Chemistry Summary G11

Introduction To Stoichiometry

Stoichiometry :

- the calculation of quantities (particles mass, volumes etc.) in a chemical reaction.

Mole Ratio : *1 reactant over 1 product or the opposite

- is a conversion factor that relates the amounts in moles of any 2 substances involved in a chemical reaction.

- It helps to determine mass relationships in chemical reactions.

Example Image :

- $2\ H_2 + O_2 \rightarrow 2\ H_2O$

- $\frac{2 \text{ mole } H_2}{1 \text{ mole } O_2}$ $\frac{2 \text{ mole } H_2O}{2 \text{ mole } H_2}$

- They help in getting ratios of elements/substances.

Molar mass :

- is the conversion factor that relates the mass of a substance to the amount of moles of that substance.

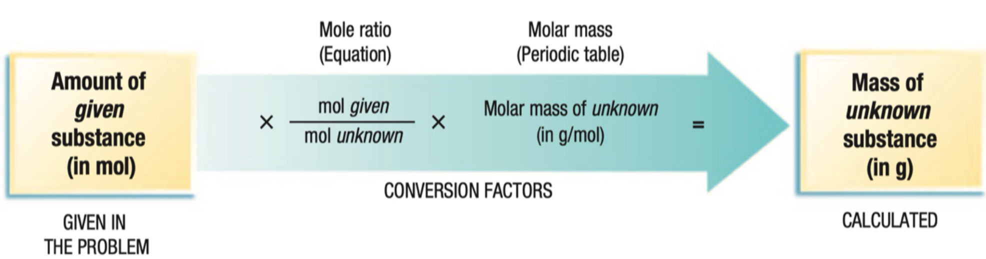
Ideal Stoichiometry Calculations

- Must begin with a ***balanced*** chemical equation.
    - It provides mole ratios needed to solve stoichiometry problems.
- **Coefficients** represent the relative number of moles of reactants and products.

Theoretical stoichiometric calculations :

- allow us to determine the maximum amount of product that could be obtained in a reaction when the reactants are not pure or when products are formed in addition to the expected products.

Formulas :



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Limiting & Excess Reactant

Limiting Reactant :

- A substance that restricts the amount of other reactant used in chemical reactions.

Excess Reactant :

- is the substance that is not used up completely in a reaction.

- In the calculation part, <u>the limiting factor is the lower amount of moles calculated</u>.

Percentage Yield

- This lesson is mostly about application(calculation) —> More in the revision

Theoretical Yield :

- is the maximum amount of product that can be ~~praduet~~ produced from a given amount of reactant.

Actual Yield :

- The measured amount of a product obtained from a chemical reaction.

Percentage Yield :

- is the ratio of the actual yield to the theoretical yield, multiplied by 100.

Formula :

$$percent\ yield\ = \frac{actual\ yield}{theoretical\ yield} \times 100\%$$

$$percent\ yield\ = \frac{actual\ yield}{theoretical\ yield} \times 100\% = \frac{55g}{89g} \times 100\% = 62\%$$

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Kinetic Molecular Theory

Assumptions of Kinetic-Molecular Theory : *ideal gas

1. Gases consist of large numbers of tiny particles that are far apart relative to their size. Most of the volume occupied by a gas is empty space.
2. Collisions between gas particles and between particles and container walls are elastic collision (no net loss of total KE).
3. Gas particles are in continuous, rapid, random motion (KE).
4. There are no forces of attraction between gas particles.
5. The temperature of a gas depends on the average kinetic energy of the particles of the gas.

- A **real gas** is a gas that does not behave completely according to the assumptions of the kinetic-molecular theory.

- **Ideal gas** is a gas, no forces, follows rules exactly every time.
    - hypothetical gas perfectly fits the assumptions of kinetic molecular theory.

- A **real gas** behaves like an **ideal gas** at high temperature and low pressure (both needed.)

Diffusion : spontaneous mixing of particles caused by their random motion
Effusion : process by which gas particles pass through a tiny opening

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Liquids and Solids

- Most solids are **crystalline solids**—they consist of crystals.
- **Mercury** is filled in manometers and barometers

Crystalline Solid :

- is a substance in which the particles are arranged in an orderly, geometric, repeating pattern.

Amorphous Solid :

- solid is one in which the particles are arranged randomly
    - Are sometimes classified as **supercooled liquids**(retain liquid properties)

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Changes of State and Equilibrium

Phase : *Ex: solid, liquid, and gas
- is any part of a system that has uniform composition: and properties.

Equilibrium :
- is a dynamic condition in which two opposing changes occur at equal rates in a closed system.

  Reversible reaction : *every reactant has a product (vice versa)
  - it reaches an qual change of rale (eventually)
    - No overall change (volume)

Equilibrium vapor pressure :
- The pressure exerted by a vapor equilibrium with its corresponding liquid at a given temperature.

- equilibrium vapor pressure increases with increasing temperature, which increases the average KE of the liquid molecules.

Volatile Liquids :
- liquids that evaporate readily(quickly).

Molar enthalpy of vaporization :
- The amount of energy as heat that is needed to vaporize one mole of liquid at the liquid's boiling point at constant pressure.

Molar enthalpy of fusion :
- The amount of energy as heat required to melt one mole of solid at the solid's melting point.

- The change of state from a solid directly to a gas is known as **sublimation**.
- The reverse process is called **deposition**, the change of state from a gas directly to a solid.

Phase Diagram :
- is a graph of pressure versus temperature that shows the conditions under which the phases of a substance exist.

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Water

Structure of Water :
- Water molecules consists of two atoms of hydrogen and one atom of oxygen united by polar-covalent bonds.

    - The molecules in solid or liquid water are linked by **hydrogen banding.**

- "Liquid water is denser than ice."
    - Ice (solid water) is less dense because of its crystalline structure where it has more empty spaces(in atomic structure).

Formula :

amount of substance (mol) × molar enthalpy of fusion or vaporization (kJ/mol) = energy (kJ)

2.61 mol × 6.009 kJ/mol = 15.7 kJ (on melting)

2.61 mol × 40.79 kJ/mol = 106 kJ (on vaporizing or boiling)

Gases and Pressure

Pressure : *P = F/A
- is defined as the force per unit area on a surface.
    - **Unit** : pascal

- The greater the number of collisions of gas (particles/molecules), the higher the pressure will be.

- Standard atmospheric pressure is equal to **760 mm Hg**.

- As altitude increases, the amount of gas molecules in the air decreases—the air becomes less dense than air nearer to sea level. While below sea level, the atmospheric pressure is caused by the weight of the air above you so it is greater.

UNITS OF PRESSURE

Unit	Symbol	Definition/relationship	Application
pascal	Pa	SI pressure unit $1\ Pa = \frac{1\ N}{m^2}$	scientific (kPa)
millimeter of mercury	mm Hg	pressure that supports a 1 mm mercury column in a barometer	blood pressure monitors
torr	torr	1 torr = 1 mm Hg	vacuum pumps
atmosphere	atm	average atmospheric pressure at sea level and 0°C 1 atm = 760 mm Hg = 760 torr $= 1.013\ 25 \times 10^5$ Pa = 101.325 kPa	atmospheric pressure
pounds per square inch	psi	$1\ psi = 6.892\ 86 \times 10^3$ Pa 1 atm = 14.700 psi	tire gauges