\text{C}$$

$$= 2.5 \times 10^4 \text{ cal} = 25 \text{ kcal}$$

1.7 DENSITY AND SPECIFIC GRAVITY

A. Density

- The **density** of a sample of matter is defined as the mass per unit volume:

$$d = \frac{m}{V} \qquad d = density, \quad m = mass, \quad V = volume$$

- Example: If 73.2 ml of a liquid has a mass of 61.5 g. What is its density in g/ml?
- Solution:

$$d = \frac{m}{V} = \frac{61.5\ g}{73.2\ ml} = 0.840\ \frac{g}{ml}$$

Specific Gravity

- **Specific gravity:** the density of a substance compared to water as a standard
  - it has no units (it is dimensionless).
  - **Example:** the density of copper at 20°C is 8.92 g/mL. The density of water at this temperature is 1.00 g/mL. What is the specific gravity of copper?

$$\text{Specific gravity} = \frac{8.92\ \text{g/mL}}{1.00\ \text{g/mL}} = 8.92$$

Chemical connections
Hypothermia and Hyperthermia

- **Hypothermia** is a condition in which core temperature drops below the required temperature for normal metabolism and body functions which is defined as 35.0 °C (95.0 °F).
- As body temperature decreases, characteristic symptoms occur such as shivering and mental confusion.
- **Hyperthermia** is opposite to hypothermia, it can be caused by either high outside temperature or by a body itself.

END OF THE LECTURE

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