N
R
G!

You Can’t See Energy

- But you can see energy as it changes from one form into another.

Work & Power

Work

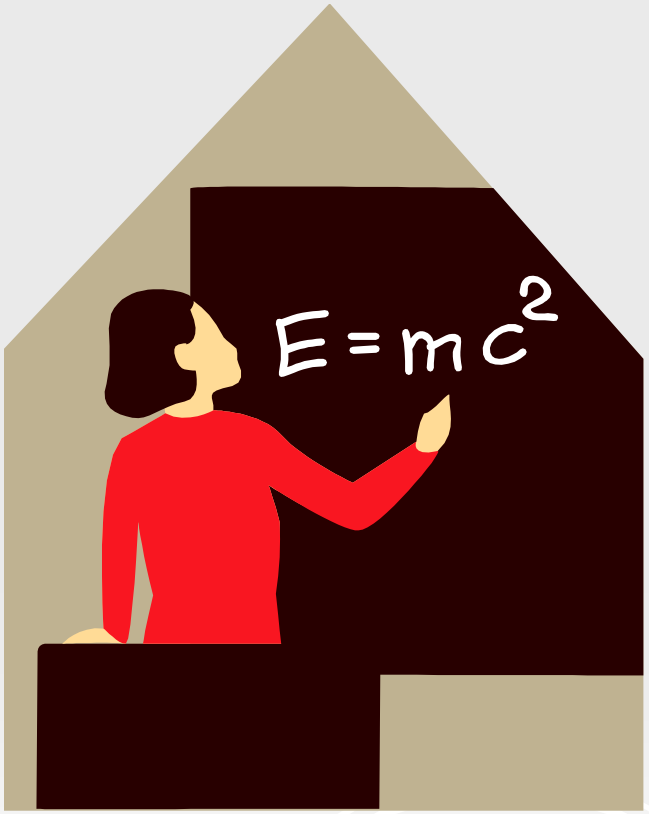
- All of these people are doing work on some object….

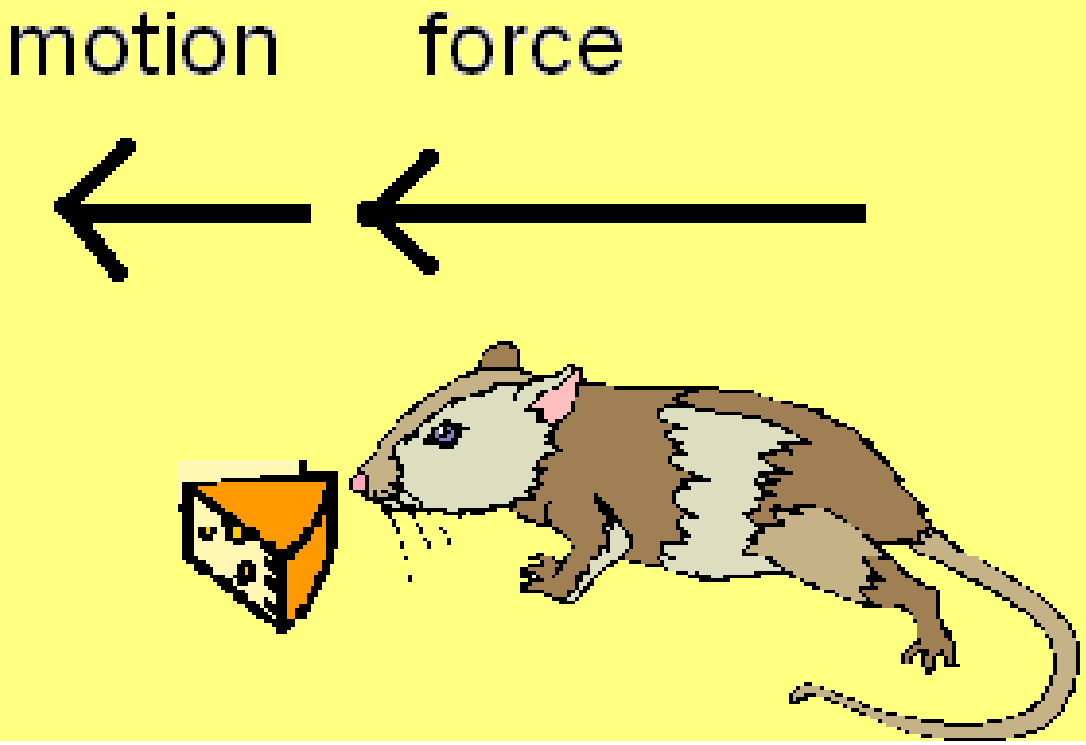
What is work?

- In science, the word work has a different meaning than you may be familiar with.
- The scientific definition of work is: using a force to move an object a distance (when both the force and the motion of the object are in the same plane of motion.)
- Work changes the energy of an object.

Work or Not?

- According to the scientific definition, what is work and what is not?
  - a teacher lecturing to her class
  - a mouse pushing a piece of cheese with its nose across the floor





The mouse is using a force to move the cheese a distance; both the force and motion are in the same direction.

What's work?

- A scientist delivers a speech to an audience of his peers.
- A body builder lifts 350 pounds above his head.
- A mother carries her baby from room to room.
- A father pushes a baby in a carriage.
- A woman carries a 20 kg grocery bag to her car?

What's work?

- A scientist delivers a speech to an audience of his peers. No
- A body builder lifts 350 pounds above his head. Yes
- A mother carries her baby from room to room. No
- A father pushes a baby in a carriage. Yes
- A woman carries a 20 km grocery bag to her car? No

Formula for work

Work = Force x Distance

- The unit of force is newtons
- The unit of distance is meters
- The unit of work is newton-meters
- One newton-meter is equal to one joule
- So, the unit of work is a **joule**

W=FD

Work = Force x Distance

Calculate: If a man pushes a concrete block 10 meters with a force of 20 N, how much work has he done?

W=FD

Work = Force x Distance

Calculate: If a man pushes a concrete block 10 meters with a force of 20 N, how much work has he done? 200 joules

(W = 20N x 10m)

Power

- Power is the rate at which work is done.
- Power = Work*/Time

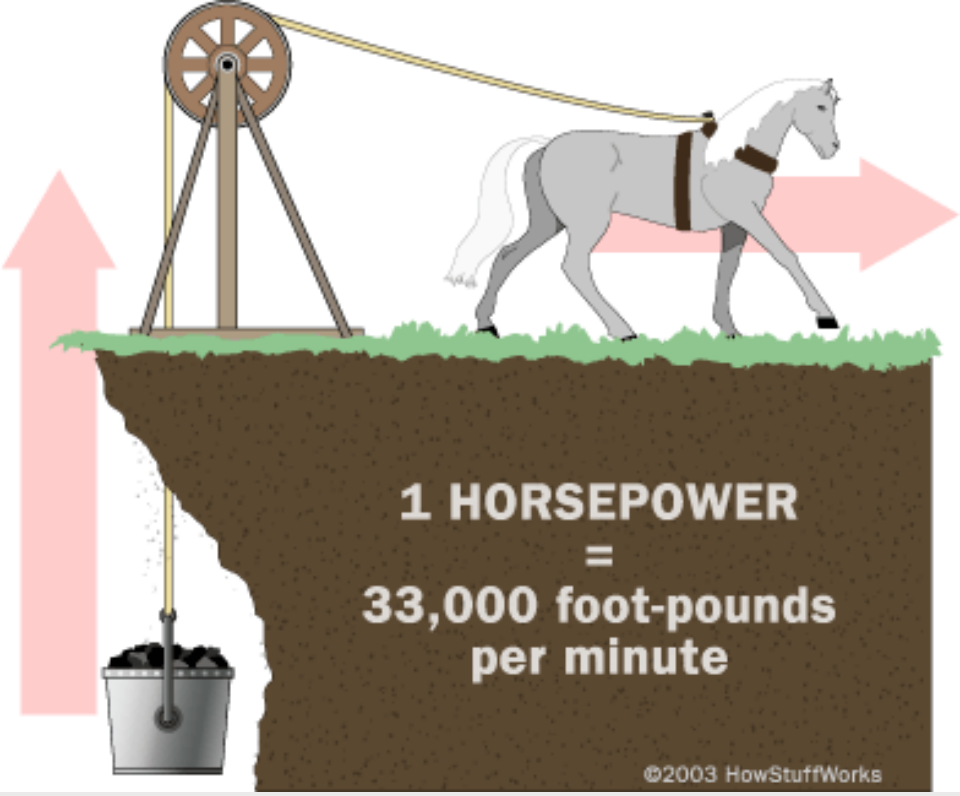
  *(force x distance)
- The unit of power is the watt.

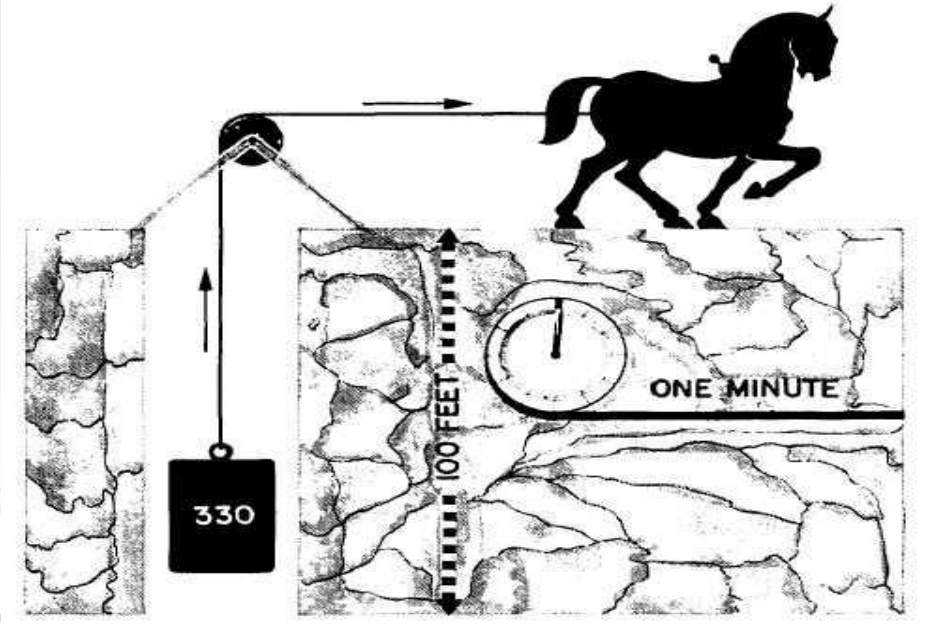
Power

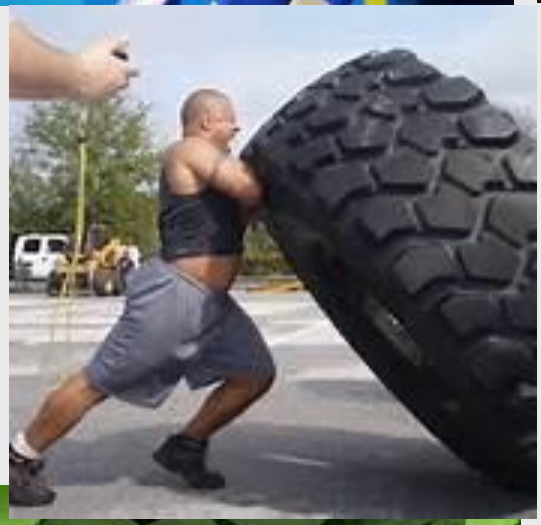
- Power is the rate at which work is done.
- Power is work over time…
- P = W/t
- Units for Power: Watts = Joules/second
- The faster you do work, the more powerful you are!! Light bulbs rated at 100 Watts are able to convert electrical energy into light (& heat) energy twice as fast as a 50 Watt light bulb.
- Horsepower: 746 Watts = 1 Horsepower

POWER!

- Average Power P_{avg} is the average rate at which work W is done; it is work over time…
- Get it… *work over time*…
- P_{avg} = Work / time = W / t
- Units: J/s = Watts
- Can also think of Power as the rate at which energy is changing…
- P_{avg}= change in energy / time
- 1 horsepower = 745.7 Watts








HABITS
OF
HIGHLY
EFFECTIVE
PEOPLE


The only thing
that overcomes
hard luck is
hard work.
Harry Golden
marketingartfully.com

Check for Understanding

1.Two physics students, Ben and Bonnie, are in the weightlifting room. Bonnie lifts the 50 kg barbell over her head (approximately .60 m) 10 times in one minute; Ben lifts the 50 kg barbell the same distance over his head 10 times in 10 seconds.

Which student does the most work?

Which student delivers the most power?

Explain your answers.

Ben and Bonnie do the same amount of work; they apply the same force to lift the same barbell the same distance above their heads.

Yet, Ben is the most powerful since he does the same work in less time.

Power and time are inversely proportional.

2. How much power will it take to move a 10 kg mass at an acceleration of 2 m/s/s a distance of 10 meters in 5 seconds? This problem requires you to use the formulas for force, work, and power all in the correct order.

Force=Mass x Acceleration

Work=Force x Distance

Power = Work/Time

2. How much power will it take to move a 10 kg mass at an acceleration of 2 m/s/s a distance of 10 meters in 5 seconds? This problem requires you to use the formulas for force, work, and power all in the correct order.

Force=Mass x Acceleration

Force=10 x 2

Force=20 N

Work=Force x Distance

Work = 20 x 10

Work = 200 Joules

Power = Work/Time

Power = 200/5

Power = 40 watts