



Worlds in Comparison

How small is Earth compared to Jupiter or Saturn? How much bigger are the gas giants to the terrestrial planets? Have students use Play-Doh to find out in this perfectly scaled and perfectly fun activity!

GBO suggestion - follow this activity with the GBO **Toilet Paper Solar System** lesson plan.

Time

- 30 minutes prep time to make Play-Doh
- 30– 45 minutes activity time

Grade

- 3-6

Next Generation Science Standards

- 5-ESS1-1 Understanding relative distances through the solar systems scale
- MP.4 –Model with mathematics
- MS– ESS1-3 Analyze and interpret data to determine scale of objects in the solar system

Materials

- Worlds in Comparison Play-Doh Recipe / Instruction Sheet for teacher
- Play-Doh – enough for each student or group
- Worlds in Comparison Planet Boxes print out, 1 for each student or group
- Plastic knife and ruler for each student or group
- Ruler for each student or group

Utah Science Core Standards

- 6.1.3 Use computational thinking to analyze data and determine the scale and properties of objects in the solar system. Scale can be size and distance. Data can be models.
- 6.3 Students will understand the relationship and attributes of objects in the solar system.



Kitt Peak National Observatory

<http://www.noao.edu/kpno/>

This lesson is adapted from

- You may want to start your lesson with the GBO introductory video, find on the video tab here: <http://www.greatbasinobservatory.org/lesson-plans/worlds-comparison>

Background information for Teachers/Parents

It is difficult to compare the sizes of the planets in our solar system directly since the solar system is so vast and the planets are so large. In science making models is a helpful, hands-on way to gain understanding of hard to conceptualize subjects. Because our solar system's planets vary widely in size (both in diameter and mass), creating a model of comparison can be very helpful for conceptualization.

Our solar system's four inner planets are small and dense, and made up of rock and metal. Our four outer planets are large, with low density, and are composed mainly of gas and ice. Tiny Pluto is not a planet at all, scientist's demoted Pluto to a dwarf planet in 2006.

Characteristics of material, size, and density help us to understand the differences between planets. This activity is also a good way to review the names of the planets. Older students can hypothesize why the inner planets are smaller than the outer planets. Might this have something to do with their proximity to our sun? What can we learn about the formation of the solar system and the force of gravity through understanding the sizes of planets?

If you have not done the Toilet Paper Solar System- a Scale Model activity yet, do that after this one. Through these two activities student's will gain a much better understanding of the scale of our solar system.

Kool-Aid/Play-Doh Recipe

You can prepare home made Play-Doh or use store bought. This homemade Play-Doh can be stored in Ziploc bags for future use.

INGREDIENTS:

2 ½ cups flour

½ cup salt

2 packages of dry/unsweetened Kool-Aid (your color/flavor preference)

*If you don't have access to Kool-Aid, food coloring also works or the Play-Doh can be left plain.

2 cups boiling water

3 tablespoons vegetable oil

Mix the flour, salt and Kool-Aid (food coloring) in a mixing bowl. Combine boiling water and oil then pour the liquid over the dry ingredients. Stir mixture until it forms a ball (this takes some time but just keep stirring). As the mixture cools, it becomes less sticky. When cooled sufficiently, remove it from the bowl and knead it until it is smooth.

Directions

1. Print out the planet boxes. Or have students take 3 pieces of paper and separate it into thirds to create 9 sections. Write the names of all 8 planets and 1 dwarf planet on the papers (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto (a dwarf planet)).
2. Then students should follow the instructions below to divide up their Play-Doh and place the parts into the proper planet boxes, you can have your students work in pairs, sharing jobs.
3. **Divide the Entire Ball of Play-Doh into 10 Equal Parts**
 - a. *Roll the ball into one big hot dog shape. Then use a ruler to cut the shape into 10 equal parts.*
 - b. Combine 6 parts together and put them into the Jupiter box.
 - c. Similarly combine 3 parts and put them into the Saturn box.
4. **Cut the Remaining Part into 10 Equal Parts**
 - a. *Once again roll the ball into one big hot dog shape. Then use a ruler to cut the shape into 10 equal parts.*
 - b. Take 5 parts and combine them with the ball in the Saturn box.
 - c. Combine 2 parts to put into the Neptune box.
 - d. Combine 2 parts to put into the Uranus box.
5. **Cut the Remaining Part into 4 Equal Parts**
 - a. Take 3 parts and combine them with the ball in the Saturn box.
6. **Cut the Remaining Part into 10 Equal Parts**
 - a. *You're an expert at this now. Roll the ball into one big hot dog shape. Then use a ruler to cut the shape into 10 equal parts.*
 - b. Put 2 parts into the Earth box.
 - c. Put 2 parts into the Venus box.
 - d. Take 4 parts and combine them with the ball in the Uranus box.
7. **Combine the Remaining 2 Parts and Cut into 10 Equal Parts**
 - a. *That's right make that hot dog shape again and grab your ruler.*
 - b. Put 1 part into the Mars box.
 - c. Take 4 parts and combine them with the ball in the Neptune box.
 - d. Take 4 parts and combine them with the ball in the Uranus box.
8. **Cut the Remaining Part into 10 Equal Parts**
 - a. *That's right make that hot dog shape again and grab your ruler.*
 - b. Put 7 parts into the Mercury box.
 - c. Take 2 parts and combine them with the ball in the Uranus box.
9. **Cut the Remaining Part into 10 Equal Parts**
 - a. *Last time! Roll the ball into one big hot dog shape and use a ruler to cut 10 equal parts.*
 - b. Take 9 parts and combine them with the ball in the Uranus box.
 - c. Put 1 part into the Pluto box.
10. ***Finally:*** *Now that you have divided the Play-Doh to represent the planets by volume, roll the pieces in each planet's box into balls to best represent the shapes of the planets.*

Going Deeper

1. After creating your planets ask students why they think the planets vary so much in size? Might it have something to do with how our Solar System was formed?
2. We have three videos you can show students on our webpage about the Solar System's formation. Find them at <http://www.greatbasinobservatory.org/lesson-plans/z-homeschool-worlds-comparison> You'll need to click on the video tab. Decide if you will show one, two, or all the videos.
3. After watching, have students come together in small groups, 4 students works well. Have students converse about the following, trying to provide as much evidence in their conversations as possible. As a teacher circulate through the room while the students are doing this, prompting students with questions, and analyzing whether they are articulating the main learning objectives. Students should discuss:
 - a. How do the four inner planets and four outer planets differ? You want students to describe how the materials the planets are made of are different. Inner planets are made of rock and metal. They are dense, small, and close to the sun. Outer planets are made of gas and ice. They are less dense. They are very far from the sun, and therefore colder.
 - b. How do the planets help us understand how the Solar System was formed? Students should use the key word **gravity, or gravitational force** when discussing the Solar System's formation. They may also describe **rotation**.