**Lab-Aids Correlations for**
**Minnesota Academic Standards in Science**
**Middle Level – Grades 6-8**

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This document is intended to show how the SEPUP 3rd edition materials align with the *Minnesota Academic Standards in Science*.

ABOUT OUR PROGRAMS

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SEPUP

Materials from the Science Education for Public Understanding Program (SEPUP) are developed at the Lawrence Hall of Science, at the University of California, Berkeley, and distributed nationally by LAB- AIDS, Inc. Since 1987, development of SEPUP materials has been supported by grants from the National Science Foundation and other public and private sources. SEPUP programs include student books, equipment kits, teacher materials, and online digital content, and are available as full year courses, or separately, as units, each taking 3-8 weeks to complete, as listed below.

MIDDLE LEVEL, GRADES 6-8

| **Earth Science** | **Life Science** | **Physical Science** |
|---|---|---|
| Earth's Resources | Biomedical Engineering | Chemistry of Materials |
| Geological Processes | Body Systems | Chemical Reactions |
| Land, Water, and Human Interactions | Ecology | Energy |
| Solar System and Beyond | From Cells to Organisms | Force and Motion |
| Weather and Climate | Evolution | Fields and Interactions |
| | Reproduction | Waves |

*Citations included in the correlation document are as follows:*
Unit title: Activity Number
*The Chemistry of Materials: 14*
*Indicates where the Benchmark is assessed

## ISSUES AND SCIENCE UNITS

| Grade | Strand | Sub-strand | Standard | Content Area | Benchmark | Lab-Aids |
|---|---|---|---|---|---|---|
| 6 | 1 Exploring phenomena or engineering problems | 1.1 Asking questions and defining problems | 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read. | ESS: Earth's Place in the Universe | 6E.1.1.1.1 Ask questions that arise from observations of patterns in the movement of night sky objects to test the limitations of a solar system model. (P: 1, CC: 1, CI: ESS1) *Emphasis is on students questioning the limitations of their own models and questioning the kinds of revisions needed to account for new data. Examples of observations may include the student's own observations or observations made by others. Examples of night sky objects include the Moon, constellations, and planets.* | Solar System and Beyond: 2, 3, 4, 5, 11, 12 |
| 6 | 1 Exploring phenomena or engineering problems | 1.1 Asking questions and defining problems | 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read. | ESS: Earth's Systems and Processes | 6E.1.1.1.2 Ask questions to examine an interpretation about the relative ages of different rock layers within a sequence of several rock layers. (P: 1, CC: 1, CI: ESS1) *Emphasis is on the interpretation of rock layers using geologic principles like superposition and cross-cutting relationships.* | *Evolution:* 9, 12<br><br>*Earth's Resources:* 8, 9, 11, 12 |

| Grade | Strand | Sub-strand | Standard | Content Area | Benchmark | Lab-Aids |
|---|---|---|---|---|---|---|
| 6 | 1 Exploring phenomena or engineering problems | 1.1 Asking questions and defining problems | 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read. | ESS: Human Impacts and Sustainability in Earth's Systems | 6E.1.1.1.3 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. (P: 1, CC: 7, CI: ESS3) *Emphasis is on the major role that human activities play in causing the rise in global temperatures. Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities.* | *Weather and Climate: 1, 14, 15, 16** |
| 6 | 1 Exploring phenomena or engineering problems | 1.2 Planning and carrying out investigations | 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena. | ESS: Weather and Climate | 6E.1.2.1.1 Collect data and use digital data analysis tools to identify patterns to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.** (P: 3, CC: 2, CI: ESS2) *Emphasis is on how weather at a fixed location changes in response to moving air masses and to interactions at frontal boundaries between air masses. Examples of weather data may include temperature, air pressure, precipitation, and wind. Examples of data analysis may include weather maps, diagrams, and visualizations or may be obtained through laboratory* | *Weather and Climate:*11, 12, 13* |

| Grade | Strand | Sub-strand | Standard | Content Area | Benchmark | Lab-Aids |
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| | | | | | *experiments (such as with condensation).* | |
| 6 | 2 Looking at data and empirical evidence to understand phenomena or solve problems | 2.1 Analyzing and interpreting data | 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables. | ESS: Earth's Place in the Universe | 6E.2.1.1.1 Analyze and interpret data to determine similarities and differences among features and processes occurring on solar system objects. (P: 4, CC: 3, CI: ESS1) *Examples of objects may include moons, planets, comets or asteroids. Example features may include characteristics of an object's atmosphere, surface or interior. Examples of processes may include erosion, deposition, cratering, or volcanism.* | Solar System and Beyond: 10, 12, 13* |
| 6 | 2 Looking at data and empirical evidence to understand phenomena or solve problems | 2.1 Analyzing and interpreting data | 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables. | ESS: Earth's Systems and Processes | 6E.2.1.1.2 Analyze and interpret data on the distribution of fossils, rocks, continental shapes, and seafloor structures to provide evidence of past plate motions. (P: 4, CC: 1, CI: ESS2) *Examples of data may include similarities of rock and fossil types on different continents, the shapes of the continents (including the continental shelves), and the locations of ocean floor features such as ridges and trenches.* | *Geological Processes:* 10, 11, 12, 13, 14* |
| 6 | 2 Looking at data and empirical evidence to understand phenomena or solve problems | 2.1 Analyzing and interpreting data | 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible | ESS: Human Impacts and Sustainability in Earth's Systems | 6E.2.1.1.3 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.* (P: 4, CC: 1, CI: ESS3, ETS1) *Examples of natural hazards may be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis),* | *Geological Processes*: 1, 3, 4, 6, 7, 8, 11, 18* |

| Grade | Strand | Sub-strand | Standard | Content Area | Benchmark | Lab-Aids |
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| | | | relationships between variables. | | *or severe weather events. Examples of data may include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies may include building tornado shelters or barriers to protect from flooding.* | |
| 6 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.1 Developing and using models | 3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions and/or explanations, and communicate ideas to others. | ESS: Earth's Place in the Universe | 6E.3.1.1.1 Develop and use scale models of solar system objects to describe the sizes of objects, the location of objects, and the motion of the objects; and include the role that gravity and inertia play in controlling that motion. (P: 2, CC: 3, CI: ESS1) *Emphasis is on the regularity of the motion and accounting for Earth-based visual observations of the motion of these objects in our sky. Emphasis is also on recognizing the limitations of any of the models. Examples may include physical models (such as the analogy of distance along a football field or computer visualizations of orbits) or conceptual models (such as mathematical proportions relative to the size of familiar objects such as students' school or state). Not included are Kepler's Laws and retrograde motion of planets.* | Solar System and Beyond: 10, 11, 12, 14, 15, 16* |

| Grade | Strand | Sub-strand | Standard | Content Area | Benchmark | Lab-Aids |
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| 6 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.1 Developing and using models | 3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions and/or explanations, and communicate ideas to others. | Earth's Systems and Processes | 6E.3.1.1.2 Develop a model, based on observational evidence, to describe the cycling and movement of Earth's rock material and the energy that drives these processes. (P: 2, CC: 5, CI: ESS2) *Emphasis of the practice is on using observations of processes like weathering and erosion of soil and rock, deposition of sediment, and crystallization of lava to inform model development. Emphasis of the core idea is on how these processes operate over geologic time to form rocks and minerals through the cycling of Earth's materials. Examples of models may be conceptual or physical.* | *Geological Processes*: 2, 5, 8, 9, 10, 11, 13, 14, 15* |
| 6 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.1 Developing and using models | 3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions and/or explanations, and communicate ideas to others. | ESS: Earth's Systems and Processes | 6E.3.1.1.3 Develop a model, based on observational and experimental evidence, to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. (P: 2, CC: 5, CI: ESS2) *Emphasis of the practice is on developing a way to represent the mechanisms of water changing state, the global movements of water and energy, and on how the observational and experimental evidence supports the model. Examples of models may be conceptual or physical.* | *Land, Water, and Human Interactions:* 2, 5, 7, 8, 9* |

| Grade | Strand | Sub-strand | Standard | Content Area | Benchmark | Lab-Aids |
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| 6 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.2 Constructing explanations and designing solutions | 3.2.1 Students will be able to apply scientific principles and empirical evidence (primary or secondary) to explain the causes of phenomena or identify weaknesses in explanations developed by the students or others. | ESS: Earth's Systems and Processes | 6E.3.2.1.1 Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. (P: 6, CC: 3, CI: ESS1) *Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of major events may include the evolution or extinction of particular organisms, the formation of mountain chains and the formation of ocean basins. Not included is using radioactive decay to age date rocks.* | *Earth's Resources*: 9, 10, 11, 12* |
| 6 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.2 Constructing explanations and designing solutions | 3.2.1 Students will be able to apply scientific principles and empirical evidence (primary or secondary) to explain the causes of phenomena or identify weaknesses in explanations developed by the students or others. | ESS: Earth's Systems and Processes | 6E.3.2.1.2 Construct a scientific explanation based on evidence for how the uneven distribution of Earth's mineral, energy, or groundwater resources is the result of past geological processes. (P: 6, CC: 2, CI: ESS3) *Emphasis is on how these resources are limited and typically non-renewable on a human timeframe. Examples of uneven distribution of resources may include petroleum (like in the North Dakota Bakken Shale), metal ores (like iron in the rocks of Minnesota's Iron Range), or groundwater in the different regions of Minnesota.* | *Geological Processes*: 2, 16, 17* |
| 6 | 3 Developing possible explanations of phenomena or designing | 3.2 Constructing explanations and designing solutions | 3.2.1 Students will be able to apply scientific principles and empirical evidence (primary or | ESS: Earth's Systems and Processes | 6E.3.2.1.3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.* (P: 6, CC: 2, CI: ESS3, ETS1) *Emphasis of the* | *Land, Water, and Human Interactions*: 2, 3, 4, 5, 6, 9, 13, 14, 15, 16* |

| Grade | Strand | Sub-strand | Standard | Content Area | Benchmark | Lab-Aids |
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| | solutions to engineering problems | | secondary) to explain the causes of phenomena or identify weaknesses in explanations developed by the students or others. | | *practice is on applying scientific principles about Earth's natural processes (like how water moves through the ground and air) to designing solutions to problems caused by human activity. Emphasis of the core idea is on how human activity impacts Earth's environments. Examples of parts of the design process may include assessing the kinds of solutions that are feasible, and designing and evaluating solutions that may reduce those impacts. Examples of human activities that impact the environment may include withdrawing too much water from aquifers, altering stream flow by building dams or levees, increasing runoff caused by impermeable surfaces like parking lots, or adding undesirable materials to the air, water or land.* | |
| 6 | 4 Communicating reasons, arguments and ideas to others | 4.1 Engaging in Argument from Evidence | 4.1.1 Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of | ESS: Earth's Systems and Processes | 6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales. (P: 7, CC: 3, CI: ESS2) *Emphasis is on how processes like erosion, deposition, mountain building, and volcanism affect the surface of Earth. Some processes, like mountain building take a long time. Other processes, like landslides, happen quickly. Examples may include how weathering, erosion and* | *Geological Processes*: 2, 3, 4, 6, 7, 9, 10, 11, 12, 13* |

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| | | | others, and present counter arguments. | | *glacial activity have shaped the surface of Minnesota.* | |
| 6 | 4 Communicating reasons, arguments and ideas to others | 4.2 Obtaining, evaluating and communicating information | 4.2.2 Students will be able to gather information about and communicate the methods that are used by various cultures, especially those of Minnesota American Indian Tribes and communities, to develop explanations of phenomena and design solutions to problems. | ESS: Earth's Place in the Universe | 6E.4.2.2.1 Communicate how a series of models, including those used by Minnesota American Indian Tribes and communities and other cultures, are used to explain how motion in the Earth-Sun-Moon system causes the cyclic patterns of lunar phases, eclipses and seasons. (P: 8, CC: 1, CI: ESS1) *Examples of cultures may include those within the local context of the learning community and within the context of Minnesota. Emphasis is on students questioning the limitations of their models and revising them to account for new observations. Models may be physical, graphical or conceptual.* | *Solar System and Beyond*: 2, 3, 4, 5, 6, 7, 9*<br><br>This standard is partially covered. A Western explanation is provided, but not a Native one. |
| 7 | 1 Exploring phenomena or engineering problems | 1.1 Asking questions and defining problems | 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read. | LS: Heredity: inheritance and Variation of Traits | 7L.1.1.1.1 Ask questions about the processes and outcomes of various methods of communication between cells of multicellular organisms. (P: 1, CC: 6, CI: LS1) *Examples of questions about processes and outcomes may include questions about disruptions to normal communication processes in the human body, such as in cancer, diabetes, paralysis, or other disorders.* | Reproduction: 1<br><br>From Cells to Organisms: 1, 10, 15 |
| 7 | 1 Exploring phenomena or engineering problems | 1.1 Asking questions and defining problems | 1.1.1 Students will be able to ask questions about aspects of the phenomena they | LS: Heredity: inheritance and Variation of Traits | 7L.1.1.1.2 Ask questions that arise from careful observations of phenomena or models to clarify and or seek additional information about how changes in genes can affect | *Evolution*: 3, 5, 6, 7, 16<br><br>*Reproduction*: 1, 8, 12, 13 |

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| | | | observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read. | | organisms. (P: 1, CC: 6, CI: LS3) *Examples of changes may include neutral, harmful, or beneficial effects to the structure and function of the organism.* | |
| 7 | 1 Exploring phenomena or engineering problems | 1.2 Planning and carrying out investigations | 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena. | LS: From Molecules to Organisms: Structures and Processes | 7L.1.2.1.1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. (P: 3, CC: 3, CI: LS1) *Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or of many and varied cells.* | *From Cells to Organisms*: 1, 2, 3, 4, 5, 6, 7, 8, 9* |

| Grade | Strand | Sub-strand | Standard | Content Area | Benchmark | Lab-Aids |
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| 7 | 2 Looking at data and empirical evidence to understand phenomena or solve problems | 2.1 Analyzing and interpreting data | 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables. | LS: Ecosystems: Interactions, Energy, and Dynamics | 7L.2.1.1.1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.** (P: 4, CC: 2, CI: LS2) *Emphasis is on cause and effect relationships between resources and growth of individual organisms and the number or organisms in ecosystems during periods of abundant and scarce resources. Examples may include populations of MN deer, moose, wolf, scavengers or aquatic populations in Lake Superior or algal blooms in lakes and ponds. Examples of evidence may include the use of flow charts to organize and sequence the algorithm, and to show relationships.* | *Ecology*: 1, 2, 5, 6, 7, 8, 9* |
| 7 | 2 Looking at data and empirical evidence to understand phenomena or solve problems | 2.1 Analyzing and interpreting data | 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables. | LS: Evolution: Unity and Diversity | 7L.2.1.1.2 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth. (P: 4, CC: 1, CI: LS4) *Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.* | *Evolution*: 7, 8, 9, 10 11* |
| 7 | 2 Looking at data and empirical evidence to understand phenomena or solve problems | 2.1 Analyzing and interpreting data | 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those | LS: Evolution: Unity and Diversity | 7L.2.1.1.3 Analyze visual data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.** (P: 4, CC: 1, CI: LS4) *Emphasis is on inferring general* | *Evolution*: 12, 13* |

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| | | | patterns, and possible relationships between variables. | | *patterns of relatedness among embryos of different organisms by comparing their macroscopic appearances on diagrams or pictures.* | |
| 7 | 2 Looking at data and empirical evidence to understand phenomena or solve problems | 2.2 Using mathematics and computational thinking | 2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds. | LS: Evolution: Unity and Diversity | 7L.2.2.1.1 Use an algorithm to explain how natural selection may lead to increases and decreases of specific traits in populations.** (P: 5, CC: 2, CI: LS4) *Emphasis is on using proportional reasoning to develop mathematical models, probability statements, or simulations to support explanations of trends in changes to populations over time.* | *Evolution*: 1, 2, 3, 4, 5, 6*<br><br>This correlation works towards using an algorithm, but does not do it directly. |
| 7 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.1 Developing and using models | 3.1.1 Students will be able to develop, revise, and use models to represent their understanding of phenomena or systems as they develop questions, predictions and/or explanations and communicate ideas to others. | LS: From Molecules to Organisms: Structures and Processes | 7L.3.1.1.1 Develop and use a model to describe the function of a cell as a whole and describe the way cell parts contribute to the cell's function. (P: 2, CC: 6, CI: LS1) *Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.* | *From Cells to Organisms*: 4, 6, 7, 8* |
| 7 | 3 Developing possible explanations of phenomena or | 3.1 Developing and using models | 3.1.1 Students will be able to develop, revise, and use models to represent | LS: From Molecules to Organisms: | 7L.3.1.1.2 Develop and use a model to describe how food is rearranged through chemical reactions forming new molecules that support growth | *From Cells to Organisms*: 5, 11* *Body* |

| Grade | Strand | Sub-strand | Standard | Content Area | Benchmark | Lab-Aids |
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| | designing solutions to engineering problems | | their understanding of phenomena or systems as they develop questions, predictions and/or explanations and communicate ideas to others. | Structures and Processes | and/or release energy as this matter moves through an organism. (P: 2, CC: 5, CI: LS1) *Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released. Examples may include models of sugar breakdown into molecules of glucose that power our bodies, or protein breakdown into amino acids that are later reassembled to create body structures.* | *Systems*: 5 |
| 7 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.1 Developing and using models | 3.1.1 Students will be able to develop, revise, and use models to represent their understanding of phenomena or systems as they develop questions, predictions and/or explanations and communicate ideas to others. | LS: Ecosystems: Interactions, Energy, and Dynamics | 7L.3.1.1.3 Develop and use a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (P: 2, CC: 5, CI: LS2) *Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems.* | *Ecology*: 7, 8, 11, 12* |
| 7 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.1 Developing and using models | 3.1.1 Students will be able to develop, revise, and use models to represent their understanding of phenomena or systems as they develop questions, predictions and/or explanations and communicate ideas to others. | LS: Heredity: inheritance and Variation of Traits | 7L.3.1.1.4 Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. (P: 2, CC: 2, CI: LS3) *Emphasis is on using models, such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variations.* | *Reproduction*: 1, 2, 3, 4, 5, 6, 7, 8, 9* |

| Grade | Strand | Sub-strand | Standard | Content Area | Benchmark | Lab-Aids |
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| 7 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.2 Constructing explanations and designing solutions | 3.2.1 Students will be able to apply scientific principles and empirical evidence (primary or secondary) to construct causal explanations of phenomena or identify weaknesses in explanations developed by themselves or others. | LS: From Molecules to Organisms: Structures and Processes | 7L.3.2.1.1 Construct an explanation based on evidence for how environmental and genetic factors influence the growth of organisms and/or populations. (P: 6, CC: 2, CI: LS1, ETS2) *Examples of environmental factors may include local environmental conditions such as availability of food, light, space, and water. Examples of genetic factors may include large breed cattle and species of grass affecting growth of organisms. Examples of evidence may 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. Examples of human activity may include agricultural practices, phosphorus and nitrogen loading in lakes, hybridization and breeding practices.* | *Reproduction*: 1, 7* |
| 7 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.2 Constructing explanations and designing solutions | 3.2.1 Students will be able to apply scientific principles and empirical evidence (primary or secondary) to construct causal explanations of phenomena or identify weaknesses in explanations developed by | LS: From Molecules to Organisms: Structures and Processes | 7L.3.2.1.2 Construct an explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. (P: 6, CC: 2, CI: LS1) *Emphasis of the core idea is on plants and algae using energy from light to make sugars (food for themselves and as an energy source for other organisms) from carbon dioxide (from air) and water; and in the process release oxygen.* | *From Cells to Organisms*: 12, 13* |

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| | | | themselves or others. | | | |
| 7 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.2 Constructing explanations and designing solutions | 3.2.1 Students will be able to apply scientific principles and empirical evidence (primary or secondary) to construct causal explanations of phenomena or identify weaknesses in explanations developed by themselves or others. | LS: Evolution: Unity and Diversity | 7L.3.2.1.3 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. (P: 6, CC: 1, CI: LS4) *Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity of differences of the gross appearance of anatomical structures.* | *Evolution*: 7, 8, 9, 10 11, 12* |
| 7 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.2 Constructing explanations and designing solutions | 3.2.1 Students will be able to apply scientific principles and empirical evidence (primary or secondary) to construct causal explanations of phenomena or identify weaknesses in explanations developed by themselves or others. | LS: Evolution: Unity and Diversity | 7L.3.2.1.4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. (P: 6, CC: 2, CI: LS4) *Emphasis is on using simple probability statements and proportional reasoning to construct explanations.* | *Evolution*: 1, 2, 3, 4* |
| 7 | 4 Communicating reasons, arguments and ideas to others | 4.1 Arguing from evidence | 4.1.1 Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise | LS: From Molecules to Organisms: Structures and Processes | 7L.4.1.1.1 Support or refute an explanation by arguing from evidence for how the body is a system of interacting subsystems composed of groups of cells. (P: 7, CC: 4, CI: LS1) *Emphasis is on the conceptual understanding that cells* | *From Cells to Organisms*: 10, 14, 15 |

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| | | | their interpretations when presented with new evidence, critically evaluate the scientific arguments of others, and present counter arguments. | | *form tissues and tissues form organs specialized for particular body functions. Examples may include arguments that deal with the interaction of subsystems within a system and the normal functioning of those systems.* | |
| 7 | 4 Communicating reasons, arguments and ideas to others | 4.1 Arguing from evidence | 4.1.1 Students will be able to engage in argument from evidence for the explanations they construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of others, and present counter arguments. | LS: From Molecules to Organisms: Structures and Processes | 7L.4.1.1.2 Support or refute an explanation by arguing from evidence and scientific reasoning for how animal behavior and plant structures affect the probability of successful reproduction. (P: 7, CC: 2, CI: LS1) *Examples of behaviors that affect the probability of animal reproduction may include nest building to protect young, herding of animals to protect young from predators, and vocalization and/or colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction may include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures may include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.* | *Reproduction*: 10*, 11* |
| 7 | 4 Communicating reasons, | 4.1 Arguing from evidence | 4.1.2 Students will be able to argue from evidence to justify the best | LS: Ecosystems: Interactions, | 7L.4.1.2.1 Construct an argument supported by empirical evidence that changes in physical or biological components of an ecosystem affect | *Ecology*: 1, 2, 3, 4, 5, 6, 12, 13, 14* |

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| | arguments and ideas to others | | solution to a problem or to compare and evaluate competing designs, ideas, or methods.* | Energy, and Dynamics | populations.* (P: 7, CC: 7, CI: LS2) *Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes and/or impacts to ecosystems. Examples of physical components may include human-built structures like urban developments, or dams.* | |
| 7 | 4 Communicating reasons, arguments and ideas to others | 4.1 Arguing from evidence | 4.1.2 Students will be able to argue from evidence to justify the best solution to a problem or to compare and evaluate competing designs, ideas, or methods.* | LS: Ecosystems: Interactions, Energy, and Dynamics | 7L.4.1.2.2 Evaluate competing design solutions for maintaining biodiversity or ecosystem services.* (P: 7, CC: 2, CI: LS2, ETS2) *Emphasis is on evaluating a solution that reduces environmental harm while still benefiting humans. Examples of ecosystem services (natural processes within ecosystems that humans also benefit from) may include water purification as it cycles through Earth's systems, nutrient recycling, climate stabilization, decomposition of wastes, and pollination. Examples of design solution constraints may include scientific, economic, and social considerations.* | *Ecology*: 2, 3, 4, 5, 13, 14, 15* |
| 7 | 4 Communicating reasons, arguments and ideas to others | 4.2 Obtaining, evaluating and communicating information | 4.2.2 Students will be able to gather information about and communicate the methods that are used by various cultures, especially those of Minnesota American Indian | LS: Ecosystems: Interactions, Energy, and Dynamics | 7L.4.2.2.1 Gather multiple sources of information and communicate how Minnesota American Indian Tribes and communities and other cultures use knowledge to predict or interpret patterns of interactions among organisms across multiple ecosystems. (P: 8, CC: 1, CI: LS2, ETS2) *Examples of cultures may* | *Ecology*: 2, 6, 7, 8, 10*<br><br>This standard is partially covered. A Western explanation is provided, but not a Native one. |

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| | | | Tribes and communities, to develop explanations of phenomena and design solutions to problems. | | *include those within the local context of the learning community and within the context of Minnesota. Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions may include competition, predation and mutualisms.* | |
| 8 | 1 Exploring phenomena or engineering problems | 1.1 Asking questions and defining problems | 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read. | PS: Matter and its Interactions | 8P.1.1.1.1 Ask questions about locations of common elements on the periodic table to note patterns in the properties of similarly grouped elements. (P: 1, CC: 1, CI: PS1) *Emphasis is on the similar properties within columns of the periodic table. Examples of questions that students may think to ask may include how are the properties of elements in a column similar and different.* | *Chemistry of Materials*: 2, 2 extension |
| 8 | 1 Exploring phenomena or engineering problems | 1.1 Asking questions and defining problems | 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read. | PS: Motion and Stability: Forces and Interactions | 8P.1.1.1.2 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. (P: 1, CC: 2, CI: PS2) *Examples of data may include the number of turns of wire in a coil, the strength of magnets, and the current through the wire and their effect on the speed of rotation in a simple motor.* | *Fields and Interactions*: 7, 8, 9, 12, 13* |

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| 8 | 1 Exploring phenomena or engineering problems | 1.2 Planning and carrying out investigations | 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena. | PS: Matter and its Interactions | 8P.1.2.1.1 Plan and conduct an investigation of changes in pure substances when thermal energy is added or removed and relate those changes to particle motion. (P: 3, CC: 2, CI: PS1) *Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs.* | *Chemistry of Materials*: 8, 9, 10* |
| 8 | 1 Exploring phenomena or engineering problems | 1.2 Planning and carrying out investigations | 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena. | PS: Motion and Stability: Forces and Interactions | 8P.1.2.1.2 Plan and conduct an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. (P: 3, CC: 7, CI: PS2) *Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.* | *Force and Motion:* 1, 6, 7, 8, 9, 13* |

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| 8 | 1 Exploring phenomena or engineering problems | 1.2 Planning and carrying out investigations | 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena. | PS: Motion and Stability: Forces and Interactions | 8P.1.2.1.3 Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. (P: 3, CC: 2, CI: PS2) *Examples of this phenomenon may include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations may include first-hand experiences or simulations.* | *Fields and Interactions*: 5, 7, 9, 10, 12* |
| 8 | 1 Exploring phenomena or engineering problems | 1.2 Planning and carrying out investigations | 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena. | PS: Energy | 8P.1.2.1.4 Plan and conduct an investigation to determine how the temperature of a substance is affected by the transfer of energy, the amount of mass, and the type of matter. (P: 3, CC: 2, CI: PS 3) *Emphasis is on conceptualizing temperature as the average kinetic energy of a substance's particles. Examples of investigations may include comparing final water temperatures after different masses of ice melt in equal volumes of water with the same initial temperature, and temperature changes of different materials with the same mass as they heat or cool in the environment.* | *Energy*: 1, 4, 6, 7, 8* |

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| 8 | 2 Looking at data and empirical evidence to understand phenomena or solve problems | 2.1 Analyzing and interpreting data | 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables. | PS: Matter and its Interactions | 8P.2.1.1.1 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (P: 4, CC: 1, CI: PS1) *Examples of reactions may include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride. Examples of properties may include density, melting point, boiling point, solubility, flammability, and odor.* | *Chemical Reactions*: 1, 2, 3, 4, 5* |
| 8 | 2 Looking at data and empirical evidence to understand phenomena or solve problems | 2.1 Analyzing and interpreting data | 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables. | PS: Energy | 8P.2.1.1.2 Construct and interpret graphical displays of data to describe the relationship of kinetic energy to the mass and speed of an object. (P: 4, CC: 3, CI: PS3) *Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples may include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a Wiffle ball versus a tennis ball.* | *Force and Motion*: 1, 2, 3, 4, 5* |
| 8 | 2 Looking at data and empirical evidence to understand phenomena or solve problems | 2.2 Using mathematics and computational thinking | 2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in | PS: Waves and their Applications | 8P.2.2.1.1 Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. (P: 5, CC: 1, CI: PS4) *Emphasis is on describing waves (standard repeating waves) with both qualitative and quantitative thinking. Not included is electromagnetic waves.* | *Waves*: 1, 2, 3, 4, 7* |

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| | | | computational thinking as they use or develop algorithms to describe the natural or designed worlds. | | | |
| 8 | 2 Looking at data and empirical evidence to understand phenomena or solve problems | 2.2 Using mathematics and computational thinking | 2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds. | PS: Energy | 8P.2.2.1.2 Create a computer program to illustrate the transfer of energy within a system where energy changes form.** (P: 5, CC: 7, CI: PS3) *Emphasis of the programming skills is the use of sequences, events and conditionals. Examples of a system may include a roller coaster, a pendulum, an electric water heater, and a solar electric collector.* | *Energy*: 13<br><br>This correlation is working towards creating a computer program, but the activity does not make the students develop one. |
| 8 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.1 Developing and using models | 3.1.1 Students will be able to develop, revise, and use models to represent their understanding of phenomena or systems as they develop questions, predictions and/or explanations and communicate ideas to others. | PS: Matter and its Interactions | 8P.3.1.1.1 Develop models to describe the atomic composition of simple molecules and crystals. (P: 2, CC: 3, CI: PS1) *Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules may include ammonia and methane. Examples of crystal structures may include sodium chloride or quartz, pyrite or diamonds. Does not include valence electrons and bonding energy, discussing the ionic nature of* | *Chemistry of Materials*: 2, 6, 7, 11, 12* |

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| | | | | | *subunits of complex structures, or a complete description of all individual atoms in a complex molecule or crystal structure.* | |
| 8 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.1 Developing and using models | 3.1.1 Students will be able to develop, revise, and use models to represent their understanding of phenomena or systems as they develop questions, predictions and/or explanations and communicate ideas to others. | PS: Matter and its Interactions | 8P.3.1.1.2 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. (P: 2, CC: 5, CI: PS1) *Emphasis is on the law of conservation of matter. Examples of models may include physical models, digital formats, or drawings, which represent atoms. Not included are atomic masses, balancing symbolic equations, or intermolecular forces.* | *Chemical Reactions*: 1, 2, 3, 4, 5, 6, 7* |
| 8 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.1 Developing and using models | 3.1.1 Students will be able to develop, revise, and use models to represent their understanding of phenomena or systems as they develop questions, predictions and/or explanations and communicate ideas to others. | PS: Energy | 8P.3.1.1.3 Develop and revise a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. (P: 2, CC: 5, CI: PS3) *Emphasis is on relative amounts potential energy and not on calculations of potential energy. Examples of objects within systems interacting at varying distances may include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models may include representations,* | *Fields and Interactions*: 3, 4, 6, 7, 10, 11* |

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| | | | | | *diagrams, pictures, and written descriptions of systems.* | |
| 8 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.1 Developing and using models | 3.1.1 Students will be able to develop, revise, and use models to represent their understanding of phenomena or systems as they develop questions, predictions and/or explanations and communicate ideas to others. | PS: Waves and their Applications | 8P.3.1.1.4 Develop and use a model to qualitatively describe that waves are reflected, absorbed, or transmitted through various materials. (P: 2, CC: 4, CI: PS4) *Emphasis is on both light and mechanical waves. Examples of models may include drawings, simulations, a storyboard/diagram and written descriptions.* | *Waves*: 3, 8, 9, 10, 11, 12, 13* |
| 8 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.2 Constructing explanations and designing solutions | 3.2.1 Students will be able to apply scientific principles and empirical evidence (primary or secondary) to explain the causes of phenomena or identify weaknesses in explanations developed by the students or others. | PS: Matter and its Interactions | 8P.3.2.1.1 Construct an explanation based on evidence and scientific principles of a common phenomenon that can be explained by the motions of molecules. (P: 6, CC: 3, CI: PS1) *Emphasis of the core idea is that the movement of small particles (atoms or molecules) can explain the behavior of macroscopic phenomena. Examples of phenomena may include expansion of balloons, diffusion of odors, and pressure changes in gases due to heating and cooling.* | *Chemistry of Materials*: 9 (AI #1) |
| 8 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.2 Constructing explanations and designing solutions | 3.2.2 Students will be able to use their understanding of scientific principles and the engineering design process to design solutions that meet established criteria and constraints.* | PS: Matter and its Interactions | 8P.3.2.2.1 Construct, test and modify a device that either releases or absorbs thermal energy by chemical processes.* (P: 6, CC: 5, CI: PS1, ETS1) *Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of chemical reactions* | *Chemical Reactions*: 2, 3, 5, 8, 9, 10, 11* |

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| | | | | | *include dissolving ammonium chloride or calcium chloride in water.* | |
| 8 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.2 Constructing explanations and designing solutions | 3.2.2 Students will be able to use their understanding of scientific principles and the engineering design process to design solutions that meet established criteria and constraints.* | PS: Motion and Stability: Forces and Interactions | 8P.3.2.2.2 Design a solution to a problem involving the motion of two colliding objects using Newton's 3rd Law.* (P: 6, CC: 4, CI: PS2, ETS1) *Examples of practical problems may include the impact of one dimensional collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.* | *Force and Motion*: 1, 10, 11, 12* |
| 8 | 3 Developing possible explanations of phenomena or designing solutions to engineering problems | 3.2 Constructing explanations and designing solutions | 3.2.2 Students will be able to use their understanding of scientific principles and the engineering design process to design solutions that meet established criteria and constraints.* | PS: Energy | 8P.3.2.2.3 Design, construct, and test a device that either minimizes or maximizes thermal energy transfer.* (P: 6, CC: 5, CI: PS3, ETS1) *Emphasis is on using scientific principles to design the device. Examples of devices may include an insulated box, a solar cooker, and a foam cup.* | *Energy*: 1, 7, 8, 9, 10, 11, 12, 13* |
| 8 | 4 Communicating reasons, arguments and ideas to others | 4.1 Arguing from evidence | 4.1.1 Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of | PS: Motion and Stability: Forces and Interactions | 8P.4.1.1.1 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. (P: 7, CC: 3, CI: PS2) *Examples of evidence for arguments may include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system. Not included are* | *Fields and Interactions*: 3, 4, 7* |

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| | | | others, and present counter arguments. | | *Newton's Law of Gravitation or Kepler's Laws.* | |
| 8 | 4 Communicating reasons, arguments and ideas to others | 4.1 Arguing from evidence | 4.1.1 Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of others, and present counter arguments. | PS: Motion and Stability: Forces and Interactions | 8P.4.1.1.2 Compare and evaluate evidence to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. (P: 7, CC: 5, CI: PS3) *Examples of empirical evidence used in the students' arguments may include the temperature or motion of an object before and after an energy transfer.* | *Energy*: 2, 3, 4, 5, 6* |
| 8 | 4 Communicating reasons, arguments and ideas to others | 4.2 Obtaining, evaluating and communicating information | 4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats. | PS: Matter and its Interactions | 8P.4.2.1.1 Gather and evaluate information from multiple sources to describe that synthetic materials come from natural resources and impact society. (P: 8, CC: 6, CI: PS1) *Emphasis of the practice is to synthesize information from multiple appropriate sources and assess the credibility, accuracy and possible bias of each publication. Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials may include plastic, medicines, foods, and alternative fuels.* | *Chemistry of Materials*: 1, 2, 3, 4, 5, 11, 12, 13* |

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| 8 | 4 Communicating reasons, arguments and ideas to others | 4.2 Obtaining, evaluating and communicating information | 4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats. | PS: Waves and their Applications | 8P.4.2.1.2 Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.** (P: 8, CC: 6, CI: PS4) *Emphasis of the practice is on using information to support and clarify claims. Emphasis of the core idea is on understanding that waves (encoded both analog and digitally) can be used for communication purposes. Examples of encoding and transmitting information may include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.* | *Waves*: 5, 6 |