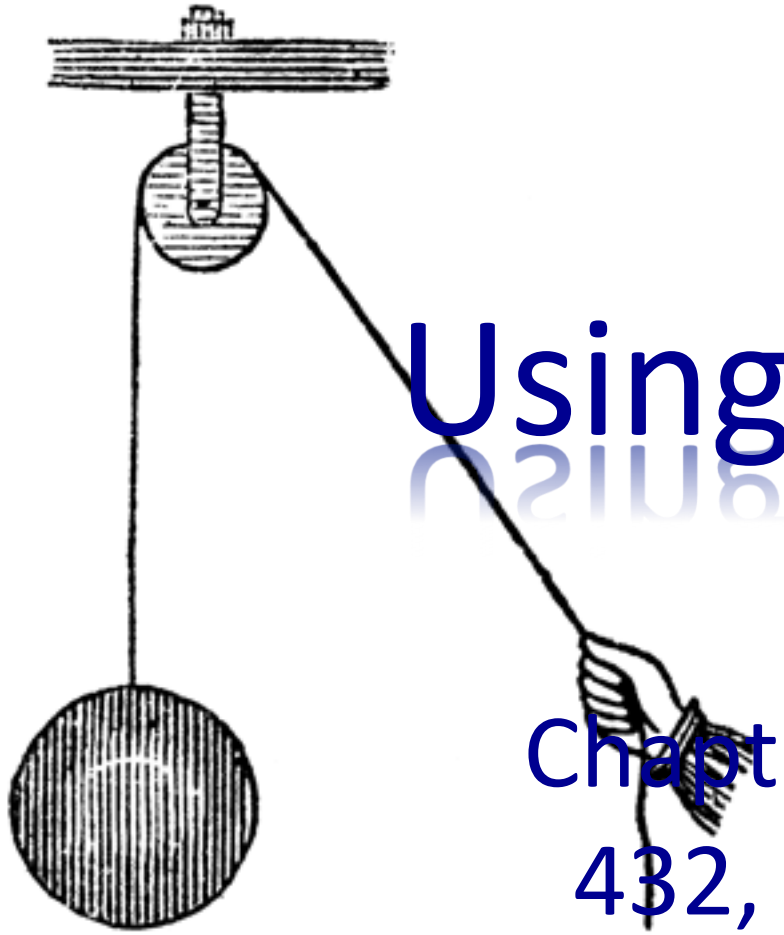
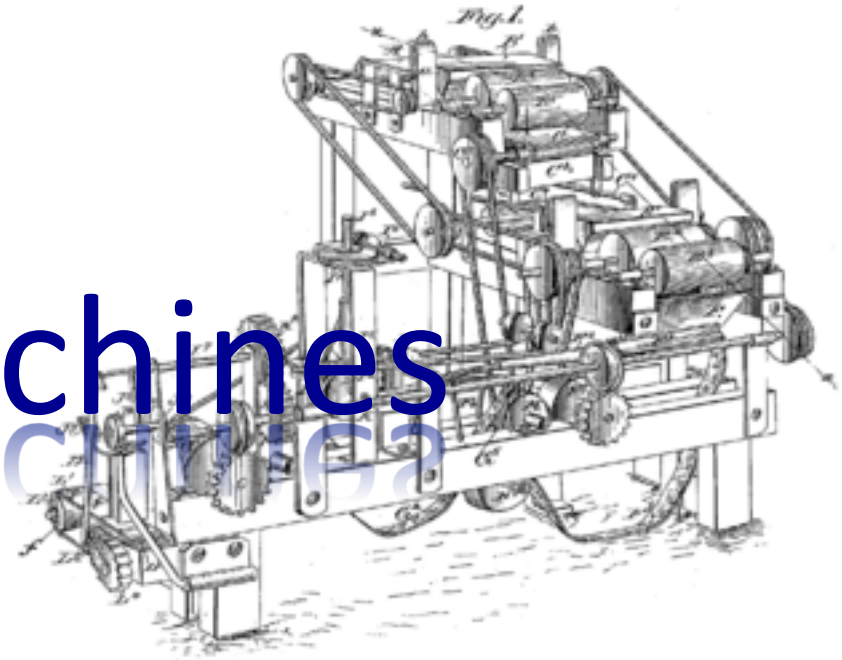




Using Machines

Chapter 14 Lesson 2
432, 433, and 435

Determine the amount of force needed to do work using different simple machines.

What You Will Learn

- Explain how a machine makes work easier
- Calculate mechanical advantage
- Explain how friction reduces efficiency

What Mastery Looks Like

This is the type of question you will be able to answer at the end of this lesson.

- What is the mechanical advantage of a lever that requires an input force of 20 N and lifts an object that weighs 60 N?

What is a machine?

- With your group, discuss what *you think* a machine is.
- A machine is a device that makes doing a task easier.
- With your group, discuss how *you think* a machine makes things easier.
- A machine makes work easier by changing the size and/or direction of a force.

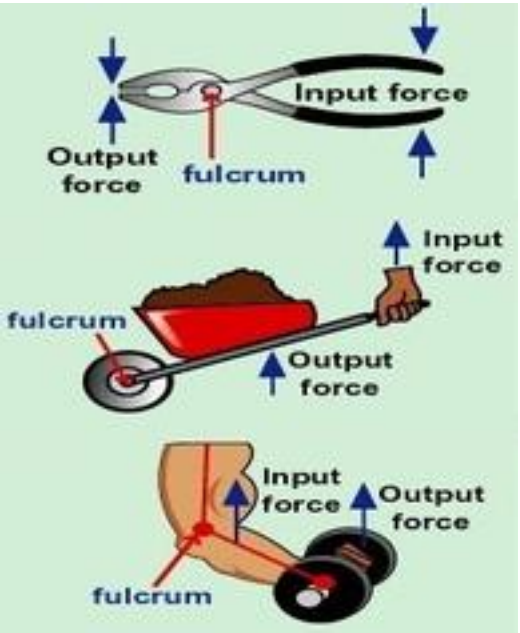
Mechanical Advantage

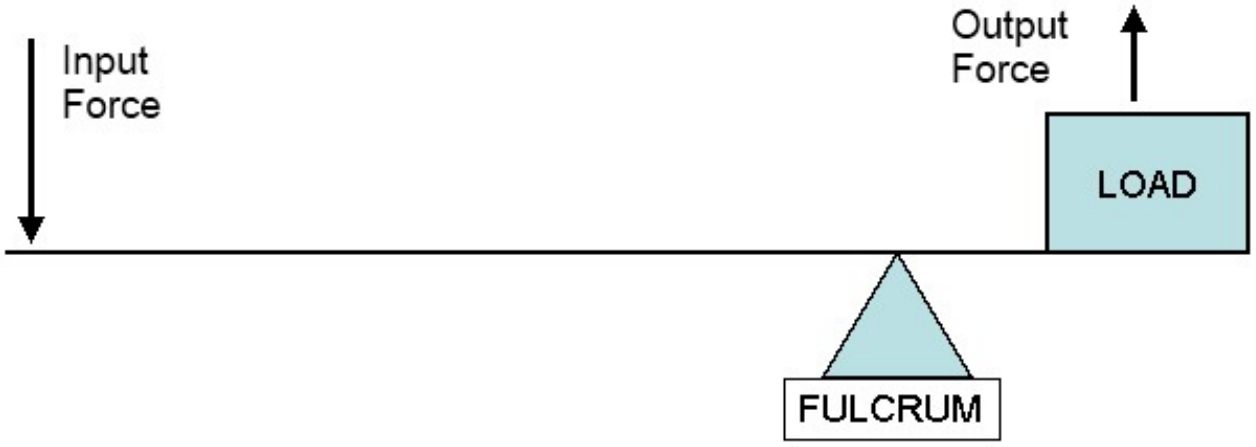
- Machines make work easier, but they DON'T DECREASE the amount of work you need to do.
- A machine changes the way you do work.

- https://www.youtube.com/watch?v=-huZw8Dq3JU&safe=active

Mechanical Advantage

- The force you apply on a machine is the input force.
- The force that the machine applies is the output force.
- ***Energy cannot be created or destroyed. That means, when you use a machine, the output work can never be greater than the input work.***





Mechanical Advantage

- A machine can increase force or distance, but not both.
- A machine makes work easier by…
  - changing the amount of force you need to exert
  - the distance over which the force is exerted
  - the direction in which you exert your force.

Changing Force

- Mechanical advantage tells how many times a machine multiplies force.
- https://www.youtube.com/watch?v=yhzMYHiuEC4

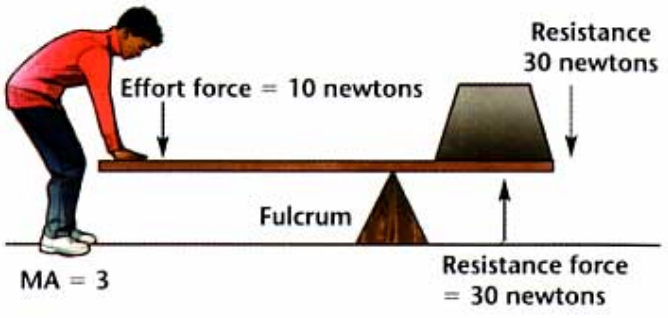
EXAMPLE

$$MA = \frac{F_r}{F_e}$$

$$MA = \frac{30 \text{ newtons}}{10 \text{ newtons}}$$

$$MA = 3$$

The mechanical advantage is 3. The machine has multiplied the woman's effort force by 3. This makes the object easier for her to lift.



Mechanical Advantage Equation

- Practice Problem #1 p. 433

$$MA = \frac{f_{output}}{f_{input}}$$

Efficiency

- The efficiency of a machine is the ratio of the output work to the input work.
- Basically, it's a comparison of a machine's work output with work input.
- Efficiency (in percent) = work output/work input x 100
- Machines aren't 100% efficient because some of the work done is used to overcome friction.
- Practice Problem #1 p. 435

Exit Ticket

- To lift a crate, a pulley system exerts a force of 2,750 N. Find the mechanical advantage of the pulley system if the input force is 250 N.