

CORE BODY OF KNOWLEDGE

CHEMISTRY -- ADVANCED PLACEMENT (Pre-requisites Honors Chemistry and Integrated III Math) 11th and 12th Grade Course

For each of the sections that follow students may be required to recall, explain, interpret, apply, analyze or evaluate the particular concepts being taught.

Chemical Foundations

- Summarize the scientific method of inquiry
- Explain the meaning and importance of accuracy and precision in measurement
- Utilize the factor label method and rules for significant figures in problem solving

Atoms, Molecules, and Ions

- Describe the development of Dalton's atomic theory
- Describe the experimental evidence for the existence of the proton, neutron, electron, nucleus and electron energy levels
- Identify the principle bond types
- Explain the organizational principle of the periodic table

Stoichiometry

- Explain the relationship between the atomic mass and the mole, and solve related problems
- Write balanced chemical equations, and solve related problems

Types of Reactions and Solution Stoichiometry

- Define molarity concentration
- Explain the chemical principles behind the major aqueous reaction systems, including precipitation, acid-base neutralization, and oxidation-reduction
- Solve solution based stoichiometry problems

Gases

- Outline the historical developments in the study of gases
- Define the ideal gas law and use it to solve problems
- Apply the principles of stoichiometry to gas systems
- Use Kinetic Theory to explain observable behavior of gases

Thermochemistry

- Define and explain the relationships among energy, heat and work
- Define enthalpy

- Use calorimetry to measure the change in enthalpy in a reaction
- Use Hess's Law to calculate the enthalpy change in a reaction

Atomic Structure and Periodicity

- Describe the historical development of the modern atomic theory
- Explain the relationship between electromagnetic radiation and the behavior of electrons
- Use quantum theory to describe the arrangement of the electron cloud
- Relate the position of an atom on the Period Table to its atomic structure

Bonding

- Use atomic theory to distinguish among ionic, non-polar covalent and polar covalent bonds
- Explain the relationships among bond type, molecular shape and molecular polarity
- Use Lewis structures, VSEPR theory and hybridization to predict molecular geometry and molecular polarity

Liquids and Solids

- Use kinetic theory to explain observable properties of liquids and solids
- Explain properties of solids based on particle type and type of attractive force
- Relate phase change to vapor pressure

Solutions

- Express solution concentration in units of molality, molarity and normality
- Relate mechanism of solution formation to solubility and heat of solution
- Solve problems about the colligative properties of solutions

Chemical Kinetics

- Write rate laws for chemical reactions
- Use collision theory to model reaction mechanisms
- Relate the reaction rate law to the reaction mechanism

Chemical Equilibrium

- Write equilibrium expressions using the Law of Mass Action
- Solve problems involving gas phase equilibrium
- Apply Le Chatelier's Principle to gas phase equilibrium

Acid-Base Equilibrium

- Define acids and bases in the Arrhenius, Bronsted and Lewis theories
- Solve problems involving acid ionization equilibrium
- Solve problems involving acid-base titrations

Solubility Equilibrium

- Relate solubility to the solubility product constant
- Solve problems involving solubility equilibrium

Spontaneity, Entropy and Free Energy

- Relate entropy, enthalpy and free energy
- Calculate free energy change in a chemical reaction

Electrochemistry

- Distinguish between electrolytic and galvanic cells
- Use half reactions to determine cell potential
- Solve problems involving electrolysis

Nuclear Chemistry

- Describe the principle types of nuclear decay
- Write nuclear equations to describe each process

Graduation Project / Problem Based Unit

- Determination of thickness of Copper on a Post-1982 Penny

AP Chemistry Textbooks:

Chemistry, 8th Edition, Zumdahl, Holt McDougal (Brooks/Cole Cengage Learning)

Chemistry, 8th Edition, Student Solutions Manual, Zumdahl, Houghton Mifflin Co.

Solving Equilibrium Problems (with Applications to Qualitative Analysis), Zumdahl, D.C. Heath and Company

Experimental Chemistry Lab Manual (Paperback), 7th Edition, James F. Hall, Houghton Mifflin Co.

