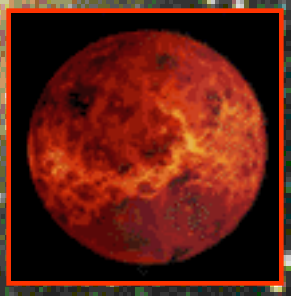
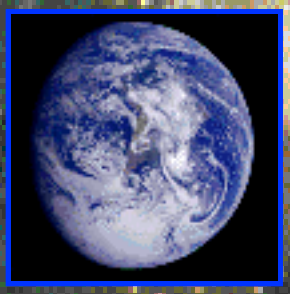
PLANETS OF OUR SOLAR SYSTEM

Mercury

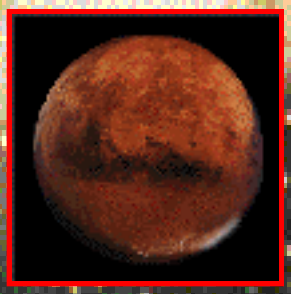
Venus

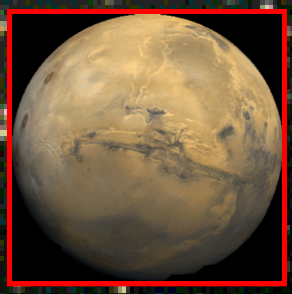


Earth

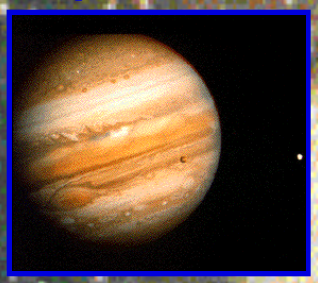


Mars

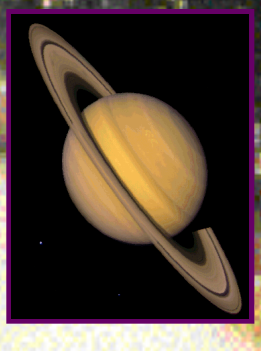




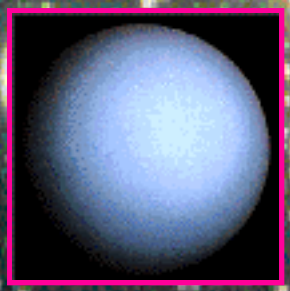
Jupiter



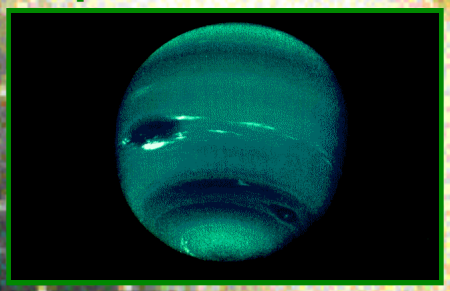
Saturn



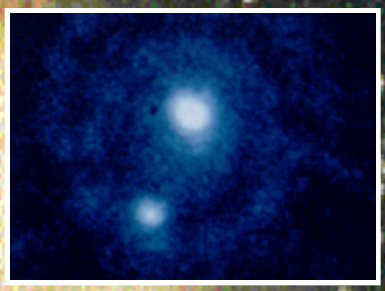
Uranus



Neptune



Pluto



Introduction

This is a set of worksheets to accompany the Jet Propulsion Laboratories excellent CD (or web page), Welcome to the Planets. It was designed for and first used with my elementary learning disabilities students.

I later posted this set for use with the column "Teacher Tools 1: AppleWorks," which appeared on the Low-End Mac web site:
http://lowendmac.com/macinschool/991115.html

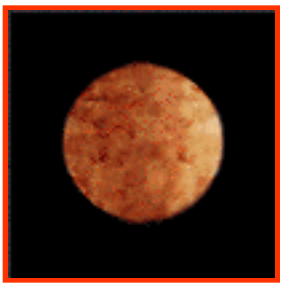
The permanent archived version of the column is available at:
http://www.mathdittos2.com/columns/view/v991115.html

The graphics contained are all the property of NASA and JPL, but I believe this use comes within their posted use policy.

Welcome to the Planets is available at the JPL site and their numerous mirror sites:
http://pds.jpl.nasa.gov/planets/
http://pds.jpl.nasa.gov/planets/welcome/mirrors.htm

Steve Wood
11/11/99
updated 7/2/2000

MERCURY



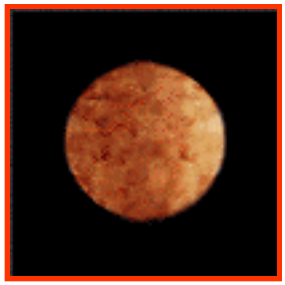
Mercury is the planet closest to the sun--only 36 million miles from our star. It is also the second smallest planet of our solar system, larger only than Pluto.

Mercury's surface is covered with craters from impacts of meteors early in its history. There is also evidence of volcanic activity in the distant past.

Mercury's rotation period is almost 59 days, making one complete rotation (day-night) in that time. It's "year," or revolution period is about 88 days.

Because Mercury is so close to the sun and rotates so slowly, there are widely varying maximum and minimum temperatures, from 700° F. to -460° F.

Mercury was explored by the Mariner 10 spacecraft in the mid-1970's. Both Mercury and Venus are difficult to study, as their orbits are closer to the sun than ours. This causes the planets to appear only low in the sky.



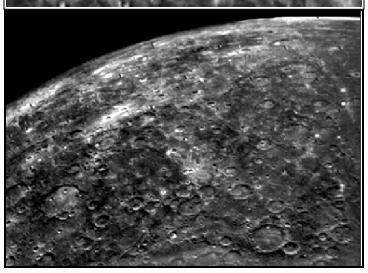
MERCURY

Name _____

Date _____

1. Circle the planet below that shows where Mercury is in order from the sun.

2. How long does it take Mercury to orbit (one complete circle) the sun? _____



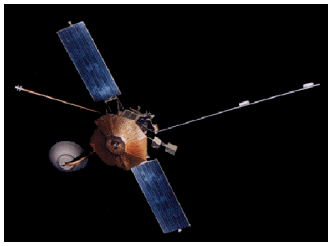
3 & 4. What do you think caused Mercury's surface to look as it does? (There are really two things.)

_____

_____

_____

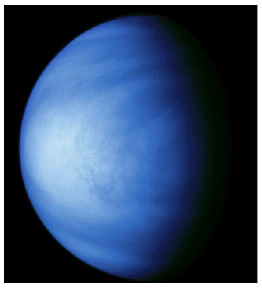
5. What is the name of the spacecraft that photographed Venus and Mercury? _____



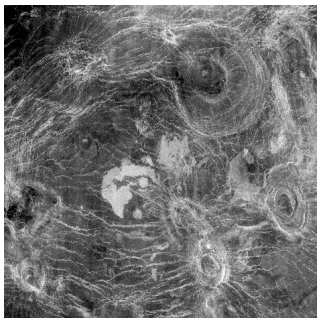
6. When did it do it? _____

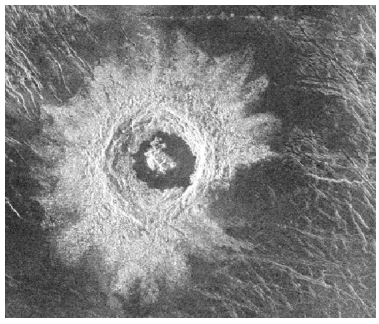
7. On the back of this page, or on another sheet of paper, tell two (2) new things you learned about Mercury.

VENUS



Venus is the second planet from the sun. It is covered with a heavy layer of clouds that hid the surface of the planet from view until the Magellan probe used radar to look through the clouds. Magellan mapped and photographed the surface of Venus. The radar images on the right show incredible detail of the planet's surface.





Venus is a hot planet-as hot as 900º! It's "air pressure" is 88 times as great as on earth. It also has clouds of sulfuric acid droplets.

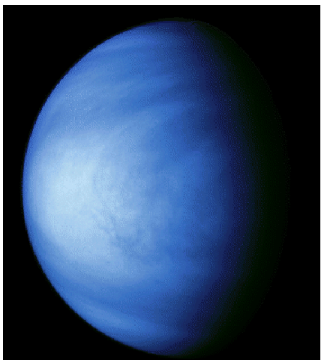
Venus is about the same size and shape as earth. It is our near-twin in the solar system.

Like all the other planets, Venus has never been visited by men, only by robot spacecraft. Beginning in 1962, Venus was explored by Mariner 2, 5, and 10, and Pioneer Venus 1 and 2.

Venus

Photos and drawings courtesy of NASA and the Jet Propulsion Laboratory. Data is from *Welcome to the Planets,* an NASA educational CD-ROM and *The New Grolier Multimedia Encyclopedia.*

VENUS



Name _____

Date _____

1. How long does it take Venus to orbit the sun (length of year in earth days)?

_____

2. What gasses make up most of Venus's atmosphere?

_____

3. Why couldn't men explore the surface of Venus?

_____

_____

_____

4. What two forces, like Mercury, have shaped the surface of Venus?

_____

_____

5. Venus is known as earth's twin. How is Venus different from earth?

_____

_____

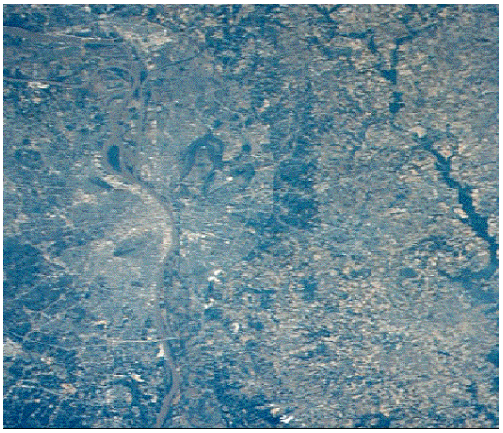
EARTH

Our home planet earth is the third planet from the sun. It is one of the four terrestrial (solid-ground) planets. Earth is unique because it has large amounts of water and oxygen on its surface. No other planet possesses these resources.

Even from space, earth looks different from the other planets. At the left is a Space Shuttle photo of the Straits of Gibraltar and the Mediterranean Sea.

At the right is a photo of Mt. Etna in Italy. Mt. Etna is considered an active volcano as it still gives off steam and other gasses.

Below is a space photo of part of the Mississippi River system.

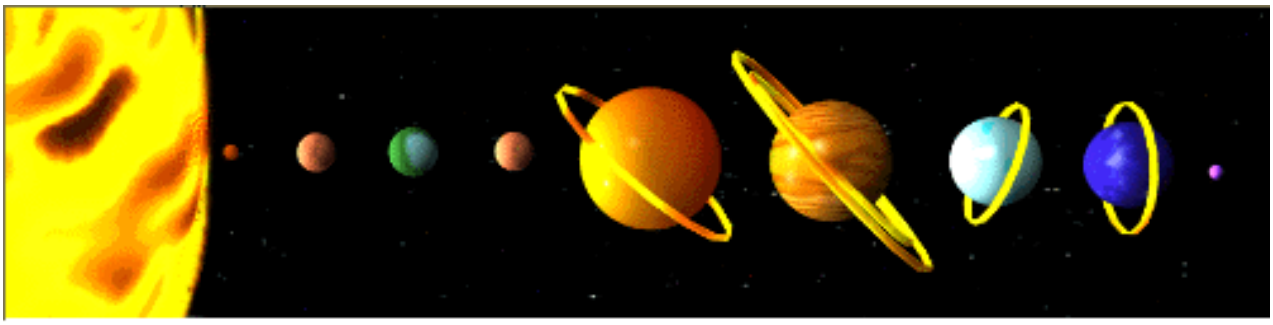


If you look closely at some of the photos, you will be able to see signs of life. Compare these photos to the closeup photo of Mars on the bulletin board.

EARTH WORKSHEET

Name _____ Date _____

1. Circle earth in the diagram below.

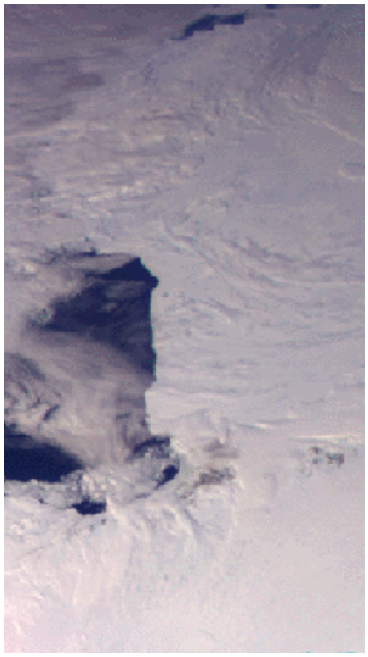


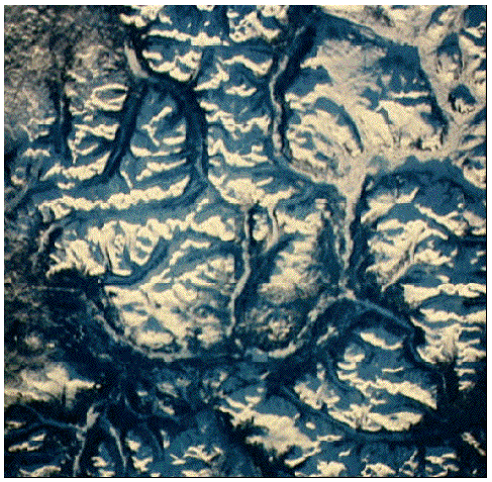
2. How long is earth's rotational period? _____

Using the CD, "Welcome to the Solar System," look closely at the earth photos from the first page. Magnify them. What signs of life do you see?

_____

_____





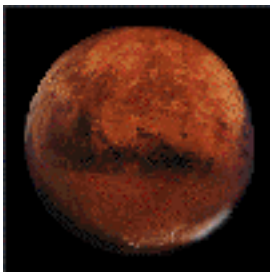
If you were a traveler from another world and landed at one of these locations, what would you think of planet earth?

_____

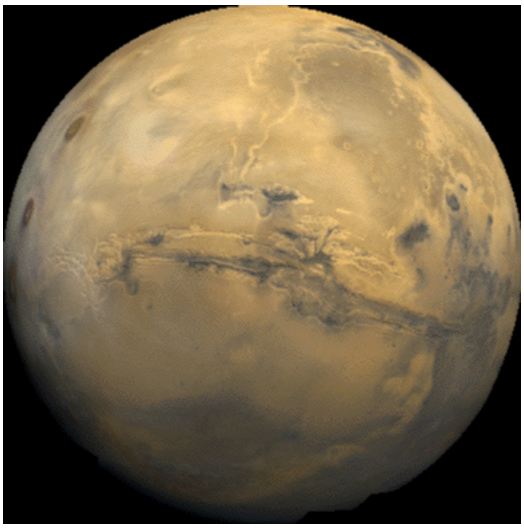
_____

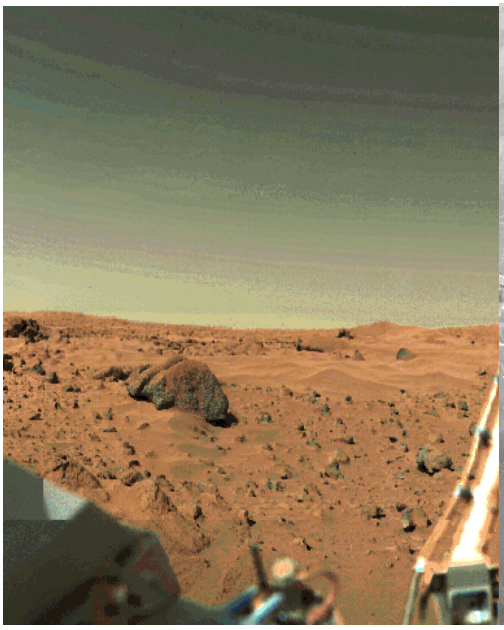
_____

MARS



Mars may be the best known planet in the solar system. It can be seen without a telescope as a bright reddish spot in the night sky. Unlike Mercury and Venus, where we are always looking towards the sun when observing them, Mars orbit is outside earth's orbit. Mars has been studied for years. It is much like earth. It's day is just over 24 hours. It's year is over two of our years. It has traces of water, oxygen, and carbon dioxide. But there isn't nearly enough air to breathe. Mars has been visited by several unmanned probes. Landers have taken pictures like the one below on the left.

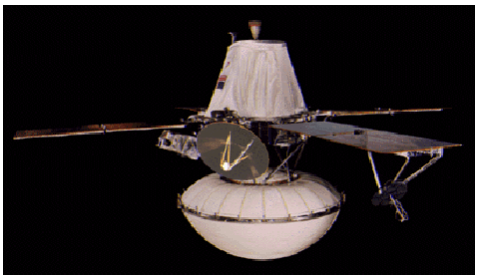




Mars is the fourth, and last, of the terrestrial planets.

1. List the four terrestrial planets.

_____

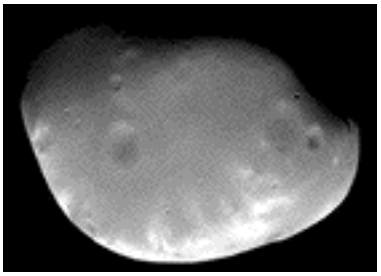


What satellites or probes did most of this study of Mars?

2. _____

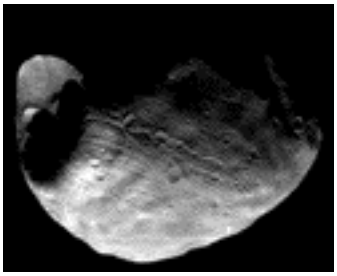
3. _____

4. When did these satellites land on Mars? _____



Mars has 2 moons. List the name of each beside its photo.

5. _____



6. _____

7. What forces have shaped the surface of Mars?

_____

_____

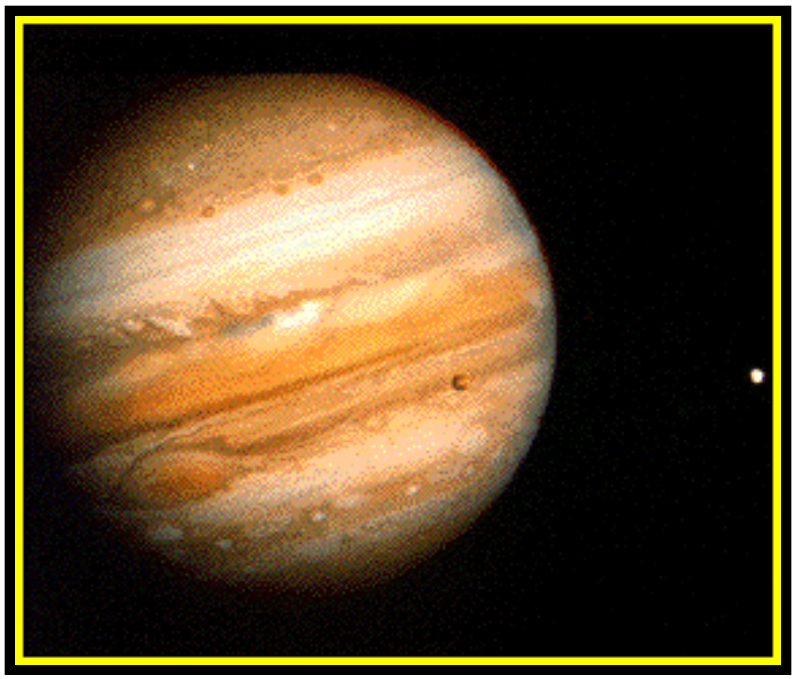
_____

Name _____

Date _____

JUPITER

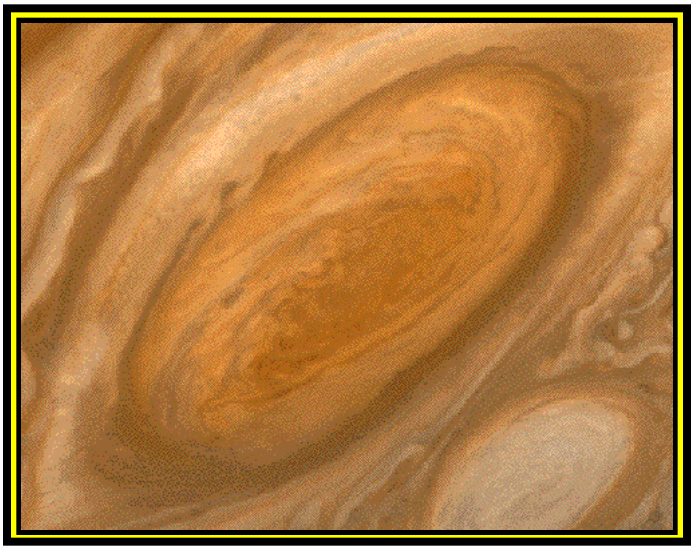
Jupiter is the fifth planet from the sun. It is by far the largest planet in our solar system. It would take



1,317 Earths to match Jupiter's size. But it would still take 1,000 Jupiter's to fill the sun! Had Jupiter been 3 or 4 times larger, it might have become a star.

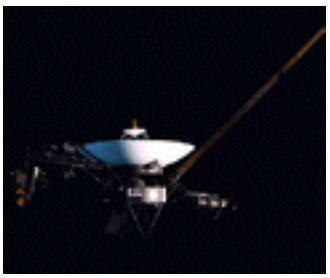
Jupiter rotates very fast on its axis. It has just a 10 hour day! It takes almost 12 years to revolve around the sun.

Jupiter's most famous feature is its giant (Earth-sized) red spot. This storm moves across Jupiter's surface. It, and 4 of the larger moons, can be seen with a small telescope, or with binoculars. You can see Jupiter at night as a bright orange spot in the sky.

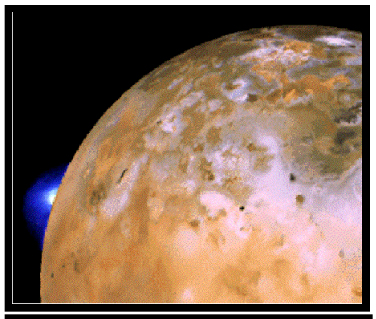


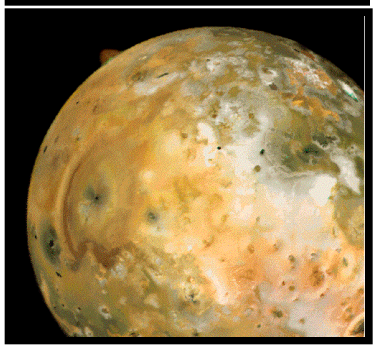
Much of the information we have about Jupiter comes

from the flybys of Voyager 1 and Voyager 2. Both satellites returned spectacular images of Jupiter and its moons. Launched in 1977 from Titan III/Centaur rockets, both visited Jupiter and Saturn, with Voyager 2 going on to return the first close-ups of Uranus and Neptune.

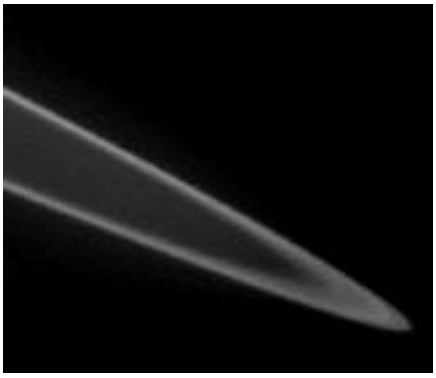


One of the biggest surprises to scientists were the photos here of an active volcano erupting on the moon, Io. Scientists had long thought active volcanoes existed elsewhere in our solar system, but were totally amazed when Voyager sent these images back to earth. The chances of seeing an actual eruption happening were very slim.



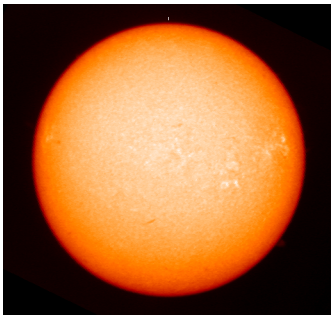


Pictured at the right is a ring of Jupiter! Until the Voyager flights, scientist only knew of Saturn's rings. Rings were seen on Uranus and Neptune as well.



Both Voyager spacecraft have now left our solar system. They continue to fly outward through space. Who knows if they may make another unexpected discovery?

QUESTIONS



1. If Jupiter had been a little larger, what could it have been?

_____

2. What is the land-mark that most people know about on Jupiter?

_____

3. How many of Jupiter's moons can you see with binoculars?

_____

4. Can you see Jupiter without a telescope?

YES NO (CIRCLE ONE)

5. Find one interesting fact about Jupiter or its moons not covered in this worksheet on the CD-ROM "Welcome to the Planets". Tell about it.

_____

_____

_____

_____

6. Voyager 2 was launched <u>before</u> Voyage 1. Why did it reach Jupiter later than Voyager 1?

_____

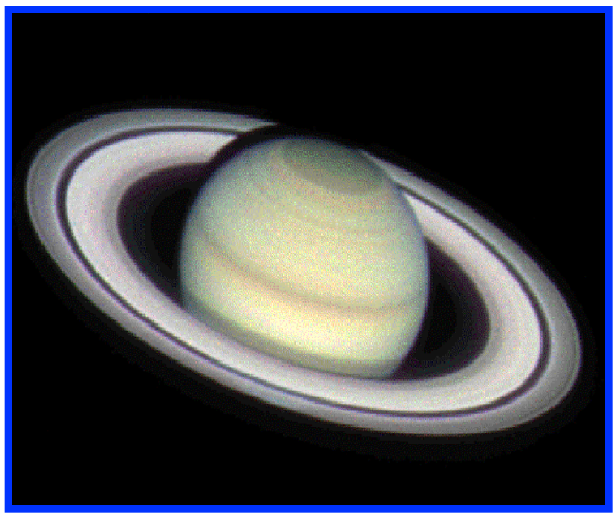
_____

7. What planets did Voyager 1 and 2 study?

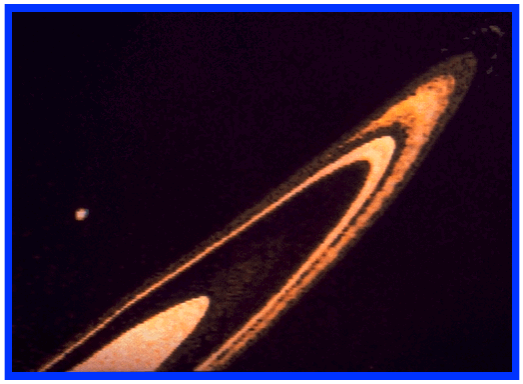
_____

Name _____ Date_____

SATURN



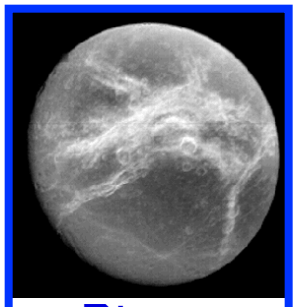
Saturn is the sixth planet from the sun in our Solar System. It is one of the gas giants--big planets made of gas. It is best known for its rings, which can be seen only through a telescope. Saturn's rings were first seen by Galileo Galilei in 1610.



Much of what we now know about Saturn came from the flybys of the Voyager 1 and Voyager 2 satellites in the 1980's. Saturn is 893,000,000 miles from the sun. It orbits the sun once in 29 1/2 years. It is second in size only to Jupiter. And...it could hold 769 Earths!

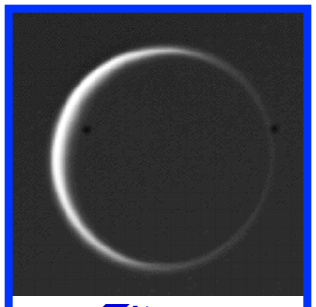
Most of Saturn's moons are covered with impact craters. Titan, the largest moon, is covered with clouds.

A few of Saturn's moons

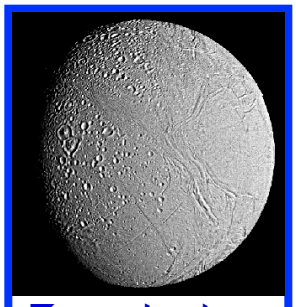


Dione

Mimas



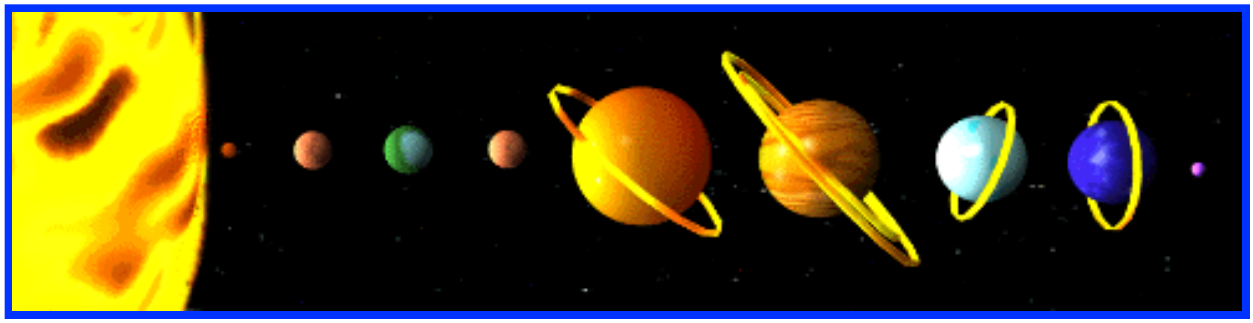
Titan



Enceladas

QUESTIONS

Name_____ Date_____



1. Who was the first man to see Saturn's rings?

_____

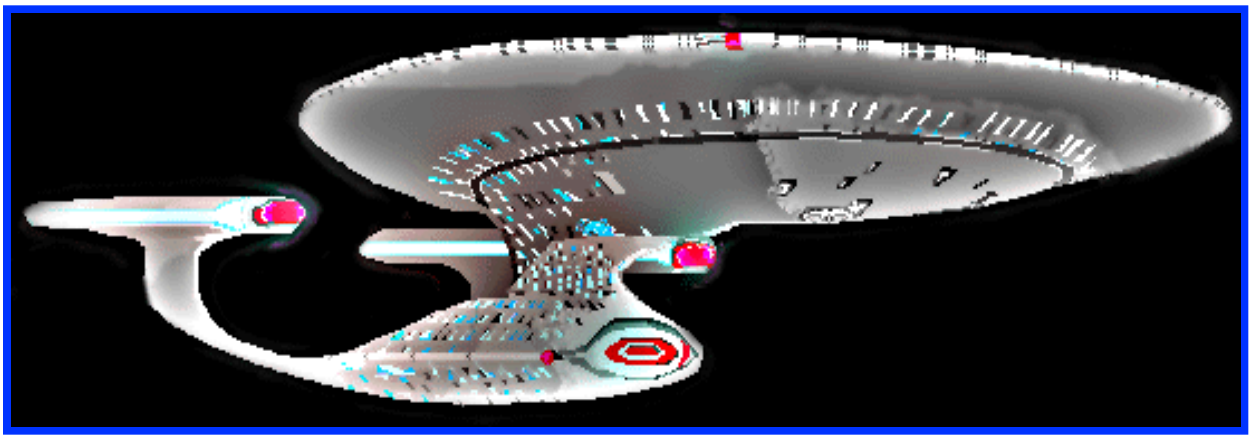
2. Which planet is bigger than Saturn? _____
3. What word in the article means 'go around the sun?" _____
4. How many years does it take for Saturn to go around the sun? _____
5. What are Saturn's rings made of? _____

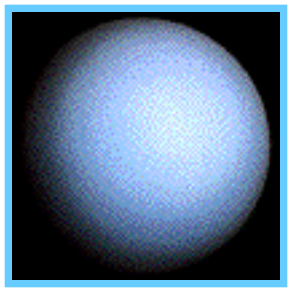
_____

6. If a spaceship could take you anywhere in our solar system, where would you like to go? _____

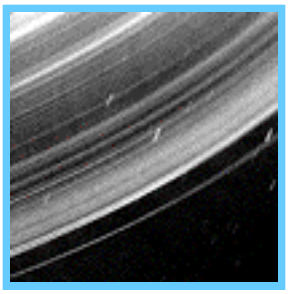
_____

_____



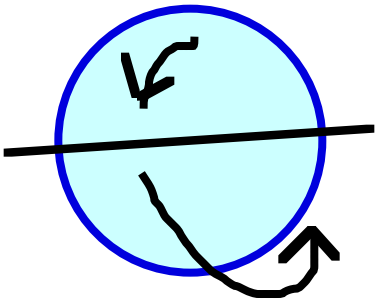


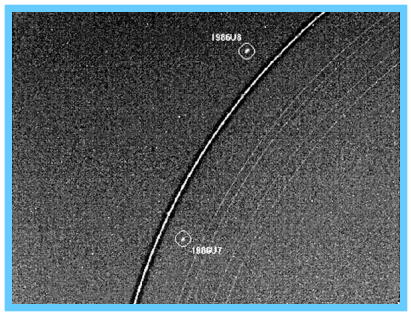
URANUS



Uranus is the seventh planet from the sun. It is one of the gas giants. It's atmosphere is mostly hydrogen, with some helium, and a little methane. As with all the gas giants, Uranus's surface is not visible.

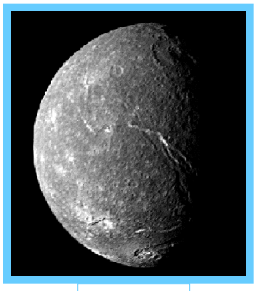
Uranus had several interesting surprises for scientists. One was that it rotates on its side! Another was its system of rings. Until



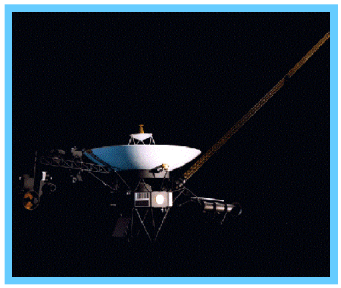


Voyager 2 flew near Uranus, these things were not known. Scientists also saw two tiny "shepherd satellites" that seem to hold a ring in its shape.

Uranus's larger moons appear much like moons of other planets--cratered by meteors and signs of volcanic activity.



Titania



Voyager 2 photographed Uranus and its moons late in 1986--10 years after its launch from earth. As we study planets farther and farther from earth, less and less is known about them. Most of what we know about Uranus comes from the Voyager 2 probe. Uranus is too far away for even a telescope to tell much about it.

URANUS QUESTIONS

1. How long does it take Uranus to go around the sun (in years)? _____

2. What two forces have shaped the surface of Uranus's moons? _____

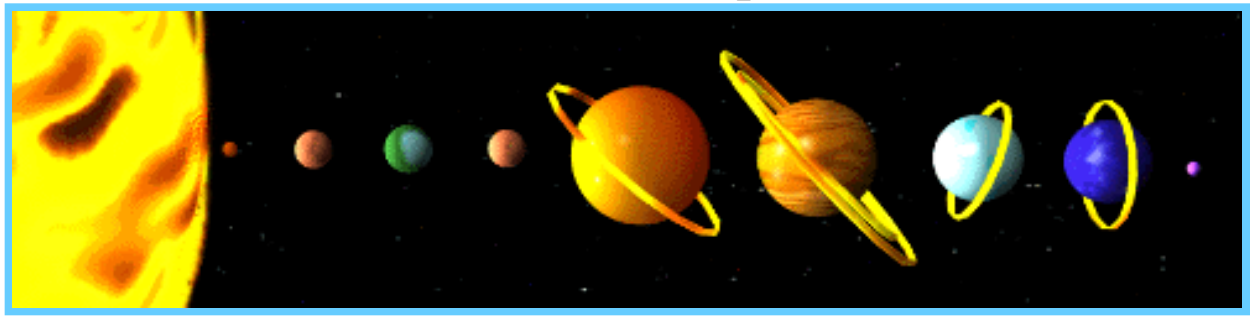
_____

3. Why couldn't Voyager photograph the surface of Uranus? _____

4. What do the two "shepherd satellites" found by Voyager 2 do? _____

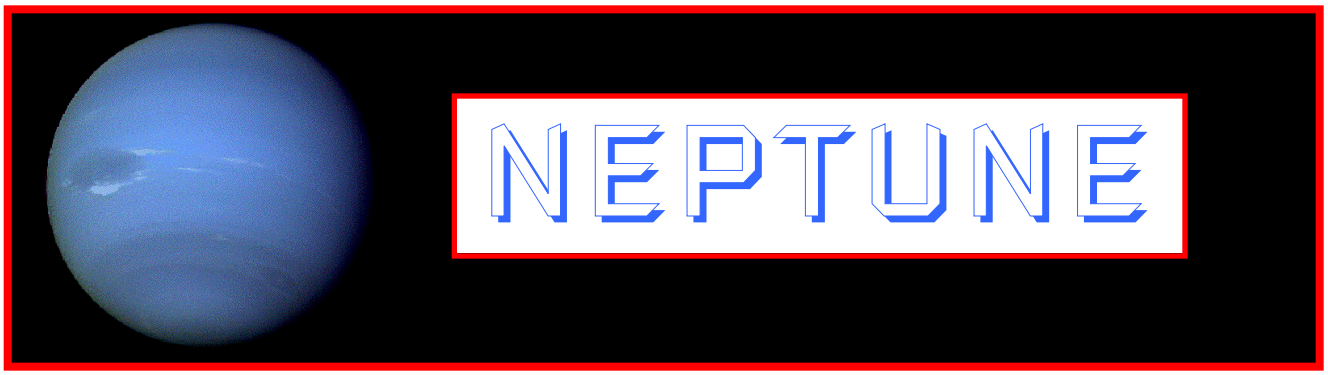
_____

5. Circle Uranus in the drawing below.

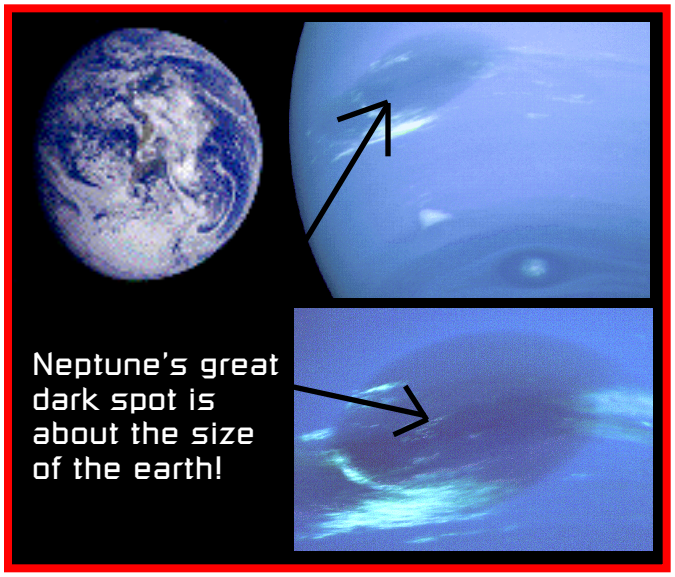


6. According to the drawing above, Uranus is
   a. the largest planet.
   b. the third largest planet.
   c. the smallest planet.
   d. about the same size as Venus.

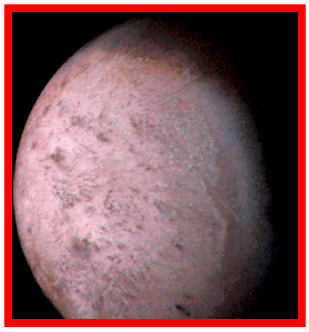
Name _____ Date _____



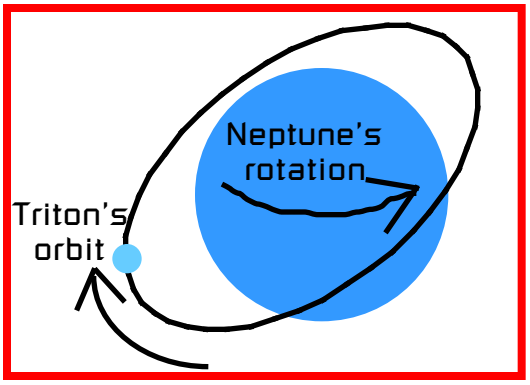
Neptune is the last of the gas giants. Composed of hydrogen, helium, and methane like the other gas giants, Neptune shows storms on its surface much like Jupiter's red spot. The storms move rapidly across Neptune's surface. Some of them rapidly change shape. The clouds of Neptune show much detail in the Voyager 2 photo at left.

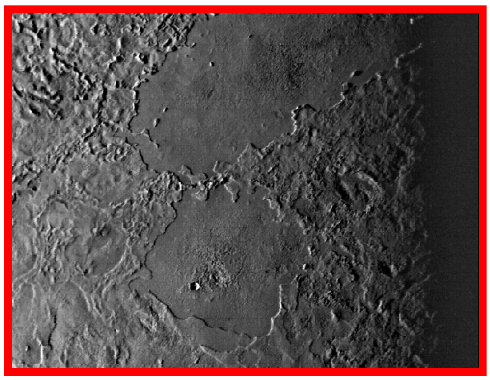


Like the other gas giants, Neptune also has rings. Three very faint rings were visible with special photography techniques.

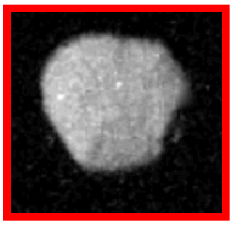


Triton is the largest satellite of Neptune. It orbits the planet in the opposite direction of most moons.





The surface of Triton is cratered. It looks much like our moon.

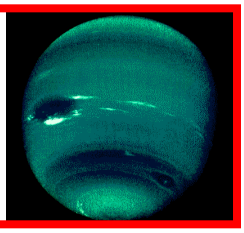


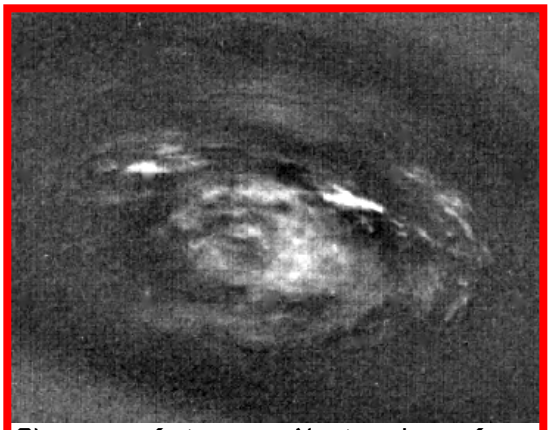
Proteus, another of Neptune's moons has an irregular shape. It appears to be constantly frozen with no past or present volcanic activity. It's shape would suggest that it has been hit by many objects.

Because Neptune is so very, very far from the sun, it is quite cold on the planet and its moons. It receives very little light or heat from the sun. Full daylight on Neptune would be no brighter than moonlight on earth!

Neptune and Triton

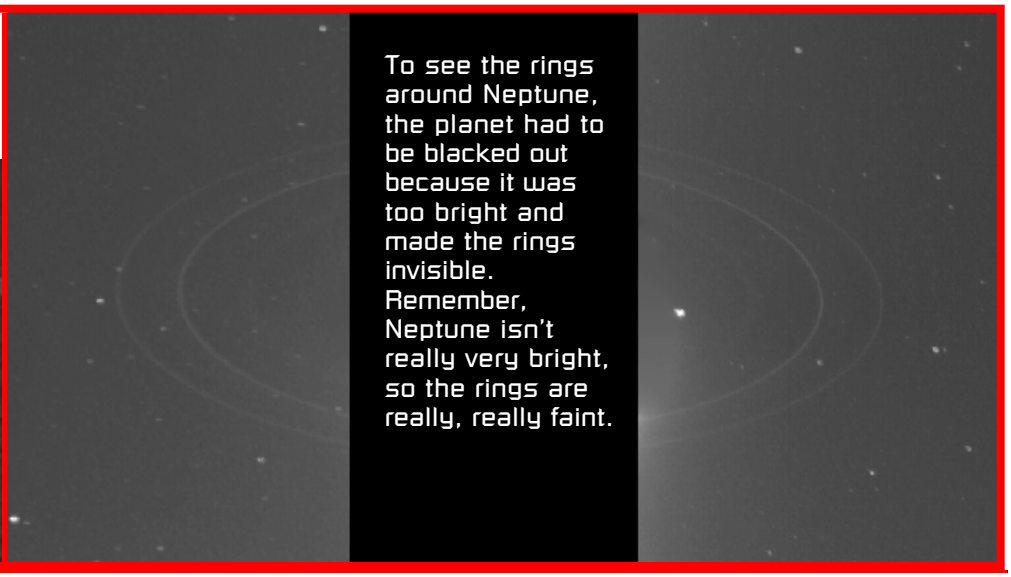
Neptune Photo Gallery





Close-up of storm on Neptune's surface.

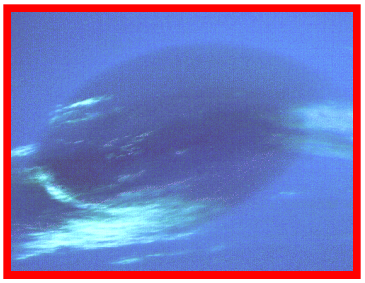
Right: Neptune's faint rings.
Bottom: Close-up of one ring.



To see the rings around Neptune, the planet had to be blacked out because it was too bright and made the rings invisible. Remember, Neptune isn't really very bright, so the rings are really, really faint.

Neptune Questions

1. About how large is the great dark spot on Neptune? _____



_____

_____

2. What two words in the following section are synonyms? Circle them.
"Triton is the largest satellite of Neptune. It orbits the planet in the opposite direction of most moons."

3. What word in the sentences above means "goes around something in a path?" _____

4. Circle Neptune in the drawing at the right.

5. What word is used to mean the top or ground layer of a planet or moon? _____

6. What year did Voyager 2 fly by Neptune? _____

7. Where is Voyager 2 today? _____

_____

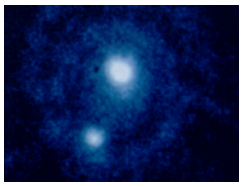
Name _____ Date _____

Pluto

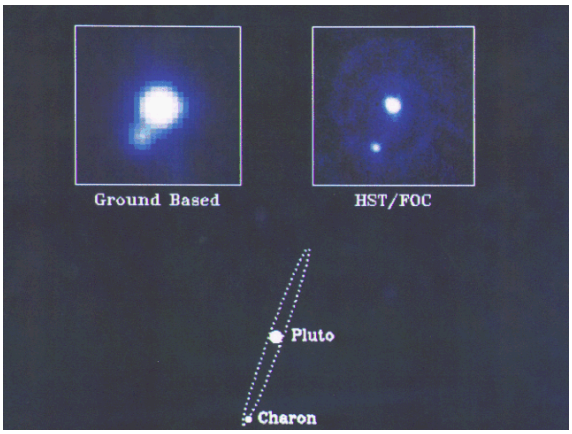
and Charon

Pluto has remained a mystery since its discovery by astronomer Clyde Tombaugh in 1930. It is the only planet not yet viewed close-up by spacecraft. A robot mission to Pluto and its moon, Charon, is being planned. Satellites should reach Pluto and Charon around 2010 or later.

Pluto is the smallest planet in our solar system. It is usually farther from the Sun than any of the nine planets. Because of its unusual orbit, Pluto is now closer than Neptune. It will remain within the orbit of Neptune until March 14, 1999.



This view of Pluto was taken by the Hubble Space Telescope. It shows a rare image of tiny Pluto with its moon Charon, which is slightly smaller than the planet. Due to its great distance from the sun, Pluto's surface is believed to reach temperatures as low as -400°F. From Pluto's surface, the Sun appears as only a very bright star.



Pluto's orbit is highly tilted--17 degrees to the orbital plane of the other planets. Pluto's spin axis is also tipped--122 degrees. Pluto's north pole is upside down with respect to the other planets, and it rotates in the opposite direction from them. Observations indicate that Pluto's surface is covered with methane ice. There may be a thin atmosphere that might freeze and fall to the surface as the planet moves away from the Sun.

Pluto Statistics		Charon Statistics	
Discovered by	.Clyde W. Tombaugh	Discovered by	J. Christy
Date of discovery	February 18, 1930	Date of discovery	1978
Mass (kg)	1.29e+22	Mass (kg)	1.77e+21
Mass (Earth = 1)	2.1586e-03	Mass (Earth = 1)	2.9618e-04
Equatorial radius (km)	1,160	Equatorial radius (km)	635
Equatorial radius (Earth = 1)	1.8188e-01	Equatorial radius (Earth = 1)	9.9561e-02
Mean density (gm/cm^3)	2.05	Mean density (gm/cm^3)	1.83
Mean distance from the Sun (km)	5,913,520,000	Mean distance from Pluto (km)	19,640
Mean distance from the Sun (Earth = 1)	39.5294		
Rotational period (days)	-6.3872	Rotational period (days)	6.38725
Orbital period (years)	248.54	Orbital period (days)	6.38725
Mean orbital velocity (km/sec)	4.74	Mean orbital velocity (km/sec)	0.23
Orbital eccentricity	0.2482	Orbital eccentricity	0.00
Tilt of axis	122.52°		
Orbital inclination	17.148°	Orbital inclination	98.80°
Equatorial surface gravity (m/sec^2)	0.4		
Equatorial escape velocity (km/sec)	1.22	Escape velocity (km/sec)	0.610
Visual geometric albedo	0.3		
Magnitude (Vo)	15.12	Magnitude (Vo)	16.8
Atmospheric composition			
Methane			
Nitrogen			

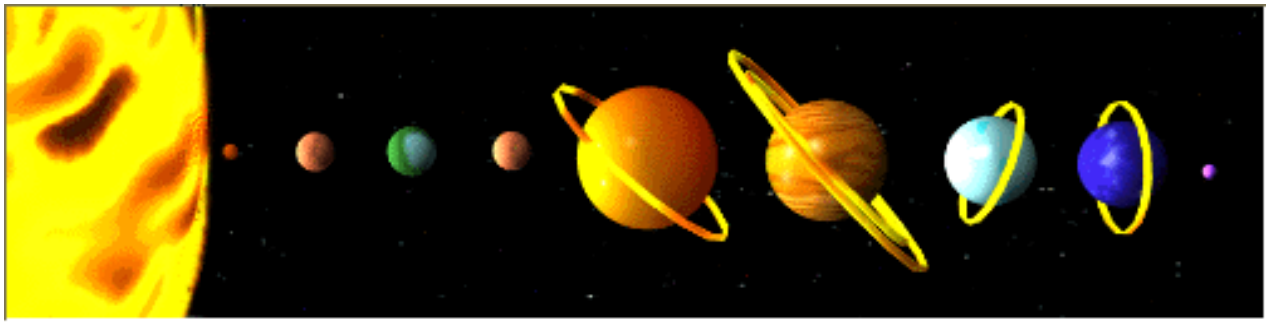
Questions-Pluto

1. When was Pluto discovered? _____

2. Give two reasons why we know so little about Pluto. _____

3. The best pictures we have so far of Pluto don't come from a regular satellite (a flyby). What do they come from? _____

4. Normally, which drawing would be Pluto?



5. What would the sun look like from Pluto?

_____

6. If satellites do fly by and photograph Pluto in 2010, how old will you will you be by then?

Hint: 2010 _____
-year of your birth - _____

_____

Name_____ Date _____

Planets Mnemonic

The following mnemonic is often helpful in memorizing the nine planets in their order from the sun.

"My very earnest mother just sat upon nine pins." Pins.

My	Very	Earnest	Mother	Just	Sat	Upon	Nine	Pins.
e	e	a	a	u	a	r	e	l
r	n	r	r	p	t	a	p	u
c	u	t	s	i	u	n	t	t
u	s	h		t	r	u	u	o
r				e	n	s	n	
y				r			e	

mnemonic (nĭ-mŏn′ ĭk**)** A device, such as a formula or rhyme, used as an aid in remembering.