Classroom Teacher Preparation

Earth Science 7: Celestial Mechanics – Moon Phases & Eclipses

Please use the following to prepare for the next SfS lesson.

Description:

Celestial mechanics refers to the movement of celestial objects (objects found in space). In this lesson, students learn how the geometry of the Moon's orbit around Earth and the Earth's orbit around the Sun result in the phases of the Moon that we observe. They will determine how the Moon progresses through its eight major phases, and may discuss why most Earthlings have only ever seen one side of the Moon! Older students and longer classes will also be able to explore the causes of solar and lunar eclipses, and their relationships to the phases of the Moon.

Lesson Objectives – SWBAT ("Students Will Be Able To…"):

3rd-8th

- Sketch the expected appearance ("phase") of the Moon at each of 8 positions relative to the Earth and the Sun as observed on a model.
- Explain how the Moon phases progress in sequence
- *If teaching eclipses: Model the celestial mechanics required to create solar and lunar eclipses*

Disciplinary Core Idea (DCI)

ESS1 Earth's Place in the Universe – ESS1.B Earth and the Solar System

- (3rd-5th) The Earth's orbit and rotation, and the orbit of the moon around the Earth cause observable patterns.
- (6th-8th) The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.

Science & Engineering Practice (SEP)

Developing and Using Models

- (3rd-5th) Develop and/or use models to describe and/or predict phenomena.
- (6th-8th) Develop and/or use a model to predict and/or describe phenomena.

Crosscutting Concept (CCC)

Patterns

- (3rd-5th) Patterns of change can be used to make predictions.
- (6th-8th) Patterns can be used to identify cause and effect relationships

Preparation:

This lesson is an introduction to the phases of the moon and celestial mechanics. To help students become familiar with the moon's phases, please distribute the worksheet on page 3 of this document prior to our lesson so that students can observe and record the phase of the moon that they see each night.

Room Set Up for Activities:

The activity is structured in small groups of 3-4 students (8 groups max) and requires either table or floor space. The ability to darken the room will be helpful for the eclipse portion of the lesson.

Safety:

There are no safety concerns with this lesson.

Related Modules:

This lesson may be taught as part of a sequence or group of related modules on **Space**. Other modules in this sequence include:

Earth Science 8: Solar System - This lesson provides an overview of the objects that make up our solar system, with an emphasis on scale. Students will learn about the vastness of space by building their own Solar System model to scale, in order to visualize how it really looks.

Earth Science 11: Stars - Students create and then analyze their own Hertzsprung-Russell Diagram in order to discover patterns amongst stars.

Physics 4: Gravity - This exploration-driven lesson uses an interactive physical model of a gravity well to introduce students to the laws governing the gravitational interactions of objects.

For other module sequences and groups, look here: www.sciencefromscientists.org/sequences

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state: www.sciencefromscientists.org/standards/

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson by reviewing the phases of the Moon with Oreo cookies!

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

- More information about earth's moon: https://solarsystem.nasa.gov/planets/profile.cfm?Object=Moon
- Celestial Mechanics Game: http://www.wonderville.ca/asset/phases-of-the-moon
- Observing the moon, day or night: https://planetarium.madison.k12.wi.us/mooncal/daymoon.htm
- Moon Phases – Crash Course Astronomy (9:45): https://www.youtube.com/watch?v=AQ5vty8f9Xc
- Eclipses - Crash Course Astronomy (10:31): https://www.youtube.com/watch?v=PRgua7xceDA

Prep Worksheet

Earth Science 7: Celestial Mechanics

Tuesday
10/31

8:03pm

Directions: starting with the day of the week you receive this worksheet:

1. Write down the date in the top corner.
2. Write down the time of your observation in the bottom corner.
3. Color in the circle to match the portion of the moon that is dark.

Observations:

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
○	○	○	○	○	○	○
○	○	○	○	○	○	○
○	○	○	○	○	○	○
○	○	○	○	○	○	○
○	○	○	○	○	○	○