Earth in Space Pacing Guide (63 instructional days)

Lesson	Recommended Number of Periods	Focus Questions	Concepts
Lesson 1: Thinking About Earth As A Planet	3	• 1.1: Examining Our Ideas About Space – What are our ideas about Earth in the Solar System and about space?	• Earth is a planet in our solar system. • People's ideas about Earth have evolved through history. • Phenomena such as day and night, seasons, tides, and gravity can be explained within the context of Earth as a planet. • Student preconceptions about astronomy can be assessed through discussion.
Lesson 2: Introducing the Sun-Earth-Moon System	3	• 2.1: Demonstrating What We Know About the Sun-Earth-Moon System – What models can we build to demonstrate relationships between the sun, earth and moon? What are the strengths and limitations of these models? • 2.2: Scaling the Sun-Earth-Moon System – How do the diameters and distances between the sun, earth and moon compare?	• The sun, a star, is the largest body in the solar system. • The moon and earth rotate on their axes. • The moon orbits (revolves around) the earth while Earth orbits (revolves around) the sun. • Scale models demonstrate relationships in size and in distance and motion between the sun, earth, and moon.
Lesson 3: Tracking Shadows	5	• 3.1: Analyzing Shadows – How do shadows change throughout one day? • 3.2: Collecting Computerized Shadow Data – How do shadows change throughout the year? • 3.3: Modeling Winter and Summer Shadows – What causes shadows to be different in winter and summer? • 3.4: Analyzing the Effects of Earth's Rotation – How does the rotation of the Earth affect shadow lengths and positions?	• Shadows reveal relationships between time of day and the apparent position of the Sun in the sky. • Shadow length and position change according to the time of day and year. • The apparent path of the Sun is highest in the sky during summer, lowest during winter, and highest each day at solar noon. • The ecliptic is the apparent path of the Sun across the sky. • Due to Earth's counterclockwise rotation on its axis (from a perspective above the North Pole), the Sun appears to move in a clockwise southerly arc across the sky from east to west (in the Northern Hemisphere.)
Lesson 4: Seasons on Earth	6	• Overall: What causes the seasons? What evidence do we have that the Earth is tilted on its axis? • 4.1: How does the position of the Earth change during winter, spring, summer, and fall? • 4.2: Why do stars appear to rotate around the North Star, Polaris? • 4.3: Why do the sunrise and sunset times change more at some latitudes than at others throughout the year?	• Seasons are the result of Earth being tilted on its axis as it orbits the Sun. • Earth's northern axis is currently fixed on Polaris, the North Star. • Shadows change according to the time of day and time of year. • The length of daylight and apparent path of the Sun for each season vary at different latitudes. • When it is summer in the northern hemisphere it is winter in the southern hemisphere, and vice versa

Lesson 5: Investigating Lunar Phases	**6**	• Overall: What causes the Moon's different phases? • 5.1: When viewed from space, how much of the Moon is illuminated by the Sun as it orbits Earth? • 5.2: When viewed from Earth, how much of the Moon's illuminated side is visible as it orbits Earth?	• The Moon is a sphere and reflects the Sun's light. Therefore, only the half of the Moon facing the Sun is illuminated at one time. • The Moon goes through a predictable cycle of changes in its appearance, called phases. • The Moon's phases occur because we see only portions of the Moon's illuminated side, depending on the Moon's position relative to Earth. • The pattern of lunar phases is predictable. • From any place on Earth where the Moon is visible, the phase of the Moon is the same on any given day.
Lesson 6: Analyzing Solar and Lunar Eclipses	**5**	• What are the conditions that cause solar and lunar eclipses to occur? How are eclipses different from phases of the moon?" • 6.1: Under what conditions do partial and total eclipses occur? • 6.2: Why don't solar and lunar eclipses occur every month?	• An eclipse occurs when the Sun, Earth, and Moon align and the Moon crosses the plane of the Earth's orbit. • A solar eclipse can occur only during a new moon when the Moon is between the Sun and the Earth and casts a shadow on part of Earth. • A lunar eclipse can occur only during a full moon when Earth is between the Sun and the Moon and casts a shadow on part of the Moon.
Lesson 7: The Sun as an Energy Source	**4**	• Overall: What factors affect the amount of energy received at a specific location from an energy source? How does a radiometer and clamp lamp model processes occurring in our Solar System? • 7.1: How does distance from an energy source affect the amount of energy received? • 7.2: Which different variables affect the amount of energy received?	• Solar radiation is energy from the Sun. It is a major source of energy on Earth. We see the visible portion of energy which we call light energy. • The farther away an energy source, the greater its energy output must be to produce the same effect as a closer source. • Earth and its atmosphere absorb and reflect the Sun's radiant energy; the absorbed energy heats the planet and its atmosphere.
Lesson 8:		NOTE: Skip Lesson 8: Sunspots and Space Weather – the content is not part of Washington State Science Standards.	
Lesson 9: Sun-Earth-Moon System Assessment	**3**	• What do we know now about the Sun-Earth-Moon system?	• This lesson includes a performance-based assessment where students design an experiment and a written, summative assessment.
Lesson 10: Anchor Activity: Space Exploration	**3**	• How has our space program contributed to our understanding of the solar system?	• Science and technology have advanced through the contributions of many different people at different times in history. • Tracing the history of the space program shows how scientific discoveries can lead to technological innovations. It can be difficult to break through the scientific ideas of the time to reach new conclusions. • The space program has provided information about the variations in the features and properties of the bodies in our solar system.

Lesson 11: The Solar System: Designing a Scale Model	**5**	• How can a scale model of the solar system help us understand the vastness of the solar system? • 11.1: What does a model of the solar system look like? • 11.2: What is a scale factor? How does a scale model of the solar system compare to our first model? • 11.3: What does a scale model of the solar system look like?	• The solar system – mostly empty space – includes the Sun, Moon, Earth, eight other planets and their moons, and smaller objects such as asteroids and comets. • A model is a representation – often mathematical – that helps demonstrate how complex processes, systems, and devices look and act. • Scale is a ratio between two sets of measurements. When the scale factor is known, scale measurements can be calculated from true measurements, and vice versa. • Most models of the solar system (in texts, museums, etc.) do not accurately represent the distances between the planets.
Lesson 12:		**NOTE:** Skip Lesson 12 as it does not match Washington State content standards in science.	
Lesson 13:	**1**	In Lesson 13, review the concept of erosion (developed in the 5th grade unit Land and Water). Do not do the lab. Materials for this are not included in the module.	
Lesson 14: Surface Gravity	**3**	• 14.1: What does the weight of an object on a planet's surface tell us about the planet? • 14.2: What is the difference between mass and weight?	• Gravitation refers to a force that attracts objects to each other. • Surface gravity holds us to Earth's surface and depends on the mass and radius of the planet. • Mass is the amount of matter in an object. • Weight is the measure of the force of gravity on a body.
Lesson 15:		**NOTE:** Materials from Lesson 15, Gravity and Orbital Motion, have been removed because the state middle school GLE's don't cover this topic.	
Lesson 16: Gravity and Tides	**3**	• How does gravity affect the periodic rise and fall of Earth's oceans? • 16.1: What patterns exist in tidal data? How is the position of the Moon and Earth in the Sun-Earth-Moon system related to tides?	• Tides are the periodic rise and fall of the sea level and other bodies of water. • The gravitational attraction between the Moon and Earth (and the Sun and Earth) contributes to the formation of tides. • Normally two high and two low tides occur each day. • The time at which high and low tides occur changes by about 50 minutes each day due to the Moon's orbit around Earth.

Lesson 17: Asteroids, Comets, and Meteoroids	**4**	• What objects other than planets, moons, and our Sun exist in the solar system? How do they compare? • How has our understanding of these objects helped us to learn about Earth's history as a planet?	• The solar system includes smaller objects, such as asteroids and comets. • Asteroids are rocky and metallic objects that orbit the Sun but are too small to be considered planets; the majority of asteroids move between Jupiter and Mars in an area known as the "asteroid belt." • Comets are relatively small solar system bodies made of ice, rock, and dust; each is in an independent elliptical orbit around the Sun, often outside of the solar system. • Meteoroids are space matter too small to be called asteroids or comets; meteors are streaks of light produced when meteoroids are illuminated as they fall into Earth's atmosphere. • Earth experiences occasional catastrophes, such as asteroid impact, which can change or destroy human and wildlife habitats, damage property, and harm or kill living organisms.
Lesson 18:		**NOTE:** Skip Lesson 18. Fossils are a part of the Evolution lessons of Ecology & Evolution.	
Lesson 19: Comparing Planets: Is Earth Unique?	**5**	• Is Earth unique? How does Earth compare to other planets? • What has the space program told us about the planets in our solar system? • How does learning about the Sun-Earth-Moon system and the Solar System affect us in our lives?	• There are many similarities and differences among Earth and the other planets. • Life on other planets would most likely be different than life on Earth because environments and conditions on other planets are different from those on Earth. • The different climates on Earth support different animals, plants, and microorganisms; climate changes also can cause extinction of a species. • Living organisms play many roles in the systems on Earth.
Lessons 20 and 21:		**NOTE:** Skip Lessons 20 and 21. They can be assigned as homework if students are given resources to find information and complete the projects.	
Lesson 22: Solar System Assessment	**4**	• What concepts and skills have students learned about the solar system?	• This lesson includes a performance-based assessment where students design an experiment and a written, summative assessment.