

## Rocky Dimensions and Volume

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### VITAL INFORMATION

Site:

Challenger Learning Center of Lucas County (OH)

Mission Scenario:

Moon and Mars

Application to Mission Preparation:

This lesson provides students with an opportunity to use rock size as a classification extending their observation, predicting, and classifying skills.

Whole Group/Small Group/Individual:

Group

Team (if applicable):

Remote Team

Summary:

Students will classify rock samples using scale into one of five size categories used by geologists. Once all the rocks have been classified, a class bar graph of all findings will be constructed. Student teams then conclude by writing summary statements using the bar graph.

### LESSON AT A GLANCE

Subject(s):

Elementary, Mathematics, Science

Grade/Level:

4-6

Objective:

By the end of this lesson, students will be able to:

- Measure, collect, and organize data.
- Recognize and describe patterns.
- Develop skills of estimation.
- Develop and use graphs to describe situations.
- Use scale to classify rock samples.
- Use physical properties to classify rock samples.



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Standards:

OH- Ohio Academic Content Standards

- Subject: Mathematics
- Standard: Measurement Standard

Students estimate and measure to a required degree of accuracy and precision by selecting and using appropriate units, tools, and technologies.

- Grade Range: By the end of the 3-4 program:

Benchmark: C. Develop common referents for units of measure for length, weight, volume (capacity) and time to make comparisons and estimates.

- Grade Range: By the end of the 5-7 program:

Benchmark: G. Understand and demonstrate the independence of perimeter and area for two-dimensional shapes and of surface area and volume for three-dimensional shapes.

- Standard: Data Analysis and Probability Standard

Students pose questions and collect, organize, represent, interpret and analyze data to answer those questions. Students develop and evaluate inferences, predictions and arguments that are based on data.

- Grade: Grade Four
- Area: Data Collection

Grade Level Indicator 2: Represent and interpret data using tables, bar graphs, line plots and line graphs.

- Grade: Grade Five
- Area: Data Collection

Grade Level Indicator 4: Determine appropriate data to be collected to answer questions posed by students or teacher, collect and display data, and clearly communicate findings.

- Grade: Grade Six
- Area: Data Collection

Grade Level Indicator 2: Select, create and use graphical representations that are appropriate for the type of data collected.

- Subject: Science
- Standard: Earth and Space Sciences

Students demonstrate an understanding about how Earth systems and processes interact in the geosphere resulting in the habitability of Earth. This includes demonstrating an understanding of the composition of the Universe, the Solar System and Earth. In addition, it includes understanding the properties and the interconnected nature of Earth's systems, processes that shape the Earth and Earth's history. Students also demonstrate an understanding of how the concepts and principles of energy, matter, motion and forces explain Earth systems, the Solar System, and the Universe. Finally, they grasp an understanding of the historical perspectives, scientific approaches and emerging scientific issues associated with Earth and space sciences.

- Grade Range : By the end of the 3-5 program:

Benchmark: A. Explain the characteristics, cycles and patterns involving Earth and its place in the solar system.

- Standard: Physical Sciences

Students demonstrate an understanding of the composition of physical systems and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes demonstrating an understanding of the structure and properties of matter, the properties of materials and objects, chemical reactions and the conservation of matter. In addition, it includes understanding the nature, transfer and conservation of energy, as well as motion and the forces affecting motion, the nature of waves and interactions of matter and energy. Students also demonstrate an understanding of the historical perspectives, scientific approaches and emerging scientific issues associated with the physical sciences.

- Grade Range: By the end of the 3-5 program:

Benchmark: B. Identify and describe the physical properties of matter in its various states.

USA- National Science Education Standards

- Chapter 6: Science Content Standards
- Grade Level: 5-8
- Content Standard D: Earth and Space Science: As a result of their activities in grades 5-8, all students should develop an understanding of
- Ability/Concept: Structure of the earth system

Detail: Some changes in the solid earth can be described as the “rock cycle.” Old rocks at the earth’s surface weather, forming sediments that are buried, then compacted, heated, and often recrystallized into new rock. Eventually, those new rocks may be brought to the surface by the forces that drive plate motions, and the rock cycle continues.

- Chapter 6: Science Content Standards
- Grade Level: 5-8
- Content Standard A: Science as Inquiry: As a result of their activities in grades 5-8, all students should develop
- Ability/Concept: Abilities necessary to do scientific inquiry

Detail: USE APPROPRIATE TOOLS AND TECHNIQUES TO GATHER, ANALYZE, AND INTERPRET DATA. The use of tools and techniques, including mathematics, will be guided by the question asked and the investigations students design.

Time Required:  
45 minutes

Essential Question:

How can we use scale and physical properties to classify rock samples and represent the data in graph form?

#### Lesson Overview:

Students will use the physical property of size to classify rock samples. Each team is given a set of rock samples to classify as boulders, cobbles, pebbles, granules, or sand. Using grid paper the students draw around the sample and count the centimeter squares to indicate surface area. The teams will use the water displacement method to determine volume. Using a scale provided the students then classify their rock samples.

Boulders - more than 25 cm across

Cobbles - 6 cm - 26 cm across

Pebbles 0.4 cm to 6 cm across

Granules - 0.2 cm to 0.4 cm across

Sand - up to 0.2 cm across

Each team then adds their samples to a classroom bar graph. Each team then writes a summary statement.

#### TEACHER PREPARATION

##### Subject Matter Overview:

Review the rock size classification chart.

Relate the rock size to the erosion patterns and rock cycle processes of Earth.

##### Materials:

- 4 rocks per group
- Centimeter grid paper
- 200 ml beaker
- Tongs
- Paper towels
- Poster for bar graph
- Rock size chart

##### Preparation:

1. Prepare a poster board with the rock size categories across the bottom.
2. Prepare square units for each rock sample for the groups to place in a column to complete a classroom bar graph.
3. Gather appropriate rocks to fit into the various categories.

##### Differentiated Instruction:

Effective team strategies create a learning opportunity for all students. The role assigned to the special needs student is one that he/she could accomplish.

For English learners the visual comparison of rock sizes allows them to see the various classifications. For advanced learners, the teacher would assign the task of relating rock size to the Earth processes.

## TEACHING THE LESSON

### Lesson Management:

1. Divide the class into groups of 3 students each.
2. Assign team roles to maximize learning.
3. Provide instruction sheet to each team and a size chart for each team.
4. Allow 20 minutes for classification work giving a five minute warning.

### Teaching Tips:

- Be sure to rotate from team to team allowing them to do the work, but watching for barriers.

Clearly observe each team using the displacement volume measurement.

### Instructions:

1. Select a rock from your 4 samples.
2. Place the rock on grid paper.
3. Draw around the rock.
4. Count the number of squares it covers (surface area).
5. Fill the beaker with 100 ml of water.
6. Place the rock sample in the water.
7. Measure the volume.
8. Subtract 100 ml (the amount of water already in the beaker) from the total. Your answer is the volume of the rock itself.
9. Record the volume and the surface area of the sample.
10. Repeat the procedure (steps 1 - 9) for each of the 3 remaining rock samples.
11. Using the rock size chart, classify each sample.
12. Add your findings to the classroom bar graph.
13. After all teams have added their findings to the bar graph, write a summary statement of the class findings.

Student Worksheet:  
Rocky Dimensions Data Sheet

Rock Sample 1

Surface Area:

Volume:

Classification:

Rock Sample 2

Surface Area:

Volume:

Classification:

Rock Sample 3

Surface Area:

Volume:

Classification:

Rock Sample 4

Surface Area:

Volume:

Classification:

## Resources:

DeBruin, Jerome E. *Creative Hands on Science Experiences Using Free and Inexpensive Materials*. Good Apple, 1980. This book is an informative guide that focuses on the use of day-to-day materials, some of which are free or rather inexpensive. It places due importance on 'starter' activities, which are designed to prompt children to ask 'why' or 'what' questions. This facilitates explorations and cross-referencing for further information on the part of the child rather than memorizing facts. The author also emphasizes using English measurements and focusing on 'interdisciplinary activities via webbing.' The topics covered include teaching, planning and implementation themes for an elementary K-6 program in the first half of the book and by the latter half explanations of 100 hands-on activities. Technology resources:

Geometer's Sketchpad - <http://www.dynamicgeometry.com/>

## ASSESSMENT AND EXTENSIONS

### Assessment/Rubrics:

#### Score 3: Exceptional Achievement

Demonstrates a solid understanding of the assignment.

- \* Accurately counts the number of centimeter squares to determine surface area.
- \* Uses the displacement method to accurately determine rock volume of all 4 rocks.
- \* Correctly classifies all rocks into one of the five categories.
- \* Adds data to the class bar graph.
- \* Interprets data and explains the implications of the interpretations.

#### Score 2: Quality Achievement

Demonstrates a general understanding of the assignment.

- \* Accurately counts the number of centimeter squares to determine surface area.
- \* Uses the displacement method, but does not accurately measure the volume of all 4 rock samples.
- \* Correctly classifies 3 of the 4 rock samples.
- \* Adds data to the class bar graph.
- \* Interprets data and attempts to link the implications of the data.

#### Score 1: Some Evidence of Achievement

Demonstrates a partial understanding of the assignment.

- \* Accurately counts the squares, but does not record the data accurately in the student sheet.
- \* Is unable to use displacement method to determine the volume.
- \* Classifies at least 2 of the rock samples correctly.
- \* Adds data to the class bar graph.
- \* Sometimes interprets data incorrectly and errors in interpreting the results.

Extension Activities:

1. Ask each student to bring in a rock sample to fit into one of the five categories.
2. Have the teams add other physical property characteristics to the data sheet such as texture, color, and magnetism.
3. Have teams determine the total surface area for each sample.
4. Have teams use the geometer to create a model of a rock sample.