Dear Teacher,

Thank you for having the Rock and Roll van visit your school. We hope you enjoyed investigating physics with your students during this Science On Wheels experience. This flyer is intended to help continue the enthusiasm generated by our visit and extend your students’ learning.

The following activities have been selected because they encourage creativity and problem solving skills and support state adopted learning objectives. Please feel free to adapt the projects to your needs. The one page insert is written for your students, with activities you may choose to do as a class, or copy for home use.

Thank you again for having the Rock and Roll van visit your classroom and remember, have fun!

~Science On Wheels Teachers

Materials (per team)

- large shallow container, such as a long cake pan or several shallow plastic food containers
- sponges
- toothpicks
- water
- liquid laundry bluing (found at hardware/drug stores)
- table salt
- food coloring (optional)
- household ammonia
- magnifying lens (optional)

Crystal Garden

Minerals are a specific arrangement of atoms. When minerals form in proper conditions, atoms are arranged into geometric shapes that we call crystals. Here is a fun experiment in growing crystals. Students can observe their crystal garden as it forms over a period of two or three days.

Procedure

- Cut sponges into pieces and stick several toothpicks (some long, some shorter) into the sponges. Place sponges in the shallow container(s).
- Mix together 2 tablespoons each of salt, water, and bluing, and drizzle over the sponges until they are saturated. Sprinkle 2 more tablespoons of salt over the sponges.
- Pour 2 tablespoons of salt, water, bluing, and ammonia into the bottom of the container (not directly on the sponges).
- Observe what happens! Look at your crystals with a magnifying lens. Record the shapes that you see after one day, after two days, after one week, etc.

Extensions

- Discuss with students that for a mineral to achieve its crystal form, it needs the proper time and space. If minerals in nature cool too quickly or do not have enough space, they will not achieve their crystal form. Find pictures of different minerals.
- Try to grow your crystals in a variety of containers (plastic, glass, porcelain, etc.) and compare the results. Also try growing your crystals on different materials (charcoal, brick, terra cotta pots, etc.).
- Try changing other variables! Grow crystals in different temperatures or use sugar instead of salt.
Lava Layers

Materials
(per group of students)
- paper cup, cut to 1/2 inch tall
- six-sided die
- pie pan or deep paper plate covered with foil
- teaspoon
- baking soda
- white vinegar
- playdough or clay: red, yellow, green, blue
- food coloring: red, yellow, green, blue
- paper or cloth towels
- crayons or colored pencils: red, yellow, green, blue
- 4 - 8 1/2 x 11" pieces of paper

Materials for Analysis
- 4 straws
- 4 toothpicks
- 4 pieces of paper

Procedure
- Cover the plate or pan with foil, making sure there are no gaps for the vinegar to fit through.
- Place the cut paper cup in the center of the plate. This is your eruption source, and the plate is the original land surface.
- Place two teaspoons of baking soda and six drops of red food coloring into the cup.
- Roll the six-sided die. The number that you roll is the number of “eruptions” that occurs at that site.
- For each number you roll, pour two teaspoons of vinegar into the cup. For example, if you roll a 3, pour six teaspoons of vinegar into the cup. The mixture should overflow onto the tray. This represents your flow of lava.
- On your paper, map out the location of the flow of lava. Use color, as you will have to repeat this again. You may want to color it in stripes: // or \||| so that you can see through the layers. See Data Sheet 1.
- Before mopping up the spill, use a pencil or crayon to outline the extent and location of the flow on the foil.
- Mop up most of the vinegar with towels.
- Place red clay in the same location where the red lava flowed.
- Rinse out the cup and have another student place it in another location on the plate. Predict where the lava will flow. Repeat steps 3 through 9 four times, with a different food coloring and playdough color each time.
- When you are finished, you will have four colors of lava on your plate and on your paper, each representing a different eruption.
- You will soon hand your volcano to another group for analysis.

Analyzing the Volcanoes
When geologists analyze rocks to understand their history, they take core samplings. They have special drills that will cut and remove a sample of the rock.
- Trade your volcano with another group. Look at the other group’s volcano. Analyze the landform. Draw a diagram of the volcano on another piece of paper.
- With your group, decide which four places you want to drill. Number these spots on your paper. Stick your straw into this location. Slowly pull it out, and remove the sample by poking the toothpick into the straw and pulling out the playdough.
- In the margins of your paper, sketch the side view of the core sample. Which is the oldest layer? Which is the newest layer?
- Compare your sketch to the original group’s drawings. How accurately did the core samples tell you where the lava flowed? What were some of the factors that made it difficult to know?
- What criteria did your group use to decide where to drill? As a class, try to come up with a general list of criteria.
Materials
(Per pair of students)
- Four crayons (different colors)
- Crayon sharpener
- Two pieces heavy duty aluminum foil (approximately 8 in x 4 in each)
- Ruler

(Per class)
- Iron
- Dish towels or rags
- Rolling pin or glass bottle

All rocks are made of different types of minerals cemented together. Minerals can meld together in different ways, resulting in rocks with a variety of colors and features. Students will get a chance to mimic the formation of the three main types of rocks using crayons instead of minerals. For definitions of the three rock types, see below.

Procedure
- Place the two pieces of aluminum foil together for double thickness.
- Make crayon shavings by sharpening the crayons with a crayon sharpener. Make a pile that is approximately 2 in x 2 in and 1/2 in thick. This collection of shavings is your “sediment.”
- Place the crayon sediment inside the aluminum foil and fold it over. Fold the edges so none of the crayon sediment can fall out.
- Using the rolling pin or glass bottle, gently flatten the packet. Open it and record your observations. How does it look different from before? What type of rock might this be? (sedimentary)
- Rewrap and flatten the packet with much more pressure. Re-examine the crayon rock and record your observations. What kind of rock have you made this time? (metamorphic)
- Iron your rock by placing the packet in between two pieces of cloth to catch any leaking wax and gently pressing the iron on top for approximately 20 seconds. Let the packet cool for at least one minute before opening the packet. What do you notice? Record your observations. What kind of rock is this? (metamorphic or igneous)

Extensions
- Create different sized sediment chunks. How does original size affect the final rock?
- Assign groups of students different processes (slight pressure, a lot of pressure, a little heat, high heat, pressure with heat, etc.). Label results and record observations as a class.
- Look at the picture below of the simplified rock cycle. Are there other paths or processes that can exist between the three types of rocks? How can you re-create these processes with your crayon rocks?
- Show examples of sedimentary, metamorphic, and igneous rocks. What types of events on the Earth would cause these rocks to form?

Rock Vocabulary

Sedimentary rock
A rock resulting from the consolidation of loose sediment (rock fragments) that has accumulated in layers; often hardening is a result of pressure from additional layers of sand, dirt, or rock.

Metamorphic rock
“Changed-form rock.” Any rock changed in texture or composition by heat, pressure, or chemically active fluids.

Igneous rock
Rock formed by the cooling of molten magma.
Crack This Case

Materials (per student)
- 1 clear film canister with lid
- Dried garbanzo beans (enough to fill canister)
- water

The Earth is a ready made laboratory with countless opportunities to observe geological processes and discover unbelievable occurrences. For example, could a tiny seed be powerful enough to crack a rock? Try the following experiment to find out!

Procedure
- Fill the film container to the top with garbanzo beans, making sure the lid will fit tightly.
- Fill the container with water.
- Put the lid on the container and set aside.
- Make predictions as to what will happen to the containers in the next few days. Record daily observations.

The beans represent seeds and the film container represents a rock. The beans absorb the water and expand becoming powerful enough to pop the top off the container. Students can find natural examples of this where tree roots have cracked sidewalks or trees are growing in cliffs.

Backyard Volcano

The Paricutin volcano in Mexico is the only volcano in recorded history that geologists have been able to watch from inception to extinction. In 1943, farmers Dionisio and Paula Pulido noticed a swelling in the ground of their cornfield. They heard the rumbling noise, but did not realize it was an earthquake until they saw a two-meter fissure forming in the ground. Volcanic ash and dust emerged from the crack, accompanied by the smell of sulfur. Fortunately the family evacuated the farm, because 24 hours later the volcano was 50 meters high (165 feet). Four months later, lava began to advance toward the nearby village, ultimately covering 25 square kilometers (15 square miles). The eruptions persisted for nine years, alternating between pyroclastic (ash and dust) flow and lava. In 1953, the volcano was 424 meters high (1,400 feet). By watching a volcano from beginning to end, geologists have learned “mountains” about the process of volcanic formation.

Resources

Rocks, Gems, and Minerals, by Paul R. Schaffer and Herbert S. Zim, 2001
Geology Rocks!: 50 Hands-On Activities to Explore the Earth, by Cindy Blobaum and Michael Kine, 1999
Earth Science for Every Kid, by Janice VanCleave, 1991
Everybody Needs a Rock, by Byrd Baylor and Peter Parnall, 1985
Roadside Geology of Washington, by David D. Alt and Donald W. Hyndman, 1984
Science On Wheels web site: www.pacificsciencecenter.org/education/sow/

Credits

Science on Wheels Staff
Teresa Demel
April Wedman
Zeta Strickland
Jenica Wood-Beauchamp

Graphic Designer
Katie Dresel

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