SCOPE AND SEQUENCE: Science 7, BRJHS

SEMESTER ONE: THE BIG PICTURE This quarter introduces the main concepts for 7th grade life science. Patterning is stressed and interwoven into each topic. What, Why, Cause-and-effect. Course will utilize the 5E model of instruction: Engage, Explore, Explain, Elaborate, Explain.			
Week	Concept(s)	Az State Science Standards[1]	Crosscutting concepts and background information[2]
1	Introduction to learning in Canvas, class pretest, logical thinking		
2	Using Canvas and navigating online learning platforms, notetaking, answering questions, learning styles, avoiding plagiarism	7.W.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation. 7.W.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and	
3	Research project, self-guided research, creating presentations, presenting to class. Intro to ecosystems, food chain, observation skills		**Interdependent organisms** living together in particular environmental conditions form an **ecosystem**. In a stable ecosystem there are **producers** of food (plants), **consumers** (animals) and **decomposers**, (bacteria and fungi which feed on waste products and dead organisms).

[1] Arizona State Science Standards, https://www.azed.gov/standards-practices/k-12standards/standards-science
[2] Arizona State Science Standards, https://www.azed.gov/standards-practices/k-12standards/standards-science

		conclusions of others while avoiding plagiarism and following a standard format for citation. 7.W.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. 7.SL.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, appropriate vocabulary, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation. 7.SL.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.	
4	What is science, patterns overview, visual pattering in science: camouflage, skeletons	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	The crosscutting concepts identified in *A Framework for K-12 Science Education* are: ● patterns ● structure and function ● systems and system models

		evidence is discovered, models and theories can be revised.	
5	Repeating patterns: collecting leaves, using a stereoscope Sequential patterns: life cycles		The crosscutting concepts identified in *A Framework for K-12 Science Education* are: ● patterns ● structure and function ● systems and system models
6	Cause and effect patterns: life cycles and growth, adapting to habitats, skin color, variables	**Develop and use models** to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.	The crosscutting concepts identified in *A Framework for K-12 Science Education* are: ● patterns ● cause and effect ● structure and function ● systems and system models ● stability and change **Interdependent organisms** living together in particular environmental conditions form an **ecosystem**. In a stable ecosystem there are **producers** of food (plants), **consumers** (animals) and **decomposers**, (bacteria and fungi which feed on waste products and dead organisms). The decomposers produce materials that help plants to grow, so the molecules in the organisms are constantly re-used. At the same time, **energy** resources pass through the ecosystem. When **food** is used by organisms for **life processes** some energy is **dissipated** as **heat** but is replaced in the ecosystem by **radiation** from the **Sun** being used to produce plant food. **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) **Food webs** are models that demonstrate how matter and energy is transferred between producers (generally plants and other organisms that engage in photosynthesis), consumers, and decomposers as the three groups interact—primarily for food—within an ecosystem. Transfers of matter into and out of the physical environment occur at every level—for example, when molecules from food react with oxygen captured from the environment, the carbon dioxide and water thus produced are transferred back to the environment, and ultimately so are waste products, such as fecal material. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (p. 153-154) In any given ecosystem there is **competition** among species for the energy resources and the materials they need to live. The persistence of an ecosystem depends on the continued availability in the environment of these energy resources and materials.[2](p.27) **Organisms** and populations of organisms are dependent on their environmental interactions both with other **living** things and with **nonliving** factors. Growth of organisms and population increases are limited by access to resources. In any ecosystem, organisms and **populations** with similar requirements for food, water, oxygen, or other
7	Grouping patterns: food webs, food chains and niches, Venn diagrams, classifying living things	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. **6.L2U3.12Engage in argument from evidence** to support a claim about the factors that cause species to change and how humans can impact those factors. 6.L2U1.13**Develop and use models** to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.	

			resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. Similarly, **predatory** interactions may reduce the number of organisms or eliminate whole populations of organisms. **Mutually beneficial** interactions, in contrast, may become so interdependent that each organism requires the other for survival. A healthy ecosystem is one in which multiple **species** of different types are each able to meet their needs in a relatively stable web of life. Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all of its populations. [4] (p. 155)
8	Demonstrating patterning with graphs: bar, line and scatter plot, creating graphs in the computer, interpreting graphs		The crosscutting concepts identified in *A Framework for K-12 Science Education* are: • patterns • cause and effect • systems and system models • scale, proportion, and quantity
9	Using grouping for identification and classification: dichotomous keys QUARTER ONE BENCHMARK TEST		The crosscutting concepts identified in *A Framework for K-12 Science Education* are: • patterns • structure and function

QUARTER TWO: THE DETAILS

This quarter introduces the details, "how", of life science. Cause and effect patterning is stressed and interwoven into each topic.

Week	Concept(s)	Standard(s)	Crosscutting concepts and background information
1	Introduction to atoms, molecules and compounds, chemistry of life: photosynthesis and respiration	P1: All matter in the Universe is made of very small particles. 6.P1U1.3 Develop and use models to represent that matter is made of smaller particles called atoms 6.L2U1.14 **Construct a model** that shows the cycling of matter and flow of energy in ecosystems. 8.L2U1.12 **Construct an explanation** for how some plant cells convert light energy into food energy.	The crosscutting concepts identified in *A Framework for K-12 Science Education* are: • patterns • energy and matter If a **substance** could be divided into smaller and smaller pieces it would be found to be made of very, very small **particles**, smaller than can be seen even with a **microscope**. All materials, anywhere in the universe, living and non-living, are made of a very large number of basic 'building blocks' called **atoms**, of which there are about 100 different kinds. 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 All materials, anywhere in the universe, living and non-living, are made of a very large numbers of basic 'building blocks' called **atoms**, of which there are about 100 different
2	Chemistry of food, internal organs, body systems		

		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. L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms. 6.L2U1.14 **Construct a model** that shows the cycling of matter and flow of energy in ecosystems. 7.L1U1.9 **Develop and use a model** to explain how cells, tissues, and organ systems maintain life (animals). 7.L1U1.11**Construct an explanation** for how organisms maintain internal stability and evaluate the effect of the external factors on organisms' internal stability.	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. 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) In most cases, the energy needed for life is ultimately derived from the sun through **photosynthesis** (although in some ecologically important cases, energy is derived from reactions involving inorganic chemicals in the absence of sunlight e.g. chemosynthesis). Plants, algae (including phytoplankton), and other energy-fixing microorganisms use sunlight, water and carbon dioxide to facilitate photosynthesis, which stores energy, forms plant matter, releases oxygen, and maintains plants' activities. [4] (p. 147-148)
3	Using a microscope, cells, single celled organisms, plant/animal cell	L1: Organisms are organized on a cellular basis and have a finite life span. 7.L1U1.8 **Obtain, evaluate, and communicate information** to provide evidence that all living things are made of cells, cells come from existing cells, and cells are the basic structural and functional unit of all living things. 7.L1U1.9 **Construct an explanation** to demonstrate the relationship between major cell structures and cell functions (plant and animal).	The crosscutting concepts identified in *A Framework for K-12 Science Education* are: • patterns • structure and function • systems and system models • scale, proportion, and quantity All living organisms are made of one or more **cells**, which can be seen only through a microscope. All the basic processes of life are the results of what happens inside cells. Cells divide to replace aging cells and to make more cells in growth and in reproduction. Food is the energy source they need in order to carry out these and other functions. Some cells in **multicellular organisms**, as well as carrying out the **functions** that all cells do, are **specialized**; for example, muscle, blood and nerve cells carry out specific functions within the organism. Cells are often aggregated into tissues, tissues into organs, and organs into **organ systems**. In the human body, systems carry out such key functions as respiration, digestion, elimination of waste and temperature control. The circulatory system takes material needed by cells to all parts of the body and removes soluble waste to the urinary system. Stem cells, which are not specialized, are capable of repairing tissues by being programmed for different functions. Cells function best in certain conditions. Both single cell and multi-cellular organisms have mechanisms to maintain temperature and acidity within certain limits that enable the organism to survive. [2] (p. 26) Life is the quality that distinguishes living things - composed of living cells, from nonliving objects or those that have died. While a simple definition of life can be difficult to capture, all living things - that is to say all organisms -can be characterized by

			common aspects of their structure and functioning.[4] (p.143) Organisms are complex, organized and built on a hierarchical structure, with each level providing the foundation for the next, from the chemical foundation of elements and atoms, to cells and systems of individual organisms to species and populations living and interacting in complex ecosystems. Organisms range in composition from a **single cell** (unicellular microorganisms) to multicellular organisms, in which different groups of large number of cells work together to form **systems of tissues and organs** (e.g. circulatory, respiratory, nervous, musculoskeletal), that are specialized for particular functions. Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (Boundary: At this grade level, only a few major cell structures should be introduced.)[4] (p. 144) Organisms respond to **stimuli** from their environment and actively maintain their internal environment through **homeostasis**.[4] (p. 143)
4 5	Cell division, meiosis and mitosis, DNA Reproduction in living things, inheritance, genetics	L3: Genetic information is passed down from one generation of organisms to another. 8.L3U1.9 **Construct an explanation** of how genetic variations occur in offspring through the inheritance of traits or through mutations. 8.L3U1.9 **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.	The crosscutting concepts identified in *A Framework for K-12 Science Education* are: • patterns • cause and effect • structure and function • systems and system models • stability and change **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 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) 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.

6	Change over time, fossil evidence of change, geologic time, natural selection	6.L2U3.11**Engage in argument from evidence** to support a claim about the factors that cause species to change and how humans can impact those factors. 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.	The crosscutting concepts identified in *A Framework for K-12 Science Education* are: • patterns • cause and effect • structure and function • systems and system models • stability and change 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 on to 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) Plant species have **adaptations** to obtain the water, light, minerals and space they need to grow and reproduce in particular locations characterized by climatic, geological and hydrological conditions. [2](p. 27) The sorting and recombining of genetic material when egg and sperm cells are formed and then fuse results in an immense variety of possible combinations of genes, and in differences that can be inherited from one generation to another. These provide the potential for **natural selection** as a result of some variations making organisms better adapted to certain environmental conditions. [2](p. 28)
7	Evolution by natural selection	L4: The unity and diversity of organisms, living and extinct, is the result of evolution. 8.L4U1.12 **Gather and communicate evidence** on how the process of natural selection provides an explanation of how new species can evolve.	
8	Man's influence on nature: artificial selection, changes in environments Research project: how we can help	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. 6.L2U3.11**Use evidence** to **construct an argument** regarding the impact of human activities on the environment and how they positively and negatively affect	The crosscutting concepts identified in *A Framework for K-12 Science Education* are: • patterns • cause and effect • structure and function • systems and system models • stability and change • scale, proportion, and quantity Newly **introduced species** can damage the balance of an ecosystem. [4](p. 152) Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of many other species. But changes to Earth's environments 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

		the competition for energy and resources in ecosystems.	involved are engineered otherwise. [4] (p. 196) Human activity which controls the growth of certain plants and animals changes an ecosystem. [2](p.27) 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 on to offspring. [4] (p. 164) The sorting and recombining of genetic material when egg and sperm cells are formed and then fuse results in an immense variety of possible combinations of genes, and in differences that can be inherited from one generation to another. These provide the potential for natural selection as a result of some variations making organisms better adapted to certain environmental conditions. [2] (p. 28)
9	Course wrap-up and final exam		

Arizona State Science Standards, https://www.azed.gov/standards-practices/k-12standards/standards-science

By the end of seventh grade, students will explore how energy is transferred in environmental processes. Students investigate and explain the structure and function of cells and understand how genetic information is passed down to produce variation among the populations. Students will describe how stability and change and the process of cause and effect influence changes in the natural world. 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 seventh grade focus on helping students understand phenomena though patterns, cause and effect, scale, proportion, and quantity; systems and system models; energy and matter structure and function and stability and change. [3]

Crosscutting Concepts

Crosscutting concepts[4] cross boundaries between science disciplines and provide an organizational framework to connect knowledge from various disciplines into a coherent and scientifically based view of the world. They build bridges between science and other disciplines and connect core ideas and practices throughout the fields of science and engineering. Their purpose is to provide a lens to help students deepen their understanding of the core ideas as they make sense of phenomena in the natural and designed worlds. The crosscutting concepts identified in *A Framework for K-12 Science Education* are: patterns, cause and effect, structure and function, systems and system models, stability and change, scale, proportion, and quantity, energy and matter

[3] Arizona State Science Standards, https://www.azed.gov/standards-practices/k-12standards/standards-science