WGSD Curriculum -- Chemistry A
Role of Energy

Missouri Grade-Level Expectations (or other standards)
NGSS-HS-PS 1-2: 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. NGSS-HS-PS 1-4: 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. NGSS-HS-PS 1-5: 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. NGSS-HS-PS 1-6: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

Learning Goal	Proficiency Scales
Students will be able to show the role of energy in chemical reactions (ie. rates of reactions).	4: The student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: The student demonstrates mastery of the learning goal by ● explaining how changing the conditions of a reaction will affect the rate of that reaction. ● give evidentiary support how changing conditions affect the amount of product. ● calculating the total energy change required to change the temperature of a substance a given amount. ● modifying an explanation of rate change based on experimental data.

	2: The student demonstrates he/she is nearing proficiency by ● recognizing or recalling specific vocabulary, such as: *endothermic, exothermic, entropy, heat of vaporization, heat of fusion, enthalpy.* ● performing specific processes, such as: ● identifying actions that will affect the rate of a reaction: stirring, particle size, temperature. ● explaining what changing conditions might affect the amount of product. ● describing why temperature doesn't change during a phase change. 1: The student demonstrates limited understanding or skill with the learning goal.

WGSD Curriculum -- Chemistry A
Interaction of Geospheres

Missouri Grade-Level Expectations (or other standards)
NGSS-HS-ESS 2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. NGSS-HS-ESS 3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. NGSS-HS-ESS 3-6: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

Learning Goal	Proficiency Scales
The student will be able to develop a logical argument about about how the interaction of geospheres affects, and is affected by, earth populations.	4: The student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: The student demonstrates mastery of the learning goal by ● analyzing the interaction of the chemical properties of pollution with air and water to assess their effects. ● showing and discussing evidence illustrating the effects of humans on a particular resource scarcity and purity. ● discussing how colligative properties are affected by the hydrogen bonding in water. ● assessing the impact of chemistry on the environment. 2: The student demonstrates he/she is nearing proficiency by ● recognizing or recalling specific vocabulary, such as: *geosphere, population, pollution, acid rain, deposition.* ● performing specific processes, such as: ● summarizing the properties of air and water. ● summarizing the major sources of pollution of air and water. ● analyzing the interaction of the properties and human behavior with teacher help. 1: The student demonstrates limited understanding or skill with the learning goal.

Energy Transferred

Missouri Grade-Level Expectations (or other standards)

NGSS-HS-PS 3-1: 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 components(s) and energy flows in and out of the system are known.
NGSS-HS-PS 3-2: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as either motions of particles or energy stored in fields.
NGSS-HS-PS 3-4: 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).

Learning Goal

Students will be able to model energy transfer within chemical systems as the total energy remains constant (i.e., Law of Conservation of Energy).

Proficiency Scales

4: The student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: The student demonstrates mastery of the learning goal by

- demonstrating mathematically and experimentally the conservation of energy in a system.
- creating a computational model relating a system to its surroundings.
- evaluating the transfer of thermal energy.
- discussing the behavior of particles that creates the observed temperature, pressure and volume changes.

2: The student demonstrates he/she is nearing proficiency by

	● recognizing or recalling specific vocabulary, such as: *pressure, temperature, volume, kinetic, heat, specific heat capacity.* ● performing specific processes, such as: ● describing the movement of heat energy. ● discussing the Law of Conservation of Energy and its affect on systems. ● evaluating an experiment to determine the system studied and the surroundings present. 1: The student demonstrates limited understanding or skill with the learning goal.

WGSD Curriculum -- Chemistry A
Composition and Interaction of Atoms

Missouri Grade-Level Expectations (or other standards)
NGSS-HS-PS 1-1: 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. NGSS-HS-PS 1-3: 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. NGSS-HS-PS 1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. NGSS-HS-PS 2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Learning Goal	Proficiency Scales
Students will be able to identify the composition and model the interactions of atoms.	4: The student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: The student demonstrates mastery of the learning goal by ● drawing a sketch showing the relative position of subatomic particles in an atom and their relative numbers for a given isotope. ● drawing conclusions on how the characteristics used to identify atoms relate to the periodicity of the periodic table. ● interpreting the development of the modern model of the atom. ● constructing chemical formulas using outermost electron energy levels. ● developing a model of interaction of subatomic particles. ● constructing simple chemical reaction equations showing conservation of atoms and mass. 2: The student demonstrates he/she is nearing proficiency by ● recognizing or recalling specific vocabulary, such as: *period, group, nucleus, electron cloud, isotope, ion, formula, molecule.* ● performing specific processes, such as ○ creating a timeline depicting the development of the modern model of the atom. ○ describing the structure of the periodic table and how that structure was developed. ○ balancing simple chemical equations. 1: The student demonstrates limited understanding or skill with the learning goal.

WGSD Curriculum -- Chemistry A
Classify Matter

Missouri Grade-Level Expectations (or other standards)
NGSS-HS-PS 1-1: 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. NGSS-HS-PS 1-3: 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. NGSS-HS-PS 2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Learning Goal	Proficiency Scales
Students will be able to describe and classify matter.	4: The student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: The student demonstrates mastery of the learning goal by ● predicting physical and chemical properties of matter based on their position on the periodic table. ● differentiating matter as pure substances or mixtures. ● describing physical and chemical properties and changes of matter. ● classifying chemical change based on experimental evidence. 2: The student demonstrates he/she is nearing proficiency by ● recognizing or recalling specific vocabulary, such as: *matter, density, solubility, mixture, pure substance, phases of matter, homogeneous, heterogeneous, precipitate.* ● performing basic processes, such as: ● classifying an object based on its physical and chemical properties. ● describing the relationships among matter, pure substances, mixtures, elements, compounds and types of mixtures. ● identifying types of mixtures. ● recognizing evidence of a chemical change. 1: The student demonstrates limited understanding or skill with the learning goal.