SAMPLE SYLLABUS #2

AP® Chemistry

Curricular Requirements

CR1	The students and teacher have access to college-level resources including a recently published (within the last 10 years) college-level textbook and reference materials in print or electronic format.	*See page:* 2
CR2	The course is structured to incorporate the required content outlined in each of the units described in the AP Course and Exam Description (CED).	*See pages:* 2, 5
CR3	The course provides opportunities for students to develop the skills related to Science Practice 1: Models and Representations.	*See page:* 8
CR4	The course provides opportunities for students to develop the skills related to Science Practice 2: Question and Method.	*See page:* 8
CR5	The course provides opportunities for students to develop the skills related to Science Practice 3: Representing Data and Phenomena.	*See page:* 5
CR6	The course provides opportunities for students to develop the skills related to Science Practice 4: Model Analysis.	*See page:* 7
CR7	The course provides opportunities for students to develop the skills related to Science Practice 5: Mathematical Routines.	*See page:* 9
CR8	The course provides opportunities for students to develop the skills related to Science Practice 6: Argumentation.	*See page:* 6
CR9	The course provides students with opportunities to apply their knowledge of AP Chemistry concepts to real-world questions or scenarios to help them become scientifically literate citizens.	*See page:* 10
CR10	Students spend a minimum of 25% of instructional time engaged in a wide range of hands-on, laboratory investigations to support the learning of required content and development of science practice skills throughout the course. At minimum, 16 labs are performed including at least 6 labs conducted in a guided inquiry format.	*See pages:* 3, 4, 5
CR11	The course provides opportunities for students to record evidence of their scientific investigations. Evidence can be recorded in lab reports or another appropriate formal manner for inclusion in lab notebooks/portfolios (print or digital format).	*See pages:* 3, 4

Advanced Placement Chemistry Sample Syllabus #2

Course Overview:

Advanced Placement® Chemistry is a course designed much like a college freshman chemistry course. An AP® Edition college textbook will be used, college level laboratories will be conducted, and exams will be given that are on a collegiate level. We will meet 3 times a week for a 60-minute class period, and once a week for an 85-minute period which will be used to perform a laboratory. It will also be necessary to spend time out of class doing lab work or other assignments.

Text:

Chemistry & Chemical Reactivity, Kotz, P. Treichel, Townsend, and D. Treichel, (publisher Cengage Learning) 11th edition, 2023. **CR1**

CR1
The syllabus must cite the title, author, and publication date of a college-level textbook. The primary course textbook must be published within the last 10 years.

Lab Manual:

AP Chemistry Guided Inquiry Experiments: Applying the Science Practices

Structure of the Course:

AP Chemistry is organized into nine units with science practices integrated and spiraled throughout the course.

Unit 1: Atomic Structure and Properties

Unit 2: Compound Structure and Properties

Unit 3: Properties of Substances and Mixtures

Unit 4: Chemical Reactions

Unit 5: Kinetics

Unit 6: Thermochemistry

Unit 7: Equilibrium

Unit 8: Acids and Bases

Unit 9: Thermodynamics and Electrochemistry

Science Practice 1: Models and Representations – Units 1, 4, 5, 6

Science Practice 2: Question and Method – Units 1, 3, 4, 6, 7, 8, 9

Science Practice 3: Representing Data and Phenomena – Units 2, 3, 4, 5, 6, 7

Science Practice 4: Model Analysis – Units 1, 2, 3, 6, 7, 9

Science Practice 5: Mathematical Routines – Units 1, 3, 4, 5, 6, 7, 8, 9

Science Practice 6: Argumentation – Units 2, 3, 4, 5, 6, 7, 8, 9

CR2
The course is structured to incorporate the required content outlined in each of the units described in the AP Course and Exam Description (CED).

Grading

Exams will count for 40% of the grade; homework quizzes will count for 20%; and laboratory will count for 40%. Major exams will be over textbook material, homework, and lectures. It is your responsibility to read the textbook and make sure that you understand the assigned portions, as it is impossible to cover all the material that you will need to know during lectures.

Homework

Learning to do problems of all types quickly will be one of the major goals of this class. Homework will be assigned on a regular basis. Most assignments will probably take more than one evening to complete. Homework for the preceding week will be due by 3:30 p.m. on Mondays, and each Monday there will be a homework quiz over the assigned problems. Homework must be turned in to retake a homework quiz each week, and a highest score of 80% can be earned on a retake.

Laboratories

A laboratory manual with bound pages and carbon copies will need to be purchased. Each student will keep an individual lab notebook. Many colleges are reluctant to grant lab credit for AP courses without seeing a record of laboratory work. The notebook is what may be given to the chemistry department of a college or university to determine whether or not credit will be earned. **CR11** At a minimum, 25% of instructional time during this course will be spent in hands-on laboratory work. Labs listed below in the syllabus with the Investigation number are from the AP Chemistry Lab Manual: *AP Chemistry Guided Inquiry Experiments: Applying the Science Practices* **CR10**

CR11
The syllabus must include an explicit statement that students are required to maintain a lab notebook or portfolio (hard-copy or electronic) that includes all their lab reports.

CR10
The syllabus must include an explicit statement that at least 25% of instructional time is spent engaged in hands-on laboratory experiences.

Tests

In order to simulate the AP Exam testing format, unit tests will be formatted in multiple choice and free response questions. You will have 30 minutes to complete 20 multiple choice questions (no calculators used) and 32 minutes to complete 2 free response questions (with calculator). If you have an unexcused absence the day of the test, you will need to take the exam the day you return to school unless you previously arrange a makeup time with the instructor.

The AP Exam

By the time you take the AP Chemistry Exam in May, you will have been exposed to three or four complete exams and many different types of problem sets. The AP Exam is not required to pass the class, but it is highly encouraged. Whether or not you take the AP Exam, your final in this course will be a full-length AP exam given during class.

AP Chemistry Lab Report Guidelines

During the course of the year, we will be doing 17 laboratories, almost all will be inquiry-based. CR10 Lab reports will be written up in bound laboratory notebooks that produce a copy of each page. A copy will be torn out and turned in for grading, leaving a copy of each lab in the book. It is important that the notebook is a neat, accurate representation of laboratory work. In collaboration with other students, each student will collect, process, and manipulate data during class discussions and prepare presentations using a method of individual choice (slideshow, poster, etc.) CR11

The school is equipped with a full range of glassware (beakers, flasks, burets, eudiometer tubes, etc.), instruments (Spec-20s, analytical balances, centrifuges, ovens, etc.), and many of our investigations will utilize Logger Pro® software (pH, temperature, colorimeters, etc) to record and analyze data.

Format: If a "table of contents" is not provided in the notebook, reserve the first page to be filled in at the end of the course. All reports are to be handwritten in blue or black ink. No erasures are to be made, and no white-out may be used. All errors should be drawn through with a single line. Pages are never to be removed from your notebook. Lab reports are due the second Monday after the lab is completed. There will be lab quiz to test student understanding and mastery of the procedures, data collection, and calculations as applicable.

CR10
A minimum of 16 lab investigations with descriptive titles must be listed.

AND

A minimum of six investigations must be identified as guided inquiry.

Each lab should include the following parts: CR11

I. Title, your name, date
II. Learning Objective(s)
III. Materials List and Procedure
IV. The procedure should be complete enough to carry out the lab without referring to the original instructions. Use diagrams rather than a list of steps.
V. Pre-Lab Questions (if assigned)
VI. Data Tables and Observations
VII. Any tables needed should be drawn before entering the lab area.
VIII. Calculations (if applicable)
IX. At least one of each type of calculation must be shown.
X. Discussion and Conclusion
XI. This section includes an interpretation of what took place in the lab as well as results of the investigation. Provide reasons for interpretations and support any claims. Include real or potential errors and how they affected results.

Parts I–V, including empty data tables, must be written up before lab day!

CR11
The syllabus must include the components of the written reports required of students for all laboratory investigations..

AP Chemistry Major Topics And Schedule CR2

First Semester

WEEKS 1 & 2

Book Chapter	Topic	AP Unit	Learning Objectives (LO)
	Classroom Procedures/ Syllabus/Lab Information		
2	Moles and Molar Mass	1	1.1.A
2	Mass Spectrometry	1	1.2.A
2	Photoelectron Spectroscopy	1	1.6.A
2	Empirical Formulas and Elemental Composition	1	1.3.A
2	Composition of Mixtures	1	1.4.A

- **Non-Laboratory Activity: Students use data to determine the percentages of isotopes and sketch the mass spectrum of the element—SP 3** CR5
- **Investigation 3 (Guided Inquiry): What makes hard water hard?** CR10

WEEKS 3–5

Book Chapter	Topic	AP Unit	LO
3	Types of Reactions	4	4.1.A 4.7.A
3	Net Ionic Equations	4	4.2.A
3	Representations of Reactions	4	4.3.A
3	Physical & Chemical Changes	4	4.3.A
3	Acids and Bases	4	4.8.A
3	Oxidation-Reduction Reactions	4	4.9.A

- **Investigation 8 (Guided Inquiry): Analysis of hydrogen peroxide**

WEEKS 6–8

Book Chapter	Topic	AP Unit	LO
19	Voltaic and Electrolytic Cells	9	9.8.A
19	Cell Potential Under Nonstandard Conditions	9	9.10.A
19	Electrolysis and Faraday's Law	9	9.11.A

- **Guided Inquiry Lab: Voltaic cells**

CR5
The syllabus must include a **brief description** of an activity or series of activities **(not including the labs listed in CR10)** in which students create representations or models of chemical phenomena. Activities must be labeled with the relevant science practice(s).

WEEKS 9–11

Book Chapter	Topic	AP Unit	LO
4	Stoichiometry	4	4.5.A
4	Titrations	4	4.6.A

- **Investigation 7 (Guided Inquiry): An experiment applying green chemistry to purification**
- **Investigation 4 (Guided Inquiry): How much acid is in fruit juices and soft drinks?**

WEEKS 12 & 13

Book Chapter	Topic	AP Unit	LO
5	Exothermic/Endothermic Processes	6	6.1.A
5	Energy Diagrams	6	6.2.A
5	Heat Equilibrium/Transfer	6	6.3.A
5	Calorimetry	6	6.4.A
5	Energy of Phase Changes	6	6.5.A
5	Enthalpy of Reaction	6	6.6.A
5	Bond Enthalpies	6	6.7.A
5	Enthalpy of Formation	6	6.8.A
5	Hess's Law	6	6.9.A

- **Investigation 12 (Guided Inquiry): The hand warmer design challenge—Where does the heat come from?**

WEEKS 14 & 15

Book Chapter	Topic	AP Unit	LO
18	Calculating Entropy	9	9.1.A
18	Entropy Changes	9	9.2.A
18	Gibb's Free Energy	9	9.3.A
18	Thermodynamics and Kinetic Control	9	9.4.A
18	Cell Potential and Free Energy	9	9.9.A

- **Non-Laboratory Activity: Given a set of conditions, the students determine and show reasoning for spontaneity by calculating changes in entropy, enthalpy, and Gibbs Free Energy—SP 6** CR8

CR8
The syllabus must include a **brief description** of at least one activity or series of activities (**not including the labs listed in CR10**) in which students develop an explanation or scientific argument. Activities must be labeled with the relevant science practice(s).

WEEKS 16–18

Book Chapter	Topic	AP Unit	LO
6	Electromagnetic Spectrum and Spectroscopy	3	3.11.A
6	Properties of Photons	3	3.12.A
6	Beer-Lambert Law	3	3.13.A
7	Atomic Structure and Electron Configurations	1	1.5.A
7	Periodic Trends, Valence Electrons, and Ionic Compounds	1	1.7.A 1.8.A

- **Investigation 1 (Guided Inquiry): What is the relationship between the concentration of a solution and the amount of transmitted light through the solution?**
- **Investigation 2 (Guided Inquiry): How can color be used to determine the mass percentage of copper in brass?**

Second Semester

WEEKS 1 & 2

Book Chapter	Topic	AP Unit	LO
8	Types of Chemical Bonds	2	2.1.A
8	Lewis Diagrams	2	2.2.A
8	Resonance and Formal Charge	2	2.3.A
9	VSEPR and Hybridization	2	2.4.A

- **Non-Laboratory Activity: Using potential energy curves as data representations, students will compare bond order and bond strength while analyzing the data for patterns—SP 4** CR6

WEEK 3

Book Chapter	Topic	AP Unit	LO
10	Ideal Gas Law and Gas Properties	3	3.4.A
10	Kinetic Molecular Theory	3	3.5.A
10	Deviation from Ideal Gas Law	3	3.6.A

CR6
The syllabus must include a **brief description** of an activity or series of activities **(not including the labs listed in CR10)** in which students create representations or models of chemical phenomena. Activities must be labeled with the relevant science practice(s).

WEEKS 4 & 5

Book Chapter	Topic	AP Unit	LO
11	Intermolecular and Interparticle Forces	2	3.1.A
11	Solids, Liquids, and Gases	3	3.3.A
12	Properties of Solids	3	3.2.A
12	Structure of Ionic Solids	2	2.3.A
12	Structure of Metal and Alloys	2	2.1.A
13	Solutions and Mixtures	3	2.2.A
13	Representations of Solutions	3	3.8.A
13	Solubility and Separation of Solutions and Mixtures	3	3.9.A 3.10.A

- **Investigation 5 (Guided Inquiry): Sticky question—How do you separate molecules that are attracted to one another?**
- **Investigation 6 (Guided Inquiry): What's in that bottle?**

WEEKS 6–8

Book Chapter	Topic	AP Unit	LO
14	Reaction Rates	5	5.1.A
14	Rate Laws	5	5.2.A
14	Concentration vs. Time	5	5.3.A
14	Elementary Reactions	5	5.4.A
14	Collision Model	5	5.5.A
14	Reaction Energy Profile	5	5.6.A
14	Mechanisms	5	5.7.A
14	Reaction Mechanisms and Rate Laws	5	5.8.A
14	Pre-Equilibrium Approximation	5	5.9.A
14	Multistep Reaction Energy Profile	5	5.10.A
14	Catalysis	5	5.11.A

- **Non-Laboratory Activity: Students will use candy and paper plates to simulate nuclear decay of an isotope and to construct graphs of change in concentrations over time and to calculate the half-life—SP 1** CR3
- **Non-Laboratory Activity: The teacher demonstrates that a cell created from a copper plate and magnesium ribbon poked into a lemon can power a quartz clock that normally requires one AA battery to run. The teacher prompts students to ask questions about the system, and the class decides which questions could be tested experimentally. The class breaks into small groups to brainstorm a procedure that could provide evidence to answer one of the questions posed. Each group presents their procedures to the class for review and refine—SP 2** CR4

CR3
The syllabus must include a **brief description** of an activity or series of activities **(not including the labs listed in CR10)** in which students describe models and representations, including across scales. Activities must be labeled with the relevant science practice(s).

CR4
The syllabus must include a **brief description** of an activity or series of activities **(not including the labs listed in CR10)** in which students determine scientific questions and methods. Activities must be labeled with the relevant science practice(s).

- **Investigation 10 (Guided Inquiry): How long will that marble statue last?**
- **Investigation 11 (Guided Inquiry): What is the rate law of the fading of crystal violet using Beer's Law?**

WEEKS 9 & 10

Book Chapter	Topic	AP Unit	LO
15	Introduction to Equilibria	7	7.1.A
15	Reversible Reactions	7	7.2.A
15	Reaction Quotient and Equilibrium Constant	7	7.3.A
15	Calculating the Equilibrium Constant	7	7.4.A
15	Magnitude of the Equilibrium Constant	7	7.5.A
15	Properties of the Equilibrium Constant	7	7.6.A
15	Calculating Equilibrium Concentrations	7	7.7.A
15	Representations of Equilibrium	7	7.8.A
15	Disturbing a Chemical Equilibrium	7	7.10.A
15	Reaction Quotient and Le Châtelier's Principle	7	7.11.A

- **Non-Laboratory Activity: Students will identify various types of equilibrium problems and calculate missing values using an ICE (or RICE) table—SP 5** CR7
- **Investigation 13 (Guided Inquiry): Can we make the colors of the rainbow? An application of Le Châtelier's Principle**

WEEK 11 & 12

Book Chapter	Topic	AP Unit	LO
16	Introduction to Acids and Bases	8	8.1.A
16	Strong Acids and Bases	8	8.2.A
16	Weak Acids and Bases	8	8.3.A
16	Acid and Base Reactions	8	8.4.A
17	Acid/Base Titrations	8	8.5.A
16	Molecular Structure of Acids/Bases	8	8.6.A
17	Solubility Equilibria	7	7.11.A
17	Common Ion Effect	7	7.12.A
17	pH and Solubility	7	8.11.A
17	Free Energy of Dissolution	7	9.6.A
18	Free Energy and Equilibrium	9	9.5.A
18	Coupled Reactions	9	9.7.A
17	pH and pKa	8	8.7.A

CR7
The syllabus must include a **brief description** of at least one activity or series of activities **(not including the labs listed in CR10)** in which students solve problems using mathematical relationships. Activities must be labeled with the relevant science practice(s).

- **Real World Application: Students investigate the major components of acid rain and write the reactions that occur between the pollutant (e.g. sulfur oxides, nitrogen oxides) and the compounds naturally present (i.e. water, oxygen, carbon dioxide)** CR9
- **Investigation 14 (Guided Inquiry): How do the structure and the initial concentration of an acid and a base influence the pH of the resultant solution during a titration?**

CR9
The syllabus must label and provide a **brief description** of at least one assignment or activity requiring students to apply their knowledge of AP Chemistry concepts to understand real-world questions or scenarios.

WEEKS 13 & 14

Book Chapter	Topic	AP Unit	LO
17	Properties of Buffers	8	8.8.A
17	Henderson-Hasselbalch	8	8.9.A
17	Buffer Capacity	8	8.10.A

- **Investigation 9: Can the individual components of quick ache relief be used to resolve consumer complaints?**
- **Investigation 15 (Guided Inquiry): 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?**

WEEK 15

Book Chapter	Topic	AP Unit	LO
23	Carbon: Not Just Another Element	2	2.5.A
25	Nuclear Reactions and Rates of Nuclear Decay	5	5.3.A
	FINAL EXAM		