GONE WITH THE WEATHERING

THE RESULT – EROSION

WESTERNRESERVE PUBLIC MEDIA

http://www.WesternReservePublicMedia.org/weathering

Contents

Credits

Project Coordinator
Maria Mastromatteo, Western Reserve Public Media

Teacher Guide

Teacher Design Team
Cathy Page Adler, Ravenna School District
Theresa Boyle, Crestwood Local School District
Maria Mastromatteo, Western Reserve Public Media
Barb Moore, Western Reserve Public Media

Teacher Guide Layout and Design
Paula Kritz, Western Reserve Public Media

Video

Produced by Western Reserve Public Media (WNEO/WEAO, Youngstown/Akron, Ohio)

Executive Producer
Maria Mastromatteo, Western Reserve Public Media

Producer
Duilio Mariola, Western Reserve Public Media

Videographer
Duilio Mariola, Western Reserve Public Media

Video Script
Larry Chance, Chance Productions

Photographs
Rod Chlysta, Photographer

Professional Development Script
Cathy Adler, Ravenna School District

Web

Layout and Design
Paula Kritz, Western Reserve Public Media

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Gone With the Weathering: The Result — Erosion

Overview

Did you ever wonder why the Cuyahoga River is so crooked, the Rocky Mountains are so high or the road by your house gets so bumpy? The lessons in this guide and the accompanying videos will help you discover how majestic mountains, crooked rivers and bumpy roads are formed. This teacher guide is divided into three sections: slow weathering, fast weathering and the redepositing of sediments. In each section, the desert is used as an example of the results of weathering and erosion.

Part 1: Slow Weathering

Specific to this unit are lesson plans on icebergs and glaciers and their effect on the earth. Additional lesson plans help students to identify landforms and understand what created them. A special section offers instruction on slow erosion forces in desert areas.

Part 2: Fast Weathering

This unit begins with a lesson that introduces all the rapid processes and is followed by hands-on lessons on earthquakes, volcanoes, tsunamis and floods. It also includes a special concentration on how these rapid forces affect the desert regions.

Part 3: What's Left Behind: Redepositing

This unit begins with a PowerPoint lesson that explains what redepositing is. Using maps of the continental United States, the lessons ask students to locate various redepositing landmarks. Students also work in pairs to make a book about canyons, sandbars, deltas, caves and other natural formations created through redepositing. A special concentration of the desert and what landforms are found there along with a story-writing activity finish the unit.

Standards Addressed

Current Standards

Grade 4

Earth and Space Science

3-5 Benchmark *B. Summarize the processes that shape Earth's surface and describe evidence of those processes.*

Y2003.CSC.S01.G03-05.BB.L04.I08 Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09 Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10 Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

GONE WITH THE WEATHERING

THE RESULT – EROSION

Resources

http://www.WesternReservePublicMedia.org/weathering

Background: Weathering

The processes of weathering and erosion are similar, but not the same. **Weathering is the gradual breaking down of rocks into smaller pieces caused by the action of weather conditions.** Plant and animal life, atmosphere and water can cause weathering effects. When weathering occurs, the rock stays in the same place. The particles removed are called **sediments**.

As soon as rock sediments begin to move, erosion takes place. **Erosion is a process that transports rock, soil and sediment to a different location.** Erosion can occur on its own, but it more often happens after weathering occurs. Weathering and erosion often create amazing landscape features.

Types of Rocks

All rocks are made up of minerals. Geologists (scientists who study rocks) classify rocks into three basic types: igneous, metamorphic and sedimentary.

- **Igneous** rocks are created from superheated liquids that originate deep within the earth. They are formed from hot, molten rock known as magma. The magma cools and hardens after it comes to the surface. Granite is an example of an igneous rock.
- **Metamorphic** rocks are rocks that have changed due to heat and/or pressure. Marble is an example of a metamorphic rock.
- **Sedimentary** rocks are created when sediments are deposited and compressed or cemented together by lime, silica, etc. Sedimentary rocks make up about three-quarters of the rocks on the earth's surface. Limestone is an example of a sedimentary rock.

Types of Weathering

Mechanical weathering takes place when rocks are broken down without any change in the chemical nature of the rocks. The main cause of weathering is extreme changes in temperature. One example is that there might be a crack in a rock. Rain can then seep into the crack and expand as it freezes. This causes small cracks in the rock to grow larger, forcing the rock to split apart. Extreme heat causes rocks to expand. When the weather cools, the rock weakens and eventually breaks apart.

Another type of weathering is **salt weathering**. As water enters the holes and cracks in the surface of rocks, it often carries salt with it. As the water later evaporates, the salt is left behind. Over time, these salt deposits build up, creating pressure that can cause rocks to split and weaken.

Chemical weathering occurs when the minerals that make up a rock are dissolved or chemically changed. These chemical reactions can break down the bonds holding the rocks together, causing them to fall apart. Water can also be absorbed into the minerals in the rock. The rock then expands and is weakened. Sometimes rainwater contains acid (acid rain). When this comes in contact with rocks such as limestone, it slowly dissolves the rock.

The most common forms of weathering are oxidation, hydrolysis and carbonation.

- **Oxidation** occurs when oxygen combines with other elements, creating new kinds of rocks.
- **Hydrolysis** occurs when water combines with substances in the rock, forming new kinds of substances.
- **Carbonation** occurs when carbon dioxide reacts with rocks, forming a solution that is then carried away by water.

Resources

Types of Rocks

- **Discover How Rocks Are Formed** Gives a brief explanation and then shows examples.
  http://www.fi.edu/fellows/fellow1/oct98/create
- **Geography4Kids: Rocks and Minerals**
  http://www.geography4kids.com/files/earth_rocktypes.html
- **Types of Rocks** Has videos, games and quizzes.
  http://www.neok12.com/Types-of-Rocks.htm

Weathering

- **Chemical Weather**
  http://www.kidsgeo.com/geology-for-kids/0067-chemical-weathering.php
- **Geography4Kids: Mechanical Weathering**
  http://www.geography4kids.com/files/land_weathering.html
- **Mechanical Weathering**
  http://www.kidsgeo.com/geology-for-kids/0066-mechanical-weathering.php
- **Observe the chemical weathering of feldspar to clay** Very short video
  http://www.classzone.com/books/earth_science/terc/content/visualizations/es1202/es1202page01.cfm?chapter_no=visualization

Source: Gifford, Clive. *Looking at Landscapes: Weathering and Erosion*. North Mankato: Smart Apple Media, 2006. Print.

Background: Erosion

Erosion is a process that transports rock, soil and sediment to a different location.

Water is one of the most powerful forces causing erosion, continuously changing the landscape. Waves in oceans and other large bodies of water produce coastal erosion. Rain is absorbed by the land, filling tiny spaces in the rock. The ground eventually becomes saturated and carries loose sediments away. Rivers carry water downhill and carry surface runoff, causing rocks to eventually break away. Chemicals in the water cause sediments to change and move. An example of the power of water is the Colorado River, which formed the Grand Canyon.

Wind erosion, which almost always occurs in deserts, plays a very important role in the displacement of surface soil. This type of erosion carries the smallest particles, particularly clay, to locations near and far. The most spectacular wind erosion formations are mounds of sand called dunes, where the sand covers everything in its path. An example of wind erosion can be seen in the dunes of the Sahara Desert.

Ice Erosion

Ice erosion occurs as a result of glaciers, which are made up of fallen snow that, over many years, compresses into large, thickened ice masses that move very slowly. Glaciers pick up rocks and grind away the land surface. We can see an example of what moving glaciers create when we look at the Great Lakes and the land around them.

People

Agriculture and construction cause erosion because humans move the topsoil, which makes it more prone to erosion. Grazing and deforestation remove the vegetation, causing the surface soil to be bare and more easily eroded.

Resources

- **About Causes of Erosion**
  http://www.landscapeplanet.com/maintenance-1-cause-of-erosion.htm
- **All About Glaciers**
  http://nsidc.org/cryosphere/glaciers/index.html
- **Facts About Wind Erosion**
  http://www.buzzle.com/articles/facts-about-wind-erosion.html
- **Geography4Kids: Erosion**
  http://www.geography4kids.com/files/land_erosion.html
- **Hot Chalk: Erosion** Good lesson plan on erosion
  http://www.lessonplanspage.com/sciencessmdunitonerosion46-htm
- **Introduction to Erosion**
  http://www.kidsgeo.com/geology-for-kids/0059-introduction-to-erosion.php
- **Lesson Planet: Erosion — Hotlist of Lessons on Erosion**
  http://www.kidsgeo.com/geology-for-kids/0059-introduction-to-erosion.php
- **Science Lab on Erosion — lesson plan**
  http://teacher.scholastic.com/dirt/erosion/lab.htm
- **People's Impact on Erosion**
  http://www.msnbc.msn.com/id/15993162/ns/us_news-environment/t/humans-said-have-huge-impact-erosion

Weathering and Erosion Vocabulary

Avalanche: The sudden downslope movement of snow, ice and rocks or mixtures of all these things.

Canyon: A deep, narrow valley with high, steep sides.

Chemical weathering: Changes to the composition of rocks, often transforming them when water interacts with minerals to create various chemical reactions.

- **Acid rain:** Rain containing harmful chemicals caused by burning fossil fuels.
- **Hydration:** The process by which water is absorbed into minerals in rock, expanding and weakening them.
- **Hydrolysis:** The process of rocks turning into clay through chemical reaction between water and some minerals.
- **Oxidation:** The process of oxygen in the air mixing with iron in rocks to produce iron oxide, which weakens rock structure.

Delta: The often triangular-shaped alluvial deposition area at the mouth of a river.

Desert: A region with less than 10 inches of water per year. There are both hot and cold deserts.

- **Dune:** A hill or mound of sand formed by wind erosion.
- **Haboob:** An intense dust storm carried on an atmospheric gravity current.

Disaster: An occurrence causing widespread destruction and distress; a catastrophe.

Earthquake: A sudden movement of Earth's crust caused by the release of stress accumulated along geologic faults or by volcanic activity.

- **Aftershock:** A quake of lesser magnitude, usually one of a series, following a large earthquake in the same area.
- **Epicenter:** The point on Earth's surface directly above the focus of an earthquake.
- **Intensity:** The amount or degree of strength per unit of area or volume.
- **Magnitude:** A measure of the amount of energy released by an earthquake.
- **Seismograph:** An instrument for automatically detecting and recording the intensity, direction and duration of a movement of the ground, especially of an earthquake.

Erosion: The process that transports rock, soil or sediment to a different location.

Fault: A fracture in the continuity of a rock formation caused by a shifting or dislodging of Earth's crust, in which adjacent surfaces are displaced relative to one another and parallel to the plane of fracture.

Flooding: An overflowing of water onto land that is normally dry

Geologist: A scientist who studies landforms and the process of change.

Glacier: A massive river of ice, rocks and soil formed from densely packed snow that does not melt. Pressure forces the glacier to move slowly downhill.

- **Glacial till:** The mass of rocks and finely ground material carried by a glacier, then deposited when the ice melted.
- **Moraine:** An accumulation of boulders, stones or other debris carried and left by a glacier.
- **Striations:** Grooves or scratches left behind in the bedrock after a glacier has passed.

Gorge: A deep ravine, usually with a river running through it.

Landslide: The rapid movement of snow, soil and/or rock material down a slope.

Mineral: A chemical substance in Earth's crust.

Mountain: Formed when two plates push against each other. The land at the edge of the plate lifts and folds over itself.

Physical weathering: When rocks are broken into smaller pieces without any change in their chemical composition.

Plates or tectonic plates: Earth's crust is broken into huge sections like a cracked eggshell. Theses plates drift very slowly on top of Earth's mantle. Most earthquakes and volcanoes occur along the margins (edges) of these plates.

Rocks: Consolidated or unconsolidated solid mineral matter. There are three types of rocks:

- **Igneous rock:** Rock formed from the cooling and hardening of hot liquid magma (i.e., lava).
- **Metamorphic rock:** A type of rock formed when igneous, sedimentary or other metamorphic rock is altered by intense heat and pressure.
- **Sedimentary rock:** A type of rock formed from sediment that is compressed over time until it becomes solid.

Sediment: Solid fragments of material that come from the weathering of rock and are carried and deposited by wind, water or ice.

Soil: Little pieces of rock that are accompanied by a mixture of decayed plants and animals known as organic matter.

Soil erosion: The process by which loose soil is washed or blown away.

Summit: The highest point.

Tornado: A localized, violently destructive windstorm occurring over land, especially in the Middle West, and characterized by a long, funnel-shaped cloud.

Tsunami: A giant sea wave, sometimes called a tidal wave, caused by the motion created by earthquakes or volcanic eruptions in or near the ocean.

- **Crest:** The top of a wave.
- **Surge:** A large wave or billow.
- **Trough:** The lowest point between waves.

Volcano: An opening in Earth's crust through which molten lava, ash and gases are ejected.

- **Ash:** The soft residue that remains after combustion.
- **Crater:** A bowl-shaped depression with a raised rim, such as the mouth of a volcano or geyser.
- **Dormant:** In a state of temporary inactivity or rest; suspended or slowed down.
- **Eruption:** Any volcano that is actively releasing lava and/or gases.
- **Lava:** Molten rock erupting from a volcano or volcanic fissure.
- **Magma:** The hot, liquefied matter beneath Earth's surface that erupt from volcanoes and cools to produce igneous rock.
- **Pumice:** Light, porous hardened lava, powdered or whole, used as an abrasive and polishing agent.
- **Vent:** An opening that allows entrance, passage or exit of a gas or vapor.

Warning: An intimation, threat or sign of impending danger or evil.

Weathering: The gradual breaking down of rocks to smaller pieces caused by the action of weather conditions.

- **Chemical weathering:** Occurs when the minerals that make up a rock are dissolved or chemically changed.
- **Mechanical or physical weathering:** When rocks are broken down without any change in the chemical nature of the rock.

Desert Hotlist

Information

- **Animals**
  http://www.blueplanetbiomes.org/animals.htm
- **The Desert Biome**
  http://www.ucmp.berkeley.edu/exhibits/biomes/deserts.php
- **Desert Biome(s) — Research-related Topics**
  http://www.marietta.edu/~biol/biomes/desert.htm
- **Desert Topics**
  http://www.mbgnet.net/sets/desert/index.htm
- **Hotlist of Desert Topics Appropriate for Children**
  http://edtech.kennesaw.edu/web/desert.html
- **National Geographic**
  http://environment.nationalgeographic.com/environment/habitats/desert-profile
- **Plants**
  http://www.blueplanetbiomes.org/plants.htm
- **WikiPedia: Deserts**
  http://en.wikipedia.org/wiki/Desert
- **World Biomes**
  http://www.blueplanetbiomes.org/world_biomes.htm

Lesson Plans for the Desert

- **BrainPop** (can read text, but there is a fee for some videos)
  http://www.brainpopjr.com/science/habitats/desert/grownups.weml
- **Cross-curricular Lesson on Deserts of the World**
  http://www.pbs.org/newshour/extra/teachers/lessonplans/world/sahara_key.pdf
- **The Desert Alphabet Book** (series of lessons that ends with a story)
  http://teacherlink.ed.usu.edu/tlresources/units/byrnes-literature/moulton/mlitss.html
- **Desert Animals**
  http://school.discoveryeducation.com/lessonplans/programs/deserts
- **Desert** (lesson plans, activities, worksheets, units, clip art and more)
  http://www.teacherplanet.com/resource/desert.php
- **Deserts** (hotlist of activities and units)
  http://geography.mrdonn.org/deserts.html
- **Deserts** (hotlist of lessons)
  http://www.atozteacherstuff.com/Themes/Deserts
- **Life in the Sahara** (one lesson)
  http://www.pbs.org/newshour/extra/teachers/lessonplans/world/sahara_key.pdf
- **Sand, Sand, Everywhere Sand** (section on a faith group, so there may be religious elements here)
  http://learningtogive.org/lessons/unit373/lesson1.html

How Earth Was Created

- **Bob the Alien's Tour of the Solar System**
  http://www.bobthealien.co.uk/earthform.htm
- **Development of the Earth's Structure and Composition** (has lessons and many videos)
  http://www.britannica.com/EBchecked/topic/175962/Earth/242081/Development-of-Earths-structure-and-composition
- **Geology for Kids: How the Earth Was Created**
  http://www.kidsgeo.com/geography-for-kids/0005-earths-origins.php

Hot Desert Animal Vocabulary

A quick glance at the desert landscape might make you think that there are no animals there. The truth, however, is that desert animals are plentiful. They are generally small, survive on little water and make adaptations or changes to fit the desert environment.

Below are characteristics of all animals. Let's use this information to find out about desert animals.

What Animals Eat

- **Carnivore** – An animal that eats flesh.
- **Herbivore** – An animal that feeds chiefly on plants.

When Animals Are Active

- **Diurnal** – An animal that is active in the daytime.
- **Nocturnal** – An animal that is active at night.

Another Classification

- **Invertebrate** – Having no backbone**.**
- **Vertebrate** – Having a backbone.

Animals Types

- **Amphibian** – A cold-blooded vertebrate animal such as frogs, toads, newts and salamanders. It returns to water to reproduce.
- **Arachnid** – An air-breathing animal that has simple eyes and eight legs with jointed feet.
- **Bird** – Any warm-blooded vertebrate having wings, scaly legs, a beak, no teeth and a body covered with feathers.
- **Insect** – Any of numerous small invertebrate animals that have a well-defined head, thorax and abdomen, six legs and typically one or two pairs of wings.
- **Mammal** – A warm-blooded vertebrate animal of a class that is distinguished by the possession of hair or fur and the secretion of milk by females.
- **Reptile** – An animal that is cold-blooded and usually egg-laying.

Desert Animals

Roadrunner

- The roadrunner is a diurnal bird with brown feathers with white spots.
- It makes nests in the desert plants.
- It is an omnivore (eats meat). It also eats seeds, mice, lizards and insects.
- Its enemy is the coyote.
- It runs very fast – up to 17 miles per hour – to catch dinner.

Jackrabbit

- The jackrabbit is a diurnal mammal that has brown and gray fur and a white belly.
- It lives under bushes and trees in the desert.
- It is an herbivore and eats cactus and other plants.
- It has to watch out for coyotes, owls and eagles.
- It can run up to 40 miles per hour and has very strong back legs.

Lizard

- The lizard is a diurnal reptile. It has dry, scaly skin that is brown.
- It lives under rocks in the desert.
- It is a carnivore that eats insects.
- It is careful to avoid foxes and owls.
- Fringed-toed lizards dig in the sand to bury themselves to keep cool and to stay away from predators.

Scorpion

- A scorpion is a nocturnal arachnid. It has a golden brown shell.
- It makes its home by burrowing into the sand in the desert.
- It is a carnivore and eats insects.
- It stays away from roadrunners, snakes and owls.
- It uses its pincers to paralyze prey.
- Scorpions hide in the sand and then stun their victims.

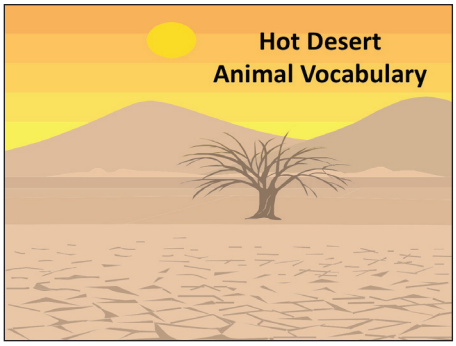
Pictured above are a desert **bird**, **mammal**, **reptile** and **arachnid**. There are many other desert animals. You can use the sites below to find further information.

- **Birds in the Desert**
  http://library.thinkquest.org/26634/desert/bird.htm
- **Desert Insects**
  http://www.buzzle.com/articles/desert-insects.html
- **Desert Reptiles and Landscapes**
  http://www.desertreptiles.net/reptileshome.htm
- **Desert Snakes**
  http://www.discoverseaz.com/Wildlife/snakes.html
- **Desert Snakes**
  http://www.supiri.com/nature/animals/desert-snakes
- **Mammals in the Desert**
  http://library.thinkquest.org/26634/desert/mammal.htm
- **Tarantula**
  http://digital-desert.com/wildlife/tarantula.html

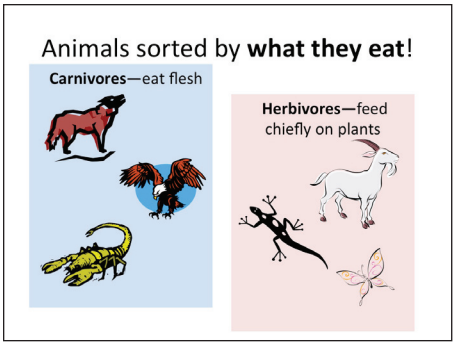
Some general sites include the following.

- **Desert Animals**
  http://www.desertanimals.net/
- **Desert Animals**
  http://www.blueplanetbiomes.org/desert_animal_page.htm

PowerPoint Presentation: Desert Animals



Slide 1



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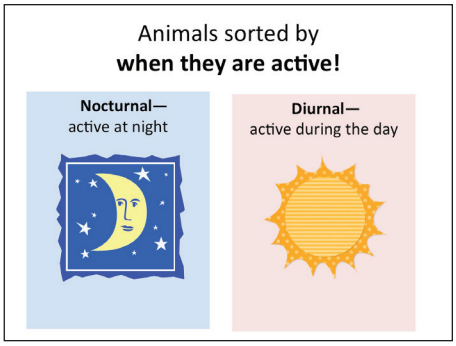

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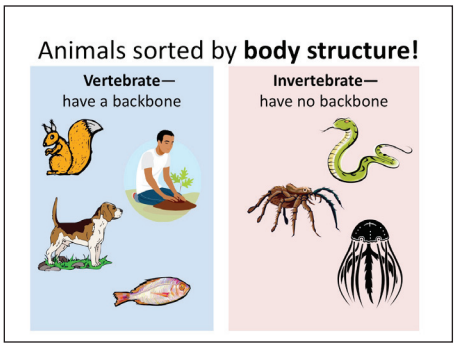

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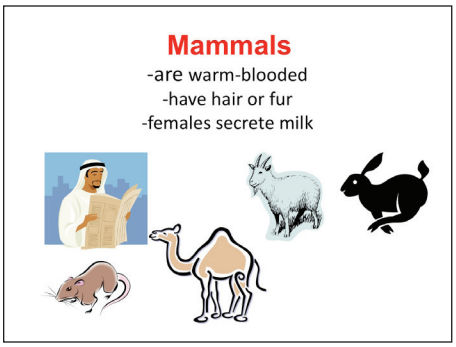

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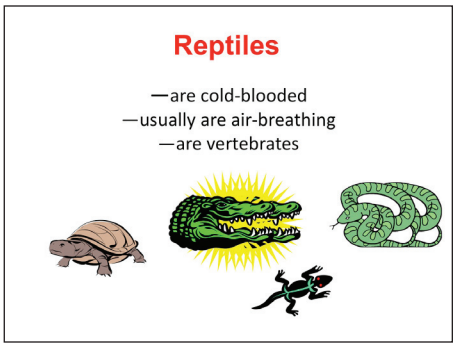

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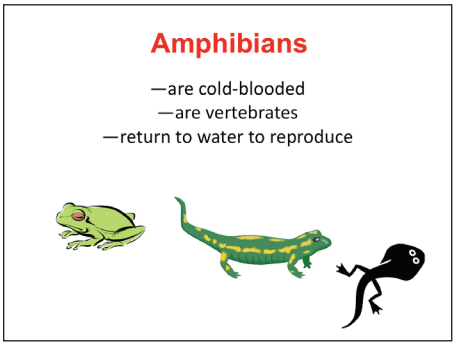

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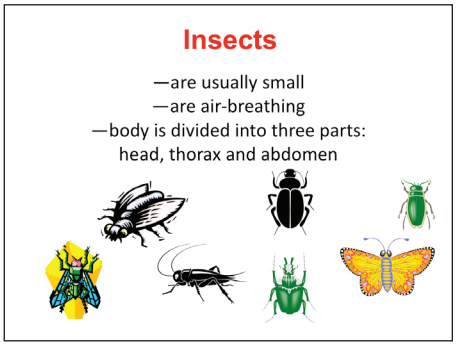

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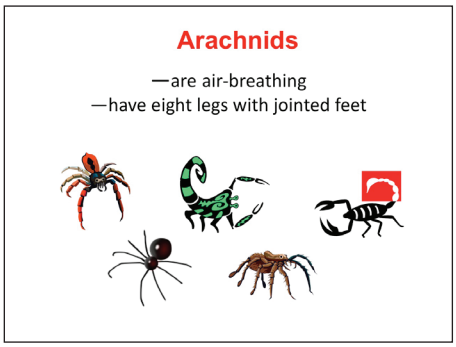


Slide 10

Desert Plants

When you imagine a desert, what do you think of first? Maybe it's sand, heat or Gila monsters, but most likely it's a cactus. Cacti are probably the most memorable characteristic of the desert.

Barrel Cactus

- The barrel cactus can be easily distinguished from other cacti because of its cylinder-shaped body.
- It usually reaches from around five to 11 feet tall, and at that height it is one of the largest cacti in the North American deserts.
- Its sides have ridges that are topped with dangerously sharp three- to four-inch spines.
- The barrel cactus is also a flowering plant. It has rings of yellow-green or red blossoms at its top.

Joshua Tree

- The Joshua tree got its name from the Mormon pioneers who thought the tree reminded them of Joshua, from the Old Testament of the Bible.
- The Joshua tree is the largest of the yuccas and grows only in the Mojave Desert.
- The Joshua tree's height varies from 15 to 40 feet and its diameter ranges from one to three feet.
- The Joshua tree has a lifespan of about 200 years.

Saguaro Cactus

- The saguaro cactus has a smooth and waxy skin and is covered with two-inch spines that are located on the tree's vertical ribs.
- In May and June, the cactus bears creamy white flowers with yellow centers that measure about three inches. The stem of the cactus can be 18 to 24 inches in diameter.
- Since it does not rain a lot in the desert, the cactus uses the water that it stores when it does rain.
- Its average lifespan is about 200 years.

Deserts are home to many living things. In fact, deserts are second only to tropical rainforests in the variety of plant and animal species that live there.

Many desert plants have made adaptations or changes that help the plants to survive in an environment with little water. Desert plants have two main adaptations:

- The ability to collect and store water
- Features that reduce water loss

Resources

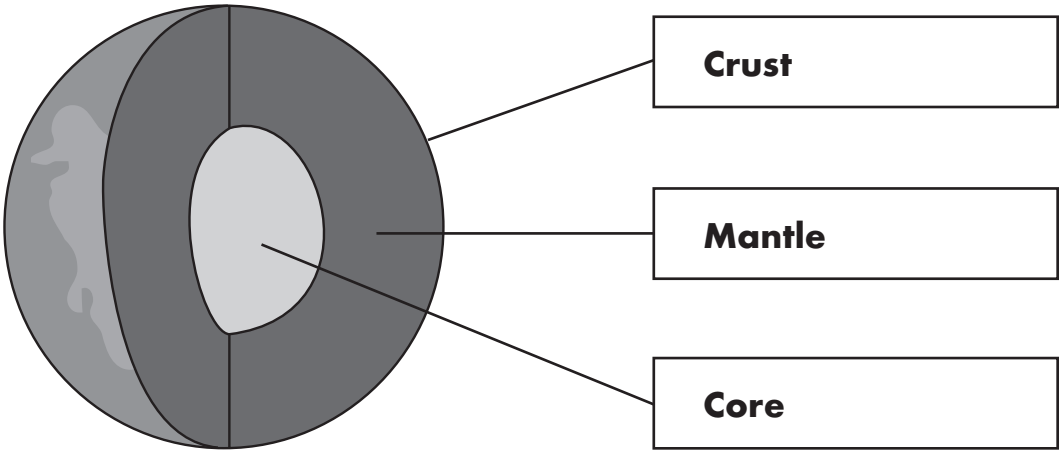
- **Desert Flora: Cactus, Grasses, Shrubs, Trees and Wildflowers**
  http://www.desertusa.com/flora.html
- **Desert Plants**
  http://www.mbgnet.net/sets/desert/tplants.htm
- **Desert Plants**
  http://www.blueplanetbiomes.org/desert_plant_page.htm
- **Plants in the Desert**
  http://library.thinkquest.org/26634/desert/plant.htm

Images are from http://www.sxc.hu/home. The text is adapted from *Desert Plants*, http://www.blueplanetbiomes.org/desert_plant_page.htm

Plate Tectonics

Basic Structure of the Earth

Understanding plate tectonics requires a little knowledge of the earth's basic structure. If you could slice through the earth, you would find that it is made up of three layers.



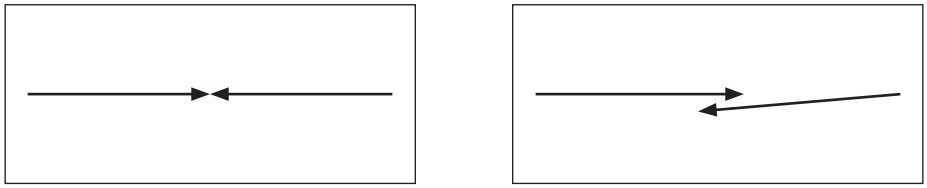
The innermost layer is a very hot **core** of iron and nickel. The inside of the core is solid and the outside is liquid. The middle layer is the **mantle**. It is composed of rock that flows very slowly. The outermost layer is the **crust**. There is oceanic crust and continental crust.

The crust and the upper part of the mantle (which is cooler and more rigid than the lower parts) together make up the **lithosphere**. The lithosphere is broken into huge rocky slabs called **tectonic plates**. These plates ride on top of the **asthenosphere**, a hot, semisolid part of the mantle that lies directly under the lithosphere.

Plate Tectonics

Sometimes when the plates move, they can either collide or bump into each other or one can slide under the other. This process is called **convergent boundaries**. Plates sliding under one another is called **subduction**, and often results in volcanoes. If the crusts collide, mountains can be formed.

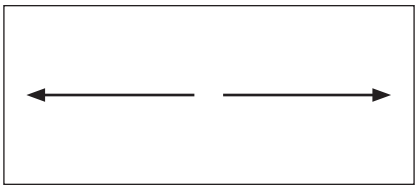
Convergent boundaries



Subduction

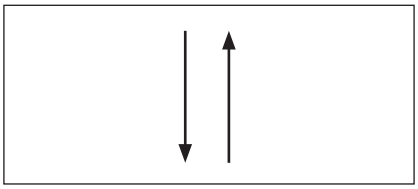
A second type of plate has a **divergent boundary**. This is when the plate move apart. The space that this creates is filled with new crustal material that comes from the molten magma below it.

Divergent boundaries



The third type of movement involves **transform boundaries**. This is when the plates build up as they try to slide against one another. Eventually the pressure becomes too great and the plates break apart. This causes an earthquake. A fault line is made.

Transform boundaries



Scientists still have a lot to learn about the movement of the plates. This will help them more readily they will be able to predict earthquakes and volcanoes and ultimately save lives.

Proof of Movement of the Plates

Continental drift is the theory that explains why the landmasses on the surface of the planet have changed over time. There is fossil and plant evidence of the continental drift. Identical fossils and plants are found on different continents and no where else. This leads us to the conclusion that the continents were once joined. These plants and animals could have lived on the continents when the continents when they were connected. Then when the continents divided, animals and plants from one area were stuck in other areas. Scientists believe that the continents had moved and formed through the movement of tectonic plates.

The Changing Earth

The movement of the plates has caused and continues to cause enormous changes in the earth. Mountains have formed, volcanoes have erupted and earthquakes have shaken the land. This is all due to **plate tectonics**.

Earthquakes

An earthquake is a sudden violent shock of Earth's plates. It is Earth's natural means of releasing stress. More than 1 million earthquakes rattle the world each year. In the United States, the West Coast is most at risk of having an earthquake, but they also happen in the Midwest and along the East Coast. Earthquakes can be felt over large areas and usually last less than one minute. The exact occurrence of earthquakes cannot be predicted.

There are about 20 plates along the surface of Earth that move continuously and slowly past each other. When the plates squeeze or stretch, huge rocks form at their edges and the rocks shift with great force, causing an earthquake. As the plates move, they put forces on themselves and each other. If the force is large enough, the crust is forced to break. This causes the release of energy that moves through Earth in the form of shock waves.

A fault is an area of stress in our planet where broken rocks slide past each other, causing a crack in Earth's surface.

The aftermath of an earthquake can result in large fissures on the ground, creating gorges and valleys where none existed before. Earthquake vibrations can cause sandy soils to liquefy. Such a process would make the ground sink suddenly – the result of a process called fluidising. In a mountainous terrain, landslides may occur and sometimes, small hills disappear or are leveled to the ground.

Resources

- **Dragonfly TV: Earthquakes**
  http://pbskids.org/dragonflytv/show/earthquakes.html
- **Earthquakes 101**
  http://video.nationalgeographic.com/video/environment/environment-natural-disasters/earthquakes/earthquake-101
- **Earthquakes for Kids**
  http://earthquake.usgs.gov/learn/kids
- **Earthquake for Kids**
  http://www.historyforkids.org/scienceforkids/geology/earthquakes/index.htm
- **Weather Wiz for Kids: Earthquakes**
  http://www.weatherwizkids.com/weather-earthquake.htm

Volcanoes

A volcano is a mountain that opens downward to a pool of molten rock below the surface of Earth. When pressure builds up, eruptions occur. Gases and rock shoot up through the opening and spill over or fill the air with lava fragments. Eruptions can cause lateral blasts, lava flows, hot ash flows, mudslides, avalanches, falling ash and floods. Volcano eruptions have been known to knock down entire forests. An erupting volcano can trigger tsunamis, flash floods, earthquakes, mudflows and fallen rock.

Volcanoes are formed when magma from within Earth's upper mantle works its way to the surface. At the surface, it erupts to form lava flows and ash deposits. Over time as the volcano continues to erupt, it will get bigger and bigger.

Earth's crust is made up of huge slabs called plates that fit together like a jigsaw puzzle. These plates sometimes move. The friction causes earthquakes and volcanic eruptions near the edges of the plates. The theory that explains this process is called plate tectonics.

Resources

- **Discover Kids: Volcano Explorer**
  http://kids.discovery.com/games/build-play/volcano-explorer
- **Geology for Kids: The Study of Our Earth**
  http://www.kidsgeo.com/geology-for-kids/
- **Hot Spots and the Ring of Fire: Map**
  http://vulcan.wr.usgs.gov/Glossary/PlateTectonics/Maps/map_plate_tectonics_world.html
- **Impact and Effects**
  http://library.thinkquest.org/17457/english.html
- **Photo Gallery: Volcanoes**
  http://www.geology.sdsu.edu/how_volcanoes_work/Home.html
- **Ring of Fire**
  http://www.crystalinks.com/rof.html
- **Ring of Fire**
  http://geography.about.com/cs/earthquakes/a/ringoffire.htm
- **Volcanoes**
  http://42explore.com/volcano.htm
- **Volcanoes: FEMA**
  http://www.fema.gov/kids/volcano.htm
- **Volcanoes Online**
  http://library.thinkquest.org/17457/english.html
- **Volcano World**
  http://volcano.oregonstate.edu/kids/index.html
- **Weather Wiz Kids**
  http://www.weatherwizkids.com
- **What is a Volcano?**
  http://wwww.nationalgeographic.com/forcesofnature/interactive/index.html?section=v
- **What Is the Ring of Fire?**
  http://geography.about.com/library/faq/blqzringoffire.htm

Tsunamis

Tsunamis are huge waves of water, sometimes reaching heights of over 100 feet (30.5 meters), that can cause widespread destruction when they crash ashore.

The awe-inspiring waves are typically caused by large undersea earthquakes at tectonic plate boundaries. When the ocean floor at a plate boundary rises or falls suddenly, it displaces the water above it and launches the rolling waves that will become a tsunami.

Approximately 80 percent of tsunamis happen within the Pacific Ocean's Ring of Fire, a geologically active area where tectonic shifts make volcanoes and earthquakes common.

Tsunamis may also be caused by underwater landslides or volcanic eruptions. They may even be launched, as they frequently were in Earth's ancient past, by the impact of a large meteorite plunging into an ocean.

Tsunamis race across the sea at up to 500 miles (805 kilometers) an hour – about as fast as a jet airplane. At that pace, they can cross the entire expanse of the Pacific Ocean in less than a day. Because of their long wavelengths, they lose very little energy along the way.

In deep ocean water, tsunami waves may be only a foot or so in height. But as they approach shoreline and enter shallower water, they slow down and begin to grow in energy and height. The tops of the waves move faster than the bottoms do, which causes them to rise precipitously.

A tsunami's trough – the low point beneath the crest of the wave – often reaches shore first. When it does, it produces a vacuum effect that sucks coastal water seaward and exposes harbor and sea floors. This retreating of water is an important warning sign of a tsunami because the crest of the wave and its enormous volume of water typically hit shore five minutes or so later.

A tsunami is usually composed of a series of waves, called a wave train, so its destructive force may be compounded as more and more waves reach shore.

Some tsunamis do not appear on shore as massive breaking waves but instead resemble a quickly surging tide that inundates coastal areas.

Tsunami Review

1. An earthquake occurs below the ocean.
2. The ocean floor cracks.
3. Water rushes in to fill the crack, causing a swell.
4. The swell spreads and causes large waves.
5. Large waves hit the shore. When they ebb (go back into the ocean), they take dirt, soil, buildings and whatever else is in their way.

Resources

- **Tsunami Facts for Kids**
  http://www.sciencekids.co.nz/sciencefacts/earth/tsunamis.html
- **Tsunamis: Killer Waves**
  http://environment.nationalgeographic.com/environment/natural-disasters/tsunami-profile
- **Tsunami Trivia Game** – Kids select a picture to answer the questions about tsunamis
  http://www.tsunami.noaa.gov/pdfs/Tsunami-Trivia.pdf
- **Wave That Shook the World**
  http://www.pbs.org/wgbh/nova/tsunami

Floods

A flood is a great flowing or overflowing of water onto normally dry land. A flood happens when too much rain, brought by storms and strong winds, falls and cannot be absorbed by the soil. Rivers burst their banks and the water spills onto the land. Strong winds blowing across the sea make huge waves that surge onto the land and flood coastal areas.

River floods happen when rivers and streams cannot carry away all the extra water from excessive rain or melting snow. The water rises in the rivers and streams and overflows onto land. Floods destroy farmland, wash away people's houses and drown people and animals. Buildings in towns and cities can be damaged as well.

Coastal flooding can be caused by strong winds blowing waves onto the land. Hurricanes and major storms produce most coastal floods. Very high tides and tsunamis also flood the coasts. In many countries, large groups of people live along the coasts and for these people, coastal flooding can be very serious.

A flash flood is a quick flood caused by a sudden cloudburst or thunderstorm. Huge amounts of water fall in a short time and in cities and towns, the drains overflow and roads flood. Flash floods also happen in mountainous areas, where steep slopes cause the water to travel at high speeds. The rushing water erodes the soil, washing it away down the slopes. Flash floods often occur rapidly and with little warning.

Floods sometimes occur when artificial structures such as dams fail. If the dam is poorly designed or built in a place where earthquakes and landslides occur, the dam will break and the water will flood the land.

Review the following facts:

- A flood happens when too much rain falls.
- Storms can cause floods.
- In a flood, water from rivers flows over the land.
- Flood water enters houses and other buildings.

Resources

- **I'm a Flood Zone Kid**
  http://www.floodfacts.com/floodzone_kids_intro.html
- **InFocus: Floods**
  http://www.pbs.org/newshour/infocus/floods.html
- **Planet Earth: Floods**
  http://www.kidcyber.com.au/topics/floods.htm
- **Rain and Floods**
  http://www.weatherwizkids.com/weather-rain.htm

GONE WITH THE WEATHERING

THE RESULT – EROSION

Slow Weathering

http://www.WesternReservePublicMedia.org/weathering

Iceberg Sighting

Overview

In this two-day experiment, students will explore how erosion and weathering can be accomplished by ice, using glaciers and frozen cracks as examples of these processes. The experiments require the use of a freezer. **Day 1:** The experiment will focus on how glaciers can be a source of erosion and abrasion to Earth's surface. **Day 2:** The experiment will show how water can seep into and under hard surfaces and freeze and, when the freezing water expands, it can cause surfaces to crack.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark

B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Y2003.CSC.S01.G03-05.BB.L04.I08
Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09
Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Ice cube trays
- Water
- Clay
- Sand
- Plastic cups with lids (i.e., small containers used for salad dressing)
- Flat tray
- Paper towels

Procedure: Day 1

1. The day before the lesson, put a little bit of sand at the bottom of each space in ice cube trays, fill them with water and freeze.

2. Share the PowerPoint presentation "What Do They Have in Common?" Discuss how cracks in sidewalks, potholes in streets and broken rock all have pores in which water can enter.

3. With students working in groups, have them flatten and smooth clay, which will represent Earth's surface.

4. Instruct the students to rub a "glacier" (ice cube) over the clay. As the ice cube starts to melt, the sand becomes more exposed and grooves and holes in the clay will be formed. If the "glacier" is left to melt into the holes that have been created, "lakes" will be formed.

5. Lead a discussion about the students' findings. *(Glaciers can be a source of erosion and abrasion. They also provide the water necessary to fill in a created groove or depression with water, which plays a role in the development of lakes.)*

6. Instruct the students to record their observations on the sheet provided. Remind them that their observations should include correct spelling and grammar.

7. Have the students fill plastic cups to the top with water, making sure there is no air space, and then affix the lids.

8. Instruct them to place the cups on a tray. Some should be right-side up and some upside down. Put the tray in a freezer for observation on the next day.

Assessment

Observations should include the following:

- How the ice cubes mimicked glaciers in changing the appearance and shape of the clay surface.
- As the cubes melted, they filled in some of the holes and grooves with water.
- Striation patterns were carved into the clay.

Procedure: Day 2

1. Take the tray of frozen cups out of the freezer.

2. Students should observe that the ice had enough force to pop lids off and crack containers.

3. Encourage the students to discuss their findings.

4. For a second time, show the PowerPoint presentation "What Do They Have in Common?" Have students explain how the changes in the various surfaces occurred. *(Discussion should include understanding the force of weathering as seen by ice wedging. Example: The expansive force of the ice in a rock or under the sidewalk or pavement would cause a crack in the surface. When water has seeped into and under hard, porous surfaces, cracks will form.)*

5. Instruct the students to fill out the second observation sheet.

Evaluation

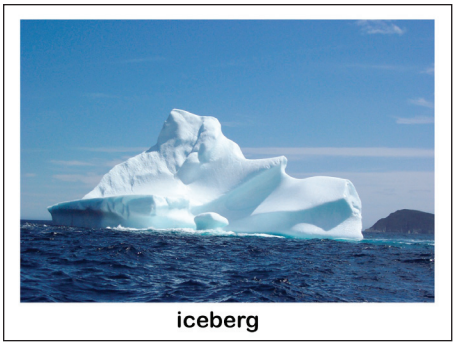
Observations should include the concepts that when water freezes it expands and the force of expanding ice causes the surface to crack.

Students should have the following items on the two Student Observation Records. You can rate the response to each of the four items by using the scale one through five, with one being low and five being "wow." (20 points possible)

1. Were the findings accurate? _____
2. Was there a clear explanation of what the student did? _____
3. Was there a clear explanation of what the student learned? _____
4. Did you need to do the task more than once to get an answer to the questions above? _____
5. BONUS: Was there an interesting fact given? _____

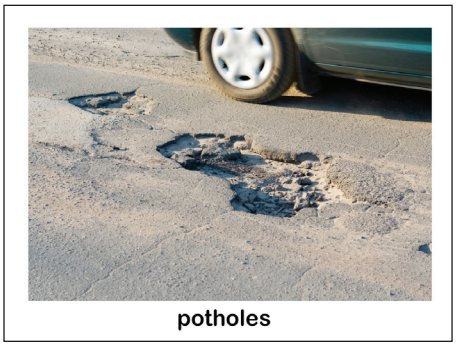
PowerPoint Presentation: What Do They Have in Common?

Slide 1



Slide 2

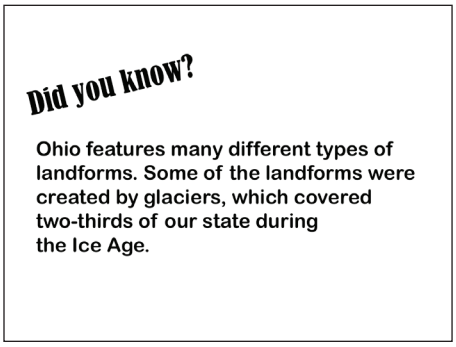
Slide 3



Slide 4

Slide 5

Slide 6



Slide 7

Slide 8

Name _____

Iceberg Sighting

Observation Record: Day 1

Materials Used:

_____

_____

Question: How do icebergs change the surface of Earth?

What I Did:

_____

_____

_____

_____

What I Learned:

_____

_____

_____

_____

Interesting Facts:

_____

_____

_____

_____

Name _____

Iceberg Sighting

Observation Record: Day 2

Materials Used:

_____

_____

Question: How do icebergs change the surface of Earth?

What I Did:

_____

_____

_____

_____

What I Learned:

_____

_____

_____

_____

Interesting Facts:

_____

_____

_____

_____

A Glacier of Our Own

Overview

Glaciers will be examined by making an edible model. Snow (depicted here as ice cream) will accumulate faster than it melts over a class period. Through this classroom demonstration, students will observe the formation of landforms and how they change. Glacial till, striations and melting will be observed. The experiment also will show river and lake formation.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark

B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Y2003.CSC.S01.G03-05.BB.L04.I08
Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09
Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Half-gallon carton of chocolate-vanilla swirl ice cream
- Crushed Oreos
- Crushed cereal such as Froot Loops
- Butterscotch or chocolate chips
- Peanuts (optional)
- M&Ms
- Cookie sheet
- Bowls and spoons
- Large spoon

Procedure

1. Initiate class discussion to review facts learned about glaciers.

2. Explain to the class that they will create a glacier in the classroom.

3. Remove the ice cream from the carton in one big chunk and put it on the cookie sheet. The ice cream represents the glacier.

4. Show the students the marbling in the ice cream. Explain that the white represents the snow and ice, and the chocolate swirls represent the dirt and soil – the glacial till that the glacier picks up as it moves and becomes streaked with dirt and rocks.

5. Put the rest of the ingredients – crushed Oreos and cereal, M&Ms etc. – on the cookie sheet in the path of the "glacier." Ingredients will be picked up and moved by the force of the glacier.

6. Instruct students to predict what will happen as the glacier encounters the till and have them fill in Prediction 1 on the Observation Record. *(Possible outcomes: it can stick to the glacier; it can be pushed along in front of the glacier; it can be pushed off to the side of the glacier.)*

7. Discuss predictions.

8. Discussion time allows for melting and moving of ice cream glacier.

9. Slightly tilt the pan and use the large spoon, if needed, to move the glacier on the cookie sheet.

10. Discuss movement.

11. Encourage students to predict what will happen as the glacier begins to melt. *(Possible outcomes: it needs an outlet for the melt water; it creates rivers and streams.)*

12. Discuss predictions.

13. The glacier has shown how landforms and bodies of water came to be.

14. Following discussion, serve up the edible glacier for students' enjoyment!

Adapted from: How Glaciers Formed the Minnesota Landscape
http://serc.carleton.edu/sp/mnstep/activities/26539.html

Evaluation

As students eat the glacier, they will complete a Venn diagram to compare and contrast glaciers and their ice cream model. They will then use their ideas in to write a paragraph describing how glaciers impact the land.

Writing Evaluation

A Glacier of Our Own

CATEGORY	4	3	2	1
Accuracy of Facts (Content)	All supportive facts are reported accurately.	Almost all supportive facts are reported accurately.	Most supportive facts are reported accurately.	No facts are reported or most are inaccurately reported.
Capitalization and Punctuation (Conventions)	The writer makes no errors in capitalization or punctuation, so the paper is exceptionally easy to read.	The writer makes one or two errors in capitalization or punctuation, but the paper is still easy to read.	The writer makes a few errors in capitalization and/or punctuation that catch the reader's attention and interrupt the flow.	The writer makes several errors in capitalization and/or punctuation that catch the reader's attention and greatly interrupt the flow.
Conclusion (Organization)	The conclusion is strong and leaves the readers feeling that they understand what the writer is saying.	The conclusion is recognizable and ties up almost all the loose ends.	The conclusion is recognizable, but does not tie up several loose ends.	There is no clear conclusion; the paper just ends.

Name _____

A Glacier of Our Own — Observation Record

Materials Used:

Prediction 1

What will happen to the till as the glacier moves?

Prediction 2

What will happen as the glacier begins to melt?

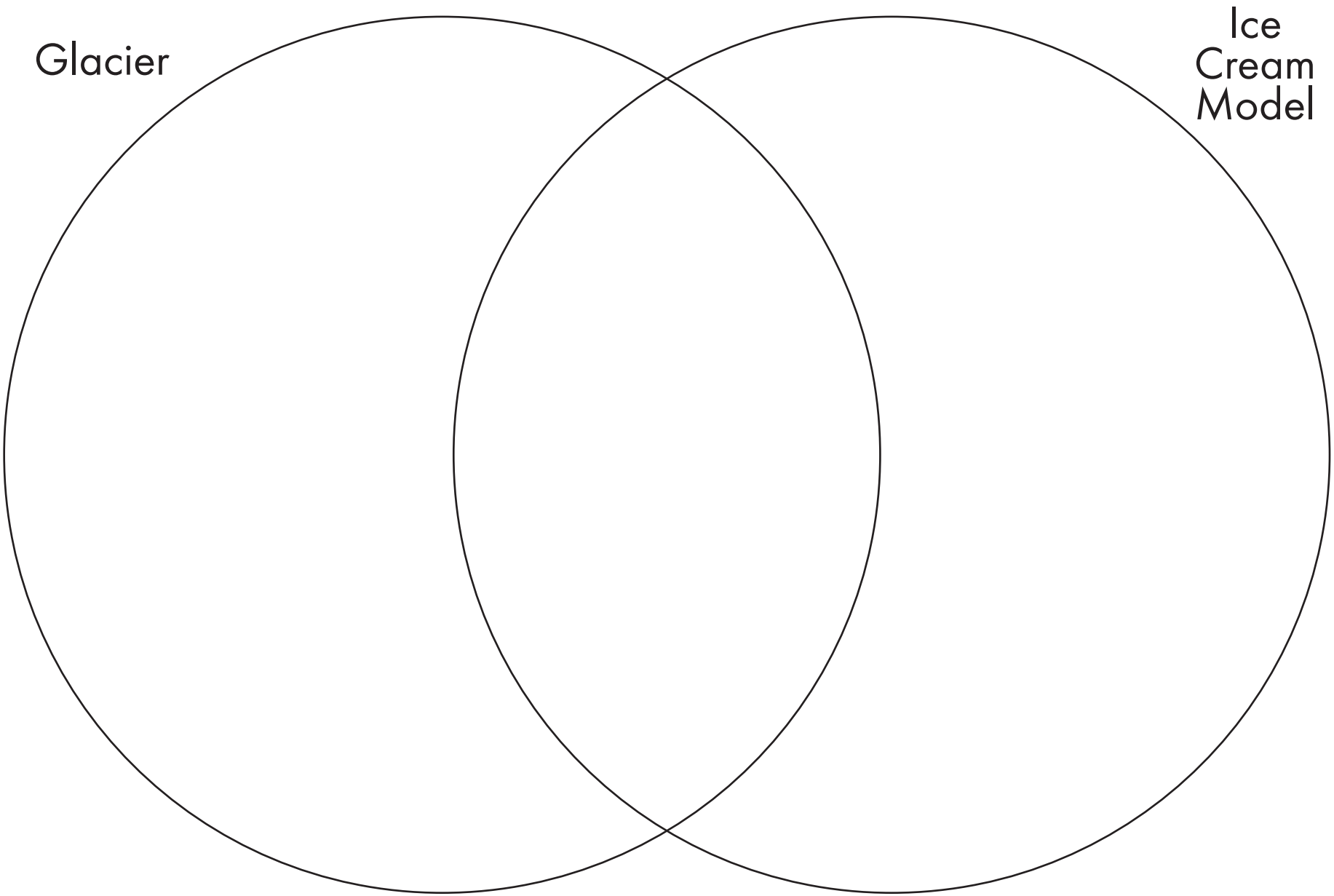
Name _____

A Glacier of Our Own

Using your Venn diagram as your pre-write, write a paragraph describing how glaciers changed the surface of Earth. Use the box below to illustrate your paragraph.

Name _____

Venn Diagram



Landform Project: Breaking It Loose and Putting It Together

Overview

Students will use information they have learned and gained through research to create a PowerPoint presentation showing the slow processes that change Earth's surface.

Standards Addressed

Current Standards

Grade 4

Earth and Space Science

3-5 Benchmark

B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Y2003.CSC.S01.G03-05.BB.L04.I08
Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09
Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Science textbook
- Collection of library books on landforms
- Computer with Internet access

Procedure

1. Divide students into six groups.
2. Randomly assign each group one of the following aspects of slowly changing processes: wind, water, waves, ice, plant roots and glaciers.
3. Each member of the group will design at least one slide to describe one of the processes.
4. Every presentation must have the following items:
    a. The name of the process.
    b. A description of how this process affects the changing surface of Earth.
    c. A picture of the process.
    d. Information on where in the United States the effects of this process can be seen.
    e. A picture of where the process can be found in the United States.
5. Each student should complete the provided PowerPoint planning guide before starting on a PowerPoint slide. This guide will be used to plan the layout and text. It also includes resources used. In some cases, it is wise to review students' planning guides before they proceed further.
6. Upon completion of the PowerPoint presentation, have each group present its slide show to class.

Optional: This project could also be completed as posters showing each aspect of change.

Assessment

Power Point Rubric

CATEGORY	4	3	2	1
Content	Information is clear and accurate, with extra details added.	Information is clear and accurate.	Information is not always clear or correct.	Information is incomplete or incorrect.
Writing Process	Writing is clear, concise, well written and edited.	Writing is clear, concise and well written with only a few errors.	Writing has many errors, but one can understand the main idea.	Writing is difficult to understand, with many errors in spelling and grammar.
Page Layout	Layout is organized, consistent and professional looking in appearance.	Sections are labeled and organized.	Text is broken into sections.	Layout has no structure or organization.
Images	Images enhance topic. Student created some images.	Images are related to text and are the correct size.	Images are unrelated to topic or are too big or small.	Pictures are missing or incorrect.
Group Work	Student consistently contributes to group goal and encourages other group members to participate.	Student contributes to group goal.	Student sometimes contributes to group goal.	Student does not contribute to group goal.

Name_____ Topic _____

PowerPoint Planning Guide

Picture or Internet Image

Text

_____

_____

_____

_____

_____

_____

_____

Following are examples of websites that may be helpful:

http://www.kidsgeo.com/geology-for-kids/0059-introduction-to-erosion.php

http://flashcards.engrade.com/landformsintro

http://sciencenetlinks.com/lessons/soil-erosion

Checklist

___ Included name of process in title.

___ Described how process affects Earth's surface.

___ Stated where process can be seen in the United States.

___ Included picture or image where process can be seen in United States.

___ Used picture or image of process.

___ Checked spelling and grammar.

___ Checked sentence structure.

___ Remembered to put name on slide.

Resources Used to Create PowerPoint

Books Used

Websites Used

Other Resources Used

The Desert: An Example of Weathering and Erosion

Overview

This lesson is an introduction to one example of weathering and erosion – the desert. Students will learn key definitions, vocabulary and facts. They then will work with a partner and conduct Internet research to find answers to a worksheet.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark

B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Y2003.CSC.S01.G03-05.BB.L04.I08
Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09
Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Procedure

1. Ask the class if they know the difference between weathering and erosion. Answers will vary. After some discussion, share the definitions with the class. *(Weathering is the gradual breaking down of rocks into smaller pieces caused by the action of weather conditions. Erosion is a process that transports rock, soil and sediment to different locations.)*

2. Show the PowerPoint presentation "The Desert: An Example of Weathering and Erosion."

3. Pass out the Desert Scavenger Hunt handout and instruct the class to turn it to the back and write the numbers one through five.

4. Show the PowerPoint presentation "Which Is It: Weathering or Erosion?" Have the class write whether each of the five statements describes erosion or weathering.

Answers

Which Is It: Weathering or Erosion?

1. Erosion – Weathering occurs before erosion takes place, so the river broke down the rock and created the canyon.

2. Weathering – The rock was broken down but not moved from the site.

3. Weathering – The acid rain has pitted the statue and has caused a chemical change in the rock.

4. Weathering – The sediments from the walkway remain there.

5. Erosion – Over millions of years wind has moved the sand sediments to form the desert.

Review the answers and ask if there are any questions.

Instruct the students to work with a partner on the Desert Scavenger Hunt handout.

Desert Scavenger Hunt

1. 20 percent

2. Less than 10 inches

3. About 1 billion or one-sixth of the population of the world

4. Sahara Desert

5. Antarctic Desert and Gobi Desert

6. Mohave Desert, Great Basin and Sonoran Desert

7. Tropic of Cancer (23.5° N) and Tropic of Capricorn (23.5° S)

8. Flash floods

9. Food and water are difficult to get; temperatures are too hot or too cold

10. Wind

PowerPoint Presentation: Which Is It: Weathering or Erosion?

Which Is It:
Weathering or Erosion?

Slide 1

Weathering
The gradual breaking down of rock to smaller pieces (sediments).

Slide 2

Erosion
A process that transports rock, soil or sediment to different locations.

Slide 3

1. The Colorado River has worn down the land in Arizona to form Grand Canyon.

Is this weathering or erosion?

Slide 4

2. You have a sandstone wall in your front yard. After a heavy rain, you see loose pieces of the sandstone.

Is this weathering or erosion?

Slide 5

3. You notice that a limestone statue at your church has become pitted. You are notified by the city that there has been acid rain in your neighborhood.

Is this weathering or erosion?

Slide 6

4. The cold weather has caused your cement walkway to break up.

Is this weathering or erosion?

Slide 7

5. The Sahara Desert has many miles of sand dunes.

Is this weathering or erosion?

Slide 8

Which Is It: Weathering or Erosion?

Weathering – The gradual breaking down of rocks to smaller pieces caused by the action of weather conditions.

Erosion – A process that transports rock, soil or sediment to different locations.

1. The Colorado River has worn down the land in Arizona to form Grand Canyon. Is this weathering or erosion?

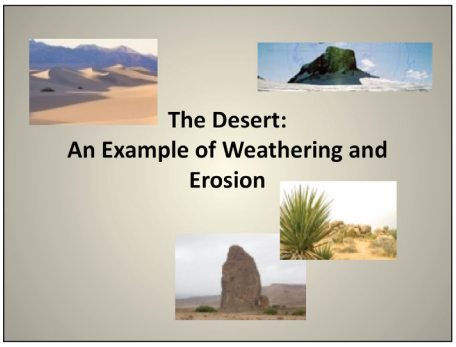
2. You have a sandstone wall in your front yard. After a heavy rain, you see loose pieces of the sandstone. Is this weathering or erosion?

3. You notice that a limestone statue at your church has become pitted. You are notified by the city that there has been acid rain in your neighborhood. Is this weathering or erosion?

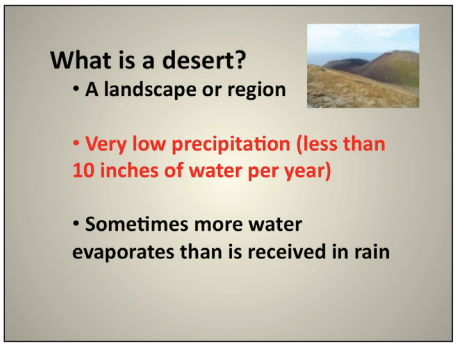
4. The cold weather has caused your cement walkway to break up. Is this weathering or erosion?

5. The Sahara Desert has many miles of sand dunes. Is this weathering or erosion?

PowerPoint Presentation: The Desert: An Example of Weathering and Erosion



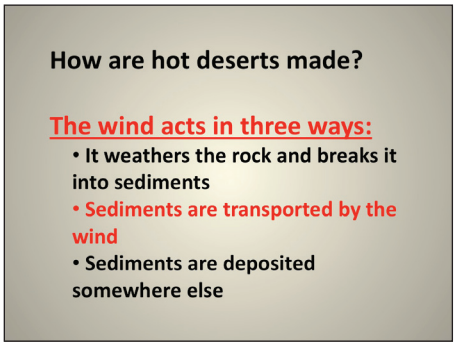
Slide 1



Slide 2

Slide 3

Slide 4



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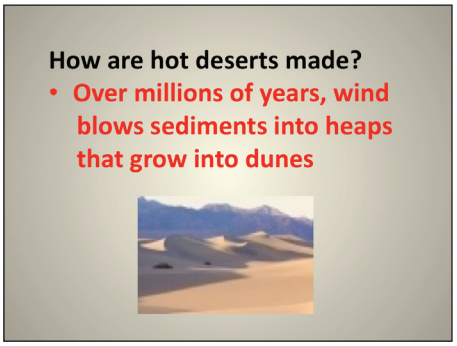

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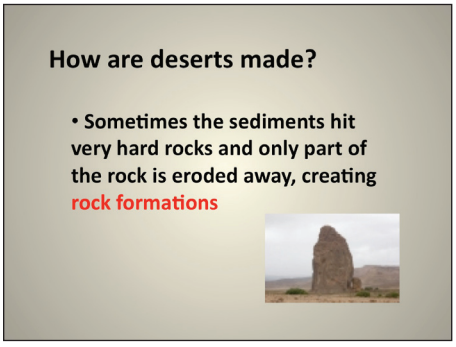

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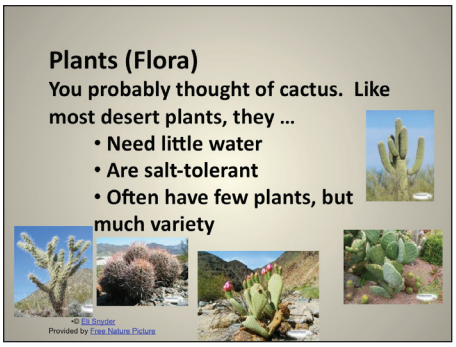

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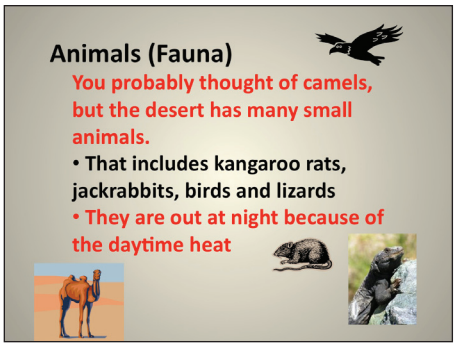

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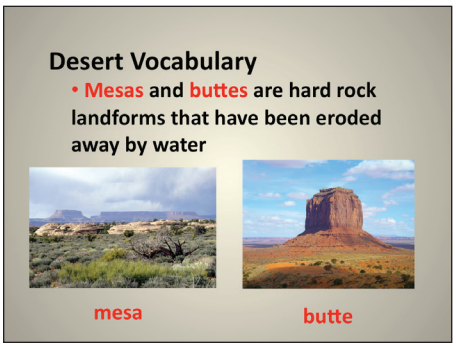

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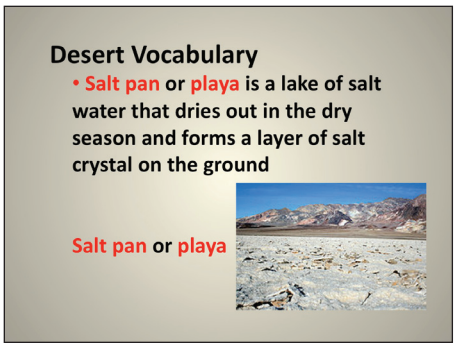

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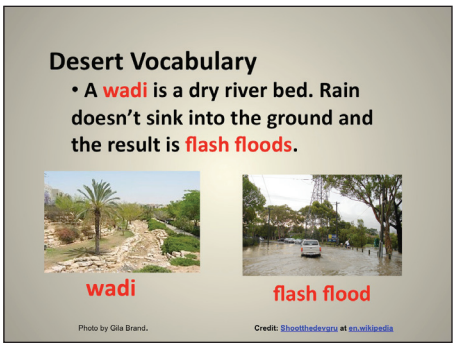

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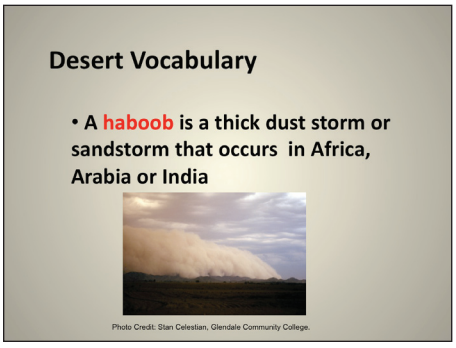

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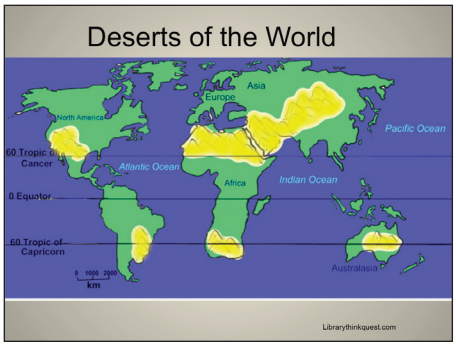


Slide 17

Names _____

Desert Scavenger Hunt

Directions: What do you know about the desert? Use the information that you find on the websites provided to answer the questions on this page. Write your answers on the lines under each question and cite your sources.

Use this website from National Geographic for questions 1-5.
http://environment.nationalgeographic.com/environment/habitats/desertprofile

1. How much of the earth's surface is covered by deserts?

_____

_____

2. What is the maximum amount of rain that can fall for an area to be called a desert?

_____

_____

3. About how many people live in desert regions?

_____

_____

4. What is the largest hot desert in the world?

_____

_____

5. You may think that all deserts are hot and sandy. This is not true. Some deserts are very cold but are considered deserts because they have so little rainfall. Name two deserts that are very cold.

_____

_____

The wind acts on the desert in three different ways:

- The wind first weathers the rock and breaks it into sediments.
- The sediments are transported by the wind.
- The sediments are deposited somewhere else.

Over millions of years, the wind may deposit the sediments into heaps that grow in size to form dunes. Sometimes the sediments might hit very hard material. The weak part of the hard material wears away or breaks off, but the hard part of the rock may make strange and beautiful shapes.

sand dune

rock formation

For the rest of these answers, please use this website: http://www.stmarysmedia.co.uk/jb19/project/home.htm

6. There are three deserts in the United States. Name them.

_____

_____

7. Most deserts are found between what two lines of latitude?

_____

_____

8. What might cause someone to drown in the desert?

_____

_____

9. Why would it be difficult to live in the desert?

_____

_____

10. What causes sand dunes to form?

_____

_____

GONE WITH THE WEATHERING

THE RESULT – EROSION

Fast Weathering

http://www.WesternReservePublicMedia.org/weathering

Expert Groups: You Are One of the Rapid Processes That Shapes the Earth

Overview

Students will look at rapid processes that create changes on Earth's surface. Working in groups, they will research one process (volcanic eruption, earthquake, tsunami or flood) and present the information they find to the rest of the class.

Standards Addressed

Current Standard

Grade 4
Earth and Space Science

3-5 Benchmark

B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Objectives

- Students will do research on the topics associated with the rapid processes that shape Earth's surface.
- Students will answer five questions about their topic.
- Students will present what they learned to the rest of the class.

Time Needed

This lesson should take three days – one each for student research, presentation preparation and presentations. The first two days might be combined if time is limited.

Materials

- Index cards
- Text references

Procedure

1. Divide the class into four equal groups. Write the topics (volcanic eruptions, earthquakes, tsunamis, flooding) on index cards and have each group select a topic.
2. Have the students do research on the rapid process topic they have chosen.
3. Have the students create their presentations based on the answers to the five questions. They should answer the questions as if they were the process. The test is based on the information the students provide.

Questions

1. How do you form?
2. Where would you occur?
3. When would you occur?
4. What would cause you to occur?
5. How do you change Earth's surface?

Evaluation

Worksheet Rubric

CATEGORY	Excellent	Good	Satisfactory	Needs Improvement
Quality of Information	Information clearly relates to the group's topic. It includes several supporting details and/or examples.	Information clearly relates to the group's topic. It provides one or two supporting details and/or examples.	Information clearly relates to the group's topic. No details and/or examples are given.	Information has little or nothing to do with the group's topic.
Organization	Information is very organized, with well-constructed paragraphs and subheadings.	Information is organized with well-constructed sentences.	Information is organized, but sentences are not well-constructed.	The information appears to be disorganized.
Amount of Information	Five facts are given and five questions are asked about the topic.	Four facts are given and four questions are asked about the topic.	Three facts are given and three questions are asked about the topic.	Two facts are given and two questions are asked about the topic.

Presentation Rubric

CATEGORY	Excellent	Good	Satisfactory	Needs Improvement
Content	Student shows a full understanding of the topic.	Student shows a good understanding of the topic.	Student shows a good understanding of parts of the topic.	Student does not seem to understand the topic very well.
Preparedness	Student is completely prepared and has obviously rehearsed.	Student seems somewhat prepared but could have used a few more rehearsals.	Student is somewhat prepared, but it is clear that rehearsal was lacking.	Student does not seem at all prepared to present.
Topic Relevance	Student stays on topic 100 percent of the time.	Student stays on topic 99 percent to 90 percent of the time.	Student stays on topic 89 percent to 75 percent of the time.	It was hard to tell what the topic was.
Enthusiasm	Facial expressions and body language generate a strong interest and enthusiasm about the topic in others.	Facial expressions and body language sometimes generate a strong interest and enthusiasm about the topic in others.	Facial expressions and body language are used to try to generate enthusiasm, but seem somewhat faked.	Very little use of facial expressions or body language. Did not generate much interest in topic being presented.

Names _____

Expert Groups

Narrow your topic to a reasonable amount of material to teach in a five-minute lesson.

Large Topic: You Are One of the Rapid Processes That Shapes the Earth

Your Subtopic: _____

1. Name your team and make a logo that shows your chosen topic. Draw your logo or use clip art. Use your team name and a picture for your logo.

2. Do research on your topic and find out important facts. Pretend that you are the topic to answer the following questions.

    1. **How do you form?**
    2. **Where would you occur?**
    3. **When would you occur?**
    4. **What would cause you to occur?**
    5. **How do you change Earth's surface?**

3. Brainstorm the facts and concepts that you plan to include in your lesson. List them below.

    1. _____

        _____

    2. _____

        _____

    3. _____

        _____

    4. _____

        _____

    5. _____

        _____

4. Now plan how you will teach the information. Remember that you are being graded on how well the class does in answering questions about what you have presented. You must plan a strategy to ensure that they will remember what you want them to know. Think about how you learn best! Describe your strategy below. Remember, "cute" may not be the same as "effective."

How Do Earthquakes Happen?

Overview

Do you ever feel really stressed after a day at school? Believe it or not, our planet also feels stress. An earthquake is a sudden movement of Earth's crust caused by the release of stress accumulated along geologic faults or by volcanic activity. It is a natural means of releasing stress. In this lesson, students will use pieces of foam to learn about pressure.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark

B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Thick slab of packing foam

Procedure

1. Divide the class into pairs or small groups.

2. Ask if the students know any words related to earthquakes. If so, write the words for the class to see. A vocabulary list is provided here.

3. As a supplemental activity, you could give them the vocabulary and the websites listed and then discuss their findings.

4. Each group should have a piece of packing foam and a flat surface on which to work.

5. Tell the groups that this activity will help them to understand what happens when two plates slide against each other.

6. Instruct the class to do the following:

    a. Break a thick block of packing foam in half and place the two pieces on a smooth table.

    b. Put the rough edges of the packing foam pieces together.

    c. Use light pressure to push the two pieces together. Almost at the same time, push the packing foam under your right palm away from your body, and pull the other piece toward yourself. See how they stick?

    d. Keep pushing and pulling, increasing the pressure with each stroke. Notice how the packing foam pieces give a sudden jerk – a little piece will fall from the crack (the fault). Then the two pieces will suddenly slip past each other. That sudden jerk and breaking away of the packing foam mimics what happens along a fault during an earthquake.

Source: http://www.pitara.com/discover/5wh/online.asp?story=135

Vocabulary

Aftershock: A quake of lesser magnitude, usually one of a series, following a large earthquake in the same area.

Earthquake: A sudden movement of Earth's crust caused by the release of stress accumulated along geologic faults or by volcanic activity.

Epicenter: The point on Earth's surface directly above the focus of an earthquake.

Intensity: The amount or degree of strength per unit of area or volume.

Magnitude: A measure of the amount of energy released by an earthquake.

Seismograph: An instrument for automatically detecting and recording the intensity, direction and duration of a movement of the ground, especially of an earthquake.

Resources

- **How Earthquakes Work**
  http://science.howstuffworks.com/earthquake.htm
- **Earthquakes for Kids**
  http://earthquake.usgs.gov/learn/kids/
- **Kidipedi: Earthquakes**
  http://www.historyforkids.org/scienceforkids/geology/earthquakes/index.htm
- **The Science of Earthquakes**
  http://earthquake.usgs.gov/learn/kids/eqscience.php
- **WeatherWiz Kids: Earthquakes**
  http://www.weatherwizkids.com/weather-earthquake.htm

Making a Volcano

Overview

Students will first talk about volcanoes using the correct terminology. They will then build models of volcanoes using baking soda and vinegar. They will build what looks like a volcano around a pop bottle and then watch the "eruption."

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark — *B. Summarize the processes that shape Earth's surface and describe evidence of those processes.*

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Newspapers
- Clay or soil
- Empty plastic two-liter bottles (one per group)
- Pans
- Liquid soap
- Baking soda (placed in packets of two tablespoons each)
- Funnels
- Vinegar

Procedure

1. Review what the class should already know about volcanoes. A resource page about volcanoes is included in this teacher guide.

2. Through this discussion, students should use the vocabulary words listed in this lesson. If they are unfamiliar with the words, they can use the sites listed to find definitions.

3. Place students in groups of three or four. Each group will build a model of a volcano.

4. One student should collect the materials. It is helpful to have the small items in plastic bags so that the students can easily collect them.

5. Instruct the students to do the following:
    a. Fill the bottle with warm water and stand it up in the pan.
    b. Put clay or soil around the bottle so that it looks like a volcano. Be careful not to cover the top of the bottle.
    c. Add about six drops of detergent.
    d. Use the funnel to add two tablespoons of baking soda.
    e. Slowly add a few drops of vinegar until foaming begins.

6. Students should see a foamy mixture come out of the bottle and flow down the side of the "mountain." Explain that this represents the lava that flows from a volcano.

7. Review once again what the students should know about volcanoes:

    A volcano is a mountain that opens downward to a pool of molten rock below the surface of the earth. When pressure builds up, eruptions occur. Gases and rock shoot up through the opening and spill over or fill the air with lava fragments. Eruptions can cause lateral blasts, lava flows, hot ash flows, mudslides, avalanches, falling ash and floods. Volcano eruptions have been known to knock down entire forests. An erupting volcano can trigger tsunamis, flash floods, earthquakes, mudflows and rockfalls.

    Volcanoes are formed when magma from within Earth's upper mantle works its way to the surface. At the surface, it erupts to form lava flows and ash deposits. Over time as the volcano continues to erupt, it will get bigger and bigger.

    Earth's crust is made up of huge slabs called plates, which fit together like jigsaw puzzle. These plates sometimes move. The friction causes earthquakes and volcanic eruptions near the edges of the plates. The theory that explains this process is called plate tectonics.

8. For evaluation purposes, instruct the students to answer each of the following questions with a few sentences. Extra credit can be given if they draw and label the parts of a volcano.
    a. What did you do?
    b. What happened?
    c. Why did it happen?

Evaluation

Give up to 10 points for each of the categories below:

a. What they did.
b. How well they followed directions.
c. The quality of their written summation.
d. Correctness of grammar and spelling in the summation.

Adapted from Understanding Volcanoes – http://www.discoveryeducation.com/teachers/free-lesson-plans/understanding-volcanoes.cfm

Vocabulary

Ash: The soft residue that remains after combustion.

Crater: A bowl-shaped depression with a raised rim, such as the mouth of a volcano or geyser.

Disaster: A sudden calamity, especially one causing widespread damage or suffering.

Dormant: In a state of temporary inactivity or rest; suspended or slowed down.

Eruption: Any volcano that is actively releasing lava and/or gases.

Lava: Molten rock erupting from a volcano or volcanic fissure.

Magma: The hot, liquefied matter beneath Earth's surface that erupts from volcanoes and cools to produce igneous rock.

Pumice: Light, porous, hardened lava, powdered or whole, used as an abrasive and polishing agent.

Summit: The highest point.

Vent: An opening that allows entrance, passage or exit of a gas or vapor.

Resources

- **Discover Kids: Volcano Explorer**
  http://kids.discovery.com/games/build-play/volcano-explorer
- **Geology for Kids: The Study of Our Earth**
  http://www.kidsgeo.com/geology-for-kids
- **Hot Spots and the Ring of Fire: Map**
  http://vulcan.wr.usgs.gov/Glossary/PlateTectonics/Maps/map_plate_tectonics_world.html
- **Impact and Effects**
  http://library.thinkquest.org/17457/english.html
- **Photo Gallery: Volcanoes**
  http://www.geology.sdsu.edu/how_volcanoes_work/Home.html
- **Ring of Fire**
  http://www.crystalinks.com/rof.html
- **Ring of Fire**
  http://geography.about.com/cs/earthquakes/a/ringoffire.htm
- **Volcanoes**
  http://42explore.com/volcano.htm
- **Volcanoes: FEMA**
  http://www.fema.gov/kids/volcano.htm
- **Volcanoes Online**
  http://library.thinkquest.org/17457/english.html
- **Volcano World**
  http://volcano.oregonstate.edu/kids/index.html
- **Weather Wiz Kids**
  http://www.weatherwizkids.com
- **What Is a Volcano?**
  http://wwww.nationalgeographic.com/forcesofnature/interactive/index.html?section=v
- **What Is the Ring of Fire?**
  http://geography.about.com/library/faq/blqzringoffire.htm

Model of a Tsunami Wave

Overview

Students will talk about their memories of the tsunami that hit Japan and then view pictures of this disaster. They will learn how tsunamis are formed and will illustrate the giant wave.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark

B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Markers, crayons, pencils, etc.
- Computers, Smart Board or overhead projector

Procedure

1. Distribute the Tsunamis student handout.

2. Read the quotation at the top of the page. Ask if anyone remembers when this happened in Japan in March of 2011 and what they remember.

3. Ask the students to pair up at computers and visit the website http://www.buzzfeed.com/mjs538/the-most-incredible-pictures-of-the-japan-earthqua. This could also be done using a Smart Board or a projector. Spend about 10 minutes looking at the photos.

4. Ask the students to fill in five words on the handout that explain how they feel about what happened in Japan.

5. Ask the students to share some of their words and reactions to the photos.

6. Review with the students how tsunamis are formed, using the provided resource page as a reference.

7. Instruct the students to use the grid to show the creation of a tsunami. Have crayons, markers and colored pencils available.

8. When completed, share some of the drawings and ask the students to explain their work.

Vocabulary

- **Aftershock:** A quake of lesser magnitude, usually one of a series, following a large earthquake in the same area.
- **Crest:** The top of a wave.
- **Disaster:** An occurrence causing widespread destruction and distress; a catastrophe.
- **Earthquake:** A sudden movement of Earth's crust caused by the release of stress accumulated along geologic faults or by volcanic activity.
- **Epicenter:** The point on Earth's surface directly above the focus of an earthquake.
- **Fault:** A fracture in the continuity of a rock formation caused by a shifting or dislodging of Earth's crust, in which adjacent surfaces are displaced relative to one another and parallel to the plane of fracture.
- **Flooding:** An overflowing of water onto land that is normally dry.
- **Intensity:** The amount or degree of strength per unit area or volume.
- **Magnitude:** A measure of the amount of energy released by an earthquake.
- **Seismograph:** An instrument for automatically detecting and recording the intensity, direction and duration of a movement of the ground, especially of an earthquake.
- **Surge:** A large wave or billow.
- **Trough:** The lowest point between waves.
- **Warning:** An intimation, threat or sign of impending danger or evil.

Vocabulary source: The Online Teacher Resource (www.teach-nology.com)

Evaluation

CATEGORY	4	3	2	1
Drawing Details	All assigned details have been added. The details are clear and easy to identify.	Almost all assigned details (at least 85 percent) have been added. The details are clear and easy to identify.	Almost all assigned details (at least 85 percent) have been added. A few details are difficult to identify.	Fewer than 85 percent of the assigned details are present, or most details are difficult to identify.
Accuracy	Ninety-five percent or more of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.	Ninety-four to 85 percent of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.	Ninety-four to 85 percent of the assigned structures are drawn accurately and are recognizable. Ninety-four to 85 percent of the assigned structures are labeled accurately.	Less than 85 percent of the assigned structures are drawn and/or labeled accurately.
Labels	Every item that needs to be identified has a label. It is clear which label goes with which structure.	Almost all items (90 percent) that need to be identified have labels. It is clear which label goes with which structure.	Most items (75-89 percent) that need to be identified have labels. It is clear which label goes with which structure.	Less than 75 percent of the items that need to be identified have labels, or it is not clear which label goes with which item.

Resources

- **Know the Facts**
  http://www.ready.gov/know-facts
- **Tsunami Facts for Kids**
  http://www.sciencekids.co.nz/sciencefacts/earth/tsunamis.html
- **Tsunamis: Killer Waves**
  http://environment.nationalgeographic.com/environment/natural-disasters/tsunami-profile
- **Tsunami Trivia Game**
  http://www.tsunami.noaa.gov/pdfs/Tsunami-Trivia.pdf

Name_____

Tsunamis

"At 2:46 p.m. on March 11, 2011, the seabed off northeast Japan lurched in a megathrust earthquake of magnitude 9.0. On Honshu, the ground shook for nearly six minutes. A massive displacement of seawater raced toward shore, arriving as a tsunami that overtopped seawalls. Harbors, whole towns and the Fukushima Dai-ichi nuclear power complex fell victim to the surges. Nearly 20,000 people perished or went missing in a catastrophe broadcast in real time to a global audience of millions." *Source: http://www.oregonlive.com/opinion/index.ssf/2012/03/earthquake_resilience_planning.html*

1. Go to the website 50 Stunning Pictures of the Japan Earthquake and Tsunami: **http://www.buzzfeed.com/mjs538/the-most-incredible-pictures-of-the-japan-earthqua**, and look at the pictures.

2. After looking at the pictures, write five words that describe your reaction to the photos:

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

Let's review how tsunamis occur:

a. Earthquakes occur below the ocean.

b. The ocean floor cracks with an up or down movement.

c. Water rushes in, causing a swell.

d. The swell spreads and causes large waves close to shore.

e. Large waves hit the shore. When they ebb (go back into the ocean), they take dirt, soil, buildings and whatever is in their way with them.

3. Your job is to illustrate how a tsunami is made. Use one event for each box below.

	Drawing of Event	**Explanation of Event**
1		
2		
3		
4		
5		

How to Simulate a Flood

Overview

Students will determine which type of material would be best to keep water from entering an area.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark B. *Summarize the processes that shape Earth's surface and describe evidence of those processes.*

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- One yard of burlap material
- Scissors
- Soil, sand, fine gravel and coarse gravel
- Needle and thread
- Wooden board, at least a square foot
- One-inch wooden plank
- Table
- Two buckets
- Stopwatch
- Graduated cylinder

Procedure

1. Prepare burlap bags prior to the day of the lesson: Cut the burlap into 6-inch squares. Fold the squares in half and sew the edges together, leaving a small space in one corner. Create six bags for every type of ground material that you have.

2. Fill six bags with one-half cup of the same ground material. Repeat with the remaining materials and then sew all the bags shut.

3. Introduce the concept of floods. Review the resource sheet on flooding with the students.

4. Divide the students into groups of three or four.

5. Show the class the materials available and instruct each group to write a hypothesis about which material will be most effective in stopping the water.

6. Place the wooden board on a table and put the plank under one side of it so that the board is slightly inclined. Maneuver the board so that the other end of the board is flush with the edge of the table.

7. Wet the wood before you simulate the first flood. That way, the wetness of the table before the other floods will not influence the results.

8. Place two rows of three bags along the center of the "flood table." Make sure the bags are packed as tightly together as possible.

9. Place a bucket on the floor at the lower end of the table. This will catch the water so that you can measure how much has gotten through the sandbags.

10. Pour three quarts of water on the top of the flood table at a steady rate. When the water hits the table, start the stopwatch. After exactly 10 seconds, move the bucket away from the flood table.

11. Measure the water with a graduated cylinder to see how much went through the sandbags.

12. Dry the table and repeat the process with sandbags that have a different filling. At the end of the experiment, compare the amount of water that went through each set of sandbags.

13. Instruct the groups to write a paragraph explaining what occurred during the experiment.

Evaluation

CATEGORY	4	3	2	1
Summary	Summary describes the skills learned, the information learned and some future applications to real-life situations.	Summary describes the information learned and a possible application to a real-life situation.	Summary describes the information learned.	No summary is written.
Scientific Concepts	Report illustrates an accurate and thorough understanding of scientific concepts underlying the lab.	Report illustrates an accurate understanding of most scientific concepts underlying the lab.	Report illustrates a limited understanding of scientific concepts underlying the lab.	Report illustrates inaccurate understanding of scientific concepts underlying the lab.
Conclusion	Conclusion includes whether the findings supported the hypothesis, possible sources of error and what was learned from the experiment.	Conclusion includes whether the findings supported the hypothesis and what was learned from the experiment.	Conclusion includes what was learned from the experiment.	No conclusion was included in the report, or the report shows little effort and reflection.

Source: http://www.ehow.com/how_7515724_simulate-flood.html

Resources

- **I'm a Flood Zone Kid**
  http://www.floodfacts.com/floodzone_kids_intro.html
- **InFocus: Floods**
  http://www.pbs.org/newshour/infocus/floods.html
- **Planet Earth: Floods**
  http://www.kidcyber.com.au/topics/floods.htm
- **Rain and Floods**
  http://www.weatherwizkids.com/weather-rain.htm

Letter to the Desert

Overview

Students will read a letter from a fictitious student named Amed, who is 10 years old and living in the Sahara Desert in Morocco. They will then write a letter back to him where they compare their lives to his. They must find at least seven differences between their ways of life.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark

B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Y2003.CSC.S01.G03-05.BB.L04.I08
Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09
Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Procedure

1. Tell the class that they have received a letter from Amed. He tells about himself in the letter and he'd like to hear back from them. It is a good idea for each student to have a copy of the letter to refer to in their writing. As an alternative, the letter could be shown on a computer or Smart Board and read as a class.

2. Tell the students that they must each write their own letter, but they may work with a partner while writing.

3. Go over the directions on the student handout. Students must write at least seven differences between their lives and Amed's. Possible differences include the following:
    - Geography
    - Food
    - Size of school
    - Language
    - Pet
    - Family
    - School size
    - Subjects taught
    - Climate
    - Sport
    - Classroom

4. Students could also include a map of the United States that shows their location.

Evaluation

Students will use this rubric before they hand in their work.

Category	Responsibilities
Fluency	❑ My sentences are organized in a logical manner.
	❑ The meaning of each of my sentences is clear.
	❑ My sentences flow from one to another.
	❑ I've checked for correct spelling.
	❑ I've checked for correct grammar.
Ideas	❑ The ideas are written in my own words.
	❑ I understand my topic.
	❑ My letter is clear and focused. I stay on topic.
	❑ My details give the reader important information.
Organization	❑ My report is in a logical order.
	❑ My ideas flow well and are clearly connected to one another.
	❑ I have a satisfying conclusion.

A grade can be given if the teacher chooses to do so.

Name_____

Letter From Amed

Amed is from Africa. He has written you a letter about his life in the Sahara Desert in Morocco and would like to hear back from you.

Here's your job! First fill out the table below and compare your life with Amed's life. You can exchange ideas with a partner, but you must each fill in the chart below and also write your own letters. Then write a letter to him telling him about your life. Remember to use correct grammar and spelling. To check that you've done everything you needed to do, fill out the evaluation sheet.

Amed's Life	My Life

Hi,

My name is Amed and I live in the Sahara Desert in Morocco. I'll put a map at the end of this letter to show you the location. I am 10 years old. I have one brother and one sister. My family lives in a camp with five other families for most of the year. My sister and my mother stay there a lot of the time, but my dad and my brother are gone most of the year to stay with the herds of sheep and camel. We are called nomads because we move with the animals. We carry "portable homes" or tents made of heavy woven goat hair. It is hot in the day, but it gets VERY cold at night. We are sometimes called Berbers.

It is very hot and dry here. There is also much sand, so we wear this turban-like cloth to keep the sand out of our mouth and hair. They are called howlis. We also wear loose-fitting clothes so we can take advantage of the wind to cool us off and keep us protected from the sun.

I am really lucky because I get to go to school. It's a very small school. There is only one teacher, Omar, who lives in a small tent connected to the school building. We go to school from September to June and only get one day off each week — Sunday. There are 18 kids in my school, from 3-13 years old, and we all come from the camp. There is only one room in my school plus a toilet room. The school is made from sticks and small pieces of wood that can be found in the desert.

There are benches in the classroom and a few desks. We have a chalkboard, notebooks, pens and paper as well as two textbooks: one for French reading and the other for math. Other textbooks in Arabic are shared among the students.

We are very lucky at school because we have very good food. Sheep and camel provide the meat when we have it. Because it is so sandy and there is so little water, we cannot plant crops. There are some plants that grow in the desert, but we have to be careful to only pick the ones that will not hurt us. We also have to be careful of poisonous snakes and spiders. My favorite food is dates. They are grown at an oasis near our school. The oasis is fed by underground water and allows plants to be grown there.

My favorite sport is football. I think you call it soccer in America. We can only play when it cools down. I also have a pet goat named Abdoullah.

I hope you found my letter interesting. I'd like to hear back from you to find out how you live and what you do in school.

Sincerely,

Amed

The shaded part is Morocco.

Evaluation

Category	Responsibilities
Fluency	❑ My sentences are organized in a logical manner.
	❑ The meaning of each of my sentences is clear.
	❑ My sentences flow from one to another.
	❑ I've checked for correct spelling.
	❑ I've checked for correct grammar.
Ideas	❑ The ideas are written in my own words.
	❑ I understand my topic.
	❑ My letter is clear and focused. I stay on topic.
	❑ My details give the reader important information.
Organization	❑ My report is in a logical order.
	❑ My ideas flow well and are clearly connected to one another.
	❑ I have a satisfying conclusion.

GONE WITH THE WEATHERING

THE RESULT – EROSION

What's Left Behind: Redepositing

http://www.WesternReservePublicMedia.org/weathering

What's Left Behind

Overview

Students will play a memory game using the information they find in the PowerPoint presentation "What's Left Behind: Redepositing."

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark *B. Summarize the processes that shape Earth's surface and describe evidence of those processes.*

Y2003.CSC.S01.G03-05.BB.L04.I08
Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09
Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Scissors (if you want the students to cut out the cards themselves)

Procedure

1. Show the students the PowerPoint presentation "What's Left Behind: Redepositing." Impress upon them that these features are all the result of weathering and erosion.

2. Divide the class into pairs of students. Give each pair a set of game cards. You can already have them in envelopes or you can have the students cut the cards apart. You may want to copy these onto heavy paper so that they can be reused.

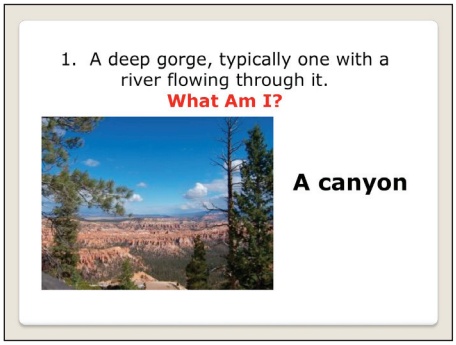
3. Instruct the class on how to play the game:
    a. Shuffle the cards so that they are randomly arranged.
    b. There are 20 cards, so lay them on the table in five rows of four cards each.
    c. Take turns picking two cards. If the definition matches the word, then take the two cards.
    d. Continue to play until all the cards are matched.
    e. The winner is the person with the most cards after all the cards have been taken.

Evaluation

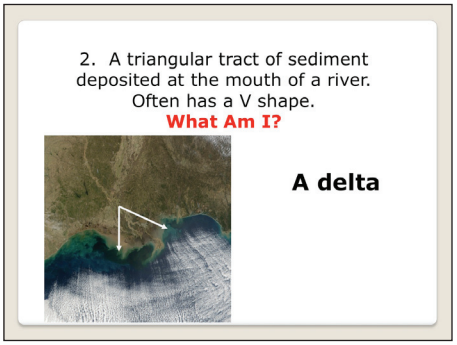
This is an introductory activity. Ask the students to write one thing they learned about erosion and weathering. Use this as a formative evaluation

PowerPoint Presentation: What's Left Behind: Redepositing

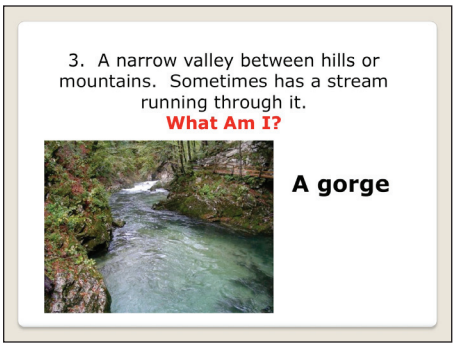
Slide 1



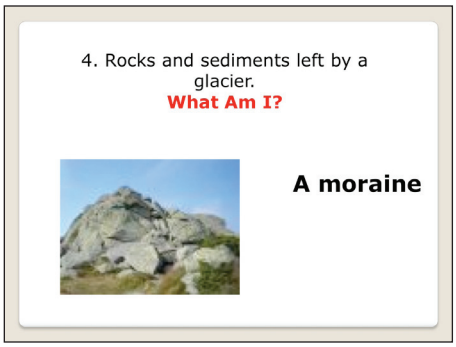
Slide 2



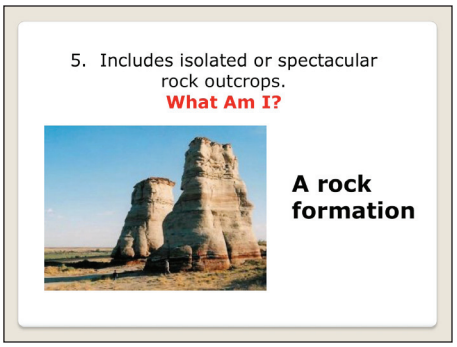
Slide 3



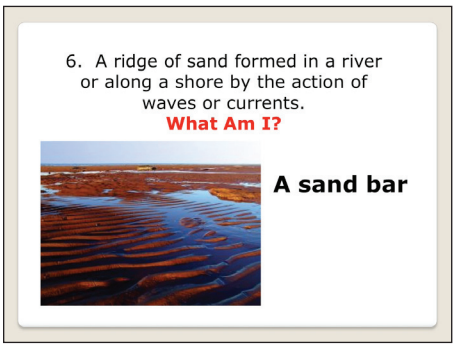
Slide 4



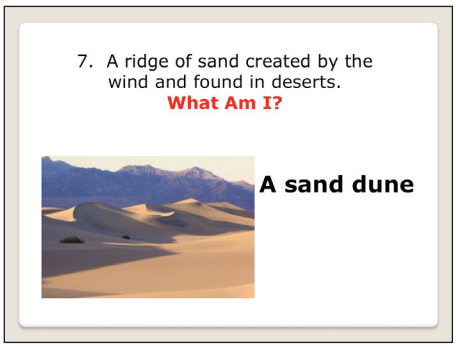
Slide 5



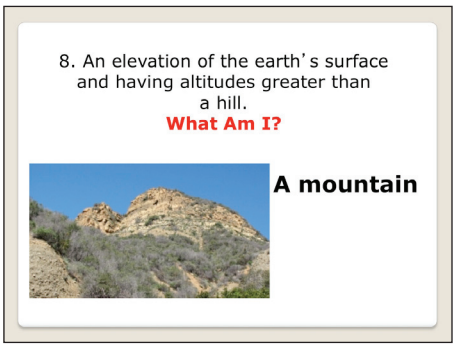
Slide 6



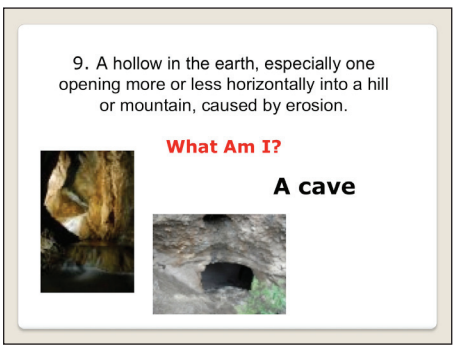
Slide 7



Slide 8



Slide 9



Slide 10

A deep gorge, typically one with a river flowing through it	canyon
A triangular tract of sediment deposited at the mouth of a river	delta
A narrow valley between hills or mountains – Sometimes with water running through it	gorge
Rocks and sediments left by a glacier	moraine
Isolated or spectacular rock outcrops	rock formations

A ridge of sand formed by a river or along a shore by the action of waves	sand bar
A ridge of sand created by the wind and found in deserts	sand dune
An elevation of the earth's surface and higher than hills	mountains
A hollow in the earth; an opening into a hill or mountain	cave
Pieces of stone left by weathering	sediment

Wind and Water

Overview

Soil erosion, a naturally occurring slow process, is caused by wind and water. Is there a way to slow down this erosion? Students will explore how plants growing in the soil affect the rate of soil erosion.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark

B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Y2003.CSC.S01.G03-05.BB.L04.I08
Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09
Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Sand
- Watering can
- Measuring cup
- Five pans or cookie sheets
- Jellyroll type of pan with higher lip or sides
- Ruler or block of wood

Procedure

Whole Class

1. Place a pile of sand on a cookie sheet.
2. Gently blow on the sand to create the effect of wind.
3. Discuss what happens and why. *(The experiment shows the effect of wind on an unprotected surface. As the sand is blown, it will move away from the direction that you are blowing, just as it would from wind during a sandstorm.)*
4. Fill a watering can with water.
5. Sprinkle the top of the sand pile with water, creating a rain effect.
6. Gently blow on the sand again and then discuss what happens and why.
7. Tilt the watering can to produce a stronger flow of rain on the sand. *(The experiment shows that runoff can occur whenever there is excess water that cannot be absorbed into the soil or trapped on the surface. Soil movement by rainfall – i.e., a raindrop splash – is greatest during high-intensity thunderstorms.)*
8. Use your finger to make a groove through the sand.
9. Fill the measuring cup with water, slightly tilt the pan and pour water into the groove.
10. Encourage the students to describe what happens as the water flows down the model river. *(The experiment shows water moving the sand aside. Rain can permanently change the shape of areas that are unprotected by grass or rock.)*
11. Place sand on one end of a jellyroll pan at a slight slope.
12. Add enough water to cover about half of the pan. Hold a ruler or a block of wood against the sand and gently rock the pan to create gentle waves that move steadily against the sand. *(The experiment shows that waves cause the sand to move from the drier part of the pan and end up under the water, creating a sandbar.)*

Small Groups

1. Divide the class into five groups. The task of each group is to find a way to slow down the erosion process.
2. Each group plans for what they will collect outside to add to their sand pile to slow down the erosion process.
3. Go outside for a collection walk. Examples of collection items include parts of plants, leaves, twigs, rocks and gravel.
4. Back inside, give each group a pan containing a sand pile into which they can add the objects they have collected.
5. Using a water can (rain), measuring cup (river) and gentle blowing (wind), groups will demonstrate and explain how they will slow down erosion process.
6. After all groups have completed their presentations, discuss as a class how roots of trees and other plants help to slow the erosion process by holding the soil in place.
7. After group presentations and class discussion, have the students individually design what they would do to a sand pile to slow the erosion process and write a paragraph to describe idea.

Evaluation

CATEGORY	4	3	2	1
Description of Procedure	Procedures were outlined in a step-by-step fashion that could be followed by anyone without additional explanations. No adult help was needed to accomplish this.	Procedures were outlined in a step-by-step fashion that could be followed by anyone without additional explanations. Some adult help was needed to accomplish this.	Procedures were outlined in a step-by-step fashion, but had one or two gaps that require explanation even after adult feedback had been given.	Procedures that were outlined were seriously incomplete or not sequential, even after adult feedback had been given.
Diagrams	Student provided an accurate, easy-to-follow diagram with labels to illustrate the procedure or the process being studied.	Student provided an accurate diagram with labels to illustrate the procedure or the process being studied.	Student provided an easy-to-follow diagram with labels to illustrate the procedure or process, but one key step was left out.	Student did not provide a diagram, or the diagram was quite incomplete.
Conclusion/ Summary	Student provided a detailed conclusion clearly based on the data and related to previous research findings and hypothesis statement(s).	Student provided a somewhat detailed conclusion clearly based on the data and related to hypothesis statement(s).	Student provided a conclusion with some reference to the data and hypothesis statement(s).	No conclusion was apparent, or important details were overlooked.

Name_____

Wind and Water: What I Would Do

Directions: In the box below, draw a picture of what you would do to slow down the erosion process. Write a paragraph to describe your idea.

Popular U.S. Land Formations

Overview

Students will learn about popular land formations that have been (and are still being) formed by weatherization and erosion.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark *B. Summarize the processes that shape Earth's surface and describe evidence of those processes.*

Y2003.CSC.S01.G03-05.BB.L04.I08
Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09
Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

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- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Computer access

Procedure

1. Write the list of landmarks discussed in the Natural Landmarks in the USA handout on a board.
2. Poll the students, asking how many of them had visited these sites.
3. Display a U.S. map that is large enough for the class to see. Ask the students to show on the map where they think the landmarks are.
4. Have the students work with a partner to look up an assigned landmark, record what they find on the map and share the information with the class. They can then see how accurate their predictions of the locations are.
5. Discuss how each of these landmarks was the result of weathering and erosion.

Alternate Approach

1. Write the list of the landmarks provided in this section on a board.
2. Poll the students, asking how many of them had visited these sites.
3. Distribute the Natural Landmarks in the USA and Map of the United States student handouts.
4. Have the students work with a partner and use the links on the handout to find the accurate locations on the map, then record the numbers in the correct places.
5. After the class has finished, review the correct locations so that students can check their accuracy.
6. Discuss how each of these landmarks was the result of weathering and erosion.

Evaluation

CATEGORY	5	4	3	2	1
Completeness	Project is complete.	Project is missing one to five items.	Project is missing six to 10 items.	Project is missing 11 to 15 items.	Project is incomplete.
Accuracy	Everything is located accurately.	One to five items are out of place.	Six to 10 items are out of place.	More than 10 items are out of place.	Project is incomplete.

Enrichment

Ask students what landmarks they would add to this list. They could include Mammoth Cave, Old Faithful and Denali.

Additional Resources

- **An Internet Hotlist on U.S. Landmarks**
  http://lrs.ed.uiuc.edu/students/halasiku/tourresources.html
- **A Kid's Guide to Famous Landmarks**
  http://www.partsgeek.com/parts/famous_us_landmarks.html
- **List of Natural Landmarks in the USA** (by state)
  http://en.wikipedia.org/wiki/List_of_National_Natural_Landmarks
- **National Parks: Top 10 Landmarks to See by 2010**
  http://blog.rv.net/2009/02/national-parks-top-10-natural-landmarks-to-see-by-2010

Natural Landmarks in the USA

The following very popular land formations have been (and are still being) formed by weathering and erosion. Use the map provided to write the number of the landmark on the map in the correct location, or use a Smart Board to show the locations.

1. **Death Valley**
   http://en.wikipedia.org/wiki/Death_Valley
   A mysterious desert place, Death Valley, Calif., is the hottest spot in the United States, as well as the country's lowest location. Most of the area is encompassed by Death Valley National Park. Death Valley is 282 feet below sea level. It has the highest temperature reported in the United States at 134 degrees.

2. **Appalachian Mountains**
   http://en.wikipedia.org/wiki/Appalachian_Mountains
   This is a string of mountains in the eastern United States. The Appalachians first formed roughly 480 million years ago. The Appalachian chain was a barrier to east-west travel because it had many ridges and valleys. Many people walk The Appalachian Trail as a sporting or camping experience.

3. **Everglades**
   http://en.wikipedia.org/wiki/Everglades_National_Park
   Everglades National Park in southern Florida protects the southern 25 percent of the original Everglades and is the largest subtropical wilderness in the United States. It is visited on average by 1 million people each year. This tourism plus the diversion of water away from the Everglades is a serious problem to the birds and animals who inhabit the region.

4. **Grand Canyon**
   http://en.wikipedia.org/wiki/Grand_Canyon
   The Grand Canyon is a steep-sided canyon carved by the Colorado River in the state of Arizona. Geologists can easily see the ancient rocks that are beautifully preserved and exposed in the walls of the canyon. These rock layers record much of the early geologic history of the North American continent.

5. **Great Lakes**
   http://www.worldatlas.com/webimage/countrys/namerica/greatlk.htm
   Glaciers over the land near Michigan and Ontario that melted over time created these massive lakes. Since at least the last ice age, the Great Lakes have been naturally connected by way of a series of rivers and straits.

6. **Mississippi River Delta**
   http://en.wikipedia.org/wiki/Mississippi_River_Delta
   The Mississippi River Delta is built up by alluvium deposited by the Mississippi River as it slows down and enters the Gulf of Mexico. Over the past 5,000 years, this process has caused the coastline of south Louisiana to advance toward the gulf from 15 to 50 miles. It is V-shaped.

7. **Mississippi River**
   http://en.wikipedia.org/wiki/Mississippi_River
   The Mississippi River is the largest river system in North America. It flows entirely in the United States. It starts in western Minnesota and twists and turns slowly to the south for 2,530 miles. It ends at the Mississippi River Delta and then in the Gulf of Mexico. It ranks fourth longest and 10th largest among the world's rivers.

8. **Ohio River**
   http://en.wikipedia.org/wiki/Ohio_River
   The Ohio River is the largest tributary of the Mississippi River. It has great significance in the history of the Native Americans, as many civilizations formed along its valleys. Major earthwork mounds were built. European explorers and settlers used the river as a major transportation and trading route.

9. **Mt. Whitney**
   http://en.wikipedia.org/wiki/Mount_Whitney
   Mt. Whitney is the highest mountain in North America. Its elevation has changed over the years but now is at 14,505 feet. Because it is slowly rising, glacial and river erosion have stripped the upper layers of rock and revealed the granite we see today.

10. **Niagara Falls**
    http://www.niagara-usa.com/get-around/maps.html
    Niagara Falls was formed when glaciers receded at the end of the last ice age. Water from the Great Lakes carved a steep slope that occurred from erosion or faulting and separates two relatively level areas of differing heights en route to the Atlantic Ocean. Four to 6 million cubic feet of water falls over the falls every minute. The falls are known for both their beauty and as a valuable source of electrical power.

11. Rocky Mountains

http://en.wikipedia.org/wiki/Rocky_Mountains

The Rocky Mountains were formed before the mountains were raised by tectonic forces (the moving of Earth's plates). They are the major mountain range in western North America. They stretch 3,000 miles from the northernmost part of British Columbia to New Mexico.

12. Mammoth Cave

http://www.nps.gov/nr/twhp/wwwlps/lessons/35mammoth/35locate1.htm

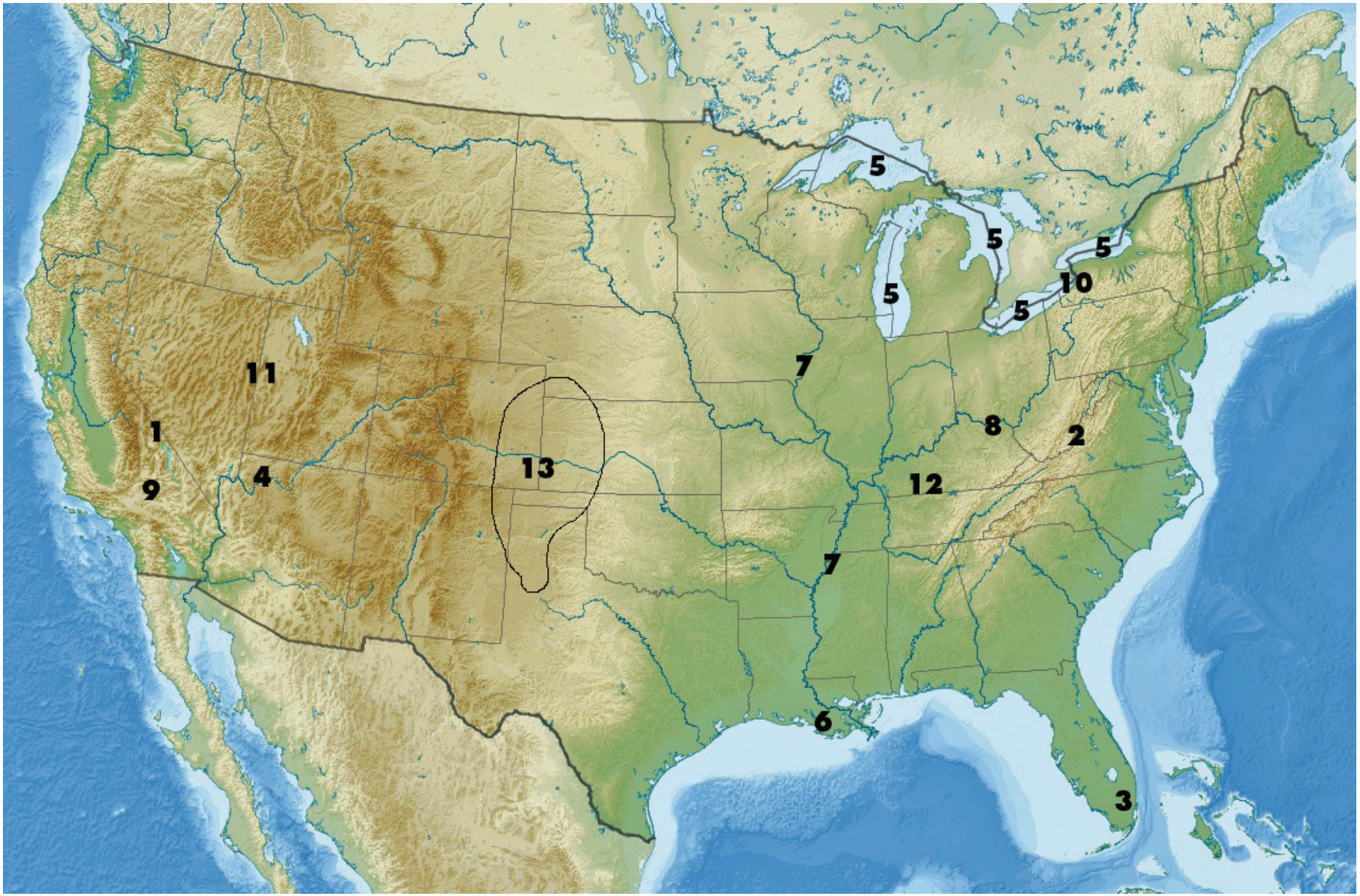
Mammoth Cave in Kentucky is the longest cave in the world, with more than 345 miles of explored passageways. The cave is particularly interesting because the processes that formed it in the first place are continuing. Passageways are being carved out today in the same way that they have for more than 1 million years. The Mammoth Cave area includes numerous deep cracks, sinkholes, underground streams and layers of limestone rock. These rock layers are eroded and dissolved by underground water. Above ground and in the cave, there are approximately 1,000 kinds of plants and about 500 types of animals.

Map of the United States

Write the number of the landmark on the map in the correct location.

Map of the United States — Answer Key

Write the number of the landmark on the map in the correct location.



Weathering and Erosion: Book Project

Overview

Students will pair up to make a book that shows the results of weathering and erosion.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark

B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Y2003.CSC.S01.G03-05.BB.L04.I08
Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09
Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Computer with Internet access
- Printer
- Material to fasten pages into a book (staple, ribbon, etc.)

Procedure

1. Review the definitions of weathering and erosion. *(Weathering is the gradual breaking down of rock into smaller pieces. Erosion is a process that transports rock, soil and sediment to a different location.)*

2. Ask the students to name ways that weathering occurs. *(Students might give examples of physical, mechanical and chemical weathering. The actual process would include water, wind and ice.)*

3. Show the PowerPoint presentation "What's Left Behind: Redepositing."

4. Distribute the vocabulary sheet.

5. Distribute the Directions for Making a Book handout.

6. Have the students pick a partner.

7. At this point, students could either copy the pages from the Internet or actually do the work online.

    - Student will have a cover sheet that gives their names, the date they started and what they want to name their book.
    - They will select five of the eight categories of redepositing. They will find the information online or they could go to the library and use reference books to find the information.
    - They will either copy a picture from the Web or draw a picture that shows each category of redeposited material.

Evaluation

CATEGORY	4	3	2	1
Completion of Required Sections	All required sections are complete.	One required section is missing.	Two or three required sections are missing.	More than three required sections are missing.
Organization	All pages are kept in a logical or numerical sequence.	One or two pages are not in a logical or numerical sequence.	Three or four pages are not in a logical or numerical sequence.	More than four pages are not in a logical or numerical sequence.
Accuracy	All information collected is accurate.	One or two pieces of information are inaccurate.	Three or four pieces of information are inaccurate.	More than four pieces of information are inaccurate.
Pictures	All pictures show the correct topic.	One or two pictures are inaccurate.	Three or four pictures are inaccurate.	More than four pictures are inaccurate.
Neatness	Overall notebook is kept very neat.	Overall notebook is kept in a satisfactory condition.	Overall notebook is kept in a below satisfactory condition.	Overall notebook is unkempt and very disorganized.

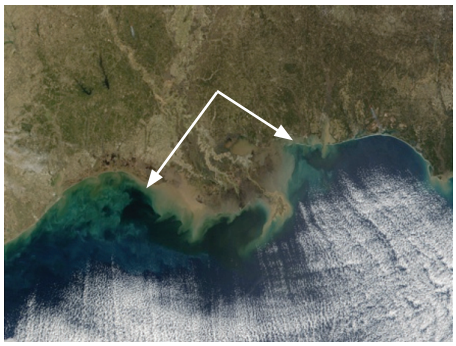
Vocabulary — Redepositing

Canyon: A deep gorge, typically one with a river flowing through it, as found in North America.

Photo from http://www.sxc.hu

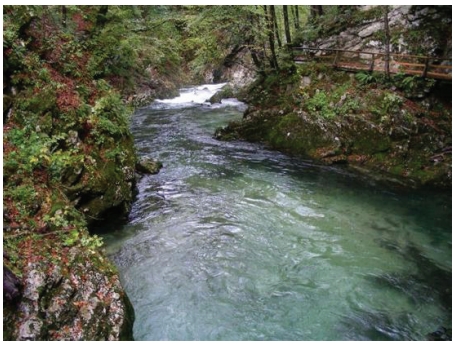
Cave: A hollow in the earth, especially one opening more or less horizontally into a hill or mountain caused by erosion.

Photo from http://www.sxc.hu



Delta: A triangular tract of sediment deposited at the mouth of a river, often shaped like a V.

***Photo credit:** Jacques Descloitres, MODIS Land Rapid Response Team, NASA/GSFC*



Gorge: A narrow valley between hills or mountains, typically with steep rocky walls and a stream running through it.

Photo: Vintgar Gorge in Bled, Slovenia http://www.tripadvisor.com/Attraction_Review-g274863-d519724-Reviews-Vintgar_Gorge_Soteska_Vintgar-Bled.html

Moraine: A mass of rocks and sediment deposited by a glacier, typically as ridges at its edges or extremity.

Photo from http://www.sxc.hu

Mountain: A natural elevation of the earth's surface rising more or less abruptly to a summit, and attaining an altitude greater than that of a hill, usually greater than 2,000 feet.

Photo from http://www.sxc.hu

Rock formation: Isolated, scenic or spectacular surface rock outcrops.

Photo from http://www.sxc.hu

Sandbar: A ridge of sand formed in a river or along a shore by the action of waves or currents.

Photo from http://www.sxc.hu

Sand dune: A ridge of sand created by the wind; found in deserts or near lakes and oceans.

Photo from http://www.sxc.hu

Directions for Making a Book

1. **Cover Sheet:** Write your name, the date you started working on the book and the name of the book. Also on the cover, make some kind of display that describes what the book is about.

2. Select five of the eight examples of redepositing from the list below.

    - Grand Canyon
    - Mississippi Delta
    - Hanging glacier
    - Rock formations
    - Gorge Metro Park
    - Sandbars
    - South Florida sand dunes
    - Mountains

3. Collect the pages from your teacher for the areas your book will cover, or use the pages that are online at http://westernreservepublicmedia.org/weathering.

4. Find information online or go to the library and use the material there to fill in each category on the sheets:

    a. How the feature was formed.

    b. Two interesting things about the feature.

    c. A picture that you found online or that you drew.

Name _____

Name _____

Start Date _____

Grand Canyon

1. How was Grand Canyon formed?

2. Write two things that you find interesting about Grand Canyon.

3. Show a picture of Grand Canyon.

Grand Canyon http://www.nps.gov/grca/naturescience/geologicactivity.htm

Mississippi Delta

1. How was the Mississippi Delta formed? (Look under Geography on the Web page.)

2. Write two things that you find interesting about the Mississippi Delta.

3. Show a picture of the Mississippi Delta.

Mississippi Delta http://en.wikipedia.org/wiki/Mississippi_Delta

Hanging Glacier

1. How was the hanging glacier at Jasper National Park in Canada formed?

2. Write two things that you find interesting about the hanging glacier at Jasper National Park.

3. Show a picture of the hanging glacier at Jasper National Park.

Hanging glacier at Jasper National Park in Canada http://nsidc.org/cryosphere/glaciers/questions/formed.html

Rock Formations

1. How was Arches National Park in Utah formed?

2. Write two things that you find interesting about Arches National Park.

3. Show a picture of Arches National Park.

Arches National Park in Utah http://www.nps.gov/arch/naturescience/index.htm

Gorge Metro Park

1. How was the gorge in Akron's Gorge Metro Park formed?

2. Write two things that you find interesting about the gorge in Gorge Metro Park.

3. Show a picture of the gorge in Gorge Metro Park.

Gorge Metro Park http://www.summitmetroparks.org/parksandtrails/gorge.aspx

Sandbars

1. How is a sandbar formed?

2. Write two things that you find interesting about sandbars.

3. Show a picture of a sandbar.

Encyclopedia: Sandbars http://www.britannica.com/EBchecked/topic/522050/sandbar

South Florida Sand Dunes

1. How is a sand dune formed?

2. Write two things that you find interesting about sand dunes.

3. Show a picture of a sand dune.

Turbulent Landscapes in South Florida: Sand Dunes http://www.miamisci.org/youth/unity/tl/Unity2/Sand_Dunes/index.htm

Mountains

1. How are mountains formed?

2. Write two things that you find interesting about mountains.

3. Show a picture of a mountain.

Mountains http://www.edu.pe.ca/southernkings/mountainmm.htm

Desert Concentration

Overview

Students will learn about weathering and erosion in deserts by watching a PowerPoint presentation and then playing a concentration game.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark *B. Summarize the processes that shape Earth's surface and describe evidence of those processes.*

Y2003.CSC.S01.G03-05.BB.L04.I08
Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09
Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Scissors (if you want the students to cut out the cards)
- Index cards

Procedure

1. Show the students the PowerPoint presentation "The Desert: An Example of Weathering and Erosion." Impress upon them that these desert features are all the result of weathering and erosion.

2. Divide the class into pairs of students. Give each pair a copy of the game cards. You can already have them in envelopes or you can have the students cut the cards apart. You may want to run these on heavy paper so that they can be reused.

3. Instruct the class on how to play the game:

    a. Shuffle the cards so that they are randomly arranged.

    b. Lay them out in a grid of five rows across and four down.

    c. On your turn, select two cards. If the word and definition match, then turn those two cards over and give yourself two points.

    d. Continue to play until all the cards are matched.

    e. The winner is the person with the most cards when all the cards have been turned over.

Evaluation

This is an introductory activity. Give each student an index card and ask him or her to write one fact about erosion or weathering. Use this as a formative evaluation.

Largest desert in the world	Sahara Desert
Largest cold desert in the world	Antarctica
Number of people who live on desert land	1 billion
Process where rocks exposed to the weather gradually break down	weathering
Process that transports rock, soil or sediments to a new location	erosion

A ridge of sand formed by a river or along a shore by the action of waves	sandbar
A ridge of sand created by the wind and found in deserts	sand dune
Amount of the world covered by deserts	20%-30%
Names of deserts in the United States	Mohave Desert Sonoran Desert Great Basin Desert
Amount of rain that desert landscapes have	Less than 10 inches

Our Desert Story

Overview

After studying the desert in other lessons, student will use the information they have gained to write a story. Working with a partner, they will use a graphic organizer to organize their story, create a picture of their setting and write the story. They will then share their story with the class.

Standards Addressed

Current Standards

Grade 4
Earth and Space Science

3-5 Benchmark — *B. Summarize the processes that shape Earth's surface and describe evidence of those processes.*

Y2003.CSC.S01.G03-05.BB.L04.I08
Processes That Shape Earth /

08. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).

Y2003.CSC.S01.G03-05.BB.L04.I09
Processes That Shape Earth /

09. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.

Y2003.CSC.S01.G03-05.BB.L04.I10
Processes That Shape Earth /

10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides).

Common Core Standards

Strand: Earth and Space Science (ESS)

Topic: *This topic focuses on the variety of processes that shape and reshape Earth's surface.*

- Earth's surface has specific characteristics and landforms that can be identified.
- The surface of Earth changes due to weathering.
- The surface of Earth changes due to erosion and deposition.

Materials

- Computer
- Markers, colored pencils or crayons

Procedure

1. Review information about the desert, specifically about desert plants and animals.
2. Have the students work with a partner.
3. Distribute three handouts: Our Desert Story Directions, Graphic Organizer and Desert Story Setting.
4. Review the instructions for all three handouts with the class.
5. Students can complete the assignment using the handouts, or by using a computer and downloading the graphic organizer and handouts.
6. Have some or all of the students share their stories with the class.

Evaluation

Rubric for Desert Stories

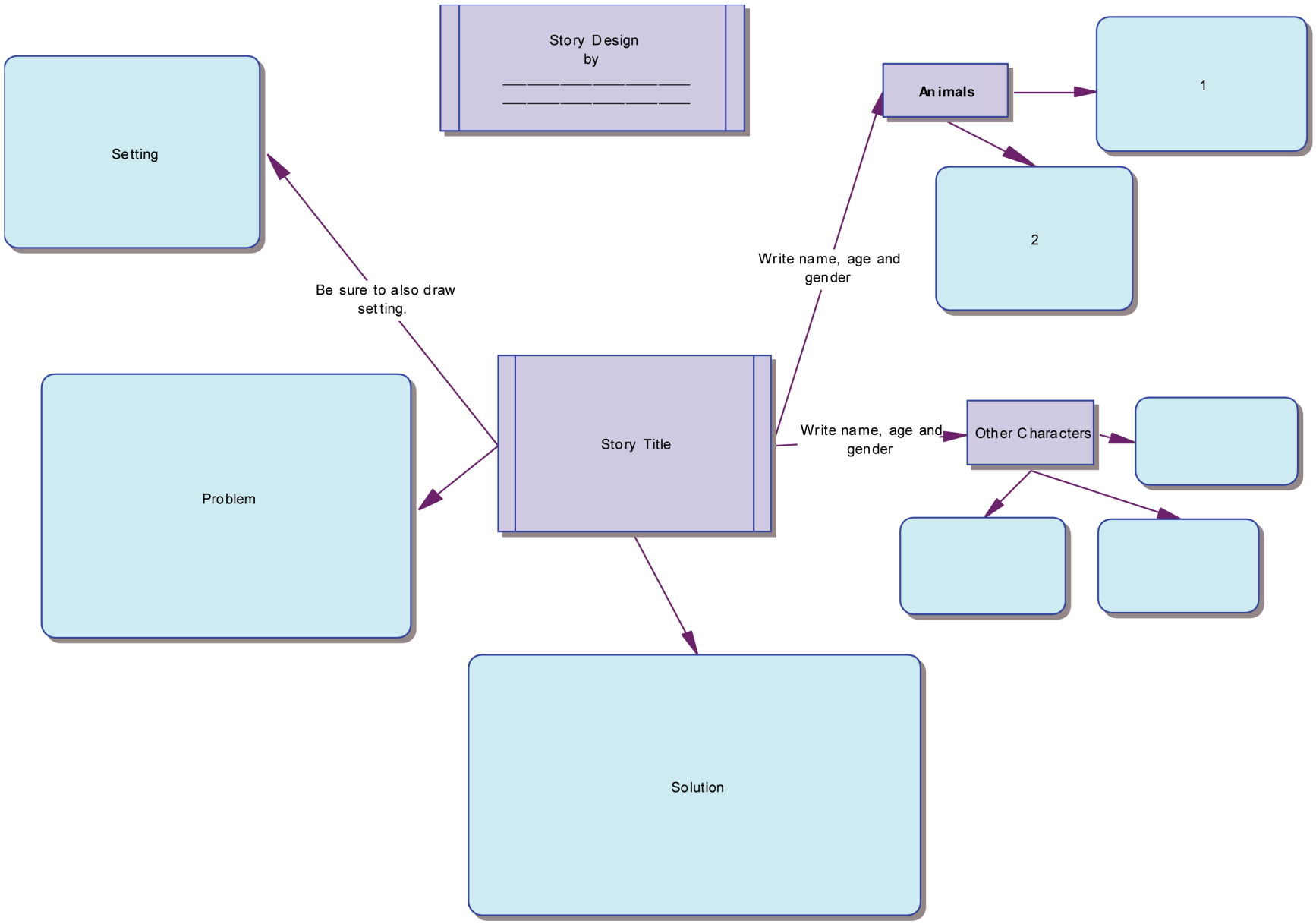
CATEGORY	4	3	2	1
Title	Title is creative, sparks interest and is related to the story and topic.	Title is related to the story and topic.	Title is present, but does not appear to be related to the story and topic.	There is no title.
Characters	The main characters are named and clearly described in the text. At least two characters are desert animals.	The main characters are named and described. At least two characters are desert animals.	The main characters are named. Only one character is a desert animal.	It is hard to tell who the main characters are. None of the characters are desert animals.
Setting	Many vivid, descriptive words are used to tell when and where the story took place. Setting drawing is accurate.	Some vivid, descriptive words are used to tell the audience when and where the story took place. The setting drawing shows some details.	The reader can figure out when and where the story took place, but the author didn't supply much detail.	The reader has trouble figuring out when and where the story took place.
Problem/Conflict	It is very easy for the reader to understand the problem the main characters face and why it is a problem.	It is fairly easy for the reader to understand the problem the main characters face and why it is a problem.	It is fairly easy for the reader to understand the problem the main characters face but it is not clear why it is a problem.	It is not clear what problem the main characters face.
Solution/ Resolution	The solution to the character's problem is easy to understand, and is logical. There are no loose ends.	The solution to the character's problem is easy to understand and is somewhat logical.	The solution to the character's problem is somewhat hard to understand.	No solution is attempted or it is impossible to understand.
Accuracy of Facts	All facts presented in the story are accurate.	Almost all facts presented in the story are accurate.	At least 70 percent of the facts presented in the story are accurate.	There are many factual errors in the story.
Spelling and Punctuation	There are no spelling or punctuation errors in the final draft. Character and place names that the author invented are spelled consistently throughout.	There is one spelling or punctuation error in the final draft.	There are two or three spelling and/or punctuation errors in the final draft.	The final draft has more than three spelling or punctuation errors.

Our Desert Story Directions

Write a story about an adventure in the desert by using the following steps.

1. Complete the graphic organizer handout. Be sure to include all of the items:
    a. Your names at the top.
    b. The title of your story (in the center box).
    c. At least four characters, two of which must be desert animals. The animals may talk if you'd like them to. Tell the names, the ages and the gender of your human characters.
    d. A written summary of the problem to be solved.
    e. A written summary of the solution to the problem.
2. Use the handout to draw the desert setting of where your story will take place.
3. Write your story. There are plant and animal pictures at http://www.WesternReservePublicMedia.org/weathering. You may use this as a reference.
4. Share your story with the class.

Graphic Organizer



Desert Story Setting

Western Reserve Educational Services
A service of Western Reserve Public Media
1750 Campus Center Drive
Kent, OH 44240-5191
330-677-4549
http://www.WesternReservePublicMedia.org