



Drexel-SDP GK-12 ACTIVITY

Activity: Planets and Scale

Subject Area(s) Earth &Space, Physical Science

Associated Unit Astronomy, module 1

Associated Lesson

Activity Title Planets and Scale

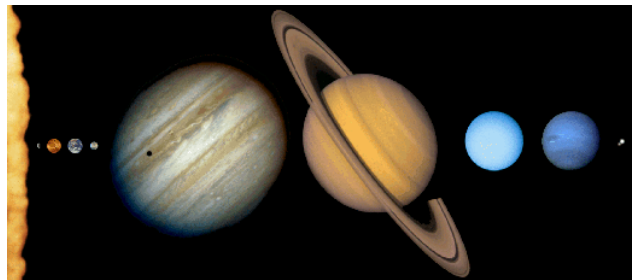
Grade Level 6 (3-8)

Activity Dependency None

Time Required 50 minutes

Group Size 2

Expendable Cost per Group approx. \$0.20 or less



Summary

After researching the nine planets of our solar system and the sun, the students will be able to describe the detail characteristics of the planets, sun, and stars of our solar system.

Engineering Connection

Engineers are involved in the design process of new tools and instrumentation on a wide range of scale—from the nano-scale drug-delivery systems inside the human body, to the macro-scale simulations that model weather patterns on the planet Jupiter. In this activity, we focus on the macro-scale of planetary size, comparing the sizes of planets respective to one another.

Keywords

Astronomy, scale, planets

Educational Standards

Pennsylvania Standards

3.1.7 Unifying Themes

3.1.7.D. Explain scale as a way of relating concepts and ideas to one another by some measure.

3.4.7. Physical Science

3.4.7.C. Identify and explain the principle of force and motion.

3.4.7.D. Describe essential ideas about the composition and structure of the universe and the earth's place in it.

Pre-Requisite Knowledge

None.

Learning Objectives

- Students will work in teams to research an assigned planet within our solar system.
- Students will be given a ratio of the real diameter of the sun and a scaled diameter. They will then determine the scaled diameter of their assigned planet and use it to make a paper model. Each team will then place their planet in the proper order on the chalkboard.
- Students will determine the length of time it takes sunlight to reach their assigned planet.
- Students will determine the density of their planet.

Materials List

- Computer (for research)
- Informational books (encyclopedias and/or science books)
- Construction paper
- Ruler
- Compass
- String
- Scissors
- Calculator (optional)
- Tape

Introduction / Motivation

Engineers play a large part in the exploration of our solar system and beyond. One of the most basic things that must be known in order to determine how rovers or satellites will behave on another planet is based on the mass (size and material) of those planets. This is because the force due to gravity on a planet is directly related to its mass. Today we will be investigating the size of the other planets in the solar system compared to Earth and the sun.

After researching the nine planets of our solar system and the sun, the students will be able to describe the detail characteristics of the planets, sun, and stars of our solar system. Many students have no concept of the size of the Earth compared to other planets in our solar system.

This activity combines group research on the individual planets culminating in class compilation of data regarding the size of the planets.

Review the background material with the students, discuss the vocabulary, then begin the activity.

Vocabulary / Definitions

Word	Definition
Solar system	The Sun and all things orbiting around it, including the nine major planets, their satellites, and all the asteroids and comets.
Diameter	The length of a straight line through the center of a circle.
Density	Mass (m) per unit volume (V) — the ratio of the amount of matter in an object compared to its volume.
Scale	The ratio between the actual size of something and a representation of it; "the scale of the map"; "the scale of the model."

Procedure

Background

Our solar system has at its center, an average star we call the Sun. In orbit around the Sun are the nine planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. There are also many comets, asteroids, satellites of the planets, and background dust in the solar system. The Sun contains 99.85% of all the matter in the Solar System. The planets, which condensed out of the same disk of material that formed the Sun, contain only 0.135% of the mass of the solar system. Jupiter contains more than twice the matter of all the other planets combined. Satellites of the planets, comets, asteroids, meteoroids, and the interplanetary medium constitute the remaining 0.015%. Below is an image containing pictures (from spacecraft missions) of the nine planets (drawn to scale, that is, the relative sizes of one planet to another planet are correct).

The terrestrial planets are the four innermost planets in the solar system, Mercury, Venus, Earth and Mars. They are called terrestrial because they have a compact, rocky surface like the Earth's. The planets, Venus, Earth, and Mars have significant atmospheres while Mercury has almost none. Below is a close-up picture of the four terrestrial planets. Jupiter, Saturn, Uranus, and Neptune are known as the Jovian (Jupiter-like) planets, because they are all gigantic compared with Earth, and they have a gaseous nature like Jupiter's. The Jovian planets are also referred to as the gas giants, although some or all of them might have small solid cores (<http://www2.jpl.nasa.gov/galileo/sepo/education/nav/scale.html>).

Before the Activity

Collect and distribute materials.

With the Students

Procedure:

1. Organize the students into 9 groups and assign each team a planet.
2. The teams will conduct research on their planet utilizing the internet and/or informational books that are available in the classroom or in the library. (The students must find the diameter of their assigned planet and its distance from the sun.)
3. The teacher will give the group the real diameter and a scaled diameter of the sun. The students must scale the diameter of their planet (see the table below).
4. The students will make a scale model of their planet using construction paper.
5. Students will use **unit conversion and dimensional analysis** and the speed of light (299,792,458 meters per second) to determine the amount of time it takes light to travel from the sun to their planet.
6. Students will present their research about their planets and the above calculations to the class.
7. Each planet will be taped to the chalkboard so that the class may see the planets relative to each other.

	Actual Diameter (km)	Scaled Diameter (cm)
Sun	1,392,000	612
Mercury	4880	2
Venus	12104	5
Earth	12742	6
Mars	6780	3
Jupiter	139822	61
Saturn	116464	51
Uranus	50724	22
Neptune	49248	22
Pluto	2274	1

Safety Issues

- None

Troubleshooting Tips

Help the students to calculate the volume of the planet using pi and a calculator.

Investigating Questions

Have student groups prepare a report and presentation of their findings, including any questions they have formulated during their research.

Assessment

Pre-Activity Assessment

None

Activity Embedded Assessment

Have the student groups prepare a report and presentation to be given in front of the class.

Post-Activity Assessment

Evaluation will be based upon teacher observation of student participation, and a student team report and presentation.

Activity Extensions

(<http://www2.jpl.nasa.gov/galileo/sepo/education/nav/scale.html>).

Owner

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Contributors

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Version: Mar 2007