

# AP Chemistry Audit

2013-14

**Version 2**

Curriculum Requirement	Page
<b>CR1:</b> Students and teachers use a recently published (within the last 10 years) college level chemistry textbook.	3
<b>CR2:</b> The course is structured around the enduring understandings within the big ideas as described in the AP Chemistry Curriculum Framework.	6
<b>CR3a:</b> The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 1: Structure of matter.	6
<b>CR3b:</b> The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 2: Properties of matter-characteristics, states, and forces of attraction.	6
<b>CR3c:</b> The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 3: Chemical reactions.	7
<b>CR3d:</b> The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 4: Rates of chemical reactions.	7
<b>CR3e:</b> The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 5: Thermodynamics.	7
<b>CR3f:</b> The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 6: Equilibrium.	7
<b>CR4:</b> The course provides students with the opportunity to connect their knowledge of chemistry and science to major societal or technological components (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens.	3, 4, 5
<b>CR5a:</b> Students are provided the opportunity to engage in investigative laboratory work integrated throughout the course for a minimum of 25 percent of instructional time.	8
<b>CR5b:</b> Students are provided the opportunity to engage in a minimum of 16 hands-on laboratory experiments integrated throughout the course while using basic laboratory equipment to support the learning objectives listed within the AP Chemistry Curriculum Framework.	8
<b>CR6:</b> The laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Chemistry Curriculum Framework. At minimum, six of the required 16 labs are conducted in a guided-inquiry format.	8
<b>CR7:</b> The course provides opportunities for students to develop, record, and maintain evidence of their verbal, written, and graphic communication skills through laboratory reports, summaries of literature or scientific investigations, and oral, written, and graphic presentations.	5, 8

**Introduction** Advanced Placement (AP) Chemistry is a course that is designed to be the equivalent of a first year, general chemistry college course. As such, the course is suitable only for high school students who are (or will be) particularly able in chemistry.

This is especially true of AP Chemistry students that I teach, since the overwhelming majority of high schools in the United States only deliver the AP Chemistry program to juniors or seniors who have already been exposed to a first year high school chemistry course, (and the AP course is designed by The College Board (CB) to specifically be a second year course to be taken after an introductory course in chemistry), BUT the AP Chemistry students at that I teach are sophomores, receiving their first (and often, only) high school chemistry course. As a result my students need to exhibit unusually high levels of commitment, motivation and academic maturity.

When considering the course and its syllabus the following points should be very carefully noted;

- (i) **[CR4]** Students are expected to play an active role in their studies by reading around the subject and taking an enthusiastic and proactive approach to all their work. This helps to build general chemical knowledge **[CR4]** around the fundamentals they will learn from the course.
- (ii) The course will not necessarily involve studying the material in the order it is presented in the CB's topic outline or as in the syllabus, and there will often be overlap between topics.
- (iii) If a student intends to use their AP Chemistry score for college credit then it is his or her responsibility to research if the college(s) of their choice will accept it. Colleges have widely differing policies in relation to this matter ranging from complete acceptance to total disregard.
- (iv) My AP course is **NOT designed to prepare students for the SAT subject test in chemistry nor any examination other than the AP.**
- (v) For most students a course in AP Chemistry will provide some of the greatest intellectual challenges of their high school and early college career.

**The Textbooks and Other Resources [CR1]** I do **not** insist that students buy a textbook since I don't ask them to *specifically* refer to one nor do I use one. However, students have access to, and have been provided with, reference reading and questions in *Chang, Chemistry, 8<sup>th</sup> Edition*, copyright 2005.

Whilst not an absolute requirement, it is very strongly recommended that students invest in one of the AP Chemistry course preparation books currently on the market. There are several available and each student should peruse the titles and select one based upon personal preference. It is not a good idea to wait until a few weeks before the examination to purchase the book, rather buy it at the beginning of the course and use it regularly throughout the year. Two examples of such books are,

- 5 Steps to a 5: AP Chemistry by John Moore and Richard Langley
- SPARKNOTES AP Chemistry POWER PACK (Revised Edition)

But there are many similar and equally as useful.

One other publication may be of interest to students. The College Board's AP Chemistry Course description (formerly known as 'The Acorn Book') contains information relating to the AP Chemistry course from the CB's perspective that makes for an informative read. It can be downloaded from

[http://media.collegeboard.com/digitalServices/pdf/ap/2013advances/AAP-ChemistryCED\\_Effective\\_Fall\\_2013.pdf](http://media.collegeboard.com/digitalServices/pdf/ap/2013advances/AAP-ChemistryCED_Effective_Fall_2013.pdf)

**The Course Notes** Course notes amplify the content of the whole course. The notes are vitally important to students as they form a permanent, hard copy record that summarizes of all the knowledge and understanding that students require in order to perform well in the AP Chemistry examination. Each set of notes should be used and annotated however the student sees fit. They must be used as the basis for study.

**The Website** All the materials for the course can be downloaded from the website. It is the student's responsibility to visit the site to get materials as and when they are needed. In addition to the course material there is a very large amount of other helpful information on the web site, such as blog posts and external references to other useful articles and materials related to the course **[CR4]**. Students are **required** to visit regularly, almost certainly that will mean daily!

### **The Expectations**

- (i) Student obligations. I hope it goes without saying that attendance, punctuality, courtesy and good behavior of the highest levels are expected at all times. On the occasions when it is unavoidable that a class is missed it remains the responsibility of the student to catch up with any material missed. Laboratory safety is always of paramount importance. Exemplary behavior and observance of safety procedures is required at all times. The very nature of the

AP Chemistry program, attempting as it does to mimic a college chemistry course, requires students to learn and apply college style learning skills. **[CR4]** More specifically taking the initiative for ones own learning and being prepared to think around problems to find solutions. Seeking help and using time outside of class for study is vital.

- (ii) My commitment. I will always grade and return work as soon as possible and will be happy to review any problems that arise from it. I am always happy to speak to students and parents outside of class time, as and when time permits.

**The Assessment** The course will be assessed in three areas.

- (i) **Testing.** Students will be tested on a regular basis, approximately once every two weeks. The tests will make up 60% of the final FIRST semester grade and 60% of the final SECOND semester grade. All tests have two sections – a multiple –choice section and a free response section that mimic the real AP Chemistry exam. **[CR7]**
- (ii) **Homework.** Homework will be set on a regular basis and deadlines must be met. The homework will make up 20% of the final FIRST semester grade and 40% of the final SECOND semester grade and will include examination questions and opportunities for reading and other activities related to chemical general knowledge. **Students will be asked to interpret one news article related to chemistry that should be analyzed in accordance with their knowledge of chemistry. [CR4] [CR7]**
- (iii) **Examination.** All material studied up to the middle of December of the FIRST semester will be assessed in a written examination in December 2013. The exam will make up 20% of the final FIRST semester grade. There is no internal SECOND semester examination. This is replaced by the AP Chemistry examination itself in May 2014. **[CR7]**

**Course Outline [CR2]** The following table gives the complete course outline. (My) unit numbers coincide with the Big Idea numbers, and I have given meaningful topic titles to each of the Enduring Understandings. The Essential Knowledge and Learning Objectives that I will cover in each of my topics are listed in the final two columns.

UNIT	UNIT TITLE	TOPICS & TITLES	COVERS			
			BI	EU	EK	LO
0	<i>Preamble</i>	A: Chemistry, Scientific Method and Chemical & Physical Change	NA	NA	NA	NA
		B: Measurement	NA	NA	NA	NA
		C: Atomic Theory	NA	NA	NA	NA
		D: Nomenclature	NA	NA	NA	NA
1	<i>Chemistry of Atoms and Elements</i> [CR3a]	A: Atoms and the Elements	1	1A	1-3	1.1, 1.2, 1.3, 1.4
		B: Electrons	1	1B	1-2	1.5, 1.6, 1.7, 1.8, 1.12, 1.13
		C: The Periodic Table and Periodicity	1	1C	1-2	1.9, 1.10, 1.11
		D: Spectrometry and Spectroscopy	1	1D	1-3	1.14, 1.15, 1.16
		E: Conservation of Atoms and Mass	1	1E	1-2	1.17, 1.18, 1.19, 1.20
Students will be assigned AP FRQ questions from old AP chemistry exams, that are STILL 100% relevant Big Idea #1 in the new course.						
2	<i>Chemical Bonding</i> [CR3b]	A: States of Matter & Solutions	2	2A	1-3	2.3, 2.4, 2.5, 2.6, 2.12, 2.7, 2.10, 2.9
		B: Intermolecular Forces	2	2B	1-3	2.11, 2.13
		C: Intrabonding	2	2C	1-4	2.17, 2.1, 2.14, 2.15, 2.19, 2.23, 2.24, 2.8, 2.17, 2.18, 2.20, 2.26, 2.27, 2.28, 2.21, 2.2
		D: Bonding and the Properties of Solids	2	2D	1-4	2.25, 2.29, 2.30, 2.31, 2.32
Students will be assigned AP FRQ questions from old AP chemistry exams, that are STILL 100% relevant Big Idea #2 in the new course.						

3	<b>Chemical Reactions and Energy Change</b> <b>[CR3c]</b>	A: Chemical Reactions	3	3A	1-2	3.2, 3.1, 3.3, 3.4
		B: Types of Chemical Reaction	3	3B	1-3	3.8, 3.5, 3.6, 3.9, 3.7
		C: Driving Forces, Energy Changes and Electrochemistry	3	3C	1-3	3.10, 3.11, 3.12, 3.13
Students will be assigned AP FRQ questions from old AP chemistry exams, that are STILL 100% relevant Big Idea #3 in the new course.						
4	<b>Chemical Kinetics</b> <b>[CR3d]</b>	A: Factors Affecting Rates	4	4A	1-3	4.1
		B: Collision Theory	4	4B	1-3	4.5, 4.4
		C: Reaction Mechanisms	4	4C	1-3	4.8, 4.7, 4.2, 4.3, 4.6, 4.4
		D: Catalysts	4	4D	1-2	4.8, 4.9
Students will be assigned AP FRQ questions from old AP chemistry exams, that are STILL 100% relevant Big Idea #4 in the new course.						
5	<b>Thermochemistry</b> <b>[CR3e]</b>	A: Heat	5	5A	1-2	5.2, 5.3
		B: Work, Calorimetry and Conservation of Energy	5	5B	1-4	5.4, 5.6, 5.5, 5.7
		C: Bond Energy and Enthalpies	5	5C	1-2	5.1, 5.8, 5.6
		D: Physical and Chemical Changes and Bonding	5	5D	1-3	5.9, 5.11, 5.10
		E: Entropy	5	5E	1-5	5.18, 5.12, 5.13, 5.14, 5.15, 5.16, 5.17
Students will be assigned AP FRQ questions from old AP chemistry exams, that are STILL 100% relevant Big Idea #5 in the new course.						
6	<b>Chemical Equilibrium</b> <b>[CR3f]</b>	A: Equilibrium	6	6A	1-4	6.1, 6.3, 6.7, 6.5, 6.6, 6.4, 6.2
		B: Le Chatelier's Principle and Optimum Conditions	6	6A	1-2	6.8, 6.10, 6.9
		C: Acid Base Equilibria and K <sub>sp</sub>	6	6C	1-3	6.11, 6.12, 6.14, 6.20, 6.18, 6.19, 6.13, 6.15, 6.16, 6.17, 6.21, 6.22, 6.24, 6.23
		D: Gibbs Free Energy and Equilibrium	6	6D	1	6.25
Students will be assigned AP FRQ questions from old AP chemistry exams, that are STILL 100% relevant Big Idea #6 in the new course.						

**Laboratory Work [CR5a] [CR5b] [CR6]** Students will be exposed to a laboratory program where a minimum of 16 labs will be conducted, 6 being guided-inquiry based labs, and the *College Board's Guided-Inquiry Experiments* lab manual will be 'the basis for the source of those labs'. **The list of the labs that appear in the College Board Lab manual are given below with the ones most likely to be conducted in an inquiry manner also listed. The alternative approach to lab time will represent 25% of the instructional time available.**

**Investigation 1: What Is the Relationship Between the Concentration of a Solution and the Amount of Transmitted Light Through the Solution?**

**Investigation 2: How Can Color Be Used to Determine the Mass Percent of Copper in Brass?**

**Investigation 3: What Makes Hard Water Hard? - INQUIRY**

**Investigation 4: How Much Acid Is in Fruit Juices and Soft Drinks? - INQUIRY**

**Investigation 5: Sticky Question: How Do You Separate Molecules That Are Attracted to One Another?**

**Investigation 6: What's in That Bottle?**

**Investigation 7: Using the Principle That Each Substance Has Unique Properties to Purify a Mixture: An Experiment Applying Green Chemistry to Purification - INQUIRY**

**Investigation 8: How Can We Determine the Actual Percentage of H<sub>2</sub>O<sub>2</sub> in a Drugstore Bottle of Hydrogen Peroxide? - INQUIRY**

**Investigation 9: Can the Individual Components of Quick Ache Relief Be Used to Resolve Consumer Complaints?**

**Investigation 10: How Long Will That Marble Statue Last? - INQUIRY**

**Investigation 11: What Is the Rate Law of the Fading of Crystal Violet Using Beer's Law?**

**Investigation 12: The Hand Warmer Design Challenge: Where Does the Heat Come From? - INQUIRY**

**Investigation 13: Can We Make the Colors of the Rainbow? An Application of Le Châtelier's Principle**

**Investigation 14: How Do the Structure and the Initial Concentration of an Acid and a Base Influence the pH of the Resultant Solution During a Titration?**

**Investigation 15: To What Extent Do Common Household Products Have Buffering Activity?**

**Investigation 16: The Preparation and Testing of an Effective Buffer: How Do Components Influence a Buffer's pH and Capacity?**

Other Labs they may make up the INQUIRY (or other) portion of the lab program include the following;

AP LAB 1a  
- Density (Sig Figs)

AP LAB  
- Conservation of Mass  
AP LAB  
- Inorganic Nomenclature  
AP LAB  
  
- Radioactive Decay Simulation

AP LAB  
- Flame Tests

AP LAB  
- Hydrated Salts  
AP LAB  
- Empirical Formula  
AP LAB  
- Preparing a Standard Solution  
AP LAB  
- Acid v. Hydrogen Carbonate Titration

**AP LAB**  
**- REDOX Titration Simulations**

**AP LAB**  
**- Determination of R**  
**(the Universal Gas Constant)**

**AP LAB 7c**  
**- Periodic Table Simulator**

**AP LAB**  
**- Molecular Models**

AP LAB  
- Enthalpy Changes

AP LAB  
- Le Chatelier's Principle  
AP LAB  
- Le Chatelier's Principle SIMULATION  
AP LAB  
- Le Chatelier's Principle SIMULATION II

AP LAB  
- Titration Simulation  
AP LAB  
- Acid versus Hydroxide Titration

AP LAB  
- Rates of Reaction (Concentration)

AP LAB  
- Electrochemistry Simulations

**PLEASE NOTE: Due to the fact that this course is being taught to sophomores as their only high school chemistry course, the timings and number of labs are approximate, and the lab component will be supplemented by an 'alternative approach' of using demonstrations, video, web and computer simulations and old AP lab questions, in order to illustrate some of the required laboratory techniques and skills. This has been noted on the AP Chemistry Audit form, as and is entirely in line with the previously approved audits presented by me for use at my school and in my particular circumstances.**

The labs will be performed at times in the course when they coincide with the theory being delivered. For example, a lab such as Lab 10, Kinetics: Rate of Reaction: *How Long Will That Marble Statue Last?*, would be delivered during Unit 4.

The total time requirements (for labs that are conducted in a guided-inquiry fashion), and representative lab titles can be found in the *College Board Guided-Inquiry Experiments* lab manual.

The labs will cover the seven science Practices as outlined in Appendix D of the *College Board AP Chemistry Course Description* and *Guided-Inquiry Experiment* lab manual, and students will leave the course with hard-copy records of all of their laboratory work. Typical Components of a lab report will include;

Title

Aim

Apparatus

Method

Results

Conclusion/Discussion

[CR7]