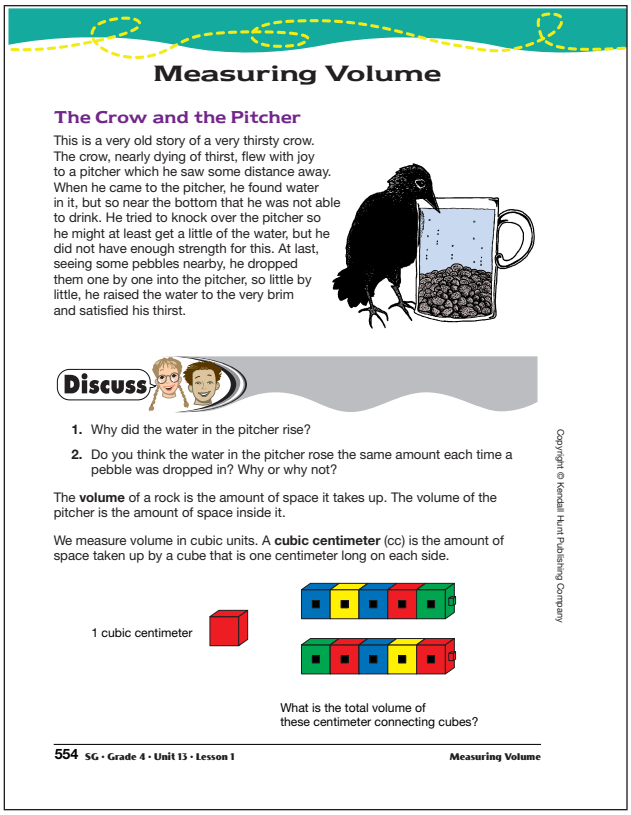

Measuring Volume

The Crow and the Pitcher

This is a very old story of a very thirsty crow. The crow, nearly dying of thirst, flew with joy to a pitcher which he saw some distance away. When he came to the pitcher, he found water in it, but so near the bottom that he was not able to drink. He tried to knock over the pitcher so he might at least get a little of the water, but he did not have enough strength for this. At last, seeing some pebbles nearby, he dropped them one by one into the pitcher, so little by little, he raised the water to the very brim and satisfied his thirst.

Discuss

1. Why did the water in the pitcher rise?
2. Do you think the water in the pitcher rose the same amount each time a pebble was dropped in? Why or why not?

The **volume** of a rock is the amount of space it takes up. The volume of the pitcher is the amount of space inside it.

We measure volume in cubic units. A **cubic centimeter** (cc) is the amount of space taken up by a cube that is one centimeter long on each side.

1 cubic centimeter

What is the total volume of these centimeter connecting cubes?

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Questions 1–6 (SG pp. 554–557)

1.* As the crow added pebbles to the pitcher, the water in the pitcher was displaced or pushed away by the pebbles, so the water level rose.

2.* No, each pebble took up a different amount of volume, so the water level rose a different amount each time.

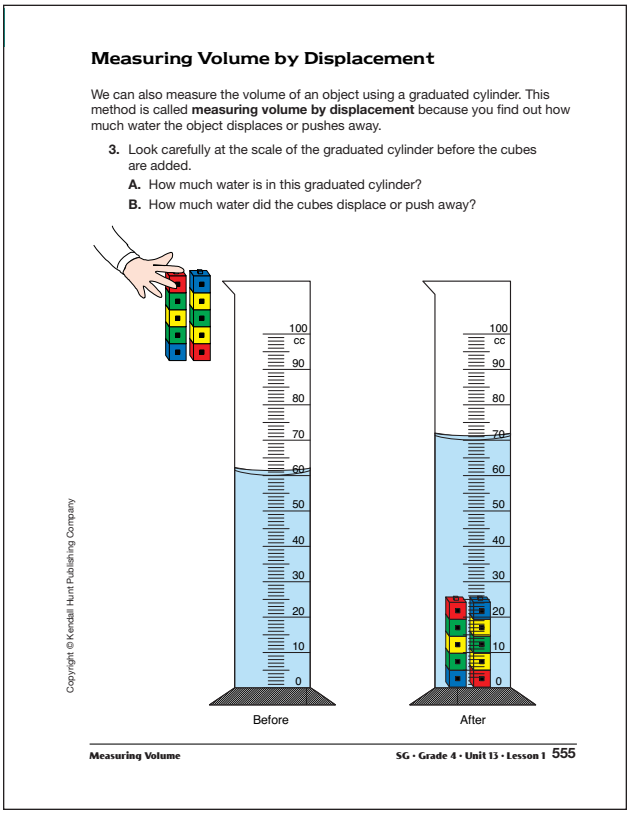
3. **A.*** 60 cc

   B.* 10 cc

4. About 11 cc

5. **A.*** Read at eye level, at the bottom of the meniscus, and holding the cylinder level.

   B.* Jerome should not look from above or below or tilt the cylinder.



Measuring Volume by Displacement

We can also measure the volume of an object using a graduated cylinder. This method is called **measuring volume by displacement** because you find out how much water the object displaces or pushes away.

3. Look carefully at the scale of the graduated cylinder before the cubes are added.
   - **A.** How much water is in this graduated cylinder?
   - **B.** How much water did the cubes displace or push away?

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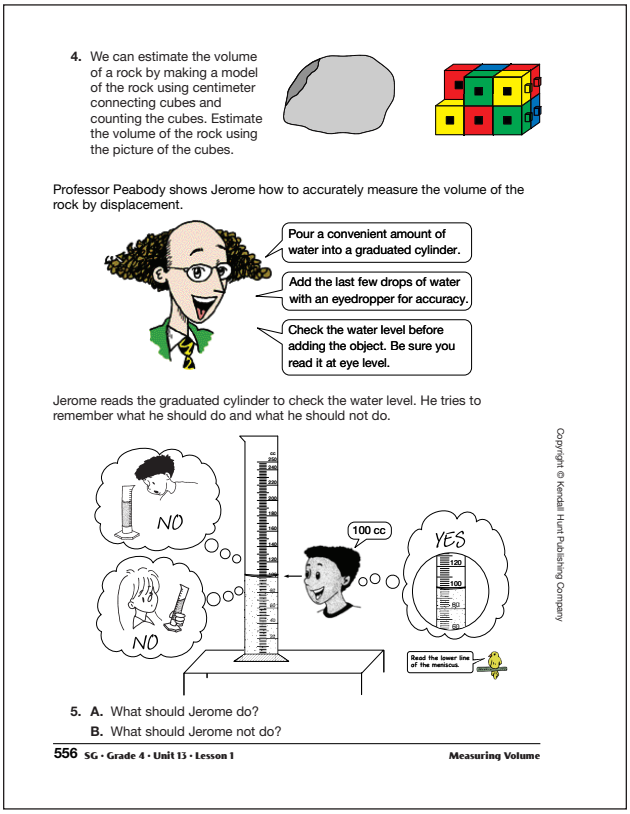

4. We can estimate the volume of a rock by making a model of the rock using centimeter connecting cubes and counting the cubes. Estimate the volume of the rock using the picture of the cubes.

Professor Peabody shows Jerome how to accurately measure the volume of the rock by displacement.

Pour a convenient amount of water into a graduated cylinder.

Add the last few drops of water with an eyedropper for accuracy.

Check the water level before adding the object. Be sure you read it at eye level.

Jerome reads the graduated cylinder to check the water level. He tries to remember what he should do and what he should not do.

5. **A.** What should Jerome do?

   B. What should Jerome not do?

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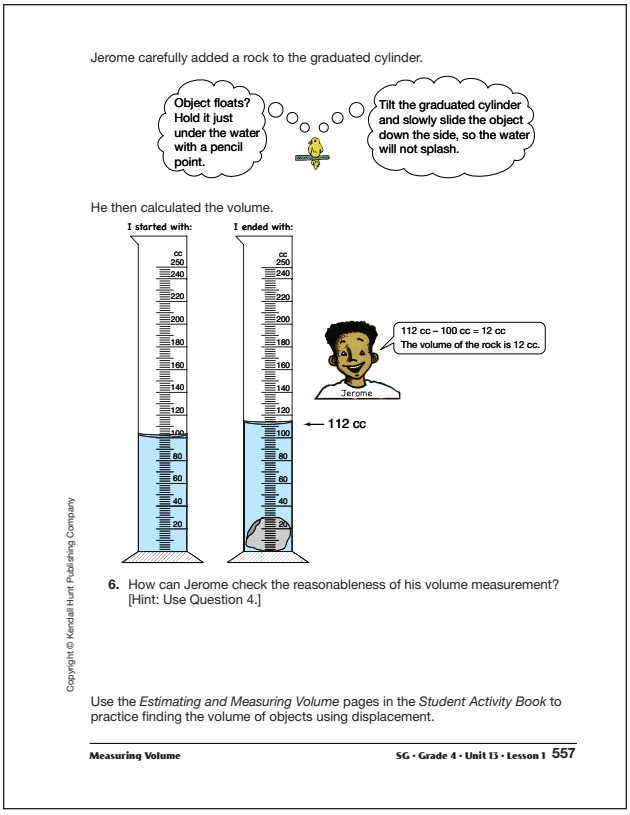
*Answers and/or discussion are included in the lesson.

6. Jerome should compare his measurement to his estimate.


Jerome carefully added a rock to the graduated cylinder.

Object floats? Hold it just under the water with a pencil point.

Tilt the graduated cylinder and slowly slide the object down the side, so the water will not splash.

He then calculated the volume.

I started with: I ended with:

112 cc

112 cc – 100 cc = 12 cc
The volume of the rock is 12 cc.

Jerome

6. How can Jerome check the reasonableness of his volume measurement? [Hint: Use Question 4.]

Use the *Estimating and Measuring Volume* pages in the *Student Activity Book* to practice finding the volume of objects using displacement.

Measuring Volume SG • Grade 4 • Unit 13 • Lesson 1 557

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Student Activity Book

Estimating and Measuring Volume (SAB pp. 541–542)

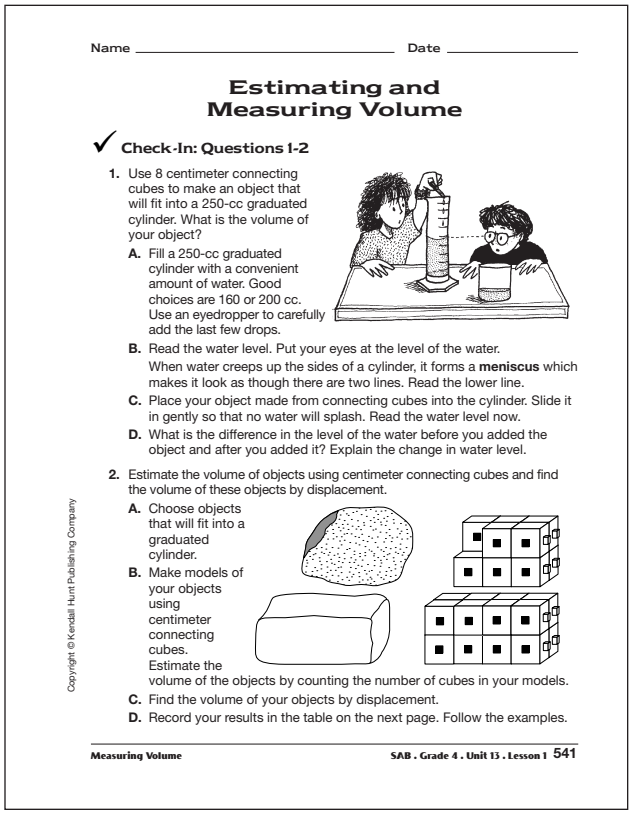
Questions 1–4

1. 8 cc

A–C. Observe students as they follow directions.

D.* 8 cc; The cubes displaced or pushed away 8 cc of water, so the water level went up.

2. Estimates and volumes will vary based on models made.


Name _____ Date _____

Estimating and Measuring Volume

✓ Check-In: Questions 1-2

1. Use 8 centimeter connecting cubes to make an object that will fit into a 250-cc graduated cylinder. What is the volume of your object?

A. Fill a 250-cc graduated cylinder with a convenient amount of water. Good choices are 160 or 200 cc. Use an eyedropper to carefully add the last few drops.

B. Read the water level. Put your eyes at the level of the water. When water creeps up the sides of a cylinder, it forms a **meniscus** which makes it look as though there are two lines. Read the lower line.

C. Place your object made from connecting cubes into the cylinder. Slide it in gently so that no water will splash. Read the water level now.

D. What is the difference in the level of the water before you added the object and after you added it? Explain the change in water level.

2. Estimate the volume of objects using centimeter connecting cubes and find the volume of these objects by displacement.

A. Choose objects that will fit into a graduated cylinder.

B. Make models of your objects using centimeter connecting cubes. Estimate the volume of the objects by counting the number of cubes in your models.

C. Find the volume of your objects by displacement.

D. Record your results in the table on the next page. Follow the examples.

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***Answers and/or discussion are included in the lesson.**

Name _____ Date _____

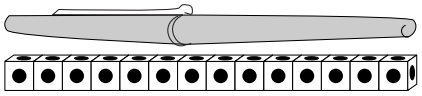
Volume Data Table

Object	Estimated Volume from Cube Model	Volume by Displacement
Rock	11 cc	12 cc
Clay	16 cc	15 cc

3. A. Were your estimates close to your measured volumes? Why or why not?

B. Which estimates were closest to the measured volumes? Why?

4. Frank made a model of a marker using centimeter connecting cubes. By counting the cubes, he estimated that the marker has a volume of 14 cc. When he measured the volume using a graduated cylinder, he found the volume to be 11 cc. Why do you think there is a 3 cc difference?



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3. A.* Answers will vary. Possible response: Some of my estimates were not close to my measured volumes. It was difficult to make the centimeter connecting cube model look exactly like the object I was measuring.

B.* Possible response: The estimates for the objects that more closely resembled the connecting cube models were easier for me to build and to use to estimate the measured volume.

4.* Answers will vary. The marker is slightly thinner than one cm and the marker tapers off at the ends. There may also be measurement error.

***Answers and/or discussion are included in the lesson.**

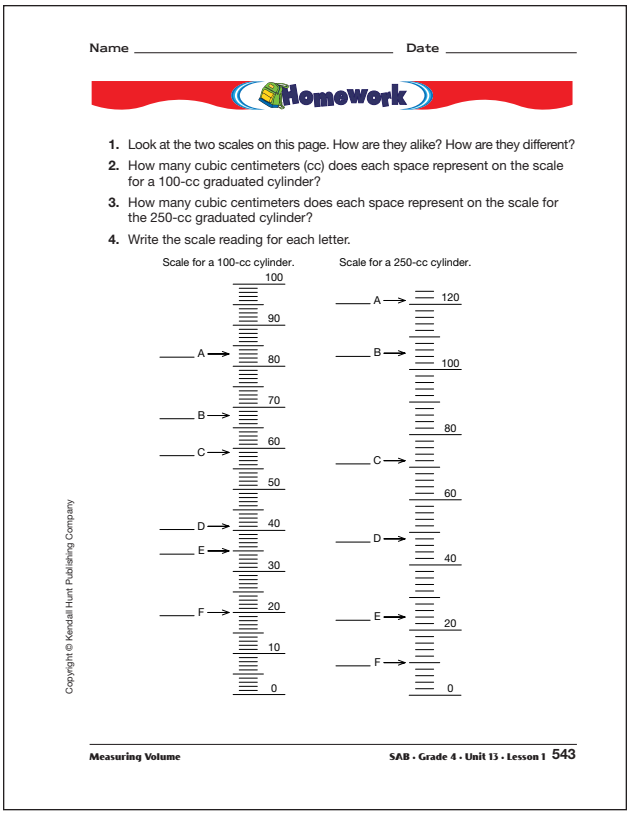
Student Activity Book

Homework (SAB pp. 543–544)

Questions 1–5

1. Answers will vary. Students may notice that each scale goes up to about 100 and that they both start at zero. On the 100-cc scale, the multiples of 10 are written on the scale. On the 250-cc scale, the multiples of 20 are written on the scale.
2. 1 cc
3. 2 cc
4. 100 cc cylinder:
   A=83 cc
   B=68 cc
   C=59 cc
   D=41 cc
   E=35 cc
   F=20 cc

   250 cc cylinder:
   A=121 cc
   B=105 cc
   C=72 cc
   D=48 cc
   E=24 cc
   F=10 cc
5. 16 cc. The water rose from 50 cc to 66 cc.
   66 – 50 = 16 cc.


Name _____ Date _____

Homework

1. Look at the two scales on this page. How are they alike? How are they different?
2. How many cubic centimeters (cc) does each space represent on the scale for a 100-cc graduated cylinder?
3. How many cubic centimeters does each space represent on the scale for the 250-cc graduated cylinder?
4. Write the scale reading for each letter.

Scale for a 100-cc cylinder. Scale for a 250-cc cylinder.

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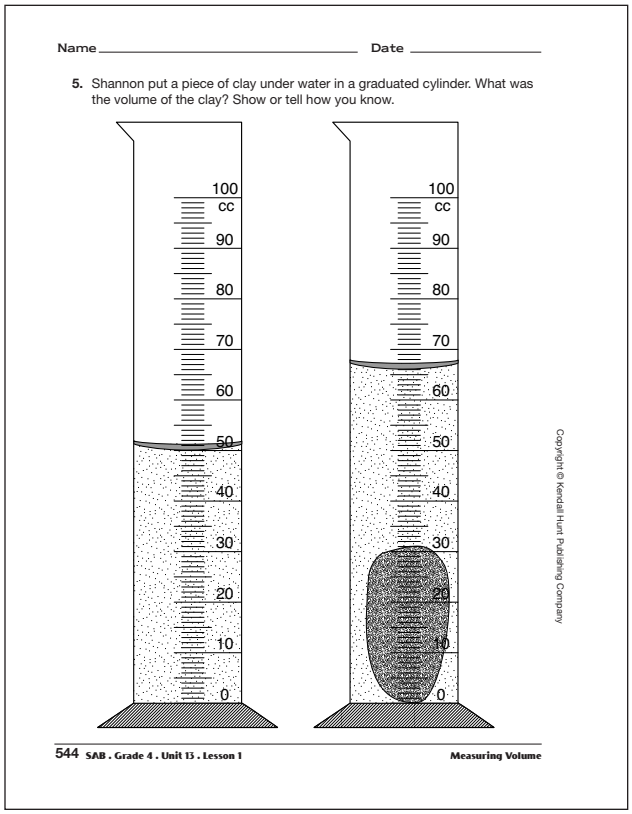
Name _____ Date _____

5. Shannon put a piece of clay under water in a graduated cylinder. What was the volume of the clay? Show or tell how you know.

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