Hang On!

This module is designed to help Venturing and Sea Scouts explore how engineering affects their life each day.

1. Choose A *or* B *or* C and complete ALL the requirements.
    A. Watch about three hours total of engineering-related shows or documentaries that involve motion or motion-inspired technology. Then do the following:
        (1) Make a list of at least five questions or ideas from the show(s) you watched.
        (2) Discuss two of the questions or ideas with your counselor.

Some examples include—but are not limited to—shows found on PBS ("NOVA"), Discovery Channel, Science Channel, National Geographic Channel, TED Talks (online videos), and the History Channel. You may choose to watch a live performance or movie at a science museum instead of watching a media production. You may watch online productions with your counselor's approval and under your parent's or guardian's supervision. One example is the NOVA Lever, an Obelisk page on ancient Egypt and the use of levers, available at www.pbslearningmedia.org/resource/phy03.sci.phys.energy.vegypt/raising-an-obelisk-an-engineering-puzzle/?student=true&focus=true

    B. Read (about three hours total) about motion or motion-inspired technology. Then do the following:
        (1) Make a list of at least two questions or ideas from each article.
        (2) Discuss two of the questions or ideas with your counselor.

Examples of magazines include—but are not limited to—Odyssey, Popular Mechanics, Popular Science, Science Illustrated, Discover, Air & Space, Popular Astronomy, Astronomy, Science News, Sky & Telescope, Natural History, Robot, Servo, Nuts and Volts, and Scientific American.

    C. Do a combination of reading and watching (about three hours total). Then do the following:
        (1) Make a list of at least two questions or ideas from each article or show.
        (2) Discuss two of the questions or ideas with your counselor

2. Complete ONE subject from the following list. Complete ALL the requirements for a Venturing and Sea Scout exploration in that field. See STEM Explorations for the requirements. If you have already completed a Venturing or Sea Scout exploration in one of these fields, choose a different field for this award. After completion, discuss with your counselor how the exploration you earned uses engineering.

Archery	Engineering	Rifle Shooting
Aviation	Inventing	Robotics
Composite Materials	Mining in Society	Shotgun Shooting
Drafting	Model Design and Building	
Electronics	Railroading	

Composites can be found just about everywhere: in airplanes and sports cars, golf clubs and guitars, boats and baseball bats, bathtubs and circuit boards, and even bridges. Composites make bicycles and skis lighter, kayaks and fishing poles stronger, houses warmer, and helmets tougher. Venturers and Sea Scouts can choose one of these items for their discussion to answer requirement 3c.

3. Do ALL the following.
    A. Make a list or drawing of the six simple machines.
    B. Be able to tell your counselor the name of each machine and how each machine works.

Helpful Links
"Six Simple Machines": http://www.constructionknowledge.net/
https://www.livescience.com/49106-simple-machines.html
https://www.teachengineering.org/populartopics/simplemachines

    C. Discuss the following with your counselor:
        (1) The simple machines that were involved with the motion in your chosen merit badge (Hint: Look at the moving parts of an engine to find simple machines.)
        (2) The energy source causing the motion for the subject of your STEM exploration.
        (3) What you learned about motion from earning your STEM exploration.

4. Choose A or B and complete ALL the requirements.
    A. Visit an amusement park. Then discuss the following with your counselor:
        (1) The simple machines present in at least two of the rides
        (2) The forces involved in the motion of any two rides
    B. Visit a playground. Then discuss the following with your counselor:
        (1) The simple machines present in the playground equipment
        (2) The forces involved in the motion of any two playground fixtures

5. Do the following:
    A. On your own, design one of the following and include a drawing or sketch: an amusement park ride OR a playground fixture OR a method of transportation.
    B. Discuss with your counselor:
        (1) The simple machines present in your design
        (2) The energy source powering the motion of your creation

6. Discuss with your counselor how engineering affects your everyday life.

2022 May 25

Hang On! Counselor's Notes

This module is designed to help you explore how engineering affects your life each day.

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    B. Do a combination of reading and watching (about three hours total). Then do the following:
        (5) Make a list of at least two questions or ideas from each article or show.
        (6) Discuss two of the questions or ideas with your counselor

    C. Do a combination of reading and watching (about three hours total). Then do the following:
        (7) Make a list of at least two questions or ideas from each article or show.
        (8) Discuss two of the questions or ideas with your counselor

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Archery	Engineering	Rifle Shooting
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3. Do ALL the following.

    A. Make a list or drawing of the six simple machines.

Helpful Links
"Six Simple Machines": http://www.constructionknowledge.net/
https://www.livescience.com/49106-simple-machines.html
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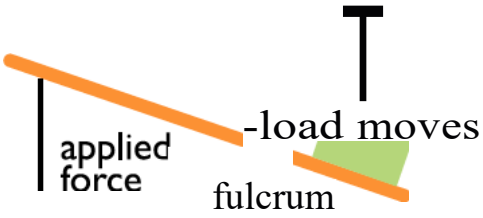
A lever is a rigid bar that turns around a fulcrum or fixed point. The force—a push or a pull that is applied to the lever—is called the effort. The farther the effort is from the fulcrum, the easier it is to use the lever. What the lever moves is called the load or the resistance. Levers can change the direction of motion, make it easier to move something, or cause something to move a greater distance. There are three classes, or types, of levers.

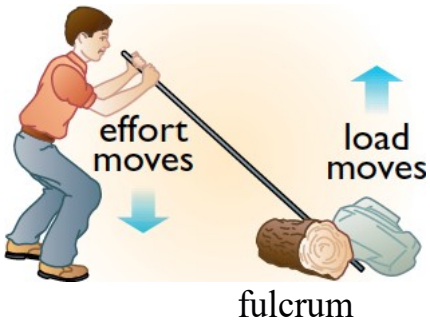
Class 1 lever—The fulcrum is located between the effort and the load. The direction the load moves is opposite the direction of the effort. Depending on where the fulcrum is placed, a class 1 lever can either move the load more easily or move the load a greater distance. Examples of class 1 levers include seesaws, crowbars, scissors, and pliers.

Class 2 lever—The fulcrum is at one end, the effort is at the other end, and the load is in the middle. The effort and the load move in the same direction. A class 2 lever makes an object easier to move. Examples of class 2 levers include catapults, screwdrivers, nutcrackers, staplers, and wheelbarrows.

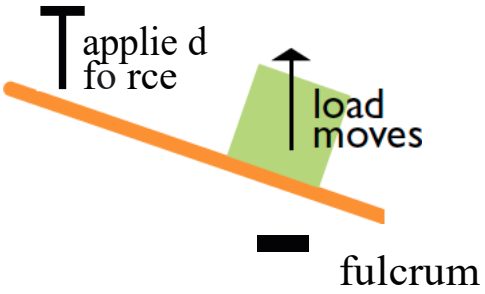
Class 3 lever—The fulcrum is at one end, and the effort is applied between the fulcrum and the load. The effort and the load move in the same direction. A class 3 lever makes an object harder to move but moves the object a much greater distance than the effort moves. Because the load end moves faster than the effort (it has to travel farther during the same amount of time), the load gains speed. Many sporting activities use class 3 levers. Examples of class 3 levers include bats, rackets, paddles, clubs, fishing poles, and brooms.

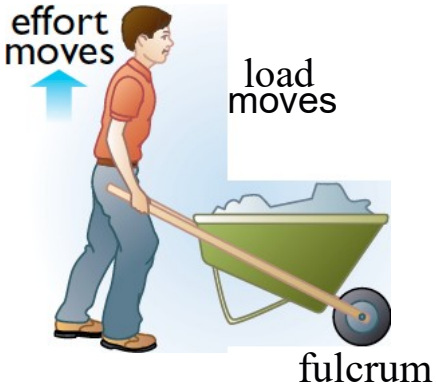
CLASS I LEVER



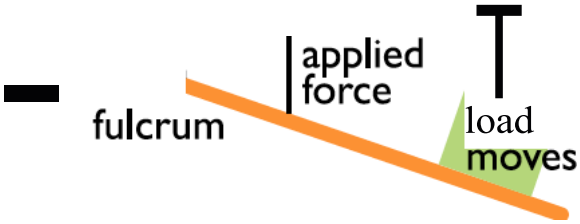


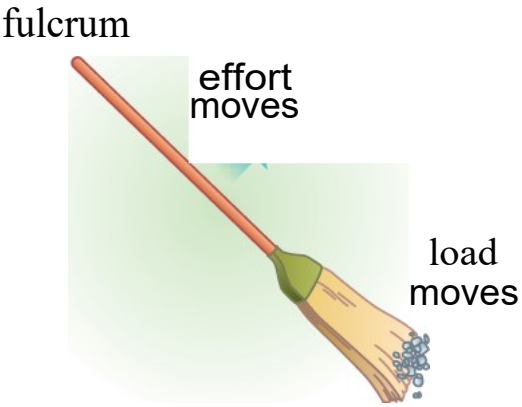
CLASS 2 LEVER

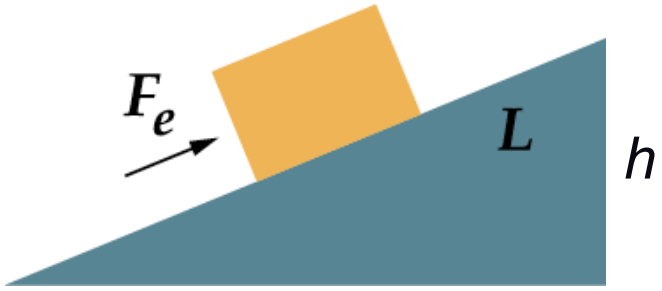




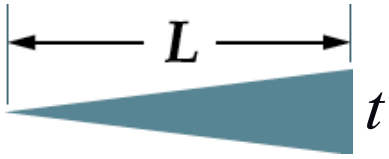
CLASS 3 LEVER



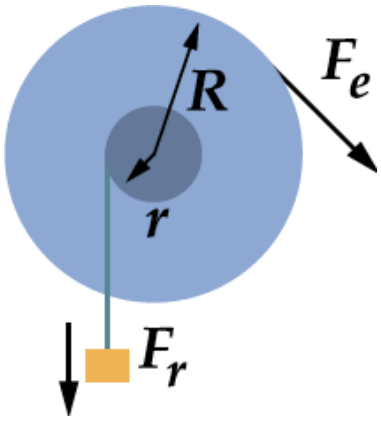




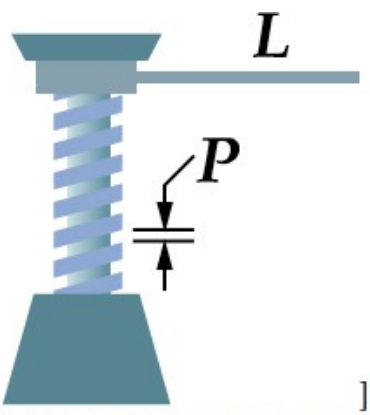
An inclined plane is a device such as a ramp, stair, or ladder and is used to more easily raise a load. The steepness of the incline affects the level of ease of movement. While a shallow incline makes it easier to raise a load, the length of the incline must be longer to compensate.



A wedge is a movable double incline plane used to separate objects using force. Examples include a knife, ax, and nail.



A wheel and axle are essentially a modified lever, but it can move a load farther than a lever can. The center of the axle serves as a fulcrum. Gears, belts, cams, and cranks include applications of a wheel and axle.



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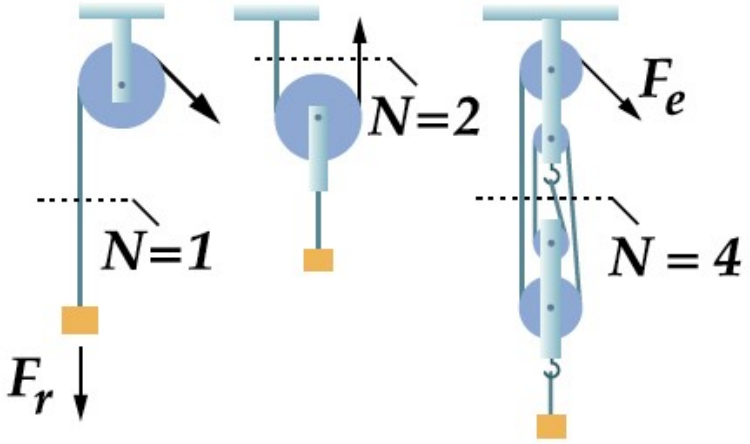
A screw is an inclined plane wrapped in a spiral around a shaft.



A pulley is a wheel over which a rope or belt is passed. It is also a form of the wheel and axle. Pulleys are often interconnected in order to obtain considerable mechanical advantage. Pulleys may be used to change the direction of the force or to increase the ease of lifting an object.

B. Be able to tell your counselor the name of each machine and how each machine works.

C. Discuss the following with your counselor:

(1) The simple machines that were involved with the motion in your chosen merit badge (Hint: Look at the moving parts of an engine to find simple machines.)

(2) The energy source causing the motion for the subject of your STEM exploration

(3) What you learned about motion from earning your STEM exploration.

Archery—The bow is a lever, and the hand is the fulcrum. Crossbows use a pulley.

Aviation—Wheel and axle, levers, and pulleys. Propellers are a type of screw.

Composite Materials—Composites can be found just about everywhere: in airplanes, golf clubs, baseball bats, circuit boards, and even bridges.

Composites make sporting equipment lighter and stronger, houses warmer, and helmets tougher. Pick a composite product and discuss the machines made of the components.

Drafting—Incline plane (triangle), wheel and axle, and lever.

Electronics—Varies. Lever used in soldering irons, switches, and circuit breakers (see https://electronics.howstuffworks.com/circuit-breaker.htm

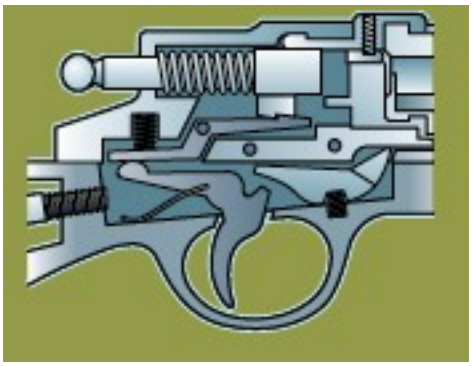
Engineering—Engineering makes use of all the simple machines. See https://www.teachengineering.org/lessons/view/cub_simp_machines_lesson01

Inventing—Inventors can use simple machines to help them construct their prototypes; their inventions may incorporate simple machines.

Model Design and Building—Tools such as knives (wedge), handsaws (wedge), vises (screw and lever), files, hammers (lever), screwdrivers (lever), hand drills (screw, wheel and axle), drill bits (screw), and pliers (two levers working together).

Railroading—Levers, wheel and axle.

Rifle Shooting—The fulcrum (pivot point) in the trigger mechanism is between the effort (applied by the trigger finger) and where the pressure (the load or resistance) is applied to the spring.



Robotics—Robot designers and builders can use simple machines to help them build their robots. Robots may contain simple machines to help them function, like how the human body incorporates simple machines.

Shotgun Shooting—See Rifle Shooting.

Wind, gasoline/fossil fuel, electric power, and human power all are sources of energy.

1. Choose A or B and complete ALL the requirements.
    A. Visit an amusement park. Then discuss the following with your counselor:
        (1) The simple machines present in at least two of the rides
        (2) The forces involved in the motion of any two rides
    B. Visit a playground. Then discuss the following with your counselor:
        (1) The simple machines present in the playground equipment
        (2) The forces involved in the motion of any two playground fixtures

A force is a push or a pull. Many rides use the force of gravity to cause changes in up and down motion. Rides that go in a circle use centripetal force.

2. Do the following:
    A. On your own, design one of the following and include a drawing or sketch: an amusement park ride OR a playground fixture OR a method of transportation.
    B. Discuss with your counselor:
        (1) The simple machines present in your design
        (2) The energy source powering the motion of your creation

3. Discuss with your counselor how engineering affects your everyday life.

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