

# KAP/AP Chemistry Syllabus

## 2014-2015

### 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

Classroom: Room 143

Email: [khofferberth@mvcsd.us](mailto:khofferberth@mvcsd.us)

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  $\frac{1}{2}$  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); whiteboard markers

TI-84 or TI-83 calculator, or other graphing calculator

### Technology in the Classroom

My chemistry classroom is one of only a few that has been given permission to use personal devices (laptops, tablets, phones) for educational purposes. At the teacher's discretion, students may use of their devices to increase their chemistry learning. While we will discuss in detail how to use technology responsibly, a few expectations are:

- devices are only to be used with Mrs. Hofferberth's permission and for learning purposes
- use of devices for non-educational purposes is unacceptable and any student engaging in such behavior will lose the right to use their device in my classroom
- MVHS school policy still applies outside of my classroom – all devices must be turned off and put away before leaving my room
- MVHS cannot be held responsible for data usage – wifi is available in the school
- no student is required or expected to bring or use their own device

## 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. 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, for particular labs each student may 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. Occasionally, 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. **All missed work must be completed prior to the unit test to receive credit.**

## Course Outline

Please note, the number of days allotted to each topic is approximate.

### Unit 0: Scientific Thinking (5 days)

#### Topics:

1. Lab safety
2. Scientific thinking
3. Study skills

#### Labs:

- Which is Which?  
Students correlate the identity of two different sets of solutions based upon patterns of reactivity.

### Unit 1: Structure (19 days)

#### Topics:

1. Atomic structure
2. Electronic structure
3. Periodic structure
4. Mass structure

#### Labs:

- *Guided Inquiry: Modeling Coloumb's Law*  
Students use electrolysis to develop a qualitative understanding of Coulomb's law.
- Flame tests  
Students carry out flame tests and interpret their results in terms of electronic structure of atoms.
- *Guided Inquiry: Decomposition of Sodium Bicarbonate*  
Students design a procedure to determine the product of the decomposition of sodium bicarbonate.

#### 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 2: Bonding (15 days)

#### Topics:

1. Ionic bonding
2. Metallic bonding
3. Covalent bonding
4. Lewis structures and resonance
5. VSEPR
6. Molecular orbital theory

#### 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 3: Molecular Structure and Spectroscopy (12 days)

#### Topics:

1. Organic Structure
2. UV/Visible spectroscopy and Beer's law
3. IR
4. NMR

#### 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 4: Properties (21 days)

#### Topics:

1. Intermolecular forces
2. Phase change
3. Gases and Kinetic Molecular Theory
4. Solutions

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

#### Teacher Demo:

##### Graham's Law of Diffusion

HCl and NH<sub>3</sub> are placed at either end of a glass tube. Based on the location of formation of the NH<sub>4</sub>Cl ring, the relation of molar masses of HCl and NH<sub>3</sub> are calculated.

#### Activity:

##### Attractions and Biological Systems

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

## Unit 7: Thermochemistry (15 days)

### Topics:

1. Heat
2. Chemical Energy
3. Entropy
4. Free Energy
5. Work

### 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 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. Reaction rate and collision theory
2. Rate laws and their determination
3. Mechanism

### 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 (30 days)

### Topics:

1. Equilibrium and LeChatelier's principle
2. Solubility equilibrium
3. Acid-base equilibrium
4. Titration

### Labs:

- Determining the  $K_c$  of the  $\text{FeSCN}^{2+}$  equilibrium

Students use Beer's Law to determine the concentration of  $\text{FeSCN}_2^+$  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.
- K<sub>sp</sub> of Calcium Hydroxide  
Students carry out a microscale lab to determine the K<sub>sp</sub> of calcium hydroxide.
- *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:**

Equilibrium Dry Lab

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

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. Voltaic cells
3. Electrolytic cells
4. Non–standard conditions

**Labs:**

- *Guided Inquiry* – Redox Titration: How Can We Determine the Actual Percentage of  $\text{H}_2\text{O}_2$  in a Drugstore Bottle of Hydrogen Peroxide?  
Students will develop a procedure to determine the concentration of  $\text{H}_2\text{O}_2$  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  $\text{CuCl}_2$   
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.

- Green Crystal Lab  
Students synthesize and then determine the empirical formula for an iron oxalate salt.