Boone County Chemistry Curriculum Map

Unit 1: Matter, Energy, and Change	**Duration**:
Key Essential Questions: ● How can I explain the structure, properties, and interactions of matter? ● How is energy transferred and conserved?	
Transfer Goals: *Students will be able to independently use their learning to* ● Create and use models to evaluate [energy transformations in various systems.] ● Plan and conduct an investigation to evaluate [energy transformations in various systems.]	
Performance Expectation	
HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.	
HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).	
HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	
HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.	
HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.	
Notes:	

Unit 2: Atomic Structure	**Duration**:

Key Essential Questions:

- What are the characteristic properties and behaviors of waves?
- What forces hold nuclei together and mediate nuclear processes?
- How do particles interact to form the variety of matter one observes?

Transfer Goals:
Students will be able to independently use their learning to

- Create and use models to illustrate and predict changes [in atomic structure.]
- Apply scientific understanding [of atomic structure and stability] to explain [the composition of matter in the universe.]
- Use mathematical and computational thinking to evaluate [the relationship between waves and particles.]

Performance Expectation

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

HS-PS4-3. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.

HS-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

HS-ESS1-1. Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.

HS-ESS1-2. Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

HS-ESS1-3. Communicate scientific ideas about the way stars, over their life cycle, produce elements

HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history
Notes:

Unit 3: Intermolecular and Intramolecular Forces	**Duration**:
Key Essential Questions: ● What underlying forces explain the variety of interactions observed?	
Transfer Goals: *Students will be able to independently use their learning to* ● Develop and use models to illustrate [properties of substances based on interactions between particles.] ● Plan and conduct an investigation to gather evidence to explain [properties based on the interactions between particles.] ● Communicate information about the relationship between observations [at the bulk scale to particles interactions at the microscopic scale.]	
Performance Expectation	
HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.	
HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*	
HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.	
HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.	
Notes:	

Unit 4: Chemical Reactions	**Duration**:
Key Essential Questions: ● How do substances combine or change to make new substances? ● How does one characterize and explain these reactions and make predictions about them? ● How does characterizing reactions help one make predictions? ● How is matter transferred between systems?	
Transfer Goals: *Students will be able to independently use their learning to* ● Use models and mathematical representations to explain [the transfer of matter (and inherently the conservation of mass) between different systems.] ● Use patterns [in atomic structure and the Periodic Table] to construct an explanation about [the outcome of a chemical reaction.]	
Performance Expectation	
HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.	
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	
HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere	
Notes:	

Unit 5: Rates and Stability of Chemical Reactions	**Duration**:
Key Essential Questions: ● How do various factors affect how quickly a reactions reaches completion? ● Why are some systems more stable than others? ● What are the characteristics of a chemical reaction system that never reaches completion?	

Transfer Goals:
Students will be able to independently use their learning to

- Apply knowledge [of chemical reactions] to demonstrate the cause and effect relationship [of variables in a system at equilibrium.]
- Construct an explanation of [the variables affecting the rate of a chemical reaction.]
- Develop a model illustrating [the changes in energy in a chemical system.]
- Evaluate design solutions [for energy and other resources] in regards to cost vs. benefits.

Performance Expectation

HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.

HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*

HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*

Notes: