IPS Unit 2.1- Inertia Name: Michael Plasmeier

WHAT DO YOU THINK?

- How do figure skaters keep moving across the ice at high speeds for long time while seldom pumping their skates?

there is not much friction with a small blade on ice. the inerta carrees forward with not much to stop it.

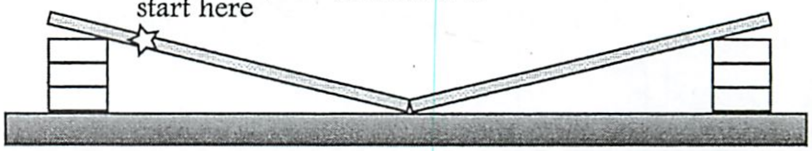
- When a cannon ball is fired, the blast starts the cannonball moving, is there a force necessary to keep it sailing through the air?

No, and there is no way to make it go faster once in the air. Inero carries it foward. I don't think that is a force inerta is a property that keeps it moving

FOR YOU TO DO

1. You (or your teacher if done as a demonstration) will set up a track as shown. You will place a cart at the starting point on the track, release the car let it roll down the hill and up the other side, stopping it when it reaches it's highest position. You will measure the **vertical height** that it starts at and the vertical height at which it ends. Track one (this track) has equal slopes on each side. Place the cart at the starting point, measure the height and record that number as the "Start Height" in the table below. Release the cart. Stop the cart at its highest point on the upward slope and measure the height. Record that height as the "End Height" in the table below. Now calculate the ration of "Ending Height" to "Starting Height" by dividing the "Ending Height" by the "Starting Height" . Record that number in the table below.

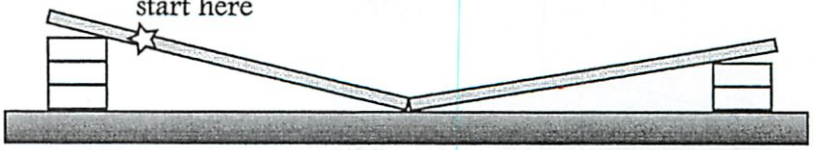
Track #1



We used long tracks = more fiction

	Start Height	End Height	$\frac{\text{Ending Height}}{\text{Starting Height}}$
Track #1	13 cm	10 cm	.769 cm cm

Track #2



2. Track #2 is slightly different from track #1. Track #2's left side is exactly the same and the cart will start from the same height, but the right side of track #2 is not as steep, notice there are only two blocks, as opposed to three). Before you release the cart on track #2 make a prediction of how high up (vertical height) the cart will get to on the right side of the track, the "End Height". (The "Start Height" will be exactly the same- enter that number on the table

below.) Enter your prediction for the "End Height" on the chart below. Calculate the ratio of "End Height" to "Start Height".

Is your number similar or different to the ration you calculated in the previous table?

Now let's do it. Measure as you did earlier. Record your data in the appropriate places in the table below.

	Start Height	End Height	$\frac{\text{Ending Height}}{\text{Starting Height}}$
Prediction for Track #2	13cm	7cm	.538cm
Actual For Track #2	13cm	10cm	.769

Over shot track

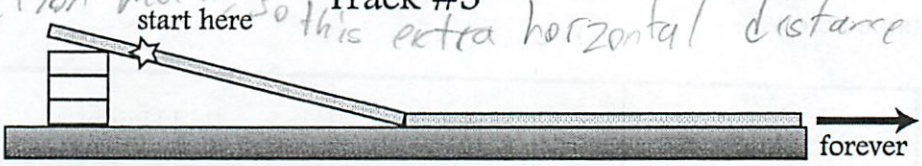
3. a) How well did you guess the position? Why do you think your guess was "on" or "off"?

I thought it would go lower, it stayed the same. I was "off"

b) Did the ratio of "$\frac{EndHeight}{StartHeight}$" change from track 1 to track 2? Why do you think this is so?

No. It still traveld the same vertical distance, even if it traveld a different vertical distance. The carts are not affected by friction much so this extra horzontal distance is different.

Track #3



4. Imagine what would happen if you again rolled a car down a ramp. The left side stays the same, just like in track #2, but the right side is horizontal, as seen in the picture.

a) If the horizontal track went on forever, how far would the car roll?

It would theretically go on forever, but friction + air restance would stop it

b) When rolling on the horizontal track, what keeps the car rolling?

Just it inerta. The car wants to remain in motion till something acts against it.

5. Read "For You To Read" and "Physics Talk" on pages 58 and 59.

J

Not a force

Not makes, Inertia is not a force, it just is a word that explains why an object keeps in a constant speed in motion

6. Watch the short video "Inertia".

✓

7. In your own words write what inertia is, with examples.

The property that explains why an object stays in a constant speed or stays still in a straight line path till another force acts upon it.

in relasion to something (remember: motion is relative)

His words

The property of all matter which causes it to resist acceleration.

9. Your teacher will do several examples that demonstrate inertia. For each example fill in the table below.

Name of Example	Is the object at rest or in motion?	How does this demonstrate inertia?
Penny over cup 	At rest	The card stops the penny from falling, when it is quickly remould, the penny doesn't have time to go with it & falls w/ gravity
Ball down ramp 	In motion	The ball rolls down the incline, one it reaces the flat part it is still going quickly. and will roll forever
Pendulum	In Motion	The pendulum moves back and forth, when you add more weight it continues to move longer

The more mass, the more it resists change.

mass - Def #2 - A measure of the amount of inerta an object will experence -

10. Come up with an example that demonstrates inertia. Describe that example here.

Birds or Ice skater who push then glides. There is little friction, so they stay at near constant speed and can travel a great distance

Reflecting on the Activity

Skater - Correct the skater moves with inerta. There is not much friction to slow it down

Cannon - Correct

Physics To Go (p.60 #1-#6)

See Back

1, A ball hit from a baseball bat continues in motion till a catcher catches it.

A golf ball stays on a golf tee till hit

A Bolling ball stays in a straight line till it hits the pins. The ally is waxed to reduce friction

2. Curling shows friction and inerta because the heavy stone slides along the ice. The person must guess where the stone will go in order to get it in the circle. The broom roughs the ice to increase friction

3, They would go in a straight line forever. However if they are leaning to one side and friction will slow them down

4. The puch will travel in a straight line at a constant speed before something hits it. However friction defeats th

5. A slide stops you and you can't run anymo

A slide will take longer then running and is done to avoid a tag.

6, Magnetic levetation trains have no friction, the power + asstance is needed to levatate them. So in the real word, no, not possible.

//

Michael Plasmeier
Brown
IPS 9H
20 Dec 2005

Chap 4 Blue Book
Review Questions
Newtons 1st Law (Inerta)

12/20

Not caused by force

1. Natural motion occured as an object tried to reach its final resting place, a rock would drop and smoth would rise. Not caused by a force. Violent motion was forced motion, It had an external cause or force in order to move.

Detention

w/o friction = 0 friction

2. Copernicus was afraid to publish his ideas because he was afraid that he would get in trouble with the church because his ideas were very ratical and went againts the church's teachings and old ideas set up by Aristotle.

3 Friction slows down a moving object.

4. The ball will (if there is absolutely 0 friction) will continue straight at a constant speed forever

5. When a ball goes down one incline and up another (with out friction) it will go up to exactly the same hight from the point which it was released.

7. You have to keep pedeling a bike because of friction and to gain speed after you stop

6. The law of inertia aplies to objects in rest and in motion. Dishes don't move when you pull the tablecloth out from under them. The forces isn't great enough to move it.

8. No, once a canonball is launched in space nothing is needed ([illegible]) ~~do~~ to keep it moving at a constant speed

9. A 2kg rock does have twice the inertia, mass and weight (if weighed in the same location) as a 1-kg rock

10. A liter of molton lead will have the same volume (1L) as 1L apple juice but not the same weight, unless weighed in different locations. I was almost tricked-the problem as a volume not mass measurement

different mass

11. Physicists say that mass is more fundemental (or basic) then weight because it is the same everywh Weight changes based on location and the amount of force put out by an object.

12. An elephant would bump into you harde (w/ more force?) then a mouse in gravity free space. This is because the elephant is more massive. If you were to lift them, they would both weigh the same (0~~kg~~)N

not kg-measure of mass but N measure of weigh

The elephant has more mass

9.8×2

13. 2kg of yoger weighs 19.6 N on Earth.

$F_g = (2\,kg)(9.8\,m/s^2) = 19.6\,\frac{kg \times m}{s^2} = 19.6\,N$

FORCE AND ACCELERATION

Name Michael Plamier

A force is a push or a pull. To calculate force, we use the following formula,

$F = ma$ where F = force in newtons
m = mass in kg
a = acceleration in m/sec^2

Example: With what force will a rubber ball ~~hit~~ be pulled to the ground if it has a mass of 0.25 kg?

Answer: $F = (0.25 \text{ kg})(9.8 \text{ m/s}^2)$ Where is it thrown from- How long does it fall
$F = 2.45 \text{ N}$

F
m | a

Solve the following problems. Find what they want

1. With what force will a car hit a tree if the car has a mass of 3,000 kg and it is accelerating at a rate of 2 m/s^2?

F=ma
F = 3000 kg × 2 m/s^2

Answer: 6000N

2. A 10 kg bowling ball would require what force to accelerate it down an alleyway at a rate of 3 m/s^2?

F=ma
F=10kg × 3 m/s^2 = 30 $\frac{\text{kg}\cdot\text{m}}{\text{s}}$

Answer: 30 N

3. What is the mass of a falling rock if it hits the ground with a force of 147 newtons? weight is 147N

F = ma
147N = m(9.8 m/s^2)
147N / 9.8 m/s^2 = m

Answer: 15 kg

4. What is the acceleration of a softball if it has a mass of 0.50 kg and hits the catcher's glove with a force of 25 newtons?

F=ma
25N = .5kg a
a = F/M
a = 25N/.5kg

Answer: 50 m/s^2

5. What is the mass of a truck if it is accelerating at a rate of 5 m/s^2 ~~and~~ when hits a parked car with a force of 14,000 newtons?

14000N = m(5 m/s^2)
m = F/a
m = 14000N / 5 m/s^2

Answer: 2800 kg

FORCE DIAGRAMS

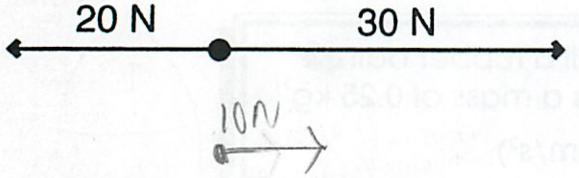
Name Michael Plasmeier

Find the resultant force in each of the following diagrams and draw the resultant vector. Use a ruler and a protractor where necessary. Scale: ~~1 cm = 10 N~~, where N represents newtons of force.

Copy Error

1.5cm = 10N

1.



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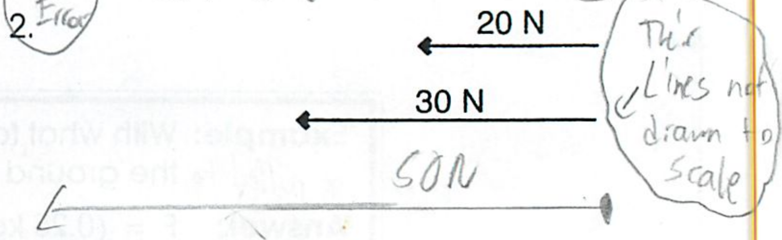

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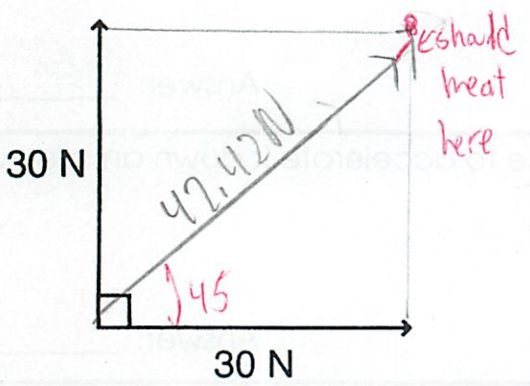

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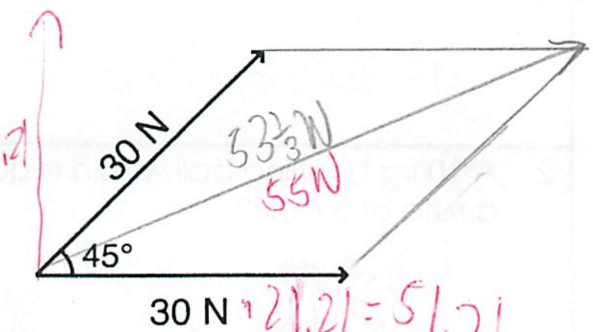


30 N + 21.21 = 51.21

Math way

$a^2 + a^2 = 30^2$

$2a^2 = 900$

$a^2 = 450$

$a = 21.21$

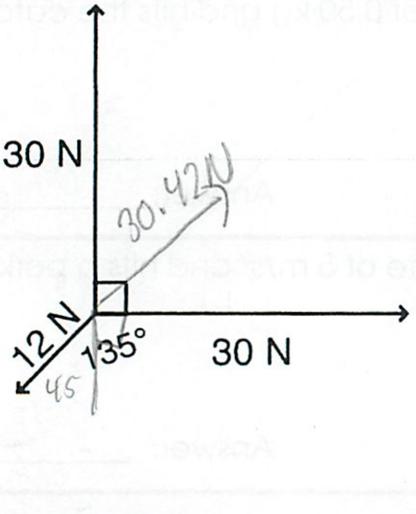
$\sqrt{(21.21^2 + 51.21^2)}$

55.428N

rounding error

Approx draw to scale

5.



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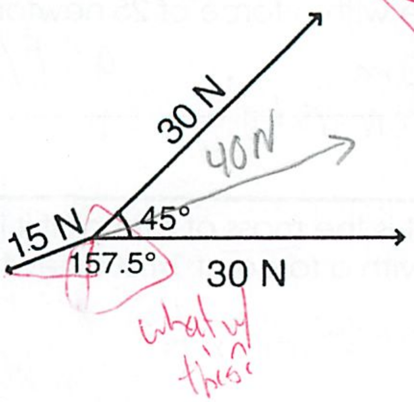


what is this?

After Break Review

1/3

1. What is inertia?

The property of matter that it will continue is a straight line forever untill another force acts upon it.

2. Neton's 1st law: Bacially Above (law or inerta)

3. A force is whatever change the path or speed of an object a push or a pull

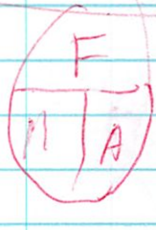
4. Mass = How much "stuff" (matter, atoms etc) is in an obeect.

5. How does mass relates to inerta? The more mass an object has the more force and work is needed to change it's path or speed

Weight is not a force

weight = force of gravity

$W = F_g$



$\boxed{F = M \times A}$

weight of tape

$\text{Mass} = \frac{F_g}{g} = \frac{.1N}{9.8 m/s^2} = m = .01 kg$

mass of tape

Pasco Carr $m = \frac{F_g}{g} = \frac{2N}{10 m/s^2} = .2 kg$ mass

Newtons 2nd Law -

The accleration of an object is directly proportion to the Net Force which causes the object to acc accelorate

Michael Plasmeier
Brown
IPS 1H
3 Jan 2005

Physics to Go
2.2

p 66+67

1/5

1.

Law =	F =	Objects' mass	× a
Sprinter starting 100 m dash	$350 (kg) m/s^2$ 350 N	70kg	$5 m/s^2$ acc of runner
Long jumber in flight	800N	80kg	$10 m/s^2$ gravity
Shot put ball	70N	7kg	gravity $10 m/s^2$
Ski Jumper	400N	80kg	skiing slowly $5 m/s^2$
Hokey player	-1500N	100kg	stoping quickly $15 m/s^2$
Player being talked	-3000N	100kg	$-30 m/s$ Stoping very quickly

2. a) The long jumper + Shot put ball both have an acceleration of $10 m/s^2$. This is not a concindince with g - both long jumper + ball are projecties in flight

b) Negitive acceleration happens as a speed is decreasing, so the player's speed is decreacing

c) It depends who you talk about - If you talk about the running back he is slowing down. The unbalance motion againts his own forward motion is greater. So he slows down. When he hits the ground, the friction also pushes againts his forward motion

d) See above for partial explanation - As the sprinter starts to run, inertia wants to keep him still. He needs more acceleration to have him move at his desired speed. He needs to exert a force

Remember g must be kg for kg/m/s/s or N

3. $42N = (.3kg)a$ $a = 140 m/s/s$

4. $F = (.04kg)(20m/s/s) = .8N$-Net Force

5a. A base ball has less mass theirfore less inertia and bangs into you w/ less force

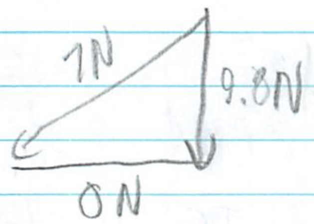
b) A baseball has less mass, (and when flying at the same speed, the same deceleration as it hits you) So, theirfore with $F=ma$, the force will be greater with a bowling ball.

6. $W=mg$ $W = .1kg(9.8m/s^2) = .98N$ or round to 1N
Name = A Newton

7. Some person's weight = 100 lbs × 4.38 = 438N

$438N = m(9.8 m/s^2)$
$m = 44.69 kg$

8. Because vector additons of forces



9. The net force is = when both sides don't go anywhere
To win one side must pull harder then the other

10. No, once you aren't touching it, forget it

Car Sim
Net Force

1/9

2.5N

Weight of Pasco Car + 1000 g

Find acceloration

run 1 -

Speed	time
0m/s -	.5sec
.675m/s -	1.8sec

$$a = \frac{(.675-0)}{1.4} = .4821 \text{ m/s/s}$$

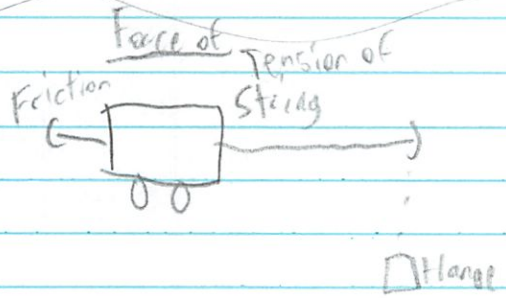
tl's answer (other data points) .452 m/s/s

m = 1.25kg
ass car

Fnet = ma = (1.25kg)(.4821m/s/s)

Fnet = .602625N

weight of hanger = 200g ; 2kg = 1.96N



Tension of string is less then weight of hanger

IPS Unit 2.2 Newton's Second Law Name: Michael Plasnea

25/25

WHAT DO YOU THINK?

- What is a force?

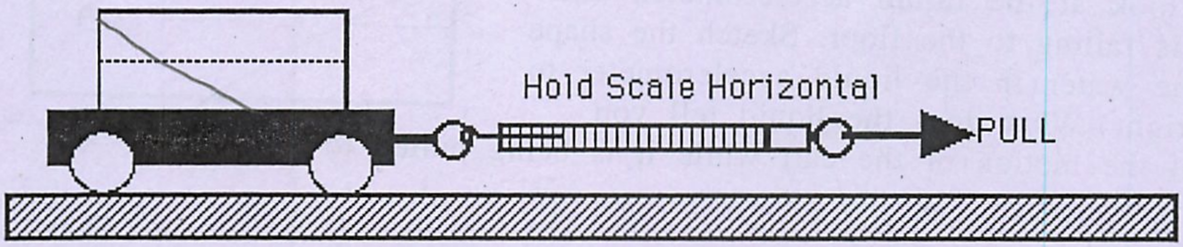
a push or a pull or something that changes the path or speed (inerta) of an object

- Can the same force move a bowling ball and a ping pong ball?

Yes, but at different accelerations so the ping pong ball would move faster

FOR YOU TO DO

1. Place the liquid accelerometer on top of a cart. Tie a string to the cart so that you can pull the cart horizontally across your desk or the floor with a scale as shown below.



Make sure that the scale and string are always horizontal and practice pulling a few times trying to keep the force as indicated on the scale constant (say 1 N). That is the scale should read 1 N the whole time that you are pulling on the cart!!

a) Pull the cart with a constant force of one newton (1 N). What happens to the <u>liquid accelerometer</u>?

The water moves away from where I am pulling

Color in the position of the liquid on the drawing shown above.

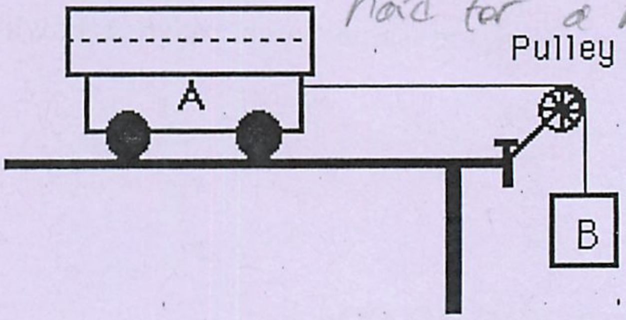
What does this tell you about the motion of the cart? How do you know?

It is accelerating because the water is moving away from the force

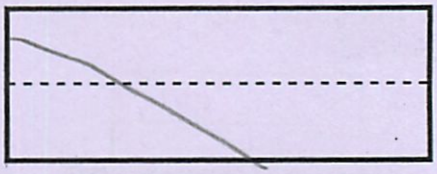
So by now you may be a little frustrated. Why do you think it is so hard to pull on the scale so that it reads 1 N all the time?

If you see F=ma, the force must always be 1N. That means the mass and accelerating must be constant or change in propertion. Because the mass does not change you must have constant acceleration. That is hard for a human to do.

2. So let's try again. We can use gravity to help us out. Get a pulley and clamp and set up a system like the one shown at the right.



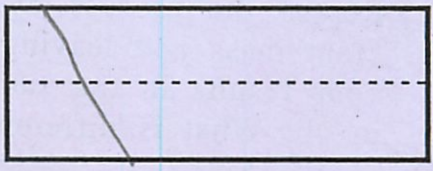
a) By placing masses at "B" we can let gravity acting on the mass pull the cart system to the right. A mass of 100 grams will apply a force of about 1 N to the cart system. **Note:** the hanger's mass is 50 grams so you have to add a 50-gram mass to the hanger to make a total mass of 100 grams. Pull the cart back until "B" is just below the pulley. Release the cart and look at the liquid accelerometer while "B" is falling to the floor. Sketch the shape of the water in the liquid accelerometer to the right. What does the liquid tell you about the motion of the cart while it is being pulled to the right?


→ moving

more acceleration

b) Repeat the process by pulling the cart with a constant force of 2 N by placing a total mass of 200 grams at "B." Sketch the shape of the water in the liquid accelerometer to the right. How is it different from what you observed in "a" when the force was 1 N? What does the liquid tell you about the motion of the cart while it is being pulled to the right in this case?

c) Repeat the whole process by pulling the cart with a constant force of 3 N, Which means the total mass of "B", will be approximately 300 grams. Sketch the shape of the water in the liquid accelerometer to the right. How is it different from what you observed in "b" when the force was 2 N?



even more acceleoration, higher water.

3. Based on your observations, complete the statement: *"The greater the constant, unbalanced force pulling on the cart, the......"* more the car will acceleorate

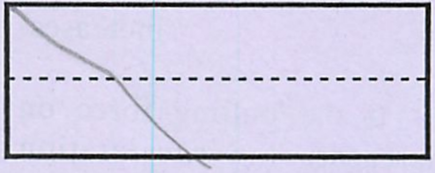
In other words how does the size of the constant, unbalance force affect the motion of an object?

The greater the force is unbalanced, either the mass or acceleoration will be different.

the greater the acceleration

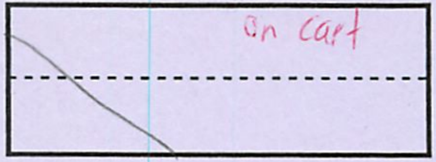
4. Repeat step 2b using the same amount of constant force, 2 N, to pull the cart of greater and greater mass.

a) This is the same one you did in 2b. You should redo it so that the level of the liquid is fresh in your mind. Start off with the cart by itself and a constant force of 2 N (mass of B is 200 grams). Sketch the shape of the water in the liquid accelerometer to the right. What does the liquid tell you about the motion of the cart while it is being pulled to the right?



↓ less acceleoration greater mass on cart

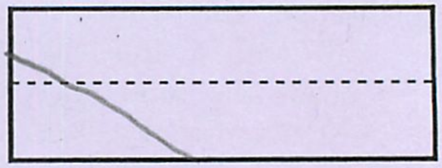
b) Add a 500-gram mass to your cart and leave "B" alone so that the force is still 2 N. Sketch the shape of the water in the liquid accelerometer. How is it different that what you observed in 4a? What does the liquid tell you about the motion of the cart?



the unbalanced net force becomes less

less acceleoration

c) Repeat the process by adding another 500-gram mass and leaving "B" alone. Record your results in the same manner as you did in 4b. What is different from 4b?



it will not speed up as fast

5. Based on your observations, complete the statement: *"If the force acting on the cart is kept constant, when mass is added to the cart, the cart ...."*

the acceleoration will decrease to keep the force Constent

In other words if the same force is used to pull the cart, how does increasing the mass of the cart affect the cart's motion?

It will accelerate slower

6. Let's review: If the pulling force on an object is increased, the acceleration of the object:

[✓ increases] decreases

7. If the pulling force on an object stays the same, but the mass of the object increases, the acceleration of the object:

increases [✓ decreases]

8. Read "PhysicsTalk" and "For You To Read" on pages 64 & 65 of your text.

REFLECTING ON THE ACTIVITY

I was correct.

PHYSICS TO GO (p. 66-67, #1-7, 10)

✓ Michael Plasmeier 1/11 Force causes acceleratio

IPS - Sports: Unit 2 – Unit 1.1 & 1.2 Problems
Analyzing the Forces on an object

What are the two possible motions of an object that obeys Newton's First Law? Without friction, an object can be either at rest or remain in costant motion forever

No acceleration

What do we know about the forces acting on an object that obeys Newton's First Law? They are normal?? All objects obey N's First Law

In questions #1-4 you are standing, facing forward on a bus. How do you have to brace yourself if the bus is...

1. at rest?

You don't have to brace yourself. The bus is at rest.

2. moving forward at a constant speed?

" " " " " " " " ② No change in the net force it is like

3. moving forward and speeding up?

You need to hold on or move backwards

4. moving forward and braking?

" " " " " " " forwards

In questions #5-8 you are standing, facing forward on a bus. You are holding a pen immediately to the right of your right shoulder. You drop the pen. Where will the object land if the bus is...

5. at rest?

At your feet

6. moving forward at a constant speed?

" " "

7. moving forward and speeding up?

Behind you

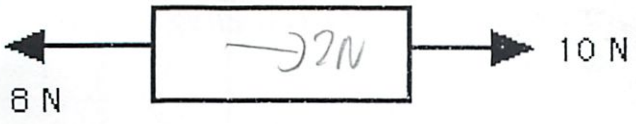
8. moving forward and braking?

Ahead of you

The distance from you depends on how much the bus is changing speed.

What is the unbalanced force on each of the blocks shown below?

9.



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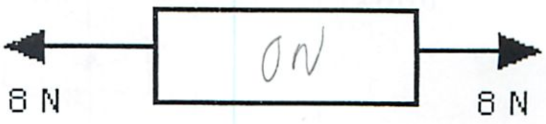
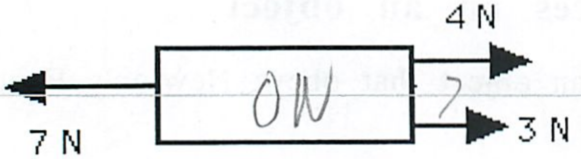
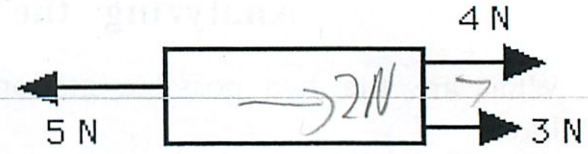


11.

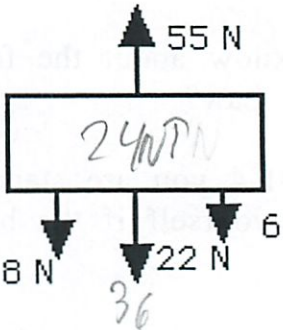


12.



13.

14.



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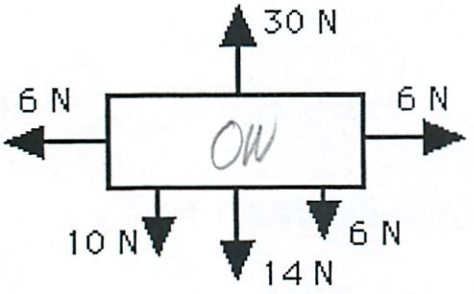
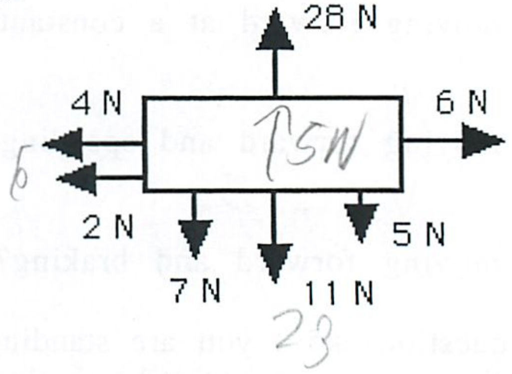
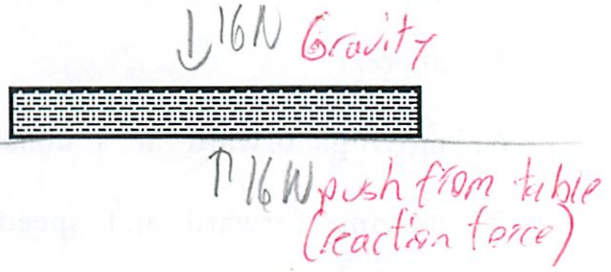


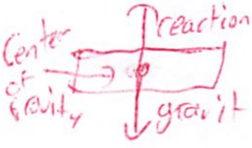
16.



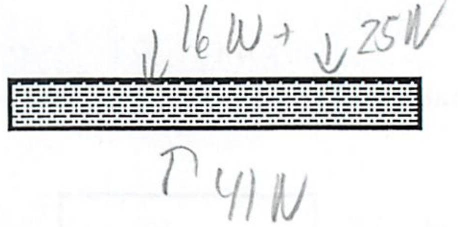
17. A book weighing 16 newtons sits on a table. On the drawing to the right draw and label the forces acting on the book.

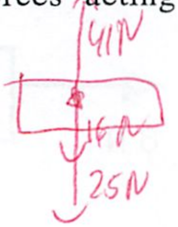


Draw like this:

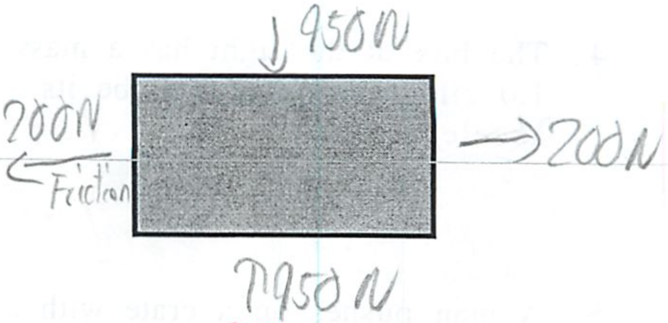


18. The same book shown in #17 above has a person pushing down on it with a force of 25 newtons. On the drawing to the right draw and label the forces acting on the book.

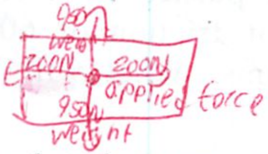




19. A large crate is being pushed to the right by a force of 200 newtons. The box weighs 950 newtons and moves at a constant speed.



Newton's Second Law of Motion



If there is an unbalanced force acting on an object, what happens to the object?

It ~~dosn't~~ moves

In what direction will the object accelerate?

It moves w/ the force

1. A student pushes on a 50 kilogram wagon so that is accelerates at 2.0 m/s^2. What force did the student apply to the wagon?

$F = ma$

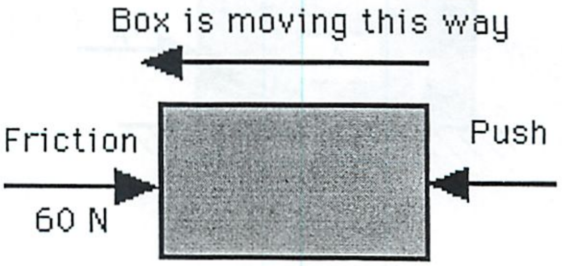
$F = 50 kg (2 m/s^2) = \boxed{100 N}$

2. A woman pushes on an 40 kilogram object with an unbalanced force of 20 newtons. What will be the acceleration of the object?

$\frac{20 N}{40 kg} = \frac{40 kg (a)}{40 kg} =$

$\boxed{.5 m/s^2}$

3. A man pushes on a crate in the direction shown. Friction acts on the crate to the right as shown. If the crate is already moving to the left, will it speed up, slow down, or stay at the same speed if the man pushes with a force of...

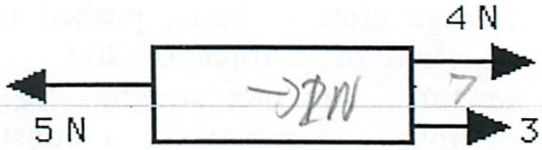


a) 60 N? stay the same

b) 50 N? slow down

c) 75 N? speed up

4. The box at the right has a mass of 1.0 kilogram. What will be its acceleration?



$F_{net} = ma$

$\frac{2N}{1kg} = \frac{1kg\ a}{1kg}$ $\boxed{a = 2 m/s^2}$

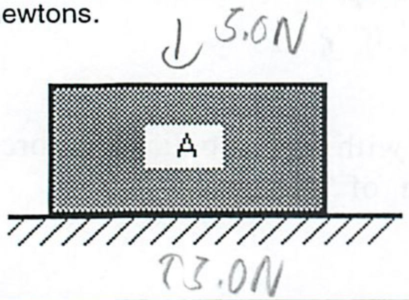
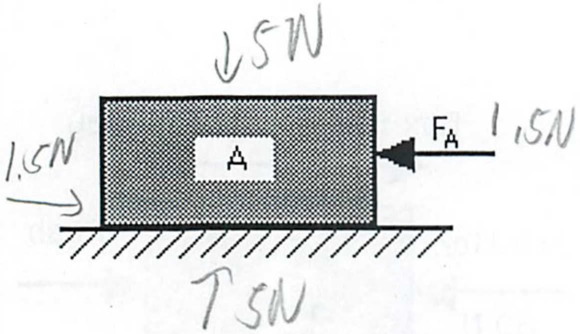
5. A man pushes on a crate with a force of 100 newtons East against a force of friction of 60 newtons. The crate has a mass of 100 kilograms. What will be the acceleration of the crate? 60N ← $\boxed{\rightarrow 40N}$ → 100n

$F_{net} = ma$

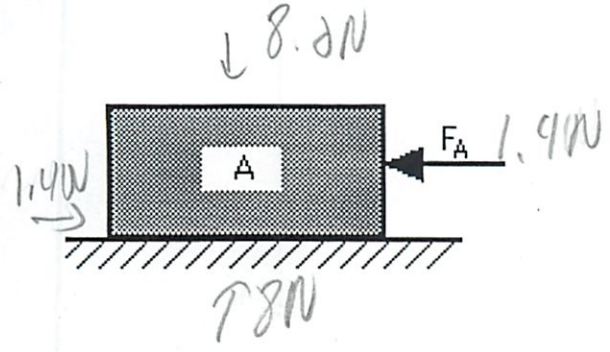
$\frac{40N}{100kg} = \frac{100 kg\ a}{100kg}$

$\boxed{.4 m/s^2 = a}$

By showing all the forces acting on the block, draw an arrow to show the direction of the force, identify the force, and indicate the magnitude of the force.

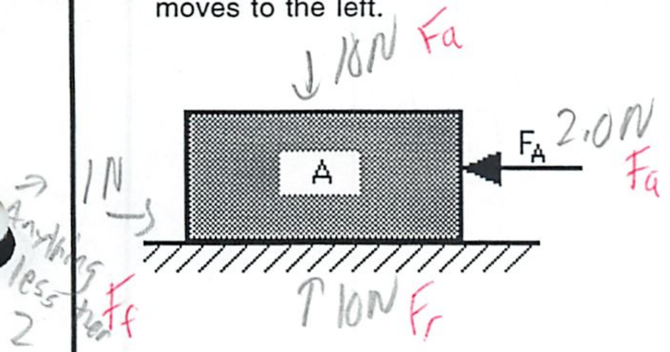
6. The force of gravity on block A is 5.0 newtons.  	Draw a picture of just Block A and show all the forces acting on the block.
7. The weight of block A is 5.0 newtons and the applied force (F_A) is 1.5 newtons. Block A is at rest.  	Draw a picture of just Block A and show all the forces acting on the block.

8. The weight of block A is 8.0 newtons and the applied force (F_A) is 1.4 newtons. Block A is moving to the left with a constant velocity.

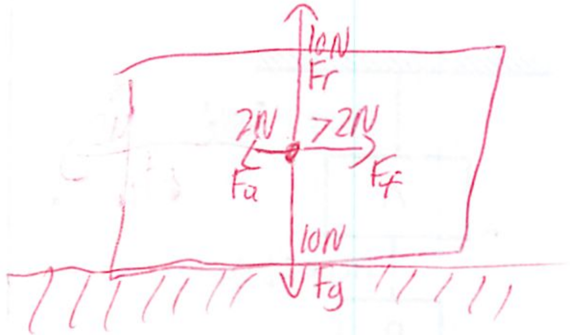


Draw a picture of just Block A and show all the forces acting on the block.

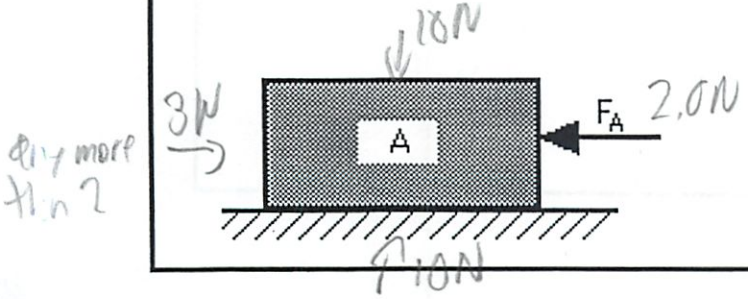
9. The weight of block A is 10.0 newtons and the applied force (F_A) is 2.0 newtons. Block A is speeding up as it moves to the left.



Draw a picture of just Block A and show all the forces acting on the block.

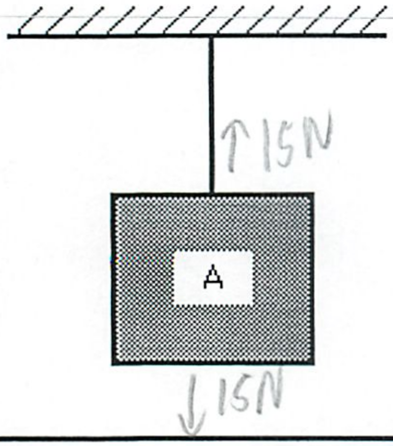


10. The weight of block A is 10.0 newtons and the applied force (F_A) is 2.0 newtons. Block A is slowing down as it moves to the left.



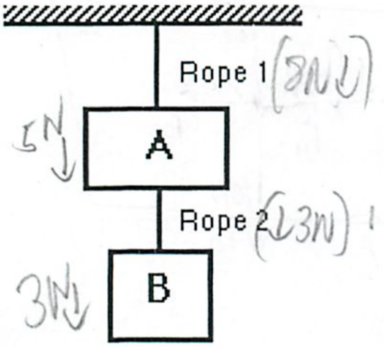
Draw a picture of just Block A and show all the forces acting on the block.

11. The weight of block A is 15.0 newtons and the system is static.

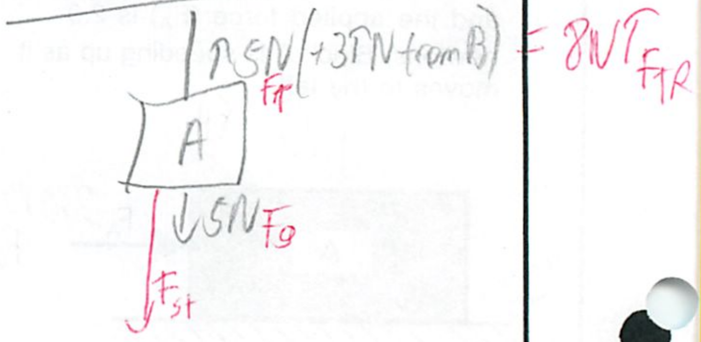


Draw a picture of just Block A and show all the forces acting on the block.

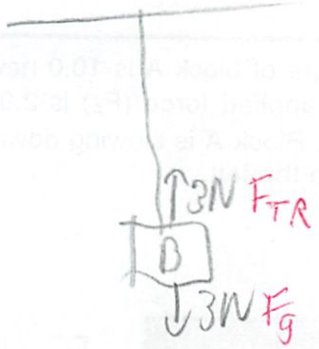
12. The weight of block A is 5.0 newtons, the weight of block B is 3.0 newtons, and the system is static. at rest



Draw a picture of just Block A and show all the forces acting on the block.



Draw a picture of just Block B and show all the forces acting on the block.



Newton's 3rd Law

: For every applied force, there is an equal and opposite reaction force

Another Force defenition: Force: something that causes an equal and opposite reaction (not a thing or property)

forces always occure in pairs

What do you know about

Motion

moving object
speed
velocity
acceleration
will contine till force acts
friction acts againts it
gravity can cause it
gravity acc = 9.8m/s/s

inertia
reletive
avr. speed $\frac{\text{distance}}{\text{time}}$
instantious speed
constant speed

Force

1/17

Net Force
causes acceleration
Newtons
none needed at constant speed
↑ w/ no friction
push or a pull
Something that causes something to move
$1N = 9.8kg \times m/s^2$
$N = kg(m/s^2)$

inertia
friction
causes change in motion
causes accelegation

Common Forces

1/20

Gravity	F_g
Friction	F_f
Tension	F_T
Applied	F_A
Reaction	F_R

Michael Plasmeier
Brown
IPS 9H
13 Jan 2006

Activity 2.5

White Book p81

✓

1/13

What do you think

If I would talk to someone who never jumped before. I would tell the person to bend their knees and aply alot of force quickly to the floor. Also once they left the ground they should not kick their feet. They can not get any higher once they leave the ground.

For you to do

1. I am pushing off the wall while I stand on a skateboard
   a) My motion accelerates while I am pushing on the wall. The acceleration I attained lasts till friction over comes it as I roll to a stop. I accelorate in the direction opposite the force - or foward away from the wall.
   b) Your motion is never at a constant speed with fiction. If there is no friction, once you stop touching the wall, you will continue at a constant speed forever.
   c) When you push on the wall, the wall pushes back on you, with an almost even amount. This causes you to move forword.
   d) You push on the wall in the direction opposite you need to travel.
   e) The wall pushes back on you with almost the same amount of force you push on it. If the wall flexes in or moves, you don't get as much force back - Stronger the wall the more force you get back

The wall exerts a force somewhere else

2. When you walk + push against the wall, you are exerting a force opposite to the direction you wish to go. Then either the floor or the wall pushes back with an equal opposite force that causes you to move. However, when you push againts the wall, there is no sliding friction as there is when you walk.

✓

2b. The forward force comes from the floor pushing back on you. If the floor is truely solid - the force will be equal to what backwards force you aply

c) No you can't run on an ice rink, unless you have very high friction shoes. Normal shoes don't have enough friction to be able to run

3 ad)

c.) The force you exert on the floor and the force the floor exerts on you are equal because your are in equallibreum and don't move

5. Nothing we saw happens. But the penny pushes down on the meter stick and the stick pushes up with tension. This is not visible

6. The meter stick sags a ferther half a mm each time we add 1N weight

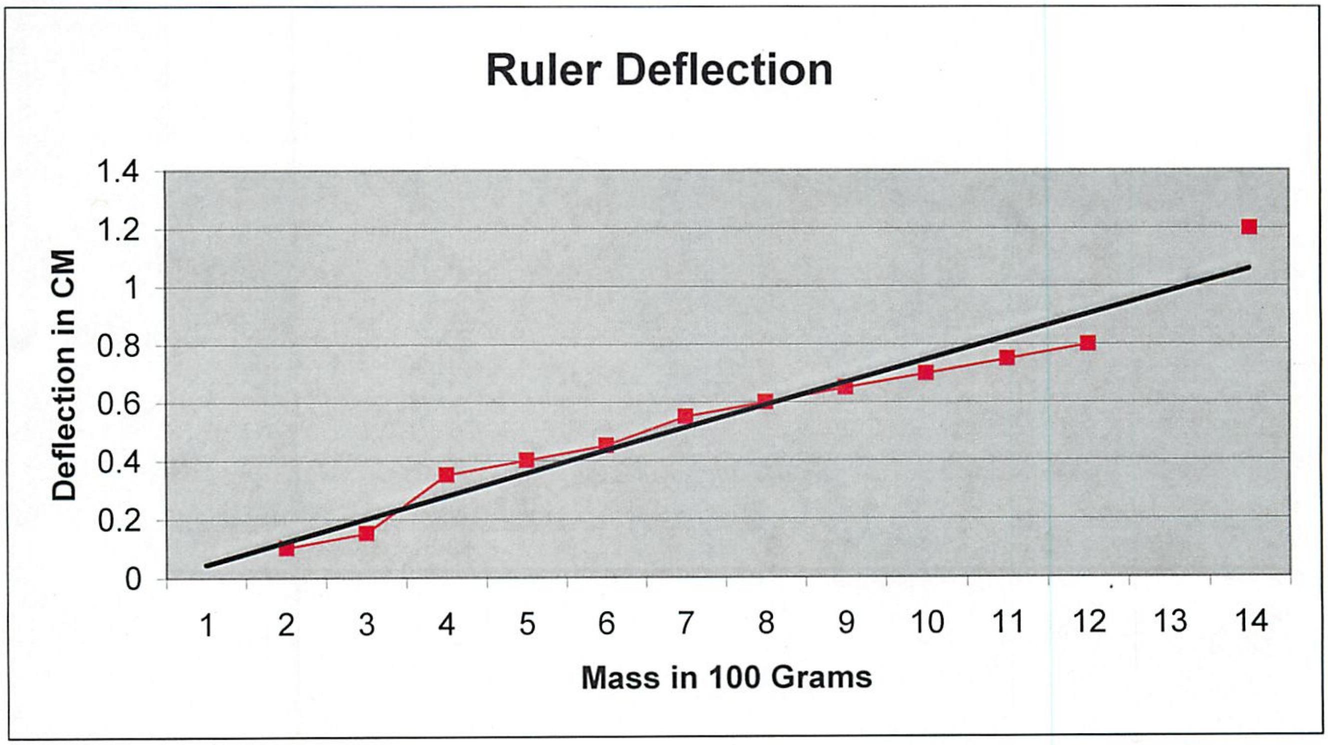
b

# Weight	CM Hight	Deflection
0	10.2	—
1	10.1	.1
2	10.05	.05
3	9.85	.2
4	9.8	.05
5	9.75	.05
6	9.65	.1
7	9.6	.05
8	9.55	.05
9	9.5	.05
10	9.45	.05
11	9.4	.05
18	9.0	.4

c) I agree w/ my above statement. The penny made the stick more a little

See next page

Mass in 100 grams	Ruler Hight off Ground	Additional Deflection	Total Deflection
0	10.2	0	
1	10.1	0.1	0.1
2	10.05	0.05	0.15
3	9.85	0.2	0.35
4	9.8	0.05	0.4
5	9.75	0.05	0.45
6	9.65	0.1	0.55
7	9.6	0.05	0.6
8	9.55	0.05	0.65
9	9.5	0.05	0.7
10	9.45	0.05	0.75
11	9.4	0.05	0.8
18	**9**	**0.4**	**1.2**



Prepared by: Michael Plasmeier

REFLECTING ON THE ACTIVITY AND THE CHALLENGE

According to Newton's Third Law, each time an athlete acts to exert a force on something, an equal and opposite force happens in return. Countless examples of this exist as possibilities to include in your video production. When you kick a soccer ball the soccer ball exerts a force on your foot. When you push backwards on the ground, the ground pushes forward on you (and you move). When a boxer's fist exerts a force on another boxer's body, the body exerts an equal force on the fist. Indeed, it should be rather easy to find a video sequence of a sport which illustrates all three of Newton's Laws of Motion.

PHYSICS TO GO

1. When preparing to throw a shot put ball, does the ball exert a force on the athlete's hand equal and opposite to the force which the hand exerts on the ball?
2. When you sit on a chair, the seat of the chair pushes up on your body with a force equal and opposite to your weight. How does the chair know exactly how hard to push up on you—are chairs intelligent?
3. For a hit in baseball, compare the force exerted by the bat on the ball to the force exerted by the ball on the bat. Why do bats sometimes break?
4. Compare the amount of force experienced by each football player when a big linebacker tackles a small running back.
5. Identify the forces active when a hockey player "hits the boards" at the side of the rink at high speed.
6. Newton's Second Law, $F = ma$, suggests that when catching a baseball in your hand, a great amount of force is required to stop a high speed baseball in a very short time interval. The great amount of force is needed to provide the great amount of deceleration required. Use Newton's Third Law to explain why baseball players prefer to wear gloves for catching high speed baseballs. Use a pair of forces in your explanation.

Answers →

Reflection + To-Go
4.5

1/18

Reflection

Golf is a sport that contains all of Newton's 3 Laws. The golf ball will remain at rest till a golf club hits it. When the club hits the ball, the ball exerts an equal and opposite force on the ball. Because the ball is lighter, it has a greater accelozation then the club. When a golf ball is in sand there is more friction and more force need to be applied to make the golf ball move.

Physics to Go

1. Yes, the forces are always equal + opposite. The difference in mass changes the acceleoration which the ball flies.

2. No the chair just supports you so you don't fall through.

3. The bats break because the ball hits the bat with too much force which causes it to snap.

4. The small player folled over because the small player has less mass and has a greater accleoration when hit with an equal force.
other answer →

5. The player pushes against the wall and the wall pushes back on him w/ a equal + opposite force.

6. The force can be better distrebuted with a glove. Also a bigger glove can catch bigger balls. This reduces the pressure on the catcher's hand.

Newtons 3rd Law

Chap 6 Blue Book

p83

1/18

1. The same force is exerted both by the hammer on the nail, and the nail on the hammer. Because the nail is less massive it's acc is more. Also the reaction force is on the hammer

2. They are the same

3. You push on the floor and the friction of the floor pushing back ~~on~~ you moves you forword.

4. When swiming the reaction force is the water molecu pushing on your hands + body, making you go.

5. The arrow pushes back on the bowstring. The arrow moves because the reaction force occures on the bowstring making it bounce back. (??)
 -But if no arrow, still bounces back - Must also involve tension

6. It is too small because the earth has a really really, really large mass. This makes it much, much, much more resistant to accleloration or chan

7. The force is equal, but because $a = \frac{F}{m}$ for the ball + $a = \frac{F}{M}$ for the cannon. Because the cannon has more mass it is more resistant to acceleration.

8. "The rocket recoils from the "molecular cannonballs" it fires to climb upword." -(caption p78) It does not requrie air to "push againts"

??

9. If the apple + orange are holding the rope, there is enough tension in it to keep it taunt but not move them, the net forces balance out + equal + opposite thing is true. The vectors look like the forces cancle each other out + there is no acceleration $Oa = \frac{OF}{M}$

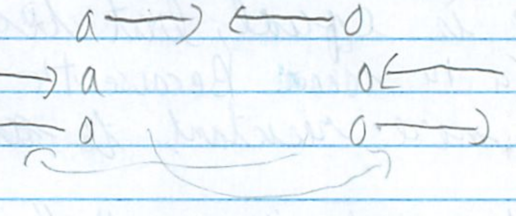
??

10. If the apple is pulling and orange is pulling back won't orange move??

Book ans " In this case, the interaction is between system (orange) something external (the apple) so forces don't cancel, the fact that the orange simultaneously exerts a force to the apple, which is external to system, affects the apple, not the orange)

11. Yes, now the forces cancel. The will remain together, because of the tension in the rope

This
can be
drawn:



(??) can it be done?

Concept. Physics
Chap 6 Notes + Thoughts

1/28

- Hammer - Nail - Nail moves b/c mass is less | Nail $a = \frac{F}{m}$ | Force is = | Hammer $a = \frac{F}{M}$

- When swimming you push on water, molecues of water push on you

- Harder to walk on ice = less friction

- Bolder Falling : Ground pulling it (Gravity)
  Bolder also pulling ground (Though doesn't move) $a = \frac{F}{M}$

- Cannon Firing - Cannonball - $\frac{F}{m} = a$ Cannon : $\frac{F}{M} = a$
  Force ≠ acceleration

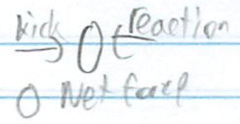
Equal Force ≠ equal acceleration

- Rocket Flies by many little recoils from the "molecular cannonballs" it fires to go upwards
  - no air needed to push againts

- if action + reaction are =, don't they cancel each other out

(No)

- Joe says I can't move a football when I kick it b/c the reaction force by the ball would cancle out my kick
  ↘



- No, b/c the reaction force is againts my foot which recoils when I kick the ball, so it will move

Bit Iffy on systems

System

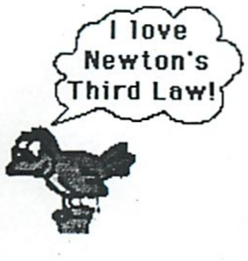
everything inside a system gets canceld out, a system can only move if it pushes againts something else (ex: floor)
(my theory of reletivity = everything in reletive)

in orange/apple thing p78 if only orange system apple pulling on him makes him move, recoil force is w/ apple (? what if not on wheels?)

if apple + orange = system, apple must exert pressure on floor.

Name: ✓

Michael Plasmeier

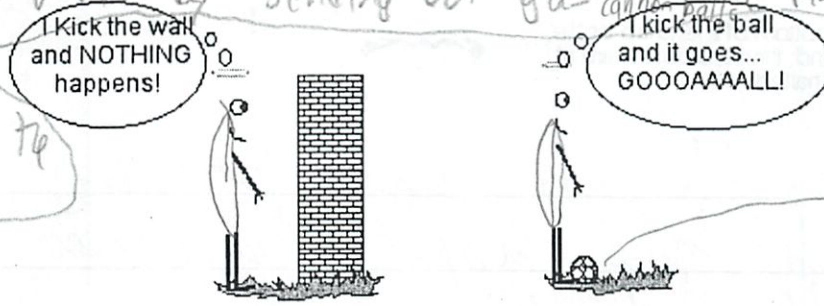


Newton's Laws

For the following 3 images, decide which of Newton's Laws each of them represents. Write the number of the law & write out the law. Explain why you feel the image meets the description of that law.

A. 1st - An object in motion (or at rest) will continue in motion (or at rest) in a straight line till something acts upon it. The bike hit the wall and the person continued in motion over the wall. The bike stopped when it hit the wall

B. 3rd - For every action, there is an equal and opposite reaction - A spaceship works by sending out gas, (cannon balls) which makes the ship recoile and these recoils propel the ship.



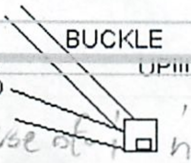
C. 2nd - Net Force = Mass × Acceleration - The wall has a big mass, therefore it has a little acceleration when it is kicked. The ball has a small mass, therefore it has a lot of acceleration, even though it is hit with the same net force, and goes flying. Goooaaal!!

1. While driving down the road, Anna Litical observed a bug striking the windshield of her car. Quite obviously, a case of Newton's third law of motion. The bug hit the windshield and the windshield hit the bug. Which of the two forces is greater: the force on the bug or the force on the windshield? Explain....

Both forces are equall because of Newton's Third Law, Every force has an equal and opposite recoil force on you.

2. Explain the following scenarios using Newton's 1st Law of motion...

*Two kids are riding in a car. One is wearing a seat belt, the other is not. They crash into a tree. What happens to them?



They both go forward because of inerta, but The one that is wearing a seat belt stops before hitting the dashboard or flying out the windsheild + lives. The one that was not wearing a seatbelt goes out the front windshe and dies. Too bad

*to dislodge ketchup from the bottom of a ketchup bottle, it is often turned upside down and, thrusted downward at high speeds and then abruptly halted.

The ketchup then continues moving because of inerta and hopefully comes out of the bottle onto the food.

IPS-9

1/23

NAME Michael Plasmeier
BLOCK # 2A

25/25

QUIZ – NEWTON'S LAWS

Fill in the blank with a word or words from the following list: (Each word or phrase is used only once).

~~ACCELERATED~~
~~ACCELERATION~~
~~AT~~ REST
CHANGE

~~CONSTANT~~
~~FORCE~~
~~INERTIA~~
~~INTERACTION~~

~~REACTION~~
~~STRAIGHT LINE~~
~~UNBALANCED~~
~~WEIGHT~~

Newton's First Law

1. If an object is at rest and there is no unbalanced force acting on it, the object will remain at rest. If an object is in motion and there is no unbalanced force acting on it, the object will continue to move at Constant speed in a(n) straight line.

2. Whenever a net external force acts on an object, the velocity of the object will Change, that is, the object will undergo accelerated motion.

3. The property of matter which causes it to resist acceleration is called inerta.

Newton's Second Law

1. According to Newton's second law of motion a(n) force can be described as a push or a pull that will cause the object to speed up, slow down, or change its direction of motion.

2. The gravitational force acting on an object near the Earth's surface is called the weight of the object. When this force acts on an object, the acceleration is always 10 m/s^2.

3. In the equation $F_{NET} = m\,a$, F_{NET} stands for the Unbalanced force.

Newton' Third Law

1. According to Newton's third law a force can only exist if there is a(n) interaction between two objects.

2. Newton's third law also states that from every force there is a(n) reaction force from another object.

Multiple Choice (2 pts each): Circle the one best answer. For any partial credit you must show your work.

1. An object with a mass of 6 kg is pulled with a net force of 1.5 N. What is the acceleration of the object?
   - a) 9 m/s^2
   - b) 4 m/s^2
   - [✓ c) 0.25 m/s^2]
   - d) 0 m/s^2

$F = ma$

$\frac{1.5}{6} = \frac{6a}{6}$

2. What force is needed to give an object with a mass of 150 kg an acceleration of 10 m/s^2?
   - [✓ a) 1,500 N]
   - b) 150 N
   - c) 15 N
   - d) 10 N

$F = ma$

$F = 150(10)$

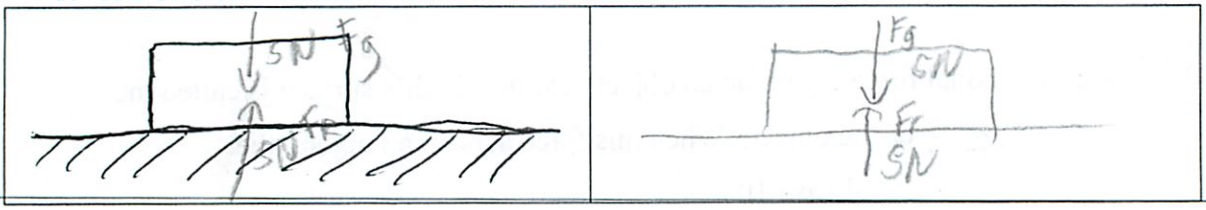
3. What is the weight of this object of mass 150 kg? weighted where? earth?
   - [✓ a) 1,500 N]
   - b) 150 N
   - c) 15 N
   - d) 10 N

$F = ma$

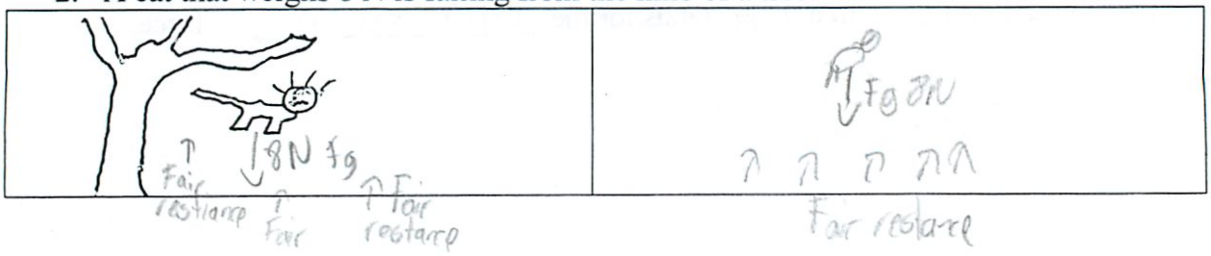
$F = 150(10)$

Force Diagrams (4 pts each): Draw a force diagram to the right for each of the situations given below. Label each force drawn.

1. A 5 N block sits motionless on a floor.



2. A cat that weighs 8 N is falling from the limb of a tree.



Conceptual Physics
p84 Questions

1/30/06

22. The log moves backwords because of the friction of your feet moving backward trying to move you forword.

26. Gravity + air restance is the only force that touches you if you are not touching you.

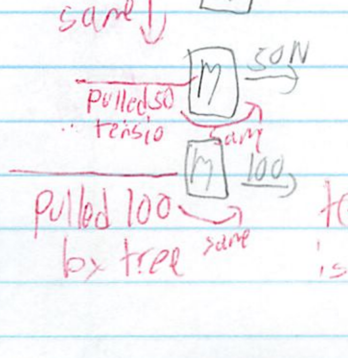
31. A spaceship travels by putting out little cannon balls or gasses. The recoil from sending these out propels it. There is no need for air to "push" againts.

34. No, wouldn't the scales read the half of the sum of both people's forces, so no, they can't both read something different. Pulls are same if rope not moving but this is correct ↗

35. Would it read ~~100~~, the sum of both? It gets pull 50 ← then 50N → so adds up
50 - tension - add 1 + hold other end

36. The force would be haff when one horse pulls.

and he could not stand 2 pulling in one direction



- but if adds too ↓ then frise

-same as #35, total on 50

tension is all on one side

reads 50, but add 50 + let go, that replaces the held force so it would read 50

15/15

IPS- Unit 2.3 "Bang Up Job" Name: Michael Plasreir

Data- Jeff Hall, Kelly, Kristen

WHAT DO YOU THINK?

- An unfortunate bug collides with the windshield of a car. Which has the greater force acting on it- the bug or the car? How do you know?

  They both have the same force. The reaction of the car hitting the fly is the same as the fly hitting the car. (Newtons 3rd Law)

- In the same situation as above, what has the greater acceleration, the bug or the car? Why?

  The bug because it has less mass

FOR YOU TO DO

1. This activity is a challenge. Here is the challenge: To create a collision between two PASCO cars on a track where the force on one car is different than the force on the other car. For each car, you can modify the mass, speed and direction (or any other thing that you want to modify- within reason). You can also choose whether the collision is sticky (the cars stick together after the collision) or bouncy (they bounce off of each other when they collide).
2. The two cars will be equipped with force sensors that will tell us about the force that acts on that car. We can then compare the force acting on each car and determine if the force on one car is indeed greater. If you can get the force on one car to be greater than the force on the other car your group will receive extra credit! Sounds easy, right?
3. With the members of your group decide on what could make the force on one car larger than the other. Once you have discussed the features of each car circle the components of the cars.

this is a wild goose chase - the forces are alwas =, mabey not the acc but the forces

	Car #1	Car #2
Mass	Light (no added mass) Medium (one added mass) Heavy (two added masses)	Light (no added mass) Medium (one added mass) Heavy (two added masses)
Speed See paper	Slow Medium Fast	Slow Medium Fast
Direction	[✓ Towards the other car] Away from the other car Not Moving	[✓ Towards the other car] Away from the other car Not Moving
Other Modifications		

Collision: sticky [✓ fast bounce (rubber)] slow bounce (spring)

4. Now let's test the cars. Your teacher will do the collisions one group at a time on the main TV (or on computer) so that everyone in the class can see. When your group is called be prepared to tell your teacher how to configure the cars. Record the results of each group below.

Group #	Was the force on one car greater?
1	No
2	yes
3	no
4	yes
5	no
6	
7	

Should be always no
sensor might be broken

5. Were there any groups that were able to create a collision where the force on one car was greater than the force on the other car?

6. In a head on collision between a huge train and a tricycle, which object gets hit with a bigger force?
The both have an equal force on each other

7. In the previous question, which object has a greater acceleration? Why? (Hint: look back at Unit 2.2- Newton's Second Law.)
the train has much less acceloration because it is much more massive Again;

Train $m = \frac{F}{a}$ Tricycle $m = \frac{F}{a}$

REFLECTING ON THE ACTIVITY

How do action + reaction forces compare in terms of size + direction?
They should be the same and occure in opposite directions, both cars should have reported the same maximum force.

2.3 Bang up Results and Log

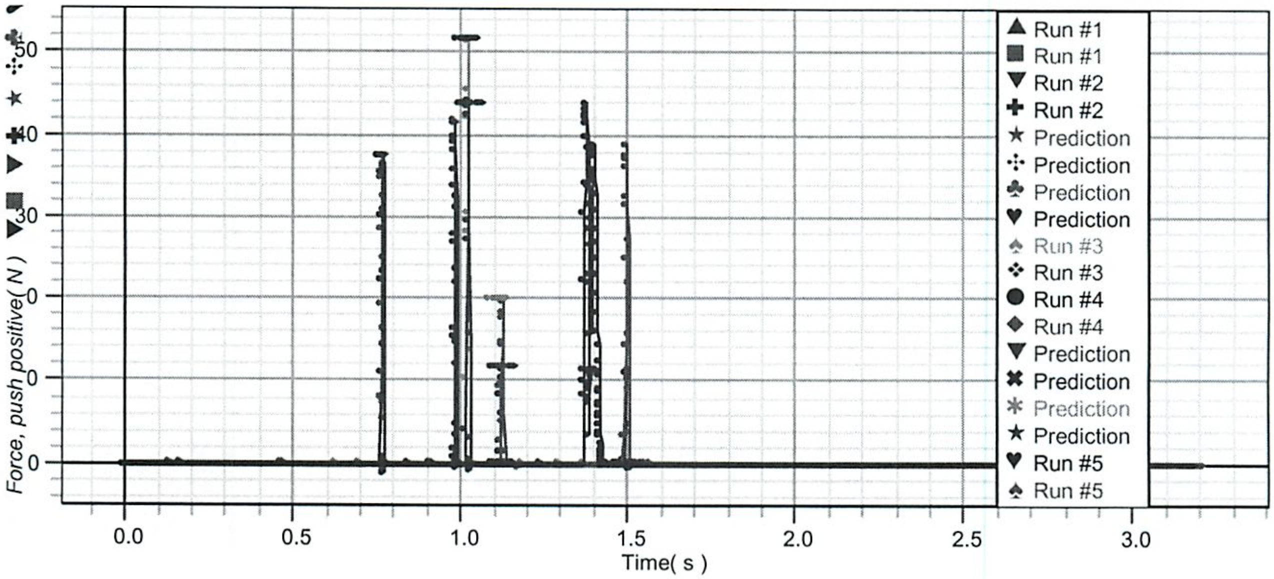
Run 1: Pushed Car2 , Car 1 still
Run 2: Push car 1; car 2 still
Run 3: Pushed both cars - ONE CAR HAS 10 more force then the other
--New Day--
Run 4: Push both real lightly - Car 2: 20 N, Car 1:12N
RUN 5: Car 2 has 1 kg mass, push medium - Car 1 had 11.5 force, car 2 had 39.0 force !!!What!
Run 6: Car 2 (with 1kg of mass on it) crashes into Car 1 which is againts the wall, so it can't move -
Car 2 has peaks at both ~~45~~ 44 and 39; Car 1 has one steady peak at 12 which last for .6 seconds

Run 1+2 are only valid results

always hit rubber

Graph 1

Entire Graph

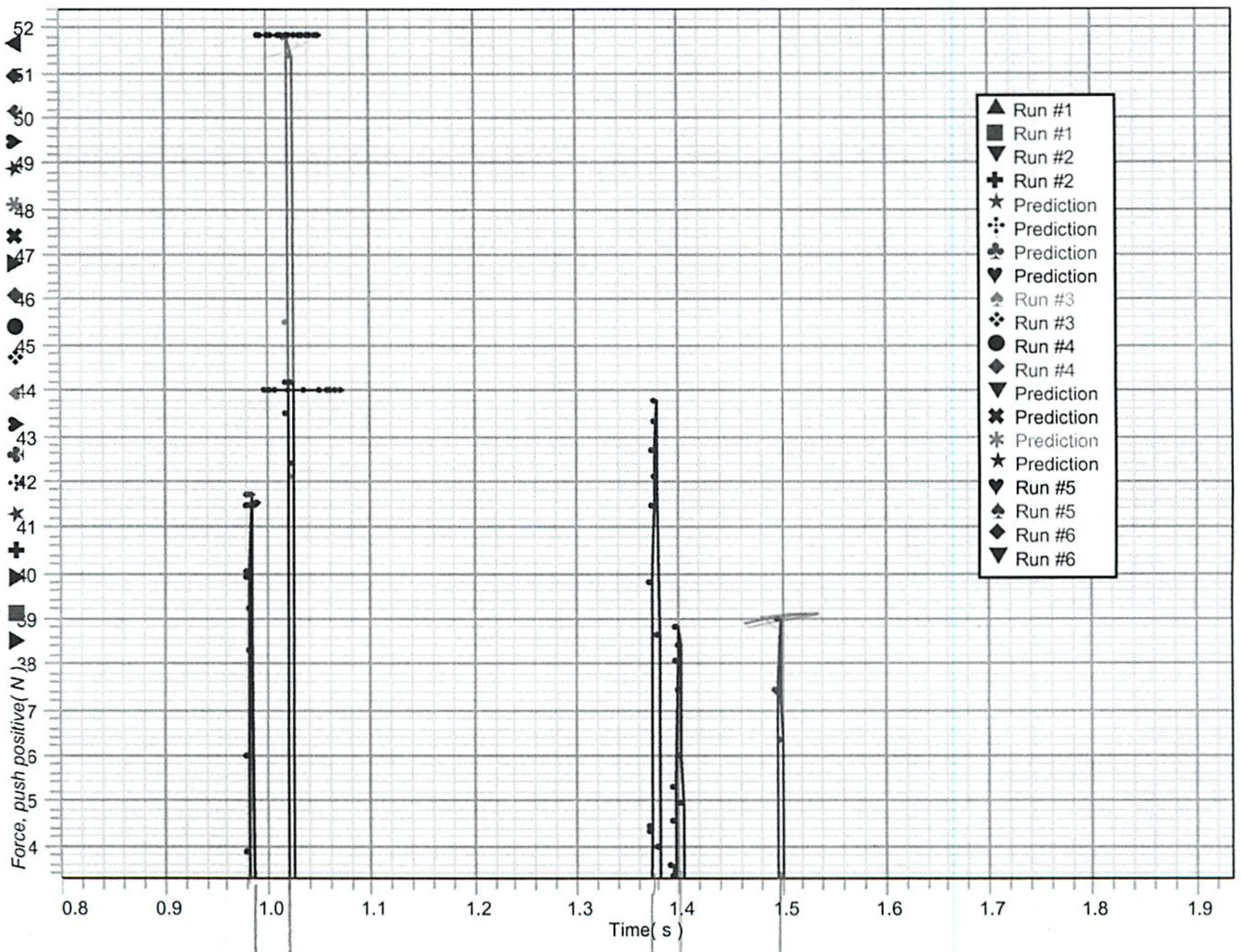


2.3 Bang up Job Sensors.ds

01/30/2006 10:09 AM

Graph 1

Close-up



=30

2.3 Bang up Job Sensors.ds

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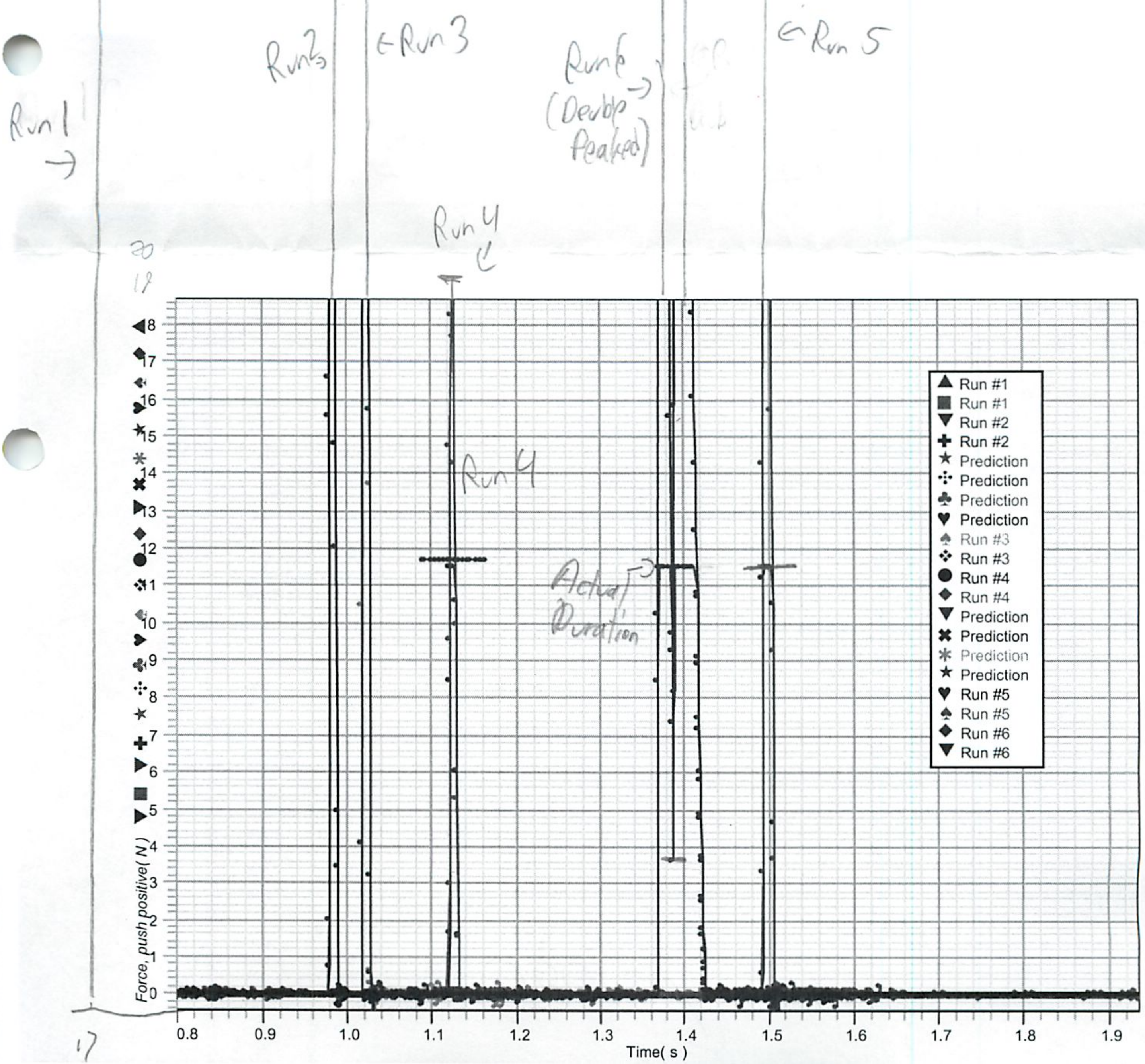
Graph 1



Open

Table 1

Car 1

New Day

Force, push positive Run #1		Force, push positive Run #2		Force, push positive Run #3		Force, push positive Run #4		Force, push positive Run #5		Force, push positive Run #6	
Time (s)	(N)	Time (s)	(N)	Time (s)	(N)	Time (s)	(N)	Time (s)	(N)	Time (s)	(N)
2.0000E-3	0.0	2.0000E-3	0.0	2.0000E-3	0.0	2.0000E-3	0.0	2.0000E-3	0.0	2.0000E-3	0.0
3.0000E-3	0.0	3.0000E-3	0.0	3.0000E-3	0.0	3.0000E-3	0.0	3.0000E-3	0.0	3.0000E-3	0.0
4.0000E-3	0.0	4.0000E-3	0.0	4.0000E-3	0.0	4.0000E-3	0.0	4.0000E-3	0.0	4.0000E-3	0.0
5.0000E-3	0.0	5.0000E-3	0.0	5.0000E-3	0.0	5.0000E-3	0.0	5.0000E-3	0.0	5.0000E-3	0.0
6.0000E-3	0.0	6.0000E-3	0.0	6.0000E-3	0.0	6.0000E-3	0.0	6.0000E-3	0.0	6.0000E-3	0.0
7.0000E-3	0.0	7.0000E-3	0.0	7.0000E-3	0.0	7.0000E-3	0.0	7.0000E-3	0.0	7.0000E-3	0.0
8.0000E-3	0.0	8.0000E-3	0.0	8.0000E-3	0.0	8.0000E-3	0.0	8.0000E-3	0.0	8.0000E-3	0.0
9.0000E-3	0.0	9.0000E-3	0.0	9.0000E-3	0.0	9.0000E-3	0.0	9.0000E-3	0.0	9.0000E-3	0.0
0.0100	0.0	0.0100	0.0	0.0100	0.0	0.0100	0.0	0.0100	0.0	0.0100	0.0
0.0110	0.0	0.0110	0.0	0.0110	0.0	0.0110	0.0	0.0110	0.0	0.0110	0.0
0.0120	0.0	0.0120	0.0	0.0120	0.0	0.0120	0.0	0.0120	0.0	0.0120	0.0
0.0130	0.0	0.0130	0.0	0.0130	0.0	0.0130	0.0	0.0130	0.0	0.0130	0.0
0.0140	0.0	0.0140	0.0	0.0140	0.0	0.0140	0.0	0.0140	0.0	0.0140	0.0
0.0150	0.0	0.0150	0.0	0.0150	0.0	0.0150	0.0	0.0150	0.0	0.0150	0.0
0.0160	0.0	0.0160	0.0	0.0160	0.0	0.0160	0.0	0.0160	0.0	0.0160	0.0
0.0170	0.0	0.0170	0.0	0.0170	0.0	0.0170	0.0	0.0170	0.0	0.0170	0.0
0.0180	0.0	0.0180	0.0	0.0180	0.0	0.0180	0.0	0.0180	0.0	0.0180	0.0
0.0190	0.0	0.0190	0.0	0.0190	0.0	0.0190	0.0	0.0190	0.0	0.0190	0.0
0.0200	0.0	0.0200	0.0	0.0200	0.0	0.0200	0.0	0.0200	0.0	0.0200	0.0
0.0210	0.0	0.0210	0.0	0.0210	0.0	0.0210	0.0	0.0210	0.0	0.0210	0.0
0.0220	0.0	0.0220	0.0	0.0220	0.0	0.0220	0.0	0.0220	0.0	0.0220	0.0
0.0230	0.0	0.0230	0.0	0.0230	0.0	0.0230	0.0	0.0230	0.0	0.0230	0.0
0.0240	0.0	0.0240	0.0	0.0240	0.0	0.0240	-0.1	0.0240	0.0	0.0240	0.0
0.0250	0.0	0.0250	0.0	0.0250	0.0	0.0250	0.0	0.0250	0.0	0.0250	0.0
0.0260	0.0	0.0260	0.0	0.0260	0.0	0.0260	0.0	0.0260	0.0	0.0260	0.0
0.0270	0.0	0.0270	0.0	0.0270	0.0	0.0270	0.0	0.0270	0.0	0.0270	0.0
0.0280	0.0	0.0280	0.0	0.0280	0.0	0.0280	0.0	0.0280	0.0	0.0280	0.0
0.0290	0.0	0.0290	0.0	0.0290	0.0	0.0290	0.0	0.0290	0.0	0.0290	0.0
Minimum	-1.1	Minimum	-0.4	Minimum	-0.4	Minimum	-0.2	Minimum	-0.4	Minimum	-0.3
Maximum	37.7	Maximum	41.5	Maximum	51.8	Maximum	11.5	Maximum	11.5	Maximum	11.6
Mean	0.1	Mean	0.1	Mean	0.2	Mean	0.0	Mean	0.0	Mean	0.2

Broken sensor

Car 2: Max	37.6	41.7	44.2	19.9	39.0	43.8
Diff:	+.1	-.2	+ 7.6	-8.4	-27.5	-32.2
Avg(abs(Diff)) 12 2/3	✓	✓	✗	✗	✗	✗

Only runs 1+2 demonstrate the proper result that the forces should both be ~=.

Table 3

Car 2

Force, push positive Run #1		Force, push positive Run #2		Force, push positive Run #3		Force, push positive Run #4		Force, push positive Run #5		Force, push positive Run #6	
Time (s)	Force, push (N)	Time (s)	Force, push (N)	Time (s)	Force, push (N)	Time (s)	Force, push (N)	Time (s)	Force, push (N)	Time (s)	Force, push (N)
0.0000	0.0	0.0000	0.0	0.0000	0.0	0.0000	0.0	0.0000	0.0	-2.0000E-3	0.0
1.0000E-3	0.0	1.0000E-3	0.0	1.0000E-3	0.0	1.0000E-3	0.0	1.0000E-3	0.0	-1.0000E-3	0.0
2.0000E-3	0.0	2.0000E-3	0.0	2.0000E-3	0.0	2.0000E-3	0.0	2.0000E-3	0.0	0.0000	0.0
3.0000E-3	0.0	3.0000E-3	0.0	3.0000E-3	0.0	3.0000E-3	0.0	3.0000E-3	0.0	1.0000E-3	0.0
4.0000E-3	0.0	4.0000E-3	0.0	4.0000E-3	0.0	4.0000E-3	0.0	4.0000E-3	0.0	2.0000E-3	0.0
5.0000E-3	0.0	5.0000E-3	0.0	5.0000E-3	0.0	5.0000E-3	0.0	5.0000E-3	0.0	3.0000E-3	0.0
6.0000E-3	0.0	6.0000E-3	0.0	6.0000E-3	0.0	6.0000E-3	0.0	6.0000E-3	0.0	4.0000E-3	0.0
7.0000E-3	0.0	7.0000E-3	0.0	7.0000E-3	0.0	7.0000E-3	0.0	7.0000E-3	0.0	5.0000E-3	0.0
8.0000E-3	0.0	8.0000E-3	0.0	8.0000E-3	0.0	8.0000E-3	0.0	8.0000E-3	0.0	6.0000E-3	0.0
9.0000E-3	0.0	9.0000E-3	0.0	9.0000E-3	0.0	9.0000E-3	0.0	9.0000E-3	0.0	7.0000E-3	0.0
0.0100	0.0	0.0100	0.0	0.0100	0.0	0.0100	0.0	0.0100	0.0	8.0000E-3	0.0
0.0110	0.0	0.0110	0.0	0.0110	0.0	0.0110	0.0	0.0110	0.0	9.0000E-3	0.0
0.0120	0.0	0.0120	0.0	0.0120	0.0	0.0120	0.0	0.0120	0.0	0.0100	0.0
0.0130	0.0	0.0130	0.0	0.0130	0.0	0.0130	0.0	0.0130	0.0	0.0110	0.0
0.0140	0.0	0.0140	0.0	0.0140	0.0	0.0140	0.0	0.0140	0.0	0.0120	0.0
0.0150	0.0	0.0150	0.0	0.0150	0.0	0.0150	0.0	0.0150	0.0	0.0130	0.0
0.0160	0.0	0.0160	0.0	0.0160	0.0	0.0160	0.0	0.0160	0.0	0.0140	0.0
0.0170	0.0	0.0170	0.0	0.0170	0.0	0.0170	0.0	0.0170	0.0	0.0150	0.0
0.0180	0.0	0.0180	0.0	0.0180	0.0	0.0180	0.0	0.0180	0.0	0.0160	0.0
0.0190	0.0	0.0190	0.0	0.0190	0.0	0.0190	0.0	0.0190	0.0	0.0170	0.0
0.0200	0.0	0.0200	0.0	0.0200	0.0	0.0200	0.0	0.0200	0.0	0.0180	0.0
0.0210	0.0	0.0210	0.0	0.0210	0.0	0.0210	0.0	0.0210	0.0	0.0190	0.0
0.0220	0.0	0.0220	0.0	0.0220	0.0	0.0220	0.0	0.0220	0.0	0.0200	0.0
0.0230	0.0	0.0230	0.0	0.0230	0.0	0.0230	0.0	0.0230	0.0	0.0210	0.0
0.0240	0.0	0.0240	0.0	0.0240	0.0	0.0240	0.0	0.0240	0.0	0.0220	0.0
0.0250	0.0	0.0250	0.0	0.0250	0.0	0.0250	0.0	0.0250	0.0	0.0230	0.0
0.0260	0.0	0.0260	0.0	0.0260	0.0	0.0260	0.0	0.0260	0.0	0.0240	0.0
0.0270	0.0	0.0270	0.0	0.0270	0.0	0.0270	0.0	0.0270	0.0	0.0250	0.0
Minimum	-0.7	Minimum	-0.3	Minimum	-0.7	Minimum	-0.2	Minimum	-0.4	Minimum	-0.2
Maximum	37.6	Maximum	41.7	Maximum	44.2	Maximum	19.9	Maximum	39.0	Maximum	43.8
Mean	0.1	Mean	0.1	Mean	0.2	Mean	0.1	Mean	0.1	Mean	0.5

See other sheet for analysis.

Newton's Law's Review

1st Law: (inerta)	Every body continues in its state of rest, or of motion in a straight lie at a constant speed, unless it is compelled to change that state by a net force exerted upon it.
2nd Law: Net Force + Acceleration ($F = ma$)	The acceleration produced by a net force on a body is directly proportional to the magnitude of the net force, is in the same direction of the net force, and is inversely proportional to the mass of the body.
3rd Law: Reaction (Equal + Opposite forces)	Whenever one body exerts a force on a second body, the second body exerts an equal + opposite force on the first.

How laws affect force

1/20

1. Newton's First Law (of Inertia)
   a force causes an object to change it's sped + direction
   A force is the only thing that can acceleorate an object
2. Newtons Second Law ($F_{net} = ma$)
   a force is a push or pull that causes an object to move
3. Newtons Third Law (Equal + Opposite forces)
   A force is something that is returned equal and opposite
   A force requires at least 2 objects to interact

Newton's Laws Quiz

Review Topics for

Quiz on Monday 2/13/06 Newton's 3 laws of motion.

- Be able to tell what each of Newton's 3 laws say. For example,

1st law - an object in motion or at rest will not change its speed (velocity) or its direction of motion unless it is pushed or pulled.

2nd law - if an object is pushed or pulled its change in velocity (acceleration) will depend on how much mass it has. A large mass will have a smaller acceleration than a small mass if they are pushed by the same force.

$$F = ma \;; \; a = \frac{F}{m}$$

3rd law — For every force exerted by an object on another object there is an equal an opposite force exerted back on the original object. Forces always occur in pairs and always need 2 objects to interact.

- Know definitions and meanings of the following words:

inertia
force
mass
net force
- tension

friction
acceleration
- interaction
- normal force
weight

force diagram
coefficient of friction
applied force

Know how to calcute:

- weight knowing mass in kg $F = mg$ $w = m(10)$ kg
- net force knowing individual forces on an object.
- acceleration knowing mass and net force. $a = \frac{F}{m}$
- net force knowing mass and acceleration. $F = ma$
- coefficient of friction knowing weight and applied force at constant speed. F_a / F_b
- frictional force knowing coefficient of friction and weight.

$\frac{F_f}{m \mid C_o}$ ← ?

- Know what the 2 factors are which affect amount of friction.
  - weight.
  - types of materials in contact. ← co-eff only

- Know how to measure the frictional force on an object.
  - pulling the object at constant speed with a spring scale.

- Know the difference between the 2 types of friction
  - static
  - kinetic

  which one is greater.

  static

IPS-9

NAME Michael Plasmeier
BLOCK # ____________

34/35

QUIZ – NEWTON'S LAWS PART 2 / FRICTION

True or False (2 pts each): Write TRUE or FALSE in the space provided. If the statement is false, change any word or words to make the statement true.

False 1. Newton's first law says that an object needs ~~a~~ no force to continue moving at a constant speed. without friction

True 2. A force requires that there is an interaction between two objects.

true 3. A net force on an object will always change the object's velocity if the net force is not zero.

True 4. Inertia is the property of matter which causes it resist acceleration.

False 5. Doubling the net force on an object will ~~decrease~~ ~~change~~ increase −1 the object's acceleration. Unless the net force is zero

Matching (1 point each): Match the correct term in Column I with its definition in Column II.

Column I		Column II
1. e	newton	a) rate at which velocity changes over time
2. c	weight	b) a push or a pull
3. g	net force	c) amount of force exerted on an object by gravity
4. i	mass	d) amount of force needed to move an object against friction divided by the object's weight
5. j	static friction	e) unit of measurement for force
6. h	kinetic friction	f) forces which exist in a cord, rope, or cable
7. d	coefficient of friction	g) total force affecting an object's motion
8. f	tension	h) force exerted between objects that are sliding against each other
9. a	acceleration	i) amount of matter in an object
10. b	force	j) friction between non-moving objects

Multiple Choice (2 points each): To receive any partial credit for any calculations you must show your work in the available space. F= ma   F= 15 kg(10 m/s²) = 150 N

1. Calculate the weight of an object that has a mass of 15 kg.
   - a) 0.67 N
   - b) 1.5 N
   - c) 15 N
   - [✓ d) 150 N]

2. What is the coefficient of friction of a block of wood sliding on a vinyl floor if the block of wood weighs 6.5 N and it takes 2.5 N of force to pull the block of wood at a constant speed. $\mu = \frac{F_a}{F_g}$ $\frac{2.5N}{6.50N}$ = .384
   - [✓ a) 0.38]
   - b) 2.60
   - c) 4.0
   - d) 16.25

3. The two things that affect the amount of friction an object feels as it slides across a surface are:
   - a) its weight and its speed
   - b) its speed and its surface area
   - [✓ c) its weight and the material the surfaces in contact are made of] (μ)
   - d) its speed and the material the surfaces in contact are made of

4. Static friction is _______________ kinetic friction.
   - [✓ a) greater than]
   - b) equal to
   - c) less than

5. You and your best friend each pull on a pair of spring scales attached to the ends of a horizontal rope in a tug-of-war fashion. How do the readings on the two scales compare?
   - a) one scale reads greater than the other scale
   - [✓ b) both scales have the same reading]
   - c) not enough information to tell

Short Answer (5 points): Choose a sport or activity and explain the effects that friction has in the sport or activity.

In racing the tires push againts the roadway, The roadway pushes back againt the tires, making the car stay on top of the track. When the engine makes the wheels push backword. The wheels push againts the road which push againts the tires with an equal and opposite (reaction) force. This causes the car to move forword the tires must have a large amt of friction to be able to do this.

IPS UNIT 2.6

The Mu of the Shoe - Friction

Coeffecent of Friction

Name: Michael Plasmeier

$$Mu = \mu = \frac{F_A}{\underset{(weight)}{F_g}} = \frac{.8N}{2N} = \mu = 0.4$$

No units

WHAT DO YOU THINK?

- Why do some sports require special shoes?

  Different sports require different amounts of friction or grip. Some shoes also have different friction. Also different shoes hold the feet better and provide more cushining. Some even have spikes for more grip.

- What affects the amount of friction between your shoe and the floor?

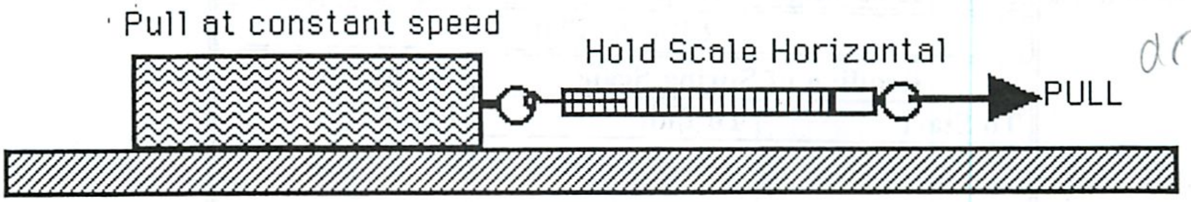
  The surface of the floor or ground affects the amt. of friction as well as the surface of the shoe.

- When we drag a block of wood across a table or counter at a constant speed what do you think affects the amount of friction that the surface exerts on the block?

  The speed of the pull and the weight of the block. * The surface area that is touching.

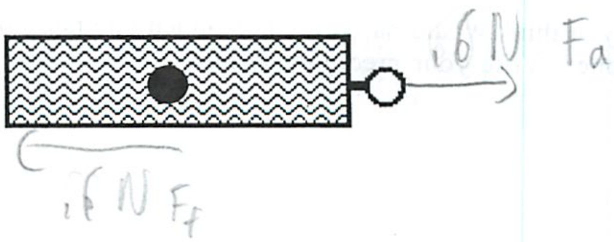
FOR YOU TO DO

1. Place the block of wood with its largest face on the table and connect the scale to the screw-eye at the end of the block. Pull the scale and the block **horizontally** across the table. Make sure the scale is horizontal (parallel to the table surface) at all times. Make sure that you pull the block across the table at a **constant speed**, read the force on the scale in newtons.



around .6N

Draw the forces acting on the block on the freebody diagram of the block shown below. Remember we learned that if the block is not moving or moving at a constant speed, that the forces on the block must be balanced. If you are pulling on the block to keep it moving, then the force that you apply must be the force that balances the friction of the surface on the block.



When pulling at constant speed, how does the force that you pull with and the force of friction compare? Why? They are the same, so the block stays at a constant speed, they cancel each other out - no acceleration

2. First observe the force necessary to **start** the block moving and record the reading under "**To Start.**" Do this by pulling slowly and observing the largest force just as the block starts to move. Do this a few times to make sure your results are consistent. Next, while pulling the block across the table at a **constant speed**, read the force on the scale and record this under "**To Pull.**" Try this several times to see if there is consistency. Hang the block from the scale and record the weight of the block where it says "weight of block =".

1 Block Flat		
Reading of Spring Scale		**Weight of block =**
To Start	**To Pull**	
1N	.6N	~~160 G~~ 1.6N

See for corrections →

Is there any difference between the force needed to start the block and the force needed to keep the block moving? Which case requires the greater force?

Yes, more force is needed to cause acceleration (make the block start moving) then keep a constant speed

3. Do you think adding a block on top of the first will affect the force needed to pull the block across the table at a constant speed? If so how?

Yes, I think there will be more friction

Place the block on its largest face again and place another block on top of it. Repeat the steps that you did in #1 with the two-block system and record your results in the chart. Hang the second block from the scale and add its weight to the first block and record the weight of the two-block system.

2 Blocks Flat		
Reading of Spring Scale		**Weight of blocks =**
To Start	**To Pull**	
1.5N.	1N	~~340 G~~ 3.4N

How did adding a block on top of the first block affect the amount of friction?

It increased it

4. What do you think would happen if you added one more block so there are two blocks on top of the first one? Write your prediction here.

It would still increase the friction but to a lesser degree

Now do it to find out. Record your results in the table below.

3 Blocks Flat		
Reading of Spring Scale		Weight of blocks = 5N
To Start	To Pull	
2N	1.2N	~~500g~~

See for correction →

How did the force needed to pull the three-block system compare to the force needed to pull the one-block system?

More force is needed to pull the three block system then the one block system.

What does this tell you about the friction force acting when the number of blocks (the weight) is increased?

When the weight is increased, so does the friction

New Day

5. What else might affect the friction force acting on the block as it is pulled at a constant speed? One thing that may affect friction is the two surfaces that are in contact. To test this we will keep the weight the same by using the two-block system, but we will change the surfaces that we pull the blocks on. We will pull the two blocks at a constant speed across different surfaces including the back of the whiteboards and then the front. Which surface do you think will have the most friction? Write your thoughts before testing it.

The roughthest surface will have the most friction. (or the back of the white bord)

6. Now test the two block system on both sides of the whiteboard Pull a couple of times on each surface to check for consistency. Fill in the table below based on your experiment.

Surface	Force Required to pull at constant speed	Weight of 2 Blocks
Front (White) Side	1.3 N	3.4N
Back (Brown) Side	1.5N	3.4N

Do the two surfaces that are in contact affect the amount of friction between them? Explain how you know.

Yes, the surface texture affects the amount of contact and therefore the amount of friction

---

7. Turn to page 87 in your text and read the blue-shaded area about the coefficient of friction (μ). Also read blue shaded area on page 89.

Your teacher should discuss coefficient of friction, then do an example of how to calculate it.

The table below is based on work that you have already done in this activity.
For # 1-3 in the table, fill in based on what we did on page 2 and 3

For # 4-5 in the table, fill in based on the data that you collected in #5 of this activity (page 3).

For #6 in the table, pick another object to find the mu of. This could be sneakers, a bag, etc. Find the force required to pull at constant speed and its weight. Then calculate the mu between the object and the surface it was dragged on. For #7 in the table, add mass to the same object (#6) and find the mu with the additional mass.

For each situation in the table below calculate the coefficient of friction and record it in the appropriate place.

When you double the amt of mass, the amt of friction doubles so the co-effecient stays the same

System	Force to Pull **Force of friction** (N)	Weight of blocks **Normal Force** (N)	Coefficient of friction - μ Force of Friction/ weight
1. One block on Table (from #2 on page 2)	.6N	1.6N	.375
2. Two blocks on Table (from #3 on page 2)	1.2 1N bigger	3.4N bigger	.294 same
3. Three blocks on Table (from #4 from page 2 and 3)	1.8 1.2N	5N	.24
4. Two blocks on back (brown side) of whiteboard (#6 from page 3)	.5N	3.4N	.147
5. Two blocks on front (white side) of whiteboard (#6 from page 3)	1.3N	3.4N	.382
6. Object you choose. My shoe	2N	3.8N	.526
7. Object you chose in #6 plus extra mass My shoe + 250g Mass	5N	6.3N	.794

Weight should not matter!
Surface area should not matter

8. In the table #1-3 what do you notice about the coefficient of friction (μ)?

The coeffecent decreased as I added more blocks even though it should stay the same b/c friction should increase in proportion

9. From the table, which surfaces had the highest coefficient of friction?

The only surface beside the table we tested was the whiteboard, where the front had the highest coeffient

10. Which surface had the biggest force of friction? Why do you think that it is largest?

The whiteboard, (same qu as 9) had the most friction. This is because the board is rough to trap ink from the marker

11. What do you think affects the coefficient of friction?

~~The surfaces, surface area, and the mass??~~

Only surface material (b/c mass gets balanced out!! w/ force to pull)

~~mass matters~~

REFLECTING ON THE ACTIVITY

Yes different shoes have different friction Some are also tougher And some hold up in water without getting soggy.

I was correct, only the surface materal matters for the coeffecent b/c mass and friction force balance out in preportion to have the co-effecient stay the same

The surface area touching has no effect.

The actuall amt. of friction is affected by the surface type + mass of object

PHYSICS TO GO (p90-91 #1-4, 7, 9-10) And problems below.

1. What is static friction?

Friction that occures when the object is not moving

2. What is kinetic friction?

Friction that occures when the object is in motion

3. What are the units of mu? Why?

Mu = the coeffecnt of friction $\mu = \frac{F_a}{F_g}$

No units because Newtons divided by Newtons is nothing somehow?

? because it is a ratio ? - Yes

4. You push on a 5200 N car with a force of 100 N and the car does not move.

What is the force of friction in this case?	Is this kinetic or static friction?	What is mu in this case?
100 N	Static Friction	.019 $\frac{F_a}{F_g} = \frac{100N}{5200N}$

5. You push on a 1200 N crate with a force of 98 N. The crate travels at a constant speed because of the constant push.

What is the net force on the crate?	What is the force of friction acting on the crate?	What is the mu between the crate and the ground?
0N	98N kinetic	.081

6. The force of friction required to pull a 1200 N sled on ice at constant speed is 50 N.

What is the mu here?	If a 500 N child got on the sled, what would the mu be with the child on it? Why? (Consult your activity)	How much force would it require to pull the sled with the extra weight?
.041 → Same	.041 because if you increase the weight, the friction will increase in proportion and the μ will stay the same.	~70 N $Mu = \frac{F_a}{F_g}$ $Mu \times F_g = M_a$ (.41) 1700N = 69.7N

900N

90000g or 1kg = 9.8 or 10N

7. A desk with a **mass of 90 kg** is pushed across the floor at constant speed by a force of 500 N. What is the mu between the desk and the floor?

$\mu = .555$

$\mu = \frac{F_a}{F_g} = \frac{500N}{900N}$

8. Suppose, in the previous problem, your friend is tired and sits on the desk. His weight is 400 N.

A) What is the total weight of your friend and the desk?

$400 + 900N = 1300N$

B) Earlier you were able to push the desk with a force of 500 N. Now, with your friend adding weight, how much force must you push with to move it at constant speed?

$a = \frac{F}{m}$

$\frac{X}{1300} = .555$

$X = 1300 \times .555$

$722N = F_a$

or $\mu = \frac{F_a}{F_g}$

$F_a = F_g \times m$

$F_a = 1300 \times .555$

$\boxed{F_a = 715N}$

15/15

IPS Unit 2.7 Circular Motion

Name: Michael Plesweler

Period 2A Date 2/15

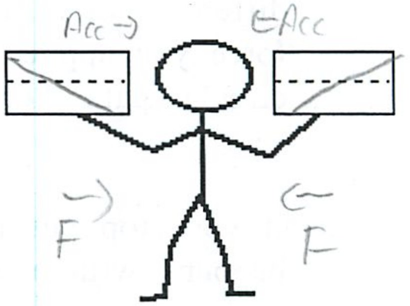
WHAT DO YOU THINK?

- When you are on a psycho (really fast) merry go round, you are traveling in a circular path. Is there an unbalanced ("net") force pushing or pulling on you? Is it directed towards the ground, the sky, the center of the merry-go-round, away from the center or no "net" force at all?

You are pulled toward the center of the merry go round though you still want to continue in a straight line through inertia (not a force) so centipal force pulls you towards center

FOR YOU TO DO

1. Remember your friendly neighborhood accelerometer? He's back! He missed you, too. Recall from a long time ago that you can tell if an object is accelerating, how much it is accelerating (a lot or a little)and what direction it is accelerating based on the liquid in the accelerometer. Discuss with your partner how an accelerometer can tell you what direction you are accelerating and how much you are accelerating.



2. a) Use our liquid accelerometer and place it in your hand so that it points straight out from you. Twirl in a circular path and draw the position of the liquid in the accelerometer at the positions shown at the right.

2. What does the position of the liquid in the accelerometer tell you about the direction of the acceleration?

The direction of the acc is towards the center of rotation the person

3. Draw an arrow in the picture at the right to show the direction of the acceleration in each case.

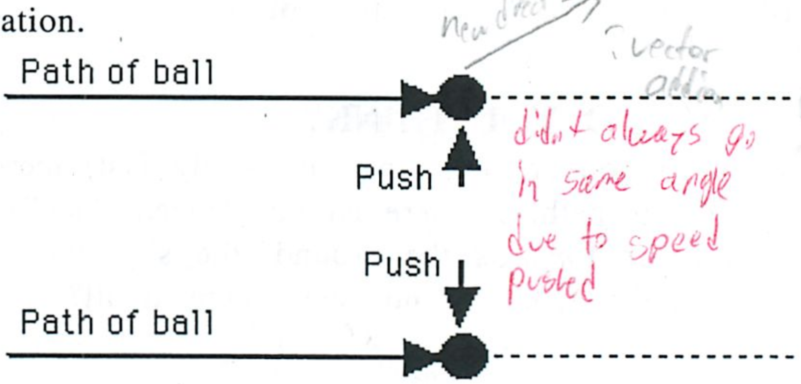
3. Based on what you learned in Unit 2.2 (Newton's Second Law), what does the acceleration tell you about the direction of the force on the liquid accelerometer as it is being twirled? (Hint: Read the bold paragraph on page 64 of your text.)

(Fnet = ma) The Net force occures in the same direction as the acceleration (when you push a book it moves away from you) when you pull a book toward you it moves toward you

15/15

This can be done as a class demonstration.

4. Start a ball rolling across the floor. While it is rolling give it a push sideways, perpendicular to its path as shown at the right. In each case sketch the path of the ball after it is given the push.



didn't always go in same angle due to speed pushed

5. a) Try to make the ball go in a circular path by giving it short quick taps. Describe what you must do to keep the ball moving in a circular path. Describe the direction of the taps.

You must keep tapping it twords the center, and must achive an infinite # of taps to achive a perfect Circle. You must also push the ball to make it overcome table friction.

If all F_a are = and perpedicular to velcaty, you have constant speed

b) On the drawing shown at the right place an arrow with a "v" to show the direction of the velocity of the ball at each position shown. v is tangent to Circle

c) On the drawing place an arrow of a different color to show the direction of the force you applied to make the ball go in a circular path, Put an "F" next to this arrow.

The Fa is perpendicular to the velocty of the ball

d) If you stop pushing the ball, what path does the ball take. Describe what happens with a written statement and draw a sketch.

Thats what I did for b) The ball will travel away from the circle in a straight line forever

6. We have learned about Galileo's Principle of Inertia and Newton's First and Second Laws. Each helps us describe the motion of an object and why it happens in a particular way. Use each of the following to help describe what you just did in this activity.

a) Galileo's Principle of Inertia & Newton's First Law of Motion. (p58 –59)

If you don't constantly apply a force toward the center the Object will move, tangent to the circle, in a straight line forever. A force must constanly be applied to have movement around a circular path. A force is nessassry to make something travel in a circl

Force needed to make an object swing at constant speed → $F_{net} = \frac{mv^2}{R}$

$a = \frac{v^2}{R}$ ← radius

If you have a force, you have acceleration

b) Newton's Second Law of Motion. (p.64)

The harder you push the ball, the faster it will move. You need to push the ball with the same Force all the way around the circle pushing inward in order for the ball to go in a Perfect circle. Also the Force you push determins the direction (vector addition)

The force is in the direction of acc.

REFLECTING ON THE ACTIVITY

I was Correct. A force (friction) is nessassary to pull you twoards the center of the merry go round or else you will travel tanget to the circle in a straight line forever.

*Friction in nessary to stay on it (centripetal force) $\boxed{F_c = \frac{mv^2}{r}}$

real Fore center-seaking

Centrifugal force - not a real force

A merry go round w/ ice on it, you can't stand on it, you need friction to stay on merry go round + go in a circle

PHYSICS TO GO (see next page)

1. (HINT: The force of friction is the reason for the centripetal acceleration; the force of friction **IS** the centripetal force)

1, The weight of the car is 1000 kg · 10 m/s² = 10,000 N. How does that matter to the main friction. Is that not still 7,300 N or do we subtract to get, 2,700 N. Find $\mu = \frac{F_f}{F_g}$ $\frac{7,300N}{10000N} = \boxed{.73}$

2. If the string breaks while you are twirling a string, it will fly off without any force being added to it. One is only being subtracted. The thing flies off because it wants to continue is a straight line. This is really inerta (which isn't a force anyway) so centrifugal force is a myth.

3, Fc = (mv²)/r

(50kg(270m/s × 270m/s))/1000m

(50kg · 72900 m/s)/1000m

3645000 kg·m/s /1000m = 3645N/500N = $\boxed{7.29}$ $\frac{F_n}{F_g\text{(weight)}}$

Don't seem realistic

REFLECTING ON THE ACTIVITY AND THE CHALLENGE

Both circular motion and motion along curved paths which are not parts of perfect circles are involved in many sports. For example, both the discus and hammer throw events in track and field involve rapid circular motion before launching a projectile. Track, speed skating, and automobile races are done on curved paths. Whenever an object or athlete is observed to move along a curved path, you can be sure that a force is acting to cause the change in direction. Now you are prepared to provide voice-over explanations of examples of motion along curved paths in sports, and in many cases you perhaps can estimate the amount of force involved.

PHYSICS TO GO

1. For the car used as the example in the For You To Read, what is the minimum value of the coefficient of sliding friction between the car tires and the road surface which will allow the car to go around the curve without skidding? (Hint: First calculate the weight of the car, in newtons.)

2. If you twirl an object on the end of a string, you, of course, must maintain an inward, centripetal force to keep the object moving in a circular path. You feel a force which seems to be pulling outward along the string toward the object. But the outward force which you detect, called the "centrifugal force," is only the reaction to the centripetal force which you are applying to the string. Contrary to what many people believe, there is no outward force acting on an object moving in a circular path. Explain why this must be true in terms of what happens if the string breaks while you are twirling an object.

3. A 50-kg jet pilot in level flight at a constant speed of 270 m/s (600 miles per hour) feels the seat of the airplane pushing up on her with a force equal to her normal weight, 50 kg × 10 m/s^2 = 500 N. If she rolls the airplane on its side and executes a tight circular turn which has a radius of 1000 m, with how much force will the seat of the airplane push on her? How many "*g*'s" (how many times her normal weight) will she experience?

Michael Plasmier

Conceptual Physics

Circolor Motion Qu.

5/5

2/19

1. a rotation or spin occures when te axis (the point te object rotates around) is inside te body. ~~A~~ revelaction is when te object turns arouNt a external axis

2. a child ~~rotates~~ revolves when they are on a merry go ra,

~~we~~ if you only consider te child, he relaves, but child + merry-go round rotate

3. Liniar speed is te distance moved per unit of time. This is what we learned before and can be called tangential speed. Rotation or te angular speed is te number of rotations per unit of time. Rotational speed always stays te same no matter how far you are from te axis, but linear speed can change.

??

4. Liniar speed when it moves in a circle is tangential speed.

6. The farther you move from te axis, te faster yar tangential speed becomes. $v = r\omega$

5. ? The liniar speed increases as te rotational speed increases ? in preportion $v = r\omega$

7. a tapered cup curves because both ends have a different radius. Tangential speed is dependent on rotational speed and radius, So te different radius makes one side go faster then te other and te bigger side trys to get away

8. Te Force that acts on te can is to te right angle of te forward motion that is labeled centripetal force

5/5

9. The force on a carnaval ride act toward the center.

10. The clothes are forced inword. ?Why I just answered this way b/c that is this chapter

?

11. The seat belts hold you to the car which use centripal force to turn. Oterwise inerta would throw you outwards

12. Centrifugal force which is not a force or anything just the lack of force or inertia to continue in a straight line path

Centripetal Acceleration and Centripetal Force

An object can move around in a circle with a constant speed yet still be accelerating because its velocity/direction is constantly changing. This acceleration, which is always directed twoards the center of the circle, is called Centripetal acceleration. Centripetal means center seeking. The magnitude of this acceleration is found using the equation:

centripetal acceleration = (speed x speed)/ radius

or

$$a_c = v^2/r$$

If an object with a mass, m, is being accelerated toward the Center/axis of a circle, it must be pusled or pulled by an unbalanced force that gives it this acceleration. This force, called the Centripetal force, is always directed inward toward the center of the circle. The amount of this force is found using the equation:

centripetal force = mass x centripetal acceleration

or

$$F_c = m\ a_c = (m\ v^2)/r$$

The units for centripetal acceleration and centripetal force are m/s^2 and N, respectively.

Problem:

Missy's favorite ride at Hershey Park is the Rotor, which has a radius of 4.0 m. The ride takes 2.0 seconds to make one complete spin or rotation.

$a_c = v^2/r$

$F_c = (mv^2)/r$

a) What distance will Missy travel on the ride during the 2 seconds when the ride is going around one time?

Given: radius = r = 4 meters

Unknown: distance = d = 2 (pi) r → $2\pi(4m)$

d = 25.13 meters

b) What is Missy's speed on the Rotor?

Known: distance = d = 25.13 m

Time = t = 2.0 seconds

Unknown: speed = v = distance / (time)

v = 25.13 m/ 2sec

v = 12.57 m/s

c) What is Missy's centripetal acceleration on the Rotor?

Known: speed = v = 12.57 m/s

Unknown: centripetal acceleration = $a_c = v^2/r$

a_c = (12.57 x 12.57) / 4m

a_c = 39.48 m/s²

d) If Missy weighs 85 lbs., what centripetal force does the wall of the Rotor push on Missy to make her go around in a circle (use: 1 lb. is 4.4 N).

Known: weight = F_g = 85 lbs. = 374 N

centripetal acceleration = a_c = 39.48m/s

Unknown: mass = weight / acceleration of gravity

m = F_g / 10 m/s² = 374 N / 10 m/s²

m = 37.4 kg

To be found: centripetal force = $F_c = m\,a_c$

F_c = 37.4kg x 39.48 m/s²

F_c = 1476.49N or just $(mv^2)/r = F_c$

↓

Around 1470 N/4.4 = 335.58 lbs

Chap 9
Blue Book
Think + Solve Questions p 133

2/22

31. $F = (mv^2)/r \rightarrow F = 1kg \times 2m/s^2 / 2m \rightarrow F = 1kg \times 4m/s / 2m \rightarrow 4N/2m$
$\rightarrow$ $\boxed{\text{2N Force of centripetal}}$?? Don't for N - keep ^{2}'d

32. a - 2× mass
$F = mv^2/r \rightarrow F = 2kg \times 2m/s^2 / 2m \rightarrow F = 2kg \times 4m/s / 2m \rightarrow 8N/2m \rightarrow \boxed{4N}$

b - 2× speed
$F = mv^2/r \rightarrow F = 1kg \times 4m/s^2 / 2m \rightarrow f = 1 \times 16m/s / 2m \rightarrow 16 N/2m \rightarrow \boxed{8N}$

c - 2× radius
$F = mv^2/r \rightarrow 1kg \times 2m/s^2 / 4m \rightarrow f = 1kg \times 4m/s / 4m = 4N/4m \rightarrow \boxed{1N}$

d - 2× mass, speed, distance
$F = mv^2/r \rightarrow F = 2kg \times 4m/s^2 / 4m \rightarrow F = 2kg \times 16m/s / 4m \rightarrow F = 32 N/4m \rightarrow \boxed{8N}$

33 $r_{mars} = 2 r_{venus}$?
$y_{mars} = \frac{1}{3} y_{venus} \rightarrow y_{venus} = 3_{mars}$

b) Venus Defently has a greater linior speed. It goes around 3 times while Mars manages only 1

a) Venus has a greater rotational speed, I believe.

- Update - p124 says inner most planets have greatest rotational + linior speeds

35 Don't you need enough speed to overcome gravity
So you need enough so it deacc at 10m/s and gets to 0 at the top

IPS-9

Name: Michael Plasmeier
Block #: 2/28

10/12

Circular Motion Quiz

Please watch the demonstration to help you answer questions 1 and 2. The demonstration is of what is called a vertical circle.

X 1. Where is the bottle when the tension in the string is the greatest?
   a) at the top of its path.
   [✓ b)] at the bottom of its path. if the bottle is going around fast enough
   ~~[✓ c)]~~ the tension in the string is the same no matter where the water bottle is.

2. Why does the water in the bottle not spill out of the opening at the top of the circular path?
   a) Because gravity does not affect water the way it does solid objects.
   b) Because centrifugal force is pushing the water up.
   [✓ c)] Because the water's inertia keeps the water moving in a direction tangent to the circular path.
   d) Because the weight of the water is less than the tension in the string.

3. Why does an object going around in a circular path at a constant speed have acceleration?
   a) Because it is speeding up.
   b) Because it is slowing down.
   [✓ c)] Because it is constantly changing direction.
   d) Because of centrifugal force.

4. A car travels in a circle with constant speed. The net force on the car:
   [✓ a)] is directed toward the center of the curve.
   b) is directed forward, in the direction of travel.
   c) is directed away from the center of the curve.
   d) is zero because the car is not accelerating.

5. If you whirl a tin can on the end of a string and the string suddenly breaks, the can will:
   a) fly directly toward you.
   b) spiral away from your hand.
   c) spiral in toward your hand.
   [✓ d)] fly off in a straight line tangent to its circular path.
   e) fly directly away from you.

6. The centripetal force on a car going around a curve is provided by
   [✓ a)] friction of the road pushing on the tires
   b) force of the engine speeding up the car
   c) the weight of the car.
   d) the reaction force of the brakes applied to the wheels.

20/20

Name Michael Plasmeier

Period 2A Date 2/24

IPS UNIT 2.8 Concentrating on Collisions

WHAT DO YOU THINK?

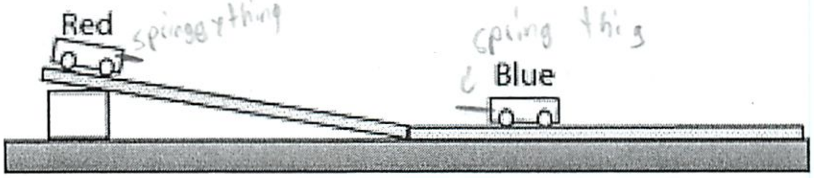
- A football player runs toward the goal line and a defensive player tries to stop him with a head-on collision. What factors determine whether the offensive player scores?

The factor what determans who moves is how fast the player is going and how fat he is (how much mass he has). These 2 multiply together to define momentum or the amount of inertia an object in motion has.

FOR YOU TO DO

In this activity, we will set up several collisions between two Pasco carts and observe the results.

1. Set up the Pasco tracks so that there is one block under one end of the track to create a slope. Align the second track at the bottom of the first, along the table so the track is level and the grooves in the track for the Pasco Cart wheels are aligned. The red cart gets placed at the top of the hill. Place the blue cart on the horizontal part of the track about one cart's length from the bottom of the hill as pictured below. In all of the collisions set up the carts to bounce off each other, not stick together.



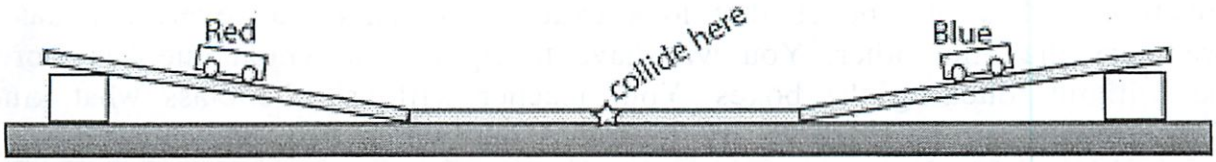
2. We will do three collisions with this track configuration. Record your observations below.
   - Collision #1: the red cart + 250 gram mass into the blue cart + 250 gram mass.
   - Collision #2: the red cart + 250 gram mass into the blue cart with no additional mass.
   - Collision #3: the red cart with no additional mass into the blue cart + 250 gram mass.

Te blue car goes farther up the hill then te red car would if it didn't hit anything

Collision #		What Happens to Red Cart?	What Happens to Blue Cart?
1	Red Car +0.250 kg into Blue Car +0.250 kg	It stops or starts moving slowly after hitting	It speeds up + almost hits te top of te other side. It then slows down + moves backwords and hits te red car and stops as te red cars starts movin
2	Red Car +0.250kg into Blue Car by itself	It stays moving but only slightly slows down	It goes further up te hill and ten comes back to hit te red car again
3	Red Car by itself into Blue Car +0.250 kg	It stops more then any other time	It goes te least up the hill of all

3. Identify a real-life situation, which the previous collisions could represent.

A car crasing into a truck thats stopped



4. Arrange another head-on collision between the two carts, but this time have them moving at the same speed towards each other. Release the carts from the same height on opposite hills so that the collision takes place at the middle of the flat track as shown above.

5. We will do three collisions with this track configuration. Record your observations below.
   - Collision #1: the red cart + 250 gram mass into the blue cart + 250 gram mass.
   - Collision #2: the red cart + 250 gram mass into the blue cart with no additional mass.
   - Collision #3: the red cart with no additional mass into the blue cart + 250 gram mass.

Collision #		What Happens to Red Cart?	What Happens to Blue Cart?
1	Red Car +0.250 kg into Blue Car +0.250 kg	It goes $\frac{1}{4}$ way up hil	It goes $\frac{1}{4}$ way up hill Sping goes all te way in
2	Red Car +0.250kg into Blue Car by itself	It stops pretty fast	It flies off and goes up to te top of te hill so hord it falls off the track
3	Red Car by itself into Blue Car +0.250 kg	It flies off and goes up to te top of te hill so hard it flies off te tr	It stops pretty fast

6. Identify a real-life situation which these collisions could represent.

Vehicle crashes between cars(no extra mass) and trucks(with extra mass)

7. Your teacher has two boxes that look exactly the same; however, one has more mass than the other. You will have to figure out which one has more mass without touching the boxes. Your teacher will ask the class what kind of experiment can be done to try to figure out which box has more mass. Your teacher will then set up and do the experiment as a demonstration.

Bump a Pasco car into it (with weight on car)

8. Which box had more mass?

9. What experiment did you ask your teacher to perform? What were your observations and how did they indicate which box had more mass?

The box that did move or had the car bounce off weaker had less mass. If both cars bounce off the same, use more mass th car or a bigger car

10. Read "For You To Read" on page 94. ✓

Reflecting On The Activity

I was correct. Momentum determin who will be affected by a crash and by how much. Howeve the book says that the parts don't move alon Both mass and velocity factor in. A light fast moving object can have the same momentum as a heavy slow moving ite

Physics To Go (p. 95-96, #1-9, #4b ~~is optional, ask your~~ teacher if ~~you should do it.)~~ K

REFLECTING ON THE ACTIVITY AND THE CHALLENGE

You already have identified several real-life situations which involve collisions, and many such situations happen in sports. Some involve athletes colliding with one another as in hockey and football. Others cases include athletes colliding with objects such as when kicking a ball. Still others include collisions between objects such as a golf club, bat, or racquet and a ball. Some spectacular collisions in sports provide fun opportunities for demonstrating your knowledge about collisions during voice-over commentaries. Use the concept of momentum when describing collisions in your sports video.

PHYSICS TO GO

1. Sports commentators often say that a team has “momentum” when things are going well for the team. Explain the difference between that meaning of the word “momentum” and its specific meaning in physics.

2. Suppose a running back collides with a defending linebacker who has just come to a stop. If both players weigh the same, what do you expect to see happen in the resulting collision?

3. Describe the collision of a running back and a linebacker of equal mass running toward each other at equal speeds.

4. Suppose that you have two baseball bats, a heavy (38-ounce) bat and a light (30-ounce) bat.
   a) If you were able to swing both bats at the same speed, which bat would allow you to hit the ball the farther distance? Explain your answer.
   b) How fast would you need to swing the light bat to produce the same hitting effect as the heavy bat? Explain your answer.

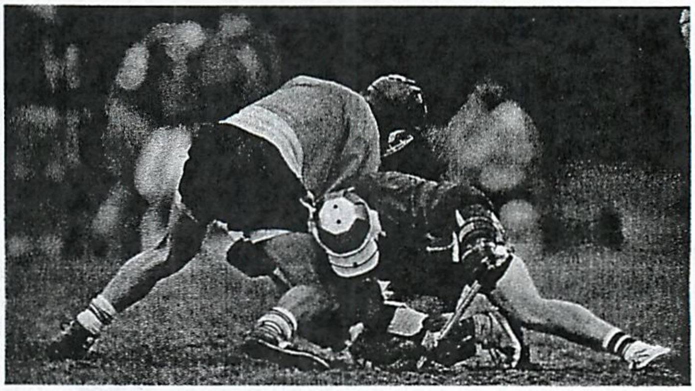
5. Why do football teams prefer offensive and defensive linemen who weigh about 300 pounds?

6. What determines who will get knocked backward when a big hockey player checks a small player in a head-on collision?

7. A 100-kg athlete is running at 10 m/s. At what speed would a 0.10-kg ball need to travel in the same direction so that the momentum of the athlete and the momentum of the ball would be equal?

8. Use the words mass, velocity, and momentum to write a paragraph which gives a detailed "before and after" description of what happens when a moving shuffleboard puck hits a stationary puck of equal mass in a head-on collision.

9. Describe a collision in some sport by using the term momentum. Adapt this description to a 15-s dialogue that could be used as part of the voice-over for a video.



Physics to Go
2.8

2/28

1. When comentators talk about a teams momentum they don't mean the teams mass times its weight. They mean that when a team wins, it gains a good felling that makes them win more games. People also like to believe in streaks.

2. The running back has more momentum because he is moving. The linebacker has no momnentum and would be quickly bowled over onto the ground.

3. Both people would bounce off eachother and be affected by the colision in the same way, because they have the same momentum.

4. ? The lighter bat, I know because people like using light alluminum bats in baseball. I guess this is because the light bat would have less of the force disappear in making the bat move so more force goes into the ball? I don't really know

5. Football teams perfer heavy players because they have more mass then a skinny player. Theirfore the heavy player has more momentum then the other person and affects the other players momentum and movement more.

6. The momentum or their mass times their velocity, detemins who gets knocked backword when a large player checks a smaller player

7. athlete's momentum (p) = 100kg × 10m/s = 1000 kg(m/s) , $\frac{kg \cdot m}{s}$ or Newtons·sec
ball's momentum 1000kg(m/s) / .10 kg = 10000 m/s

8. Before the collision when a moving shuffleboard puck hits a static puck, the moving puck is moving at a quick velocity but is slowly decellerating due to friction. The moving puck has momentum which is equal to the puck's mass times its velocity
After the puck hits the momentum determines how much the former non moving puck moves. The former moving puck almost stops and the former static puck moves quickly.

Blue Book p100
Chap. 7 Momentum

3/4

1. Mass is the amount of inertia in an object and is in proportion with weight when the objects are weighed in the same location. Momentum is the amount of inertia an object has while it is in motion. Momentum is = ~~1x~~ an objects mass times its velocity.

2. A heavy truck has more mass then a skateboard reguardless of their speed. However any object that moves has more momentum then any object at rest (as its momentum = 0) So the skateboard in motion has more momentum then a skateboard at rest.

3. Impact is a force (in N) when something hits. Impulse is a change in momentum and is expressed as: impact (force) × time. (in Newton-seconds) So impulse is the product of impact + time.

Think more about 7.

4. ✓ When a force (impact) is sustained for longer the impulse (change in momentum) also increases.

5. Impulse is the force × time that ~~is~~ produces a change in momentum. Momentum is the inertia in motion that is mass times velocity.

6. Impulse is a change in momentum

7. When the amount of time a force affects an object doubles, so does the impulse, thus the amount the momentum changes also doubles.

8. In a car crash, the occupant wants to increase the amount of time the crash takes place because a longer impact time reduces the force of impact and decreases the resulting decellerating.

9. If the time of the force of the impact is extended four times, the force is 4x less - the impulse remains the same.

10. It is better for a boxer to ride with the punch because that lenghtens the impact time, as the difference between the speed of the hand and head decreases. If you move towards the hand that difference increases more

hand ← 4m/s)
head ← 2m/s) -2m/s diff

hand ← 4m/s ← 6m/s diff
head → 2m/s

Law of Conservation of Momentum

3/3

- Total Momentum before a collision equals total momentum after a collision,

- In the absence of a net external force, the momentum of an object or system remains unchanged.

- The total momentum before a collision is = to the total momentum after a collision if no external forces act upon it.

3/8

- Total Momentum of all objects before a collison equals the total momentum of all the objects after the Collision (in the absence of all external forces to the system)

Momentum Terms + Sample

3/8

Momentum - inertia in motion - vector quatity (has direction)
momentum = mass × velocity - $p = mv$

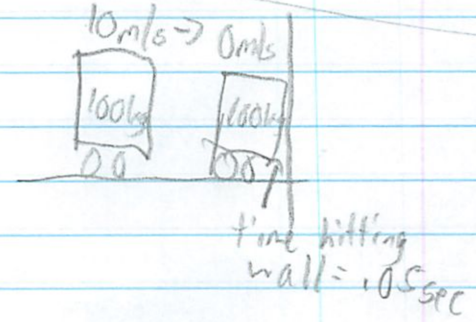
Impulse - a force which is exerted over a certain amount of time - change in momentum
Impulse = Force × times = $J = Ft$
produces a change in momentum (not the force that does it)
produced by another object

Impact - designates (assigns) a force
describes a force, describes an impulse

Sample Problem

$J = F\,t$

$J = f\,{\Large t}$ ← would rather do this



$\boxed{\Delta mv = J}$

Change in momentum = impulse
mv before → mv after
10 m/s × 100 kg → 0 kg m/s
1000 kg m/s → 0 kg m/s

1000 kg m/s = J = Ft

$$\frac{1000\,kg\,m/s}{.05\,sec} = \frac{F(.05\,sec)}{.05\,sec}$$

$2000\,kg\,m/s^2$ or N is force it hits wall with

Find mass of Cart

3/10

Momentum = mass × velocity

$P = m \times v$

(kg) (m/s)

Impulse = Force × time = change in momentum

$J = m(\Delta v)$

$\boxed{F \times t = m(\Delta v)}$

$\frac{F_{net} \times t}{\Delta v} = m$ ← use that to find the mass of the cart w/ 3×5N scales

Friction Force = 5 N - Subtract that from total that they all pull

Start at 4.5 sec at 0 m/s
End at 7.5 sec at .8 m/s
Diff of 3 sec and .8 m/s
↑ should be 3.0 sec to show significant figures

Pulling at 3×4N = 12N - 5N Friction = 7 N Net Force

$\frac{F_{net}\ \Delta t}{\Delta v} = m \quad \frac{7N \times 3sec}{.8 m/s} \rightarrow \frac{7 kg\ m/s^2 \times 3sec}{.8 m/s} \rightarrow$

$\frac{21 kgm/s}{.8 m/s} = 26.25 kg$

Actual →

Weight = 33 lbs × 4.448 N

$$\frac{146.78\,N}{9.8\,m/s}$$

$F_g = mg$

$\boxed{15\,kg}$ ← actual mass of cart

Cathey Group was close at 15.5 kg
We were way off because of error adds up
we had 3 people trying to pull the cart at the same constant speed.

Phz

didn't need to do ✓

2.9

Physics to Go p101-102 white book

3/6

1. Momentum Before = Momentum After

2000 kg × 3m/s + 2000 kg × 2 m/s = mv after

6000 kgm/s + 4000 kgm/s = 10,000 kgm/s = mv after

$\frac{10,000 \text{ kgm/s}}{4000} = \frac{4000 \text{ kg} v}{4000}$

$\boxed{2.5 \text{ m/s} = v}$

2. Momentum Before = Momentum After

80 kg × 10m/s + 100 kg × 8m/s = mv after

800 kgm/s + 800 kgm/s = mv after

1600 kgm/s = mv after

1600 kg m/s = 100kg × 9.78 m/s + 80 kg v

1600 kgm/s = 978 kgm/s + 80 kg v

-978 -978

$\frac{622 \text{ kgm/s}}{80 \text{ kg}} = \frac{80 \text{ kg } v}{80 \text{ kg}}$

speed = 7.775 m/s in the same direction as always

3. Mv Before = Mv after

3kg × 2m/s + 1kg × -2m/s = mv after

6kgm/s + -2 kgm/s = mv after

4kgm/s = mv after

4kgm/s = 3kg × 0 m/s + 1kg v

$\frac{4 \text{ kg m/s}}{1 \text{ kg}} = \frac{1 \text{ kg } v}{1 \text{ kg}}$

4m/s speed in the direction the big ball was ← originally going

4. Mv Before = Mv after

given → 0 kgm/s = 45 kg × 2m/s + 75 kg × v

0 kgm/s = 90 kgm/s + 75 kg v

$\frac{-90 \text{ kgm/s}}{75} = \frac{75 \text{ kg} \times v}{75}$

-1.2m/s = v = The male skater moves at 1.2m/s

5. Mv before = mv after (right = positive)

.35kg × 20m/s + .06kg × -30m/s = momentum after

7kgm/s + -1.8kgm/s = mv after

5.2kgm/s = .35kg 10m/s + .06kg × v

5.2kgm/s = 3.5kgm/s + .06kg(v)

$$\frac{1.7kgm/s}{.06} = \frac{.06kg(v)}{.06}$$

$\boxed{28.33 m/s = v \text{ to the right}}$

6. Mv before = mv after

3kg × 0m/s + 1kg × 4m/s = mv after

0kgm/s + 4kgm/s = 4kgm/s

4kgm/s = 3kg × 2m/s + 1kg v

4kgm/s = 6kgm/s + 1kg(v)

-2kgm/s = 1kg v

-2m/s = v - Small ball goes to left 2m/s

7. See Racecar page

Equations Review

3/13

Equation	Quantity	Units
$p = m \cdot v$	momentum - p	$\frac{kg \cdot m}{s}$
$m = \frac{p}{v}$	mass - m	kg
$v = \frac{p}{m}$	velocity - v	m/s
$J = F \cdot t$ or $J = m \cdot (\Delta v)$	impulse - J	$N \cdot s$ or $\frac{kg \cdot m}{s}$
$F = \frac{J}{t}$	Force - F	N or $\frac{m \cdot kg}{s^2}$
$t = \frac{J}{F}$	time - t	s

Δ = change in

Impulse = change in momentum

$N = \frac{m \cdot kg}{s^2}$

Michael Plasmeier

$$\frac{P}{M \mid V}$$

IPS Unit 2 .10 Problems

Momentum and Impulse

1. A 50.0-kg football player is running East at 1.20 m/s. What is his momentum?

$P = mv$ $P = 50kg(1.20m/s)$ $\boxed{P = 60kg\,m/s}$ or $60\frac{kgm}{s}$

2. A 5.00-kg object is moving North at 12.0 m/s, what is its momentum?

$P = mv$ $P = 5kg(12\,m/s)$ $\boxed{P = 60kg\,m/s}$

3. An object with a momentum of 120-kg·m/s [South] has a velocity of 15.0 m/s. What is the mass of the object?

$mass = \frac{P}{V}$ $m = \frac{120\,kgm/s}{15m/s}$ $\boxed{m = 8kg}$

4. An object with a mass of 3.20 kg has a momentum of 54.0 kg·m/s [West], what is the velocity of the object?

$V = \frac{P}{m}$ = $V = \frac{54\,kgm/s}{3.2\,kg}$ = $\boxed{v = 16.875\ m/s}$

5. A truck of mass 2,500-kg is moving East at 14.0 m/s (approximately 30 mph). A bullet of mass 10.0-g (0.010-kg) is moving East at 88.0 m/s (approximately 180 mph).

watch out don't use that

a) Which one has the greater momentum? truck

b) What is the momentum of the truck? $p = mv$ = $p = 2500\,kg\ 14m/s$ = $\boxed{35000\,kgm/s}$

c) What is the momentum of the bullet? $p = mv$ = $p = .01kg \times 88m/s$ = $\boxed{.88\,kgm/s}$

6. A 1,000-kg car has a velocity of 25.0 m/s. What is the velocity of a truck of mass 3,500-kg, if it has the same momentum as the car?

$P_{car} = mv$

$P_{car} = 1000kg \times 25m/s = 25000\,kg\,m/s$

$V_{truck} = p/m = 25000\,kg\,m/s / 3500kg$

$\boxed{V_{truck} = 7.14\ m/s}$

7. A 1,000-kg car has a velocity of 10.0 m/s. What is the velocity of a sled of mass 20.0-kg, if it has the same momentum as the car?

$P_{car} \overset{mv}{=} 1000kg \times 10m/s = 10,000\,kgm/s$

$V_{sled} = p/m = 10000\,kgm/s / \underset{20}{\cancel{3500}}kg = \underset{500}{\cancel{2.86}}\ m/s$

copy error

8. A 1,000-kg car has a velocity of 10.0 m/s. What is the velocity of a bullet of mass 40.0-g, if it has the same momentum as the car?

$p_{car} \overset{mv}{=} 1000\,kg \times 10\,m/s = 10000\,kgm/s$

$V_{bullet} = p/m = 10000\,kgm/s / .04\,kg = \boxed{25{,}000\,m/s}$

9. A force of 10.0 newtons [West] is applied to an object for 32.0 seconds. What impulse is given to the object?

$J = F\Delta t$ $\quad J = 10N \times 32sec$ $\quad \boxed{J = 320\,kg\,m/s}$

$J = m(\Delta v)$

10. An object received an impulse of 50.0 N·s [South]. If the force applied was 2.50 N [South], how long was the force applied?

✓ Sames as kgm/s

$J = F\Delta t$ $\quad 50kgm/s = 2.50\,\Delta t$ $\quad \boxed{t = 20sec}$

11. A car received an impulse of 2500 N·s [East]. If a force was applied for 40.0 seconds, what force was applied to the car?

$J = F\Delta t$ $\quad 2500\,kg\,m/s = F(40sec)$ $\quad \boxed{62.5\,N}$

12. A 20.0 newton force is applied to a 50.0-kg object for 65.0 seconds.
   a) If another object receives the same impulse when a force of 5.00 newtons is applied, how long must the force act?
   b) If yet another object receives the same impulse for 40.0 seconds, what force was applied?

$J = F\Delta t$ $\quad J = 20N(65sec)$ $\quad J = 1300\,Ns$

a. $1300\,Ns = 5_N\,t$ $\quad \boxed{t = 2600sec}$

b: $1300\,Ns = F(40sec)$ $\quad \boxed{F = 32.5N}$

Impulse and Change in Momentum

1. A golf ball and a baseball are initially at rest. Both receive an impulse of 0.150 N·s [East]. The mass of the golf ball is 46.0 g and the mass of the baseball is 0.145 kg.
   a) What will be the velocity of the golf ball?
   b) What will be the velocity of the baseball?

$J = m(\Delta v)$ $\quad .15Ns = .046\,v$ $\quad \boxed{v = 3.26\,m/s}$

$J = m(\Delta v)$ $\quad .15Ns = .145v$

$\boxed{v = 1.03\,m/s}$

Pafter = mΔV
3kg × 18m/s = 54N

Pprior = mv

Pprior = 3kg × 10m/s = 30N

Change 54-30N
24N

C

2. A force of 12.0 N accelerates a 3.00-kg body, from 10.0 m/s [East] to 18.0 m/s [East].
   a) What is the change in momentum of the body? J = mΔv J = 3kg(8m/s) J = 24Ns
   b) What impulse was given to the body? Same
   c) How long was the force acting on the body?

J = FΔt 24Ns = 12N t 2sec

C

Pbefore = mΔv = .046kg × 0m/s = 0m/s

3. A golf ball of mass 0.046-kg is hit off a tee with a velocity of 35.0 m/s [East].
   a) What is the change in momentum of the golf ball? Pafter = .046kg × 35m/s = 1.61 kgm/s −0 = 1.61 kgm/s
   b) What impulse is given to the ball by the club? Same as change in momentum; 1.61kgm/s :)
   c) If the club is in contact with the ball for 0.0080 seconds, what force was applied to the ball by the club?

J = FΔt 1.61kgm/s = F(.008sec) F = 201.25 N

C

4. Superman can exert a force of 50,000 N. He uses this force to **stop** a train (m = 80,000 kg) that has a velocity of 25.0 m/s [North].
   a) What must be the change in momentum for the train? MVBefore = 80000kg × 25m/s = 2000,000
   MVAfter = 0 Change = 2,000,000 kg m/s
   b) What impulse does superman give to the train? Same = 2,000,000 kgm/s
   c) How long will it take to stop the train?

J = FΔt

2,000,000 kgm/s = 50,000N t

t = 40sec

5. When you catch a fast-moving baseball is it better to try to hold your hand perfectly still or to let it move back as the ball hits it? Explain in terms of change in momentum, impulse, time of impact and force applied to the ball.

It is best to let your hand move back because that increases the amount of time (time of impact) that your hand hits the ball, This decreases the force you aply to the ball to stop it. You can not change the impulse (change in momentum)

6. Everybody knows that you will be harmed less if you fall on a floor with 'give' than a rigid floor. In terms of change in momentum, impulse etc., explain why this is so.

Agains the longer the time of impact the less the force that is aplied to you doring that time. That means it hurts less.

7. In terms of safety in an accident, much has been said about people who do not use seat belts, those who use a seat belt, and cars with air bags. Assume that a car is involved in a head on crash; explain each of the following.
   a) Which person will experience the greatest change in momentum?
   b) Which person will experience the greatest impulse?
   c) Which person will experience the greatest force?

They all experance the same impulse and change in momentum however the person with out saftey device experiences a bigger force in a shorter time Then the people with seat belts and airbags experiencing a lesser force in a longer amt. of time. All have the same impulse or total change in momentum

REFLECTIONS

Now that we know about impulse, can you explain the following?

- What is the importance of following through when swinging a bat or a golf club?

  Following through lets the club slow down slowly so the force on your hand doesn't hurt you.

- Why do boxers "roll with the punch"? Hint: The answer is the same for all of these questions, no need to write it three times!

  Again, it increases the time of impact, decreasing the force upon you at each instant

Energy
Start Notes/Brainstorm

What is energy?

heat
electristy
provides power
does work

Work = Force × distance

Energy = the "something" That enables an object to do work

Potental Engrgy - m g h
mass gravity (acceleration) hight

Potental Energcy - stored energy or energy of position
depends on the position, mass, acc due to gravity

Force associated w/ this

Kenetic Engrgy - $\frac{1}{2}mv^2$ - Energy of motion
mass velocity

Tricks

Name Michael Plasmeir

Unit 2.11 Energy

Period _____ Date _________

WHAT DO YOU THINK?

- Knowing that roller coasters don't have engines, what determines how fast they can go?

The amount of kinetic energy they have built up

FOR YOU TO DO

1. This activity is about energy. The energy that we will discuss in this class is one of two types: potential and kinetic. Your teacher will briefly discuss each type. Your teacher will give you the formula for each and show a couple of examples.
Fill in the table below.

Potential Energy (stored energy)	**Kinetic Energy**
Formula: $PE = \underbrace{mg}_{weight} h$	Formula: $KE = \frac{1}{2} m v^2 = F_{net} d$
What does potential energy depend on? The position, mass, acc due to gravity	What does kinetic energy depend on? The speed, mass

weight (Force ass.)

2. For the following examples determine if the object has any potential energy and any kinetic energy. Place a checkmark in the appropriate place if the object has that type of energy.

	Object has PE	Object has KE
A ball rolling on the ground.		✓
A crate at rest on the ground.		
A person skydiving in mid-air.	✓	✓
A ball held above a cliff.	✓	
The same ball dropped from the cliff in mid-air	✓	✓

3. The following is based on stuff that we learned a long time ago, in projectile motion- Unit 1-9. A ball (mass = 1 kg) is held 45m above a cliff, then is dropped. Fill in the table below based on the dropped ball.

Time	Velocity (Speed) $= gt$	Distance traveled $= \frac{1}{2} g t^2$	Height from ground
0	0	0	45
1	10 m/s	5 m	40 m
2	20 m/s	20 m	25 m
3	30 m/s	45 m	0 m

4. Based on the calculations made above fill in the following table below.

Time	Potential Energy (m·g·h)	Kinetic Energy(1/2·m·v^2)	PE + KE
0	450 J	0 J	450 J
1	400 J	50 J	450 J
2	250 J	200 J	450 J
3	0 J	450 J	450 J

5. What happened to the PE?	What happened to the KE?	What happened to the PE + KE?
It decreased	It increased	It stayed the same

6. Your teacher has a pendulum set up in the class room. He (or she) will offer a test of courage to the classroom. The test of courage: place the pendulum to your nose, release it, let it swing to one side and back, when it gets close to you- don't flinch! Try it, its tough to do.

7. When the pendulum swings back and forth, do you think that the total energy (PE + KE) increases, decreases or stays the same?

I think the total energy decreases slightly, as friction in the air and at the top of the string turned into thermal energy or heat.

8. In terms of energy, why will you never get hit by the pendulum (as long as you don't give it a push)?

The energy is lost, so the kinetic energy is lost and can not overcome gravity as much

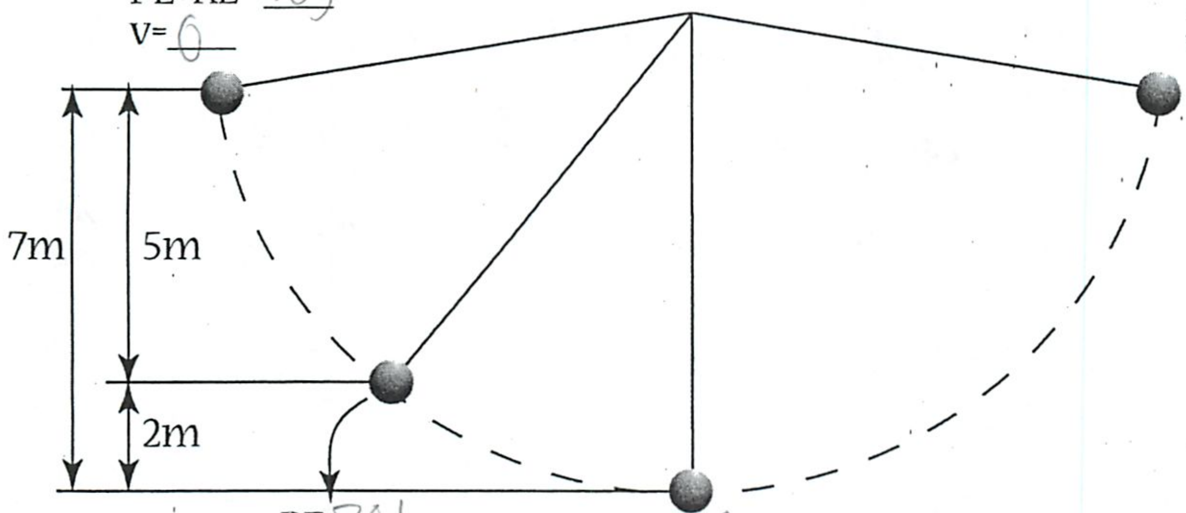
9. It turns out that the PE + KE of any system will always be the same, as long as there are no forces from anything outside the system. Another way to say it is that energy cannot be created or destroyed- it only is transferred from one type into another- such as from potential energy into kinetic energy. This is known as the conservation of energy.

10. Fill in the blank spaces based on what we learned in this activity.

● = 1 kg

PE= 70J
KE= 0
PE+KE= 70J
v= 0

PE= 70J
KE= 0J
PE+KE= 0J
v= 0m/s



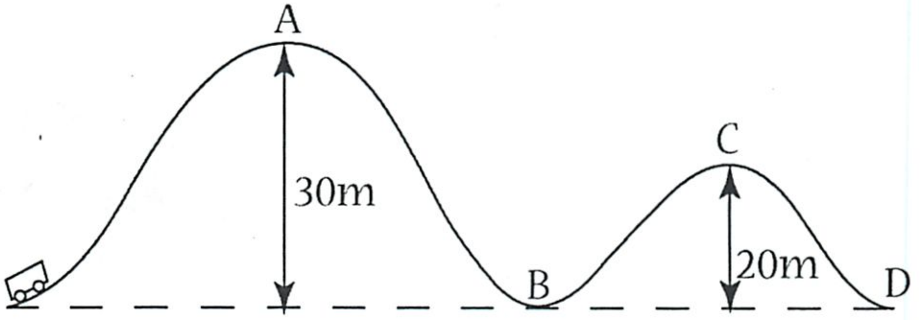
PE= 20J
KE= 50J
PE+KE= 70J
v= 10m/s

$50 = .5(v^2)$
$100 = v^2$

PE= 0
KE= 70J
PE+KE= 70J
v= 11.83 m/s

$70 = .5(v^2)$
$140 = v^2$

11. A 500 kg roller coaster gets pulled to the top of the first hill. Its speed as it passes point "A" is 5 m/s. You can fill in the rest of the blanks based on this information.



A	B	C	D
PE= 150000J	PE= 0J	PE= 100,000J	PE= 0J
KE= 6250J	KE= 156250J	KE= 56250J	KE= 156250J
PE+KE= 156250J	PE+KE= 156250J	PE+KE= 156250J	PE+KE= 156250J
v= 5m/s	v= 25m/s	v= 15m/s	v= 25m/s

Actual will be less because energy turns to heat w/ friction

$KE = 250kg(5^2)$ $156250 = 250kg(v^2)$ $56250 = 250kg(v^2)$

$$\boxed{V = \sqrt{\frac{2KE}{m}}}$$

What do you think? revisited

I was mostly correct. The amount of kinetic Energy directly determains the speed. But I left out because I did not know that kinetic Energy turns into Potential Energy going up hills. This energy then turns back into kinetic Energy comming down the hill. The kinetic + Potential Energy always stay the same without friction turning energy into heat.

Name: Michael Plasmeier 20/20

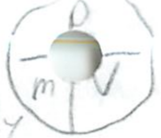
p = momentum

momentum = inertia in motion

mass x velocity

momentum changes with a force only

Change speed or mass



IPS Unit 2.9

Conservation of Momentum

WHAT DO YOU THINK?

- What determines the momentum of an object?

The objects mass times the velocity it is traveling at (before it hits) $p = mv$

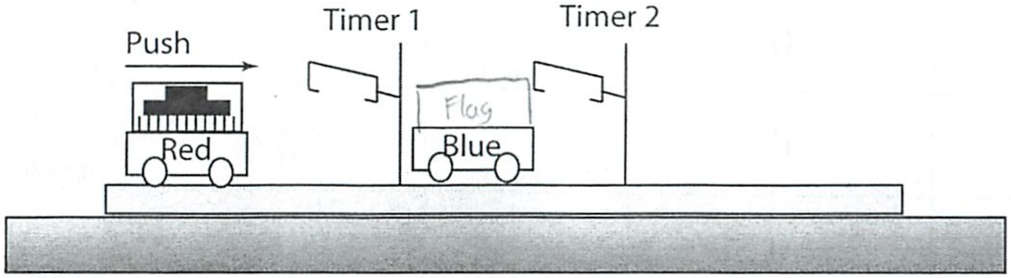
- What does it mean to conserve something?

To not use it now and save it for latter

FOR YOU TO DO

1. In this activity you will produce four "sticky" collisions between 2 Pasco Cars. You will only use one track. In all four of the collisions the red car will be pushed into (and stuck to) the blue car originally at rest. The two cars (now stuck together) will continue moving together. To get the red car moving you simply give it a firm push. You will have two photogate timers set up; one between the red and blue car the other after the blue car, as seen in the picture below. Timer 1 will tell you the velocity of the red car. Timer 2 will tell you the velocity of the combined cars. *You need to make sure that the timer is only "seeing" the top row of bars, otherwise the velocity that it calculates will not be correct. Based on this information and the mass of each car we can determine the momentum of the red car before the collision and the momentum of the combined cars after the collision. We will examine the momentum of the cars before the collision and compare it to the momentum of the combined cars, after the collision.

-inelsastic



2. Spend some time playing with the timers. How does the timer work? How does it calculate speed?

The timer sends out a little light beam at the bottom, when the beam is interrupted the timers starts and the timer stops timing when it sees the beam come through again

3. Do the four collisions described below. Fill in the tables below based on doing the four collisions. For the first table you need to be working with the cars and timers. Table 2 is only calculations based on these data.

Sticky Head-on Collisions:
One Car Moving before Collision

Collision #		**Mass** of Red Car (kg)	**Velocity** of Red Car before Collision (m/s)	**Mass** of Blue Car (kg)	**Velocity** of Blue Car before Collision (m/s)	**Mass** of Combined Objects after Collision (kg)	**Velocity** of Combined Cars after Collision (m/s)
							Just use velocity of Blue car
1	Red Car by itself into Blue Car by itself	Car by itself .25	1.238	Car by itself .25	0	.5	.56 + ~~.59 =~~ ~~1.15~~
2	Red Car +0.250kg into Blue Car by itself	Car +0.250 kg .5	0.972	Car by itself .25	0	.75	.610 ~~+ .620 =~~ ~~1.23~~
3	Red Car by itself into Blue Car +0.250 kg	Car by itself .25	1.279	Car +0.250 kg .5	0	.75	.479 + ~~.413 =~~ ~~.842~~
4	Red Car +0.250 kg into BlueCar +0.250 kg	Car +0.250 kg .5	.994	Car +0.250 kg .5	0	1	.512 + ~~.473 =~~ ~~.985~~

Momentum of object before and after collisions.

Momentum = mass x velocity   p = m·v

Collision #	Momentum of Red Car before collision kg(m/s) (calculated from data above)	Momentum of Blue Car before collision kg(m/s) (this is too easy to tell you)	Sum of Momentum of both cars before collision kg(m/s) (add the first two columns)	Momentum of combined cars after collision. kg(m/s) (calculated from data above)
1	.3095	0	.3095	~~.575~~ .28
2	.486	0	.486	~~.9225~~ .4575
3	.31975	0	.31975	~~.6315~~ .321
4	.497	0	.497	~~.985~~ .512

Should be same or a little less for friction

REFLECTING ON THE ACTIVITY

The what do you thinks were correct. The law of the conservation of momentum are interesting. Momentum (mass × velocity) is just transfered. If both objects weight the same like in this crash, the cars continue at the same momentum. There is no net force from outside the system. Therefore no momentum is lost or gained. This is called the Law of Conservation of Momentum (see below)

PHYSICS TO GO Problems below and p.101-102 #1-7

1. What is the Law of Conservation of Momentum (get it from your book)? Is momentum conserved in every collision? When is momentum not conserved?

- In the absence of an external force, the net momentum of a system remains unchanged. Momentum is always conserved inside the system. If you consider a collision between the system and an external object, momentum is lost out of the system. But include that object into the system + momentum is conserved.

2. A 1290-kg rail car is coasting along some railroad tracks at 12-m/s. Ahead of it is an unsuspecting passenger train (975-kg) at rest. The two cars collide and stick together.

A) What is the momentum of the cars before the collision?

p=mv

Car = 1290×12 = 15480kgm/s

Train = 975×0 = 0

15480 kgm/s

B) What is the momentum of the cars after the collision?

The same, 15480 kgm/s

C) What is the mass of the two stuck together cars?

1290 + 975 kg =

2265 kg

D) What is the final speed of the two cars?

$\frac{15480}{2265} = \frac{2265 kg}{2265}$ v

v = p/m

6.83 m/s

3. The same scenario as above, except after the collision the trains do not stick to each other. The1290-kg rail car travels on its path at 3.0m/s after the collision.

A) What is the momentum of the cars before the collision?

The same

15480 kgm/s

B) What is the momentum of the cars after the collision?

Again the same, 15480 kgm/s

C) What is the speed of the 975-kg rail car after the collision?

15480 kgm/s = 1290×3 + 975v

15480 = 3870 + 975v

-3870 -3870

$\frac{11610}{975} = \frac{975v}{975}$

v = 11.91 m/s

IPS-9 1 joule = 1 watt x 1 sec Review Worksheet

Momentum, Impulse and Energy

Part 1

Momentum is inertia **in motion.**

Momentum is calculated using the equation: p = mv **.**

- Calculate the momentum of a 12 kg bowling ball moving down the alley at 14m/s.

$p = mv$

$p = 12 kg \times 14 m/s$

$p : 168 kgm/s$

Impulse is the amount of momentum given to or taken away from an object when the object collides with or interacts with another object. Because of Newton's Third Law the other object applies a force to the original object for a period of time. **The amount of the impulse is equal to the** change **in momentum.**

Impulse is calculated using the equation: J = $m\Delta v$ or Ft **.**

- Calculate the impulse given to a baseball if a baseball bat hits the ball with a force of 500 N for a time of 0.15 seconds when they are in contact with each other.

$J = 500 N \times 0.15 sec$

$J = 75 Ns$

A change in the momentum of an object can be determined in two ways:

- Method #1: If the mass of the object is known and the velocity of the object changes, then the change in momentum is calculated by subtracting the momentum at one velocity from the momentum at the other velocity. An equation that can be used is:

Change in momentum = mass x (change in velocity **)**

- Calculate the change in momentum when a 1,500 kg car accelerates from rest to a speed of 30 m/s.

$J : 1500 kg \times 30 m/s$

$J : 45000 kg m/s$

- Method #2: The change in momentum is equal to the impulse given to an object.

- Find the change in momentum of a 2 kg hockey puck as it is shot toward the goal with a force of 50 N from a hockey stick that made contact with the puck for 0.55 seconds.

J=50N×.55sec

J=27.5 kgm/s

The total momentum of a system of objects is conserved in a collision or an interaction between those objects. This means that the momentum of all the objects added together before the interaction equals their momentum added together after they lose contact.

- A person stands motionless on a skateboard holding a bowling ball. What is the total momentum of the three objects?

0 kgm/s

- The person then throws the bowling ball out over the front of the skateboard. What happens to the person and the skateboard?

conserved

0 kgm/s - cancle each oter out

- What is the total momentum of the bowling ball, skateboard, and person system after the bowling ball is thrown?

0 kgm/s

Part 2

Energy is used by objects in order to do Work.

The unit of energy when using kg, m, and s is a joule.

In comparison to a 100 watt light bulb it would take 100 **joules** of energy to light the bulb for 1 second.

Potential energy is energy associated with position.

Kinetic energy is energy associated with m o t i o n .

Gravitational potential energy is calculated using the equation:
PE = mgh

- Calculate the potential energy of a 1.75 kg basketball when it is 3 m above the floor of the gym.

$PE = 1.75 kg \times 10 m/s \times 3 m$

$PE = 52.5 J$

Kinetic energy is calculated using the equation:
KE = $\frac{1}{2} m v^2$

- Calculate the kinetic energy of a 0.05 kg bullet shot from a pistol at a speed of 425 m/s.

$KE = \frac{1}{2}\ 0.05 kg \times 425 m/s^2$

$4515.625 J$

The total of the potential energy plus the kinetic energy of a system (e.g. a roller coaster, pendulum, falling object, or even an object attached to a spring) is C o n s e r v e d . This means that the total mechanical energy of all the objects added together does not change.

IPS-9

20/20

Name: Michael Plasmeier

Block/ Date: 3/28

Quiz: Momentum and Energy

Fill in the blank with a word(s) from the word bank below (1 point for each blank).

1. Potential energy is stored energy due to position.
2. Kinetic energy is energy that depends on mass and velocity.
3. An object lifted to a higher position has gained potential energy.
4. Inertia in motion is a description for momentum.
5. Impulse can be calculated using the equation: impulse = Force x time .
6. The amount of impulse given to an object is equal to the change in momentum of the object assuming all forces outside the system are ignored.
7. A Joule is a unit of energy that is used if kilograms, meters, and seconds are the units used in other quantities.
8. If a quantity is conserval, it means the amount of the quantity does not change.
9. If an object has energy, it can do work.

Word Bank:

~~conserved~~
equal to
~~force~~
greater than
~~joule~~
less than
~~mass~~
~~momentum~~
position
~~potential~~
~~velocity~~
work

IPS-9

Name: ____________________

Block/ Date: ____________________

Calculations (2 points each): To receive any partial credit you must show all of your work. Place your answer on the line next to the units.

A German Shepherd has a mass of 20 kg and is running along a road with a velocity of 9 m/s.

1. Calculate the momentum of the dog.

$p = mv$

$p = 20kg \times 9m/s$

$p =$ 180 kg m/s

2. Calculate the kinetic energy of the dog.

$KE = \frac{1}{2} m v^2$

$KE = \frac{1}{2} 20 kg \times 9m/s^2$

$KE = 10kg \times 81m/s$

$KE =$ 810 joules

3. What is the potential energy of the dog if it is running along the ground?

On ground - relitie to ground 0

0 joules

4. If the dog started from rest to attain this speed of 9 m/s, calculate the dog's change in momentum?

$\Delta p = m \Delta v$

$\Delta p = 20kg \times 9m/s$

$\Delta P =$ 180 kg m/s

5. What was the impulse on the dog?

Same

180 kg m/s

Michael Plasmeier

15/15

IPS Unit 2:12 Hi Ho, Hi Ho its off to Work I go.

WHAT DO YOU THINK?

- What is work?

A transfier of energy

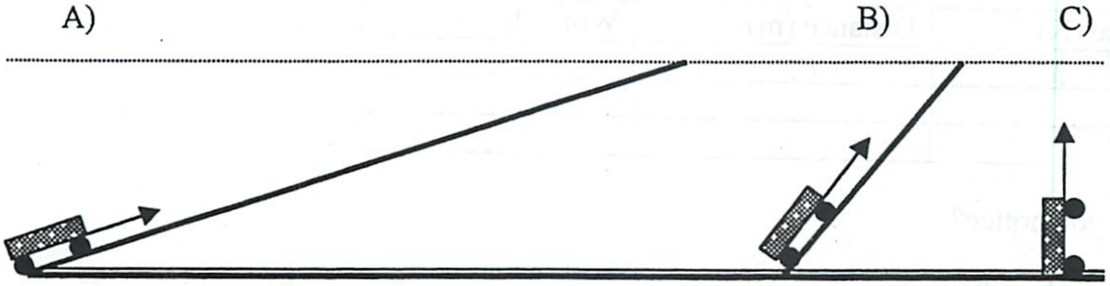
Work in science is moving a mass over a certain distance (work = F×D)

The amount of energy put into something The aml of energy gained by something

- Is homework really work?

not really, but you usually need to do work in order to do your homework (you must do work on a pencil)

- A cart is being pulled along a track or lifted straight up at a constant speed. In each case the cart is being pulled to the same height above the floor.



1. In which case is the most work done on the cart? Why?

A - the most lateral work is being done (to overcome friction on the ramp)

2. In which case is the least work done on the cart? Why?

C - No ramp, no friction, no latteral work

* However the same work is being done on each if you don't include lateral work) friction

3. In which case is the most force required to move the cart? Why?

C - when the distance is shortest - force is applied more at once

FOR YOU TO DO.

Read the Physics Talk found on page 77 in your book (read only page 77 at this time).
The equation for work is: Work = Force x Distance the force is applied.

1. Calculate the work that must be done to pull the cart up ramp "A."
   a) Measure the length of the track from start to finish. Record your value below.
   b) Attach the scale to the cart and pull the cart at a constant speed. Make sure that the scale is parallel to the track. Record your value below.

Distance = d = 1.2 m

Force = F = 1.8 N

Work = W = F x d = 2.16 J

2. Repeat the process used in #1 to calculate the work done to pull the cart up ramp 'B."

.6 m x 3N = 1.8 J

3. Repeat the process used in #1 to calculate the work done to lift the cart straight up (illustrated in "C") to the same height as in #1 and #2.

,15 m × 12,5 N = 1,875 J

4. Summarize your results in the following chart.

Case	Force (N)	Distance (m)	Work (J)
A	1,8	1,2	2,16
B	3	,6	1,8
C	12,5	,15	1,875

5. What trend do you notice?

Work B+C were almost the same
A - I think was off

Force Increased
Distance Decreased

6. Which case required the most work?

A - should all be almost the same

7. Which case required the most force?

C

8. What is the advantage of lifting something straight up?

Less distance

Same work

9. What is the advantage of pulling something up a long ramp.

Less force

Michael Plasmeier

✓

Bang up Job

Racecar Physics

2/1

Annoncer: This race is getting boring. We will now have Michael fill us in on some of the physics behind racecars.

Michael: Ok, let me tell you what is happening now. The road actually is pushing along the car. It may sound hard to believe, but think about it. If the car is lifted off the road, the car won't go anywhere. So the cars engin turns the wheels which then push against the road. The tires are special, they have a lot of friction to be able to push against the road. Newtons 3rd Law says that the road then pushes against the car in order to move. If there is no friction (like on ice) the car won't go anywhere. Physics is everywhere. Back to you!

Friction

Annoncer: There you have it. Physics sure is cool. We will be right back.

2/7

Annoncer: Were back. The race is till boring so wec are going back to Michael who well tell us some of the conclusions he made while do activity 2.6.

Michael: Ok, Have you ever heard of Mu? It's the coeffecent of friction. When you move your hand against sand paper, there is a lot of restance.

The amant of friction your hand encanters differs depending on how hard you push which is like adding mass to your hand. However the amt of friction always changes in preportion to the amount of mass you aply to the surface. The only way to change the coeffecent of frictions is to change the surface. You see mu is found by dividing the force needed to move something by the weight of the object. There are no units for mu because a ~~force~~ force divided by a force is a ratio, so mu has no units. The asphalt on the track has a coefferent that is engineered to help the tires push againts the road but not hinder the forward motion of the cars. The mu is corefully constructed to have a good race. Back to you - Physics is cool man!

Announcer There you have it! We'll be right back.

2/22

Centripetal Acceleration Were back. The race hasn't improved much, so we are going back to Plaz who has detals on how circlar motion works

Plaz Well unit 2.7 has taught me alot. Did you know that racecars have to push outward againts the track while cornering. You see the tendency of an object is to contine is a straight line. If an object, like a race car wants to curve it must get a push inward. That push is a force and causes acceleration. This acceleration is called centripetal acceleration. That means it is center-seeking. The acceleration is toward the center. In racing, that acceleration is provided by what else but our friend friction! Again without enough friction the car could not turn or corner. If friction was magically turned off while a racecar is turning, then the car would stop curving and move in a straight line tangent to the circle. Tangent means it goes away from the center. Because of inertia the race car will continue moving in that straight line path indefently. Some people wrongly call this event Centrifugal Force. Centrifugal Force is a myth, it doesn't exist! Centrifugal force means center fleeing. When you swing an object around in a circle it seemes that it is being pulled outward. However that is just inertia happening. The tension on the string that you feel is an example of centripetal force. I hope the race gets better soon, I am running out of topics.

A: (not paying attenion) Ok there Plaz, we will be right back

---

2/28

A: Were back to the race and Plaz

2.7 Momentum

Plaz: Oh, now I am going to talk about what happens when 2 cars meet. I know this is the fun part for me. I only watch the race for physics properties, and for the chras

That is when racing gets interesting. I know some of you serious fans think crashing is bad but it is fun and there is a lot of physics involved when the two systems meet. The big thing in determaining which car goes where is momentum. This is the object, in this case a car, mass and the speed or velocity it is traveling at. Lets start with head on collisions. Even though this dosnt happen too often in racing, this is a good place to start. When a fast moving small object hits a truck that is stopped the truck moves a lot, However if the car was moving slowly, the mass is still the same but the truck moves less. If the truck was moving slowly and the car was moving quickly and the things crash, both would react the same, they both have the same momentum. The same happens in racing. Momentum or the mass and the speed of the cars when they hit shows how the cars will hit. So next time a car crashes, think Physics - Back to you.

A: Ok, we will be right back. Mabey a car will crash so you can see to physics be hind it.

3/7

2.4 Consv, Mation

A: And were back. No crashes have happened but if they would, momentum would be conserved, or so Plaz tells us.

P: Thats right. In the absence of a external force, the net momentum of a system remans unchanged. This means that when ever a car crashes momentum remains within the system of two cars. No momentum is lost or gained during a crash. This is called the law of the conversation of momentum. Do not confuse momentum with speed. Rember what I said before the comerical that when a heavier (more massive) car hits a smaller car, the smaller car goes much faster while the big car almost stops. Remember momentum is mass times velocity, not just velocity. Mabey a car will hit another car and the race will get more interestin

Back to you.

A: We will be right back

A: And were back. Nothing has happened here so we are back to Plaz.

Plaz: Thats right. I am now going to tell you about energy. What is energy you ask? Energy is the something that does work. Energy is all around us. You can't see it, you can only see its effect when somthis is happening, like when you are doing work. Work in science is applying a force to something to move it a certon distance. Work is measured in Joule (rhymes with cool). Power in science is how fast the work can be done. Power is measured in watts. Electricty is a form of energy, ever though your television (as a whole) isn't doing any work. The molecules in your tv are converting elecrity into thermal energy or heat. We are using up energy, but really energy is always consirved within a system. But not usefull energy, so turn off that television when you aren't using it.

Another type of energy is mechanical energy. That is what you see in race cars. When they go up a hill or a pendulm or roller coster. There are the two most common types of mechanical energy - potetial energy and kinitic Energy. Potental Energy is energy of position and is related to how high an object is off the the ground. Kinetic Energy is energy of motion kinetic energy is related to how fast something is moving. Whats really cool is that these 2 energys are conserved. In a pendalum potental energy is turned into kinetic energy as it goes down and then kinetic energy gets turned back into potental energy as the object slows down and rises. Thats it. back to you

Sports- Chapter 2 Rubric **Name** Michael Plasmeier

VIDEO VOICE-OVER PROJECT

Estimate from video

3 Physics Principles (10 points each): **You must provide a typed script of your commentary and what you will be saying in your presentation or recording.** • Clarity of explanation • How well it explains the principle • Is it an appropriate example • Expanded explanation	1. 10 10pts. Newton's 3rd Law	30 / 30 points
	2. 10 10pts. Centripetal Acc.	
	3. 10 10pts. Momentum/Impulse	
Calculation of quantity from one of the concepts presented above.		10 / 10 points
Delivery/ Clear Presentation		10 / 10 points
Creativity		10 / 10 points
Timing 1.5 - 3 min		10/ 10 points
Handing in Rubric (Filled in)		10 /10 points
Total		80 / 80 points

Principles:

- 1st Law/ Inertia
- 2nd Law/ Net F = ma
- 3rd Law/ Action, Reaction
- Friction / MU
- Momentum/ Impulse
- Conservation of Momentum
- Centripetal Force/ Circular Motion
- Kinetic Energy/ Potential Energy

Quantities:

mass, force, weight, centripetal force, velocity, distance, time, momentum, impulse, kinetic energy, potential energy.

Time Frame for project: You will be given time during parts of two class days to work on your project. Your project will be due on the third class day.

PROJECT DUE DATE 3/30

Michael Plasmeier
Brown
IPS 9H
30 March 2006

Revision: A
3/30/2006

NASCAR Video Transcript

Announcer: Busch Series racing On Fox!

Plaz: Special Physics Report by Michael Plasmeier, sponsored by ThePlaz.com

As the cars race around the track, the first law you will notice is Newton's Third Law of motion. That forces always occur in pairs, an action and reaction force. Newton's Third Law states that "Whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object." You can see that in racing as the racecar tires push backwards against the road, and the road pushes back on the tires causing the car to go forward. Friction is also necessary in this re-, in this operation, or else the racecar will not move.

You might wonder why if the forces are equal and opposite, why the road doesn't move instead of the race car. The answer is because the road is connected to the earth, which has an extremely large amount of mass. The race car, comparatively so, has much less mass, therefore has much more acceleration when the same amount of force is applied to it.

The next physics property you can notice is centripetal acceleration. Did you know that race cars hafta push out against the track while cornering? You see, the tendency of an object is to continue in a straight line. If an object, like a race car, wants to curve, it must push inward. That push is a force and causes acceleration. Therefore it's centripetal acceleration. That means that it's center-seeking.

This force is provided by what else but our old friend, friction! Again, without enough friction the car could not turn or corner. If friction was magically turned off while a race car is turning, then the car would stop curving and move in a straight line tangent to the circle. Tangent means that it goes away from the center. Because of inertia, the car will continue moving in that straight line path indefinitely; it can not speed up or slow down.

Announcer: Looks like a nightmare. <Flashback sound effect> What happened here buddy? Hit the curb, hit the curb! The same place---

Plaz: Bam! That was a good crash! I don't know about you but that is what I watch the races for. Crashes are a good opportunity to see momentum in action. Momentum is the object's mass times its velocity. Momentum can also be called "inertia in motion." When momentum changes, that's called an impulse. An impulse is the force times the time that force is app- applied for. So a race car wants to increase the amount of time the force is applied for. So that means the force is less because it's spread out over a longer period of time. That is why the race car wants to hit tire walls, and not a solid brick wall.

There are many other physics principles that you can find by watching NASCAR. See you next time on physics talk with ThePlaz. <Ending music>

Michael
Plasreer

Unit 3.1

Generate Activity

20/20

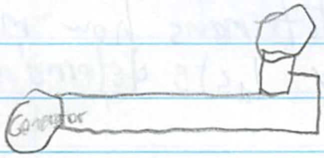
4/21

What do You think

Is there any "free" electricty availble and if so why do we pay for it?

There is plenty of free energy coming in from the sun. The trouble is converting it into electricty. We would need solor panels, or wind-generators. These are expensive to buy and maintain, as well as a pain. If they break, no power as well as the limitation of what power you can draw. In short its eaiser to pay someone else for the hassel.

Vol. a:



b. if the circut is not completed - if any wire is disconected the bulb won't light

c) if you crank faster, the bulb will get brighter if you reverse the direction, the bulb will go out for a second and then light again

d) same as spining the generator the other way

2. The generator is easer to turn without any load or restance from the bulb

3. The Generator was easy to turn at first, then got harder
For a while nothing happened - the wool twitched
but that was because of the wires conected
to the generator

Eventually with a different type of steel wool
and turning really fast, I got it to smoke
a very little bit

a- The steel wool is little pieces of steel all wrapped
togeter in a disorgnized clump. The wires touch
at some points and are seperate at other points

b- The amount of electricty it reciews and the
contact in the wool determains how much it glows
how long the electricty lasts determains how long it
glows

c- they both provide resistance and glow when lit
because there is a very little wire

Reflect
sort-of
but not

4. Yes the electricty was free but the equipment, the
muscell work was not free. Also the light wasn't
very even - The light kept getting brighter
and darker - you couldn't power any thing like that

a) energy sore = generator → your arm → your body →
food → plants → sun

b) forms of energy = electricty → kinetic energy →
potential energy → light energy

c) you powered the generator, not a coal plant miles away
- they both used a generator

REFLECTING ON THE ACTIVITY AND THE CHALLENGE

This activity has given you some experience with a process that is involved in the electrical system you will use for the HFE dwelling: using a generator to provide energy for electric light bulbs. The generator and the light bulbs used in this activity are scaled-down versions of the ones to be used for the dwelling, but they work in the same way. One additional feature will exist in the electrical system for the dwelling, the electrical energy from the generator will be able to be stored in batteries until it is needed to operate lights and other appliances.

Part of your challenge is to write a training manual to help instructors teach the inhabitants about their wind-generator system. You will probably want to include what you learned in this activity in your manual.

PHYSICS TO GO

1. Make a chart with two columns, the first one labelled "Word" and the other labelled "Meaning."
   - a) In the first column make a list of "electricity words"—words that you have heard used in connection with electrical units of measurement, parts of electrical systems, or how electricity behaves.
   - b) In the second column write what *you* think each word means, or describes.

2. You know that electricity comes "out of the wall." You also know that it "starts" in a power plant. Draw a picture that shows how *you* think the electricity is "created" and how it gets to your home.
3. Explain what *you* think electricity is, how it behaves, and how it does what it does.
4. A variety of energy sources are used to operate light bulbs. Identify as many energy sources as you can which are used to power light sources.
5. The kind of light bulb you used in this activity is called "incandescent." Another kind of light bulb often used is called "fluorescent." Look up the meaning of the two words and explain how they are related to what glows to cause each kind of bulb to give off light.
6. "You don't get something for nothing." Explain how this expression applies to using a hand-operated generator to light a bulb.

Activity
#1
"GENERATE"

3.1 Reflect+ to Go

9/27

Reflect: I was mostly correct, but I need to add some stuff. There are other ways to generate electricty - you could be the one turning a crank. However, who would want to do this. Also during the experement, the light output floated a lot. A tv can't run on that - and who could sit in the room and concentrate? You could get capacitors and batteres to regulate, but they are ineffeciant and cost $ $.

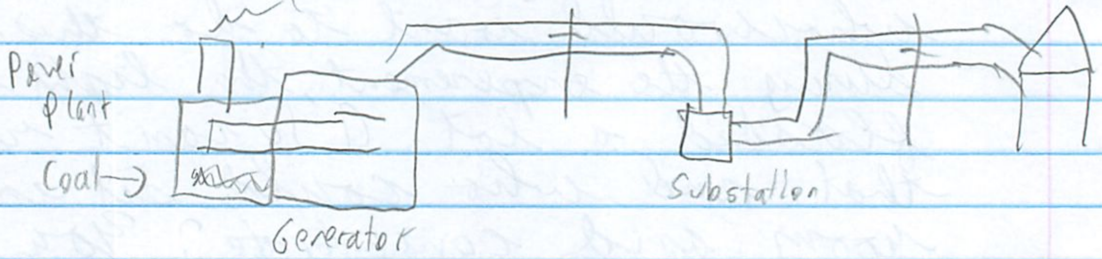
Would need a big hard to turn crank

In short, its a pain to generate our own power. Its easier to pay someone.

Physics 4 To 6.

Words	Meanings
load	something that uses electricty
Volts	strenght of power "push"
watts	amt of power needed - rate electrical energy converted into diff form
amp	amt of power flowing
circut	-complete loop of electricty
Ω ohm	?
diff AC/DC	?

2. ~~All~~ Most (not solar) power plants need a generator to be turned - Most use some way a steam turning a turbine



3. Electricty is energy that can move along a wire. ? It is electrons that jump from one place to another ? It can be used to carry signals or power motors

4. Any electricty generator - hand crank   air turbine
steam turbine   solar
water turbine

5. incandescent: current passes through thin filimant - heating it + produces light - ineffecent

fluorescent - electricty gets excited in argon or neon gas - causing phoshor to glo.

6. You still need to turn the crank - You are putting mechincal energy in.

3.1

His Chart

To Go #1

electricity	energy from moving electrons
current-amperage	measure of flow of electrons
Voltage	measure of the electric potential energy per electric charge
ohm Ω	measure of the resistance to the flow of electrons
resistance	property of a substance which slows the motion of electrons
conductor	a substance which allows the motion of electrons without much resistance
insulater	a substance that does not allow electrons to flow through it
electrons	negatively charged particals which are free to move
switch	controls the flow of electrons in a circut
circut	a closed path where electrons flow from a source to a load

Michael Plasne'or

15/15

IPS - Unit 3.2
"What is a Circuit" - Lighting a Light Bulb

WHAT DO YOU THINK?

- What is meant by a circuit?

a complete loop of electricty

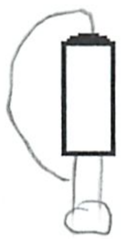
his: a closed path where electricty flows from a socre to a load

- What parts are needed to make a circuit?

Source + load

FOR YOU TO DO.

Use a single "D" battery, a single bare wire and a light bulb. Find four different ways to light the light bulb using **only** a battery, one wire and the bulb. Sketch the four different ways on the battery drawings shown below.



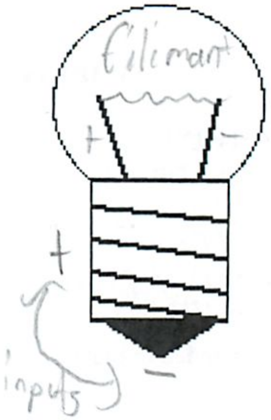
1. What are the **two important parts of a battery** that must be used in order to make the bulb light? Draw a battery and label them.

2. What is a source? Give some examples of a source.

Something that provides electrial energy

- Converts other energy into electrial energy
- generator:
  - hand crank
  - steam tubine
  - water turbie
  - air tubre
- Solor panel

3. What are the two **important parts of a light bulb** that must be used in order to make the bulb light? Draw a light bulb, show the parts and how the filament is wired.



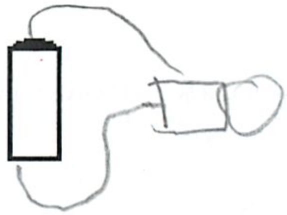
4. What is a load? Give some examples of a load.

Something that consumes electricty
-Changes it from electrical energy to other type
- heat
  - electric arc furnace
  - heater
- light
  - incandesant
  - fluorescent bulbs
- motion
  - motor

5. What does a circuit mean? Write your own description of a circuit using the terms that were just defined.

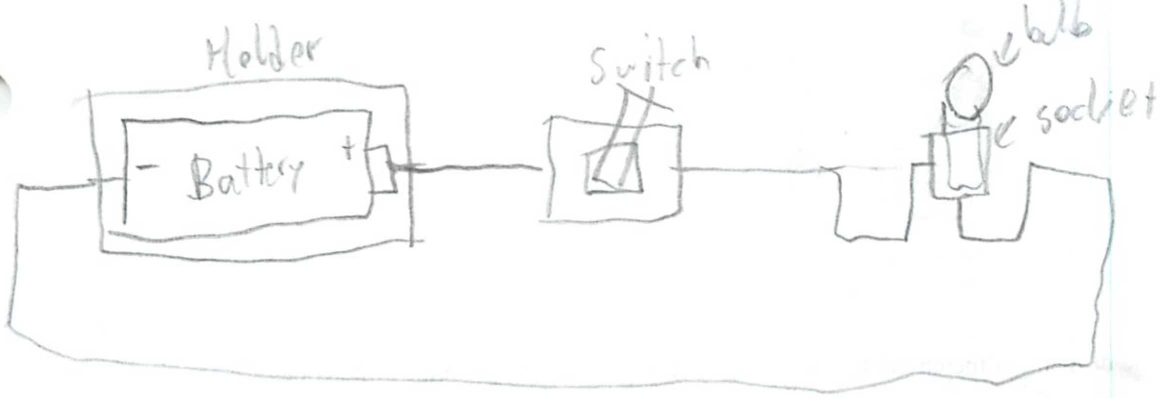
again a complete loop of electricty from a source, through a load, back to the source

6. Use the battery drawing at the right to sketch a way to light the light bulb using a "D" battery, **two** wires and the bulb. This time the **light bulb may not touch the battery**. Use your definition of a circuit and what you just wrote about the parts of a battery and a light bulb to first predict how to wire the circuit. Then show your drawing to your teacher, get another wire and test your hypothesis.



7. As a class write a complete definition of a circuit.

8. Wire a complete circuit using a battery holder, switch, socket, battery, wires, and light bulb. Draw this circuit.



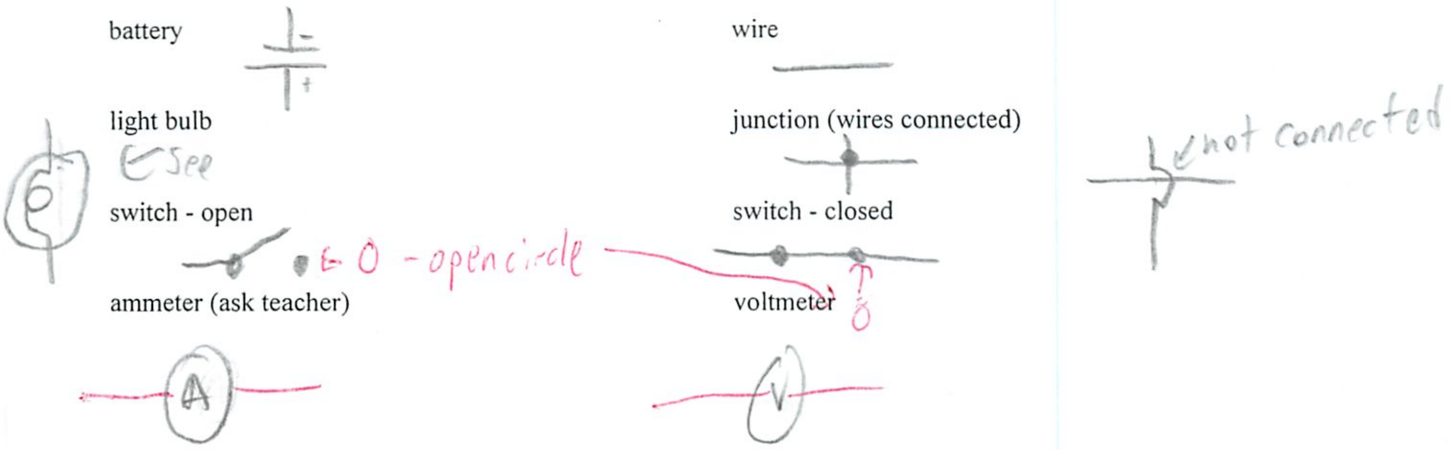
9. What is a switch? How does a switch work?

something that Controls electricity - starts + stops it

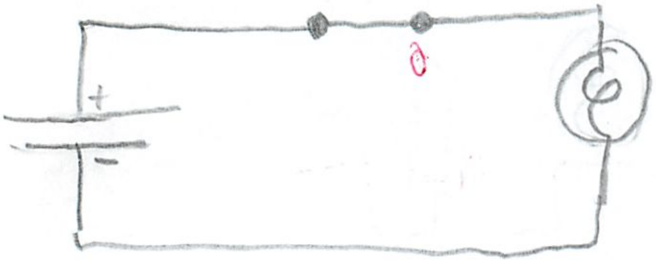
Controls te flow of electrons in a circuit

Instead of drawing a diagram, we have developed schematic symbols to illustrate different circuits.

10. Make a table of the schematic symbols for a battery, light bulb, open switch, closed switch, wire, and junction, which are on page 62. (The rest of these will be revealed in a later activity.)



11. Draw a schematic drawing of the circuit that you wired and sketched in #8 with the switch closed.



12. Draw a schematic drawing of the circuit that you wired and sketched above with the switch open.

Michael Plasnier
Brown
IPS 9H
1 May 2006

3.3 Lighten Up

from Book p50

15/15

5/1

What do you think

How do light bulbs and the electricty that makes them glow work?

Incandescent light bulbs work because electric current passes through a thin filament, heating it and causing it to emit light. Electricity current is electrons that transfer quickly and have the ability to do work

For you to do

Prediction

In Series circuts the electricty goes from one light to another. I predict that the first light is the brightest, and substquent lights are less bright. Also, removing or burning out a bulb would caus all of the lights to go out.

In Parallel circuts the electricty flows equally to each, so they are all the same brightness. If a bulb burns out, the others remain lit and even become brighter.

Observation

Series Circut - All 3 the same brightness - if one is at fault, all go out
* Generator seems same hardness to crank, but bulbs less bright

Parrall Circut - All 3 same brightness - but brighter then series - if one goes off - others still light.
* Generator very hard to turn

To-Go 1. I would defently wire in parallel because that way the circut still works with one device disconected or light blown out. The only downside to parallel is that it is needs more wire.

2. Well I was sort of the output limiter. I did not want the bulbs to blow out. But yes, you can only turn the generater so fast and to overcome a certain resistance. There is an Amp limit.
-Also that puts out a certain amount of w

3. The HFE generator can only output at a certain wattage. That wattage is divided among the appliances - limiting how much you can run.
* I don't just mean the generator - I mean the battery output of the generater system

Stretching Edison means that these discoveries take a lot of work and fine tuning. Thinking about new things is only a small part.

Michael Plasmeier
Brown
IPS 9H
3 May 2006

Blue Book

Chap 35
Electric Circuits

✓

5/3

Review p 554

C

1. No, aren't there electrons allready their, The battery makes them move.

2. If there is a gap, the electrons can't get all of the way around. I don't really know why this matters - Battery needs to pull as well as push for electrons to me.

3. A series circuit is wired all together. There is only one path for the electrons to take. A break would turn off all lights. A parallel circuit provids more paths for the electrons to take. The resistance becomes less

4. 1/3 of what te battery puts out. 6 volt batt / 3 lights = 2 volts drop
because of voltage drops between lights
it goes 6 (-2) 4 (-2) 2 - te votage drop matters

5. It goes to 0, + lights go out! voltage drop bt each lamp

6. Te ~~same - still 1/3, but te battery puts out more,~~ (current) ~~so That 1/3 is equal to what would be if tere was just one light~~ 6 volts - remember voltage is push, it pushes te same in each branch

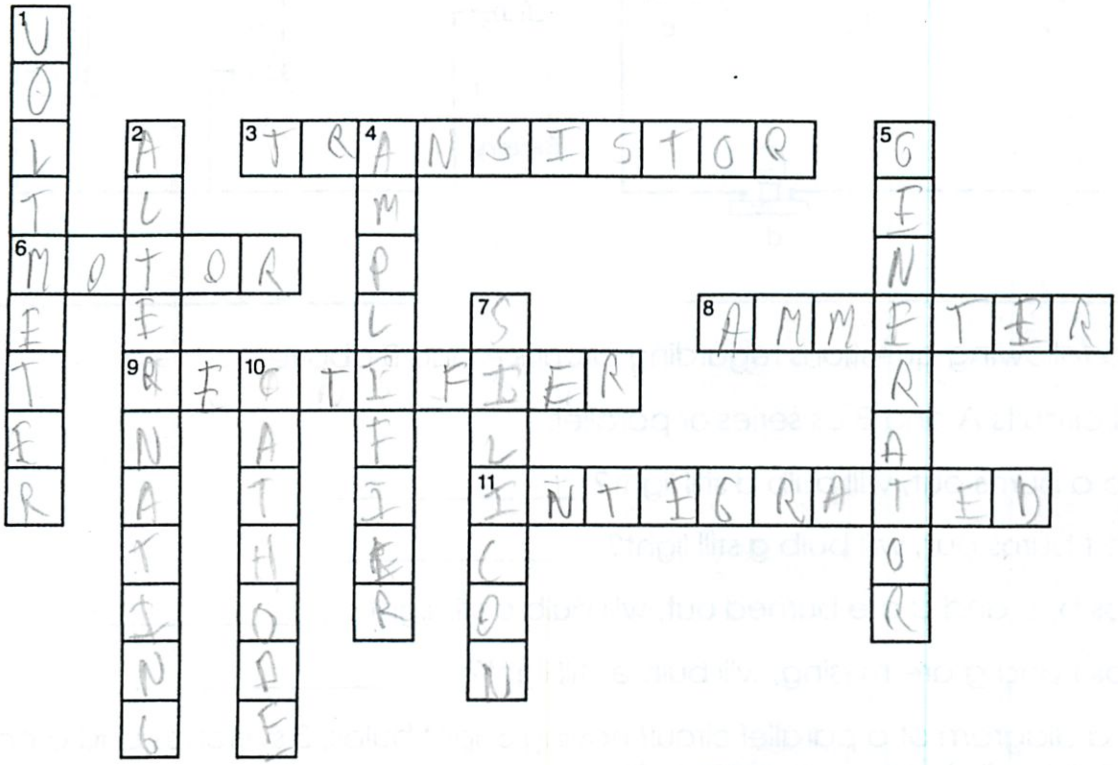
7. (see p 554 #1 Ans) Te other lights are unaffected. Te current is too. Current in each branch is voltage/resistance, Neither of these two variables change. Total current, however, is affected

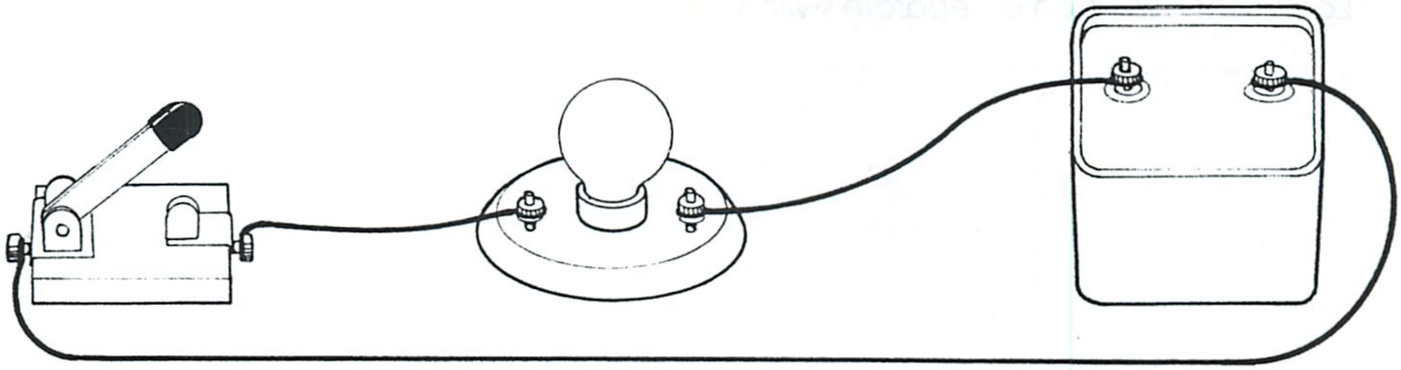
8. a: more current : ? ~~te same as series~~ porrall - least restance

b: more voltage while in porrallel

ELECTRICITY CROSSWORD

Name ______________________





ACROSS

3. Made from semiconductors and need little voltage
6. An electric _____ converts electrical energy to kinetic energy.
8. Measures current
9. Changes alternating current to direct current
11. This type of circuit may contain thousands of tiny transistors

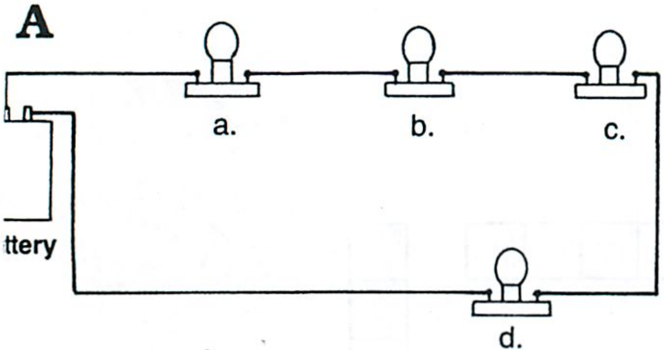
DOWN

1. Measures potential difference
2. Current that changes direction
4. Magnifies a small electric signal
5. A device that produces current by moving a magnetic field across a wire
7. A semiconductor material
10. A device that uses electrons to produce images on a screen is a _____ ray tube.

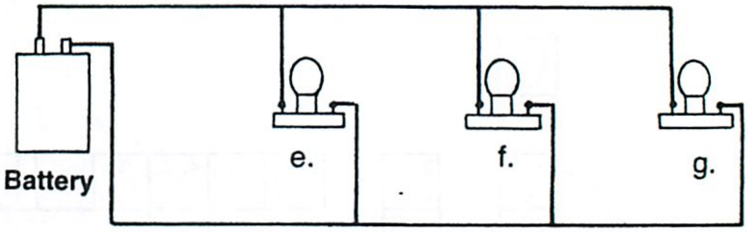
SERIES AND PARALLEL CIRCUITS

Name michael Plasmeier

A



B

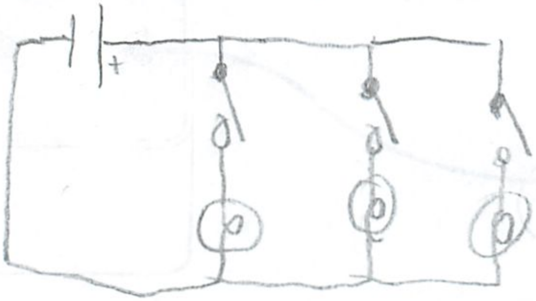


series

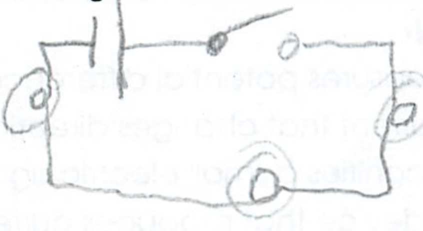
parallel

Answer the following questions regarding circuits A and B above.

1. Label circuits A and B as series or parallel.
2. If bulb a burns out, will bulb d still light? No
3. If bulb f burns out, will bulb g still light? Yes
4. If bulbs b, c and d are burned out, will bulb a still light? No
5. If bulbs f and g are missing, will bulb e still light? Yes
6. Draw a diagram of a parallel circuit having 3 light bulbs, 3 switches and a battery. Each light bulb is on a separate switch.



7. Draw a diagram of a series circuit having 3 light bulbs, one switch and a battery.



8. Would series or parallel circuits be better for wiring light in a house? parallel

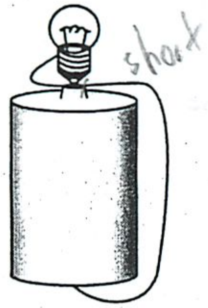
Why? if you un-plug something or it breaks, the other equipment still stays on

29/29

UIZ Unit 3.1 & 3.2

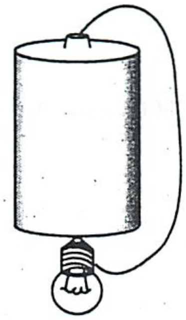
Name: Michael Plasmeier

1. Look at each of the following pictures. Write two things: a) Is the bulb "lit" or "not lit"? b) Is there current "flowing" or "not flowing"?



Bulb is:
lit [✓ not lit]

Current is:
[✓ flowing] not flowing



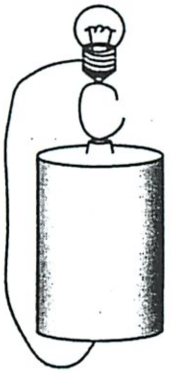
Bulb is:
[✓ lit] not lit

Current is:
[✓ flowing] not flowing

Bulb is:
lit [✓ not lit]

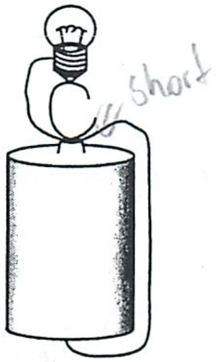
Current is:
[✓ flowing] not flowing

Good to ✓ ✓



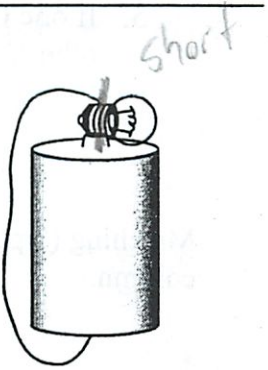
Bulb is:
[✓ lit] not lit

Current is:
[✓ flowing] not flowing



Bulb is:
lit [✓ not lit]

Current is:
[✓ flowing] not flowing



Bulb is:
lit [✓ not lit]

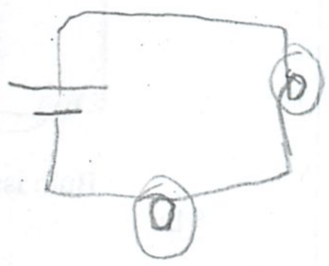
Current is:
[✓ flowing] not flowing

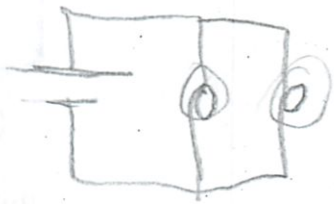
Short Answer (3 points each):

2. Explain the difference between a series and parallel circuit.

In a saries circut, the electrons can only follow one path
" " parallel " " " " flow in different paths

3. Draw a **schematic diagram** of both a series circuit and a parallel circuit. (Use correct symbols)





4. If one of the 3 lamps blows out when connected in series, what happens to the other 2 lamps?

They go out

5. If one of the 3 lamps blows out when connected in parallel, what happens to the other 2 lamps?

They stay lit

Matching (1 point each): Place the letter in the space of the description from the right column.

D source
B load
A switch
C current
E filament

A. a device which controls the flow of electrons.
B. a device which uses electrical energy.
C. an amount of electric charge which passes a point in an electric circuit in a certain amount of time.
D. a device which provides the push for the electric charges
E. a thin metal wire inside a light bulb which gives off light when an electric current passes through it.

Michael Plasmeier

15/15

IPS: Unit 3.3 "Using meters"

WHAT DO YOU THINK?

- How do you measure electricity?

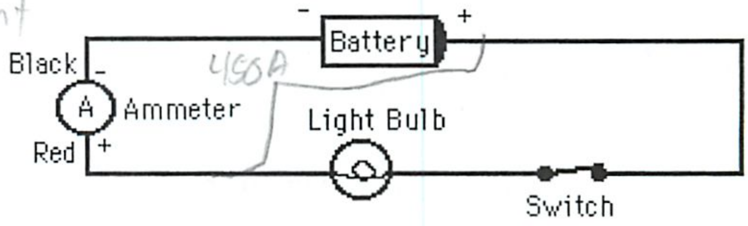
Each measurement has different units. You need to measure each unit. - I guess you would measure the current in Amps.

FOR YOU TO DO.

Using an ammeter

An ammeter is an electrical device used to measure the amount of current that flows through a wire. An ammeter is **wired in series** with the rest of the circuit. To measure the current going through a given wire you have to break the circuit and insert the ammeter so that all current goes through the ammeter and then the rest of the circuit. The ammeter has two terminals, one black and one red. The **black terminal** is placed in the circuit so that the wire connected to it is closest to the negative terminal of the battery. Closest is decided by following the wire directly from the black terminal through any other devices like light bulbs to the negative terminal of the battery. The **red terminal** is wired closest (along the wires) to the positive terminal of the battery.

This is done as illustrated at below. We are using a "D" battery placed in one of the yellow battery holders. **If you wire the ammeter backwards the needle will deflect the wrong way. Immediately turn off the switch and rewire the ammeter in the opposite direction or reverse the battery.**



An ammeter measures Amps or current

How is an ammeter wired in a circuit? Series

What is meant by a series circuit?

all the electrons must flow through it

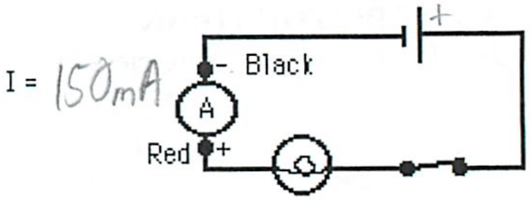
Current is The flow of an electric charge

② # of electrons moving through

The symbol for current is ~~A~~ I

The unit for current is Ampere

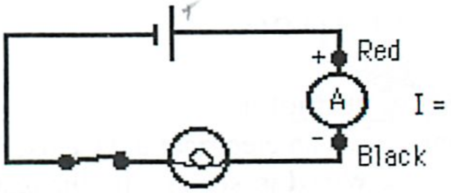
Here is a schematic of the circuit that you just wired. Measure the current passing through the circuit and record it on your drawing.



In the last circuit the ammeter measured the current before it went through the light bulb. Is the current different after it goes through the light bulb? Make a prediction and explain why you made the prediction.

Is: $I_{in} > I_{out}$ [✓ $I_{in} = I_{out}$,] $I_{in} < I_{out}$,

Should be



In order to find out move the ammeter so that it is after the light bulb, as shown above, and measure the current again. Was your prediction correct?

Yes 150 mA $I_{in} = I_{out}$

What is true about the **current** in a simple circuit (the circuit above)?

it desn't matter where you put te ampmeter, but don't fip te battery of te ampmeter will go into negitive - and this one doesn't do that

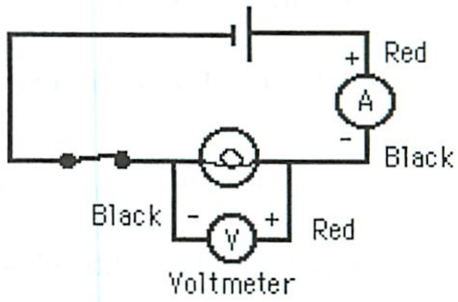
more restiance somewhere slows down te entire circut

$I = V/\Omega$

neiter change

te light bulb resitss in a different place

Using a voltmeter



We are now going to add a voltmeter to the circuit, leaving the ammeter in place. A voltmeter is an electrical device used to measure the potential difference (potential drop or gain) between any two points in a circuit. A voltmeter is **wired in parallel** with the device that you want to measure the voltage across. To measure the voltage between any two points in the circuit you touch one terminal of the voltmeter to one point and the other terminal to the other point. The voltmeter has two terminals, one black and one or more red. The **black terminal** is placed in the circuit so that the wire connected to it is closest to the negative terminal of the battery. The **red terminal** is wired closest to the positive terminal of the battery. This is done as illustrated at the right.

A voltmeter measures the volt drop

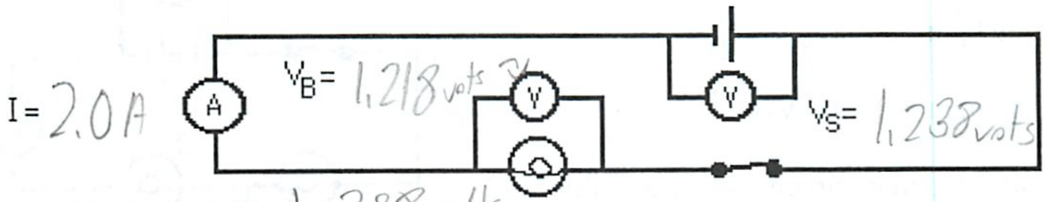
How is a voltmeter wired in a circuit? in parallel

What is meant by a parallel circuit? On a seperate line

Voltage is The "push" put out by te batter

The symbol for voltage is V The unit for voltage is volts

Measure the current passing through the circuit (I) and record it on your drawing. Measure the voltage loss across the light bulb (V_B) and the voltage gain across the battery (V_S). You do not need 2 voltmeters. You will measure the voltage from one, the measure the other after that.



Voltage gain of the battery V_S = 1,238 volts

Voltage loss of the light bulb V_B = 1,218 volts

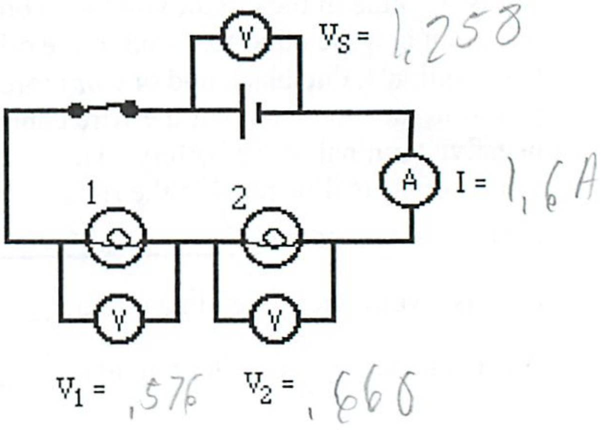
How do these two values compare, are they relatively close in value or way off?

Yes, they are very close only .02 volts off this is probably resistance in te wire

Using voltmeters and ammeters to analyze circuits.

Two bulbs in series

Wire the circuit shown below with two light bulbs in series.



Voltage gain of the battery V_S = 1.258 volts

Voltage loss of the light bulb #1 V_1 = .576

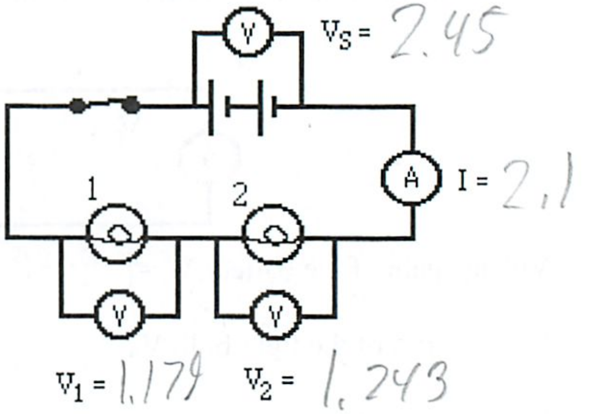
Voltage loss of the light bulb #2 V_2 = .660

How does the voltage gain compare to the sum of the voltage losses, close or not?
Explain why. pretty close, sort of

Are the bulbs bright or dim? dim

Two bulbs wired in series and two batteries in series.

Wire the circuit shown below with two light bulbs in series and two batteries in series.



2 has more restance

Voltage gain of the batteries V_S = 2.45

Voltage loss of the light bulb #1 V_1 = 1.179

Voltage loss of the light bulb #2 V_2 = 1.243

How does the voltage gain compare to the sum of the voltage losses?
Almost the same

Are the bulbs bright or dim? pretty bright

AN ELECTRIC MOTOR

Name ____________________

Label the following parts on the picture of the electric motor below. List the function/ purpose of each part.

horseshoe electromagnet (or permanent magnet) armature rotates inside it and pushes againts the opposite polarities of the electromagnet

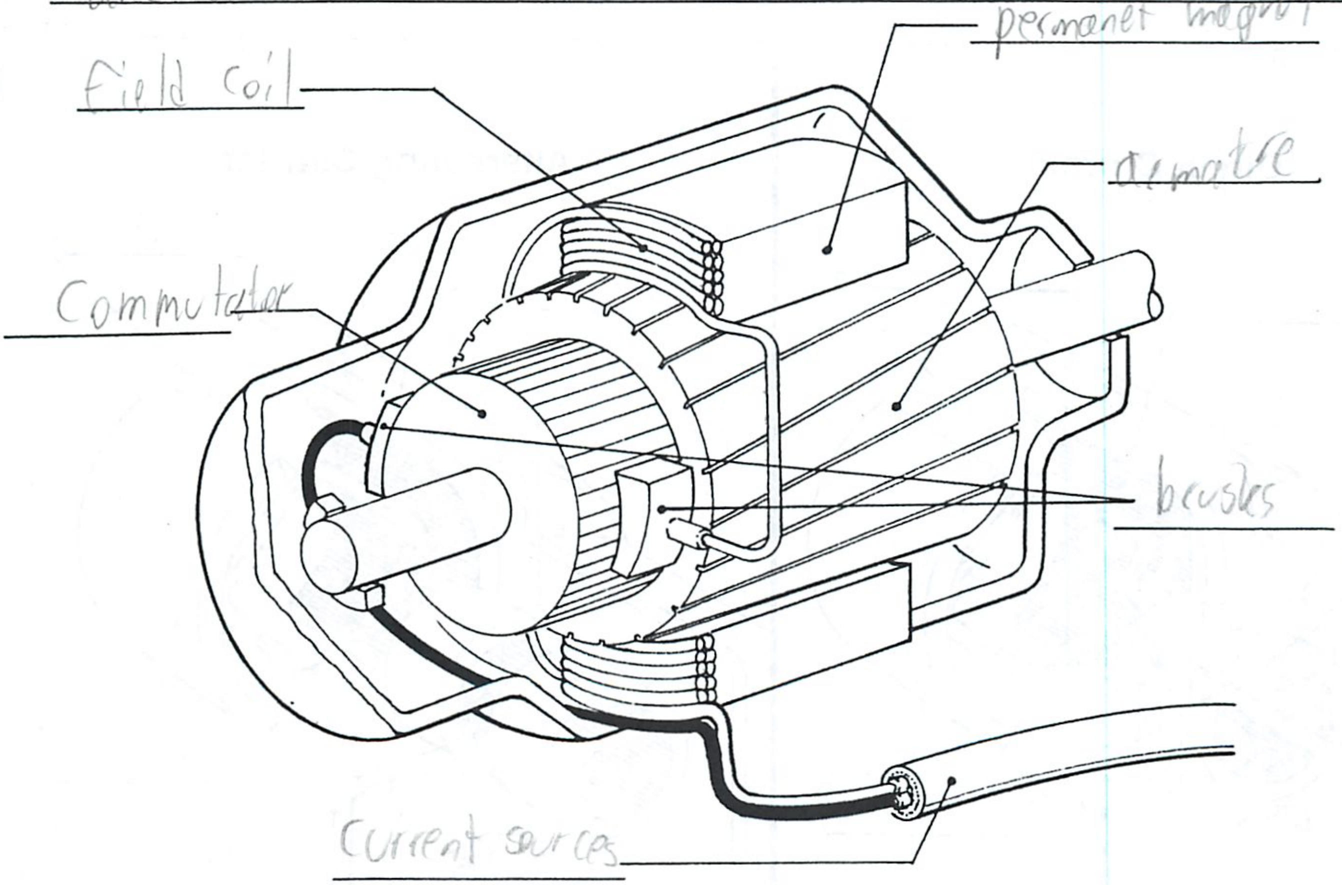
armature the spining thing inside the motor that produces the motion by switching it's electromagnet on and off

commutator reverses the direction of the current twice each cycle so the armature can push away from one side of the armature

brushes (+ and –) push againts the commutator to provide power to it

field coil produces magnetitic field to make things turn

current source where the voltage (push) to switch the eclectromagnet on and off



AN ELECTRIC GENERATOR

Name Michael Plasmeier

Label the following parts on the picture of the diagrams below of an alternating current and a direct current generator. List the function/purpose of each part.

wire coils have electricty turn on + off/switch directions

brushes push againts commutator - transfer power from battery to commutator

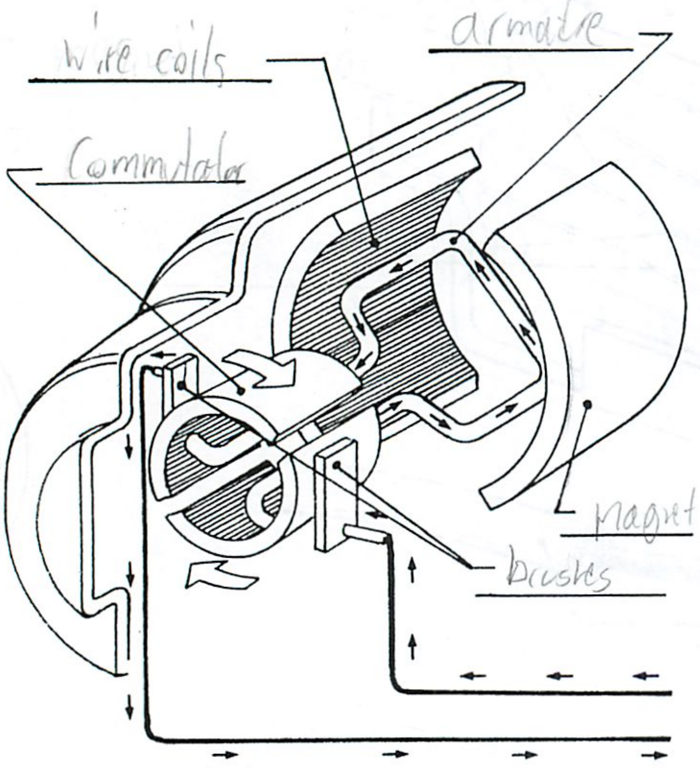
slip rings (A.C. only) ______

commutator (D.C. only) reverses the direction of the current twice every cycle to flow through the armature so that the poles of electromatic push against the primary magnets

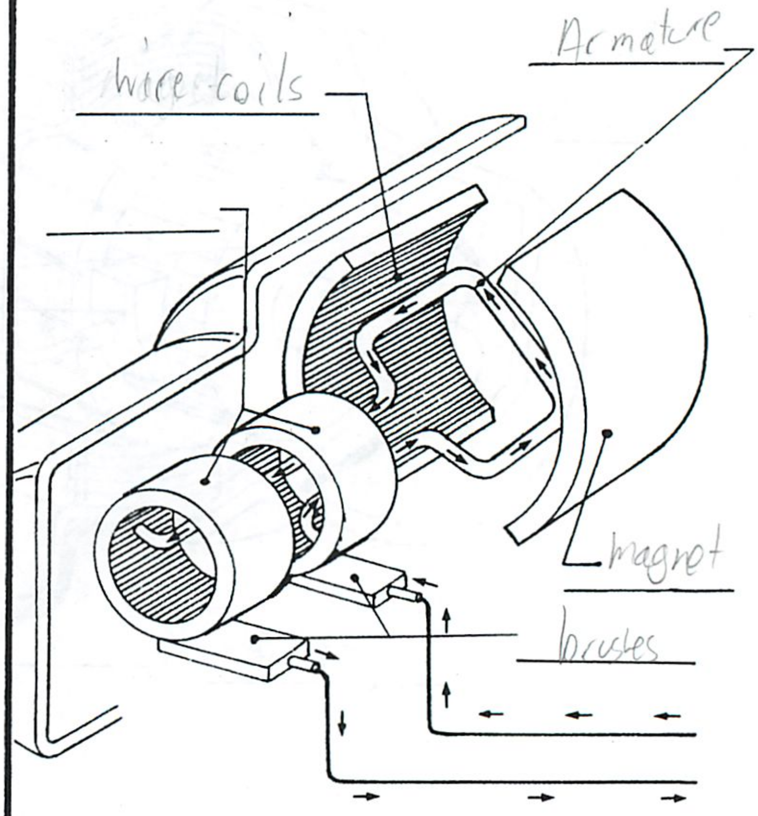
armature the spining part inside the magnet - series of electromagnets - turn on and off - wound in wire / ACTUALLY - The part where the input voltage is put, may not spin

magnet The permanatee magnet is on the outside and the armature rotates inside it - 2 with opposite polarities -could also be electro magnet

Direct Current



Alternating Current



Michael Plourmier

IPS: Unit 3.5 "I Just Couldn't Resist Lighting Up Again"

P = IV

P
I | V
← He said that

P - watts

Next Unit

✓ I used that for this

V
R | I
- Ohm's Law

✓ DB

WHAT DO YOU THINK?

- What affects the amount of current passing through a circuit?

The power being used + the voltage "push"

The resistance

- How can you dim a light bulb? - ~~Dimming is using less power~~

↑ different place

reduce the current

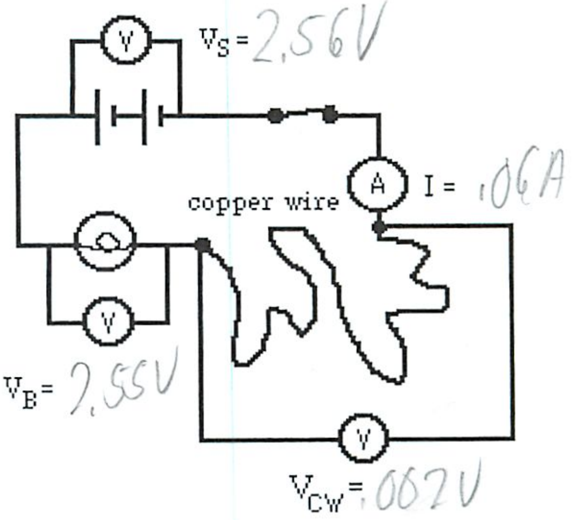
or voltage

turn current in heat instead

add resistors

FOR YOU TO DO.

1. Wire the circuit pictured in the schematic at the right. Your teacher will give you a long piece of copper wire about one meter long. Measure the current passing through the circuit, the voltage gain of the battery, and the voltage loss of the bulb and the long copper wire.



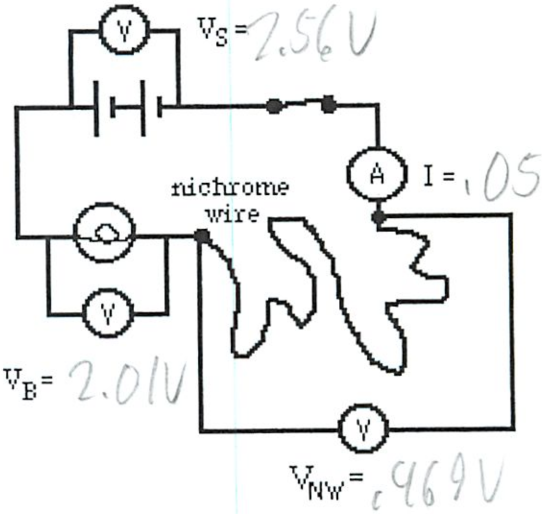
Current passing through the circuit: I = .06 A

Voltage gain of the battery V_S = 2.56V

Voltage loss of the light bulb: V_B = 2.55 V

Voltage loss of the copper wire: V_{CW} = .002 V

2. Wire the circuit pictured in the schematic at the right. Your teacher will give you a long piece of nichrome wire to replace the copper wire used in #1. Make sure you spread out the wire so it does not touch itself. Measure the values shown.



Current passing through the circuit: I = .05 A

Voltage gain of the battery: V_S = 2.56V

Voltage loss of the light bulb: V_B = 2.01V

Voltage loss of the nichrome wire: V_{NW} = .469 V

3. What happened to the current passing through the circuit in #2 compared to #1?

It stayed the same almost, dropped a bit

4. What happened to the voltage drop across the nichrome wire as compared to voltage drop across the copper wire? It was much higher on the nichrome wire

5. What happened to the brightness of the bulb when the nichrome wire was used? It decreased

6. Which wire is a <u>better conductor</u> of electricity, the nichrome wire or copper wire? Think about this a little before you answer. Copper, because nichrome has much higher restance + uses a lot of power by dropping the voltage

7. Which wire has <u>more resistance</u>? nichrome

8. What do we mean by resistance? how hard it is for the electricty to pass through, the inverse of the voltage drop

9. What is the unit for resistance ohm

10. What is the schematic symbol for a resistor?

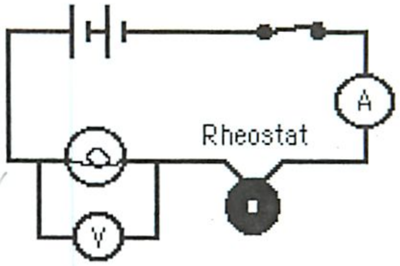
11. Complete the following table.

A. Start with the circuit that you already wired with the long nichrome wire.
B. Loosen the screw on the meter and shorten the nichrome wire so that it is one half its original length.
C. Shorten the nichrome wire so that it is one quarter of its original length.
D. Shorten the nichrome wire so that it is one eighth of its original length.

Length of wire	Current - I amps	Brightness of bulb
Full	.053	dimish
1/2	.056	↓ Brighter
1/4	.058	
1/8	.06	

12. How does a dimmer switch work? It has a pretty resistant wire, and moves a contact up and down to expose more or less Of the wire, some also burn the rest of the energy w/ heat

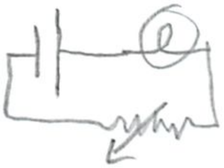
13. Take out the nichrome wire from your circuit and insert a dimmer switch to complete the circuit. Turn the knob on the dimmer switch and see what happens to the light bulb.



14. What is a rheostat (dimmer switch)? It reduces the voltage, therefore the power (wattage) in the circuit

15. a) What is the schematic symbol for a rheostat?

b) Draw a schematic of a circuit with a battery, light bulb and a rheostat (dimmer switch).



PHYSICS TO GO.

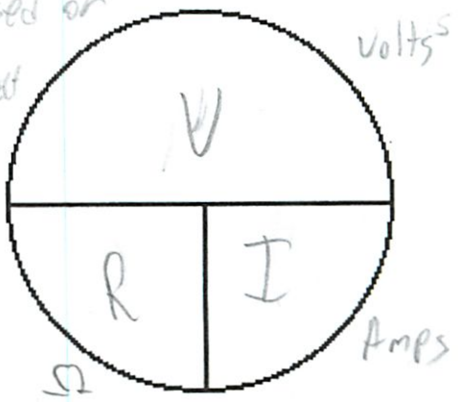
The statement that current in a circuit is directly proportional to the voltage impresed on the circuit + inversely proportional to the resistance of the circuit

Ohm's Law Problems

What is the equation for Ohm's Law?

$V = RI$

Write the equation in the memory circle at the right.



Show the equation and your work to solve the following problems.

1. When a given light bulb is connected to the 120-volt outlet of a house a current of 0.4 amps passes through it. What is the resistance of the bulb?

~~$P = IV$~~

~~$P = .4(120)$~~

~~$P = 48$ watts used~~

$V = RI$

$120 = R \times .4$ amps

$R = V/I$

$R = 120/.4$

$\boxed{R = 300\ \Omega}$

① One volt per ampere

Over

2. When another, brighter bulb is also connected to the 120 volt outlet of a house a current of 1 amp passes through it. What is the resistance of this bulb?

$R = V/I$

$R = 120/I$

$R = 120\ \Omega$

3. When a toaster is plugged into the 120 volt of a house a current of 10 amps passes through it. What is the resistance of the toaster?

$R = V/I$

$R = 120/10$

$R = 10\ \Omega$

4. A hair dryer has a resistance of 8 ohms. How much current will pass through it when it is plugged into a 120-volt outlet?

$I = V/R$

$I = 120/8$

$I = 15$ Amps

5. What properties of a wire affect its resistance? How does each property affect the resistance?

How easily electrons can be transfer - electrons that can move eaiser, don't reduce voltage "push"

Name: Michael Plosmeier

Unit 3.5 Quiz

5/17

20/20

1. Draw the schematic diagram of 2 batteries connected together in series. (2pts)

Short circuit

2. What was the voltage gain of your 2 batteries connected in series? (2pts)

3 volts (if 1.5V batteries)

3. Which wire had a larger voltage loss? (circle one) (2 pts)

copper wire [✓ nichrome wire]

4. Which wire is a better conductor of electricity? (circle one) (2 pts)

[✓ copper wire] nichrome wire

5. Draw the schematic symbol for a resistor. (2 pts)

6. (circle one answer) (2 pts)
   A rheostat is a:
   a) voltage source
   b) conductor
   [✓ c) variable resistor]
   d) resistance meter

7. Write the equation for Ohm's Law and draw a memory circle for the equation. (3 pts)

V=RI

8. List three properties of a wire that might affect its resistance. (3 pts)
   a) Material
   b) thickness
   c) lenght

9. What setting of the voltmeter is ~~used~~ best to use to measure the voltage loss across the long piece of copper wire in step #1. (2 pts)
   a) 200 volt maximum scale
   b) 20 volt maximum scale
   c) 2 volt maximum scale
   [✓ d) 200 millivolt maximum scale]

IPS UNIT 3.6- Load Limit

Name: Michael Plasmeier

WHAT DO YOU THINK?

- What is a fuse or circuit breaker?

A fuse or circuit breaker shuts off power if there is too much current flowing.

- Exactly what conditions do you think make a fuse "blow" or a circuit breaker trip?

adding too much load (too many watts)
Short circuit!

FOR YOU TO DO

1. Your teacher has an apparatus with light bulbs that he will use to show what a fuse is and how it works. Before we can do this, it is worthwhile to examine how the whole circuit works, then we will focus on what a fuse is. Your teacher will demonstrate the basics of the circuit now, including the use of steel wool.

2. Are the bulbs in the apparatus wired in series or in parallel? How do you know?

in parallel - if one goes off, the others stay on

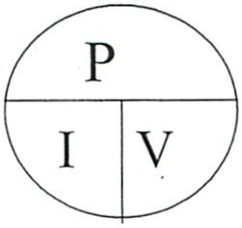
3. Is the steel wool fuse wired in series or parallel with the rest of the bulbs in the circuit? How do you know?

in series - if it blows, all the lights go out

There is a formula that includes P - Power (Watts), I - Current (Amps) and V- Voltage (Volts). Here it is:

$$P = IV$$

It can be put into the memory circle as seen to the right.



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4. Based on the above equation, if you increase the amount of current (I) that flows in a circuit, and the voltage (V) is kept the same, does the power (P) used go up, down or not change?

go up

5. We will now find the maximum amount of current that can flow through one strand of steel wool, this is also know as the "load limit". We will also find the maximum amount of current that can flow through two strands and three strands of steel wool. To find this load limit, the maximum current (in amps) that the circuit can support, we will light bulbs in increasing order of wattage (thus increasing the current flowing through the circuit) until the steel wool burns through. We will then calculate the maximum current the steel wool can take. We rearrange the formula P=IV and solve for I and we get $I = \frac{P}{V}$. Fill in the table on the next page based on the data we collect and this equation.

Number of strands	Max power	Voltage from PECO	Current flowing in system, Load limit
1	double 105 W	120 V	.875 A Not double
2	? (210 W)	120 V	(1.75 A)
3	? (315 W)	120 V	(2.625 A)

6. Suppose your parents are going out to dinner. They don't want you playing on your PS-2 while they are out, they want you to study. They know better than to trust you. They know that the PS-2 uses 270 Watts of power, but your reading light uses only 100 Watts of power. How could they use steel wool in a similar way as above to keep you from using the PS-2? Explain fully.

Use a $\left(I = \frac{100W}{120V} = .8\overline{33} \rightarrow \text{Round up} \rightarrow\right)$ 1 A fuse or fuse-like piece of steel wool. If you try to use the PS2, the steel wool will break, and you can't even read. (Just steal the power cord of the PS2)

7. Notice that in each case in the table above the current gets big enough that the steel wool glows and burns. It turns out that this can happens with any wire, including wires in your house. If you send too much current through wires in your house, by using too many appliances at once, the circuit will become unsafe, making the wire get hot and possibly starting a fire. Having a fuse is like having a piece of steel wool in series with the rest of the circuit, it only allows a certain amount of current to flow before it burns and allows no more current to flow.

8. The fuses that we use in class will allow up to 15 Amps to flow through it. Based on the table above, how many pieces of steel wool would you have to use to have the same effect as the 15 Amp fuse? Explain.

Around 18 $(15/.8\overline{33})$

Schematic Diagrams

9. Your teacher will light only one of the bulbs using one piece of steel wool. Draw a schematic diagram of the circuit, including only the one bulb that is lit, the power source, wires and steel wool.

10. Your teacher will now light another bulb. Draw another schematic diagram, similar to the one above, but now with two bulbs.

11. Suppose your teacher were to light all 5 bulbs with only one piece of steel wool (not likely). Draw a schematic, similar to those that you did above, for this case.

See back

12. Read PHYSICS TALK on page 57 of your text.

✓

Reflecting on the Activity

Perfect

#1 - The load limit is how many Amps (how much current) the fuse/ Circut breaker will support.

2. See pg 72 ad 73

3. Refrigerator - 795W - Need or to store food
   Hot Plate - 1200 W - Cook food
   Computer 60 W - You would be bored w/o one!

Physics To Go (#1-8, p.58)

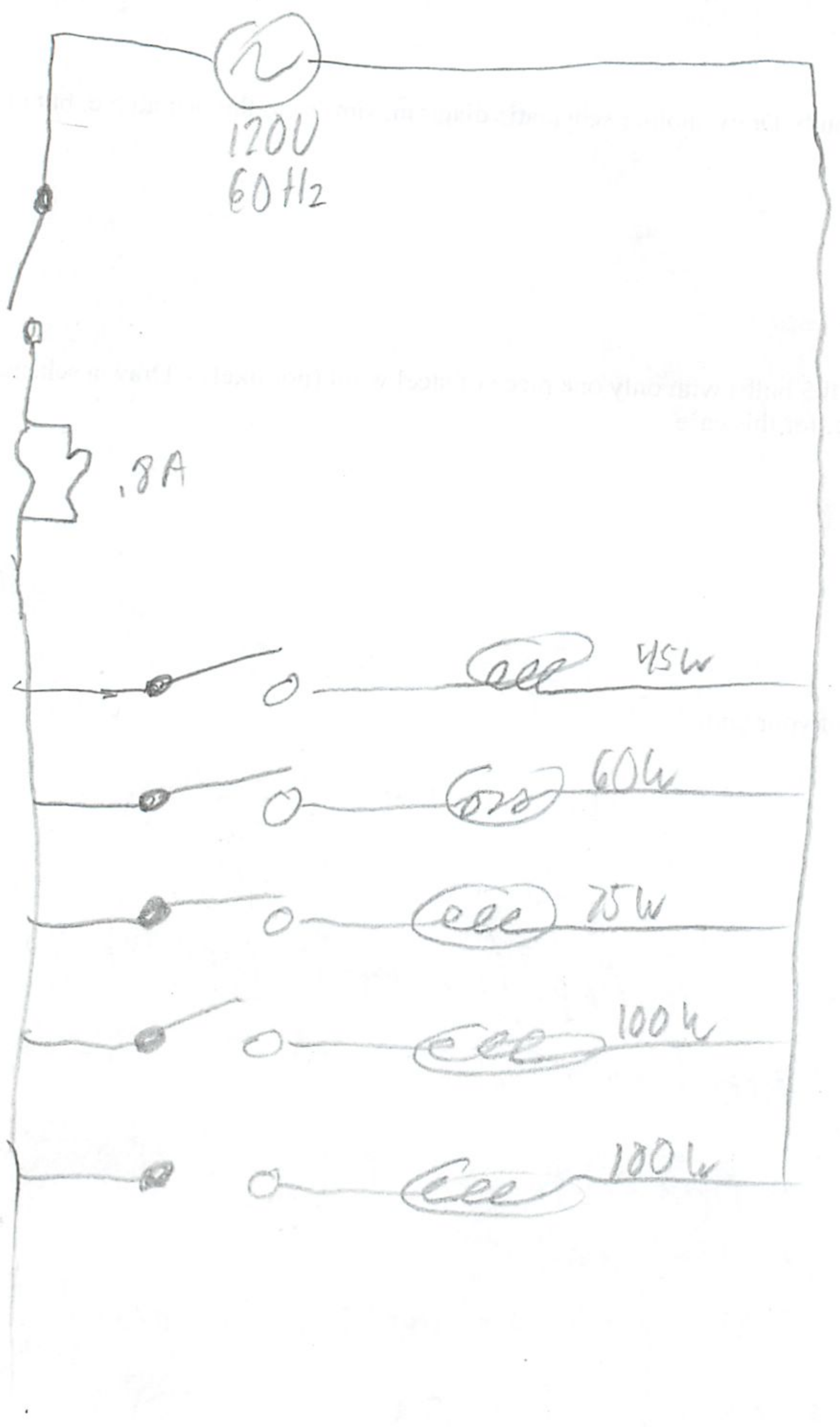
4. $I = P/V$ - $I = 1200\,W/120V = 10$ amps

5. Any 2 or blender + coffe maker as well as toaster or pan
   Anything that adds to <2400 w

6. $P = IV \Rightarrow P = 120 \times 15 \rightarrow P = 1800\,W/60\,W = 30$ regulor bulbs
   $1800\,W/22\,W = 81$ CFLs

7. $746\,W \times .8\,HP = 596.8\,W \rightarrow I = P/V \rightarrow I = 596.8/120V = 5$ Amps $= I$

8. $P = IV \rightarrow P = 6A \cdot 120\,V = 720$ Watts


120V
60Hz
.8A
45W
60W
75W
100W
100W

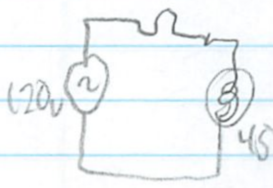
Circuits

5/22

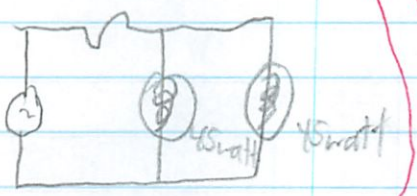
Which has more resistance __A__

" " " current __B__

A



B



current = power/voltage

Current is proportinal to power (wattage) being used

* current is inversly proportinal to power (wattage) *

Ohm's Law

resistance = voltage/ current

restance is propertal to power

restance is inversly porportial to current flowing

IPS: Unit 3.7 "Short Cuts"

Michael Plasmeier

WHAT DO YOU THINK?

- Why do houses have circuit breakers or fuses?

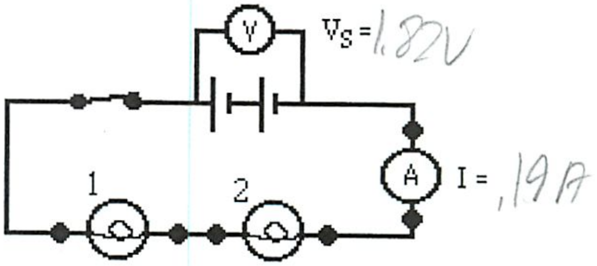
In addition to stoping too much current, circuit breakers + fuses also stop shorts.

- What is meant by a short?

A short is when the power does not go through loads and instead rushes arround at high speeds through the circt, causing wires to heat up + catch fire

FOR YOU TO DO.

Wire the circuit at the right, read the meters to get the following measurements, and write the values on the schematic.



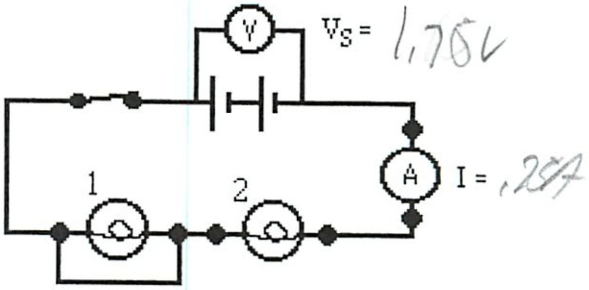
Potential gain at the batteries.

1.82V

Current passing through the circuit.

.19A

Place a wire between the terminals of bulb #1, as shown at the right. Measure the values shown and write the values on the schematic.



1. What happens to each of the following?

   a) the current, I? increases to .25A

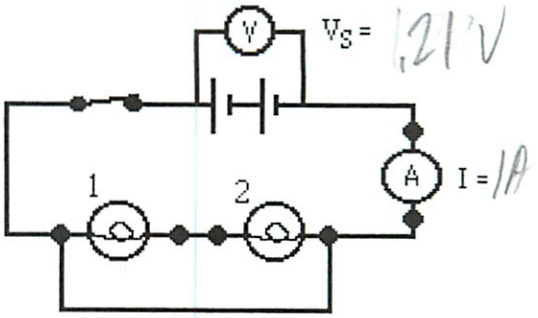
   b) Bulb #1? goes out

   c) Bulb #2? flickers, grows brighter

- The voltage across the battery, V_s? decreases to 1.70V
- Why does this happen?

?The light can only handal so much voltage?

Place a wire between the first terminal of Bulb #1 and the last terminal of Bulb #2, as shown at the right. Measure the values shown and write the values on the schematic.



2. What happens to each of the following?

   a) The current, I? increases alot to 1A

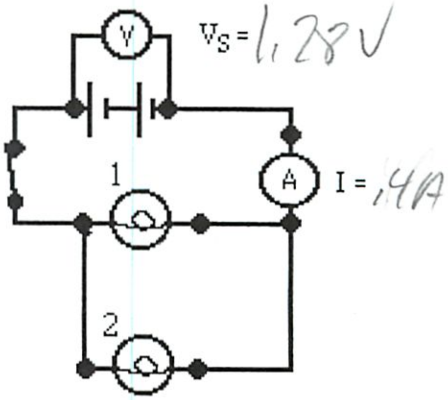
   b) Bulb #1? out

   c) Bulb #2? out

   d) The voltage across the battery, Vs?

   drops sharply to ,21 V

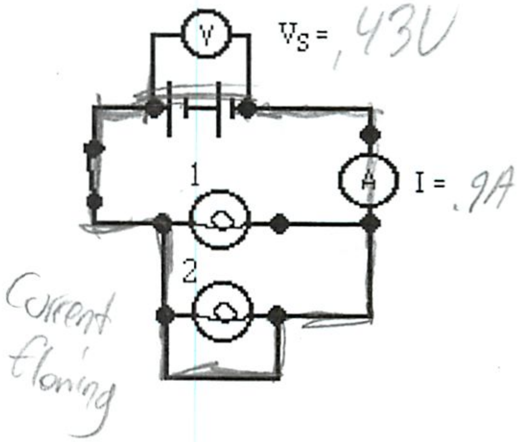
OK, we learned that our homes are wired in parallel. So what happens when we have a short in a parallel circuit?



3. Wire the circuit at the right.
   a) Measure the current coming from the battery, the potential gain across the batteries and write the values on the schematic.

   b) Use a colored pencil to show the path(s) taken by the current.

4. Place a wire between the terminals of bulb #2, as shown at the right. Measure the values shown and record them on the schematic.



   a) What happened to the current, I?

   back up to ,9A

   b) The voltage across the battery, Vs?

   1,43 V

   c) What happens to bulb #2?

   Out

   d) What happens to bulb #1?

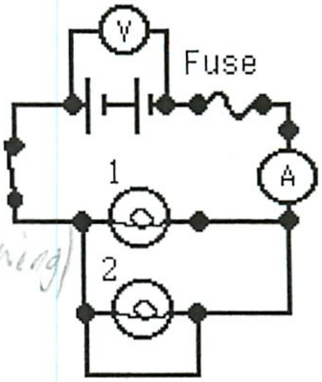
   Out

e) Why does this happen?

When tere is a place to go where tere is very little resistance (like a wire w/ no load aka short) all of the electrons go through there and as Ohm's Law, all te power goes that way

f) Using a colored pencil show which way most of the current goes when there is the short.

5. To protect a circuit fuses or circuit breakers are placed near the source.



a) What happens to the fuse when there is a short like the one shown?

When the current flowing exceeds the fuse as what happens in a short (lots of current flowing) the fuse breaks

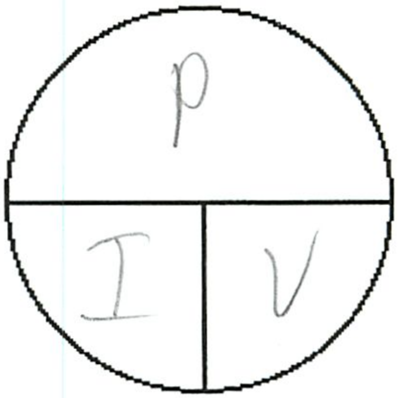
b) What happens if there is a circuit breaker instead of a fuse?

The circut breaker is slower, but can be reset, it works almost like a fuse

Electric Power

What is the equation for power? $P = IV$

Write the equation in the memory circle at the right.



What is the unit for power? wattage

What is the unit for current? amperage

What is the unit for voltage? volts

So that means that the unit for power is a watt = amp x volt

1. A 40.0-watt bulb is connected to the 120.0-volt outlet of a house:
   a) What current will pass through the bulb?

Given: V = 120

P = 40

Solution: I = .33 Amps

I = P/V

I = 40/120

   b) What is the resistance of the bulb?

Given: V = 120

I = .33

Solution: R = 360 Ω

R = V/I

R = 120/.33

2. A 40.0-watt bulb is connected to the 12.0-volt power supply of a camping trailer.
   a) What current will pass through the bulb?

Given: V = 12

P = 40

Solution: 3.33 Amps

I = P/V

I = 40/12

   b) What is the resistance of the bulb?

Given: V = 12

I = 3.33

Solution: 3.6 Ω

R = V/I

R = 12/3.33

Compared to a 40 watt bulb used in our homes, a bulb operating off a 12 volt battery can have the same power (brightness too) if it has .33 A current passing through it. In order to have more current passing through it, the resistance of the bulb operating off 12 volts must be 100 than the resistance of the bulb operating off 120 volts.

3. An electric heater with a resistance of 8 ohms is plugged into a 120.0-volt outlet in a house.
   a) What current will pass through the heater?

Given: R = 8 Ω

V = 120

Solution: I = 15 A

I = V/R

I = 120/8

   b) What is the power of the heater?

Given: I = 15A

V = 120

Solution: V = 1800 watts

P = IV

P = 15 × 120

P = 1800 watts

16/16

Name: Michael Plasmeier

Unit 3.6 Quiz

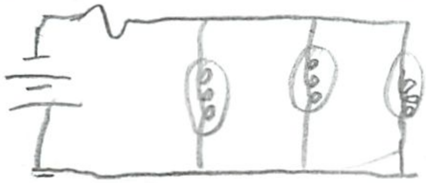
1. What is the purpose of a fuse? (3pts)

A fuse or circut breakers job is to shut off the circut when the amount of current flowing exceds its raiting which could happen if too much load was placed on the circut or a total short of the circt occurs

2. How does it work? (3pts)

A fuse works by having a thin wire that can only support a certain amount of current flowing before blowing out. The amount of current is printed on the side as a raiting

3. Draw an example of a schematic diagram with a fuse and three bulbs in parallel in a circuit that works (the bulbs light and the fuse serves its purpose). (4pts) The symbol for a fuse: ∿



4. A VCR uses 22 Watts of power in a standard United States outlet. How much current passes through the circuit? (3pts) (You need to use the formula from "Load Limit":)

P
I
V
R I

I = P/V

I = 22W/120V

I = .18333 Amps

5. You hook up a 100 watt bulb to a standard outlet. The circuit has a certain amount of current that passes through it. Suppose you add another 100 watt bulb (in parallel as we did in class). How much current flows through the circuit now, as compared to the single bulb? (3pts)

1 Bulb	2 Bulbs
I = P/V	I = P/V
I = 100/120	I = 200/120
I = .8333 Amps	I = 1.666 Amps

.8333 Amps more or double befor

Michael Plasmeier

✓

Act 3.7

Effecincy of heating water

5/26

What is the most effieent way of heating water?
- microwave
- hotplate - I think this, because this is what we do
- immersion coils.

$$\frac{E}{P \mid T}$$

1. Get 200 mL of water
   - 200g
   - 23°C

2. Put in microwave
   1400 w consumption - 800w output
   60 seconds
   57°C

b- You need to mesure quickly because the water will cool down quickly before you can mesure

3. Hotplate
   - 200 mL, 200g, 23°C before
   - 300w consumption
   - 7 min - 45 sec till 57°C

4. Coil
   - 200 mL, 200g, 23°C
   - 200w consumption
   - 3 min 12 sec till 57°C

5. Joules
   Microwave - Energy = 1400w × 60 sec = 84,000 Joules
   Hotplate - Energy = 300w × 465 sec = 139,500 Joules
   * Coil - Energy = 200w × 192 sec = 38,400 Joules

6b. the coil was the winner, but it very unsafe. It also might be less effective with more water My Hotplate actually lost. I compared the Joules used and the one with the least "won"

cd. The comparison was not really fair, the styrophane cup was in the microwave which insultaes and the hot plate will be more effective with a metal cup instead

Also the construction + manufacturing of the equipment plays a part.

Also the stiring and measuring wasn't completely equal and fair.

Physics to Go

1. Yes materials do affect effiancys. Some metals transfer heat better then others like plastic, so metal is used for pots, but plastic for utensils and handles

2. A microwave can do more then just heat water, and so can a hot plate. A coil can only heat water (and contaminates it) and is dangerous

3. Compare $E_H = mc\Delta T$ or 4180 J/kg °C to spetic heat of water 28,429 J Then compare this to the energy use of appliances

4,5. $Energy_1 = 1500\,w \times 180\,sec = 270{,}000\,J$ ← Better
$Energy_2 = 1200\,w \times 240\,sec = 288{,}000\,J$

6. $Power = IV = 10 \times 120 = 1200\,w \times 120\,sec = 144{,}000\,J$ per day × 260 days/year
37,914 0,000 J

3.7 Reflection

5/31

The coil was the most effective in relation to total energy useage mesaured in joules and calcucated Power × time. However the emersion coil is very unsafe as it is handeled very closely le people. Also the coil must be completely clean as not to soil the water. In addition the coil can not be used when cooking food like soup as this would dirty the coil which is hard to clean. A microwave can not be used because is removes essitential nutrients and changes the consistancy and taste of the food. Therefore a hot plate is the best choice.

A new measurment was introduced in the unit, energy. The HFE home can only out-put 90 kWh per month. This means that it can only power a certain amount of joules per month.

There are 2 units that must be accounted for when writting the manual.

Total power at one time <2400 W

Total Energy useage for a month < 90 kWh

CALCULATING ELECTRICAL ENERGY AND COST

Name Michael Plasmeier

1 kwh = 3,666,666 J

One kilowatt hour is 1,000 watts of power for one hour of time. The abbreviation for kilowatt hour is kWh.

Example: A coffee pot operates on 2 amperes of current on a 110-volt circuit for 3 hours. Calculate the total kWh used.

1. Determine power: P = V x I
   = 110 volts x 2 amps
   = 220 watts

kWh = P x hours

$$kWh = \frac{V \times I \times hours}{1{,}000}$$

2. Convert watts to kilowatts:
   $$220 \text{ watts} \times \frac{1 \text{ kilowatt}}{1{,}000 \text{ watts}} = 0.22 \text{ kW}$$
3. Multiply by the hours given in the problem:
   0.22 kW x 3 hrs = 0.66 kWh

Solve the following problems.

1. A microwave oven operates on 5 amps of current on a 110-volt circuit for one hour. Calculate the total kilowatt hours used. ,55 kWh   110×5 = 550 × 1 hr = $\frac{550}{1000}$
2. How much would it cost to run the microwave in Problem 1 if the cost of energy is $0.10 per kWh? 5,5¢   ,55 kWh × ,1
3. An electric stove operates on 20 amps of current on a 220-volt circuit for one hour. Calculate the total kilowatt hours used. 4,4 kwh   20×220 = 4400 ×1 = $\frac{4400}{1000}$
4. What is the cost of using the stove in Problem 3 if the cost of energy if $0.10 per kWh? 44 ¢   4,4 × ,1
5. A refrigerator operates on 15 amps of current on a 220-volt circuit for 18 hours per day. How many kilowatt hours are used per day? 59,4 kwh   15×220 = 3300 × 18 = $\frac{59400}{100}$
6. If the electric costs are 15¢ per kWh, how much does it cost to run the refrigerator in Problem 5 per day? $ 8,91   59,4 × ,15
7. The meter reading on June 1 was 84502 kWh. On July 1, the meter read 87498 kWh. If the cost of electricity in the area was 12¢ per kWh, what was the electric bill for the month of June? $ 359.52   2996 kWh used × ,12
8. A room was lighted with three 100-watt bulbs for 5 hours per day. If the cost of electricity was 9¢ per kWh, how much would be saved per day by switching to 60-watt bulbs? 5,4¢   300 × 5 = 1500/1000 = 1,5 × ,09 = ,135
   180 × 5 = 900/1000 = ,9 × ,09 = ,081
   to kW

CALCULATING POWER

Name ____________

P = V x I
Power (watts) = Voltage (volts) x current (amperes)

Solve the following problems.

1. A 6-volt battery produces a current of 0.5 amps. What is the power in the circuit?

P = 6v × .5 = 3 watts

3 watts

2. A 100-watt light bulb is operating on 1.2 amperes current. What is the voltage?

V = 100/1.2 = 83333

~83 Volts

3. A potential difference of 120 volts is operating on a 500-watt microwave oven. What is the current being used?

I = 500/120 =

4.16 amps

4. A light bulb uses 0.625 amperes from a source of 120 volts. How much power is used by the bulb?

P = .625 × 120

75 watts

5. What voltage is necessary to run a 500-watt motor with a current of 200 amperes?

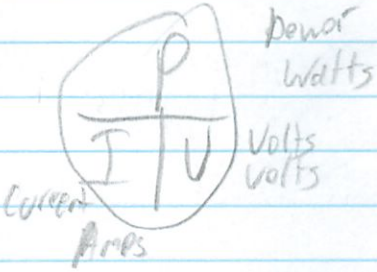
I = 500/200

2.5 volts

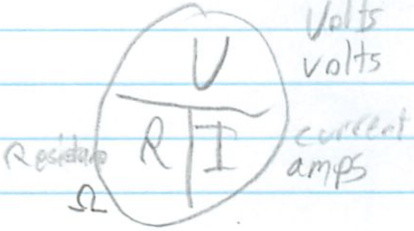
Memory Circles
Review

5/26

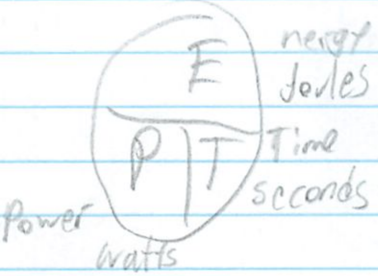
$P = IV$



$V = RI$
Ohm's Law



$E = PT$
Energy Use



Energy = Current • voltage • time

Activity 4.1

from book

5/31

What do you think?

Electric motors and genorators are very important to our standards of living, Elevators and esclators work with there many toys and such use electricaly Convayer belts run on motors. Also genorators work using magnets. With out these there could be no steady flow of power. We would be using steam(coal) or gas(oil) engins which are very dirty. Also most new alternative forms of energy use electricty to work, life would be very different with out magnets.

Electromagnets too

Appliance Usage List

- Use the Appliance Usage List to determine the estimated cost of electrical items in your home.
- Some items were not included in the list due to their relatively low monthly cost.
- Typical monthly costs are based on a family of four.
- Totals do not include the monthly customer charge or meter fees which may be part of your bill.
- Percent On Time is the average amount of time the appliance is drawing electricity when it's in use.

To get a customized monthly cost of everything in your home try our interactive Energy Calculator.

Appliance	Typical Wattage	Percent On Time	Average Hours Used	Average Monthly kWh	Typical Monthly Cost
Air Compressor - 1 H.P.	1000	100	20	20	$3.18
Air Compressor - 1/2 H.P.	500	100	20	10	$1.59
Air Compressor - 3 H.P.	3000	100	20	60	$9.53
Air Compressor - 6 H.P.	6000	100	20	120	$19.06
Air Conditioner - 10,000 BTU	1000	75	200	150	$23.82
Air Conditioner - 5,000 BTU	500	75	200	75	$11.91
Air Conditioner - 7,000 BTU	750	75	200	112	$17.79
Air Purifier	120	100	720	86	$13.66
Answering Machine	10	100	720	7	$1.11
Boat De-Icer - 1 H.P.	1000	100	720	720	$114.34
Boat De-Icer - 1/2 H.P.	500	100	720	360	$57.17
Boat De-Icer - 3/4 H.P.	750	100	720	540	$85.75
Bug Killer	40	100	300	12	$1.91
Ceiling Fan w/o light	50	100	180	9	$1.43
Ceiling Fan with 3 - 60 Watt Bulbs	230	100	180	41	$6.51
Christmas Lights - 100 Large Bulbs	70	100	150	10	$1.59
Christmas Lights - 100 Small Bulbs	50	100	150	8	$1.27
Clock - Electric	3	100	720	2	$0.32
Clothes Dryer - Electric	5000	100	24	120	$19.06
Clothes Washer	1200	100	16	19	$3.02
Coffee Maker	900	100	13	12	$1.91
Compactor (Trash)	400	100	10	4	$0.64
Computer Printer (Printing)	600	100	3	2	$0.32
Computer with Monitor	270	100	120	32	$5.08

Appliance	Typical Wattage	Percent On Time	Average Hours Used	Average Monthly kWh	Typical Monthly Cost
Deep Fat Fryer	1500	100	3	4	$0.64
Dehumidifier - 20 pint	480	50	720	173	$27.47
Dehumidifier - 40 pint	625	50	720	225	$35.73
Dehumidifier - 65 pint	790	50	720	284	$45.10
Dishwasher (With Dry Cycle)	1000	50	20	10	$1.59
Dishwasher (Without Dry Cycle)	200	100	20	4	$0.64
DVD	60	100	120	7	$1.11
Electric Blanket	165	50	240	20	$3.18
Electric Fence	10	100	720	7	$1.11
Electric Frying Pan	1500	100	10	15	$2.38
Electrostatic Air Cleaner (On Furnace)	50	100	720	36	$5.72
Exercise Equipment - Treadmill 2 H.P.	2000	100	15	30	$4.76
Exercise Equipment - Treadmill 3 H.P.	3000	100	15	45	$7.15
Fan	200	100	50	10	$1.59
Fan (Attic)	500	100	60	30	$4.76
Fan (Window)	200	100	50	10	$1.59
Fax Machine	10	100	720	7	$1.11
Fish Tank (10 Gallon)	80	50	720	29	$4.61
Fish Tank (50 Gallon)	230	50	720	83	$13.18
Freezer - Upright/Chest 17 cu. ft	600	40	720	173	$27.47
Freezer - Upright/Chest 17 cu.ft. - Frostfree	600	50	720	216	$34.30
Grill - Counter Top	1425	100	8	11	$1.75
Hair Dryer (Hand Held)	1500	100	10	15	$2.38
Heat Lamp	250	100	20	5	$0.79
Heater - Auto Engine - 1,000 Watt	1000	50	360	180	$28.58
Heater - Auto Engine - 500 Watt	500	50	360	90	$14.29
Heater - Portable - 1500 Watt	1500	100	75	112	$17.79
Heating Cable - Roof - 60 Ft.	500	100	30	15	$2.38
Heating Cable - Water Pipes - 24 Ft.	200	100	720	144	$22.87
Heating System - Hot Air 1/2 HP Motor	500	40	720	144	$22.87

Appliance	**Typical Wattage**	**Percent On Time**	**Average Hours Used**	**Average Monthly kWh**	**Typical Monthly Cost**
Heating System - Hot Air 3/4 HP Motor	750	40	720	216	$34.30
Heating System - Hot Water (1 Zone)	315	40	720	91	$14.45
Heating System - Hot Water (2 Zones)	423	40	720	122	$19.37
Heating System - Hot Water (Summer Use)	135	40	720	39	$6.19
Home Theater Receiver	100	100	180	18	$2.86
Hot Tub - Insulated/Indoor (4 person)	1500	15	720	162	$25.73
Hot Tub - Insulated/Outdoor (4 person)	1500	55	720	594	$94.33
Humidifier - Cool Mist	200	100	200	40	$6.35
Humidifier - Warm Mist	384	100	200	77	$12.23
Iron	1100	50	10	6	$0.95
Lawn Mower	3000	100	5	15	$2.38
Lighting - 10 rooms (15 60W)	900	100	100	90	$14.29
Lighting - 100 Watt	100	100	240	24	$3.81
Lighting - 3 rooms (8 60W)	480	100	100	48	$7.62
Lighting - 40 Watt	40	100	240	10	$1.59
Lighting - 5 rooms (10 60W)	600	100	100	60	$9.53
Lighting - 60 Watt	60	100	240	14	$2.22
Lighting - 7 rooms (12 60W)	720	100	100	72	$11.43
Lighting - 75 Watt	75	100	240	18	$2.86
Lighting - Chandelier 5 - 40 Watt Bulbs	200	100	240	48	$7.62
Lighting - Comp Fluorescent - 18 Watt	18	100	240	4	$0.64
Lighting - Comp Fluorescent - 23 Watt	23	100	240	6	$0.95
Lighting - Fluorescent 2 bulb	100	100	240	24	$3.81
Lighting - Halogen	90	100	240	22	$3.49
Medical Equipment - Nebulizer	1035	100	45	47	$7.46
Medical Equipment - Oxygen Concentrator	460	100	720	331	$52.56
Microwave Oven	1500	100	10	15	$2.38
Mixer - Stand	300	100	20	6	$0.95
Motor - 1 H.P.	1000	100	20	20	$3.18
Motor - 1/4 H.P.	250	100	20	5	$0.79

Appliance	Typical Wattage	Percent On Time	Average Hours Used	Average Monthly kWh	Typical Monthly Cost
Motor- 1/2 H.P.	500	100	20	10	$1.59
Oven	5000	50	10	25	$3.97
Range - Large Surface Unit	2400	100	10	24	$3.81
Range - Small Surface Unit	1200	100	10	12	$1.91
Refrigerator - 1.7 cu. ft.	126	33	720	30	$4.76
Refrigerator - 14 cu. ft.	226	40	720	65	$10.32
Refrigerator - 14 cu. ft. - Frostfree	383	33	720	91	$14.45
Refrigerator - 17 cu. ft - Frostfree	463	33	720	110	$17.47
Refrigerator - 19 cu. ft. - Frostfree	509	33	720	121	$19.21
Refrigerator - 21 cu.ft. - Frostfree	572	33	720	136	$21.60
Refrigerator - Freezer 21 cu. ft.- Side by Side	783	33	720	186	$29.54
Refrigerator - Freezer 24 cu. ft. - Frostfree	653	33	720	155	$24.61
Refrigerator - Freezer 25 cu. ft. - Side by Side	841	33	720	200	$31.76
Septic Pump	1000	100	40	40	$6.35
Slow Cooker	200	100	40	8	$1.27
Stereo	75	100	130	10	$1.59
Sump Pump	500	100	20	10	$1.59
Swimming Pool - Above Ground	500	50	360	90	$14.29
Swimming Pool - In Ground 16 X 32	500	50	360	90	$14.29
Swimming Pool - In Ground 18 X 36	750	50	360	135	$21.44
Swimming Pool - In Ground 20 X 40	1000	50	360	180	$28.58
Telephone - Cordless	5	100	720	4	$0.64
Television - 13 inch	60	100	120	7	$1.11
Television - 19 inch	100	100	120	12	$1.91
Television - 25 inch	123	100	120	15	$2.38
Television - 27 inch	125	100	120	15	$2.38
Television - 32 inch	130	100	120	16	$2.54
Television - 36 inch	133	100	120	16	$2.54
Television - 43 inch	200	100	100	20	$3.18
Television - 55 inch	220	100	120	26	$4.13

Appliance	Typical Wattage	Percent On Time	Average Hours Used	Average Monthly kWh	Typical Monthly Cost
Television - 60 inch	240	100	120	29	$4.61
Television Cable Converter Box	35	100	720	25	$3.97
Television/DVD/VCR Combination	120	100	120	14	$2.22
Toaster	1000	100	3	3	$0.48
Toaster Oven	1500	27	25	10	$1.59
Tools - Bench Grinder	600	100	10	6	$0.95
Tools - Circular Saw	1000	100	10	10	$1.59
Tools - Drill	400	100	10	4	$0.64
Tools - Saber Saw	400	100	10	4	$0.64
Tools - Sander Belt	300	100	10	3	$0.48
Tools - Soldering Gun	600	100	10	6	$0.95
Tools - Table Saw	3000	100	10	30	$4.76
Vacuum - Central	800	100	10	8	$1.27
Vacuum - Regular	1440	100	6	9	$1.43
Vaporizer	750	100	4	3	$0.48
VCR	45	100	30	1	$0.16
Video Game	200	100	100	20	$3.18
Water Cooler With Hot Water	600	15	720	65	$10.32
Water Heating - LCS 10-11 Hours	4500	25	308	346	$54.94
Water Heating - LCS 8 Hours	4500	32	243	350	$55.58
Water Heating - Master MTRD (20 G)	4500	10	720	324	$51.45
Water Heating - Quick Recover (QR)	4500	11	720	356	$51.83
Water Pump	900	100	43	39	$6.19
Waterbed - Double 100 °	375	74	720	200	$31.76
Waterbed - Double 80 °	375	37	720	100	$15.88
Waterbed - Double 90 °	375	62	720	167	$26.52
Waterbed - King 100 °	375	100	720	270	$42.88
Waterbed - King 80 °	375	50	720	135	$21.44
Waterbed - King 90 °	375	83	720	224	$35.57
Waterbed - Queen 100 °	375	87	720	235	$37.32

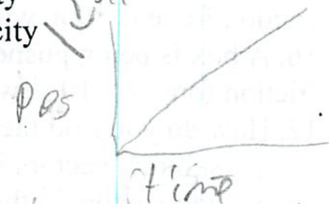
Appliance	Typical Wattage	Percent On Time	Average Hours Used	Average Monthly kWh	Typical Monthly Cost
Waterbed - Queen 80 °	375	43	720	116	$18.42
Waterbed - Queen 90 °	375	72	720	194	$30.81
Whirlpool Tub	1800	100	15	27	$4.29

Fnet = ma
mass acceleration

review projectile
$d = \frac{1}{2} g t^2$

IPS Final Exam Review

1. Draw ticker tapes for the following:
   a. slow constant speed – – – –
   b. fast constant speed – – – – – – – –
   c. accelerating (speeding up) – – – – – –
   d. decelerating (slowing down) – – – – – – –
2. Plot position-time graphs for the following:
   a. illustrating an object moving to the left at constant velocity see
   b. illustrating an object moving to the right at constant velocity
   c. illustrating an object slowing down
   d. illustrating an object speeding up
   e. illustrating an object at rest



3. Define the following:
   [✓ a.] speed amount of distance something can cover in a certain amt of time
   b. acceleration change in speed per unit of time
4. Suppose you go on a trip that covers 60 km and takes 0.5 hours. What is your average speed? $60/.5 = 120 \frac{km}{hr}$ ph
5. Can a liquid accelerometer tell you the direction that a car is *moving*? No if steady speed
6. Can a liquid accelerometer tell you the direction that a car is *accelerating*? Yes
7. Draw liquid accelerometers for the following:
   a. showing a car moving to the right (+) and speeding up
   b. showing a car moving to the left (-) and speeding up
   c. showing a car moving to the right and slowing down
   d. showing a car moving to the left and slowing down
   e. showing a car at any constant speed

Force [✓ 8.] What unbalanced force is needed to accelerate a 60.0-kg mass at a rate of 2.00 m/s^2? 120 kg m/s^2
9. What is the unbalanced force on an object moving at constant speed? 0
10. Which of the following statements is true?
   a. Total energy, potential energy, and kinetic energy all decrease as a cart rolls down a hill.
   b. Total energy, potential energy, and kinetic energy all increase as a cart rolls down a hill.
   c. Total energy remains the same, the potential energy increases, and the kinetic energy decreases
   [✓ d.] Total energy remains the same, the potential energy decreases, and the kinetic energy increases as car rolls down hill
11. Which equation can be used to calculate total energy?
   a. TE = KE – PE
   b. TE = PE – KE
   [✓ c.] TE = PE + KE
   d. TE = PE × KE

Newton's laws

(2.12) work - transfer of energy / (F×t)

Circular motion

12. What do you know when an unbalanced force is zero?
    - [✓ a.] the object must have a constant velocity
    - b. the object must be accelerating
    - c. the object must be decelerating

13. If I hit the wall with a force of 400 N, with what force does the wall "hit" (push back on" me? 400N

14. A force of 100 N is pushing a box across the floor at a constant speed. What is the magnitude of the friction force? 100N

15. A box is being pushed to the right across the floor by a force of 100 newtons. If the friction force is 80 newtons, what will happen to the motion of the box? box speeds up

16. A box is being pushed to the right across the floor by a force of 100 newtons. If the friction force is 110 newtons, what will happen to the motion of the box? slows down

17. How do you find the net force acting on a block given a force diagram of the block?
    - a. subtract vectors in the same direction, and add vectors in the opposite direction
    - [✓ b.] add vectors in the same direction, and subtract vectors in the opposite direction
    - c. multiply vectors in the same direction, and divide vectors in the opposite direction
    - d. divide vectors in the same direction, and multiply vectors in the opposite direction ✓ $F = ma$

Velocity has direction

18. How do you find the mass of an object given the weight of that object? weight ~~×~~ 10 m/s² (?)

19. How do you find the weight of an object given the mass of that object? mass · 10 m/s²

20. Make a list of steps to find the acceleration of an object given a free-body diagram showing all of the forces acting on the object and the weight of the object? add up ↕ then ↔ then com those (vec

21. What two aspects must an object have in order to be having work done on it? How much work is done on a 40 N rock that is lifted 5 meters straight up? 200 Ns

moving unbalanced force

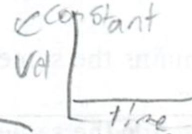
22. You are in a car going around a curve and the speedometer has a constant reading. Write true or false next to each statement:
    - a. The car is accelerating F
    - b. The speed of the car is constant T
    - c. The velocity of the car is constant F
    - d. The velocity of the car is changing T

$a_c = v^2/r$

$F_c = ma_c = (mv^2)/r$

23. A car is moving in a straight line and its speed is increasing at a constant rate. If the car moves from 30 km/h to 40 km/h in the first second and from 40 km/h to 50 km/h in the second second, what is the car's acceleration? 10 km/h·s

24. Draw velocity time graphs for the following:
    - a. illustrating constant velocity
    - b. positive acceleration (speeding up)
    - c. negative acceleration (slowing down)



jerk acceleration

speed traveling → before (constant)

25. How does the weight of an object affect (or not affect) how fast it will fall? $V = gt^2$ Doesn't effect

10 m/s² ↑↓

26. Draw a parabola showing the path of a projectile and show the change (or consistency) of the vertical and horizontal motions of the object using arrows.

27. A ball is dropped from the top of a building. How fast will it be traveling after falling for 8 seconds? $V = gt^2$ 10×64 640 m/s (?)

28. A ball is dropped from the top of a building. How far will the ball drop in 8 seconds/ $d = \frac{1}{2}gt^2$ $d = 5 \cdot 64$ 320 m

29. What is the launch angle that would cause a soccer ball kicked from the ground to go the greatest distance? 45°

30. What is the launch angle that will cause a projectile to go the highest?

90° ↑

$MV = \frac{F_a}{Fg_\ell}$ less then 1

weight

31. A 25.0-kg wagon is being pulled to the right at a constant velocity of 5.0 m/s by a force of 10 N. What force of friction acts on the wagon? 10 N
32. Another phrase for net force is unbalanced force. False - opposites - true?
33. If an unbalanced force is not zero, then what must the object be doing? accelocating
34. If an object weighs 600 newtons and is at rest, what force must be pushing up on the object? 600 N up
35. A guy is pushing on a 50.0 kg box with a force of 25.0 N to the right. The friction force of the ground on the box is 5.0 N to the left. What is the acceleration of the box? Fnet = ma

$25 - 5 = 50a$

$\frac{20}{50} = \frac{50a}{50}$

a = .4m/s

36. A 6 kg box is being pulled to the right by a force of 12 N. The box is moving at a constant speed of 3 m/s. What is the coefficient of friction, mu, between the box and floor? Weight = mass · 10 mu = $\frac{12}{60 \cdot 10}$ = 1.2 .2 (20)
37. What affects potential energy? position
38. What affects kinetic energy? speed mass
39. A car travels in a circle with a constant speed. Which way does the net force act on the car? ~~in a circle~~ pulling to center of circle
40. State the entire law of inertia An object in motion will remain in motion; object at rest unless actated upon another object

not exact wording

41. When 2 objects collide head-on, what do you know about the forces acting on each object? Point in opposite directions - equal but opposite
42. Draw a diagram showing the path of a life-guard whistle as you twirl it horizontally, and the string breaks. the break point - tanget to circle
43. The mass of the whistle is 0.1 kg and the length of the string is 0.5 m. If the speed of the whistle is 3.0 m/s, what is the tension in the string? .45N = $F = m(v^2/r)$

$a_c = v^2/r$

$F = ma$

44. Why do many people fall over when they try to touch their toes while standing against a wall? c/g shifts
45. Give an item in which the center of mass is located at a point where there is no mass. bannan
46. When carrying a heavy bucket of water, I put my other hand out. Why do I do this? Stablize - distribe mass
47. What makes a good conductor? low restance
47. Which is a better conductor – a metal or a nonmetal?
48. Describe the path of motion of a projectile with an irregular shape. where air restance hits, might slow horizontal distance
48. Why are metals such good conductors? low restance
49. What does mu depend on? surface only
50. What is the relationship between weight, mu, and the force required to push an object? $M = \frac{F_a}{weight}$
51. What is the relationship between weight and mass? W = m/g
52. What does the length of time that a goalie is in the air for depend on? how hard he pushed off ground - can't flap
53. Draw 3 ramps of the same height, but different angles of incline. If a ball was released from rest at the top of each incline, which ball would be going the fastest when they reach the bottom? ~~middle ramp~~ all the same KE

54. In the same scenario above, which ball will reach the bottom of the ramp first? ~~Middle ramp~~ steepist starting slope
55. What is the equation for momentum? kg (m/s)
56. A 1000 kg car is driven on the highway with a speed of 10 m/s. What is the momentum of the car? 1000 · 10 = 10,000
57. If momentum is conserved, explain how the momentum of the car above is not zero, but when it comes to a stop, its momentum is zero. Hint: the phrase "outside force" friction
58. A 4000-kg truck is driving at 15 m/s. Up ahead is a 1000-kg car at rest. The two vehicles collide and stick together. What is the final speed of the two vehicles?

4000 · 15 + 1000 · 0

60,000 + 0

60,000/5000 = 12m/s

Total momentum before = total after

Work = F·d

5,000 · 25 + 1500 · 0

125000 = 1500 · 50

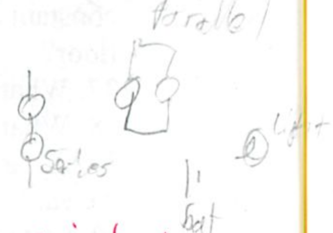
125 − 75 = 50,000 / 5,000 = $\boxed{10\ m/s}$

59. A 5000 kg truck driving at 25 m/s hits a 1500 kg car at rest. After the collision, the car shoots off at a speed of 50 m/s. What is the speed of the truck after the collision?

60. A 150-kg hockey player is moving to the right at 5.0 m/s when he runs into and grabs onto a 100-kg hockey player moving the left at 5.0 m/s. If they remain together after the collision, what is their combined velocity after collision? ←500 750→ 250/250 = 1 m/s →

61. A 100-kg hockey player moving to the right at 5.0 m/s, catches up to a 150-kg hockey player that is moving to the right at 2.5 m/s. When he catches up to him, he grabs on to him. If they remain together after collision, what is their combined velocity after collision? 500→ + 375→ = 875/250 = 3.5 m/s →

62. Draw the following schematics:



- a. containing 1 battery, 1 light bulb, and 2 wires.
- b. containing 1 battery, 2 light bulbs in series, and 3 wires
- c. containing 2 batteries and 2 light bulbs (all in series), and 4 wires
- d. containing 2 batteries in series, 1 light bulb, and 3 wires
- e. containing 1 battery and 2 light bulbs in parallel

63. Using the schematics above, in which case(s) are the bulb(s) the brightest? in Series – get dimmer – in parallel – Stay the Same

64. What is meant by a series circuit? in a row

65. What is meant by a parallel circuit? separate branchs

66. What is a load? Consumer of electricity

67. Draw a schematic of a circuit with 2 batteries, 3 light bulbs in series, and one ammeter.

67. Draw a schematic of a circuit with 2 batteries, 3 light bulbs in parallel, each with their own switch, and one ammeter.

68. All the lights are lit in parallel, and the bulb in the middle burns out. What happens to the rest of the bulbs? Stay on, ~~I get brighter?~~ Stay the same

68. The lamps in a parallel circuit are tuned on one at a time. What will happen to the amount of current that passes through the ammeter? increases? More power at same voltage

69. Draw a schematic with 2 batteries, an ammeter, and 2 light bulbs wired in parallel.

70. What will happen to the current and the light when a wire is connected to either side of the light bulb furthest from the battery? Short Circt – lots of current flow, lights out

71. Draw a schematic with 2 batteries, an ammeter, and 2 light bulbs wired in series.

72. What will happen to the current and light when a wire is connected on either side of one of the light bulbs?

73. What is the equation for power? P = IV

A water heater has a 1.5-kilowatt heating element that is hooked to a 120-volt outlet. P = 1500 · 120

180,000

74. How much current will go through the heater?

75. The heater runs for an average of 5 hours per day. How much energy does the heater use in a month (30 days)? 270,000 00

76. A household electrical circuit (120 V) is protected by a 20-amp fuse or circuit breaker.

- a. What is the load limit of the fuse? 2400 W
- b. How much power will cause the circuit to overload? 2401 W

77. A donut maker is rated at 1500 watts. It is plugged into a 120-volt outlet. How much current will pass through the donut maker? 1500/120 = 12.5 A

78. Which appliance was the most efficient way to heat a cup of water?

immersion coil

$KE = \frac{1}{2}mv^2$

$PE = mgh$

$P = IV$

$E = PT$

6

79. What device converts chemical energy into electrical energy? battery
80. What device converts electrical energy into kinetic energy? Moter
81. What device converts kinetic energy into electrical energy? generator
82. What device converts electrical energy into heat and light energy? light bulb
83. A 1600 watt microwave is used at maximum power to heat up a cup of soup for 2 minutes. How much energy was used by the microwave to heat the soup? 3200 watts
84. What is the cost of running a 13000 watt kitchen stove for 100 minutes at a const of $0.05 /kWh? ~~$65~~ 2 $1.08 ← divide 100/60
85. How much time is required to generate 7000 joules of energy with a 70 watt heating element?

100 minutes

? unit

IPS Finale Sheet

6/13

Basic	$F_{net} = ma$ $s = d/t$ $a = \frac{v_1 - v_2}{t} = m/sec^2$
Energy	$TE = PE + KE$ - doesn't change $ke = \frac{1}{2}mv^2$ $PE = mgh$
Weight	weight / 10 m/s = mass mass • 10 m/s = weight
Centrip	$a_c = V^2/r$ $F_c = ma_c = (mv^2)/r$
P(o)	$d = \frac{1}{2}gt^2 \Leftrightarrow d = \frac{at^2}{2}$ $v = gt^2$??
Momentum + Work	Work = F • d Impulse = F t tranfer of energy total momentum before = total momentum after Momentum = kg (m/s)
Friction	$mu = \frac{Fa}{Fg}$ (always less tan 1) Fg = weight - only affected by surface
Electricity	$P = IV$ $\frac{P}{IV}$ $V = RI$ Ohm's Law $E = PT$ - current • voltage • time

Newton's Laws

Review

1st law (inertia)	Every body continues in its state of rest, or in motion in a straight line at a constant speed, unless it is compelled to change that state by a net force exerted upon it.
2nd Law Net Force + Acceleration ($F=ma$)	The acceleration produced by a net force on a body is direclty proportional to the magnitude of the net force, is in the same direction of the net force and is inversely proportional to the mass of the body.
3rd Law Reaction (Equal + Opposite forces)	Whenever one body exerts a force on a second body, the second body exerts an equal and opposite force on the first.