AP Chemistry
Syllabus

Course Description:
AP Chemistry is equivalent to an introductory college level chemistry class. Students taking this course should have already successfully completed a year of laboratory chemistry. AP Chemistry requires a serious commitment from students. You should be prepared to devote a significant amount of time to reading a college level text book, working on problem sets, writing lab reports, and working on projects outside of class. This class will be conducted primarily through laboratory experiments and problem solving activities, reinforced with lecture and discussion. We will also complete long-term projects throughout the year.

Course Objectives:
- Provide students with a college level chemistry experience.
- Develop strong problem solving and critical thinking skills.
- Develop and reinforce laboratory skills and techniques, including: questioning, observing, data collection, and data analysis.
- Develop and reinforce appropriate laboratory safety skills.
- Develop an understanding of how chemistry completes the world around us and how chemistry is applied in the "real world".

Course Requirements:

Lab Notebook: All students must keep a laboratory notebook. Data, observations, and calculations should be recorded in the lab notebook. All lab reports should be recorded in the lab notebook, using the required lab report format.

Problem Sets: Students will be required to complete several problem sets in each unit. We will review and discuss problem sets in class. At least one problem set will be collected and graded for each unit.

Reading Assignments: Students are expected to complete all reading assignments. Reading assignments should be outlined in your notebook. This is to help you become comfortable with a college level textbook.

Quizzes: Short quizzes will be given weekly. Quizzes will generally reflect problem sets that have been completed that week.

Tests: Tests will be given at the end of each unit. Tests will include multiple choice questions, similar to the AP format, and challenging problems and short essays.

Projects: The following projects will be required.

First Semester: Element Mobile

For this project you will be designing and building a three dimensional quantum model of an element and a three dimensional model of a compound containing that element. You must then combine your two models into a mobile.

Second Semester: Energy Resources

For this project you will choose an alternative or traditional energy resource and generate a chemistry based research question pertaining to this resource. You will conduct research to address your question and present your findings to the class.

AP Exam: It is expected that all students taking this course will take the AP Chemistry Exam in May. Financial assistance with the exam fee is available if needed.

Resources:

Text:

Zumdahl, Steven S. and Zumdahl, Susan A. ***Chemistry***. Sixth Edition.

Supplemental Resources:

Vonderbrink, Sally Ann, Ph.D. ***Laboratory Experiments for Advanced Placement Chemistry***. Second Edition.

Jones, Loretta and Tasker, Roy. ***Bridging to the Lab, Media Connecting Chemistry Concepts with Practice.*** (Lab Manual and CD)

Behar, Sharon. ***Testing the Waters, Chemical and Physical Vital Signs of a River***

Grading System:

You will be graded on problem sets, quizzes, tests, lab reports, class activities and projects.

problem sets	10%
labs/activities/quizzes	45%
tests/projects	45%

Make-up work: You will be allowed one week to turn in work missed from excused absences. Make-up work from unexcused absences will not be accepted.

Late work: Late problem sets will not be accepted. Late lab reports/activities and projects will loose ten points for every day after the due date.

Extra Help: If you need help with an assignment you can see me during learning lab, before school, or after school.

Course Outline

Summer Assignment:
Over the summer students will be expected to read sections and complete selected problems in chapter two of the course textbook, ***Chemistry***, by Steven S. Zumdahl and Susan A. Zumdahl (Sixth Edition).
Topics addressed by summer reading and problems include:

- atomic theory
  - history
- atomic structure
- ions
- formulas and naming of ionic compounds
- the periodic table

Semester One:
Note: Units one and two will primarily be conducted as a review, as it is expected that students are already familiar with much of this material from laboratory chemistry. Students will spend a significant amount of time refreshing their problem solving skills, particularly with dimensional analysis and significant figures.

Unit One: Review, Chemical Reactions, and Stoichiometry
Estimated Time: 2.5 weeks **Corresponding Textbook Chapter(s):** 1, 2 ,3, 4

Topics:

- review and discussion of summer work
- measurement review
- significant figures review
- reaction types
- stoichiometry review
- percent composition and formula determination
- writing and balancing net ionic equations
- stiochiometric calculations, including limiting reactant and percent yield
- lab procedures and safety

Laboratories and Activities:
Stoichiometry Practice with Copper and Silver Nitrate
Gravimetric Analysis of a Metal Carbonate*
Determination of the Emperical Formula of Silver Oxide*

Unit Two: Atomic Structure and Periodic Properties
Estimated Time: 2 weeks **Corresponding Textbook Chapter(s):** 7

Topics:

- the quantum model
- quantum numbers
- electron configurations
- atomic spectra
- periodic properties

Laboratories and Activities:
Comparing Atomic Spectra
Liquid Chromatography*

First semester project is assigned.

Unit Three: Bonding, Molecular Structure, and Ionic Compounds
Estimated Time: 2 weeks **Corresponding Textbook Chapter(s):** 8, 9

Topics:
- electronegativity and polarity
- bond types
- ionic bonding
  - ionic formulas
- covalent bonds
  - molecular structure and geometry
  - intermolecular forces
- hybridization

Laboratories and Activities:
Molecule Models

Unit Four: Phases of Matter
Estimated Time: 3 weeks **Corresponding Textbook Chapter(s): 5, 10**

Topics:
- kinetic molecular theory
- gas laws
- gas stoichiometry
- phase changes
- heat of fusion
- heat of vaporization
- phase diagrams and heating curves
- structure and properties solids
  - ionic crystals
  - metals
  - molecular solids
  - network solids

Laboratories and Activities:
- Determining Molar Volume of a Gas*
- Determination of the Molar Mass of Volatile Liquids*
- Heat of Vaporization of Water*

Unit Five: Solutions
Estimated Time: 2 weeks **Corresponding Textbook Chapter(s): 4, 11**

Topics:
- representing concentration
- solution stoichiometry factors that affect solubility
- solid vs. gas solutes
- solubility product
- colligative properties

Laboratories and Activities:
- Molar Mass by Freezing Point Depression*
- Concentration: Preparing a Standard Solution**
- Dissolved Oxygen in Stream Water

Unit Six: Thermochemistry
Estimated Time: 3 weeks **Corresponding Textbook Chapter(s): 6, 16**

Topics:

- specific heat and heat capacity
- bond energy
- endothermic and exothermic processes
- enthalpy
  - enthalpy of formation
  - enthalpy of solution
  - enthalpy of reaction
  - Hess's Law
- Calorimetry
- Gibb's free energy

spontinaity

- entropy
- energy diagrams

energy resources

Laboratories and Activities:

- Enthalpy of Solution
- Enthalpy of Reaction
- Calorimetry: Developing a New Ice Pack**

Unit Seven: Kinetics
Estimated Time: 2 weeks **Corresponding Textbook Chapter(s): 12**

Topics:

- reaction rates
- rate laws
- reaction mechanisms
- catalysts

Laboratories and Activities:

- Kinetics of a Reaction*
- Reaction Dynamics: How Does it Happen? **

Unit Seven: Equilibrium
Estimated Time: 3 weeks **Corresponding Textbook Chapter(s): 13**

Topics:

- equilibrium conditions
- Law of Mass Action
- equilibrium constant
  - calculating
  - interpreting
- equilibrium calculations with pressure
- reaction quotient vs equilibrium constant
- multistep processes
- Le Chatelier's Principle

        - concentration
        - pressure and volume
        - temperature
    - solubility equilibria and Ksp
    - common ion effect

Laboratories and Activities:
- Determination of Ksp for an Ionic Compound*
- Equilibrium: The Chemistry of Magic**

Unit Nine: Acids and Bases
Estimated Time: 3 weeks **Corresponding Textbook Chapter(s): 14,15**

Topics:
- properties of acids and bases
- Arrhenius, Bronstead-Lowry, and Lewis
- pH calcuations
    - ion concentration
    - Kw
    - Ka
    - percent dissociation
    - Kb
    - strong vs. weak acids and bases
    - salts
    - polyprotic acids
- buffers
- titrations
- indicators

Laboratories and Activities:
- Selecting Indicators
- Acid-Base Titrations
- Determination of Ka for Weak Acids
- Preparation and Properties of Buffer Solutions

Unit Nine: Electrochemistry **Estimated Time:** 2 weeks
Topics:
- redox review
    - oxidation states
    - redox reactions
- reduction potentials
- galvanic cells
    - cell potential
- potential, work, and free energy
- potential and concentration
- electrolytic cells
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Laboratories and Activities:
- Electrochemical Cells
- Electrolysis

- Fruit and Veggies clocks

Unit Ten: Nuclear Chemistry **Estimated Time:** 2 weeks

Topics:

- radioactive decay
  - types of decay
  - stability
  - ½ life
- nuclear energy
  - fission vs. fusion
- radiation
  - detection
  - effects
  - applications

Laboratories and Activities:

- representing radioactive decay
- personal radiation detectors

Unit Eleven: Organic Chemistry **Estimated Time:** 2 weeks

Topics:

- hydrocarbons
- functional groups
- polymers
- bio-molecules
- reactions involving organic compounds

Laboratories and Activities:

- aspirin lab
- slime lab
- making and analyzing biodiesal

AP Exam Review
Candy Chromatography
Reaction Types: Treatment of Copper Waste**

Road Salt Project