

## Lesson 9 Simple Machines

Note: See the curriculum developed by the Museum of Science Industrial Engineering unit.

Objectives: Students learn that different simple machines make work easier in different ways.

Students learn that engineers conduct experiments to collect data that will help them to design and improve technologies.

Students will be able to analyze and compare the performance of five kinds of simple machines for moving a standard load. They will be able to decide which kinds of simple machines are best to use for moving a load in different directions: up, down, sideways.

### Literature

Tie-in: Have students read *Aisha: Industrial Engineering and Making Work Easier* from *Engineering is Elementary* (Museum of Science, Boston) prior to doing this lesson.

Materials: For entire class:

- ∞ DVD from Museum of Science Industrial Engineering: Making Work Easier
- ∞ DVD player and monitor
- ∞ 5 stations, one for each of the following simple machines: lever, single pulley, double pulley, inclined plane, wheel and axle

For each group:

- ∞ Handouts: Testing Simple Machines: Group Results, Using a Spring Scale (EiE 3-8), picture of both kinds of pulleys (p. 51 from EiE lesson plan)
- ∞ .5 L water bottle, filled
- ∞ Strong string
- ∞ Spring scale

For each student:

- ∞ Pencil
- ∞ Handouts: Using Simple Machines (EiE 3-7), Observing Simple Machines (EiE 3-6)

Sponge: Review handout Using a Spring Scale

### Initial

Discussion: Show DVD Industrial Engineering: Making Work Easier.

Review book. How did Aisha and Tanya make work easier?

Explain to students that they will be designing their own factory subsystems to make work easier using simple machines. They will be testing simple machines to determine which ones they want to use for their factory subsystems.

Encourage students to predict which simple machines will work best to: lift heavy things, move heavy things sideways, lift light things, move light things sideways.

Demonstrate how to use the spring scale. Movement should be smooth and constant. When measuring force of load without simple machine, be sure to measure the direction the load is being moved.

**Project:** Students work in groups, going from one simple machine station to the next. Students record results of observations on group results page and on page for each station.

After completing all stations, assign groups to observe a simple machine and to fill out the worksheet Observing Simple Machines. Students will present their machines to the class.

**Vocabulary:** Newton – unit of force in metric system  
Force – the capacity to do work or cause physical change  
Load – a weight or mass that is supported

**Final**

**Discussion:** Discuss data recorded at each station. If there are any outliers, discuss why these might have happened and what they may represent.

Have students present as a group the simple machine they observed. Talk about that machine with the class. Ask:

- ∞ What happened when you used the simple machine?
- ∞ Did the amount of force you exerted to lift the load change? Why or why not?
- ∞ Did the direction of force you exerted to lift the load change? Why or why not?

Complete the worksheet Using Simple Machines as a class.

**Credits:** Based on Museum of Science (Boston) curriculum Simple Machines: Industrial Engineering (see <http://www.mos.org/eie/>).