CURRICULUM MAP
ADVANCED PLACEMENT CHEMISTRY

August/September	October	November	December
I. Structure of Matter 20% A. Atomic theory and atomic structure 1. Evidence for the atomic theory 2. Atomic masses; determination by chemical and physical means 3. Atomic number and mass number; isotopes 4. Electron energy levels: atomic spectra, quantum numbers, atomic orbitals	5. Periodic relationships including, for example, atomic radii, ionization energies, electron affinities, oxidation states B. Chemical bonding 1. Binding forces a. Types: ionic, covalent, metallic, hydrogen bonding, van der Waals (including London dispersion forces) b. Relationships to states, structure, and properties of matter c.Polarity of bonds, electronegativities 2. Molecular models a. Lewis structures b. Valence bond: hybridization of orbitals, resonance, sigma and pi bonds c. VSEPR 3. Geometry of molecules and ions, structural isomerism of simple organic molecules and coordination complexes; dipole moments of molecules; relation of properties to structure 2. Relationships in the periodic table: horizontal, vertical, and diagonal with examples from alkali metals, alkaline earth metals, halogens, and the first series of transition elements	**III. Reactions (35-40%)** A. Reaction types 1. Acid-base reactions; concepts of Anhenius, Br0nsted-Lowry, and Lewis; coordination complexes; amphoterism 2. Precipitation reactions 3. Oxidation-reduction reactions a. Oxidation number b. The role of the electron in oxidation-reduction c. Electrochemistry: electrolytic and galvanic cells; Faraday's laws; standard half-cell potentials; N emst equation; prediction of the direction of redox reactions B. Stoichiometry 1. Ionic and molecular species present in chemical systems: net ionic equations 2. Balancing of equations including those for redox reactions 3. Mass and volume relations with emphasis on the mole concept, including empirical formulas and limiting reactants	1. Chemical reactivity and products of chemical reactions

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January	February	March/April	May
II. States of Matter (20%) A. Gases 1. Laws of ideal gases a. Equation of state for an ideal gas b. Partial pressures 2. Kinetic molecular theory a. Interpretation of ideal gas laws on the basis of this theory b. Avogadro's hypothesis and the mole concept c. Dependence of kinetic energy of molecules on temperature d. Deviations from ideal gas laws B. Liquids and solids 1. Liquids and solids from the kinetic-molecular viewpoint 2. Phase diagrams of one-component systems 3. Changes of state, including critical points and triple points 4. Structure of solids; lattice energies C. Solutions 1. Types of solutions and factors affecting solubility 2. Methods of expressing concentration (use of normalities is not tested) 3. Raoult's law and colligative properties (nonvolatile solutes); osmosis 4. Nonideal behavior (qualitative aspects)	C. Equilibrium 1. Concept of dynamic equilibrium, physical and chemical; Le Chatelier's principle; equilibrium constants 2. Quantitative treatment a. Equilibrium constants for gaseous reactions: K_p, K_c b. Equilibrium constants for reactions in solution (1) Constants for acids and bases; pK; pH (2) Solubility product constants and their application to precipitation and the dissolution of slightly soluble compounds (3) Common ion effect; buffers; hydrolysis	D. Kinetics 1. Concept of rate of reaction 2. Use of experimental data and graphical analysis to determine reactant order, rate constants, and reaction rate laws 3. Effect of temperature change on rates 4. Energy of activation; the role of catalysts 5. The relationship between the rate-determining step and a mechanismE. Thermodynamics 1. State functions 2. First law: change in enthalpy; heat of formation; heat of reaction; Hess's law; heats of vaporization and fusion; calorimetry 3. Second law: entropy; free energy of formation; free energy of reaction; dependence of change in free energy on enthalpy and entropy changes 4. Relationship of change in free energy to equilibrium constants and electrode potentials	C. Nuclear chemistry: nuclear equations, half-lives, and radioactivity; chemical applications 3. Introduction to organic chemistry: hydrocarbons and functional groups (structure, nomenclature, chemical properties)

CURRICULUM MAP
ADVANCED PLACEMENT CHEMISTRY

Embedded throughout the curriculum are the following:

V. Laboratory (5-10%)

The differences between college chemistry and the usual secondary school chemistry course are especially evident in the laboratory work. The AP Chemistry Exam includes some questions based on experiences and skills students acquire in the laboratory:

- making observations of chemical reactions and substances
- recording data
- calculating and interpreting results based on the quantitative data obtained
- communicating effectively the results of experimental work

For information on the requirements for an fuD Chemistry laboratory program, the *Guide for the Recommended Laboratory Program* is included on pages 34-47 of this book. The guide describes the general requirements for an AP Chemistry laboratory program and contains a list of recommended experiments. Also included in the guide are resources that AP Chemistry teachers should find helpful in developing a successful laboratory program.

Colleges have reported that some AP students, while doing well on the exam, have been at a serious disadvantage because of inadequate laboratory experience. Meaningful laboratory work is important in fulfilling the requirements of a college-level course of a laboratory science and in preparing a student for sophomore-level chemistry courses in college.

Because chemistry professors at some institutions ask to see a record of the laboratory work done by an AP student before making a decision about granting credit, placement, or both, in the chemistry program, students should keep reports of the'ir laboratmy work 'in such a fash'ion that the reports can be readily reviewed.

Chemical Calculations

The following list summarizes types of problems either explicitly or implicitly included in the preceding material. Attention should be given to significant figures, precision of measured values, and the use of logarithmic and exponential relationships. Critical analysis of the reasonableness of results is to be encouraged.

1. Percentage composition
2. Empirical and molecular formulas from experimental data
3. Molar masses from gas density, freezing-point, and boiling-point measurements
4. Gas laws, including the ideal gas law, Dalton's law, and Graham's law 5. Stoichiometric relations using the concept of the mole; titration calculations
6. Mole fractions; molar and molal solutions
7. Faraday's laws of electrolysis
8. Equilibrium constants and their applications, including their use for simultaneous equilibria

9. Standard electrode potentials and their use; Nemst equation 10. Thermodynamic and thermochemical calculations 11. Kinetics calculations