Advanced Placement Chemistry

Course Syllabus, Including Laboratory Component and Evidence of Satisfying the A. P. Curricular Requirements

A. P. Chemistry at our high school is a 1.5 credit course. Prerequisites for this course are: *two credits in algebra *one credit in chemistry *one credit in physics (may be taken concurrently) Classes meet for 83 minutes each day for semester one (90 days), and 83 minutes every-other-day for semester two (45 days). Preparing for and taking the A.P. Chemistry Exam is a requirement for all students enrolled in this course. The course provides instruction in each of the five content areas outlined in the Course Description. The content areas addressed in each topic are listed in blue print at the end of each topic.

The student textbook is Chemistry by Zumdahl and Zumdahl, 6th edition, and the Study Guide to Accompany Chemistry by Zumdahl. A rigorous laboratory component is included, with college-level calculations, real-time data gathering with PASCO probes, the use of DataStudio graphing and analysis software, and written lab reports. A complete list of course resources is at the end of this Syllabus.

Topic	Starting Date	Laboratory Work
Review of chemistry 1 Topics	September	* Density Determinations
Matter: property and states	Weeks1 and 2	* Determination of the Empirical Formula of SnOx
Atomic theory & structure		
Quantum theory		
Periodic properties & trends		
Chemical bonding		
Chemical reactions & balancing equations		
Mole concept / Stoichiometry		
Descriptive chemistry		

Content Areas: **Structure of Matter**
                        Chemical calculations and mathematical formulation of chemical principles

Topic	Starting Date	Laboratory Work
Types of Chemical Reactions	September	* Titration of an acid and a Base (PASCO probes)
Reaction Prediction	Weeks 3 and 4	* Types of Chemical Reactions
Weekly equation set from A.P. Exam	October to April (weekly)	

Content Areas: **Chemical Reactions**
                        Descriptive Chemistry

Topic	Starting Date	Laboratory Work
Oxidation-Reduction Reactions and	October	* Determination of Iron by Redox Titration
Electrochemistry	Week 1	* The Potential of Electrochemical Cells (PASCO)
Redox reactions		
Balancing oxidation-reduction reactions		
Galvanic Cells		
Cell potential, electrical work, free energy		
Dependence of cell potential on concentration		
Corrosion, Electrolysis		

Content Areas: **Chemical Reactions**
                        Chemical calculations and mathematical formulation of chemical principles

Topic	Starting Date	Laboratory Work
Chemical Bonding and Molecular Geometry	October	* Molecular Model Building
Types of bonds	Weeks 2 and 3	* Determination of Caffeine in Beverages by HPLC
Bond polarity and dipole moments		(Science in Motion (SIM) Lab, equipment borrowed
Lewis structures		from a local university)
Octet rule exceptions, Resonance		
VSEPR model and molecular shape		
Hybridization, Molecular orbital model		
Homonuclear and heteronuclear diatomics		

Content Areas: **Structure of Matter**
                        Descriptive Chemistry

Topic	Starting Date	Laboratory Work
Gases	October, week 4	* Oxygen and Hydrogen Preparation
Pressure	November, week 1	* Molar Volume of a Gas
Gas laws:Boyle's, Charles', Avogadro's,		* Evaluation of the Gas Law Constant
Gay-Lussac's combined and ideal		* Percentage of Oxygen in Air
Gas stoichiometry		* Molar Mass of Butane
Dalton's law of partial pressures		* (Diffusion of gases) Graham's Law of Effusion
Kinetic molecular theory of gases		
Effusion and diffusion		
Real gases, Atmospheric gases		

Content Areas: States of Matter
               Chemical calculations and mathematical formulation of chemical principles
                Descriptive Chemistry

Topic	Starting Date	Laboratory Work
Thermochemistry/ Thermodynamics	November	* Enthalpy of a Chemical Reaction
Enthalpy equations, laws, calculations	Weeks 2 and 3	Hess's Law (PASCO probes)
Calorimetry, Hess's Law		* Specific Heat/ Temperature of a Bunsen Burner Flame
Standard enthalpies of formation		* Heat of combustion / Heat of Solidification
Enthalphy equations and calculations in reactions		

Content Areas: States of Matter
               Chemical calculations and mathematical formulation of chemical principles
                Descriptive Chemistry

Topic	Starting Date	Laboratory Work
Liquids and Solids / Phase Changes	November, week 4	* The Triple Point of Carbon Dioxide
Intermolecular forces	December, week 1	(PASCO probes)
Liquids, Solids, Metal bonds		
Molecular and ionic solids		
Vapor pressure curves, Phase diagrams		

Content Areas: States of Matter, Descriptive Chemistry, Structure of Matter

Topic	Starting Date	Laboratory Work
Solutions	December	* The Solubility of a Salt
Molarity and molality	Weeks 2 and 3	* Molar Mass by Freezing Point Depression (SIM lab)
Solubility factors, Ideal and nonideal solutions		* Spectrophotometric Analysis of Commercial Aspirin
Colligative properties		using Beers' Law
Boiling point elevation and freezing point depression		
Colloids		

Content Areas: **Chemical calculations and mathematical formulation of chemical principles**
Structure of Matter

Topic	Starting Date	Laboratory Work
Nuclear Chemistry	January	* Exponential Decay (Kinetics) / Geiger Counter
Balancing nuclear equations	Week 1	
Nuclear transformations in equations		
Nuclear stability		
Radioactive decay and kinetics		

Content Areas: **Structure of Matter**
Chemical calculations and mathematical formulation of chemical principles

Topic	Starting Date	Laboratory Work
Kinetics	January	* Iodine Clock Reaction
Reaction rates, Rate laws	Weeks 2 and 3	* Rates of Chemical Reactions
Determination of the form of the rate law		
Method of initial rates		
Differential rate law		
Integrated rate law		
Rate constants, Reaction mechanisms		
Homogeneous and heterogeneous catalysis		

Content Areas: **Chemical Reactions**
Chemical calculations and mathematical formulation of chemical principles

Topic	Starting Date	Laboratory Work
Equilibrium	January, week 4	* Determination of an Equilibrium Constant
Equilibrium constant	February, week 1	(Iron (III) and SCN^- by Spectrophotometry)
Equilibrium and pressure		* Stresses Applied to an Equilibrium System
Heterogeneous and homogeneous equilibria		(Le Châtelier's Principle)
Equilibrium problems and calculations		
Le Châtelier's principle		

Content Areas: **Chemical Reactions**
                 Chemical calculations and mathematical formulation of chemical principles

Topic	Starting Date	Laboratory Work
Acid- Base Equilibria	February	* Titration of a Diprotic or Triprotic Acid (PASCO)
Arrhenius, Bronsted-Lowry, Lewis	Weeks 2 and 3	* Ka Determination
pH scale and calculations		* Determination of Calcium in Calcium Supplements
Polyprotic acids		
Acid-base properties of salts		
Acid-base problems using pH, pOH, [H+] and [OH -]		
Buffered solutions and buffering capacity		
Common ion effect		
Titrations and pH curves, Acid-base indicators		

Content Areas: **Chemical Reactions**
                 Chemical calculations and mathematical formulation of chemical principles

Topic	Starting Date	Laboratory Work
Solubility Equilibria	February, week 4	* K_{sp} of $Ca(OH)_2$
Solubility & Solubility Product (K_{sp})	March, week 1	
Precipitation and qualitative analysis		

Content Areas: **Chemical Reactions**
                 Chemical calculations and mathematical formulation of chemical principles

Topic	Starting Date	Laboratory Work

Descriptive Chemistry
    Zumdahl Chapters 19, 20, 21
	October - April
	    Independent Study Unit	

Content Areas: Descriptive Chemistry

Topic	Starting Date	Laboratory Work

Organic Chemistry
    Alkanes, alkenes, alkynes, alkadienes,
       aromatic hydrocarbonds, alcohols,
       aldehydes, ketones, and amines
    Nomenclature, Isomers, Polymers
	March
	    Weeks 2 and 3
		* Synthesis of Aspirin (SIM lab)
		* Chromatography of plant extracts (SIM lab)

Content Areas: States of Matter
**   Chemical Reactions**
**   Structure of Matter**

Topic	Starting Date	Laboratory Work
Coordination Chemistry	March Week 4	* Coordination compounds (Copper II)

Content Areas: Chemical Reactions
**   Structure of Matter**

Topic	Starting Date	Laboratory Work

Review for A.P. Chemistry Exam	April (entire month)
	May (until exam)
		* Qualitative Analysis
		    - Cations of groups I, II, III,
		    - Anions
		* "Unknown" Determination by Qualitative Analysis

Content Areas: All Five Content Areas are Reviewed during the A.P. Exam Preparation Time

Course Text, Laboratory Manual, and Additional Resources

Student Textbook:
Zumdahl, Steven S. and Susan A. Zumdahl. *Chemistry, 6th edition.*
New York: Houghton-Mifflin, 2003.

Student Study Guide:
Kelter, Paul B. *Student Study Guide to accompany Zumdahl's Chemistry, 6th Edition.*
New York: Houghton-Mifflin, 2003.

Laboratory Resources:
Labs come from a variety of sources, but most are from these two college-level laboratory manuals:

Hall, James F. *Experimental Chemistry. A Laboratory Manual to accompany*
Zumdahl's Chemistry, 6th Edition. New York: Houghton-Mifflin, 2003.

Weiss, Gerald S. and Robert K. Wismer and Thomas G. Greco. *Experiments in*
General Chemistry: A Laboratory Program to accompany Petrucci's General Chemistry. New York: MacMillan Publishing Company,
1985.

Reference Resources:
Lide, David R., ed. *CRC Handbook of Chemistry and Physics, 79th Edition,*
Boca Raton, Florida: CRC Press, 1998.

Petrucci, Ralph H. *General Chemistry, 5th Edition.* New York: Macmillan Publishing
Company, 1989.

Budavari, Susan., ed. *The Merck Index: An Encyclopedia of Chemicals, Drugs,*
and Biologicals, 11th Edition. Rahway, N.J.: Merck & Co., Inc., 1989.

Laboratory Software and Sensors:
PASCO Scientific Laboratory Data Collection System:
Passport (digital probeware which connects to our networked PC's)
ScienceWorkshop (black interface boxes)
DataStudio Softare (data collection and data analysis software)
PASCO Scientific, Roseville, Ca. 95747