

French Creek Outdoor School



Geology Field Study



Siskiyou County Office of Education Kermith R. Walters, County Superintendent

French Creek Outdoor School

Geology Field Study

Station Summary:

This station includes...

- a guided geology walk
- a review of rock cycle
- an overview of plate tectonics
- a Pangaea model demonstration
- a volcanic eruption demonstration
- a river cutting processes activity

Station Leaders:

1. **Be sure to pick up the station backpack.**
2. **Pick up the first aid kit fanny pack.**
3. **Pick up the radio before you leave the fire ring area! Make sure the radio is on, functional, and on channel 2.**
4. **In case of an emergency, contact Jason Singleton, the Camp Director.**
5. **Between stations, contact the leader of the challenge course station to coordinate student group exchange and meeting at the drinking fountains near the pond.**
6. **Give students a quick bathroom and drinking fountain break during the group exchange. Students should use the bathrooms in the lodge only!!!**
7. **Do not allow students to go to their cabins!!!**

Timeline: (1 1/2 hours total time for the station)

- | | |
|--|---------------|
| • Guided geology walk to the station site | 20-25 minutes |
| • Introduction demonstration plate tectonics Pangaea | 15-20 minutes |
| • Volcano demonstration | 5 minutes |
| • River Cutters orientation and instructions | 5-10 minutes |
| • River Cutters student activity | 20 minutes |
| • Review, Closure, Questions | 5-10 minutes |
| • Walk to next station, or return to camp | 5 minutes |

Station Over-View:

The following information is meant as a guide only; please feel free to add personal insights!

Geology Field Study Part I

The Guided Geology Walk

Stop 1

1. **Meet students** at the fire ring area.
2. **Welcome students**, make introductions and provide a quick overview of the station
3. **Walk with students** from the fire ring (Village Circle) area and across the covered bridge. Head up the hill towards the pond and lodge. Skirt along the east side of the pond staying to your left. Pass underneath the high ropes course elements and take the trail to your left. You will cross two bridges on this trail; one over a wetland area and the next over Payne's Creek. Once you are across the bridge, stop and gather the students together and discuss the following points, asking the students questions.
 - a. **How did the sand in this area form?** Weathering of rock.
 - b. **Can creeks make sand? How?** The constant smashing together of rocks in the creek will break the rocks apart.
 - c. **Why is sand accumulating here and not somewhere else?** Because the velocity of the water slows down in this area and as the water slows down, the sand drops out. Shake the rock, sand sediment jar and show students that different materials settle out at different rates. Look at the edges of the channel where the sand is settling and the main channel where the bottom is still rocky.
 - d. **Where will this sand go?** Trace the path of Payne's Creek into French Creek, then into the Scott River, the Klamath River, to the Pacific Ocean where all of the sand carried by rivers becomes beach sand and is carried along the coastline by the action of waves.
 - e. **What force will carry the sand to its destination?** The force of moving water and gravity.
 - f. **When will the creek carry the most sand and rock in the shortest period of time?** During floods and high water events. Ask students to visualize a time when they have seen a river flooding, or the material carried by a river or creek after a flood event. On French Creek, a flood once caused the creek to rise 20 feet, huge boulders were moved, the creek bed changed and an entire beach was created during this one event.

Stop 2

1. **Walk with the students to a large disturbed road area where rocks and sand are clearly visible on the surface.**
 - a. **What kind of rock is this?** Granite.
 - b. **How does granite rock form?** It forms from molten rock that cools beneath the surface, forming large crystals.
 - c. **If it cools beneath the surface originally, why is it on the surface now?** Erosion has uncovered this rock.
 - d. **Pick up some of the granite, can you see the crystals?** Yes.
 - e. **Can you break this rock apart into sand in your hands?** Yes.

- f. **If you squeeze this soil will it stay together?** Have the students do this. Is it sandy, sticky, etc? This soil is extremely sandy, and will fall apart easily.
- g. **How can one type of rock change into another type of rock?** Review rock cycle with students; use the terms igneous, metamorphic and sedimentary.
- h. **In a big rainstorm, would this area or the area nearby that has weeds growing on it wash away more easily?** The bare soil area would wash away or erode more easily. Plant roots absorb and transport water to leaves where it evaporates into the air. Roots also physically hold the soil in place.

Stop 3

2. **As you walk up along the road, stop to look at areas where water has carved small channels in the soft disturbed soil.**
 - a. **Ask students what is happening here?** The soil is being moved by water.
 - b. **Where is the soil moving?** The soil is moving down slope, and might eventually be washed into the creek.
 - c. **What is this process called?** Erosion.
 - d. **Do these patterns look familiar to you?** Yes, they look like miniature river and stream channels.
- **As soon as you arrive at the creek, ask the high school counselors and the intern to begin to get the river cutters station materials ready for students. Move the material far enough away and out of sight of students so that their preparations will not disturb your presentation or distract students.**
 - **The preparation list for the counselors and interns is on a separate sheet.**
 - A big volcano poster will be hanging on a tree.
 - Six station numbers will be hanging from trees.

Plate Tectonics, Pangaea and Volcano Demonstration

Ask students to listen carefully to your explanations so that later they will be able to answer questions when you quiz them at the end of the station.

Plate Tectonics

1. Ask the students “What formed Mt. Shasta?”

Allow time for answers and discussion.

2. Show the volcano poster.

Ask students where the molten magma to form Mt. Shasta came from?

3. Why is Mt. Shasta here and not somewhere else?

As the oceanic plate sub ducted under the North American plate the oceanic plate melted forming magma, as the molten rock is heated, it expands becoming lighter. The lighter molten magma rises and forces its way to the surface, forming Mt. Shasta.

Pangaea

(Show the floating foam model of Pangaea.)

Pangaea is the ancient continent that once combined all of the landmass on earth. Show how Pangaea began to break up and the continents began to drift apart, floating on the mantle of the earth, like a solid piece of butter “floats” on a hot frying pan. The entire

earth is made up of plates, both continental and oceanic plates. Demonstrate how these plates can either pull apart, or slam together. Ocean crust is heavier than continental crust. When ocean crust and continental crust slam into each other, the lighter continental crust wants to ride up over the heavier oceanic crust. This is happening on the western border of our continent, North America. The ocean plate is going under or subducting under the continental plate. When the ocean plate is pushed far enough under the surface, the heat and pressure melt the rock and it becomes molten magma. The molten magma is lighter than solid rock; it expands and wants to push up towards the surface.

Volcanoes

- 1. When a spout of molten magma reaches the surface it forms a volcano** like Mt. Shasta, or Mt. Lassen south of us. Mt. Shasta and Mt. Lassen are actually part of a whole chain of volcanoes that stretch all the way into Canada; this chain of mountains is called the Cascade **Range**. It includes some very famous volcanoes, like Mt. St. Helens and Mt. Hood. Crater Lake is the bottom of an ancient volcano; the mountain was blown away, leaving only a crater behind.
- 2. Show the poster of the Cascade Mountain Range.**
- 3. What is pushing the oceanic plate under the continental plate?**
Out in the middle of the ocean, molten magma is pushing its way to the surface, pushing two huge ocean plates apart forming an underwater mountain range. As the oceanic plates are forced apart in the middle of the ocean the opposite edges are forced under continental plates causing a huge ring of volcanoes around the entire Pacific Ocean called the **Ring of Fire**.
- 4. Show the Ring of Fire poster.**

Next, the Resource Professional can show students a model of an erupting volcano.

5. Erupting Volcano Demonstration

- Place a 16 oz. soda bottle in a pan.
- Pour the flour and baking soda mixture from the small zip-lock bag through the funnel into the bottle.
- Pour in about 1/2 cup of white vinegar per volcano.
- After the demonstration, dump volcano fluids into the collection bucket.

Volcanoes form differently depending on the chemical makeup of the lava. Some types of lava flow quickly and other types of lava flow slowly.

Geology Field Study Part II

Rivers & Erosion

- *Transition:* We just talked about some of the ways that mountains and other landforms are made, through plate tectonics, which results in uplift, earthquakes, and volcanoes. Now we are going to look at another powerful force of nature, water, and how it shapes the land.
- Ask the students to get up and walk over to look at Payne's Creek. Ask the students the following questions and discuss the answers with them.

1. What is the stream doing?

Eroding the banks and hillsides and carrying sediment.

2. Where does the sediment go?

The sediment eventually goes to the deltas. It dumps into the ocean, and spreads along the beaches and the continental shelf.

3. Why isn't the earth worn completely flat by all of the rivers and creeks?

Plate tectonics is still uplifting mountains and producing volcanoes.

Model stream table for students:

1. Scoop sand or earth out of buckets into a tray.
2. Create a flat section about an inch high with a cliff like edge. You can use the wooden angle to shape the sand in the tray.
3. Place the ruler horizontally over the end of the tray.
4. Fill up small "deli" container with water from a bucket, making sure to cover the hole in the bottom.
5. Place the deli container on the ruler and allow the water to start draining out, eroding the sand and making a river.
6. Show students the landforms poster. Have students point out the parts of the model river in the tub, including the delta and meanders.

- Count students off from 1-6.
- Ask each group to designate a supply person and a leader.
- Ask student groups to gather under their station number (tacked to trees) i.e., the #1 is under the 1 Station.
- Instruct students to make *four different river systems* and draw each system on the blank sheet of paper at the back of their packet. Let them know you will be sharing the drawings and giving them to their teacher. Have students also fill in the missing words on their landforms sheet, and label their drawings. The drawings don't have to be very intricate.

*** Use one-quart deli container full of water for each of these 4 river systems.**

The four river systems are:

1. *Shallow slope* - prop the tray up on the wooden angle
 2. *Steep slope* - prop the tray up 6 inches
 3. *Flood* - pour the water onto one spot high on the tray
 4. *Obstacles* - put rocks, sticks and other things in the way of the stream.
- Have the supply person from each group refill their water pitcher when needed. (Use water from the bucket, not the creek)
 - Have the students finish filling out their packets by drawing their river systems.
 - Circulate from group to group.
 - Ask Counselors to clean up while you review with students. (Dump soil back into the bucket.)
 - Gather students together again in a circle for the closure activity
 - Closure: Share drawings. Look at Payne's Creek - where are meanders, deltas, etc. Does Payne's Creek have a steep slope or shallow slope? Have students explain their

answers. Review some of the material from the plate tectonics sections with students by quizzing them.

- Call the leader of the obstacle course to coordinate the student group switch.
- Clean up and walk students back down to the lodge for bathroom break and switch with obstacle course, or back down to camp if it is your last group.

If you have time left at the end of the station you can give groups Pangaea puzzles on an individual basis. Puzzles are in small zip lock bags in the station bin.

Thank you for leading this station at French Creek Outdoor School, we sincerely appreciate your participation!!

Resources Used:

Plate Tectonics, the Way the Earth Works, Lawrence Hall of Science-University of California at Berkeley

Delta Science Module-Earth Processes

FOSS Landforms

Fires Mountains of the West by Stephen L. Harris

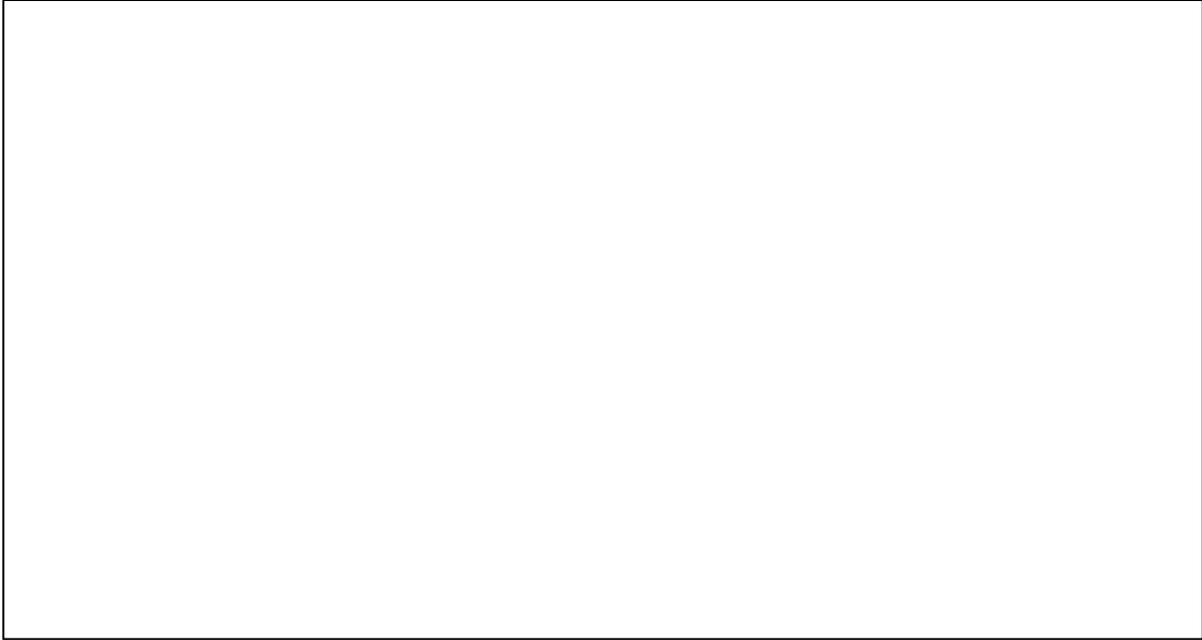
Volcanoes by Janice Van Cleaves

Materials: All necessary equipment will be at the station, most in a large plastic tub.

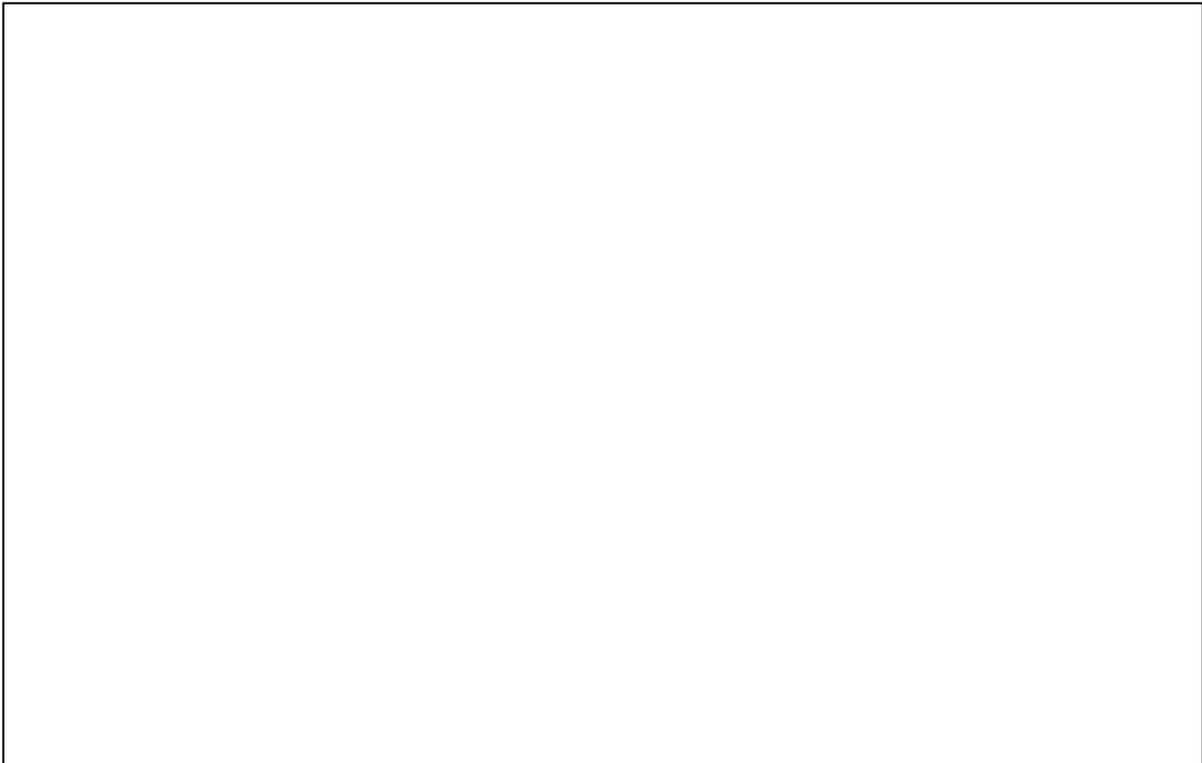
- 1 set floating Pangaea pieces
- 1 clear plastic tub
- 1 small bottle
- 1 funnels
- bags of baking soda & flour mixture
- vinegar
- assorted measuring cups & pitchers
- 1 big bucket of sand-soil mix
- 2 big buckets of water
- 1 bucket for volcano mixture
- 6 clipboards
- 6 student packets (1 per group)
- 6 bags of Pangaea puzzle pieces
- 6 “deli” containers with large holes
- 6 rulers
- 6 “scrabble” smoothers (wooden “L” shaped tools)
- 6 pencils

Stream Drawings

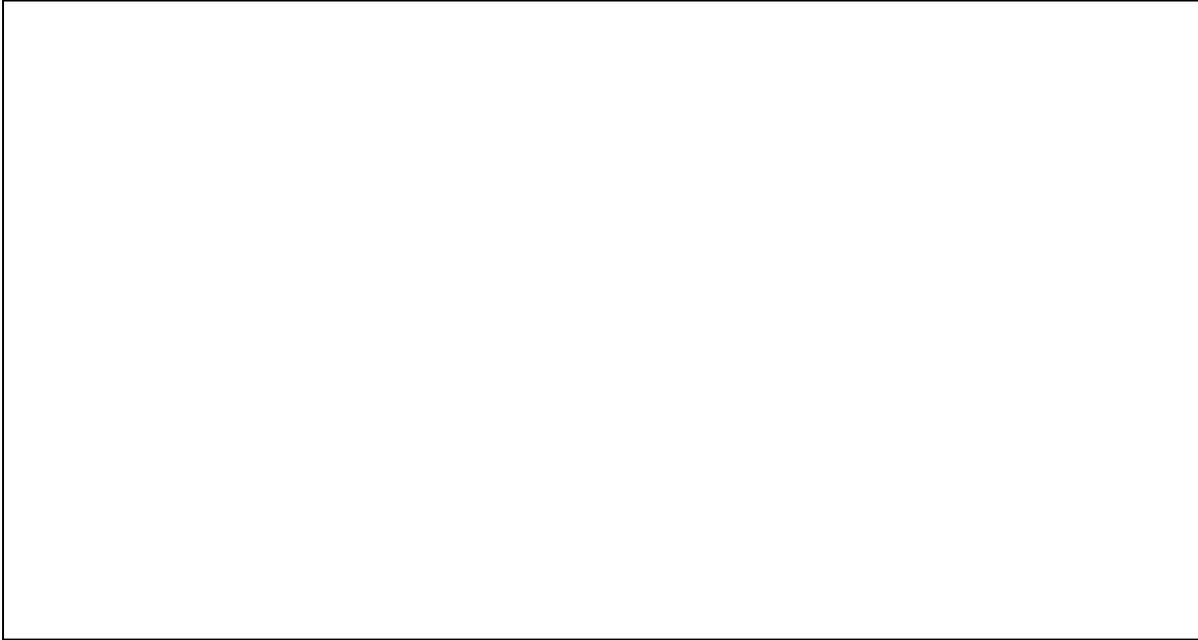
Shallow Slope



Steep Slope:



Flood:



Obstacles:



Standards & Frameworks for Geology Field Study

California Standards Alignment

6th Grade, CA Science Standards

Area: Focus on Earth Science

Sub-Strand: Plate Tectonics & Earths Structure

Concept 1 - Plate tectonics accounts for important features of Earth's surface and major geologic events. As a basis for understanding this concept:

Standards:

- a. Students know evidence of plate tectonics is derived from the fit of the continents; the location of earthquakes, volcanoes, and mid-ocean ridges; and the distribution of fossils, rock types, and ancient climatic zones.
- b. Students know Earth is composed of several layers: a cold, brittle lithosphere; a hot, convecting mantle; and a dense, metallic core.
- c. Students know lithospheric plates the size of continents and oceans move at rates of centimeters per year in response to movements in the mantle.
- d. Students know that earthquakes are sudden motions along breaks in the crust called faults and that volcanoes and fissures are locations where magma reaches the surface.
- e. Students know major geologic events such as earthquakes, volcanic eruptions, and mountain building, result from plate motions.
- f. Students know how to explain major features of California geology (including mountains, faults, volcanoes) in terms of plate tectonics.

Sub-Strand: Shaping Earth's Surface

Concept 2 - Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment. As a basis for understanding this concept:

Standards:

- a. Students know water running downhill is the dominant process in shaping the landscape, including California's landscape.
- b. Students know rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural and recurring patterns.
- c. Students know beaches are dynamic systems in which the sand is supplied by rivers and moved along the coast by the action of waves.
- d. Students know earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.

Sub-Strand: Energy in the Earth System

Concept 4 - Many phenomena on Earth's surface are affected by the transfer of energy through radiation and convection currents. As a basis for understanding this concept:

Standards:

- a. Students know the sun is the major source of energy for phenomena on Earth's surface; it powers winds, ocean currents, and the water cycle.

Sub-Strand: Resources

Concept 6 - Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. As a basis for understanding this concept:

Standards:

- b. Students know different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or nonrenewable.

Area: Investigation and Experimentation

Sub-Strand 7: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

Standards:

- b. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
- e. Recognize whether evidence is consistent with a proposed explanation.
- f. Read a topographic map and a geologic map for evidence provided on the maps and construct and interpret a simple scale map.
- g. Interpret events by sequence and time from natural phenomena (e.g., the relative ages of rocks and intrusions).
- h. Identify changes in natural phenomena over time without manipulating the phenomena (e.g., a tree limb, a grove of trees, a stream, a hill slope).

5th Grade, CA Science Standards

Area: Physical Sciences

Sub-Strand 1: Elements and their combinations account for all the varied types of matter in the world. As a basis for understanding this concept:

Standards

- g. Students know properties of solid, liquid, and gaseous substances, such as sugar (C₆H₁₂O₆), water (H₂O), helium (He), oxygen (O₂), nitrogen (N₂), and carbon dioxide (CO₂).

Area: Earth Sciences

Sub-Strand 3: Water on Earth moves between the oceans and land through the processes of evaporation and condensation. As a basis for understanding this concept:

Standards

- a. Students know most of Earth's water is present as salt water in the oceans, which cover most of Earth's surface.
- b. Students know when liquid water evaporates it turns into water vapor in the air and can reappear as a liquid when cooled or as a solid if cooled below the freezing point of water.
- c. Students know water vapor in the air moves from one place to another and can form fog or clouds, which are tiny droplets of water or ice, and can fall to Earth as rain, hail, sleet, or snow.

d. Students know that the amount of fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water.

Area: Investigation & Experimentation

Sub-Strand 6: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

Standards

a. Classify objects (e.g., rocks, plants, leaves) in accordance with appropriate criteria.

f. Select appropriate tools (e.g., thermometers, meter sticks, balances, and graduated cylinders) and make quantitative observations.

g. Record data by using appropriate graphic representations (including charts, graphs, and labeled diagrams) and make inferences based on those data.

California Framework

Physical Education Goals 5th & 6th Grades

Goal: Movement Skills and Movement Knowledge

Students need to develop effective motor skills and to understand the fundamentals of movement by practicing and analyzing purposeful movement.

Key Component 1: Motor Learning

Key Component 2: Biomechanics

Key Component 3: Exercise Physiology and Health-related Physical Fitness

Goal: Self-Image and Personal Development

Students develop and maintain a positive self-image and strive to become the best that they can be through planned physical activities.

Key Component 1: Human Growth and Development

Key Component 2: Psychology

Goal: Social Development

Students develop appropriate social behaviors by working independently and with others during planned physical activity.

Key Component 1: Sociology

Health Grade Range: 3-6

Unifying Idea: Acceptance of personal responsibility for lifelong health

Expectation 1: Students demonstrate ways to enhance and maintain their health and well-being

Topic: Physical Activity

Skill and Behavior: Participate regularly in a variety of enjoyable physical activities

Skill and Behavior: Explore out- of- school play activities that promote fitness and health

Skill and Behavior: Observe safety rules during physical activities

Unifying Idea: Respect for and promotion of the health of others

Expectation 2: Students will promote positive health practices within the school and community, including developing positive relationships with their peers.

History- Social Science

Goal: Goal of Knowledge and Cultural Understanding

Strand: Geographic Literacy

Key Concept: Develop an awareness of place.

Key Concept: Develop vocational skills and understanding.

Key Concept: Understand human and environmental interaction.

Goal: Skills Attainment & Social Participation

Strand: Participation Skills

Key Concept: Develop Personal Skills

Key Concept: Develop group interaction skills.

Key Concept: Develop social & political participation skills

Oregon Science Standards

Not specific to each grade level, benchmarks in 3rd & 5th grade

5th Grade Oregon Benchmarks

Content Strand: Earth & Space Science

Common Curriculum Goal: THE DYNAMIC EARTH: Understand the properties and limited availability of the materials that make up the Earth.

Content standard: Identify the structure of the Earth system and the availability and use of the materials that make up that system.

Area: Benchmark 2 (Grade 5)

Standard: Identify properties and uses of Earth materials.

Common Curriculum Goal: THE DYNAMIC EARTH: Understand changes occurring within the lithosphere, hydrosphere, and atmosphere of the Earth.

Content Standard: Explain and analyze changes occurring within the lithosphere, hydrosphere, and atmosphere of the Earth.

Area: Benchmark 2 (Grade 5)

Standard: Identify causes of Earth surface changes.

Content Strand: SCIENTIFIC INQUIRY: Use interrelated processes to pose questions and investigate the physical and living world.

Common Curriculum Goal: COLLECTING AND PRESENTING DATA: Conduct procedures to collect, organize, and display scientific data.

Content Standard: Collect, organize, and display scientific data.

Area: Benchmark 2 (Grade 5)

Standard: Collect, organize, and summarize data from investigations.

*****No Oregon State P.E. standards*****

Oregon Standards Subject: Social Sciences

Content Strand: Geography: Understand and use geographic skills and concepts to interpret contemporary and historical issues.

Common Curriculum Goal: Use maps and other geographic tools and technologies to acquire, process, and report information from a spatial perspective.

Content Standard: Locate places and understand and use geographic information or relationships by reading, interpreting, and preparing maps and other geographic representations.

Area: Benchmark 2 (Grade 5)

Standard: Examine and understand how to prepare maps, charts, and other visual representations to locate places and interpret geographic information.

Common Curriculum Goal: Understand how people and the environment are interrelated.

Content Standard: Understand how humans affect the physical environment.

Area: Benchmark 2 (Grade 5)

Standard: Understand how physical environments are affected by human activities.

Content Standard: Understand how physical characteristics in the environment and changes in the environment affect human activities.

Area: Benchmark 3 (Grade 8)

Standard: Understand how changes in a physical environment affect human activity.

Common Curriculum Goal: Compare and analyze physical (e.g., landforms, vegetation, wildlife, climate, and natural hazards) and human (e.g., population, land use, language, and religion) characteristics of places and regions.

Content Standard: Identify and analyze physical and human characteristics of places and regions, the processes that have shaped them, and their geographic significance.

Area: Benchmark 2 (Grade 5)

Standard: Identify physical and human characteristics of regions in the United States and the processes that have shaped them.