



Ms. Zukowski

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AP Chemistry Syllabus 2015-2016

Course Description

AP Chemistry is considered the equivalent of the first year general chemistry course at the college level. With an acceptable score on the national exam in May, students will be able to register for second year courses in their chemistry sequences in their first year of college. The curriculum is focused on six big ideas compiled by the College Board and are listed below. There are also seven science practices that are discussed in the content outline of the syllabus and will be exercised in the laboratory to combine curricular content with inquiry, reasoning skills, and experimental design.

Big Idea 1: Structure of Matter

Big Idea 2: Properties of matter- characteristics, states, and forces of attraction

Big Idea 3: Chemical reactions

Big Idea 4: Rates of Chemical Reactions

Big Idea 5: Thermodynamics

Big Idea 6: Equilibrium

Goals of the course

- Students are prepared to be critical thinkers who are able to function and communicate effectively in a scientifically and technology based community.
- Students will be able to analyze scientific and societal issues using appropriate methodical problem solving.
- Students will emerge from this program with an appreciation and deeper understanding of their immediate surroundings from biological, mathematical, chemical, and industrial viewpoints.
- Students will be able to pass the AP Chemistry Examination in May.

In laboratory experiments, students will physically manipulate equipment and materials in order to make relevant observations and collect data. They will use the collected data to form conclusions and confirm

or negate hypotheses. Students will also be able to articulate and compare results and procedures informally to their peers or formally to their instructor and in verbal or written formats. [C5]

Textbook and Lab Manual

Zumdahl, Steven and Susan Zumdahl. Chemistry, 8th Edition. Belmont, CA: Cengage Learning, 2012.

The College Board. AP Chemistry Guided Inquiry Experiments: Applying the Science Practices. 2013.

Required materials

Scientific calculator (with graphing capabilities if possible), composition notebook, 4 spiral one-subject notebooks

The Seven Science Practices and Content Outline *durations are approximate

Science Practice 1

The student can use representations and models to communicate scientific phenomena and solve scientific problems.

Science Practice 2

The student can use mathematics appropriately.

Science Practice 3

The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.

Science Practice 4

The student can plan and implement data collection strategies in relation to a particular scientific question. (Note: Data can be collected from many different sources, e.g., investigations, scientific observations, the findings of others, historic reconstruction and/or archived data.)

Science Practice 5

The student can perform data analysis and evaluation of evidence.

Science Practice 6

The student can work with scientific explanations and theories.

Science Practice 7

The student is able to connect and relate knowledge across various scales, concepts and representations in and across domains.

First Quarter

Unit 1: Chemical Foundations (Ch. 1), Atoms, Molecules and Ions (Ch. 2)

12 days

Lab: Math and Measurement in Science & Density of an Organic Liquid **Description:** Students learn how to measure mass and volume with varied pieces of equipment and focus on the accuracy of those pieces of equipment in their calculation and determination of significant figures. Students also determine the identity of an unknown organic liquid using density determination.

GUIDED INQUIRY Lab: Discovery of Physical and Chemical Properties **Description:** Students are given the materials to conduct various procedures. They construct a procedure for each of the eight changes to be observed, have their procedures approved by the instructor, and then carry out the procedures. The data collected is used to develop a set of criteria for determining whether a given change is chemical or physical.

Unit 2: Stoichiometry (Ch. 3) 11 days

Lab: Stoichiometry Lab **Description:** Students determine the correct mole ratio of reactants in an exothermic reaction by mixing different amounts of reactants and graphing temperature changes.

Unit 3: Gases (Ch. 5) 10 days

Lab: Molar Mass of a Volatile Liquid **Description:** Students use the Dumas method for determination of the molar mass of an unknown volatile liquid.

Unit 4: Thermochemistry (Ch. 6) 11 days

Lab: Hess's Law Lab **Description:** Students perform a series of reactions and calculate enthalpy, proving Hess's law.

Second Quarter

Unit 5: Atomic Structure and Periodicity (Ch.7) 10 days

Lab: Spectrum and Spectroscopy Lab **Description:** Students look at a series of emission spectra and determine the identity of an unknown. They will also receive and analyze IR and mass spectroscopy data.¹²

Unit 6: Bonding: General Concepts (Ch. 8), Covalent Bonding: Orbitals (Ch. 9.1, 9.5)

Organic Chemistry (Ch.22.1 -22.5) 11 days

GUIDED INQUIRY Lab: Bonding Lab **Description:** Students experimentally investigate ionic and molecular substances deducing properties of their bonds in the process.

GUIDED INQUIRY Lab: Investigation of Solids **Description:** Students investigate types of solids using various experimental techniques.

Unit 7: Forces of Nature: Liquids, Solids (Ch.10) 5 days

Lab: Preparation of Solutions **Lab Description:** Students make solutions of specified concentrations gravimetrically and by dilution. Solution concentrations will be checked for accuracy using a spectrophotometer.

Lab: Vapor Pressure of Liquids **Description:** Students measure the vapor pressure of ethanol at different temperatures to determine ΔH .

Unit 8: Solutions (Ch. 4.1 – 4.3, 11.1 – 11.3) 9 days

Lab: pH Titration **Lab Description:** Students perform a titration and then determine the concentration of an HCl solution by using a potentiometric titration curve and finding the equivalence point. Data is graphed in a graphing program.

Lab: Bleach **Lab Description:** Students perform redox titrations to determine the concentration of hypochlorite in household bleach.

Unit 9: Solubility and Colligative Properties (Ch.4.5-4.7, 11.4-11.8) 8 days

Lab: Copper Reaction **Lab Description:** Students perform a series of reactions, starting with copper and ending with copper. Students then calculate percent recovered.

Third Quarter

Unit 10: Chemical Kinetics (Ch. 12) 9 days

GUIDED INQUIRY Lab: Determining the Rate Law of a Crystal Violet Reaction **Description:** Using colorimetry and Beer's law, students determine the order of a reaction and its rate law.

Lab: Determining the Activation Energy of the Crystal Violet Reaction **Description:** Students use the same set up as in the crystal violet lab, but this time varying temperature to calculate the activation energy with the use of the Arrhenius equation.

Unit 11: Chemical Equilibrium (Ch. 13) 11 days

Lab: Determining K_c with Various Initial Concentrations **Description:** Students use a spectrophotometer to determine the K_c of a series of reactions.

Unit 12: Acids and Bases (Ch. 14) 10 days

Lab: Determining K_a by Half Titration **Description:** Students do a titration in which $\frac{1}{2}$ of the weak acid titrated is neutralized (aka midpoint) and then the K_a is determined.

GUIDED INQUIRY Lab: Types of Titrations **Description:** Students investigate titration curves by doing titrations of different combinations of weak and strong acids and bases.

Unit 13 Application of Aqueous Equilibria (Ch.4.8, 15) 10 days

GUIDED INQUIRY Lab: Preparation of a Buffer **Description:** Given a selection of chemicals, students prepare a buffer of a given pH.

Lab: Molar Solubility and Determination of K_{sp} **Description:** Students find the K_{sp} of calcium hydroxide doing a potentiometric titration with the addition of methyl orange indicator for verification.

Fourth Quarter

Unit 14: Spontaneity, Entropy, and Free Energy (Ch. 6.4, 16) 7 days

Lab: Solubility and Determination of ΔH° , ΔS° , ΔG° of Calcium Hydroxide **Description:** Students collect and analyze data to determine ΔH° , ΔS° , and ΔG° of calcium hydroxide.

Unit 15: Electrochemistry (Ch. 4.9- 4.10, 17) 6 days

Lab: Voltaic Cell Lab **Description:** Students find the reduction potentials of a series of reactions using voltaic cells/multi-meters and build their own reduction potential table. Dilutions will be made and the Nernst equation will also be tested.

Within last 4 weeks before exam in May:

2 AP style exams

1 full mock AP exam

Review of all topics for AP Final Exam

Lab: Green Crystal Lab **Description:** A series of labs completed over a 4-week period. Students work at their own pace in pairs. The goal of this lab is to determine the empirical formula of a ferro-oxalato crystal. It includes the following experiments:

Experiment 1: Synthesis of the crystal, Experiment 2: Standardization of KMnO_4 by redox titration, Experiment 3: Determination of percent oxalate in crystal by redox titration, Experiment 4: Standardization of NaOH by acid/base titration, Experiment 5: Determination of percent K^+ and Fe^{3+} by ion exchange chromatography and a double equivalence point titration, Experiment 6: Determination of the percent water in the hydrated crystal.