AP Chemistry Syllabus 2008 - 2009
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Required Materials: textbook(s), notebook (bound; can be spiral bound) for class notes, **lab notebook** (bound, not spiral bound), binder (for worksheets and returned tests, quizzes, and assignments), pencils and pens (blue or black ink), scientific calculator. You may also want to purchase a hold punch, index cards, and card holder. **Note: Not all tests allow the use of a calculator.**

Grading System: Approximately 6 major tests (100 points each) and 15 quizzes (25-50 points each) will be given each year. Tests and quizzes are worth 75% of your class grade. Homework assignments will be given approximately weekly and will be worth 10% of your grade. Approximately 15 labs will be completed each year. Lab reports are worth 15% of your class grade. Lab notebooks may be graded and must be kept neat and current. Each student must submit her own lab report (group reports are not acceptable). Two exams (one at the end of the first trimester and one at the end of the year) are cumulative.

Academic Dishonesty: Any student found cheating on a test or assignment will receive a grade of "0" for that test or assignment. Cheating includes, but is not limited to, copying another student's work (with or without their knowledge), allowing another student to copy your work, or using materials during a test other than those allowed. Studying together can be beneficial, but the work each student submits must be their own. Plagiarism will not be tolerated.

Work Required of Students:
Attendance is expected. After entering the classroom, students are to immediately begin getting themselves ready for class by opening their books and/or notebooks, taking out assignments that are due, and listening for instructions.
Homework (both written work and reading assignments) is to be done in full and on time. Late work will not be accepted. Homework is to be done on loose-leaf paper, in pencil, and brought to class when due. Students are expected to check their answers with the appropriate solutions and to ask questions if they do not understand something. Not all homework will be graded.
Quizzes and Tests will occur approximately once per week. Unannounced ("pop") quizzes are possible. Chapter tests will emphasize the material covered in that chapter, but may contain previously covered material also.
Laboratory work will occur approximately 15 times during the year. Laboratory procedures will be discussed in detail in a separate handout. Students must work together and with the teacher. All students are expected to participate in all labs unless absent that day. Lab notebooks must be written in pen. All data must be in the notebooks. Notebooks may be graded. All students must turn in their own lab report by the due date. If absent, a student is held responsible for material covered that day, but will not be expected to make up the lab. See a separate handout for the lab report format. Because of time constraints, labs may be held outside of class time (such as on weekends).
** Lab work is very important to AP Chemistry. Lab safety is paramount. All students must sign a lab safety contract. **

Exams will be given twice per year: once at the end of the first semester and once at the end of the third semester. Both exams are cumulative.

** Students must take the **AP Chemistry Test,** given in May. If not previously taken, students are also expected to take the **SAT Chemistry Subject** test. **

Tentative AP Chemistry Schedule
Text: Chemistry, 4th edition, by Olmsted & Williams, Wiley (2006); Additional resources: Barron's AP Chemistry 2008

Week	Chapters	Topics
1	1 – 2	Policies and Philosophy; Vocabulary, Math, Atomic Theory, Moles
2	3	The Composition of Molecules
3	4	Chemical Reactions and Stoichiometry
4		Catch-up; Review; **Test**
5	5	The Behavior of Gases
6	6	Energy and Its Conservation
7	7	Atoms and Light
8	8	Atomic Energies and Periodicity; **Test** and Catch-up
9	9	Fundamentals of Chemical Bonding
10	10	Theories of Chemical Bonding
11	11	Effects of Intermolecular Forces; **Test**
12		Review; **Trimester Exams**
13	12	Properties of Solutions
14	13	Macromolecules (Organic Chemistry)
15	14	Spontaneity of Chemical Processes (Thermodynamics)
16	15	Kinetics: Mechanisms and Rates of Reactions
17		Catch-up; Review; **Test**
18	16	Principles of Chemical Equilibrium
19	17	Aqueous Acid-Base Equilibria
20	18	Applications of Aqueous Equilibria
21	19	Electron Transfer Reactions (Electrochemistry)
22	20	Review; **Test;** The Transition Metals (short!)
23	21	The Main Group Elements
24	22	Nuclear Chemistry and Radiochemistry; **Test**
25		Catch-up & Review
26		Catch-up & Review
27		Catch-up & Review
	Spring Break	
28		Review
29		Review
30		Review
31		Review
32		Review
33		Review & AP Examination
34		Review & Final Examination

AP Chemistry Course Outline

I. Review (fast; covered last year)

A. Vocabulary

1. Atoms (and Related Vocabulary), Molecules and Compounds
2. The Periodic Table: Metals, Nonmetals, Metalloids
3. Characteristics of Matter: Phases and Changes

B. Math Review

1. Units
2. Unit Conversions
3. Precision and Accuracy
4. Significant Figures
5. Density

C. Chemical Problem Solving Methods

II. Atomic Nature of Molecules (fast; covered last year)

A. Atomic Theory

1. Dalton
2. Conservation of Atoms and Mass
3. Dynamic Molecular Equilibrium

B. Atomic Structure

1. Electrons
2. Nucleus
3. Isotopes
4. Nuclear Stability

C. The Mole

1. Avogadro's Number
2. Molar Mass
3. Mole-Mass-Atom Conversions

D. Ionic vs. Molecular Compounds and the term “Molecule”

III. The Composition of Molecules (fast; covered last year)

A. Representing Molecules

1. Chemical Formulas
2. Structural Formulas
3. Three-Dimensional Models
4. Line Structures

B. Naming Chemical Compounds (memorize)

1. Nonmetallic Binary Compounds
2. Binary Compounds of Hydrogen
3. Compounds that Contain Carbon

C. Formula Names of Ionic Compounds (memorize)

1. Cations and Anions
2. Polyatomic Ions
3. Ionic Formulas
4. Cations of Variable Charge

5. Hydrates *Lab 1: Determine the Percent Water in a Hydrate (PASCO 02)*

D. Mass-Molar-Number Conversions; Molar Masses of Compounds

E. Determining Chemical Formulas

1. Mass Percent Composition
2. Empirical Formula *Lab 2: Determine the Empirical Formula for a Compound (PASCO 01)*

F. Aqueous Solutions: Molarity, Concentrations, Dilutions

IV. Chemical Reactions and Stoichiometry (fast through here; covered last year)

A. Writing and Balancing Chemical Equations

B. The Stoichiometry of Chemical Reactions *Lab 3: Mole Relationships in a Chemical Reaction (PASCO 09)*

C. Yields of Chemical Reactions

D. Limiting Reagent

E. Precipitation Reactions

1. Species in Solution
2. Net Ionic Equations
3. Solubility Guidelines (memorize)
4. Precipitation Stoichiometry

F. Acid-Base Reactions

1. Definitions of Acids and Bases (Lewis, Bronsted-Lowery, Arrhenius)
2. Proton Transfer
3. Strong and Weak Acids and Bases
4. Acid-Base Stoichiometry
5. Titration *Lab 4: Standardizing a Solution of NaOH (PASCO 06); Lab 5: Acid-Base Titration (PASCO 07)*

G. Oxidation-Reduction Reactions

V. The Behavior of Gases (fast through here; covered last year)

A. Pressure: Units

B. The Ideal Gas Equation and Variations

C. Molecular View of Gases: Kinetic Theory *Lab 5: Exploring Gas Laws (PASCO 29)*

D. Additional Gas Properties

1. Molar Mass *Lab 6: Molar Volume of a Gas (PASCO 05)*
2. Density
3. Rates of Gas Movement; Effusion; Diffusion

E. Gas Mixtures: Dalton's Law of Partial Pressures; Mole Fraction; ppm

F. Gas Stoichiometry: Problems

G. The Chemistry of the Earth's Atmosphere

VI. Energy and Its Conservation

A. Types of Energy: Kinetic, Potential, Thermal, Radiant, Electrical, Transfer of Energy

B. State Functions

C. Thermodynamics

1. Conservation of Energy

2. Heat; Heat Capacity
3. First Law of Thermodynamics
4. Energy Changes in Chemical Reactions: Bond Energies
5. Measuring Energy Changes: Calorimetry (*Lab done last year; review if possible*)
6. Enthalpy: of Vaporization, of Formation; Hess's Law

VII. Atoms and Light
A. Characteristics of Light: wavelength, frequency; photoelectric effect
B. Atomic Spectra (*Lab done last year; review if possible*)
C. Bohr vs. Quantum Theory
D. Energy Level Diagrams
E. Properties of Electrons
1. Quantum Numbers
2. Heisenberg's Uncertainty Principle
F. Shapes & Sizes of Atomic Orbitals

VIII. Atomic Energies and Periodicity
A. Orbital Energies
1. Shielding vs. Proton Pull vs. Electron-Electron Effects
2. Ionization Energy
B. Structure of Periodic Table
1. Pauli Exclusion Principle
2. Aufbau Principle
3. Order of Orbital Filling
4. Valence Electrons
5. Electron Configurations
6. Hund's Rule
7. Orbitals with Nearly Equal Energy
8. Configuration of Ions
9. Magnetic Properties
10. Excited States
C. Periodicity of Atomic Properties
1. Atomic Radii
2. Ionic Radii
3. Ionization Energy
4. Electron Affinity
5. Cations and Anions
D. Ions and Chemical Periodicity: s-, p-, d-, f-block elements

IX. Fundamentals of Chemical Bonding
A. Overview of Bonding
1. Hydrogen Molecule
2. Bond Length and Bond Energy
3. Other Diatomic Molecules
4. Unequal Sharing (Polar Covalent Bonds)

5. Electronegativity and Bond Type

B. Lewis Structures
1. How to Draw
2. Beyond the Octet
3. Formal Charge
4. Resonance Structures

C. Molecular Shapes: VSPER (*Ball and stick lab done last year; review if possible*)
D. Properties of Covalent Bonds: bond angle, length, energy, dipole moment

X. Theories of Chemical Bonding
A. Localized bonds: Orbital Overlap & Examples
B. Hybridization of Atomic Orbitals: sp, sp2, sp3, d participation
C. Multiple Bonds: σ and π
D. Molecular Orbital Theory: Delocalized bonds (brief)

XI. Effects of Intermolecular Forces
A. Real Gases
B. Van der Waals Forces
C. Melting and Boiling Points
D. Dispersion forces, Dipole forces, Hydrogen Bonding
E. Liquids
1. Surface Tension
2. Capillary Action
3. Viscosity
4. Vapor Pressure

F. Solids
1. Network Solids
2. Metallic Solids
3. Ionic Solids
4. Crystal Structures
5. Amorphous Solids

G. Phase Changes
1. Heats of Phase Changes (*Reference Calorimetry Lab*)
2. Phase Diagrams; Triple Point, Critical Point
3. Variations on Phase Diagrams

XII. Properties of Solutions
A. Concentration Measures: molarity, molality, normality *Lab 7: Colorimetric Analysis (PASCO 17)*
B. Determinants of Solubility & Solubility Rules (memorize)
C. Solubility Equilibrium
D. Effect of Temperature
E. Gas-Solution Equilibria: Henry's Law
F. Colligative Properties of Solutions
1. Vapor Pressure Reduction

2. Raoult's Law (vapor pressure proportional to mole fraction)
3. Boiling Point Elevation
4. Freezing Point Depression *Lab 8: Molecular Weight by Freezing Point Depression (PASCO 04)*
5. Osmosis

G. Colloidal Suspensions

XIII. Macromolecules (supplement from AP study guide)

A. C-H Compounds
1. Isomers
2. Alkanes, Alkenes, Alkynes

B. Side Chains and Functional Groups

C. Review of Nomenclature and Drawing Rules

D. Types of Polymers

E. Organic Reactions

XIV. Spontaneity of Chemical Processes

A. Spontaneity

B. Entropy and Spontaneity: The Second Law of Thermodynamics

C. Calculations with Entropy

D. Gibbs Free Energy

E. Free Energy and Concentration: the Reaction Quotient

XV. Kinetics

A. Reaction Mechanisms
1. What is a Reaction Mechanism?
2. Intermediate Steps
3. Rate-Determining Step

B. Rates of Chemical Reactions: Macro- and Microscopic Views

C. Concentration and Reaction Rates: Rate Laws and Rate Constants *Lab 9: Hydrogen Peroxide Decomposition (PASCO 12)*

D. Calculations of Reaction Rates using Experimental Data

E. Reaction Rates and Temperatures

F. Activation Energy

G. Catalysts

XVI. Principles of Chemical Equilibria

A. Dynamic Equilibrium

B. Equilibrium Constant & Reversibility *Lab 10: Determine the Equilibrium Constant for a Chemical Reaction (PASCO 10)*

C. Properties of Keq
1. Concentration Units
2. Pure Liquids and Solids
3. Magnitudes
4. Relationship to ΔG

5. Effect of Temperature

D. Le Chatelier's Principle
1. Concentrations
2. Catalysts
3. Temperature

E. Problems Involving Equilibria
1. ICE Method
2. Calculating Keq
3. Small and Large Keq

F. Equilibria in Aqueous Solution: Ksp *Possible Lab: Determining a Solubility Product Constant (PASCO 23) -- If time and equipment permit*

XVII. Aqueous Acid-Base Equilibria

A. Proton Transfers of Water
1. Disassociation of Water
2. Strong and Weak Acids and Bases

B. pH Scale & pOH scale *Lab 11: Indicators for pH Determination (PASCO 11)*

C. Weak Acids and Bases

D. Recognizing and Naming Acids and Bases (memorize naming)

E. Conjugate Acid-Base Pairs

F. Acid and Base Salts

G. Polyprotic Acids

XVIII. Applications of Aqueous Equilibria

A. Buffer Solutions *Lab 12: Properties of Buffer Solutions (PASCO 19)*
1. Composition
2. Molecular View
3. Buffer Equation
4. Buffer Action

B. Capacity and Preparation of Buffer Solutions

C. Acid-Base Titrations *Lab 13: Acid-Base Titration (PASCO 07)*
1. Equivalence Point vs. Midpoint
2. Polyprotic Acids
3. Indicators

D. Solubility Equilibria & Common Ion Effect

XIX. Electron Transfer Reactions

A. Recognizing Redox Reactions (Oxidation Numbers)

B. Balancing Redox Reactions: Half-Reaction Method

C. Galvanic Cells & Cell Potentials (fast through here); Calculations

D. Free Energy and Electrochemistry: Nernst Equation

E. Electrolysis & Electroplating *Lab 14: Electroplating (PASCO 21 or other)*
Lab 15: Determination of Electrochemical Series (PASCO 20 or other)

XX. The Transition Metals

A. Overview: Physical Properties, Redox Behavior, Compounds

B. Coordination Complexes
    1. Ligands
    2. Color Change Evidence
    3. Structures
C. Metallurgy (if time permits)
D. Applications

XXI. The Main Group Elements
A. Lewis Acids and Bases
B. Hard and Soft Lewis Acids and Bases
C. The Main Group Metals
        D. The Metalloids
E. Other Nonmetals

XXII. Nuclear Chemistry and Radiochemistry
A. Nuclear Stability
    1. Nuclear Composition
    2. Binding Energy
    3. Fission and Fusion
    4. Energy Barriers
    5. Stable Nuclides
B. Nuclear Decay
    1. Decay Processes: α, β, Positron, γ Radiation
    2. Rates of Nuclear Decay: Half-Life
    3. Applications