Balance Construction and Use

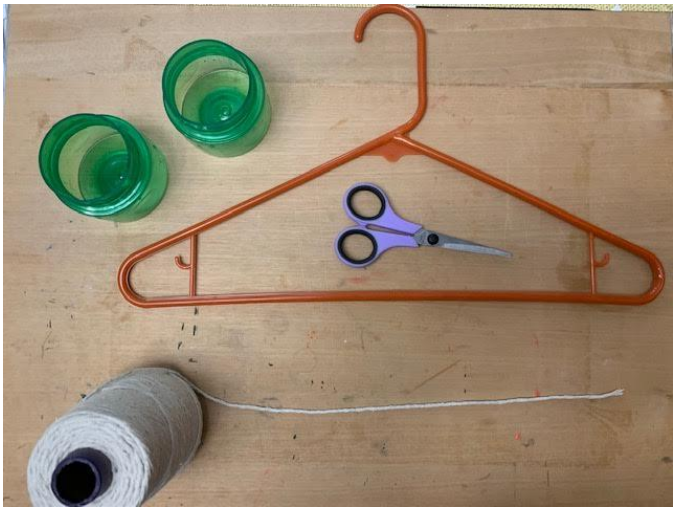
Always exercise caution when working on any project or laboratory. These activities are for adults not children.

Objective

In this activity you will build a balance and calibrate it based on the known density of water (d_{water} = 1.00 g/mL). You will then use it to determine the mass of some object. Finally, you will write a laboratory report with your results.

Instructions

To build a balance you will need:

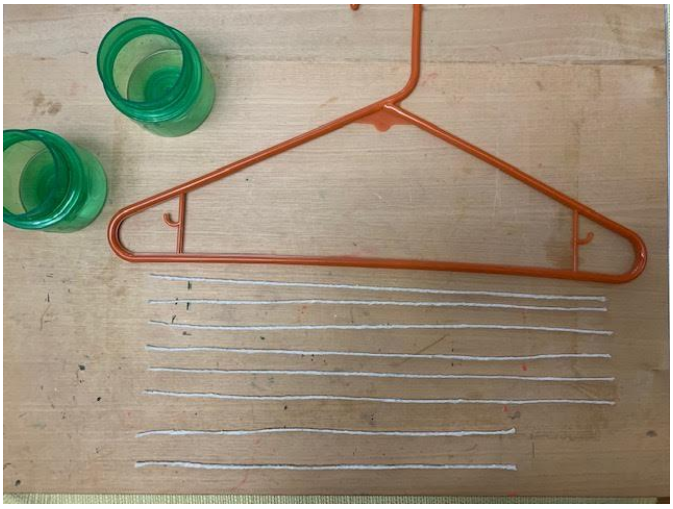


Hanger (any hanger will work if it has two places to secure the string – you can use a wire hanger if you bend it). Notice my hanger has two hooks on it.

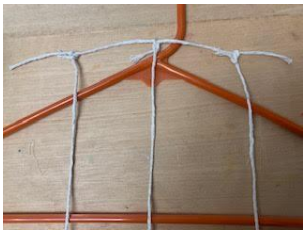
Two identical cups – I used the tops of bottles of laundry detergent. Any cups will work but make sure they can hold at least ½ cup of water.

String – any strong string will work; yarn will also work. Approximate lengths are shown in the photo.

Scissors or Nail Clippers – to cut the string



Step One: Tie the string to each cup so that the cup is suspended by three pieces of string. If your plastic cup is thin you may be able to cut holes in it for a place to tie the string. I tied the string like this:



and then tied it around the cup. Your three supports need to be evenly spaced around the cup or the cup will tilt. Try to keep the cup as level as possible.

This is a square knot.

Step Two: Using a broom or mop handle(or any pole) and two chairs suspend the hanger. It should be level.

If it isn't level, you can add pieces to tape to the bottom of the cup which is higher until the balance is level. It might be useful to place some kind of paper with a straight level line on it to visually line up your balance.

You have completed the construction of your balance. Take a photo of your balance. Include a small piece of paper in the photo with your name written on it!! This is how I know it is your picture 😊

Calibration of the balance.

Step Three: To calibrate a balance, you will need **a way to measure 2.0 ounces or 60.0 mL** of water. There are many ways to do this. Some ideas are medicine cups, baby bottles, measuring spoons (1 Tablespoon = 15 mL), measuring cup (2.0 ounces = ¼ cup), shot glass. It is very important that you measure the water carefully. The accuracy of your balance will depend on this.

Step Four: You will also need **some countable small objects**. I used red beans. Other ideas are M&Ms, jellybeans, skittles. You will need enough of these to balance with 60.0 mL of water.

Add 60.0 mL of water to one side of your balance. Your balance will tilt to one side. Then add your small objects, a few at a time, until the balance is level again.

Next count the small objects. Record the number of small objects required to balance 60.0 mL of water.

Not Level **Level**

Step Five: Record Data

Create a data sheet like this and put in your own data!

(repeat this process with three different 60mL portions of water - three trials)

Amount of water used	60.0 mL
Mass of water used	60.0 grams
Type of small object used	Red Beans
Number of small objects needed to balance	92
Average weight of each small object	60.0/92 = 0.65 grams

Now use the balance to find the mass of something using your small objects:
(repeat this process so you have three trials, to repeat empty the cups and then refill them)

Object you selected to weigh	a pen
Number of small objects needed to balance	32
Mass of object	32 X 0.65 grams = 21 grams

Please note that my data is given as an example. Your data might be different. You don't have to weigh a pen. You can weigh any small object. You don't have to use red beans; you can use whatever you have available. You should choose something that is about the size of red beans and has pieces that are all close to the same size/mass. Use the same small object for all three trials. Also, you will have three trials weighing the same object and I only show one trial here. **Calculate the average of your three trials.**

Include a picture of an object being weighed with your balance in your lab report.

Important Notes:

Keep the main objective in mind but use your own ideas to make your balance. Take pictures and notes on your process.

You are required to submit a lab report (pdf) (see rubric) that includes:

- title
- your name
- introduction/purpose
- 2 photos of your balance – empty and in use (please do not use more than two photos)
- a data sheet like the sample but with your own data showing three trials of the same procedure
- a discussion and analysis of your data
- a conclusion – what did you learn? what problems did you solve?
- answers to the following questions
- references (at least two including a link to this document)

Questions

1. What is the difference between mass and weight?

2. What is the difference between accuracy and precision?

3. What fact is used to calibrate the balance?

4. How does the size of the small object affect the precision of the balance?

5. How does the measurement of the water affect the accuracy of the balance?

6. Comment on the accuracy of your balance.

7. Comment on the precision of your balance.