

Mass and Volume

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Name: _____

Partner(s) Name: _____

Mass and Volume

In this module you will determine:

How much mass does the object contain?

How much space does it occupy?

Activity 1:

The mass of an object is the total amount of matter in the object.

Mass is measured in grams. The abbreviation for grams is g.

- A** Predict which of the objects in your group will have the greatest mass and write this in your chart below. Which object would have the least amount of mass? Highlight these in your chart.
- B** Using a balance, measure each of the following items in the chart and record their mass to the nearest gram. Make sure to check your balance before each sample to be sure that it is in the zero location. Modify your balance if needed.

Chart: Mass of Objects

| Item Name | Prediction (g) | Actual Mass (g) |
|-----------|----------------|-----------------|
| Penny | | |
| Quarter | | |
| Rock | | |
| Item A | | |
| Item B | | |
| Item C | | |

Which object actually had the greatest mass? _____

Which object actually had the least mass? _____

- C** If one penny has a mass of _____ grams, predict the mass of five pennies. _____

Measure the mass of five pennies and check your results. _____

Explain any difference that you find. _____

VOCABULARY:

Balance

Gram

Mass

Milliliter

Prediction

Volume

Inside This Packet

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Students will be able to:

Determine the mass of objects to the nearest gram.

Determine the volume of a regular shaped object to the nearest tenth of a centimeter.

Determine the volume of an irregularly shaped object to the nearest ml.

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Activity 2: How much water does it hold?

Directions:

- 1 Look at the list of objects in your chart below and predict which has the most mass. Place an X in the box next to your prediction.
- 2 Select the first item in your chart, the paper towels, and place them on your balance. Determine the mass of the dry towels. Record this information on your chart. Continue to determine the mass of each of the objects on your chart.
- 3 Look at the list of objects in your chart below and predict which will hold or absorb the most water? Place an X in the box next to your prediction.
- 4 Place the first item in your chart, the paper towels, in the water and wait at least 20 seconds. Pull the object out of the water and place it back on the balance. Write down the mass of the object when it is wet. Continue this process for each object in the chart. Write down the mass of each object when wet.
- 5 What is the mass of the water that the paper towels were able to absorb? Continue to calculate the mass of the water absorbed by each object in the chart below and record this information.
- 6 Which object on your list had the most mass while it was dry? Circle this object. Was your prediction accurate? Explain.
- 7 Which object held the most water? How did you determine your answer? Why do you think it held the most water?

Chart:

| Object | What object do you think will have the most mass? | Mass of dry object: Nearest gram | What object will hold or absorb the most water? | Mass of wet object: Nearest gram | What is the mass of the water absorbed by the object? |
|--------------|---|-------------------------------------|---|-------------------------------------|---|
| Paper towels | | | | | |
| Sponge | | | | | |
| Cotton balls | | | | | |
| Wash Cloths | | | | | |
| Tissues | | | | | |

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Activity 3: Volume equals mass of water

Mass of Water: It is very easy and helpful to know the mass of water. Always be sure to add your correct units with your number value.

Directions:

- 1 Measure the mass of the graduated cylinder. Record this in your chart below.
- 2 Place 10 ml of water in the graduated cylinder.
- 3 Record the mass of the water plus the graduated cylinder in your chart below.
- 4 Subtract the two values to find just the mass of the 10ml of water – what is this value?
- 5 Try the same process with 20 ml of water. What was the answer?
- 6 If you had 30 ml of water, how many grams would this be equal to? _____
Explain the relationship between milliliters and grams of water.

Chart: Mass of Water

| |
|---|
| A Mass of graduated cylinder = _____ |
| B Mass of graduated cylinder plus 10 ml of water = _____ |
| C Mass of the 10 ml of water = _____ |
| D Mass of graduated cylinder = _____ |
| E Mass of graduated cylinder plus 20 ml of water = _____ |
| F Mass of 20 ml of water = _____ |

Note: To complete the math a calculator can be used to assist with larger numbers.

Name: _____

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Activity 4: Volume of a Box

- A** Volume is the amount of space an object occupies. Look at the cardboard shoe box. Let's determine its volume, or the amount of space the shoe box takes up. Put your answers in the chart below. Measure the length of the box to the nearest tenth of a centimeter. Record the value. What is the width of the shoe box? Record this to the nearest tenth of a centimeter. What is the height of the box? Record this to the nearest tenth of a centimeter.

Chart: Volume

| Dimension | Value to the nearest tenth of a cm |
|-----------|------------------------------------|
| Length | |
| Width | |
| Height | |
| Volume | |

To find the volume of the box, multiply the length times width times height. The answer will give you the volume of the box. The units for this form of calculating volume would be cm^3 . This is due to the fact that we are multiplying a length times a width times a height all of which are measured in centimeters.

- B** Look at the three different packs of gum or samples provided. Which do you predict will have the greatest volume? Place an X in the chart. Using the method described above and the sample pack your team was provided calculate the volume of the pack. Record the volume for the pack of gum in your chart.

Fill in your blank boxes with the answers from the other teams. Check your data to determine which sample had the greatest volume. Was your prediction correct? Explain your answer using the data to help you.

Chart: Practice Volume

| Sample label: | Predict which has the greatest volume and place an X in that box. | Actual volume to the nearest tenth of a cm |
|---------------|---|--|
| Sample A | | |
| Sample B | | |
| Sample C | | |

- C** From the selected boxes of items your teacher has provided, select one. With a partner determine the volume of the box you selected. Compare your box's volume with other student's volumes. Describe the differences in the volumes of the boxes. Write one comparison between the two boxes below:

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Activity 5: Volume of an irregular shape

A Measure the following object's length, width and height to determine a volume: A ball, an irregular rock, a pencil.

What is the problem with this request?

B For objects that are irregular in shape we can use a different method to find the volume of the object.

Let's do some experimenting. Beside the bucket or beaker of water you will find three objects.

Which one do you think has the greatest volume? _____

Which has the least volume? _____

Submerge them in the water one at a time and make observations. What did you observe?

C To measure the volume of an irregular shaped object you can submerge it in water. Notice the level of the water before the object is placed in it and note the level of the water after it is placed in it. Subtract the two values and the result is the volume of the object recorded in milliliters (ml).

Let's try a sample:

- 1 Select sample A.
- 2 Pour 200 ml of water into a beaker.
- 3 Place sample A into the beaker and be sure that the water covers the sample.
- 4 Record the level of water after the sample A is submerged.
- 5 Subtract the smallest number from the biggest number to get the volume measurement.
- 6 The units placed on a volume measured in this manner would be millileter (ml). Can you explain why?

Chart: Liquid Volumes

| Level of water to start | Level of water after object is submerged | Subtract the two values | Volume of sample A |
|-------------------------|--|-------------------------|--------------------|
| | | | |

D Now try the three objects again and record their volumes.

Chart: Sample Volumes

| Object name or sample letter | Volume of water to start | Volume of water ending | Volume of object |
|------------------------------|--------------------------|------------------------|------------------|
| | | | |
| | | | |
| | | | |

Do you have any thoughts or questions to share?

You should now be experts on mass and volume.

New York State Standards

Inquiry Based Process Skills:

Comparing and contrasting, gathering and organizing data, interpreting data, manipulating materials, measuring, predicting

Standard 1: Mathematical Analysis:

Key Idea 1: M1.1b, M1.1c

Key Idea 2: S2.3a, S2.3b

Key Idea 3: S3.2a, S3.3a, S3.4a

Skills and Strategies for Interdisciplinary Problem Solving:

Working effectively, gathering and processing information, presenting results

Standard 4: Key Idea 3: 3.1a, 3.1c, 3.1d, 3.1e, 3.1f, 3.2a