Toilet Paper Solar System – A Scale Model

The distances between our planets are so vast they are almost incomprehensible. Visualize the expansiveness of our "cosmic neighborhood" with a roll of toilet paper to create a scale model.

Next Generation Science Standards

- 5-ESS1-1-Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.

Materials

- A roll of toilet paper for each group or student
- Clear tape to repair toilet paper tears- 1 for each group or student (Optional)
- 1 marker for each group or student
- A way to mark the sun
- Rocks/weights to keep TP from blowing if outside
- Toilet Paper Solar System worksheet for each student
- Students can use coins or other small round objects to represent planets.

This is a fun activity that students can do by themselves at home using the worksheet. This activity presents a great opportunity for students to step away from the screen to learn science.

We have several videos available to discuss *extremophiles.* Check them out first to determine which ones you want to share with your class to deepen the activity.

Overview

Our solar system is so immense that the distances in space can be difficult for anyone to comprehend. In this activity, students will unroll a roll of toilet paper to build a scale model of distances in the solar system. While understanding these distances, students will explore why the sun is so essential to life on earth by examining the temperatures of each planet relative to the distance away from the sun. They will grasp that the location of the earth from the sun allows for life to be sustained due to the perfect amount of heat and energy produced by the sun.

Great Basin
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Notes for teachers

- 100 sheets of toilet paper stretch out to nearly 42 feet.
- Be aware that even slight wind can blow toilet paper, you can ask students to place rocks on TP if you are working outdoors.
- Planets do not have to all be in a line! The planets in our solar system lie in a general circle around our sun. If you have the space- tell students to spread their planets out. It will demonstrate distance better than if planets are all in one line.
- If doing this activity virtually, ask students to print the worksheet, do their model at home, and submit a photo of their model with a photo or scan of their answers to the questions on the worksheet.

Directions- Activity #1- Build your scale solar system model

- Provide each student or student group with a worksheet.
- Place something to designate the sun. <u>You will always be starting at the sun.</u>
- Instruct students to use their worksheet table and toilet paper to find the scaled distance of the planets from the sun.
- The number in the table is the number of sheets of toilet paper needed to reach the orbit of each planet. Each time they will start counting their toilet paper squares from the sun.
- Have them repeat this for their second planet and then the rest of the 8 planets.
- In real life the planets are not laid out in a single line. If space allows, encourage students to think about how they should place their planets to best represent the real solar system.
- Once their models are created, have students write the planets average temperature in marker on the toilet paper by each planet.
- Have students answer the questions on the worksheet to make a connection about the sun's role in temperature throughout the solar system.
- You can end your activity and discussion with this fun video, click on the **video tab**:
    - Bill Nye Demonstrates Distance Between Planets
      http://www.greatbasinobservatory.org/lesson-plans/toilet-paper-solar-system-scale-model
    - As an extension you can discuss *Extremophiles* (life that lives in extreme conditions and often does not need sunlight for survival). There are 2 great videos on the **video tab** placed after the Bill Nye video.
      http://www.greatbasinobservatory.org/lesson-plans/toilet-paper-solar-system-scale-model

Table for Toilet Paper Solar System Scale Model

Remember to start counting TP squares from the Sun each time.

Planets	Squares of Toilet Paper from the Sun	Average Temperature of Planets
Mercury	1.0	811 °F
Venus	1.8	873 °F
Earth	2.5	61°F
Mars	3.8	-20 °F
Jupiter	13.2	-162 °F
Saturn	24.2	-217 °F
Uranus	48.6	-319 °F
Neptune	76.3	-332°F

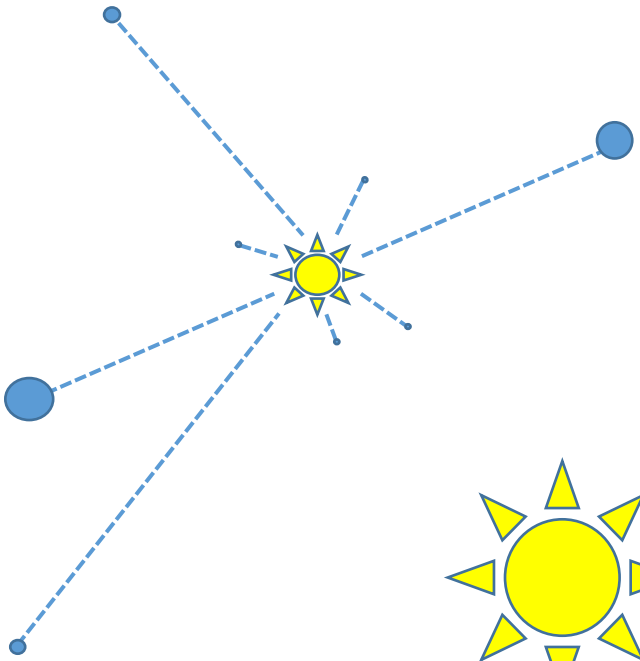

Diagram 1. This model is best used when there is access to a large room or outdoors area.

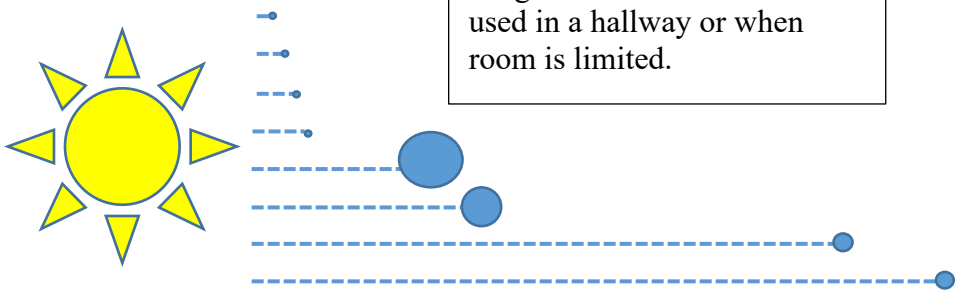

Diagram 2. This model is best used in a hallway or when room is limited.

Answers/Additional Information for worksheet

1. Why Earth is called the “Goldilocks Planet”- it is not too hot and not too cold for life to exist.
2. Could any of Earth’s life forms live on another planet? Why or why not? – This question is designed to help your students think critically. **There is no right answer.**

   Note:

   You can dig deeper by discussing extremophiles and showing the videos on our video tab. Life forms that exist in extreme conditions may be able to live on other planets. Scientists call these extremophiles (an organism, that lives in conditions of extreme temperature, acidity, alkalinity, or chemical concentration). Astrobiologists (scientists who study and look for life in outer space as well as on Earth) study extremophiles to learn about what life forms may exist beyond our world.
3. What would happen to all living things if the earth was where Jupiter is? **Most likely every living thing would perish.** Because Jupiter is so much farther away from the Sun it is much colder. Life on Earth is adapted to the day lengths, seasons, and temperatures that exist on Earth.
4. Imagine we discover life in outer-space- in a neighboring solar system. What is most likely to support that life? **A sun.** Help students understand that each star in the sky is a sun. Each star/sun is smaller or larger than our sun. Many planets exist around these suns.

   Note:

   To date, NASA's Kepler space telescope has discovered roughly 30 Earth-size exoplanets in their host stars' “habitable or ‘Goldilocks’ zone”! Scientists discovered the first planet outside our solar system (what we call an exoplanet) in 1988. Since then scientists have discovered 3,706 more planets!