# AP Chemistry Summer Review

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The purpose of this document is to highlight the essential topics covered in chemistry with which you should be somewhat familiar prior to starting AP Chemistry. The resources provided are video tutorials and/or notes for you to review as needed. Please start memorizing the polyatomic ions!

| Topic | Objectives | Resources |
|---|---|---|
| Polyatomic Ions<br>Significant Digits | • Learn the name, formula, and charge [Memorize them!]<br>• Get ahead for unit 1! | Polyatomic Ion List<br>Significant Digits |
| Atomic Structure | • Know the location, charge, and relative mass of the subatomic particles<br>• Write isotope notation for any atom or ion: AZX or line/hyphen format<br>• Provide a basic description of the quantum model of the atom: energy level, sublevel, orbital<br>• Write full electron configurations and noble gas configurations for any atom or ion<br>• Draw orbital-filling diagrams for any atom or ion<br>• Calculate average atomic mass from isotope data | Basic Atomic Structure<br>Atomic Symbols (AZX)<br>Ions<br>Isotopes<br>Calculating Average Atomic Mass<br>Electron Configurations<br>Orbital Filling Diagrams |
| Chemical Bonding | • Know the difference between an ionic and covalent bond and how each forms<br>• Write the name and formula for any 2-element (binary) ionic or covalent compound, including acids<br>• Write the name and formula for any simple polyatomic ion containing compound, including acids<br>• Draw Lewis structures and identify molecular shapes (VSEPR). | Ionic and Covalent Bonding<br>Interactive Simulation (ionic)<br>Interactive Simulation (covalent)<br>Naming & Formula Writing Overview<br>Naming Acids #1 Naming Acids #2<br>VSEPR #1 VSEPR #2 |
| Chemical Reactions | • Balance a chemical equation<br>• Recognize the following types of reactions: synthesis, decomposition, single replacement, double replacement, and combustion<br>• Describe the main components of collision theory and what causes a chemical reaction to occur | Types of Chemical Reactions<br>Collision Theory Analogy<br>Collision Theory Overview<br>Balancing Equations<br>Balancing Equations with Polyatomic Ions |
| Quantitative Chemistry | • Calculate percent composition by mass<br>• Define the mole and molar mass and complete simple mole conversions<br>• Determine mole ratios from a chemical formula and a balanced equation<br>• Solve a stoichiometry problem using a balanced equation<br>• Identify limiting /excess reactants and calculate percent yield<br>• Calculate a simple empirical or molecular formula<br>• Calculate molarity and apply the dilution formula | Percent Composition<br>The Mole Defined Molar Mass<br>Mole Conversions<br>Mole Ratios<br>Empirical and Molecular Formulas<br>Stoichiometry (#1) Stoichiometry (#2)<br>Limiting & Excess Reactants and Percent Yield |

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|---|---|---|
| States of Matter and IMFs | • Distinguish different states of matter based on particle arrangement and strength of intermolecular forces<br>• Name phase changes and distinguish as exothermic or endothermic<br>• Read a heating/cooling curve or a triple point/phase diagram<br>• Identify basic intermolecular forces and explain how they impact observed physical properties (ie - MP/BP, volatility, viscosity, etc.) | Phase Changes - Exothermic or Endothermic<br>Heating and Cooling Curves<br>Intermolecular Forces<br>Intermolecular Forces and Physical Properties |
| Properties of Gases | • Describe the kinetic molecular theory of gases<br>• Define: temperature, pressure, volume as they relate to a gas<br>• State the relationship between measurable gas variables: T & P, T & V, V & P, V & n (ie - gas laws: Boyle, Charles, Gay-Lussac, Avogadro)<br>• Convert between Celsius and Kelvin temperature<br>• Understand the concept of absolute zero on the Kelvin scale<br>• Solve gas law problems using the combined and ideal gas laws | Understanding Pressure<br>KMT & Ideal Gas Law<br>Kinetic Theory & Temperature<br>The Gas Laws<br>Choosing the Appropriate Formula<br>Solving Ideal Gas Law Problems |
| Solution Chemistry | • Describe the components of a solution: solute and solvent<br>• Calculate solution concentration as percent by mass or molarity<br>• Use molarity as a ratio to calculate mass of solute or volume of solvent<br>• Describe how a solution is prepared using a volumetric flask<br>• Use the dilution formula to calculate solution molarity, volume of solvent, etc.<br>• Differentiate solubility and miscibility and factors that impact both<br>• Interpret a solubility curve | Solutions Overview<br>Unsaturated, Saturated, Supersaturated Solutions<br>Molarity #1 Molarity #2<br>Dilution Problems<br>Solution Preparation - AP required procedure |
| Acid-Base Chemistry | • Explain the difference between Arrhenius and Bronsted-Lowry acids and bases<br>• Write a Bronsted-Lowry acid-base reaction, labeling the acid, base, conjugate acid, and conjugate base<br>• Describe substances as acidic, basic, or neutral using the pH scale.<br>• Explain what it means for an acid or base to be strong or weak in terms of ion concentration. | Defining Acids & Bases<br>B-L Conjugate Acid/Base Pairs<br>Acids, Bases, and pH<br>Strong vs. Weak Acids & Bases |
| Thermochemistry | • Describe the difference between thermal energy, heat, and temperature<br>• Differentiate system vs surroundings when describing heat flow<br>• Distinguish exothermic vs endothermic reactions based on values of $\Delta H$ and observed properties (including changes in temperature)<br>• Describe what specific heat means for a substance<br>• Solve heat transfer problems using the $q = mc\Delta T$ equation<br>• Calculate $\Delta H$ using enthalpy of formation values ($\Delta H_f$)<br>• Calculate $\Delta H$ using Hess's Law | Thermal Energy vs Temperature<br>Heat Flow<br>Enthalpy and $\Delta H$<br>Exothermic or Endothermic<br>Specific Heat Defined<br>Using the $q = mc\Delta T$ Equation<br>Enthalpy of Formation<br>Hess's Law |

**Practice Problems**

*These problems will not be collected. However, they are a sample of problem types you should be able to answer based on what you learned in standard level chemistry.*

- Atomic Structure
  - answer key
- Chemical Bonding & Chemical Reactions
  - answer key
- The Mole & Stoichiometry
  - answer key
- States of Matter & IMFs
  - answer key
- Properties of Gases
  - answer key
- Solutions and Acid-Base Chemistry
  - answer key
- Thermochemistry
  - answer key