Work and Simple Machines Vocabulary

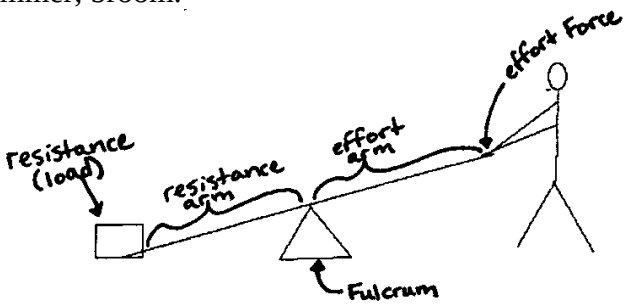
1. **Work**: A force applied over a distance; you know that work has been done if an object moves. The only things that affect the amount of work done are the force applied (the weight of the object) and the distance the object is moved. The formula for work is: work = force * distance.

2. **Joules**: The units for work. A joule is equal to one Newton meter.

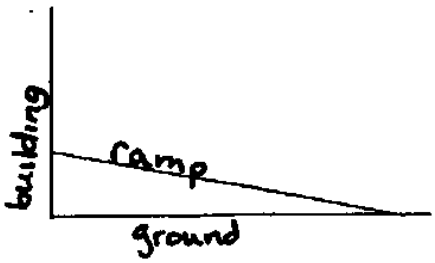
3. **Machine**: A device that allows you to do work easier or faster by either:
   a. changing the amount of force needed
   b. changing the distance over which you must exert the force
   c. changing the direction of the force needed

4. **Simple Machine**: A device that can produce work with one movement or motion. There are six types of simple machines:

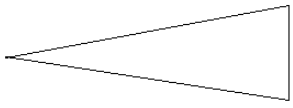
a) **Lever**: A rigid bar that is free to move "about" a fulcrum. The longer the effort arm is, the less force you need to lift the load. A lever allows you to change the direction of force by allowing you to push down instead of lift up. Examples of levers: crow bar, baseball bat, hammer, broom.



b) **Inclined plane (ramp)**: a slanted surface which may be used to lift objects to higher places. The benefit of using an inclined plane is that it requires less effort to move an object, but… you need to move the object a farther distance. Examples of inclined planes: handicapped ramp, slide, stairs, ladder.

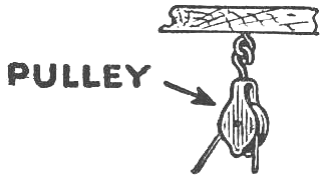


c) **Wedge**: a device that is thick at one end and tapers to a thin edge at the other end. Wedges can be thought of as two inclined planes back to back that move. Wedges are used to cut, split, or pierce some sort of material. Long narrow wedges require less force to use than wider, shorter wedges. Examples of wedges: knifes, , axe, door stop, chisel, plow blade.



d) **Screws**: can be thought of as an inclined plane wrapped around a cylinder. The spiral inclined plane forms the threads of the screw. The closer together the threads of a screw are, the greater the mechanical advantage is (the easier it is to use the screw). Screws can be used in two ways: to hold things together and to lift things.

e) **Pulley:** a wheel that turns on an axle which is used with a rope, chain, or belt to change the direction or amount of force needed to move a load. Examples of pulleys: bike chain, pulley on flag-pole, pulley on blinds. There are three types of pulleys:
   a. **Fixed pulleys**: usually attached to a ceiling or beam- they do not move. Fixed pulleys change the direction of the force needed, but not the amount of force needed to lift a load.
   b. **Movable pulleys**: are attached to the load and move with the load. Movable pulleys decrease the amount of force needed to lift a load, but not the direction of the force needed.
   c. **Block and Tackle**: Combination of fixed and movable pulleys. A block and tackle not only changes the direction of the force needed, but also changes the amount of force needed.



f) **Wheel and Axle**: made up of two circular or cylindrical shaped objects fastened together that rotate around a common axis. The trade off with a wheel and axle is that you need to exert less force on the wheel, but you need to turn it a greater distance. Examples of wheels and axles: door knob, screw driver, pencil sharpener, dial on telephone.

5. **Compound Machine**: Made up of two or more simple machines.

6. **Mechanical advantage**: the mechanical advantage of a machine is the number of times a machine increases the force exerted on it.

7. **Input force**: the force that you exert on a machine (the amount of force that you put into the machine)

8. **Output force**: the force that the machine exerts on the object it

9. **Efficiency**: the comparison of work output to work input. The efficiency of a machine is always expressed as a percent- the higher the percent, the more efficient a machine is. Efficient machines conserve energy and save money. Machines can be made more efficient by reducing friction.

Formula for efficiency: $\text{Efficiency} = \frac{\text{work output}}{\text{work input}} * 100$

To calculate the work input for a machine, you multiply the effort force * the effort distance.

To calculate the work output for a machine, you multiply the resistance force * the resistance distance.