



Classroom Teacher Preparation

Physics 4: Gravity

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

Description:

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. A qualitative understanding of Newton's Law of Universal Gravitation, the nature of planetary and comet orbits, and the use of gravity in changing spacecraft trajectories are all touched upon. This lesson is geared towards older (6th-8th grade) students.

Lesson Objectives – SWBAT (“Students Will Be Able To...”):

6th-8th

- Define gravity as an attractive force exerted by all objects that have mass
- Recognize that the strength of the gravitational force between two objects depends on the masses of the objects and the distance between them
- Understand that gravity is the force responsible for the orbits of objects in space (e.g., planets and comets within the solar system, stars within the galaxy), as well as being the force responsible for the acceleration of falling objects on Earth

Preparation:

This is an introductory lesson, and the necessary background and vocabulary will be presented.

Disciplinary Core Idea (DCI)

PS2 Motion and Stability: Forces and Interactions – PS2.A Forces and Motion

- (6th-8th) The role of the mass of an object must be qualitatively accounted for in any change of motion due to the application of a force.

Science & Engineering Practice (SEP)

Developing and Using Models

Room Set Up for Activities:

The kit consists of four gravity wells, which are each 40” in diameter and about 30” tall. The gravity wells are free standing and will be placed directly on the floor. Students will be divided into four groups and will need space to stand around the perimeter of each apparatus. Since this may result in larger student groups than we normally use, please consider ahead of time how best to assign students into productive working groups.

Safety:

Students will use marbles to model orbiting objects, and will need to use them with restraint so that they do not fly off of the gravity well apparatus.



Related Modules:

This lesson may be taught as part of a sequence or group of related modules on **Space** or **Physics**, particularly Motion. Other modules in these sequences include:

Physics 5: Pendulums – Students are introduced to pendulums and their periodic motion. They design and execute an experiment to determine whether bob mass, chain length, or displacement angle affects the period of a pendulum.

Physics 6: Ballistics - This module is a qualitative introduction to projectile motion, and includes a more extensive discussion of Newton's laws of motion.

Earth Science 8: Solar System – Introduces students to our solar system, reviewing the major planets as well as some of the smaller objects that are gravitationally bound to our Sun. Students gain an appreciation of the scale of both planetary sizes and interplanetary distances, and therefore the distance scale over which the gravity well of the Sun affects other bodies.

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: <http://www.sciencefromscientists.org/standards/>

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

After Our Visit:

Extend this lesson by experimenting with "weightless water" and learning about microgravity - the force that creates a sense of "weightlessness" for astronauts in the space station.

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:

- An overview of gravity for kids: <http://idahoptv.org/sciencetrek/topics/gravity/facts.cfm>
- Crash Course Kids #4.1: "Defining Gravity" (video, 3:11): <https://www.youtube.com/watch?v=ljRIB6TuMOU>
- Crash Course Kids #4.2: "Down to Earth" (video, 2:59): https://www.youtube.com/watch?v=BIPtF_NqIQI

