WGSD Curriculum -- Conceptual Chemistry - Role of Energy

Missouri Grade-Level Expectations (or other standards)

9-12.PS1.A.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.
9-12.PS1.A.5 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.
9-12.PS1.B.1: 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.
9-12.PS1.B.2: 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: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: Student demonstrates mastery of the learning goal as evidenced by: ● Explaining how changing the conditions of a reaction will affect the rate of that reaction. ● Modifying an explanation of rate change based on experimental data. ● Interpreting a phase change graph using heat energy and temperature. 2: Student demonstrates he/she is nearing proficiency by ● Recognizing or recalling specific vocabulary, such as: *endothermic, melting, boiling, condensing, freezing, temperature.*

	● Performing processes such as:
	  ● Identifying actions that will affect the rate of a reaction: stirring, particle size, temperature.
	  ● Describing why temperature doesn't change during a phase change.
	  ● Identifying melting, boiling, condensing, and freezing on a phase change graph.
	
	1: Student demonstrates a limited understanding or skill with the learning goal.

WGSD Curriculum -- Conceptual Chemistry
Interaction of Geospheres

Missouri Grade-Level Expectations (or other standards)
9-12.ESS2.C.1 : Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. 9-12.ESS3.C.2 : Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. 9-12.ESS3.D.2 : 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. ● 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. ● giving examples of the interactions of properties and human behavior. 1: The student demonstrates limited understanding or skill with the learning goal.

Missouri Grade-Level Expectations (or other standards)

9-12.PS3.A.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.
9-12.PS3.A.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.
9-12.PS3.B.1: 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	Proficiency Scales
Students will be able to apply the Law of Conservation of Energy.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: Student demonstrates mastery of the learning goal as evidenced by: ● Demonstrating 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: Student demonstrates he/she is nearing proficiency by: ● Recognizing or recalling specific vocabulary, such as: *pressure, temperature, volume, kinetic, heat, specific heat capacity, endothermic, exothermic, and insulator.*

	● Performing 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: Student demonstrates a limited understanding or skill with the learning goal.

WGSD Curriculum -- Conceptual Chemistry
Composition and Interaction of Atoms

Missouri Grade-Level Expectations (or other standards)
9-12.PS1.A.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. 9-12.PS1.A.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. 9-12.PS1.B.3: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Learning Goal	Proficiency Scales

Students will be able to create models and predict interactions of atoms.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: Student demonstrates mastery of the learning goal as evidenced by: ● Drawing a sketch showing the relative position of subatomic particles in an atom. ● 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: Student demonstrates he/she is nearing proficiency by: ● Recognizing or recalling specific vocabulary, such as: *period, group, nucleus, electron cloud, isotope, ion, formula, molecule, valence electrons.* ● Performing processes such as: ○ Matching the development of the modern model of the atom with the correct scientist. ○ Describing the structure of the periodic table. ○ Balancing simple chemical equations. 1: Student demonstrates a limited understanding or skill with the learning goal.

Classify Matter

Missouri Grade-Level Expectations (or other standards)

9-12.PS1.A.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: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: Student demonstrates mastery of the learning goal as evidenced by: ● Differentiating matter as pure substances or mixtures. ● Describing physical and chemical properties and changes of matter. ● Classifying chemical change based on experimental evidence. 2: 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 processes such as: ● Classifying an object based on its physical and chemical properties. ● Classifying matter as a pure substance, mixture, element, compound and type of mixture. ● Identifying types of mixtures. ● Recognizing evidence of a chemical change. 1: Student demonstrates a limited understanding or skill with the learning goal.

WGSD Curriculum -- Conceptual Chemistry
Nuclear

Missouri Grade-Level Expectations (or other standards)
9-12.PS1.C.1 : 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. 9-12.PS4.B.2: Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. 9-12.ESS1.A.1: Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in sun's core to release energy that eventually reaches Earth in the form of radiation. 9-12.ESS1.A.3: Communicate scientific ideas about the way stars, over their life cycle, produce elements. (fusion)

Learning Goal	Proficiency Scales
Students will be able to evaluate the composition and interactions of the atomic nucleus.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: Student demonstrates mastery of the learning goal as evidenced by: ● Modeling the process by which energy and particles are released from an atomic nucleus. ● Comparing energy released through nuclear processes. ● Evaluating the validity and reliability of claims of effects of EMR on living organisms. 2: Student demonstrates he/she is nearing proficiency by: ● Recognizing or recalling specific vocabulary, such as: *radiation, decay, half-life, exposure, alpha particle, beta particle, gamma*

	radiation, fission, fusion, isotope, ionizing, and EMR. ● Performing processes such as: ○ Completing a nuclear decay series. ○ Describing the process by which stars produce/release energy. ○ Comparing and contrasting the processes of fission and fusion. ○ Describing three ways we may limit radiation exposure. 1: Student demonstrates a limited understanding or skill with the learning goal.