

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

- 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...

Symbols and Charge for Polyatomic Ions

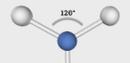
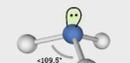
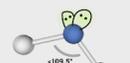
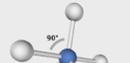
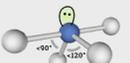
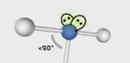
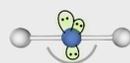
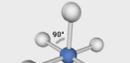
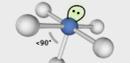
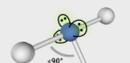
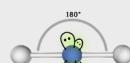
- Ammonium: NH_4^+
- Acetate: $\text{C}_2\text{H}_3\text{O}_2^-$
- Carbonate: CO_3^{2-}
- Nitrate: NO_3^-
- Sulfate: SO_4^{2-}
- Hydroxide: OH^-
- Etc...

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:

- $\Delta H < 0$: Exothermic
- $\Delta S > 0$: Increase in Entropy
- $\Delta G < 0$: Thermodynamically-favored

Not favored for reactions:

- $\Delta H > 0$: 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
+	+	\pm	At high temperatures only
-	-	\pm	At low temperatures only

Strong Acids:

- HCl (Hydrochloric acid)
- HBr (Hydrobromic acid)
- HI (Hydroiodic acid)
- HNO₃ (Nitric acid)
- H₂SO₄ (Sulfuric acid)
- HClO₄ (Perchloric acid)

Strong Bases:

- 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[H₃O⁺]
- pOH = -log[OH⁻]
- pH = 14 - pOH
- K_w = [OH⁻][H₃O⁺] = 1.0 × 10⁻¹⁴ at 25°C
- K_w = K_a × 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.

