

Chapter 9 Section 1: Our Solar System

Solar System: The solar system includes the sun, planets and many smaller structures. A planet and its moon(s) make up smaller systems in the solar system.

Scientists use the astronomical unit and the light year (Light travels 300,000 km per second). to measure distances in space. An **astronomical unit (AU)** is the average distance from the Earth to the Sun, approximately 150,000 million km. This is a convenient unit of measurement for structures in our solar system. The light year is a much longer unit of distance and is good for structures beyond our solar system. One AU is also equal to 8.3 light minutes which is how long it takes for light to reach Earth from our Sun.

The discovery of the solar system was made helped by the telescope. Our solar system includes 8 planets in the following order from the sun: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. By using the mnemonic device **“My Very Excellent Mother Just Served Us Nachos”** it makes the order easier to remember.

By dividing the planets into two groups, the first 4 and the last 4, we have also divided the planets into the inner planets and the outer planets. The inner planets are Mercury, Venus, Earth and Mars and the outer planets are Jupiter, Saturn, Uranus and Neptune.

Inner Planets

- planets are closer to the Sun
- planets are closer together
- inner planets are small and terrestrial (solid)
- inner planets are unique from each other

Outer planets

- planets are further from the Sun
- planets are distantly spaced from each other
- outer planets are gaseous giants

Starting from closest to the Sun, name the orbiting planets in order. _____

What are two ways that scientist measure distance in space? _____

What is distance is the astronomical unit based on? _____

Name the two groups of planets? _____

What tool helped discovery of the structures in the outer solar system? _____

Name the inner planets in order starting with their orbits closest to the Sun? _____

Name 3 characteristics of the inner planets. _____,

Name the outer planets in order starting from their orbits closest to the Sun _____

Name 3 characteristics of the outer planets. _____,

Chapter 9 Section 2: The Inner Planets

The inner planets are referred to as the Terrestrial Planets. The inner planets are denser and rockier than the outer planets.

Mercury is closest to the sun, is smaller than the Earth with less surface gravity, has a slower rotation (one rotation takes 59 Earth days), but has a faster revolution around the sun is equal to 88 Earth days.

The length of time that it takes an object to rotate once is the objects **period of rotation**. The time that it takes an object to revolve around the sun once is the objects **period of revolution**.

Venus is Earth’s twin planet because Venus is only slightly smaller than Earth (less dense, less mass) and therefore less gravity. Venus has its differences though. Venus rotates the opposite direction that Earth rotates. We call Earth’s rotation **prograde** (counterclockwise as viewed from above the north pole) and Venus’s rotation **retrograde** (clockwise as viewed from the north pole). On Venus the sun rises in the direction that the Earth’s sun sets. Venus has the densest atmosphere of the inner planets and it is mostly CO₂ gas. This CO₂ is a greenhouse gas and Venus is therefore has the hottest surface temperature of any planet in the universe. Radar waves have been used to map the surface of Venus and it closely resembles the valleys, plains and mountains of the Earth.

Earth is considered to be the oasis in space. Being at just the right distance from the Sun, the Earth has temperatures for mainly liquid water which is essential to the chemical processes for life. If it were too cold, then Earth’s water would all be frozen and if it were too hot, then all of Earth’s water would boil away.

The **Earth Science Enterprise** studies Earth as a global system using satellite technology. The purpose is to better understand our global system and to monitor how humans impact the global system.

Mars has been widely studied by space craft (Viking 1 and 2) and land rovers. Mars is much colder than the Earth due to thin atmosphere and greater distance from the Sun. Due to the low atmospheric pressure on Mars’ surface, liquid water would quickly boil away. However Mars has frozen water in its polar ice caps and possibly below the surface of the soil. Mars has volcanoes like Earth, but the volcanoes are always in the same place due to Mars’ crust not moving like Earth’s crust does. Mars’ volcanoes simply get reused over and over again when the interior pressures are great enough.

What technology was used to map the surface of Venus? _____

Why is Earth considered to be an oasis in space? _____

Why is Earth suitable for life? _____

What is the Earth Science Enterprise? _____

Why is Mercury (closer to the sun) colder than Venus? _____

How are mass and gravity related? _____

The counterclockwise rotation of a structure as seen above it north pole is called _____.

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List 3 similarities between Earth and Venus. _____

List 3 differences between Earth and Venus. _____

The period of time for an object to spin once on its axis is called the period of _____.

The period of time that it takes for an object to completely orbit the sun is called its period of _____.

Chapter 9 Section 3: The Outer Planets

The outer planets have deep massive atmospheres and not solid rocky surfaces like the inner planets.

Jupiter is the largest planet, is made of hydrogen and helium (like the Sun), and has an atmosphere made of hydrogen and helium with water, methane and ammonia in the outer atmosphere. Jupiter's interior is very hot and radiates more heat into space than it receives from the Sun. Jupiter also has a giant storm called the Great Red Spot and there is a faint ring around the planet. Jupiter has the fastest rotation of any of the planets (9 hrs. and 54 min.). The many colors of Jupiter's atmosphere is probably due to its organic compounds that are present.

Saturn is the second largest planet, is still forming, is made of helium and hydrogen (like Jupiter), and has an atmosphere that is made of methane, ethane, and ammonia. Saturn's interior is very hot and it also radiates more heat into space than it receives from the Sun. Saturn's heat is thought to be from helium sinking to the core of Saturn indicating that Saturn is still forming. Saturn has the largest rings of any planet and the rings are made of icy particles of varying sizes.

Uranus has an atmosphere made of hydrogen and methane. Uranus has a similar density to Jupiter and Saturn, but is much smaller suggesting that Uranus has to be made of different elements. Uranus rotates on its side with its axis (tilted nearly 90 degrees) pointing toward the Sun. Uranus, like Venus, also has retrograde rotation.

Neptune was difficult to discover. Due to the abnormal orbit of Uranus, scientist finally decided that another planet's gravitational pull had to be the reason. Scientists eventually found Neptune. Neptune's interior releases heat into its atmosphere creating convection currents (causes wind) of cooler gases sinking and warmer gases rising. Wind patterns resulted and created belts of clouds in the atmosphere.

Pluto is half the size of Mercury and is made of ice and rock. Pluto is a dwarf planet because it has not cleared its orbit of debris.

How are gas giants different from terrestrial planets? _____

What makes up Saturn's rings? _____

What characteristics of Neptune's interior accounts for the belts of clouds in Neptune's atmosphere?

Which of the outer planets has retrograde rotation? _____

Chapter 9 A Family of Planets

What are the many colors of Jupiter's atmosphere caused by? _____

What is the Great Red Spot? _____

Why does Jupiter radiate more heat into space than it receives from the sun? _____

Name the largest planet? _____

Which planet is still forming? _____

How far is Uranus's axis tilted? _____

Which planet has belts of clouds? _____

Chapter 9 Section 5: Smaller Bodies in the Solar System

The solar system contains smaller bodies including comets, asteroids, and meteoroids.

Comets are icy rock and dust loosely packed. Comets consist of a **nucleus** (actual body of the comet) surrounded by a **coma** and may have tails associated with it. Comets are formed in the cold outer solar system and are thought to be left over from the time of planet formation and are studied to learn more about the early solar system. Comets have very elongated **elliptical** orbits. When they come near the sun, the solar radiation heats the ice giving off a long **gas and dust tail**. Comets also have **ion tails** which are charged particles from the comet and these tails point in the opposite direction from the sun. It is the **solar wind** (also made of ions) that causes the ion tail to point in that direction. See figure 1 on p. 274 and figure 2 on p. 275. Comets originate from either the Oort Cloud or the Kuiper Belt. The **Oort Cloud** surrounds our solar system like we are inside of a ball. The **Kuiper Belt** is a narrow band just beyond the orbit of Neptune.

Asteroids are small rocky bodies that orbit the Sun in the **Asteroid Belt** located between Mars and Jupiter.

Meteoroids are smaller than asteroids and are small rocky bodies that travel through space around the sun. Meteoroids are thought to be from asteroids. When a meteoroid enters the Earth's atmosphere, it begins to burn up in the Earth's atmosphere causing a streak of light (shooting star) in our sky and now the object is called a **meteor**. If the meteor does not burn up completely and it strikes the ground, then it is called a **meteorite**. Occasionally, Earth experiences meteor showers when small pebble size pieces of debris, possibly from a comet's tail, enter our atmosphere and then burn up. The three types of meteors are Stony, Metallic and Stony- Iron (Metallic) meteorites.

Chapter 9 A Family of Planets

Why are comets, asteroids and meteoroids important for scientist to study? _____

How are asteroids and meteoroids similar? _____

How are asteroids and meteoroids different? _____

Is their extraterrestrial material on Earth? _____ Explain _____

Name the four prominent features of a comet? _____

From which two regions do comets come from? _____

Based on a rocky object traveling through space and then entering the Earth's atmosphere and eventually striking the Earth's surface, give the three terms associated with this object in the order of the pathway of the object. _____

Why do the comets two tails often point in different directions? _____

Where is the asteroid belt located? _____