

## Chemistry 221



## Key Equations for CH 221

This may not include all the important equations from CH 221, but most of them are included here, separated by chapter.

Good luck!

## Important Equations, Constants, and Handouts from Chapter 1:

metric prefixes:  
 nano (n) =  $10^{-9}$   
 micro ( $\mu$ ) =  $10^{-6}$   
 milli (m) =  $10^{-3}$   
 centi (c) =  $10^{-2}$   
 kilo (k) =  $10^3$

$$\text{Density} = \frac{\text{mass (g)}}{\text{volume (cm}^3\text{)}}$$

$$T (\text{K}) = T (^{\circ}\text{C}) + 273.15$$

$$1 \text{ cm}^3 = 1 \text{ mL}$$

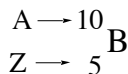
significant figures!!!

mass percentages

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## Important Equations, Constants, and Handouts from Chapter 2 Part 1:

- alpha, beta, gamma radiation
- the "gold foil experiment"
- protons, neutrons, electrons
- mass number, atomic number
- isotopes
- atomic weight and molar mass
- Avogadro's number



A mole is the amount of any substance containing  $6.022 \times 10^{23}$  particles

**Periodic table:** groups, periods, metals, metalloids, nonmetals, alkali, alkaline earth, halogens, noble gases, transition metals, lanthanides, actinides, *how to find the molar mass of an element!*

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## Important Equations, Constants, and Handouts from Chapter 2 Part 2:

- be able to find the molar mass of any compound using the periodic table
- be able to convert grams of a compound into moles and/or molecules
- understand how to calculate empirical formula (EF) and molecular formula (MF) using the molar mass and mass percentages

$$A \text{ mole} = 6.022 \times 10^{23}$$

**Nomenclature:** Greek prefixes, Roman numbers, nonmetal + nonmetal, fixed charge metal + nonmetal, variable charge metal + nonmetal, **polyatomic ions**, acids, bases, hydrated compounds, the 7 diatomics, cations, anions, covalent, ionic, the "stairs", Coulomb's Law

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## Important Equations, Constants, and Handouts from Chapter 4 Part 1:

- be able to find the theoretical yield, actual yield, percent yield
- be able to determine the limiting reactant, excess reactant, excess reactant remaining at end of reaction
- understand how to calculate empirical formula (EF) and molecular formula (MF) using organic compounds containing oxygen

**Balancing Equations:** Reactants, Products, states of matter (s, l, g, aq), stoichiometric coefficients, Law of Conservation of Matter ("mass action")

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## Important Equations, Constants, and Handouts from Chapter 4 Part 2:

- Know how the **solubility guide** works
- Know what makes an acid acidic (and bases basic) and strong or weak; know how to use the pH scale
- Know how to write and determine net ionic equations and find spectator ions
- Know how to use molarity with solution stoichiometry problems
- Molarity (M) = mol of solute per Liter of solution
- $M_1V_1 = M_2V_2$

**Solutions:** Solute, solvent, aqueous, electrolyte (strong, weak, non), solubility (use the **Net Ionics solubility table**), precipitation, types of reactions, **molarity (M)**

Know the **five types of reactions:** precipitation, acid-base, gas forming, combustion and redox. Know how to determine if something has been **oxidized** or **reduced** (and the **oxidizing agent** and **reducing agent**)

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## Important Equations, Constants, and Handouts from Chapter 5:

### Thermodynamics:

- endothermic & exothermic
- product & reactant favored
- Law of Conservation of Energy
- units of energy (J, kJ, cal, etc.)
- system & surroundings
- heat & work
- enthalpy
- calorimetry
- heat of reaction and heat of formation
- standard enthalpy conditions
- Hess's Law

$$\Delta E = q + w = 0$$

$$q = mC\Delta T \text{ (no phase change)}$$

$$q = (\text{heat of "something"})$$

("mass") (phase change)

$$\text{memorize } C_{\text{water(liquid)}} = 4.184 \text{ J g}^{-1} \text{ K}^{-1}$$

$$\Delta H^{\circ}_{\text{rxn}} = \sum n\Delta H_f^{\circ} (\text{products}) - \sum n\Delta H_f^{\circ} (\text{reactants})$$

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## Important Equations, Constants, and Handouts from Chapter 6 Part 1:

- know relationship between frequency, wavelength, energy, speed of light, energy per mole
- know the regions and relative energies within the electromagnetic spectrum
- know about sharp line spectra, absorbance and emission spectra
- know about wave particle duality (including de Broglie)
- **quantum numbers:** know the origin and meaning of  $n$ ,  $l$ ,  $m_l$
- know "**nl**" notation (4s, 3d, etc.)
- know how to find spherical and planar nodes, number of orbitals, etc.

$$c = 2.998 \times 10^8 \text{ m/s}$$

$$h = 6.626 \times 10^{-34} \text{ J s}$$

$$E = h\nu = hc/\lambda \text{ (E/M)}$$

$$\lambda = h / m\nu \text{ (particles)}$$

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## Important Equations, Constants, and Handouts from Chapter 6 Part 2:

- **quantum numbers:** know the origin and meaning of  $n$ ,  $l$ ,  $m_l$ ,  $m_s$
- understand paramagnetism and diamagnetism for atoms and ions
- know "**nl**" notation (4s, 3d, etc.) and the "**n + l**" rule for energy
- know how the Pauli Exclusion Theory and Hund's Rule apply towards electrons in orbitals; know the Aufbau Principle
- know how to create electron configurations for neutral atoms and also cations and anions using both orbital box and spectroscopic notation
- know the periodic trends for size, ion size, ionization energy and electron affinity

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