Advanced Placement Chemistry

Text:	*General Chemistry* 2nd Edition Hill and Petrucci

Supplemental Materials:	*The Ultimate Chemical Equation Handbook* –George R. Hague, et.al. 2001

Course Description:	The AP chemistry course is intended to be the equivalent of the general chemistry course taken during the first year of college. Students should obtain a depth of understanding of fundamentals and a reasonable competence in dealing with chemical problems. The course should contribute to the development of the students' abilities to think clearly and to express their ideas, orally and in writing, with clarity and logic. The course differs from Chemistry 332 in the type of textbook used, topics covered, and emphasis on calculation and formula representing chemical principals. The number of topics treaded and time required spend in individual study will increase from general chemistry The nature of the experiments done in laboratory will emphasize quantitative over qualitative results and will require written lab reports with error analysis and discussion of how method lets you meet the goals of the lab. This is to be supported with clearly labeled calculations. Students are expected to take the AP Chemistry examination in May. Should a student not sit the AP Chemistry exam, they will be required to take a comprehensive course final exam during final exam week. All students are urged and expected to take the AP exam. Prerequisite: General chemistry B grade or better, and recommendation of previous science teachers

Methods of Evaluation:	Students can be evaluated through tests, laboratory reports and quizzes, concept quizzes, classwork, homework, projects, semester exams and/or any other form of evaluation instrument the instructor finds applicable to the course.

Pace of Instruction:	This course meets two class period per day. Weeks indicate calendar weeks – actual days indicate the number of class meeting spent in content coverage. Actual days do not equal number of days in a five day week due to scheduled testing for course, standardized testing, holidays, semester exams and school related events resulting in missed or reduced class time. Unit assignments are communicated via print calendar and class website calendar. Text exercises, additional practice exercises, labs and unit tests are listed in each unit calendar. Supplemental practice exercises may be drawn from Zumdahl, *Chemistry* (including marathon problems), Brown, LeMay and Bursten, *Chemistry: The Central Science* (text and website) and Oxtoby, Freeman and Block, *Chemistry Science of Change.* Laboratory activities are drawn from a wide variety of sources including but not limited to: Vonderbrink, *Laboratory* Experiments for Advanced Placement Chemistry, Slowinski, Wolsey and Masterton, *Chemical Principles in the Laboratory* and CollegeBoard AP chemistry workshops. Please see attached syllabus

AP Chemistry Course Syllabus

Unit And # of Days	Chapter(s)	Focus	Lab	AP Guide
Unit 1 3 weeks (13 days actual)	*Hill/Petrucci Text* Chpt 1: Chemistry: Matter and Measurement Chpt 2: Atoms, Molecules and Ions Chpt 3: Stoichiometry: Chemical Calculations *TUCEH Text* Chpt 3Ternary Nomenclature: Acids and Salts Chpt 6 Organic Nomenclature and Simple Reactions	1. Nomenclature Review, including organic 2. atomic structure review – mass number, average atomic mass, abundance, synthetic elements, decay. 3. Stoichiometry and chemical quantities (% composition, empirical and molecular formula, and concentration measurements)	1. % composition of a compound lab – MgO preparation and analysis 2. stoichiometric proportions lab – continuous variations with □H soln as evidence of stoich ratio using hypochlorite + thiosulfate rxn.	**I. Structure of Matter** 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 **III. Reactions** B. Stoichiometry 3. Mass and volume relations with emphasis on the mole concept, including empirical formulas and limiting reactants **Lab** 1. Determination of the formula of a compound 9. Determination of mass and mole relationship in a chemical reaction

Unit 2 4 weeks – (17 days actual)	*Hill/Petrucci Text* Chpt 4: Chemical Reactions in Aqueous Solutions TUCEH Chpt 7Balancing Molecular Equations Chpt 8 Single replacement rxns Chpt 9 Double Replacement rxns Chpt 10: Aqueous solutions and Ionic equations Chpt 11: Redox equation balancing	Reactions in Solution – Concentration measurements Electrolytes precipitation reactions and solubility rules Acid base neutralization Reactions Titration Redox reactions	1. A/B Titration lab – standardization of soln. 2. Activity Series for metals and halogens 3. Redox titration lab - permanganate	**III. Reactions** A. Reaction types 1. Acid-base reactions; concepts of Arrhenius, Brønsted-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 B. Stoichiometry 1. Ionic and molecular species present in chemical systems: net ionic equations 2. Balancing of equations including those for redox reactions Lab 6. Standardization of a solution using a primary standard 8. Determination of concentration by oxidation-reduction titration
Unit 3 – Gas Laws – 2 weeks (7 days actual)	*Hill/Petrucci Text* Chpt 5 Gases	-Fundamental relationships between T, P and V from kinetic theory including molar volume and density. -Ideal gas law calculations -Graham's Law and Dalton's Law	1. Molar Volume of a Gas- H^+ + Mg displacement 2. Ideal Gas Law – propellant determination via water displacement.	**II. States of Matter** 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 Lab 5. Determination of the molar volume of a gas

Unit 4 – Energy and Phase changes (five weeks – 16 days actual)	*Hill/Petrucci Text* Chpt 6 Thermochemistry Chpt 11 States of Matter sections 1-4	-Energy and systems -Calorimetry -Hess's Law -Phases of matter -Vapor pressure -Phase changes, cooling curves and phase diagrams	1. Specific heat of metals –ID of unknown metals lab 2. Hess's Law lab – Enthalpy of $OH^- + H^+$	**II. States of Matter** 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 **III. Reactions** E. 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 Lab 13. Determination of enthalpy change associated with a reaction
Unit 5 – Solutions (4 weeks - 15 days actual)	*Hill/Petrucci Text* Chpt 12 Physical Properties of Solutions	-Concentration calculations -Heat of solution -Factors that influence solubility -colligative properties	1. Freezing Pt Depression Lab 2. Factors influencing solubility lab	**II. States of Matter** C. Solutions 1. Types of solutions and factors affecting solubility 2. Methods of expressing concentration 3. Raoult's law and colligative properties (nonvolatile solutes); osmosis 4. Nonideal behavior (qualitative aspects) Lab 4. Determination of molar mass by freezing-point depression

Unit 6 – Quantum numbers and Electrons (1 week – 5 days actual)	*Hill/Petrucci Text* Chpt 7 Atomic Structure Chpt 8 Electron Configurations, Atomic Properties, and the Periodic Table	-Electron configurations, -exceptions -Quantum numbers -Periodicity trends for ionization energy, electron affinity, atomic and ionic radus, electronegativity, physical properties	1. S before D for iron in Fe(II) and Fe (III) chloride (from prerequisite course).* 2. Flame test ID for cations (from prerequisite course)*	**I. Structure of Matter** A. Atomic theory and atomic structure 1. Evidence for the atomic theory 4. Electron energy levels: atomic spectra, quantum numbers, atomic orbitals 5. Periodic relationships including, for example, atomic radii, ionization energies, electron affinities, oxidation states
Unit 7 - Kinetics (3 weeks 12 days actual)	*Hill/Petrucci Text* Chpt 13 Chemical Kinetics: Rates and Mechanisms of Chemical Reactions	-Rates of reaction and rate law -Integrated rate law -Integrated rate law lab -Collision theory -Catalysts	1. method of initial rates-iodine clock rxns.	**III. Reactions** 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 mechanism Lab 12. Determination of the rate of a reaction and its order

Unit 8 – Equili-brium (30 days)	*Hill/Petrucci Text* Chpt 14: Chemical Equilibrium Chpt:15: Acids, Bases, and Acid-Base Equilibria Chpt 16: More Equilibria in Aqueous Slns: Slightly Soluble Salts and Complex Ions	-Equilibrium expressions - LeChatielier's Principle - Coordination complex ions -Pressure in equilibrium expressions -Equilibrium concentration calculations -Acid and base review -Weak acid/base equilbria -indicator selection for weak A/B titration -titration curves and calculations for weak vs strong. -Solubility and solution equilibria -common ion effect	1. Le Chatelier's Principle Lab – Acid/base indicators, complex ion and saturation equilibria 2. Determination of Ka for weak acid.- $KHSO_3$ and hydrogen tartrate. 3. Preparation of a Buffer Solution	**III. Reactions** 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 Lab 7. Determination of concentration by acid-base titration, including a weak acid or weak base 11. Determination of appropriate indicators for various acid-base titrations; pH determination 19. Preparation and properties of buffer solutions
Unit 9 Therm-o-dyanmics 13 Days	*Hill/Petrucci Text* Chpt 17: Thermodynamics: Spontaneity, Entropy, and Free Energy	- Spontaneous rxns -Entropy and 2nd law -Stnd Free energy -Trouton's rule -Keq and free energy calculations		**III. Reactions** E. Thermodynamics 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
Unit 10 Electr-o-chemi	*Hill/Petrucci Text*	-Half cell balancing -Definitions of cell, cathode,	1. hydrolysis of water	**III. Reactions** A. Reaction types 3. Oxidation-reduction reactions

stry (10 days)	Chpt 18: Electrochemistry	anode and potential -Cell diagramming -Calculation of °E and direction of rxn -pH meters -batteries	2. half cell construction metal in salt solns.	c. Electrochemistry: electrolytic and galvanic cells; Faraday's laws; standard half-cell potentials; Nernst equation; prediction of the direction of redox reactions 4. Relationship of change in free energy to equilibrium constants and electrode potentials Lab 21. Measurements using electrochemical cells and electroplating
Unit 11 Bonding and structures (9 days)	*Hill/Petrucci Text* Chpt 9: Chemical Bonds Chpt 10: Bonding theory and Molecular Structure Chpt 11 States of Matter and Intermolecular Forces sections 5-8	-Review of bond types -Review of electronegativity -Review of IMF's -Formal charge -VSEPR -Complex ions and d level e- -Dipole moment -Hybridization of bonds -Sigma and pi bonds	1. Bond type based on properties, conduct, MP, sol in water, sol in organic. (from prerequisite course)*	**I. Structure of Matter** 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 C. Nuclear chemistry: nuclear equations, half-lives, and radioactivity; chemical applications

Unit 12 About 10 remaining days post test		Topics in organic chemistry	Synthesis of esters	Lab 22. Synthesis, purification, and analysis of an organic compound

Lab covered in general chemistry
2. Determination of the percentage of water in a hydrate
5. Determination of the molar volume of a gas
9. Determination of mass and mole relationship in a chemical reaction
14. Separation and qualitative analysis of cations and anions
20. Determination of electrochemical series