



Classroom Teacher Preparation

Physics 4b: Gravity Basics

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

Description:

This lesson focuses on the force of gravity and how it affects objects. Students will experiment with gravity wells and marbles to model the effects of gravity. They will learn that gravity acts in a downward direction keeping us on the surface of the Earth. Students will also learn that gravity attracts objects together and acts at-a-distance. Finally, students will explore how mass and distance affect the strength of gravity on two objects.

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

3rd-5th

- Identify that gravity acts in a downward direction
- Investigate how the gravitational force between two objects is affected by mass and distance

Disciplinary Core Idea (DCI)

PS2 Motion and Stability: Forces and Interactions - PS2.B. Types of Interactions

- (3rd-5th) Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass – e.g., Earth and the sun.

Science & Engineering Practice (SEP)

Developing and Using Models

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

Crosscutting Concept (CCC)

Cause and Effect

- (3rd-5th) Cause and effect relationships are routinely identified, tested, and used to explain change.

Preparation:

It is helpful if the students have some background with forces and how they can affect objects. It is recommended that the term **force** be defined prior to the lesson (*a force is a push or a pull on an object*).

Room Set Up for Activities:

The kit consists of four gravity wells; each 40” in diameter and about 30” tall. The gravity wells are free standing and will be placed directly on the floor. Please clear 4 areas that will allow room for the wells and for students to stand around them.

Students will be divided into small groups of 2-3 with 3 small groups being placed at each well. Since there will be anywhere from 6-9 students around a well, they will need space to stand around the perimeter of each apparatus. 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 **Forces**. Modules include:

Physics 1: Introduction to Magnetism – Students explore with various types of magnets to gain greater understanding of magnetic forces, poles, and attraction/repulsion rules of magnets.

Physics 5: Pendulum Patterns – Students are introduced to pendulums and their periodic motion. After experimenting individually with pendulums of different lengths and bob masses, they systematically measure the period of pendulums with different lengths.

Physics 19b: Friction Basics – This lesson provides students with an introduction to friction as a force that opposes motion. Students experiment with different surfaces and classify them as having low, medium, or high friction.

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 completing an activity on “weightlessness.” Students will demonstrate “weightlessness” as they use water and a plastic cup to replicate how astronauts “float” inside the International 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” (3:11): <https://www.youtube.com/watch?v=ljRIB6TuMOU>
- Crash Course Kids #4.2: “Down to Earth” (2:59): https://www.youtube.com/watch?v=BIPtF_NqIQI
- Fun gravity simulator <https://www.testtubegames.com/gravity.html>