

Name _____ Date _____ Class _____

How do machines make work easier?

What is the difference between actual and ideal mechanical advantage?

How can you calculate the efficiency of a machine?

Guide for Reading

Mechanical Advantage and Efficiency

A machine is a device with which you can do a certain amount of work in a way that is easier or more effective than if you did not use the machine. A machine can be as complex as a bulldozer or as simple as a ramp.

A machine does not decrease the amount of work you do but changes the way you do the work. A machine makes work easier by changing the amount of force you exert, the distance over which you exert your force, or the direction in which you exert your force. The force you exert on the machine is called the input force or the effort force. The force exerted by the machine is called the output force or the resistance force. A machine makes work easier by multiplying either force or distance, or by changing the direction of the force. A machine's mechanical advantage is the number of times a force exerted on a machine is multiplied by the machine.

Mechanical advantage = Output force / Input force

For a machine that multiplies force, the mechanical advantage is greater than 1 because the output force is greater than the input force. For a machine that multiplies distance, the output force is less than the input force. The mechanical advantage is less than 1. If a machine only changes the direction of the force, the input force is the same as the output force. The mechanical advantage is 1.

The efficiency of a machine compares the output work to the input work. Efficiency is expressed as a percent. The higher the percent, the more efficient the machine is. An ideal machine would have an efficiency of 100%. To calculate the efficiency of a machine, divide the output work by the input work and multiply the result by 100 percent.

Efficiency = Input work / Output work \times 100%

The mechanical advantage that a machine actually provides in a real situation is called the actual mechanical advantage. The mechanical advantage of a machine without friction is called the ideal mechanical advantage of the machine. The more efficient a machine is, the closer the actual mechanical advantage is to the ideal mechanical advantage.