

19. Uranus

By Sharon Fabian

¹ As long as people have lived on Earth, they have been able to look up in the sky and see planets. Prehistoric people looked up and saw Mars and some of the other planets; they just didn't know that they were planets. By the time of the ancient Greeks, some logically-minded people had figured out that not everything up there was a star. Stars stayed in one place, but other heavenly bodies, such as planets, moved. In this way, they discovered the planets closest to Earth: Mercury, Venus, and Mars, and also two of the giant planets, Jupiter and Saturn.



² It wasn't until the age of astronomy and telescopes that people were able to learn much more about the solar system.

³ William Herschel was an astronomer in the 18th century who enjoyed looking through his telescope to see what he could see. In fact, he became so interested in astronomy that he began to build his own telescopes. In 1781, Herschel was looking through one of his own telescopes in his hometown of Bath, England. It was a seven-foot long telescope with a seven-inch lens. When he noticed an interesting dot in the sky, he reset his telescope to a higher magnification and looked again. The dot was bigger. At an even higher magnification, the dot was bigger still. Since stars always look about the same size because they are so far away, this told him that what he was looking at must be something else. At first he thought he had sighted a comet.

⁴ As astronomers did at that time, he quickly shared his discovery so that others could observe it too. They were not convinced that it was a comet. Most comets have a tail and get brighter. Herschel's discovery didn't fit this description. For a while they weren't sure what it was. Finally, an astronomer from Russia named Anders Lexell determined that it must be a planet by calculating its orbit.

⁵ William Herschel had discovered Uranus, the first planet to be discovered by modern astronomy. He also discovered two of Uranus' moons.

⁶ This was not the end of the Uranus discoveries. Later, three more moons were discovered from Earth. Later still, the Voyager 2 spacecraft discovered ten more moons orbiting Uranus. After that, more moons were discovered through new and more powerful telescopes in California and Hawaii.

⁷ The discovery of Uranus' rings is an interesting part of the story too. The rings were discovered during a phenomenon known as "occultation." Occultation is when a planet moves in front of a star; it's a type of eclipse. Astronomers were watching Uranus during an occultation and noticed that the light of the star flickered several times before the actual eclipse. The same thing happened at the end of the eclipse. Since it happened on both sides of the eclipse, the scientists knew that rings, not more moons, caused the star's light to flicker as Uranus passed by.

⁸ More and more discoveries are being made about Uranus as scientists study the data from the telescopes and from the information Voyager 2 sent back. One of the unusual facts that they have discovered is that Uranus' north and south poles point towards and away from the sun, not "up and down" like the poles of Earth and the other planets. Uranus has become an interesting place, and it all started when William Herschel looked through his telescope and noticed one dot that looked just a little bit different from all the others.

Uranus

<p>1. William Herschel discovered _____. <input type="radio"/> A Mercury <input type="radio"/> B Uranus and its rings <input type="radio"/> C Uranus and two of its moons <input type="radio"/> D Mars</p>	<p>2. William Herschel was _____. <input type="radio"/> A An ancient Greek astronomer <input type="radio"/> B An astronomer in Bath, England <input type="radio"/> C A prehistoric person <input type="radio"/> D The first person to use a telescope</p>
<p>3. When Herschel increased the magnification on his telescope and noticed that the size of the object he was viewing became larger, he knew that it was _____. <input type="radio"/> A A comet <input type="radio"/> B Not a star <input type="radio"/> C A planet <input type="radio"/> D A star</p>	<p>4. Herschel _____. <input type="radio"/> A Discovered Uranus <input type="radio"/> B Made telescopes <input type="radio"/> C Studies the sky with his telescope <input type="radio"/> D All of the above</p>
<p>5. Uranus was discovered _____ Jupiter. <input type="radio"/> A After <input type="radio"/> B Behind <input type="radio"/> C Before <input type="radio"/> D At the same time as</p>	<p>6. From the article, you can infer that astronomy means _____. <input type="radio"/> A All branches of science <input type="radio"/> B Studying the stars and planets <input type="radio"/> C Traveling in spacecrafts <input type="radio"/> D Making telescopes</p>
<p>7. Which happened first? <input type="radio"/> A Uranus was discovered <input type="radio"/> B Telescopes were invented <input type="radio"/> C Mars was discovered <input type="radio"/> D Voyager 2 explored space</p>	<p>8. Draw a picture of the planets orbiting the sun. Label Earth's north and south poles. Label Uranus' north and south poles.</p> <hr/> <hr/>

20. Neptune

By Sharon Fabian

¹ The story of Neptune's discovery is a story about *Math* and *Chemistry*. Neptune was discovered because of the predictions of two mathematicians. Later, Voyager 2 gave us some clues as to Neptune's chemical makeup. Scientists have put all of these mathematical and chemical clues together to learn as much as they can about planet Neptune.



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Neptune Math

In the 1840's, astronomers were interested in the planet Uranus, the most recently discovered planet. Since it was so far away, one of the best ways they had to learn more details about Uranus was through math. Mathematicians were studying Uranus's orbit when they noticed something strange. Uranus didn't travel along its path at an even speed. It sped up sometimes, and sometimes it slowed down. What did this mean? What was causing Uranus to change its speed at certain times? The scientists had a theory. They thought the cause might be a pull from the gravity of another planet even farther out. In England, a mathematician named John Couch Adams worked on the problem. He was able to calculate Uranus's orbit and then predict where the gravitational pull should be coming from. In France another mathematician, Urbain Leverrier, studied the same problem and came up with a similar solution. Then two German astronomers, Johann Galle and Heinrich D'Arrest, began looking through their telescopes for the mystery planet. They used Adams's and Leverrier's calculations to tell them just where to look. This is how they discovered Neptune.

³ Mathematical calculations have also made it possible for scientists to discover Neptune's moons. Its largest moon, Triton, was discovered in 1846, the same year that Neptune was discovered. In 1949 a second moon, Nereid, was discovered. Then, in 1989, six more moons were discovered when the Voyager 2 spacecraft flew by Neptune. Only by precise mathematical calculation was this voyage even possible. Exact calculations of speed, time, distances, gravities, and orbits guided Voyager 2.

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Neptune Chemistry

Since Neptune is so far away, about 30 times the distance from the Earth to the sun, it is amazing that we know anything at all about what it is made of. Yet scientists have some pretty good theories about the makeup of Neptune. Chemists know about the properties of each chemical element, so they can make some predictions about what Neptune is made of from even basic information such as its size, mass, temperature, and even its colour. By comparing Neptune to planets that they already know more about, they can make even more hypotheses about the chemical composition of Neptune. The fact that Neptune's mass is small compared to the giant size of the planet tells us that Neptune is one of the gas planets. Hydrogen, helium, and methane are probably present in Neptune's atmosphere. Scientists believe that Neptune has a core of melted rock, just as earth does, but they cannot be sure. Neptune has a dark band around the middle, and it is brighter on both sides of the dark band. The brightness may originate from sunlight reflecting from methane ice crystals in the atmosphere.

⁵ Scientists continue to use clues from math and chemistry to discover more about Neptune. Four more moons were discovered in 2002, and another one in 2003.

⁶ We still have more questions than answers about Neptune. One interesting question is what happened to Neptune's giant dark spot. The dark spot was a huge storm, similar to Jupiter's giant red spot. Scientists had watched it for years, but no one has seen it lately. The scientists wonder if it has really disappeared, or if we are just not able to see it from Earth now. They have lots of other questions about Neptune too. That is why astronomers try to get every bit of knowledge that they can from even the smallest fact like a measurement or a chemical property.

Neptune

<p>1. According to this article, math and chemistry _____. <input type="radio"/> A Were used to discover all of the planets <input type="radio"/> B Are no longer necessary subjects <input type="radio"/> C Made it possible to discover Neptune <input type="radio"/> D Were Urbain Leverrier's favourite subjects</p>	<p>2. Neptune was discovered in _____. <input type="radio"/> A 1846 <input type="radio"/> B 1800 <input type="radio"/> C 1949 <input type="radio"/> D 1989</p>
<p>3. The article names _____ spacecraft that flew by Neptune. <input type="radio"/> A One <input type="radio"/> B Two <input type="radio"/> C No <input type="radio"/> D Five</p>	<p>4. Neptune was discovered by _____. <input type="radio"/> A Mathematicians <input type="radio"/> B Neither <input type="radio"/> C Both <input type="radio"/> D Astronomers</p>
<p>5. From this article, we know that _____. <input type="radio"/> A Pluto is the last planet in the solar system <input type="radio"/> B It does not say. <input type="radio"/> C Neptune is the last planet in the Solar System <input type="radio"/> D Neptune is the last planet visited by Voyager 2</p>	<p>6. The Voyager 2 spacecraft used math to guide its journey. <input type="radio"/> A False <input type="radio"/> B True</p>
<p>7. Parts of Neptune appear very bright, even though Neptune is far away from the sun. This may be because sunlight reflects from _____ in Neptune's atmosphere. <input type="radio"/> A Dust storms <input type="radio"/> B Methane gas <input type="radio"/> C Water vapour <input type="radio"/> D Ice crystals</p>	<p>8. Compare Neptune to one of the other planets. Tell how they are similar and how they are different.</p> <hr/> <hr/>