



Pocket Solar System

Dark Skies, Bright Kids
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Activity Time: 35 min

Prep Time: 10 min

Grade: 3rd+

Standards of Learning Topic

- Primary SOL
 - Science 4.7: The student will investigate and understand the organization of the solar system. Key concepts include
 - a) the planets in the solar system;
 - b) the order of the planets in the solar system;
 - c) the relative sizes of the planets.

Description

Students begin by predicting the locations of the eight planets and Pluto on a piece of register tape. The students then place stickers at the actual locations of the planets and compare this to their predictions. Relative locations are determined by folding the register tape, taking advantage of the (roughly) even ratios between planetary distances. Students can be given the option of decorating their Solar System model.

Materials

- Teacher needs
 - Scissors
- Each student needs
 - Writing utensils
 - Art supplies
 - Cash register tape (3-4 ft per student)
 - Stickers (at least 10 per student for the 8 planets, the Sun, and Pluto)

Alternate Materials

- Planet stickers can be found at most educational stores.

Goals

- Illustrate the relative distances in the Solar System
- Demonstrate how large the Solar System is
- Reinforce the names and order of major Solar System bodies



Introduction to Topic

The scale of the Solar System is very difficult to comprehend. Making a scale model emphasizes how large the distances are between Solar System objects.

Pre-Activity Instruction

This activity works best if the students are already familiar with the name and order of the planets in the Solar System.

Preparation

- 1) Cut register tape into 3-4 ft segments.
- 2) Give out stickers.

Procedure

- 1) Have students mark the location of the Sun at one end of the tape and Pluto at the other. Ask them to mark on the paper where they think the rest of the planets should be on this scale. Simply placing an x and labeling the location is sufficient.
- 2) Now the students will place stickers at the correct locations on the paper.
 - a. Fold the paper in half, open it back up, and place a sticker at the crease. This is Uranus.
 - b. Fold the paper back in half, then in half again (to make quarters). Open it back up and place a sticker at the $\frac{1}{4}$ fold closer to the Sun. This is Saturn.
 - c. Place another sticker at the $\frac{3}{4}$ fold. This is Neptune.
 - d. Fold the Sun up to Saturn and make a crease (this is $\frac{1}{8}$ th of the paper). Open it back up and place a sticker at the new crease for Jupiter.
 - e. Fold the Sun to Jupiter and make a crease (this is $\frac{1}{16}$ th of the paper). There is actually no planet here; this is the center of the asteroid belt! Students can place a number of small dots here to represent asteroids.
 - f. Fold the Sun to the asteroid belt and make a crease (this is $\frac{1}{32}$ nd of the paper). This is Mars.
 - g. The remaining planets (Earth, Venus, and Mercury) are all within the orbit of Mars and it is no longer useful to try and mark the locations by folding. Instead, have the students evenly space the remaining stickers to mark the location of the inner three planets: Mercury (closest to the Sun), Venus, and Earth.
- 3) Open up the entire paper and look at the Solar System! Students can write the names under the planets and continue decorating their pocket Solar System.
- 4) Have the students compare the real locations with their predictions.

Pro Tips

- You may want the names of the planets, Sun, and asteroid belt on the board to help students with spelling.
- Students can place the stickers to the side of the creases in the register tape so they are not bent with additional folding.

Post-Activity Discussion

- *The most distant body that humans have visited is the Moon. Where would the Moon be on this model?*



The Moon would be about 1/1000th inch from the Earth! This is about the diameter of a single human hair. It takes humans 3 days to travel from the Earth to the Moon. Based on this, how long would it take to travel to the Sun? Jupiter?

- *While humans have gone no farther than the Moon, we have sent spacecraft to other locations in the Solar System. The Voyager spacecraft left Earth in 1987. How far do you think Voyager has traveled?*

As of November 2012, Voyager is more than 122 astronomical units from the Sun. That is 3 times farther from the Sun than Pluto, or 3 times the length of your pocket Solar System!

- *Using your model, how far away is the nearest star?*

Proxima Centauri is the closest known star to the Sun at a distance of 4.2 light years. A light year is the distance that light can travel in 1 year. An astronomical unit is roughly 9 light minutes. For your model, Proxima Centauri would be 3.8 miles away!

- *The planets in your model are spaced correctly, but their sizes are not to scale. How big should the planets be in your model?*

The Sun would be smaller than a single grain of sand. The planets would all be too small to see without a magnifying glass!

- *Can you see a pattern to the spacing of the planets in your model?*

Yes – a planet is located roughly 1.5 to 2 times the distance from the Sun as the next closest planet. This only holds true if we treat the asteroid belt like a planet.

- *Why didn't a planet form at the distance of the asteroid belt?*

There are two reasons why no planet formed at the distance of the asteroid belt. First, even though there are many asteroids, most are very small. All of the asteroids added together have only 0.4% the mass of the Earth (or 4% the mass of the Moon)! Second, both Jupiter and Mars exert gravitational tugs on the asteroid belt. These constant tugs prevent the small bodies from coming close enough to bind together. Asteroids exist all over the Solar System!

- *Why isn't Pluto a planet?*

In 2006 the International Astronomical Union redefined the criteria for a body orbiting our Sun to be considered a planet. These criteria are: (i) the object must be in orbit around the Sun (it cannot just be passing through!); (ii) the object be sufficiently massive to have formed a round shape; and (iii) the object must have been able to clear its orbit of large debris. Pluto satisfies two of the three criteria. It both orbits the Sun and has a round shape, but it has not cleared its orbit of large debris! Pluto's largest moon, Charon, is 10% the mass of Pluto, and several other large objects have been discovered around Pluto. Pluto is now considered a dwarf planet. It is important to remember that while Pluto's classification has changed, it is still there and nothing about it has changed! It is very much like changing which group you work with in class – nothing about you changes if you are in the Green or Red group.

Extensions and Related Activities

- DSBK Lessons:



- Scale model of the Solar System
- Edible model of the Solar System
- Wiggle time activity: Payload Races, Spacecraft Sprints

Resources

- Online scale model of the Solar System where the length of the page represents scale distances between planets
www.scalesolarsystem.66ghz.com
- A simulation of our Solar System allowing for view of all orbits and how the rest of the Solar System moves relative to one planet
www.gunn.co.nz/astrotour/?data=tours/retrograde.xml

Glossary

- *Astronomical Unit* – The distance between the Earth and Sun, approximately 1.5 million miles.
- *Dwarf Planet* – An object orbiting the Sun that is larger than an asteroid but does not qualify as a planet.
- *Gas Giant* – Massive planets in the outer part of the Solar System composed primarily of gas.
- *Light Year* – The distance that light can travel in one year.
- *Solar System* – The collection of bodies orbiting our Sun. The order of the major solar system bodies is:
 - Mercury – The 1st planet from the Sun
 - Venus – The 2nd planet from the Sun
 - Earth – The 3rd planet from the Sun, our home and the most massive terrestrial planet
 - Mars – The 4th planet from the Sun
 - Asteroid Belt – The region between Mars and Jupiter with many asteroids
 - Jupiter – The 5th planet from the Sun and the first of the four gas giant planets
 - Saturn – The 6th planet from the Sun, known for its distinct rings
 - Uranus – The 7th planet from the Sun
 - Neptune – The 8th and furthest planet from the Sun
 - Pluto – The most well-known dwarf planet
- *Terrestrial Planet* – A small, rocky planet orbiting in the inner Solar System