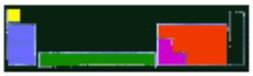
Revised August 2011

Adrian Dingle's AP Chemistry Class Introduction 2011/12



The Course and its Content 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 at The Westminster Schools **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.** Since AP Chemistry students at The Westminster Schools are sophomores receiving their first high school chemistry course, they need to exhibit unusually high levels of commitment, motivation and academic maturity. To illustrate these points the CB makes the following statement in the course description in relation to student commitment;

"Students in an AP Chemistry course should spend at least five hours a week in individual study outside of the classroom"

The AP examinations are sponsored by the CB and administered and operated by the Educational Testing Service (ETS). The CB provides a topic outline for the subject, which is intended to be a guide to the level and breadth of the treatment expected, but not a specific syllabus. The specific syllabus objectives for my AP course have been determined by me, are based upon the CB's topic outline, and are designed to prepare students for the AP Chemistry examination. The specific syllabus objectives for my AP Chemistry course at The Westminster Schools can be read at; www.adriandingleschemistrypages.com/apguide.html

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

(i) There are two consequences of the close to unique inexperienced circumstances that the AP Chemistry students at The Westminster Schools find themselves in. Firstly 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 around the fundamentals they will learn from the course. Secondly the AP Chemistry course and examination will most likely present students with some problems that they find very difficult or even impossible to solve. This is less alarming than it might at first appear when one considers that in order to achieve the highest grade (5) on the AP exam, it has traditionally only been necessary to score somewhere in the region of 65-70% of the points available.

(ii) Unlike almost all other externally assessed, standardized examinations, the AP Chemistry exam has a somewhat open-ended structure and there is no prescribed syllabus handed down by the CB. The topic outline only serves as a ***guide*** to the content of an AP Chemistry course. As a result, AP courses delivered by different teachers, whilst fundamentally similar, will have slightly differing content and emphasis.

(iii) 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.

(iv) 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.

(v) My AP course is **NOT designed to prepare students for the SAT subject test in chemistry nor any examination other than the AP**. You should read more about my views on this matter at www.adriandingleschemistrypages.com/faqs.html#ap

(vi) For most students a course in AP Chemistry will provide some of the greatest intellectual challenges of their high school and early college career.

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The Textbooks and Other Resources I do **not** insist that students buy a textbook since I don't ask them to *specifically* refer to one. However, as back up I have provided reference reading and questions at www.adriandingleschemistrypages.com/ap.html to Chang, Chemistry, 8th Edition.

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; 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, 2012-2013 4th Edition by John Moore and Richard Langley
ISBN: 0071751688

SPARKNOTES AP Chemistry POWER PACK (Revised Edition)
ASIN: B003Q5GEN8

As an aside, I re-wrote the entire net ionic equation writing section of the Sparknotes Power Pack, (along with the introduction and a few of the questions and answers) to reflect the changes in the AP exam that were introduced for the 2007 exam.

Two other publications, both available from the College Board, may be of interest. The first is the AP Chemistry course description Effective Fall 2010 (AKA 'The Acorn Book') referred to many times by me. It 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://apcentral.collegeboard.com/apc/public/repository/ap-chemistry-course-description.pdf

The second is the AP Chemistry teacher's guide. Whilst not of general interest to students or parents it does have a short, but nevertheless very interesting section entitled **"Demands of an AP Chemistry course on students and their parents"**. The relevant section can be found on the last three pages of this document;

http://apcentral.collegeboard.com/apc/members/repository/ap07_chem_teachersguide_1-17.pdf

In addition to these publications the CB has a portion of its website dedicated to AP Exams at;

http://apcentral.collegeboard.com/apc/Controller.jpf

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 you will find a very large amount of other helpful information there. You are **required** to visit regularly, almost certainly that will mean daily!

www.adriandingleschemistrypages.com

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The Expectations In order for us all to have a successful year we have to work together. There are two sides to this partnership;

(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. Your 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. More specifically taking the initiative for one's own learning and being prepared to think around problems to find solutions. Please seek help and use backwork time if you are having difficulties.

(ii) My commitment. I will always grade and return work to you 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.

(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.

(iii) **Examination**. All material studied up to the middle of December of the FIRST semester will be assessed in a written examination in December 2011. 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 2012.

The AP Chemistry examination format

The AP Chemistry exam is divided into two sections

Section I: (90 minutes in length, 50% of the total grade, no calculators allowed)

75 Multiple choice questions. Select the best answer from a choice of five (A-E)

The questions cover the whole course and are scored as follows; 1 point for a correct answer, 0 points without penalty (as of 2011) for a wrong answer and 0 points for a "blank".

The College Board quote with reference to this part of the exam;

"…the test (Section I) must be so comprehensive that no student should be expected to make a perfect or near perfect score".

Section II: (95 minutes in length, 50% of the total grade)

PART A: (55 minutes of the 95, calculators allowed)

Question 1: The Equilibrium Question (Compulsory, 20% of the 50%)

Since the introduction of a new examination format in 1998, question 1 has asked about some aspect of equilibrium and associated questions. In 2012 question 1 will continue to focus on some aspect of equilibrium.

1998:	Ksp		
1999:	Kc & Kb		
2000:	Kc		
2001:	Ksp		
2002:	Ka	2002B:	Ka
2003:	Kb	2003B:	Kp & Kc
2004:	Ksp	2004B:	Kp & Kc
2005:	Ka & Kb	2005B:	Ka
2006:	Ka & Kb	2006B:	Ka
2007:	Ka	2007B:	Kp
2008:	Kp	2008B:	Kc
2009:	Ka	2009B:	Kb
2010:	Ksp	2010B:	Kc
2011:	Kb & Ka	2011B:	Ksp & Kp

Questions 2 and 3: The Calculation Questions (Compulsory, 20% each of the 50%)

In questions 2 and 3 expect CALCULATIONS to be involved. A question based upon laboratory procedure could be asked here (calculation based), or in Part B (non-calculation based).

PART B: (40 minutes of the 95, NO calculators allowed)

Question 4: The Net Ionic Equation Question (Compulsory, 10% of the 55%)

Since the introduction of a new examination format in 1998, question 4 used to ask candidates to convert five out of a choice of eight word equations into symbol equations. Equations used not have to be balanced. Since 2007, candidates are now asked to write three, **balanced** net ionic equations (showing only show extensively ionized species as ions and omitting any spectator species) **AND** to answer a short question that follows each equation.

Questions 5 and 6: The "Essay" Questions (Compulsory, 15% each out of the 55%)

Since the introduction of a new examination format in 1998, question 5 has asked about a laboratory situation or experiment. From 2007 onwards, laboratory situations WILL still be asked, but they may be the subject of question 2 or 3 and have a calculation component. Question 5 or 6 could also be about a laboratory situation. Questions 5 and 6 are not "essays", but this term is often used to distinguish them from calculation based questions.

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The Advanced Placement Chemistry Topic Outline for Fall 2011 The following list describes the topic outline provided by the College Board in the AP Chemistry course description (AKA The Acorn Book). The outline is designed to be a guide to the breadth and depth of an AP Chemistry course and not a syllabus. For the **specific syllabus objectives** for my AP course see my Advanced Placement Guide at;

www.adriandingleschemistrypages.com/apguide.html.

The outline describes the five major areas listed below plus a list of types of chemical calculations one might to encounter in an AP Chemistry course.

I Structure of Matter
II States of Matter
III Reaction Types
IV Descriptive Chemistry
V Laboratory Work

Chemical Calculations

I Structure of Matter (20% of multiple-choice questions)

A. Atomic theory and atomic structure

1. Evidence for the atomic theory
2. Atomic masses; determination by chemical and physical means
3. Atomic number and mass number; isotopes
4. Electron energy levels: atomic spectra, quantum numbers, atomic orbitals
5. Periodic relationships including, for example, atomic radii, ionization energies, electron affinities, oxidation states

B. Chemical bonding

1. Binding forces
    a. Types: ionic, covalent, metallic, hydrogen bonding, van der Waals (including London dispersion forces)
    b. Relationships to states, structure, and properties of matter
    c. Polarity of bonds, electronegativities
2. Molecular models
    a. Lewis structures
    b. Valence bond: hybridization of orbitals, resonance, sigma and pi bonds
    c. VSEPR
3. Geometry of molecules and ions, structural isomerism of simple organic molecules and coordination complexes, dipole moments of molecules, relation of properties to structure

C. Nuclear chemistry: nuclear equations, half-lives, and radioactivity; chemical applications

II States of Matter (20% of multiple-choice questions)

A. Gases

1. Laws of ideal gases
    a. Equation of state for an ideal gas
    b. Partial pressures

2. Kinetic-molecular theory
    a. Interpretation of ideal gas laws on the basis of this theory
    b. Avogadro's hypothesis and the mole concept
    c. Dependence of kinetic energy of molecules on temperature
    d. Deviations from ideal gas laws

B. Liquids and solids

1. Liquids and solids form the kinetic-molecular viewpoint
2. Phase diagrams of one-component systems
3. Changes of state, including critical points and triple points
4. Structure of solids; lattice energies

C. Solutions

1. Types of solutions and factors affecting solubility
2. Methods of expressing concentration (The use of normalities is not tested.)
3. Raoult's law and colligative properties (non-volatile solutes); osmosis
4. Non-ideal behavior (qualitative aspects)

III Reactions (35-40% of multiple-choice questions)

A. Reaction types

1. Acid-base reactions; concepts of Arrhenius, Brönsted-Lowry, and Lewis; coordination complexes; amphoterism
2. Precipitation reactions
3. Oxidation-reduction reactions
    a. Oxidation number
    b. The role of the electron in oxidation-reduction
    c. Electrochemistry: electrolytic and galvanic cells; Faraday's laws; standard half-cell potentials; Nernst equation; prediction of the direction of redox reactions

B. Stoichiometry

1. Ionic and molecular species present in chemical systems: net ionic equations
2. Balancing of equations including those for redox reactions
3. Mass and volume relations with emphasis on the mole concept, including empirical formulas and limiting reactants

C. Equilibrium

1. Concept of dynamic equilibrium, physical and chemical; Le Chatelier's principle; equilibrium constants
2. Quantitative treatment
    a. Equilibrium constants for gaseous reactions: Kp, Kc
    b. Equilibrium constants for reactions in solution
        (1) Constants for acids and bases; pK; pH
        (2) Solubility product constants and their application to precipitation and the dissolution of slightly soluble compound
        (3) Common ion effect; buffers; hydrolysis

D. Kinetics

1. Concept of rate of reaction
2. Use of differential rate laws to determine order of reaction and rate constant from experimental data
3. Effect of temperature change on rates
4. Energy of activation; the role of catalysts
5. The relationship between the rate-determining step and a mechanism

E. Thermodynamics

1. State functions
2. First law: change in enthalpy; heat of formation; heat of reaction; Hess's law; heats of vaporization and fusion; calorimetry
3. Second law: entropy; free energy of formation; free energy of reaction; dependence of change in free energy on enthalpy and entropy changes
4. Relationship of change in free energy to equilibrium constants and electrode potentials

IV Descriptive Chemistry (10-15% of multiple-choice questions)

Knowledge of specific facts of chemistry is essential for an understanding of principles and concepts. These descriptive facts, including the chemistry involved in environmental and societal issues, should not be isolated from the principles being studied but should be taught throughout the course to illustrate and illuminate the principles. The following areas should be covered:

1. Chemical reactivity and products of chemical reactions
2. Relationships in the periodic table: horizontal, vertical, and diagonal with examples from alkali metals, alkaline earth metals, halogens, and the first series of transition elements
3. Introduction to organic chemistry: hydrocarbons and functional groups (structure, nomenclature, chemical properties).

V Laboratory Work (5-10% of multiple-choice questions)

The differences between college chemistry and the usual secondary school chemistry course are especially evident in the laboratory work. The AP Chemistry Examination includes some questions based on experiences and skills students acquire in the laboratory:

- making observations of chemical reactions and substances
- recording data
- calculating and interpreting results based on the quantitative data obtained
- communicating effectively the results of experimental work

Colleges have reported that some AP candidates, while doing well on the examination, have been at a serious disadvantage because of inadequate laboratory experience. Meaningful laboratory work is important in fulfilling the requirements of a college-level course of a laboratory science and in preparing a student for sophomore-level chemistry courses in college

Because chemistry professors at some institutions ask to see a record of the laboratory work done by an AP student before making a decision about granting credit, placement, or both, in the chemistry program, students should keep reports of their laboratory work that can be readily reviewed

Chemical Calculations in Sections I–V above

The following list summarizes types of problems either explicitly or implicitly included in the topic outline. Attention should be given to significant figures, precision of measured values, and the use of logarithmic and exponential relationships. Critical analysis of the reasonableness of results is to be encouraged

1. Percentage composition
2. Empirical and molecular formulas from experimental data
3. Molar masses from gas density, freezing point, and boiling point measurements
4. Gas laws, including the ideal gas law, Dalton's law, and Graham's law
5. Stoichiometric relations using the concept of the mole; titration calculations
6. Mole fractions; molar and molal solutions
7. Faraday's law of electrolysis
8. Equilibrium constants and their applications, including their use for simultaneous equilibria
9. Standard electrode potentials and their use; Nernst equation
10. Thermodynamic and thermochemical calculations
11. Kinetics calculations

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