KAP Chemistry Syllabus—2010-2011

Background: KAP Chemistry 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. Prerequisites include three credits in Math, one 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 AP curriculum. Classes will either be 50 minutes or 104 minutes in length, with an average of 375 minutes of class time each week.

Required Texts:

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

Vonderbrink, S. A., *Laboratory Experiments for Advanced Placement Chemistry*, Batavia, IL: Flinn Scientific, Inc., 1995

AP Chemistry Free Response Practice Book designed for Hilliard City School District

Supplemental Materials:

General Chemistry companion website

Vernier LabPro with assorted sensors; DataMate, EasyData, or LoggerPro; TI-84+ Silver Edition Calculator or Windows-based laptop computers, experiments from Vernier Lab Books

Lab experiments come from a variety of sources including Vonderbrink, Vernier, Kenyon College, workshops, and labs that I have designed.

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

My Classroom Expectations can be summed up as follows:

1. **Be nice to everyone**
2. **Act in a safe manner**
3. **Take responsibility for your actions**
4. **Work hard**

The details…

About attendance:

Because much of this course is centered on group-work, attendance is important. **You** are responsible for showing excuses for tardies or absences, for obtaining any missed assignments and for making them up. This includes getting the class notes, completing homework, and making up any tests, quizzes, or labs. ***Note: Labs must be made up after school. Occasionally they may be made up during study hall.***

*According to school policies, you will have as many days to make up assignments as you have missed; after that they are considered late. **You must arrange time with the teacher to make up missed work.**

About academic honesty:

Do your own work. Do not copy. Show all calculations, not just the answer. Papers found to be similar to other students will be given an F grade. All material that is not your own should be cited—do not plagiarize other students or reference material (including the internet).

About evaluation:

There are a variety of ways to evaluate students in AP Chemistry.

Tests and quizzes	55%
Labs and projects	35%
Free Response Questions/Textbook Homework	10%

About labs:

- You will be expected to know and observe safety rules **every** time we are in the laboratory. You will not be permitted to participate in labs until your safety contract is on file.
- READ THE LAB AND COMPLETE PRELAB before class. You should have the purpose and procedure outlined in your lab notebook and data tables ready to go. Prelab worksheets should be turned in *before* you begin the lab activity. You will waste valuable time if you need to complete these in class, before starting the lab activity.
- You should come to lab DRESSED APPROPRIATELY, including SAFETY GOGGLES AND APRONS. If you do not have a pair of approved safety goggles, you should buy a pair from the school store. If you are not wearing your goggles during a lab, you will receive **one** reminder. If it is still a problem, you will be asked to sit down and lose credit for that lab experiment.
- **Food and drink are never permitted in a laboratory. This includes the <u>entire room</u>. This includes bottles of water, pop, etc.**
- Participation in lab includes being prepared, following directions, observing SAFE procedures, CLEANING UP the lab and equipment, and protecting equipment. Messy labs are dangerous labs, and leaving a laboratory bench in such a condition will affect your grade.
- **ABSOLUTELY NO HORSEPLAY**. This type of behavior will result in removal from class, a phone call home, and possibly a disciplinary referral.
- If you choose not to follow any of the class requirements, laboratory privileges may be revoked. You will be given written lab assignments for partial credit.

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 often 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, <u>*show all calculations*</u>. 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 will often include sample free response questions from previous AP Chemistry tests

- Success in the KAP requires **<u>significant effort outside of class</u>**.

KAP

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.

Students participating in the KAP program will receive credit for the four following Kenyon courses, totaling 12 semester hours of college credit:

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)

***Approximate* schedule:**

Topic	Approximate time	Textbook Chapters (H&P)	Major Assessment(s)	Major Theme(s)
Review and extend including empirical formulas, basic atomic structure, introduction to organic chemistry, nuclear chemistry, nomenclature of ionic, covalent, organic, and coordination compounds, limiting reactants and theoretical yield,	3 ½ weeks	1, 2, 19, 3	Practice AP Questions, Unit Test, **Labs:** Double Dribble. Decomposition of Baking Soda, Determining Ratio of Moles, Synthesis and analysis of alum	Reactions, Structure of Matter, Descriptive Chemistry, Laboratory
Reactions in aqueous solution, including precipitation, acid-base, redox, molarity, net ionic equations, solution stoichiometry	3 ½ weeks	4	Practice AP Questions, Unit Test, **Labs:** Determine calcium in milk, Potentiometric titration of hydrogen peroxide, Qualitative Analysis, Gravimetric analysis	Reactions, Descriptive Chemistry, Laboratory
Gas laws and kinetic molecular theory	2 ½ weeks	5	Practice AP Questions, Unit Test, **Labs**: Mini-Bell Jar labs, Using the Ideal Gas Law, Using vapor density to determine molar mass	States of Matter, Laboratory
Equilibrium	3 weeks	14	Practice AP Questions, Unit Test, **Labs:** LeChatelier's Principle, Determination of an equilibrium constant/ Beer's Law	Reactions, Laboratory
Acids and bases	2 ½ weeks	15	Unit Test, **Labs:** Determination of a Ka, pH of salts	Reactions, States of Matter, Descriptive Chemistry, Laboratory
Acid-base equilibria including buffers, pH indicators, and titrations	2 weeks	15	Practice AP Questions, Unit Test, **Labs**: Properties of a buffer, Buffers lab, pH indicator lab, Standardization of sodium hydroxide, Titrations of strong and weak acids, Titration of a polyprotic acid/determination of equivalent mass and molar mass	Reactions, States of Matter, Descriptive Chemistry, Laboratory
Semester Exam a. Identification of unknown solids or solutions b. Rank unknown solutions of acids and bases in order of increasing pH ***End First Semester***				

Topic	Approximate time	Textbook Chapters (H&P)	Major Assessment(s)	Major Theme(s)
Thermochemistry and thermodynamics	2 weeks	6, 17	Practice AP Questions, Unit Test, **Labs:** Determine the molar mass of a metal, Hess's Law	Reactions, Laboratory
Kinetics of chemical reactions	3 weeks	13	Practice AP Questions, Unit Test, **Labs:** Determine a rate law (bromate), Determine a rate law (crystal violet)	Reactions, Laboratory
Electronic structure and the periodic table	2 weeks	7, 8	Practice AP Questions, Unit Test, **Labs:** Light and atomic structure, NMR lab	Structure of Matter
Ionic and covalent bonding and molecular structure	3 weeks	9, 10	Practice AP Questions, Unit Test, **Labs:** Chromatography of dyes, Synthesis and analysis of aspirin, Synthesis of an ester, Building molecules	Structure of Matter, Laboratory
Precipitation equilibria and complex ions	< 1 week	16	Practice AP Questions, Unit Test, **Labs:** Ksp of calcium iodate	Reactions, States of Matter, Descriptive Chemistry, Laboratory
Electrochemistry	2 ½ weeks	18	Practice AP Questions, Unit Test, **Labs:** Voltaic cells, Producing copper	Reactions, States of Matter, Descriptive Chemistry, Laboratory
Liquids, solids, and solutions, including intermolecular forces, liquid-vapor equilibrium, phase diagrams, concentration, and colligative properties	2 weeks	11, 12	Practice AP Questions, Unit Test, **Labs:** Vapor Pressure, Solution concentrations, Freezing Point depression	States of Matter, Laboratory
AP Test Review				
Assorted labs and Final Project	2 weeks		Changing a penny	Reactions, Laboratory

Lab Experiments

Expt.	*Lab*	*Content*	**2006-2007** *AP?*	***Time Class period (CP)= 50 minutes Double Block (DB) = 104 minutes***	
1	Double Dribble	Students react solutions in 4 Beral pipets, A, B, C, D. Based only upon their observations, they determine the identity of four unknowns		30 min	Student-done
2	Decomposition of Baking Soda	Stoichiometry and balanced equations	**X**	90 min	Student-done
3	Determining Ratio of Moles	Using continuous variations/temp to determine stoich of reaction of bleach with "reactant B"	**X**	DB	Student-done
4	Synthesis and analysis of alum	synthesis of coordination compound, complex ions, determination of waters of hydration, melting point	**X**	2 DB + 1 CP	Student-done
5	Determine calcium in milk	calcium-edta titration (microscale)	**X**	CP	Student-done
6	Mini-Bell Jar labs	Observing effects of pressure on balloons, suction cups, marshmallows; calculating density of air		CP	Student-done
7	Using the Ideal Gas Law	molar volume of a gas; molar mass of an unknown gas	**X**	CP	Student-done
8	Using vapor density to determine molar mass	molar mass of an unknown volatile liquid	**X**	DB	Student-done
9	Potentiometric titration of hydrogen peroxide	LabPro/ORP sensor redox titration--H2O2 and MnO4^-	**X**	DB	Student-done
10	Qualitative Analysis	qual--limited groups to avoid heavy metals; use ppt techniques, centrifuge, formation of complex ions, development of flow-chart to identify unknown mixture	**X**	2 DB	Student-done
11	LeChatelier's Principle	4 stations--qualitative observations of changes in equilibrium and making predictions using LeChatelier's Principle	**X**	DB	Student-done

12	Determination of an equilibrium constant/ Beer's Law	LabPro/Colorimeter/FeSCN2+: preparing a standard curve and using it to determine the concentration of an unknown and to determine concentrations to determine K	**X**	DB	Student-done
13	Determination of a Ka	LabPro/pH meter determining the Ka of a solution of acetic acid (varying concentrations)	**X**	DB	Student-done
15	pH of salts	using universal indicator to compare pH of various salts with pH of water and write net ionic equations		30 min	Student-done
16	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		30 min	Student-done
17	Buffers lab	LabPro/pH meter/Vernier lab--properties of a buffer, calculating Ka, and preparing a buffer of a certain pH	**X**	DB	Student-done
18	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	**X**	CP	Student-done
19	Standardization of sodium hydroxide	Titration to standardize NaOH with KHP	**X**	DB	Student-done
20	Titrations of strong and weak acids	LabPro/pH meter/Drop counter showing the different shapes of curves when titrating strong and weak acids with strong and weak bases	**X**	CP	Demonstration
21	Titration of a polyprotic acid/determination of equivalent mass and molar mass	LabPro/pH meter graph of polyprotic titration; determine Ka's, equivalent and molar masses	**X**	DB	Student-done
22	Changing a penny	Zn/ZnCl2 solution to form alloys; turn pennies silver and gold		CP	Student-done
23	Chromatography of dyes	TLC plates; identification of unknown mixture by comparison with known dye samples	**X**	DB	Student-done

24	Light and atomic structure	Observe emission spectra, analyze lines to determine identity of spectra, match 6 IR spectra with the molecules		DB	Student-done
25	Semester Exam	a. Identification of unknown solutions b. Rank unknown solutions of acids and bases in order of increasing pH		90 min	Student-done (some students exempted)
26	Synthesis and analysis of aspirin (at a local college)	synthesis and analysis of acetylsalicylic acid including melting point	**X**	3 hours + 1 CP	Student-done
27	Synthesis of an ester	synthesis of methyl salicylate	**X**	CP	Student-done
28	Building molecules	Molecular model kits; Lewis structure, VSEPR, molecular shape		CP	Student-done
29	Determine the molar mass of a metal	Specific heat; DuLong and Petit		CP	Student-done
30	Hess's Law	LabPro/Thermometer NaOH, HCl, and water	**X**	DB	Student-done
31	Gravimetric analysis	percent P in Miracle Gro	**X**	2 DB + 1 CP	Student-done
32	Vapor Pressure	LabPro/Temp sensor, Gas pressure sensor Determine dH vap of an alcohol using Clausius-Clapeyron equation		DB	Student-done
33	Solution concentrations	prepare solutions using molal, mass %, molarity, mole fraction		CP	Student-done
34	Freezing Point depression	LabPro/Temp sensor/computer determine the molar mass of benzoic acid based on FP depression of lauric acid	**X**	DB	Student-done
35	Determine a rate law (bromate)	method of initial rates to find rate law; compare rate with that of catalyst, use 2-pt arrhenius eqn. to find activation energy	**X**	DB	Student-done
36	Determine a rate law (crystal violet)	LabPro/colorimeter/computer to determine integrated rate law based on graphs of [A] vs t, ln[A] vs t, 1/[A] vs t	**X**	DB	Student-done
37	Voltaic cells	LabPro/voltage probes/calculator determine reduction potential chart, make predictions, and compare	**X**	DB	Student-done

38	NMR lab	Use NMR at a local college to determine structure of organic compounds		4 hours	Student-done
39	Producing copper	Using electric current to convert CuCl2 (aq) to Cu (s) and Cl2 (g)	**X**	1/2 hour	Demonstration
40	Ksp of calcium iodate	Microscale titration (using “weight buret” to determine Ksp of calcium hydroxide		CP	Student-done