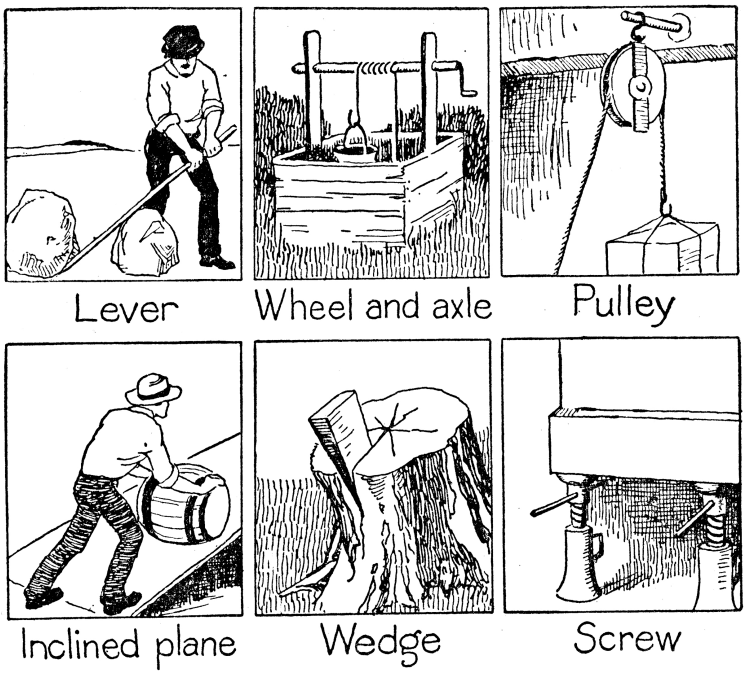
Name: _____ Date: _____ Per: _____

Work and Machines

Mr. Ahearn



Key Questions:

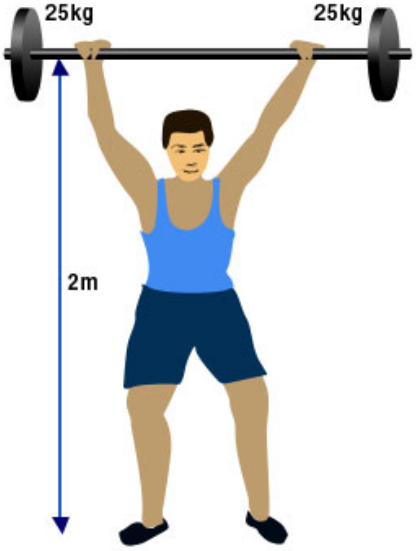
1. When is work done on an object?
2. How do you calculate work and power?
3. How do machines make work easier?
4. What is the difference between ideal mechanical advantage and actual mechanical advantage?
5. How can you calculate the efficiency of a machine?
6. What are the six simple machines?
7. How do you calculate the mechanical advantage of simple machines?

Test Date: _____

Vocabulary

Work	Machine	Input Force
Output Force	Mechanical Advantage	Efficiency
Inclined Plane	Wedge	Screw
Lever	Fulcrum	Wheel & Axle
Pulley	Compound Machine	Power

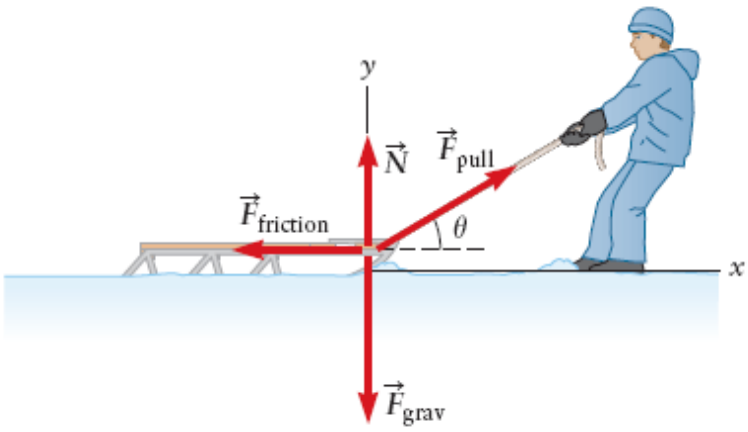
Work- when you exert a force on an object that causes the object to move some distance.



*The object must move as a result of force (no motion = no work!)

What happens if the weightlifter above walks with the weight, is work done on the weight?

Is work done when pulling a sled?



Calculating work

Work = _____ X _____

A hydraulic lift raises a 12,000 N car 2 meters. How much work is done on the car?

Given	Work

You exert a force of 4 N to pick up your backpack. How much work do you do to lift it 1.5 meters to your shoulder?

Given	Work

If two weightlifters lift the same weight the same distance which one is more powerful?

Power- how quickly work is done

Power = _____

Unit of power is _____

Practice

In the course of a short race, a car does 50,000 J of work in 7 seconds. What is the power of the car during the race?

Given	Work

A student does 140 J of work in 20 seconds. How much power did she use?

Given	Work

You do 200 J of work and exert 17 watts. How much time did the work take?

Given	Work

Review Questions:

1. If you exert a force, do you always do work? Explain.

2. What is the formula for work and power?

3. Compare the amount of work done when a force of 2 N moves an object 3 meters with the work done when a force of 3 N moves an object 2 meters.

4. If a man moves a large box that weighs 10 N 20 meters in 30 seconds, how much power was used?

5. You need to move five one-gallon cans of paint from the basement to the second floor of a house. Will you do more work on the cans of paint if you take them up all at once or if you take them up individually? Explain

What is a machine? - device that makes work easier or more effective

Ex. Shovel, Ramp, Hydraulic lift

- **Do not** change the amount of work being done
- Make work easier by:
    a) changing the amount of force you exert
    b) changing the distance over which the force is exerted
    c) changing the direction

Input force- (aka effort force) is the force that you exert on the machine

Output force- (aka resistance force) is the force exerted by the machine

Multiplying Force- input force is applied over a greater distance

ex) _____

Multiplying Distance- output force is less than input→ allows force to spread over a greater distance ex) _____

Changing Directions- advantage being pulling down is easier than lifting up

Ex) _____

Mechanical Advantage

-number of times a force exerted on a machine is multiplied by the machine.

Mechanical Advantage = _____

If a machine multiplies force the MA _____ 1

If a machine multiplies distance MA ____ 1

If a machine changes direction MA _____ 1

Efficiency of Machines – compares output force to input force

- Ideal situation output force = input force
- Real life output force is always less than input → because of _____

$$\text{Efficiency} = \frac{\text{Work}_{\text{out}}}{\text{Work}_{\text{in}}} \times 100\%$$

*The higher the percent the more the efficiency!

You do 1,500 J of work using a hammer. The hammer does 825 J of work on the nail. What is the efficiency of the hammer?

Given	Work

You put 250,000 J of work into a rusty lawn mower that only does 100,000 J of work on the grass. What is the efficiency of the lawn mower?

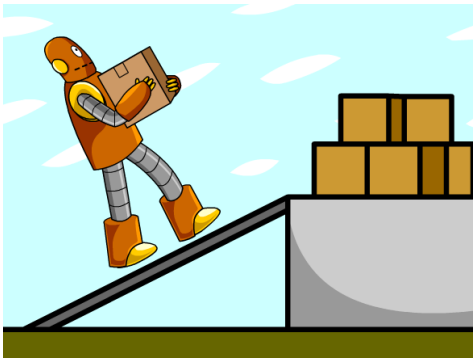
Given	Work

What is the difference between Actual Mechanical Advantage and Ideal Mechanical Advantage?

Simple Machines

6 basic kinds: inclined plane, wedge, screw, lever, wheel & axle, and pulley

Inclined Plane- flat slanted surface



Ideal MA = _____

allows you to: _____

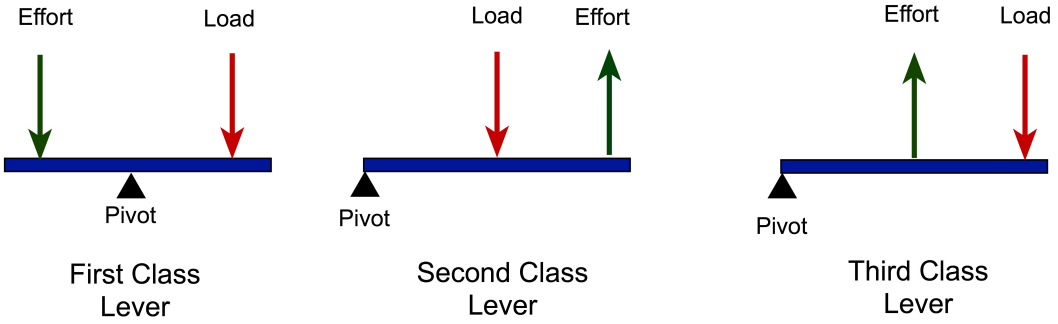
Wedge- inclined plane that moves

Screw- inclined plane wrapped around a cylinder

- input force over a larger distance
- closer together the threads the greater the MA

Lever- rigid bar that is free to pivot of rotate about a fixed point called a *fulcrum*

3 Types of Levers

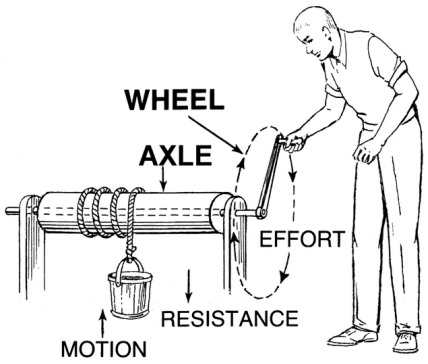


Ideal MA of Lever = _____

Wheel and Axle- two circular or cylindrical objects that are fastened together and rotate about a common axis.

Ex) Screw driver- handle is wheel, shaft is the axle

-multiples the force by exerting your input over a longer distance



Pulley- grooved wheel with a cord wrapped around it

-Changes the direction and can change the input force

-Ideal MA = to the number of sections of the rope that support the object