**Jupiter WebQuest Lab Activity**

*Astronomy*

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part I*:* Planet Jupiter**

1. What is Jupiter’s most [significant feature](http://www.nasa.gov/audience/forstudents/5-8/features/what-is-jupiter-58.html)? <http://www.nasa.gov/audience/forstudents/5-8/features/what-is-jupiter-58.html>

Describe and list some of the physical characteristics of this feature.

1. How many rings does Jupiter have and what are they made of?

“If a person could stand on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at the top of Jupiter's atmosphere, the force of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ he or she would feel would be about \_\_\_\_\_\_ times the force of gravity on the surface of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. A person who weighs 100 pounds on Earth would weigh about \_\_\_\_\_\_ pounds on Jupiter.”

1. Jupiter is the \_\_\_\_\_\_\_\_\_\_\_\_\_ [planet from the Sun](https://space-facts.com/jupiter/) and is primarily made up of \_\_\_\_\_\_\_\_\_\_\_\_\_. <https://space-facts.com/jupiter/>

How much more massive is Jupiter as compared to Earth?

1. Why are the clouds of Jupiter [different colors](http://www.universetoday.com/15152/color-of-jupiter/)? <http://www.universetoday.com/15152/color-of-jupiter/>

What are the significance of the white, brown & red spots in Jupiter’s atmosphere?

1. Describe the more recent storm on Jupiter named “Oval BA.”

How long has this been a storm on Jupiter and how did it form?

1. Why are scientists interested in studying Jupiter? (Watch the [short video link here](https://www.missionjuno.swri.edu/origin).)

How long (approximately) did it take for the JUNO mission to reach Jupiter?

1. Describe Jupiter's [magnetic field](https://airandspace.si.edu/exhibitions/exploring-the-planets/online/solar-system/jupiter/environment.cfm). How does it compare to Earth's magnetic field? <https://airandspace.si.edu/exhibitions/exploring-the-planets/online/solar-system/jupiter/environment.cfm>

 How is the magnetic field created?

1. Describe Jupiter's [magnetosphere](http://www.windows2universe.org/jupiter/upper_atmosphere.html).

<http://www.windows2universe.org/jupiter/upper_atmosphere.html>

How does the magnetosphere [create auroras](http://www.windows2universe.org/jupiter/magnetosphere/jupiter_aurora.html)?

1. Could astronauts survive the [radiation trapped in the magnetic field lines](https://www.reddit.com/r/askscience/comments/316qay/how_dangerous_is_jupiters_radiation_at_different/) on the surface of Jupiter’s main moons? Explain.
2. How [far away is Jupiter from Earth](https://www.space.com/18383-how-far-away-is-jupiter.html) at its closest?

 Why does Jupiter's brightness in the night sky rival Venus if it is so far away?

1. Describe the [interior of Jupiter](https://www.windows2universe.org/jupiter/interior/J_int_compo_overview.html). <https://www.windows2universe.org/jupiter/interior/J_int_compo_overview.html>

How does hydrogen behave when it is compressed like on Jupiter?

**Part II: Jupiter's Moons**

1. How [many (total) moons](https://spaceplace.nasa.gov/how-many-moons/en/) does Jupiter have?

<https://spaceplace.nasa.gov/how-many-moons/en/>

Name the four largest moons. Why are they called "[Galilean" satellites](http://abyss.uoregon.edu/~js/ast121/lectures/lec13.html)?

2. Describe the other 59 (or more) moons of Jupiter.

 Why is Ganymede unique when compared to other satellites in the Solar System?

3. Describe the features that have been observed on the [surface of Io](http://www.windows2universe.org/jupiter/moons/io_surface_overview.html). <http://www.windows2universe.org/jupiter/moons/io_surface_overview.html>

 What is thought to cause these features to form?

4. How large is Io and how does this compare to Earth's Moon?

 How did the four Galilean satellites [get their names](http://en.wikipedia.org/wiki/Galilean_moons)?

5. Compare the [surface features of Europa](http://solarsystem.nasa.gov/planets/europa/indepth) to Io. Why are they so different?

<http://solarsystem.nasa.gov/planets/europa/indepth>

 What most likely lies beneath the fractured ice surface of Europa?

6. List several of the elements that Europa contains that [may support life](http://lasp.colorado.edu/education/outerplanets/moons_galilean.php#europa).

<http://www.space.com/26905-jupiter-moon-europa-alien-life.html>

 What are two other places on Europa where life may exist besides the ocean floor?

7. Briefly describe NASA's planned "[Europa Clipper](http://www.jpl.nasa.gov/missions/europa-clipper/)" mission. When is this mission due to launch?

<http://www.jpl.nasa.gov/missions/europa-clipper/>

8. Describe the [three main layers of Ganymede.](https://solarsystem.nasa.gov/moons/jupiter-moons/ganymede/in-depth/)

<https://solarsystem.nasa.gov/moons/jupiter-moons/ganymede/in-depth/>

 Why does Ganymede have a magnetic field?

9. Describe the surface of Jupiter's farthest [major moon Callisto](http://solarsystem.nasa.gov/planets/callisto).

<http://solarsystem.nasa.gov/planets/callisto>

 Name the two [largest impact basins](http://solarviews.com/eng/callisto.htm) on Callisto. Why haven't these features changed?

Go to [AstronomyDad.com](http://www.astronomydad.com/blog/jupiter-rex) and read the blog about “Jupiter Rex.” Answer the questions below.

* Why was the current mission to Jupiter named "Juno?"
* What will Juno the spacecraft be able to study?
* What does planetary opposition mean?
* What does "retrograde motion" mean and when will this next occur with Jupiter? (Hint: click on "retrograde motion" as "appears from Earth" link in the blog)

**Answer Key Part I**

1. The Great Red Spot. Resembles a giant hurricane on Earth; about as large as three Earths in diameter; very windy & made up of mostly hydrogen and helium gas.
2. 3 rings (possibly 4) made up of dust. Clouds, gravity, 2.4, Earth, 240
3. 5th, gases; about 318 times more massive than Earth
4. Different colors indicate different chemical composition that reflect sunlight; White spots appear to be cool storms, brown are warm, and red are hot storms
5. Large hurricane-like “Red Jr.” storm that is about ½ the size of the Great Red Spot; since the year 2000 and likely formed from a merger of 3 smaller storms
6. Various answers will include - to understand how the atmosphere of Jupiter works; how did Jupiter get so large; how do planets form in general; JUNO mission arrival is approximately over 18 months away (as of late 2014)
7. Very large, complex, doughnut-shaped (toroidal) up to ten times stronger than Earth's; rapidly spinning metallic hydrogen interior creating electrical currents
8. Very large area of magnetic field lines extending outward from Jupiter's poles; solar particles are trapped within the field lines creating intense auroras as the particles clash with the atmosphere at Jupiter's poles
9. Not on the inner two main moons IO & Europa. Possibly on the outer two moons Ganymede (which has its own magnetic field) and Callisto which is far enough away from the radiation belts. The radiation detected by the Voyager & Pioneer space probes was over 400,000 rads - or about 1000 times the lethal dose for humans
10. About 400 million miles away (644 million Km); Jupiter is much larger than Venus and can appear very bright at opposition (when Earth & Jupiter are on the same side of the Sun)
11. Mostly liquid hydrogen with about 10% helium, small rocky core; hydrogen becomes liquid and can conduct electricity like a metal

**Part II**

1. 63; Io, Europa, Ganymede, Callisto; named after Galileo who first observed them through his telescope in 1610

2. Small, irregular shapes that are probably captured asteroids; Ganymede is the largest moon in the solar system- larger than the planet Mercury!

3. Resembles a "splotchy pizza" caused by massive volcanoes/lava that cover almost its entire surface; tidal (gravity) forces between Jupiter on one side & Io's sister moons on the other causing a great amount of internal heating

4. 1132 miles in radius (1821 km)or just a little bigger than Earth's Moon; after the Greek god Jupiter's (Zeus) lovers in mythology

5. Europa has a very smooth surface layer of water ice that is tidally heated underneath like Io; differences may include the distance from Jupiter (Europa is the next moon out and has less tidal heating than Io); liquid ocean above the rocky mantle possible twice as deep as Earth's oceans

6. Answers should include a warm salty ocean beneath the ice layer, ice layer shielding radiation, possible hydrothermal vents on Europa's ocean floor that may provide the chemicals for the basis of life that we find here on Earth; subsurface lakes and ice plumes being ejected from Europa's surface

7. Jupiter orbiter flying by Europa at least 45 times to get a close-up reconnaissance/analyses of the water plumes etc.; no determined launch date has been set (as of late 2014)

8. metallic iron at the center (the core, which generates a magnetic field), a spherical shell of rock (mantle) surrounding the core, and a spherical shell of mostly ice surrounding the rock shell and the core, the ice shell on the outside is very thick; solid iron core rotates differentially creating electric currents inside the moon which generates a magnetic field

9. Callisto is the most heavily cratered object in the solar system, its surface is over 4 billion years old; the Asgard and Valhalla impact basins are the largest that are frozen in ice - & have not changed due to inactive geologic processes

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- named for Jupiter's (Zeus) wife Juno (or Hera) who could "see through" Jupiter's clouds of deception to reveal the truth

- the atmosphere and magnetic field of Jupiter

- planetary opposition means when planets line up on the same side of the Sun

- retrograde means the opposite of "prograde" motion of an object in the night sky; answers will vary depending on the date. As of late 2014 Jupiter just left the retrograde motion and has returned to prograde (Dec. 2014). The map link automatically updates and shows Jupiter in the night sky compared to the constellations etc.