Central Kitsap School District

Instruction Driven by Standards

Essential Learnings

Revised 2001

Central Kitsap School District

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2002

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SCIENCE

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Adapted from Washington State CSL Interpretation and Clarification document, May 7, 1999
GRADES K-5

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.1: Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.

PHYSICAL SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Properties of substances Use properties to sort natural and manufactured materials and objects, for example, size, weight, shape, color, texture, and hardness.	Identify, describe, and sort objects and materials, using physical properties including shape, color, texture, hardness, weight, and whether something is magnetic, and whether it conducts electricity.	Paper (K) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-5 Wood (K) Activity 1, Parts 1-5 Activity 2, Parts 1-7 Solids and Liquids (1) Activity 1, Parts 1-3 Activity 2, Parts 1-4 Activity 3, Parts 1-3 Activity 4, Parts 1-3 Pebbles, Sand, and Silt (2) Activity 1, Parts 1-5 Activity 3, Parts 1-5 Activity 4, Parts 1-3 Water (4) Structures of Life (4) Activity 1 Magnetism and Electricity (4) Activities 1, 2 Mixtures and Solutions (5) Activities 1, 2, 3, 4
	Accurately measure physical quantities, including length, weight, and temperature, using tools, such as rulers, balances, spring scales, and thermometers.	

Key:
Bold and italics font indicates an EALR not addressed by FOSS teacher manual as written but easily addressed by supplemental lessons linked to FOSS.
Regular font indicates EALR addressed when the teacher teaches the FOSS module as written in the teacher's guide.

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.1: **Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.**

PHYSICAL SCIENCE – Benchmark 1		
Benchmark Indicators	Benchmark Clarifiers	**FOSS Modules**
Motion of objects Describe the relative position and motion of objects.	Use words such as in front of, behind, to left or right, above or below to describe the position of one object relative to another object or relative to surroundings.	Balance and Motion (2) Activity 1, Parts 1-4 Activity 2, Parts 1-3 Activity 3, Parts 1-3 ***Models and Designs*** (5) Activity 3 Starbase Atlantis: Law of Gravity (5) (covered by Benchmark II more completely) Gravity Unit
	Describe the position of an object relative to a distance laid out in units such as centimeters, meters, kilometers, feet, yards, or miles.	
	Associate a particular position with a particular reading of a clock (an instant in time), and associate a distance traveled in a straight line with an amount of elapsed time, called a time interval (a difference between two clock readings).	
	The farther an object travels in a particular time interval, the faster the object is moving.	
	Interpret representations, using words, pictures, or simple tables to describe the position and associated clock reading or moving objects.	
	Direction of motion can be described relative to a direction one if facing or pointing, such as forward or backward, to the left or right, up or down.	
Sound, Light, and Waves Describe experiences with sound, for example, vibrations, echoes, and pitch; describe experiences with light in terms of bouncing off, passing through, and changes in path or direction.	Sound is caused by things that move back and forth (vibrate) frequently. The more frequently the vibration goes back and forth, the higher the sound's pitch. Hearing involves getting the eardrum to vibrate.	Physics of Sound (3) Activity 1, Parts 1-2 Activity 2, Part 1 Activity 3, Part 1 Activity 4, Part 1 Starbase Atlantis: Balloon in a Vacuum Jar (5) Bell in a Jar
	Sound can bounce off surfaces, sometimes returning to its source, for example, echoes.	
	Light travels in a straight line until it hits a substance. Then, some of the light will bounce off the surface and some light passes through the surface. When traveling between substances that touch, like air, clear plastic, or water, some light will bounce off (reflect) and some may pass through (transmit). In passing through, the light may change direction from its original path, for example, when sunlight passes from air to water some reflects off the water's surface and some travels into the water, traveling in a different direction.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

PHYSICAL SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Systems Identify the parts of a system, how the parts go together, and how they depend on each other.	A system is a group of related objects that make up a whole. Thus, systems are made of parts (called subsystems). Systems can be found in the natural world (e.g., the parts of an insect or the solar system), or may be put together (e.g., a flashlight circuit or a mousetrap).	***Physics of Sound*** (3) Activity 3, Part 1 Magnetism and Electricity (4) Activity 2, Part 1 Activity 4, Parts 1-2 Models and Design (5) Activity 2, Parts 1-2 Activity 3, Parts 1-2 Activity 4, Parts 1-2 Starbase Atlantis: Delta Dart (5)
	Objects or parts of systems do things to each other. They produce or impart changes of various kinds. These changes give us evidence that the parts have interacted with each other.	
	When parts work together, they can do things as a system that they couldn't do by themselves.	
	If parts within a system are missing, broken, worn out, mismatched, or not correctly connected, then that system may not work properly or may not work at all.	
Energy sources and kinds Understand that energy keeps things running and comes in many forms.	Energy is the inherent ability of an animal, a flashlight battery, or any other system to bring about changes in the state of its surroundings, in itself, or in other systems. Energy keeps things running, moving, growing, making sound, working, playing, etc. Energy is not a thing or a substance, but a thing or a substance may be in a particular energetic state, e.g., a rapidly moving object has more energy of motion than when it is moving slowly, or a fuel may be particularly energetic if it gives off a lot of heat when it is burned.	***Insects*** (1) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, Parts 1-5 ***Balance and Motion*** (2) Activity 2, Parts 1-3 Activity 3, Parts 1-3 ***Magnetism and Electricity*** (4) Activity 2, Part 1 Mixtures and Solutions (5) Activity 4 ***Models and Designs*** (5) Activity 3 Starbase Atlantis: Physics Unit
	Energy sources are systems that are changing to a lower state of energy by giving off energy.	
	Energy receivers are systems changing toward a more energetic state by receiving energy from another energy source. Example, energy sources include the burning of fuel to heat a house to a higher temperature, the muscle energy run down in running a race, the discharging of a battery to run a light, the relaxing of a rubber band as it propels a stick airplane forward, or the loss of speed of a bicycle as it coasts up a hill.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: Recognize the components, structure, and organization of systems and the interconnections within and among them.

PHYSICAL SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Energy transfer and transformation Know that energy can be transferred between various forms.	Energy is said to be transferred, or energy changes occur, when systems interact or "do things" to each other. Energy is transferred when an energy source changes to a lower energy state and/or an energy receiver is changing to a higher energy state. For example, when one marble hits a stationary marble, some of the energy of motion of the first marble is transferred to the second object.	***Physics of Sound*** (3) Activity 2, Part 1 ***Magnetism and Electricity*** (4) Activity 3, Part 1 ***Water*** (4) Activity 2 Mixtures and Solutions (5) Activity 4 Starbase Atlantis: Newton's Aircraft Carrier (5)
	Energy is transformed when, during a transfer of energy, it changes from one form (kind of energy) to another. For example, when a compressed spring is used to shoot a marble, energy is transferred from the spring to the marble. The energy of a compressed spring is transferred to a marble when a spring is released. Elastic potential energy is transformed into energy of motion.	
	Thermal energy can be transferred from one object or substance to another, such as from a stove burner to a pan, to water in the pan. The transfer is by touching and is called conduction.	
	In order to convert the chemical energy in a battery into light, a complete circuit of conducting material is needed from one end of the battery to one end of the bulb, and back from the other end of the bulb to the other end of the battery.	
Structure of matter Know that matter is made of small particles.	Objects are made of materials. Some objects are made of only one kind of material and others are made of several kinds of materials.	Pebbles, Sand, and Silt (2) Activity 2, Parts 1-4 Activity 3, Parts 1-5 Activity 4, Parts 1-3 Earth Materials (3) Activity 1 ***Mixtures and Solutions*** (5) Activities 1, 2, 3
	Materials are made of particles, too small to be seen with the naked eye.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

PHYSICAL SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Physical/chemical changes Know that matter can undergo changes of state such as evaporation, condensation, or freezing and thawing.	There are three states of matter: a solid state with a defined shape; a liquid state with a defined volume and an ability to change shape or flow; and a gaseous state that can change shape or volume. Matter changes state by being heated or cooled, such as in melting, freezing, or boiling. The changes of state are reversible. Even though the matter changes state, it remains the same kind of material substance.	Wood (K) Activity 2, Parts 1-3 Water (4) Activity 3 Mixtures and Solutions (5) Activity 4 Starbase Atlantis: Air Has Weight (5) Air Unit

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: Understand how interactions within and among systems cause changes in matter and energy.

<table>
<tr><th colspan="3">PHYSICAL SCIENCE – Benchmark 1</th></tr>
<tr><th>Benchmark Indicators</th><th>Benchmark Clarifiers</th><th>FOSS Modules</th></tr>
<tr><td rowspan="4">Nature of forces
Describe forces in terms of strength and direction.</td><td>When objects stretch, bend, and/or change their motion, forces are acting on them.</td><td rowspan="4">Balance and Motion (2)
Activity 1, Parts 1-4
Activity 2, Parts 1-3
Activity 3, Parts 1-3

Models and Designs (5)
Activity 3

Magnetism and Electricity (4)
Activity 1, Parts 1-2
Activity 3, Part 1

Starbase Atlantis:
Focus on Pressure (5)
Tornado Tube lessons
Water, Gravity, Pressure
Funnel and Ball
Egg in the Bottle
The Four Forces of Flight
Bernoulli Principle

Magnetism and Electricity (4)
Activity 3, Part 1</td></tr>
<tr><td>A push or pull is a force on an object by whatever is touching it. Each force acts in a particular direction. The force might be actively exerted, such as by living things pushing or pulling or by a colliding object. The force might be passively exerted on an object, such as a force by another object that blocks motion, supports the first object, or rubs against the first object as it moves.</td></tr>
<tr><td>Some forces can act across space without objects touching each other (action at a distance). Magnets can affect each other and can affect things made of iron without touching them. Magnets can be set up to attract each other or to repel each other. Electrically charged objects can affect other things around them. Some electrically charged objects repel each other and attract others. We know that something is electrically charged if at first it does not attract other things but after being rubbed it does attract other things.</td></tr>
<tr><td>Identify each force; describe the direction in which it acts, and compare the strength of each force with the strength of other single forces in the same or the opposite direction.</td></tr>
<tr><td rowspan="4">Forces to explain motion
Investigate and recognize factors, which determine the effects of a push or pull on the motion of objects.</td><td>A short duration shove in one direction may get an object to begin moving in that direction. To get the object to continually speed up (or to slow down) will require a sustained push or pull through time. For an object to begin moving or to continually speed up in one direction, the forces in that direction must be bigger than the forces in the opposite direction.</td><td rowspan="4">Balance and Motion (2)
Activity 1, Parts 1-4
Activity 2, Parts 1-3
Activity 3, Parts 1-3

Models and Designs (5)
Activity 3

Starbase Atlantis:
Laws of Gravity
Quarter Drop
Anti-Gravity Marble
Newton's Aircraft Carrier
Astrolunatic
Newton Mobile</td></tr>
<tr><td>If a certain short duration shove is applied to a heavier object, it won't go as fast as a lighter object would, under the influence of that same shove.</td></tr>
<tr><td>A blocking force might keep a push or pull from moving an object.</td></tr>
<tr><td>An unblocked object will end up going faster if you push or pull constantly for a longer time or if you push or pull harder but for the same amount of time.</td></tr>
</table>

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Adapted from Washington State CSL Interpretation and Clarification document, May 7, 1999
GRADES K-5

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.1: Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.

LIFE SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Basis of biological diversity Distinguish living organisms from non-living objects, and use characteristics to sort common organisms into plant and animal groups.	Living organisms have basic needs that distinguish them from non-living objects, such as the need for nutrients, water, air, and energy.	Animals Two by Two (K) Activities 1, 2, 3, 4 Environments (5) Activity 1, Parts 1-2 Activity 2, Parts 1-2 Insects (1) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, Parts 1-5 New Plants (2) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, Parts 1-2 Structures of Life (4) Activities 2, 3, 4
	One distinguishing characteristic between plants and animals is that plants require water, nutrients, light, and air (for photosynthesis) and animals, instead, consume food.	
	Unique characteristics of animals can include appendages such as legs, feelers, or talons; sense organs; ability to communicate; body movement; rapid responses to stimuli; reproduce live offspring or from eggs; grow and develop in stages; and use food and oxygen.	
	Distinct plant features can include structural features such as roots, stems, flowers, and leaves; reproduce using seeds produced in cones or fruits; use carbon dioxide, water, and minerals in photosynthesis; generally grow in specific locations.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: Recognize the components, structure, and organization of systems and the interconnections within and among them.

LIFE SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Systems Identify the parts of a system, how the parts to together, and how they depend on each other.	A system is a group of related objects that make up a whole. Thus, systems are made of parts (called subsystems). Systems can be found in the natural world (e.g., the parts of an insect or the solar system), or may be put together (e.g., a flashlight circuit or a mousetrap). Objects or parts of systems do things to each other. They produce or impart changes of various kinds. These changes give us evidence that the parts have interacted with each other. When parts work together, they can do things as a system that they couldn't do by themselves. If parts within a system are missing, broken, worn out, mismatched, or not correctly connected, then that system may not work properly or may not work at all.	***Insects*** (1) New Plants (2) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, Parts 1-2 Human Body (3) Activity 1, 2, 3, 4 Structures of Life (4) Activity 5 Environments (5) Activity 1, Parts 1-2 Activity 2, Parts 1-2 Activity 3, parts 1-2 Activity 4, Parts 1-3 Activity 5, Parts 1-3
Structure and organization of living systems Know that living things are composed of parts made of cells.	The building blocks of all organisms are cells. Cells are organized in many ways within living things. Multicellular organisms contain a variety of kinds of cells that look very different from each other and perform unique functions. In plants and animals, cells are arranged into body structures (tissues, organs, and systems) that are organized in an interconnected manner that results in a functioning organism. An organism's survival depends on the body structures performing needed functions, for example, in animals, the skeleton and muscles for movement; sense organs and the brain for control; skin, hair, or scales for body protection; or in plants, rigid trunks or stems for support; green leaves for carrying on photosynthesis; and seeds for reproduction.	***Human Body*** (3) Activity 1 *Activity 2* **Activity 3** ***Structures of Life*** (4) ***Activity 3*** **Activity 4**

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Component 1.2: Recognize the components, structure, and organization of systems and the interconnections within and among them.

LIFE SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Molecular basis of heredity Describe the life cycle of plants and animals, and recognize the differences between inherited and acquired characteristics.	Plants and animals closely resemble their parents.	Insects (1) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, Parts 1-5 New Plants (2) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, Parts 1-2 ***Human Body*** (3) Activity 4 Structures of Life (4) Activity 3
	All organisms begin life, mature, and die. So, there must be a reliable way to transfer information between generations to sustain an organism's population on the earth. This is accomplished by reproduction, for example, animal eggs or plant seeds.	
	Some likenesses between offspring and parents are inherited, such as eye color in human beings, or leaf shapes of plants. Other likenesses are learned, such as people's table manners or carpentry skills, and a parrot's imitation of human speech. In plants, their ultimate size may be influenced by environmental factors such as temperature and the availability of water and light.	
Human biology Understand the organization and function of human body structures and internal organs, and how they work together.	The human body has many parts. Some parts help it find and take in food, water, and air to survive. Other parts help humans sense their environment, communicate, and reason. There are parts that help babies form, grow, and develop into adults.	Human Body (3) Activities 1, 2, 3, 4
	The brain gets signals from all parts of the body, controls human life functions, and sends signals out to different body parts. As an example, muscles receive signals from the brain and cause movement in body parts in response to the messages.	Human Body (3) Activity 4
	People breath in air and use oxygen from the air in order to live.	
	People obtain energy and substances from food for growth and body repair. The indigestible parts of food are eliminated.	
	Skin protects the body from harmful substances, unhealthy organisms, and from drying out.	
	Like all animals, people have a reproductive system for producing offspring.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: **Understand how interactions within and among systems cause changes in matter and energy.**

LIFE SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Life processes and the flow of matter and energy Recognize that living things need constant energy supplied from food or light, and that in ecosystems, substances such as air, water, nutrients, and the chemicals in food are continually recycled.	Some source of energy is needed for all organisms to stay alive and grow. Plants need light energy and animals need energy from food.	Insects (1) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, Parts 1-5 New Plants (2) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, Parts 1-2 Structures of Life (1) Activities 3, 4
	Plants use water, light, air (carbon dioxide), and nutrients to produce food molecules. In producing food molecules, plants release oxygen as a by-product.	
	Animals take in water, food, and oxygen to sustain life. Almost all kinds of animal food can be traced back to plants.	
	Over the whole earth, organisms are growing, reproducing, dying, and decaying. Decomposers break down dead material, and the broken down molecules can then be reused by organisms in the ecosystems.	
Biological evolution Know that fossil records show patterns of structural change in organisms over time.	Prehistoric plants and animals have been preserved in rocks as fossils.	
	Fossils can be used to trace how living organisms have adapted and changed their body characteristics over time.	
	Fossils can be compared to one another and to living organisms. Fossils from some ancient organisms are similar to existing organisms, but others are quite different.	
	Examination of fossils shows that some organisms that lived on earth have completely disappeared.	
Interdependence of life Describe how an organism's behavior and ability to survive is influenced by its environment, other life forms, and availability of food and/or other resources.	The behavior of individual organisms is influenced by internal and external cues, such as hunger or smoke from a forest fire. Humans and other organisms have senses that help them detect internal and external cues.	Animals Two by Two (K) Activities 1, 2, 3, 4 ***New Plants*** (2) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, Parts 1-2 Structures of Life (4) Activity 5 Environments (5) Activity 1, Parts 1-2 Activity 2, Parts 1-2 Activity 3, Parts 1-2 Activity 4, Parts 1-3 Activity 5, Parts 1-3 Activity 6, Parts 1-2
	All animals depend on plants. Some animals eat plants to survive. Other animals eat the animals that eat plants. Other life forms decompose dead organisms.	
	For any particular environment, some kinds of plants and animals survive well, some struggle to live and others die. When an environment changes, some plants and animals survive and reproduce because they have characteristics that help them adjust, and others die or move to new locations.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: Understand how interactions within and among systems cause changes in matter and energy.

LIFE SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Environmental and resource issues Know humans and other living things depend on the natural environment, and can cause changes in their environment that affect their ability to survive.	Environments are the space, conditions, and factors that affect an individual's and population's ability to survive and maintain their quality of life.	***Structures of Life*** (4) Activities 1, 5 ***Water*** (4) Activity 3 ***Environments*** (5) Activity 1, Parts 1-2 Activity 2, Parts 1-2 Activity 3, Parts 1-2 Activity 4, Parts 1-3 Activity 5, Parts 1-3 Activity 6, Parts 1-2
	All necessary resources can be found in living and non-living environments to meet the needs and wants of humans and other living things.	
	To survive, humans and other animals need water, food, air, waste removal, and a particular range of temperature in their environment.	
	The supply of resources is limited. Resources can be conserved and their usable life extended through recycling and decreased use.	
	Natural causes or humans may produce positive, negative, or neutral environmental change. Occasional desert brush fires burn vegetation back to optimum levels for a healthy habitat. Pollution can negatively change the environment and decrease the health, survival, or activities of organisms, including humans. Flooding can change a river delta without significantly altering its habitat, plants, or animal life.	

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EARTH SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Nature and properties of earth materials Observe and examine physical properties of earth materials, such as rocks and soil, water (as liquid, solid, and vapor), and the gases of the atmosphere.	Chunks of rocks come in many sizes and shapes, from boulders to grains of sand and even smaller. Smaller rocks come from weathering or destruction of larger rocks.	Wood (K) Activity 1, Parts 1-3 Activity 3, Parts 1-5 Air and Weather (1) Activity 2, Parts 1-4 Earth Materials (3) Activity 1, 2, 3, 4 Pebbles, Sand, and Silt (2) Activity 1, Parts 1-5 Activity 2, Parts 1-4 Activity 3, Parts 1-5 Activity 4, Parts 1-3 Solids and Liquids (1) Activity 1, Parts 1-3 Activity 2, Parts 1-4 Activity 3, Parts 1-3 Activity 4, Parts 1-3 Water (4) Activity 1, 2, 3 Wood (K) Activity 1, Parts 1-5 Activity 2, Parts 1-7 Starbase Atlantis: Crushed Can (5) Magdeburg Hemispheres Paper Wing Balloon in a Vacuum Jar Air Has Weight Coin and Feather Tube
	Soils have properties of color and texture, capacity to retain water, and ability to support the growth of many kinds of plants, including those in our food supply.	
	Water can be liquid, solid, or gas and can go from one form to the other. If water is turned into ice and then the ice is allowed to melt, the weight of water is the same as it was before freezing.	
	When liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled, or as a solid if cooled below the freezing point of water. Clouds and fog are usually made of tiny droplets of water.	
	Air is a substance that surrounds us, takes up space, and whose movement we feel as wind.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: Recognize the components, structure, and organization of systems and the interconnections within and among them.

EARTH SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Systems Identify the parts of a system, how the parts go together, and how they depend on each other.	A system is a group of related objects that make up a whole. Thus, systems, are made of parts (called subsystems). Systems can be found in the natural world (e.g., the parts of an insect or the solar system), or may be put together (e.g., a flashlight circuit or a mousetrap).	Starbase Atlantis: Astronomy Unit
	Objects or parts of systems do things to each other. They produce or impart changes of various kinds. These changes give us evidence that the parts have interacted with each other.	
	When parts work together, they can do things as a system that they couldn't do by themselves.	
	If parts within a system are missing, broken, worn out, mismatched, or not correctly connected, then that system may not work properly or may not work at all.	
Components and patterns of the earth system Recognize that the earth is a spherical planet composed of landforms, bodies of water, atmosphere, and a dense interior.	The earth has a distinctive pattern in terms of both the location of the oceans and landmasses and the physical features on the surface of the landmasses.	***Earth Materials*** (3) Activity 1
	There are interconnections and patterns among the major components of the earth system – continents, oceans, mountain ranges, river systems, lakes, deserts, forests, grasslands, etc.	
Components of the solar system and beyond (universe) Know that the earth is one of several planets that orbit the sun, and the moon orbits the earth.	The sun can be seen only in the daytime, but the moon can be seen sometimes at night and sometimes during the day. The sun, moon, and stars all appear to move slowly across the sky.	Astro Adventures (5) Starbase Atlantis: Introduction to Astronomy Tracking the Sun
	The moon looks a little different every day, but looks the same again about every four weeks.	
	The earth revolves around the sun in approximately 365 days (1 year), and the moon revolves around the earth in approximately 28 days.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: **Understand how interactions within and among systems cause changes in matter and energy.**

EARTH SCIENCE – Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Processes and interactions in the earth system Identify processes that slowly change the surface of the earth, such as erosion and weathering, and those that rapidly change the surface of the earth, such as landslides, volcanic eruptions, and earthquakes.	Things on or near the earth are pulled toward it by the earth's gravity.	***Pebbles, Sand, and Silt*** (2) **Activity 1, Parts 1-5** Activity 2, Parts 1-4 ***Earth Materials*** (3) Activity 1 ***Water*** (4) Activity 4
	Waves, wind, running water (streams and rivers), and ice shape and reshape the earth's land surface by eroding rock and soil in some areas and depositing them in other areas, sometimes in seasonal layers.	
	Some changes on the surface of the earth arise from internal processes, such as volcanoes and earthquakes.	
History and evolution of the earth Recognize that fossils provide evidence of plants, animals, and environments that existed long ago.	Prehistoric plants and animals are preserved in rocks as fossils.	
	Fossils are not only evidence of actual organisms, but also of their activities, such as footprints or burrows.	
	Prehistoric environments can be estimated by plant and animal remains in fossils, for example, some dinosaurs lived in a warm, lush habitat.	
Hydrosphere/atmosphere Observe and measure weather indicators such as temperature, wind direction and speed, and precipitation, noting changes and patterns of change from day to day and over the seasons.	Some events in nature have a repeating pattern. The weather changes some from day to day, but measures such as temperature and amount of rain (or snow) tend to be high, low, or medium in the same months every year.	Air and Weather (1) Activity 1, Parts 1-6 ***Water*** (4) Activity 3 Starbase Atlantis: Oceans of Air (5)
	The sun provides the light and heat necessary to maintain the temperature of the earth.	
Interactions in the solar system and beyond Observe and describe the patterns of movement of the sun and moon to each other and the earth, and relate them to the earth's rotation.	Objects in the sky have patterns of movement. The sun, for example, appears to move across the sky in nearly the same way every day, but its path changes slowly over the seasons. The time and place of rising and setting and the angle of the sun above the horizon at noon all change through the year. The moon moves across the sky each day much like the sun. the observable shape of the moon changes from day to day in a cycle that lasts about a month.	Astro Adventures (5) Starbase Atlantis: Tracking the Sun
	The rotation of the earth on its axis determines day and night.	

SCIENCE ESSENTIAL ACADEMIC LEARNING REQUIREMENTS
Adapted from Washington State CSL Interpretation and Clarification document, May 7, 1999
GRADES K-5

EALR #2: The student understands the skills and processes of science and technology.

Component 2.1: Develop abilities necessary to do scientific inquiry.

Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Questioning Ask questions about objects, organisms, and events in the environment.	Generate questions based on observations of the natural world. For example, salt was placed in a glass, and then water was poured in and the solution stirred. Now you can no longer see the salt. Where did the salt go? Identify what is already known about an object, organism, or event in the environment. For example, the "light" from a full moon is a result of reflected light that has come from the sun. Distinguish between questions that can be answered using science and those which cannot. For example, a question that can be investigated such as, "What substances will dissolve in water?" A question not answered by science is, "What is a friend?" The latter question is a matter of definition and the former is answered by definition.	Animals Two by Two (K) Activities 1, 2, 3, 4 Paper (K) Activity 1, Parts 1-3 Wood (K) Activity 1, Parts 1-5 Air and Weather (1) Activity 1, Parts 1-6 Activity 2, Parts 1-4 Activity 3, Parts 1-5 Activity 4, Parts 1-5 Structures of Life (1) Activity 1 New Plants (2) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, Parts 1-2 Earth Materials (3) Activity 4 Physics of Sound (3) Activity 2, Part 1 Magnetism and Electricity (4) Activity 2, Part 1 Environments (5) Activity 1, Parts 1-2 Activity 2, Parts 1-2 Activity 3, Parts 1-2 Activity 4, Parts 1-3 Activity 5, Parts 1-3 Activity 6, Parts 1-2

EALR #2: The student understands the skills and processes of science and technology.

Component 2.1: Develop abilities necessary to do scientific inquiry.

<table>
<tr><th colspan="3">Benchmark 1</th></tr>
<tr><th>Benchmark Indicators</th><th>Benchmark Clarifiers</th><th>FOSS Modules</th></tr>
<tr><td rowspan="4">Designing and conducting investigations
Plan and conduct simple investigations, using appropriate tools, measures, and safety rules.</td><td>Plan and conduct an observational investigation that collects information about characteristics or properties, and how these characteristics or properties might change over time or with different conditions. For example, observe the changes in a moistened seed over time.</td><td rowspan="4">Air and Weather (1)
Activity 1, Parts 1-6
Activity 2, Parts 1-4
Activity 3, Parts 1-5
Activity 4, Parts 1-5

Solids and Liquids (1)
Activity 4, Parts 1-3

Balance and Motion (2)
Activity 1, Parts 1-4
Activity 2, Parts 1-3
Activity 3, Parts 1-3

New Plants (2)
Activity 1, Parts 1-3
Activity 2, Parts 1-3
Activity 3, Parts 1-3
Activity 4, Parts 1-2

Pebbles, Sand, and Silt (2)
Activity 2, Parts 1-4
Activity 4, Parts 1-3

Earth Materials (3)
Activities 1, 2, 3, 4

Physics of Sound (3)
Activity 1, Parts 1-2
Activity 2, Part 1
Activity 3, Part 1

Magnetism and Electricity (4)
Activity 1, Parts 1-2
Activity 2, Part 1
Activity 3, Part 1

Water (4)
Activities 2, 3, 4

Environments (5)
Activity 1, Parts 1-2
Activity 2, Parts 1-2
Activity 3, Parts 1-2
Activity 4, Parts 1-3
Activity 5, Parts 1-3
Activity 6, Parts 1-2

Human Body (5)
Activity 4</td></tr>
<tr><td>Identify an experimental factor and identify a variable that may change the effect of the experimental factor. Design an experiment to determine whether the variable changes the effect. For example, comparing the behavior of a balloon filled with different kinds of gas (carbon dioxide, oxygen, helium, nitrogen), or observing the germination of seeds under different conditions (wet, moist, and dry conditions; hot, warm, cool, and cold).</td></tr>
<tr><td>Use simple equipment and tools (such as magnifiers, rulers, balances, scales, and thermometers) to gather data and extend the senses.</td></tr>
<tr><td>Collect, categorize, order, and organize observational data.</td></tr>
</table>

EALR #2: The student understands the skills and processes of science and technology.

Component 2.1: Develop abilities necessary to do scientific inquiry.

Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Designing and conducting investigations (cont'd) Plan and conduct simple investigations, using appropriate tools, measures, and safety rules.	Identify and correct sources of error in measurement with respect to the way measurement tools are used. For example, adjusting an equal arm balance so that it is level prior to weighing an object or ensuring youngsters are using rulers properly (such as laying it at the zero mark at the end of the object being measured) when making linear measurements.	
	Follow safety rules during investigations.	
Evidence and explanation Use data to construct reasonable explanations.	Describe the procedures by which individual pieces of data were obtained.	Animals Two by Two (K) Activities 1, 2, 3, 4 Air and Weather (1) Activity 1, Parts 1-6 Activity 2, Parts 1-4 Activity 3, Parts 1-5 Solids and Liquids (1) Activity 2, Parts 1-4 Earth Materials (3) Activities 3, 4 Physics of Sound (3) Activity 3, Part 1 Water (4) Activities 3, 4 Environments (5) Activity 1, Parts 1-2 Activity 2, Parts 1-2 Models and Designs (5) Activity 1, Parts 1-3 Activity 2, Parts 1-2
	Repeat procedures or experiments to show others how results were obtained.	
	Examine data/results and propose a meaningful interpretation (explanation or conclusion). For example, in an investigation on the cardiovascular system, what was the effect of exercise on pulse rate?	
	Relate data and interpretations obtained by self to the data and interpretations by others. For example, in an investigation on the cardiovascular system (effect of exercise on pulse rate), compare your team's results and conclusion with those of other teams in the class.	
	Check conclusions, explanations, and interpretations to see if they are consistent with evidence (results, prior experience, and observations of others). For example, compare the conclusion drawn from your team results with the class results or with those in a book on science.	

EALR #2: The student understands the skills and processes of science and technology.

Component 2.1: Develop abilities necessary to do scientific inquiry.

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<tr><th>Benchmark Indicators</th><th>Benchmark Clarifiers</th><th>FOSS Modules</th></tr>
<tr><td rowspan="4">Modeling
Model objects, events, or processes by representing them with concrete objects, metaphors, analogies, or other conceptual or physical constructs.</td><td>Construct a physical model of a familiar object. For example, a three-dimensional contour model of Mt. St. Helen's.</td><td rowspan="4">Air and Weather (1)
Activity 1, Parts 1-6
Activity 3, Parts 1-5
Activity 4, Parts 1-5

Solids and Liquids (1)
Activity 2, Parts 1-4

Balance and Motion (2)
Activity 1, Parts 1-4
Activity 2, Parts 1-3
Activity 3, Parts 1-3

Pebbles, Sand, and Silt (2)
Activity 2, Parts 1-4

Earth Materials (3)
Activity 1

Human Body (3)
Activities 1, 2, 3

Structures of Life (4)
Activity 5

Models and Designs (5)
Activity 1, Parts 1-3
Activity 2, Parts 1-2</td></tr>
<tr><td>Explain how toy models are like real things in some ways only. They are not the same size, are missing many details, or are not able to do all of the same things. For example, what is similar and dissimilar about a model rocket and a real rocket?</td></tr>
<tr><td>Describe how a model of something can be used to learn something about the real thing, even though it is different from the real thing. For example, a model stream table can be used to simulate some aspects of stream erosion.</td></tr>
<tr><td>Describe an object, event, or process by telling how it is like something else (analogies and metaphors). For example, consider how the action of the lower arm and elbow are like the action of a door on a hinge. What other things in the world around us seem to act like the elbow and the arm?</td></tr>
<tr><td rowspan="4">Communication
Record and report observations, explanations, and conclusions using oral, written, and mathematical expression.</td><td>Accurately record and report observations, methods, and results of simple experiments and describe how conclusions were derived. For example, "How did you get your results?" and "What do you think is happening?"</td><td rowspan="4">Animals Two by Two (K)
Activities 1, 2, 3, 4

Paper (K)
Activity 1, Parts 1-3
Activity 2, Parts 1-3

Wood (K)
Activity 1, Parts 1-5

Air and Weather (1)
Activity 1, Parts 1-6
Activity 2, parts 1-4
Activity 3, Parts 1-5
Activity 4, Parts 1-5

Insects (1)
Activity 1, Parts 1-3
Activity 2, Parts 1-3
Activity 3, Parts 1-3
Activity 4, parts 1-5</td></tr>
<tr><td>Use listening, observing, reading, and writing skills and developmentally appropriate levels to obtain and comprehend science ideas. For example, "listen to her. How is your idea different?"</td></tr>
<tr><td>Write and speak clearly about science ideas and explanations using developmentally appropriate vocabulary and writing skills. For example, "What do you mean? Can you say that another way?"</td></tr>
<tr><td>Use numbers, shapes, symbols, and graphs to describe situations in the physical world. For example, "How does your picture show what really happened?"</td></tr>
</table>

EALR #2: The student understands the skills and processes of science and technology.

Component 2.1: Develop abilities necessary to do scientific inquiry.

Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Communication (cont'd) Record and report observations, explanations, and conclusions using oral, written, and mathematical expression.	Use developmentally appropriate (and available) computer programs and science software to learn about science and prepare science reports. Present science information using strategies such as drawings and other visual media, role-playing, lists, and/or data tables.	Solids and Liquids (1) Activity 3, Parts 1-3 Activity 4, Parts 1-3 Balance and Motion (2) Activity 1, Parts 1-4 Activity 2, Parts 1-3 Activity 3, Parts 1-3 New Plants (2) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, Parts 1-2 Earth Materials (3) Activities 1, 2, 3, 4 Physics of Sound (3) Activity 1, Parts 1-2 Activity 2, Part 1 Activity 3, Part 1 Activity 4, Part 1 Magnetism and Electricity (4) Activity 1, Parts 1-2 Activity 3, Part 1 Structures of Life (4) Activities 1, 4 Water (4) Activities 3, 4 Environments (5) Activity 1, Parts 1-2 Activity 2, Parts 1-2 Activity 3, parts 1-2 Activity 4, Parts 1-3 Activity 5, Parts 1-3 Activity 6, Parts 1-2 Models and Designs (5) Activity 1, parts 1-3 Activity 2, Parts 1-2

EALR #2: The student understands the skills and processes of science and technology.

Component 2.2: Apply science knowledge and skills to solve problems or meet challenges.

Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Identifying problems Identify problems found in familiar contexts in which science/technology can be or has been used to design solutions.	Describe a problem that is amenable to a scientific or technological solution. For example, slugs are eating the vegetables growing in the garden. What is an environmentally acceptable way of eliminating them without contaminating the vegetables?	Pebbles, Sand, and Silt (2) Activity 2, Parts 1-4 Magnetism and Electricity (4) Activity 4, Parts 1-2
	Examine simple technological objects and products found at home or school and describe their functions and the purposes they serve. For example, in a typical classroom the following "technological objects" would be found: crayons, pencils, waste paper basket, pencil sharpener, clock, and chair.	
	Describe a technological solution to a problem of a practical or scientific nature. For example, slugs eating vegetables in a garden is the problem and using an abrasive material (such as egg shells or diatomaceous earth) might prevent them from reaching the vegetables.	

EALR #2: The student understands the skills and processes of science and technology.

Component 2.2: Apply science knowledge and skills to solve problems or meet challenges.

Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Designing and testing solutions Propose, design, and test a solution to a problem.	Identify the difficulties that exist in designing and implementing a solution to a problem.	Paper (K) Activity 3, Parts 1-5 Air and Weather (1) Activity 3, Parts 1-5 Activity 4, Parts 1-5 Solids and Liquids (1) Activity 1, Parts 1-3 Activity 2, Parts 1-4 Activity 4, Parts 1-3 Balance and Motion (2) Activity 1, Parts 1-4 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Measurement (3) Physics of Sound (3) Activity 4, Part 1 Electricity and Magnetism (4) Models and Designs (5)
	Use more than one material and developmentally appropriate manipulation skills to solve a problem, such as keeping a door from slamming shut.	
Evaluating potential solutions Evaluate how well a design or a product solves a problem.	Evaluate a solution in relation to criteria. For example, using diatomaceous earth would be a useful solution to the problem of slugs eating garden vegetables if: the slugs stopped eating the vegetables because of it and if the diatomaceous earth did not harm the vegetables, humans, or pets.	Air and Weather (1) Activity 3, Parts 1-5 Activity 4, Parts 1-5 Balance and Motion (2) Activity 1, Parts 1-4 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Physics of Sound (3) Activity 4, Part 1 Ideas and Inventions (4)
	Modify a design based on results of evaluation. For example, if we found the diatomaceous earth only partially prevented slugs from reaching the vegetables, we might consider including an additional substance in the diatomaceous earth that might repel the slugs (such as pepper or salt).	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.1: Understand the nature of scientific inquiry.

Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Intellectual honesty Understand that all scientific observations should be reported accurately even when they contradict expectations.	Data should be presented as actually observed, not as the investigator might want or expect them to be. Keeping clear, accurate descriptions enables people to compare their observations with those of others. For example, "Did you observe this result, or is this just what you think will happen?"	Wood (K) Activity 1, Parts 1-5 Air and Weather (1) Activity 1, Parts 1-6 Activity 3, Parts 1-5 Activity 4, Parts 1-5 ***Human Body*** (3) Activity 2
	Records should be accurately kept during scientific observations and not changed later.	
	The discoverers of science ideas should be given credit for their achievements. For example, "Who suggested this explanation?"	
Limitations of science and technology Distinguish between questions that can be answered with science and technology and those that cannot.	The kind of investigation used depends on the kind of question being asked, for example, investigations may be used to seek answers to questions about natural events; to describe or classify objects, events, and organisms; or to conduct a fair test or experiment. For example, science does not answer the question of which rock is prettiest, but scientific methods can be used to answer the question of which kind of rock can be found locally.	
	Scientific investigations involve answering questions about the natural world and comparing the answers with what is already known.	
	People have always had questions about their world. Science is one way of answering these questions and making sense of the natural world.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.1: Understand the nature of scientific inquiry.

Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Dealing with inconsistencies Explain why similar investigations may not produce similar results.	Science investigators ask questions, form hypotheses, and look for evidence to support positions. For example, sometimes experimenters working on the same question/problem use different designs, methods, and controlled variables which yield differing results.	Air and Weather (1) Activity 1, Parts 1-6 ***New Plants*** (2) Activity 1, Parts 1-3 Activity 2, Parts 1-3 Activity 3, Parts 1-3 Activity 4, parts 1-2 ***Earth Materials*** (3) Activity 3 Models and Designs (5) Activity 1, Parts 1-3
	It is important to collect as much data as possible before drawing conclusions. For example, insufficient data from a narrowly focused investigation may yield limited results.	
	Scientific investigations using similar procedures often give slightly different results when carried out by different individuals or at different times or places. This is due to different methods of experimentation, limitations in equipment, or errors in conducting the investigation. However, if the results of repeated experiments give significantly different results, something must be wrong with the design of the investigation.	
	A combination of evidence and logic can be used to convince others of the validity of scientific ideas. For example, the acceptance of scientific ideas depends on the use of data to form logical arguments that can withstand intense public critique by knowledgeable reviewers.	
Evaluating methods of investigation Recognize that results of scientific investigations can come from expected and unexpected sources.	People may give different descriptions of the same thing. It is usually a good idea to make some fresh observations, instead of just arguing about whom is right. For example, repeating an experiment or observing it in a new way (videotaping it, using a microscope, etc.) may assist observers in clarifying the nature of their observations and interpretations.	Physics of Sound (3) Activity 1, Parts 1-2
	A willingness to modify explanations when evidence suggests different ways of explaining is an important scientific practice. For example, science is dependent on being open to alternative methods, approaches, or explanations when inconsistencies or valid objections to evidence arise.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.1: Understands the nature of scientific inquiry.

Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Evaluating methods of investigation (cont'd) Recognize that results of scientific investigations can come from expected and unexpected sources.	An experiment may need to be repeated when conflicting data and explanations arise. For example, scientific results should be replicable, and repetition and refinement of experimental approaches is encouraged.	
	Scientific data should be interpreted objectively and accurately, even when the results are contrary to predictions. For example, critical review of results relative to the hypothesis being tested is essential, and should be accepted if the methodology is shown to be valid and reliable.	
Evolution of scientific ideas Know that ideas in science change as new scientific thinking, theories, and evidence arises.	Science is an attempt to construct rational explanations for what is observed in the natural world. For example, science has developed a rich and cohesive "story" of the underlying principles and processes that operate in the natural world (such as the cell theory, plate tectonics, and the relation between forces and the pivot point for levers).	Physics of Sound (3) Activity 4, Part 1 Models and Designs (5) Activity 1, Parts 1-3
	Scientific explanations about the natural world are always tentative and subject to change. For example, the ideas of science undergo continuous refinement and modification as new evidence is generated (moving from a "flat" earth interpretation to a spherical earth interpretation).	
	Testing hypotheses provides valuable information in scientific endeavors, even if the hypotheses are disproved. For example, using experimental results to accept or reject science ideas is the normative behavior of science. Disproving ideas assists the processes of refinement of explanations by eliminating ideas that do not stand up to rigorous scientific scrutiny.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.2: **Know that science and technology are human endeavors, interrelated to each other, to society, and to the workplace.**

Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
All peoples contribute to science and technology Know that science and technology have been practiced by all peoples throughout history.	The fields of science and technology have developed over time as people experimented, invented, and discovered things and solved problems in their everyday lives. For example, any area such as agriculture, transportation, medicine, manufacturing, and communication can be examined and significant advancements identified that have occurred over the last 400 years.	
	Many people enjoy doing science and developing technology. For example, scientists, engineers, and technologists have chosen to participate in science because of the interesting and exciting investigations they carry out and the challenging problems that are available for them to work on.	
	Many diverse individuals, including women, men, members of ethnic minority groups, and people with disabilities have made significant scientific discoveries and technological advances.	
Relationship of science and technology Recognize that people have invented tools for everyday life and for scientific investigations.	Science is the exploration and investigation of the natural world. Technology is the process of designing solutions to human problems and inventing ways to adapt to the environment. For example, science is focused on the underlying principles governing the natural world and utilizes the scientific inquiry process, while technology seeks solutions to human-centered issues and utilizes design and engineering methods in creating new products and processes.	Air and Weather (1) Activity 1, Parts 1-6 Activity 2, Parts 1-4 Activity 3, Parts 1-5 Activity 4, Parts 1-5 Pebbles, Sand, and Silt (2) Activity 2, Parts 1-4 Activity 3, Parts 1-5 Magnetism and Electricity (4) Activity 4, Parts 1-2
	Tools help scientists observe things that are too small or too far away to be seen without assistance. Scientific instruments also help people study the motion of objects that are moving too rapidly or are hardly moving at all. For example, scientific tools (microscopes, telescopes, satellites, lasers, etc.) have provided valuable assistance in expanding the kinds of science investigations and data that can be collected.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.2: **Know that science and technology are human endeavors, interrelated to each other, to society, and to the workplace.**

Benchmark 1		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Relationship of science and technology (cont'd) Recognize that people have invented tools for everyday life and for scientific investigations.	Tools are used in everyday life to extend human ability to cut, shape, or put together materials; to move things from one place to another; to quantify and manipulate; and to reach farther than is physically possible with human hands, voices, senses, and minds. For example, the "tools" that are the products of technology allow us to do such things as keep track of time (watches, clocks), stay warm (furnaces, heaters), move about (bicycles, automobiles, airplanes), cook our food (stoves), illuminate our homes (lamps), and entertain ourselves (television, VCR, radio, CD player).	
Careers and occupations using science, mathematics, and technology Identify the knowledge and skills of science, mathematics, and technology used in common occupations.	Books, media, and web sites can be used to identify the characteristics and nature of the work associated with occupations that require knowledge and skills of science, mathematics, and technology.	Air and Weather (1) Activity 1, Parts 1-6
	Individuals who are presently engaged in occupations involving science, mathematics, and technology are able to provide specific kinds of information about careers in these fields.	
	The workplaces of those individuals engaged in occupations requiring a science, mathematics, and technology background are an excellent place to visit in order to obtain direct experience and insights in a given field of work.	

SCIENCE ESSENTIAL ACADEMIC LEARNING REQUIREMENTS
Adapted from Washington State CSL Interpretation and Clarification document, May 7, 1999
GRADES 6-8

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.1: Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.

PHYSICAL SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Properties of substances Use physical and chemical properties to identify and describe substances, for example, density, boiling point, and solubility.	Appropriately use physical properties, including density, boiling point, freezing point, and solubility to identify or describe particular substances.	Food and Nutrition (6) Activity 1, Parts 1-2 Activity 2, Parts 1-3 Activity 3, Parts 1-2
	Appropriately use chemical properties, including pH and reactivity to describe substances.	
	Operationally define, measure, and use appropriately the ideas of length, area, and volume to describe the size of objects.	
	Differentiate between operations to obtain measures of mass (equal arm balance), weight (spring scale), and density (mass associated with each one unit of volume, e.g., the number of grams of substance for each one cubic centimeter of the substance). For a given substance, the density is the same number, regardless of the amount of the substance. Thus, density is a property of the particular kind of substance.	
Motion of objects Describe the positions, relative speeds, and changes in speed of objects.	Words, graphs, tables, and pictures (strobe-like) are used to represent the position or speed of an object at any time during the story.	
	From representations of position vs. time, the average speed is determined by measuring or calculating how far the object travels in each unit of time, and the speed is expressed in units, such as meters traveled for each one second (m/sec), centimeters per minute, miles per hour, or inches per year.	
	An object might move through a time interval at a constant speed or the speed might vary considerably, but in either case if the object had traveled the same distance, its average speed would have been the same (same distance divided by the same time).	

Key:
Bold and italics font indicates an EALR not addressed by FOSS teacher manual as written but easily addressed by supplemental lessons liked to FOSS.
Regular font indicates EALR addressed when the teacher teaches the FOSS module as written in the teacher's guide.

3/01

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.1: Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.

PHYSICAL SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Motion of objects Describe the positions, relative speeds, and changes in speed of objects.	Whether an object is speeding up, slowing down, or moving with constant speed can be determined by determining and comparing the relative speeds during those intervals.	
	Determine the speed at any instant and the change in speed for any time interval from representations (graphs, tables, speedometer pictures) of speedometer readings vs. time.	
	Determine whether an object is speeding up, slowing down, or moving at a constant speed, using representations of speedometer readings vs. time.	
Wave behavior Describe water waves and waves on springs, and describe sound and light using wave properties, such as wave length, reflection, refraction, transmission, absorption, scattering, and interference.	Vibrations may set up a traveling disturbance that repeats itself and moves away from its source. This disturbance is called a wave.	
	Differentiate between the motion of the wave and the motion of a particle of the medium along which the wave is traveling. For a slinky spring, the disturbance of a coil of wire may be back and forth, from side to side, or it might be forward and backward along the slinky. The individual coil may not have moved very far at all. But, in either case, the disturbance moves along the spring, away from the source of the disturbance. In deep water, while the motion of a water wave is along the surface, the motion of particles of water is mostly up and down as the wave passes. While the motion of a sound wave is away from the vibrating source, the motion of the medium (e.g., air) through which it travels is short cyclic motions toward and away from the source.	
	Describe situations from which one can readily tell that sound has a speed, that it takes an interval of time for the sound to travel a particular distance. Describe situations from which you can tell that sound travels slower than light.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.1: **Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.**

PHYSCIAL SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Wave behavior (cont'd) Describe water waves and waves on springs, and describe sound and light using wave properties, such as wave length, reflection, refraction, transmission, description, scattering, and inference.	Describe any changes in speed (speeding up or slowing down) and changes in direction as the wave goes from one medium into another. For example, a spring wave going from a slinky into another spring or rope tied to the slinky goes at a different speed in the second medium. At a boundary between two mediums (e.g., air to water), transmitted light may change direction from its original path. (refraction)	
	Describe the behavior of a wave when it hits a surface. For example, light hitting a light-colored, rough surface will scatter in many directions. When sound or light is transmitted into a material from which the sound or light doesn't get out, the sound or light energy is absorbed by the material.	
	Describe situations that demonstrate that when two waves "collide" they pass through each other, for example, describe what happens when different (shape or size) water waves are sent toward each other or when different size or shape spring waves are sent toward each other. Since sound and light pass through each other, they behave like waves. For a brief time when two spring waves are in the same part of the spring, they may add to, or take away from, the effects of each other (they interfere). This can occur for all types of waves, including waves on water or on springs.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: Recognize the components, structure, and organization of systems and the interconnections within and among them.

PHYSICAL SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Systems Describe how the parts of a system interact and influence each other.	A system may involve processes (e.g., respiration in animals, erosion of rock, or evaporation of a liquid), as well as things (e.g., lungs, rocks, or water).	Variables (6)
	Thinking about things as systems means looking for how every part relates to others. The output from one part of a system can become the input to other parts. Such feedback can serve to control what goes on in the system as a whole.	
	Any system is usually connected to other systems, both internally and externally. Thus, a system may be thought of as containing sub-systems and being a subsystem of a larger system. For example, a watershed for a particular stream can contain tributary smaller streams and ponds into which it flows, and it can be thought of as part of a larger river watershed. For another example, a Cartesian diver may be made up of the subparts air and glass, but the diver itself can also be thought of as a subsystem of the entire sealed container in which the diver floats or sinks.	
Energy sources and kinds Understand that energy is a property of substances and systems and comes in many forms, including stored energy, energy of motion, and heat energy such as heat, light, electrical, mechanical, sound, nuclear, and chemical.	Moving things have energy of motion or kinetic energy. The faster they move the higher their energy state.	Food and Nutrition (6) Activity 1, Parts 1-2 Activity 2, Parts 1-3 Activity 4 Levers and Pulleys (6) Activity 2
	Distinguish between "heat" and "temperature." When a substance or object is heated, it gains thermal energy and comes to a higher temperature. A higher state of thermal energy can be produced by rubbing or by burning fuel. The term "heat" refers to energy that is transferred in interaction between higher and lower temperature systems. Heat can be transferred by radiation, conduction, or convection.	
	Thermal energy involves motions of particles (atoms or molecules) in various random directions. The hotter a material, the faster the motion of the particles and the greater the energy of motion (kinetic energy) of the particles.	
	Energy can be stored in springs, batteries, food, or fuel. Energy can also be stored by putting something in a high place for transformation at a later time when the object falls. Such stored energy is referred to as potential energy.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

PHYSICAL SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Energy transfer and transformation Determine factors that affect rate and amount of energy transfer; associate a decrease in one form of energy with an increase in another.	Energy is transformed when, during a transfer of energy, it changes from one form (kind of energy) to another. For example, when a compressed spring is used to shoot a marble, energy is transformed from elastic potential energy to kinetic energy, from "springy" energy held in the compressed spring to energy of motion of the marble.	
	When energy is transferred between systems, typically some energy gets converted to thermal energy (motion of surrounding particles). This often results in moving systems coming to rest. For example, the motion of a coasting bicycle eventually stops. In the process, the energy from the moving bicycle has been transferred to the motion of surrounding air and to heating the tires and road surface.	
	Thermal energy always flows from a warmer body or substance to a cooler one and gradually the two interacting bodies will always come to the same temperature.	
	For a given mass of substance, some substances take more thermal energy to change their temperature by one degree than other substances. For a given substance, the more mass, the more thermal energy it will take to raise the temperature of the substance by one degree. Some materials are better at preventing transfer of thermal energy. For example, Styrofoam is a very good insulator, and wood insulates pretty well. Other materials are better at conducting, transferring thermal energy, e.g., copper and aluminum. Glass is a moderately good conductor of thermal energy.	
	Some materials conduct electrical current and are better at transferring electrical energy from one location to another. Other materials are better at preventing the transfer of electrical energy.	
	When a moving object hits a particular "parked" object, the heavier and faster the moving object, the more energy of motion that can be transferred to the stationary object. More energy will be transferred to the second object the more elastic ("bouncy" rather than "sticky") the collision.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: Recognize the components, structure, and organization of systems and the interconnections within and among them.

PHYSICAL SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Energy transfer and trans-formation (cont'd) Determine factors that affect rate and amount of energy transfer; associate a decrease in one form of energy with an increase in another.	It takes energy to create a vibration or wave. Waves can be used to transfer energy from one place to another.	
	Whenever the amount of energy associated with one object or in one form diminishes, the amount associated with other objects or forms increases.	
	In various circuits of batteries and bulbs, the more bulbs in series the more resistance to converting energy to light. The more bulbs in parallel, the faster the conversion of chemical potential energy to light.	
Structure of matter Understand that all matter is made up of atoms, which may be combined in various kinds, ways, and numbers.	All matter is made of tiny particles (atoms) that cannot be seen without magnification. Atoms do not break down into smaller parts in common day-to-day situations.	
	Matter made up of one kind of atom is called an element. Only about 100 elements exist. Each element has a unique set of properties. The atoms of those elements can attach to each other in a very large number of ways.	
	Two or more kinds of elements that react with each other in definite proportions result in matter called a compound. The resulting compound has unique properties that are different from the properties of each of the individual elements it contains. For example, through electrolysis, water can be broken down into hydrogen gas and oxygen gas, always resulting in two units of volume of hydrogen to one unit volume of oxygen.	
	Two or more atoms attached to each other make up a molecule. A molecule is the smallest particle of an element or compound that can exist by itself and still keep its properties.	
	A mixture is made up of two or more different kinds of atoms or molecules that keep their original characteristics and can be separated from each other by a simple physical process.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

PHYSICAL SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Structure of matter (cont'd) Understand that all matter is made up of atoms, which may be combined in various kinds, ways, and numbers.	A solution is homogeneous material that does not have a definite chemical composition. It is a mixture wherein one or more substances dissolve in one kind of substance. For example, salt dissolves in water creating a salt water solution. Air is a solution of nitrogen, oxygen, carbon dioxide, water vapor, and many other substances. Solids can even be solutions. The component of a solution that exists in greatest amount is called the solvent. The lesser quantities are called solutes. The greater the amount of solute that dissolves, the greater the concentration of the solution. The solution is saturated if no more solute will dissolve. If solute begins to come out of a solution, it is called a precipitate.	
Physical/chemical changes Understand physical and chemical changes at the particle level and know that matter is conserved.	Particles in a solid vibrate rapidly, are close to each other, and are usually arranged in an orderly, repeating pattern. Thermal energy transferred to a solid will cause particles to vibrate more quickly and farther. The result may be that the solid material expands, or the molecules may break out of their regular fixed positions, and cause a physical change, such as melting.	
	Particles of a substance in a liquid state move more rapidly than the particle movement in the solid state, but slower than in the gaseous state. In a liquid the particles are only loosely connected and can slide past each other, but there is very little empty space between molecules in a liquid. Liquids expand and contract only slightly (compared to gases) under the influences of changes in temperature or pressure. Heat applied to a liquid will cause particles to move more rapidly and slightly farther apart from each other. Part of the evidence for movement of liquid molecules is diffusion. For example, a drop of food coloring eventually spreads evenly throughout a glass of water.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: Recognize the components, structure, and organization of systems and the interconnections within and among them.

PHYSICAL SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Physical/chemical changes (cont'd) Understand physical and chemical changes at the particle level and know that matter is conserved.	When particles in a container are free to move, they collide with the walls of the container. The faster the particles are traveling and the more times the particles hit the walls, the stronger they push on the walls. This results in a force being exerted on each area of wall. Force/unit of area is called pressure. If we squeeze the container into a smaller volume, the particles will not have to travel so far between walls and therefore will hit the walls more frequently, even if the particles are not moving faster. That results in an increase in the pressure on the walls (same force, but smaller area). Part of the evidence for the rapid movement of separate particles of gas is diffusion. For example, the spread of the fragrance of perfume throughout a room.	
	Particles in a gas move rapidly, are farther apart than in a liquid, and move randomly through the space, colliding with each other and with the boundary walls of the space they occupy. Increasing pressure on a gas-filled container likely decreases the volume containing the gas, if the temperature remains constant. For a fixed volume, if the gas is heated, the average kinetic energy of the particle increases and the gas pressure will increase. In order for the pressure to remain constant, if the temperature of a gas is increased, the volume will increase.	
	Some changes produce matter with different properties and characteristics from the original matter. During these changes (referred to as "chemical changes"), molecules may break apart, freeing the individual atoms or smaller molecules. These particles collide with one another, and reattach differently from their original attachments. Chemical reactions typically result in an increase or decrease in thermal energy and may happen gradually or result in an explosion.	
	Some chemical reactions can decompose materials. One important type of reaction involves a combination of oxygen with something else, such as in burning, rusting, and oxidizing. Substances may also be decomposed by acids or bases. Acids and bases can be used to neutralize each other, to make them less capable of decomposing another material.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: Understand how interactions within and among systems cause changes in matter and energy.

<table>
<tr><th colspan="3">PHYSICAL SCIENCE – Benchmark 2</th></tr>
<tr><th>Benchmark Indicators</th><th>Benchmark Clarifiers</th><th>FOSS Modules</th></tr>
<tr><td rowspan="6">Nature of forces
Know the factors that determine the strength of various forces.</td><td>Force is always an interaction between two objects. One object cannot push on a second without the second object pushing back.</td><td rowspan="6">Levers and Pulleys (6)
Activities 2, 3, 4</td></tr>
<tr><td>Every magnet has magnetic north and south poles. Like poles repel each other and opposite poles attract each other.</td></tr>
<tr><td>The force that one magnet exerts on another is increased by increasing the strength of each magnet and is weakened by increasing the distance between them.</td></tr>
<tr><td>The electrical force of one charged object on another is increased by increasing the electrical charge on either or both objects, and is reduced by increasing the distance between the charged objects.</td></tr>
<tr><td>Every object exerts a gravitational force on every other object. This gravitational force is weak and hard to detect, unless one of the objects has very sensitive equipment. Gravitational force is strengthened as the mass of one or both objects increases. Widening the distance of separation between the objects and/or decreasing the mass of one or both objects decreases gravitational force.</td></tr>
<tr><td>Magnets and moving electrical charges (electrical current) can exert a force on each other. This force is increased by increasing the electrical current and/or by increasing the strength of the magnet. The force is decreased by increasing the distance between the current and the magnet.</td></tr>
<tr><td rowspan="3">Forces to explain motion
Understand the effects of balanced and unbalanced forces on the motion of objects along a straight line.</td><td>If an object is not moving, the forces acting on it are balanced.</td><td rowspan="3">Levers and Pulleys (6)
Activities 1, 2, 3, 4</td></tr>
<tr><td>An object moving in a straight line will change speed (accelerate), if an unbalanced force acts on it.</td></tr>
<tr><td>A change in an object's speed is proportional to the unbalanced force acting on it and the time interval during which the unbalanced force is applied. Also, doubling or tripling the mass of the object will half or third the change in speed, other factors being kept the same.</td></tr>
</table>

SCIENCE ESSENTIAL ACADEMIC LEARNING REQUIREMENTS
Adapted from Washington State CSL Interpretation and Clarification document, May 7, 1999
GRADES 6-8

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.1: Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.

EARTH SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Nature and properties of earth materials Classify rocks and soils into groups based on their chemical and physical properties; describe the processes by which rocks and soils are formed.	The earth is mostly rock and rock is composed of minerals which are made of atoms. Rocks are classified based on the ways that they are formed: igneous rocks from the cooling of molten material; sedimentary rock from weathered rock and sediments gradually buried and cemented together by dissolved minerals (chemical change); and metamorphic rock from buried rock that is reformed by high pressure and temperature (possibly through partial melting and recrystallizing).	Landforms (6) Activity 3
	Some minerals are very rare and some exist in great quantities, but—for practical purposes—the ability to recover them is just as important as their abundance. As minerals are depleted, obtaining them becomes more difficult. Recycling and the development of substitutes can reduce the rate of depletion but may also be costly.	
	Sediments, including sand and smaller particles (sometimes containing the remains of organisms), are gradually buried and are cemented together by dissolved minerals to form solid rock again.	
	Rock bears evidence of the pressures and temperatures that created it.	
	Soil consists of weathered rocks, decomposed organic materials from dead plants, animals, and bacteria, water, and air. Soils are often found in layers, with each having a different chemical composition and texture.	
	Although weathered rock is the basic component of soil, the composition and texture of soil and its fertility and resistance to erosion are greatly influenced by plant roots and debris, bacteria, fungi, worms, insects, rodents, and other organisms.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: Recognize the components, structure, and organization of systems and the interconnections within and among them.

EARTH SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Systems Describe how the parts of a system interact and influence each other	A system may involve processes (e.g., respiration in animals, erosion of rock, or evaporation of a liquid), as well as things (e.g., lungs, rocks, or water).	Variables (6)
	Thinking about things as systems means looking for how every part relates to others. The output from one part of a system can become the input to other parts. Such feedback can serve to control what goes on in the system as a whole.	
	Any system is usually connected to other systems, both internally and externally. Thus, a system may be thought of as containing subsystems and being a sub-system of a larger system. For example, a watershed for a particular stream can contain tributary smaller streams and ponds into which it flows, and it can be thought of as part of a larger river watershed. For another example, a Cartesian diver may be made up of the subparts air and glass, but the diver itself can also be thought of as a subsystem of the entire sealed container in which the diver floats or sinks.	
Components and patterns of the earth system Describe the components and relationships of the earth system, including the solid earth (crust, host convecting mantle, and dense metallic core), the hydrosphere (oceans, seas, lakes, rivers, and streams), and the atmosphere (a mixture of gases).	The outermost rigid shell of the earth is made up of the crust and part of the upper mantle. It is broken into about a dozen rigid plates that move; deformation occurs in the interior of plates at boundaries where they collide. These plates are very thin compared to the thickness of the mantle and core.	*Landforms* (6) Activity 1
	Three-fourths of the earth's surface is covered by a relatively thin layer of water (some of it frozen), and the entire planet is surrounded by a relatively thin blanket of air.	
	Ocean floors are the tops of thin oceanic plates that spread outward from mid-ocean rift zones; land surfaces are the tops of thicker, less-dense continental plates.	
	The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor.	
	The atmosphere has different properties at different elevations.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: Recognize the components, structure, and organization of systems and interconnections within and among them.

EARTH SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Components of the solar system and beyond (universe) Describe the relationships of the earth to the sun, the moon, the other planets and their moons, and smaller objects such as asteroids and comets.	The earth is a small planet, third from the sun (a medium-sized star) in one of few known systems of planets.	Astro Adventures (5)
	The sun is many thousands of times closer to the earth than any other star.	
	Nine planets of different size, composition, and surface features move around the sun in nearly circular (elliptical) orbits. Some planets have a great variety of moons and flat rings of rock and ice particles orbiting around them.	
	One moon, many artificial satellites, and debris orbit the earth.	
	Large numbers of chunks of rock orbit the sun. Some of those that the earth meets in its yearly orbit around the sun glow and disintegrate from friction as they plunge through the atmosphere—and sometimes impact the ground. Other chunks of rocks mixed with ice have long, off-center orbits that carry them close to the sun, where the sun's radiation (of light and particles) boils off frozen material from their surfaces and pushes it into a long illuminated tail.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: Understand how interactions within and among systems cause changes in matter and energy.

EARTH SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Processes and interactions in the earth system Describe the processes of constructive and destructive forces and how they continually change landforms on earth.	Some changes in the earth's surface are abrupt (such as earthquakes and volcanic eruptions) while other changes happen very slowly (such as uplift and wearing down of mountains). The earth's surface is shaped in part by the motion of liquid water, glaciers, and wind over very long times, which act to level mountain ranges.	Landforms (6) Activities 2, 3, 4
	The interior of the earth is very hot. Heat flow and movement of material within the earth cause earthquakes and volcanic eruptions and create mountains and ocean basins. Gas and dust from large volcanoes can change the atmosphere.	
	Some changes in the solid earth can be described as the "rock cycle." Old rocks at the earth's surface weather, forming sediments that are buried, then compacted, heated, and often recrystallized into new rock. Eventually, those new rocks may be brought to the surface by the forces that drive plate motions, and the rock cycle continues.	
	Sedimentary rocks are formed by the weathering and erosion of igneous, metamorphic, or sedimentary rocks (the sediments are compressed); metamorphic rocks are formed by solid-state alteration (heat, pressure, deformation, and recrystallization) of sedimentary, igneous, or other metamorphic rocks; and igneous rocks are formed (crystallize from magna) by the melting of sedimentary, metamorphic, or other igneous rocks.	
	Human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, nuclear weapons tests, and intensive farming, have changed the earth's land, oceans, and atmosphere. Some of these changes have decreased the capacity of the environment to support some life forms.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: **Understand how interactions within and among systems cause changes in matter and energy.**

EARTH SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
History and evolution of the earth Know the importance of fossils in documenting life and environmental changes over time.	Fossils document the existence of plant and animal life on earth over long periods of time.	
	Environmental changes, species extinction or evolution, and climatic variances can be tracked with fossil records. Fossils taken from various layers of sedimentary rock can provide a physical timeline of life on earth.	
	The importance of fossils cannot be minimized. They provide physical evidence of life as it existed before recorded history, for example, the diversification of earth environments or changes in species diversification.	
Hydrosphere/atmosphere Relate global atmospheric movement and the formation of ocean currents to weather and climate.	Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds an enormous amount of thermal energy.	***Landforms*** (6) Activity 4
	The sun is the major source of energy for weather phenomena on the earth's surface, such as winds, ocean currents, and the water cycle.	
	As air absorbs energy from sunlight, it rises which makes room for cooler air to flow in below it. Air is warmed faster at the equator than at the poles because of the decreased intensity per unit area of the sunlight radiation. The mechanism of differential heating which in turn affects the density and relative air pressure is responsible for much of weather phenomena.	
	Thermal energy carried by ocean currents has a strong influence on climate around the world, for example, El Nino and La Nina.	
	The cycling of water in and out of the atmosphere plays an important role in determining climatic patterns. Water evaporates from the surface of the earth, rises and cools, condenses into rain or snow, and falls again to the surface. The water falling on land runs off the surface or collects in soil, porous layers of rock, and rivers and lakes, and much of it flows back into the ocean.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: Understand how interactions within and among systems cause changes in matter and energy.

EARTH SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Hydrosphere/atmosphere (cont'd) Relate global atmospheric movement and the formation of ocean currents to weather and climate.	Climates have sometimes changed abruptly in the past as a result of changes on the earth's surface, such as volcanic eruptions or impacts of huge rocks from space. Even relatively small changes in the atmosphere or ocean (such as salinity, temperature, or amount of water in the ocean) can have widespread effects on climate if the change lasts long enough.	
Interactions in the solar system and beyond Describe how the regular and predictable motions of most objects in the solar system account for such phenomena as the day, year, phases of the moon, eclipses, seasons, and ocean tides.	Seasons are explained by the different angle at which the sunlight hits any place on earth during different times of the year. There is an apparent motion of the stars around the earth during each 24-hour day. Although it appears that a starry sphere is rotating, the motion is better explained by the daily rotation of the earth. The north end of the axis of that rotation points to the same place (that's how the star Polaris got its name) in the sky through the year and from year to year. But, because that axis of rotation is not inclined at 90 degrees (actually it is at about 67 degrees) with respect to the plane of the motion of the earth around the sun, the sunlight hits the earth from directly over some northern region of the earth during the months of April to August and directly over some southern region during the months of October to February. This also accounts for changes in the rising and setting (times and places on the horizon) of the sun during different times of the year. Thus, different latitudes get more or less sunlight during different parts of the year, and we have seasons.	Astro Adventures (5)
	The apparent motion of the moon across the sky is a bit slower than the sun, so moonrise happens nearly an hour later each day. The sun illuminates half of the moon at all times. But, because the moon orbits the earth once in about 28 days, the portion of the moon that we can see from day to day changes. Thus, we observe a small change in the phase of the moon from one day to the next.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: Understand how interactions within and among systems cause changes in matter and energy.

EARTH SCIENCE – Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Interactions in the solar system and beyond (cont'd) Describe how the regular and predictable motions of most objects in the solar system account for such phenomena as the day, year, phases of the moon, eclipses, seasons, and ocean tides.	The angle formed between sighting to the sun and sighting to the moon is related to the phase of the moon that we can see from earth. For example, a full moon occurs when the sun and moon are approximately opposite each other, and a quarter moon occurs when the angle is approximately 90 degrees. A new moon happens when the sun and the moon are in approximately the same part of the sky. That is the condition when the opposite side of the moon is illuminated, so we don't see it from earth.	Astro Adventures (5)
	Eclipses occur when the earth or the moon get in the way of the sun's light. If the earth is in the way of light getting to the moon, the earth's shadow crosses the face of the moon and we have a lunar eclipse. If the moon is in the way of the sunlight getting to the earth, the moon's shadow crosses the face of the earth and we have a solar eclipse. Eclipses generally occur rarely (at most every few months) because the earth, moon, and sun are rarely exactly in line.	
	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 and is the major mechanism for explaining the phenomena of ocean tides. Since gravitational force is stronger when an object is closer, the moon's pull on a bit of water on the moon side of earth is greater than the pull on the water when it is on the side away from the moon.	

SCIENCE ESSENTIAL ACADEMIC LEARNING REQUIREMENTS
Adapted from Washington State CSL Interpretation and Clarification document, May 7, 1999
GRADES 6-8

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.1: Develop abilities necessary to do scientific inquiry.

Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Questioning Identify questions that can be answered through scientific investigations.	Use a variety of strategies to determine how the question or problem might be investigated to obtain an answer or solution.	Levers and Pulleys (6) Activity 3
	Analyze existing knowledge about a science question or problem to determine what is as yet unknown and unanswered. For example, "What is known and unknown regarding the formation of the seasonal ozone hole over the Antarctic and arctic regions?"	
	Understand science is limited to investigating that which is accessible by the senses, either alone or enhanced by scientific instruments. For example, a question amenable to investigation is, "Relative to the horizon, where will someone, who is south of me, see the moon rise?" A question not amenable to investigation is, "Using an astrological forecast, who are my friends?"	
Designing and conducting investigations Design, conduct, and evaluate scientific investigations, using appropriate equipment, mathematics, and safety procedures.	Test for whether a particular variable does have an effect on the experimental factor. Design a fair test experiment to determine whether a particular variable has an effect and what that effect is on the experimental factor. (For example, does the amount of water affect the development of corn seeds. Some seeds get one drop of water each, and some seeds get ten drops of water each, and some seeds get a cup of water each. All seeds and water are wrapped in plastic wrap. All seeds experience the same conditions such as light and temperature except for the variable under investigation.)	Food and Nutrition (6) Activity 1, Parts 1-2 Activity 2, Parts 1-3 Landforms (6) Activity 3 Levers and Pulleys (6) Activities 2, 3, 4
	Use appropriate tools (including microscopes) and techniques, including mathematical analysis, to gather, analyze, and interpret data.	

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.1: Develop abilities necessary to do scientific inquiry.

Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Designing and conducting investigations (cont'd) Design, conduct, and evaluate scientific investigations, using appropriate equipment, mathematics, and safety procedures.	Identify and correct sources of systematic error associated with the measurement tool itself (for example, a spring scale that reads positive even with nothing on it) and with the ways measurement instruments are used (for example, always rounding measurements up to the next whole number).	
	When results from an experiment are ambiguous, redesign the experiment with an improved design and procedures to obtain clearer experimental results and more definitive conclusions. For example, if the results in an investigation of the factors that affect the rate at which bread dough rises are ambiguous, redesign the investigation so that one specific variable is being changed and other factors are being controlled (held constant).	
	Identify and practice safety procedures.	
Evidence and explanation Use evidence from scientific investigations to think critically and logically to develop descriptions, explanations, and predictions.	Examine relationships between evidence and explanation. Is the explanation consistent with the evidence?	Food and Nutrition (6) Activity 1, Parts 1-2 Activity 2, Parts 1-3 Activity 3, Parts 1-2 Activity 4 Landforms (6) Activity 3 Levers and Pulleys (6) Activities 1, 2, 4
	Draw inferences and recognize relationships using scientific knowledge.	
	Link references to data gathered through observations and experimentation. Consider alternative references that fit the data.	
	Relate the data and interpretations obtained by self to accepted scientific ideas. For example, relate observational data involving the moon during the lunar cycle to what a scientific source says about the motion of the earth and moon.	
	Make continued attempts to derive a scientific explanation, and consider other possible explanations that could account for the same data. For example, when investigating with batteries and bulbs, consider various explanations or analogies for what bulbs do to the flow to get the effects observed.	

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.1: Develop abilities necessary to do scientific inquiry.

Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Modeling Correlate models of behavior of objects, events, or processes to the behavior of the actual things under investigation; test models by predicting and observing actual behaviors or processes.	Construct to scale a physical model of a physical or biological object, event, or process. For example, a drawing of a cell containing the major sub-cellular structures and their relative sizes.	Landforms (6) Activities 1, 2, 3, 4, 5 Variables (6)
	Predict how the real thing might work if something were done to it by making modifications in a model of it and observing resultant changes. For example, in a model stream table system divert the stream flow with a "dam" and predict and observe the resultant changes.	
	Explain how models are often used to think about processes that happen too slowly, too quickly, or on too small a scale to observe directly, or are too vast to be changed deliberately, or that are potentially dangerous.	
	Use geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories to represent an approximation of objects, events, and processes in the real world. For example, make a series of sketches showing the sequence of events from the original Pangea to the current configurations of the continents. Use an arrow having length and direction to represent the strength and direction of each force acting on the continents.	
Communication Communicate scientific procedures, investigations, and explanations orally, in writing, with computer-based technology, and in the language of mathematics.	Accurately record and report data and communicate clearly the approach, methods, results, conclusions, and known limitations of investigations. For example, have students keep written records in their journals of the questions, procedures, results, and conclusions of their science investigations, and be able to explain what happened in their investigation.	Food and Nutrition (6) Activity 1, Parts 1-2 Activity 2, Parts 1-3 Activity 3, Parts 1-2 Activity 4 Landforms (6) Activities 1, 2, 3, 4, 5 Levers and Pulleys (6) Activities 1, 2, 3, 4, 5
	Describe the thought processes used in carrying out a scientific investigation. For example, have students be able to list or describe the steps in the investigation and explain the purpose of each of the steps.	
	Demonstrate comprehension of science ideas and procedures by paraphrasing the content of a science presentation, orally and in writing.	

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.1: Develop abilities necessary to do scientific inquiry.

Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Communication (cont'd) Communicate scientific procedures, investigations, and explanations orally, in writing, with computer-based technology, and in the language of mathematics.	Plan and deliver a written or oral presentation about science using effective logic, supportive data, and appropriate science terminology. For example, prepare a report indicating the scientific reasons for prohibiting minors from purchasing, possessing, and using tobacco products.	
	Recognize and describe patterns, situations, and relationships with words, numbers, symbols, graphics, and tables. For example, describe the pattern, relative abundance, and distribution of native coniferous trees in the state of Washington.	
	Use available computer technology and software to gather experimental data, access and process information, and report on science activities and investigations. For example, using a motion probe with interface software represent the motion of the object, generate graphs of the motion, and interpret the graphs.	
	Select and use appropriate and effective strategies to clearly present scientific information to an audience. For example, the representation should be planned so that it is logically presented (question, experimental design, procedures, results, and conclusion), uses appropriate visual aids, and computer technology, if appropriate.	

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.2: Apply science knowledge and skills to solve problems or meet challenges.

Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Identifying problems Identify and examine common, everyday challenges or problems in which science/technology can be or has been used to design solutions.	Define the parts of a problem and the criteria that would constitute a suitable solution for a particular situation or circumstance. For example, what are potential sources of pollution of the local drinking water and how would we know if the pollution problem had been resolved?	Variables (6)
	Examine and evaluate the use of technological objects, products, and systems common to home, school, or immediate community such as consumer products (food, clothing), structures, simple mechanical and electrical devices, and systems that involve communications, ideas, and rules. For example, given a particular tool, what sorts of problems can it help solve and how?	
	Describe how science is related to the design, materials, and use of a tool, or to the implementation of a technological solution to a problem. For example, what science ideas were involved in the design or use of this tool?	
Designing and testing solutions Identify, design, and test alternative solutions to a challenge or problem.	Identify the constraints to implementing proposed alternative solutions to a challenge or problem. For example, describe a solution for getting more salmon up stream. Identify various reasons why the solution might not work or might not get implemented.	Variables (6)
	Construct drawings and simple models of proposed solutions.	
	Implement a solution using readily available materials and existing or easily learned manual techniques and skills.	

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.2: Apply science knowledge and skills to solve problems or meet challenges.

Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Evaluating potential solutions Compare and contrast multiple solutions to a problem or challenge.	Evaluate solutions against the needs and criteria a technological product or system was designed to meet. For example, evaluating ways of disposing of solid wastes (human generated refuse) involves selecting a method that is safe to humans, environmentally acceptable, and economical.	Variables (6)
	Using evaluation results, determine which solution is best. For example, using the criteria above for evaluating the ways of disposing of solid wastes, select a method, and describe the reasons why it was chosen.	
	Modify the design of a solution to a problem or challenge. For example, assume after five years that the method chosen above to dispose of solid waste was no longer economical, indicate how the solution could be modified so that it was more economical.	
	Suggest improvements for technological products of others. For example, the wrist support device used by individuals while keyboarding alleviates fatigue. Suggest a way to improve the device.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.1: Understand the nature of scientific inquiry.

Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Intellectual honesty Understand the operational and ethical traditions of science and technology such as skepticism, cooperation, intellectual honesty, and proprietary discovery.	Openness, intellectual honesty, and skepticism are valued in the field of science. For example, students should feel encouraged to share their ideas. Other students are guided to be respectful of people sharing ideas while being skeptical of the ideas themselves.	
	Scientific conclusions based on limited data (small sample size, unrepresentative sample, or biased approach to sampling) should be viewed with skepticism. For example, "Could your data support a different conclusion?" "How might you design the study to be more sure of your conclusion?"	
	Scientists need to demonstrate tolerance for ambiguity. Data and scientific information are seldom compelling by themselves. Scientific data can either support or refute an idea, but never prove it in an absolute sense. For example, notice that a particular observation can support more than one idea. Keep trying to observe and eliminate those ideas not consistent with the observation.	
	Science information used in oral and written communications, presentations, and reports must be appropriately referenced and credited as to source, author, etc.	
Limitations of science and technology Understand that scientific investigation is limited to the natural world.	The type of question asked determines whether scientific investigations can be conducted. The questions must be amenable to scientific methods that involve inquiry and experimentation. For example, questions amenable to investigation include, "What is needed to help the radish seedlings grow?" and "What factors affect the rate at which water cools?" A question not amenable to scientific investigation is "Who is the best basketball player?"	
	The methods, core theories, and standards of an investigation relate to the scientific domain of the investigation being under-taken. For example: in medical investigations ethical considerations restrict the kinds of experimentation; in deep space astronomy limitations in the ability to carry out controlled experiments restricts the kinds of investigations. Whereas, in other fields both descriptive studies and experi-mental research (involving an experimental variable and controls) can be conducted.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.1: Understand the nature of scientific inquiry.

Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Dealing with inconsistencies Provide how methods of investigation relate to the validity of scientific experiments, observations, theoretical models, and explanation.	The relationship between evidence and explanation should be examined and scrutinized. For example, new ideas that do not mesh well with prevailing views should be reviewed carefully to ensure evidence supports the conclusions. Indeed, challenges to new ideas are the legitimate business of science in building valid knowledge.	
	Scientific data from one experiment are seldom conclusive. For example, ideas in science change as substantive supportive evidence from multiple sources (experiments) accumulates.	
	In scientific inquiry, continued attempts and consideration of alternative interpretations may be necessary to derive a scientific explanation. For example, in scientific investigations it is seldom that the results from a single experiment provide sufficient evidence for an explanation. More often than not, the results raise new questions and directions for the research or ambiguity in which multiple explanations might be derived from the results.	
	Conflicting ideas and interpretations should be compared and contrasted to arrive at an informed scientific opinion or judgment. For example, competing interpretations or explanations need to have the evidence supporting them examined critically, and where additional information is needed, experiments designed that will attempt to resolve these contrasting views.	
Evaluating methods of investigation Describe how methods of investigation relate to the validity of scientific experiments, observations, theoretical models, and explanation.	High-quality, scientific explanations emphasize evidence, employ logically consistent arguments, and use sound scientific principles, models, and theories. For example, scientific explanations are assumed true when they withstand such rigorous review by the scientific community.	Variables (6)
	Faulty reasoning or arguments can be evidenced by any of the following: 1) fact and opinion are intermingled or conclusions do not follow from the evidence given; 2) an analogy is not apt; 3) no mention is made of whether the control groups are very much like the experimental group; or 4) all members of a group are implied to have nearly identical characteristics that differ from those of other groups.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.1: Understand the nature of scientific inquiry.

Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Evolution of scientific ideas Explain how scientific theory, hypothesis generation, experimentation, and observation are interrelated and may lead to changing ideas.	An experiment is often repeated before a result is accepted as an accurate interpretation. For example, replicability of science results and confirmation by others with similar scientific data is accepted scientific protocol.	
	A variety of terms, such as "hypotheses," "law," "principle," and "theory" are used to describe various types of scientific explanation. They are used in contexts where they are supported by evidence and they are subject to change if new evidence arises.	
	Scientific knowledge is subject to modification if new information challenges current theories and if a new explanation provides a more complete interpretation of previous data. For example, scientific knowledge and many theories undergo change as evidence accumulates (the ideas involving the formation of continents have undergone significant change as new evidence over the last 50-100 years has caused modifications in the underlying theory).	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.2: Know that science and technology are human endeavors, interrelated to each other, to society, and to the workplace.

Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
All peoples contribute to science and technology Know that science and technology have been developed, used, and affected by many diverse individuals, cultures, and societies throughout human history.	Science and technology are outgrowths of the inquisitive and inventive sides of human nature. Throughout human history, humans around the world have engaged in science and technology, exploring, experimenting, inventing, and designing. In many ways, science and technology help satisfy the human need to make sense of the world in which we live.	
	Contributions to science and technology have been made by people with diverse interests, talents, qualities, and motivations. For example, scientists and engineers specialize in fields (geology, biochemistry, physics, atmospheric sciences, etc.) or design areas (structures, transportation, communication, materials, mechanical systems, etc.) in which the problems and challenges are of interest to them.	
	The 20th century has been a period of tremendous scientific and technological developments. Individuals engaged in this research have faced difficulties, challenges, and setbacks, before reaching conclusions and gaining acceptance of their ideas. For example, the development of the scientific enterprise in this past century has been extensive, and the rapid technology transfer of innovation has affected all aspects of our lives.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.2: Know that science and technology are human endeavors, interrelated to each other, to society, and to the workplace.

Benchmark 2		
Benchmark Indicators	**Benchmark Clarifiers**	**FOSS Modules**
Relationship of science and technology Compare and contrast scientific inquiry and technological design in terms of activities, results, and influence on individuals and society; know that science enables technology and vice versa.	Similarities and differences exist between technological design and scientific inquiry in terms of their historical evolution, purposes, processes, and results. For example, they are both interdependent, and yet have differences in their goals (natural world-centered vs. human needs centered) and methods (limited only by creativity and certain physical restraints vs. limited by economic considerations, material constraints, environmental constraints, etc.).	Variables (6)
	Technology is essential to science for purposes such as access to outer space and other remote locations; collection and treatment of samples; measurement; computation; and communication of information.	
	Scientific knowledge helps engineers, architects, and others who engage in design and technology to solve practical problems.	
	Both science and technology influence solutions to problems in medicine, agriculture, manufacturing, energy generation, and other areas.	
Careers and occupations using science, mathematics, and technology Investigate the use of science, mathematics, and technology within occupational/career areas of interest.	Careers or occupational opportunities involving science, mathematics, and technology can be investigated by researching information about the career (such as on web sites or in career centers), interviewing individuals in the field, and on-the-job shadowing in the occupational/career area(s) of interest.	
	Many occupations that require a preparation in science, mathematics, and technology are also involved in activities related to the improvement of the quality of everyday life.	
	First-hand knowledge of scientifically- or technologically-based occupations or careers can be effectively obtained by observing the nature of the work during visitations to a work site in an area of interest.	

SCIENCE ESSENTIAL ACADEMIC LEARNING REQUIREMENTS
Adapted from Washington State CSL Interpretation and Clarification document, May 7, 1999
GRADES 9-10

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.1: **Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.**

PHYSICAL SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Properties of substances Examine the basis for the structure and use of the periodic table.	In the periodic table, elements are arranged by increasing atomic number.	
	In the periodic table, elements with similar properties are arranged in vertical columns in chemical families called groups.	
	Use the periodic table to predict properties of various elements.	
Motion of objects Describe the average speed, direction of motion, and average acceleration of objects.	Estimate the average speed and identify the direction of motion of objects during short intervals, for example: one can estimate that the runner went 700 meters west in about 17 seconds, so averaged about 9 m/s toward the west, or an ant that jerkily moves along about 160 cm in 2 minutes had an average speed of 80 cm/s toward the end of the driveway.	
	Determine an object's average speed and direction of motion for any interval of time, from graphs, pictures, or tables of position vs. time.	
	Define the average acceleration of an object traveling in one direction by determining the change in the object's instantaneous speedometer reading and dividing by the elapsed time associated with the change.	
	Determine the average acceleration of an object for any interval of time, during which the object is moving in a straight line, using data from graphs, pictures, or tables of instantaneous speed vs. time.	
Sound, light and waves Describe relations between wave length, speed, and frequency for water waves and describe ways in which water waves, waves on springs, and the phenomena of sound and light exhibit wave-like behavior.	The distance between successive peaks of disturbance is called a wavelength, for example, the distance from the top of one water wave pulse to the top of the next.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.1: **Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.**

PHYSICAL SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Sound, light, and waves (cont'd) Describe relations between wave length, speed, and frequency for water waves and describe ways in which water waves, waves on springs, and the phenomena of sound and light exhibit wave-like behavior.	The number of round trips a particle of the medium makes in one unit of time is called the frequency. Describe the idea of frequency as it applies to generating waves on a spring or on the surface of water. For sound, pitch raises or lowers as its frequency becomes higher or lower. For visible light and other electromagnetic waves, the frequency determines where it is found on the electromagnetic spectrum.	
	Differentiate between speed of a wave and frequency of generating the wave. Every wave has a particular speed in a particular medium like air or water.	
	For water waves or spring waves, describe what happens to the speed and to the wave-length as the frequency is increased, or as frequency is decreased. For springs, describe what happens to the wavelength as the frequency is increased or as it is decreased.	
	Speed and direction change as a wave goes from one medium into another. For example, as a water wave travels from deep into shallow water, it slows down and bends (refracts) to travel closer to the perpendicular to the boundary between deep and shallow. When speeding up from one medium to another, it bends farther from perpendicular. As light goes from air into glass, plastic or water, it changes direction to travel closer to the perpendicular to the surface.	
	Vibrations can be described by the size of the back and forth movement (amplitude). The greater the amplitude, the greater the energy of vibration. For example, in vibrating the end of a particular spring, the farther the movement of the individual coils, the greater the amount of energy in the spring wave. The farther the vibration of some particular thing that generates sound, the more energy is being put into the sound wave.	
	When something exhibits some or all of the wave properties, it is said to behave like a wave. Describe some of the ways that sound, light, and water waves and spring waves seem to exhibit wave-like behavior (behavior consistent with a wave model for motion).	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

PHYSICAL SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Systems Analyze systems, including the inputs and outputs of a system and its subsystems.	A system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts. For example, a radio gives off sound when turned on, but the components are interacting electrically to drive the speaker which interacts with the air which interacts with other air, etc., which eventually interacts with the eardrum, and so on.	
	Understanding how things work and designing solutions to problems of almost any kind can be facilitated by analyzing systems. In defining a system, it is important to specify its boundaries and subsystems, indicate its relation to other systems, and identify what its input and output are expected to be. For example, spaceship earth is nearly a closed system with respect to matter. Very little matter enters or leaves the earth during one year. However, the earth takes in a lot of energy from the sun and radiates away considerable energy. Systems can be either open or closed.	
Energy sources and kinds Understand many forms of energy as they are found in common situations on earth and in the universe.	Many situations involve potential energy that is stored for transformation at a later time. The higher an object is relative to some location, the more energy associated with being in a high place (gravitational potential energy). The more a springy material is bent, or the more a spring is stretched or compressed, the more "springy" energy (elastic potential energy). The more food or fuel in a system, the greater the chemical potential energy available to be transferred.	
	Chemical and nuclear reactions can be sources or receivers of energy. Chemical reactions involving recombination of atoms or molecules can be an energy source. Nuclear energy can be converted into thermal energy when heavy atoms are split (fission) or when very light atoms, like H and He, combine into heavier ones (fusion).	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

PHYSICAL SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Energy sources and kinds (cont'd) Understand many forms of energy as they are found in common situations on earth and in the universe.	Thermal energy is produced from a variety of natural sources, such as volcanoes, geo-thermal vents, and forest fires, and can be carried by atmospheric or oceanic motions throughout the earth's environment. Thermal energy can also be produced by man-made systems, such as electrical resistance heating.	
	The sun, wind, water, water waves, light, and sound can be energy sources and transfer energy in interactions.	
Energy transfer and transformation Understand that total energy is conserved; analyze decreases and increases in energy during transfers, in terms of total energy conservation.	Total energy is conserved in a closed system. If the system is closed, no energy comes into the system and no energy leaves the system.	
	In a closed system, when energy is transferred from one part of the system to another, the amount lost by one part of the system is gained by other parts of the system.	
	In a closed system, when energy is transformed from one kind to others, the amount transferred from one kind of energy is the amount transferred to other kinds of energy.	
	In energy analysis, when the amount of energy lost by some parts of the system is not equal to the amount gained by other parts of the system, the system is apparently not closed. Other energy sources and/or energy receivers are probably involved in the whole system.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

PHYSICAL SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Energy transfer and transformation (cont'd) Understand that total energy is conserved; analyze decreases and increases in energy during transfers, in terms of total energy conservation.	When a force is exerted through a distance (work done), there has been a transfer of energy. Simple machines allow people to exert a lesser force through a greater distance, making the work seem easier. "Trading" a greater distance for a smaller force can be demonstrated with systems including inclined planes, pulleys, and levers. In a perfectly efficient machine, all the energy transferred into the machine would be transferred out through the work done by the machine. Since the machine by itself is typically not a closed system, some of the energy is transferred to thermal energy and is dissipated into the surrounding medium, including objects, air, and water.	
	A large concentration of electrical charge can provide the electrical potential energy to push charges along a wire and create a current. A complete circuit may result in a conversion of the electrical energy into light and thermal energy. Electrical devices (e.g., switches, batteries, wires, and bulbs) can be used to control the flow of charge per unit of time (current) and the transfer of electrical energy. The relative amounts of electrical current can be predicted from the different number and arrangements of the electrical devices.	
Structure of matter Relate the structural characteristics of atoms to the principles of atomic bonding.	Atoms are composed of particles called protons, electrons, and neutrons. Protons have a positive electrical charge, electrons are negatively charged, and neutrons have no electrical charge.	
	An atom of a particular element has a unique number of protons called the atomic number. This is graphically represented in the periodic table.	
	The nucleus of an atom is composed of proton and neutron particles. An atom's protons and neutrons have masses approximately equal to each other but are each approximately 2000 times the mass of an electron.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

PHYSICAL SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Structure of matter (cont'd) Relate the structural characteristics of atoms to the principles of atomic bonding.	The outermost electrons of an atom dictate whether or not that atom will attach to other atoms, forming molecules. Molecules are held together by transferring or sharing the outermost electrons of their atoms. The sharing or transfer of electrons is called bonding.	
	Radioactive decay is due to atomic nuclei spontaneously breaking apart and emitting subatomic particles.	
Physical/chemical changes Analyze and explain the factors that affect physical and chemical changes, and how matter and energy are conserved in a closed system.	Rates of change in chemical, physical, and nuclear interactions depend on factors such as temperature of reactants, atmospheric pressure, or nuclear stability of atomic particles.	
	Increased temperature means greater average kinetic energy of the molecules, typically resulting in expansion of most substances when they are heated. (An exception is water which contracts between 0 and 4 degrees C.) In melting, particles of a solid break out of their typical repeating pattern of tight connections. In evaporation, the particles of liquid collide with such speed that they knock each other far apart such that some are knocked away from the surface of the liquid and become part of the surrounding gas.	
	Increased temperature allows the particles of one substance in a liquid to combine with particles of different substances, resulting in chemical reactions with reattachment of particles to form different substances.	
	Decreased pressure allows liquids to boil (to change phase from liquid to gas) and evaporate at lower temperatures. In gases, the particles diffuse more readily and increase the distance between particles. In solids, decreased pressure more readily allows particles to be broken out of their connected patterns.	
	Solid substances, when physically broken up, will increase the rate of dissolving. The increased surface area of the broken particles increases the likelihood that the particles will combine with more atoms in the solution.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

PHYSICAL SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Physical/chemical changes (cont'd) Analyze and explain the factors that affect physical and chemical changes, and how matter and energy are conserved in a closed system.	"Physical change" refers to interactions that do not produce a different substance from the original substance(s) involved. The term "chemical change" refers to interactions that produce a different substance from any of the original substances involved.	
	Total mass remains constant even during chemical and physical changes. Matter is neither created nor destroyed regardless of how substances interact, combine, or break apart in a closed system. The total atomic weight and mass remains the same. This principle is known as the conservation of matter.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: **Understand how interactions within and among systems cause changes in matter and energy.**

PHYSICAL SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Nature of forces Identify various forces and their relative magnitudes, and explain everyday situations in terms of force.	Force is an interaction. For every force exerted by one object on a second object, the second object exerts an equal force in the opposite direction on the first object. Even when one object is more massive or much stronger than the other, they still exert equal and opposite forces on each other, for example, the gravitational force between the earth and a ball near the earth, the electrical force between a charged plastic rod and a small scrap of paper, or the magnetic force between a big magnet and a small nail.	
	There are two kinds of electrical charge, positive and negative. There is also a neutral condition with equal amounts of both charges. Like electrical charges repel each other and opposite electrical charges attract each other.	
	Gravity is responsible for bringing together the dust and gasses in the formation of stars, planets, and the other objects in the universe. A celestial body's gravity can hold another body or object in orbit due to its gravitational pull, for example, a moon or satellites orbiting a planet. Planets in our solar system orbit the sun due to the sun's gravitational pull on them.	
Forces to explain motion Explain the effects of unbalanced forces in changing the direction of motion of objects.	An object's rate of slowing down is directly proportional to the net force acting in the backward direction on the object AND the rate is inversely proportional to its mass.	
	An object, which is moving with constant speed in a straight line, has no unbalanced forces acting on it.	
	If a moving object has a sideways force on it directed toward one central point, the object may be caused to move in a curved path or even in an orbit around the central point.	

SCIENCE ESSENTIAL ACADEMIC LEARNING REQUIREMENTS
Adapted from Washington State CSL Interpretation and Clarification document, May 7, 1999
GRADES 9-10

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.1: **Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.**

LIFE SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Basis of biological diversity Classify organisms into distinct groups according to structural, cellular, biochemical, and genetic characteristics.	Specific biological classifications are based on how organisms are related. Organisms are classified into a hierarchy of groups and subgroups based on similarities that reflect their evolutionary relationships. Species is the most fundamental unit of classification.	
	Larger groups of organisms can be divided into smaller classification groups using physical and functional characteristics, for example, body plan differences, such as body plans found in organisms like insects, mosses, ferns, or fish; reproductive strategy, such as flowers, cones, spores, or sex cells (sperm and egg); physiology, such as warm-blooded, cold-blooded; internal organs, such as their structure and function; and way of life, such as terrestrial, aquatic, etc.	

EARL #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

LIFE SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Structure and organization of living systems Understand that specific genes regulate the functions performed by structures within the cells of multicellular organisms.	Multicellular organisms have a complex internal organization of cells. These cells are specialized in their functions, and their structure is based on the function they perform. Genes located on cell chromosomes control the functions in cells.	
	Inside the cell are specialized parts (such as the cell membrane, nucleus, ribosomes, mitochondrion, and chloroplast) involved in energy production, transport of molecules, waste disposal, information feedback, movement, synthesis of new molecules, and protein building. Genes regulate these activities through the production of specific molecules.	
	Complex interactions at the cell's molecular level initiate many life activities, such as growth and division. Molecules internal or external to the organism can affect these interactions.	
	Genes regulate the work of the cell and carried out by the many different types of molecules it assembles mostly proteins. Protein molecules are long, usually folded chains made from 20 different kinds of amino acid molecules. The function of each protein molecule depends on its specific sequence of amino acids and the shape the chain takes is a consequence of attractions between the chain's parts.	
	The many body cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions. Different parts of the instructions are used in different types of cells, influenced by the cell's environment and past history.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

LIFE SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Molecular basis of heredity Describe how genetic information (DNA) in the cell is controlled at the molecular level, and provides genetic continuity between generations.	The genetic information in DNA molecules provides instructions for assembling protein molecules. The code used is virtually the same for all life forms.	
	Four nucleotide bases (adenine, guanine, cytosine, and thymine) combine to form the DNA molecule. The chemical and structural properties of DNA explain how the genetic information is both encoded in genes and replicated. Each DNA molecule forms a single chromosome.	
	The genetic information for heredity is encoded in genes as a string of molecular "letters" and replicated by a template mechanism. This in turn results in the assembly of amino acids into protein molecules that perform specialized cellular functions.	
	The information passed from parents to offspring is coded in DNA molecules. In all organisms, the instructions for specifying the characteristics of the organism are carried in their DNA.	
	The sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations within the offspring of any two parents.	
	Some new gene combinations make little difference in an organism. However, these combinations can produce organisms with new and perhaps enhanced capabilities, or some combinations can be deleterious.	
	Most of the cells in a human contain two copies of each of 22 different chromosomes. In addition, a pair of chromosomes determines sex: a female contains two X chromosomes and a male contains one X and one Y chromosome. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. An egg and sperm unite to form a new individual.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

LIFE SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Human biology Compare and contrast the specialized structural and functional systems that regulate human growth and development, and maintain health.	Human growth, development, and health are maintained through complex relationships between body systems, organs, tissues, and cells.	
	The endocrine system exerts its influence through chemicals or hormones that circulate in the blood. It controls and regulates human growth, development, metabolic processes, and tissue function. Endocrine glands secrete the controlling hormones, for example, pituitary gland, hypothalamus, or thyroid.	
	Humans have nervous systems that generate behavior, provide information, and process input from the sense organs. The nerve cells communicate with each other by secreting specific excitatory and inhibitory molecules. These molecules initiate electrical impulses that carry information much more rapidly than is possible by diffusion or blood flow.	
	Sense organs use specialized cells to detect light, sound, and specific chemicals. Humans use their sense organs to monitor what is going on in the world around them.	
	The immune system protects against microscopic organisms, external foreign substances, and some cancer cells. Sometimes, the immune system may attack some of the body's own cells. Allergic reactions can be caused by immune system responses to usually harmless substances and conditions.	
	Communication between cells is required to coordinate their activities. Cells can secrete substances that spread only to nearby cells. Others secrete hormones carried in the bloodstream to receptor sites on widely distributed cells. Some drugs mimic or block the molecules involved in transmitting nerve or hormone signals and therefore disturb normal operations of the brain and body.	
	In embryonic development, as successive generations of an embryo's cells form by division, small differences in their immediate environments cause them to develop slightly differently, by activating or inactivating different parts of the DNA information.	

EALR #1: The student understands and uses scientific conditions and principles.

Component 1.2 **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

Benchmark Indicators	Benchmark Clarifiers	
Human biology (cont'd) Compare and contrast specialized structural and functional systems that regulate human growth and development, and maintain health.	Some viral diseases, such as AIDS, destroy critical cells of the immune system, leaving the body unable to deal with multiple infection agents and cancerous cells.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: **Understand how interactions within and among systems cause changes in matter and energy.**

LIFE SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Life processes and the flow of matter and energy Explain how organisms can sustain life by obtaining, transporting, transforming, releasing, and eliminating matter and energy.	The energy for life primarily comes from the sun. Plants and some microorganisms use solar energy to transform carbon dioxide and water into sugar, and in the process release oxygen. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats). The process of photosynthesis provides a vital connection between the sun and the energy needs of living systems.	
	Most cell functions involve chemical reactions. The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds are formed. Both breakdown and synthesis are made possible by a large set of protein catalysts, called enzymes. Cells usually store this energy temporarily in a small high-energy compound called adenosine triphosphate or ATP.	
	Chemical elements are recombined in different ways, as matter and energy flow through different levels of living systems and their environment – cells, organs, organisms, and communities.	
	All matter tends toward more disorganized states. Living systems require a continuous input of energy to maintain their chemical and physical organization. With death or the cessation of energy input, living systems rapidly disintegrate.	
	The amount of life any environment can support is limited by the availability of energy, water, oxygen, and minerals. Another limitation is the ability of ecosystems to recycle the residue of dead organic materials. Human activities and technology can influence (both positively and negatively) the productivity of an ecosystem.	
Biological evolution Investigate and examine the scientific evidence used to develop theories for evolution, speciation, adaptation, and biological diversity.	Evolutionary theory is based on the idea that the millions of different species of plants, animals, and microorganisms alive on earth today are related by descent from common ancestors.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: **Understand how interactions within and among systems cause changes in matter and energy.**

LIFE SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Biological evolution (cont'd) Investigate and examine the scientific evidence used to develop theories for evolution, speciation, adaptation, and biological diversity.	Molecular evidence substantiates the anatomical evidence for evolution and provides additional detail about the sequence in which various lines of descendants branched off from one another.	
	The theory of natural selection provides a scientific explanation for the history of life on earth as depicted in the fossil record and in the similarities evident within the diversity of existing organisms.	
	Variation in heritable characteristics exists within every species. Some characteristics give individuals a survival or reproduction advantage over others. The advantaged offspring are also more likely to survive and reproduce. In this way, the proportion of individuals with characteristics providing a survival advantage will increase.	
	Variations in organisms within a species increase the likelihood that some organisms will survive under changed environmental conditions. Also, diversity of species increases the chance that some members of a species will survive in the face of large changes in the environment.	
	Hereditary characteristics can be observed at the molecular or whole-organism level of an organism. These inheritable attributes can be seen in many aspects of an organism, including its structure, biochemistry, or behavior. These characteristics strongly influence an organism's capabilities to react, reproduce, and survive.	
	Life on earth is thought to have begun as simple, one-celled organisms about 4 billion years ago. During the first two billion years, only single-celled microorganisms existed, but once cells with nuclei and other cellular components (mitochondria, chloroplasts, etc.) developed about a billion years ago, increasingly complex multi-cellular organisms evolved.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: **Understand how interactions within and among systems cause changes in matter and energy.**

LIFE SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Interdependence of life Compare and contrast the complex factors (biotic and abiotic) that affect living organisms' interactions in biomes, ecosystems, communities, and populations.	All life on earth is dependent on the planet's biosphere of water resources, landmasses, and atmosphere.	
	Atoms and molecules on earth cycle among the living and non-living components of the biosphere. Energy flows through ecosystems in one direction, from photosynthetic organisms, to herbivores, to carnivores, and finally to decomposers.	
	Organisms within populations have behavioral responses to internal changes, to external stimuli, and to environmental changes. These responses also can result from interactions within species, between species, or among populations. These responses can either be innate or learned, for example, slowly bending towards a light (plants) or bears hibernating in winter.	
	The broad patterns of behavior exhibited by animal populations have evolved to ensure reproductive success. Animals often live in unpredictable environments, and so their behavior must be flexible enough to deal with uncertainty and change (such as migratory behavior, the ability to hibernate, or the social behavior of some insects).	
	Like many complex systems, ecosystems tend to have cyclical fluctuations around a state of rough equilibrium. As any population of organisms grows, it is held in check by environmental factors, resource or energy availability, and predators, parasites, or disease.	
	Ecosystems can change due to climatic shifts, or as new species appear due to migration or evolutionary modifications in the species characteristics. Ecosystems also can be reasonably stable over hundreds or thousands of years.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: **Understand how interactions within and among systems cause changes in matter and energy.**

LIFE SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Environmental and resource issues Analyze the effects of natural events and human activities on the earth's capacity to sustain biological diversity.	Human beings live within the world's ecosystems. Materials from human societies affect both physical and chemical cycles of the earth. Increasingly, humans have modified ecosystems to improve their quality of life, for example, by technological advances, and through the consumption of natural resources.	
	The earth has finite resources. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors threatens global stability. The natural processes that renew some resources have been stressed. Once the limited resources are depleted, they cannot be renewed.	
	Carrying capacity is the maximum number of individuals that can be supported in a given environment. Limiting factors are the availability of space, the number of people in relation to resources, and the capacity of the earth's systems to support organic life. Human impacts and technological advances can cause significant changes, either positive or negative, in the carrying capacity of an environment.	
	Natural adjustments of earth may be hazardous for humans. Humans live at the interface between the atmosphere driven by solar energy and the upper mantle where convection creates changes in the earth's solid crust. As societies have grown, become stable, and come to value aspects of the environment, vulnerability to natural processes of change have increased.	

SCIENCE ESSENTIAL ACADEMIC LEARNING REQUIREMENTS
Adapted from Washington State CSL Interpretation and Clarification document, May 7, 1999
GRADES 9-10

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.1: **Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.**

EARTH SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Nature and properties of earth materials Correlate the chemical composition of earth materials–-rocks, soils, water, gases of the atmosphere—with properties that determine their use to humans.	The earth is a system consisting essentially of a fixed amount of each stable chemical atom or element.	
	Each element can exist in several different chemical reservoirs. Each element on earth moves among reservoirs in the solid earth, oceans, atmosphere, and organisms as part of the geochemical cycles.	
	A wide variety of natural resources exist on earth such as fossil fuels, metals, industrial minerals, and gems, with distinctive chemical and physical properties that make them useful in human societies.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.2: **Recognize the components, structure, and organization of systems and the interconnections within and among them.**

EARTH SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Components and patterns of the earth system Explain how natural forces determine patterns and arrangements of continents, landforms, and oceans and how the theory of plate tectonics accounts for movement over time.	Earth systems have internal and external sources of energy, both of which create heat.	
	The sun is the major source of energy received by the earth's surface.	
	Two primary sources of internal energy are the decay of radioactive isotopes and the effects of gravitational energy from the earth's original formation (heating resulting from internal compression and accretion of earth material).	
	The outermost solid layer of the earth—including both the continents and the ocean basins—consists of separate plates that ride on a denser, hot, gradually deformable layer of the earth.	
	The slow movement of material within the earth results from heat flowing out from the deep interior and differential gravitational forces on regions of different density.	
Components of the solar system and beyond (universe) Understand that the solar system is in a galaxy in an expanding universe composed of immense numbers of stars and celestial bodies.	On the basis of scientific evidence, the universe is estimated to be over ten billion years old. The current theory is that its entire contents expanded explosively from a hot, dense, chaotic mass. Stars condensed by gravity out of clouds of atoms of the lightest elements until nuclear fusion of the light elements into heavier ones began to occur. Fusion released great amounts of energy over millions of years. Eventually, some stars exploded, producing clouds of heavy elements from which other stars and planets later condensed. The process of star formation and destruction continues.	
	Stars differ from each other in size, temperature, and age, but they appear to be made up of the same elements that are found in our solar system and to behave according to the same physical principles. Unlike the sun, most stars are in systems of two or more stars orbiting around one another.	
	Early in the history of the universe, matter, primarily forms of hydrogen and helium, clumped together by gravitational attraction to form countless billions of stars, which now form most of the visible mass in the universe.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: **Understand how interactions within and among systems cause changes in matter and energy.**

EARTH SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Processes and interactions in the earth system Understand that patterns of movement in the plates that comprise the earth's surface are the result of outward transfer of the earth's internal heat, and that historical patterns of movement can be identified from clues in rock formations; describe the nature of the earth forces that have formed and caused the volcanoes and earthquakes, respectively, in Washington State.	The tectonic plates (crust and uppermost mantle) of the earth move very slowly, pressing against one another in some places, pulling apart in some places, and sliding past one another in other places. Ocean-floor plates may slide under continental plates or other ocean floor plates, sinking deep into the earth. The surface layers of these plates may fold, forming mountain ranges.	
	Most earthquakes occur along the boundaries between colliding plates in zones of weakness in the crust (faults). The pent-up strain of a fault builds until it overcomes friction and releases its energy at a point of fracture (focus). Earthquakes produce waves and they either result in a push-pull effect (primary waves) or an up-down effect (secondary waves). Such waves are used to locate the source of the earthquake and its relative intensity.	
	Molten rock from below creates pressure that is relieved by venting through weakness in the earth's crust. This "venting" forms volcanoes that build up mountains.	
	Under the ocean basins, molten rock may well up between separating plates to create new ocean floor. Volcanic activity along the ocean floor may form undersea mountains, which can rise above the ocean's surface to become islands.	
	The outward transfer of the earth's internal heat causes convection in the mantle that propels the tectonic plates across the face of the earth.	
	Interactions among the solid earth, the oceans, the atmosphere, and organisms have resulted in the ongoing evolution of the earth system. Some events, such as earthquakes and volcanic eruptions, result in immediate observable changes, whereas other processes, such as mountain building and plate movements, occur gradually over long periods of time (such movements can be measured using advanced technological instruments).	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: **Understand how interactions within and among systems cause changes in matter and energy.**

EARTH SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
History and evolution of the earth Understand that fossils and radioactive elements can be used to correlate and determine the sequence of geological events.	Geologic time can be estimated by observing rock sequences and using fossils to correlate the sequences at various locations. Current methods include using the known decay rates of radioactive isotopes present in rocks to measure the time since the rock was formed. These methods indicate that the earth is approximately 5 billion years old.	
Hydrosphere/atmosphere Correlate global climate to energy transfer by the sun, cloud cover and the earth's rotation, and positions of mountain ranges and oceans.	Weather (in the short run) and climate (in the long run) involve the transfer of energy in and out of the atmosphere. Solar radiation heats the landmasses, oceans, and air. Transfer of heat energy at the boundaries between the atmosphere, the landmasses, and the ocean results in layers and regions of different temperatures and densities in both the ocean and atmosphere. The action of gravitational force on regions of different density causes them to rise or fall—and such circulation, influenced by the rotation of the earth, produces winds and ocean currents.	
	Global climate is determined by energy transfer from the sun at and near the earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and the earth's rotation, and static conditions such as the position of mountain ranges and oceans.	
Interactions in the solar system and beyond Understand that the earth, planets, sun, and the rest of the celestial bodies in the universe are continuing to evolve due to interactions between matter and forces of nature.	The origin of the universe remains one of the greatest questions in science. The "big bang" theory places the origin between 10 and 20 billion years ago, when the universe began in a hot dense state; according to this theory, the universe has been expanding ever since.	
	The sun, the earth, and the rest of the solar system formed from a nebular cloud of dust and gas about 5 billion years ago. The early earth was very different from the planet we live on today.	

EALR #1: The student understands and uses scientific concepts and principles.

Component 1.3: **Understand how interactions within and among systems cause changes in matter and energy.**

EARTH SCIENCE – Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Interactions in the solar system and beyond (cont'd) Understand that the earth, planets, sun, and the rest of the celestial bodies in the universe are continuing to evolve due to interactions between matter and forces of nature.	Increasingly sophisticated technology is used to learn about the universe. Visual, radio, and x-ray telescopes collect information from across the entire spectrum of electromagnetic waves; computers handle an avalanche of data and increasingly complicated computations to interpret them; space probes send back data and materials from the remote parts of the solar system; and accelerators give subatomic particles energies that simulate conditions in the stars in the early history of the universe before stars formed.	
	Stars produce energy from nuclear reactions, primarily the fusion of hydrogen to form helium. These and other processes in stars have led to the formation of all the other elements.	

SCIENCE ESSENTIAL ACADEMIC LEARNING REQUIREMENTS
Adapted from Washington State CSL Interpretation and Clarification document, May 7, 1999
GRADES 9-10

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.1: **Develop abilities necessary to do scientific inquiry.**

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Questioning Identify and formulate questions and related concepts that guide scientific investigations.	Use analytical thinking to examine a question or problem from different points of view. For example, a biologist, a wildlife biologist, geologist, forester, and hydrologist are attempting to make a decision about logging a steep wooded hillside at the 4000 foot elevation in the Cascade Mountains.	
	Propose strategies to learn more of what is unknown and unanswered about a question or problem. For example, our garden is overrun with snails and our question is, "What do we know about the needs and activities of snails?"	
	Refine and restructure broad and ill-defined questions; revise or modify questions that extend beyond the scope of science so they are amenable to scientific investigation. For example, refining a question like, "How can we save the salmon population?" to a question more amenable to investigation such as, "Do streams with vegetation along the banks support the hatching of salmon eggs better than streams with little or no vegetation?"	
Designing and conducting investigations Design, conduct, and evaluate systematic and complex scientific investigations, using appropriate technology, multiple measures, and safe approaches.	Design controlled experiments to determine the effects of more than one variable on the experimental factor under investigation. Determine how each variable influences the effect.	
	Determine how variables in combination increase, decrease, or keep the effect the same. For example, how do the amount of moisture and the amount of light each affect the development of corn seeds? Control moisture to test effects of light, and control amount of light to test the effect of moisture.	

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.1: Develop abilities necessary to do scientific inquiry.

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Designing and conducting investigations (cont'd) Design, conduct, and evaluate systematic and complex scientific investigations, using appropriate technology, multiple measures, and safe approaches.	Use technologically developed instruments to aid investigations, including appropriate tools, units, and procedures to measure physical and chemical properties. Use specialized instruments and techniques to measure physical and chemical properties such as a pH meter or gel electrophoresis system. Use specialized instruments and techniques to measure objects or events not directly accessible such as a compass, stopwatch, micrometer, barometer, and motion probe.	
	Estimate and take into account the variations in the readings obtained when repeated measurements are made. For example, when a quantity is measured several times, one may get several slightly different readings. Determine the best value and uncertainty for the quantity being measured. Also, identify and correct, or appropriately manage, sources of error in measurement, such as if one person's measurements seem different from others.	
	Revise experiments with more careful and logical procedures for testing a theoretical perspective (hypothesis, principle, law, or theory). Conduct the revised investigation or explain what is needed to conduct the revised investigation.	
	Know and use safe approaches in investigations.	
Evidence and explanation Formulate and revise scientific explanations and models using logic and evidence; recognize and analyze alternative explanations and predictions.	Evaluate evidence to determine scientific validity of claims and explanations. Does your observation support your ideas about what you think is happening?	
	Use scientific knowledge to compare, order, and categorize information in complex situations. For example, factors that influence why plants of the same species in different locations have leaves of different sizes were investigated. Factors such as plant density, soil depth, pH, moisture content, and light intensity were variables included in the investigation.	

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.1: **Develop abilities necessary to do scientific inquiry.**

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Evidence and explanation (cont'd) Formulate and revise scientific explanations and models using logic and evidence; recognize and analyze alternative explanations and predictions.	Differentiate between results and conclusions. Formulate conclusions based on data and results. Our results are our organized observations. The conclusions involve the interpretation or meaning we construct from those results. "What did you observe?" and "What do the observations tell us about the nature of the…..?"	
	Relate conclusions from experimentation to a theoretical perspective (a particular hypothesis, principle, law, or theory) and whether it supports or refutes that theoretical perspective. For example, using the results and conclusion involving an inheritance investigation in Fast Plants (Brassica), relate it to the theory of inheritance developed by Gregor Mendel.	
	Evaluate investigations and suggest revisions to the investigations, including data to be collected, in order to make the relationship between evidence and explanation clearer. For example, investigations indicate that global warming is occurring, but that it is uncertain whether this is due primarily to natural causes or is being influenced substantially by human actions on earth. What additional investigation and types of data would provide evidence to answer this question?	
Modeling Use mathematics, computers, and/or related technology to model the behavior of objects, events, or processes.	Develop a mathematical representation (model) of an object, event, or process under investigation that gives insight about how something really works. For example, develop a mathematical relation between volume and pressure of air in a closed calibrated syringe in which the plunger is pushed in or pulled out.	
	Explain how a mathematical model or simulation may fit observations very well, even though it has no intuitive meaning.	
	Display mathematical models on a computer and modify them to see what happens. This investigative process is especially helpful with complex, large-scale, or dangerous situations or outcomes.	

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.1: Develop abilities necessary to do scientific inquiry.

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Communication Research, interpret, and defend scientific investigations, conclusions, or arguments; use data, logic, and analytical thinking as investigative tools; express ideas through oral, written, and mathematical expression.	Accurately record, report, and display data and communicate clearly the approach, methods, results, conclusions, and known limitations of complex investigations. For example, students should keep written records from investigations in their journals, be able to explain the steps and their purposes in complex investigations, and the limitations associated with conducting their investigations.	
	Identify and explain the thought processes used in conducting a scientific investigation. For example, students should be able to describe the rationale for each of the steps in an investigation they have conducted.	
	Demonstrate comprehension of presentations, oral or written, about science by asking clarifying questions, contributing to the conversations, and paraphrasing the information presented.	
	Produce written and oral science reports and explanations that are coherent, logical, and scientifically accurate, and include appropriate vocabulary.	
	Use patterns derived from observations and mathematics (such as symbols, graphs, geometry, or algebra) to represent and describe results and make predictions. For example, observing and graphing the population of razor clams on a specific beach over the last ten years and predicting what the population will be next year.	
	Produce science reports and information using computer software features such as word processing, graphics, spreadsheet, and access to Internet.	
	Use available science software programs, computer equipment, telecommunications systems, and peripherals to access information and conduct scientific investigations.	
	Select and use appropriate data and strategies to effectively present a clear and persuasive science position or conclusion to an audience. For example, include relevant data that supports a scientific interpretation and disproves alternative interpretations as well as using visual representations and technological aids appropriately.	

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.2: **Apply science and knowledge and skills to solve problems or meet challenges.**

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Identifying problems Study and analyze challenges or problems from local, regional, national, or global contexts in which science/technology can be or has been used to design a solution.	Define the parts of a problem, the variables that may affect the solution design, and the criteria that will be used to determine if a satisfactory solution has been reached (such as cost, human or environmental impact, safety, etc.). For example, what might be involved in addressing and solving the problems associated with driving through a dust storm in Eastern Washington?	
	Study current technological products and systems in a range of contexts, some familiar and close to home, others from different contexts to determine what changes could be made to improve their technological design. For example, what is presently done to reduce injury from side impacts to a car? What could be done to improve the situation? What are the costs and benefits?	
	Understand how science knowledge can be used to aid in the process of carrying out a technological solution to a problem or challenge; identify areas of science knowledge that may be used in the design, production, use, and eventual disposal of technological products. For example, what science ideas might be used in design, production, use, and eventual disposal of a better home garbage container?	
Designing and testing solutions Research, model, simulate, and test alternative solutions to a problem.	Identify and describe the risks, benefits, trade-off, and constraints to implementing alternative solutions to a problem or challenge. For example, "What are the costs and benefits of the solution you have suggested?"	
	Construct a model or simulation to predict the effectiveness of alternative solutions.	
	Implement a solution using a variety of materials such as wood, metal, plastics, and textiles, or using available computer software.	
	Use manual and technical skills developed in science activities, in other schoolwork, such as craft or computer classes, or develop new skills to implement a solution.	
	Test the effectiveness of various solutions using appropriate skills and materials at hand.	

EALR #2: The student knows and applies the skills and processes of science and technology.

Component 2.2: **Apply science knowledge and skills to solve problems or meet challenges.**

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Evaluating potential solutions Propose, revise, and evaluate the possible constraints, applications, and consequences of solutions to a problem or challenge.	Evaluate multiple solutions to a problem or challenge. Consider the quality of any solution in relation to constraints and criteria such as cost, durability, safety, human factors, etc. For example, a number of solutions have been proposed to alleviate the decline of the native salmon populations in the Northwest. Evaluate each of the proposed solutions.	
	Using evaluation results, determine which solution is best and predict the consequences of its implementation. For example, based on the evaluation of the multiple proposed solutions for preserving the native salmon populations in the Northwest, describe the best solution(s), indicate the reasons it was/they were chosen, and the predicted consequence of the solution, if implemented.	
	Describe modifications that would improve a technological product or system. For example, describe two modifications that would improve the mountain bike and how they would improve upon the present design.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.1: **Understand the nature of scientific inquiry.**

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Intellectual honesty Analyze and explain why curiosity, honesty, openness, and skepticism are integral to scientific inquiry.	Evidence must be collected with integrity to insure scientific objectively and the quality of the research. For example, "Why is it important to be completely honest and open in describing your observations in a scientific investigation?" "How might the resulting scientific knowledge be different if a scientist was not open or not honest?" Alternative scientific interpretations should be evaluated in an open, intellectually honest way.	
	Science and technology should be thoughtfully viewed and examined, being neither categorically antagonistic to nor uncritically accepting of results. For example, look for students to be critical of ideas but respectful and encouraging to others as they share their ideas.	
	Scientific discoveries are proprietary in nature and should never be plagiarized. For example, "What might happen to a scientist who heard some new idea and claimed it as her/his own?"	
Limitations of science and technology Identify and analyze factors that limit the extent of scientific investigation.	Investigations are conducted for many purposes, for example, to explore new phenomena, check on previous results, test how well a theory predicts, and to compare different theories. For example, although the purposes of scientific investigations vary and there are questions not amenable to investigation, the results of all scientific investigations contribute to an increased understanding of how the natural world operates.	
	Science distinguishes itself from other ways of knowing and from other bodies of knowledge through the use of empirical standard, logical arguments, and testable hypotheses. In these ways, scientists develop the best possible explanations about how the natural world works. For example, there are many matters that cannot be usefully examined in a scientific way. For instance, beliefs such as the existence of supernatural powers or the true purposes of life—by their very nature—cannot be proved or disproved.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.1: Understand the nature of scientific inquiry.

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Dealing with inconsistencies Compare, contrast, and critique divergent results from scientific investigations based on scientific arguments and explanations.	Scientists evaluate the results of scientific investigations and explanations proposed by other scientists. This evaluation can include: review of experimental procedures; examination of evidence; identification of faulty reasoning and statements that go beyond evidence; and suggestions of alternative explanations for the same observations. For example, science is a public enterprise, and once experimental results and conclusions are published, they are open to critical review and discussion. Authoritarian claims, which prevent or inhibit the review process, are inappropriate in the culture of science.	
	Part of scientific training and expertise is the ability to notice and criticize arguments that are based on faulty, incomplete, or misleading use of numbers, statistics, or technology. Such instances can include: 1) average results are reported, but not the amount of variation around the average; 2) a percentage or fraction is given, but not the total sample size; 3) absolute and proportional quantities are mixed; and 4) results are reported with overstated precision.	
	Data, explanations, or conclusions represented as the only ones worth considering should be suspect and reviewed and analyzed carefully to determine the validity of the conclusions.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.1: Understand the nature of scientific inquiry.

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Evaluating methods of investigation Analyze and evaluate the quality and standards of investigative design, processes, and procedures.	The kind and quality of tools or technology used to gather and measure data affects the data's accuracy and precision, and therefore the quality of an investigation. For example, the quality of an investigation is dependent on the accuracy and precision of the instruments being used to gather information or make measurements, as well as the ability of the experimenter to use them properly.	
	The experimental design of a scientific investigation must delineate a way of testing the hypothesis. For example, the experimental design process involves a "fair" test of the idea under investigation, and isolates the experimental factor and controls the other variables.	
	All scientific investigations involve choosing the most appropriate measures, tools, approach, and experimental design. In making these choices, the investigator must weigh the trade-offs in choosing a specific approach, method, design, or investigative tool. If these trade-offs are not acknowledged by the researcher, the investigative results may end up being flawed, lack reliability, or be uninterpretable. For example, sometimes difficulties due to ethical considerations (use of animals), limitations in investigating the phenomena (distant galaxies), or complexity in the system (the human brain) severely restrict the nature of the methods and approaches of an experimenter, and should be acknowledged in order to assist reviewers who are examining the results and conclusions.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.1: **Understand the nature of scientific inquiry.**

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Evolution of scientific ideas Know that science involves testing, revising, and occasionally discarding theories; understand that scientific inquiry and investigation lead to a better understanding of the natural world and not to absolute truth.	Principles, theories, and laws are scientific interpretations of how the natural world functions, and are constructed by scientists based on information obtained through scientific research.	
	In science, the universe is viewed as a vast single system in which the basic principles and laws are the same everywhere. The principles that govern the workings of the natural world may range from very simple to extremely complex, but scientists operate on the belief that these principles can be understood through careful, systematic study.	
	Scientific principles, theories, and laws are logically consistent, aided by rules of evidence, and are open to question and modification. They are based on historical and current knowledge, created by acts of imagination, intelligence, and logic through scientific reasoning, and supported by experimental evidence.	
	From time to time, major shifts occur in the scientific view of how the world works. More often, however, the changes that take place in a body of scientific knowledge are small modifications of prior knowledge. Change in explanations and improvements in investigative procedures are persistent features of science. For example, under-standing that the sun is at the center of the solar system, harnessing power, development of the germ theory, and under-standing the nature of electromagnetism are examples of ideas that lead to fundamental changes in world views.	
	Changes in scientific understanding of the natural world result from repeated testing of hypotheses, revision of theories, or complete new thoughts about a science problem or challenge.	
	Scientific inquiry and technological devel-opments should be viewed objectively, without blinding enthusiasm or unyielding criticism. For example, scientific develop-ments have the potential to affect society in many ways, and should be critically examined by all stakeholders to ensure their applications are reasonable, safe, ethical, and appropriate.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.1: Understand the nature of scientific inquiry.

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Evolution of scientific ideas (cont'd) Know that science involves testing, revising, and occasionally discarding theories; understand that scientific inquiry and investigation lead to a better understanding of the natural world and not to absolute truth.	Science is a dynamic enterprise and scientific theories are subject to modification or may even be discarded when new evidence provides better interpretations or explanations of a natural phenomena.	
	Scientific interpretations are judged by how well they fit with other scientific thought, clarify the phenomena or situation being studied, explain scientific observations, and provide predictions that can be tested.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.2: **Know that science and technology are human endeavors, interrelated to each other, to society, and to the workplace.**

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
All peoples contribute to science and technology Analyze how scientific knowledge and technological advances discovered and developed by individuals and communities in all cultures of the world contribute to changes in societies.	Historical periods, events, cultures, and values have influenced and been influenced by scientific and technological progress. For example, the period of Enlightenment provided the opportunity for the development of scientific thought; the harnessing of steam power and the subsequent development of the field of thermodynamics demonstrates the interconnectedness between science and technology.	
	Significant advances in science and technology have had important and long-lasting effects on societies, historical contexts, and various cultures from which they emerged. For example, understanding the germ theory has resulted in vast improvements in public health measures, and the development and understanding of chemical fertilizers has significantly improved crop yields.	
	Many people who practice science as a career or a hobby find it fascinating, absorbing, and intellectually rewarding. For example, people engaged in science are connected to a community of researchers and learners who communicate and share their knowledge and personal interests in specialized fields of science.	
	Science and technology result in incremental advances in our understanding of the world and our ability to meet human needs and wants.	
	The conduct of science and technology has changed considerably over the last 500 years. For example, the rate of growth of both science knowledge and new technologies has increased dramatically in the last 50 years, and it appears that the continued investments in research and development will continue in the 21st century.	

EALR #3: The student understands the nature and contexts of science and technology.

Component 3.2: **Know that science and technology are human endeavors, interrelated to each other, to society, and to the workplace.**

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Relationship of science and technology Analyze how the scientific enterprise and technological advances influence and are influenced by human activity, for example, societal, environmental, economical, political, or ethical considerations.	Scientific inquiry results in knowledge that can improve technological design and vice versa. For example, the rapid development of scientific knowledge and technological innovation has increased the inter-connectedness between these endeavors over the last 25 years—particularly in the areas of electronics and communication.	
	Science and technology have contributed to economic growth and productivity among societies and groups within societies. For example, technological innovations based on scientific developments (such as lasers and their applications) have improved the productivity in the industrial, commercial, and service sectors, and have contributed to the improvement in the standard of living.	
	Considerations of equity, fairness, and honesty are integral to ethical codes of conduct in science and technology. This is demonstrated by attributing results, discoveries, inventions, processes, techniques, or information to the individuals or teams responsible for them; acknowledging experimental bias or faulty procedures that may have affected results; fully disclosing information about risks to individuals, communities, or the natural environment; or taking responsibility for unintended consequences of scientific or technological results. For example, it is unlawful to copy and use copywritten material such as computer programs and CDs.	
	Science and technology alone cannot resolve local, national, and international challenges (such as improving human health and nutrition, communication, resource management and sustainability, and environmental protection). Social, political, and economic factors also play critical roles in resolving societal problems.	

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Component 3.2: **Know that science and technology are human endeavors, interrelated to each other, to society, and to the workplace.**

Benchmark 3		
Benchmark Indicators	**Benchmark Clarifiers**	
Careers and occupations using science, mathematics, and technology Investigate the scientific, mathematical, and technological knowledge, training, and experience needed for occupational/career areas of interest.	Relate the preparatory knowledge and abilities obtained in the school-based science, mathematics, and technology program to occupations/careers of interest.	
	Practical avenues used to explore occupational/career areas needing skills and knowledge in science, mathematics, and technology include: research about the educational requirements associated with the career of interest, workplace visits, job shadowing, interviews of workers, collaboration with workplace mentors on school projects, and participation in internships.	

Washington State Essential Academic Learning Requirements For Science

See OSPI Web Site
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