

## Build It: Engineering (3<sup>rd</sup>-5<sup>th</sup> grades) Pre-Visit Activities

### Vocabulary List and Student Definitions (elementary level):

- **Wheel and Axle:** rods called axles connect wheels (circular frame or disk) so that items can be moved easily.
- **Wedge:** simple machine that has at least one slanted side, often two. It can separate objects, slide under things, and hold things in place.
- **Lever:** simple machine consisting of a rigid bar that rotates about a fixed point (fulcrum).
- **Pulley:** simple machine used to lift objects that consists of a grooved wheel or disk and a rope or cable threaded around the track
- **Screw:** simple machine that consists of an inclined plane wound spirally around a cylinder and is used to fasten objects
- **Inclined Plane:** a simple machine, consisting of a ramp that connects a lower surface to a higher surface
- **Simple Machine:** a device that makes doing work easier
- **Compound machine:** two or more simple machines working together

### Teacher Background and Supporting Information

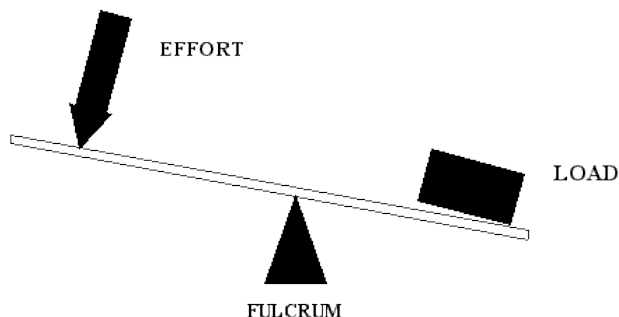
#### 1. What are simple machines?

a. **Simple machines** make our lives easier by helping us do things that would be very hard, maybe even impossible, to do without them. How would we ride a bike without wheels? How would we put a shelf or bookcase together without screws? How would we lift heavy objects without levers? Simple machines make doing work easier.

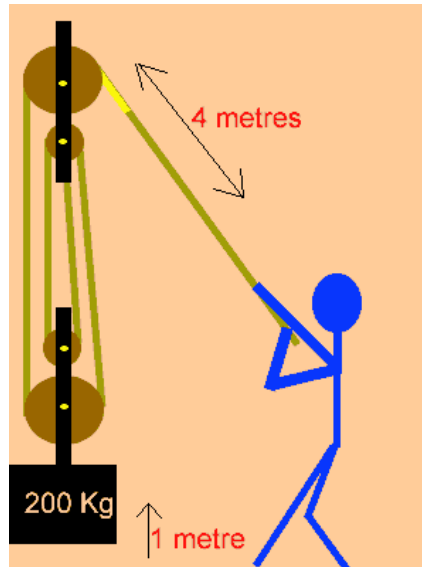
b. There are six basic types of simple machines:

i. **Lever** – lifts objects using a board or bar with a support piece called a fulcrum. The fulcrum is the point of balance. The load is the object that is being lifted or lowered. The force (or effort) is the push or pull that allows the load to be raised or lowered.

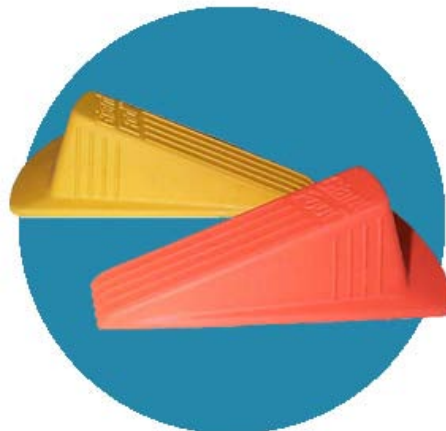
FIRST CLASS LEVER



ii. **Pulley** – has a grooved wheel (or wheels) with a rope, belt, or cable around it. The wheel makes it easier to lift heavy objects as the rope, belt, or cable moves along the track.



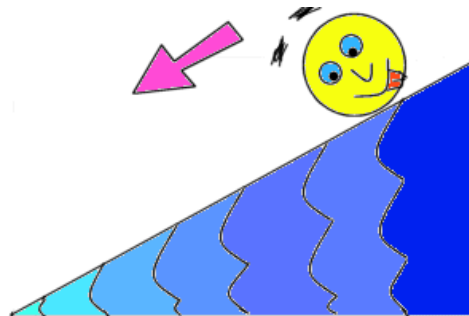
iii. **Wedge** – has at least one slanted side, often two. It can separate objects, slide under things, and hold things in place.



iv. **Wheel and Axle** – rods called axles connect wheels so that items can be moved easily.



v. **Inclined Plane** – a ramp that connects a lower surface to a higher one.



vi. **Screw** – an inclined plane that is wrapped around a small rod. It is used to hold things together or to lift items.



- c. What is mechanical advantage?
- i. Simple Machines have a property called mechanical advantage. These devices allow us to do work with less effort. They give us an advantage when it comes to moving and lifting things. How does each simple machine give us mechanical advantage?
    1. A lever has a load on one end and a force on the other, with the fulcrum (point of balance) in the middle. Rocking on the fulcrum provides the mechanical advantage.
    2. With a pulley, the rope or cable glides over the wheel of the track, giving it mechanical advantage.
    3. Wedges use friction to hold things tight. The narrow end of a wedge separates an object into two. These allow for mechanical advantage.
    4. The mechanical advantage of a wheel and axle allows heavy objects to easily move, gliding along a surface.
    5. Inclined planes allow objects to move from one point to another by easily sliding up and down a ramp. This provides mechanical advantage.
    6. A screw is an inclined plane that is wrapped around a small rod. The long edge of the inclined plane holds against an object, due to friction. This is the mechanical advantage.
- d. What are compound machines?
- i. **Compound machines** are devices made up of many simple machines.

**Student Activities:**

1. Visit <http://teacher.scholastic.com/dirtrep/simple/invest.htm>
  - a. Have students work in pairs to browse the site, gathering information about the six types of simple machines.
2. Challenge students to move about the classroom to identify examples of simple machines.
3. Have a whole group discussion about how simple machines affect our daily lives.
4. Provide students with common kitchen utensils. In teams, have them examine each utensil and decide what type of simple machine(s) they are made of.
  - a. Utensils may include: a butter knife, scissors, pizza cutter, cheese grater, can opener, measuring spoons, bottle opener, fork, spoon, cheese slicer, cheese grater, and so on.
  - b. Some utensils may be made of more than one type of simple machine (Example: A can opener contains 4 simple machines – a screw, lever, wedge, and a wheel and axle).
  - c. Caution students to carefully and safely handle utensils.