# **Earth in Space Discussion Guide (for use during or after reading)**

1. Earth’s features are divided into four spheres, the lithosphere, hydrosphere, biosphere, and atmosphere. Describe each sphere’s characteristics. (Earth’s Spheres, p. 6-11)
   1. The lithosphere includes all rock and land below Earth’s surface. The lithosphere refers to Earth’s crust (tectonic plates), mantle (molten rock), outer core (liquid iron and nickel), and inner core (solid iron and nickel).
   2. The hydrosphere includes all water on and beneath Earth’s surface, as well as any water in the atmosphere. The hydrosphere is about 3% fresh water, and the rest is salt water.
   3. The biosphere includes all living things, such as microorganisms, animals, plants, and humans. The biosphere also includes biomes, collections of living things in an area with a specific climate and specific geographical features.
   4. The atmosphere includes all the air that surrounds Earth. The atmosphere is comprised of about 78% nitrogen, 21% oxygen, and about 1% argon and trace amounts of other gasses. Space begins at the end of the atmosphere, about 62 miles above Earth’s surface.
2. Describe Earth’s place in space, including its relation to the solar system, galaxy, and universe. (Earth’s Place in Space, p. 12-13)
   1. Earth is one of eight planets in our solar system. The others are Neptune, Uranus, Saturn, Jupiter, Mars, Venus, and Mercury. Our solar system also includes one star, the sun, at its center. In our solar system, the planets travel around the sun in an elliptical path called an orbit. Earth is the third planet from the sun. Our solar system is part of a larger galaxy, which is just a tiny part of the universe that includes all matter that exists anywhere in space or time.
3. What path does Earth take when orbiting the sun? Include aphelion and perihelion in your answer. (Earth’s Orbit, p. 14-15)
   1. Earth and all the other planets in our solar system orbit in an elliptical path around the sun. An ellipse is like an oval, or a stretched-out circle. Not all points on this orbit path are the same distance from the sun, so Earth does not orbit the sun in a perfect circle. Aphelion occurs when the Earth is farthest from the sun during its orbit. This takes place in early July. Perihelion occurs when the Earth is closest to the sun during its orbit. This takes place in early January. Earth makes a complete orbit of the sun once every 365 days, 6 hours, 9 minutes, and 9.54 seconds. This is why we measure a year as 365 days, with a leap year and an “extra” day every four years to account for those extra hours, minutes, and seconds.
4. Earth rotates on its axis once every 24 hours. What effects does this cause on Earth? (Earth’s Rotation, p. 16-17)
   1. Earth’s axis is an imaginary line from the North to the South pole. Earth spins on this axis and makes a complete rotation once every 24 hours. We consider this to be one full day During the day, particular places on Erath are rotated to face the sun, and at night, these places are rotated away from it. As the 24 hour period continues, other places on Earth are rotated to receive direct sunlight. Earth’s rotation also affects the air in the atmosphere causing it to curve in different directions depending on its hemisphere. This is known as the Coriolis effect and impacts wind patterns, weather, and ocean currents.
5. Earth is also tilted on its axis. How does this tilt affect the amount of sunlight at different latitudes on the planet? (Earth’s Tilt and Latitude, p. 18-19)
   1. Earth is tilted about 23.5 degrees on its axis. This allows for one hemisphere to angle toward the sun while the other angles away from it. This creates the seasons we experience on Earth as some areas get more sunlight, whereas others get less.
6. Describe how Earth’s orbit, rotation, and tilt create the typical four seasons experienced by many. (Seasons, p. 20-25)
   1. Due to Earth’s tilt, the Northern and Southern hemispheres face the sun differently throughout the year. This creates seasons because it affects how much sunlight reaches Earth’s surface. In the summertime, the hemisphere that is tilted towards the sun is at a relatively direct angle. In the wintertime, the hemisphere that is tilted away from the sun causes it to be darker and colder. As the Earth rotates and orbits the sun, the amount of direct sunlight an area receives changes, causing the change in seasons we experience.
7. What are seasons typically like in areas found near the equator? Why is this? (Seasons, p. 20-25)
   1. Instead of experiencing summer, fall, winter, and spring, areas near the equator experience a dry season and a rainy season. Their latitude and proximity to the sun affects their climate. Areas near the equator receive about 12 hours of sunlight each day year-round.
8. Describe Earth’s moon, including its topography and information about the dark side of the moon. (Earth’s Moon, p. 26-29)
   1. Earth’s moon is located relatively close to Earth and is made of rock. Its topography includes hills, valleys, and mountain ranges like Earth, but the moon does not have liquid water or an atmosphere to protect it from meteors and other space debris.
   2. The dark side of the moon refers to the side that is not visible to humans from Earth. Because the moon rotates at the same speed as the Earth, we always see the same side of the moon. This led people to refer to the far side of the moon as its dark side. After exploration, scientists know this side of the moon includes the same types of features as the side that faces us.

1. In what ways does the moon affect Earth? (Earth’s Moon, p. 26-29)
   1. The moon affects Earth in two major ways. First, it reflects sunlight back to Earth in the form of moonlight, allowing us natural light at night. Second, the moon’s gravity plays an important role. It not only controls the tides in Earth’s oceans but also holds Earth at its current tilt, keeping our seasons as they are.
2. How have space travel and the study of space changed over time? How do satellites help scientists study Earth? (Humans in Space, p. 32-35)
   1. Humans’ understanding of space has changed drastically over time. People used to believe Earth was the center of the universe rather than the sun! Humans developed such technology as telescopes to help them study space. In the 1960’s, astronauts traveled into space for the first time. Since then, humans have set foot on the moon, sent probes to study space, and have used rovers on Mars!
   2. Humans use satellites to monitor and track Earth’s geography. For example, satellites contain sensors that can determine the levels of carbon dioxide in the atmosphere, the temperatures of different locations, and information related to weather conditions and events. Large satellites, like the International Space Station, are big enough for astronauts to live and work!