Grades 6 and Up

WHICH PLANET IS THE FLATTEST?

BE A PLANETARY RESEARCHER

Instruction Sheet

What shape are the planets? It's likely not what you think. In this activity, you will create your own model of a rotating planet and make some observations. Then, determine which planet is indeed the flattest.

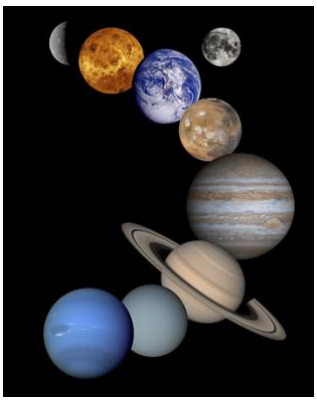


Image Source: Wiki Commons

MATERIALS

Make sure you have permission to use the materials from an adult!

- ☐ Paper
- ☐ Scissors
- ☐ Pencil, pen and/or marker
- ☐ Glue or tape
- ☐ Stick (skewer, straw, chopstick etc…)
- ☐ Template on page 3 (optional)
- ☐ Planetary Fact Sheet

INTRODUCTION

Argonne researchers specializing in astronomy, cosmology and astrophysics study space and the universe to answer some of the greatest questions and challenges of all time--the evolution and expansion of the universe and the mysterious dark energy and dark matter. Because their research happens down here on Earth, they need special tools, models, and simulations to do their work. You will be like an Argonne researcher by developing a model to understand the shapes of the planets. The shape of a planet will depend on a number of factors, including how fast it rotates. You will use flexible paper strips assembled around a stick to model how matter changes shape when rotated at different speeds. Follow the procedure to make your model and observe what happens!

ACTIVITY HIGHLIGHTS

- ☐ **Analyze planetary data**
- ☐ **Explore and learn more about what causes planetary shapes!**
- ☐ **Share your results with Argonne Education!**

U.S. DEPARTMENT OF ENERGY Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

PROCEDURE 1: Modeling a Planet's Rotation and Shape

1. Gather the materials.
2. Put a tick mark every cm on your stick so that it looks like a ruler.
3. Cut out two small circles (~4cm). You may want to print out a copy of the template (optional) or trace two circles on your piece of paper before cutting.
4. Make a small hole in the middle of one circle so that it is just large enough for the stick to fit.
5. Make a larger hole in the middle of the second circle so that it can easily move up and down the stick.
6. Cut out 8 strips about 28cm-30cm in length and about 1.25 cm in width. You may use the template or measure out the dimensions on your own using a ruler.
7. Glue or tape the 8 strips onto one of the circles you cut out (see Figure 1).
8. Glue or tape the other ends of the strip to the other circle so that it creates a sphere-like shape (see figure 3).
9. Insert the stick. One side should be able to easily move up and down. Make sure the other side is secure and fixed on the stick. You may want to add additional glue or tape (see Figure 2).
10. Spin the stick bewteen the palms of your hands and see what happens!
11. Now try spinning the stick slower, and then faster. How does the shape change with speed?
12. (Optional) Record what happens on your phone. Ideally use a slow motion setting so you can capture the motions.

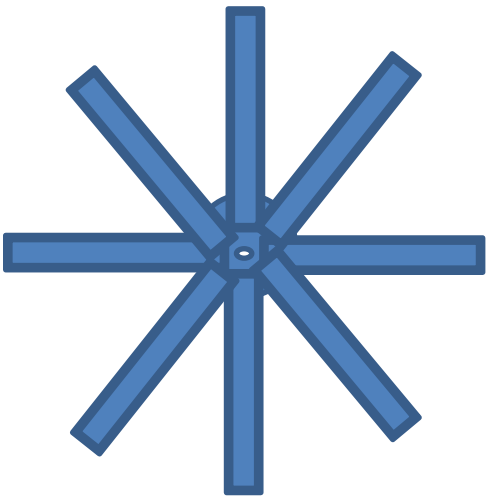


Figure 1

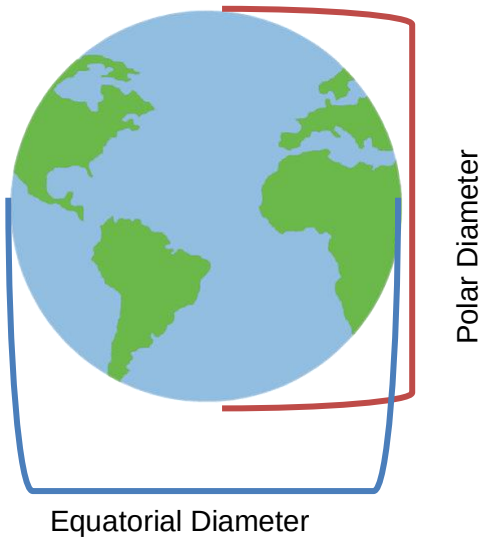
Figure 2

Figure 3

This procedure is inspired by [Sky at Night Magazine](), "6 Simple Experiments You Can Do at Home".

WHAT IS HAPPENING?

Planets aren't flat like a piece of paper, but they also aren't perfectly round or spherical either! A more accurate description of the shape would be an **oblate spheroid**, where the planets flatten at the poles and bulge along the equator. This is also what astronomers call an **equatorial bulge**. Speed of rotation, along with other factors, influences how drastic the equatorial bulge is.



PROCEDURE 2: Determining the "Flattest" planet"

1. Take a look at the data table on page 4.
2. Determine with planet has the greatest equatorial bulge.
3. Compare your answers to the rotation period, mass and density.

   Do you notice any trends?

Argonne NATIONAL LABORATORY

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Data Sheet

Planetary Fact Sheet - Metric

	MERCURY	VENUS	EARTH	MARS	JUPITER	SATURN	URANUS	NEPTUNE
Mass (10^{24}kg)	0.330	4.87	5.97	0.642	1898	568	86.8	102
Density (kg/m^3)	5427	5243	5514	3933	1326	687	1271	1638
Rotation Period (hours)	1407.6	-5832.5	23.9	24.6	9.9	10.7	-17.2	16.1
Equatorial Diameter (km)	4,881	12,103.6	12,756.3	6,792.4	142,984	120,536	51,118	49,528
Polar Diameter (km)	4,876.6	12,103.6	12,713.5	6,752.4	133,708	108,728	49,946	48,682

Note that the negative sign for Venus and Uranus's Rotation Period is because they spin or rotate "backwards" or in the opposite direction.

This data sheet was modified. See original NASA Planetary Fact Sheet:
https://nssdc.gsfc.nasa.gov/planetary/factsheet/