

Worlds in Comparison

Activity D10

Grade Level: 3–12



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What’s This Activity About?

In understanding the solar system, getting a good sense of the relative sizes (volumes) of the planets can be a challenge. This activity is a fun, tactile way to help students model the relative sizes.

What Will Students Do?

Student groups each receive a large ball of playdough and instructions for how to divide it up to make the planets in our solar system.

Tips and Suggestions

- Playdough is commercially made by several manufacturers and sold in stores and the Internet. Depending on how many groups are doing the activity, this can be an expense. The activity also gives a recipe for making home-made play dough.
- Dividing the playdough is easiest if students take the initial ball or tub of playdough they receive and roll it into a cylinder shape first.
- You really do need three pounds of playdough for each group. If you give them less, they will not be able to produce a Pluto at the end.

- This activity was written before Pluto was demoted to dwarf planet status. If students raise issues about whether Pluto is a planet, you can distribute the sheet (3.12) about this topic from *The Universe at Your Fingertips* disk. Since dwarf planet Eris is a bit larger than Pluto, you could also change the Pluto part of this activity to an Eris part.
- If students, especially younger students, are surprised by the results of this activity, it will be important to give them a chance to discuss it, so they can share their thoughts and internalize the results. (This is what scientists do at colloquia and meetings when they come up with a surprising result.)

What Will Students Learn?

Concepts

- Solar System Scale Models
- Volume and Size

Inquiry Skills

- Modeling
- Comparing
- Measuring

Big Ideas

- Scale
- Models and simulations



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Worlds in Comparison Activity Guide

Originally developed by Dennis Schatz (Pacific Science Center) for Family ASTRO

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Type of Activity:	Classroom or drop-in station; facilitated or self-guided
Set up Time:	5 minutes
Time to Do:	20 minutes
Audience age:	8 years and older
Group size:	variable, as individuals or in groups of 2 - 4

What's This Activity About?

This activity allows participants to develop an understanding of the relative sizes (volumes) of the planets in the solar system. Families start with a big ball of playdough and divide it up following the steps on the instructions sheet. When they are done, they see how the planets vary in size. By the time they get to the tiny dwarf planet, Pluto, they are typically quite amazed.

Materials

Each group will need:

- Three pounds of playdough per group (see recipe on page 3)
- Plastic knife
- Breadboard or wax paper as surface for cutting playdough
- Instruction sheet (see page 4)
- Planet name worksheets (see pages 5 – 7)

Setting Up the Activity

This activity works best if the **worksheets** with the planet names (pages 5 – 7) are placed side-by-side on a table, and are arranged to match the order from the Sun. In front of these sheets place the **instruction sheet** (page 4) and the **playdough** and **plastic knife** on the **breadboard** (or equivalent). Be sure there is enough room in front of the table for the group to work together. It is **crucial to have the indicated amount** of playdough for each group. If there is less than three pounds, the Pluto piece will be too small to see! We recommend three pounds each and urge you to try the activity for yourself before leading it.

Suggestions for Introducing the Activity

For any of these scale model activities, it is useful to start by exploring the notion of models. Referring to playthings, such as dolls or toy cars, can be a useful reference for talking about scale models. For a more thorough exploration of this concept with ideas of how to introduce and discuss it, see the introduction to the Saturn Project.

This activity is designed as a self-guided station activity. Nevertheless, if you choose to do so, it can also be a facilitated activity from the beginning. If you facilitate this activity from the start, begin by asking the participants which planet they think is the largest. For whatever planet they say is the largest (it will most likely be Jupiter), ask them the following question: If we could combine all the planets together into a big ball, what fraction of that ball would the largest planet be? Might it be $1/9$ or $1/5$, for example? Which is the smallest? Some may say Pluto, even though it is no longer defined as a major planet, but is a dwarf planet. For our purposes, that is fine. We've kept it in this activity and it will be dramatically demonstrated just how much smaller it is than the others. End the introduction by telling them they will get a better idea of these relative sizes or volumes after completing this activity.

Note: If people will be using previously used playdough of various colors, you can reassure participants that mixing colors is fine (after all, many planets are multicolored!).

Doing the Activity

Participants start by reading the instructions handout (page 4), but they should get into working with the playdough as quickly as possible. They should follow the instructions as to how to divide up their playdough, placing the parts in the proper planet boxes (pages 5 – 7). Each time the playdough is divided up and parts are combined to make a planet, be sure participants roll the combined parts around in their hands until the planet has a ball shape.

Wrap-up

Start by asking the group about some of the discoveries they made regarding the sizes of the planets. Were there any surprises? Ultimately direct the discussion so that they realize the smaller planets (except the dwarf planet Pluto) are the inner planets, while the larger planets are the outer planets. You may also want to note that more than 96% of the combined volume of the planets is in Jupiter and Saturn (approximately 60% in Jupiter and 36% in Saturn). Those giant planets really ARE giants.

Complementary Activities:

Scale models of the Solar System and planets:

- Pocket Solar System
- Earth As a Peppercorn
- Sizing Up the Moon
- Saturn Project

Other scale models:

- Birdseed Galaxy
- Sizing Up the Stars

Materials Sources:

Playdough:

Three-pound tubs of Play-Doh™, Crayola Dough™ or other similar modeling clay can be purchased from many craft suppliers. As of this writing, Dick Blick sells tubs of Crayola Dough™ for \$7.49 each (www.dickblick.com or (800) 828-4548).

Alternatively, you can make your own dough using the recipe below. The only drawback is that this can grow moldy, so if you plan to do this activity often, it is recommended that you invest in the commercial product.

Kool-Aid™ Playdough Recipe

This recipe makes three pounds of colorful, scented playdough:

- 5 cups of flour
- 1 cup salt
- 4 packages dry unsweetened Kool-Aid™
- 4 cups boiling water
- 6 tablespoons vegetable oil

Mix the dry ingredients together in a bowl. Mix the liquids together and pour them over the dry ingredients. Stir the mixture until it forms a ball (this may take a while — keep stirring). As the mixture cools, it will become less sticky. After the mixture has cooled to room temperature, take it out of the bowl and knead it until it is smooth. Store in ziplock™ bags in the refrigerator until ready to use.

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What's This About?

This activity demonstrates the different sizes of the planets in our solar system. Follow the steps outlined below to see the relative size (volume) of each planet. Start with a big 3-pound ball of playdough, which represents the volume of all the planets combined.

1. Divide the Entire Ball of Playdough into 10 Equal Parts

You may find it easiest to start by rolling the ball into one big hot dog shape.

- Combine 6 parts together and put them into the Jupiter box.
- Similarly combine 3 parts and put them into the Saturn box.

2. Cut the Remaining Part Into 10 Equal Parts

- Take 5 parts and combine them with the ball in the Saturn box.
- Combine 2 parts to put into the Neptune box.
- Combine 2 parts to put into the Uranus box.

3. Cut the Remaining Part Into 4 Equal Parts

- Take 3 parts and combine them with the ball in the Saturn box.

4. Cut the Remaining Part Into 10 Equal Parts

- Put 2 parts into the Earth box.
- Put 2 parts into the Venus box.
- Take 4 parts and combine them with the ball in the Uranus box.

5. Combine the Remaining 2 Parts and Cut Into 10 Equal Parts

- Put 1 part into the Mars box.
- Take 4 parts and combine them with the ball in the Neptune box.
- Take 4 parts and combine them with the ball in the Uranus box.

6. Cut the Remaining Part Into 10 Equal Parts

- Put 7 parts into the Mercury box.
- Take 2 parts and combine them with the ball in the Uranus box.

7. Cut the Remaining Part Into 10 Equal Parts

- Take 9 parts and combine them with the ball in the Uranus box.
- Put 1 part into the Pluto box.

And Now...

Now that you have divided the playdough to represent the planets by volume, roll the pieces in each planet's box into balls to best represent the shapes of the planets.

Mercury

Venus

Earth

Mars

Jupiter

Saturn

Uranus

Neptune

Pluto