BRIDGE UP!
ENGINEERING

LESSON 3 – GRADE 4

LESSON 3 – GRADE 4: Materials

Big Idea

Earth materials are present during engineering. Recognition that rocks may be uniform or made of mixtures of different materials. Minerals can be described and classified based on their physical properties.

Essential Questions

What is our Earth made of?

What properties of rocks and minerals are present in our environment?

Background Information

When constructing bridges, engineers use different types of footings based on soil and rock conditions present. Bridges need to be built on the right type of foundation to make sure the ground can support the bridge. Engineers take soil samples to determine what will need to be constructed to secure the bridge to the Earth's surface. A soil sample tells the engineer what is below the surface of the earth. They can determine the types of rocks: metamorphic, igneous and/or sedimentary. Rocks and minerals have different strengths and qualities, and the supports the bridge will require, is determined by what the engineers find.

Standards & Benchmarks

Minnesota Science Standards

4.1.2.2 Practice of Engineering

Engineering design is the process of identifying problems, developing multiple solutions, selecting the best possible solution, and building the product.

Benchmark 4.1.2.2.2 Ideas & Constraints

Generate ideas and possible constraints for solving a problem through engineering design.

Benchmark 4.1.2.2.3 Evaluating Solutions

Test and evaluate solutions, including advantages and disadvantages of the engineering solution, and communicate the results effectively.

4.4.1 Data Analysis

Collect, organize, display and interpret data, including data collected over a period of time and data represented by fractions and decimals.

Benchmark 4.4.1.1 Collect & Interpret Data

Use tables, bar graphs, timelines, and Venn diagrams to display data sets. The data may include fractions and decimals. Understand that spreadsheet tables and graphs can be used to display data.

Wisconsin Science Standards

C.4.5 Use data they have collected to develop explanations and answer questions generated by investigations.

C.4.6 Communicate the results of their investigations in ways their audiences will understand by using charts, graphs, drawings, written descriptions, and various other means, to display their answers.

D.4.1 Understand that objects are made of more than one substance, by observing, describing and measuring the properties of earth materials, including properties of size, weight, shape, color, temperature, and the ability to react with other substances.

D.4.2 Group and/or classify objects and substances based on the properties of earth materials.

Connections with Multimedia Program

Not applicable.

Activity Description

In this activity, the students will recognize, describe, and classify the different types of rocks in different core samples. After completing the first part of the activity, students will complete pie graphs to represent the specific rock part to the whole core.

FOSS Earth Materials:

This activity could be used after the students have completed the Earth Materials unit or once they have learned about the properties of rocks and minerals, especially with the activities that use limestone and sandstone.

Vocabulary

Crystal – The solid form of a material that can be identified by its natural shape or pattern.

Earth material – The various solids, liquids, and gases that make up the earth.

Erosion – The wearing away of Earth materials by water, wind, or ice.

Geology – The scientific study of Earth's history and structure.

Hardness – A property of minerals that refers to the resistance of a mineral to being scratched.

Igneous – A rock that forms from molten or melted rock.

Metamorphic – A rock that forms into another kind of rock by heat, pressure, or both.

Mineral – A basic Earth material; a rock ingredient that cannot be physically broken down any further.

Rock – An Earth material made up of different ingredients called minerals.

Sediment – Solid matter such as sand or gravel deposited by wind, water, and ice.

Sedimentary rock – A layered rock formed by deposits of sediment.

Credit: Minnesota STEM Teacher Center. SciMathMN and the Minnesota Department of Education.

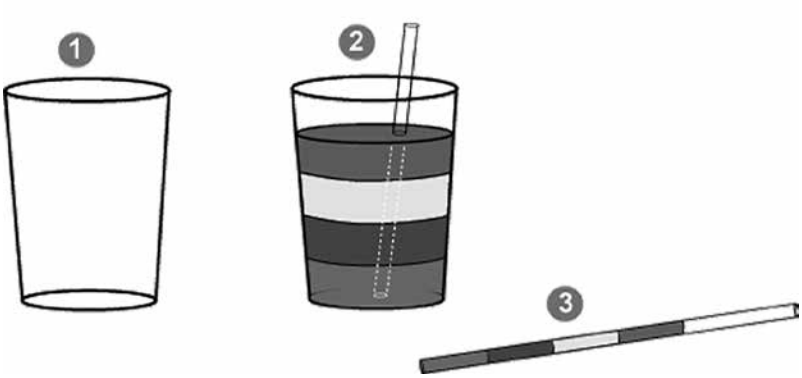
Materials

- Core samples pictures
- Pie graph templates
- Rulers
- Calculator
- Examples of rocks represented in core sample layers

Procedure

Part 1

- Each group will need: Toothpick, plastic knife, clear straw, clear cup, various colors of Play-Doh, sand and glitter to mix into individual layers.
- Prior to analyzing images of core samples of the earth materials below the river bottom, students will need to understand what a core sample is and interact with a basic idea of how a sample could be obtained. Introduce students to what a core sample is and why it is necessary.
- Using Play-Doh of varying colors each group will create a layered "foundation".



- Students will be given "tools" (toothpick, plastic knife or clear straw) to get their own "core sample" without digging up the entire foundation. Students will eventually see that the best core sample will be obtained using the straw.
- Students should draw a picture of their core sample and discuss the layers.

Part 2

- Present the different core samples (or pictures of core samples) available and describe the areas where the core samples were gathered. (If time is available, you may use a map to identify the locations of where the samples were taken).
- Group students and give each a core sample (or picture of core sample). Also provide examples of different materials present in the core samples.
- While looking at the core samples, students should work with partners to label and describe the different layers that are present in their core samples.
- After labeling the materials, measure the size of each of the different layers (to the nearest inch) and put in a table.
- Measure the overall length of the core sample and record in table.
- Compute the percentage of the whole for the present core sample materials.
- Use the pie graph graphic organizer to present the finding from the core sample.
- Display the students' findings to the class.

Assessment

Core Sample Table
https://docs.google.com/document/d/1I_pfREXRZhLC-LAmgjAC51REpudJxDzHUje5d325gnM/edit?pli=1

Name: _____

Class: _____

Date: _____

Core Sample Table

Core Sample # _____

Core Sample Location _____

Total Core Sample Length _____

MATERIAL / COLOR	MATERIAL LENGTH	FRACTION LENGTH OF TOTAL (Material Length/ Total Core Length)	% OF TOTAL	DESCRIPTION OF CORE SAMPLE
Exp. Granite/ Brown	5 inches	5/40	12.5	Grainy/Brown

(% of Total = Material Length / Total Core Length* 100)

* Use the pie graphic organizer to present the findings from the core sample
Create a pie chart: **https://www.meta-chart.com/pie**

Extensions

Have students take core samples from school yard.

Invite in a geologist from local college or university to explain the importance of soil samples.

Other Resources

Under Michigan: The Story of Michigan's Rocks and Fossils by Charles Ferguson Barker.

Soil Core Sample Activity
https://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_rock/cub_rock_lesson05_activity1.xml

Soil Core Sample Document
https://www.teachengineering.org/collection/cub_/activities/cub_rock/cub_rock_lesson05_activity1_soilcoreworksheet.pdf

Collecting Soil Samples

Photo Credit: U.S. Department of Agriculture
Agricultural Research Service

Testing Soil

Photo Credit: U.S. Department of Agriculture
Agricultural Research Service