

LESSON 14:

MEASURING PLANET DISTANCES

Students will create a scaled model of the planets and their distances from the Sun, examining how far apart the planets are from one another.

OBJECTIVES

- ✓ How far apart are different planets?
- ✓ Which planets are the furthest apart?
- ✓ Which planets are the closest together?

MAIN BIN

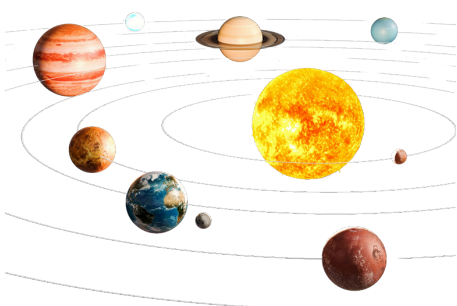
- Toilet Paper - 2 Rolls

PENCIL BOX

- Pencils - 20
- Scissors - 15
- Measuring Tape
- Tape
- Glue Sticks

FOLDER

- Construction Paper - 20
- Scientist's Worksheet - 15
- Planet Distance Chart - 5



INTRO

🕒 2-3 min

Did you know that Mercury is the closest planet to the Earth within our solar system? Our planetary neighbor is a whopping 113 million miles from Earth. That means traveling to Mercury is the same distance as circling the entire Earth over four thousand times! Today we will examine the planets within our solar system and their distances from the sun and one another.

HOOK

- Ask children to recall the order of the planets from the Sun. (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune).
- Ask children to recall the biggest planet and the smallest planet. (Biggest - Jupiter; Smallest - Mercury).
- Tell children that today they will be exploring the distance between planets and the distance their distance from the Sun. These can't be measured on Earth because the distances are so big, so the activity will be done to scale. Review what doing something to scale means a ratio of size in a model.

HYPOTHESIS

🕒 3-5 min

Ask children to predict:

- Which planets are the closest together?
- Which planets are the furthest apart?


Ask children to create the chart for the Scientist's Worksheet and record their predictions on this chart by starring the two planets they think are closest together and circling the two planets they think are furthest apart.

KEYWORDS

- Planet
- Radius
- Diameter
- Scale
- Astronomical Unit (A.U.)



ACTIVITY

 25-30 min

1. Put the children into groups of 2. Assign each group a planet or planets: Mercury & Venus, Earth & Mars, Jupiter, Saturn, Uranus, Neptune.
2. Using the planet model sheet, have students cut out their planet with construction paper and decorate as they like.
3. Then, students will use construction paper to create a "sun"
4. Find a long hallway or space where things can be spread out.
5. Place the "sun" down and have the "Mercury" group take the roll of toilet paper. Unroll the paper the distance the planet is from the sun based on the chart provides (0.38 AU).
6. One student will hold the end of the toilet paper roll, the other will walk backwards with it to that distance.
7. Repeat for the remaining 7 planets to see the distance of each from the sun. Make sure children are following a linear path from the Sun with their planets.
8. When the model is complete, have children measure the distance between each planet and fill it in on a chart.

TIP

Since the outcome of the lesson is to look at planet distance, not planet size, making the planets to scale is optional. If choosing to make the planets to size, to help keep to time, within each group, encourage children to work on multiple planets at once. For example, two children can work together to draw Mercury while the other two children in the group work together to draw Venus





OBSERVATION

🕒 5-10 min

Ask students to reflect on their models. Ask them to discuss:

- Were you able to tell which planets were the closest or furthest apart without measuring? Why or why not?
- Why do you think we didn't cut out a model of the Sun to scale?
- What do you notice about the inner planets versus the outer planets?

Students should notice that it was easier to spot the difference between the planets which were furthest apart as there was more of a discrepancy here, whereas the ones that were closest together needed to be measured as some were very close together.

Students should also have noted that the Sun is so large, even if done to scale, would need too many pieces of paper to be made!

Finally, students should have noticed that the inner planets were all close together while the outer planets are much more spread out.

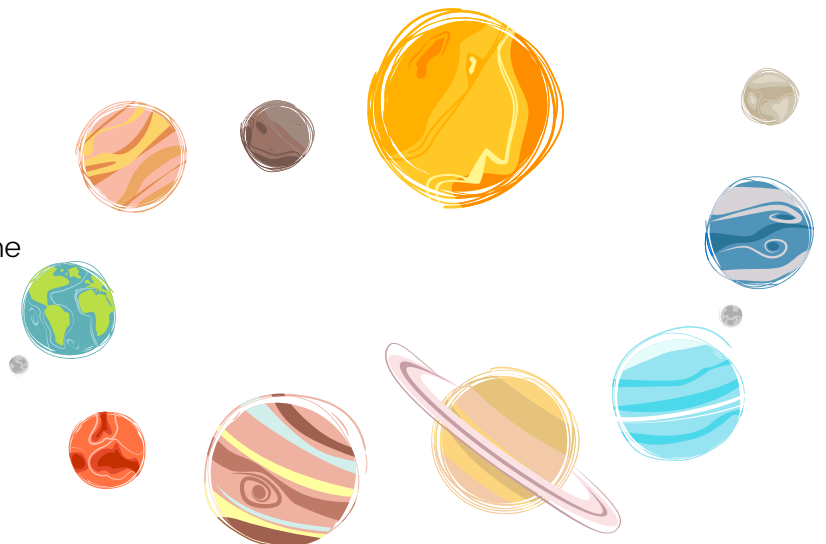
CONCLUSION

🕒 3-5 min


Ask students to share their findings. Ask:

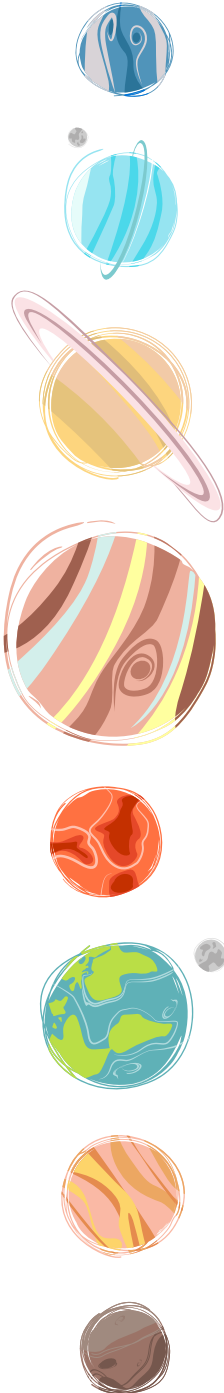
- Which planets were the closest?
- Which planets were the furthest apart?

Earth and Venus were closest together, while Neptune and Uranus were the furthest apart. Ask students to review their hypothesis to see how close they were.



EXPLANATION

 5-10 min



- The planets are all varying distances from the Sun, as seen in the model. The model created was based on astronomical units that were then converted to meters to make a scaled model. An astronomical unit is a unit of measure that is equal to 149.6 million kilometers. The model gives a great visual of the different sizes and distances of planets. While our observations and conclusions were true, it's important to note that this wouldn't always be the case in outer space.
- When we created the model, we created a linear model, meaning all the planets were in a straight line and distances were measured between planets this way. While Earth and Venus are the closest in terms of astronomical units, this only happens occasionally when their orbits align. Likewise, Uranus and Neptune are furthest away when their orbit aligns.
- As we know from previous lessons, all the planets orbit the Sun in an elliptical shape, rather than a circular motion. Each planet's orbit also takes a different amount of time. Therefore, at a given point, Earth and Venus could be on opposite sides of the Sun due to the differences in their orbit patterns.
- During this activity, it was clear that the inner planets (Mercury, Venus, Earth, and Mars) were closer together, while the outer planets (Jupiter, Saturn, Uranus, and Neptune) were all further apart. The inner planets and outer planets are separated by an asteroid belt. The inner planets all are made from rock and metal, do not have rings, have shorter orbits around the Sun and spin more slowly than the outer planets. The outer planets are made from gases and liquid, spin faster, have longer orbits around the sun and often have multiple moons and rings.



Exit Ticket



Can you name the planets in order from the sun?

Tip: Try this mnemonic device to remember:

"My Very Educated Mother Just Served Us Nachos."
Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune.



PLANET DISTANCE CHART

Tip: Write this on the board or print this for children to use as a reference.

| Planet | Distance from the Sun in Astronomical Units | Individual Squares of Toilet Paper from the "Sun" |
|---------|------------------------------------------------|------------------------------------------------------|
| Mercury | 0.38 | 0.75 (3 inches) |
| Venus | 0.72 | 1.5 (6 inches) |
| Earth | 1.0 | 2 (8 inches) |
| Mars | 1.5 | 3 (12 inches/1 foot) |
| Jupiter | 5.2 | 10.5 (42 inches/3.5 feet) |
| Saturn | 9.5 | 19 (76 inches/6.3 feet) |
| Uranus | 19.2 | 38 (152 inches/12.5 feet) |
| Neptune | 30.1 | 60 (240 inches/20 feet) |

SCIENTIST'S WORKSHEET

Tip: Can draw or write the following down on whiteboard!

| Planets | Distance apart in meters |
|-------------------|-----------------------------|
| Mercury to Venus | |
| Venus to Earth | |
| Earth to Mars | |
| Mars to Jupiter | |
| Jupiter to Saturn | |
| Saturn to Uranus | |
| Uranus to Neptune | |

