KAP Chemistry Syllabus

2013-2014

Contact Information

If you need to get a hold of me, I am available. You can email me at anytime. Your parents are encouraged to call or email me if they have questions or concerns. Be proactive, if you have a question contact me before it becomes a problem!

Instructor: Mrs. Hofferberth
Email: khofferberth@mvcsd.us
Classroom: Room 143
Phone: 393-5900 x5601

Course Website: *Hofferberth KAP Chemistry* on MV Moodle 2 (https://moodle21.mvcsd.us/)

Course Overview

The school day consists of eight 48-minute periods. KAP Chemistry meets Monday thru Friday, two periods per day. Prerequisites include Physical Science, Biology, Chemistry I, and Algebra II with a B or higher. Concurrent enrollment in Pre-calculus or Calculus is recommended.

KAP Chemistry is a college level course that is designed to not only provide students with a solid general chemistry education but also to develop the student's abilities in the following areas: (1) read, understand, and interpret information from a wide variety of sources, (2) use appropriate problem solving skills, (3) use mathematical reasoning in solving problems, and (4) complete lab experiments, including data acquisition, interpreting the results and acknowledging the uncertainties associated with the experimental outcome. Students should expect to spend a minimum of ½ to 1 hour a day studying outside of class in order to master the course material.

Students are required to take the ACS College General Chemistry Exam in the spring.

Textbook

Chemistry Principles and Reactions ©2012
7th edition by Masterton and Hurley
ISBN 1-111-57258-5
Brooks/Cole-Thompson Learning, Belmont CA 94002

Required Materials

3-ring binder with dividers for notes, handouts, and homework
3-ring binder (1- 2 inch) for labs, this will be left in the classroom
Quad ruled (graph) filler paper for labs
pencils and pens (pen required for lab)
TI-84 or TI-83 calculator, or other graphing calculator

Labs

The laboratory portion of this class is designed to be the equivalent of a college laboratory experience. Because some colleges require proof of the laboratory portion of the course before granting credit, all students will generate a portfolio of lab reports.

A minimum of 25% of class time will be spent in hands-on laboratory activities. The laboratory portion of the course consists of 26 investigations. Of these, 13 are guided inquiry labs. See the course outline provided for details.

Formal lab reports are required and include the following sections: date, title, purpose, procedure, data, analysis, postlab questions, and conclusion (including error analysis). In addition to the formal lab report, at least once each semester each student will be required to communicate their results to the class using a method of their choice (PowerPoint, Poster, Article, etc.)

Assessment

Tests and Quizzes (60%): Quizzes will be given frequently. They may or may not be announced. Tests will be announced and typically cover one to two chapters of the textbook.

Homework (10%): Homework will be collected at the unit test and will be graded for both completion and correctness. Occassionally, homework may be checked the day after it is assigned – these spot checks may or may not be announced.

Labs (30%): Labs are an integral part of KAP chemistry and will constitute at least 25% of our class time. All lab data will be collected on graph paper and each page will be signed at the completion of every lab period.

Labs will be assessed either by lab quiz, formal lab report or other written prompt.

Formal lab reports consist of:

- Title Page/Lab Handout
- Purpose
- Procedure
- Table(s) of Data
- Computations
- Graph(s) of Results
- Summary (including error analysis)

All lab materials will be compiled into a portfolio graded lab materials that will be kept in the classroom.

I grade according to the approved Mount Vernon High School Student Handbook.

I strongly encourage each of you to check your course grade online on a weekly basis.

Late Work and Absence Policy

Late work will be penalized 10% per day late. All late work should be placed in the Absent/Late bin and **must be received prior to the unit test to receive credit.**

In the case of absence, it is YOUR responsibility to determine any assignments missed and turn them in within the required time. A list of daily assignments and all handouts will be available in the classroom and on the course website. All work must be made up within the number of days absent unless other arrangements are explicitly approved by me. If you are absent for a lab day, you will be expected to complete the lab outside of regular class time. A**ll missed work must be completed prior to the unit test to receive credit.**

Course Outline

Unit 1: Chemical Fundamentals (15 days)

Topics:

1. Measurement, units, and significant figures
2. Chemical and physical changes
3. Inorganic nomenclature
4. Moles, grams, and molecules
5. Empirical formulas, molecular formulas
6. Molarity
7. Equation stoichiometry
8. Graphical treatment of data

Labs:

- Identity determination
  Students correlate the identity of two different sets of solutions based upon patterns of reactivity.
- *Guided Inquiry*: Decomposition of Sodium Bicarbonate
  Students design a procedure to determine the product of the decomposition of sodium bicarbonate.
- Green Crystal Lab
  Students synthesize and then determine the empirical formula for an iron oxalate salt.

Unit 2: Electronic Structure and the Periodic Table (10 days)

Topics:

1. Nature of light
2. The Bohr atom
3. The quantum mechanical atom
4. The periodic table and trends in properties of the elements
5. Ions

Labs:

- Flame tests
  Students carry out flame tests and interpret their results in terms of electronic structure of atoms.

Activity:

Periodic Trends
Students graph values for atomic radius, electronegativity, and ionization energy to predict trends and explain the organization of the periodic table.

Unit 3: Bonding (12 days)

Topics:

1. Ionic bonding
2. Covalent bonding
3. Polar covalent bonds
4. Electronegativities

5. Lewis structures
6. VSEPR theory
7. Resonance
8. Formal charge
9. Hybridization
10. Sigma and pi bonding

Labs:

- *Guided Inquiry*: Bonding in Solids – What's in That Bottle?
  Students develop a procedure to determine the type of bonding in unlabeled chemicals using physical and chemical properties.

Activity:

Bonding, Molecular Shape and Polarity
Students make drawings of a series of molecules, use molecular models to construct the molecules and predict geometry, hybridization and polarity.

Unit 4: Liquids, Solids and Solutions (10 days)

Topics:

1. Structure and bonding
2. Intermolecular forces
3. Changes in state
4. Heating and cooling curves
5. Vapor pressure curves
6. Phase diagrams
7. Solubility curves
8. Colligative properties of solutions
9. Separation techniques
10. Biological applications

Labs:

- *Guided Inquiry* – Chromatography: Sticky Question: How Do You Separate Molecules that are Attracted to One Another
  Students develop a method to separate three similar molecules.
- Heat and changes of state
  Students will calculate the enthalpy of fusion for ice.
- *Guided Inquiry* – How are Boiling Point and Freezing Point Affected by the Presence of a Solute?
  Students will measure boiling point elevation and freezing point depression for multiple concentrations and solutes and develop an understanding of what affects these colligative properties.

Activity:

Attractions and Biological Systems
Students examine a model of DNA and determine which atoms/base pairs are involved in hydrogen bonding with the molecule and the resulting alpha-helical structure. Students then discuss how environmental factors (like UV light, DNA intercolators, etc.) can result in disruptions of protein folding.

Unit 5: Molecular Structure and Spectroscopy (12 days)

Topics:

1. Nature of light
2. Beer's Law
3. Organic Structure
4. Organic nomenclature
5. NMR
6. IR

Labs:

- *Guided Inquiry* – Spectroscopy: What Is the Relationship Between the Concentration of a Solution and the Amount of Transmitted Light Through the Solution
  Students formulate an answer to the question, "How can light be used to study color and determine concentrations of chemical species in solutions?"
- Synthesis and analysis of a coordination compound
  Students synthesize a coordination compound, analyze its purity and determine their yield.
- Analysis of an unknown using NMR and IR spectroscopy
  Students use instrumentation at Kenyon College to obtain IR and NMR spectra and determine the identity of an unknown molecule.

Activity:

Guided Inquiry -- Spectroscopy Dry Lab
Students use a series of provided spectra to deduce the patterns and rules underlying IR and NMR spectroscopy.

Unit 6: Gas Laws (10 days)

Topics:

1. Gas laws
2. Ideal gas equation
3. Avogadro's Law
4. Dalton's Law of Partial Pressures
5. Graham's Law of Effusion
6. Kinetic Molecular Theory
7. Real vs. ideal gases

Teacher Demo:

Graham's Law of Diffusion
HCl and NH_3 are placed at either end of a glass tube. Based on the location of formation of the NH_4Cl ring, the relation of molar masses of HCl and NH_3 are calculated.

Labs:

- Molecular mass of a volatile liquid
  Students determine the molar mass of a volatile liquid.

Unit 7: Thermochemistry (15 days)

Topics:

1. Nature of heat and heat flow
2. First Law of Thermodynamics
3. Calorimetry
4. Enthalpy
5. Hess's Law
6. Heats of formation and heats of reaction
7. Entropy
8. Second Law of Thermodynamics
9. Free Energy
10. The equilibrium constant

Labs:

- *Guided Inquiry* – Calorimetry: The Hand Warmer Design Challenge, Where Does the Heat Come From
  Students will design a procedure to determine which of three ionic compounds is most suitable for use in a handwarmer.
- *Guided Inquiry* – Hess's Law
  Students perform a series of reactions to develop the Hess's Law.

Activity:

Thermochemistry Online Activity
Students will use a web-based simulation to explore heat transfer and calorimetry.

Unit 8: Kinetics (12 days)

Topics:

1. Meaning of reaction rate
2. Rate law from initial rate data
3. Integrated rate laws
4. Collision theory of reaction rates
5. Factors affecting the rates of reaction
6. Catalysts
7. Mechanisms
8. Potential energy diagrams

Labs:

- *Guided Inquiry* – Rate of Reaction
  Students carry out a number of processes to develop a list of factors that affect the rate of a reaction.
- Rate Law of the Iodine Clock Reaction
  Students use the method of initial rates to determine the rate law for an iodine clock reaction.
- *Guided Inquiry* – Kinetics: Rate Laws: What is the Rate Law of the Fading of Crystal Violet? (LO 4.2, 4.1; SP 4, 5, 6)

Activity:

Kinetics Online Activity

Using a web based simulation, students will study the elementary steps of a mechanism and how it relates to reaction rate and collision theory.

Unit 9: Equilibrium (15 days)

Topics:

1. The nature of equilibrium
2. The equilibrium constants K_C and K_P
3. LeChatelier's principle
4. Relationship to thermochemistry

Labs:

- Determining the K_C of the $FeSCN^{2+}$ equilibrium

  Students use Beer's Law to determine the concentration of FeSCN2+ and therefore reacting species at equilibrium. These values are then used to calculate the equilibrium constant of the reaction.

- *Guided Inquiry* -- LeChatelier's Principle

  Students manipulate a system at equilibrium to develop an understanding of how changes affect a system at equilibrium.

Activity:

Equilibrium Dry Lab

Students simulate an equilibrium system using popbeads to develop a conceptual understanding of equilibrium.

Unit 10: Solubility Equilibria (5 days)

Topics:

1. The solubility product, Ksp
2. The common ion effect
3. Solubility rules

Labs:

- Ksp of Calcium Hydroxide

  Students carry out a microscale lab to determine the Ksp of calcium hydroxide.

Unit 11: Acid-Base Equilibria (15 days)

Topics:

1. Acid-base models: Arrhenius, Bronsted/Lowry, Lewis
2. Strong acids and bases
3. Kw
4. pH, pOH
5. weak acids and bases, Ka and Kb
6. Hydrolysis
7. Buffers

8. Henderson-Hasselbalch equation
9. Indicators
10. Titrations

Labs:

- *Guided Inquiry* – Acid-Base Titration: How Do the Structure and the Initial Concentration of an Acid and a Base Influence the pH of the Resultant Solution During a Titration?
  Students will develop a procedure to, using different combinations of two acids and two bases, perform acid-base titrations, draw titration curves, and calculate unknown molarities.
- *Guided Inquiry* – Buffer Design: The Preparation and Testing of an Effective Buffer
  Students will work collaboratively to design a buffer to meet a particular set of conditions.

Activity:

Acid-Base Online Activity

Students will use a web-based simulation to explore the differences between strong and weak acids representing their understanding as both chemical equations and particulate diagrams.

Unit 12: Electrochemistry (15 days)

Topics:

1. Oxidation-reduction reactions
2. Redox-titrations
3. Electrolysis
4. Electrochemical cells
5. Cell potentials
6. Nernst equation

Labs:

- *Guided Inquiry* – Redox Titration: How Can We Determine the Actual Percentage of H_2O_2 in a Drugstore Bottle of Hydrogen Peroxide?
  Students will develop a procedure to determine the concentration of H2O2 in commercial hydrogen peroxide solution.
- *Guided Inquiry* – What Factors Affect Cell Voltage?
  Students will investigate what factors affect the cell voltage of a galvanic cell.
- Electrolysis of CuCl2
  Students will perform an electrolysis experiment and experimentally confirm the value of Avogadro's number and a Faraday.

Unit 13: The Nucleus (5 days)

Topics:

1. Radioactive decay
2. Transformation rules
3. Artificial transformations
4. Decay rate and half life

Activity:

Nuclear Decay Rate Simulation

Students will use a web-based simulation to model nuclear decay and determine half-life.