

Gas Laws & Conditions

760 Torrs = 760 mmHg = 1 atm

P = pressure V = volume

T = temperature n = moles

Boyle's Law (P $\uparrow$ V): $P_1V_1 = P_2V_2$

Charles' Law (T $\uparrow$ V): $(V_1/T_1) = (V_2/T_2)$

Avogadro's Law (M $\uparrow$ V): $(V_1/n_1) = (V_2/n_2)$

Static Conditions:

$PV = nRT$ R = 0.0821 L*atm/ mol*K

note: units should be L, K, atm, & mol

Dalton's Law Pressure:

$P_{total} = P_{gas1} + P_{gas2} + P_{gas3} + P...$

Types of Branches

Alkyl Branches: named based on # of carbon contained

have a -yl ending

CH₃ methyl branch

CH₂CH₃ ethyl branch

CH₂CH₂CH₃ propyl branch

Halogen Branches: from group 17 of periodic table

F - fluoro

Cl - chloro

Br - bromo

I - iodo

Units of Conversion

100 centimeters = 1 meter

1,000 millimeters = 1 meter

10,000 micrometers = 1 meter

1,000,000 nanometers = 1 meter

1,000 meters = 1 kilometer

Density Equation

Density = (m/v) g/mL³

Energy

4184J = = 1 = 1000
4.184kJ kcal cal

Kinetic = (1/2) mv²
Energy

Kelvin = C° + 273.15

Specific Heat = ms Δ T (Δ change in temp.)
(q)

Fats = 9 kcal/g

Carbs = 4 kcal/g

Proteins = 4 kcal/g

Liquid $\rightarrow$ = freezing

Solid

Solid $\rightarrow$ = sublimation

Gas

Gas $\rightarrow$ = condensation

Liquid

Solid $\rightarrow$ = melting

Liquid

Liquid $\rightarrow$ = deposition

Gas

Gas $\rightarrow$ = vaporization

Solid

Molarity & Concentration

Molarity = moles $\div$ L

Dilution: $M_1V_1 = M_2V_2$

Acids & Bases

Arrhenius increase H⁺ / increases
Acids protons / increases H₃O⁺

Arrhenius increase OH⁻ (hydroxide)
Bases

Acids & Bases (cont)

Simple H + element off periodic table
Acids (e.g. HCl)

Oxoacid H + polyatomic ion (e.g. HNO₃)

Naming Acids: Drop the ending in simple acids and add "-ic acid" ex: Hydrochloric Acid

If the polyatomic ion ends in "-ite", change to "-ous acid" ex: Chlorous Acid

Note: Strong acids and strong bases dissociate completely.

pH & Relative Acidity

Calculating Hydroxide: $1 \times 10^{-14} = [H_3O^+][OH^-]$

pH Equation: $pH = -\log[H^+]$

Finding pH from Hydroxide Equation: solve for H₃O⁺, then solve for pH.

Intermolecular Attractive Forces

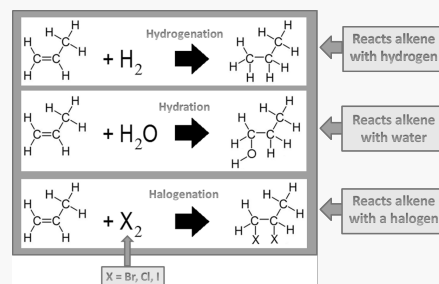
Hydrogen Bonding - Strongest of the three. Requires an H to be directly bonded to an N, O, or F within a molecule.

Dipole-Dipole - During the next two sections of this module we'll learn to ID molecules with this IMF. Molecules with dipole-dipole forces have a permanent positive and negative "sidedness" or polarity.

Dispersion Forces - Weakest of the three. All molecules have dispersion forces, but they're the primary (strongest) forces for nonpolar molecules.

IMF Strength: (lowest) D $\Rightarrow$ D-D $\Rightarrow$ HB (highest)

Reactions of Alkenes



Calculating Abundance

(mass x abundance %) + (mass x abundance %)

Note: abundance must be calculated by a decimal (moving decimal place two times to the front)

Molecular Prefixes

- 1 = mono
- 2 = di
- 3 = tri
- 4 = tetra
- 5 = penta
- 6 = hexa
- 7 = hepta
- 8 = octa
- 9 = nona
- 10 = deca

Note: Ending of last element is replaced by -ide.

Example: CO₂ - carbon dioxide SF₆ - sulfur hexafluoride

Percent Yield

PY = (Actual Yield (g) x 100) ÷ (Theoretical Yield (g))

Ionic Compounds

- Acetate → (C₂H₃O₂)⁻¹
- Nitrate → (NO₃)⁻¹
- Chlorate → (ClO₃)⁻¹
- Chlorate → (ClO₄)⁻¹
- Ammonium → (NH₄)⁺¹
- Hydronium → (H₃O)⁺¹
- Carbonate → (CO₃)⁻²
- Phosphate → (PO₄)⁻³
- Hydroxide → (OH)⁻¹

Ionic Compounds (cont)

Sulfate → (SO₄)⁻²

Contains : a metal and/or a polyatomic ion

Note: Cations come first (+) and Anions come last (-)

Ion Charges (exceptions): Al → +3 Zn → +2

Writing Formulas: Cation keeps the name off periodic table while anion ends in -ide.

Hydrocarbon Alkanes

Name	Molecular Formula
ethane	C ₂ H ₆
propane	C ₃ H ₈
butane	C ₄ H ₁₀
pentane	C ₅ H ₁₂
hexane	C ₆ H ₁₄
heptane	C ₇ H ₁₆
octane	C ₈ H ₁₈
nonane	C ₉ H ₂₀
decane	C ₁₀ H ₂₂

Functional Groups List

Alcohol	Aldehyde	Ketone	Alkene
R-OH	R-CHO	R-C(=O)-R	C=C
Ether	Amine	Alkyne	
R-O-R	R-NH ₂	C≡C	
Phenol	Amide	Ester	
R-OH	R-C(=O)-NH ₂	R-C(=O)-OR	
Thiol	Phenyl	Carboxylic Acid	
R-SH	C ₆ H ₅	R-COOH	

D = Dispersion
D-D = Dipole-dipole
H-B = Hydrogen Bonding

Relating IMF Strength

As IMF strength increases:

- Boiling point (B.P.) will require higher temperature to boil.
- Melting point (M.P.) will require higher temperature to melt.
- Solubility in water will increase (like dissolves like, and water exhibits H-bonding, a strong IMF)
- Volatility, how readily a substance will go to the gas phase, will decrease.

IMF ↑ B.P. ↑ M.P. ↑ Solubility in Water ↓ Volatility

Types of Reactions

- Decomposition Reaction **ex:** 2HgO(s) → 2Hg(l) + O₂(g)
- Combustion Reaction **ex:** C₃H₈(g) + 5O₂(g) → 3CO₂(g) + 4H₂O(g)
- Single-Replacement Reaction **ex:** Zn(s) + 2HCl(aq) → ZnCl₂(aq) + H₂(g)

Types of Reactions (cont)

- Double-Replacement Reaction **ex:** Na₂S(aq) + 2HCl(aq) → 2NaCl(aq) + H₂S(g)
- Combination Reaction **ex:** 2Na(s) + Cl₂(g) → 2NaCl(s)

Note: Δ → reaction is heated up
hλ → energy is added in form of light

Strong Acids

- HCl HBr HClO₃
- HI HNO₃ HClO₄
- H₂SO₄

Notes: Molecular substances act as nonelectrolytes. Soluble ionic substances make for strong electrolytes.

Balanced equations with double-sided arrows (↔) rules an electrolyte is weak because it dissociates and recombines.

Conversion Roadmap

- mass → moles (use molar mass)
- moles → molecules (use Avogadro's number)
- molecules → atoms (use chemical formula)

Note: Avogadro's Number 6.022x10²³

Stoichiometry

- Step #1: Balance Equation
- Step #2: Given mass, convert with moles
- Step #3: Perform Stoichiometry, convert back to mass at the end if needed.