Memorize for the AP Chemistry Exam

Metric System Prefixes:

- $\times 10^{6}$ (Mega-)
- $\times 10^{3}$ (Kilo-)
- $\times 10^{-2}$ (Centi-)
- $\times 10^{-3}$ (Mili-)
- $\times 10^{-6}$ (Micro-)
- $\times 10^{-9}$ (Nano-)

Periodic Trends - Helps predict the behavior of elements.

Atomic Radius: Generally decreases rightwards and upwards. • About ratio of nucleus charge to subshell count.	Ionic Radius: Generally decreasing rightwards and upwards like atomic radius, but... • Radius of cation < Radius of neutral counterpart (losing subshells) • Radius of anion > Radius of neutral counterpart (gaining valence electrons) • Exception: Noble Gases
Electron Affinity: Generally increases rightwards and upwards, pretty random though. • About fulfilling orbital stability. (Randomly filled < Half-filled < Full subshell) • Exception: Noble Gases (0), Group 1 (more than Group 2)	Electronegativity: Generally increases rightwards and upwards. • About ratio of nucleus charge to subshell count. • Exception: Noble Gases (0)

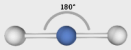
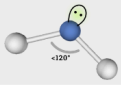
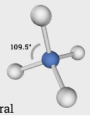
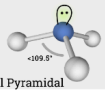
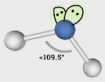
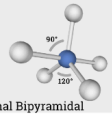
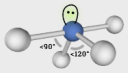
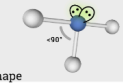
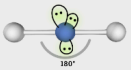
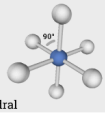
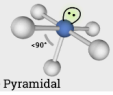
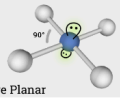
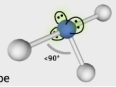
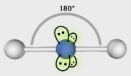
Molar Masses and Symbols for Commonly-Used Elements	**Symbols and Charge for Polyatomic Ions**
• Hydrogen (H): 1.01 g/mol • Carbon (C): 12.01 g/mol • Nitrogen (N): 14.01 g/mol • Oxygen (O): 16.00 g/mol • Etc...	• Ammonium: NH_4^+ • Acetate: $C_2H_3O_2^-$ • Carbonate: CO_3^{2-} • Nitrate: NO_3^- • Sulfate: SO_4^{2-} • Hydroxide: OH^- • Etc...

Oxidation States:

- Electrically-Neutral Compounds: Oxidation states add up to 0.
- Ions: Oxidation states add up to their charge.
- Hydrogen: Carries an oxidation number of +1.
    - When bonding to less electronegative elements, it carries an oxidation number of -1.
- Fluorine: Carries an oxidation number of -1.
- Oxygen: Carries an oxidation number of -2.
    - Oxygen carries an oxidation number of -1 in peroxides (O_2^{2-})
    - When bonded to fluorine, oxygen carries an oxidation number of +2.

Solubility Rules: Sodium ions (Na^+), potassium ions (K^+), ammonium (NH_4^+), and nitrates (NO_3^-) are always soluble in water.

Molecular Geometries:

Densities	Lone Pairs: 0	Lone Pairs: 1	Lone Pairs: 2	Lone Pairs: 3	Lone Pairs: 4
2	 Linear				
3	 Trigonal Planar	 Bent			
4	 Tetrahedral	 Trigonal Pyramidal	 Bent		
5	 Trigonal Bipyramidal	 See-Saw	 T-Shape	 Linear	
6	 Octahedral	 Square Pyramidal	 Square Planar	 T-Shape	 Linear

Effects of Electromagnetic Radiation:

- Microwave: Causes molecules to rotate.
- Infrared: Causes molecular bonds to vibrate.
- Visible/Ultraviolet: Causes electrons to transition to different energy levels.
    - Ultraviolet radiation is ionizing, so it can eject electrons and break bonds.

Intermolecular Forces:

- London Dispersion Forces: Occurs between all particles with electron clouds, stronger with more size.
- Dipole-Dipole Forces: Occurs between polar molecules, stronger with more difference in electronegativity.
- Hydrogen Bonding: Occurs when H bonds with N, O, or F to produce strong dipoles.

Favored for reactions:	**Not favored for reactions:**
• $\Delta H < 0$: Exothermic • $\Delta S > 0$: Increase in Entropy • $\Delta G < 0$: Thermodynamically-favored	• $\Delta H > 0$: Endothermic • $\Delta S < 0$: Decrease in Entropy • $\Delta G > 0$: Not Thermodynamically-favored

ΔH - Change in Enthalpy	ΔS - Change in Entropy	ΔG - Change in Free Energy	Spontaneous?
–	+	–	Yes
+	–	+	No
+	+	±	At high temperatures only
–	–	±	At low temperatures only

Strong Acids:	**Strong Bases:**
• HCl (Hydrochloric acid) • HBr (Hydrobromic acid) • HI (Hydroiodic acid) • HNO_3 (Nitric acid) • H_2SO_4 (Sulfuric acid) • $HClO_4$ (Perchloric acid)	• LiOH (Lithium hydroxide) • NaOH (Sodium hydroxide) • KOH (Potassium hydroxide) • $Ca(OH)_2$ (Calcium hydroxide) • $Sr(OH)_2$ (Strontium hydroxide) • $Ba(OH)_2$ (Barium hydroxide)

Percent Yield Formula: (Actual Yield)/(Theoretical Yield) × 100

Percent Error Formula: (Actual Value - Theoretical Value)/(Theoretical Value) × 100

Acid/Base Chemistry Formulas (Actually NOT on Official Reference Sheet!):

- pH = $-\log[H_3O^+]$
- pOH = $-\log[OH^-]$
- pH = 14 - pOH
- $K_w = [OH^-][H_3O^+] = 1.0\times10^{-14}$ at 25°C
- $K_w = K_a \times K_b$

Types of Lab Setups:

- Distillation: Separating substances within a liquid mixture by boiling point.
- Filtration: Separating substances by permeability of a filter, usually solids from liquids.
- Titration: Determines unknown concentration of a solution via controlled reaction with a titrant.
- Chromatography: Separates substances based on solubility differences.
- Flame Test: Identifies ions based on their emission spectra.
- Spectrophotometry: Measures concentration based on the solution's light absorbance.
- Calorimetry: Measures heat energy transfer in processes.
- Electrochemical Cells: Measures voltage generated from redox reactions.
