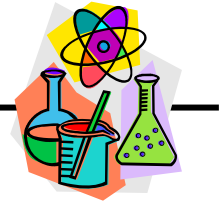


Grade 8 Unit D: Mechanical Systems



Mechanical Systems and Subsystems

Simple machines can be combined to form mechanical systems.



Gears

Gears are toothed or pegged wheels fitted together to transmit (pass along) motion and force. For example:

- gears turn the hands of a clock
- pedals turn the chain on a bicycle, which then turns the back wheel.



Rack and pinion

In a rack and pinion, a single gear (the pinion) fits into a sliding toothed rack (longer, screw-like piece). The gear makes the pinion turn. For example:

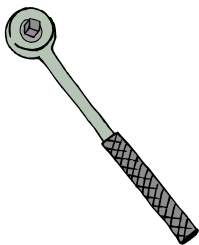
- a steering wheel turns the wheels of a car.



Crank and rod

A crank is a wheel with an arm attached. The arm is attached by a hinge to a rod. When the crank turns, the rod is pushed back and forth. For example:

- a crank and rod move a steam engine.



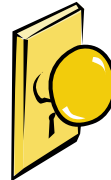
Ratchet

A ratchet is a device that allows a wheel to turn in only one direction. The ratchet wheel has specially shaped teeth that lock to move something in one direction. For example:

- a ratchet is used to remove bolts.

1. Identify simple machines that are found in a variety of places, such as:

- kitchens
- schools
- garages
- boats
- playgrounds
- amusement parks
- workplaces.

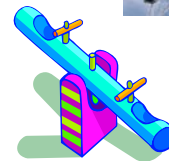


Draw a diagram or create a model of a simple machine, and present it to the class. Explain how the machine was designed to perform a specific function or task.

Check out [Processing and Displaying Data](#) for help on drawing scientific diagrams.

2. Identify mechanical systems used in a variety of places, such as:

- gardens/farms
- offices/schools
- garages/workshops
- boats/marinas
- playgrounds/amusement parks.

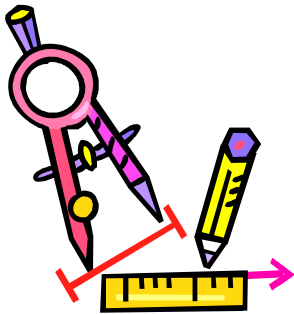


Draw a diagram or create a model of one mechanical system and label any subsystems (simple machines) that are part of the larger machine.

Check out [Processing and Displaying Data](#) for help on drawing a scientific diagram.

3. As a class, brainstorm new machines that could be created using simple machines, or combine simple machines into mechanical systems. Explain how each new machine could make a task easier.

4. Individually or in small groups, design and build a new machine.
See [Solving Technological Problems](#) for a process you can use.

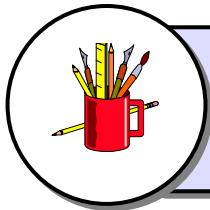


While designing your machine, think about the work you need the machine to do.

Consider questions like these.

- What load will your machine work against?
- Will your machine lift or push the load?
- What forces are involved in the task?
- How will your machine work?

Demonstrate your machine to the rest of the class and explain how it works.



Use Tool [Analyzing a Constructed Device or System](#).

Machines give force and/or speed advantages.

Force advantage: The effort machines provide to help complete tasks.

Example:

- The effort needed to lift a heavy object with your bare hands is greater than the effort needed to lift the object with a pulley.

Speed advantage: The increased speed machines provide to help move loads.

Example:

- Elevators and escalators move people from floor to floor faster than stairs.

5. Examine a bicycle and discuss how changing gears results in force and speed advantages.



6. Choose one of each type of simple machine. Demonstrate and explain how the machine helps complete a task. Respond to questions like these.
- Would you be able to complete the task with your bare hands?
 - If so, how hard would it be?

Review [Processing and Displaying Data](#) for hints on creating a scientific diagram.