St Aiden's Homeschool

Our Solar System

Pluto

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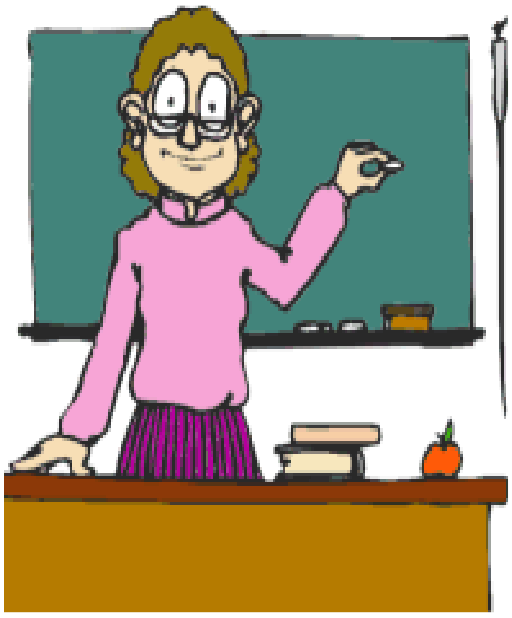
In a Nutshell:

Neptune and Uranus are very much alike. They are both large gas planets that look like big blue-green balls in the sky. Neptune has winds in its atmosphere which blow at over 2000 kilometres per hour! This planet has large, dark circles on its surface which astronomers believe to be storms. Neptune has two thick and two thin rings which surround it. Neptune also has thirteen known moons. Four of these moons orbit the planet within the rings. One of Neptune's moons, Triton, orbits the planet in a direction opposite to Neptune's other moons. Neptune is the farthest planet from the Sun.

Parent/Teacher Discussion Ideas

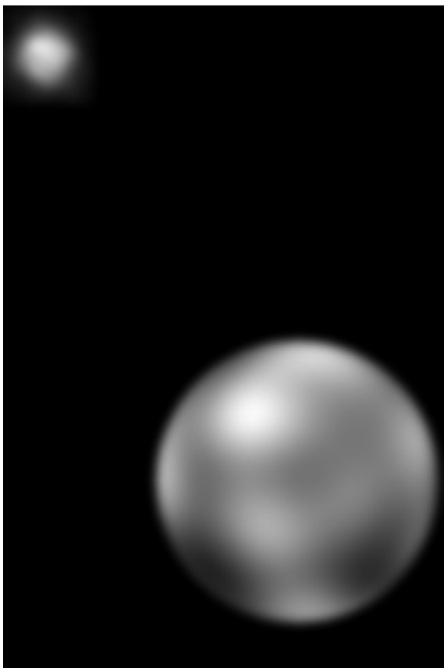
- *Neptune's magnetic field is off[illegible]e and at a large angle to its rotation axis. What processes in the interior generate this oddly shaped field?*
- *What accounts for the relative lack of hydrogen and helium in Neptune (and Uranus)?*
- *Why are Neptune's winds so strong in spite of the fact that it is so far from the Sun and has a relatively weak internal heat source?*
- *What happened to the Great Dark Spot?*
- *Can we design a useful Neptune orbiter mission cheap enough to be funded?*



Pluto

Pluto Facts:

- *Pluto is a dwarf planet, smaller even than Earth's Moon.*
- *Pluto sometimes moves closer to the sun than Neptune.*
- *Pluto is a dwarf planet that was discovered by the astronomer Clyde W. Tombaugh in Arizona on February 18, 1930.*
- *Astronomers are now finding new objects far, far from the Sun which they call dwarf planets. Pluto, which was once called a planet, is now called a dwarf planet.*
- *Pluto is actually smaller than one of Neptune's moons, Triton.*



Pluto twice, a smaller raw and a larger processed image combined, from the Hubble Space Telescope

How big is Pluto?

Comparison of the sizes of Pluto, Charon, the Moon and Earth

Pluto's **mass** is about 12,500,000,000,000,000,000,000 kilograms. While this may seem large, it's only about 1/500th of the Earth's mass. Pluto is between 2200 and 2400 kilometres across. Its **surface area** is about 17,950,000 square kilometres (or 1/30th of the Earth's). Its **volume** is 7,150,000,000 km^3 (or 1/150th of the Earth's)

What is its Surface like?

We don't really know for sure what its surface is like. No spacecraft has ever been there, and even the best telescopes can't see any detail. It is certainly very cold, at about -230 °C. The surface is covered with ice. Pluto also has a very thin **atmosphere** which freezes when Pluto moves far away from the Sun.

The image to the left shows Pluto's colour.

What are Pluto's moons like?

Pluto has three known moons. The largest is called Charon. Charon is about half as wide as Pluto. Because Pluto and Charon are so close in size, they are sometimes called a "double planet". Charon's surface is covered in water ice. In Roman mythology, Charon took dead souls across the river Acheron to the land of the dead. Two other moons were discovered in 2005. They have been named Nix and Hydra.

How long is a day on Pluto?

One day on Pluto is about 6.487 Earth days long. Like Uranus, Pluto also spins on its side.

How long is a year on Pluto?

One year on Pluto would be about 90,613 days or 248 years on Earth!

What is it made of?

Scientists believe Pluto is made mostly of rock and ice, but they will not be sure until more research is done. The discovery of Charon helped scientists estimate the **density** of Pluto. The information collected told them what Pluto was and was not made out of. If Pluto were made out of heavy solids, it would have a very high density. If it were made of gases, it would have a low density. Pluto is somewhere in between, so it is probably made of rock and ice.

How much would Pluto's gravity pull on me?

If you were on Pluto, gravity would be only 0.06 times as strong as it is on Earth. This means you could do really high jumps—even more than people could on the Moon!

Who is Pluto named after?

Pluto was named after the Roman god of the underworld. In Roman mythology, he kidnapped Proserpina (Persephone) so he could marry her. This made her mother, the goddess of agriculture, very sad, causing winter. To end winter,

Jupiter, his brother, sent Mercury to get her back. Pluto agreed that she could go back, assuming she had not eaten anything from the underworld. However, she had eaten six pomegranate seeds, so Jupiter decided she had to spend six months in the underworld each year. This is the Roman myth of winter. When she goes to the underworld, everything stops growing. When she comes back, her mother is happy again, and life returns.

In Roman mythology, Pluto (Greek: Hades) is the god of the underworld. The planet received this name (after many other suggestions) perhaps because it's so far from the Sun that it is in perpetual darkness and perhaps because "PL" are the initials of Percival Lowell.

Is Pluto a planet?

Pluto has been officially classified as a dwarf planet, which is different than a regular planet. One of the reasons is that it is a lot smaller than other planets - although it is the tenth largest known object that revolves around the sun, it is smaller than many moons, including Earth's moon. Scientists used to think that Pluto was a lot larger than it actually is, and it was thought of as the ninth planet for many years.

Another key reason is that Pluto is part of a large group of objects called the Kuiper Belt, which all revolve around the Sun in the area beyond Neptune. It appears that there are several Pluto-sized objects in this part of the solar system, as well as millions of smaller objects.

In the world of astronomy, not everyone agrees. However, most scientists now accept that Pluto isn't a regular planet.

Who Discovered Pluto:

Pluto was discovered in 1930 by a fortunate accident. Calculations which later turned out to be in error had predicted a planet beyond Neptune, based on the motions of Uranus and Neptune. Not knowing of the error, Clyde W. Tombaugh at Lowell Observatory in Arizona did a very careful sky survey which turned up Pluto anyway.

Pluto has not yet been visited by a spacecraft. Even the Hubble Space Telescope can resolve only the largest features on its surface (left and above). A spacecraft called New Horizons was launched in January 2006. If all goes well it should reach Pluto in 2015.

Pluto has a satellite, Charon which was discovered in 1978.

In a Nutshell:

For many years, Pluto was thought of as the farthest known planet from the Sun. It has a very unusual orbit. Once every 248 Earth years, Pluto swings inside the orbit of Neptune. It stays there for twenty years. During those twenty years, Pluto is closer to the Sun than Neptune. While it is closer to the Sun, Pluto has an atmosphere. The methane and nitrogen frozen at the poles thaw out, rise, and temporarily form an atmosphere. As it moves toward its farthest point from the Sun, Pluto's atmosphere freezes and falls back to the ground. Since the year 2000, astronomers realized that Pluto was not like the other eight planets but very much like a new group of objects found in the outer solar system. In 2006, astronomers re-classified Pluto to be a dwarf planet.

Pluto has three moons. Pluto's largest moon, Charon, is half the size of Pluto. In 2005, astronomers observed two more moons of Pluto. The moons were named Nix and Hydra. Like the Earth's Moon, Charon may be the result of a collision between Pluto and another body.

Charon is named after the mythological figure who ferried the dead across the River Acheron into Hades (The Underworld). Charon's discoverer, Jim Christy, also named this moon/planet after his wife, Charlene. Christy discovered Charon in 1978

The surface temperature on Pluto varies between about -235 and -210 C. Pluto can be seen with an amateur telescope but it is not easy

Fact Sheet

Pluto

Ninth planet from the Sun

Hubble Space Telescope PI#00027

Orbit
39.5 astronomical units (AU) from the Sun
Earth is 1 AU from the Sun

Length of year
248 Earth years

Length of Day
6.39 Earth days

Tilt of Rotation Axis
122.5 degrees versus 23.5 degrees for Earth

Size
Diameter: 0.2 of Earth's diameter

Surface Gravity
0.08 of Earth's gravity
If you weigh 80 pounds on Earth, you would only weigh about 6.4 pounds on Pluto.

Mass
0.0022 of Earth's mass

Surface Temperature
Mean temperature: -375 degrees Fahrenheit

Atmosphere
Little is known about Pluto's atmosphere, but it probably consists primarily of nitrogen with some carbon monoxide and methane. It is extremely tenuous, the surface pressure being only a few millionths of the Earth's surface pressure. Pluto's atmosphere may exist as a gas only when Pluto is closest to the Sun; for the majority of Pluto's year, the atmosphere is frozen.

Surface
Pluto's composition is unknown, but its density indicates that it is probably a mixture of 70% rock and 30% water ice, much like Triton. **The bright areas of the surface seem to be covered with ices of** nitrogen with smaller amounts of (solid) methane, ethane and carbon monoxide. The composition of the darker areas of Pluto's surface is unknown but may be primordial organic material or the result of photochemical reactions driven by cosmic rays.

Moons
Charon, the single moon of Pluto, has a diameter half that of Pluto.

Past Missions:
Much of what we know about Pluto we have learned since the late 1970's from Earth-based observations, the Infrared Astronomical Satellite (IRAS) and the Hubble Space Telescope.

Future Missions
The New Horizons Pluto-Kuiper mission is in development. New Horizons is scheduled to launch in January, 2006 and reach Pluto and its moon, Charon, in July, 2015. Then the spacecraft would head deeper into the Kuiper Belt to study one or more of the icy mini-worlds in that vast region, at least a billion miles beyond Neptune's orbit.

Pluto was discovered at Lowell Observatory in Flagstaff, Arizona, during a systematic search for a trans-Neptunian planet predicted mathematically by Percival Lowell and William H. Pickering, and found in 1930 by Clyde Tombaugh, a young apprentice at Lowell Observatory.

Pluto was named after the Greek god of the underworld who was able to render himself invisible. Charon, the only moon of Pluto, is named after the mythological boat man who ferried souls across the river Styx to Pluto for judgment.

Charon was discovered in 1978 by Jim Christy on photographs taken at the U.S. Naval Observatory in Flagstaff, Arizona. Prior to that it was thought that Pluto was much larger since the images of Charon and Pluto were blurred together.

A current controversy is whether Pluto should be called a planet, or the largest of the Kuiper belt objects (asteroids which circle the Sun beyond the orbits of Neptune and Pluto). The International Astronomical Union has decided that Pluto will continue to be classified as a planet.

1/21/06

Student Activity ~ Pluto

Describe Pluto.

How big is it?

What is its surface like?

Why is there no life on Pluto?

How many Moons does Pluto have?

How long is a day and a year on this planet?

What is Pluto made of?

How much would Pluto's gravity pull on me?

Who is Pluto named after?

Discuss who discovered Pluto. Refer to the notes on the previous pages.

What are its rings like?

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Discuss its Satellites if it has any.

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What are its moons like?

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- **Charon**

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- **Nix**

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- **Hydra**

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- **Other moons**

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