Content: Physical Science	**Grade or Course:** Honors Chemistry	**Date Developed:** 3/7/2018

Overview:

Honors Chemistry is a one-year introductory course. It focuses on building a conceptual framework of the key theories, models and methods in chemistry and applying them to real world phenomena. Historical examples are used to clarify both the content and methodology of chemistry. As an Honors level course, it deepens students' already strong mathematical problem-solving, abstract thinking, and critical thinking skills and is designed to prepare students for AP Physics as well as for majoring in science at competitive universities.

Essential Questions:

- How can the properties and behavior of materials be explained by their atomic and molecular structure?
- How can observed chemical phenomena be modeled both mathematically and visually (at a molecular level)?
- How are new ideas in chemistry generated, tested, and evaluated?
- What are the key components for successful team and class collaborative problem-solving?

EO's addressed to proficiency level:

Students will understand, demonstrate, and be evaluated on the following Scientific Practices:

- Developing and Using Models
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Engaging in Argument over Evidence
- Constructing Explanations and Designing Solutions

Standards:

Students will understand and use the following additional Scientific Practices:

- Developing and Using Models
- Using Math and Computational Thinking
- Constructing Explanations and Designing Solutions
- Obtaining, Evaluating, and Communicating Information

Students will understand and use the following Cross-Cutting Concepts:

- Patterns
- Cause and effect: Mechanism and explanation
- Scale, proportion, and quantity
- Systems and system models
- Stability and change
- Energy & Matter

Students will understand, use, and be evaluated on the following Disciplinary Core Ideas:

- 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. PS1.B

- Attractions and repulsions between electric charges at the atomic scale explain the structure, properties and transformations of matter, as well as the contact forces between material objects. PS2.B
- Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into
- or out of the system. PS3.B
- Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. PS3.B
- … at the microscopic scale, at which all of the different manifestations of energy can be modeled as either motions of particles or energy stored in fields (which mediate interactions between particles). PS3.A
- The availability of energy limits what can occur in any system. PS3.B
- Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. PS1.A
- 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. PS1.A
- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. PS1.A
- Attractions and repulsions between electric charges at the atomic scale explain the structure, properties and transformations of matter, as well as the contact forces between material objects. PS2.B
- 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. PS1.B
- Stable forms of matter are those in which the electric and magnetic field energy is minimized. A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart.
- Nuclear processes, including fission, fusion, and the radioactive decays of unstable nuclei, involve the release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. PS1.C
- Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric
- dating to be used to determine the ages of rocks and other materials. PS1.C
- Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. PS3.D
- The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. ESS1.A
- Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all
- atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. ESS1.A

Units:

Unit 1A	**The Chemical World**
Unit 1B	**Atoms and Elements**
Unit 2	**Molecules and Compounds**
Unit 3	**Chemical Reactions**
Unit 4	**Chemical Energy**
Unit 5	**States of Matter**
Unit 6	**Chemical Bonding**
Unit 7	**Solutions, Acids and Bases**
Unit 8	**Nuclear Chemistry**

EO Assessments:

- Essay on Invention and Discovery
- Metals vs. Nonmetals Practicum
- Stoichiometry (Tin Sponge) Test
- Reaction Speed Practicum Test
- Chemical Bonding Practicum
- Specific Heat of a Metal Practicum
- Essay on Models
- Acid & Base (Titration) Test
- Radiation Lab