KAP Chemistry Syllabus—2012-2013

Major themes include ***structure of matter*** (atomic theory and structure, chemical bonding), ***states of matter*** (gases, liquids and solids, solutions), ***reactions*** (reaction types, stoichiometry, equilibrium, acids and bases, kinetics), ***descriptive chemistry*** (relationships in the periodic table), and ***laboratory*** (physical manipulation; processes and procedures; observations and data manipulation; communication, group collaboration, and the laboratory report.)

Students should be able to

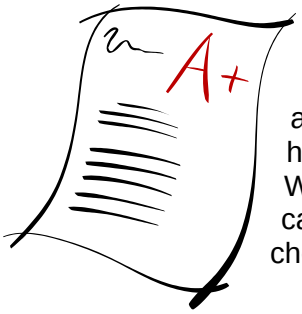
- Apply first-year chemistry Essential Outcomes to new situations.
- Use safe chemical practices when working in the laboratory.
- Display proficiency with a variety of laboratory skills and a variety of laboratory equipment.
- Use technology when appropriate to solve chemical problems (both written and in the laboratory.)
- Predict products of word equations by understanding classification schemes of reactions and write the reaction using correct chemical formulas.
- Use stoichiometry as a tool to make quantitative predictions about a variety of chemical reactions.
- Use a variety of chemical and spectroscopic methods (such as titrations, freezing point depression, percent composition, empirical formulas, vapor density, and others as well as IR and NMR) to determine the molar mass and molecular formula of an unknown compound.
- Understand the nature of gases and use gas laws to make quantitative calculations.
- Understand that atomic structure is the basis of the chemical and physical behavior of matter including radioactivity.
- Apply their knowledge of atomic structure to determine chemical structures and to explain chemical and physical observations and trends in the periodic table. Explain how d-orbital splitting causes color changes in complex ions.
- Understand the nature of equilibrium, both quantitatively and qualitatively, in terms of gas-phase reactions, acid-base reactions, complex-ion formation, solubility, solubility, and electrochemistry.
- Understand how free energy (ΔG) drives chemical reactions and understand its relationships to enthalpy (ΔH), entropy (ΔS), and equilibrium.
- Use kinetics to evaluate whether a mechanism is possible.
- Explain how reduction-oxidation reactions generate electric current and make predictions about the chemical energy produced by or required for a chemical change.
- Differentiate between ionic, covalent, network covalent, and metallic bonding and describe characteristics of each.
- Understand intermolecular forces and their effects.
- Understand the nature of solids, liquids, and solutions both quantitatively and qualitatively.

These concepts cover the following chapters in the required text:
1-9 (*except* 9.12), 10.1-10.5, 11.1-11.9, 12-19, 22.7, 22.8, 22.10, 22.11, 23.1-23.5, 23.11-23.14

Required Texts:
Hill, John. W, Petrucci, Ralph H, et. al., *General Chemistry*, 4th ed., Upper Saddle River, NJ: Pearson Education, Inc., 2005.

KAP Chemistry Free Response Practice Book designed for KAP Chemistry classes in our school district

Other Supplies: Bound lab record book (provided as part of class fees), **approved safety goggles** (note—safety glasses are *not* an acceptable substitute for goggles), graphing calculator, notebook with separated sections for notes and homework, pens, pencils, highlighters



Academic honesty:
Students often work together in advanced science classes. This is valuable and I encourage working together. HOWEVER, 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.

Example: You do not know how to approach solving an old AP Test question that you have for homework. What should you do?

a) Search the internet for the answer	NO—that is CHEATING
b) Search the internet for another explanation of the topic	YES—good idea!
c) Copy the answer from your friend or older sister	NO—that is CHEATING
d) Tell your friend you could do a, b, and c but are stuck on d. Ask your friend to point you in the right direction.	YES—good idea!
e) Steal the answer key from your teacher	NO—that is CHEATING
f) Ask your teacher for help a day or two before the due date	YES—good idea!
h) Ask your teacher for help a day or two after the due date	OK—Better late than never, but your teacher might get annoyed
i) Cry	Okay for the short term, but you still need to figure out the answer!
j) Ignore it and hope it goes away.	NO—it won't go away, and neither will your teacher

More background… This is a **college-level** chemistry course. It is a *second-year course*—students should have successfully completed Chemistry 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 one and one-half credits of AP level 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 50 minutes or 104 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 and/or AP Sciences in 3 class periods.

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

Students who will have junior or senior status will have the opportunity to apply for admission to the KAP (Kenyon Academic Partnership) program. The 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 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)

NOTES:

a. 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.

b. Students may earn a maximum of 3.0 Kenyon units while in high school.

c. I will submit **four separate grades** to Kenyon College. Students receive separate lecture and lab grades for each semester. These grades are **not** figured into the Davidson GPA and may be different than the grade on the student's Davidson report card.

Assessment…

The class is graded on a weighted scale. Tests and quizzes are 60% of the grade, labs and projects 30%, and Free Response and homework are 10% of the grade. For students who receive a C or higher, AP 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)

Homework Students should be doing homework daily. Homework is graded on a sliding scale—students with higher test grades need to turn in less homework.

Free Response Questions are questions from old AP tests. They require synthesis of a variety of chemical concepts, and are often complex. All students must turn in Free Response questions.

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.

Tests are given at the end of each unit. Lab questions will be included on tests. **All** students take an in-class college-level test. The grade is part of the fourth quarter.

Semester and final exams are both lab-based. The semester exam is more like a traditional lab while the final exam varies depending upon the interests of the class.

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 as well as the summer review. Quizzes over earlier material will appear throughout the year.
- Tests may include sample free response questions from old AP Chemistry tests, since they incorporate several concepts into one question.

KAP Chemistry Lab Investigations (*Projected—Subject to Change)* 2012-2013 Semester 1

Expt.	***Investigation***	***Content***	***Time Class period (CP)= 50 minutes Double Block (DB) = 104 minutes***
1	Decomposition of Baking Soda	Use stoichiometry to determine the formula of the solid product formed when baking soda is heated	CP
2	Properties of Gases	Using a mini-bell jar to explore the properties of air pressure	DB
3	Molar mass of an unknown gas	Use a syringe to collect a known amount of a gas; determine the molar mass of the gas	
4	Using vapor density to determine molar mass	molar mass of an unknown volatile liquid	DB
5	Analysis of a hydrate	Determine the mass of copper(II) sufate pentahydrate required to produce a known amount of anhydrous copper(II) sulfate	CP
6	So what is that formula	Using continuous variations to determine whether an unknown contains oxalate ions or phosphate ions	CP
7	Synthesis of an ester	synthesis of methyl salicylate, pentyl acetate, and octanyl acetate	DB
8	Synthesis of Green Crystal	synthesis of coordination compound, complex ions	2 DB + 1 CP
9	Standardization of NaOH	Standardization of NaOH using KHP	1 DB
10	NMR and IR lab (field trip)	Use NMR and IR at Kenyon to determine structure of organic compounds	4 hours
11	Analysis of the Green Crystal	oxalate titration with MnO_4^-, cation exchange, acid-base titration curve to determine Fe^{3+} and K^+, waters of hydration	3 DB
12	Mini-labs: Acids and bases	Observing the pH of various gases dissolved in water (CO_2, NH_3, N_2 and O_2, HCl) Observe the shift in equilibrium when NaOH is added to a sample of ammonium chloride	CP
13	Driving under the influence	Use Beer's Law and the redox reaction between chromate and ethanol to determine the % alcohol in a sample	DB
14	Qualitative Analysis	Determine the identities of ions in a mixture	DB & CP
15	Determine K of a silver complex	Determine K using microscale techniques, manipulation of equilibrium constants	DB
16	Determine K of an iron complex	Determine K of $FeSCN^{2+}$ using absorbance spectroscopy	DB
17	LeChatelier's Principle	qualitative observations of changes in equilibrium in cobalt complexes and making predictions using LeChatelier's Principle	CP
18	Determination of a Ka	LabPro/pH meter determining the Ka of a solution of acetic acid (varying concentrations)	DB
19	Hydrolysis of salts	Predict the pH of salts and check predictions by comparing the pH of various salts with pH of water using universal indicator; write net ionic equations	CP
20	*Semester Exam*	Determine the moles of gas produced and the identity of M_xCO_3 by reacting with 3 M HCl determination of identity of four unknown solutions	90 min

KAP Chemistry Lab Investigations (*Projected—Subject to Change)* 2012-2013
Semester 2

1	Properties of a buffer	Compare drops of H+ or OH- to change color of water or phosphate buffer with universal indicator; compare carrying capacity; write net ionic equations	CP
2	Preparing and using a buffer	LabPro/pH meter/Vernier lab--properties of a buffer, calculating Ka, and preparing a buffer of a certain pH	DB
3	pH indicator lab	8 indicators and 12 buffers--observe colors, determine pK's and determine which is best for different pH changes; determining the pH of an unknown solution	CP
4	Titration of mixed acids	LabPro/pH meter graph of mixture of phosphoric and hydrochloric acids: determine Ka's and concentration of each acid	DB
5	Comparing fuels	Develop the ideas of specific heat and heat of combustion by determine the temperature change of water when heated by several different fuels	DB
6	Determination of Thermodynamic Data for the Dissolution of Urea	Determine q then ΔH. Determine solubility (molarity, molality, mass percent) then K then ΔG then ΔS	2 CP periods
7	Vitamin C-Iodine clock reaction	Use initial rates to determine the rate law and E_a for the reaction of hydrogen peroxide and iodine	DB
8	**DEMO lab:** Phenolphthalein/hydroxide reaction	Follow decolorization of phen by NaOH spectroscopically, determine the rate law	CP
9	Voltaic cells	Determine a reduction potential series, make predictions about E^o for several reactions, and determine the identity of unknown metals	DB
10	Freezing point depression	LabPro/Temp sensor/computer determine the molar mass of benzoic acid based on FP depression of lauric acid	DB
11	Building molecules	Molecular model kits; Lewis structure, VSEPR, molecular shape	CP
12	Chromatography of dyes	TLC plates; identification of unknown mixture by comparison with known dye samples	DB
13	Synthesis and analysis of aspirin	synthesis and analysis of acetylsalicylic acid including melting point, reaction with iron ions	DB & CP
14	Analysis of cobalt complexes	Prepare solutions of cobalt complexes, measure absorption spectra, determine high-spin or low-spin and energy of transition	DB
15	Halogens and halides	Use a separatory funnel to extract Br_2(aq) into hexane, redox reaction between Br_2 (aq) and I^-(aq)	CP
16	Synthesis and analysis of biodiesel	Prepare biodiesel, analyze some physical properties, determine ΔH of combustion and compare with other hydrocarbons	DB & CP
	DEMO GC of ethyl acetate	Determine ΔH vap of ethyl acetate using Clausius-Clapeyron equation and MiniGC	
17	Extraction of orange peel oil	Use liquid CO_2 under pressure to extract orange peel oil. Predict nmr structure, identify peaks of IR	DB