**Welcome to AP Chemistry 2019-2020**

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**Course Description**

This AP Chemistry course is designed to be the equivalent of the general chemistry course usually during the first year of college. For most students, the course enables them to undertake, as a freshman, second year work in the chemistry sequence at their institution or to register in courses in other fields when general chemistry is a prerequisite. This course is structured around the six big ideas articulated in the AP Chemistry curriculum framework provided by the College Board.

**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: Rate of Chemical Reactions**

**Big Idea 5: Thermodynamics**

**Big Idea 6: Equilibrium**

A special emphasis will be placed in the seven science practices, which capture important aspects of the work that scientists engage in, with learning objectives that combine content with inquiry and reasoning skills. AP Chemistry is open to all students that have completed a year of chemistry who wish to take part in a rigorous and academically challenging course.

**Prerequisites**

In order to take AP Chemistry, students must have completed Chemistry I. Successful completion of Algebra II is also recommended.

**Required Materials**

* Writing utensils
* Dell laptop and charging unit
* 3-ring binder with loose-leaf paper for notes, handouts, practice problems
* 1-subject notebook for laboratory activities (composition notebooks are fine)
* $5 Lab Fee (for each science class taken) to participate in laboratory activities

Grades for a student’s work will have the following weights:

* **Tests: 50%**
  + Unit tests
* **Quizzes/Labs: 30%**
  + Quizzes will be announced or unannounced (pop quizzes). Students will be giving several days of notice for announced quizzes.
  + Lab reports will mainly be written up in the lab notebook and will follow a specific format (found further in this syllabus). Some lab activities may be handouts.
* **Homework/Classwork: 20%**
  + Homework and classwork will be assigned daily.

**Make-up Work**

If a student is absent, they are **expected** to make up any missed work. Students will need to contact me to find out what they missed while absent, and will be expected to turn in any missed work the next time they come in for chemistry class. If a student misses a quiz or test, the student must make up that quiz or test the very next day they are in school, even if the student has missed a review class. Students will need to make up quizzes/tests before school, during Panther Time, or after school: please set up an appointment with Ms. Salisbury ASAP. If a student misses a lab, they will be expected to obtain the data from their group and complete the lab as if they were present. If an assignment is due the day you are absent, it will be due the day you return to class.

**Extra Help**

AP Chemistry will be very demanding, and is heavily reliant on math skills and consistent practice. I will be available for extra help during **Panther Time in room 167**. Students who want help during Panther Time will need to **obtain a pass** from me during class or before school. Other opportunities for help are available by request (during my planning periods, before school, after school). There will be other students in the building who have successfully completed the class, they can help also. Don’t wait too long to ask for help.

**Remind 101**

I will be using Remind 101 to alert and remind students about upcoming major assignments (tests, quizzes, projects) and also upcoming lab days.

To join and get updates…

**Text: SalzAPchem to 81010**

**Laboratory Reports**

A specific format will be given to the student for each lab. Students must follow that format and label all sections very clearly. AP Chemistry lab reports are much longer and more in depth than the ones completed in Chemistry I. Some laboratory activities may require extra time and they must be done (finished) during Panther Time or before/after school by appointment.

**Pre- Lab Work**

In college, and therefore this class, students are required to have read the entire laboratory procedure before entering the laboratory classroom. Laboratory activities will be scheduled well in advance, so students will have plenty of time to prepare for the lab ahead of time. Students who fail to prepare properly will not participate in lab and receive a zero for that lab. Safety is the main reason behind this requirement.   
If a student was absent the day before a laboratory activity, they will be able to find the lab procedures/information on Schoology and will need to prepare for the lab if they plan to attend class on lab day. I will be available in the mornings of laboratory activities so that students may come ask questions or get caught up before the lab.

**Pre-Laboratory Write-up Tips and Requirements**

1. Title: The title should be descriptive. For example, “pH Titration Lab” is descriptive title and “Experiment 5” is not a descriptive title.

2. Date: This is the date the students performed the experiment.

3. Purpose: A purpose is a statement summarizing the “point” of the lab.

4. Procedure Outline: Students need to write an outline of the procedure. They should use bulleted statements or outline format to make it easy to read. If a student is doing a guided inquiry lab, they may be required to write a full procedure that they develop.

5. Pre- Lab Questions: Students will be given some questions to answer before the lab is done. They will need to either rewrite the questions or incorporate the questions in the answer. The idea here is that when someone (like a college professor) looks at a student’s lab notebook, they should be able to tell what the question was by merely looking at their lab report. It is important to produce a good record of lab work.

6. Data Tables: Students will need to create any data tables or charts necessary for data collection in the lab.

**What to Expect During the Lab**

7. Data: Students need to record all their data directly in their lab notebook. They need to label all data clearly and always include proper units of measurement. Students should underline, use capital letters, or use any device they choose to help organize this section. They should space things out neatly and clearly.

**Post- Lab Requirements**

8. Calculations and Graphs: Students should show how calculations are carried out. Graphs titled, axes labeled with units.

9. Conclusions: This will vary in from lab to lab. Students will usually be given directions as to what to write, but it is expected that all conclusions will be well thought out and well written.

10. Post Lab Error Analysis Questions: Students may be asked to calculate percent error, theoretical yield, averages, or other statistical tests to further enhance their conclusions or explain results.

**The Laboratory Notebook is a record of lab work and is an important document which will show the quality of the lab work that you, the student, have performed.**

**Honesty and Integrity**

Please do your own work. If the teacher believes that any student has cheated on an assignment, the student will receive a zero on the assignment. If two identical assignments are received, both students will receive zeroes on the assignment. The use of cell phones during quizzes or tests is considered cheating: you will receive a zero. Any offenses for cheating may also be turned in for an Honor code violation, which will follow you after high school.

I’m really excited about this upcoming school year, it’s going to be a great year in chemistry. I’m also looking forward to getting to know all of you and working with you to help you obtain the knowledge and skills needed for success. Please keep me informed of any problems that may pop up this year, you may contact me at any time. I want you all to do well and have the best school year yet.

**AP Chemistry Unit Overview**

**Unit 1: Chemistry Fundamentals (2.5-3 weeks)**

Topics Covered: Curriculum Framework Articulation:

1. Scientific Method 1.D.1:a

2. Classification of Matter

a. pure substance vs. mixtures 1.A.1:b LO 2.25

b. law of definite proportions 1.A.1:c

c. law of multiple proportions 1.A.1:d

d. chemical and physical changes 3.C.1:b,3.C.1:c,5.D:2

3. Nomenclature and formula of binary compounds 1E.2:b

4. Polyatomic ions and other compounds 1.E.2:b

5. Determination of atomic masses 1.A.1:a

6. Mole concept 1.A.3:b, 1.A:c, 1.A.3:d, 1.E.2:b

7. Percent Composition 1.A.2:a

8. Empirical and molecular formula 1.A.2:b

9. Writing chemical equations and drawn representations 1.E.1:a, 1.E.1:c,3:C.1:a

10. Balancing equations 1.A.3:a, 1.E.2:c,1.E.2:d, 3.A.1:a

11. Applying mole concept to chemical equations (Stoichiometry) 1.A.3:a, 1.E.1:b

12. Determine limiting reagent, theoretical and % yield. 3.A.2:a

Associated Activities:

\*Lab #1 Guided Inquiry: Stoichiometry 1.1, 3.5, 3.3; 3.4; SP 5.2, 2.1, 2.2

Description: Students determine the correct percent composition of a mixture based on the amount of gas lost (AP Investigation #7)

Lab #2: Empirical Formula 1.17, 1.18, 3.6; SP2.1, 2.2

Description: Students determine the correct empirical formula for an oxide of magnesium.

Simulation: Chromatography Basics 1.3, 1.19, 2.7

http://sciencespot.net/Media/FrnsScience/chromacard.pdf

In this simulation students will model how solutes can be separated by chromatography based on intermolecular interactions.

**Unit 2: Gas Laws (<2 weeks)**

Topics Covered: Curriculum Framework Articulation:

1. Measurement of gases

2. General gas law- Boyle, Charles, Combined and Ideal 2.A.2:a, 2.A.2:c

3. Dalton’s Law of partial pressure 2.A.2.b

4. Molar volume of gases and Stoichiometry 3.A.2.b

5. Graham’s Law 2.A.2.f

6. Kinetic Molecular Theory 2.A.2:d, 5.A.1

7. Real Gases and deviation from ideal gas law 2.A.2:e, 2.A.2:f ,2.A.2:g, 2.B.2:c, 2.B.2:d

8. Graham’s Law Demonstration 2.6: SP 1,6

Associated Activities:

Lab #3: Molar Mass of a Volatile Liquid 1.4, 2.4, 2.5, 5.2; SP 2,5

Description: Students use the Dumas method for determination of the molar mass of an unknown volatile liquid.

Teacher Demo: Graham’s Law of Diffusion 2.6; SP 1, 6

Description: HCl and NH3 are placed in either end of a glass tube. Using distance traveled of each gas by looking at the formation of NH4Cl ring, MM of HCl is calculated.

**Unit 3: Types of Chemical Equations (2 weeks)**

Topics Covered: Curriculum Framework Articulation:

1. Electrolytes and properties of water 2.A.3:h

2. Molarity and preparation of solutions 1.D.3:c, 2.A.3:i,2.A.3:j

3. Net Ionic Equations

a. Redox and Single Replacement Reactions 3.A.1, 3.B.3:e,3.C,1:d

b. Double Replacement Reactions, Precipitation, & Solubility Rules 3.A.1, 3.C.1:d, 6.C.3:d.

c. Combustion Reactions 3.A.1, 3.B.3: e

d. Addition Reactions 3.A.1., 3.B.1.A

e. Decomposition Reactions 3.A.1,3.B.1:a

4. Acid Base reactions and formation of a salt by titration 1.E.2:f,3.A.2:c

5. Gravimetric calculations 1.E.2:e

Associated Activities:

\*Lab #4: Guided Inquiry: Preparation of Solutions Lab–Intro to Beer’s Law 1.15, 1.16, 2.3, 2.12, 2.13, 2.16; SP 2.2, 5.1,

4.2, 6

Description: Students make solutions of specified concentrations gravimetrically and by dilution. Solution concentrations will be checked for accuracy using a spectrophotometer. Analysis of an unknown using Beer’s Law

Lab #5: Double Replacement and Precipitation Reactions 1.19, 2.1, 2.8, 2.15, 3.1, 3.2 SP 3, 5, 6

Description: Students perform multiple reactions to determine solubility rules, formation of gases, and solids

Lab #6: Titration Lab 1.2, 6.11, 6.12, 6.13, 6.14, 6.15, 6.16, 6.17;

SP 2, 5, 6

Description: Students perform multiple titrations to generate the four classic titration curves

Simulation: Titrations 1.20, 2.2

http://chem-ilp.net/labTechniques/AcidBaseIdicatorSimulation.htm

In this simulation, students will design and/or interpret data from a titration experiment in order to determine the concentration of an analyte in a solution.

Virtual Titration http://lrs.ed.uiuc.edu/students/mihyewon/chemlab\_experiment.html

**Unit 4: Electrochemistry (3 weeks)**

Topics Covered: Curriculum Framework Articulation:

1. Balancing redox 3.B.3:a, 3.B.3:b, 3.B.3:c 3.B.3:d

2. Balancing redox 3.B.3:a, 3.B.3:b,3.B.3:d

3. Simple redox titrations 1.E.2:f

4. Electrochemical cells and voltage 3.C.3:a,3.C.3:b,3.C.3:c, 5.E.4:a

5. The Nernst equations (qualitative) 3.C.3:d

6. Spontaneous and non-spontaneous equations 3.C.3:e

7. Chemical applications 3.C.3:f

Associated Activities:

\*Lab #7\_Guided Inquiry: Determination of % Hydrogen Peroxide 1.3, 1.20, 3.3; SP 2.1, 2.2, 4.2, 6.1, 6.4

Description: Students perform redox titrations to determine the percent of hydrogen peroxide in a drugstore bottle (AP Investigation #8)

Lab #8: Voltaic Cell Lab 3.3; SP 3.1, 3.2, 3.3, 4.2, 4.3, 4.4, 5.1

Description: Students will determine the reduction potentials of a series of reactions using voltaic cells and multi-meters to build their own reduction potential table to compare with known values

Lab #9: Electrolysis 3.3; SP 3.1, 3.2, 3.3, 4.2, 4.3,4.4, 5.1

Description: Students will complete multiple reactions in various solutions.

Teacher Demo: Lead Storage Battery Demonstration 3.12, 3.13, 5:15: SP1

Simulation: Redox Reactions 3.8, 3.9

http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/flashfiles/redoxNew/redox.html

In this simulation students will design and/or interpret the results of a redox titration experiment.

**Unit 5: Thermochemistry (3 weeks)**

Topics Covered: Curriculum Framework Articulation:

1. Law of conservation of energy, work and internal energy 5.B.1, 5.E.2:a

2. Endothermic and exothermic reactions 3.C.2,5.B.3:e, 5.B.3:f

3. Potential energy diagrams 3.C.2,5.C.2:c, 5.C.2:d,5.C.2:e

4. Calorimetry, heat capacity, and specific heat 5.A.2, 5.B.2, 5.B.3:a, 5.B.3:b, 5.B.4

5. Hess’s Law 5.B.3:a

6. Heat of Formation/Combustion 5.C.2:g

7. Bond energies 2.C.1:d, 5.C.1, 5.C.2:a, 5.C.2:b

8. Law of Thermodynamics

9. Spontaneous process and entropy 5.E.1

10. Spontaneity, enthalpy, and free energy 5.E.2:c, 5.E.3

11. Free energy 5.E.2:d, 5.E.2:e, 5.E.2:f, 6.C.3:c, 6.D.1:a

12. Free energy and Equilibrium 5.E.2,6.D.1:b, 6.D.1:c., 6.D.1:d

13. Rate and Spontaneity 5.E.2:e, 5.E.5

Associated Activities:

\*Lab #10\_Guided Inquiry: Hand Warmer Challenge 5.7, 5.6; SP 1.4, 4.2, 5.3, 2.2, 5.1

Description: Students perform a series of calorimetry experiments to find the relative heat of solutions of salts in order to design a hand warmer (AP Investigation #12). After the lab, in order to increase relevance to the real-world, students will research the chemicals present in several brands of commercial hand warmers, and analyze their toxicity and effectiveness v. cost. Students will make a presentation recommending which hand warmers are the safest to the user and the environment.

Simulation: Thermochemistry 2.23, 2.24, 3.11, 5.3, 5.4, 5.5, 5.8, 5.12 5.13,

5.14

http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/flashfiles/thermochem/solutionSalt.html

http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/flashfiles/thermochem/heat\_soln.swf

In this simulation students will draw qualitative and quantitative connections between the reaction enthalpy and energies involved in the breaking and formation of chemical bonds.

**Units 6: Kinetics (2 weeks)**

Topics Covered: Curriculum Framework Articulation:

1. Rates of Reactions 4.A.1:a

2. Factors that affect rates of reactions/collision theory 4.A.1:b 4.A.1:c 4.D.1, 4.D.2

3. Reaction Pathways 4.B.3:a 4.B.3:b

4. Rate equation determination 4.A.2:a

a. Rate constant 4.A.3

b .Mechanisms 4.B.1, 4.C.1, 4.C.2, 4.C.3

c. Method of initial rates 4.A.2:c

d. Integrated rate laws 4.A.2:b 4.A.3:d

5. Activation energy and Boltzmann distribution 4.B.2, 4.B.3:c

Associated Labs:

\*Lab #11\_Guided Inquiry: Determination of the Rate Law of a Crystal Violet Reaction

4.2, 4.1; SP 1.4, 2.1, 4.2, 5.1

Description: Using calorimetry and Beer’s Law, students determine the order of a reaction and its rate law. (AP Investigation #11)

Lab #12: Determination of Equilibrium Constant 5.17, 6.1-6.10; SP 2, 5

Description: Students use a spectrophotometer to determine the equilibrium constant for a reaction (Chemistry with Computers for Vernier #20)

\*Teacher Demo: Factors that Effect Rates of Reaction 4.1, 4.8, 4.9; SP1

Simulation: Chemical Kinetics 4. 2, 4.3, 4.4, 4.5, 4.6, 4.7, 5.18

http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/flashfiles/kinetics2/kinetics.html

http://www.chm.davidson.edu/vce/kinetics/bromatebromidereaction.html

http://www.chm.davidson.edu/vce/kinetics/integratedratelaws.html

In this simulation students will analyze concentration vs. time data to determine the reaction order and rate law.

**Unit 7: General Equilibrium and Ksp (2 weeks)**

Topics Covered: Curriculum Framework Articulation:

1. Characteristics and conditions of chemical equilibrium 6.A.1, 6.A.3:a, 6.A.3:f

2. Equilibrium expression derived from rates 6.A..3:b

3. Factors that affect equilibrium 6.A.3:c

4. LeChatelier’s Principle 6.A.3:b, 6.B.1, 6.B.2,6.C.3:e,6.C.3:f

5. The Equilibrium Constant 6.A.3:d, 6.A.3:e, 6.A.4

6. Solving Equilibrium Problems 6.A.2

7. Ksp Calculations and Solubility Product 6.C.3:a, 6.C.3:b

Associated Activities: 6.9; SP 4.1, 4.2, 5.1, 6.2, 6.4

\*Lab #13\_Guided Inquiry: Le Chatelier’s Principle

Description: Students are challenged to use multiple equilibrium systems to produce the colors of the rainbow via principles of LeChatelier’s Principle

Simulation: Equilibrium 5.16, 6.25

http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/animations/CoCl2equilV8.html

http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/animations/no2n2o4equilV8.html

http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/animations/equilvpBr2V8.html

http://phet.colorado.edu/en/simulation/reversible-reactions

http://phet.colorado.edu/en/simulation/reactions-and-rates

In this simulation students will express the equilibrium concentration in terms of Gibbs free energy and RT, and use this relationship to estimate the magnitude of K and, consequently, the thermodynamic favorability of the process.

**Unit 8: Acids, Bases, and Buffers (3 weeks)**

Topics Covered: Curriculum Framework Articulation:

1. Definition and nature of acids and bases 3.B.2, 6.C.1:c, 6.C.1:d, 6.C.1:e, 6.C.1:f

2. Ka and the pH scale 6.C.1:a, 6.C.1:b, 6.C.1:g

3. pH of strong and weak acids and bases 6.C.1:h

4. Polyprotic acids 6.A.1:n

5. pH of Salts

6. Structure of Acids and Bases

7. Characteristics and capacity of buffers 6.C.2

8. Titrations and pH curves 6.C.1:i, 6.C.1:j, 6.C.1:k, 6.C.1:l, 6.C.1:m

9. Choosing Acid Base Indicators

10. pH and Solubility

Associated Activities: 2.2, 3.7; SP 2, 5

\*Lab #14: Guided Inquiry: Preparation of a Buffer 6.18, 6.19, 6.20; SP 2, 3, 4, 5

Description: Given a selection of chemicals, students prepare a buffer of a given pH (AP Investigation #16)

Lab #15: Determination of Ka by Half Titration

Description: Students do a titration of a weak acid to determine its Ka by analyzing its midway to the endpoint.

Lab #16: Conductivity Titrations, Molar Solubility, and Determination of Ksp

2.14, 2.23, 2.24, 6.21, 6.22, 6.23, 6.24;

SP 2, 5, 6

Description: Students will do a conductivity titration with barium hydroxide and sulfuric acid to determine the concentration and investigation of solubility and solution principles

Simulation: Titrations 1.20, 2.2

http://chem-ilp.net/labTechniques/AcidBaseIdicatorSimulation.htm

In this simulation students will design, and /or interpret data from an experiment that uses titration to determine the concentration of analyte in a solution.

Virtual Titration: 1.20, 2.2

http://lrs.ed.uiuc.edu/students/mihyewon/chemlab\_experiment.html

In this simulation students will design, and /or interpret data from an experiment that uses titration to determine the concentration of analyte in a solution.

Simulation: Acid Base/Buffer 6.19, 6.20

http://phet.colorado.edu/en/simulation/acid-base-solutions

http://introchem.chem.okstate.edu/DCICLA/pHbuffer20.html

In this simulation, students will relate the predominant form of a chemical species involving a labile proton (i.e., protonated/deprotonated form of a weak acid) to the pH of a solution and the pKa associated with the labile proton.

**Unit 9: Atomic Structure and Periodicity (2 weeks)**

Topics Covered: Curriculum Framework Articulation:

1. Electron configuration and the Aufbau Principle 1.B.2:a

2. Valence electrons and Lewis dot structures 1.B.2:c

3. Periodic Trends 1.B.1:b,1.B.1:c, 1.B.2:b, 1.B.2:d ,1.C.1:c,

1.D.1:b, 2.C.1:a, 2.C.1:b

4. Table arrangement based on electronic properties 1.C.1:a,1.C.1:b, 1.C.1:d

5. Properties of Light and Study of Waves 1.C.2:e,1.D.3:a,5.E.4:b

6. Atomic spectra of hydrogen and energy levels 1.B.1:d,1.B.1:e, 1.D.3:b

7. Quantum mechanical model 1.C.2:d

8. Quantum Theory and electron orbitals 1.C.2:c

9. Orbital shape and energies 1.C.2:b

10. Spectroscopy 1.D.2:a,1.D.2:b, 1.D.2:c, 1.D.3:b

Associated Labs:

Lab #17: Spectra and Spectroscopy Lab – Flame Tests and Gas Discharge Tubes

1.5, 1.6, 1.7, 1.8, 1.13, 1.14, 1.15; SP 1, 6

Description: Students perform flame tests and analyze emission spectra to determine the identity of unknowns. The will also receive and analyze IR and mass spectroscopy data

Graphing Activity: Periodic Trends 1.9, 1.10, 1.11, 1.12

http://www.chemeddl.org/resources/ptl/

In this activity students will use online data to graph and analyze the various periodic trends.

**Unit 10: Chemical Bonding (2 weeks)**

Topics Covered: Curriculum Framework Articulation:

1. Lewis Dot Structures 2.C.4:a

2. Resonance structures and formal charge 2.C.4:c, 2.C.4:d, 2:C.4:e

3. Bond polarity and dipole moments 2.C.1:c, 2:C.1:e, 2.C.1:f

4. VSERP models and molecular shape 2.C.4:b, 2:C.4:e, 2.C.4:f

5. Polarity of molecules 2.C.1:e

6. Lattice energies 1.B.1:a, 1:C.2:a, 2.C.1:d (1-2), 2.C.2:a,

2:C.2:b, 2:D.1:b

7. Hybridization 2.C.4:g

8. Molecular orbitals and diagrams 2.C.4:h, 2:C.4:j

Associated Activities:

Lab #18: Bonding Lab 2.1, 2.17, 2.19, 2.20, 2.21, 2.22, 2.23, 5.1,

5.10; SP 1, 3, 4

Description: Students experimentally investigation the 3-D shape an structures of many covalent molecules

**Unit 11: Liquids, Solids and Solutions (2 weeks)**

Topics Covered: Curriculum Framework Articulation:

1. Structure and bonding

a. Metals, network and molecular 2.A.1:a, 2:A.1:d, 2.C.3, 2:D.1:a, 2.D.2:a,

2:D.1:b, 2.D.3, 2:D.4 LO 2.26, 2.27, 2.28, 2.29, 2.30, 2.31, 2.32

b. Ionics, hydrogen, London, van der Waals 2.A.1:b, 2:B.1:a, 2.B.1:b, 2:B.1:c, 2.B.2:a,

2:B.2:b, 2.B.2:c, 2:B.2:d, 2.B.3:a, 5:A.1

2. Vapor Pressure and changes in state

3. Heating and cooling curves 2.A.1:e, 5:B.3:c, 5.B.3:d

4. Composition of solutions 2.A.1:c, 2:A.3:b, 2.A.3:c, 2:B.3b

5. Colloids and suspensions 2A.3:a, 2.A.3:b, 2.A.

Associated Activities:

Lab #19: Vapor Pressure of Liquids 2.3, 2.12, 2.13, 2.16; SP 2, 5, 6

Description: Students measure the vapor pressure of ethanol at different temperatures to determine the heat of vaporization (Adv. Chemistry with Vernier #34)

Teacher Demo: Evaporation of Liquids 2.11, 2.18, 5.9, 5.12; SP 1, 6

Description: Using a data collection device, the teacher will show the temperature curves of evaporation of various liquids. Students must deduce the differences based on IMF’s

Lab #20: Green Crystal Lab 1.2, 2.7, 2.10, 3.7, 3.8, 3.9, 3.10, 5.11;

SP 2, 5, 6

Description: A series of labs completed over a multi-week period. The goal of this lab is to determine the empirical formula of a ferro-oxalato crystal. It includes the following experiments:

EXP 1: Synthesis of the crystal

EXP 2: Standardization of KMnO4 by redox titration

EXP 3: Determination of % oxalate in crystal by redox titration

EXP 4: Standardization of NaOH by titration

EXP 5: Determination of %K and Fe by ion exchange chromatography and a double equivalence point titration

EXP 6: Determination of the % water in the hydrated crystal