



## Gifted LearningLinks Program

### AP Chemistry

**Instructor name: David Chan**

**E-mail address: xxx@xxx.xxx**

#### **Course Description:**

The AP Chemistry course is designed to be the equivalent of the general chemistry course usually taken during the first college year. The college course in general chemistry differs quantitatively from the usual first secondary school course in chemistry with respect to the kind of textbook used, the topics covered, the emphasis on chemical calculations and the mathematical formulation of principles, and the kind of laboratory work done by the students.

One of the objectives of the course is to pass the Advanced Placement (AP) examination in May. This objective is always kept in mind as lessons, labs and work is done for the class. However, this is not the only objective. A three-hour test cannot possibly cover all the material that should be studied in a college level course. This course will be a serious course in College Level Chemistry.

**Outcomes:** Upon successful completion of this course, students will be able to:

- solve quantitative chemistry problems and demonstrate reasoning clearly and completely.
- integrate multiple ideas in the problem solving process, and check their results to make sure they are physically reasonable.
- employ critical thinking and hypothesis-driven methods of scientific inquiry.
- clearly explain qualitative chemical concepts and trends.
- describe, explain, and model chemical and physical processes at the molecular level in order to explain macroscopic properties.
- perform basic laboratory techniques correctly using appropriate safety procedures.
- analyze the results of simple laboratory experiments, evaluate sources of error, synthesize this information, and express it clearly in written laboratory reports.
- develop effective written and oral communication skills, especially the ability to transmit complex technical information in a clear and concise manner.
- work collaboratively in teams through online discussion boards and virtual meetings.

**Resources and Materials:**

- Text (Required): *Chemistry* 7th ed. Zumdahl and Zumdahl, Houghton Mifflin Company, 2007 ISBN: 0-618-52844-X
- Student Study Guide and Student Solution Manual (Recommended)
- Scientific calculator
- User ID/Password for [www.smartsience.com](http://www.smartsience.com) will be provided by CTD.
- Gmail Account – online portfolio will be maintained through Google Apps.

**Laboratory Experiments:**

(Laboratory AP Curricular Requirement – Alternate Approach)

Chemistry is meant to be a “hands-on” experience. However, due to the nature of this course (online), a safe laboratory alternative needs to be considered and implemented. Thus, all lab experiments will be conducted using simulation programs. Through the simulators, students will still gain exposure to standard lab equipment as well as familiarity with general types of laboratory work (as suggested by the AP Chemistry course guide).

Students are required to maintain written lab reports in which they will make their observations, qualitative and quantitative measurements, and comment on methods involved. Students will use Google Docs as a collaboration tool to work with other online students in the course. As individuals, they will compile an online portfolio of their written work, and as groups, they will create presentations and projects to deepen their understanding of the material.

**Student Evaluation and Grading Policies for Credit Courses Only:**

A+ 97-100	B+ 87-89	C+ 77-79	D+ 67-69	F Below 60
A 93-96	B 83-86	C 73-76	D 63-66	
A- 90-92	B- 80-82	C- 70-72	D- 60-62	

- **Labs (20%)** – As required by the College Board, the laboratory portion of this course includes a minimum of 34 laboratory hours. The AP Chemistry course description has 22 recommended labs that may appear on the AP Exam. This course attempts to give students repeated exposure to as many of these experiences as possible. These are labeled with the “AP-#” to signify which of the recommended labs each corresponds to.

Students are required to keep copies of lab reports as a written record as these documents may be requested by universities when determining placements. Each lab report should adequately reflect the student’s purpose, procedures, hypotheses, data collection, analysis, and conclusions for each experiment. The lab portfolio should demonstrate growth on the part of the student, especially when comparing the initial report/project with the culminating experience.

- **Tests/Quizzes (60%)** – Tests will be given at the end of each unit. Units may cover one chapter or several. Test formats will be similar to the AP exam, containing multiple choice with no calculator, short answer and calculations. Since there is so much material to cover during the year, clarifying comprehension is very important. Tests will not be given until the homework, quizzes and labs have been completed for the unit. Consequently, tests are viewed as summative assessments and only a limited amount of retake options will be available.
- **Homework (20%)** - A majority of the suggested homework problems will come from the Zumdahl text at the end of the chapter along with AP type problems found with the notes on Blackboard. Other homework will be downloadable worksheets or questions/problems under assignments in blackboard. Formative quizzes will be available for each chapter assigned. Thus, a student can gauge whether they are ready to move onto the next chapter or if they additional experience. Generally, formative quizzes can be re-taken until mastery is achieved.

### **Course Overview (Units/Chapters/Sections):**

#### **Semester I (18 weeks)**

#### **Unit I: Chapters 1-4 (5.5 weeks)**

#### **Chapter 1: Chemical Foundations (1 week)**

- 1.1: Overview
- 1.2: Scientific Method
- 1.3: Units of Measurement
- 1.4: Uncertainty in Measurement
- 1.5: Significant Figures and Calculations
- 1.6: Dimensional Analysis
- 1.7: Temperature
- 1.8: Density
- 1.9: Classification of Matter

Suggested Problems

#### **Lab:**

Density Lab (SmartScience)

#### **Chapter 2: Atoms, Molecules, and Ions (1 week)**

- 2.1: History of Chemistry
- 2.2: 2 Early Laws
- 2.3: Dalton's Atomic Theory
- 2.4: Early Experiments
- 2.5: Modern View of the Atom

- 2.6: Molecules and Ions
- 2.7: Introduction to the Periodic Table
- 2.8: Naming Simple Compounds

Suggested Problems

Chapter 2 Notes Problems

Discussion Question

Lab:

Glassware Lab (SmartScience)

HW Quiz

### **Chapter 3: Stoichiometry (1.5 weeks)**

(Reactions AP Curricular Requirement)

(Chemical Calculations AP Curricular Requirement)

- 3.1: Counting by Weighing
- 3.2: Atomic Masses
- 3.3: The Mole
- 3.4: Molar Mass
- 3.5: Percent Composition
- 3.6: Empirical Formulas
- 3.7: Chemical Equations
- 3.8: Balancing Equations
- 3.9: Stoichiometric Calculations
- 3.10: Limiting Reactants

Suggested Problems

Chapter 3 Notes Problems

Discussion Question

Lab:

(AP-1): Determination of the formula of a compound - Empirical Formula Chlorides Lab  
(SmartScience Lab)

(AP-2): Determination of the percentage of water in a hydrate – Hydrate Analysis  
(SmartScience Lab)

HW Quiz

**Chapter 4: Types of Chemical Reactions and Solutions (2 weeks)**  
(Reactions AP Curricular Requirement)

- 4.1: Water
- 4.2: Electrolytes
- 4.3: Solutions
- 4.4: Types of Reactions
- 4.5: Precipitation Reactions
- 4.6: Reactions in Solutions
- 4.7: Stoichiometry of Precipitation Reactions
- 4.8: Acid-Base Reactions
- 4.9: Oxidation-Reduction Reactions
- 4.10: Balancing Redox Equations

Suggested Problems

Chapter 4 Notes Problems

Discussion Question

Lab:

(AP-14): Separation and qualitative analysis of cations and anions – Precipitate Procedure (SmartScience Lab)

(AP-9): Determination of mass and mole relationship in a chemical reaction – Mole Ratios Exercise (SmartScience Lab)

HW Quiz

Unit 1 Test

Unit 2: Chapters 5, 10, 6 (5 weeks)

**Chapter 5: Gases (1.5 weeks)**

(States of Matter AP Curricular Requirement)  
(Chemical Calculations AP Curricular Requirement)

- 5.1: Pressure
- 5.2: Gas laws
- 5.3: Ideal Gas Law
- 5.4: Gas Stoichiometry
- 5.5: Dalton's Law
- 5.6: Kinetic Molecular Theory
- 5.7 Effusion and Diffusion
- 5.8: Real Gases
- 5.9: Characteristics of Real Gases

## 5.10: Chemistry in the Atmosphere

Suggested Problems

Discussion Question

Lab:

(AP-5): Determination of the molar volume of a gas – Molar Volume (SmartScience Lab)

(AP-3): Determination of molar mass by vapor density – Vapor Density (SmartScience Lab)

HW Quiz

## **Chapter 10: Liquids and Solids (1.5 weeks)**

(States of Matter AP Curricular Requirement)

10.1: Intermolecular Forces

10.2: Liquid State

10.3: Types of Solids

10.4: Metallic Bonding

10.5: Network Atomic Solids

10.6: Molecular Solids

10.7: Ionic Solids

10.8: Changes in State

10.9: Phase Diagrams

Suggested Problems

Chapter 10 Notes Problems

Discussion Question

Lab:

(AP-16): Analytical gravimetric determination – Gravimetric Analysis (SmartScience Lab)

HW Quiz

## **Chapter 6: Thermochemistry (2 weeks)**

6.1: Energy

6.2: Enthalpy and Calorimetry

6.3: Hess's Law

6.4: Standard Enthalpies of Formation

6.5: Sources of Energy

6.6: New Energy Sources

Suggested Problems

Chapter 6 Notes Problems

Discussion Question

Lab:

(AP-13): Determination of enthalpy change associated with a reaction – Enthalpy of a Solution (SmartScience)

HW Quiz

Unit 2 Test

Unit 3: Chapters 7, 18 (3 weeks)

**Chapter 7: Atomic Structure and Periodicity (2 weeks)**

(Structure of Matter AP Curricular Requirement)

(Descriptive Chemistry AP Curricular Requirement)

7.1: Electromagnetic Radiation

7.2: Nature of Matter

7.3: Atomic Spectrum of Hydrogen

7.4: Bohr Model

7.5: Quantum Mechanical Model

7.6: Quantum Numbers

7.7: Orbital Shapes and Energies

7.8: Electron Spin and Pauli Principle

7.9: Polyelectronic Atoms

7.10: History of Periodic Table

7.11: Aufbau Principle

7.12: Periodic Trends

7.13: Alkali Metals

Suggested Problems

Discussion Question

Lab:

Activity: Periodic Properties (Handout)

HW Quiz

**Chapter 18: Nuclear Chemistry (1 week)**

18.1: Radioactive Decay

18.2: Half Life  
18.3: Transformations  
18.4: Detection and Uses  
18.5: Thermodynamic Stability  
18.6: Fission and Fusion  
18.7: Effects of Radiation

Suggested Problems

Discussion Question

Lab:

iLabs – Radioactivity iLab (<http://www.ilabcentral.org/>)

HW Quiz

Unit 4: Chapters 8-9 (3.5 weeks)

**Chapter 8: Bonding (2 weeks)**

(Structure of Matter AP Curricular Requirement)

8.1: Types of Chemical Bonds  
8.2: Electronegativity  
8.3: Polarity and Dipoles  
8.4: Electron Configurations  
8.5: Lattice Energy  
8.6: Partial Ionic Character of Covalent Bonds  
8.7: Covalent Bonds  
8.8: Bond Energy  
8.9: Localized Electrons  
8.10: Lewis Structures  
8.11: Exceptions to the Octet Rule  
8.12: Resonance  
8.13: VSEPR Model

Suggested Problems

Discussion Question

Chapter 8 Notes Problems

Lab:

ChemSketch Program Assignment – Submit PDF

**Chapter 9: Covalent Bonding (1.5 week)**

9.1: Hybridization

- 9.2: Molecular Orbitals
- 9.3: Paramagnetism
- 9.4: Diatomic Molecules
- 9.5: Combining the Models

Suggested Problems

Discussion Question

Lab:

ChemSketch Program Assignment – Submit PDF

HW Quiz

**Review/Final Exam (1 week)**

Semester II (18 weeks)

Unit 5: Chapters 11-13 (5.5 weeks)

**Chapter 11: Solutions (2 weeks)**

(States of Matter AP Curricular Requirement)

- 11.1: Solution Composition
- 11.2: Solution Formation
- 11.3: Solubility
- 11.4: Vapor Pressures of Solutions
- 11.5: BP Elevation, FP Depression
- 11.6: Osmotic Pressure
- 11.7: Colligative Properties
- 11.8: Colloids

Suggested Problems

Chapter 11 Notes Problems

Discussion Question

Lab:

(AP-4): Determination of molar mass by vapor density – Freezing Point (SmartScience)

HW Quiz

**Chapter 12: Chemical Kinetics (2 weeks)**

(Reactions AP Curricular Requirement)

- 12.1: Reaction Rates
- 12.2: Rate Laws
- 12.3: Determining Rate Laws
- 12.4: Integrated Rate Laws
- 12.5: Rate Law Summary
- 12.6: Reaction Mechanisms
- 12.7: Chemical Kinetics Model
- 12.8: Catalysis

Suggested Problems

Chapter 12 Notes Problems

Discussion Question

Labs:

(AP-12): Determination of the rate of a reaction and its order – Reaction Rates (SmartScience)

(AP-17): Colorimetric or spectrophotometric analysis – Colorimetric Analysis (SmartScience Lab)

HW Quiz

**Chapter 13: Equilibrium (1.5 weeks)**  
(Reactions AP Curricular Requirement)

- 13.1: Equilibrium Condition
- 13.2: Equilibrium Constant
- 13.3: Equilibrium Expressions
- 13.4: Heterogeneous Equilibria
- 13.5: Applications of the Equilibrium Constant
- 13.6: Solving Equilibrium Problems
- 13.7: Le Chatelier's Principle

Suggested Problems

Chapter 13 Notes Problems

Discussion Question

Lab:

(AP-10): Determination of the equilibrium constant for a chemical reaction – Solubility Products (SmartScience Lab)

Unit 6: Chapters 14-15 (4.5 weeks)

## **Chapter 14: Acids and Bases (1.5 weeks)**

- 14.1: Nature of Acids and Bases
- 14.2: Acid Strength
- 14.3: pH Scale
- 14.4: Strong Acids
- 14.5: Weak Acids
- 14.6: Bases
- 14.7: Polyprotic Acids
- 14.8: Salts
- 14.9: Effect of Structure
- 14.10: Oxides
- 14.11: Lewis Acid-Base Model
- 14.12: Summary

Suggested Problems

Chapter 14 Notes Problems

Discussion Question

Lab:

Lab:

(AP-6): Standardization of a solution using a primary standard – pH Titration (SmartScience Lab)

(AP-7): Determination of concentration by acid-base titration, including a weak acid – Polyprotic Acid Titration (SmartScience Lab)

HW Quiz

## **Chapter 15: Aqueous Equilibria (3 weeks)**

- 15.1: Common Ion Effect
- 15.2: Buffers
- 15.3: Buffering Capacity
- 15.4: Titrations
- 15.5: Indicators
- 15.6: Solubility Product
- 15.7: Precipitation and Qualitative Analysis
- 15.8: Complex Ion Equilibria

Suggested Problems

Chapter 15 Notes Problems (AP only)

Discussion Question

Lab:

(AP-11): Determination of appropriate indicators for various acid-base titrations; pH determination – pH indicators (SmartScience Lab)

(AP-19): Preparation and properties of buffer solutions – Buffers (SmartScience Lab)

HW Quiz

Unit 7: Chapters 16, 17 (3 weeks)

**Chapter 16: Thermodynamics (1.5 weeks)**

(Reactions AP Curricular Requirement)

16.1: Spontaneous Processes

16.2: 1<sup>st</sup> and 2<sup>nd</sup> Law of Thermodynamics, Entropy

16.3: Effect of Temperature on Spontaneity

16.4: Gibbs Free Energy

16.5: Entropy Changes

16.6: Free Energy and Chemical Reactions

16.7: Free Energy and Pressure

16.8: Free Energy and Equilibrium

16.9: Free Energy and Work

Suggested Problems

Chapter 16 Notes Problems

Discussion Question

Lab:

(AP-18): Separation by chromatography – Chromatography (SmartScience Lab)

HW Quiz

**Chapter 17: Electrochemistry (1.5 weeks)**

17.1: Galvanic Cells

17.2: Standard Reduction Potentials

17.3: Cell Potential, Work, and Free Energy

17.4: Cell Potential and Concentration

17.5: Batteries

17.6: Corrosion

17.7: Electrolysis

17.8: Electrolytic Processes

Suggested Problems

Chapter 17 Notes Problems

Discussion Question

Labs:

(AP-8): Determination of concentration by oxidation-reduction titration – Oxidizing Power (SmartScience Lab)

(AP-20): Determination of electrochemical series – Electrochemical Series (SmartScience Lab)

(AP-21): Measurements using electrochemical cells and electroplating – Electroplating (SmartScience Lab)

HW Quiz

Unit 8: Chapters 21-22 (2 weeks)

**Chapter 21: Coordination Chemistry (1 week)**

21.1: Transition Metals

21.2: First Row Transition Metals

21.3: Coordination Compounds

21.4: Isomers

21.5: Complex Ions

21.6: Crystal Field Model

21.7: Biologic Importance

21.8: Metallurgy

Suggested Problems

Discussion Question

Lab:

(AP-15): Synthesis of a coordination compound and its chemical analysis – Equilibrium Constants (SmartScience Lab)

HW Quiz

**Chapter 22: Organic Chemistry (1 week)**

22.1: Alkanes

22.2: Alkenes and Alkynes

22.3: Aromatic Hydrocarbons

22.4: Derivatives

22.5: Polymers

## 22.6: Natural Polymers

### Suggested Problems

### Discussion Question

### Lab:

(AP-22): Synthesis, purification, and analysis of an organic compound – Inorganic Synthesis (SmartScience Lab)

### HW Quiz

### **Review: (3 weeks)**

### **Final Exam, AP Exam**

*Note: While a staff member (which includes but is not limited to instructors, teaching assistants, residential staff, office staff) may use or refer students to third-party web sites for instructional purposes, s/he is required to review thoroughly any such web sites for inappropriate content before referencing them. This includes clicking on all links contained in any such web site, reviewing the materials contained on every page within a web site, and ensuring that the web site does not provide links to other inappropriate web sites. If there is any doubt about whether something is appropriate, a staff member is instructed to err on the side of caution and not use the web site or check with a CTD supervisor. If a referenced third-party web site is later determined to contain inappropriate content, the staff member may be subject to discipline.*