



## Classroom Teacher Preparation

### Physics 4a: Gravity

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

#### Description:

In this lesson, students will use gravity wells to explore how mass and distance affect gravity. They then use their knowledge and the gravity wells to create models of the current solar system and its formation. The lesson wraps up with students considering the benefits and limitations of the gravity well models.

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

6<sup>th</sup>-8<sup>th</sup>

- Investigate how the gravitational force between two objects is affected by mass and distance
- Design models of the solar system in different states using the gravity well

#### Disciplinary Core Idea (DCI)

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

- (6<sup>th</sup>-8<sup>th</sup>) 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

- (6<sup>th</sup>-8<sup>th</sup>) Develop and/or use models to describe and/or predict phenomena.

#### Crosscutting Concept (CCC)

Cause and Effect

- (6<sup>th</sup>-8<sup>th</sup>) Cause and effect relationships may be used to predict phenomena in natural or designed systems.

#### 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*). They should also have understanding on the term **orbit** prior to the lesson (*an orbit is the revolution of an object around another one usually in regards to space*).

#### 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** or **Space**. Modules include:

*Physics 19: Friction* – This lesson provides students with an introduction to the concept of friction and a chance to discover static and kinetic friction. Students explore the differences in frictional forces for different materials through experimentation.

*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 work in pairs to build a Hertzsprung-Russell (H-R) diagram, a powerful tool based on temperature and brightness of stars used by astronomers to study the stars. Students then analyze data from the H-R diagram and learn what the position of a star on H-R diagram can tell us about the star.

For other module sequences and groups, look here: [www.sciencefromscientists.org/sequences](http://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/](http://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](http://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](http://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=IjRIB6TuMOU>
- Crash Course Kids #4.2: “Down to Earth” (2:59): [https://www.youtube.com/watch?v=BIPtF\\_NqIQI](https://www.youtube.com/watch?v=BIPtF_NqIQI)
- Fun gravity simulator <https://www.testtubegames.com/gravity.html>