How To Use a Balance

Pre-Lab Discussion

The ability to measure accurately the mass of an object is an important skill in the science laboratory. You can use a triple-beam balance to measure mass.

As you can see in figure 1, the balance has several parts. The pan is the flat surface on which you can place the object to be measured. The three beams show the mass of the object. Notice that each beam has a different scale. The scale of the middle beam is 0-500 grams and measures an object to the nearest 100 grams. The scale of the beam in the back is from 0-100 grams and measures an object to the nearest 10 grams. The scale of the beam in front is from 0-10 grams and measures an object to the nearest tenth of a gram.

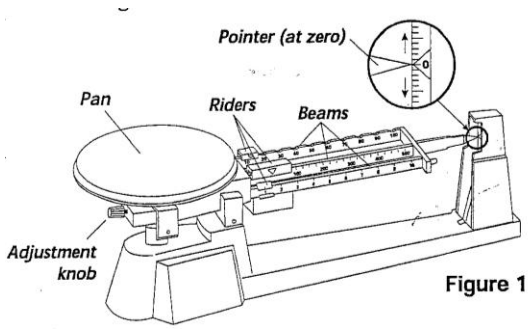

Figure 1

Notice that each beam carries a weight called a rider. You find the mass of an object by placing it on the pan and moving the riders until the pointer on the right of the balance stays pointed to zero.

To ensure precision, make sure the balance is on a flat surface, the pan is clean, and the pointer is at zero (use adjustment knob to correct). Be sure to measure to the smallest increment to ensure precision.

When carrying the balance, move the heaviest rider to 500g to reduce motion. Use two hands and do not hold any moving part (hold under base). When you are finished measuring an object; clean the pan and return riders to zero.

There are three ways you can use the triple-beam balance to find mass:

Method 1. Measure mass directly.
Place the object on the pan and move the riders until the pointer points to zero. Add up the numbers on the beams where the riders are positioned to find mass.

Method 2. Find mass by difference.
How could you find the mass of a liquid?
First, measure the mass of an empty container that can hold the liquid. Then, measure the combined mass of the container and the liquid. Finally, subtract the mass of the container from the combined mass.

Method 3. Measure out a chemical substance.
Suppose you need to obtain50 g of a powdered chemical. How could you do it? First find the mass of a piece of paper or empty container that will hold the chemical. Then, add this amount to the desired mass of the chemical and preset the riders to this number. Finally, add the chemical to the paper a little at a time until the pointer points to zero.

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

1. What does it mean when the pointer of the balance reads “zero”? Avoid “it” and the word “balanced”.

_____

_____

2. Suppose a rock is balanced on a triple-beam balance. The riders on the three beams point to 60 g. 300 g. and 3.5 g. What is the mass of the rock?_____

Problem

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

Materials *(per class)*

Triple beam balance	small scoop	weighing paper (use NB paper)
100-mL graduated cylinder	table salt/sand	250-mL beaker

3 different solid objects (rubber stopper, wax bar, and large paper clip)

Safety Review the safety guidelines in the front of your lab book.

Procedure

Before you measure an object’s mass-be sure that the riders are moved all the way to the left and that the pointer rests on zero. If necessary, slowly turn the adjustment knob until the pointer rests on zero. This is called zeroing the balance.

Part A: Measuring Mass Directly

1. Get measuring kit from teacher.
2. Place a small, solid object on the balance pan. The beams will rise and the pointer will point above the zero.
3. Move the rider on the middle beam one notch at a time until the pointer drops and stays below zero. Move the rider back one notch.
4. Move the rider on the back beam one notch at a time until the pointer again drops and stays below zero. Move the rider back one notch.
5. 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.
6. Record the mass to the nearest tenth of a gram in Data Table 1.
7. Remove this object and repeat steps 1-5 twice, using two other solid objects.

Data Table A	
Object	Mass (g)

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 mass in Data Table 2

Data Table B		
Mass of Empty Beaker (g)	Mass of Beaker with Water (g)	Mass of water only (g)

Part C: Measuring Out a Chemical Substance

1. Place a piece of notebook paper (substitute for weighing paper) on the balance pan and find its mass. Record the mass in Data Table 3.
2. Add 5 g to the mass of the weighing paper (mathematically) and **move the riders to this number**.
3. Obtain a sample of the table salt/sand from the teacher. Using the scoop, add a small amount of salt/sand at a time to the paper on the balance until the pointer rests on zero. Record the total mass of the weighing paper and salt in Data Table 3.
4. Return table salt to the container provided by the teacher.

Data Table C	
Mass of Weighing Paper (g)	Mass of Weighing Paper and Table Salt (g)

1. When you are finished, have Ms. Whitt inspect your balance. _____
2. Demonstrate how to move the balance to another location on the lab: _____

Analyze and Conclude

1. What is the mass of 50-mL of water? How did you find this mass?

   _____

   _____

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

   Explain.

   _____

   _____

3. What is the largest mass the balance is ABLE to measure?

   _____

4. What is the smallest mass the balance is ABLE to measure? _____ What metric unit is equivalent to this amount (think prefixes) ?_____ What does this measure?_____

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

   _____

   _____

Critical Thinking and Applications

1. Suppose you did not zero the balance before finding the mass of the object. How might that affect the measurement? See question 4 (above section)

   _____

   _____

2. In this lab, you found the mass of 50mL of water. **Calculate** the mass of 1 mL of water. Set up a ratio problem:

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

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4. If you were baking a dessert and the recipe called for 250 g of sugar, how could you use a triple beam balance to obtain this amount?

   _____

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