

SUGGESTED REFERENCES

- *NASA'S Solar System Exploration Page (click 'Pluto')*
<http://solarsystem.nasa.gov/planets/>
- *Windows to the Universe, our solar system - information and activities delivered at three levels*
www.windows.ucar.edu/
- *Why is Pluto no longer considered a planet?*
<http://science.howstuffworks.com/pluto-planet.htm>
- **Is Pluto a Planet? A Historical Journey through the Solar System**, by David Weintraub
 Princeton University Press, October 2006

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 5 - 8
History & Nature of Science
 Nature of science
 History of science

Grades 5 - 8
Science as Inquiry
 Abilities necessary to do scientific inquiry
 Understandings about scientific inquiry

**Source: National Science Education Standards, 1996, National Academy Press*

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VOLUME 21 ISSUE 3 SPACE SCIENCE - *Studying Distant Pluto*

SYNOPSIS

Scientists have been debating the planetary designation of Pluto ever since it was discovered in 1930. In this program, students are given a firsthand look at the scientific process that first classified Pluto as a planet and then reclassified it as a dwarf planet in 2006. Not all scientists are in agreement with this definition and the future may bring further reclassification. Also, students will learn the scientific process of categorizing a planet and details about this tiny world at the farthest reaches of our solar system.



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10 minutes

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BACKGROUND

Is Pluto a planet? This question has been debated ever since Clyde Tombaugh first discovered it in 1930. The question itself highlights both the nature and process of scientific research.

Tombaugh studied photographic plates made of the night sky and compared plates of the same area of the sky taken on several different nights. He discovered one object that had what they were looking for - planet X. The area of sky was re-photographed and the discovery confirmed.

Ever since, Pluto has been controversial. It has characteristics unlike other planets. Pluto orbits in an eccentric ellipse and has the greatest inclination of all the planets. Its orbit takes it inside the orbital path of Neptune. All of the inner planets are rocky worlds. All of the outer planets are gaseous, except Pluto. Only 1/6 the mass of our moon, Pluto seems to be made up of frozen gases and some non-icy material.

For over 70 years, although Pluto's inclusion into the league of planets was debated, scientific consensus was that Pluto was a planet. In 2003, other objects in the Kuiper Belt were discovered that were similar in size, composition and orbit to Pluto. Two of these objects, named Eris and Ceres, were either to be given planetary status or reclassified.

The discovery of Eris and Ceres caused the International Astronomical Union (IAU) to formally define a planet for the first time. According to the IAU a planet has to meet three requirements: a body that orbits the Sun; is large enough for its own gravity to make it round and has "cleared the neighborhood" of smaller objects. Because Pluto did not meet that definition, it was placed into a new category called Dwarf Planet, along with Eris and Ceres. Pluto's status is still being debated, but it appears the weight of evidence has firmly redefined its status.

CRITICAL THINKING EXERCISES

1. Describe the technique Clyde Tombaugh used to study the cosmos.
2. Compare and contrast the orbits of Pluto and the eight planets of our solar system.
3. Propose reasons why Pluto should be considered a dwarf planet.
4. Construct a timeline detailing scientific tools used to gather information regarding Pluto, and the change in classification of Pluto as a result of new information.

CAREER POSSIBILITIES

- ASTRONOMER
- ASTRONAUT
- ASTROPHYSICIST
- COSMOLOGIST
- ENGINEER
- PHYSICIST

ADVANCED ORGANIZERS

Prior to viewing this program, students should have some understanding of the following Benchmarks for Science Literacy, Oxford University Press which are excerpted and, in some cases, abbreviated below. Refer to the Benchmarks for more information.

Benchmark 4. The Physical Setting

Section A: The universe, Grades 6-8

- Eight (plus three dwarf) planets of very different size, composition, and surface features move around the sun in nearly circular orbits. Some planets have a great variety of moons and even flat rings of rock and ice particles orbiting around them. Some of these planets and moons show evidence of geologic activity.

Benchmark 4. The Physical Setting

Section F: Motion, Grades 6-8

- An unbalanced force acting on an object changes its speed or direction of motion, or both. If the force acts toward a single center, the object's path may curve into an orbit around the center.

**Benchmarks can be found at www.project2061.org/tools/benchol/bolintro.htm*

VOCABULARY

Astronomy The scientific study of the universe and objects in it, including planets, stars, nebulae, and galaxies. Astronomy deals with the position, size, motion, composition, energy, and evolution of celestial objects. Astronomers analyze not only visible light but also radio waves, x-rays, and other ranges of radiation that come from sources outside the Earth's atmosphere.

Charon The only known moon of Pluto; just over half Pluto's size, it orbits so closely that it was not discovered as a distinct body until 1978.

Eclipse The partial or total blocking of light of one celestial object by another.

Ellipse Closed, symmetric curve shaped like an oval, which can be formed by intersecting a cone with a plane that is not parallel or perpendicular to the cone's base.

Kuiper Belt An area of the solar system outside of Neptune's orbit, which is believed to contain asteroids, comets, and icy bodies.