# 48. Bicycles and Mechanical Advantage

**Classroom Activity:** Use a bicycle to explain how gears work.

**Grade(s):** 4 and 8

**Strand (s):** Understanding Structures and Mechanism (Grades 4 and 8)

This task addresses the following grade 4 overall expectations:

- investigate ways in which pulleys and gears modify the speed and direction of, and the force exerted on, moving objects;
- demonstrate an understanding of the basic principles and functions of pulley systems and gear systems.

and the following grade 4 specific expectations:

- follow established safety procedures for working with machinery;
- use scientific inquiry/ experimentation skills to investigate changes in force, distance, speed, and direction in pulley and gear systems;
- use technological problem-solving skills to design, build, and test a pulley or gear system that performs a specific task;
- use appropriate science and technology vocabulary, including pulley, gear, force, and speed, in oral and written communication;
- use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes;
- describe the purposes of pulley systems and gear systems;
- explain how the gear system on a bicycle works;
- identify the input components that drive a mechanism and the output components that are driven by it.

This task addresses the following grade 8 overall expectations:

- investigate a working system and the ways in which components of the system contribute to its desired function;

- demonstrate an understanding of different types of systems and the factors that contribute to their safe and efficient operation.

and the following grade 8 specific expectations:

- use scientific inquiry/experimentation skills to investigate mechanical advantage in a variety of mechanisms and simple machines;
- use technological problem-solving skills to investigate a system that performs a function or meets a need;
- use appropriate science and technology vocabulary, including mechanical advantage, input, output, friction, gravity, forces, and efficiency, in oral and written communication;
- use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes;
- calculate the mechanical advantage (MA = force needed without a simple machine divided by

force needed with a simple machine) of various mechanical systems.

## Assessment Categories:

- Knowledge and Understanding
- Thinking and Investigation
- Application

**Type of Activity:** Classroom and Science Lab

**Preparation:** gather materials

**Materials and Resources for Teachers:** a bicycle

Time needed to complete this activity: 35 minutes

## Materials/Resources for students:

Lego Dacta kits

## Activity Description:

Place a bicycle with gears upside down on a desk.

Count the number of teeth on the sprockets and use these figures to explain gear ratios.

Discuss how the gears on the bicycle are used to when going uphill and downhill.

Pedal the bicycle, and count and compare the rotations of the pedal to the rotations of the back wheel of the bike.

After the demonstration, divide students into teams and have them use the Lego Dacta kits to build similar gear ratios.

Encourage them to use these structures to further explore the concept of gear ratios on their own. Students can be asked to build the highest and lowest gear ratios using 4 gears in combination.