

5th Grade Earth Science Unit

Astronomy: The Earth and the Sky

Teacher Background Information – for teacher content knowledge only, NOT student learning goals

Students should begin to develop an inventory of the variety of things in the universe. Planets can be shown to be different from stars in two essential ways – their appearance and their motion.

Gravity is the universal attraction between any two objects with mass. The two factors that affect the magnitude of the force of gravity are the mass of the attracted objects and the distance between them. The greater the mass, the greater the gravitational force. The greater the distance, the less the gravitational force. Whether you are on the moon, earth, or deep in outer space, gravity is present. Air or an atmosphere is not needed for gravity.

Earth's tilt changes the angle of the sunlight hitting earth. Seasons are primarily caused by the 23.5° of earth's axis as it revolves around the sun in a slightly elliptical orbit. As the earth revolves around the sun the tilted axis always points in the same direction.

Instructional Implications

* Students grasp of many of the ideas of the composition and magnitude of the universe has to grow slowly over time.

* To understand the day/night cycle, the phases of the moon and the seasons, students should first master the idea of a spherical earth.

* Students must understand the concept of light reflection and how the moon gets its light from the sun before they can understand the phases of the moon.

* No particular educational value comes from memorizing the names of the celestial bodies nor should students invest much time in trying to get the scale of distances firmly in mind.

* Research supports teaching the concepts of spherical earth, space, and gravity in close connection.

Big Idea

The movement of the earth and the moon and their relationship to the sun are observable, predictable and help us understand the universe.

Essential Question

What is the relationship between the earth and celestial objects in the sky?

AAAS Benchmarks/National and Science Education Standards

Universe: Gravity

- Like all planets and stars, the earth is approximately spherical in shape. 4B/E2
- The rotation of the earth on its axis every 24 hours produces the night-and-day cycle. To people on earth, this turning of the planet makes it seem as though the sun, moon, planets, and stars are orbiting the earth once a day. 4B/E2
- People cannot determine how the solar system is put together just by looking at it. (BSL, p. 67)
- The earth is one of several planets that orbit the sun, and the moon orbits around the earth. 4A/E4

Universe: Solar System

- Telescopes magnify the appearance of some distant objects in the sky, including the moon and the planets. The number of stars that can be seen through telescopes is dramatically greater than can be seen by the unaided eye. 4A/E2*
- Planets change their positions against the background of stars. 4A/E3

Universe: Stars

- A large light source at a distance looks like a small light source that is much closer. (BSL p. 63)
- Stars are like the sun, some being smaller and some larger, but so far away that they look like points of light. 4A/E5

Motion

- The greater the force is, the greater the change in motion will be. The more massive an object is, the less effect a given force will have. 4F/E1bc
- Light travels and tends to maintain its direction of motion until it interacts with an object or material. Light can be absorbed, redirected, bounced back, or allowed to pass through. 4F/E3 (ASL)
- How fast things move differs greatly. 4F/E2*
- One way to make sense of something is to think how it is like something more familiar. 9E/E1

Forces of Nature

- The earth's gravity pulls any object on or near the earth toward it without touching it. 4G/E1*

Local Connections

Moon stories from Tlingit culture

Materials/Resources

Seeds & Roots: Planets & Moons

Gems Kit: Space Science

“Power of Ten” documentary

Marie Drake Planetarium

Alaska State Museum’s Globe

Assessment

- * Probes, Vol 1: Talking About Gravity, Gazing at the Moon, Going Through a Phase
- * Probes, Vol 2: Darkness at Night
- * Probes, Vol 3: Summer Talk, Me and My Shadow

Related Scientist or Career Path

Galileo- Starry Messenger by Peter Sis
Erastosthenes- The Librarian Who Measured the Earth by Kathryn Lasky

Alaska GLE’s

Earth Science Content Standard

The student demonstrates an understanding of the theories regarding the origin and evolution of the universe by

[5] SD4.1 distinguishing among stars, planets, moons, comets, and meteors (L)

[5] SD4.2 recognizing that the Earth is in regular and predictable motion and this motion explains the length of a day and a year

[5] SD4.3 recognizing and using appropriate instruments of magnification (e.g., binoculars and telescopes) (L)

The student demonstrates an understanding of cycles influenced by energy from the sun and by Earth’s position and motion in our solar system by

[4] SD3.1 recognizing changes to length of daylight over time and its relationship to seasons

[5] SD3.1 observing a model that shows how the regular and predictable motion of the Earth and moon determine the apparent shape (phases) of the moon over time (L)

Cultural Perspectives

The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives by

[5] SF1.1-SF3.1 telling a local or traditional story that explains a natural event and relating it to a scientific explanation

History and Nature of Science

The student demonstrates an understanding of the That advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base by

[5] SG4.1 investigating that scientists’ curiosity led to advancements in science (L)

Student Misconceptions

* In spite of its common depiction, the sun-centered system seriously conflicts with common intuition. Student may need compelling reasons to really abandon their earth-centered views.

* Students don’t understand gravity as a force, but rather think that air is pushing down.