Classroom Teacher Preparation

Earth Science 8: Solar System

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

Description:

This lesson provides an overview of the objects that make up our solar system, with an emphasis on modeling the scale of both the sizes of objects and distances between them. Students will challenge their assumptions about the scale of our Solar System by building models in order to begin to visualize how much of space is really just… vast, empty space. They will use two separate models, evaluating the strengths and weaknesses of each.

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

3rd-8th

- Use provided data to build a relative distance model of the solar system
- Identify strengths and weaknesses of two different models used to represent the solar system

Disciplinary Core Idea (DCI)

ESS1 Earth's Place in the Universe

- (6th-8th) *ESS1.A The Universe and its Stars* - The solar system is part of the Milky Way, which is one of many billions of galaxies.
- (6th-8th) *ESS1.B Earth and the Solar System* - 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) Evaluate limitations of a model for a proposed object or tool; Develop and/or use models to describe and/or predict phenomena
- (6th-8th) Identify limitations of models; Develop a model to describe unobservable mechanisms

Crosscutting Concept (CCC)

Scale, Proportion, and Quantity

- (3rd-5th) Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods.
- (6th-8th) Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

Systems and System Models

- (6th-8th) Models are limited in that they only represent certain aspects of the system under study

Preparation:

This lesson is mostly introductory, but does assume students have a basic familiarity with the traditional model of the Solar System: 8 planets, some with moons, orbiting the Sun.

Room Set Up for Activities:

There are two choices for the main activity:

There is *a Small-Classroom version* of the distance model, in which pairs of students work at their desks. Each pair of students will need space (two desks side-by-side will work well) for a 1-meter model made of Lego tape.

For the *Large-Classroom* activity, each group (4-5 students) will require an 8-meter (26 ft) long space for their solar system (10.2 meters is preferable, because Pluto can then be used as an "endpoint" for the Solar System). Considering the space in most classrooms, it would be ideal for students to work in the hallway if possible or another long enclosed space (perhaps a gym, if available).

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:

Engineering 2: Rover Restraint - Students experience a hands-on, team-oriented introduction to engineering within the context of space exploration, with NASA's Mars rovers discussed as examples of the challenges engineers face.

Earth Science 6: Lunar Landing - Students learn and use knowledge about the Moon, working in groups to solve a difficult problem (astronaut crews have suffered an emergency crash landing on the moon) and make complex decisions (choose materials to salvage in order to safely reach the moon base).

Earth Science 11: Stars - Students will be introduced to the different categories and characteristics of stars, including their temperature, brightness, color, and size. Using a diagram that categorizes stars, students will determine the age of a star cluster.

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 with a visit to some of the many excellent interactive educational webpages created by NASA!

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:

- For kids, the Cosmic Distance Scale presented by NASA: https://imagine.gsfc.nasa.gov/features/cosmic/
- A scrollable version of Solar System distances: http://joshworth.com/dev/pixelspace/pixelspace_solarsystem.html

- NASA's New Horizons mission: https://www.nasa.gov/mission_pages/newhorizons/overview/index.html
- NASA's Cassini at Saturn mission: https://www.nasa.gov/mission_pages/cassini/main/index.html
- NASA's Voyager missions: https://voyager.jpl.nasa.gov/
- ALMA's website for kids: http://kids.alma.cl/?lang=en
- Hubble's website: http://hubblesite.org/
- A helpful video for the Pluto questions: "Is Pluto a Planet?": https://www.youtube.com/watch?v=Z_2gbGXzFbs.
- A good example of how we make compromises to create a Solar System image that is correct in some things but not in everything: https://mass.pbslearningmedia.org/resource/ess05.sci.ess.eiu.planetsize/all-planet-sizes/