SCIENCE PROCESSES Inquiry, Reflection, and Social Implications

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SCIENCE PROCESSES	***S.IP.M.1 Inquiry involves generating questions, conducting investigations, and developing solutions to problems through reasoning and observation.*** **S.IP.05.11** Generate scientific questions based on observations, investigations, and research. **S.IP.05.12** Design and conduct scientific investigations. **S.IP.05.13** Use tools and equipment (spring scales, stop watches, meter sticks and tapes, models, hand lens) appropriate to scientific investigations. **S.IP.05.14** Use metric measurement devices in an investigation. **S.IP.05.15** Construct charts and graphs from data and observations. **S.IP.05.16** Identify patterns in data. **Inquiry Analysis and Communication** ***S.IA.M.1 Inquiry includes an analysis and presentation of findings that lead to future questions, research, and investigations.*** **S.IA.05.11** Analyze information from data tables and graphs to answer scientific questions. **S.IA.05.12** Evaluate data, claims, and personal knowledge through collaborative science discourse. **S.IA.05.13** Communicate and defend findings of observations and investigations using evidence. **S.IA.05.14** Draw conclusions from sets of data from multiple trials of a scientific investigation. **S.IA.05.15** Use multiple sources of information to evaluate strengths and weaknesses of claims, arguments, or data. **Reflection and Social Implications** ***S.RS.M.1 Reflecting knowledge is the application of scientific knowledge to new and different situations. Reflecting knowledge requires careful analysis of evidence that guides decision-making and the application of science throughout history and within society.*** **S.RS.05.11** Evaluate the strengths and weaknesses of claims, arguments, and data. **S.RS.05.12** Describe limitations in personal and scientific knowledge. **S.RS.05.13** Identify the need for evidence in making scientific decisions. **S.RS.05.15** Demonstrate scientific concepts through various illustrations, performances,	**SCIENCE PROCESSES Inquiry Process** ***S.IP.M.1 Inquiry involves generating questions, conducting investigations, and developing solutions to problems through reasoning and observation.*** **S.IP.06.11** Generate scientific questions based on observations, investigations, and research. **S.IP.06.12** Design and conduct scientific investigations. **S.IP.06.13** Use tools and equipment (spring scales, stop watches, meter sticks and tapes, models, hand lens, thermometer, models, sieves, microscopes) appropriate to scientific investigations. **S.IP.06.14** Use metric measurement devices in an investigation. **S.IP.06.15** Construct charts and graphs from data and observations. **S.IP.06.16** Identify patterns in data. **Inquiry Analysis and Communication** ***S.IA.M.1 Inquiry includes an analysis and presentation of findings that lead to future questions, research, and investigations***. **S.IA.06.11** Analyze information from data tables and graphs to answer scientific questions. **S.IA.06.12** Evaluate data, claims, and personal knowledge through collaborative science discourse. **S.IA.06.13** Communicate and defend findings of observations and investigations using evidence. **S.IA.06.14** Draw conclusions from sets of data from multiple trials of a scientific investigation. **S.IA.06.15** Use multiple sources of information to evaluate strengths and weaknesses of claims, arguments, or data. **Reflection and Social Implications** ***S.RS.M.1 Reflecting knowledge is the application of scientific knowledge to new and different situations. 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ORGANIZATION OF LIVING THINGS	***L.OL.M.4 Animal Systems- Multicellular organisms may have specialized systems that perform functions which serve the needs of the organism.*** **L.OL.05.41** Identify the general purpose of selected animal systems (digestive, circulatory, respiratory, skeletal, muscular, nervous, excretory, and reproductive). **L.OL.05.42** Explain how animal systems (digestive, circulatory, respiratory, skeletal, muscular, nervous, excretory, and reproductive) work together to perform selected activities.	***L.OL.M.5 Producers, Consumers, and Decomposers- All animals, including humans, are consumers that meet their energy by eating other organisms or their products. Consumers break down the structures of the organisms they eat to make the materials they need to grow and function. Decomposers, including bacteria and fungi, use dead organisms or their products to meet their energy needs.*** **L.OL.06.51** Classify organisms (producers, consumers, and decomposers) based on their source of energy for growth and development. **L.OL.06.52** Distinguish between the ways in which consumers and decomposers obtain energy.	***L.OL.M.2 Cell Functions- All organisms are composed of cells, from one cell to many cells. In multicellular organisms, specialized cells perform specialized functions. Organs and organ systems are composed of cells, and function to serve the needs of cells for food, air, and waste removal. The way in which cells function is similar in all living organisms.*** **L.OL.07.21** Recognize that all organisms are composed of cells (single cell organisms, multicellular organisms). **L.OL.07.22** Explain how cells make up different body tissues, organs, and organ systems. **L.OL.07.23** Describe how cells in all multicellular organisms are specialized to take in nutrients, which they use to provide energy for the work that cells do and to make the materials that a cell or organism needs. **L.OL.07.24** Recognize that cells function in a similar way in all organisms. ***L.OL.M.3- Growth and Development- Following fertilization, cell division produces a small cluster of cells that then differentiate by appearance and function to form the basic tissue of an embryo.*** **L.OL.07.31** Describe growth and development in terms of increase of cell number and/or cell size. **L.OL.07.32** Examine how through cell division, cells can become specialized for specific functions. ***L.OL.M.6 Photosynthesis- Plants are producers; they use the energy from light to make sugar molecules from the atoms of carbon dioxide and water. Plants use these sugars along with minerals from the soil to***

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			form fats, proteins, and carbohydrates. These products can be used immediately, incorporated into the cells of a plant as the plant grows, or stored for later use. **L.OL.07.61** Recognize the need for light to provide energy for the production of carbohydrates, proteins and fats. **L.OL.07.62** Explain that carbon dioxide and water are used to produce carbohydrates, proteins, and fats. **L.OL.07.63** Describe evidence that plants make, use and store food.
HEREDITY	***L.HE.M.1 Inherited and Acquired Traits - The characteristics of organisms are influenced by heredity and environment. For some characteristics, inheritance is more important; for other characteristics, interactions with the environment are more important.*** **L.HE.05.11** Explain that the traits of an individual are influenced by both the environment and the genetics of the individual. **L.HE.05.12** Distinguish between inherited and acquired traits.		***L.HE.M.2 Reproduction- Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms reproduce sexually.*** **L.HE.07.21** Compare how characteristics of living things are passed on through generations, both asexually and sexually. **L.HE.07.22** Compare and contrast the advantages and disadvantages of sexual vs. asexual reproduction.
EVOLUTION	***L.EV.M.1 Species Adaptation and Survival- Species with certain traits are more likely than others to survive and have offspring in particular environments. When an environment changes, the advantage or disadvantage of the species' characteristics can change. Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival.*** **L.EV.05.11** Explain how behavioral characteristics (adaptation, instinct, learning, habit) of animals help them to survive in their environment. **L.EV.05.12** Describe the physical characteristics (traits) of organisms that help them survive in their environment. **L.EV.05.13** Describe how fossils provide evidence about how living things and environmental conditions have changed. **L.EV.05.14** Analyze the relationship of environmental change and catastrophic events (for example: volcanic eruption, floods, asteroid impacts, tsunami) to species extinction. ***L.EV.M.2 Relationships Among Organisms- Similarities among organisms are found in anatomical features, which can be used to***		

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	infer the degree of relatedness among organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance. **L.EV.05.21** Relate degree of similarity in anatomical features to the classification of contemporary organisms.		
ECOSYSTEMS		***L.EC.M.1 Interactions of Organisms- Organisms of one species form a population. Populations of different organisms interact and form communities. Living communities and nonliving factors that interact with them form ecosystems.*** **L.EC.06.11** List examples of populations, communities, and ecosystems including the Great Lakes region. ***L.EC.M.2 Relationships of Organisms- Two types of organisms may interact with one another in several ways: They may be in a producer/consumer, predator/ prey, or parasite/host relationship. Some organisms may scavenge or decompose another. Relationships may be competitive or mutually beneficial. Some species have become so adapted to each other that neither could survive without the other.*** **L.EC.06.21** Describe common patterns of relationships between and among populations (competition, parasitism, symbiosis, predator/prey). **L.EC.06.22** Explain how two populations of organisms can be mutually beneficial and how that can lead to interdependency. **L.EC.06.23** Predict how changes in one population might affect other populations based upon their relationships in the food web. ***L.EC.M.3 Biotic and Abiotic Factors- The number of organisms and populations an ecosystem can support depends on the biotic (living) resources available and abiotic (nonliving) factors, such as quality of light and water, range of temperatures and soil composition.*** **L.EC.06.31** Identify the living (biotic) and nonliving (abiotic) components of an ecosystem. **L.EC.06.32** Identify the factors in an ecosystem	

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		that influence changes in population size. ***L.EC.M.4 Environmental Impact of Organisms- All organisms (including humans) cause change in the environment where they live. Some of the changes are harmful to the organism or other organisms, whereas others are helpful.*** **L.EC.06.41** Describe how human beings are part of the ecosystem of the Earth and that human activity can purposefully, or accidentally, alter the balance in ecosystems. **L.EC.06.42** Predict possible consequences of overpopulation of organisms, including humans, (for example: species extinction, resource depletion, climate change, pollution).	

Physical Science Strand

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PROPERTIES OF MATTER			***P.PM.M.1 Chemical Properties- Matter has chemical properties. The understanding of chemical properties helps to explain how new substances are formed.*** **P.PM.07.11** Classify substances by their chemical properties (flammability, pH, acid-base indicators, reactivity). ***P.PM.M.2 Elements and Compounds- Elements are composed of a single kind of atom that are grouped into families with similar properties on the periodic table. Compounds are composed of two or more different elements. Each element and compound has a unique set of physical and chemical properties such as boiling point, density, color, conductivity, and reactivity.*** **P.PM.07.21** Identify the smallest component that makes up an element. **P.PM.07.22** Describe how the elements within the Periodic Table are organized by similar properties into families (highly reactive metals, less reactive metals, highly reactive nonmetals, and some almost completely non-reactive gases). **P.PM.07.23** Illustrate the structure of molecules using models or drawings (water, carbon dioxide, salt). **P.PM.07.24** List examples of physical and chemical properties of elements and compounds (boiling point, density, color, conductivity, reactivity).

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CHANGES IN MATTER		***P.CM.M.1 Changes in State- Matter changing from state to state can be explained by using models which show that matter is composed of tiny particles in motion. When changes of state occur, the atoms and/or molecules are not changed in structure. When the changes in state occur, mass is conserved because matter is not created or destroyed.*** **P.CM.06.11** Describe and illustrate changes in state, in terms of the arrangement and relative motion of the atoms or molecules. **P.CM.06.12** Explain how mass is conserved as it changes from state to state in a closed system.	***P.CM.M.2 Chemical Changes- Chemical changes occur when two elements and/or compounds react and produce new substances. These new substances have different physical and chemical properties than the original elements and/or compounds. During the chemical change, the number and kind of atoms in the reactants are the same as the number and kind of atoms in the products. Mass is conserved during chemical changes. The mass of the reactants is the same as the mass of the products.*** **P.CM.07.21** Identify evidence of chemical change through color, gas formation, solid formation, and temperature change. **P.CM.07.22** Compare and contrast the chemical properties of a new substance with the original after a chemical change. **P.CM.07.23** Describe the physical properties and chemical properties of the products and reactants in a chemical change.
FORCE AND MOTION	***P.FM.M.2 Force Interactions- Some forces between objects act when the objects are in direct contact (touching), such as friction and air resistance, or when they are not in direct contact (not touching), such as magnetic force, electrical force, and gravitational force.*** **P.FM.05.21** Distinguish between contact forces and non-contact forces. **P.FM.05.22** Demonstrate contact and non-contact forces to change the motion of an object. ***P.FM.M.3 Force- Forces have a magnitude and direction. Forces can be added. The net force on an object is the sum of all of the forces acting on the object. The speed and/or direction of motion of an object changes when a non-zero net force is applied to it. A balanced force on an object does not change the motion of the object (the object either remains at rest or continues to move at a constant speed in a straight line).*** **P.FM.05.31** Describe what happens when two forces act on an object in the same or opposing directions. **P.FM.05.32** Describe how constant motion is the result of balanced (zero net) forces. **P.FM.05.33** Describe how changes in the motion of objects are caused by a non-zero net (unbalanced)		

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	force. **P.FM.05.34** Relate the size of change in motion to the strength of unbalanced forces and the mass of the object. ***P.FM.M.4 Speed- Motion can be described by a change in position relative to a point of reference. The motion of an object can be described by its speed and the direction it is moving. The position and speed of an object can be measured and graphed as a function of time.*** **P.FM.05.41** Explain the motion of an object relative to its point of reference. **P.FM.05.42** Describe the motion of an object in terms of distance, time and direction, as the object moves, and in relationship to other objects. **P.FM.05.43** Illustrate how motion can be measured and represented on a graph.		
ENERGY		***P.EN.M.1 Kinetic and Potential Energy- Objects and substances in motion have kinetic energy. Objects and substances may have potential energy due to their relative positions in a system. Gravitational, elastic, and chemical energy are all forms of potential energy.*** **P.EN.06.11** Identify kinetic or potential energy in everyday situations (for example: stretched rubber band, objects in motion, ball on a hill, food energy). **P.EN.06.12** Demonstrate the transformation between potential and kinetic energy in simple mechanical systems (for example: roller coasters, pendulums). ***P.EN.M.4 Energy Transfer- Energy is transferred from a source to a receiver by radiation, conduction, and convection. When energy is transferred from a source to a receiver, the quantity of energy before the transfer is equal to the quantity of energy after the transfer.*** **P.EN.06.41** Explain how different forms of energy can be transferred from one place to another by radiation, conduction, or convection. **P.EN.06.42** Illustrate how energy can be transferred while no energy is lost or gained in the transfer.	***P.EN.M.3 Waves and Energy-Waves have energy and transfer energy when they interact with matter. Examples of waves include sound waves, seismic waves, waves on water, and light waves***. **P.EN.07.31** Identify examples of waves, including sound waves, seismic waves, and waves on water. **P.EN.07.32** Describe how waves are produced by vibrations in matter. **P.EN.07.33** Demonstrate how waves transfer energy when they interact with matter (for example: tuning fork in water, waves hitting a beach, earthquake knocking over buildings). ***P.EN.M.4 Energy Transfer- Energy is transferred from a source to a receiver by radiation, conduction, and convection. When energy is transferred from a source to a receiver, the quantity of energy before the transfer is equal to the quantity of energy after the transfer.*** **P.EN.07.43** Explain how light energy is transferred to chemical energy through the process of photosynthesis. ***P.EN.M.6 Solar Energy Effects- Nuclear reactions take place in the sun producing heat and light. Only a tiny fraction of the light energy from the sun reaches Earth, providing energy to heat the Earth.*** **P.EN.07.61** Identify that nuclear reactions take place in the sun, producing heat and light. **P.EN.07.62** Explain how only a tiny fraction of light energy from the sun is transformed to heat energy on Earth.

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EARTH SCIENCE STRAND

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SOLID EARTH		***E.SE.M.1 Soil- Soils consist of weathered rocks and decomposed organic materials from dead plants, animals, and bacteria. Soils are often found in layers with each having a different chemical composition and texture.*** **E.SE.06.11** Explain how physical and chemical weathering lead to erosion and the formation of soils and sediments. **E.SE.06.12** Explain how waves, wind, water, and glacier movement, shape and reshape the land surface of the Earth by eroding rock in some areas and depositing sediments in other areas. **E.SE.06.13** Describe how soil is a mixture, made up of weather eroded rock and decomposed organic material. **E.SE.06.14** Compare different soil samples based on particle size and texture. ***E.SE.M.4 Rock Formation- Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions, and forces that created them.*** **E.SE.06.41** Compare and contrast the formation of rock types (igneous, metamorphic, and sedimentary) and demonstrate the similarities and differences using the rock cycle model. ***E.SE.M.5 Plate Tectonics- The lithospheric plates of the Earth constantly move, resulting in major geological events, such as earthquakes, volcanic eruptions, and mountain building.*** **E.SE.06.51** Explain plate tectonic movement and how the lithospheric plates move centimeters each year. **E.SE.06.52** Demonstrate how major geological events (earthquakes, volcanic eruptions, mountain building) result from these plate motions. **E.SE.06.53** Describe layers of the Earth as a lithosphere (crust and upper mantle), convecting mantle, and dense metallic core.	

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		E.SE.M.6 Magnetic Field of Earth- Earth as a whole has a magnetic field that is detectable at the surface with a compass. **E.SE.06.61** Describe the Earth as a magnet and compare the magnetic properties of the Earth to that of a natural or man-made magnet. **E.SE.06.62** Explain how a compass works using the magnetic field of the Earth, and how a compass is used for navigation on land and sea.	
FLUID EARTH			***E.FE.M.1 Atmosphere- The atmosphere is a mixture of nitrogen, oxygen and trace gases that include water vapor. The atmosphere has different physical and chemical composition at different elevations.*** **E.FE.07.11** Describe the atmosphere as a mixture of gases. **E.FE.07.12** Compare and contrast the composition of the atmosphere at different elevations.
EARTH IN TIME AND SPACE	***E.ST.M.1 Solar System- The sun is the central and largest body in our solar system. Earth is the third planet from the sun in a system that includes other planets and their moons, as well as smaller objects, such as asteroids and comets.*** **E.ST.05.11** Design a model that describes the position and relationship of the planets and other objects (comets and asteroids) to the sun. ***E.ST.M.2 Solar System Motion- Gravity is the force that keeps most objects in the solar system in regular and predictable motion.*** **E.ST.05.21** Describe the motion of planets and moons in terms of rotation on axis and orbits due to gravity. **E.ST.05.22** Explain moon phases as they relate to the position of the moon in its orbit around the Earth, resulting in the amount of observable reflected light. **E.ST.05.23** Recognize that nighttime objects (stars and constellations) and the sun appear to move because the Earth rotates on its axis and orbits the sun. **E.ST.05.24** Explain lunar and solar eclipses based on the relative positions of the Earth, moon, and sun, and the orbit of the moon. **E.ST.05.25** Explain the tides of the oceans as they relate to the gravitational pull and orbit of the moon.	***E.ST.M.3 Fossils- Fossils provide important evidence of how life and environmental conditions have changed in a given location.*** **E.ST.06.31** Explain how rocks and fossils are used to understand the age and geological history of the earth (timelines and relative dating, rock layers). ***E.ST.M.4 Geologic Time- Earth processes seen today (erosion, mountain building, and glacier movement) make possible the measurement of geologic time through methods such as observing rock sequences and using fossils to correlate the sequences at various locations.*** **E.ST.06.41** Explain how Earth processes (erosion, mountain building, and glacier movement) are used for the measurement of geologic time through observing rock layers. **E.ST.06.42** Describe how fossils provide important evidence of how life and environmental conditions have changed.	

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EARTH SYSTEMS	***E.ES.M.6 Seasons- Seasons result from annual variations in the intensity of sunlight and length of day due to the tilt of the axis of the Earth relative to the plane of its yearly orbit around the sun.*** **E.ES.05.61** Demonstrate using a model, seasons as the result of variations in the intensity of sunlight caused by the tilt of the Earth on its axis, and revolution around the sun. **E.ES.05.62** Explain how the revolution of the Earth around the sun defines a year.		***E.ES.M.1 Solar Energy- The sun is the major source of energy for phenomena on the surface of the Earth.*** **E.ES.07.11** Demonstrate, using a model or drawing, the relationship between the warming by the sun of the Earth and the water cycle as it applies to the atmosphere (evaporation, water vapor, warm air rising, cooling, condensation, clouds). **E.ES.07.12** Describe the relationship between the warming of the atmosphere of the Earth by the sun and convection within the atmosphere and oceans. **E.ES.07.13** Describe how the warming of the Earth by the sun produces winds and ocean currents. ***E.ES.M.4 Human Consequences- Human activities have changed the land, oceans, and atmosphere of the Earth resulting in the reduction of the number and variety of wild plants and animals sometimes causing extinction of species.*** **E.ES.07.41** Explain how human activities (surface mining, deforestation, overpopulation, construction and urban development, farming, dams, landfills, and restoring natural areas) change the surface of the Earth and affect the survival of organisms. **E.ES.07.42** Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere, (car exhaust, industrial emissions, acid rain, and natural sources), and how pollution impacts habitats, climatic change, threatens or endangers species. ***E.ES.M.7 Weather and Climate- Global patterns of atmospheric and oceanic movement influence weather and climate.*** **E.ES.07.71** Compare and contrast the difference and relationship between climate and weather. **E.ES.07.72** Describe how different weather occurs due to the constant motion of the atmosphere from the energy of the sun reaching the surface of the Earth. **E.ES.07.73** Explain how the temperature of the oceans affects the different climates on Earth because water in the oceans holds a large amount of heat. **E.ES.07.74** Describe weather conditions associated with frontal boundaries (cold, warm, stationary, and occluded) and the movement of major air masses and the jet stream across North America using a weather map. ***E.ES.M.8 Water Cycle- Water circulates***

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			through the four spheres of the Earth in what is known as the "water cycle." **E.ES.07.81** Explain the water cycle and describe how evaporation, transpiration, condensation, cloud formation, precipitation, infiltration, surface runoff, ground water, and absorption occur within the cycle. **E.ES.07.82** Analyze the flow of water between the components of a watershed, including surface features (lakes, streams, rivers, wetlands) and groundwater.