

# WRHS Science Curriculum Syllabus

**Course Name:** Advanced Placement Chemistry

**Grade Level:** 11 & 12

## **Course Description:**

This course is designed to be the equivalent of a 1st year college chemistry course. By achieving a certain level of proficiency on the Advanced Placement Examination given in May, credit may be granted at a number of colleges. Using a college textbook, the course is an in-depth study of the fundamentals of chemistry, emphasizing quantitative applications of chemical principles. Laboratory activities involve a variety of techniques and methods, including precision instrumental work, as well as qualitative analysis of unknowns.

## **Links to Student Expectations:**

- All students will develop skills to utilize technology to gather, to evaluate, to assimilate, and to present information.
- All students will utilize critical thinking skills to identify and to provide resources to solve a problem.
- All students will learn to communicate critically, persuasively, and personally in both oral and written expression.
- All students will be able to make decisions and solve problems using logical processes (e.g., scientific method, induction, deduction, syllogism, etc.).
- All students will develop skills to promote a sense of confidence in tackling the rigors of standardized tests such as the required MCAS and optional AP, SAT.

## **Interdisciplinary Connections:**

Chemistry is the central science which connects to other scientific disciplines such as Physics, and Biology and is a cornerstone for the study of environmental, geological, astronomical studies. Any discipline that uses the scientific method to gain information about the natural world will be supported by the laboratory and project work in Chemistry. Problem solving strategies and hands on approach to learning allow students to confidently pursue fields that hold these skills valuable. According to [The College Board Course Description](#), “the course will contribute to the students’ abilities to think clearly and express their ideas, orally and in writing, with clarity and logic.”

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## **I. Essential Questions for Course**

- How is the scientific method used in solving problems in the laboratory so that reliable and valid answers can be obtained?
- What are the major theories (Atomic Theory, Bonding Theories) concerning the structure of matter and how do these theories allow us to understand the

properties, composition and behavior of elements, compounds and mixtures, especially solutions?

- What principles and theories such as the Kinetic Molecular Theory, laws of ideal gases, and intermolecular forces of attraction guide our qualitative and quantitative understanding of the three states of matter?
- How does the “mole concept” provide a quantitative bridge for our theories of Chemistry with the practice of Chemistry in the laboratory?
- How can we predict the outcomes of chemical reactions from classification schemes such as acid-base reactions, precipitation reactions and oxidation-reduction reactions?
- What is the nature of physical and chemical equilibrium and how is the theory applied both qualitatively and quantitatively to aqueous and non-aqueous situations using Le Chatelier’s Principle and equilibrium constants?
- How are rate order, rate constants, and reaction rate laws as well as the influence of factors such as temperature and catalysis determined as part of our understanding of chemical kinetics?
- How do the three laws of thermodynamics allow us to understand the driving forces of nature?
- What is the nature of electrochemical and electrolytic cells, when electricity is studied in the context of chemical change?
- What is organic chemistry and how are its compound classified?

## **II. Student Objectives**

- To collect, analyze and present data and to construct appropriate conclusions concerning information obtained through laboratory experimentation.
- To use chromatographic, spectrophotometric, volumetric and gravimetric techniques in analyzing samples.
- To understand and use the theories of atomic and molecular structure for predicting the structure, properties, and composition of elements, compounds and mixtures.
- To solve problems involving solutions in the laboratory by applying knowledge of their nature and properties such as freezing point depressions.
- To use the mole concept to solve problems in stoichiometry such as percentage composition, empirical formula determination and percent yield as well as apply this knowledge to laboratory investigations.
- To understand the nature of chemical reaction theories and to perform experiments with a variety of chemical change categories taking both qualitative and quantitative observations and analyzing the results.
- To solve equilibrium problems involving equilibrium constants in both aqueous and non-aqueous environments.
- To perform acid-base experimentation involving pH, buffers, and weak and strong acid-base titrations.
- To perform rate of reaction experiments, analyze the data and determine rate law expressions.

- To learn how and why different reactions proceed at different rates.
- To use the three laws of thermodynamics to understand the nature of the driving forces of chemical change.
- To investigate the energy changes involved in chemical reactions using the principles of calorimetry.
- To understand the nature of oxidation-reduction reactions and to predict the properties of electrochemical cells and determine the outcomes of electrolytic reactions.
- To perform an organic synthesis.

### III. Suggestions for Instruction

- Individual and small group laboratory experimentation
- Written laboratory reports in a laboratory notebook
- Using Graphical Analyses software and Computer Based Laboratory hardware
- Student classroom presentations
- Classroom problem solving sessions
- Lecture
- Discussion
- Textbook reading
- Written Homework
- Demonstrations
- Videos

### IV. Suggestion for Assessment

- Written Assignments
- Examinations
- Laboratory reports
- Student presentations

### V. Curriculum

- Precision and accuracy
- Atomic Structure and Theory
- Classification of matter
- Mole concept
- Chemical formulas and nomenclature
- Stoichiometry
- Types of chemical reactions
- Gas Laws
- Thermochemistry
- Periodicity and Periodic Table
- Chemical bonding

- Liquids and Solids
- Solutions
- Chemical Kinetics
- Thermodynamics
- Acid and bases
- Chemical Equilibrium
- Electrochemistry
- Organic Chemistry
- Nuclear Chemistry

**VI. Lesson Extensions**