Chemistry Chapters 12-15 Study Guide

Equations (provided on test)

Comparing Rates of Diffusion

$$\frac{\text{Rate A}}{\text{Rate B}} = \text{square root of } \frac{\text{molar mass B}}{\text{molar mass A}}$$

Dalton's Law of Partial Pressures

$$P_{total} = P_1 + P_2 + P_3\ldots$$

Boyle's Law

$$P_1V_1 = P_2V_2$$

(for a given amount of gas held at constant temperature)

Charles's Law

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

(for a given amount of gas at constant pressure)

(T is in Kelvin)

Gay-Lussac's Law

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

(for a given amount of gas at constant volume)

(T is in Kelvin)

Combined Gas Law

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

(for a given amount of gas)

(T is in Kelvin)

Avogadro's Principle: 1 mol of any gas occupies 22.4 L

Ideal Gas Law

$$PV = nRT$$

(Temperature in Kelvin)

Values of R

Units	Numerical Value
L-atm/mol-K	0.08206
J/mol-K*	8.314

Concentration Description	Ratio
Percent by mass	Mass of solute/mass of solution x 100
Percent by volume	Volume of solute/volume of solution x 100
Molarity	Moles of solute/liter of solution
Molality	Moles of solute/kilogram of solvent
Mole fraction	Moles of solute/(moles of solute + moles of solvent)

Dilution Equation

$$M_1V_1 = M_2V_2$$

(where M is molarity, and V is volume)

Henry's Law

$$\frac{S_1}{P_1} = \frac{S_2}{P_2}$$

(where S is solubility and P is pressure)

Equation for Calculating Heat

q = c x m x change in T

(q is heat absorbed or released,
c is specific heat of the substance,
m is mass of sample
change in T is change in temp
(T_{final}-$T_{initial}$))

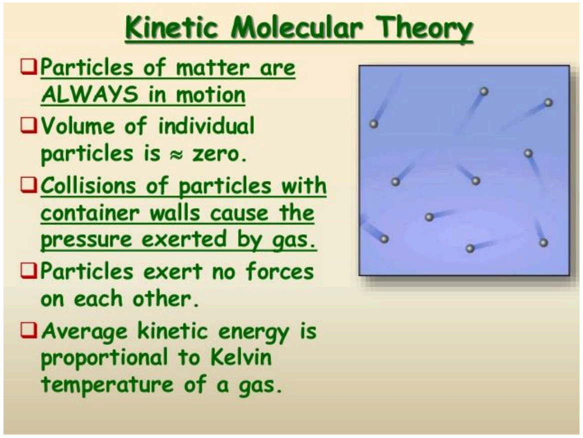
Enthalpy (heat) of reaction

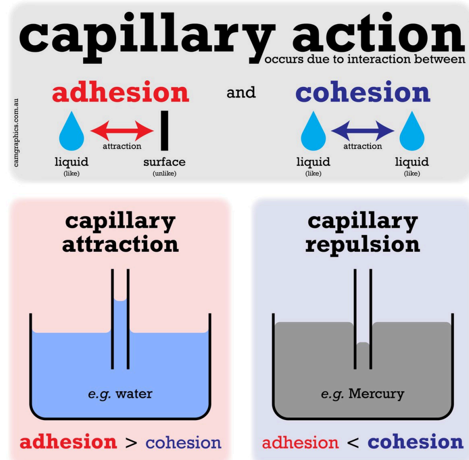
$$H_{rxn} = H_{final} - H_{initial}$$

Measuring heat

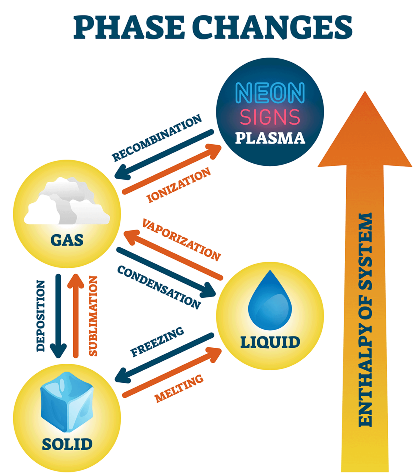
- Metric system: calorie (cal)
  - Heat required to raise the temperature of 1 gram of pure water 1°C
- Food Calories differ from heat calories
  - 1 Calorie = 1000 cal
- SI unit: joule (J)
  - 1 J = 0.2390 cal
  - 1 cal = 4.184 J

Concepts



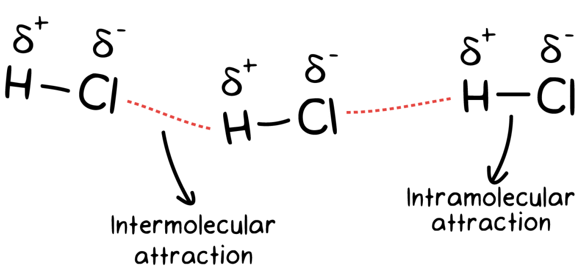


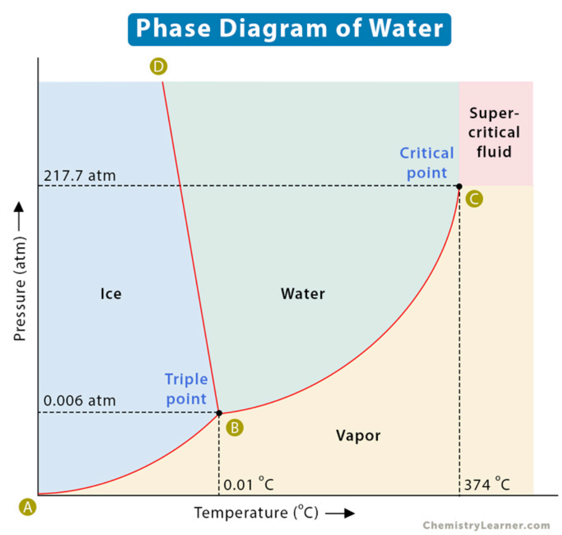
PROPERTIES	SOLID	LIQUID	GAS
Mass	Definite	Definite	Definite
Shape	Definite	Acquires the shape of the conatiner	Acquires the shape of the conatiner
Volume	Definite	Definite	Indefinite
Compressibilty	Not Possible	Almost Negligible	Highly Negligible
Fludity	Not Possible	Can flow	Can flow
Rigidity	Higly Rigid	Less Rigid	Not Rigid
Diffusion	Slow	Fast	Very Fast
Space bewteen particles	Most Closely packed	Less Closely packed	Least Closely packed
Interparticle force	Definite	Slightly weaker than in solid	Negligible

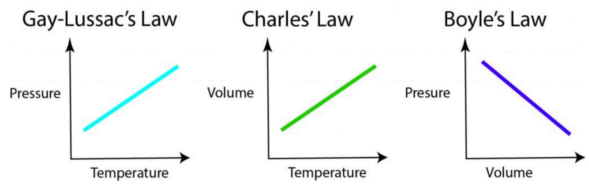


Type of Force	Applied to	Strength
Dispersion Forces	All molecules	0.1 – 5 kJ/mol
Dipolar Forces	Polar molecules	5 – 20 kJ/mol
Hydrogen Bonding	Polar molecules with N – H, O – H or F – H bond	5 – 50 kJ/mol

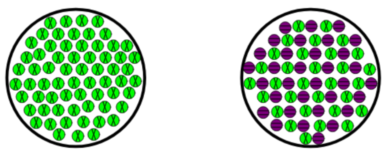
Table 2.6 Summary of the Three Major Intermolecular Forces





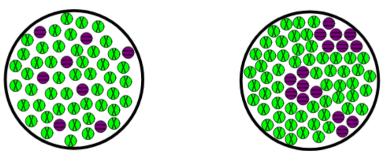


Pure Substances

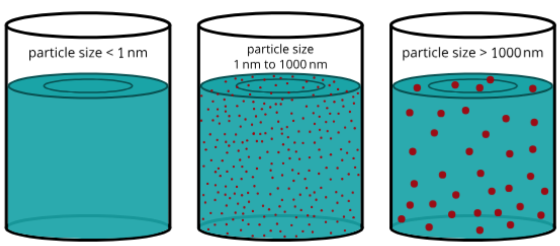


Element   Compound

Mixtures

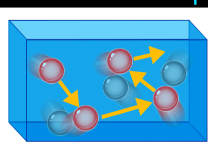


Homogeneous   Heterogeneous

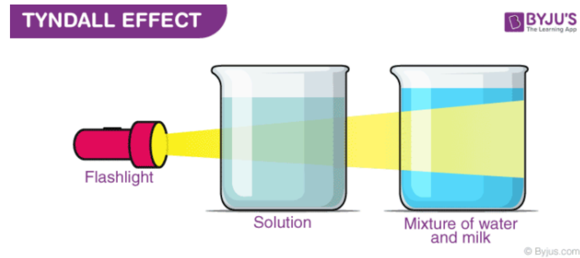


Solution   Colloid   Suspension

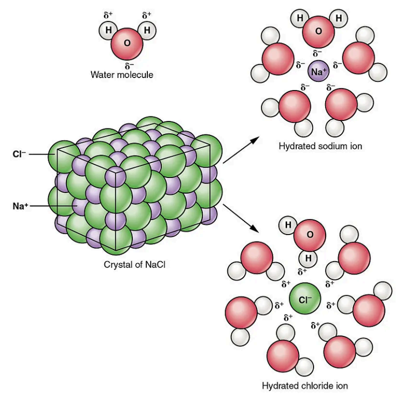
The random movement of particles in a colloid caused by collisions between the particles



Brownian motion



"Like dissolves like"



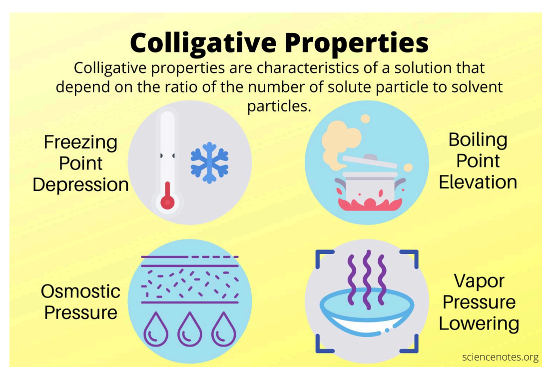
Factors that affect Solvation

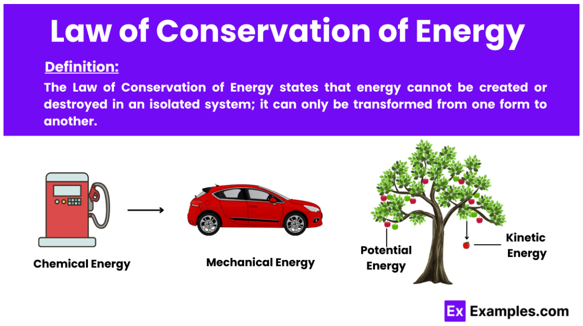
Agitation

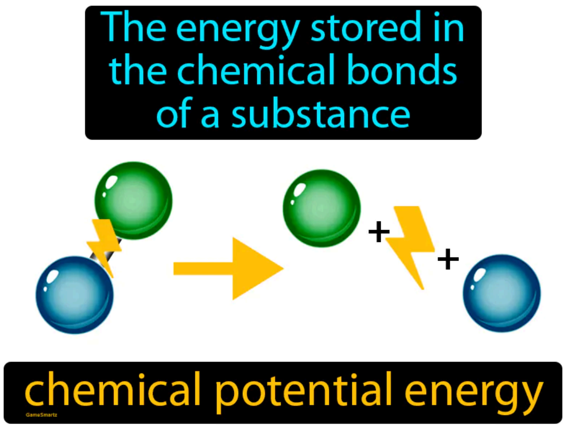
Surface Area

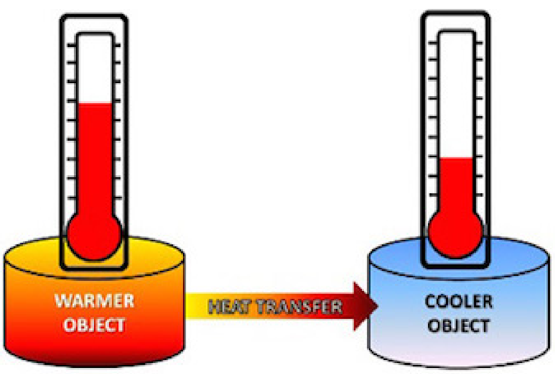
Temperature

Solubility of gas DECREASES as temperature INCREASES

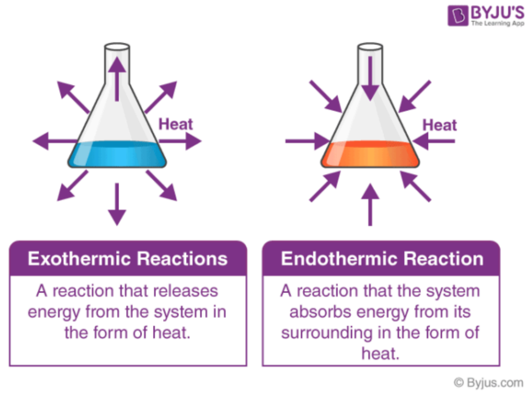


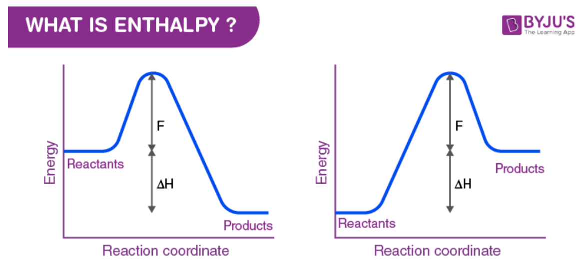






The specific heat of any substance is the amount of heat required to raise the temperature of one gram of that substance by one degree Celsius.





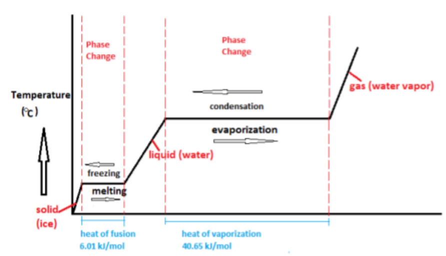
Thermochemical equations

- A typical chemical equation is $S + O_2 \rightarrow SO_2$
- It is called a "thermochemical equation" when we add information about ΔH …

  $S + O_2 \rightarrow SO_2 \quad \Delta H = -296.9 \text{ kJ}$
- If we change the equation, then the ΔH also changes …

  $SO_2 \rightarrow S + O_2 \quad \Delta H = +296.9 \text{ kJ}$
- If the reaction is reversed the sign is reversed
- Also, if numbers in the equation change, so will the amount of energy produced/absorbed:

  $2S + 2O_2 \rightarrow 2SO_2 \quad \Delta H = -593.8 \text{ kJ}$



Molar heat of vaporization: heat required to vaporize one mole of a liquid (- heat of condensation)

Molar heat of fusion: heat required to melt one mole of a solid substance (- heat of solid)