# *Science Standards*
# *Grades 6-8*

The science standards for grades 6-8 consist of nine Core Content Standards within the science domains. These standards should be learned during the three-year grade span, so that only three of them need to be learned ***in depth*** each year. Local school district curriculum teams will decide which of the areas will be learned at which grade level, depending on students' needs and interests.

As illustrated by the grid below, the three crosscutting EALRs of Systems, Inquiry, and Application are not to be learned in isolation, but rather in conjunction with content in the science domains. Not every topic needs to address all three crosscutting EALRs. But in any given year, content in Systems, Inquiry, and Application should be experienced in the context of several science lessons so that students can see the commonalities among the fields of science.

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| **Grades 6-8**<br><br>**EALR 4 Domains of Science** | **EALR 1 Systems SYS** | **EALR 2 Inquiry INQ** | **EALR 3 Application APP** |
|---|---|---|---|
| **Physical Science**<br>PS1 Balanced and Unbalanced Forces<br>PS2 Atoms and Molecules<br>PS3 Interactions of Energy and Matter<br>**Earth and Space Science**<br>ES1 The Solar System<br>ES2 Cycles in Earth Systems<br>ES3 Evidence of Change<br>**Life Science**<br>LS1 From Cells to Organisms<br>LS2 Flow of Energy Through Ecosystems<br>LS3 Inheritance, Variation, and Adaptation | Inputs, Outputs, Boundaries and Flows | Questioning and Investigating | Science, Technology, and Problem Solving |

**EALR 1: Systems**

**Big Idea: Systems (SYS)**

**Core Content: *Inputs, Outputs, Boundaries and Flows***

In prior grades students learned about the functioning of simple systems, including inputs and outputs. In grades 6-8 students learn how to use systems thinking to simplify and analyze complex situations. Systems concepts that students learn to apply at this level include choosing system boundaries, determining if a system is open or closed, measuring the flow of matter and energy through a system, and applying systems thinking to a complex societal issue that involves science and technology. These insights and abilities can help students see the connections between and among the domains of science and among science, technology, and society.

| | **Content Standards** | **Performance Expectations** |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 SYSA | Any *system* may be thought of as containing *subsystems* and as being a *subsystem* of a larger *system*. | • Given a *system*, identify *subsystems* and a larger encompassing *system* (e.g., the heart is a *system* made up of tissues and cells, and is part of the larger circulatory *system*). |
| 6-8 SYSB | The boundaries of a *system* can be drawn differently depending on the features of the *system* being *investigated*, the size of the *system*, and the purpose of the *investigation*. | • *Explain how* the boundaries of a *system* can be drawn to fit the purpose of the study (e.g., to study how insect *populations* change, a *system* might be a forest, a meadow in the forest, or a single tree). |
| 6-8 SYSC | The *output* of one *system* can become the *input* of another *system*. | • Give an example of how *output* of *matter* or energy from a *system* can become *input* for another *system* (e.g., household waste goes to a landfill).*a |
| 6-8 SYSD | In an *open system, matter* flows into and out of the *system*. In a *closed system*, energy may flow into or out of the *system*, but *matter* stays within the *system*. | • Given a description of a *system*, analyze and defend whether it is open or closed. |
| 6-8 SYSE | If the *input* of *matter* or energy is the same as the *output*, then the amount of *matter* or energy in the *system* won't change; but if the *input* is more or less than the *output*, then the amount of *matter* or energy in the *system* will change. | • Measure the flow of *matter* into and out of an *open system* and *predict* how the *system* is likely to change (e.g., a bottle of water with a hole in the bottom, an *ecosystem*, an *electric circuit*).*b |
| 6-8 SYSF | The *natural* and *designed world* is complex; it is too large and complicated to *investigate* and comprehend all at once. Scientists and students learn to define small portions for the convenience of *investigation*. The units of *investigation* can be referred to as "*systems*." | • Given a complex societal issue with strong *science* and *technology* components (e.g., overfishing, global warming), *describe* the issue from a *systems* point of view, highlighting how changes in one part of the *system* are likely to influence other parts of the *system*. |

**Mathematics Connections**

| | | |
|---|---|---|
| *a | 6.6.D | Represent a problem situation, describe the process used to solve the problem, and verify the reasonableness of the solution. |
| | 6.6.E | Communicate the answer(s) to the question(s) in a problem, using appropriate representations, including symbols and informal and formal mathematical language. |
| *b | 6.6.H | Make and test conjectures based on data (or information) collected from explorations and experiments. |

**EALR 2: Inquiry**

**Big Idea: Inquiry (INQ)**

**Core Content: *Questioning and Investigating***

In prior grades students learned to plan investigations to match a given research question. In grades 6-8 students learn to revise questions so they can be answered scientifically and then to design an appropriate investigation to answer the question and carry out the study. Students learn to think critically and logically to make connections between prior science knowledge and evidence produced from their investigations. Students can work well in collaborative teams and communicate the procedures and results of their investigations, and are expected to critique their own findings as well as the findings of others.

| | **Content Standards** | **Performance Expectations** |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 INQA Question | Scientific *inquiry* involves asking and answering *questions* and comparing the answer with what scientists already know about the world. | • *Generate* a *question* that can be answered through scientific *investigation*. This may involve refining or refocusing a broad and ill-defined *question*. |
| 6-8 INQB Investigate | Different kinds of *questions* suggest different kinds of scientific *investigations*. | • Plan and conduct a scientific *investigation* (e.g., *field study*, systematic *observation*, *controlled experiment*, *model*, or simulation) that is appropriate for the *question* being asked.<br>• Propose a *hypothesis*, give a reason for the *hypothesis,* and *explain how* the planned *investigation* will test the *hypothesis*.<br>• Work collaboratively with other students to carry out the *investigation*s. |
| 6-8 INQC Investigate | Collecting, analyzing, and displaying data are essential aspects of all *investigations*. | • *Communicate* results using pictures, tables, charts, diagrams, graphic displays, and text that are clear, accurate, and informative. *a<br>• Recognize and interpret *patterns* – as well as *variations* from previously learned or observed *patterns* – in data, diagrams, symbols, and words.*a<br>• Use statistical procedures (e.g., median, mean, or mode) to analyze data and make *inferences* about *relationships*.*b |
| 6-8 INQD Investigate | For an *experiment* to be valid, all (*controlled*) *variables* must be kept the same whenever possible, except for the *manipulated* (*independent*) *variable* being tested and the *responding (dependent) variable* being measured and recorded. If a *variable* cannot be *controlled*, it must be reported and accounted for. | • Plan and conduct a *controlled experiment* to test a *hypothesis* about a *relationship* between two *variables*. *c Determine which *variables* should be kept the same (*controlled*), which (*independent*) *variable* should be systematically *manipulated*, and which *responding (dependent) variable* is to be measured and recorded. Report any *variables* not *controlled* and *explain how* they might affect results. |

| | Content Standards | Performance Expectations |
|---|---|---|
| 6-8 INQE Model | *Models* are used to represent objects, events, *systems*, and processes. *Models* can be used to test *hypotheses* and better understand *phenomena*, but they have limitations. | • Create a *model* or *simulation* to represent the behavior of objects, events, *systems*, or processes. Use the *model* to explore the *relationship* between two *variables* and point out how the *model* or simulation is similar to or different from the actual phenomenon. |
| 6-8 INQF Explain | It is important to distinguish between the results of a particular *investigation* and general conclusions drawn from these results. | • *Generate* a scientific conclusion from an *investigation* using inferential logic, and clearly distinguish between results (e.g., *evidence*) and conclusions (e.g., explanation).<br>• *Describe* the differences between an objective summary of the findings and an *inference* made from the findings.*c |
| 6-8 INQG Communicate Clearly | Scientific reports should enable another investigator to repeat the study to check the results. | • Prepare a written report of an *investigation* by clearly describing the *question* being *investigated*, what was done, and an objective summary of results. The report should provide *evidence* to accept or reject the *hypothesis*, *explain* the *relationship* between two or more *variables*, and identify limitations of the *investigation*.*c |
| 6-8 INQH Intellectual Honestly | *Science* advances through openness to new *ideas*, honesty, and legitimate *skepticism*. Asking thoughtful *questions*, querying other scientists' explanations, and evaluating one's own thinking in response to the *ideas* of others are abilities of scientific *inquiry*. | • Recognize flaws in scientific *claims*, such as uncontrolled *variables*, overgeneralizations from limited data, and experimenter bias.*c<br>• Listen actively and respectfully to research reports by other students. Critique their presentations respectfully, using *logical argument* and *evidence*. *c<br>• Engage in reflection and self-evaluation. |
| 6-8 INQI *Consider* Ethics | Scientists and engineers have ethical codes governing animal *experiments*, research in natural *ecosystem*s, and studies that involve human subjects. | • Demonstrate ethical concerns and precautions in response to scenarios of scientific *investigation*s involving animal *experiments*, research in natural *ecosystems*, and studies that involve human subjects. |

**Mathematics Connections**

| | | |
|---|---|---|
| *a | 7.4.D | Construct and interpret histograms, stem-and-leaf plots, and circle graphs. |
| *b | 7.4. E | Evaluate different displays of the same data for effectiveness and bias, and *explain* reasoning. |
| *c | 7.4.C | Describe a data set, using measures of center (median, mean, and mode) and variability (maximum, minimum, and range), and evaluate the suitability and limitations of using each measurement. |

**Note:** Mathematics process standards (6.6-8.6) overlap the science inquiry standards.

**EALR 3: Application**

**Big Idea: Application (APP)**

**Core Content: *Science, Technology, and Problem Solving***

In prior grades students learned to work individually and collaboratively to produce a product of their own design. In grades 6-8 students work with other members of a team to apply the full process of technological design, combined with relevant science concepts, to solve problems. In doing so they learn to define a problem, conduct research on how others have solved similar problems, generate possible solutions, test the design, and communicate the results. Students also investigate professions in which science and technology are required so they can learn how the abilities they are developing in school are valued in the world of work.

| | **Content Standards** | **Performance Expectations** |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 APPA | People have always used *technology* to solve problems. Advances in human civilization are linked to advances in *technology*. | • *Describe* how a *technology* has changed over time in response to societal challenges. |
| 6-8 APPB | *Scientists* and technological designers (including *engineers*) have different goals. Scientists answer *questions* about the *natural world*; technological designers solve problems that help people reach their goals. | • *Investigate* several professions in which an understanding of *science* and *technology* is required. *Explain* why that understanding is necessary for success in each profession. |
| 6-8 APPC | *Science* and *technology* are interdependent. *Science* drives *technology* by demanding better instruments and suggesting *ideas* for new designs. *Technology* drives *science* by providing instruments and research methods. | • Give examples to illustrate how scientists have helped solve technological problems (e.g., how the *science* of biology has helped sustain fisheries) and how engineers have aided *science* (e.g., designing telescopes to discover distant planets). |
| 6-8 APPD | The process of *technological design* begins by defining a problem and identifying *criteria* for a successful solution, followed by research to better understand the problem and brainstorming to arrive at potential *solutions*. | • Define a problem that can be solved by *technological design* and identify *criteria* for success.<br>• Research how others solved similar problems.<br>• Brainstorm different *solutions*. |
| 6-8 APPE | Scientists and engineers often work together to *generate* creative *solutions* to problems and decide which ones are most promising. | • Collaborate with other students to *generate* creative *solutions* to a problem, and *apply* methods for making trade-offs to choose the best *solution*.*a |
| 6-8 APPF | *Solutions* must be tested to determine whether or not they will solve the problem. Results are used to modify the *design*, and the best solution must be communicated persuasively. | • Test the best *solution* by building a model or other representation and using it with the intended audience. Redesign as necessary.<br>• Present the recommended *design* using *models* or drawings and an engaging presentation.*b |
| 6-8 APPG | The benefits of science and technology are not available to all the people in the world. | • *Contrast* the benefits of science and technology enjoyed by people in industrialized and developing nations. |
| 6-8 APPH | People in all *cultures* have made and continue to make contributions to society through *science* and *technology*. | • *Describe* scientific or technological contributions to society by people in various *cultures*. |

**Mathematics Connections**

| | | |
|---|---|---|
| *a | 6.6.D | Represent a problem situation, describe the process used to solve the problem, and verify the reasonableness of the solution. |
| *b | 6.6.E | Communicate the answer(s) to the question(s) in a problem, using appropriate representations, including symbols and informal and formal mathematical language. |

**Note:** This standard is closely aligned to Core Processes 6.6, 7.6 and 8.5.

**EALR 4: Physical Science**

**Big Idea: Force and Motion (PS1)**

**Core Content: *Balanced and Unbalanced Forces***

In prior grades students learned to use basic tools to measure force, time, and distance. In grades 6-8 students learn to measure, record, and calculate the average speed of objects and to tabulate and graph the results. They also develop a qualitative understanding of inertia. Students learn to predict the motion of objects subject to opposing forces along the line of travel. If the forces are balanced, the object will continue moving with the same speed and direction, but if the forces are not balanced, the object's motion will change. These concepts and principles prepare students for a more formal understanding of mechanics in high school and help them make sense of the world around them.

| | **Content Standards** | **Performance Expectations** |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 PS1A | *Average speed* is defined as the distance traveled in a given period of time. | • Measure the distance an object travels in a given interval of time and calculate the object's *average speed*, using $S = d/t$. (e.g., a battery-powered toy car travels 20 meters in 5 seconds, so its *average speed* is 4 meters per second).*a<br>• Illustrate the *motion* of an object using a graph, or *infer* the *motion* of an object from a graph of the object's position vs. time or *speed* vs. time.*b |
| 6-8 PS1B | *Friction* is a *force* that acts to slow or stop the *motion* of objects. | • Demonstrate and explain the *frictional force* acting on an object with the use of a physical *model*. |
| 6-8 PS1C | Unbalanced *forces* will cause changes in the speed or direction of an object's *motion*. | • Determine whether *forces* on an object are balanced or unbalanced and justify with *observational evidence*.<br>• Given a description of *forces* on an object, *predict* the object's *motion*.*c |
| 6-8 PS1D | The same unbalanced *force* will change the *motion* of an object with more *mass* more slowly than an object with less *mass*. | • Given two different *masses* that receive the same unbalanced *force*, *predict* which will move more quickly. |

**Mathematics Connections**

| | | |
|---|---|---|
| *a | 6.1.F | Fluidly and accurately multiply and divide non-negative decimals. |
| | 6.2.E | Solve one-step equations and verify the solutions. |
| | 6.2.F | Solve word problems using mathematical expressions and equations, and verify the solutions. |
| | 6.3.B | Write ratios to represent a variety of rates. |
| | 6.3.D | Solve single- and multi-step word problems involving ratios, rates, and percentages, and verify the solutions. |
| *b | 5.5.C | Construct and interpret line graphs. |
| | 7.5.A | Graph ordered pairs of rational numbers and determine the coordinates of a point in the coordinate plane. |
| *c | 7.2.H | Determine whether or not a relationship is proportional and explain your reasoning. |

**EALR 4: Physical Science**

**Big Idea: Matter: Properties and Change (PS2)**

**Core Content: *Atoms and Molecules***

In prior grades students learned the scientific meaning of the word *matter*, and about changes of state. In grades 6-8 students learn the basic concepts behind the atomic nature of matter. This includes the idea that elements are composed of a single kind of atom. Atoms chemically combine with each other or with atoms of other elements to form compounds. When substances are combined in physical mixtures, their chemical properties do not change; but when they combine chemically, the new product has different physical and chemical properties from any of the reacting substances. When substances interact in a closed system, the amount of mass does not change. Atomic theory also explains the ways that solids, liquids, and gases behave. These concepts about the nature of matter are fundamental to all sciences and technologies.

| | Content Standards | Performance Expectations |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 PS2A | Substances have *characteristic* intrinsic *properties* such as *density*, *solubility*, *boiling point*, and *melting point*, all of which are independent of the amount of the sample. | • Use *characteristic* intrinsic *properties* such as *density*, *boiling point*, and *melting point* to identify an unknown substance. |
| 6-8 PS2B | *Mixtures* are combinations of substances whose *chemical properties* are preserved. *Compounds* are substances that are chemically formed and have different physical and *chemical properties* from the reacting substances. | • Separate a *mixture* using differences in *properties* (e.g., *solubility*, size, magnetic attraction) of the substances used to make the *mixture*.<br>• Demonstrate that the *properties* of a *compound* are different from the *properties* of the reactants from which it was formed. |
| 6-8 PS2C | All *matter* is made of *atoms*. *Matter* made of only one type of *atom* is called an *element*. | • *Explain that* all *matter* is made of *atoms*, and give examples of *common elements*—substances composed of just one kind of *atom*. |
| 6-8 PS2D | *Compounds* are composed of two or more kinds of *atoms*, which are bound together in well-defined *molecules* or arrays. | • Demonstrate with a labeled diagram and explain the *relationship* among *atoms*, *molecules*, *elements*, and *compounds*. |
| 6-8 PS2E | *Solids*, *liquids*, and *gases* differ in the *motion* of individual particles. In *solids*, particles are packed in a nearly rigid structure; in *liquids*, particles move around one another; and in *gases*, particles move almost independently. | • *Describe* how *solids*, *liquids*, and *gases* behave when put into a container (e.g., a *gas* fills the entire volume of the container). Relate these *properties* to the relative movement of the particles in the three *states* of *matter*. |
| 6-8 PS2F | When substances within a *closed system* interact, the total *mass* of the *system* remains the same. This *concept*, called *conservation of mass*, applies to all physical and *chemical changes*. | • *Apply* the *concept* of *conservation of mass* to correctly *predict* changes in *mass* before and after *chemical reactions*, including reactions that occur in closed containers, and reactions that occur in open containers where a *gas* is given off.*a |

**Mathematics Connections**

| | | |
|---|---|---|
| *a | 6.1.F | Solve word problems, using mathematical expressions and equations, and verify solutions. |
| | 7.1.E | Solve two-step linear equations. |

**EALR 4: Physical Science**

**Big Idea: Energy: Transfer, Transformation and Conservation (PS3)**

**Core Content: *Interactions of Energy and Matter***

In prior grades students learned how heat, light, sound, and electrical energy are generated and can be transferred from place to place. In grades 6-8 students learn how energy and matter interact in various settings. Heat (thermal energy) always moves from a warmer to a cooler place through solids (by conduction) and through liquids and gases (mostly by convection or mechanical mixing). Light energy interacts with matter and with our eyes and allows us to see things. Electrical energy provides a convenient way to transfer energy to where and when the energy is needed. Sound is yet another form of energy produced by a vibrating object. These fundamental concepts of how matter and energy interact have broad application in all of the other sciences.

| | **Content Standards** | **Performance Expectations** |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 PS3A | Energy exists in many forms: *heat*, light, chemical, electrical, *motion* of objects, and sound. Energy can be *transformed* from one *form* to another and *transferred* from one place to another. | • List different forms of energy (e.g., thermal, light, chemical, electrical, kinetic, and sound energy).<br>• *Describe* ways in which energy is *transformed* from one *form* to another and *transferred* from one place to another (e.g., chemical to electrical energy in a battery, electrical to light energy in a bulb). |
| 6-8 PS3B | *Heat* (thermal energy) flows from warmer to cooler objects until both reach the same temperature. *Conduction*, *radiation,* and *convection,* or *mechanical mixing*, are the means of *heat transfer*. | • Use everyday examples of *conduction*, *radiation*, and *convection*, or *mechanical mixing*, to illustrate the *transfer* of *heat* energy from warmer objects to cooler ones until the objects reach the same temperature. |
| 6-8 PS3C | *Heat* (thermal energy) consists of random motion and the vibrations of *atoms* and *molecules*. The higher the temperature, the greater the atomic or molecular motion. *Thermal insulators* are materials that resist the flow of *heat*. | • *Explain how* various types of insulation slow *transfer* of *heat* energy based on the atomic-molecular model of *heat* (thermal energy). |
| 6-8 PS3D | Visible light from the Sun is made up of a mixture of all colors of light. To see an object, light emitted or reflected by that object must enter the eye. | • *Describe* how to demonstrate that visible light from the Sun is made up of different colors.<br>• Draw and label a diagram showing that for an object to be seen, light must come directly from the object or from an external source reflected from the object, and enter the eye. |
| 6-8 PS3E | Energy from a variety of sources can be transformed into electrical energy, and then to almost any other *form* of energy. Electricity can also be distributed quickly to distant locations. | • Illustrate the *transformations* of energy in an *electric circuit* when *heat*, light, and sound are produced. *Describe* the *transformation* of energy in a battery within an *electric circuit*. |

| | | |
|---|---|---|
| 6-8 PS3F | Energy can be *transferred* from one place to another through *waves*. *Waves* include vibrations in materials. Sound and earthquake *waves* are examples. These and other *waves* move at different speeds in different materials. | • *Contrast* a light *wave* with a sound *wave* by identifying that both have *characteristic wavelengths*, but light *waves* can travel through a vacuum while sound *waves* cannot.<br>• *Explain* that sound is caused by a vibrating object. |

**EALR 4: Earth and Space Science**

**Big Idea: Earth in Space (ES1)**

**Core Content: *The Solar System***

In prior years, students learned the implications of the spherical-Earth concept and Earth's relationship to the Sun. In grades 6-8 students study the Moon's changing phases and learn to distinguish between phases and eclipses. They also learn about other objects in the Solar System and how they are held together by a force called "gravity." Students also learn about the Sun's position in the Milky Way, which is just one of many galaxies in the universe. This broad overview of Earth in space will provide a useful framework for students to understand new discoveries in astronomy and new milestones in the exploration of space.

| | **Content Standards** | **Performance Expectations** |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 ES1A | The Moon's monthly cycle of phases can be explained by its changing relative position as it *orbits* Earth. An *eclipse* of the Moon occurs when the Moon enters Earth's shadow. An *eclipse* of the Sun occurs when the *Moon* is between the Earth and Sun, and the Moon's shadow falls on the Earth. | • Use a physical *model* or diagram to *explain how* the Moon's changing position in its *orbit* results in the changing phases of the *Moon* as observed from Earth.<br>• *Explain how* the cause of an *eclipse* of the Moon is different from the cause of the Moon's phases. |
| 6-8 ES1B | Earth is the third planet from the sun in a *system* that includes the Moon, the Sun, seven other major *planets* and their *moons*, and smaller objects such as *asteroids*, *plutoids*, and *comets*. These bodies differ in many *characteristics* (e.g., size, composition, relative position). | • *Compare* the relative sizes and distances of the Sun, Moon, Earth, other major *planets*, *moons*, *asteroids*, *plutoids*, and *comets*. *a |
| 6-8 ES1C | Most objects in the *Solar System* are in regular and predictable *motion*. These *motion*s *explain* such *phenomena* as the day, the year, *phases of the moon*, and *eclipses*. | • Use a simple physical *model* or labeled drawing of the Earth-Sun-Moon *system* to *explain* day and night, *phases of the Moon*, and *eclipses* of the Moon and Sun. |
| 6-8 ES1D | *Gravity* is the *force* that keeps planets in *orbit* around the Sun and governs the rest of the *motion* in the *Solar System*. *Gravity* alone holds us to the Earth's surface. | • *Predict* what would happen to an *orbiting* object if *gravity* were increased, decreased, or taken away. |
| 6-8 ES1E | Our Sun is one of hundreds of billions of stars in the Milky Way galaxy. Many of these stars have planets *orbiting* around them. The Milky Way galaxy is one of hundreds of billions of galaxies in the universe. | • Construct a physical *model* or diagram showing Earth's position in the *Solar System*, the *Solar System*'s position in the Milky Way, and the Milky Way among other galaxies. |

**Mathematics Connections**

*a 7.2.D Make scale drawings and solve problems related to scale.

**EALR 4: Earth and Space Science**

**Big Idea: Earth Systems, Structures, and Processes (ES2)**

**Core Content: *Cycles in Earth Systems***

In prior grades students learned how Earth materials change and how they can be used for various purposes. In grades 6-8 students learn about planet Earth as an interacting system of solids, liquids, and gases. Solar energy powers the water cycle and drives the weather system and ocean currents. Energy from within the planet drives the rock cycle and moves huge plates on the Earth's surface, causing earthquakes and volcanoes. The landforms we see today result from processes that build up and break down Earth structures. These fundamental ideas will enable students to understand the history of their planet, Earth processes occurring today, and future geologic events.

| | **Content Standards** | **Performance Expectations** |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 ES2A | The atmosphere is a *mixture* of nitrogen, oxygen, and trace *gases* that include *water vapor*. The atmosphere has different *properties* at different elevations. | • *Describe* the composition and *properties* of the troposphere and stratosphere. |
| 6-8 ES2B | The Sun is the major source of energy for *phenomena* on Earth's surface, such as *winds*, ocean currents, and the water cycle. | • Connect the uneven heating of Earth's surface by the Sun to global *wind* and ocean currents.<br>• *Describe* the role of the Sun in the water cycle. |
| 6-8 ES2C | In the *water cycle, w*ater *evaporates* from Earth's surface, rises and cools, condenses to form clouds and falls as rain or snow and collects in bodies of water. | • *Describe* the water cycle and give local examples of where parts of the water cycle can be seen. |
| 6-8 ES2D | Water is a solvent. As it passes through the water cycle, it dissolves minerals and *gases* and carries them to the oceans. | • Distinguish between bodies of saltwater and fresh water and *explain how* saltwater became salty. |
| 6-8 ES2E | The solid Earth is composed of a relatively thin *crust*, a dense metallic *core*, and a layer called the *mantle* between the *crust* and *core* that is very hot and partially melted. | • Sketch and label the major layers of Earth, showing the approximate relative thicknesses and consistency of the *crust*, *core,* and *mantle*.*a |
| 6-8 ES2F | The *crust* is composed of huge *crustal plates* on the scale of continents and oceans which move centimeters per year, pushed by *convection* in the upper *mantle*, causing earthquakes, volcanoes, and mountains. | • Draw a labeled diagram showing how *convection* in the upper *mantle* drives movement of *crustal plates*.<br>• *Describe* what may happen when plate boundaries meet (e.g., earthquakes, *tsunami*, *faults*, mountain building), with examples from the Pacific Northwest. |
| 6-8 ES2G | *Landforms* are created by processes that build up structures and processes that break down and carry away material through *erosion* and *weathering*. | • *Explain how* a given landform (e.g., mountain) has been shaped by processes that build up structures (e.g., uplift) and by processes that break down and carry away material (e.g., *weathering* and *erosion*). |

| | Content Standards | Performance Expectations |
|---|---|---|
| 6-8 ES2H | The *rock cycle describes* the formation of *igneous rock* from magma or lava, *sedimentary* rock from compaction of eroded particles, and *metamorphic* rock by heating and pressure. | • Identify samples of *igneous*, *sedimentary*, and *metamorphic* rock from their *properties* and *describe* how their *properties* provide *evidence* of how they were formed.<br>• *Explain how* one kind of rock could eventually become a different kind of rock. |

**Mathematics Connections**

*a 7.2.D Make scale drawings and solve problems related to scale.

**EALR 4: Earth and Space Science**

**Big Idea: Earth History (ES3)**

**Core Content: *Evidence of Change***

In prior grades students learned that fossils provide evidence of environmental conditions that existed long ago. In grades 6-8 students learn a few of the methods that have made it possible to uncover the history of our planet. This includes the history includes both slow, gradual changes and rapid, catastrophic events, such as an asteroid or comet striking the Earth. It is possible to read a great deal of that history from rocks, including layers of sedimentary rock, some of which contain fossils. Understanding Earth's history is a valuable complement to the study of biological evolution.

| | Content Standards | Performance Expectations |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 ES3A | Our understanding of Earth history is based on the assumption that processes we see today are similar to those that occurred in the past. | • *Describe* Earth processes that we can observe and measure today (e.g., rate of *sedimentation*, movement of crustal plates, and changes in composition of the atmosphere) that provide clues to Earth's past.*a |
| 6-8 ES3B | Thousands of layers of *sedimentary rock* provide *evidence* that allows us to determine the age of Earth's changing surface and to estimate the age of *fossils* found in the rocks. | • *Explain how* the age of landforms can be estimated by studying the number and thickness of rock layers, as well as *fossils* found within rock layers. |
| 6-8 ES3C | In most locations *sedimentary* rocks are in horizontal formations with the oldest layers on the bottom. However, in some locations, rock layers are folded, tipped, or even inverted, providing *evidence* of geologic events in the distant past. | • *Explain why* younger layers of *sedimentary rocks* are usually on top of older layers, and *hypothesize* what geologic events could have caused huge blocks of horizontal *sedimentary* layers to be tipped or older rock layers to be on top of younger rock layers. |
| 6-8 ES3D | Earth has been shaped by many natural catastrophes, including earthquakes, volcanic eruptions, glaciers, floods, storms, *tsunami*, and the impacts of *asteroid*s. | • *Interpret* current landforms of the Pacific Northwest as *evidence* of past geologic events (e.g., Mount St. Helens and Crater Lake provide *evidence* of volcanism, the Channeled Scablands provides *evidence* of floods that resulted from melting of glaciers). |
| 6-8 ES3E | Living *organisms* have played several critical roles in shaping landforms that we see today. | • List several ways that living *organisms* have shaped landforms (e.g., coral islands, limestone deposits, oil and coal deposits). |

**Mathematics Connections**

*a 6.3.B Write ratios to represent a variety of rates.

**EALR 4:** **Life Science**

**Big Idea:** **Structure and Function of Organisms (LS1)**

**Core Content:** ***From Cells to Organisms***

In prior grades students learned how structures in the body work together to respond to internal and external needs. In grades 6-8 students learn that all living systems are composed of cells which make up tissues, organs, and organ systems. At each level of organization, the structures enable specific functions required by the organism. Lifestyle choices and environmental conditions can affect parts of the human body, which may affect the health of the body as a whole. Understanding how organisms operate as systems helps students understand the commonalities among life forms, provides an introduction to further study of biology, and offers scientific insights into the ways that personal choices may affect health.

| | **Content Standards** | **Performance Expectations** |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 LS1A | All *organisms* are composed of cells, which carry on the many *functions* needed to sustain life. | • Draw and *describe observations* made with a microscope showing that plants and animals are made of cells, and *explain that* cells are the fundamental unit of life.<br>• *Describe* the *functions* performed by cells to sustain a living *organism* (e.g., division to produce more cells, taking in *nutrients*, releasing waste, using energy to do work, and producing materials the *organism* needs). |
| 6-8 LS1B | One-celled *organisms* must contain parts to carry out all life *functions*. | • Draw and *describe observations* made with a microscope showing that a single-celled *organism* (e.g., paramecium) contains parts used for all life *functions*. |
| 6-8 LS1C | *Multicellular organisms* have specialized cells that perform different *functions*. These cells join together to *form* tissues that give organs their structure and enable the organs to perform specialized *functions* within organ *systems*. | • Relate the structure of a specialized cell (e.g., nerve and muscle cells) to the *function* that the cell performs.<br>• *Explain* the *relationship* between tissues that make up individual organs and the *functions* the organ performs (e.g., valves in the heart control blood flow, *air* sacs in the lungs maximize surface area for *transfer* of *gases*).<br>• *Describe* the components and *functions* of the digestive, circulatory, and respiratory *systems* in humans and how these systems interact. |
| 6-8 LS1D | Both plant and animal cells must carry on life *functions*, so they have parts in common, such as *nuclei*, *cytoplasm*, cell *membranes*, and *mitochondria*. But plants have specialized cell parts, such as *chloroplasts* and *cell walls,* because they are *producers* and do not move. | • Use labeled diagrams or *models* to illustrate similarities and differences between plant and animal cell structures and *describe* their functions (e.g., both have nuclei, cytoplasm, cell membranes, and mitochondria, while only plants have chloroplasts and cell walls). |
| 6-8 LS1E | In classifying *organisms*, scientists consider both internal and external structures and behaviors. | • Use a classification key to identify *organisms*, noting use of both internal and external structures as well as behaviors. |

| | Content Standards | Performance Expectations |
|---|---|---|
| 6-8 LS1F | Lifestyle choices and living *environments* can damage structures at any level of organization of the human body and can significantly harm the whole *organism*. | • *Evaluate* how lifestyle choices and *environments* (e.g., tobacco, drug, and alcohol use, amount of exercise, quality of *air*, and kinds of food) affect parts of the human body and the *organism* as a whole. |

**EALR 4:** **Life Science**

**Big Idea:** **Ecosystems (LS2)**

**Core Content:** ***Flow of Energy Through Ecosystems***

In prior grades students learned how ecosystems change and how these changes affect the capacity of an ecosystem to support populations. In grades 6-8 students learn to apply key concepts about ecosystems to understand the interactions among organisms and the nonliving environment. Essential concepts include the process of photosynthesis used by plants to transform the energy of sunlight into food energy, which is used by other organisms, and possible causes of environmental change. Students also learn to investigate environmental issues and to use science to evaluate different solutions to problems. Knowledge of how energy flows through ecosystems is a critical aspect of students' understanding of how energy sustains life on the planet, including human life.

| | **Content Standards** | **Performance Expectations** |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 LS2A | An *ecosystem* consists of all the *populations* living within a specific area and the nonliving *factors* they interact with. One geographical area may contain many *ecosystems*. | • *Explain that* an *ecosystem* is a defined area that contains *populations* of *organisms* and nonliving *factors*.<br>• Give examples of *ecosystems* (e.g., Olympic National Forest, Puget Sound, one square foot of lawn) and *describe* their boundaries and contents. |
| 6-8 LS2B | Energy flows through an *ecosystem* from *producers* (plants) to *consumers* to *decomposers*. These *relationships* can be shown for specific *populations* in a *food web*. | • *Analyze* the flow of energy in a local *ecosystem*, and draw a labeled *food web* showing the *relationships* among all of the *ecosystem*'s plant and animal *populations*. |
| 6-8 LS2C | The major source of energy for *ecosystems* on Earth's surface is sunlight. *Producers* transform the energy of sunlight into the chemical energy of food through *photosynthesis*. This food energy is used by plants, and all other *organisms* to carry on life processes. Nearly all *organisms* on the surface of Earth depend on this energy source. | • *Explain how* energy from the Sun is *transformed* through *photosynthesis* to produce chemical energy in food.<br>• *Explain that* plants are the only organisms that make their own food. Animals cannot survive without plants because animals get food by eating plants or other animals that eat plants. |
| 6-8 LS2D | *Ecosystems* are continuously changing. Causes of these changes include nonliving *factors* such as the amount of light, range of temperatures, and availability of water, as well as living *factors* such as the disappearance of different *species* through disease, *predation*, *habitat* destruction and overuse of resources or the introduction of new *species*. | • *Predict* what may happen to an *ecosystem* if nonliving *factors* change (e.g., the amount of light, range of temperatures, or availability of water or *habitat*), or if one or more *populations* are removed from or added to the *ecosystem*. |
| 6-8 LS2E | *Investigation*s of *environmental* issues should uncover *factors* causing the problem and relevant scientific *concepts* and findings that may inform an *analysis* of different ways to address the issue. | • *Investigate* a local *environmental* issue by defining the problem, researching possible causative *factors*, understanding the underlying *science*, and evaluating the benefits and risks of alternative *solutions*.<br>• Identify resource uses that reduce the capacity of *ecosystems* to support various *populations* (e.g., use of pesticides, construction). |

**EALR 4:** **Life Science**

**Big Idea:** **Biological Evolution (LS3)**

**Core Content:** ***Inheritance, Variation and Adaptation***

In prior years, students learned that differences in inherited characteristics might help organisms survive and reproduce. In grades 6-8 students learn how the traits of organisms are passed on through the transfer of genetic information during reproduction and how inherited variations can become adaptations to a changing environment. Sexual reproduction produces variations because genes are inherited from two parents. Variations can be either physical or behavioral, and some have adaptive value in a changing environment. In the theory of biological evolution the processes of inheritance, variation, and adaptation explain both the diversity and unity of all life.

| | **Content Standards** | **Performance Expectations** |
|---|---|---|
| | *Students know that:* | *Students are expected to:* |
| 6-8 LS3A | The scientific *theory* of *evolution* underlies the study of biology and explains both the *diversity* of life on Earth and similarities of all organisms at the chemical, cellular, and molecular level. *Evolution* is supported by multiple forms of scientific *evidence*. | • *Explain* and provide evidence of how biological *evolution* accounts for the *diversity* of *species* on Earth today. |
| 6-8 LS3B | Every *organism* contains a set of *genetic information* (instructions) to specify its traits. This information is contained within *genes* in the *chromosomes* in the *nucleus* of each cell. | • *Explain that* information on how cells are to grow and *function* is contained in *genes* in the *chromosomes* of each cell *nucleus* and that during the process of reproduction the *genes* are passed from the parent cells to offspring. |
| 6-8 LS3C | Reproduction is essential for every *species* to continue to exist. Some plants and animals reproduce sexually while others reproduce *asexually*. *Sexual reproduction* leads to greater *diversity* of *characteristics* because children inherit *genes* from both parents. | • Identify sexually and asexually reproducing plants and animals.<br>• *Explain* why offspring that result from *sexual reproduction* are likely to have more diverse *characteristics* than offspring that result from *asexual reproduction*. |
| 6-8 LS3D | In *sexual reproduction* the new *organism* receives half of its *genetic information* from each parent, resulting in offspring that are similar but not identical to either parent.<br>In *asexual reproduction* just one parent is involved, and *genetic information* is passed on *nearly unchanged.* | • *Describe* that in *sexual reproduction* the offspring receive *genetic information* from both parents, and therefore differ from the parents.<br>• *Predict* the outcome of specific genetic crosses involving one *characteristic* (using *principles* of *Mendelian* genetics).<br>• *Explain* the survival value of *genetic variation*. |
| 6-8 LS3E | *Adaptations* are physical or behavioral changes that are inherited and enhance the ability of an *organism* to survive and reproduce in a particular *environment*. | • Give an example of a plant or animal adaptation that would confer a survival and reproductive advantage during a given *environmental* change. |
| 6-8 LS3F | *Extinction* occurs when the *environment* changes and the adaptive *characteristics* of a *species*, including its behaviors, are insufficient to allow its survival. | • Given an *ecosystem*, *predict* which *organisms* are most likely to disappear from that *environment* when the *environment* changes in specific ways. |

| | Content Standards | Performance Expectations |
|---|---|---|
| 6-8 LS3G | *Evidence* for *evolution* includes similarities among anatomical and cell structures, and *patterns* of development make it possible to *infer* degree of relatedness among organisms. | • *Infer* the degree of relatedness of two *species*, given diagrams of *anatomical feature*s of the two *species* (e.g., chicken wing, whale flipper, human hand, bee leg). |