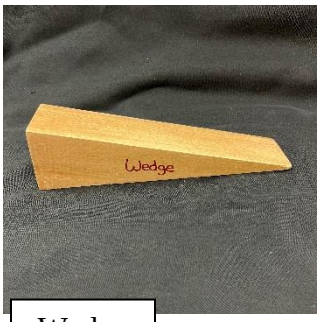
WOW! on Wheels – Educational Activities

SIMPLE MACHINES ACTIVITIES

WOW! MATERIALS: There are materials included to use/show as a demonstration.

Inclined Plane

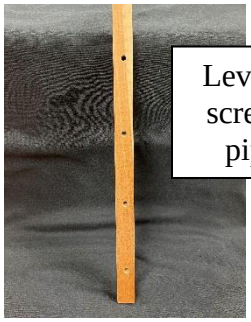
Screw



Wedge

Wheel and Axle

Pulley – platform, hooks, screws and PVC pipe included



Lever - platform, screws and PVC pipe included

You will find samples of all six types of simple machines.

- The wheel and axle, inclined plane, wedge, and screw require no assembly.
- To assemble the pulley, Place PVC pipe A into the base of the wooden platform; then connect PVC pipe C to PVC pipe A. Attach an S-Hook to the eyelet screw, then attach a pulley to the S-Hook.
- To assemble the lever, place PVC pipe B into the wooden base. Use a screw and nut to attach the lever.

WOW! MATERIALS: There are 5 student sets of materials.
Each set includes:

- 1 base
- 1 "first post" (longer)
- 1 "second post" (shorter)
- 3 pressure nuts
- 1 metal rod
- 1 balance arm
- 5 large weights
- 1 wheel and axle
- 2 pulley wheels
- 2 lengths of string
- 3 gears of varying size
- 1 ruler
- 1 small weight
- 5 fasteners
- 2 hangers (for pulleys)

You will also find 1 copy of the Teacher's Manual, and 1 copy of the Student Workbook. Please make as many copies as you need, and return the originals for the next class.

EXPLORATION STATIONS: Set up stations around the room, with real life examples for the students to test. Give the students an opportunity to travel to each station and look at or try each example.

You could prepare an Exploration Sheet, where they can record which simple machine they think it is.

Examples of Inclined Planes: slides, ramps, dump truck, roller coaster, staircase, wheel chair ramp, skateboard ramp
Examples of Levers: seesaw, pliers, crowbars, tweezers, wheelbarrow, scissors, pliers, rakes, staplers, tongs, nail clippers, hammer
Examples of Pulleys: cranes, flag poles, window blinds, wells, window shades, garage doors
Examples of Screws: spiral staircase, swivel chairs, jar lids, screws, light bulb, drill bit
Examples of Wedges: knives, chisels, axes, nail, forks, cheese grater, vegetable peeler, scissors
Examples of Wheels and Axles: doorknob, fishing reel, spinning wheel, cars, fans, office chairs, bicycle

Pencil Sharpener – made of two simple machines: the wheel and axle and the wedge
Clocks – A clock is also an example of a wheel and axle. Some clocks consist of levers, pulleys, and wedges, making them complex machines.

OTHER ACTIVITY IDEAS:

Lever Demonstration

Construct a lever by taping a marker parallel to the edge of the table. Tear off a piece of masking tape, loop it, and attach it to the end of the ruler. Place the ruler on the marker at the center point, like a seesaw, and then press a tennis ball firmly to the tape. Invite a student volunteer to demonstrate the lever; first, have the student gently lift the ball by applying force to the end of the lever (ruler) opposite the ball. Second, instruct the student to reposition the lever (ruler) so the ball is as close to the fulcrum (marker) as possible. Have the student press the lever again to lift the ball. Lastly, reposition the lever (ruler) so the ball is as far away from the fulcrum (marker) as possible while still leaving a portion of the lever (ruler) to be pressed down. Have the student press the lever to lift the ball again.

https://www.nationalgeographic.org/activity/simple-machine-challenge/

Lever Challenge

Introduce the lever challenge. Explain that each group will attempt to move a tennis ball from the table to the center of a roll of masking tape at varying distances. Introduce the rules. Hands may not be used to move the ball to the goal, but hands may be used to place the ball on the lever and to operate the lever. Nothing may be used to secure the ball to the lever. The marker may not be moved from the edge of the table. The masking tape roll may not be moved unless the teacher instructs it. The winner will be the group that moves the ball to the center of the masking tape roll from three different distances with the least amount of attempts.

Separate the class into groups of 2-4. Distribute the following items to each group: a tennis ball, a rigid ruler, a cylindrical marker, and a roll of masking tape. Instruct students to tape the marker parallel to the edge of a desk or table, as was demonstrated earlier by the teacher. Now, instruct groups to measure 24 cm (9.5 in) out from the marker and place the edge of the masking tape roll, flat on its side, at this point.

Allow groups a few minutes to collaborate on different ideas for getting the ball into the goal. Next, allow five minutes of exploration and experimentation. Instruct students to record the distance of 24 cm (9.5 in) in their journal and sketch the lever configuration that worked best at this distance directly beneath the number. Follow the same steps at a distance of 15 cm (6 in) and 5 cm (2 in). Lastly, the teacher will observe as groups demonstrate their lever configurations at the different distances. The group with the lowest total attempts after completing all three distances wins.
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Pulley Demonstration

Tell the class that pulleys make work easier by reducing the effort needed to lift an object. Instruct a student to lift a milk jug filled with water using only his or her hand. Next, have two additional students hold a broom handle at shoulder level between them. Now, tie a thin rope to the handle of the jug and let it rest on the floor. Instruct the student who earlier lifted the jug to pull the rope over the broomstick and pull down on the end of the rope to lift the jug. Ask the student to describe the difference between the two experiences. Now, untie the rope from the jug and tie one end of the rope to the broomstick. Have the two students continue to hold the broomstick at shoulder level while the other volunteer slips the free end of the rope through the handle of the jug and then back over the broomstick. Have the same student pull the end of the rope to lift the jug. Ask the student to describe the differences in the three experiences.
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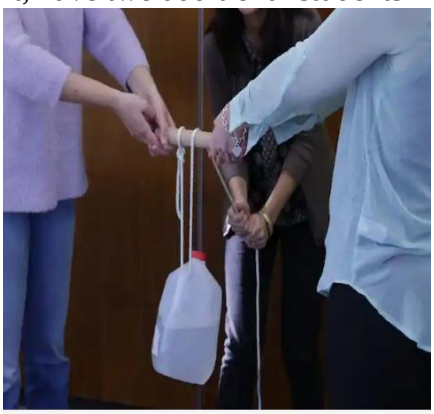

Pulley Challenge

Introduce the pulley challenge. Each group will lift metal objects from the floor using a pulley system they design. Introduce the rules. Only materials provided may be used in the design. Hands may not be used to pick up objects. An object lifted to at least 10 cm (4 in) in the air may be removed from the pulley using the hands. At least two spools must be incorporated into the design. No more than 15 cm (6 in) of tape may be used. Part of the pulley system may be taped to a fixed object, such as a desk.

Separate the class into groups of 2-4. Distribute the following items to each group: three plastic spools; a meter (3.2 ft) of string; a 1¼-inch donut magnet; various small metal objects, such as paper clips; masking tape; and three pencils. Allow groups time to collaborate on different ideas for pulley construction. Next, allow five to ten minutes of exploration and experimentation with the materials. Encourage students to make sketches of ideas in their journal. At the conclusion, each group will demonstrate for the teacher the most successful pulley system the group designed.
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Wheel and Axle Demonstration

Tell students the wheel and axle uses rotational movement to make work easier. When effort is applied to the wheel, it produces movement in the axle, and when it is applied to the axle, it produces movement in the wheel. Ask a student to hold the narrow end of a funnel and use it to roll the large end of the funnel

along the table. Ask: Is this an example of effort being applied to the axle or the wheel? (Effort applied to the axle.) Next, have a student tape the end of a 1 m (3.2 ft) piece of string to the narrow end of the funnel. Now have the student turn the funnel in a circular motion using the large end of the funnel. Ask: Is this an example of effort being applied to the axle or wheel? (Effort applied to the wheel.)
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Wheel and Axle Challenge

Introduce the wheel and axle challenge. Each group will attempt to move a tennis ball 3 meters (roughly 10 ft) using a design incorporating the wheel and axle. Introduce the rules. Only materials provided may be used. The ball may not be touched after it begins to move. The wheel and axle must be the primary mechanism by which movement of the ball is achieved.

Separate the class into groups of 2-4. Distribute the following items to each group: two pieces of cardstock paper, approximately 57 g (2 oz) of modeling clay, two drinking straws, 30 cm (12 in) of masking tape, and 30 cm (12 in) of string. Allow groups time to collaborate on different ideas for moving the ball. Next, allow ten minutes of exploration and experimentation. Encourage students to make sketches of ideas in their journals. When all groups are ready, they will compete to determine which design can move the ball the greatest distance. Give groups five minutes to reengineer or repair their vehicles after the first test, and test a second time.
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Design a robot on paper.

Ask the class to imagine how the simple machines they experimented with could be used to construct various working parts of a robot. Ask the following questions: How could a lever be used? (Perhaps as part of the arm or leg.) How about a pulley? (It could be used to operate the gripper on a robot's arm.) What about the wheel and axle? (It could be used as part of the mobility unit.) Instruct students to create drawings of their own robots incorporating all of the simple machines they experimented with in class.
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THE LEVER EXPERIMENT

https://eschooltoday.com/learn/class-two-lever-experiment/

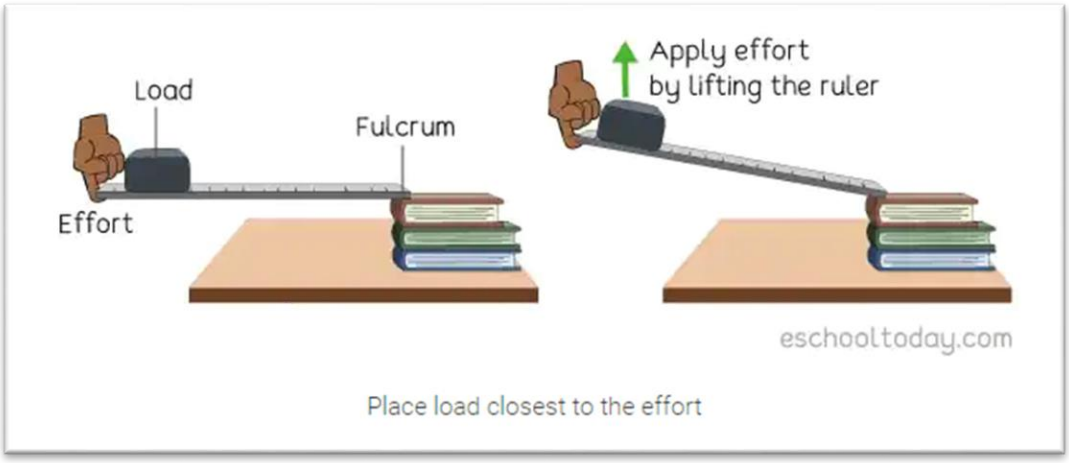
Objective:
Experiment to determine the best spot to place the load on a class two lever.

We know a wheelbarrow is a good example of a class two lever. Where is the best spot to place the wheelbarrow bucket to make lifting and moving of the load the easiest? Is it closer to the fulcrum or farther from the fulcrum? Let's find out.

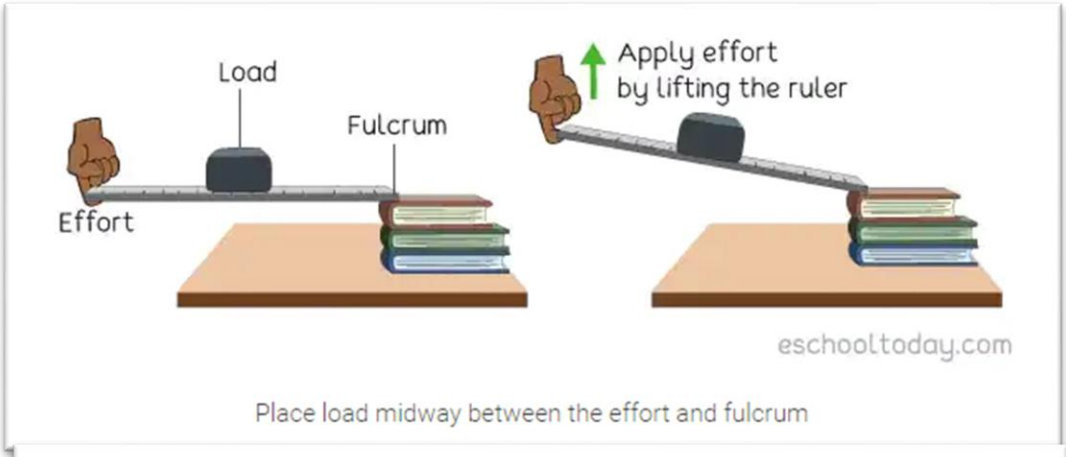
Here is what you need:
1. A foot ruler
2. Your pointer finger
3. A pile of books
4. A weight (like a block of magnet or rock)

Start by arranging the pile of books vertically. Put one end of the foot rule on the pile of books and support the other end with your pointer finger. Your lever is almost ready. The end tip on the pile of books will be the pivot (fulcrum). Your pointer finger will lift the load on the ruler, applying the effort.

Now, go ahead and place the load at three places on the foot ruler.
First, place the load on the ruler at the point closest to the effort. Try lifting the ruler and make a note of how heavy it feels.

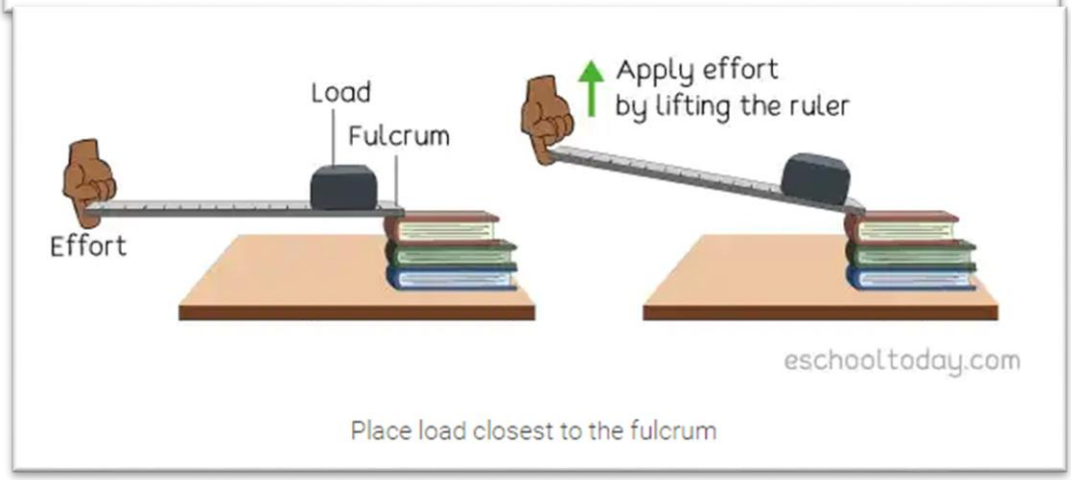


Second, place the load in the middle section of the ruler (between the effort and the fulcrum). Try lifting it again and make a note of how heavy it feels.



Third, place the load on the ruler at a point closest to the fulcrum. Try lifting the ruler and make a note of how heavy it feels.

Which of the three load positions felt very easy to lift? Which of the three positions felt very heavy to lift? Discuss your answer with your teammates.



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