Thomaston Public Schools - Curriculum Overview and Pacing Guide

Course Title: Chemistry		
School: Thomaston High School	**Grade:** 10	**Curriculum Pacing:** 36 weeks
Unit 1: Atomic Structure & Nuclear Chemistry	**Unit 2: The Electromagnetic Spectrum & Electron Configuration**	
Unit Pacing: 6 weeks	**Unit Pacing: 5 weeks**	
Unit Overview: Students will be introduced to the structure of an atom (limited to the three subatomic particles). Then, by using the periodic table, students will be able to determine the number of protons, neutrons and electrons of an element. Students will gain an understanding of the various changes/manipulations that can be done to the structure of an atom. These concepts are the foundation for Nuclear Chemistry. Nuclear chemistry is the study of the nucleus of an atom and its processes. Students will build on their understanding of isotopes and begin to look at specific cases of isotopes, known as radioactive isotopes. They will then be able to calculate their decay rate. Additionally, students will research various applications of radioactivity, including carbon dating, medical applications, along with others. Through modeling of real-world phenomena, students will compare/contrast fission and fusion reactions; nuclear power and stars will specifically be analyzed.	**Unit Overview:** This unit will build on the previous concepts of atomic structure by investigating the photoelectric effect, absorption and emission spectra, quantum numbers, and electron configurations. Students will learn how chemists use light, a form of energy, to study atoms and their electrons in a field of study known as spectroscopy. Students will then be able to use spectroscopic data to identify known elements in unknown samples. An additional pattern on the Periodic Table will be elaborated on, which is electron configuration. Students will be able to use the Periodic Table as a tool to determine the energy order of atomic orbitals (i.e. electron configuration).	
Compelling Questions: 1. What is stuff made of? 2. How has nuclear energy shaped our world?	**Compelling Questions:** 1. What is the composition of stars? 2. How does the configuration of electrons affect an atom's properties?	

Priority Learning Targets 1. I can develop a model of an atom that includes the location of the three subatomic particles and their characteristics. (HS-PS1-1) 2. I can analyze and interpret data in order to determine whether an isotope would be stable using the neutron to proton ratio. (HS-PS1-8; HS-ESS1-1) 3. I can develop an explanatory model of nuclear fission and fusion reactions and determine the age of a star using the abundance of elements found in the composition. (HS-PS1-8; HS-ESS1-1; HS-ESS1-3)	**Priority Learning Targets** 1. I can construct an explanation for the production of electromagnetic radiation from atoms and its relationship to emission spectra. (HS-PS3-1; HS-PS3-3; HS-PS4-1; HS-PS4-3; HS-PS4-4; HS-ESS1-2) 2. I can apply spectroscopy in order to determine the composition of stars based on their emission spectra that acts as a unique "barcode" for stars. (HS-PS3-1; HS-PS4-1; HS-PS4-3; HS-PS4-4; HS-ESS1-2) 3. I can use a model in order to predict how electrons fill orbitals based on three principles: Aufbau, Pauli Exclusion, and Hund's Rule. (HS-PS1-1; HS-PS1-2)
Unit 3: The Periodic Table & Bonding	**Unit 4: Properties of Matter & Intermolecular Forces**
Unit Pacing: 6 weeks	**Unit Pacing: 7 weeks**
Unit Overview: In this unit, students will take their understanding of the parts of the atom and determine how they play a role in an element's position on the periodic table, which results in the creation of periodic trends. Students will then be able to use the periodic table as a tool to justify properties of the elements. Students will additionally study the concept of chemical bonding and interactions between various particles. The rules for naming and determining the formulas of chemicals will be practiced. Students will compare bonding types and the forces that hold molecules and compounds together. Students will analyze the organization of electrons in an atom and this will allow students to think logically about how atoms bond together.	**Unit Overview:** In this unit of study, students use investigations and laboratory exercises to provide better explanations of the properties of substances. Students are able to use the periodic table as a tool to explain and predict the properties of elements. Students are expected to communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. Students will engage in a Case Study that allows them to further look into several chemical/physical properties of matter. The case summary: "A child is brought to the emergency room unconscious. The doctor is concerned that the child has been poisoned. Students will test the child's bottle to determine if it contains "just" water. They will then use the evidence they uncover to decide if a crime has been committed."
Compelling Questions: 1. How does understanding periodic trends allow us to predict properties of different elements?	**Compelling Questions:** 1. How can we use properties of a substance in order to identify what it is? 2. What role do chemical bonds play in the existence of things?

2. How does the number of valence electrons determine the type and number of bonds an element forms?	
Priority Learning Targets 1. I can analyze and interpret data in order to determine the trends on the Periodic Table (atomic radius, electronegativity, and ionization energy) and predict the relative magnitude of each for a given element based on its location in the periodic table. (*Honors Differentiation: Electron Affinity and Ionic Radius as well as in depth explanations for each properties i.e. Shielding, etc.) (HS-PS1-1; HS-PS1-3) 2. I can plan and carry out an investigation in order to explain the differences in properties of covalently and ionically bonded substances. (HS-PS1-1; HS-PS1-2; HS-PS1-3) 3. I can apply IUPAC Nomenclature in order to properly name ionic and covalent compounds. (*Honors Differentiation: Not specifically assigned in NGSS.)	**Priority Learning Targets** 1. I can plan and carry out an investigation in order to differentiate between extensive and intensive properties. (HS-PS1-3) 2. I can classify matter as pure substances or mixtures through investigation of their properties. (HS-PS1-3) 3. I can use mathematics and computational thinking in order to determine whether a bond will be polar or nonpolar. (HS-PS1-3) 4. I can construct an explanation based on data to determine the types of IMFs present within a substance and predict the effect these forces will have on the physical properties of the substance. (HS-PS1-3) 5. I can analyze and interpret phase change diagrams and identify important areas of the curves where changes of state are occurring. (HS-PS1-3)
Unit 5: Chemical Reactions: A Balancing Act	**Unit 6: Thermodynamics & Kinematics**
Unit Pacing: 6 weeks	**Unit Pacing: 6 weeks**
Unit Overview: In this unit, students will learn to predict products, recognize patterns in equations in order to identify reaction types. Students will learn the SI system of measurement along with conversion factors to convert from one unit of measure to another. Students are also introduced to accuracy, precision, significant figures, and scientific notation. The concept of the mole and stoichiometry are used to show proportional relationships between masses of reactants and products. Students will then use balanced equations to show mass relationships between reactants and products. Students should also gain an understanding of the use of	**Unit Overview**: Through the introduction of thermochemistry students will understand the flow of energy from hotter objects to colder objects. Students will view energy as a quantitative property of a system (a property that depends on the motion and interactions of matter and radiation within that system). They will also understand that the total change of energy in any system is always equal to the total energy transferred into or out of the system. Students will develop an understanding that energy, at both the macroscopic and atomic scales, can be accounted for as motions of particles or as energy associated with the relative positions of particles.

dimensional analysis to perform mass to mole conversions that demonstrate how mass is conserved during chemical reactions.	
Compelling Questions: 1. How do we know that a chemical reaction has taken place? 2. How does a limiting reactant affect a chemical reaction?	**Compelling Questions:** 1. How is energy lost or gained during changes of state? 2. What is the difference between spontaneous and non-spontaneous processes?
Priority Learning Targets 1. I can plan and carry out an investigation in order to support the law of conservation of mass. (HS-PS1-7) 2. I can predict the products of the types of chemical reactions: Synthesis, Decomposition, Single Replacement, Double Replacement, and Combustion. (*Honors Differentiation: Acid-Base Reactions and Redox) (HS-PS1-2) 3. I can use mathematics and computational thinking in order to convert between moles, grams, molecules/particles, and liters. (HS-PS1-7)	**Priority Learning Targets** 1. I can analyze lab data in order to determine which reactions are endothermic and which are exothermic. (HS-PS1-4; HS-ESS3-5; HS-ESS3-6) 2. I can use mathematics and computational thinking to calculate the change in energy during a reaction using a calorimeter. (HS-PS1-4) 3. I can collect and analyze data to support collision theory and explain how to increase/decrease the rate of a chemical reaction. (HS-PS1-5)