

Lesson 5	Resource 5G	Long Reading (page 1)
----------	-------------	-----------------------

Time: 20 minutes

The solar system is a gravitational system that consists of the sun and all the objects orbiting it. The system is made up of the sun, eight planets, dwarf planets, satellites, comets, asteroids, and other parts.

The name “planet” comes from a Greek word that meant “wanderer” and described an object that would wander or move in the sky. The Greek taxonomy of planets included the following seven—Mercury, Venus, Mars, Jupiter, and Saturn, as well as the moon and the sun. For the longest time, Earth was believed to be the centre of the universe—a geocentric system (“geo” meaning Earth). In 1543, Nicolaus Copernicus stated that the Earth actually revolved around the sun. Since then, it has been generally accepted that our solar system is heliocentric, revolving around the sun.

Traditionally, the solar system was divided into planets, satellites, asteroids, and comets. Unfortunately, as often happens with science, things seem to be more complicated than we initially expected. First of all, the planets are very different in their composition and characteristics. Planets closer to the sun (called inner or terrestrial planets) are smaller, denser, mostly composed of rock and metal, and orbited by fewer satellites. Inner planets are Mercury, Venus, Earth, and Mars. The planets farther from the sun (outer or Jovian planets) are made of gas, mostly composed of hydrogen and helium. These planets possess larger mass, rotate faster, and often include rings and many satellites. Outer planets include Jupiter, Saturn, Uranus, and Neptune. So what happened to Pluto? We used to have nine planets and, now, only have eight. As you may know, Pluto was considered to be a planet from 1930 until the 1990s.

Pluto was known as the ninth and smallest planet of the solar system. In the 1840s, French mathematician Urbain Le Verrier was observing Uranus and stated that there should be another planet in the solar system that exhibited its gravitation and affected the orbit of Uranus. Later in the 19th century, after Neptune was discovered, scientists still predicted that another object should be affecting Uranus and Neptune. In the early 1900s, an extensive search for a Planet X was undertaken. For a long time, no results were found. Finally, in 1930, Clyde Tombaugh discovered a new planet, Pluto.

Since 1992, many objects similar to Pluto have been found in the solar system. That area of the solar system became known as the Kuiper belt—a stable belt of objects located between 30 and 50 astronomical units from the sun. This finding suggested one of two options: (1) there are more planets in the solar system than we believed or (2) Pluto is not a planet. As there was no established definition of “planet,” various groups adopted their own stances on Pluto. In 2000, New

Lesson 5	Resource 5G	Long Reading (page 2)
----------	-------------	-----------------------

York's Hayden Planetarium made headlines when it reopened with a model of eight planets, excluding Pluto. In 2006, the International Astronomical Union (IAU) created an official definition of the term planet, stating that a planet must:

1. be in orbit around the sun;
2. be massive enough to be rounded by its own gravity; and
3. have cleared the neighbourhood around its orbit.

Pluto has not met the third criterion as its mass makes up less than 1% of the mass of the other objects in its orbit. In comparison, Earth's mass is 1.7 million times the remaining mass in its own orbit. The IAU decided that objects like Pluto that satisfied the first two criteria, but not the third one, would be called dwarf planets. And this is how Pluto's fate was decided. Despite the decision, New Mexico and Illinois still recognize Pluto as a planet to celebrate Clyde Tombaugh's contribution to astronomy.

But planets and their satellites are not the only masses in our solar system. Consider asteroids and comets. These may be hard to tell apart for some, but they have distinct properties. Asteroids are mostly made up of metals and rocky materials, while comets are composed of ice, dust, and rock. When comets get closer to the sun, they often release melting ice, which can be seen in the sky as the comet's tail. Most comets have highly elliptical orbits, which means that they move far into the outer reaches of the solar system and then come back close to the sun, often much closer than the Earth. Asteroids usually have shorter and rounder orbits. It is not common for asteroids to have "tails," though a few such cases have been observed. Finally, connecting the space between all of these bodies is gas, dust, radiation, and magnetic fields. Though unassuming, these masses, particles, and fields comprise a major part of our solar system.

Lesson 5	Resource 5G	Long Reading (page 3)
----------	-------------	-----------------------

1. What did the word “planet” mean in ancient times?
  - ☐ something that shines
  - ☐ something high in the sky
  - ☐ something far away
  - ☐ something that moves
  
2. What did many people believe until the 16th century?
  - ☐ There were seven planets.
  - ☐ The sun was a planet.
  - ☐ The sun moved around the Earth.
  - ☐ The Earth moved around the sun.
  
3. Pluto was considered a planet \_\_\_\_\_.
  - ☐ for over 60 years
  - ☐ for 248 years
  - ☐ in the 1840s
  - ☐ until 1930
  
4. What did Urbain Le Verrier predict?
  - ☐ the effects of Pluto on Uranus
  - ☐ the existence of a ninth planet
  - ☐ the presence of Planet X
  - ☐ the discovery of Pluto
  
5. What was the recent definition of “planet” prompted by?
  - ☐ a comparison between Pluto and the moon
  - ☐ the advances in orbit-measuring techniques
  - ☐ the new evidence sent by the space probe
  - ☐ the discovery of multiple bodies in the sun’s orbit
  
6. What made news for the Hayden Planetarium in 2000?
  - ☐ They excluded Pluto.
  - ☐ They reopened the exhibition.
  - ☐ They defined a planet.
  - ☐ They observed Pluto.

Lesson 5	Resource 5G	Long Reading (page 4)
----------	-------------	-----------------------

7. According to the passage, what is the important difference between the Earth and Pluto?
  - ☐ rounded shape
  - ☐ mass of nearby objects
  - ☐ star that it orbits
  - ☐ number of satellites
  
8. Pluto is still regarded as a planet in \_\_\_\_\_.
  - ☐ New York
  - ☐ Illinois
  - ☐ England
  - ☐ France
  
9. What characteristic is shared by comets and asteroids?
  - ☐ known quantities
  - ☐ shape of the orbit
  - ☐ possible existence of tails
  - ☐ makeup of the body
  
10. What often happens when comets get close to the sun?
  - ☐ They emit water.
  - ☐ They gain higher speed.
  - ☐ Their orbit gets smaller.
  - ☐ They become asteroids.

11. Sort each phrase below to show whether it describes asteroids or comets.

Made up of metals and rocky materials	Asteroids
Composed of ice, dust, and rock	
Release melting ice	Comets
Have shorter orbits	
Have elliptical orbits	
Have round orbits	