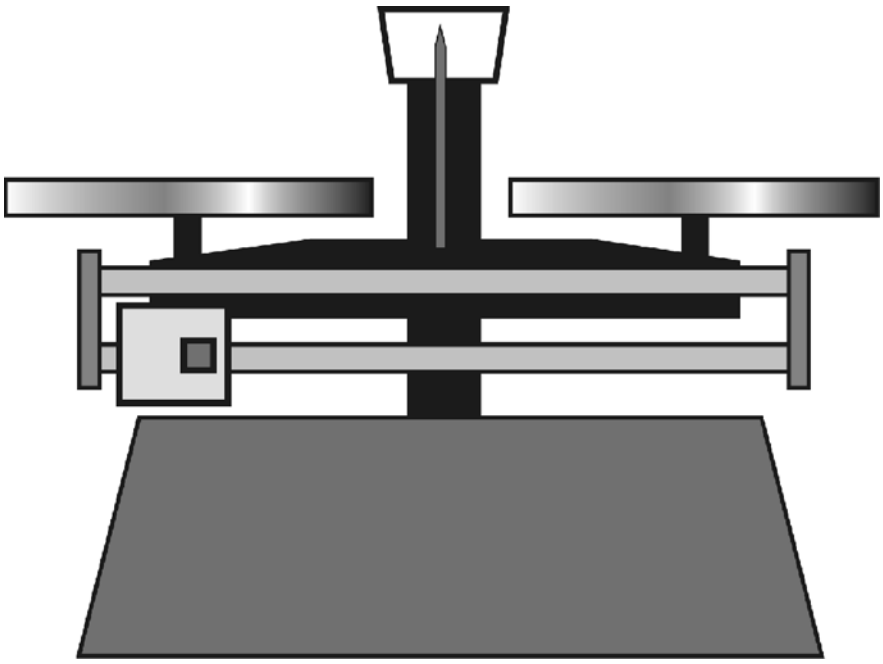
Name:

17.1 Properties of Solids

Question: How can you find the density of a solid?

On the right side of the balance below, sketch a rectangular shape to represent the size of a pound of bricks. Then, on the left side, draw a second rectangle to represent the space taken up by a pound of feathers.



1 Setting up

There are no questions to answer in part 1.

2 Finding the relationship between the mass and volume of a substance

1. Record your data in Table 1.

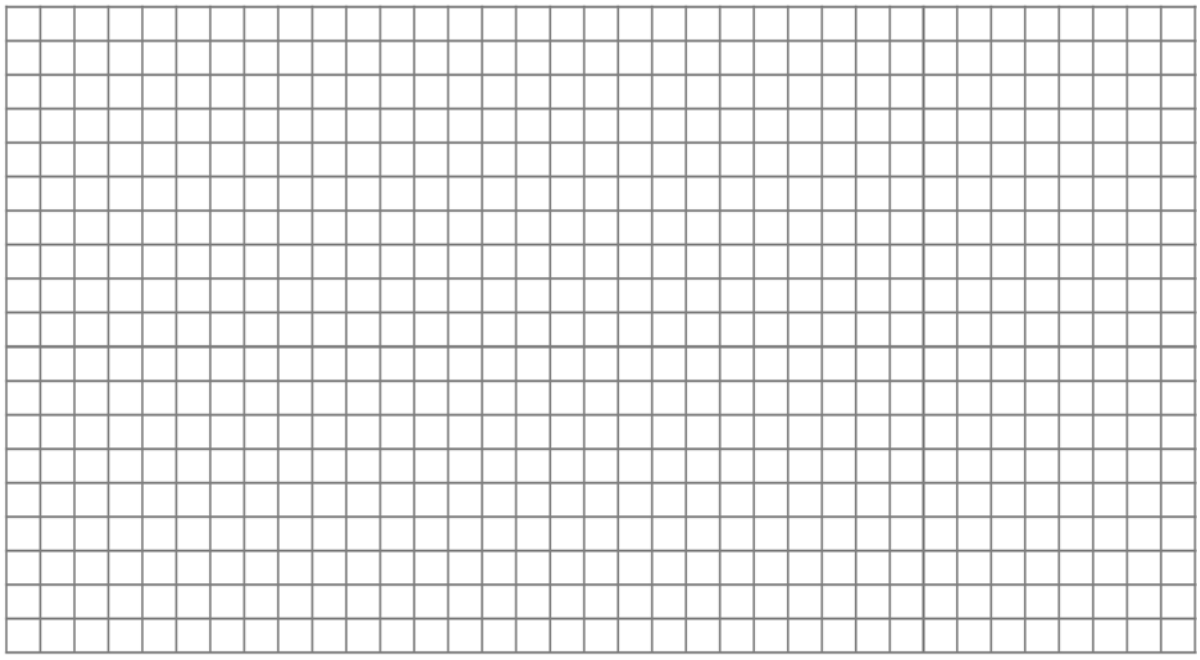
Table 1: Mass and volume data

	one object	two objects	three objects	four objects	five objects
mass in grams (g)					
volume in milliliters (mL)					

2. Plot your data on graph paper. Label the *x*-axis "volume" and the *y*-axis "mass." Be sure to use the entire space on your graph paper for making your graph.

Title: _____

y label: _____



x label: _____

3 Analyzing your results

a. Is there any pattern to the data points on your graph? For example, the points might form a smooth curve, a straight line, a random scattering, or a cluster in a certain region. If you detect a pattern, describe it.

b. Take your ruler and move it along the points of the graph in order to find the line on the paper that is as close as possible to all of the dots. This line is called the "line of best fit." Draw the line.

Now find the slope of this line.

c. Compare your slope with the result obtained by other groups. Are your slopes similar or different?

d. The relationship between a substance's mass and volume is called its density. What is the density of the material you tested?

4 Using your knowledge

a. Your graph includes data for five objects. Now, use your graph to predict the mass of *six* objects.

b. Next, use the balance to find the mass of six of these objects.

c. How does your value from your graph compare to the mass obtained using the balance?

d. Use the mass value that you found in step 4 (b). Find that number on the *y*-axis of your graph. Now find the point on the line which crosses that *y*-value. What is the *x*-value of that point?

e. What does the *x*-value found in step 4 (d) predict about the volume of the six objects?

f. Now, find the volume of six objects experimentally.

g. How does the *x*-value from the graph compare with the volume you obtained experimentally?

5 Compare class data

Collect data from each group in the class to fill in Table 2.

Table 2: Class data for density of objects

	Group1	Group 2	Group 3	Group 4	Group 5	Group 6
size of one object (mL)						
type of material						
density						

Using the data above, answer the following questions in your lab notebook:

a. Does density depend on the size of the material? Give evidence to support your answer.

b. Does density depend on the type of material? Give evidence to support your answer.

c. Using what you have observed in this lab, do you suppose that density depends on the shape of the material? Why or why not?

6 Using density to solve a mystery

There are no questions to answer in part 6.

7 Procedure

a. Each lab group has been given a stack of approximately 100 pennies. Sort them into two stacks: pre-1982 and post-1982 pennies. If you find any 1982 pennies, set them aside.

b. Find the mass of your collection of pre-1982 pennies. Use the displacement tank to find the volume of the pre-1982 pennies. Repeat the procedure for your collection of post-1982 pennies. Record your results in Table 3.

Table 3: Penny data

	Pre-1982 pennies	Post-1982 pennies
mass		
volume		
density		

c. Calculate the density of each type of penny. Record your results in the third row of the table.

8 Analyze your results

Using the data you collected, answer the following questions:

a. Are the pre-1982 and post-1982 pennies made from the same material? Give evidence to support your answer.

b. Did the bill to change the composition of the penny pass or fail?