



Greenwich Public Schools Curriculum Overview Practical Chemistry

Personalized learning is achieved through standards-based, rigorous and relevant curriculum that is aligned to digital tools and resources.

Note: Teachers retain professional discretion in how the learning is presented based on the needs and interests of their students.

Course Description

This laboratory-oriented course is designed for students to study the inter-relationships between chemistry, the consumer and the environment. Core topics concentrate on atomic structure, properties of elements, phases of matter, laboratory techniques and equipment use, bonding and chemical reactions, polymers and their applications, acids and bases, energy transformations, and energy fuel sources. This course may not meet the requirements of some colleges or nursing schools. Successful completion of this course meets the physical science course requirement for graduation.

Unit Guide

- Unit 1: Atomic Energy
 - Module 1: Chernobyl, Radiation, & Cancer
 - Module 2: Structure of the Atom
 - Module 3: Periodic Table & Trends
 - Module 4: Matter and Properties
- Unit 2 Food Chemistry:
 - Module 1: Pancake Demo
 - Module 2: Barium Hydroxide & Ammonium Chloride Demo
 - Module 3 Chemical reactions (Why do onions make you cry?)
- Unit 3: Environmental Chemistry
 - Module 1: Oil Spill
 - Module 2: Ocean Acidification / Coral Bleaching
- Unit 4: Human Chemistry (Biochem)
 - Module 1: Pharmacokinetics - Alcohol Flush
 - Module 2: Equilibrium - Le Chaterlier's Principles

Enduring Understanding and/or Performance Tasks

- Unit 1: Atomic Energy
 - **Enduring Understandings**
 - Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.
 - The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.

- **Performance Tasks**
 - Make claims based on evidence about radiation and the epidemiology of cancer.
 - Ask questions, defining problems, and analyzing and interpreting data based on the relationship between periodic trends.
 - Plan and carry out an investigation based on the Flame Test Lab to explain how energy affects atomic structure.
 - Evaluate models of the atom based on evidence throughout history.
 - Construct an explanation using a graphic organizer of how radiation leads to cancer.
 - Obtaining, evaluating, and communicating information as well as analyzing and interpreting data for each periodic trend (atomic radius, electronegativity, and first ionization energy).
- Unit 2: Food Chemistry
 - **Enduring Understandings**
 - Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between system, or be converted to thermal energy
 - Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution
 - Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.
 - **Performance Tasks**
 - Carrying out a specific heat investigation and applying computational thinking to analyze the results.
 - Carrying out and asking questions about a chemical reaction between barium hydroxide and ammonium nitrate.
 - Carrying out an investigation to compare the enthalpy changes between various chemical and physical changes.
 - Conducting experiments to examine the types of chemical reactions, specifically synthesis and combustion.
 - Planning and conducting investigations to test the law of conservation of mass.
 - Use mathematics and computational thinking to determine a balanced chemical reaction.
- Unit 3: Environmental Chemistry
 - **Enduring Understandings**
 - The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.
 - Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.
 - The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen.

- **Performance Tasks**
 - Make observations and ask questions about oil spills (to determine how atoms are bonded together influences the properties)
 - Model the structures of molecules using Lewis Dot Structures, and the structure of monomers and polymers
 - Plan and conduct an investigation on how the strength and type of IMFs affect properties such as melting point, boiling point, conductivity, vapor pressure, and surface tension
 - Report their lab investigation findings as a CER (argument from evidence) with an evaluation of validity
 - Conduct research on oil spill clean-up methods
 - Communicate about the molecular structure, polarity, IMFs, and electron movement of their chosen clean-up method (using both their research and knowledge gained from the unit)
 - Distinguish between an acid and a base, and model a acid-base interaction on a particle level
 - Investigate the chemical reaction leading to ocean acidification, and analyze data to make predictions on climate change.
 - Using an interactive reading to complete a cause and effect flow chart for reinforcing data literacy.
 - Evaluate a proposed solution for coral regeneration.
- Unit4: Human Chemistry
 - **Enduring Understandings**
 - Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present.
 - **Performance Tasks**
 - Carry out an investigation on factors that affect reaction rate (temperature, concentration etc.)
 - Analyze and interpret data on reaction rate.
 - Write a scientific explanation based on data in order to describe how variables affect reaction rate.
 - Use Le Chatelier's Principle to make predictions.
 - Specify how a change in oxygen levels can shift the amount of oxygen in the blood.

Standards

- Vision of the Graduate Standards
 - Pose and pursue substantive questions
 - Ask questions, based on observed phenomena and patterns, that can be answered empirically and distinguish a scientific question from a non-scientific question.
 - Explore, define, and solve complex problems
 - Plan and conduct experimental procedures, identifying relevant variables and collecting appropriate data in order to identify causal relationships

- and make predictions.
 - Critically interpret, evaluate, and synthesize information
 - Analyze data using mathematics and statistics, to look for patterns or to test whether data are consistent with a hypothesis.
 - Collaborate with others to produce a unified work and/or heightened understanding
 - Use scientific evidence and models to construct explanations of phenomena or solve engineering problems.
 - Communicate effectively for a given purpose
 - Read, evaluate, and produce scientific texts and construct scientific arguments to communicate about science.
- [Next Generation Science Standards](#) Performance Expectations
- Unit 1: Atomic Energy
 - PS1-1, PS1-2
 - Unit 2 Food Chemistry:
 - PS3-4, PS1-4, PS1-2, PS1-7
 - Unit 3: Environmental Chemistry
 - ESS3-5, ESS3-6, ETS1-1, LS1-5, PS1-3, PS2-6, ESS3-2, ETS1-3
 - Unit 4: Human Chemistry (Biochem)
 - PS1-5, PS1-6

Resources and Assured Experiences

- Textbook:
- FlameTest Lab
- Atomic Spectrum Lab
- Build an Atom (PhET Simulation)
- Materials Lab
- Specific Heat Lab
- Oil/Water Separation Challenge
- TuVA Data Analysis (Coral Bleaching)
- Personalized Learning Kinetics Lab
- Le Chatelier's Lab