

GALILEO FACTS:

Galileo was launched from the Space Shuttle on October 18, 1989. It took a long roundabout path to Jupiter which carried it past Venus, Earth, and the asteroids Gaspra and Ida. This long looping path was necessary to gain “gravitational assists” from both Venus and Earth which gave it the additional speed needed to reach Jupiter. *Galileo* arrived at Jupiter in December 1995.

On December 7, 1995 the *Galileo Atmospheric Probe* entered the atmosphere of the giant planet at a speed of 106,000 miles per hour! It's the fastest solid object created by people.

Galileo Orbiter weighs 2,223 kilograms or about 5000 pounds.

Galileo Atmospheric Probe weighs 339 kilograms or 746 pounds.

The Radioisotope Thermoelectric Generators (RTG's) that supply *Galileo's* power contain 7.8 kilograms (17.2 pounds) of Plutonium-238.

The entire probe uses about the same amount of energy as a 20 watt light bulb, like you'd find in a refrigerator.

Galileo's cameras can resolve objects as small as 12 meters or 39 feet.

Galileo's two gravitational assists with the earth helped the probe gain a lot of speed, but the earth in turn lost a bit of speed. How much? In 1 billion years the earth will be 5.2 inches behind in it's orbit from where it would have been if *Galileo* had not used the planet for a gravitational slingshot out to Jupiter!

PLANETARY FACTS:

JUPITER:

Jupiter was visited by Voyager 1 & Voyager 2 in 1979. Galileo reached Jupiter in December 1995. Jupiter is the largest and most massive planet in the solar system. It is larger and more massive than all the other planets, moons, and asteroids put together! The "Great Red Spot" is a hurricane that is three times larger than Earth. Atmospheric turbulence is kept in constant motion due to intense heat from Jupiter's core. It's the only planet that gives off more energy than it receives from the sun. Here are some basic statistics:



Distance from the Sun: 483.6 million miles (778.3 million kilometers)

Diameter: 88,733 miles (142,796 kilometers)

Length of year: 11.86 Earth years.

Length of day: 9 hours and 48 minutes

Mass: 317.9 Earths

Volume: 1,403 Earths

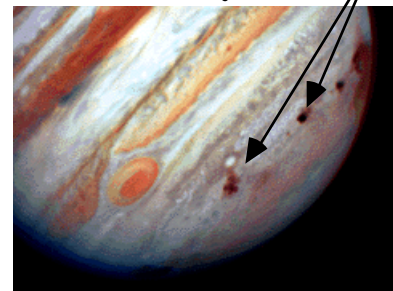
Gravity: 2.87 X Earth's gravity

Number of Known Moons: 61 + small Ring system

Temperature at the cloud tops: -243° F (-153° C)

Magnetic Field: 20,000 X stronger than Earth's.

Impact sites from Comet Shoemaker/Levy 9 7/94



In 1994 Jupiter was hit by **Comet Shoemaker/Levy 9**. When the pieces of the comet hit, they were travelling at nearly 130,000 miles per hour. Each piece exploded on impact creating huge earth-sized dark scars in the clouds.

MOONS:

---**Io** is the most volcanically active place in the solar system.

---**Ganymede** is the largest moon in the solar system, it's even larger than the planet Mercury!

---**Europa** shows evidence of a liquid ocean beneath its icy surface. Perhaps this might be the place to search for life!

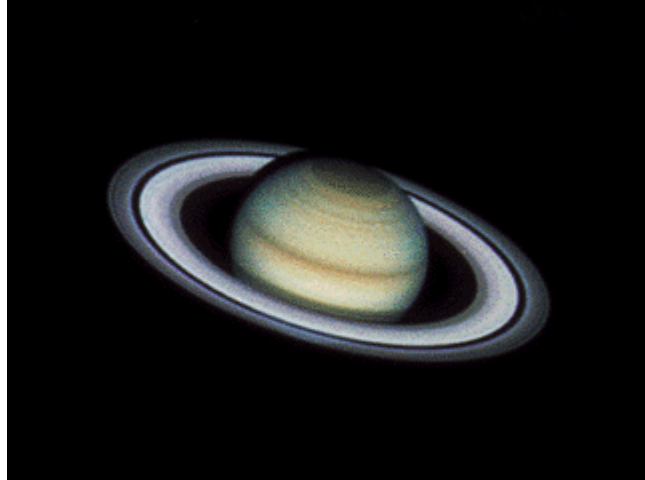
---**Callisto** has a very old surface that is as heavily cratered as any known moon.

---**Galileo Galilei** was the first person to see moons orbiting another planet when he looked at Jupiter through his telescope on January 7, 1610. What he saw were four small worlds that appeared to be orbiting Jupiter. They were Jupiter's four largest moons, Callisto, Ganymede, Europa, and Io.

PLANETARY FACTS:

SATURN:

Saturn was visited by the Voyager probes in 1980 and '81. The second largest planet in volume, Saturn is the least dense planet in the solar system. Saturn's density is so low it would float on water. Saturn has 31 known moons and more rings than any other planet. Here are some basic statistics regarding the ringed planet:



Distance from the Sun: 886.7 million miles (1,327 million kilometers)

Diameter: 74,600 miles (120,000 kilometers)

Length of year: 29.46 Earth years.

Length of day: 10 hours and 39 minutes

Mass: 95.17 Earths

Volume: 833 Earths

Gravity: .93 X Earth's gravity

Number of Known Moons: 31 and an extensive ring system

Temperature at the cloud tops: -301° F (-185° C)

Magnetic Field: 540 X stronger than Earth's and is tipped less than 1° from its rotational axis. It lines up with its rotational axis better than any other planet.

The rings around Saturn can be divided into seven major bands, each made of hundreds of smaller ringlets. The main rings are about 28,000 miles wide, while all the rings including the tenuous outer "E Ring" increase that width to over 250,000 miles! Yet with all this width they are not very thick between 33 and 330 feet thick.

Even though Saturn is larger than Earth in volume, its density is so low that you would weigh less on Saturn than you would here on earth. A 100 pound person on Earth would only weigh 93 pounds on Saturn!

Titan, Saturn's largest moon, is the second largest in the solar system and one of two known moons to have substantial atmospheres. In fact, Titan's atmosphere is so thick with cloud cover that it is impossible to see through it to the surface.

20 QUESTIONS TO CONSIDER:

1. What is the "Grand Tour"?
2. What is the "Great Red Spot"?
3. Why was a "recording of sounds and greetings from Earth" and pictures of people, animals, and places put on board each of the two Voyager Space Probes?
4. Why wasn't a similar "Record of Earth" put aboard the Galileo Probe?
5. Most space probes in the past have been solar powered. Why weren't either the Voyager probes or Galileo solar powered?
6. How do pictures taken by space probes get back to us on Earth?
- 7 & 8. The Voyager probes are moving at over 40,000 m.p.h.. Their small engines are only used for minor maneuvers, not general propulsion. How did the probes get going so fast? Why don't they slow down?
9. Jupiter has no solid surface to land a space craft on, yet it is impossible to fly through. Why?
10. Why didn't they design the Voyager or Galileo probes to return to Earth?
11. Why did they decide to name a probe, designed to orbit and study Jupiter, Galileo?
12. Who was Galileo Galilei?
13. Why is it significant that the Galileo Space Probe has found evidence of an ocean of water beneath the ices of Jupiter's moon Europa?
14. Io is the closest of the four large Galilean moons to Jupiter. It has many active volcanoes. Jupiter's gravity makes Io's solid surface have a tidal rise and fall of 330 feet. How do these two phenomena relate to each other?
15. On Galileo's journey to Jupiter it received two "gravitation assists" from Earth and one from Venus. These assists made Galileo increase speed. Did they have any effect on the planet?
16. What is telemetry?
17. Uranus and Neptune are often referred to as "twins", but Uranus is larger in volume than Neptune, yet Neptune is more massive than Uranus. Why should the more massive (heavier) planet be smaller?
18. Saturn is more than 800 times larger than Earth and more than 90 times more massive, yet if you visited the planet you would weigh less there than on Earth. Why?
19. What is a magnetic field?
20. Jupiter's magnetic field is 20,000 times stronger than the Earth's. It is so strong it strips a ton of material off Io each second! What would it do to an astronaut? How are probes protected?

MATCH THE PLANET TO THE MOON!

TITAN

MIMAS

GANYMEDE

MIRANDA

IO

PANDORA

TRITON

DIONE

NERIED

EUROPA

UMBRIEL

CALLISTO

AMALTHEA

IAPETUS

PROMETHEUS

JUPITER

SATURN

URANUS

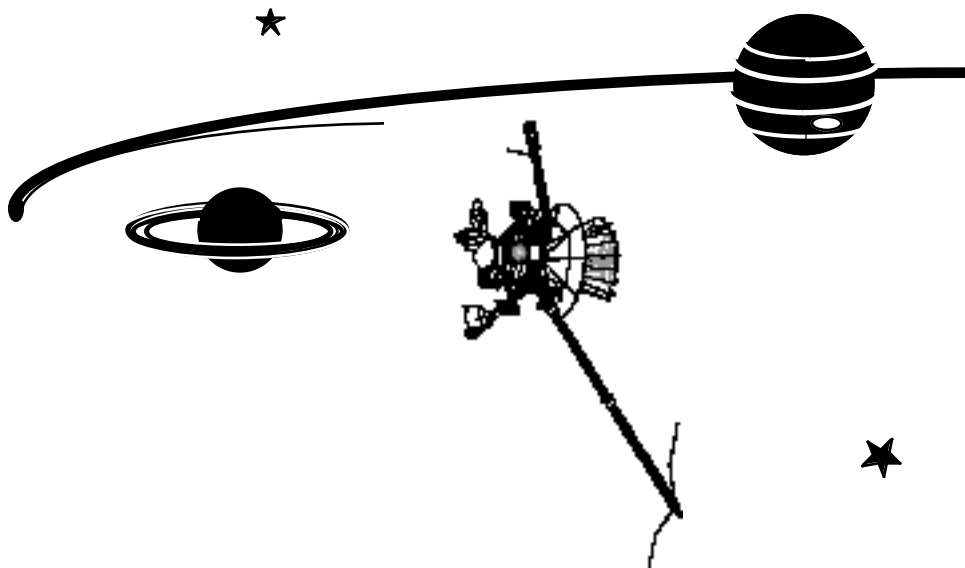
NEPTUNE

OUTER PLANETS WORD SEARCH

The following words are lost in the telemetry somewhere:

Jupiter Saturn Uranus Neptune Planets Red Spot Sun Clouds
Rings Titan Miranda Callisto Triton Mimas Io Europa Moons
Radio Waves Voyager The Grand Tour Rocket Camera Record
Antenna Probe Telemetry Kennedy Space Center

R E H N V J T E L E M E T R Y V I M D R
A W T I T A N G D L Z K I M I M A S P E
D H G H W O W E K C X B T I G N J P E D
I R M V E U R O P A L E F R E C O R D S
O V O Y A G E R A T V O C A I V P O J P
W U L C L L R M R Q U M U N C T R O U O
A H K A K D L A I U M N X D B E O R P T
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E X W E V H T C G D R H O W H G E H T T
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K E N N E D Y S P A C E C E N T E R O V
O R A N T E N N A N R S P H O Y T W G L



BIBLIOGRAPHY

Beatty & Chaikin, *The New Solar System, 2nd Ed.* Cambridge: Cambridge University Press, 1990. (High school to college age level)

Couper & Henbest, *New Worlds, In Search of the Planets*, Reading, MA: Addison-Wesley, 1986.

Gallant, Roy, *Our Universe, 2nd Ed.*, Washington D.C.: National Geographic Society, 1986.

Miller & Hartmann, *The Grand Tour: A Traveller's Guide to the Solar System*, New York: Workman Publishing, 1981.

Moeschl, Richard, *Exploring the Sky, 100 Projects for Beginning Astronomers*, Chicago: Chicago Review Press, 1989. (Contains lots of project ideas for both teachers and older students.)

Rey, H.A., *The Stars, A New Way to See Them*, Boston: Houghton Mifflin Co., 1976. (This is probably the best book for learning constellations for any age level.)

Sagan, Carl, *Murmurs of Earth, The Voyager Interstellar Record*. New York: Ballantine Books, 1978.

Watters, Thomas R. *Smithsonian Guides: Planets*. New York: Macmillan, 1995

FOR TEACHERS:

Braus, Judy, Editor, *NatureScope: Astronomy Adventures*, Washington, D.C.: National Wildlife Federation, 1986.

Fraknoi, Andrew, *The Universe at Your Fingertips*. San Francisco: Astronomical Society of the Pacific, 1995.

Universe in the Classroom, Astronomical Society of the Pacific, Teacher's Newsletter, Dept. N. 390 Ashton Ave., San Francisco, CA 94112 (free to all teachers, request on school letterhead.)

WEB SITES:

Nine Planets: <http://seds.lpl.arizona.edu/nineplanets/nineplanets/nineplanets.html>

Galileo Home Page: <http://www.jpl.nasa.gov/galileo/>

Galileo Site especially for kids: <http://eis.jpl.nasa.gov/~skientz/galileo/>

What's New with the Hubble Space Telescope: <http://oposite.stsci.edu/pubinfo/whats-new.html>

See Galileo Galilei's actual finger (ewwww, gross!) <http://www.jpl.nasa.gov/galileo/finger.html>

Build a scale model of the Galileo Space Probe: <http://www.jpl.nasa.gov/galileo/model.html>

Voyager 1 & 2 : <http://ringmaster.arc.nasa.gov/voyager/mission/mission.html>

Voyager Project Home Page: <http://vraptor.jpl.nasa.gov/voyager/voyager.html>

Shoemaker/Levy 9 Hits Jupiter: <http://pdcmoon.jpl.nasa.gov/~meyertr/Stardust/comets/sl9.html>

