



## **Classroom Teacher Preparation**

### **Engineering 5: Simple Machines**

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

#### **Description:**

This module introduces the six basic simple machines: the inclined plane, the wedge, the screw, the lever, the wheel and axle, and the pulley. The students are then challenged to design and build a Rube Goldberg device to ring a service bell in a chain reaction using multiple simple machines. After the devices are built, the groups will present their devices and describe the simple machines used in their designs.

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

**3<sup>rd</sup>-8<sup>th</sup>**

- Identify the six types of simple machines
- Design and build a Rube Goldberg device

#### **Disciplinary Core Idea (DCI)**

*ETS1 Engineering Design - ETS1.B: Developing Possible Solutions*

- (3<sup>rd</sup>-5<sup>th</sup>) Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved
- (6<sup>th</sup>-8<sup>th</sup>) A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.

#### **Science & Engineering Practice (SEP)**

*Constructing Explanations and Designing Solutions*

- (3<sup>rd</sup>-5<sup>th</sup>) Apply scientific ideas to solve design problems.
- (6<sup>th</sup>-8<sup>th</sup>) Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process, or system.

#### **Crosscutting Concept (CCC)**

*Cause and Effect: Mechanisms and Explanation*

- (3<sup>rd</sup>-5<sup>th</sup>) Cause and effect relationships are routinely identified, tested, and used to explain change.
- (6<sup>th</sup>-8<sup>th</sup>) Cause and effect relationships may be used to predict phenomena in natural or designed systems.

#### **Preparation:**

This lesson is introductory. Students do not need background knowledge of the subject matter, however if students are already learning about simple machines in class, it will allow more time for building.

#### **Room Set Up for Activities:**

Students will work in groups of 3-5 to build working Rube Goldberg devices. This activity will require some room to move around, and in addition to the building materials supplied by Science from Scientists, groups will be encouraged to make use of supplies in the room, particularly their desks/tables and chairs.



If there are any materials or areas of the room the students should not touch, these should be made clear to your instructors, as well as the students.

### **Safety:**

The instructors may need assistance keeping track of supplies, especially the marbles and toy cars, so that no one slips on a dropped marble.

### **Related Modules:**

This lesson may be taught as part of a sequence or group of related modules on **Engineering**. Modules include:

*Engineering 3 – (Re)-Building a Bridge*: Students design, build, and test prototype bridges that can transport a defined number of people, modeled by weights. During testing, they identify the failure points of their models and use these data to improve their designs, rebuild, and retest.

*Engineering 4 – Engineering Redesign (with Legos!)*: Focuses on the redesign step of the Engineering and Design process. Students must redesign a flawed prototype based on certain constraints (i.e., redesign and rebuild a Lego bookcase in order to easily transport it from classroom to classroom).

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 building a kinetic sculpture using cams. A cam is a rotating or sliding mechanism, i.e., a wheel and axle or lever that converts rotational motion to linear motion or vice versa.*

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:**

- 11 Brilliant Rube Goldberg Machines: <http://coolmaterial.com/roundup/rube-goldberg-machines>
- Rube Goldberg official site: <http://rubegoldberg.com/home>