Chem 1230
Ch. 3

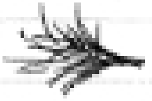
① Chem Rxns are rearrangements in bonds
- bond e^- are those w/ least amt E.
- filled orbitals undisturbed
- unfilled attempt filling through bonds

Ⓐ Balanced Equations
- Have to stay whole
- Equal #s of atoms
- reactants on left ⟷ Products on right
  - > represent lost & gained bonds
    - * shown in molecular formula (shorthand)

Ex: $\underline{2}Na_{(s)} + Cl_{2\,(g)} \longrightarrow \underline{2}NaCl$

2 Na → 2 Na
2 Cl → 2 Cl

* find coefficients to indicate the units needed to balance the equation.
> reduce to simplest form



* when balancing, try starting w/ any Carbons first

Ⓑ Atomic Masses & the Mole
- Avogadro's # –
  - > 6.022×10^{23}
  - > # of atoms in a substance

Ⓒ Chemical Arithmetic
- Stoichiometry → element measure, needed for mole/mass conversion

GOALS:
① calculate mass from given formula
② convert moles to mass & vis versa
③ Using 1 reactant in balanced equation, calc. 2nd reactant

- Molecular mass → sum of atomic masses of all atoms in, molecule mass
- Formula Mass → a formula unit of any compound; molecular or ionic
- Conversion of mass to Moles: Example

tbs sugar = 2.83g
mass of sucrose ($C_{12}H_{22}O_{11}$)

$$2.85g \times \frac{1\,mol\,sucrose}{3,42.0\,g} = 8.33 \times 10^{-3}\,mol\ sucrose$$

Formation of Ammonia (Balancing Example)

$$\underline{3}\,H_{2}(g) + \underline{\quad}\,N_{2}(g) \xrightarrow{\Delta} \underline{2}\,NH_{3}(g)$$

H: $\underline{6}$
N: $\underline{2}$

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N: $\underline{2}$

Δ = catalyst

moles

3 moles H_2 + 1 mole N_2 $\xrightarrow{\Delta}$ 2 moles NH_3

grams

3 mol H_2 = $3(2 \times 1) = 6$ g

1 mol N_2 = $1(2 \times 14) = 28$ g

2 mol NH_3 = $2(14 + 3 \times 1) = 2(17) = 34$g

II. Yields of Chem Rxns

- Actual Yield – amt actually formed
- Theoretical Yield

$$\% \text{ yield} = \frac{\text{Actual}}{\text{theoretical}}$$

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$25 = \frac{50}{x} \cdot 100$

$5 = \frac{500}{x}$

500

Concentration of Reactants in Solution: Molarity

- Molarity – # of moles of a substance disolved in each L of soluti

$$M = \frac{mol}{V(L)}$$

- Solution – homogeneous mixture
- Solute – dissolved substance
- Solvent – major component in solution

$$M = \frac{40\,g/mol}{60\,g/L}$$

250 mL
$= .25$

$_2 = M_1 M_2$

$V_1 = 250(.1)$

(3.8) Solution Stoichiometry

- Physical Interaction
  - ↳ rxns occur through collisions
    - solids rxn rare (don't move)
    - Most rxns → liquid-liquid, liquid-gas
    - Balanced Equations
      - * Molarity instead of grams
      - * $aA + bB \rightarrow cC + dD$
      - * $\text{Volume A} \rightarrow \underbrace{\text{moles A} \rightarrow \text{moles B}}_{\text{mole ratio}} \rightarrow \text{Volume B}$

Molarity (M)
$M = \frac{m}{L}$

* use givens

ex

$$\frac{50.\ \text{mL NaOH}}{} \left| \frac{.100\ \text{mol}}{\text{L}} \right| \frac{1\text{L}}{\text{mL}} = .00500\ \text{mol NaOH}$$

$$\frac{.00500\ \text{mol NaOH}}{} \left| \frac{1\ \text{mol}\ H_2SO_4}{2\ \text{mol NaOH}} \right| \frac{1\text{L}}{0.250\ \text{mol}\ H_2SO_4} \left| \frac{1000\ \text{mL}}{1\text{L}} \right.$$

ratio from balanced equation (not shown)

= 10.0 mL solution (0.250)

(3.9) Titration

- Solutions have known Molarity
- Solution w/ unknown Molarity is titrated
  - ↳ def (titration) → slowly ~~at~~ reacting w/ monitoring
- Controlled volumes of "Known" are added to "Unknown"
- * How do you know rxn is complete?
  - ↳ trace indicator added (ex: Phenolphthalein)
    (acid → base)

(3.10) % Composition & Empirical Formulas

- Uses:
  - don't know the molecule in rxn
  - complex molecule for simple formula
  - 1st approx. = ratio of atoms
  - ratios = empirical formula (simplest form of molecular formula) (whole #s!)
    - % comp def → identifies elements & mass % of each
    - molecular formula (molecular mass → factor to get)