From the Light & Color Gallery: Pour & Explore

What do fractions, volume, and fluid dynamics all have in common? At Discovery Museum, you can explore all of them at our Pour & Explore exhibit in our Water Gallery. This exhibit brings together physics and math in a fun and splashy way using water streams and containers of different sizes and shapes. Using common items from around your home, we can even expand this exhibit to talk about the differences between liquids and solids. Let's build a Pour & Explore exhibit and add an extra element of fun to it. Please share your experiences with us using the email address found on the last page. We'd love to know what you discover!

Make Your Own Pour & Explore Exhibit

Supplies for Pour & Explore
Be sure to ask an adult for help as you gather your supplies to create your exhibit!

- At least three small- to medium-sized plastic and/or metal containers; one or two extra containers might be helpful
- Small objects to fill up your containers: gather several types of objects if you can, such as beads, small blocks, pebbles, toy cars and toy figures, dried beans, marbles (see photo)
- Water; either a faucet or a pitcher of water
- *Optional*: measuring cup of any size
- *Optional*: dirt or sand, but be sure your containers and objects can get dirty before using these materials

Exploration

- Pick out two containers from your collection and fill one of them with small objects. Try to fill it to the top, if you can.
- Make a guess, or *hypothesis*, of whether all of the objects in the filled container will fit into the empty container.
- Try it! Pour all of the objects from your full container into your empty container.

What do you notice?

Things To Try

For these experiments, you do not need to fill your containers all the way to the top unless directed, so do not worry if you don't have enough objects to fill your entire containers. Also, there are lots of opportunities to use a measuring cup in this exhibit, so freely measure out objects and water whenever you would like!

- Guess, or *hypothesize*, which of your containers can hold the most amount of stuff and which can hold the least. Then pour different types of objects between containers of different sizes and shapes to test your idea.

Can you tell which containers are bigger and which containers are smaller?

Which two containers are most similar in how many objects they can hold? The least similar?

Does the size of the objects you're pouring affect how many can fit into a container?

Does the shape of the objects you're pouring affect how they fit together in a container?

- Choose two of your smallest containers. Next, guess which of the two containers is the smallest and fill it to the top with your smallest objects. Then pour the objects into your other container, shaking the second container a little bit to settle the objects into the container. Notice how full your second container is. Next, do the same thing using your largest objects, remembering to shake the second container after pouring your objects into it (see photos).




What do you observe about how the smaller objects fit in the containers compared to the bigger objects?

Count the number of smaller objects and the number of bigger objects that fit into the small containers. How do the numbers compare? Do your findings surprise you?

Do smaller and bigger objects pour differently?

- Mix together bigger and smaller objects into one container by first pouring in smaller objects, and then pouring in bigger objects. Give the container a shake to settle the objects and observe the objects in the container. Try the experiment again, but this time pour the bigger objects in first, and then pour in the smaller objects. Give the container a shake and look inside (see photos).


What happens to the objects inside of the container when you pour them in differently?

- Choose a container that looks half as big as another container. Test your idea, or hypothesis. (Hint: Fill the smaller container twice, each time pouring all of the objects from the smaller container to the bigger container.)

How do the two containers compare in size?

Now try similar experiments pouring water instead of objects. Remember that you can use your measuring cup any time you want to measure amounts of water precisely.

- Pour water between containers of different sizes and different shapes.

Can you tell which containers are bigger and which containers are smaller?

Which two containers are most similar in how much water they can hold? Are these the same two containers as when you experimented with your objects?

Does the water pour differently than the objects?

Does the water fill your containers differently than the objects do?

- Choose two containers with different shapes or sizes. Try to pour the same amount of water in each container.

What do you notice about the level of water in each of the containers?

- Choose one smaller and one bigger container. Use your water to discover how many of the smaller containers fit into the bigger container.

How do the two containers compare in size?

What's Going On?

When you pour your objects into your containers, do all of the objects pack into the containers the same way? Does the size of the object you pour affect how many objects can fit into a container?

Your Pour & Explore exhibit lets you play around with many math and science topics. We'll talk about three of them here: fractions, capacity, and volume. Let's start with fractions.

The word *fraction* means a small part of something bigger. Your Pour & Explore exhibit is full of fractions. Each individual object you use for pouring is a small

part of the larger collection of objects. Therefore, an individual object is a *fraction* of the entire collection. Your smaller containers cannot hold as many objects, or as much water, as your bigger containers. So, we say that your smallest container can only hold a *fraction* of the amount of stuff your biggest container can hold, or the smallest container is a *fraction* of the biggest container. How much stuff does that biggest container hold? The amount it can hold is called its *capacity*.

If you have ever baked, you have played around with capacity. Most measuring cups have numbers on them—2 cups, 1 cup, ½ cup (a fraction!)—that tell you how much stuff—flour, water, oil, chocolate chips—the measuring cup can hold. How much stuff a container can hold is called its *capacity*. Each container in your exhibit has its own capacity, too. By pouring objects and water in and out of the containers, we explore those capacities and how they are similar and different. A container's capacity never changes; it is a property of the container. However, you may have noticed while exploring your exhibit that the number of objects that can fit into a certain container can change. There are two reasons for this: the size of the objects and the shape of the objects.

Let's first start with the size of your objects. The amount of space an object takes up, or an amount of liquid takes up, is called *volume*. The larger an object is, the greater its volume, and the more water you pour, the more volume of water you have in your container. Let's think a little more about the volume of objects. If you have a pile of objects, each with a volume nearly the size of your entire container, can you fit many of those objects into your container? And if your objects have a really small volume compared to the container's capacity, like grains of rice, grains of sand, or molecules of water, can you fit a lot of these into your container? The relative size of your objects compared to your containers—the volume of the objects compared to the container's capacity—affects how many objects can fit into the container.

This isn't quite true for water, however. Because all water molecules are the same size and shape, water volume is determined by how much you pour into your container: the more water you pour, the greater volume of water you have. And because water takes the shape of the container—whatever shape that is (see photo)—it's easier to measure its volume very precisely. This is true of all liquids. Next time you play with your exhibit, try measuring out a certain volume of water and then measuring the same volume of objects.

What do you notice about your two measurements?

Water molecules may all be the same shape, but are all of the objects in your Pour & Explore exhibit the same shape? Are they very regular shapes, like circles or squares or cylinders, or are their shapes varied? Objects that are regular in size and shape, like water molecules, tend to pack together more closely, which allows more of them to squeeze into a container. Irregular shapes, like toy cars and small dolls, may not pack as tightly together into a container. You can use this knowledge to help you the next time you're putting away your toys, packing a lunchbox, or loading up your backpack!

Your Pour & Explore exhibit is full of possibilities for exploring fractions, capacity, and the volume of liquids and solids. Keep playing around and adding new elements to your exhibit, and be sure to check out the Discovery Museum challenge below to help you pour and explore more!

Discovery Museum Pour & Explore Challenge

Using what you have learned from your Pour & Explore exhibit, can you find a few new containers around the house to add to your collection and then organize them all by largest to smallest capacity without using a measuring device? Here are some questions to get you started:

- Can you tell anything about a container's capacity—the amount of stuff it can hold—before putting anything in it?
- Do you want to use a solid object or water to investigate your containers' capacities?
- If you want to put objects in your containers, what properties would you like these objects to have?
- How will these objects' volumes—the amount of space each object takes up—affect how many will fit into your container?
- Would you rather first explore the capacities of your larger containers, your smaller containers, or your mid-sized containers?

How many different ways can you find out the capacities of your containers?

What happens when you try using a different type of object or liquid to organize your containers by capacity?

How would your method change if you could use a measuring device? Try it!

Share Your Discoveries with Us!

We want to know about your Pour & Explore exhibit. Share your experience with us in any of the following ways:

- Take photos
- Draw a picture
- Write down the steps you took
- Write down which supplies were your favorites, why you liked making your own Pour & Explore exhibit, or any other fun things you discovered

Then email us at myhomediscoveries@discoveryacton.org. We can't wait to hear from you!

And next time you're at the Discovery Museum, check out our Pour & Explore exhibit in our Water Gallery on the first floor, and show us what you learned from the exhibit you created at home. We'll see you here!

Want even more Pour & Explore fun?

Check out these resources!

Activities

- Use dyed water to further explore volume https://littlebinsforlittlehands.com/volume-science-experiment-stem-activity/

- Practice measuring volumes while making your own fizzy potion, lava lamp, and more https://www.science-sparks.com/capacity-and-volume/

- Investigate the capacity of your own lungs https://www.sciencekiddo.com/lung-capacity/

- Explore volume through water displacement experiments https://lemonlimeadventures.com/lego-displacement-experiment-for-kids/

Videos

- Play around with fractions using Legos https://www.youtube.com/watch?v=ILUJdSsT32c

- Divide up a blank canvas into beautiful blocks of color just like artist Piet Mondrian. Do you see the fractions in your masterpiece? https://www.youtube.com/watch?v=dEq8J3ldsDU