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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 (μ) = 10^{-6}
milli (m) = 10^{-9}
centi (c) = 10^{-9}
kilo (k) = 10^{-9}

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

T (K) = T (°C) + 273.15

1 cm^3 = 1 mL

significant figures!!!

mass percentages

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

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

$$A \rightarrow {}^{10}_{Z \rightarrow 5}B$$

A mole is the amount of *any* substance containing 6.022×10^{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 mole = 6.022×10^{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

$\Delta E = q + w = 0$

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

q = (heat of "something") ("mass") (phase change)

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

$$\Delta H^o_{rxn} = \Sigma\ n\Delta H_f^o\ (products) - \Sigma\ n\Delta H_f^o\ (reactants)$$

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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.*

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

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

$E = h\nu = hc/\lambda$ *(E/M)*

$\lambda = h / mv$ *(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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