WHAT ARE SOME PROPERTIES OF ROCKS THAT CAN BE COMPARED?

BIG IDEA 8: PROPERTIES OF MATTER

BENCHMARKS AND TASK ANALYSES

SC.3.P.8.3 Compare materials and objects according to properties such as size, shape, color, texture, and hardness.

SC.3.N.1.1 Raises questions about the natural world, investigate them individually and in teams through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

The student:

- poses and investigate questions individually and collaboratively through free exploration and systematic investigation.
- draws conclusions based on the results of the explorations.

SC.3.N.1.2 Compare the observations made by different groups using the same tools and seek reasons to explain the differences across the groups.

The student:

- works in a group using the same tools as other groups to gather common data.
- compares groups; data and explains differences.

SC.3.N.1.3 Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.

The student:

- records in a science notebook, pictorial or written information or simple charts and graphs of investigations conducted.

SC.3.N.1.4 Recognize the importance of communication among scientists.

The student:

- understands the importance of communicating results.

SC.3.N.1.5 Recognize that scientists question, discuss, and check each other's evidence and explanations.

The student:

- understands that scientists question, discuss, and check each other's evidence and explanations.

KEY QUESTION

What are some properties of rocks that can be compared?

TEACHER BACKGROUND INFORMATION

Rocks are solid earth materials that compose the bulk of the Earth. The oldest rock known is approximately 3.7 to 3.9 billion years. Minerals are chemical elements found naturally in or on the Earth. Rocks are made up of minerals, but rocks themselves are not minerals. Rocks come in all shapes, sizes and colors. They can be found almost everywhere. Throughout history, rocks have been used as tools, weapons and building materials.

Soil, a thin blanket covering the bedrock of the Earth, is created as part of the rock cycle. Erosion is the wearing away and movement of rocks and soil by natural forces. Rocks slowly break apart and weather into small, jagged bits and pieces, eventually becoming smooth. Soil, however, is much more than bits of rocks. Soil also contains air, water, humus, and recycling organisms, such as earthworms. It takes hundreds of years to build just a few centimeters of topsoil.

MATERIALS

Per student
magnifying glass
science notebook
rock

Per group
tile (can be purchased at Home Depot)
chalk
small piece of granite (or marble)
various rocks to classify

SAFETY
Remind students not to place objects in their mouths.

TEACHING TIPS
Do not require students to name the rocks. Students are only comparing rocks according to the properties of shape, color, texture, size, and hardness.

Rocks can be difficult to find in Florida you may want to ask students and other teachers to bring rocks back form trips they take out of state. Begin a collection early in the year and keep for following years. Much of what students find around school is usually not rock but pieces of cement. This can be kept for comparison as a non-example. Many educational and science suppliers offer rock sample sets for purchase.

ENGAGE
1. Hold up two rocks (one smooth and one bumpy).
2. *What is the same about these two rocks?*
3. *What is different about these two rocks?*
4. *How else can we compare these two rocks?*
5. Give each group of students a group of rocks.
6. Tell students to work together to group the rocks any way they want.
7. *How did you group your rocks?*
8. *Why did you decide to group your rocks by _____?* (Size, color, shape, texture, etc)
9. *Why are we sharing our ideas of how to compare rocks with each other?* (Scientists communicate with each other so everyone can have the same information*)*

EXPLORE
Day One:
1. Distribute a rock and magnifying glass to each student. Ask students to closely examine their rocks.
2. Next, the students should share their observations with a buddy (think/pair/share).
3. Direct students to draw a diagram (labeled picture) of their rock in their science notebook.
4. Ask several students to share their observations with the class.
5. Challenge one student to describe a rock using only <u>one</u> word.
6. Ask all students whose rocks have the same property as that given by the first student to stand. Ask: *What do we know about the rocks of the students who are still sitting?* (Example: If the word given was smooth, the students who are still sitting should have rocks that are not smooth.)
7. Write the descriptive word on the board (smooth) and also write on the board the words that describe the other rocks (not smooth).
8. Have all of the students take their rocks and stand under the word that describes their rock. (Everyone should be standing under one of the descriptive words.)

9. Have the students sit down. Repeat this process with a different descriptive word given by another student. (If a student gives a quantitative description, such as big or little, the class may need to discuss a way to define those terms so everyone can agree on what they mean. For example, to be small, must a rock fit under your hand?)

EXPLAIN

1. Ask: *Did you stand with the same classmates each time? Why not?*
2. *What are some things (attributes) that we classified our rocks by?* (Size, shape, color, texture)
3. *How did you decide if your rock belonged in the group described?*
4. Continue questioning, helping students discover that rocks may have some properties that are the same as those of other rocks and some properties that are different.
5. Tell students that tomorrow you are going to learn another property that can be used to compare rocks.

EXTEND AND APPLY

Day Two:

1. Review the ways that rocks can be compared (texture, size, shape, and color).
2. Tell students that there is another property that can be used to compare rocks.
3. *Any guesses of the other property that can be used to compare rocks?*
4. Give each group a small tile, a piece of chalk, and a piece of granite.
5. Tell students to try and write on the tile using each rock.
6. *What happened?* (The chalk made a mark but the granite did not)
7. *Why do you think that is?* (The granite is harder than the chalk)
8. Tell students that scientists classify rocks based on hardness using a streak test, which is what they just did.
9. *Which rock is harder, chalk or granite? How do you know?*
10. *What are some ways to compare rocks?* (Size, color, shape, texture, and hardness)

Day Three:

1. Give groups a group of rocks.
2. *What are some properties we can use to compare these rocks?* (Size, color, shape, texture, and hardness)
3. *Choose one property as a group but don't tell anyone else! Put your rocks in groups based on your secret property.*
4. Have the class move with you to one group's separated rocks.
5. Allow students to ask the group questions to try to guess the secret property.
6. Continue process until each group has had a turn.
7. *Scientists question, discuss, and check each other's evidence and explanations. Why do you think this is important in the scientific community?*
8. *Why is it important for us to question each other's comparing of rocks?* (To share information with each other, to check each other, to make us think deeper about what we are doing in science)

ASSESSMENT

Allow students time to explain in their science notebooks how they compared rocks to each other using different properties (size, color, shape, texture, and hardness).

MASS AND VOLUME OF SOLIDS AND LIQUIDS

BIG IDEA 8: PROPERTIES OF MATTER

BENCHMARKS AND TASK ANALYSES

SC.3.P.8.2 Measure and compare the mass and volume of solids and liquids.
The student:

- uses appropriate science tools to measure the mass and volume of various solids and liquids and records the data.
- observes and compares the mass and volume of solids and liquids.

SC.3.P.8.3 Compare materials and objects according to properties such as size, shape, color, texture, and hardness.
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The student:

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SC.3.N.1.3 Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.
The student:

- records in a science notebook, pictorial or written information or simple charts and graphs of investigations conducted.

KEY QUESTION

Do all liquids have the same mass? The same volume?
Do all solids have the same mass? The same volume?

TEACHER BACKGROUND INFORMATION

Mass is defined as the measure of the amount of matter in a solid, liquid, or gas. All solids, liquids, and gases have mass because they are all made of matter. Mass is recorded in units such as kilograms or

grams. A balance is used to measure the mass of an object. A gram (g) set is used with a balance to find the mass of an object.

Volume is the amount of space an object takes up. Volume can be measured using a graduated cylinder and water. It is commonly measured in milliliters (mL).

Per group

1 graduated cylinder
4 baby food jars
1 balance with gram set
paper towels
masking tape
1 permanent marker

3 oz. cup of each solid
macaroni
popcorn kernels
sand
pinto beans

100 mL of each liquid
water
orange juice
milk
liquid soap

SAFETY

Remind students not to eat or drink any of the items.

TEACHING TIP

Have students measure the liquids they will need for Part 2 of the activity:

- Use a graduated cylinder to measure 100 mL of water.
- Pour 100 mL of water into each of the four baby food jars.
- Mark the 100 mL level with masking tape.
- Empty the water.
- Use masking tape and a permanent marker to label the four containers with the names of the liquids.
- Pour 100 mL of each liquid into the labeled jar.

If baby food jars are not available, use plastic test tubes with lids. One place to order baby soda bottles is: http://www.stevespanglerscience.com/search?sSearch=baby+soda+bottles&sClass=Product&sType=

ENGAGE (Part 1)

Display a tray holding the 3 oz. cups containing the solid materials the students will be exploring. Show them that each material takes up exactly the same amount of space – 3 oz., so they are all equal in volume. Ask students if they think the substances are also equal in mass.

EXPLORE (Part 1)

1. Have one student from each group go to a designated table and fill four 3 oz. cups to the brim with each of the four substances: popcorn kernels, sand, pinto beans, and macaroni. Use an index card to level each material.
2. Create a class data table that students will copy in their science notebooks.
3. Ask students to heft (lift) the materials, predict their order from heaviest to lightest, and record.

4. Distribute the balances and gram sets and direct students to predict the mass of the first material and record on data table. Then have them find the actual mass and record this on the data table.
5. Have students continue this process - predict and then measure each material - until they have found the estimated and actual mass for each of the four materials.

EXPLAIN (Part 1)

1. *How did the order for mass determined by hefting compare with the actual order after measuring?*
2. *How did you know that all the materials had the same volume?* (Each one occupied the same amount of space in the 3 oz. cups.)
3. *Did all the materials have the same mass?* (no)
4. *Why do you think the materials had different masses?*
5. *Which solid had the most mass?*
6. *Which solid had the least mass?*
7. *What can you conclude about the masses of solid materials when their volumes are equal?* (The masses are not likely to be equal, even though the volumes are.)

ENGAGE (Part 2)

We measured different kinds of solid materials earlier, and learned that even though they had equal volumes, they did not have equal masses. Ask: *What else could we measure in the same way?* (liquids)

EXPLORE (Part 2)

1. Tell students they are going to repeat the activity they did earlier, but this time they will be exploring the mass of equal volumes of different liquids: milk, orange juice, water, and liquid soap.
2. Create a class data table that students will copy into their science notebooks.
3. Have students use the graduated cylinder and the baby food jars to measure exactly 100 mL of each liquid. Label the jars with masking tape.
4. Have students estimate the mass of each liquid and then find the actual mass and record.
5. Have students continue this process – predict and then measure each material - until they have found the estimated and actual mass for each of the four materials.

EXPLAIN (Part 2)

Did all the liquids have the same volume? (yes)
Did all the liquids have the same mass? (no)
Why do you think the liquids had different masses?
Which liquid had the most mass?
Which liquid had the least mass?
What can you conclude about masses of liquids when their volumes are equal? (The masses are not likely to be equal, even though the volumes are.)
How does this investigation compare with the investigation of the solid materials?

EXTEND AND APPLY

Student instructions:

- Find the mass of the empty graduated cylinder.
- Pour 20 mL of water into the graduated cylinder.
- Find the combined mass of the graduated cylinder and the water.
- Subtract the two measurements to find the mass of the 20 mL of water.
- Observe that the 20 mL of water has a mass of *approximately* 20 g because the mass and volume of water are equal.

- Predict in grams the mass of 10 mL of water.
- Repeat the above procedure. (The 10 mL of water has a mass of 10 g.)
- What would the mass of one mL of water be? (1 mL of water has a mass of 1g.)

ASSESSMENT

Have students respond in their journals about what they would expect to find if they investigated to find the mass of four different substances of equal volume: 5 oz. each of pasta, salt, sugar, and soil.

COMPARING MASS OF GRAPES AND CARROTS

BIG IDEA 8: PROPERTIES OF MATTER

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KEY QUESTION

What is the difference in the mass of a carrot and a grape?

TEACHER BACKGROUND INFORMATION

Mass is defined as the measure of the amount of matter in a solid, liquid, or gas. All solids, liquids, and gases have mass because they are all made of matter. Mass is recorded in units such as kilograms or grams. A balance is used to measure the mass of an object. A gram (g) set is used with a balance to find the mass of an object.

MATERIALS

Per group
balance
gram set
grape
whole carrot

SAFETY

Remind students not to eat anything during science without adult permission.

TEACHING TIPS

1. Teach mass for several days using various materials allowing students to practice the use of the balances and gram sets.
2. Refrigerate the grapes and carrots to use for the volume lesson.
3. Integrate as many of the math measurement benchmarks as possible.

ENGAGE (Day 1)

1. Show students a balance.
2. *What do you observe about this balance?*
3. *What do you think is in each bucket?* (children tend to answer 'nothing' but the true answer is 'air')
4. Challenge students to balance the air in the buckets.
5. Pass out only the balances.
6. Circulate the room asking students how they will know the air is balanced. (Possible answers include that the line and the arrow will be aligned or the buckets will be even)
7. If students are having a difficult time balancing the air, give hints in the form of questions. For example, *I wonder what that cube is for? Do you have any ideas?*
8. Allow groups to explain how they balanced the air to the rest of the class.
9. Allow time to practice using the balance to find out which classroom items are heavier and lighter than others (box of markers will be heavier than pencil because the bucket the pencil is in will be higher than the bucket containing the markers).

EXPLORE (Day 2)

1. Allow students to observe a gram set.
2. *What do you observe (notice) about the gram set?*
3. *What do you think a gram set may be used for?*
4. Tell students that mass is the amount of matter in an object and that the gram set will be used to measure the amount of mass.
5. *If I put an object in the red bucket, where do you think the grams should go?* (yellow bucket)
6. Demonstrate to students how to balance the air, place an object in the red bucket, place the grams one at a time in the yellow bucket until the arrow and line are matched up (buckets are balanced), and add up the grams to find the mass of the object. Record the mass on the board.
7. Allow students time to practice finding the mass of classroom objects. Require that students record information in their science notebook.

EXPLAIN (Day 2)

1. *How did you find the mass of objects?*
2. *What are some important things to pay attention to when finding the mass of an object (balancing the air first, not moving the cube once grams go into the bucket, placing grams in one at a time, waiting for the balance to stop moving before adding more grams).*

EXPLORE (Day 3)

1. Show students a grape and a carrot.
2. *What do you observe about the grape and the carrot? (ask guiding questions until children tell about the size, color, shape, etc)*
3. Allow time for students to draw diagrams (labeled pictures) of the grape and the carrot.
4. *What could we do with these to learn something about both of them?* (observe, find the mass, etc)

5. Review how to use a balance and gram set.
6. Remind students to record their data in a way that makes sense to them in their science notebooks (this would include the mass of the carrot and the grape labeled, including the 'g' for grams).

EXPLAIN (Day 3)

1. Create a class data table with the labels: mass (g) across the top (leave space for a title), on the left write carrot in one box and grape in a box underneath carrot.
2. Record group responses for the mass of the carrot and the grape.
3. Discuss data.
4. *Why do you think the grape numbers are close?* (grapes were about the same size)
5. *Why do you think the carrot numbers are close?* (carrots were about the same size)
6. *Why are the carrot and grape numbers so different?* (carrots have more mass than grapes)
7. *What evidence do we have that carrots have more mass than grapes?* (the data table shows that the carrot has __grams and the grape has __grams and ___(carrot number) is larger that ___ (grape number) so carrots have more mass than grapes*)*
8. Allow time for students to respond to key question in science notebooks.

EXTEND AND APPLY

Allow students to compare the mass of classroom objects of their choosing. Repeat Explore and Explain from above replacing carrots and grapes with classroom items.

ASSESSMENT

Check science notebooks for evidence of understanding the key question, complete and accurate data tables, and accurate diagram of grape and carrot (including mass of each).

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KEY QUESTION

What is the difference in the volume of a carrot and a grape?

TEACHER BACKGROUND INFORMATION

Volume is the amount of space an object takes up. Volume can be measured using a graduated cylinder and water. It is commonly measured in milliliters (mL).

MATERIALS

Per group
graduated cylinder

grape
whole carrot
water
marbles

SAFETY

Remind students not to eat anything during science without adult permission.

TEACHING TIPS

1. Teach volume for several days using various materials allowing students to practice the use of the graduated cylinders.
2. Integrate as many of the math measurement benchmarks as possible.

ENGAGE

1. Give a graduated cylinder to each group of students.
2. *What do you observe about this graduated cylinder?*
3. *Why do you think this tool has lines on it?*
4. Tell students that they need to put 100 mL of water in the graduated cylinder.
5. Give groups the marbles.
6. Tell students to put marbles in the water, one at a time, and observe what happens each time.
7. *What happened each time you put a marble in the water?* (Water level rose)
8. *Why do you think that happened?* (Marble pushed water out of the way to make room for itself*)*
9. *Think about when you get into the bathtub. What does the water level do?* (rises) *Why?* (to make room for me)
10. Tell students that the amount of space an object (marble, you) takes up is called volume.

EXPLORE

1. Show students a grape and a carrot.
2. *What do you observe about the grape and the carrot? (ask guiding questions until children tell about the size, color, shape, etc)*
3. Allow time for students to draw diagrams (labeled pictures) of the grape and the carrot.
4. *What could we do with these to learn something about both of them?* (observe, find the mass, etc)
5. Place 100 mL of water in a graduated cylinder. Write 100 mL on the board.
6. Place 10 marbles in the water.
7. Have a student come up and read the measurement of the water. Write measurement on the board above the 100 mL (measurement should be more than 100 mL).
8. Tell students to find the difference between new measurement and 100 mL (subtract).
9. The final number is the volume of the 10 marbles.
10. Practice with a few more numbers.
11. Allow students time to put the grape in the water.
12. Direct them to calculate the volume of the grape. Record their data on a class data table.
13. Allow students time to put the carrot in the water.
14. Direct them to calculate the volume of the carrot. Record their data on a class data table.

EXPLAIN

1. *How did you find the volume of a solid (marble, grape carrot)?*
3. *Are mass and volume the same?*
4. *What is different about them?* (Tool used, unit of measurement, etc)

5. *Let's look at our data. What can you tell me about the volume of a carrot compared to the volume of a grape?*
6. *What evidence do you have to support your conclusion?* (numbers on data table)
7. *Why do you think the grape numbers are close?* (grapes were about the same size)
8. *Why do you think the carrot numbers are close?* (carrots were about the same size)
9. *Why are the carrot and grape numbers so different?* (carrots have more volume than grapes)
10. *What evidence do we have that carrots have more volume than grapes?* (the data table shows that the carrot has __mL and the grape has __mL and ___(carrot number) is larger that ___ (grape number) so carrots have more volume than grapes)
11. Allow time for students to respond to key question in science notebooks.

EXTEND AND APPLY

Allow students to compare the volume of classroom objects. Repeat Explore and Explain from above replacing carrots and grapes with classroom items.

ASSESSMENT

Check science notebooks for evidence of understanding the key question, complete and accurate data tables, and accurate diagram of grape and carrot (including mass of each).