Northern York County School District

Curriculum Overview

Course: Advanced Placement Chemistry	
Grade Level: 11-12	
Approval Date: December 2023	**Length of Time: One Year**

Course Description:

This course offers an advanced study of chemistry for those students who have exhibited strengths in science and math and wish to pursue pre-med, engineering, or other science related careers. The course emphasizes quantitative studies with integrated lab work in topics including molecular structure, thermodynamics, states of matter, stoichiometry, gas law calculations, acid-base chemistry, reaction rates, equilibrium, and electrochemistry. The course is designed to provide a foundation for preparing students to take the AP Chemistry exam, although, for best results on the AP Exam, additional independent work is recommended. For more information, visit: https://apstudent.collegeboard.org/home

Course Objectives:

- Reinforce and further develop problem solving and laboratory skills acquired in first year chemistry by applying them in advanced contexts.
- Predict structures of various types of matter and the properties and characteristics which result from structure.
- Assess, both qualitatively and quantitatively, the characteristics resulting from the states of matter and the changes from one state to another.
- Apply, in various contexts, the concepts of thermodynamics as they relate to physical and chemical changes in matter.
- Investigate changes in which chemical energy is converted to electrical energy and vice versa and use the concepts discovered to understand batteries, electroplating and other practical applications of electrochemistry.
- Describe and quantify factors related to rates of chemical reactions, including predictions involving rate laws, the effects of external reaction conditions and the use of catalysts.
- Investigate reversible reactions and the factors which establish their equilibrium positions.
- Learn the intricacies of acids and bases, the pH scale, titrations, and buffering systems.
- Experience a variety of ways in which the aforementioned topics are often intertwined and impact each other in complex problem-solving scenarios.

Related Standards:

Standards taken from the College Board AP Course and Exam Description https://apcentral.collegeboard.org/courses/ap-chemistry

Models and Representations:

- Describe the components of and quantitative information from models and representations that illustrate particulate-level properties and macroscopic level properties.

Questions and Methods:

- Identify a testable scientific question based on an observation, data or model.
- Formulate a hypothesis or predict the results of an experiment.
- Identify experimental procedures that are aligned to a scientific question.

- Make observations or collect data from representations of laboratory setups or results, while attending to precision where appropriate.
- Identify or describe potential sources of error.
- Explain how alterations to an experimental procedure will alter results.

Representing Data and Phenomena

- Represent chemical phenomena using appropriate graphing techniques, including correct scale and units.
- Represent chemical substances or phenomena with appropriate diagrams or models.
- Represent visually the relationship between the structures and interactions across multiple levels or scales, particulate to macroscopic.

Model Analysis

- Explain chemical properties or phenomena using given chemical theories, models and representations.
- Explain whether a model is consistent with chemical theories.
- Explain the connection between particulate-level and macroscopic properties of a substance using models and representations.
- Explain the degree to which a model or representation describes the connection between particulate-level properties and macroscopic properties.

Mathematical Routines

- Identify quantities needed to solve a problem from given information including text, mathematical expressions, graphs, tables, etc.,
- Identify an appropriate theory, definition, or mathematical relationship to solve a problem.
- Explain the relationship between variables within an equation when one variable changes.
- Identify information presented graphically to solve a problem.
- Determine a balanced chemical equation for a given chemical phenomenon.
- Calculate, estimate, or predict an unknown quantity from known quantities by selecting and following a logical computational pathway (dimensional analysis) and attending to precision (significant figures).

Argumentation

- Make a scientific claim.
- Support a claim with evidence from experimental data.
- Support a claim with evidence from representations or models at the particulate level, such as the structure of atoms and/or molecules.
- Provide reasoning to justify a claim using chemical principles or laws, or using mathematical justification.
- Provide reasoning to justify a claim using connections between particulate and macroscopic levels.
- Explain the connection between experimental results and chemical concepts, processes, or theories.
- Explain how potential sources of experimental error may affect the experimental results.

Units:

- Atomic Structure & Properties
- Molecular and Ionic Compound Structure and Properties
- Intermolecular Forces and Properties
- Chemical Reactions
- Kinetics
- Thermodynamics
- Equilibrium
- Acids and Bases
- Applications of Thermodynamics

Concepts:	**Competencies:**

• ATOMS: The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions. • STRUCTURE & FORCES: Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them. • CHEMICAL CHANGE: Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons. • REACTION RATES: Rates of chemical reactions are determined by details of the molecular collisions. • THERMODYNAMICS: The laws of thermodynamics describe the essential role of energy and explain and predict the direction of changes in matter. • BONDING & INTERMOLECULAR FORCES: Any bond or intermolecular attraction that can be formed can be broken. These two processes are in a dynamic competition, sensitive to initial conditions and external perturbations.	• Applying scale, proportion and quantity to a variety of physical and chemical scenarios. • Analyzing and predicting structures of various types of matter and the properties that are contingent on structure. • Understand and predict transformations of matter and energy and represent these changes and the processes used to make predictions using universally established systems of symbols. • Apply concepts of energy to the understanding, predicting, and describing of various states of matter and the spontaneity of chemical change. • Utilizing and exploring qualitative and quantitative skills of measurement, observation and manipulation of chemical systems in a laboratory setting.
Learning Activities: • Teacher-led demonstrations and explanations • Student-directed analysis of multiple chemistry texts • Problem-solving practice • Inductive and deductive laboratory experiments • Journaling and reporting of experimental procedures • Discussion of practice Advanced Placement Chemistry Exams	**Performance Tasks:** • Lab reports • Quizzes on key topics • Practice problems from textbooks and/or supplementary worksheets • Practice Test for each unit • Unit Exams • AP Practice Exams
Other Assessment Measures: • Advanced Placement Chemistry Exam	
Textbook/Primary Resource: • ***Chemistry***, 11th Edition (2024), AP Edition, Zumdahl, Steven S. (ISBN: 979-8-214-07165-7)	
Supplemental Resource Materials: • **Chemistry**, 11th Edition, AP Edition, Chang, Raymond, (ISBN: 978-0-07-661998-6) • **AP Chemistry Test-Prep Workbook** (e.g., Five Steps to a 5, Princeton Review, etc.,) • Experiments supported by Advancing Science • Vernier LabPro automated data collection system • LoggerPro Software	

- Teacher-generated experiments and activities