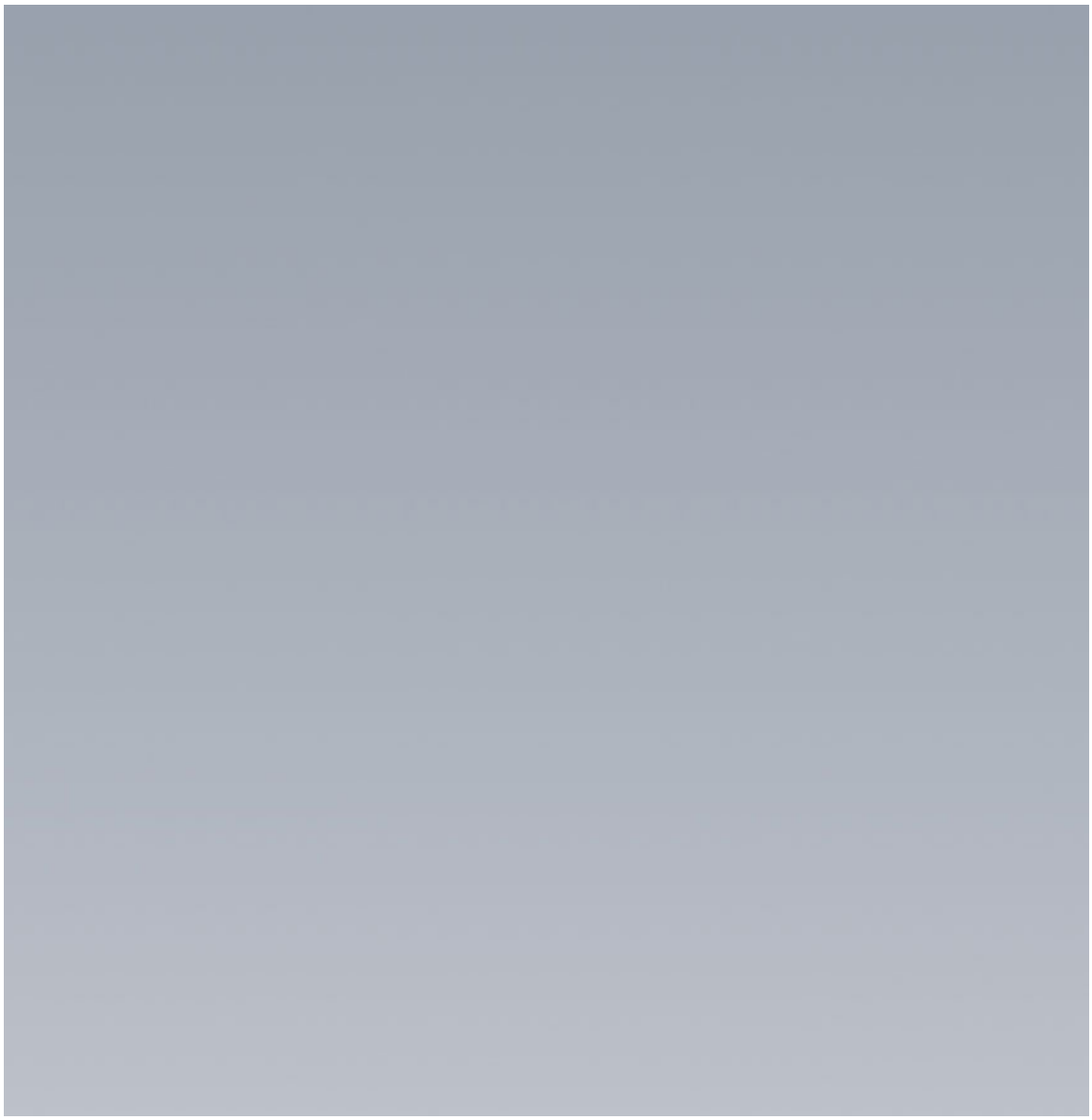
Physics Log

A comprehensive overview of all chapters

Joe Puccio
Physics Log • Woods Charter School • Junior year



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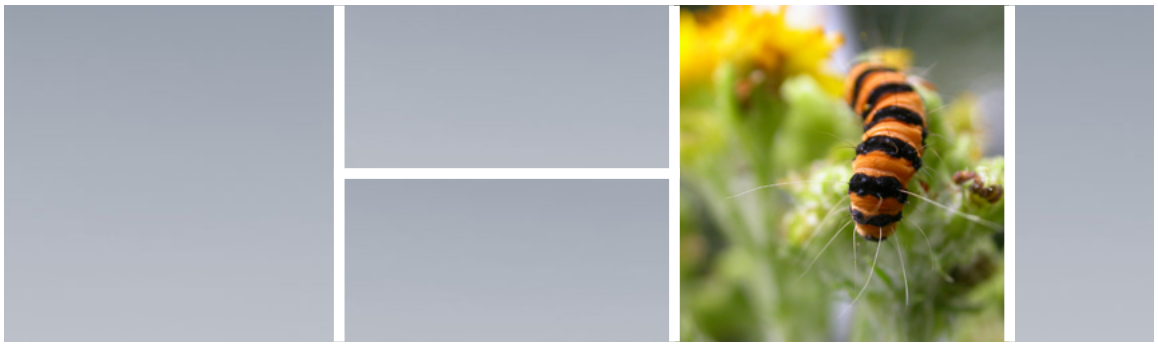
Chapter 1

SECTION 1 REACTION TIME: RESPONDING TO ROAD HAZARDS



What do you think?

What factors affect reaction time?

I think that the time it takes to perceive a response is necessary affects reaction time. I also think that the time it takes to perform the reaction affects the time. I also think that the conditions of the road and your speed affect reaction time.

Investigate

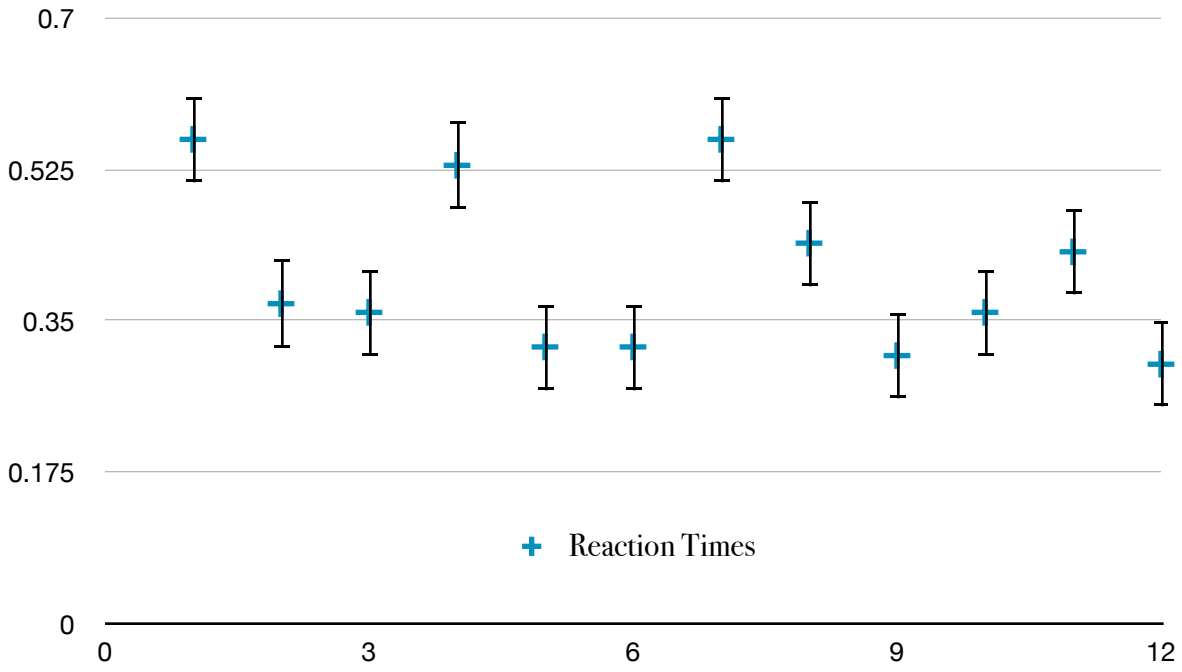
Estimate: I think that the time it takes to move your foot from the gas to the brake is 1/3 of a second.

Person	Response Time
Drew	0.56
Harrison	0.37
Jon	0.36
Matt	0.53

Person	Response Time
Joe	0.32
Brett	0.32
Chris	0.56
Conner	0.44
Grant	0.31
Justin	0.36
Jared	0.43
Jimmy	0.3

Data analysis

The results showed that the average time (.415 seconds) was slightly slower than anticipated.



Person	Response Time
Drew	5 cm
Harrison	21 cm
Jon	4 cm
Matt	12 cm
Joe	40 cm
Brett	40 cm
Chris	35 cm
Conner	27 cm
Grant	34 cm
Justin	63 cm
Jared	21 cm
Jimmy	10 cm
Stephen	22 cm
Average	26. 0833 cm

Accepted average: 25.7 cm. Average reaction time: 0.23 seconds.

Reaction Time Homework

Distractions reduce your reaction time because it's difficult for the brain (in fact, technically impossible) to analyze and respond to more than one stream of information. I've decided not to do the experiment because I'm not that involved.

Activities that distract while driving:

1. Talking on a cell phone

2. Texting on a cell phone

3. Changing a CD

4.Listening to music

5.Reading

6. Talking to someone in the backseat

7. Singing

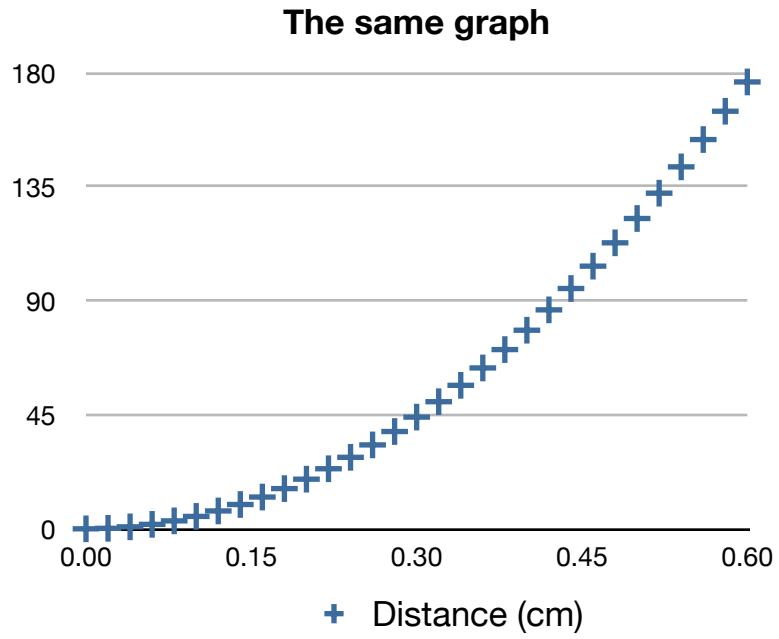
8.Eating

9.Dancing

10.Plugging in a phone

Calculating Reaction Time

Time	Distance
0	0
0.02	0.196
0.04	0.784
0.06	1.764



Distance	Time
6	0.110656667034498
7.5	0.123717914826348

0.10 0.14 0.17 0.20 0.23 0.25 0.27 0.29 0.30 0.3

Based on 5 cm increments

What factors affect reaction time?

Reaction time is determined by the time it takes to perceive that an action needs to take place, the time it takes to determine the response, and the time it takes to implement that response. Anything that can affect the these three steps can affect reaction time.

Essential Questions

What is reaction time?

Reaction time how long it takes to perceive that an action needs to take place, the time it takes to determine what to do, and the time it takes to do what was determined.

How do you know?

By using the acceleration of an object due to gravity and the distance it fell, we could calculate the amount of time it took for the person to react to the stimulus. The range was between four and sixty-three.

Why do you believe?

Reaction time is measure of a change over time because there are two different states that the person can be in: not holding the ruler and holding it. The change over time is from one state to the other.

Why should you care?

Understanding reaction time and the factors that affect it can help understanding how to drive safely.

Physics To Go

Slow reaction time means that it takes longer to respond to a situation and you were therefore more likely to hit an obstacle and cause an accident.

Their insurance costs more because they are less experienced and don't always have the right reflexes.

Knowing how fast I can react means I can make the right decisions when driving.

Investigation

My reaction time was relatively fast. This is likely because I play video games and soccer. I'm also young and have a faster reaction time. Some people's reaction times were fast but it was probably because they too play a sport. I would first take data and then inquire the subjects on what they do that may increase their reaction time.

I design a program that would randomly ask the participant to press a button when a tone is played, the program measures the time it takes to respond.

SECTION 2 MEASUREMENT: ERRORS, ACCURACY, AND PRECISION

Investigation Errors, Accuracy, and Precision

What do you think?

Perhaps both of them have made a mistake. They need to remeasure.

They probably just approximated, still, it is unknown.

1. 4 1/2 steps

2. 4 1/2 steps

3. 55 cm

4. 247.5 cm

5. Depending on how carefully each group measured and what their starting points were, they may have come to different answers. The groups will need to decide the appropriate way to measure a stride.

8. a) Perhaps, we may have conducted a parallax error. b) We may have taken poor strides.

9. a) Reasonable b) Not reasonable c) not reasonable; he doesn't work that hard d) Not reasonable e) Not reasonable f) Reasonable g) No h) Wait, don't die i) Yes.

Accuracy And Precision

Name	Precision	Accuracy	Average of Both
CF	13.6	11.5	12.55
JP	1.8	1.8	1.8
JV	1.5	1.9	1.7
BK	3.9	2.6	3.25
MG	1.2	2.2	1.7
DH	1.7	1.2	1.45
CO	2.5	3.8	3.15
GK	11.5	5.7	8.6
JT	4.9	5.4	5.15
SM	3	1.5	2.25
SS	1.4	1.7	1.55
JW	4.8	2.4	3.6

Name	Precision	Accuracy	Average of Both
JC	1.9	2.4	2.15
AT	2.4	1.6	2
Averages	4.007142857142863	3.264285714285713	3.635714285714299

Measuring the Volume and Area of the School

My Stride	Measure Surface Area (cm cubed)	Measure Volume (cm cubed)
64.2 cm	I plan to measure the length and width of the building. It consists of many rectangles and I'm going to measure each.	Measure the height, width and depth of the school.

Name	Stride (cm)	Surface Area (cm^2)	Volume (cm^3)
JP			
JV	65	25184168.75	57450000000
CF	54	18443116.81	11400000000
BK	67	28370480	
MG	52	36449356	26900000000
JW	65	28772250	34700000000
SS	67	15658440	16054493208
JC	85	44027216.25	24890000000
CO			

Name	Stride (cm)	Surface Area (cm²)	Volume (cm³)
AH	62.5	45218712	18600000000
JT	55	32890	29929900
Averages			

Side	Measurement
A	3155
B	3717
C	2362
D	1058
E	2686
F	3068
G	255
H	2362
I	1036
J	248
K	663
L	682

Sides	Area	Volume
AB	11727135	10138000000

Sides	Area	Volume
EF	8240648	5731370684
1/2(d*a-l)	1117.5	951551
1/2(d*f-l)	1069	910253
(A-L)*H	5279672	4011247604
GH	602310	
CH	585776	
Sum	26437727.5	19882480092

Team	Surface Area	Volume
JBS	26437727	19882480092
DJ	21916625	19945000000
JJ	2474181 5	20050000000
CG	24499232	18210000000
MJ	24254287	18900000000
ST	30057043	21000000000
Average	25317788.1666667	19664580015.3333
Range	8140418	2790000000

SECTION 3 AVERAGE SPEED: FOLLOWING DISTANCE AND MODELS OF MOTION

What do you think?

A safe following distance is three times your reaction time. Determine the time it takes for the two cars to pass the same obstacle.

1. 

2. 

b) No, they are different distances. .5 mi and 3/4 miles.

c) 

Twice as far as 30 mph.

3 a) C, A, Farther apart.

b) Yes, the distance is the same between any of them.

8)

A) 30 feet

B) 90 feet

C) 25 feet, 75 feet

D) 35 feet, 105 feet

E) Above 20 feet

F) 4 per second.

3) 7000 feet

4) 47.7 mph, No, she could be going any speed (including zero) for a time 4.5-1/infinity hours.

5) 20 mph

6)

a) Moving at a constant speed and then stopping

b) moving at a constant speed forward, stopping, then going backward at a constant speed

c) moving at a constant speed then increasing the constant speed

d) gradually increasing the speed.

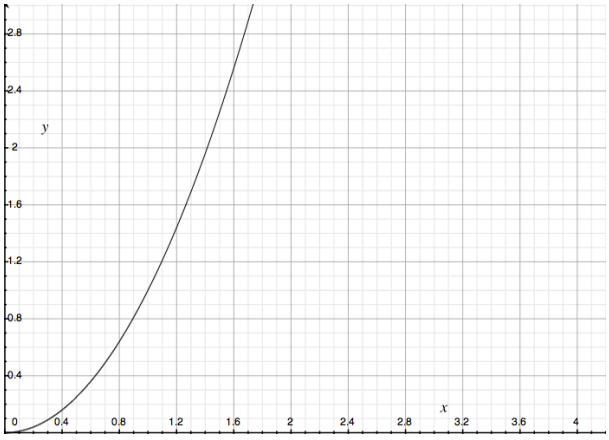
SECTION 4 GRAPHING MOTION: DISTANCE, VELOCITY, AND ACCELERATION.

What do you think?

1. The bus will accelerate slower because more force is required to accelerate larger mass.

   a. No, the amount of ground it covers per second will increase.

   b. In order of description: d,c,a,b.

c. 

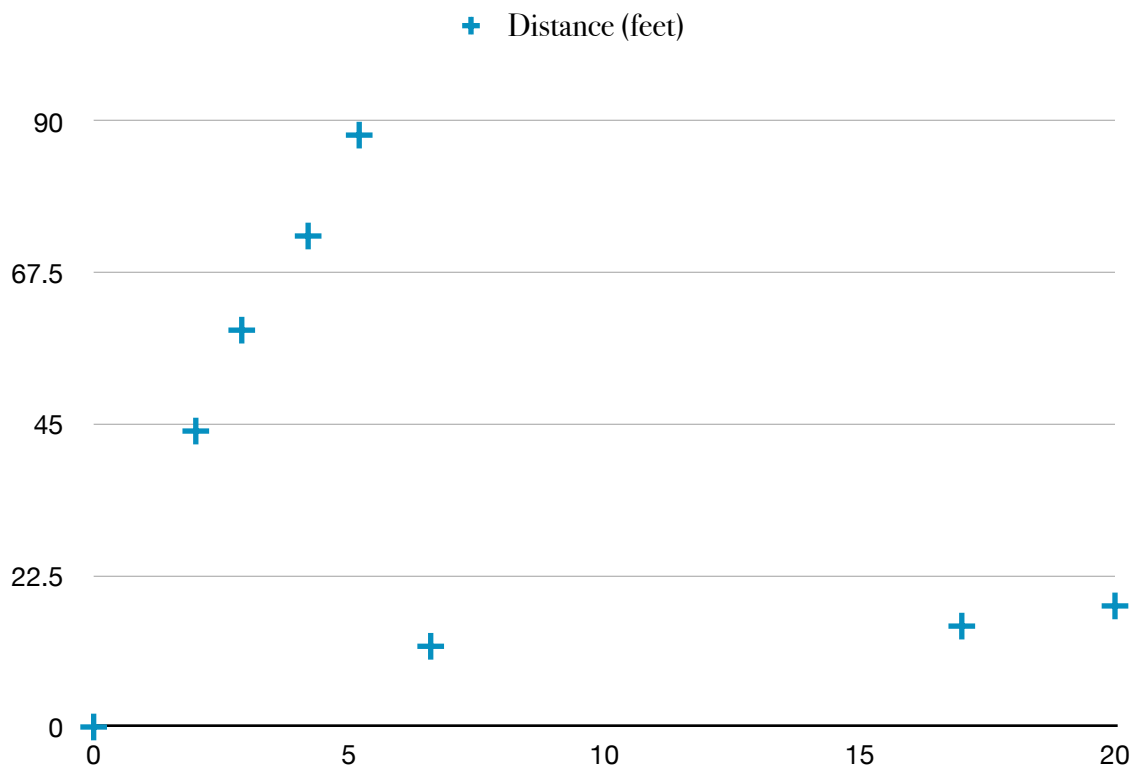
8. a) Top of the slant, accelerating. b) top of the slant, moving away and then slower down. c) accelerating away from, top of slant d) moving away from, decelerating.

9. Top right, 0-60 in 5 seconds.

1. Yes, an object could be moving at a constant speed.

2. Yes, the object's direction is changing.

3. Not necessarily, they could have a different initial velocity.



4.Not necessarily, because they could accelerate at different rates and could have started at different times.

5.Yes, although eventually, the accelerating automobile will catch up.

6. Yes, because the speed pertains to all directions of the road. mph.

7. a) 48 mph

b) .8 miles.

8. a) 8 1/3 m/s^2,

b) 37.5 m/s.

c) c) .09375 miles

d) d) 9.375 m/s^2, 37.5 mph, .09375. So, same except for acceleration.

9.

a) -3 m/s^2

b) 2.535 meters

c) 1.2 m/s

d) The latter.

SECTION 6 USING MODELS: INTERSECTIONS WITH A YELLOW LIGHT

What do you think?

They would treat them with predictability and act less defensively.

3. Yes, if A is, B is.

b) Yes.

c) Yes.

d) It will make it before the red light,

4.

a) Yes, because it is farther back than the ones before it.

b) It will not stop in time.

c) No.

Essential Questions

What does it mean?

The speed of the vehicles, the length of a yellow light. The dilemma zone is determined by all of the factors.

How do you know?

The negative acceleration will be a factor in determining stopping distance and the stop and go zones. The speed of the vehicle coupled with the negative acceleration will derive the distance that is considered the go zone.

Why do you believe?

Knowing these factors will allow me to better estimate my stopping distance.

Why should you care?

It allows me to anticipate lights and stopping distances.

1.

   a. 45 meters.

   b. 37.5 meters

2.

   a. 245 meters, 420 meters

   b. 35 meters; 20 meters

3.

   a. It would increase the zone.

SECTION 7 CENTRIPETAL FORCE: DRIVING ON CURVES

What do you think?

Because of the curvature of the road, the amount of friction or centripetal force required for the car to maintain the curvature must exceed the amount of force in any direction that does not coincide with the road.

Depending on the mass and of your vehicle, f=ma, you need to adjust your acceleration so that your cars force vector is less than the centripetal vector.

Chapter 2

SECTION 3 NEWTON'S SECOND LAW: PUSH OR PULL

Questions

6. .98 newtons

7. 657 newtons, 67 kg

9. When the ball stops accelerating, the force has ceased.

10. 90 newtons

11. 800 newtons

12. 178 ma/s^2

SECTION 4 PROJECTILE MOTION: LAUNCHING THINGS INTO THE AIR

What do you think?

The various forces acting on the object determine the amount of time and trajectory of an object in the air.

1. a) 3.06 seconds. 20.2, 10.4, .6 ... always ten.

2.a) 43.3 m/s horizontal velocity, 25 m/s vertical velocity.

b) 43.3 m/s horizontal velocity, 15.2 m/s vertical velocity.

c) 43.3 m/s horizontal velocity, -24 m/s vertical velocity.

d) -28.98 degrees direction, 36 m/s magnitude.

SECTION 7 FRICTIONAL FORCES: THE MU OF THE SHOE

What do you think?

Why do some sports require special shoes?

Different sports require different stopping times of players, therefore, requiring different coefficients of friction.

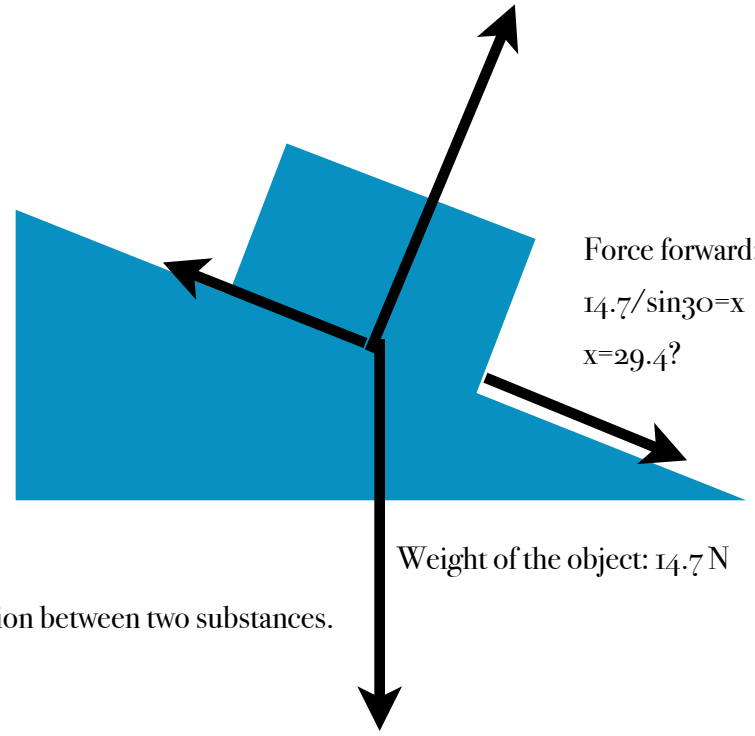
Why would different features of a shoe be useful for different sports?

They meet the requirements of the sport.

Coefficient of Friction

Name	Weight	Newtons Horizontal	Mass	μ Coefficient of Friction
Drew	4.76	3.8	0.485714285714286	0.798319327731092
Brett	4.9	3.9	0.5	0.795918367346939
Justyn	6.04	4.9	0.616326530612245	0.811258278145695

1.



Force forward: sin30=14.7/x

14.7/sin30=x

x=29.4?

Weight of the object: 14.7 N

What does it mean?

The amount of friction between two substances.

How do you know?

Measuring the resistance of an object given a force.

Why do you believe?

Because we showed it.

How do

Because it displays the ratio of how things work.

3. She cannot be sure because the coefficient of friction varies between any two substances.

4. Depending on how much slide the player wants, they can adjust accordingly. Reducing the coefficient of friction.

5. Constant speed means no acceleration, hence a balanced force. Coefficient of friction = tangential force/perpendicular force. .03=x/600...x=18.

6. Answers, doesn't make sense, we only know the distance, and that distance could be any of the many combinations of time and speed. Knowing the time means we know the speed.

a. 9800 newtons

b. .55=x/9800...x=5390 N

c. f=ma. -5390=1000*x...x=-5.39m/s^2...a force of blank newtons slows down a given mass at what acceleration?

d. 5.39 m/s^2 *6 = 32.34 m/s

e. He was going a decent amount faster than he said.

a) .6=x/50....x=30 N

b) f=ma ...30N=50*a... -.6 m/s^2

Penny Launch

***2 inch pull down**

Distance From Table (in)	Heights (in)
10	4.5

Distance From Table (in)	Heights (in)
8	15
6	82
4	
2	

3. 1/2 *12^2=gh....72/9.8=h...h=7.34

4. Because the elastic energy in the pole allows a force acting along the length of the pole which generates an acceleration that only ceases at the full extension of the pole.

5. If the pole's temperature increases, it will become less elastic, and will thus exert less force when the bend is released.

6. 1/2mv^2=mgh...1/2v^2=44.59...9.4m/s

8. a) 4.46 seconds, 43.7 m/s b) Yes, all objects accelerate at the same rate due to gravity.

9. 46.8 nm of work, f=ma..A=1875m/s^2...

12. a) one newton = 1kgm/s^2...kg*m/s^2*m....5mass*m/s^2....5n/m*m^2

energy= joule: mass * acceleration * distance traveled, or Force * distance

mass * gravity * height = 1/2 mass velocity ^2

f*height = m a

SECTION 9 CONSERVATION OF ENERGY: DEFY GRAVITY

No it doesn't, gravity is still acting upon the athlete.

No, they simply must jump at a great velocity.

503.7 N or 51 kg

Jared: 72.5 ... Connor...77.1....Stephen...97.9

Name	Center of Mass	Departure Height	Leg Muscle Extension	Peak Position	Center of Mass moved
Stephen	64	130	66	141	11
Jared	91	127	36	132	5
Connor	97	127	30	150	23
Joe	92	116	24	132	16

Name	Gravitational Potential Energy Joules	Elastic Potential Energy	Energy Expended during extension	Kinetic Energy at launch	
Joe	199.92	199	119.952	79.048	
Jared	291.305	291	255.78	35.22	
Connor	400.4574	400	226.674	173.326	
Stephen	738.7534	738	633.2172	104.7828	

Energy is entirely gravitational. Kinetic is zero because there is no movement. Legs do not store any energy.

Energy is kinetic and gravitational potential, the elastic is zero because the legs are entirely extended. I'm pretty sure the gravitational potential exists because the legs are extended as opposed to bent.

All energy is stored in elastic potential.

2. The sled obtains kinetic energy from being pushed, and then the gravitational potential energy is converted to kinetic energy. Then the cart is stopped by increasing friction.

4. I think that they and others should disprove this observation.

5. They can train their leg muscles or lose weight.

6. a) 1 joule b) 10 joules c) 10 Joules d) 10 Joules

9) 2,150 Joules

10) 2,084 joules

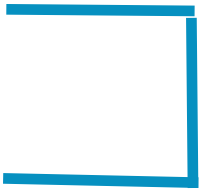
11) a) 6m/s^2 b) 562 joules

12) a) 12.5 meters b) 2.66 m/s^2

13) 120 joules

1)

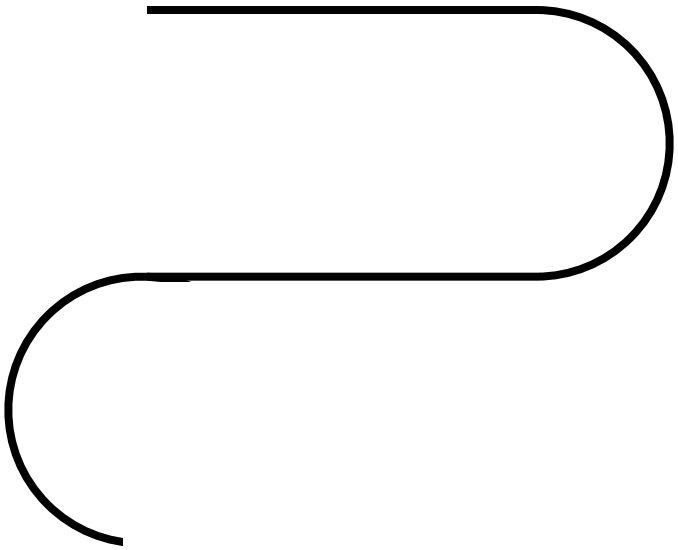
Height: 15m Height: 6m



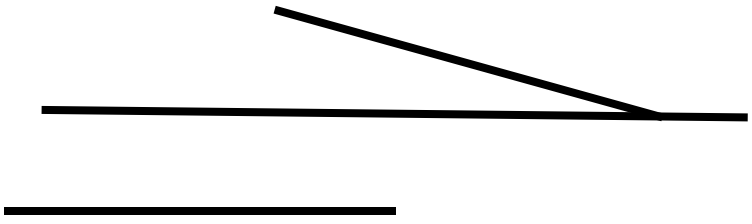
Height: 0m

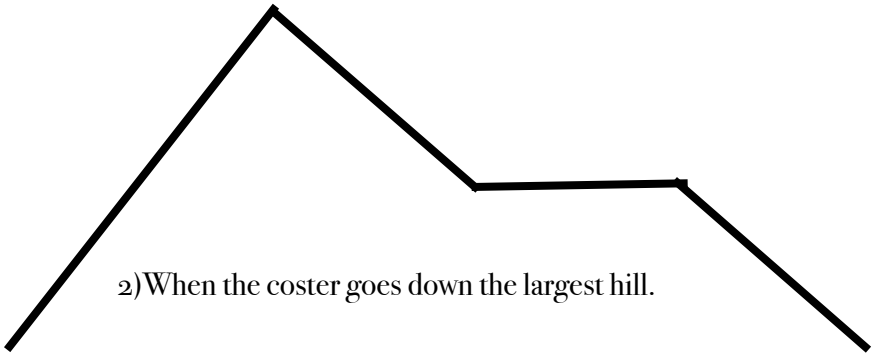
2) I'd prefer others' sketch because they can actually draw a circle.

3)



1)





2)When the coster goes down the largest hill.

a) sqrt(2)

b) sqrt(2)/second

c) 135 degrees

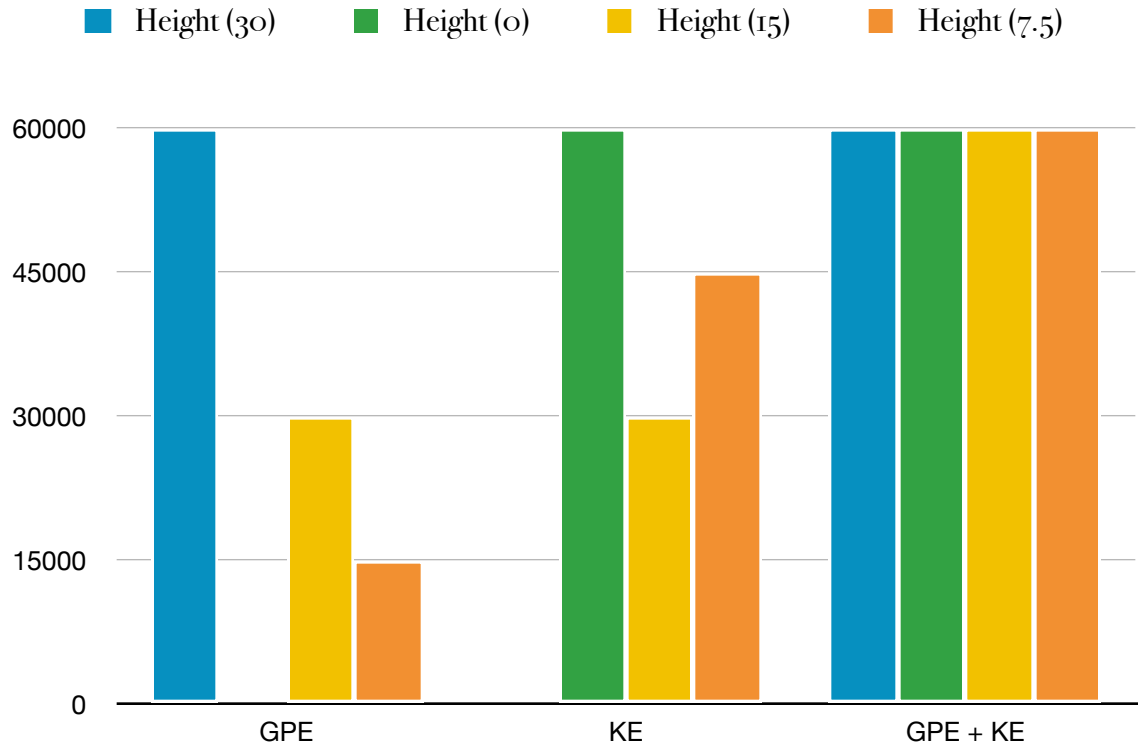
The coaster with the greater angle of decent because it is closest to free-fall.

1. They have equal speeds.

2.GPE+KE=mgh+1/2mv^2

3.

Position of car (height m)	GPE (J) = mgh	KE(J)=1/2mv^2	GPE+KE (J
30	60000	0	60000
0	0	60000	60000
15	30000	30000	60000
7.5	15000	45000	60000



4.

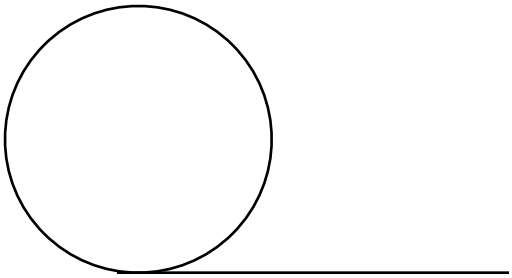
10. a) B. GPE = 0%, KE = 100%, C. GPE = 30%, KE=70%, D. 10%, KE=90%, E. GPE = 60%, KE = 40%, F. GPE = 30%, KE = 70%.

b) There isn't enough mechanical energy in the system.

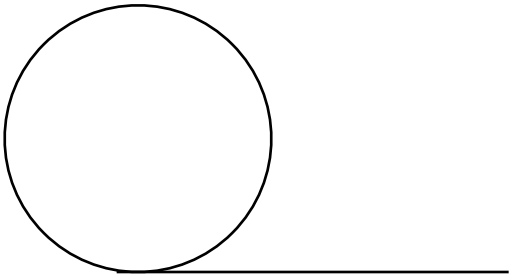
11.

Position of car (height m)	GPE (J) = mgh	KE(J)=1/2mv^2	GPE+KE (J)
0	0	60000	60000
25	50000	10000	60000
15	30000	30000	60000
0	0	60000	60000

1)



2) Centripetal force,



3) The force on the string is increasing.

4) More difficult, requires more friction to prevent the car from veering off course.

5) Mass, velocity, radius.

a) 1050 J

b) 30 J

c) 3000 J

d) 350 J