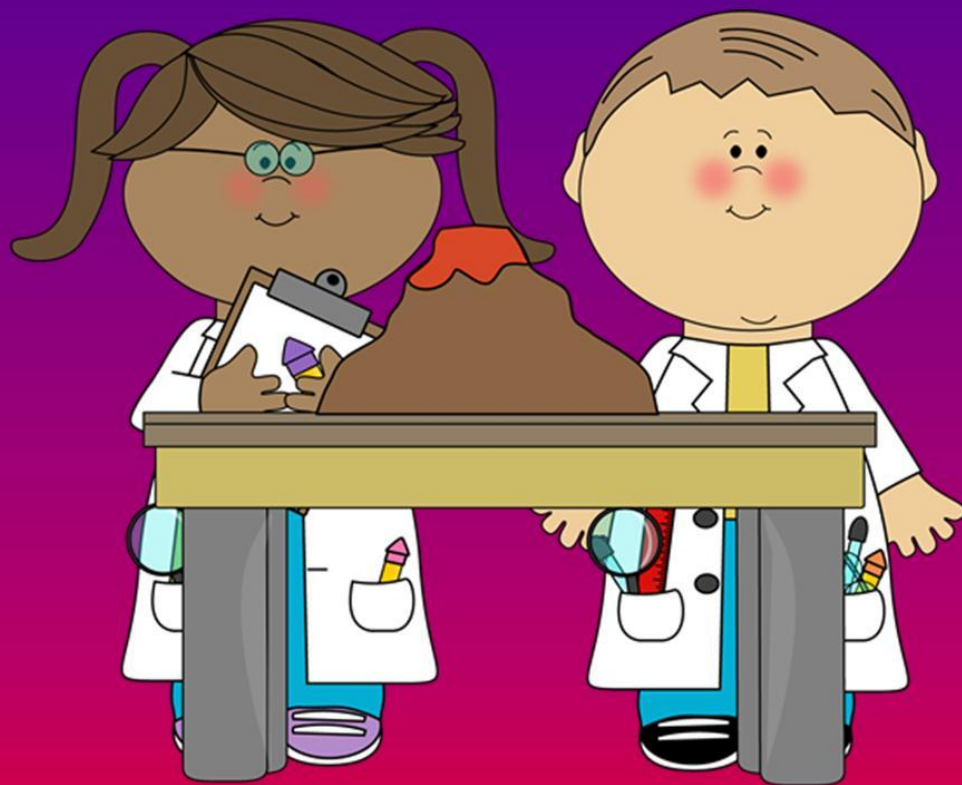


Hands-On Minds-On Science Explorations
Grades 3-5

Earth & Pollution



Hands-On Minds-On Publications

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DATE _____

Background Information: A scientist that studies rocks is called a geologist. Rocks come in many shapes, sizes, and textures. Rocks are solid objects that make up much of the earth's surface. Below the earth's surface, are rocks that form the crust. Rocks can be found on the bottoms of oceans as well as the foot of mountains. Rocks are slowly broken down into smaller pieces in a process called weathering. Eventually, rocks are broken down so small that they form the soil. Rocks contain one or more minerals. The minerals give rocks color, hardness, and sparkle.

Pretend you are a geologist as you search for rocks. Carefully dig through the sand to find the hidden rocks and shells.

Here is a drawing of my rock:

Describe the physical properties of your rock; how it looks and feels. Tell about it's color, shape, size, and texture:

Describe the physical properties of your shell; how it looks and feels. Tell about it's color, shape, size, and texture:

1

2

3

4

PROBLEM STATEMENT: How much will one rock and one shell weigh together?
HYPOTHESIS: What is your prediction?

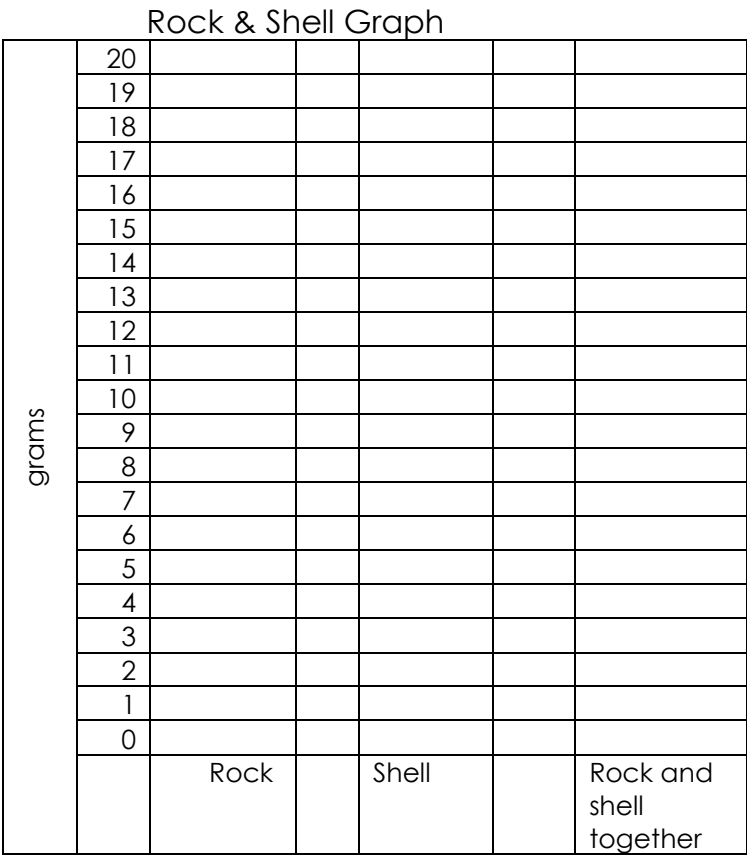
Weigh the shell. How many grams did it weigh? _____

Weigh the rocks. How many grams did it weigh? _____

How much did the rock and shell weigh in all? _____

How much more did the rock weigh than the shell? _____

Graph your results:



Item Being Weighted

Write About it: As an archeologist, you are on a very important dig to find ancient artifacts. You found a dinosaur skull. Tell about what it might have been like to live in the days of the dinosaurs.

Name _____ Date _____

EROSION SHAPES THE LAND

Weathering is the process by which the earth is changed due to conditions in the environment. There are four main agents of erosion. They are wind, water, gravity, and glaciers. Water is the most powerful agent of erosion. Erosion is a type of weathering that helps to shape our land. Many canyons began their lives as simple gullies. A **gully** is a ditch or channel cut in the earth by flowing waters, especially heavy rain. Water in streams traveled over these flat lands and carried away the earth materials. A **canyon** is a deep valley with steep walls on both sides. A canyon is also formed by running water. A **delta** is an area of land shaped like a triangle formed by deposits of sand and mud at the mouth of a river. The earth is always changing. Erosion is the wearing down of the earth by natural forces such as wind, water, and ice. Erosion happens slowly over many years so sometimes it is hard to see. Over thousands of years, mountains and hills have been worn down and rivers have been widened. Water plays a very powerful part in erosion. Each year a quarter of the rainfall runs into oceans and streams carrying with it parts of the earth. Wind erosion carries off soil and small rocks and moves them from place to place. Strong winds can even uproot small plants. Snow collects on mountaintops and, as its weight builds up, it becomes compressed into ice. The ice moves slowly downhill and glaciers are formed. Glaciers carry rocks that are frozen in the ice a great distance before dropping them. Glaciers cause erosion when the ice melts.

In this activity, you will be simulating erosion by wind and rain.

Safety Tip: Be sure to protect your eyes from flying sand.

MATERIALS: one plastic box half filled with sand, a paper cup with a hole covered with tape on the bottom, 4 straws, a container of water, sand colored with food coloring (optional), small rock

PROCEDURE:

1. Create Erosion by wind: Spread some colored sand if available on top of the sand in the box. Be careful not to get too close or you might get sand in your eyes. Wear safety goggles if available.
2. Hold the box at an angle and gently blow through the straw and watch what happens to the sand in the box.
3. Smooth out the sand and place a rock on one side of the box. Prop the box at an angle with the rock on the top end of the box. Gently blow in the sand on both sides of the rock. Watch what happens to the rock.
4. Remove the rock from the box and smooth out the sand.
5. Fill the empty cup with water. Hold the box at an angle. Carefully remove the tape from the cup and let the water drip out in one place at the top of the box. Observe the water and how it changes the surface of the sand. This is similar to what happens when it rains.

Draw the sand in the box before and after you changed it by the wind and rain erosion:

Box of sand before the simulation:	Box of sand after the wind test:	Box of sand after the rain test:

Math Connection:

During a bad flood, 12 inches of rain fell on Monday, 11 inches fell on Tuesday, and 9 inches fell on Wednesday. How much rain fell in all?

The sandbox at the park had 86 pounds of sand. During a heavy windstorm, 28 pounds flew away. How much sand was left in the sandbox?

Tell about the part you played in this activity. What was your job in the group?

--

List the four agents of erosion. Put a star next to the most powerful agent.

1.
2.
3.
4.

Tell three things you learned today that you did not already know.

--

NAME _____ DATE _____

FOSSILS AND ROCKS

BACKGROUND INFORMATION: The earth can be divided into three main layers. The outer layer of the earth is called the crust. The crust is made mostly of rock. A rock is a solid that is made of one or more minerals. The crust is the thinnest layer and can be compared to the shell of a hard-boiled egg. The mantle is the layer just below the crust. The mantle can be compared to the white of a hard-boiled egg. At the earth's center is the core. The core is like the yolk of an egg. The outer core is made of liquid that contains iron and nickel. Molten rock is called magma. Magma that reaches the earth's surface is called lava. There are three main types of rock in the earth. They are igneous, metamorphic, and sedimentary. Igneous rock is formed from melted rock that has cooled and hardened. Lava is a type of igneous rock. Rocks that form when sediments become cemented together are called sedimentary rocks. Wind, water, and ice break rocks into sediments. Streams move the sediments and deposit them at the bottom of lakes and oceans. Most sedimentary rocks form in layers. Sedimentary rocks like limestone often contain fossils. A fossil is the remains of a living thing, such as a plant or animal preserved in rocks. Metamorphic rocks form from rocks that are changed by heat and pressure building in the earth.

MAKING A FOSSIL

MATERIALS: modeling clay, plaster of Paris, petroleum jelly, metal jar lid, rocks, plants, and shells

PROCEDURE:

1. Moisten a plastic cup with petroleum jelly. Flatten a piece of clay into the cup.
2. Choose an item and lightly cover its underside with petroleum jelly.
3. Press the item into the clay.
4. Carefully lift the item out.
5. Spoon in plaster of paris until it fills the lid.
6. Let the plaster harden.
7. Gently remove the clay from the cup and detach it from the plaster.
8. (OPTIONAL) Paint your fossil.

COMPLETE YOUR VOCABULARY HERE

Crust:

Rock:

Mantle:

Core:

Magma:

Lava:

Igneous rock:

Sedimentary rock:

Fossil:

Metamorphic rock:

Name_____

Date_____

DECOMPOSITION IN A LANDFILL

Tell what you know about decomposition and landfills:

PROBLEM STATEMENT: Which items will decompose fastest in a landfill?

MATERIALS: soda bottle, food scraps, Styrofoam, tin foil, measuring cup, water

HYPOTHESIS: (Which item do you think will decompose fastest?)

Before starting, weigh the food scraps and garbage and record how much they weighed.

Trash mass:_____ **Food scrap mass:**_____

- PROCEDURE:**
1. Cut the top off of a soda bottle. Pour 1 cup of potting soil in the bottle.
 2. Place garbage and food scraps on the soil and sprinkle with water
 3. Pour another cup of potting soil in the bottle.
 4. Place garbage and food scraps on the soil and sprinkle with water
 5. Pour another cup of potting soil in the bottle.
 6. Place garbage and food scraps on the soil and sprinkle with water
 7. Cover the bottle and let it sit for two weeks.

List the items you placed in the bottle:

RESULTS: After waiting two weeks, open the landfill and pour out on a covered surface. Write about your discovery below.

Weigh the food scraps and garbage. Record the weight.

Trash mass:_____ **Food scrap mass:**_____

[illegible]

Name _____ Date _____

PERMEABILITY OF SOIL

Different types of soil allow water to percolate (flow through) faster or slower than others. Some soils absorb (hold in) water to feed the plant. Soil that is permeable allows the water to flow through easily. It is important for soil mix to hold in some water so that it can nourish or feed the plant.

Problem Statement:

Which material, potting mix or sand, will absorb the most water?

Hypothesis: (Which material do you think will absorb the most water?)

Materials: potting mix, sand, two plastic bottles, screening, water, rubber bands

Procedure:

- Step 1: Use the rubber band to attach the screening to the small opening of each bottle.
- Step 2: Invert (turn over) the top part of the bottled and place it in the bottom part.
- Step 3: Pour one level scoop of sand in the inverted bottle.
- Step 4: Repeat steps 1-3 with the potting mix.
- Step 5: Measure 200 ml of water. Pour 100 ml in each cup.
- Step 6: At the same time, pour 100 ml of water in each cup.
- Step 7: After 60 seconds, see which one held the most water, record your data.

Data table	_____ml of water came out of the sand.	_____ml of water came out of the potting mix.
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Graph your results:

	sand		potting mix

Earth material

Results: (Summarize your results. Tell which absorbed the most water and would be best from nourishing the plant.)

Conclusion:

(Was your hypothesis supported?)

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Plants need water to survive. Tell what would happen in plants are planted in earth materials that will not hold in water.

Tell something you learned today that you did not already know.

Define the following:

1. absorb:
2. percolate:
3. permeable:

Name_____ Date_____

SOIL TESTING: PH

Background Information: **Soil** is the top layer of the earth's surface. It supports plants and provides a habitat for microorganisms and animals that help recycle organic material in our ecosystem. Soil is formed by weathering, which is the break down or disintegration of rock to soil from wind, rain, erosion, and plant roots. **Decomposition** of plants and animals helps in making **humus** and increases nutrients in soil. **Topsoil** is the upper layer of soil and has the greatest amount of decomposed organic matter called humus. We test soil to find out how much of the essential **nutrients** are available for plants. PH is the measure of how **acidic** or **basic** they are. Most plants prefer **neutral** or slightly acidic soil ranging in ph from 6.0-6.8. To raise the ph of acidic soil, powdered limestone called lime is added to soil. To lower the ph of basic soil, aluminum sulfate, or alum is added.

	Ph levels	types of plants
ACIDIC		
BASIC		
NEUTRAL		

Problem Statement: Will the ph of the soil sample be acidic, basic, or neutral?

HYPOTHESIS:

MATERIALS: ½ cup water, plastic bag, 5 teaspoons of soil, filter paper, plastic bottle, ph tablet

PROCEDURE:

1. Pour ½ cup water and 5 teaspoons of soil in the zipper bag.
2. Seal the bag and shake for one minute. Let the bag sit for 2 minutes to let the sample settle.
3. Flatten two filters placing one on top of the other. Fold the filters in fourths and form a cone.
4. Place the cone in a soda bottle.
5. Pour the soil solution in the filter leaving any soil from the bottom of the bag in the bag.
6. Let the solution filter into the bottle.
7. Remove the funnel and throw away the muddy filter.
8. Fill the test bag to line C and add the ph tablet.
9. Roll down the bag and shake until the tablet disintegrates.
10. Compare the color of the soil solution and record your results.

SOIL SAMPLE Ph TEST RESULTS:

(For this activity, you will need the RapidTest Soil Test Kit. It can be purchased through Carolina Biological)

Soil Testing

Plants need food called nutrients for healthy growth. Nitrogen, Phosphorus, and Potash are nutrients that play an important role in plant growth. Plants also need proper pH levels. The pH level tells us if the soil has the correct acidity or alkalinity level, which controls how plants use the nutrients in the soil. Testing soil is one way to be sure that the soil has the proper nutrients. In this lesson, you will test the soil in the school garden to see if it has the proper amounts of each nutrient.

Greener, thicker lawns: The two most important factors for thick green lawns are proper pH and Nitrogen levels.	Flowers: Proper amounts of Potash are important for flowering plants and shrubs. Phosphorus is important for strong root development.	Vegetables and Fruits: For sweeter fruit and abundant crops, high levels of Potash are needed. Leafy vegetables need high levels of Nitrogen and Phosphorus.	Trees and Shrubs: For strong root development and strong trees, high Phosphorus levels are very important. Evergreen trees need high Nitrogen levels as well.	Happy Houseplants: Houseplant soil becomes depleted of nutrients quicker than garden soil. Soil in houseplants should be checked frequently. Nitrogen is important in leafy plants and Potash is important in flowering plants.
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Problem Statement: Will the soil tested from the garden have the proper amount of nutrients needed for healthy plant growth?

Hypothesis: (make your prediction)

Materials: soil samples, soil test chambers, chemical capsules, water, and droppers

Procedure:

- Step 1: Empty the powder from the capsule into the test chamber.
- Step 2: Add water to the fill line.
- Step 3: Place the cap on the container and shake well.
- Step 4: After the water settles, record the results on the data table.

Data Table:

Potash:	Nitrogen:	Phosphorus:	pH:

Results: Use the data table to summarize your results:

Conclusion: Was your hypothesis supported?

Home Extension Activity: Write an abstract telling what you learned in the lab today. Tell what you did, the steps you took and what you found out. Tell what you learned that you did not already know.

NAME: _____ DATE: _____

PARTICULATE MATTER: How dirty is the air we breathe?

Tell what you already know about air pollution:

BACKGROUND INFORMATION: The atmosphere is almost completely made up of invisible gaseous substances. Most major air pollutants are invisible, although large amounts of them concentrated in areas such as large cities can be seen as smog. One visible type of air pollution is particulate matter. **Particulate matter** is made up of tiny particles of solid matter and droplets of liquid. Some natural sources include volcanic ash, pollen, and dust blown by the wind. Manmade pollutants include coal and oil burned by power plants and industries and diesel fuel burned by automobiles.

PROBLEM STATEMENT: Which area of the school will have the most air pollution?

MATERIALS: Index card with petroleum jelly taped to the wall

HYPOTHESIS: (Choose from the PE shelter, outside the cafeteria, the main courtyard, the parking lot, the carpool lane, or the bus lane.) Tell why you think your guess would be correct.

PROCEDURE:

1. Spread petroleum jelly on several index cards.
2. Tape the cards around the school.
3. Look at each slide and put them in order from the least pollution to the most.

Predict where each sample came from.

	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5	SAMPLE 6
Prediction:						
Actual location:						
correct: yes or no						

Look at each sample under the microscope to get a closer look at the air pollution.

RESULTS: Tell which location had the most air pollution and which had the least. Tell why you think the results were so.

CONCLUSION: Was your hypothesis supported? Why or why not?

NAME _____ DATE _____

AFFECTS OF OIL POLLUTION

BACKGROUND INFORMATION: Oil pollution causes major damage each year our oceans and ocean wildlife. Some oil tankers carry 500,000 tons of oil. In 1989, The Exxon Valdez tanker ran aground near Valdez, Alaska. It spilled oil that spread for miles, polluting the water and killing the ocean wildlife such and fish, birds, and sea mammals. One way that oil spills affect marine life is by coating bird's feathers with oil. The oil makes it hard for the birds to fly and float. It also interferes with the bird's insulation so it cannot stay warm. Finally, when the birds clean themselves, they become poisoned by the oil on their feathers.

PROBLEM STATEMENT: Will oil on a bird's feather affect the bird?

MATERIALS: a bird feather, cooking oil, container of water, hand lens

PROCEDURE:

1. Examine the feather with the hand lens.
2. Open the feather by pulling apart the barbs (the strands attached to the shaft of the feather).
3. Close the barbs by running your finger down the barbs like a comb.
4. Drop the feather in water. What record what happened.
5. Dip the feather in water and repeat steps 2 and 3.
6. Dip the feather in oil and repeat steps 2 and 3.
7. Drop the oily feather in water. What record what happened.

RESULTS:

1. What happened when you dropped the feather in the water? Did it remain buoyant or did it sink?

2. Did the water have an effect on the feather? Did the barbs close after the were wet?

3. What happened when you dropped the feather in the oil? Did it remain buoyant or did it sink?

4. Did the oil have an effect on the feather? Did the barbs close after the were wet?

5. Give **3** reasons why oil spills are harmful to birds. Use complete sentences.

CONCLUSION: (Was your hypothesis supported?)

Name_____

Date_____

CLEANING AN OIL SPILL

PROBLEM STATEMENT:

Which of the following items will remove the most oil from the water; laundry soap, cotton, paper towel, or an eye dropper?

HYPOTHESIS:

MATERIALS:

laundry soap, cotton, paper towel, an eye dropper, vegetable oil, food coloring, water, 4 metal pans.

PROCEDURE:

1. Create an oil slick by adding 100 ml of cooking oil to each container of water.
2. Try to remove the oil with using each item listed above.

RESULTS:

Which item removed the most oil from the water?

Which item removed the least amount of oil from the water?

CONCLUSION:

WRITE ABOUT IT:

Oil spills cause great harm to our oceans and ocean wildlife. What consequences should there be for oil tankers that run aground and destroy our oceans by causing oil spills?

[illegible]

NAME: _____ DATE: _____

OZONE POLLUTION

Tell what you know about the ozone layer and pollution:

BACKGROUND INFORMATION: Ozone is the same molecule regardless of where it is found. Stratospheric ozone is found 9 to 18 miles high where it shields us from harmful ultraviolet rays from the sun. Higher accumulations of ozone gas in the lower atmosphere at ground level is air pollution and can be harmful to people, animals, and crops. Ozone pollution, a component of smog, is mainly a problem during the day in summer months because sunlight plays a role in the formation of smog. Large industrial areas and cities with heavy summer traffic are the main contributors of ozone pollution.

In this experiment, you will be making smog. Read the procedure carefully and tell what you will do in order to do this experiment safely.

MATERIALS: glass jar, water, aluminum foil, ice cubes, paper, ruler, scissors, matches

In order to do this experiment safely, I will:

PROCEDURE:

1. Cut a strip of paper 15 centimeters X 1 centimeter. Fold the strip in half and twist the end.
2. Make a lid for the glass jar by shaping a piece of aluminum foil over the top of the jar. Remove the lid and set it aside for later use.
3. Pour some water in the jar and swish it around so that the inside of the jar is wet. Pour out the water.
4. Place two or three ice cubes on the foil lid to make it cold.
5. Light the twisted end of the paper and drop the paper and the match in the jar. Put the foil lid on and seal it tightly. Keep the ice cubes on top of the lid. You must do all of this very quickly.
6. Release the "smog" outdoors.

Tell what you saw in the jar:

How is the smog in the jar like real smog?

What could happen if we continue to damage the ozone layer?

What can we do to help stop air pollution?

