Where can you find Earth materials? In every part of your life. Raw materials are essential to food, clothing, medicine, buildings, employment, manufacturing, industry, transportation, energy, recycling, and more.

That’s why Earth Science Week 2020 focuses on the theme “Earth Materials in Our Lives,” raising awareness of the many ways that raw materials impact humans — and the ways human activity impacts these materials — in the 21st century. The celebration engages young people and others in exploring this theme through learning resources and activities.

Help promote understanding of humans’ complex interactions with the Earth materials of our geosphere (earth), hydrosphere (water), atmosphere (air), and biosphere (living things). Visit the Earth Science Week website (www.earthsciweek.org). Check out new links to educational materials and information. Engage young people and others in the vital role they can play in Earth science.

And keep learning about the geosciences throughout the school year. Use this calendar, which features education resources, important geoscience dates, and exciting academic activities. Connect with geoscience learning all year long!

Geoff Camphire
Associate Director, Communications
American Geosciences Institute
This year, you’re invited to join the tens of millions of participants in all 50 states and nations worldwide who are celebrating Earth Science Week. Now in its 23rd year, this exciting event has grown steadily in momentum and participation since the American Geosciences Institute held the first Earth Science Week in 1998.

Every year, people in schools, workplaces, civic centers, and elsewhere celebrate Earth Science Week to help build public understanding and appreciation of the Earth sciences, promote recognition of the value of Earth science research, and encourage stewardship of the planet. Earth Science Week serves the geoscience community by:

- giving students new opportunities to discover the Earth sciences,
- highlighting the contributions made by the geosciences to society,
- publicizing the message that Earth science is all around us,
- encouraging responsible stewardship of the planet through an understanding of Earth processes,
- providing a forum where geoscientists can share their knowledge and enthusiasm about the Earth and how it works, and
- making learning about Earth science fun!

Whether you are a faculty member, student, parent, geoscientist, or ordinary citizen, you can play a leading role in Earth Science Week. On the event’s website at www.earthsciweek.org, you’ll find ideas and tips for planning activities at your school or workplace, along with contact information for geoscience resources in your area where you can work with local geoscientists to plan activities.

In addition, this calendar features a variety of exciting activities that you can conduct — in the schoolyard, at home, or elsewhere in the community — to explore the theme “Earth Materials in Our Lives.” This year’s theme focuses on the many ways that raw materials impact humans, and vice versa, today.

Let us know how you are planning to celebrate! Send us an email at info@earthsciweek.org. Celebrate Earth Science Week: October 11–17, 2020!

CHECK THE DATE
Please independently confirm the dates of any geoscience events in which you plan to participate. Due to the COVID-19, some events scheduled before the printing of this calendar may have been rescheduled or reformatted as “virtual meetings” since that time.

How can you get involved? Explore the Earth Science Week website at www.earthsciweek.org. You’ll find a host of tools designed to make your event experience easy, fun, and rewarding!

On the website, you’ll see a list of tips to help you share your Earth science knowledge with young people, lead an excursion, or attend an event in your area: A planning checklist, tips for fundraising, recommendations for working with the news media, ideas for events, educational activities, ways to get official recognition, downloadable logos and images, kit ordering information, a map of potential partners and activities near you, and much more.

To stay up-to-date on the latest developments and upcoming activities, subscribe to the Earth Science Week Update electronic newsletter at www.earthsciweek.org. Check it out!
LEARNING ACTIVITY:
Nature’s Water Filter

GRADES 6-8

MATERIALS
• 4 3-oz clear solo cups
• 4 5-oz clear solo cups (with 3–5 small holes in the bottom of each cup)
• 4 funnels
• Play sand
• Topsoil
• Planting mix or peat moss
• Fine gravel
• Grape drink mix packet, e.g., Kool-Aid®
• “Floaties” such as leaves, tea leaves, or grass clippings
• Water
• Pen and paper for recording

Soil is a filter that helps maintain a clean environment and safe drinking water. When rain falls on a soil surface, or when contaminated water is introduced to a soil surface, it infiltrates into the soil. As water moves downward, the soil acts as a natural water filter, removing harmful contaminants and delivering clean water to rivers, lakes, and underground water reservoirs called aquifers.

Two types of filtration occur during this process — physical and chemical. Physical filtration happens when large particles are physically prevented from traveling through small soil pores and are therefore removed from water. Chemical filtration happens when contaminants dissolved in water are attracted and held to the soil itself. This process is called sorption.

This activity demonstrates how soil acts as a physical and chemical filter for contaminants.

PROCEDURE
For the teacher: Before doing this activity, visit www.soils4teachers.org/esw and review the set-up video. To set the stage for the following activity, play the “Soils Clean and Capture Water” video for students.

1 Ready to explore physical filtration? Fill a 5-oz cup half-full of gravel. Add “floaties” to the top. Put the cup over the funnel. Slowly pour about 100 ml (3 oz) water over the gravel/floatie mixture. Observe. Discuss:
   • Did the floaties end up in the bottom cup? Why, or why not?
   • What is this type of filtration?

2 Ready to explore chemical filtration? Create three more cups — one with fine sand, one with topsoil, and one with potting soil or crushed peat moss.

3 Mix 0.5 g grape drink powder into 1 liter of water.

4 Slowly pour 50 ml grape drink into each of the four cups. For each cup, observe and record what happens:
   • What color is the grape drink that goes into each cup?
   • What color is the water that collects in each of the bottom cups?
   • Is the color of the water the same in the three cups?
   • How much time does it take for water to drain out of the top cup?

5 Set aside the bottom cups (keep the water in them). Pour the grape drink mix into the gravel a second time and collect the water in a new cup. Repeat the process three times for the sand and six times for the soil, and collect the water in new cups each time. Observe and record:
   • Is the color different for the gravel cup on the second try?
   • What about for the sand and topsoil?
   • Has the water in one of the cups turned red? Why? Blue and red dyes make purple, so the blue dye was pulled out by the soil. Why?

6 Opposite charges attract and like charges repel. The smallest soil particles are clay, which have a negative charge. If the red dye goes through the soil, it must also have a negative charge; the blue dye has a positive charge which attracts and binds it to the clay (sorption). Discuss:
   • As more of the drink mix is poured through the soil, does the water in the bottom cup get progressively more purple? Why? The clay in the soil has reached its capacity to capture the positively charged blue ions.
   • Did the water in the sand change color? Why or why not? Likely, it stayed purple, which means that there is not any clay in it to attract the blue dye. What about the gravel?

Supplemental materials, videos, and worksheets are available at www.soils4teachers.org/esw.

NGSS CONNECTIONS
• Science and Engineering Practices — Analyzing and Interpreting Data
• Disciplinary Core Ideas — Earth Materials and Systems
• Cross-Cutting Concepts — Cause and Effect: Mechanism and Explanation
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<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
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<tbody>
<tr>
<td></td>
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<td><strong>Happy Birthday!</strong> Johann Gottlob Lehmann, German Geologist Noted for Fundamental Work in Stratigraphy, Published the First Geologic Profile, Born 1719</td>
<td><strong>Happy Birthday!</strong> Neil Armstrong, American Astronaut, the First Man to Walk on the Moon, Born 1930</td>
<td><strong>Happy Birthday!</strong> Edward W. Gifford, American Self-Taught Anthropologist and Archaeologist, Born 1887</td>
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<td>Did You Know? U.S. Space Shuttle Endeavour Astronaut Barbara Morgan the First Educator to Safely Reach Space, 2007</td>
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<td><strong>Friendship Day</strong></td>
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<td><strong>Happy Birthday!</strong></td>
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<td>Did You Know? Hurricane Katrina (Category 5) Strikes Florida, Later Louisiana, 2005</td>
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<td>Henry Darwin Rogers, American Structural Geologist, Contributed to the Theory of Mountain Building, Born 1808</td>
<td>Johann Gottlob Lehmann, German Geologist Noted for Fundamental Work in Stratigraphy, Published the First Geologic Profile, Born 1719</td>
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LEARNING ACTIVITY:
Change Over Time

FROM VERY EARLY TIMES, HUMANS HAVE USED EARTH MATERIALS AROUND THEM TO MAKE THE OBJECTS THEY NEEDED. THESE OBJECTS INCLUDED TOOLS, WEAPONS, FIGURINES, VESSELS, ORNAMENTS AND MANY OTHERS. RESOURCES FOR MATERIALS ARE EITHER MINED (MINERALS) OR GROWN.

IN FACT, THESE MATERIALS PLAYED SUCH AN IMPORTANT ROLE IN HUMANS’ LIVES THAT EARLY ARCHAEOLOGICAL PERIODS WERE NAMED FOR THEM. FIRST THERE WAS THE STONE AGE, FOLLOWED BY THE BRONZE AGE, THEN THE IRON AGE. THE DISCOVERY OF FIRE ENABLED HUMANS TO COMBINE METALS TO MAKE STRONGER AND MORE SHAPEABLE MATERIALS. AS PEOPLE DISCOVERED MORE ABOUT THE PROPERTIES OF METALS AND OTHER MATERIALS, THEY WERE ABLE TO MAKE OBJECTS THAT WERE MORE SOPHISTICATED AND MORE VERSATILE.

THESE DISCOVERIES HAVE CONTINUED IN MODERN TIMES. THE MATERIALS USED TO MAKE OBJECTS IN THE 1940S AND 1950S ARE, IN MANY CASES, VERY DIFFERENT FROM THE MATERIALS USED TODAY TO MAKE THE SAME OBJECTS. WITH A LITTLE RESEARCH, YOU CAN FIND OUT HOW OBJECTS AND THEIR MATERIALS HAVE CHANGED OVER TIME.

PROCEDURE
1. Look around your home and make a list of common objects that are likely to have been around 70 or 80 years ago. (Think about food containers and packaging, toys, tools, utensils, lights, communication devices, etc.)
2. Ask an older person you know if he or she would be willing to talk with you about how materials and objects have changed over time. You may be able to do this in person, on the telephone, in writing, or through an internet connection.
3. Ask your interviewee about the decades in which he or she grew up. Record when this time was. Then ask the interviewee about the materials that household objects are made from, both now and in the past. What were the advantages in the older materials? The disadvantages? How do these materials compare with what is used to make the same objects now? Record this information.
4. Make a table showing how the materials have changed over your interviewee’s lifetime. Use the internet to research both the old and the new materials. Include this information in your table as well.
5. Review your findings. What new discoveries in materials have changed the way objects are made? How do the advantages and disadvantages of each type of material compare? What happens to the materials used to make the objects when the object is thrown away?

NGSS CONNECTIONS
- Science and Engineering Practices — Obtaining, Evaluating, and Communicating Information
- Disciplinary Core Ideas — Earth’s Materials and Systems
- Cross-Cutting Concepts — Structure and Function
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Details</th>
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<tr>
<td>Sept. 1</td>
<td>Protect Your Groundwater Day</td>
<td>Did You Know? Unnamed Hurricane (Category 5) Batters Florida Keys, 1935</td>
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<td>Sept. 4–7</td>
<td>Geoscience Event: 39th NABG Annual Technical Conference</td>
<td>National Association of Black Geoscientists</td>
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<td>Sept. 4</td>
<td>Labor Day</td>
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<td>Sept. 5</td>
<td>Happy Birthday!</td>
<td>Stephen Jay Gould, U.S. Paleontologist and Evolutionary Biologist, Born 1941</td>
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<td>Sept. 8</td>
<td>Hurricane Ike (Category 4) Strike Texas, 2008</td>
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<td>Sept. 9</td>
<td>Geoscience Event: 63rd AEG Annual Meeting</td>
<td>Association of Environmental &amp; Engineering Geologists, Portland, Oregon</td>
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<td>Sept. 15–20</td>
<td>International Day for the Preservation of the Ozone Layer</td>
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<td>Sept. 16</td>
<td>Constitution Day</td>
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<td>Sept. 18</td>
<td>Rosh Hashanah Begins (Sundown)</td>
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<td>Sept. 19</td>
<td>World Water Monitoring Day</td>
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<td>Sept. 22</td>
<td>Autumnal Equinox</td>
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<td>Sept. 23</td>
<td>Did You Know? Hurricane Rita (Category 5) Batters Texas and Louisiana, 2005</td>
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<td>Sept. 25</td>
<td>National Public Lands Day</td>
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<td>Sept. 28–1</td>
<td>Geoscience Event: AAPG International Conference and Exhibition</td>
<td>American Association of Petroleum Geologists, Madrid, Spain</td>
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<td>Sept. 29</td>
<td>Yom Kippur ends</td>
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<tr>
<td>Sept. 30</td>
<td>Yom Kippur begins (sundown)</td>
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You Found a Pencil!

A pencil contains three types of Earth materials: graphite, clay, and aluminum.

**Graphite:** A “core” of the mineral graphite makes up the writing material of a pencil and is surrounded by a tube of wood that can be sharpened into a point. Graphite is a very soft mineral that rubs off easily onto paper and is the crystalline form of carbon. It occurs naturally in metamorphic rocks such as marble, schist, and gneiss.

**Clays:** Clay minerals (such as bentonite or kaolin) are used in pencils to help the graphite stick together. Clay minerals are composed of thin sheets of Al, Si, and O and form in the presence of water.

**Aluminum Ore (Bauxite):** A small piece (ferrule) of aluminum metal is used at the end of a pencil to secure the eraser. Bauxite is a heterogeneous (mixed) material made up of aluminum hydroxide minerals, plus various types of silica, iron oxides, titanium, aluminosilicate, and other impurities.

**PROCEDURE**

1. Briefly discuss mining. How do people extract Earth materials from the solid Earth? What products are made from mined materials?

2. Look around the classroom. Make a pile of objects you think might be made from mined materials. For objects unsafe to lift, print out and affix copies of the “I’m made from” label at left.

3. Visit [www.usgs.gov/scavengerhunt](http://www.usgs.gov/scavengerhunt) online for an answer key and to learn more about the mined materials that go into many classroom objects. Consider, for example, an ordinary pencil. Explore each material’s pathway from Earth to final product through a group discussion, team presentations, or with labeled artwork.

Learn additional information at [www.usgs.gov/scavengerhunt](http://www.usgs.gov/scavengerhunt).

**I’M MADE FROM EARTH MATERIALS!**

#classroomsavengerhunt
#madefromearthmaterials

**Minerals Under Your Roof**

**LEARNING ACTIVITY:**

Did you know that many of the supplies in your classroom are made from Earth materials that are mined from solid Earth? What can you find that you think may have been mined?

This activity can be done in small teams as a contest or with the whole class, depending on grade level. In this activity, you will make a pile of items you think may have come from the solid Earth. You can then use U.S. Geological Survey resources to trace the items back to their source within the Earth and understand how they are formed.

**PROCEDURE**

1. Briefly discuss mining. How do people extract Earth materials from the solid Earth? What products are made from mined materials?

2. Look around the classroom. Make a pile of objects you think might be made from mined materials. For objects unsafe to lift, print out and affix copies of the “I’m made from” label at left.

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Learn additional information at [www.usgs.gov/scavengerhunt](http://www.usgs.gov/scavengerhunt).

**NGSS CONNECTIONS**

- Science and Engineering Practices — Constructing Explanations and Designing Solutions
- Disciplinary Core Ideas — Natural Resources
- Cross-Cutting Concepts — Cause and Effect
LEARNING ACTIVITY:

Carbon Travels

GRADES 5-12

MATERIALS
- Poster materials
- Class set of dice
- Station instructions and signs
- Carbon journey table
- Full teacher’s guide and worksheets at http://globecarboncycle.unh.edu/cmap2.shtml

We find carbon everywhere on Earth — in trees, rocks, fossil fuels, oceans, and even you! Carbon doesn’t stay in one place, though. Scientists study how carbon moves from one place to another. This is the carbon cycle.

The Industrial Revolution, starting in the 1700s, saw a move to large-scale manufacturing and the use of new technologies, such as steam power and electricity. This led to a huge increase in burning of carbon-rich fossil fuels, releasing into the atmosphere carbon (in the form of carbon dioxide) that had been buried underground for millions of years. How did these human actions affect the carbon cycle?

PROCEDURE
(For Teacher)

1. Tell students that you want to begin teaching about carbon today, but you cannot seem to find it. Ask students if anyone saw carbon today on their way into class.
   - Record the ideas of where carbon is found on the board.
   - Solicit additional ideas about the carbon cycle. What is carbon? Where is it found? How does carbon move from one place to another? What forms does it take?
   - Differentially highlight/circle the pools and fluxes.

2. Group student’s ideas into the major global carbon pools.

3. Hand out copies of the Journey Table and a die to each student and tell them the game will begin pre-1700 (before the Industrial Revolution). Model what to do at a station and how to use the Journey Table, emphasizing the importance of including all results, even if they remain at the same pool repeatedly.

4. Divide students so there is an equal number of students (if possible) at each station to begin the activity.
   - Students follow the instructions, move around the room at their own pace and record results in their tables. After 10 turns, they stand aside to show they are done.
   - Flip over the instructions to begin the post-1700 simulation. Students complete another 10 turns under the new conditions.

5. Each student adds the path of his/her journey on the board: one diagram for pre-1700, and one for post-1700.
   - Each time a student moved from one pool to another, they should draw an arrow. If they remained in a pool until the next turn, they should circle the pool.
   - Students begin to work independently on completing “What’s Your Carbon Story” until all students’ data are displayed on the board.
   - Consider students’ data. What was different before and after 1700? What do the differences reflect? Burning of fossil fuels and land use change?

NGSS CONNECTIONS
- Science and Engineering Practices — Developing and Using Models
- Disciplinary Core Ideas — Earth’s Systems
- Cross-Cutting Concepts — Energy and Matter
Daylight Saving Time Ends

Happy Birthday!
Alfred Wegener, German Meteorologist, Framer of Continental Drift Theory, Born 1880

Nov. 8–11, 2020: Geoscience Event: ASA-CSSA-SSSA International Annual Meeting, Phoenix, Arizona

Nov. 15–21, 2020: Geography Awareness Week

Happy Birthday!
James W. Mitchell, American Chemist Advanced the Accuracy of Trace Element Analyses, Born 1943

Nov. 16–20, 2020: Geoscience Event: EU Raw Materials Week, European Commission, Brussels, Belgium

Happy Birthday!
Guion “Guy” S. Bluford, Jr, American Astronaut, First Black Astronaut in Space, Born 1942

Happy Birthday!
Guion “Guy” S. Bluford, Jr, American Astronaut, First Black Astronaut in Space, Born 1942

Veterans Day

GIS Day (Geographic Information Systems) Day

Happy Birthday!
Alan Shepard, American Astronaut, First American in Space, Born 1923


Happy Birthday!
Guion “Guy” S. Bluford, Jr, American Astronaut, First Black Astronaut in Space, Born 1942

Happy Birthday!
Guion “Guy” S. Bluford, Jr, American Astronaut, First Black Astronaut in Space, Born 1942

Thanksgiving
LEARNING ACTIVITY:

Soil, Sand, and Gravel

V


“Most daily human activities occur on or near the Earth’s surface,” as the introduction to the map states. “Homeowners, communities, and governments can make improved decisions about hazard, resource, and environmental issues, when they understand the nature of surficial materials and how they vary from place to place.”

Using this map can help students see the connections between those surficial features, which are generally part of the geosphere, and other Earth systems. The following activity shows how a visualization map of surficial features can be used to consider the interactions of the geosphere, hydrosphere, biosphere, and atmosphere.

PROCEDURE

1 View the map and legend at https://pubs.usgs.gov/of/2003/of03-275/. Notice that different colors represent different types of surficial features (sediments). The map colors indicate types of sediments that differ in size, material, textures, amount of organic material, and so on. The map legend tells about various surficial feature materials.

2 Discuss: What are areas with similar surficial features? Where are there surficial features that seem to be related to features such as coastlines, mountains, or rivers? How might we model the interaction of rain, streams, and oceans with various sediments?

3 Within your group, fill three clear plastic cups equally, about halfway, with a different type of sediment (soil, sand, and gravel). Describe the sediments in the cups. How are they different?

4 Fill a measuring cup with water. With a pen and paper, record the amount of water in the measuring cup. Pour some into one of the clear plastic cups, adding water until it is just above the level of the sediment. Record the amount of water now in the measuring cup. Calculate the amount of water poured over sediment in the clear plastic cup. Repeat this process for each sediment.

5 Discuss: For which type of sediment does the most water go into the cup? (Typically, larger sediments allow more water in.) How can water go into the sediments? (It seeps into spaces between particles.)

6 Consider the sediment cups as models of surficial features. How might the different surficial features affect the amount of water (hydrosphere) available to plants (biosphere)? (In general, when water seeps into the sediments, it is available to plants.)

7 Now, return to the U.S. Geological Survey map online. What surficial features do you see in your part of the country, near major rivers, and along coastlines? Why do you think these patterns occur?

EXTENSION

For an activity relating to surficial features that you can do in the school yard, go to GLOBE at https://www.globe.gov/documents/352961/41672784-81d0-4189-81f4-280acaa3364d.

NGSS CONNECTIONS

• Science and Engineering Practices — Engaging in Argument from Evidence
• Disciplinary Core Ideas — Earth Materials and Systems
• Cross-Cutting Concepts — Cause and Effect: Mechanism and Explanation

Source: America Geophysical Union. Adapted with permission.
Happy Birthday!
Clyde Wahrhaftig, American Geologist, Environmentalist, and Recipient of GSA’s Kirk Bryan Award for Geomorphology, Born 1919

Did You Know?
Aniakchak National Monument, One of World’s Finest Examples of Dry Caldera, Established 1980

Hanukkah Begins
(Sundown)

Did You Know?
First of Three Earthquakes in New Madrid, Missouri (Estimated Magnitude 8.0), Causes Mississippi River to Change Course, 1811

Happy Birthday!
Allan Cox, American Geophysicist, Paleomagnetism Specialist, and Author of Two Books on Plate Tectonics, Born 1926

Hanukkah Ends

Did You Know?
Albert Michelson Receives the Nobel Prize in Physics, Becoming the First American to Win the Nobel Prize in a Science, 1907

Winter Solstice

Did You Know?
Pierre-Jules-César Janssen Flew in a Balloon in Order to Study a Solar Eclipse, 1870

Did You Know?
American Astronauts on Apollo 8 Become the First People to Orbit the Moon, 1968

Kwanzaa

Did You Know?
Earthquake Off West Coast of Northern Sumatra (Magnitude 9.0), Sets Off Massive Tsunami, 2004

New Year’s Eve
LEARNING ACTIVITY:

Mineral Matching

GRADES 6-12

MATERIALS
- File of mineral cards to print, downloaded at http://geologymuseum.rutgers.edu/images/PDFs/mineralmatchingcards.pdf
- Computer with internet access, printer, and paper to print cards
- Scissors
- Glue, tape, or laminator to match the front and backs of cards
- Pencils and paper

The comfort of our daily lives is built largely on our use of natural resources. However, natural resources that are often overlooked include Earth’s mineral resources. The minerals contained in rocks are just as vital to make the things we need as are water and fossil fuel resources.

Our earliest human ancestors used minerals to shape tools out of stone. Ancient Egyptian, Greek, Roman, and Aztec societies also used minerals in their everyday lives. Valued for their unique properties, minerals help humans achieve new advances in technology, build everything from cars to spaceships, and even help keep us healthy.

Look around the room. You are surrounded by minerals that make up the bricks, tiles, windowpanes, concrete, plumbing and wiring running through the walls, and even the walls themselves. In this activity you will examine some ways minerals are used in our everyday lives.

PROCEDURE
1. Break into small groups of 2-4 students and discuss: What are minerals, and where can they be found? Write down your ideas and discuss with the class.
2. Think about and make a list of everyday objects that might be made from minerals.
3. Obtain a packet of mineral cards from your teacher. Arrange them on a table with the cards of everyday items and products in one row, and the cards of the minerals in a second row.
4. Work together to match the everyday product with the mineral from which it is made. Continue until you have matched all 20 sets of cards.
5. Check your answers by flipping the mineral card over and reading through the information to find the correct mineral use illustrated on each card.
6. Read through the information provided on the cards and write down any additional everyday objects or uses of minerals you missed in step 2.
7. Look at your list and record answers to the following and discuss with others: What mineral-based product surprised you? Which one is the most important for society, and why?
8. The terms “open pit” and “underground mining” are used to describe the methods of extracting minerals from the ground. Choose one of these methods and research the process online.
9. Think about the teams that would need to work together to make these mining methods a success. Make a list of three to four professionals (scientists, engineers, etc.) who would work together to accomplish this.
10. Finally, minerals are a nonrenewable resource, and their extraction has many effects on local ecosystems. Write down three ways the environment would change, for better or worse, as a result of mining operations. Discuss your ideas.

For K-5 students: Do steps 1-5 only, then discuss natural resources and minerals with your teacher.

NGSS CONNECTIONS
- Science and Engineering Practices — Obtaining, Evaluating, and Communicating Information; Asking Questions and Defining Problems
- Disciplinary Core Ideas — Human Impacts on Earth Systems; Natural Resources
- Cross-Cutting Concepts — Structure and Function; Patterns

Source: Geological Society of America. Adapted with permission. Activity written by Lauren Neitzke Adamo, Julia Criscione, Ria Sarkar, and Carla McAuliffe in collaboration with the Geological Society of America, the Rutgers Geology Museum (https://geologymuseum.rutgers.edu/) and TERC (https://www.terc.edu/).

Card game by Geological Society of America, Rutgers Geology Museum and TERC. Copper image: Johnathan Zander, CC BY-SA 2.5
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<tr>
<th>Sunday</th>
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<td></td>
<td>New Year’s Day</td>
<td>Jan. 1–31, 2021: Hawai'i Volcano Awareness Month</td>
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<td>17</td>
<td></td>
<td>Happy Birthday!</td>
<td>Benjamin Franklin, U.S. Scientist, Pioneering Inventor and Diplomat, Born 1706</td>
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<td>Happy Birthday!</td>
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<td>26</td>
<td>Did You Know?</td>
<td>Earthquake (Magnitude 8.7–9.2) Occurs Along the Cascadia Subduction Zone and Causes a Tsunami on the Coast of Japan, 1700</td>
<td></td>
<td></td>
<td>Happy Birthday!</td>
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<td>31</td>
<td>Did You Know?</td>
<td>Earthquake (Magnitude 7.0) Strikes Capital of Haiti, Causing Nearly 300,000 Deaths, 2010</td>
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</table>

Did You Know?
Cleveland Abbe Becomes the Chief Scientist of the Newly Formed U.S. Weather Service, 1871

Did You Know?
Voyageurs National Park, Featuring Some of North America’s Oldest Rocks, Established 1975

Happy Birthday!
Benjamin Franklin, U.S. Scientist, Pioneering Inventor and Diplomat, Born 1706

Happy Birthday!
Martin Luther King, Jr. Day

Happy Birthday!
Andrija Mohorovicic, Croatian Physicist, Seismologist and Meteorologist, Namesake of Base of Earth’s Crust, the “Moho,” Born 1857

Happy Birthday!
Friedrich Mohs, German Geologist and Mineralogist, Creator of Scale of Mineral Hardness, Born 1773

American Geosciences Institute | www.americangeosciences.org

January 2021
Every day the aggregate industry sifts millions of tons of rock pieces to make important and valuable construction materials from raw resources of crushed stone or gravel. Engineers specify size ranges of rock pieces to be used to make concrete, asphalt, and so on. We depend on concrete or asphalt for sidewalks, highways, and basement floors and walls, among many other things — in fact, more than 20,000 pounds (10 tons) of size-specific aggregates are needed for every person per year in the United States!

In this exercise you will sift (screen, as it is known in the industry) randomly sized rocks into groups of specified size ranges. This process not only allows the screened product to meet an engineer’s requirements for use, but also increases the value of the material over the value of the original, random-sized material.

PROCEDURE

1. Take the crushed stone and sift it using Screen A. This produces (on top) the clean, crushed stone that is used along with sand and Portland cement to make concrete pavement. Use Screen B to sift what fell through. What stays on Screen B is the “chips” used with sand and asphalt to make asphalt pavement.

2. Estimate the amount (weight or volume) of material retained on Screen A, then estimate the amount retained by Screen B, and then estimate the amount passing through Screen B. Added together these should add up to 100 percent.

3. Assume the material coarser than Screen A is worth $15/ton, the next smaller material is worth $10/ton, and the dust worth $3/ton. What is the value of 10 tons of material sized to each of these specifications? Using the estimated percentages, which resulting pile is most valuable?

4. Discuss:
   - What size would you try to maximize for production? Minimize?
   - What factors affect the size of the materials (such as geologic, equipment, production)?
   - Where could the type of rock you used be obtained in nature? Where have you seen a mine or quarry?
   - How would you design a machine to sort rock pieces by size?
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<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>1</td>
<td>Groundhog Day</td>
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<td>2</td>
<td>World Wetlands Day</td>
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<tr>
<td>3</td>
<td>Did You Know? The First of Five Strong Earthquakes (Magnitude 7.0) Hit the Region of Calabria in Southern Italy and Produce Significant Tsunamis, 1783</td>
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<tr>
<td>4</td>
<td>International Day of Women and Girls in Science</td>
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<td>5</td>
<td>Did You Know? Death Valley National Park, Lowest Below Sea Level in North America, Proclaimed 1933</td>
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<tr>
<td>6</td>
<td>Happy Birthday! Charles Darwin, English Naturalist, “The Origin of Species” Author, Born 1809</td>
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<td>7</td>
<td>Did You Know? Earthquake (8.8 Magnitude) Shakes Chile, Triggering a Tsunami that Hits Hawai‘i, 2010</td>
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<td>8</td>
<td>Presidents Day</td>
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<td>Valentine’s Day</td>
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<td>10</td>
<td>Ash Wednesday</td>
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<td>11</td>
<td>Did You Know? John Glenn Becomes First American to Orbit the Earth, Flying Aboard Spacecraft Friendship 7, 1962</td>
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<td>12</td>
<td>Did You Know? Charles M. Hall, a Young U.S. Chemist, Invents an Inexpensive Method for Producing Aluminum by Separating It from Its Bauxite Ore, 1886</td>
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<tr>
<td>13</td>
<td>Did You Know? Grand Canyon National Park, Exhibiting Largest Section of Geologic Time on Earth, Established 1919</td>
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<td>14</td>
<td>Did You Know? Death Valley National Park, Lowest Below Sea Level in North America, Proclaimed 1933</td>
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<td>Happy Birthday! Charles Darwin, English Naturalist, “The Origin of Species” Author, Born 1809</td>
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<td>18</td>
<td>Did You Know? Grand Canyon National Park, Exhibiting Largest Section of Geologic Time on Earth, Established 1919</td>
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February 2021
LEARNING ACTIVITY:

Modeling an Oil Reserve

GRADES 8-12

MATERIALS
- A cardboard box or other opaque container with cardboard lid
- Sand
- Marker pens
- Clear plastic drinking straws
- Graph paper
- Small rock samples
- Balloon with water
- Food coloring
- Masking tape
- Bamboo kebab skewer

Since 1970, oil and natural gas have provided more than half of the energy used each year in the United States to produce electricity, heat, transportation fuels, and many everyday products from balloons to vitamins. Oil and natural gas are forms of petroleum, a word that literally means “oily rock.” Petroleum is called a fossil fuel because it is geologically very old and is found in the ground, like fossils.

Abundant oil and natural gas form only where conditions in the Earth are just right. Doing this investigation will help you understand how geoscientists identify and explore petroleum-rich reserves.

PROCEDURE
1. In a small box or opaque container set up the model similar to the one shown in the illustration. Place a small balloon containing colored water (to represent oil) into the layers. Think carefully about where to place your oil reserves in the model. Putting it in the middle might be too obvious, or placing it against the side of the box might be too confusing!

   - Mark the sides of the box “North,” “South,” “East,” and “West.” Make a map of your model to show the location of the water-balloon “oil reserve.”

   - Place a lid securely on the box and fasten it with masking tape. Exchange your model with another group.

2. With the other group’s box, you will model the method used by exploration geologists in the field. You may not move the box, and you may not look inside it. Attach graph paper to the lid of the box. Tap on the box and listen for an area that “sounds different.” Use the graph paper to record the locations of areas that sound different and seem like likely candidates for oil exploration.

3. Probe the box to search for “oil” (the water balloon) in the places you identified. Mark off divisions of one centimeter on a bamboo skewer, beginning at the bottom. Use the bamboo skewer to penetrate the box lid at the location where you think the oil may be located.

   - Probe gently through the sand. Look at the skewer for evidence of “oil.” This models the drilling process. Remember: Every centimeter of depth that you drill costs $150,000. In addition, each time you move to a new spot to drill costs $75,000.

   - Keep a record of how many centimeters you drill and how many times you move the skewer to a new spot, so you can calculate the total cost of your exploration. Continue drilling until you find “oil.”

4. What was the total cost of your exploration? If you were to start over, how would you change your exploration procedure to save money? Compare your results with the group that constructed the model. Look at their map. Was the oil deposit where they said it should be? What could you have done to make your exploration more cost-effective?

NGSS CONNECTIONS
- Science and Engineering Practices — Developing and Using Models
- Disciplinary Core Ideas — Natural Resources
- Cross-Cutting Concepts — Systems and System Models
LEARNING ACTIVITY:

Engineering Biodegradable Drifters

**GRADES 7-10**

**MATERIALS**
- Oranges, apples, and potatoes
- Twigs or bamboo skewers
- Corn-based eating utensils
- Wooden toothpicks
- Dried seaweed, corn husks, or other biodegradable sheets (e.g., cotton or bamboo) for flags or sails
- Permanent markers
- Long-handled net
- Stopwatches
- Pen and paper to use as a datasheet

Drifter buoys, or drifters, are scientific equipment that collect data from the surface of a body of water. Drifters allow scientists to track currents, temperature, salinity, and other factors as they float freely and transmit information.

The National Oceanic and Atmospheric Administration (NOAA) has hundreds of drifter buoys across the globe. These drifters gather and share information and are powered by batteries in the round floating body of the buoy. Attached to the floating body is a “drogue.” The canvas or nylon drogue, which looks like a tail towed behind the buoy, can extend many meters below the surface of the water. It allows the buoy to be pulled by currents beneath the surface, not just pushed by winds from above. NOAA mainly uses drifters in ocean waters, but they can also be useful in freshwater.

You can explore data from these buoys and apply to “adopt” one with the NOAA Adopt a Drifter Program. Visit [www.adp.noaa.gov](http://www.adp.noaa.gov) to learn more. In this activity, you will design and build a biodegradable drifter and calculate the surface current speed of a small body of water.

**PROCEDURE**

1. Divide into small groups to build your drifter buoy, perhaps as shown in the photos above. Be creative, and decorate your drifter with permanent markers. The materials will ensure that your drifter floats, and that is what matters most.

2. Test your drifter buoy in a local creek, stream, or any naturally moving water. Wear clothes you can get wet and closed-toed shoes or waders. Bring measuring tape, stopwatches, and paper for data recording. You may want a long-handled net to catch any drifters that escape.

3. Divide your group into two sub-groups. One sub-group will stand upstream at the drop-off location. The other will stand 50 meters downstream for pick-up.
   - Set up start and finish lines using strings.
   - Drop-off teams stand in the center of the stream with their drifter. When all teams are ready, at the agreed-upon signal, release drifters while pick-up teams start the stopwatches.
   - Pick-up teams grab the drifters as they float to the finish line and record time on a datasheet.

4. Back in the classroom, calculate group drifter speeds. You will start with your distance (50 meters) divided by your time in seconds to calculate the speed in meters per second (m/s).

   You can then calculate time required for drifters to travel over longer distances, such as to the entrance to the ocean. You can use this information to calculate how long it would take a piece of debris from your local waterway to drift to the ocean.

**NGSS CONNECTIONS**
- Science and Engineering Practices — Developing and Using Models
- Disciplinary Core Ideas — Human Impacts on Earth Systems
- Cross-Cutting Concepts — Analyzing and Interpreting Data
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<td></td>
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<td>April Fool’s Day</td>
<td>Did You Know?</td>
<td>Did You Know? Earthquake (Magnitude 7.9) on Hawai‘i Island Caused a Landslide and Tsunami. The Aftershock Sequence for This Event has Continued Up to the Present day, 1868</td>
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<td>Passover Ends</td>
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<td>Did You Know? Did You Know? Arches National Park, World’s Highest Concentration of Natural Arches, Established 1929</td>
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<td>Arbor Day</td>
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<td>Did You Know? Did You Know? Soviet Union Launches Salyut 1, First Space Station, 1971</td>
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<td>Did You Know? Did You Know? Start of Mount Eyjafjallajökull Eruption in Iceland, Grounding Flights Across Europe for Almost a Week, 2010</td>
<td>April 7–11, 2021: National Environmental Education Week (EE Week)</td>
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<td>Did You Know? Did You Know? Start of Great Flood of Mississippi River Valley That Would Inundate 27,000 Square Miles, 1927</td>
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<td>Did You Know? Happy Birthday! Marie Maynard Daly, American Biochemist, the First Black American Woman in the U.S. to Earn a Ph.D. in Chemistry, Born 1921</td>
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American Geosciences Institute | www.americangeosciences.org | April 2021
A plate boundary may be shown as a line on a map that defines the edge of a tectonic plate, usually indicating where one plate meets another. Plate boundaries are further divided by the direction that the two plates are moving relative to one another.

When plates are moving towards one another, the zone of contact is called a convergent plate boundary. When plates are moving away from each other, it is called a divergent plate boundary. Plates sliding past each other horizontally do so at a transform plate boundary.

In this activity, you’ll identify plate boundaries as well as continents, countries, and bodies of water to become familiar with an area known as the “Ring of Fire.” (For teachers: To explore further, download the Mount Rainier National Park “Sister Mountain Project” activity online at https://tinyurl.com/y8pvo6ke.)

**PROCEDURE**

1. Discuss: The Pacific Rim is a conglomeration of Pacific Ocean border countries including Australia, Peru, Argentina, China, Russia, Japan, Canada, and the United States, each with its own economic, geographic, political, environmental and cultural backgrounds. The countries of the Pacific Rim have a rich history of interconnected trade, travel and geologic processes known as the Ring of Fire. How are the people living in the Pacific Rim interconnected and similar?

2. Print up your own “Pacific Rim Map” and “Mapping the Ring of Fire Handout” (https://tinyurl.com/yb4hxdu). Practice your skills at reading a map and using latitude and longitude to identify locations. Read the handout and review instructions.

3. Use various library and internet resources such as atlases, encyclopedia, and plate tectonic maps to locate and label each item on the list with colored pencils.

4. Go online to the “Mapping the Ring of Fire PowerPoint” (https://tinyurl.com/y9xye7wy) to view a slideshow with seismic maps of the Pacific Rim. During the slideshow, pause to sketch notes on your map when viewing the maps of seismic data of the Pacific Northwest, Southeast Asia, and the Pacific Rim.

5. Also during the slideshow, pause to complete questions from the slideshow on the “Mapping the Ring of Fire Student Worksheet” (https://tinyurl.com/y78oank4).

6. Draw in the plate boundaries of the plates located beneath the Pacific Ocean on your “Pacific Rim Map.”

To further explore this topic in the context of U.S. national parks, go online to Plate Tectonics & Our National Parks (www.nps.gov/subjects/geology/plate-tectonics.htm).

**NGSS CONNECTIONS**

- Science and Engineering Practices — Obtaining, Evaluating, and Communicating Information
- Disciplinary Core Ideas — Plate Tectonics and Large-Scale System Interactions
- Cross-Cutting Concepts — Patterns
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<tr>
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<td>National Teachers’ Day Did You Know? Powerful Tornado (F-5) Rips Greensburg, Kansas, 2007</td>
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<td>National Space Day</td>
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<td>Mother’s Day</td>
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<td>12</td>
<td>Did You Know? Lewis and Clark Expedition Across Louisiana Territory Begins, 1804</td>
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<td>14</td>
<td>Armed Forces Day</td>
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<td>22</td>
<td>Did You Know? Chile Earthquake (Magnitude 9.5) Is Largest Earthquake of 20th Century, 1960</td>
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<td>24</td>
<td>Did You Know? Powell Expedition to Explore Grand Canyon Begins in Green River City, Wyoming, 1869</td>
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<td>25</td>
<td>Did You Know? Mammoth Cave National Park, World’s Longest Cave System With 360 Mapped Miles, Established 1926</td>
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<td>26</td>
<td>Happy Birthday! Sally Ride, American Astronaut, Physicist, and Engineer, Born 1951</td>
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<tr>
<td>28</td>
<td>Happy Birthday! Milutin Milankovitch, Serbian Geophysicist, Best Known for Theory of Climate Change, Born 1879</td>
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LEARNING ACTIVITY:

Humanitarian Geoscience

On December 26, 2004, deep below the Indian Ocean, a powerful quake shook the earth. Waves up to 100 feet high rushed to shore. All told, the disaster claimed the lives of over 227,000 people in 14 countries.

Inspired to do what they could to prevent and lessen the impact of such catastrophes, members of the Society of Exploration Geophysicists formed a volunteer relief effort that came to be called Geoscientists Without Borders® (GWB).

Since the program’s inception in 2008, GWB has supported more than 45 projects in over 31 countries. Each year, the program supports humanitarian efforts to aid communities around the globe confronted with challenges in water management, pollution mitigation, archaeology, food security, and natural hazard preparedness.

GWB projects actively involve students attending both the higher education institutions in the countries where projects take place and where the principal investigators are based. In this activity, you will explore how you might take part in such a project, apply what you are learning about geoscience, and advance your own geoscience education while solving problems.

PROCEDURE

1. Break up into groups of 3-4 students. With your group, visit Geoscientists Without Borders® online at www.seg.org/gwb. Read about GWB’s mission, goals, and history to learn more about this innovative program. Discuss in your group: Is this a type of geoscience work in which you could imagine yourself taking part? Why or why not?

2. Click on the “Funded Projects” icon. View the world map showing various kinds of projects conducted by GWB teams. Discuss in your group: In which type of project would you be most interested in participating? Water management? Archaeology? Pollution mitigation? Earthquake, tsunami, landslide, or volcano preparedness? Something else?

3. Select one focus topic for your group. Compare your group’s selection with those of other groups in your classroom. Try to divide up the focus topics so that each group is focusing on a different topic.

4. Now that your group has settled on a focus topic — say, water management — use the icons on the world map to find a project dealing with that focus topic that interests the members of your group. For instance, your group could choose a water management project in South America, Africa, or Australia.

5. Click on the icon for that project, view any photos, and read the summary. If time allows, you might briefly skim the full report. Discuss in your group: What Earth science topics are you learning about that would be relevant if you were part of this project? Plate tectonics? The water cycle? Sediments? Explorations? Other subjects?

6. Discuss also: What were the main tasks in the projects? What were the humanitarian goals? How were they accomplished? Discuss “sustainability.” Were the projects sustainable? Who benefited from the projects?

7. Now, open the discussion to the whole classroom, and take turns allowing a representative of each group to briefly explain the project that it discussed. What was familiar to you from your Earth science studies so far? What words did you encounter that you would need to look up to understand better? What topics would you want to study further if you were tackling such problems? Why?

NGSS CONNECTIONS

- Science and Engineering Practices — Obtaining, Evaluating, and Communicating Information
- Disciplinary Core Ideas — Human Impacts on Earth Systems
- Cross-Cutting Concepts — Stability and change
<table>
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<tr>
<th>Date</th>
<th>Event Description</th>
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<tr>
<td>3</td>
<td>Happy Birthday! James Hutton, Scottish Geologist, “Father” of Modern Geology, Born 1726</td>
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<td>5</td>
<td>Did You Know? Earthquake (Magnitude 8.4) Occurs off the Coast of Southern Sumatra, Indonesia near Enggano Island, Marks the Beginning of an Ongoing Period of Seismic Activity in the Area, 2000</td>
</tr>
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<td>8</td>
<td>World Oceans Day</td>
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<td>12</td>
<td>Did You Know? Big Bend National Park, Featuring Fossilized Skeleton of Quetzalcoatlus, Largest Winged Animal, Established 1944</td>
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<td>13</td>
<td>Flag Day</td>
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<td>Juneteenth</td>
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<td>18</td>
<td>Did You Know? Sally Ride Becomes First American Woman in Space, Flying Aboard Space Shuttle Challenger, 1983</td>
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<td>22</td>
<td>International Asteroid Day</td>
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LEARNING ACTIVITY:

Core Sampling

GRADES 5-12

MATERIALS

• 1 bag of dark sand
• 1 bag of light sand
• 1 bag of soil
• 1 bag of small gravel (aquarium size)
• 10 clear plastic straws
• 1 clear plastic cup per student (8 ounce)
• Water in a spray bottle
• Plastic spoons
• Metric ruler

PROCEDURE

1 Use the ruler to measure. Place a 1 cm layer of one of the earth materials in the cup with a spoon. Mist with the spray bottle of water until damp, but not soaking.

2 Place another earth material 1 cm deep on top of the first layer. Moisten this layer with water until damp.

3 Continue alternating layers of earth materials and water. The total of layers together will be four centimeters deep in the cup.

4 Use a straw to extract a core sample by pushing the straw straight down through the layers of the cup. If you hit rock, you might find it difficult to continue. Consider how drill bits are used in real drilling to churn and break rock in the sampling path.

5 Place your finger tightly over the top end of the straw and withdraw it from the cup. Observe the layers in the straw core sample.

6 Lay several core samples from different cups side by side. Compare results.

7 Discuss: What are core samples? What are petroleum geologists looking for when they examine core samples? How do geologists use core sampling to determine the geologic formation of rocks and sediments when exploring for oil and gas?

NGSS CONNECTIONS

• Science and Engineering Practices — Analyzing and Interpreting Data
• Disciplinary Core Ideas — The History of Planet Earth
• Cross-Cutting Concepts — Patterns
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**Independence Day**
- John Glenn, American Astronaut, First American to Orbit Earth, Born 1921

**LGBT STEM Day**

**Happy Birthday!**
- James B. Pollack, American Astrophysicist and Senior Space Research Scientist at NASA Ames Research Center, Born 1938
- Florence Bascom, U.S. Geologist, First American Female Ph.D., Born 1862
- John Glenn, American Astronaut, First American to Orbit Earth, Born 1921

**Did You Know?**
- Earthquake (Magnitude 5.9) Occurs in Central Peru Causing Severe Damage and Flooding, 1969
- The National Aeronautics and Space Administration Is Founded, 1958
- Marie Tharp, U.S. Geologist, Sea Floor Cartographer, Born 1920

**Parents’ Day**
- International Friendship Day
WHAT IS EARTH SCIENCE WEEK?

The American Geosciences Institute has organized this annual international event since 1998 to help people better understand and appreciate the Earth sciences and to encourage responsible stewardship of the planet. Earth Science Week takes place October 11–17, 2020, celebrating the theme “Earth Materials in Our Lives.”

Visit the Earth Science Week website — www.earthsciweek.org — to learn more about how you can become involved, events and opportunities in your community, the monthly Earth Science Week newsletter, highlights of past Earth Science Weeks, and how you can order an Earth Science Week Toolkit.

You are invited to help keep the spirit of Earth Science Week alive all year long by posting this calendar in your classroom, office, or home. Whoever you are and wherever you go, you can celebrate Earth science!

AGI MEMBER SOCIETIES

AASP - The Palynological Society
American Association of Geographers
American Association of Petroleum Geologists
American Geophysical Union
American Institute of Hydrology
American Institute of Professional Geologists
American Meteorological Society
American Rock Mechanics Association
Association for the Sciences of Limnology and Oceanography
Association for Women Geoscientists
Association of American State Geologists
Association of Earth Science Editors
Association of Environmental & Engineering Geologists
Clay Minerals Society
Council on Undergraduate Research
Geo-Institute of the American Society of Civil Engineers
Geochemical Society
Geological Association of Canada
Geological Society of America
Geological Society of London
Geoscience Information Society
History of Earth Sciences Society
International Association of Hydrogeologists/U.S. National Chapter
International Medical Geology Association

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Society of Exploration Geophysicists
Society of Vertebrate Paleontology
Water Footprint Calculator

EARTH SCIENCE WEEK

October 11–17, 2020

FUTURE DATES

October 10–16, 2021
October 9–15, 2022
October 8–14, 2023

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