Glendale Elementary School District

Science Pacing Guide

2020-2021

8th Grade

Focus on Cause and Effect; Energy and Matter; Stability and Change

By the end of eighth grade, students will describe how stability and change and the process of cause and effect influence changes in the natural world. Students will apply energy principles to chemical reactions, explore changes within Earth and understand how genetic information is passed down to produce variation among the populations. Student investigations focus on collecting and making sense of observational data and measurements using the science and engineering practices: ask questions and define problems, develop and use models, plan and carry out investigations, analyze and interpret data, use mathematics and computational thinking, construct explanations and design solutions, engage in argument from evidence, and obtain, evaluate, and communicate information. While individual lessons may include connections to any of the crosscutting concepts, the standards in eighth-grade focus on helping students understand phenomena through cause and effect, energy and matter, and stability and change.

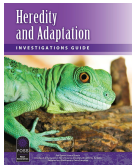
Text Resources shared with 6th - 8th:

McDougal-Littell 2006 Series:

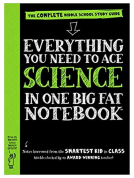
Also: www.classzone.com Click Science (middle school), click state of Az, Click GO (find book). Click on Science Modules and you will have the book series, rubrics, assessments. *Note: It is important to read and review the Chapter Openers in each curriculum book titled, "Big Idea and Big Concepts. Vocabulary will be bolded in this area and throughout each chapter.*

Worldbook

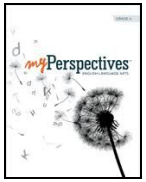
FOSS Kit: Heredity and Adaptations



Science Notebook



My Perspectives



Core Ideas for Knowing Science:

Physical Science

- P1: All matter in the Universe is made of very small particles.
- P2: Objects can affect other objects at a distance.
- P3: Changing the movement of an object requires a net force to be acting on it.
- P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event.

Earth and Space Science

- E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate.
- E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.

Life Science

- L1: Organisms are organized on a cellular basis and have a finite life span.
- L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.
- L3: Genetic information is passed down from one generation of organisms to another.
- L4: The unity and diversity of organisms, living and extinct, is the result of evolution

Core Ideas for using Science:

- U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.
- U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products.
- U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.

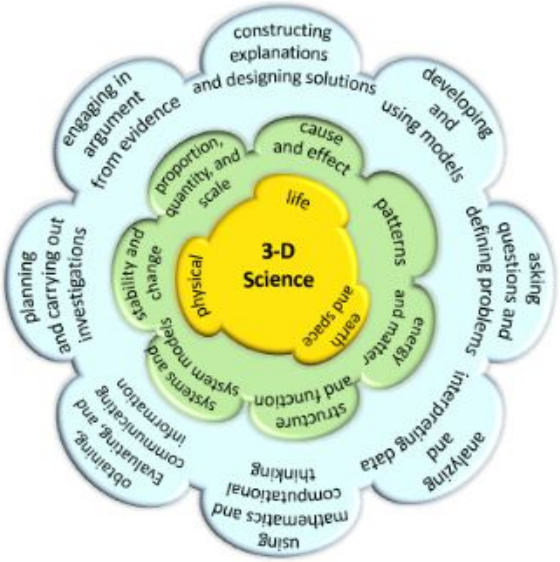
Science and Engineering Practices:

- ask questions and define problems
- develop and use models
- plan and carry out investigations
- analyze and interpret data
- use mathematics and computational thinking
- construct explanations and design solutions
- engage in argument for evidence
- obtain, evaluate, and communicate information

Crosscutting Concepts:

- **Patterns**
- **Cause and Effect**
- **Scale, Proportion, and Quantity**
- Systems and System Models
- Energy and Matter
- Structure and Function
- Stability and Change

Bold concepts are a focus for this grade level. Go to http://bit.ly/CrossCutk8 for detailed information about crosscutting concepts.



Year Snapshot -Units by Quarters			
QUARTER 1 **Heredity & Evolution** 8.L3U1.9 8.L4U1.11 8.L4U1.12 8.E1U1.8 6.L2U1.13 8.E1U1.6 8.L3U3.10	**QUARTER 2** **Physics** 7.P3U1.4 8.S5.C2. PO 5 (2004 standards) 8.P4U1.3 8.P4U1.4 8.P4U2.5	**QUARTER 3** **Chemistry** 8.P1U1.1 8.P1U1.2 6.P1U1.1 6.P1U1.3	**QUARTER 4** **Knowledge Application** Application of grade level standards to science projects. Review of Heredity & Evolution
Black Standards – grade level standards Blue Standards – transitional standards to be taught during 2020-2021 school year for last AIMS test			

Disciplinary Literacy in Science

Disciplinary literacy in science focuses on how reading, writing, speaking, and listening are used to develop sense-making in science. It emphasizes the content knowledge, experiences and skills, and the ability to acquire new knowledge that experts within science disciplines use to apply and generate new knowledge.

Standard	ELA	Rationale
These ELA standards help students gather and analyze sources and information (evidence from text) that can be used to support their reasoning as they develop conceptual understanding of science phenomena. Being able to read and interpret scientific and technical text is a fundamental practice of science and engineering.	RI.1 RI.2 RI.3	Key Ideas and Details standards can be applied to help students: • Find answers to relevant science questions or problems. • Understand and follow a written lab protocol, scientific process or procedure. • Connect new understandings with background knowledge. • Determine which information is important to answering scientific questions. • Pay attention to details, accuracy, and precision when reading/collecting data from scientific instruments. • Interpret diagrams, pictures, charts, graphs, and data to gather information. • Interpret and evaluate quality and quantity of data, evidence, and scientific reasoning. • Determine the credibility of information
These ELA standards help students navigate the norms and conventions of complex science text. Scientific and technical text often contains a variety of text structures, visual representations, and vocabulary that has a very specific meaning across science disciplines (theory) or within a single discipline (precipitation in weather vs. precipitation in chemical reactions).	RI.4 RI.5 RI.6	Craft and Structure standards can be applied to help students: • Use strategies (context clues, linguistic roots and affixes, restatement, examples, contrast, glossary, etc.) to determine the meaning of words and phrases in the text. • Use context to determine meanings of words and differentiate how vocabulary may be used differently in a science context compared to non-science contexts. • Identify structures within a text (headings, sub-headings, bold words, pictures, graphs, data tables, and paragraphs) and explain how they support or supplement information in the paragraph text. • Explain how key terms relate to each other or to broader science concepts and general understanding. • Use information to answer questions and support reasoning and conclusions. • Make meaning out of mathematical symbols and equations; diagrams, flow charts and other visual representations; and abstract ideas.
These ELA standards help students integrate and synthesize scientific knowledge and ideas when obtaining, evaluating, and communicating information. Students integrate information to	RI.7 RI.8 RI.9	Integration of Knowledge and Ideas standards can be applied to help students: • Extract information from multiple sources and text types; synthesize information to create an understanding that aligns to current scientific explanations and understanding. • Compare multiple representations of information (quantitative data, video, multimedia, articles, books, photographs, infographics,

evaluate the merit, validity, and reliability of ideas, methods, claims, and designs. They use this knowledge to generate their own questions about scientific phenomena or to identify solutions to design problems.		diagrams, etc.) related to the same phenomenon or science concept and explain whether the representations convey similar levels of detail or whether the information supports or contradicts each other. • Interpret data and analyze relationships of variables, using words and visual information. • Accurately depict written or spoken words through a visual representation (graph, chart, picture, etc.); or vice versa. • Synthesize multiple sources of information to support an evaluation of scientific research or reports, their experimental design, data collection methods, analysis, or conclusions. • Identify an argument or claim by distinguishing among facts, research findings, inferences, speculation, and reasoning; determine whether the evidence is relevant and sufficient to support the claim.
This ELA standard requires that students engage with different lengths, structures, types, and complexities of science text, appropriate for their grade level. Reading science texts requires a set of discipline-specific skills and strategies. Science texts use scientific vocabulary and present information in multiple formats.	RI.10	Students in science classrooms often read at different levels of proficiency, and even the same student may read at different levels based on text structures or format. Teachers should understand the complexity of the text provided to students and implement appropriate strategies to support student conceptual understanding of science phenomena.
These ELA standards help students write in formats that are typically found in science contexts or may be specific for their content area. Typically, only formal science writing is written in passive/third person voice. It is critical that students know how to incorporate appropriate visual representations to support the scientific explanations and arguments they write.	W.1 W.2 W.3	Text Types and Purposes standards can be applied to help students: • Record thoughts, ideas, sketches, or collected data in science notebooks to be used as evidence or to support reasoning. • Write a claim, evidence-based argument, or explanation that includes logical reasoning, accurate science content, and relevant and sufficient evidence to support the claim. Claims are created with effective word choice, appropriate use of science vocabulary, and writing style. • Write formal or informal texts. The product may include field notes, mind maps, research papers, laboratory reports, functional text, or visual displays of data. • Produce science writing in a voice appropriate for the type of writing and the audience. Objective or academic voice in science is used when a writer wants to deliver information in a neutral, factual, and unbiased way. • Write step-by-step procedures for experiments that are detailed enough that others would be able to replicate their experiments exactly and achieve the same results. • Produce texts that include charts, graphs, timelines, photographs, videos, maps, flowcharts, diagrams, models, or tables to supplement or support the text.
These ELA standards help students develop scientific writing appropriate for task, purpose and audience.	W.4 W.5 W.6	Production and Distribution of Writing standards can be applied to help students: • Develop and strengthen writing; focus on purpose and audience. • Incorporate peer or adult feedback of drafts into writing; the writing process and review of drafts can be used for any writing assignments within the science classroom. • Use technology (Internet, keyboarding skills, formatting, storing) to create a published piece where information and ideas are connected and presented clearly and efficiently. • Use technology (blogs, wikis, smartboards, apps) to support collaborative brainstorming and writing. • Integrate graphs, data tables, drawings or illustrations, or other visual representations of information to support text.
These ELA standards help students synthesize multiple texts, observations, or experiments to answer questions, gather information, reason about the evidence, and communicate findings or conclusions. Final communication products typically follow a formal writing style (documenting or publishing procedures, investigation designs, explanations of models, and research) and are written in academic or passive/third person voice.	W.7 W.8 W.9	Research to Build and Present Knowledge standards can be applied to help students: • Conduct research projects or experimental investigations of differing lengths to provide enough information to construct claims, evidence, and explanations that answer scientific questions or solve a problem. • Integrate information from a variety of credible print and digital sources, taking care to use a consistent voice, avoid plagiarism, and appropriately cite resources in a standard recognized format in both the text and the bibliography. (APA style is most commonly used by scientists) • Use evidence from informational texts (e.g., data sets, credible websites, news articles, textbooks) to support claims, analyses, reflections, and/or research. • Convert informal writing in drafts while still synthesizing information and developing claims, to a formal academic voice when publishing formal writing of claims.

This ELA standard requires that students produce informal, formal, and persuasive scientific writing across multiple delivery formats and topics, for different purposes and audiences.	W.10	Implementation strategies for this standard are embedded in the previous writing examples. • Writing assignments should be of varying lengths (field or research notes, one paragraph responses, multiple paragraph essays, lab reports or presentations, extended research). • Scientific writing often includes pictures, diagrams, charts, thinking maps, data, or statistics; these can be integrated with text or presented with minimal text.
These ELA standards help students engage in scientific discourse to gather and evaluate information. Engaging in scientific discourse communities to collaborate and build comprehension is a fundamental practice of science and engineering.	SL.1 SL.2 SL.3	Comprehension and Collaboration standards can be applied to help students: • Initiate and participate effectively in a range of collaborative discussions (one-on-one, small groups, teacher-led, digitally) to express their own ideas clearly and build on others' ideas. • Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally), evaluating the credibility and accuracy of each source. • Collaboratively plan an investigation or test a design solution, controlling variables and ensuring the data is collected with appropriate tools and in a safe and ethical manner, including considerations of environmental, social, and personal impacts. • Collaboratively conduct investigations; evaluate the types, amounts, and accuracy of data needed to produce reliable measurements; consider limitations on the precision of the data (number of trials, cost, risk, time); and refine the design to meet the goals of the investigation.
These ELA standards help students engage in scientific discourse to informally share ideas and develop understanding of scientific phenomena and provide a formal way to present information appropriate to the audience and task. Engaging in scientific discourse communities to communicate understanding and findings is a fundamental practice of science and engineering.	SL.4 SL.5 SL.6	Presentation of Knowledge and Ideas standards can be applied to help students: • Engage in science discourse with a partner or small group by discussing questions, information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of thinking and reasoning; organization, substance, and style are appropriate to purpose, audience, and task. • Engage in formal presentations to small or large groups of students to share findings and supporting evidence. Presentations should be clear, concise, and logically organized, so listeners can follow the line of reasoning; organization, development, substance, and style are appropriate to purpose, audience, and task. • Use digital media (e.g., textual, graphical, audio, visual, video conferencing, or interactive elements) when presenting findings to support claims, evidence, reasoning, and to add interest.

Quarter 1			
AZ State Standards	**Background Information and Learning Targets**	**Vocabulary**	**Curricular Resources**
Unit Title: Heredity and Evolution *Life Sciences: Students develop an understanding of patterns and how genetic information is passed from generation to generation. They also develop the understanding of how traits within populations change over time.* *Earth and Space Sciences: Students explore natural and human-induced cause-and-effect changes in Earth systems over time.*			
8.L3U1.9 **Construct an explanation** of how genetic variations occur in offspring through the inheritance of traits or through mutations.	Background Information: Genes are located in the **chromosomes** of **cells**, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of a specific **protein**, which in turn affects the **traits** of the individual (e.g., human skin color results from the actions of proteins that control the production of the pigment melanin). Changes (**mutations**) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. **Sexual reproduction** provides for transmission	Punnett Square diagram gene transmission offspring genetic variation proteins chromosomes cells	*McDougal Littel* ● Cells and Heredity Book: Chapters 1 & 2 & 3 & 5 (Sections 2.1, 3.1, 3.2, 3.3, 4.1, 4.3, 5.1,) ● Investigation: Patterns of Heredity, page A98. ● Investigation: Offspring Model, page A107

Crosscutting Concepts: patterns; **cause and effect**; scale, proportion and quantity; systems and system models; **energy and matter; stability and change;** structure and function 8.L3U3.10 **Communicate** how advancements in technology have furthered the field of genetic research and use **evidence to support an argument** about the positive and negative effects of genetic research on human lives.	of genetic information to offspring through **egg** and **sperm cells**. These cells, which contain only one chromosome of each parent's chromosome pair, unite to form a new individual (offspring). Thus offspring possess one instance of each parent's chromosome pair (forming a new chromosome pair). Variations of **inherited traits** between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited or (more rarely) from mutations. (Boundary: The stress here is on the impact of gene transmission in reproduction, not the mechanism.) 4 (pp. 158-159) In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two **alleles** of each gene, one acquired from each parent. These versions may be identical or may differ from each other. In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are **beneficial**, **others harmful**, and some **neutral to the organism**. 4 (p. 160) ● I can explain that the chromosomes of cells contain genes which are made up of proteins. ● I can explain how genetic information is transferred to offspring through sexual reproduction. ● I can construct an explanation of why the inherited traits of offspring can vary from the parents due to the transmission of genetic information through sexual reproduction. ● I can develop and use a model to describe why sexual reproduction results in offspring with genetic variation. ● I can explain what a mutation is and why they occur. ● I can develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. ● I can make and support an evidence based argument for the positive and negative impacts genetic advances in technologies have on society as well as the technologies leading to these scientific discoveries. ● I can gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms. (Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection such as genetic modification, animal husbandry, gene therapy, and selective breeding of plants and animals.)	protein mutations traits sexual reproduction egg cell sperm cell inherited traits alleles beneficial mutation harmful mutation neutral mutation	● Diversity of Living Things Book:Chapter 2 & 4 (Sections 2.1, 4.1, 4.2, 4.3, 4.4) ● Ecology Book: Chapter 2 & 4(Sections 2.1, 4.3) *World Book* Links: ● Gene Therapy ● Genetic Engineering ● Human Genome Project ● Science Power ○ Heredity: Inherited and Learned Characteristics ○ Reproduction and Inheritance *FOSS Next Generation Heredity and Adaptations* ● IG: Investigation 2-Part 1 Lines of Descent; Investigation 2- Part 2 Inheriting Traits; Investigation 2- Part 3 Modeling Heredity; Investigation 2-Part 4 Punnett Squares ● Investigation 3- Part 3 Genetic Technology ● SRB: Tree Thinking; Understanding Heredity; ● DOR: Heredity Slideshow *Science Notebook:* ● Chapter 31 - Cell Reproduction and Protein Synthesis pg. 321 ● Chapter 42 - Heredity and Genetics pg. 434 ● Chapter 43; Page 449 (Selective Breeding) *Other:* ● *Teach Engineering* Heredity Mix'N'Match activity ● Human Genetics, Chromosomes, and Alleles: What's Dominant?

8.L4U1.11 **Develop and use a model** to explain how natural selection may lead to increases and decreases of specific traits in populations over time. 8.L4U1.12 **Gather and communicate evidence** on how the process of natural selection provides an explanation of how new species can evolve. Crosscutting Concepts: patterns; **cause and effect**; scale, proportion and quantity; systems and system models; **energy and matter; stability and change;** structure and function [4]	Background Information: Genetic variations among individuals in a population give some individuals an advantage in surviving and reproducing in their environment. This is known as **natural selection**. It leads to the predominance of certain traits in a population and the suppression of others. In **artificial selection**, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. 4 (p. 164) **Adaptation** by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. In separated populations with different conditions, the changes can be large enough that the populations, provided they remain separated (a process called reproductive isolation), evolve to become separate species. 4 (p. 165) Biodiversity is the wide range of existing life forms that have adapted to the variety of conditions on Earth, from terrestrial to marine ecosystems. Biodiversity includes genetic variation within a species, in addition to species variation in different habitats and ecosystem types (e.g., forests, grasslands, wetlands). Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. 4 (p. 167) ● I can construct an explanation, argument, or model for the reasoning behind a given phenomena, which shows that characteristics of a species change over time (i.e., over generations) through adaptation by natural selection in response to changes in environmental conditions. ● I can develop a model of how natural selection or artificial selection can lead to a predominance of certain traits in a population and suppression of others. ● I can apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms. ● I can articulate a statement that relates the given phenomenon to scientific ideas about the cause-and-effect relationship between the inheritance of traits increasing the chances of successful reproduction and natural selection. ● I can find research and data to show that when environmental shifts are too extreme, populations do not have time to adapt and may become extinct. ● I can construct an explanation or argument for the reasoning that traits that better support survival and reproduction in a new environment become more common within a population within that environment, traits that do not support survival and reproduction as well become less common within a population in that environment.	proportional reasoning natural selection artificial selection adaptation	*McDougal Littel* ● Diversity of Living Things Book: Chapters 1 & 2 & 4 (Sections 1.1, 2.2, 2.3, 2.4, 4.1, 4.2, 4.3, 4.4) All Ch. 5. ● Ecology Book: Chapter 1 Chapter 1 & 2 (Sections 1.1, 1.3, 2.1, 2.2). Patterns of Heredity, pages 110-122. ● Life Over Time Book: Chapter 1, 2, 3 (Sections 1.2, 1.3, 2.1, 2.2, 2.3, 3.1, 3.2) ● Cells and Heredity Book: Chapters 4 (Sections 4.1, 4.3). Chapter 5 (Sections 5.1-, 5.3) Multiple Probabilities, page 114. Using Punnett Squares, page A 116. Meiosis, page A117 ● Investigation: Fertilization, pages A119-A123. ● **Timeline of Genetics, Cells and Heredity Book, pages 128-130. ● **Changes in DNA can produce variation, Cells and Heredity Book, pages 144-148. ● **Modern Genetics uses DNA Technology, Human Biology Book, pages 150-154. *Science Notebook:* ● Chapter 43 Evolution pg. 443 *FOSS Next Generation Heredity and Adaptations* ● IG: Investigation 3 Part 3 ● SRB: Adaptation; Natural Selection; What Makes a Scientific Theory? Influencing Evolution ● DOR: Walking Sticks: Eat Insects; Find Insects in Three Environments; Larkey Natural Selection; Genetic Technology Resources; The Making of the Fittest: Natural Selection and Adaptation; The

	• I can use evidence to explain the process of natural selection and the evolution of new species		Origin of Species: The Beak of the Finch; Biodiversity Slide Show *World Book Links* • Evolution • Breeding
6.L2U1.13 **Develop and use models** to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.	• I can create a model showing how living organisms in an ecosystem are interdependent. • I can identify the producers, consumers, and decomposers in an ecosystem and describe their roles in the ecosystem. • I can distinguish between the biotic and abiotic factors in an environment. • I can use evidence to construct an argument on the cycling of energy resources both biotic and abiotic within an ecosystem.	interdependent living nonliving predatory population resource species adaptation competition	*McDougal Littel* • Cells and Heredity Book: Chapters 1 & 2 (Sections 1.2, 2.2) • Life Over TIme Book: Chapters 1 & 2 & 3 (Sections 2.1, 2.2, 2.3, 3.1, 3.2) • Diversity of Living Things Book: Chapter 2 & 4 (Sections 2.1, 2.2, 2.3, 2.4, 4.1, 4.2, 4.3, 4.4) • Ecology Book: Chapters 1 & 2 (Sections 1.1, 1.2, 1.3, 2.2). *Science Notebook:* • Chapter 47 Interdependence and the Cycling of Energy and Matter pg. 485
8.E1U1.6 **Analyze and interpret data** about the Earth's geological column to communicate relative ages of rock layers and fossils. 8.E1U3.7 **Obtain, evaluate, and communicate** information about data and historical patterns to predict natural hazards and other geological events.	Background Information: **Plate tectonics** is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geological history. Plate movements are responsible for most **continental** and **ocean floor features** and for the distribution of most **rocks** and **minerals** within Earth's crust. Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. 4 (p. 183) Some **natural hazard**s are preceded by geological activities that allow for **reliable predictions**; others occur suddenly, with no notice, and are not yet predictable. By tracking the upward movement of magma, for example, volcanic eruptions can often be predicted with enough advance warning to allow neighboring regions to be evacuated. Earthquakes, in contrast, occur suddenly; the specific time, day, or year cannot be predicted. However, the history of earthquakes in a region and the mapping of fault lines can help forecast the likelihood of future events. Finally, satellite monitoring of weather patterns, along with measurements from land, sea, and air, usually can identify developing severe weather and lead to its reliable forecast. 4 (p. 193) **Evolution** is shaped by Earth's varying geological conditions. Sudden changes in conditions (e.g., **meteor impacts**, **major volcanic eruptions**) have	evolutionary relationships organism gross appearance anatomical structure plate tectonics continental features ocean floor features rocks minerals crust natural hazards reliable predictions evolution meteor impacts	*McDougal Littel* • Cells and Heredity Book: Chapters 4 & 5 (Sections 4.1, 4.3, 5.1). • Life Over Time Book: Chapter 3 (Sections 3.1, 3.2, 3.3). • Diversity of Living Things Book: Chapter 3 (Section 3.4). • Ecology Book: Chapters1 & 2 & 3 (Sections 1.1, 2.2, 3.1, 3.2). • Human Biology Book: Chapter 4 (Section 4.3). *FOSS Next Generation Heredity and Adaptation* • IG: Investigation 1 Parts 1 and 2; Investigation 3 Part 3 Genetic Technology

8.E1U1.8 **Construct and support an argument** about how human consumption of limited resources impacts the biosphere. Crosscutting Concepts: patterns; **cause and effect**; scale, proportion and quantity; systems and system models; **energy and matter; stability and change;** structure and function	caused **mass extinctions**, but these changes, as well as more gradual ones, have ultimately allowed other life forms to flourish. The evolution and proliferation of living things over geological time have in turn changed the rates of **weathering** and **erosion** of land surfaces, altered the composition of Earth's soils and **atmosphere**, and affected the distribution of water in the **hydrosphere**. 4 (p. 190) Human activities have significantly altered the **biosphere**, sometimes damaging or destroying natural **habitats** and causing extinction of many other species. But changes to Earth's environment can have different impacts (negative and positive) for different living things. Typically, as human populations and **per-capita consumption** of **natural resources** increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. ● I can explain how the rocks on the Earth's surface move over time and how the layering of Earth's geological column shows changing environmental conditions over time. ● I can organize the given data (e.g., using tables, graphs, charts, images), including the appearance of specific types of fossilized organisms in the fossil record as a function of time, as determined by their locations in the sedimentary layers or the ages of rocks. ● I can apply scientific ideas to construct an explanation for the anatomical similarities and differences between modern and fossil organisms to infer evolutionary relationships. ● I can analyze and interpret data for patterns in the fossil record that document the diversity and evolution of life forms throughout the history of life on Earth. ● I can organize data using graphical displays (e.g., table, chart, graph) from maps of Earth's features (e.g., locations of mountains, continental boundaries, volcanoes, earthquakes, deep ocean trenches, ocean floor structures) and use historical patterns to predict future occurrences. ● I can differentiate between natural hazards and geological events that are predictable and those that are not, and identify the tools used to monitor for such events. ● I can construct an argument between the varying of and sudden changes to Earth's conditions and mass extinctions. ● I can identify examples of how humans have negatively impacted the Earth and other living organisms. ● I can make a claim, to be supported by evidence, to support or refute an explanation or model for a given phenomenon. (Students should include the following idea in their claim: that increases in the size of the human population and per-capita consumption of natural resources affect Earth systems.)	major volcanic eruptions mass extinction hydrosphere biosphere extinction erosion weathering atmosphere habitats per-capita consumption natural resources human populations consumption natural resources: freshwater, minerals, energy appearance, composition, structure of Earth's systems rate of change	● SRB: Mass Extinctions, Influencing Evolution, Fossil Dating; An Interview with Jennifer Clack; Transitions ● DOR: Biodiversity, Genetic technology Resources Biodiversity Slide Show; Fossils Slide Show; Fish with Fingers; Great Transitions: The Origin of Tetrapods *World Book* ● Fossil ● Plate Tectonics ● Weathering ● Natural Resources ● Balance of Nature ● Population ● Science Power ○ Gradual Changes ○ Landforms: Earth's Changing Features ○ Rapid Changes ○ Shaping the Land ○ The Rock Cycle ○ Moving the Land *Science Notebook:* ● Chapter 22 - Minerals, Rocks and the Earth's Structure pg. 228 ● Chapter 23 - Earth's Crust in Motion pg. 239 ● Chapter 44 - Fossil and Rock Ages pg. 437 ● Chapter 45 - History of Life on Earth pg. 465 *Do you have a recommendation for curriculum materials that support teaching these concepts? Please email them to jmoritz@gesd40.org*

Quarter 2			
AZ State Standards	**Background Information and Learning Targets**	**Vocabulary**	**Curricular Resources**
Unit Title: Physics *Physical Sciences: Students apply stability and change to explore chemical properties of matter and chemical reactions to further understand energy and matter.*			
7.P3U1.4 Use non-algebraic **mathematics and computational thinking** to explain Newton's laws of motion.	• I can explain how an object will resist change to its motion. • I can explain how the sum of the forces cause objects to move. • I can explain how the greater the mass the greater the force needed to achieve motion. • I can explain force exertion between two objects. • I can explain Newton's Laws of Motion.	force motion sum of forces mass shape orientation	*World Book* Links • Mass • Inertia • Force • Motion *Science Notebook:* • Chapter 9, 10, 11 *World Book* Links • Advances in Physics Timeline *My Perspectives:* 8th Grade Unit 5 • "To Fly" essay by Neil deGrasse Tyson
8.S5.C2. PO 5 (2004 standards) Concept 2: Motion and Forces PO5. Create a graph devised from measurements of moving objects and their interactions, including: position – time graphs velocity – time graphs	• I can create a position-time graph devised from measurements of moving objects and their interactions. • I can create a velocity-time graph devised from measurements of moving objects and their interactions. • I can construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.		*McDougal Littel* • Cells and Heredity Book: Chapters 4 & 5 (Sections 4.1, 4.3, 5.1). • Motion and Forces Book: • Chapters 1 & 2 & 3 & 4 & 5 (Sections 1.1, 1.2, 1.3, 2.1, 2.3, 3.1, 3.2, 3.3, 3.4, 4.1, 5.1). • Electricity & Magnification Book: Chapter 5 (Section 5.1).
8.P4U1.3 **Construct an explanation** on how energy can be transferred from one energy store to another.	Background Information: Objects can have stored energy (that is, the ability to make things change) either because of their chemical composition (as in fuels and batteries), their movement, their temperature, their position in a gravitational or other field, or because of compression or distortion of an elastic material. 2 (p. 23) **Energy** can be stored by lifting an object higher above the ground. When it is released and falls, this energy is stored in its **motion**. When an object is heated it has more energy than when it is	energy motion thermal insulators conductors battery electric current transferring energy	*McDougal Littel* • Cells and Heredity Book: Chapters 4 & 5 (Sections 4.1, 4.3, 5.1). • Motion and Forces Book: • Chapters 1 & 2 & 3 & 4 & 5 (Sections 1.1, 1.2, 1.3, 2.1, 2.3, 3.1, 3.2, 3.3, 3.4, 4.1, 5.1).

8.P4U1.4 **Develop and use mathematical models** to explain wave characteristics and interactions. 8.P4U2.5 **Develop a solution** to increase efficiency when transferring energy from one source to another. Crosscutting Concepts: patterns; **cause and effect**; scale, proportion and quantity; systems and system models; **energy and matter; stability and change;** structure and function	cold. An object at a higher temperature heats the surroundings or cooler objects in contact with it until they are all at the same temperature. How quickly this happens depends on the kind of material which is heated and on the materials between them (the extent to which they are **thermal insulators** or **conductors**). The chemicals in the cells of a battery store energy which is released when the **battery** is connected so that an **electric current** flows, **transferring energy** to other components in the circuit and on to the environment. Energy can be transferred by **radiation**, as sound in air or light in air or a **vacuum**. Many processes and phenomena are described in terms of **energy exchanges**, from the growth of plants to the weather. The transfer of energy in making things happen almost always results in some energy being shared more widely, heating more **atoms** and **molecules** and spreading out by conduction or radiation. The process cannot be reversed and the energy of the random movement of particles cannot as easily be used. Thus, some energy is **dissipated**.2 (p. 23) A simple wave has a repeating pattern with a specific **wavelength**, **frequency**, and **amplitude**. 4 (p. 132) ● I can construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. ● I can develop a model to describe that when the arrangement of objects interacting at a distance change, different amounts of potential energy are stored in the system. ● I can 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. ● I can develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. ● I can propose a method or solution to increase efficiency of energy transfer between sources. ● I can apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.	circuit radiation vacuum energy exchanges atoms molecules dissipated wavelength frequency amplitude	● Electricity & Magnification Book: Chapter 5 (Section 5.1). ● Matter and Energy Book: Chapters 3 & 4(Sections 3.1, 3.2, 3.3, 4.1, 4.2, 4.3,) ● Chemical Interactions Book: Chapter 3 (Section 3.3). ● Motion and Forces Book: Chapter 4 (Section 4.2). ● Waves, Sound, Light Book: Chapters 1 & 3 & 4 (Sections 1.1, 3.3, 3.4, 4.1, 4.2, 4.3). ● Electricity & Magnification Book: Chapters 1 & 2 (Sections 1.1, 1.2, 1.3, 2.1, 2.2). *World Book* Links ● Energy ● Radiation ● Sound ● Vacuum ● Waves ● Heat ● Science Power ○ Forces and Motion ○ Motion ○ Motion and Velocity ○ Electric Circuits ○ Generating Electricity *Science Notebook* ● Chapter 13 - Forms of Energy pg. 130 ● Chapter 14 - Thermal Energy pg. 137 ● Chapter 15 - Light and Sound Waves pg. 143

Quarter 3			
AZ State Standards	**Background Information and Learning Targets**	**Vocabulary**	**Curricular Resources**
Unit Title: Chemistry *Physical Sciences: Students apply stability and change to explore chemical properties of matter and chemical reactions to further understand energy and matter.*			
8.P1U1.1 **Develop and use a model** to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved. 8.P1U1.2 **Obtain and evaluate information** regarding how scientists identify substances based on unique physical and chemical properties Crosscutting Concepts: Patterns; **Cause and Effect**; Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter**; Structure and Function; **Stability and Change**	Background Information: All materials, anywhere in the universe, living and nonliving, are made of a very large number of basic 'building blocks' called **atoms**, of which there are about 100 different kinds. **Substances** made of only one kind of atom are called elements. Atoms of different **elements** can combine together to form a very large number of **compounds**. A **chemical reaction** involves a rearrangement of the atoms in the reacting substances to form new substances, while the total amount of matter remains the same. The properties of different materials can be explained in terms of the behavior of the atoms and groups of atoms of which they are made. 2 (p. 20) 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. 4 (p. 111) GESD Context Application of Standards ● I can define an atom and explain how it is connected to all matter. ● I can use the Periodic Table of Elements to identify elements and explain their characteristics. ● I can use the grouping of elements in the Periodic Table to predict the behavior of elements alone and in groups. ● I can develop models of atomic composition of simple molecules and extended structures that vary in complexity. The models will include: individual atoms, molecules, extended structures with repeating subunits, and substances (e.g., solids, liquids, and gases at the macro level). ● I can 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. ● I can develop a model to predict and describe changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. ● I can use a model to demonstrate my understanding of the conservation of atoms when new compounds are formed in chemical reactions.	reactant atoms mass molecule substance elements compounds chemical reaction	*McDougal Littel* ● Matter and Energy Book: Chapters 1 & 2 & 4 (Sections 1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3, 4.1). ● Chemical Interactions Book: Chapters 1 & 2 (Sections 1.1, 2.1, 2.2). Chapters 3 & 4 (Sections 3.1, 3.2, 4.2, 4.3). *My Perspectives:* 8th Grade Unit 5 ● Fermented Cow Dung Air Freshener *World Book* Links ● Matter ● Atom ● Molecule ● Element ● Periodic Table ● Compound ● Chemical Reaction ● Advances in Chemistry Timeline ● Science Power ○ The Chemical Elements ○ The Structure of Matter ○ What is Matter? *Science Notebook:* ● Chapter 6 - Matter, Properties and Phases pg. 60 ● Chapter 7 - Periodic Table, Atomic Structure, and Compounds pg. 71 ● Chapter 8 - Solutions and Fluids pg. 83

	• I can identify and explain the differences between an element, substance and a compound before and after the substances interact to determine if a chemical reaction has occurred. • I can organize and analyze given data about the characteristic physical and chemical properties (e.g., density, melting point, boiling point, solubility, flammability, odor) of pure substances before and after they interact. • I can support my interpretation of the data by describing that the change in properties of substances is related to the rearrangement of atoms in the reactants and products in a chemical reaction (e.g., when a reaction has occurred, atoms from the substances present before the interaction must have been rearranged into new configurations, resulting in the properties of new substances).		*Other* • Middle School Chemistry lessons and activities for chemistry concepts • You Be The Chemist through Chemical Educational Foundation • Activity: Periodic Table Activity: Marshmallow Molecules *Do you have a recommendation for curriculum materials that support teaching these concepts? Please email them to jmoritz@gesd40.org*
6.P1U1.1 **Analyze and interpret data** to show that changes in states of matter are caused by different rates of movement of atoms in solids, liquids, and gases (Kinetic Theory).	• I can describe how the behavior of substances depends on their structures at atomic and molecular levels, which are too small to see. • I can develop a model to demonstrate that matter is made of particles too small to be seen. • I can explain the difference between a solid, liquid, and gaseous state based on the behavior of the particles and their attraction to each other. • I can describe how the speed of molecules affects the state of matter and is measured by the temperature of the matter. • I can analyze and interpret given data to identify the causal agent in changes of states of matter. (Kinetic Theory)	particles microscope speed solid liquid gas atom	*McDougal Littel* • Matter and Energy Book: Chapters 1 & 4 (Sections 1.2, 1.3m 4.1) • Chemical Interactions Book: Chapters 3 & 4 (Sections 3.1, 4.3, 4.3). *Science Notebook* • Chapter 6 - Matter, Properties and Phases pg. 60
6.P1U1.3 **Develop and use models** to represent that matter is made up of smaller particles called atoms.	• I can review given data to determine when a change in the state of matter occurred. • I can plan an investigation to demonstrate that changes in temperature and/or pressure can change the state of matter. • I can conduct an investigation to demonstrate that changes in temperature and/or pressure can change the state of matter. • I can develop a model to represent that all matter is made of atoms. • I can explain the model representing that matter is made up of small particles called atoms.		*McDougal Littel* • Chemical Interactions Book: Chapters 3 & 4 & 5 (Sections 3.1, 3.4, 4.2, 4.3, 5.1, 5.3). • Motion and Forces Book: Chapter 3 • (Section 3.4).

Quarter 4			
AZ State Standards	**Background Information and Learning Targets**	**Vocabulary**	**Curricular Resources**
Unit Title: Review Heredity and Evolution			
8.L3U1.9 **Construct an explanation** of how genetic variations occur in offspring through the inheritance of traits or through mutations.	• I can explain that the chromosomes of cells contain genes which are made up of proteins. • I can construct an explanation of why the inherited traits of offspring can vary from the parents due to the transmission of genetic information through sexual reproduction. • I can develop and use a model to describe why sexual reproduction results in offspring with genetic variation. • I can develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.		*McDougal Littel* • Cells and Heredity Book: Chapters 1 & 2 & 3. • Diversity of Living Things: Chapters 2 & 4. • Ecology Book: Chapter 2 *Science Notebook:* • Chapters 31, 42
8.L3U3.10 Communicate how advancements in technology have furthered the field of genetic research and use evidence to support an argument about the positive and negative effects of genetic research on human lives.	• I can make and support an argument for the positive and negative impacts genetic advances in technologies have on society as well as the technologies leading to these scientific discoveries. • I can gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms. • I can synthesize information from reliable sources about the influence of humans on genetic outcomes in artificial selection such as genetic modification, animal husbandry, gene therapy, and selective breeding of plants and animals.		*Science Notebook:* • Chapter 42 Page 442 (Genetic Engineering) • Chapter 43 Page 449 (Selective Breeding)
8.L4U1.11 **Develop and use a model** to explain how natural selection may lead to increases and decreases of specific traits in populations over time.	• I can construct an explanation, argument, or model for the reasoning behind a given phenomena, which shows that characteristics of a species change over time (i.e., over generations) through adaptation by natural selection in response to changes in environmental conditions. • I can develop a model of how natural selection or artificial selection can lead to a predominance of certain traits in a population and suppression of others. • I can apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms.		*McDougal Littel* • Diversity of Living Things Book: Chapters 1 & 2 & 4 & 5 (Sections 1.1, 2.1, 4.1, 5.1, 5.2, 5.3, 5.4). • Human Biology Book: Chapters 1 & 4 & 5 (Sections 1.1, 4.1, 4.2, 5.1, 5.2). *Science Notebook:* • Chapter 43