Metric Measurement: Mass

Name _____
Date _____
Class _____

Background Information

The ability to accurately measure the mass of an object is an important skill in the physical science laboratory. The triple-beam balance is the instrument most frequently used to measure the mass of an object. There are three ways in which the triple-beam balance may be used to measure mass.

1. *Measuring mass directly:* The object is placed on the pan of the balance and the riders are moved into position on the beams until the pointer is balanced at the zero point. The mass is determined by the positions of the riders on the beams.
2. *Finding mass by difference:* This procedure is most frequently used to find the mass of a liquid in a container. The mass of the empty container is subtracted from the combined mass of the container and the liquid.
3. *Measuring out a substance:* It is necessary to use this procedure to obtain an exact amount of a solid chemical substance. Chemicals should never be placed directly on the balance pan, so it is necessary to first find the mass of the weighing paper or container. Add this amount to the desired mass of the chemical, and preset the riders to this number. The chemical is then added to the paper a little at a time until the pointer is balanced at the zero point.

In this investigation you will learn how to accurately measure the mass of various objects using the three methods described above.

Problem

What is the proper way to use the triple-beam balance to measure the mass of different objects?

Materials *(per group)*

triple-beam balance
100-mL graduated cylinder
coin
large paper clip
rubber stopper
weighing paper
small scoop
table salt
250-mL beaker
10 pieces of candy

Procedure

Before beginning, be sure that the riders are moved all the way to the left and that the pointer rests on zero. See Figure 1. Be sure that the pointer is on the zero mark. If it is not the knob at the left of the balance may be rotated to "zero" the balance.

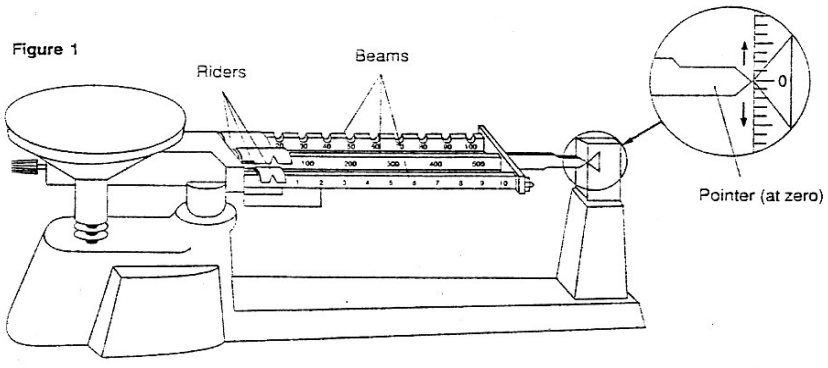

Figure 1

Part A Measuring Mass Directly

1. Place the coin on the pan of the balance.
2. Move the rider on the middle beam one notch at a time until the pointer drops below zero. Move the rider back one notch.
3. Move the rider on the back beam one notch at a time until the pointer again drops below zero. Move the rider back one notch.
4. Slide the rider along the front beam until the pointer stops at zero. The mass of the object is equal to the sum of the readings on the three beams.
5. Record the mass to the nearest tenth of a gram in Data Table 1.
6. Remove the coin and repeat steps 2 through 5 using the paper clip and then the rubber stopper.

Part B Finding Mass by Difference

1. Find the mass of an empty 250-mL beaker. Record the mass in Data Table 2.
2. Using the graduated cylinder, obtain 50 mL of water.
3. Pour the water into the beaker and find the mass of the beaker and water. Record the mass in Data Table 2.
4. Calculate the mass of water by using technique 2 (Back ground Information), and record in Data Table 2.

Part C Measuring Out a Substance

1. Place a piece of weighing paper on the balance pan and find its mass. Record the mass in Data Table 3.
2. Add exactly 5 g to the value of the mass of the weighing paper and move the riders to this number.
3. Obtain a sample of table salt from your teacher. Using the scoop, add a small amount of salt at a time to the paper on the balance pan until the pointer rests on zero. Record the mass of the paper and the salt.
4. Dispose of the table salt in the container provided by your teacher.

Part D Measuring the mass of small objects

1. Measure the mass of a clean weighing paper. Record the mass in Data Table 4.
2. Ask your teacher for 10 candies .
3. Place the candies on the weighing paper and find their mass. Record the mass.
4. *Compute* the mass of one candy. Record in your data table and on the board.
5. Share the candy with your lab partner.

Data Table 1

Object	Mass (g)	Mass (mg)	Mass (kg)
Coin			
Paper clip			
Rubber stopper			

Data Table 2

Mass of Beaker with 50 ml of water (g)	Mass of Beaker	Mass of 50 ml of water (g)	Mass of water (kg)

Data Table 3

Mass of weighing paper and salt	Mass of weighing paper	Mass of salt (g)	Mass of salt (mg)

Data Table 4

Mass of paper and 10 candies	Mass of weighing paper	Mass of 10 candies (g)	Mass of 1 candy (g)

Analysis and Conclusions

1. What is the mass of 50 mL of water? _____

2. Which rider on the balance should always be moved first when finding the mass of an object? _____

3. What is the mass of the largest object your balance is able to measure? _____

4. What is the mass of the smallest object your balance is able to measure accurately?

5. After using your balance, how should it always be left? _____

Critical Thinking and Application

1. In this lab, you found the mass of 50 mL of water. Calculate the mass of 1 mL of water. (Do not use the balance.) _____

2. Describe how you could find the mass of a certain quantity of milk that you poured into a drinking glass. _____

3. If you were baking a cake and the recipe called for 250 g of sugar, how would you use the triple-beam balance to obtain this amount? _____

Number of Wildfires in 1993–1996

Year	Arizona	New Mexico	Oklahoma	Texas
1993	10	7	17	85
1994	16	11	24	84
1995	12	5	7	72
1996	13	5	37	91

What was the average number of wildfires to occur annually in New Mexico for the years 1993–1996?

_____

What was the average number of wildfires for all four states in 1995?

_____

What was the average number of wildfires to occur annually in Texas for the years 1993–1996?

_____