

Do you remember the time when you ran the fastest you ever have? Or a time when you drove the furthest you ever had? Or when you got your highest level ever on a video game?

In this lab, your great challenge will be to measure the outside volume of an **object more accurately than you ever have.**

You will choose a waterproof container, such as an empty film canister. Your goal will be to add **exactly** the right amount of weight to the container so that when it is put in a tall cylinder of water it will sink very, very, very, very sloooooooowly. The person whose container takes the longest to touch the bottom will be the winner.

You may have asked, "How am I going to figure out the correct weight?" You actually know how to do it; it's all in those great brains of yours. Thank goodness you know how the metric system was made because it's the key to your success. Let's review how they made the first gram.

1) A gram is the weight of _____

2) If you want your canister to sink very slowly, what will it have to weigh in comparison to the weight of water? _____

That will be your goal, make the canister weigh slightly more than the volume of water it will displace. That is, **make your canister weigh just slightly more** than one gram for every cubic centimeter of its outside volume.

3) You have access to measuring instruments, weights, and scales. One tricky thing I may not have told you before is the weight of a given amount of water actually varies depending on the temperature. It shrinks and expands according to the temperature. In other words, the **density** changes with temperature. Water is heaviest at 4°C , which is about 39°F . What's

the temperature at the bottom of Lake Michigan right now? _____ In winter? _____

Many years ago a one hundred year old wrecked ship was found in Lake Michigan. Divers found some casks of cottage cheese that were still edible (they didn't say by whom though). The cold water on the bottom of the deep lake had acted as a refrigerator. It's always 4°C at the bottom of Lake Michigan, which is slightly above freezing. However the water you will use for our contest will be warmer than 4°C and that will make a difference to your target density. You should try as best you can to take that into account.

4) Will the water in our classroom be slightly heavier or lighter than 1 gram per cubic centimeter and why? _____

5) First, you will need to **find the displacement volume of your canister.**

___√ sketch a picture with the dimensions ___√ label it ___√ show your work

Remember, your goal is to **do the best job you ever did in your life.** This next information is critical to your success.

Take your time and measure everything as accurately as you possibly can. For example, if you are using a film canister, **take into account every variation**, including things like the little indented "dimple" and raised letters on the bottom. Of course, there aren't formulas for some of these things, so you will have to make estimates of their size. The difference of **one more BB will make a lot of difference** in the speed the canister sinks.

Applied Math

To the **best of my ability**, the volume of my canister = _____ cu cm.

6) Does this look reasonable? _____ Take 3 - 4 minutes mentally estimating the volume to check your work. Remember, you don't get a second chance. Make this one shot your best. Ask me if I have some cubic centimeters available. If I do, you can use them to compare their size to your canister.

Now you need to add the correct amount of weight to the canister to make it sink very, very sloooooooowly. Take your time and think this out. Just one popcorn seed will be enough to vary the time several seconds and really disappoint you. The all-time slooow record in sinking is 40.84 seconds for a distance of 41 cm. Can you beat it?

After thoughts...

7) What is the total weight of your canister when loaded? _____

8) How long did your canister take to sink to the bottom? _____

9) If you did it again, on what part would you do a better job? (Don't tell me something as obvious as adding, or taking out, more weight.) _____

10) If you could give advice to someone who is going to run this lab, what would you give them?