Motion

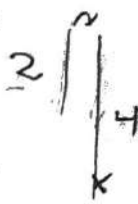
What is motion?

What is distance?

What is displacement?

For each of the situations, draw a picture of the situation and determine the distance and displacement.

- Walks 2 meters north and 4 meters south



distance = 2+4 = 6 m

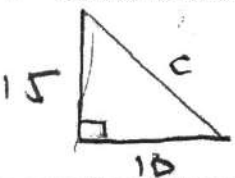
displacement = 4-2 = 2m

- Runs 5 times around a 400m track

distance = 400 × 5 = 2000 m

displacement = 0 m

- Drives 15 miles south and 10 miles east



distance = 15 + 10 = 25 miles

displacement ⇒ $a^2 + b^2 = c^2$ → $c^2 = 15^2 + 10^2$

$c = 18$ miles

Use equations for speed, velocity and acceleration for the following problems. They will be given to you for the test. Show your work and show your answer with units.

$$s = \frac{d}{t} \qquad t = \frac{d}{s} \qquad d = s \cdot t \qquad v = \frac{displacement}{time} \qquad a = \frac{V_f - V_i}{t}$$

Stephanie walked 5 miles over 2 hours. What is her speed?

$s = \frac{d}{t} = \frac{5 \text{ miles}}{2 \text{ hours}} = 2.5 \text{ miles/hour}$

Jason and Ziggy run at 8 miles per hour for 1.7 hours. How much distance did they travel?

$s = \frac{d}{t}$ (×1.7) $8 \text{ miles/hour} = \frac{d}{1.7 \text{ hours}}$ (×1.7) $d = 13.6$ miles

Ally walks at 15 mph over a distance of 20 miles. How long did she walk?

$s = \frac{d}{t}$ (×t) $15 \text{ mph} = \frac{20 \text{ miles}}{t}$ (×t)

$\frac{15t}{15} = \frac{20}{15}$ $t = 1.3$ hours

A dog runs 17 meters left and then 12 meters right in 10 seconds. What is his speed? What is his velocity? $s = \frac{d}{t} = \frac{(17+12)}{10} = \frac{29}{10} = 2.9\ m/s$

$v = \frac{\Delta x}{t} = \frac{|17-12|}{10} = \frac{5}{10} = 0.5\ m/s$ left

Annie walks 2 miles to a museum and 2 miles back in 50 minutes. What is her speed? Velocity?

$s = \frac{d}{t} = \frac{2+2}{50} = \frac{10}{50} = 0.2\ miles/min$

$v = \frac{\Delta x}{t} = \frac{0}{50} = 0$

A man accelerates from 5 to 25 m/s in 5 seconds. What is his acceleration?

$a = \frac{v_f - v_i}{t} = \frac{25-5}{5} = \frac{20}{5} = 4\ m/s^2$

Eli accelerates from 40 m/s to rest in 10 seconds. What is his acceleration?

$a = \frac{v_f - v_i}{t} = \frac{40-0}{10} = 4\ m/s^2$

Donna accelerations from rest to 60 m/s in 50 seconds. What is her acceleration?

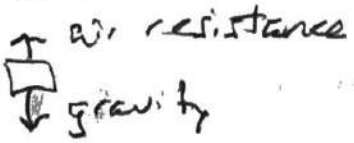
$a = \frac{v_f - v_i}{t} = \frac{60-0}{50} = \frac{60}{50} = 1.2\ m/s^2$

Forces and Newton's Laws

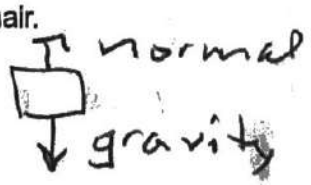
What are the Big 7 Forces?

Create a Free Body Diagram for the following situations

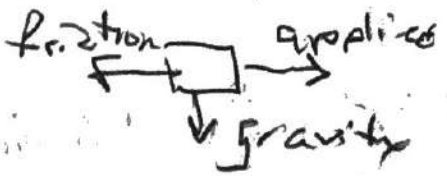
- A ball is dropped from a building.



- A student sits on a chair.

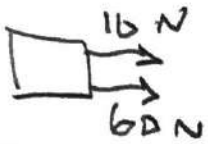


- A book is pushed across a desk. There is friction.



Create a Free Body Diagram for the following situations and find the net force.

- Two people are pushing a box, one exerts a force of 10 N and the other a force of 60 N.

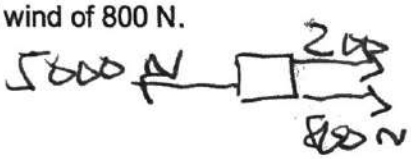


net = 70 N right

- A crane lifts boxes up with 600 N but the weight of the boxes is 400 N.

net = 200 N up

- A plane is flying with a force of 5000 N west but has opposing forces of air resistance of 200 N and wind of 800 N.



5000 - 200 - 800

4000 N West

Newton's First Law =

Newton's Second Law =

Newton's Third Law =

Solve the following using Newton's Second Law equation ~~F=m/a~~ F = ma

A baseball with a mass of 0.8 kg is given an acceleration of 20m/s^2. How much force was applied to the ball?

F = ma = 0.8 · 20 = 16 N

A golf ball hit with a force of 15 N travels with an acceleration of 25 m/s^2. What is the mass of the golf ball?

F = ma

$\frac{15}{25} = \frac{m(25)}{25}$

0.6 kg = m

A force of 1500 N is applied to a 1000 kg car. What is the acceleration of the car?

F = ma $\quad \frac{1500\ N}{1000} = \frac{1000\ kg}{1000}$ $\quad 1.5\ m/s^2 = a$

Energy, Work & Power

Define the following:

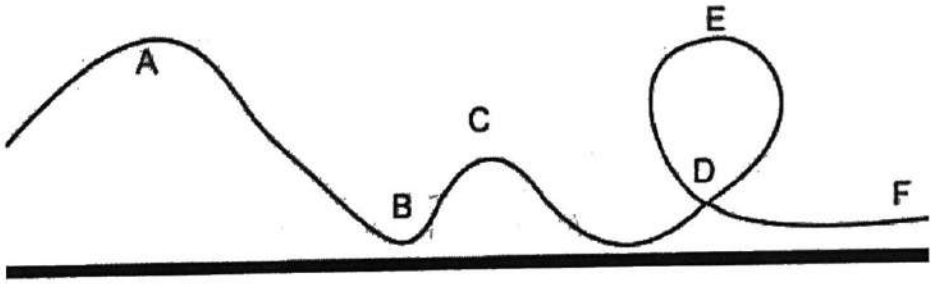
- Energy
- Kinetic Energy
- Potential Energy

What are the units for energy?

What are the equations for potential and kinetic energy?

Rank the potential energy from greatest to least. E A C D F B

Rank the kinetic energy from greatest to least. B F D C A E



Complete the following problems using the kinetic and potential energy equations:

1. You serve a volleyball with a mass of 5.8 kg. The ball leaves your hand with a speed of 15 m/s. Calculate the kinetic energy of the ball.

$KE = \frac{1}{2}mv^2 = \frac{1}{2}(5.8)(15)^2 = 652.5$ J

2. A baby carriage is sitting at the top of a hill that is 30 m high. The carriage with the baby has a mass of 25 kg. Calculate the potential energy of the carriage.

$PE = mgh = (25)(9.8)(30) = 7350$ J

3. A car is traveling with a velocity of 35 m/s and has a mass of 1500 kg. The car has kinetic energy. Calculate it.

$KE = \frac{1}{2}mv^2 = \frac{1}{2}(1500)(35) = 26250$ J

4. A cinder block is sitting on a platform 50 m high. It has a mass of 40 kg. Calculate the potential energy.

$PE = mgh = (40)(9.8)(50) = 19600$ J

Define Work. What is the formula for work? What are the units for work?

Define Power. What is the formula for power? What are the units for power?

Complete the following problems using the equations for work and power.

1. Two friends who have the same weight climb up a flight of stairs. Which one does the most work?

   both do the same

2. Friend 1 walks up the stairs in 20 seconds and Friend 2 walks up the stairs in 30 seconds. Which friend has the most power?

   Friend 1

3. If I push on the wall, am I doing any work? Power? Why or why not?

   no wall is not moving

4. A 49 newton rock is lifted 2 meters in 5 seconds. How much work is done? What power is used? $W = Fd = 49 \cdot 2 = 98$ J

   $P = \frac{W}{t} = \frac{98}{5} = 19.6$ watts

5. A teacher pushed a 98 newton desk across a floor for a distance of 5 meters in 4 seconds. How much work was done? What was his power?

   $W = Fd = 98 \cdot 5 = 490$ J

   $P = \frac{W}{t} = \frac{490}{4} = 122.5$ watts

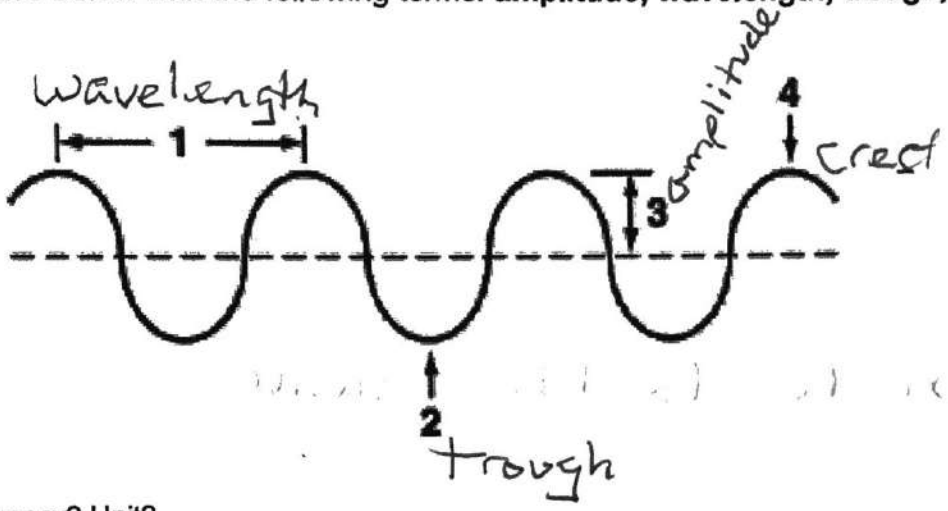
6. A student who weighs 500 newtons climbed the stairs from the first floor to the third floor, 15 meters above, in 20 seconds. How much work did she do? What was her power? $W = F \cdot d = 500 \cdot 15 = 7500\,J$

$P = \frac{7500}{20} = 375$ watts

Waves, Sound and Light

What are the 2 types of waves? Give an example of each.

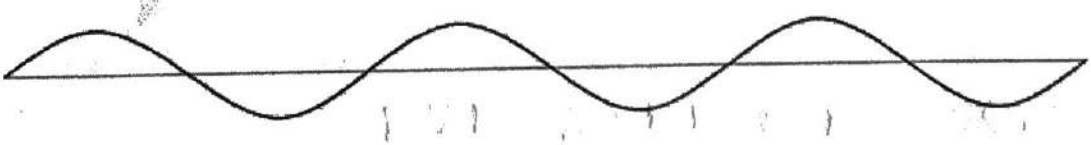
Label the wave below with the following terms: **amplitude, wavelength, trough, crest.**



What is frequency? Unit?

What is the formula for wave speed?

The wave below moves across the page in 1 second. Use a ruler to measure the following parts of the wave in centimeters. Make sure you use **units** in your answers.



Wavelength: _____

Amplitude: _____

Frequency: _____

Wave speed: _____

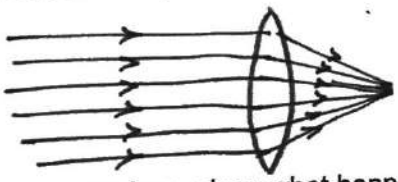
Define the following:

- Reflection – The process where light bounces off a surface depending on the angle is called reflection.
- Refraction – The process where light travels from one medium to another it bends. (changes direction.)
- Transparent – The material that allows all of the light to pass through.
- Translucent – Some light goes through the material
- Opaque – When No light passes through the material

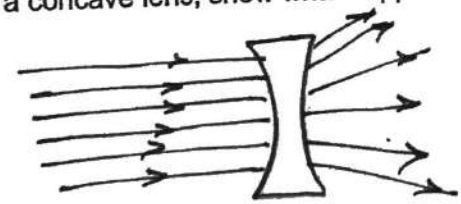
Label the following as transparent, translucent, or opaque

- Frosted Window – translusant
- Mirror – opaque (No light passes through.)
- Window – transparent
- Book – opaque
- Water – transparent

Draw a convex lens, show what happens to light when it passes through the lens

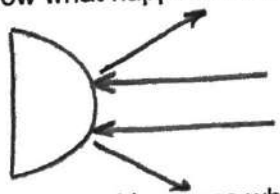


Draw a concave lens, show what happens to light when it passes through the lens



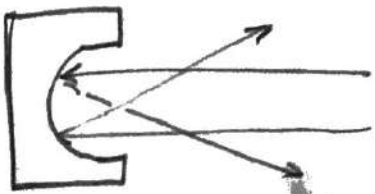
Draw a convex mirror, show what happens when light bounces off it

Convex Mirror



Draw a concave mirror, show what happens when light bounces off it

CONCAVE Mirror



Light rays are reflected inwards when light bounces off it.

Review your notes for electricity and circuits.