KAP Chemistry Syllabus—2017-2018
Mrs. Bloom
Hilliard Davidson High School

Chemistry 121 Introductory Chemistry Lecture (0.5 Kenyon units; 4 semester hours)
Chemistry 123 Introductory Chemistry Laboratory (0.25 Kenyon units; 2 semester hours)
Chemistry 124 Biophysical and Medicinal Chemistry (0.5 Kenyon units; 4 semester hours)
Chemistry 125 Biophysical and Medicinal Chemistry (0.25 Kenyon units; 2 semester hours)

KAP Chemistry is a **college-level** chemistry course. It is a *second-year course*—students should have successfully completed a chemistry course in their sophomore or junior years of high school. It emphasizes chemical understanding, both quantitatively and qualitatively, in a laboratory setting. Students should have three credits in Math, credit in Biology, and Chemistry with a "B" or better average.

Students will earn two credits of College Credit Plus laboratory science. The course is taught as a "1 ½ block" course—students will alternate between single period and double period. The double period on alternate days will allow us to complete the more rigorous laboratory activities required by the KAP curriculum. Classes will either be 48 minutes or 100 minutes in length, with an average of 375 minutes of class time each week. The classes are arranged so that students may take 2 KAP or AP Sciences in 3 class periods. A minimum of twenty-five percent of instructional time is dedicated to the lab activities.

Students will earn college credit through Kenyon College by participating in the KAP program.

The six **Big Ideas** of this course are:

Big Idea 1: The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions.
Big Idea 2: Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them.
Big Idea 3: Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.
Big Idea 4: Rates of chemical reactions are determined by details of the molecular collisions.
Big Idea 5: The laws of thermodynamics describe the essential role of energy and explain and predict the direction of changes in matter.
Big Idea 6: Any bond or intermolecular attraction that can be formed can be broken. These two processes are in a dynamic competition, sensitive to initial conditions and external perturbations.

In addition to the Big Ideas, this course incorporates seven **Science Practices**:

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 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.

Required Text:
Tro, Nivaldo J., *Chemistry, A Molecular Approach*, 3rd ed., Upper Saddle River, NJ: Pearson Education, Inc., 2012. (e-book)

Other Supplies: Bound lab record book (provided), approved safety goggles(provided), charged iPad, graphing calculator, binder for lab investigations, pens, pencils, stylus

Required Free apps:
Vernier Graphical Analysis, Period Table by the Royal Society of Chemistry, Pearson eText, Socrative (student), Classkick

The Laboratory Program:
The laboratory component is, at minimum, 25% of the instructional time. Investigations will be integrated throughout the course. Students will also need to spend time out of class, both preparing for and completing laboratory investigations. Students will typically work with a partner, but some investigations require groups of three or four.

Students are required to have a bound lab notebook (provided by Kenyon for KAP students) and a three-ring binder, which will be used as their lab portfolio.

The lab notebook will have a **table of contents**, which will include:
- Date the investigation was performed
- Title of investigation
- Page numbers of the investigation

Each laboratory investigation will have the following components:
- Title and date
- Scientific question
- Data
  - Written **directly into the lab notebook**
  - Written alongside the procedure, or, for repetitive data, in a table
  - This **must** be initialed by your teacher before you leave the laboratory area
- Data analysis
- Lab questions, copied into the notebook, with answers written clearly and concisely

In addition, *some* investigations will include
- Prelab group work
- Prelab Canvas quizzes
- Written procedure
- Graphs or charts
- Analysis of class data
- Error analysis
- Presentation to the class
- Other components as needed

Some (but not necessarily all) of the investigations come from, or are modified from:

Kenyon College Department of Chemistry Chemistry 123 Lab Manual, 2013.
Randall, Jack. Advanced Chemistry with Vernier. Oregon: Vernier Software and Technology, 2004.
The College Board. AP Chemistry Guided Inquiry Experiments: Applying the Science Practices. 2013.
Flinn Scientific Advanced Inquiry Labs, 2013
NSF Summer Project in Chemistry -- Hope College
Volz, Donald L.; Smola, Ray; Investigating Chemistry through Inquiry
Holmquist, Dan D.; Randall, Jack; Volz, Donald L.; Chemistry with Vernier
Vonderbrink, Sally. Laboratory Experiments for AP Chemistry. Batavia: Flinn Scientific, 2001.
Bernstein, Jesse; Bracken, Jeffrey; Price, Paul. Advanced Placement Chemistry Laboratory Manual: An Inquiry and Forensic Approach Towards Chemical Experimentation, 2009

About KAP…

The KAP (Kenyon Academic Partnership) program allows students to get college credit while still in high school. Students will have an official transcript from Kenyon College. Students who wish to enroll in KAP courses must be strongly motivated and should have demonstrated success in the subject areas they wish to pursue. Since KAP courses are demanding, readiness and willingness to work hard are essential for success. When students register for their courses, they must complete a separate application for the KAP program. The application includes a teacher recommendations and a transcript. There is an additional fee for KAP and additional coursework may be required. Students participating in the KAP program will receive **2 high school credit**s and college credit for the **four** following Kenyon courses:

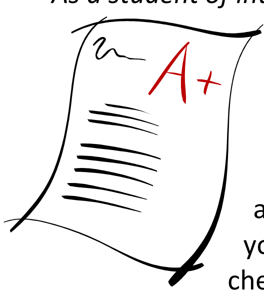
Chemistry 121 Introductory Chemistry Lecture (0.5 Kenyon units; 4 semester hours)
Chemistry 123 Introductory Chemistry Laboratory (0.25 Kenyon units; 2 semester hours)
Chemistry 124 Biophysical and Medicinal Chemistry (0.5 Kenyon units; 4 semester hours)
Chemistry 125 Biophysical and Medicinal Chemistry (0.25 Kenyon units; 2 semester hours)

NOTE:

Although there is a biological focus to the second semester Kenyon courses, the major chemical topics (equilibrium, atomic structure and bonding, kinetics) are the same as a traditional second-semester chemistry course. Students enrolled in KAP will have the same chemistry content as those enrolled only in AP Chemistry.

Academic honesty:

As a student of integrity, you will neither give nor receive unauthorized aid in class work, quizzes, examinations, preparation of reports or projects, or in any other work that I use to evaluate you without specific permission for collaboration or without proper citation. All work may be submitted to a variety of sources to check for plagiarism.



Copying another person's homework, lab report, or answers to any other sort of assessment is CHEATING. While you and your lab partner will share data, you need to do your OWN calculations and your OWN analysis. Using unapproved outside resources is also cheating. You will not receive credit for an assignment or assessment if you cheat. *Details about consequences for academic misconduct are detailed in the student handbook.*

Assessment…

The class is graded on a weighted scale. Tests and quizzes are 70% of the grade, labs, lab quizzes, and projects are 30%.

Dual enrollment courses at Hilliard Davidson High School receive an extra quality point when calculating grade point average. (A = 5.0, B = 4.0, C = 3.0, D = 1.0, F = 0.0)

While assignments in Canvas will be graded, students should use **Home Access** to determine their grades for the course. Note that a **blank space** means that it is not yet graded. A **zero** indicates that an assignment has not been turned in (or that a student scored zero points on an assignment.)

Homework Students should be doing homework daily. Homework questions may be part of pre-announced quizzes and/or board discussions. Homework is for **practice,** and some students need more practice than others. Homework is submitted through **Canvas** *or* through ***MasteringChemistry.com***

Labs are done frequently. Since most occur on double-block days, students should try not to miss lab days. All labs must be completed to receive credit for the course. Some universities require students to submit a lab notebook or portfolio to receive college credit.

Quizzes are given frequently. The primary purpose of the quizzes is to make sure everyone is keeping up with the material. If a student struggles with a concept, a requiz is possible **if** (a) the student completes all the homework **and** (b) the student receives additional intervention.

Tests are given at the end of each unit. Tests will combine multiple-choice and open-ended (Free Response) questions. Some or all of a test may be calculator-free. Tests may include questions from laboratory investigations.

*****All** students take a cumulative test towards the end of the second quarter and an in-class college-level test during the fourth quarter. The fourth-quarter test is the ACS General Chemistry Test. The grades are part of the quarter grades.

More about tests and quizzes…

- Tests and quizzes serve several purposes: they are typically viewed as a way for me to evaluate your progress, but they are also learning experiences for students.
- Tests will always be announced at least two days prior. Quizzes will almost always be announced. They may be written or lab-based.
- To receive full credit on tests and quizzes, *show all calculations*. Explain your answers completely and concisely—explanations help me to understand your thoughts.
- Each new test will include material from previously studied chapters. Quizzes over earlier material will appear throughout the year.
- Tests may include sample free response questions from old AP Chemistry tests

Curriculum Content Map

<table>
<tr><td colspan="2">Big Idea 1: The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions.
Big Idea 3: Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.</td></tr>
<tr><td colspan="2">Textbook Chapter(s): 1,2,3,</td></tr>
<tr><td>Unit & Topics What's that compound</td><td>Laboratory activities (subject to change)</td></tr>
<tr><td>Physical and chemical processes
• Nomenclature
  ○ Inorganic compounds
  ○ Simple covalent compounds
  ○ Simple Hydrocarbons and functional groups
  ○ Acids and bases
  ○ Coordination compounds</td><td>Decomposition of Baking Soda
• Using stoichiometry to determine the products formed when baking soda is heated
• SP 1, 2, 4. 5, 6
Green Analysis of a Mixture
• Determine the composition of a carbonate/bicarbonate mixture
• Science Practices 1, 2, 4, 5, 6</td></tr>
</table>

<table>
<tr><td>

Empirical formulas
Review

Balancing equations
Law of definite proportions
Stoichiometry
Limiting reactants
Physical and chemical changes
Precision, accuracy, and measurement
Significant figures

</td><td>
Modeling with Hydrocarbons

Model hydrocarbons with and without functional groups
Science Practices 1, 6

Standardization of Sodium Hydroxide

Determine the concentration of NaOH by titrating with a primary standard
SP 1, 2, 5, 6

</td></tr>
<tr><td colspan="2">Activity: Students are given a problem set and asked to determine the limiting reagents for a chemical reaction
Activity: Students will use dry-erase boards to draw particulate models of chemical reactions so that they can translate between macroscopic observations, chemical symbols, and particle views</td></tr>
</table>

<table>
<tr><td colspan="2">Big Idea 1: The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangement of atoms. These ztoms retain their identity in chemical reactions.</td></tr>
<tr><td colspan="2">Textbook Chapter(s): 2,7,8,</td></tr>
<tr><td>Unit & Topics</td><td>Laboratory activities</td></tr>
<tr><td>
Atomic Structure

Types of subatomic Particles
The nucleus
Mass Spectroscopy & Isotopes
Stability of the Nucleus
Atomic Structure
Rutherford Experiment
Cathode Ray Experiment
Atomic Structure Terms
Electromagnetic Radiation
Quantization of energy
Photoelectric Effect
PES data
Bohr Atom
Coulomb's Law
Orbital Model of Atom
Aufbau Diagram
Paramagnetism
Quantum Model
Electron configuration of atoms and ions
Periodic trends

</td><td>
On-line atomic modeling

Phet, Gizmo, and Molecular workbench
SP 3, 5, 6

Guided inquiry: Analysis of Food Dyes in Beverages

Use visible spectroscopy and Beer's Law to determine the concentration of blue dye in a sports drink
Science Practices 2, 4, 5, 6

</td></tr>
<tr><td colspan="2">Activity: Students will complete activities on interactive websites modeling electrons in atoms and molecules</td></tr>
</table>

Mid-autumn

<table>
<tr><td colspan="2">Big Idea 2: Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them.</td></tr>
<tr><td colspan="2">Textbook Chapter(s): 5, 11, 12</td></tr>
<tr><td>Unit & Topics</td><td>Laboratory activities</td></tr>
</table>

Unit & Topics	Laboratory activities
Gas, Liquids and Solids • Phases of matter • Particulate models of solids, liquids, and gases • Phase changes and phase diagrams • Vapor pressure, boiling points, and freezing points • Qualitative observations relating pressure, volume, temperature, moles of particles • Calculations involving combined gas laws, the ideal gas law, and gas densities • Stoichiometry involving balanced equations, mass, moles, and gas laws • Dalton's Law of Partial Pressures *including* combining 2 or more flasks into one, mole fractions, and collecting gases over water • Kinetic molecular theory including calculating average kinetic energy and molecular speed of a gas • Deviations between ideal behavior of gases • Types of intermolecular forces • Impact of intermolecular forces on physical properties • Electronegativity, bond polarity, and molecule polarity • Ionic bonding and Coulomb's Law • Metallic bonding	**Extraction and isolation of caffeine** • Concepts include extraction, sublimation, solubility, and chromatography • SP 4, 5, 6, 7 **Qualitative Analysis and Chemical Bonding** • Determine the identity of six unknown substances based upon chemical & physical properties • SP 1, 4, 5, 6, 7 **Separation of a Dye Mixture Using Chromatography** • SP 1, 6 **Demonstration: Separation of Components of a Homogeneous Mixture Using Simple Distillation** • Separate a simple mixture • Test the solubility of iodine in the distillates to determine the identity of the distillates • SP 3 **Properties of Air** • Explore changes in behavior of objects in a reduced-pressure environment and draw particulate models of what they observe • SP 7
Activity: Students will use interactive websites and KMT to • determine macroscopic changes in gases based upon particulate models • examine phase changes by looking at intermolecular interactions	

Late autumn

Big Idea 3: Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.	
Textbook Chapter(s): 4, 18.2	
Unit & Topics	*Laboratory activities*

Chemical Reactions in Solution
• Types of electrolytes
• Electrolytes
• Concentration Terms – Molarity
• Dilution Problems
• Stoichiometry Problems with Solutions (review)
• Classification of reaction types
    o Double-replacement, synthesis, decomposition, single-replacement, combustion
    o Redox, acid-base, precipitations
• Predicting products of DR reactions based on solubility rules
• Assigning oxidation numbers
	Mini-labs looking at properties of gases dissolved in solution, redox, acids & bases, and precipitates
	• SP 5
	Growing Crystals in Gels
	• Create a silicate gel "crystal garden" with a combination of redox and precipitate reactions
	• SP 3, 4, 5, 6
	Guided Inquiry: Driving under the influence
	• Use $Cr_2O_7^{2-}/CH_3CH_2OH$ redox reaction. visible spectroscopy, and Beer's Law to determine the percent alcohol in a sample.
	• Write a letter which provides evidence to justify the students' claim

• Determining oxidation & reduction half-reactions • Predicting products of SR reactions based on activity series • Molecular and net-ionic chemical equations • Predicting products of acid-base reactions	• SP 3, 4, 5, 6 **Guided Inquiry: Qualitative Analysis** • Identification of ions present in an unknown solution • SP 4, 5, 6 **Iron Chemistry: Variable Oxidation States** • Observe the differences in reactivity between iron(II) and iron(III) • SP 5, 6 **Lab Exam: Qualitative Analysis** • Create and carry out a procedure to determine the identities of five aqueous solutions

Late autumn/early winter

Big Idea 6: Any bond or intermolecular attraction that can be formed can be broken. These two processes are in dynamic competition, sensitive to initial conditions and external perturbations.	
Textbook Chapter(s): 14	
Unit & Topics	*Laboratory activities*
Equilibrium • Reversible processes and Reactions • Types of Systems • Kinetics relationship to Equilibrium • Equilibrium Expressions • Equilibrium Constants • LeChatelier's Principle • Equilibrium Stresses • Equilibrium Calculations • Molar Solubility • Common Ion Effects • Reaction Quotients	**Guided Inquiry: Applications of LeChatelier's Principle** • Observing the effects of changes in starting conditions and predicting the direction of shift • SP 4, 5, 6 **Determine the Equilibrium Constant of $FeSCN^{2+}$** • Student will use a prescribed procedure to perform a chemical reaction and use a series of calculations to determine the equilibrium constant for a system at equilibrium: 1. Vernier technology 2. Beer's Law • SP 1, 2, 5, 6, 7 **Solubility Matters: Determining the K_{sp} of calcium iodate** • Student will use a prescribed procedure perform a microscale titration and determine the solubility product of calcium iodate. • SP 1, 2, 4, 5, 6 **Determining the Equilibrium Constant of a Silver complex** • Student will use semi-guided inquiry to determine the K_{eq} for a complex ion and predict the K_{eq} for other reactions: • SP 2, 3, 5, 6, 7
Activity: Students will use interactive websites to explore the ideas of equilibrium and LeChatelier's principle. Students will apply their knowledge to maximize the amount of a specific product in a reaction	

Early winter

Big Idea 6: Any bond or intermolecular attraction that can be formed can be broken. These two processes are in dynamic competition, sensitive to initial conditions and external perturbations.
Textbook Chapter(s): 15, 16

Unit & Topics	*Possible Laboratory activities*
Acids, Bases and Salts • Dissociation versus Ionization • Preparation Acids, bases and salts • Classification of Acids and bases • Bronsted-Lowry theory of acids and bases • Degree of Ionization • Equilibrium constants for acids and bases • Weak acids and bases • Binary acids versus oxyacids • Determination of acid and base properties based on structure • Ionization of water • pH and pOH • Acid-base stoichiometry problems – review • Ionization calculations of weak acids and bases • Henderson-Hasselbach equation • Titration calculations • Indicators • Types of salts • Dissociation of salts and buffers	**Investigating the Effects of Acid Rain** • Students will model an acid-rain environment and make observations of the effects on natural materials • SP 1, 3, 5 **Determination of Molecular Weight and K_a of an Unknown Acid** • pH probes • Titration curves using data acquisition (Logger Pro) • Determination of Equivalence Point using 2^{nd} derivatives • Determination of midpoint to determine pK_a • Vernier technology • SP 2, 5, 6 **pH of various salts** • Students will predict the relative pH of salts and test their predictions • SP 5, 6 **Characteristics of a Buffer** • Students will explore the effects of a buffer in a microscale environment: effect on pH when OH^- or H^+ are added, effect of dilution of buffer • SP 3, 4, 5, 6 **Using and Designing a Buffer** • Students will use their understanding of buffers to create a buffer of a specific pH • SP 2, 3, 5, 6 **Using pH indicators** • Students will observe the changes of various pH indicators at a range of pH levels and identify an unknown based upon their observations • SP 5, 7 **Titration of Household Ammonia** • Choose the correct indicator for a titration and determine the molarity of household ammonia • SP 2, 3, 4, 5 **Guided Inquiry: Acidity of Beverages, Lab #4** • Using acid-base chemistry to determine the acidity of various beverages • SP 4, 5, 6, 2,
Activity: Students will calculate the pH of solutions under a variety of conditions	

Mid-winter

Big Idea 4: Rates of chemical reactions are determined by details of the molecular collisions.	
Textbook Chapter(s): 13,19.6	
Unit & Topics	*Laboratory activities*

Kinetics • Rates relationship to collisions • Reaction Mechanisms • Activation energy • Nature of reactants and Interfacial Surface Area • Temperature and Pressure effects on Rates • Catalyst – Homogenous and Heterogeneous • Potential Energy Diagrams – review • Activated Complex and Intermediates • Arrhenius Equation • Maxwell-Boltzman Diagram • Average rate • Rates relationship to stoichiometry	**Decomposition of Calcium Carbonate** • Work collaboratively to determine the rate law for the decomposition of calcium carbonate; explore the impact of particle size on rate. • SP 1, 2, 5, 6, **The Vitamin C Iodine Clock reaction** • Small-scale clock reaction with a focus on using greener reactants • SP 2, 5, 6 **Crystal Violet Kinetics** • Determine the integrated rate law of a reaction based on spectrophotometric analysis • SP 1, 2, 5, 6,
Activity: In collaborative groups, students will evaluate possible reaction mechanisms to determine which are consistent with experimental data	

Late winter/early spring

Big Idea 5: The laws of thermodynamics describe the essential role of energy and explain and predict the direction of changes in mater.	
Textbook Chapter(s): 6,17	
Unit & Topics	*Laboratory activities*
Thermochemistry • Introduction to Thermodynamics • Conservation of Energy • State Functions • Potential Energy • Kinetic Energy • Calorimetry • Heat of Fusion • Heat of Vaporization • Specific Heat • Heat of Dilution • Heat of Solution • Hess's Law – direct and indirect • Bond Dissociation energies • Gibbs Free energy Equation • Entropy • Energy of Formation of Ionic Compounds • Lattice Energy	**Combustion of ethanol** • Students will investigate the effectiveness of a variety of combustion reactions in heating water and perform calorimetry calculations using lab data • SP 4, 5 **Designing an Hand Warmer** • Use an understanding of calorimetry to design a handwarmer, given certain constraints. • SP 1, 2, 4, 5, 6, 7 **Heat Of Dissolution (Determining K, ΔS,ΔG of Urea)** • Students will use a prescribed procedure to perform a chemical reaction and use a series of calculations to determine the heat dissolution for that reaction. • SP 2, 5
Activity: Given a set of conditions, the students determine if the situation is thermodynamically favored or not favored by looking at entropy, enthalpy, and Gibbs Free Energy	

Early spring

Big Idea 3: Changes in mater involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.	
Textbook Chapter(s): 18	
Unit & Topics	*Laboratory activities*
Electrochemistry and Thermodynamics	**Investigations of Voltaic Cells**

• Oxidation and reduction • Substances gaining potential • Types of electrochemical cells • Voltaic cells • Cell potential • Concentration dependence of E • Cell potentials and equilibrium • Metal electrodes • Reference electrodes • Indicator electrodes • Applications of voltaic cells • Electrolysis • Faraday's law • Electrolytic Cells • Order of reduction • Application of electrolytic cells • Relationship of Equilibrium and Q and their relationship to E	Measure the voltage of a variety of reactions between a $Cu/Cu(NO_3)_2$ half-cell and other metal/metal ion half-cells • Predict the electrochemical potential of a variety of reactions and evaluate the quality of the predictions by measuring the voltage of those cells • Explore the effects of on the measured electrochemical potential • SP 2, 5, 6 **Determining Avagadro's Number** • Determine the number of faradays, coulombs, and current used to coat an electrode with copper • SP 2, 6
Activity: Students will calculate electrochemical potentials of reactions given a table of half-cell reactions. They will predict the change in potential as the concentration of a metal ion changes.	

Big Idea 1: The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions.	
Textbook Chapter(s):	
Unit & Topics	*Laboratory activities*

What's that compound—Using spectroscopy
• Mass Spectrometry
  ○ Isotopic determination
  ○ Molar mass and functional groups of a small organic compound
• Types of Spectroscopy
  ○ UV-Vis spectroscopy
  ○ IR spectroscopy
  ○ NMR spectroscopy
• Using spectroscopic techniques to determine the structure of a molecule
• <u>Authentic or Not? Chemistry Solves the Mystery</u>
  ○ *ChemMatters* article(April 2011) & podcast relating the use of spectroscopy to determining the authenticity of paintings
  ○ *Chemical and Engineering News* article on the role of chemists in art conservation (http://pubs.acs.org/cen/coverstory/7931/7931art.html
	Guided inquiry: Percent Copper in Brass
	• Use visible spectroscopy and Beer's Law to determine the amount of copper in a sample of brass
	• Science Practices 4, 5, 6
	
	What's that molecule?
	• Field trip to a local college to run IR and NMR of an unknown compound then determine the structure of the substance
	• Science Practices 1, 4, 5, 6, 7

Spring

<table>
<tr><td colspan="2">Big Idea 2: Chemical and physical properties of materials can be explained by the structure and arrangement of atoms, ions, or molecules and the forces between them.</td></tr>
<tr><td colspan="2">Learning Objectives: 2.11, 2.13, 2.18, 2.20, 2.21, 2.22, 2.29, 2.30, 2.31, 2.32, 5.9</td></tr>
<tr><td>Unit & Topics</td><td>Laboratory activities</td></tr>
<tr><td>Covalent Bonding and Molecules

1. Review types of Covalent Bonds
2. Lewis Structures
3. Resonance
4. Hybridization
5. Molecular Geometry
6. Isomerism
7. Classification of Molecules
8. Dipole Moments</td><td>What shape is the molecule?
• Modeling molecular geometry
• SP 1

Synthesis and analysis of aspirin
• SP 1, 4, 5, 6

Synthesis of a Coordination Compound
• Synthesize and isolate crystals of $K_x[Fe(C_2O_4)_y \cdot zH_2O$
• Science Practices 2, 4, 6
Determining the Empirical Formula of a Coordination Compound
• Dehydration to determine percent water and the waters of hydration in the formula
• Permanganate titration to determine the percent oxalate and the number of oxalate ions in the formula
• Ion exchange and pH titration to determine the percent potassium and percent iron and the number of potassium ions in the formula
• SP 1, 2, 4, 6
•</td></tr>
<tr><td colspan="2">Activity: Students will choose from a list of common organic molecules. They will research the structure, characteristics, and purpose of the molecule and will build a 3-d model of the molecule.</td></tr>
</table>