

Solar System

Eco-Meet Study Guide

Helpful Hints:

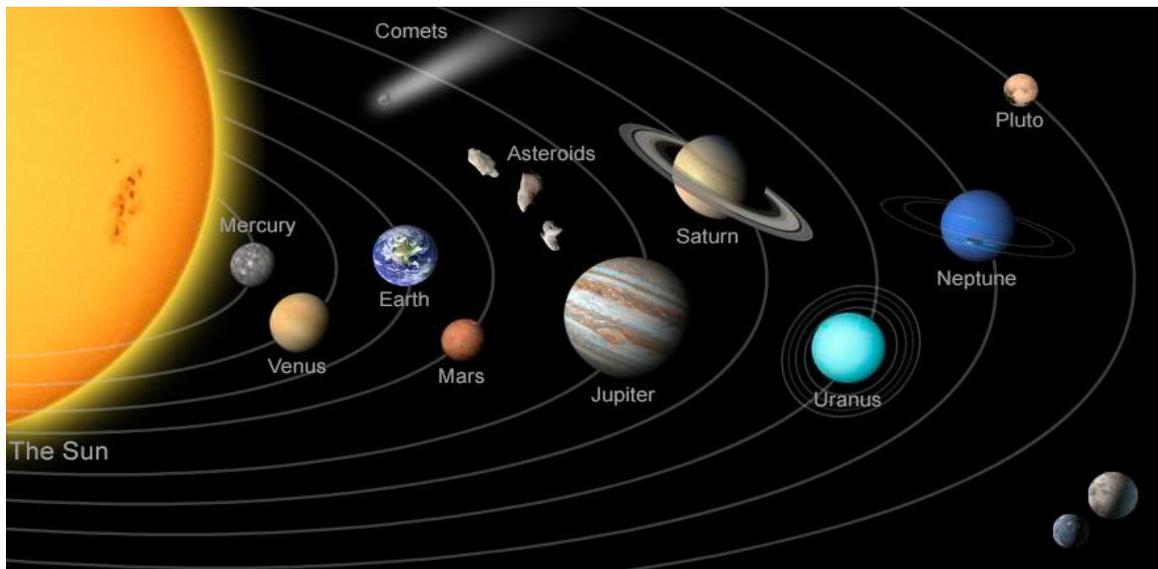
This study guide will focus on our solar system. The Eco-Meet test may consist of multiple choice, true/false, fill in the blank, matching, identification, label a diagram, or short answer. Anything in this study guide has the potential to be on the test. Pay close attention to words in bold, diagrams, and charts – it's easy to pull questions using that information.

Space Exploration

Astronomy is the study of the universe and the objects found in space. Humans have been studying astronomy for thousands of years. Greek scholars Ptolemy and Aristotle were early astronomers that believed in the **geocentric** theory – this is the idea that the Sun and planets orbit around the Earth. This theory was accepted for centuries until Nicolaus Copernicus, a Greek astronomer in the 1500s, came up with the **heliocentric** model. This is the theory that all planets orbit the sun. It was not until Galileo invented the telescope about 100 years later that the heliocentric model was proven to be correct. Since this time, astronomy has come a long way, and our knowledge of space is continually growing. The 1960's were known as the **golden age of space exploration** because it was the start of human spaceflight, including the first humans to step foot on the Earth's moon on July 20, 1969 by Neil Armstrong and Edwin Aldrin, Jr. With the use of **robotics** (unmanned spacecraft) for space exploration, a lot of discovery and understanding of our solar system has been made in the past 55 years.

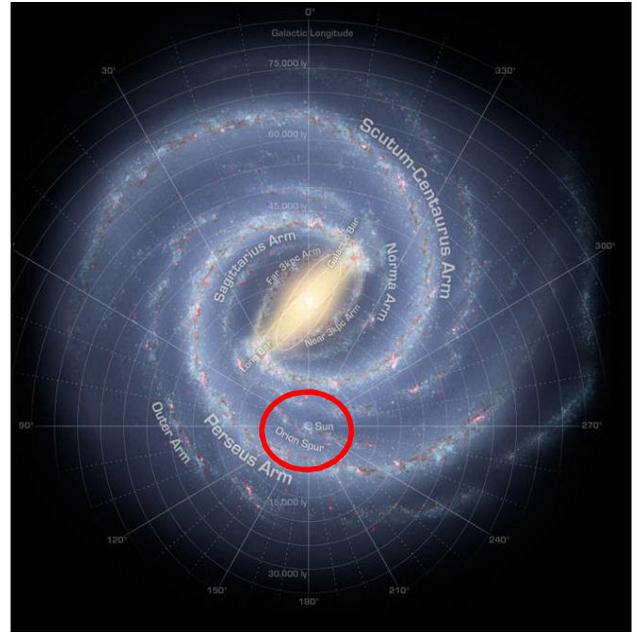
What is a Solar System?

A **solar system** consists of a star and the objects in space that **orbit** around it. An orbit is a regular, repeating path that one object in space takes around another one. An object in orbit is called a **satellite**. Satellites can be naturally occurring like the planets and moon, or they can be man-made like the International Space Station.



The Milky Way

Our solar system is located in the Milky Way **galaxy**, and it consists of the Sun (our star), 8 planets, moons, dwarf planets, asteroids, comets, meteoroids, and other space debris. A galaxy is a large group of stars, gas, and dust bound together by **gravity**. Gravity is a natural force of attraction by which all things are pulled toward each other. Galaxies can be all shapes and sizes, and there are billions in the universe. Our galaxy, the **Milky Way**, is a large spiral with “arms” that gets its name from its milky band of light in the sky that can be seen in a really dark area. Our solar system is located in the **Orion Spur** (see picture below).



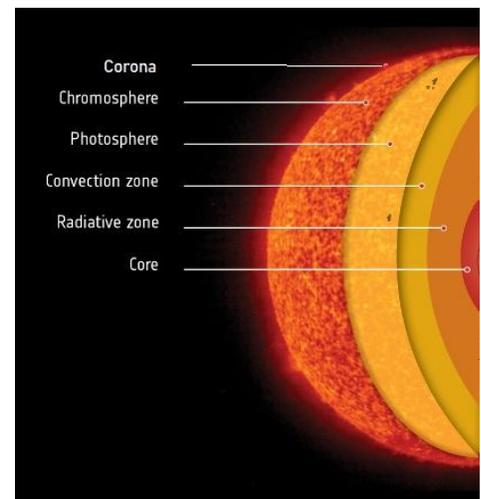
Stars

The Milky Way contains hundreds of billions of **stars** – large balls of burning gas that produce light, heat, and radiation. Stars are born from the collapse of dust and gas clouds that condense and heat up creating a **protostar**. “Proto-” means “before”, so a protostar can be thought of as a baby star, and after millions of years, it will become a star that will live for billions of years.

Stars have many different sizes, ranging from dwarfs to supergiants. The larger the star, the shorter its lifespan. As a star reaches the end of its lifespan, the hydrogen gas converts to helium, which raises the temperature and expands the outer shell. The star is now called a **red giant** at this stage, and eventually, it will shed its outer layer and become a **white dwarf**. White dwarfs will cool for billions of years, and they will eventually go dark and produce no energy.

The Sun

The Sun, a **yellow dwarf star**, is the center of our Solar System – all objects in the solar system orbit around the Sun. “Sol” is Latin for Sun, so “**solar**” is an adjective for anything Sun related. The connection between the Sun and Earth generates the seasons, ocean currents, weather, climate, radiation belts and auroras. The Sun’s radius is 432,168.6 miles; it would take 1.3 million Earths to fill the Sun! The Sun has six regions (interior to exterior; see picture to right): **core**, **radiative zone**, **convective zone**, **photosphere**, **chromosphere**, and **corona**. The core temperature is about 27 million degrees Fahrenheit, and the surface of the Sun or **photosphere** is about 10,000 degrees Fahrenheit. Radiation

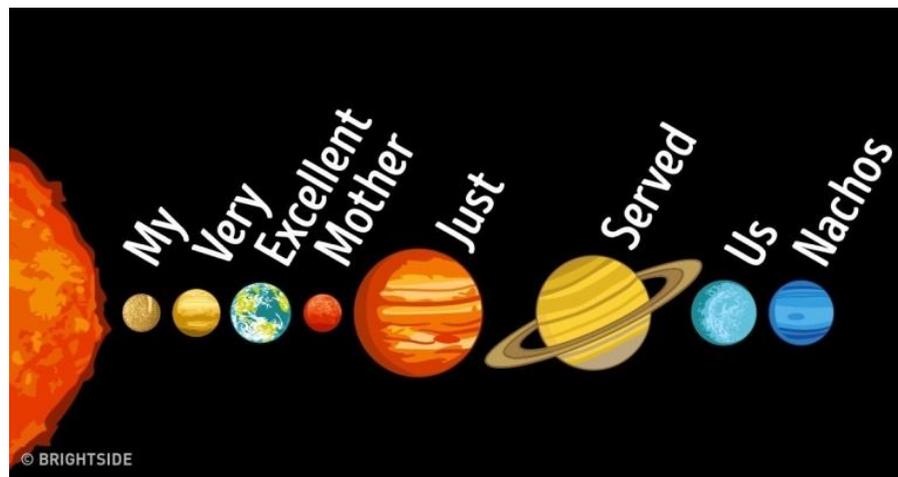


escaping the photosphere is the sunlight we see on Earth. Earth is 92.92 million miles or 1 **astronomical unit** from the Sun, and the radiation from the sun can reach the Earth in about 8 minutes! This radiation provides warmth and energy for life on Earth to be possible.

The National Aeronautics and Space Administration (NASA) launched the **Parker Solar Probe** on August 12, 2018. The Parker Solar Probe will travel into space to the Sun's corona facing brutal heat and radiation to get the closest ever observations of our star. It will take nearly 7 years for the Parker Solar Probe to travel the 93 million miles from Earth. The goal of this mission is to gain a better understanding on how energy and heat move through the corona and to explore what accelerates the **solar wind**. Solar wind is the stream of energized particles flowing outward from the Sun. To stay up-to-date with the latest mission news, check out this link to the NASA Parker Solar Probe web page: <https://www.nasa.gov/content/goddard/parker-solar-probe>

The Planets

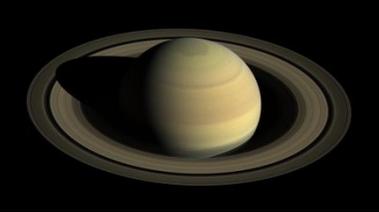
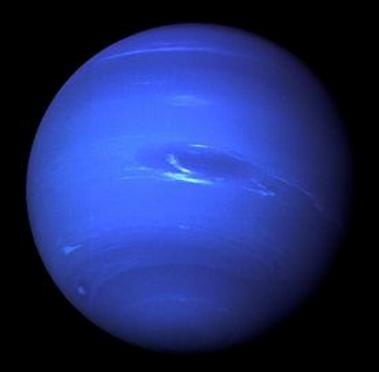
There are 8 primary planets in our solar system: **M**ercury, **V**enus, **E**arth, **M**ars, **J**upiter, **S**aturn, **U**ranus, and **N**eptune. Here is a mnemonic device to help you remember the order of the planets from closest to farthest away from the Sun: **My Very Excellent Mother Just Served Us Nachos** (see picture).



Planets have 3 requirements to be considered a planet – they are listed below:

1. It must orbit a star (the Sun).
2. It must be large enough and have enough gravity to form it into a spherical shape.
3. It must be large enough and have enough gravity to clear away any other objects of a similar size near its orbit around the star (the Sun).

Planet	Description	Picture
<p>Mercury</p>	<ul style="list-style-type: none"> • Length of a year: 88 Earth days • Closest planet to the Sun • Smallest planet – it is slightly larger than the Earth’s moon • Solid, cratered surface 	
<p>Venus</p>	<ul style="list-style-type: none"> • Length of a year: 225 Earth days • Spins slowly in the opposite direction of most planets • Similar size to Earth • Hottest planet – about 900 degrees Fahrenheit • Solid surface with volcanic mountains and plateaus 	
<p>Earth</p>	<ul style="list-style-type: none"> • Length of a year: 365 Earth days • 1 moon • Atmosphere protects us from elements of space and creates breathable conditions • Surface mostly covered in water • Solid surface with mountains, canyons, plains, and more 	
<p>Mars</p>	<ul style="list-style-type: none"> • Length of a year: 687 Earth days • Smaller size than Earth • 2 moons • Known as the Red planet because the iron minerals in the soil rust causing the soil and atmosphere to look red • Solid surface with rocky terrain 	

<p>Jupiter</p>	<ul style="list-style-type: none"> • Length of a year: 4,333 Earth days • Largest planet – 11 Earths could fit across its equator • 79 moons • Faint ring system made of ice and rock • Gas Giant– it is unknown if it has a solid inner core 	
<p>Saturn</p>	<ul style="list-style-type: none"> • Length of a year: 10,759 Earth days • Second largest planet • 53 known moons; 9 awaiting confirmation • 7 ring system made of ice and rock • Gas Giant– it is unknown if it has a solid inner core 	
<p>Uranus</p>	<ul style="list-style-type: none"> • Length of a year: 30,687 Earth days • Rotates on its side • 27 moons • 13 faint ring system made of ice and rock • Ice Giant – hot, dense fluid of “icy” materials with a rocky core 	
<p>Neptune</p>	<ul style="list-style-type: none"> • Length of a year: 60,190 Earth days • 13 moons; 1 awaiting confirmation • 6 faint ring system made of ice and rock • Windiest planet – wind speeds can be up to 1,200 miles per hour • Ice Giant – hot, dense fluid of “icy” materials with a rocky core 	

Don't worry – we have not forgotten Pluto. Pluto is not a primary planet; it is a **dwarf planet**. Dwarf planets are spherical and orbit around the sun, but they are much smaller than primary planets and cannot clear their orbital path. The first 5 recognized dwarf planets are Ceres, Pluto, Eris, Makemake, and Haumea.

The Moons

Moons are natural satellites that orbit planets and asteroids. They are generally solid bodies that can come in many shapes and sizes, and most do not have atmospheres. There are hundreds of moons in our solar system, and are typically named after mythological characters from different cultures. However, Uranus' moons are named from the works of William Shakespeare.

Comets, Asteroids, & Meteors

Comets are balls of frozen gases, rocks, and dust that orbit the sun. As the comet's orbit comes close to the sun, it develops an atmosphere, or **coma**, and the pressure from the sunlight and the solar wind can blow the dust and gas away from the coma creating a long, bright tail.

Asteroids are rocky masses without atmospheres that orbit the sun, but are too small to be planets. They are sometimes called **minor planets**. Most are irregularly shaped instead of being spherical. The current known asteroid count is 781,692 and the majority of these can be found in the main asteroid belt between Mars and Jupiter. There are 3 composition classes of asteroids:

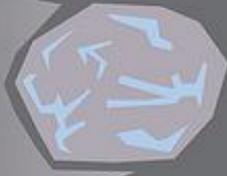
- **C-Type**: chondrite-type; consist of clay and silicate rocks and are dark in appearance; most common type
- **S-Type**: stony-type; consist of silicate materials and nickel-iron
- **M-Type**: metallic-type; consist of nickel and iron

Meteoroids are little chunks of rock and debris in space. As these enter Earth's atmosphere, they are called **meteors** or shooting/falling stars. Meteor showers occur when Earth passes through a trail of debris in space, and there is a dramatic increase in shooting stars witnessed. Meteor showers can occur at regular intervals or at random. The most famous annual meteor shower occurs in August and is called **Perseids**. If the meteor survives the brutal journey through the Earth's atmosphere and falls to the ground, it is called a **meteorite**.

Fun Facts

- A **Lunar Eclipse** occurs when the Earth aligns between the Sun and the Moon blocking the sunlight to the moon, and Earth casts a shadow on the moon.
- A **Solar Eclipse** occurs when the moon aligns between the Sun and Earth blocking the sunlight to Earth, and the moon casts a shadow on Earth.
- Spacecraft has visited every planet
- On October 8, there will be the Draconid Meteor Shower; the best time to view the shooting stars for this shower is right before nightfall.
- Hunting for meteorites is a fun activity. To check if a rock is a meteorite, test it with a magnet! Most all meteorites have magnetic properties.





Comet

A chunk of ice and rock originating from the outer solar system, often accompanied by a coma and tail.



Asteroid

A rock in orbit generally between Mars and Jupiter. Sometimes Asteroids get bounced towards Earth.



Meteoroid

A space rock that's bigger than a dust grain but smaller than an asteroid. If it strikes Earth it is then a Meteorite



Meteor

The streak of light seen when a space rock enters the atmosphere and starts burning up. A.K.A. "falling star."



Meteorite

If a meteor doesn't entirely burn up, a piece of space rock that lands on Earth is called a meteorite.

NAME THAT SPACE ROCK!

Sources:

The New York Times:
Was that Fireball a Meteor or a Meteorite?
Wikipedia pages for Asteroid and Comet

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