AP Chemistry 2011-2012

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Course Goals

AP Chemistry TEST: Monday, May 7; 8 am

AP Chemistry is designed to prepare the student to pass the College Board AP Chemistry examination. Since the examination is used to determine college level credit, the subject matter and the rate at which it is taught reflect academic performance at that level.
As defined by the College Board, the class content focuses on five major areas of study: Structure of Matter, States of Matter, Reactions, Descriptive Chemistry and a comprehensive "hands on" Laboratory program. In addition to learning significant content in these areas, our goal is that students will also improve in ability to think critically and independently, apply analytical problem solving skills to scientific and societal issues, and appreciate the integral role of chemistry in our society and the natural world.

Student Resources

Text:
Chemistry 6th edition, Zumdahl and Zumdahl, Houghton Mifflin 2003
Podcast Video Lectures:
Class time is limited for the amount of material we need to cover in AP chemistry. We will be spending class time in group activities, problem review, and labs. The lecture material will be covered primarily by podcasts (15 – 30 minutes in length) to watch as homework. The podcasts are now readily available from a variety of sources, but many we will use are prepared by teachers Jonathan Bergman and Aaron Sams at Woodland Park High School in Colorado. They use our textbook, and are very good, if a bit silly at times. The podcasts provide a detailed look at problem solving required for each chapter. To encourage you to use the podcasts, we will have weekly open-note quizzes over the material in the assigned podcast. Students who are not able to download podcasts at home should see me for options.
AP Practice Book
Student purchase. Strongly recommended for review and preparation for the exam.

Grades

Practice Problems, Podcasts and Quizzes- 25% OF GRADE

Video Podcasts will be assigned for each unit, followed by open-note quizzes in class. The podcasts are a recorded lecture, and students should take careful notes.
Homework is assigned for each unit covered. It usually consists of selected problems from the end of the chapter that reflect key concepts the student needs to master. For book assigned problems, the answers

are at the end of the book. As in many college-level classes, problems are assigned for students to use as practice. It is expected that you will bring questions to class or work with others to understand and master the problems.
Some assigned book problems will be graded on completion - showing work is necessary. Problems turned in after the due date will receive reduced credit.

CALM: Some homework will be computer-based and graded. These problems are provided as part of the Indiana University CALM program. It is similar to Webassign, (used at the UW, for example) but FREE! Each student will have an account and problems assigned. Grades will be counted!

Group work in problem solving or guided inquiry of concepts is an integral part of the course. Working with and learning from peers is a highly effective technique.

AP CHEMISTRY LAB PROGRAM- 25% of Grade

The laboratory experience is an essential component of the AP Chemistry curriculum, with simultaneous goals of learning techniques used in chemistry lab (for example, gravimetric analysis, use of colorimeters, and titrations) and also developing skills of laboratory investigation. Each week of class is divided up into three class periods, one of 50 minutes in length and two of 100 minutes. One of the 100 minute class periods is dedicated to that weeks' scheduled laboratory exercise. Students who miss the lab can make-up the lab after school hours.
Labs are conducted in the format outlined in the Science Writing Heuristic, a student-centered approach to develop critical thinking skills, laboratory techniques, chemistry investigative skills, and collaboration and cooperation among students. (Reference: Burke, K. A., and Tom Greenbowe. The Process of the Science Writing Heuristic Homepage. Chemistry Department - Iowa State University. 19 June 2009 <http://avogadro.chem.iastate.edu/SWH/homepage.htm>.)

The AP Chemistry program builds on labs accomplished during first year chemistry.
The student report consists of an experimental question, an abstract of the given background information, a purpose/problem/hypothesis statement, a summarized procedure, equipment list and safety cautions or concerns, all observations and data including any graph or table generated, and analysis showing all work. Analysis answers, when appropriate, should be written in complete sentences. All reports are contained in a bound, hard cover lab book, and turned in for evaluation and grading. Wire-spiral notebooks are not acceptable.

TESTING - 50% OF GRADE

Periodic tests and quizzes are given to assess student achievement and to provide instructional feedback. Tests are structured similarly to the AP Exam, with released multiple choice questions and released free response questions from past AP exams. Tests will be comprehensive. All students are encouraged to review each exam and strive to revisit any concepts not fully understood, and will have an opportunity to edit poor grades.

Course Outline

Summer Unit: Review of Chemistry Measurements, Math and Nomenclature. By Aug 31

Fall Semester

Unit 1: Introductory and Review Concepts: Lab Skills, Formulas, Moles, Stoichiometry	Sept 6-19
Unit 2: Solutions and Reactions: Quantitative Solution stoichiometry, Reaction Type review and prediction	Sept 20 –Oct 4
Unit 3: Gases and Kinetic Molecular theory: Gas laws and Gas reactions	Oct 6-17
Unit 4: Thermochemistry: Heats of reaction and systems	Oct 18-31
Unit 5: Atomic Theory and Bonding: electronic structure of atoms, basis of periodic trends, bonding and intermolecular forces	Nov 1-22
Unit 6: Kinetics: rates of reactions, rate laws	Nov 28 – Dec 13
Optional Winter Break Study: Nuclear and Organic	
Unit 7: Thermodynamics: Enthalpy, Entropy, and Free Energy	Jan 3-24

Spring Semester

Unit 8: Equilibria: Reaction Equilibrium, Le Chatelier's principle	Feb 2-16
Unit 9: Acid-Base and Aqueous Equilibria: Acids and Bases, pH, buffers, titrations, solubility	Feb 22 – March 29
Spring Break	
Unit 10: Electrochemistry: Redox review, activity series, electrochemical cells and electrolysis	April 9 -19
Unit 11: Solids, Liquids, Gases: phase transitions, colligative properties	April 23- 27
Review	April 30 – May 3
Exam	**May 7**
Unit 12: Post exam projects: TBD	May 14 – June 12

Detailed Schedule

Unit	Date	Objectives	Podcasts: Bergman and Sams	Labs	Book Problems
Summer Work Chapter 1 -2	By Aug 31	Know by memory the names and symbols for key elements and ions names (and charges.) Be able to name ionic compounds Be able to name acids Be able to name binary covalent compounds Be able to classify matter as pure compounds and elements or mixtures. Classify mixtures as heterogeneous or homogeneous. Know metric prefixes and values, and be able to convert between base unit and others (kilo- and milli-, in particular.) Be able to convert measurements using dimensional analysis Be able to count and use significant figures in calculations	AP Chem- Intro-Stoich-1- Dimensional Analysis.mp4 AP Chem- Intro-Stoich-2- Naming-Balancing (1-2).mp4	Cookie Baking without a recipe	p 33: 11, 13, 15, 17, 19, 25, 35, 39, 43, 47, 48, 49, 57, 63, 72 p.75: 51, 53, 55, 57, 59, 67, 71
Unit 1 Introductory and Review Concepts – Chapter 2-3 POGIL Activities: 02-1, 2, 3 03-4 5-1	Sep 6 – 19 Test Sept 19	Balance Chemical reactions Be able to use the Atomic # and Mass # of an isotope to calculate the numbers of protons, neutrons and electrons present Know what the term isotope means and be able to perform simple calculations relating to isotopic data Know the approximate locations of metals, non-metals and metalloids on the periodic table Calculate moles and molar mass Use dimensional analysis to solve stoichiometric problems Calculate percent yield Calculate percent composition Calculate empirical and molecular formulas	AP Chem- Intro-Stoich-2- Naming-Balancing (2-2).mp4 AP Chem- Intro-Stoich-3- Limiting Reactant-Yield .mp4 AP Chem-Intro-Stoich-4-Empir-MolecForm-CombustProbs.mp4	9-8 Lab: Mass % of $NaHCO_3$ in antacid tablet 9-15 Lab: Stoich and limiting reactants	Chapter 2: 19, 27, 49 Chapter 3: 29, 31, 55, 57, 63, 69, 83, 91, 95, 97
Unit 2: Solutions and reactions Chapter 4 POGIL Activities: 05-2, 3 04-2, 3, 4	Sep 20 – Oct 4 MC test Oct 3 Free Response test Oct 4	Calculate the concentrations of all solution species Prepare solutions of different concentrations by dilution. Distinguish between electrolytes and non-electrolytes Describe difference between strong and week electrolytes. Predict the solubility of ionic compounds using solubility rules. Balance chemical reactions according to the law of conservation of mass. Describe chemical phenomena by writing chemical equations Recognize the type of reaction based on the identity of the reactants. Predict the products of a reaction.	AP Chem- Reactions-1- Electrolytes and Solutions.mp4 AP Chem- Reactions-5- Reaction Stoich (1-3).mp4 AP Chem- Reactions-2- Non-Redox (1-3).mp4 AP Chem- Reactions-3- Balancing Redox (1-3).mp4 AP Chem- Reactions-4- Predicting Redox (1-2).mp4	9-22 & 27 Alum Synthesis and analysis 9-29 Qualitative Analysis (7 bottle problem)	p181: 11(a,c,e) 15(a,c) 17, 29/31, 37, p 183: 57, 61, 63, 65, 71, 73, 77, 85

Unit 3: Gases Chapter 5 POGIL Activities: 11-1, 2, 3	Oct 6-17 Test Oct 17	List the four postulates of the kinetic molecular theory and understand the limitations of each assumption. Know that temperature is a direct measure of kinetic energy, and that samples of gas at the same temperature have the same average kinetic energy Use the ideal gas equation to calculate any of the four variables relating to the gas using the equation PV = nRT. Convert between pressure units (mmHg, atm, torr, kPa, Pa). Calculate the change to a gas's temperature, pressure, or volume at two given conditions using the combined gas law. Use Dalton's law to calculate the partial pressures and total pressures of mixtures of gases. Use the mole fraction and the total pressure of a mixture of gases to calculate the partial pressure of a gas in the mixture. Use Graham's law to compare the relative rates of effusion and diffusion of two gases and understand that at a given temperature, lighter molecules move faster than heavier molecules.	5.1IntroToGasLawsIPOD 5.2MoreGasLawsIPOD	10-6 Small Scale Gas Lab 10-13 Lab: Molar Mass of a volatile liquid Lab	Chapter 5 p. 231: 16, 25, 27, 29, 33, 37, 41,45, 47 p. 234: 51, 53, 59, 63, 69 p. 236: 73, 75, 79, 81, 83, 91 p 237: 99, 103, 107
Unit 4: Thermochem Chapter 6 POGIL Activities: 06-1, 2, 3	Oct 18-31 Test MC Free Response Oct 31	Know the specific heat of water is 4.184 J/gC Use the calorimetry relationship to determine the heat of a reaction or process. Use Hess' law to calculate heats of reaction. Use heats of formation to calculate heats of reactions. Understand, be able to quote a definition and write suitable equations for standard enthalpy of formation Understand, be able to quote a definition and write suitable equations for standard enthalpy of combustion Understand and be able to use a Hess's law cycle or algebraic methods to calculate a given enthalpy change Understand the meaning of the terms exothermic and endothermic	6.1Thermochem_CalorimetryIPOD 6.2HessLawIPOD	10-20 Calorimetry technique 10-25 Heat of reaction – Hess Law	Chapter 6 11/2: p. 19, 21, 25, 31, 33 11/4: p. 282: 35, 39, 43, 45, 53, 55, 61, 65

Unit 5: Atomic Structure, and Periodic Trends Chapter 7,8, 10 Pogil Activities: 07-1,2 3,4,5 08-1,2,3 09-1,2,3 10-1,2	Nov 1 – 22 Test Nov 22 MC and Free Response	Know experiments that demonstrated existence of subatomic particles. Understand the Bohr model of the atom Understand how line emission spectra are formed Know that the electron can be considered to have wave-like properties as well as particle-type properties Understand and use equations that relate the Energy, frequency, speed and wavelength of waves including the Rydberg equation Understand the concept of electrons in shells and the use of quantum numbers Understand the use of the terms s, p, d and f and their use in orbital notation Be able to construct the electronic configuration of the elements using the s, p and d and f notation, with and without noble gas core notation Be able to construct the electronic configuration of simple ions (including d block ions) Be able to describe electronic configurations using the orbital diagrams Understand that regular, repeatable patterns occur across periods and within groups on the periodic table Know that the noble gases have full outer shells that represent stable electronic configurations Know the definition of ionization energy Know the definition of electron affinity Know and understand the variation in ionization energy and electron affinity when moving about the periodic table Be able to predict the group an element is in from ionization energy data Know how and why atomic and ionic size vary when moving about the periodic table	AtomicTheory_LightIPOD; QunMechElectConfg_iPOD PeriodicTrends_iPod BondingIntro_iPod; BondEnergyLewis_iPod MolecShapePolarity_iPod; IntermolecularForce_iPod Follow along notes for podcasts	Labs: 11-3 Light Spectra 11-10 Bonding and Solubility Lab	Chapter 7 p. 337; 41, 43, 47, 53, 55 p. 338; 61, 63, 69, 71, 73, 81, 85,87, 89, 90, 133 Chapter 8 Set 3: 21, 23, 27, 29, 31, 35 Set 4: 39, 41, 43, 51, 53, 61, 65, 77, 83, 89 10.1 p 500, 35 - 40

Unit 6: Kinetics Chapter 12 Pogil Activities 13-1, 2, 3	Nov 28 – Dec 12 Test Dec 12	Describe how temperature, concentration, surface area, pressure, catalysts, and inhibitors affect the rate of a chemical reaction. Use the Maxwell-Boltzmann distribution diagram to explain the effect of temperature on rate. Calculate the new rate constant at a different temperatures using the Arrhenius equation. Write the generic form of a rate law for any given chemical reaction. Use experimental data to determine the order of each reactant. Use the order of each reactant to write the experimental rate law and determine the overall order of the reaction. Use concentration and time data for a single experiment to determine the order of a reaction with respect to the reactant whose concentration was measured. Use plots of the data as to determine the order of the reaction. Write the integrated rate law. Use the integrated rate law to determine the relationship between time and concentration. Understand that most reactions happen in a series of interrelated steps. Identify whether or not a proposed mechanism is plausible.	PromDate12.1a 12.1 Kinetics Intro, 12.2IntegratedKinetics, 12.3 Mechanisms-Catalysts	Lab: Order of reaction Clock reaction	p. 598: 17, 19, 21, 23, 25 Set 2: p 600: 27, 28, 31, 33, 37 Set 3: p 601: 39, 41, 45, 46, 49, 53, 55, 61
Christmas study – nuclear and organic	Dec 15: Jan 3, nuclear, org wrap				
Semester end		AP Practice Test, Jan 26 Final Schedule			

Unit 8: Equilibrium Chapter 13 Pogil Activities 15-1	Jan 30- Feb 16 Test Feb 16	Distinguish between heterogeneous and homogeneous equilibria. Write equilibria expressions using a balanced chemical equation. Relate the magnitude of the equilibrium constant to whether or not the reversible reaction favors the reactants or the products. Convert between K_p and K_c. Calculate the reaction quotient (Q) and predict whether or not the reaction will proceed forwards, backwards, or whether it is already at equilibrium. Combine the *K* values for multistep processes. Predict what will happen to an equilibrium system when a stress (such as heat, changes in concentration or pressure, etc.) is placed on the system.	13.1EquilbIntro 13.2Equilibrium2	LeChatelier- CuCl2 lab Spectroscopy techniques & Determination Eq Constant	Ch 13 Bookwork: 19, 23, 31, 41, 43, 45, 47, 51, 55, 57, 59, 72
	Presidents Day Holiday: Feb 17- 21				
Unit 9: Acid-Base and Aqueous Equilibria Chapter 14 & 15 Pogil Activities 16-1, 2, 3 17-1,2, 3	Feb 22 – March 26 Test March 26 Multiple choice Free Response	Be able to recall the Bronsted Lowry, Arrhenius and Lewis definitions of an acids and bases Be able to identify acid-base conjugate pairs Recall the difference between strong and weak acids in terms of ionization Be able to calculate pH of strong acids and strong bases Be able to calculate pH of weak acids and weak bases using K_a and K_b Recall a definition of K_w, the ionic product of water Recall the definition of a buffer Understand and explain how a buffer works Be able to identify and calculate the pH of a buffer solution Understand the techniques and procedures associated with titrations Be able to sketch titration curves and be able to suggest a suitable indicator for a particular titration Determine the solubility	14.1 Acid-Base Intro; 14.2StrongAcid-Base; 14.3PercentDissociation; 14.4 SaltHydrolysis 15.1CommonIonBuffers; 15.2aTitrationCalcs; 15.2bMoreTitrationCalcsPolyprotic; 15.3Indicators_IntroToKsp; 15.4AdvKsp; Follow along notes for podcasts	Titration intro Standardization of Base Unknown Acid titration Commercial Vinegar titration Determination of Solubility Constant	14: Set 1: p703: 17, 29, 31, 39, 44, 45 Set 2: 49, 51, 53, 61, 63, 65, 75, 83, 87, 91, 93, 95a, Set 3: 99, 105, 111, 113, 117 Ch 15 problem set 1: p.776: 57, 59, 61, 63, 65, 69 Problem set 2: p774: 21, 23, 25, 27, 29, 31, 33, 35, 37, 43, 47 Problem set 3: 81, 85, 87, 89, 91, 95, 109, 117, 127

Unit 10 Electrochemistry Chapter 17 Pogil Activites 18-1, 2,	April 9- 19	Recall the definition of oxidation and reduction in terms of electrons Understand and recall the definition of standard electrode potential Understand and recall how to construct a cell diagram (line notation) and draw a diagram (picture) of the apparatus needed Recall the conditions that standard electrode potentials are measured under Understand the nature and purpose of a salt bridge Be able to predict the likelihood or otherwise of chemical reactions using standard electrode potentials and understand how those predictions may not prove to be accurate Understand and use the Nernst equation Understand the relationship between Gibbs free energy, equilibrium constants and Ecell, and be able to perform related calculations Understand electrolysis and be able to perform quantitative calculations relating to it	17.1GalvCellsRedPot.mp4; 17.2CellPotNernstBatteries.mp4 17.3Electrolysis.mp4 Follow-along notes	Activity Series Electrochemical Cells Lab.	Ch 17, p 868: 15, 16(a,c,d,f) 17, 19, 25-33(odd) 37, 45,51,57,73
Unit 11 Solids, Liquids, Solutions Chapter 10-11 Pogil Activities 10-3, 12-1	April 23 – 26	Understand the concept of vapor pressure Be able to relate changes (both quantitative and qualitative) in vapor pressure to addition of non-volatile solutes to solvents (Raoult's Law) Be able to recall and use equations relating to quantitative treatments of Boiling Point Elevation, Freezing Point Depression Be able to interpret a phase transition diagram	**AP Chem: Vapor Pressure & Phase Diagrams** **AP Chem: Solutions-1: Concentration Units** **AP Chem: Solutions-3: Colligative Properties**	No labs	