Davison Community Schools
ADVISORY CURRICULUM COUNCIL
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Matter and its Interactions

7th Grade Life, Chemical & Environmental Science	
Course Essential Questions:	
1. What is matter and how does it interact? 2. What are molecules and how do they relate to organisms within their structure? 3. What is weather and how does it affect climate?	
Unit 1: Matter and its Interactions	
Essential Questions:	**Essential Understandings:**
● What are structures and properties of matter? ● What are chemical reactions? ● How do we design a problem with a successful solution which will have an impact on humans or natural environments? ● How do we construct a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world? ● How do we analyze data in investigations, distinguish between correlation and causation, and use basic statistical techniques of data and error analysis?	● Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. ● Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. ● Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. ● In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. ● Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). ● The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. ● Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. ● The total number of each type of atom is conserved, and thus the mass does not change. ● Some chemical reactions release energy, others store energy. ● Convincing arguments support or refute claims regarding the natural or designed world. ● Distinguish between cause and effect and analyze data.
Curriculum Standards (DOK):	

MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.

MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
… models of molecules vary in complexity from simple molecules to extended structures. [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.] ...the properties of substances to determine if a chemical reaction has taken place. [Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.] ...natural resources undergo a chemical process to form the synthetic material. [Assessment Boundary: Assessment is limited to qualitative information.] ...qualitative molecular-level models of solids, liquids, and gases show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. ...the law of conservation of matter and how it applies to atoms. [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]	• Develop models of molecules. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms. • Determine properties of substances before/after the substances interact. Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride. • Describe that synthetic materials come from natural resources and impact society. Examples of new materials could include new medicine, foods, and alternative fuels. • Predict and describe changes in particle motion, temperature, and state of a pure substance when thermal energy is added/removed with a model. Examples of models could include drawings and

...some chemical reactions release energy, others store energy. [Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.] ...that the more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. ...there are systematic process for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. ...that one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process.	diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium. ● Show how the total number of atoms does not change in a chemical reaction and thus mass is conserved through models ● Construct, test and modify a device that releases or absorbs thermal energy by chemical reactions. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride. ● Ask questions and define problems to specifying relationships between variables, and clarifying arguments and models.. ● Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and solutions. ● Engage in argument from evidence and progress to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural or designed world. ● Analyze and interpret data to determine similarities and differences in findings.

Unit 2: Structures and Processes	
Essential Questions:	**Essential Understandings:**
● What are the basic units of living things and their structure? ● What are characteristic changes of living things over a lifetime? ● How do plants use energy to make food? ● How do sense receptors respond to different inputs? ● What specific molecules are involved in photosynthesis and cellular respiration? ● How do we design a problem with a successful solution which will have an impact on humans or natural environments? ● How do we construct a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world? ● How do we analyze data in investigations, distinguish between correlation and causation, and use basic statistical techniques of data and error analysis?	● All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). ● Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. ● In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. ● Animals engage in characteristic behaviors that increase the odds of reproduction. ● Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. ● Genetic factors as well as local conditions affect the growth of the adult plant. ● Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. ● Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. ● Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. ● The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. ● Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. ● Convincing arguments support or refute claims regarding the natural or designed world.

	• Distinguish between cause and effect and analyze data

Curriculum Standards (DOK):

MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells

MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
...that living things are made of cells, distinguishing between living and non-living things, and understand that living things may be made of one cell or many cells. ...cells function as a whole system: including the primary roles identified as parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall. *Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.* ...cells form tissues and tissues form organs specialized for particular body functions. *Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.* ...that behaviors affect the probability of animal reproduction. This could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. . ...local environmental conditions, that affect genetics, they include the availability of food, light, space, and water. *Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]* ..how to trace the movement of matter and flow of energy through photosynthesis. *Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.* ... how to describe molecules being broken apart and put back together; knowing that in this process, energy is released. *Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.* ...how to gather information from sensory receptors responding to stimuli. ...that the more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. ...there are systematic process for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	• Conduct an investigation to provide evidence that living things are made of cells. Examples include compare and contrast living and non-living organisms. Compare and contrast unicellular and multicellular. • Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function. Examples include listing four parts (organelles) to a cell and their functions for plant and animal cells. Describing the nucleus and its role within a cell. Comparing and contrasting a cell wall and cell membrane. • Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. Examples include listing the five levels of organization. Listing 10 different systems of the body and their functions, and describing systems of a plant. Examples could include the interaction of subsystems within a system and the normal functioning of those systems. • Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. Examples include explaining three ways animals behave to increase the odds of reproduction. Listing a variety of ways plants reproduce. • Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. Examples include listing genetic factors affecting the growth of an adult plant. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds. • Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. Examples include writing the word and chemical formula for photosynthesis. Label a plant showing where sunlight, carbon dioxide, and water enter a plant. Label a plant showing where glucose is made.

...that one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process.	• Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. Examples include writing out molecules for carbon dioxide, water, glucose, and oxygen and building molecules used in photosynthesis. • Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. Examples include recording data of sensory receptor input for smell, touch, taste, sound, and sight. • Ask questions and define problems to specifying relationships between variables, and clarifying arguments and models.. • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and solutions. • Engage in argument from evidence and progress to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural or designed world. • Analyze and interpret data to determine similarities and differences in findings.

Unit 3: Weather and Climate	
Essential Questions:	**Essential Understandings:**
● What are the roles of water in Earth's surface processes? ● How are weather and climate influenced by interactions on earth? ● How do we design a problem with a successful solution which will have an impact on humans or natural environments? ● How do we construct a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world? ● How do we analyze data in investigations, distinguish between correlation and causation, and use basic statistical techniques of data and error analysis?	● The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. ● Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. ● Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. ● Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. ● Because these patterns are so complex, weather can only be predicted probabilistically. ● The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. ● Global movements of water and its changes in form are propelled by sunlight and gravity. ● Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. ● Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. ● Convincing arguments support or refute claims regarding the natural or designed world. ● Distinguish between cause and effect and analyze data.

Curriculum Standards (DOK):	
MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. **MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.** **MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.** **MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and natural environment that may limit possible solutions.** **MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.** **MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**	
Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
… how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. ...how weather can be predicted within probabilistic ranges. [*Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.*] ...the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. [*Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.*] ... how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. [*Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.*] ...that the more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of	• Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation). • Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. Examples of models can be conceptual or physical. • Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. Examples of models can be diagrams, maps and globes, or digital representations. • Ask questions and define problems to specifying relationships between variables, and clarifying arguments and models.. • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and solutions. • Engage in argument from evidence and progress to constructing a convincing argument that supports or

constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. ...there are systematic process for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. ...that one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process.	refutes claims for either explanations or solutions about the natural or designed world. ● Analyze and interpret data to determine similarities and differences in findings.