

## Facilitator Information

(All you need to know about Gas Giants to survive the day)

A **gas giant** is a large planet that is mostly made of gas (or gas compressed into a liquid). Unlike rocky planets, gas giants do not have a well-defined surface. There are four gas giants in our solar system: Jupiter, Saturn, Uranus, and Neptune. These are also known as the **Jovian planets**.

### Jupiter

Jupiter is the largest planet in our solar system; about 1000 Earths could fit inside a hollow Jupiter. It contains more mass than all other planets combined. Because its composition is similar to the Sun, people often ask if Jupiter is a failed star. However, Jupiter would have to be at least 80 times more massive to create its own energy through the process of fusion, and thus, be a star.

Overall, Jupiter is about 90% hydrogen and 10% helium with some methane, water, and ammonia. Jupiter is thought to have a small core of rocky material. The core is surrounded by liquid metallic hydrogen (think liquid mercury to get a sense of what this could be like). It is liquid, rather than hydrogen gas, because of the immense temperatures and pressures of Jupiter. The outer layer of Jupiter is hydrogen and helium liquid that gradually transitions to a gas at the surface – the atmosphere. Water, carbon dioxide, methane and other materials are present in very small amounts.

Temperatures reach  $-200^{\circ}\text{C}$  ( $-325^{\circ}\text{F}$ ) at the top of the atmosphere. Jupiter spins on its axis once every 10 hours and orbits the Sun once every 12 years. This makes its atmosphere tumultuous. The atmosphere is divided into distinct bands. Wind speeds are high - up to 400 kilometers per hour (250 miles per hour)! Lightening on Jupiter is frequent. The Giant Red Spot is a massive storm system, twice the diameter of Earth, that has been raging for at least 300 years. Jupiter does have rings, like Saturn, but they are very faint.

Jupiter has at more than 60 moons. Galileo, the first person to look at Jupiter with a telescope, discovered four moons – Io, Ganymede, Callisto, and Europa. Ganymede, the largest of Jupiter's moons, is larger than the planet Mercury. Io is the most volcanic body in our solar system. Europa, covered by an icy surface that floats above an ocean of water, may harbor life.

### Saturn

Saturn, first viewed through a telescope by Galileo, is the second-largest planet. It is about 75% hydrogen and 25% helium with traces of water, methane, ammonia. Its interior is thought to be similar to Jupiter's – a rocky core, a liquid metallic hydrogen center, and an outer layer of hydrogen.

Saturn is best known for its beautiful rings. The ring system stretches to a diameter of 250,000 kilometers (155,000 miles) but is only 1 kilometer thick (a little over half a mile). They are made mostly of particles of water ice.

Its day is 11 hours long and its orbit around the Sun takes about 30 years. Saturn's atmosphere does have bands, but they are not as easily seen as Jupiter's. Winds reach 1770 kilometers per hour (1100 miles an hour). Saturn has almost 60 moons; more are being discovered by the Cassini mission.

## **Uranus**

Uranus, third largest planet in our solar system, was the first planet discovered by telescope. Uranus is thought to contain mostly rock and various types of ice that are distributed uniformly throughout the planet, with only about 15% hydrogen and a little helium. Like the other gas giants, its atmosphere is mostly hydrogen and helium. It has a little methane in its atmosphere, which absorbs red light, giving Uranus its blue-green color. Uranus does have bands and rings, but these are very faint.

Uranus rotates on its axis once every 17 hours and orbits the Sun once every 84 years. Unlike the other planets, Uranus' axis is tilted so that the planet rotates on its side. Given Uranus' long period of orbit, this translates into a 20-year winter or summer! Uranus has almost 30 known satellites.

## **Neptune**

Neptune is the most distant gas giant planet. Neptune's interior is thought to be similar to Uranus' but it may have a small rocky core. Like Uranus, it has methane in its atmosphere, which gives it the blue hue.

Neptune has the fastest winds in the solar system (2000 kilometers or 1250 miles per hour!), and some massive storm systems that move within its atmosphere. Neptune spins on its axis once every 16 hours, and an orbit around the Sun takes 165 years. Because Pluto's orbit is so eccentric, it sometimes crosses Neptune's orbit, making Neptune – not Pluto – the farthest planet-body from the Sun for a few years. Neptune has more than 10 known moons and several rings.