1) Formuly
2) Substitute
3) Solve

$W_o = F_o d_o$ & $W_i = F_i d_i$
Sample Problems

Name: Mr. Sinusas
Date: 5/10/17 Period: Kind

Bill used a lever to help him move a large boulder that weighed 610 N. He applied a force of 210 N to move the lever 1.5 m.

What is Bill's input work (W_i)?
Don't forget to show all work.

$W_i = F_i d_i$

$W_i = 210N \cdot 1.5m$

$W_i = 315\ J$

How far did the boulder move?
Don't forget to show all work.

$W_o = F_o d_o$

$315\ J = 610N\ d_o$

$.52m = d_o$

Bill had another boulder to move that weighed 725 N. He used the same lever, but this time he needed to apply a force of 250 N to move the lever 1.5 m to make the boulder move 0.5 m.

What is Bill's input work (W_i)?
Don't forget to show all work.

$W_i = F_i d_i$

$W_i = 250N \cdot 1.5m$

$W_i = 375\ J$

What is Bill's output work (W_o)?
Don't forget to show all work.

$W_o = F_o d_o$

$W_o = 725N \cdot .5m$

$W_o = 362.5\ J$

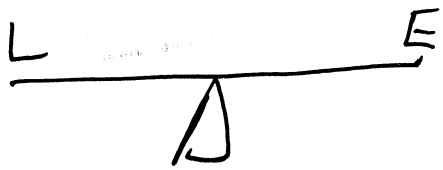
$375\ J \approx 362.5\ J$

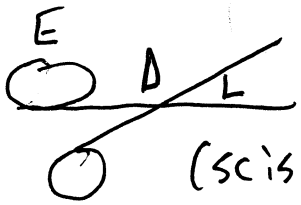
$\approx$

Levers

- Draw example for each class
- Label fulcrum (Δ), load (L), and effort (E)
- Tell advantage for each example

First Class



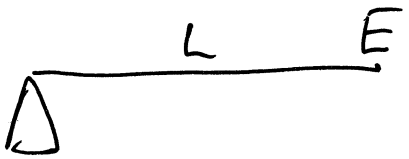


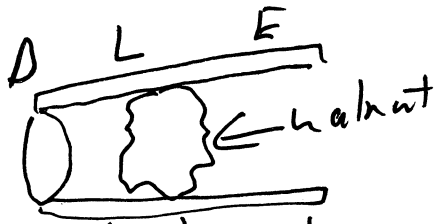
(scissors)

- Change direction

Can gain force or gain distance

Second Class

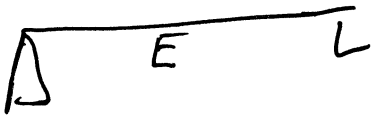


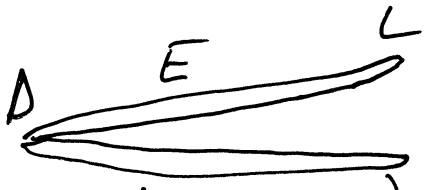


(nut cracker

gain force

Third Class





(tweezers)

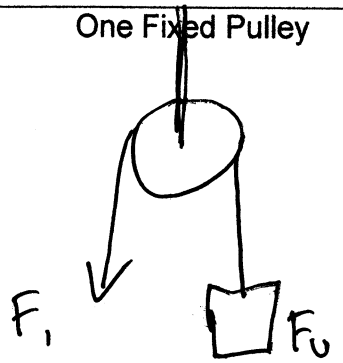
gain distance

(don't muck my drawings)

Pulleys

- Draw pulley for each example
- Label input force (F_i), output force (F_o), and pulleys (movable and/or fixed)
- Tell Mechanical Advantage

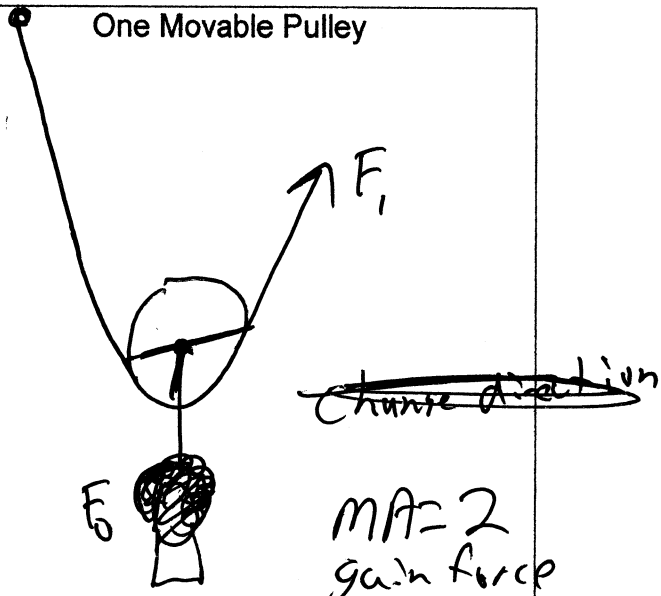
One Fixed Pulley



MA= 1

Change direction

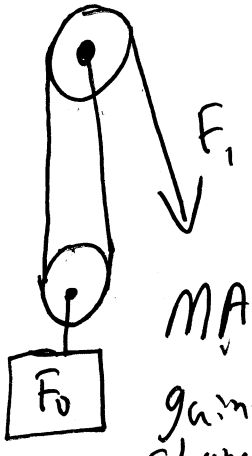
One Movable Pulley



MA= 2

gain force

Two Pulley System
(pulling down)

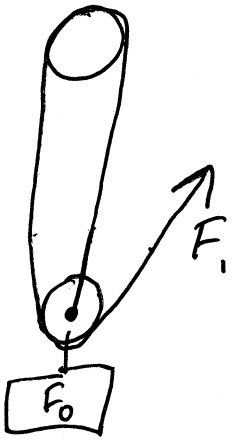


MA= 2

gain force

change direction

Two Pulley System
(pulling up)



MA= 3

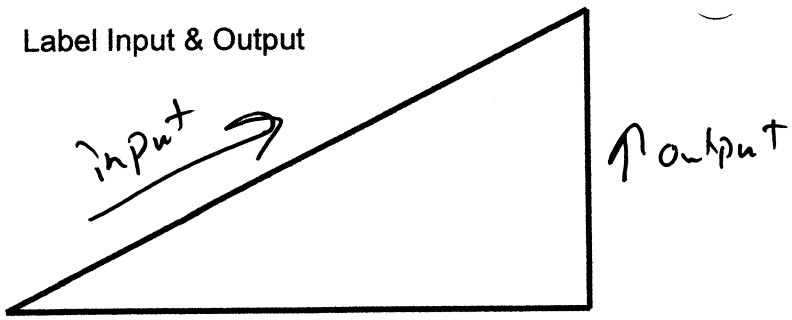
gain force

How can the mechanical advantage of a pulley system be increased? add more pulleys or pull up

Inclined Planes

What advantages do all inclined planes give? gain force

Label Input & Output



How are screws modified inclined planes? the inclined plane is wrapped around a cylinder

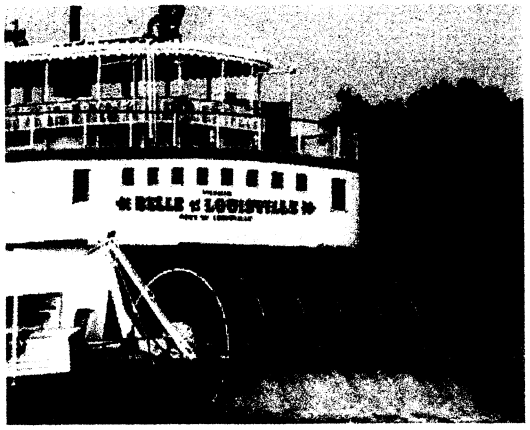
How do screws make work easier? you have a large input distance, so there is a small input force needed

How are wedges modified inclined planes? its like an inclined plane that moves (mostly to cut things

How do wedges make work easier? a small input force results in a large out put force outwards

Wheel & Axle

- Label wheel, label axle
- How does each make work easier?



hard to see with copy: axle is always the smaller one

Paddle wheel boat: input is on axle, so you gain distance

door knob: input is on wheel, so you gain force

A pulley lifts a 300 Newton object to a height of 25 m. The person lifting the object pulls with a force of 65 N, and pulls the rope 135 m.

What is the output force? (F_o) 300 N

What is the output distance? (d_o) 25 m

What is the work output? (W_o)

$W_o = F_o d_o$

$W_o = 300\,N \cdot 25\,m$

$W_o = 7500\,J$

What is the input force? (F_i) 65 N

What is the input distance? (d_i) 135 m

What is the work input? (W_i)

$W_i = F_i d_i$

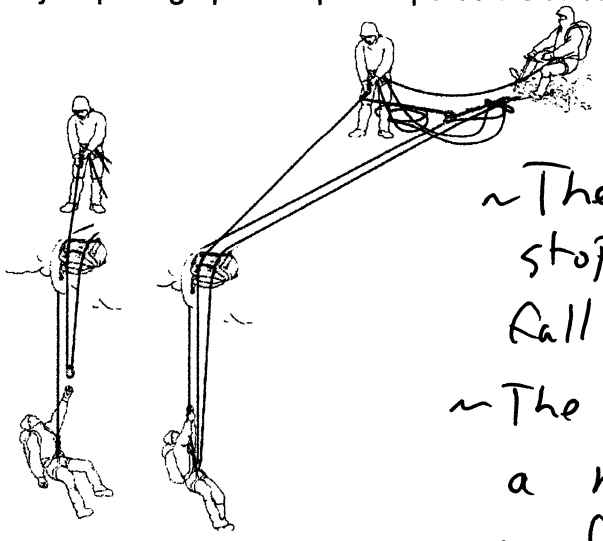
$W_i = 65\,N \cdot 135\,m$

$W_i = 8775\,J$

Why isn't the work input equal to the work output?

Some work went to overcome friction

When mountaineers travel across glaciers, they wear harnesses and use ropes so they are always connected. If a member of the climbing party falls into a crevasse (a very deep hole in the ice) then the other climbers can stop them from falling deep into the hole. However, getting the climber back to safer is difficult, as they may not be able to apply enough force to safely lift the person back onto the glacier. The two pictures below show one climber that has fallen into a crevasse and how his two climbing partners are lifting him back to safety. Explain why throwing an additional rope is easier than just pulling up the rope the person is already attached to.



~ The first rope is stopping the climber from falling further down.

~ The second rope will act as a movable pulley. Assuming no friction, the climbing partners will need an input force half as much as the output force (climber's weight)

Simple machines are all around us. For homework, you be searching your house for at least TWO different simple machines.

You will:

1) Draw a picture or describe what the simple machine is.
2) Explain how that simple machine makes work easier.

In you description, you should you as many of the following words as you can:

input force *input distance* *output force* *output distance*
gain force *gain distance* *change direction*

Answers will vary. please see me if you have questions.