Dear AP Physics 1 & UB Physics 1 students,

The following pages contain guided notes to take while watching videos about the topics we will cover in physics this coming school year. These videos are short (approximately 10 minutes each) and are meant to be an introduction to the topics for this coming school year. These are not meant to replace the learning we will be doing in anyway, but just to give students a background knowledge of the topics so that you can better participate in the class throughout this year. Please take the time to watch each video carefully and take the notes as you watch. Videos can be found at:

Crash Course Physics

Be sure the video you watch and the notes page have matching titles.

I expect you to turn these in during the first week of school during the 2019 – 2020 school year. I look forward to seeing you then, ready to learn. Until then, have a great summer!

Sincerely,
Mr. Pagliaro
AP Physics Teacher
UB Physics Teacher
Shelton High School

“Motion in a Straight Line: Crash Course Physics #1”:

1. The ______________________ use physics to figure out how fast you’re moving through the world.

2. Time, position, velocity, and acceleration are all linked together via the ________________ equations.

3. Driving on a straight highway is an example of __________ dimensional motion.

4. ______________ tells you how long you were driving for. Position lets you know where you are or where you were. It can be ____________________________.

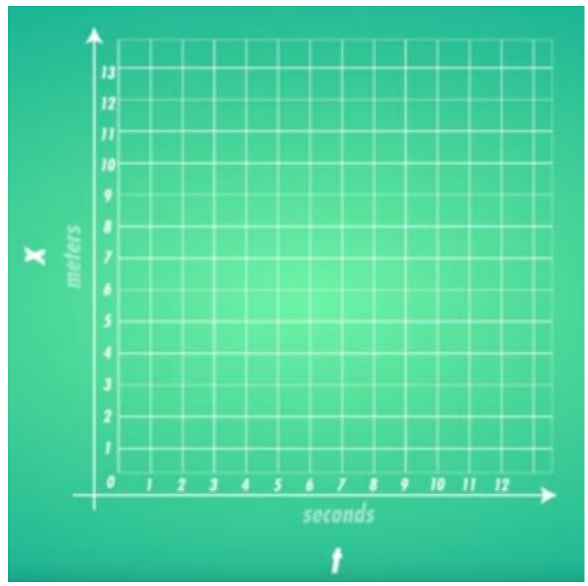
5. ___________________________ is the way your position changes over time. It’s like speed, but it tells you which _____________________________ you’re moving in.

6. Draw and label the graph of the three different scenarios given:

A) You sat for 3 seconds, 4 meters away from the light.

B) You coasted at 1 m/s for 3 s.

C) You are standing still, 4 m away from the light, you hit the gas so that after 1 s you had gone 1 m, 4 m after 2 s, and 9 m after 3 s.



7. Velocity is the change in _______________________ over time and acceleration is the change in ___________________ over time.

8. The equation known as the “definition of acceleration” is ___________________________________, where V_0 is the initial velocity, and V is the instantaneous velocity.

9. When something is falling, the force of gravity is making the object accelerate at _________________m/s^2.

10. The second kinematic equation, the displacement curve equation is _________________________________.

11. Determine whether or not you were speeding when the cops pulled you over. Show your work.

12. Did you deserve that ticket? **YES** **NO**

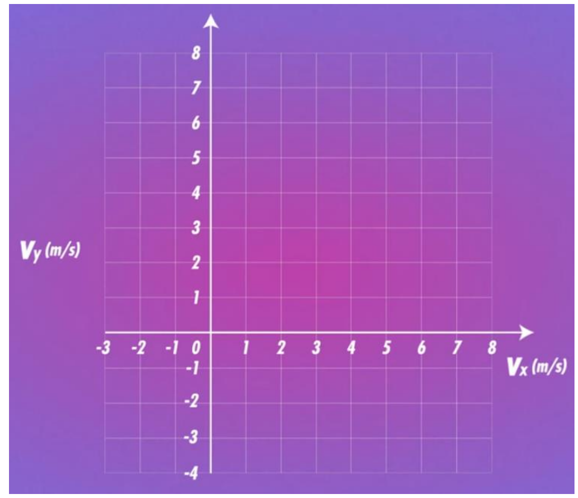
"Vectors and 2D Motion: Crash Course Physics #4":

1. In real life, when you need more than one direction, you turn to ______________________________.

2. Vectors are kind of like ordinary numbers – which are also known as **scalars** – because they have a

_______________________, which tells you how big they are. Vectors have another characteristic as well:

_________________________.



3. Draw a vector that shows a baseball launched at a 30° angle from the horizontal with a starting velocity of 5 m/s in the space to the right.

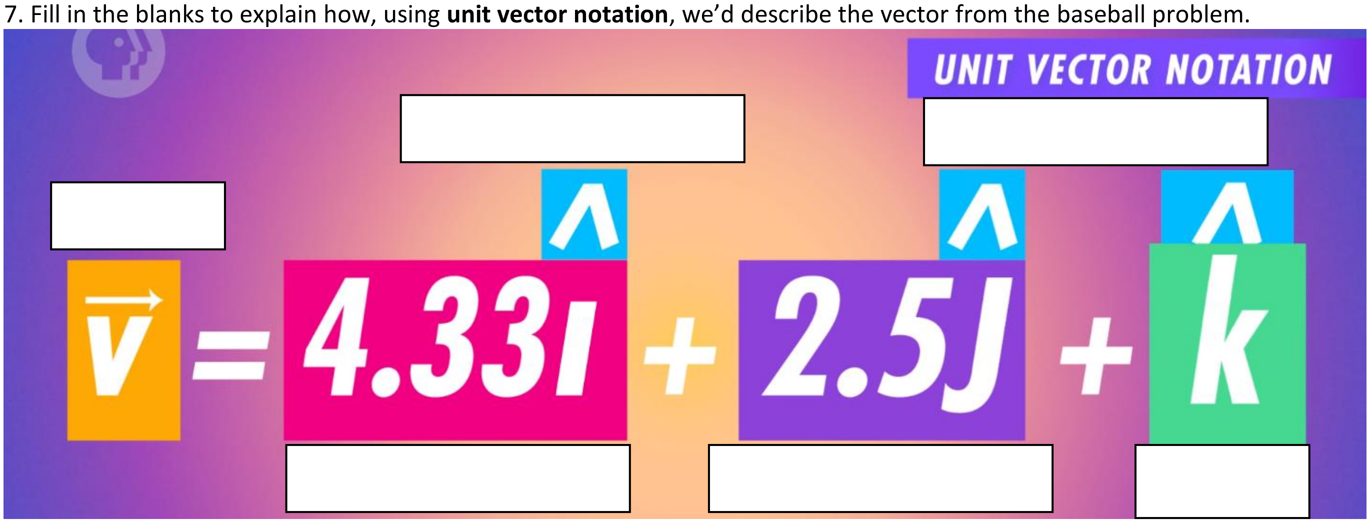
4. Draw a vector to represent the scenario Shini gives you if the catcher were to drop the ball.

5. When you draw a vector, it's a lot like the

___________________________ of a right triangle.

6. You can describe a vector by writing the lengths of the two other sides. They are so good at describing a vector that physicists call them its ______________________.

7. Fill in the blanks to explain how, using **unit vector notation**, we'd describe the vector from the baseball problem.



8. If you want to add or subtract two vectors, you just separate each of them into their ______________________ parts and add or subtract each component separately.

9. Changing a horizontal vector **WILL** **WON'T** affect its vertical component and vice versa.

10. We can figure out how long it takes the pitched ball to hit the ground by ignoring the ____________________ component. We use the ____ equation. The ball took ____________ to hit the ground.

11. If we talk about the ball's highest point, the vertical velocity HAS to be __________________. By using the ____ equation we learn that it took the ball _____________ to reach its maximum height.

“Newton’s Laws: Crash Course Physics #5”:

1. Newton’s 1st law is all about ________________________________, which is its tendency to keep doing what it’s doing. The 1st law is stated that “an object in motion will remain in motion, and an object at rest will remain at rest, unless acted upon by a ________________________________. Essentially, to change a way something moves, to give it ______________________________________, you need a **net force.**

2. Newton’s 2nd law states that “_____________________________ is equal to mass times acceleration”, or, as an equation, F_{net} = ________________________.

3. The most common case of a net force making something move is the _________________________________.

4. The value of “g” (“small g”) is ________________________.

5. We measure weight in __________________________.

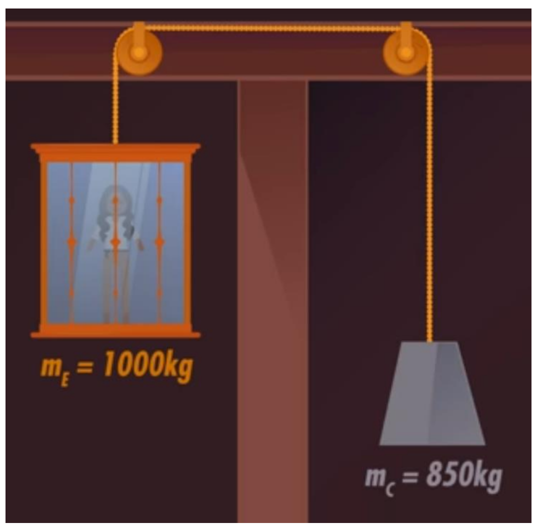
6. Newton’s 3rd law states that “for every action there is an equal and _________________________ reation.” This just means that if you exert a force on an object, it exerts an ______________________ one back on you. This is known as the **normal force**. “Normal”, in this instance, just means _______________________________. And the normal force is always perpendicular to whatever surface your object is resting on.

7. Things can _________________ because there’s more going on than just the action and reaction forces.

8. Draw and label a free body diagram for the box sitting on the ground:

9. The counteracting upward force that comes from the rope attached to the box is called the _______________.

10. On the picture to the right, draw in the forces at work.



11. How quickly is the elevator accelerating downward?

____

“Friction: Crash Course Physics #6”:

1. Without _________________________________ it would be tough to do almost anything.

2. There are two kinds of friction: _____________________________ friction, which is the force that slows the bookcase down as it slides and ______________________________ friction, the force that you have to overcome to get the bookcase moving in the first place.

3. The force of kinetic friction is in the **SAME** **OPPOSITE** direction of the movement of the object.

4. Rougher materials have **MORE** **LESS** surfaces to catch on each other, which is why the bookcase will be **HARDER** **EASIER** to slide on the wood floor than if you'd tried it on carpet. The way this roughness affects kinetic friction is called the **coefficient of kinetic friction**.

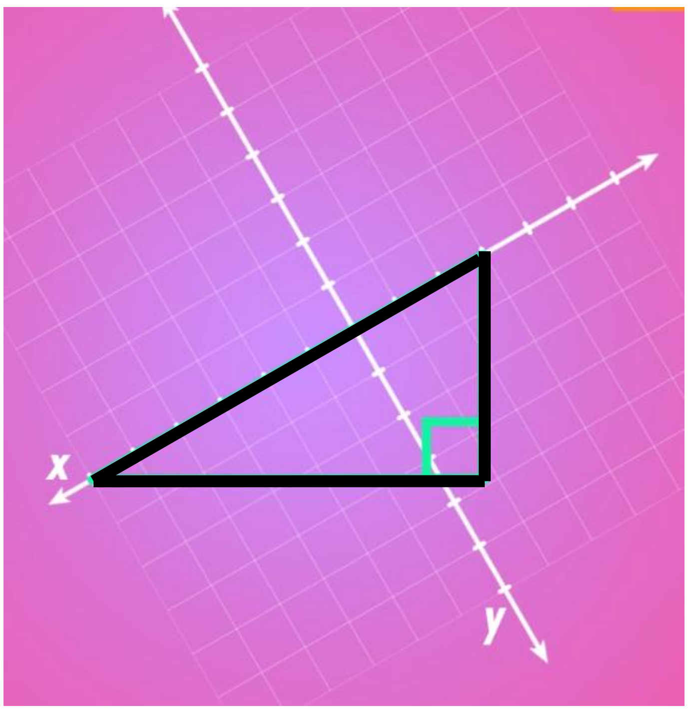
5. How hard the materials are pressed together puts **MORE** **LESS** of their surfaces in contact with each other. That's where the __________________________ force comes in.

6. The coefficient of kinetic friction is expressed as __________. The equation for kinetic friction is __________________.

7. Like kinetic friction, static friction is also a resistive force. But not only can its direction change – its ____________________ can change too.

8. The coefficient of static friction is expressed as _______________________. The equation for the maximum force of static friction is ______________________.

9. Draw the free body diagram for the box on the ramp on the picture to the right.



10. To figure out if the box will slide down the ramp, we need to find out if the part of the gravitational force pushing it down the ramp, _________________________, is greater than the maximum static friction resisting it.

11. What is the net force pushing the box down the ramp?

____

12. What is the maximum static friction?

____

13. Will the box slide down the ramp? **YES** **NO**

<u>"Uniform Circular Motion: Crash Course Physics #7":</u>

1. **Uniform circular motion** is what happens when anything moves along a circular path in a _______________ way.

2. Things accelerate **INWARD** **OUTWARD** as they move in a circle. This is known as centripetal acceleration.

3. Centrifugal acceleration **IS** **IS NOT** real.

4. Most people can withstand an acceleration of ________________________ for 10 minutes.

5. Uniform circular motion has four main quantities: _________________, velocity, acceleration, and __________.

6. Velocity is never along the path of a circle, but rather perpendicular to the radius of the circle along a line called a __________________________.

7. Something moving in a straight line is going to _____________________________ to move in a straight line unless a force – one that **IS** **ISN'T** balanced out by other forces – turns it.

8. Centripetal acceleration is always directed towards the _______________________ of the circular path.

9. The ________________________ of the motion in a circle is the amount of time it takes to come back around to a starting point. It is represented as __________. The period of the motion of the centrifuge is ________.

10. How many revolutions the ride makes in one second is its ____________________________. The equation for frequency is ____________________.

11. Circumference (C) = ______________________________. The circumference of the ride is _________________.

12. The speed equation for uniform circular motion is:

13. The magnitude of centripetal acceleration will be equal to the change in ___________________ over the change in _______________ at any given moment, or its derivative. This equation turns out to be: ______________.

14. If you increase the speed around the path or decrease the radius of the circle, you will ____________________ the acceleration.

15. The acceleration of the riders would be _________________________.

16. According to NASA, is the ride safe? **YES** **NO**

“Newtonian Gravity: Crash Course Physics #8”:

1. When Newton was starting out, there was already a concept of gravity in place. **TRUE** **FALSE**

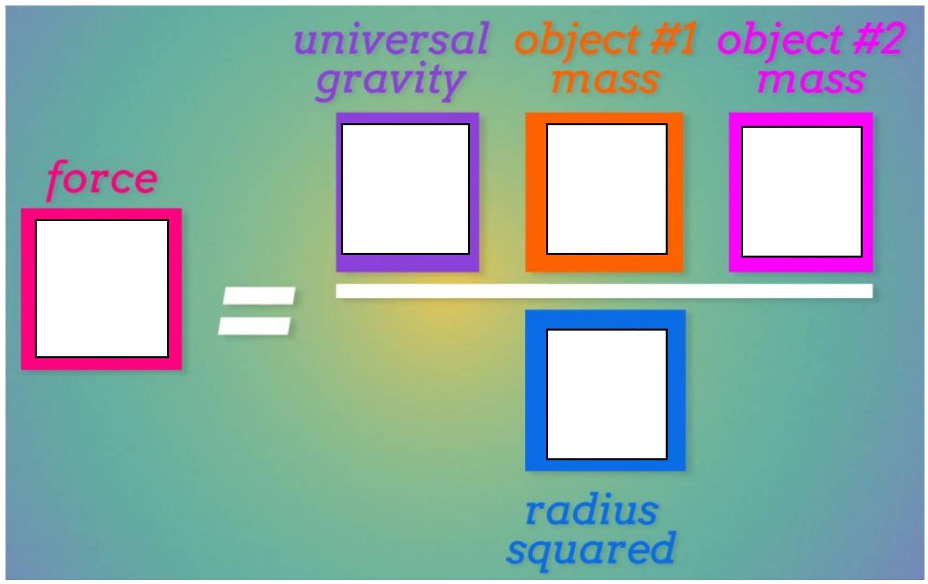
2. Newton’s Law of Universal Gravitation works well on a ________________________________ scale.

3. Newton new that however the gravitational force worked, it would probably behave like ___________________ net force on an object. It would be equal to that objects mass times its acceleration.

4. When an object is close to the Earth’s surface, like an apple in a tree, gravity makes it accelerate at about ____.

5. Newton figured that the gravitational force between two objects must get smaller the further apart they are. More specifically, on the distance of the two objects _______________________________.

6. The equation for the law of universal gravitation is



7. It was Henry Cavendish that figured out that G was equal to ___________________ Nm^2/kg^2.

8. Newton took his law of universal gravitation and applied it to ______________________ laws. According to Kepler, the orbits of the planets are __________________________________ (1st law). In Kepler’s 2nd law, he tells us that two “pizza” slices swept out of Earth’s orbit will have the exact same ________________.

9. From Newton’s law of universal gravitation, the gravitational acceleration at Mars’s surface should be ________.

“Work, Energy, and Power: Crash Course Physics #9”:

1. A ____________________________ is whatever section of the universe you are talking about at the time.

2. The amount of **work** that you are doing is equal to the _____________________ you are using times the ___________________________ that you move it. Work is most often expressed in units of _________________.

3. Physicists often write the equation of work as _________________________________ because it will fit any scenario that involves a **constant** force over any distance.

4. Joules are often used as the units for ______________________. Work is just a change in energy. One of the ways to define energy is as the ability to do ___________________________.

5. Kinetic energy is the energy of ____________________. The equation for it is ________________________.

6. Potential energy is energy that ___________________________ be used to do work. A common type is **gravitational potential energy**: energy that comes from the fact that _____________________ exists.

7. Gravitational potential energy can be calculated using the equation _______________________________.

8. Use this equation find the force of a spring using Hooke’s law: ______________________________. To find the potential energy of a spring you’d use the equation ____________________________________.

9. When someone does work on a system, its __________________________ changes.

10. A ______________________________ system is one that doesn’t lose energy through work.

11. **Average power** is defined as _________________________ over time and is measured in Watts (J/s).

12. If we change the power equation around we can say that power is the ______________________ applied to something with a particular average velocity.

13. Power is the best way to calculate how __________________________ moves around in a circuit.

“Collisions: Crash Course Physics #10”:

1. To figure out what happens when objects collide we’ll need to take into account two main qualities: ______________________ & _______________________.

2. What Newton really said in his second law was that an “object’s ‘quantity of motion’ was equal to its mass times its ____”.

3. Momentum is often described as an object’s __________________________________ to remain in motion, however it is technically it’s mass times its _______________________________.

4. _____________________________, represented by a ‘J’ is the integral of the net force on an object over time, or the _____________________________ in momentum.

5. In elastic collisions, _______________________________ energy is neither created nor destroyed.

6. When kinetic energy isn’t conserved in a collision you have an ______________________________ collision.

7. No matter the collision, __________________________________ will always be conserved.

8. A perfectly inelastic collision is what happens when objects __________________________ together.

9. The center of mass is basically the average _____________________________ of all the mass in a system.

10. To calculate the center of mass, first pick a starting point where x = _______. Then, the center of mass will be equal to the ____________ of each individual mass times its distance from the starting point, all divided by the total ________________________ of the system.

11. What is the center of mass of the system shown in the video? ______________

“Rotational Motion: Crash Course Physics #11”:

1. Translational motion descries when an object moves through space but doesn’t ______________________.

2. Rotational motion isn’t all that different from translational motion, however instead of positions there are ____________________________.

3. In translational motion, we tend to talk about position in terms of _____ and _____. In rotational motion we really want to know the object’s angle, what we call ____________________.

4. The primary unit that physicists use with rotational motion is the _________________________. This unit describes angles by telling us how much of that circumference is covered by a given angle. To convert any number of degrees to radians you just ______________________ the number of degrees times pi and then divide that by 180.

5. Rotational velocity is the measure of an object’s change in angle. This is known as ____________________ (ω).

6. Tangential velocity is equal to the _____________________________________ times the radius.

7. Like circular motion, rotational motion can also be _______________________...when the rotation repeats itself after a set amount of time, which is represented by capital ‘___’, also called the period.

8. _______________________________ and angular velocity are really just two different ways to describe the same thing, just with different units. 1 revolution = 2π. In order to convert from frequency to angular velocity, all you need to do is multiply the frequency by ____________.

9. The bottom of the wheel isn’t moving at all because its total velocity is equal to the translational velocity ___________________ the tangential velocity, since they are moving in opposite directions. If the bottom of the wheel is moving relative to the ground we would call that _____________________________.

10. Angular acceleration (α) is the derivative of the _____________________________. As an object rotates each point on it can accelerate in two different ways. Radial acceleration is another term for _____________________ acceleration and can be found as a_r = __________________. There is also tangential acceleration which describes whether an individual point on a rotating object is speeding up or slowing down. It depends on the _______________________ between the point and the center of the rotating object. It is found with the equation a_{tan} = ____________________.

“Torque: Crash Course Physics #12”:

1. Torque changes an object’s ______________________________________.

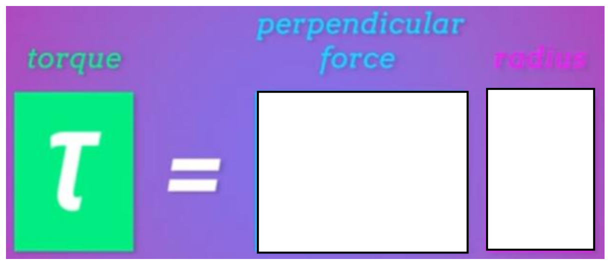
2. A lot of the relationships and equations that apply to forces apply to torque in a __________________ way.

3. When you open a door, the ______________________ you pull on the handle, the ____________ torque you will generate and the more you’ll change the door’s angular velocity.

4. The distance (radius) between the force and the axis of rotation also affects torque. A longer radius means _________________ torque.

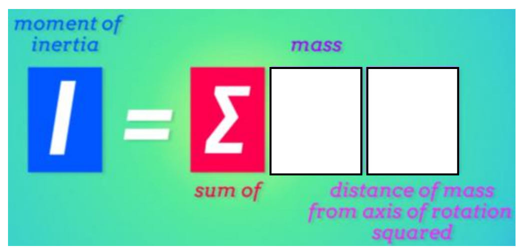
5. The _______________ between the applied force and the radius also affects torque.

6. The equation for torque (τ) is such that



7. In translational motion, the inertia of an object depends on ___________________.

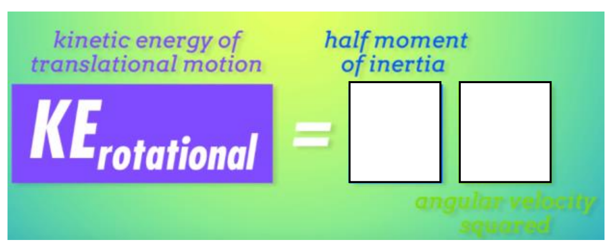
8. In rotational motion, the moment of inertia is such that:



9. Torques, like forces, have the ability to do ____________.

10. The more torque you apply while rotating an object, the **MORE** **LESS** work you do.

11. Calculating the kinetic energy is pretty easy:



12. Angular momentum (L) is just: L = _____________

13. You can’t create or destroy angular momentum. It always has to go _________________________.

14. Which object makes it to the bottom of the ramp first? _______________________

15. Which object makes it to the bottom second? ____________________ why? __________________________ ___________________________________

“Statics: Crash Course Physics #13”:

1. Statics is the science of how objects behave when they’re not ______________________________.

2. Objects that aren’t accelerating are said to be at **equilibrium**. This means that there can be _______________ on an object, but there can’t be _____________________________ on it. Otherwise, that net force would make the object accelerate. For an object to be in equilibrium, all of the forces and torques on it have to ________________________________.

3. Since the ladder isn’t moving, we know that the net torque on the ladder from the wall is ___________________.

4. The force of the ladder from the wall is _________________.

5. The horizontal component of the force from the floor on the ladder is **THE SAME AS** **DIFFERENT FROM** the force of the wall on the ladder.

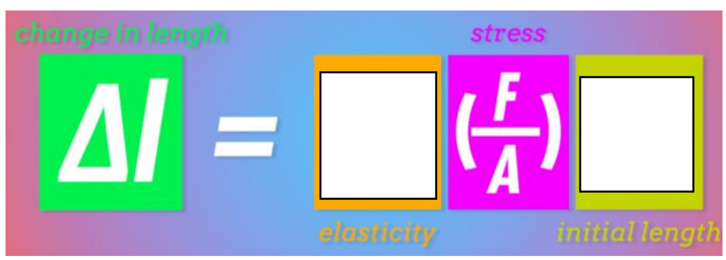
6. The ______________________________ zone is where enough force is added so that the object will stretch or compress, but still bounce back. If you apply too much force, the object may become permanently deformed. The force has reached the _______________________________.

7. The amount that an object stretches or compresses depends on:

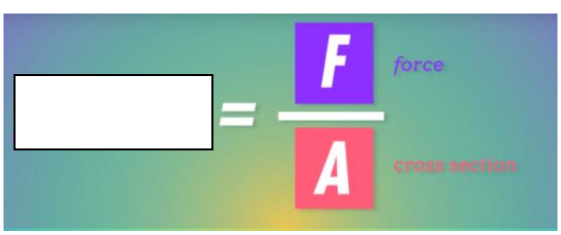
- The original ___________________ of the object.
- The strength of the applied force.
- The area of a cross-section of the object: the __________________ it is, the less it will stretch or compress.
- The type of material itself.

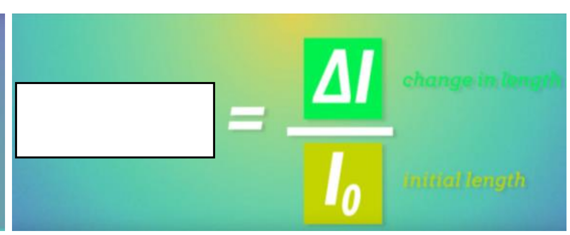
8. _________________ Modulus (E) is a number that tells you how hard it is to stretch or compress a material based on its stiffness. The higher the number, the __________________ elastic it is.

9. All of these factors (7 and 8) combine into one equation:



10. Stress and strain can be found by:





11. Shrinking is what happens to an object when you apply a force to __________________ parts of it.

12. The ____________ modulus (B) measure the stiffness of different materials in water.

“Simple Harmonic Waves: Crash Course Physics #16”:

1. The answer to the problems with the Millennium Bridge lies in ________________________________.

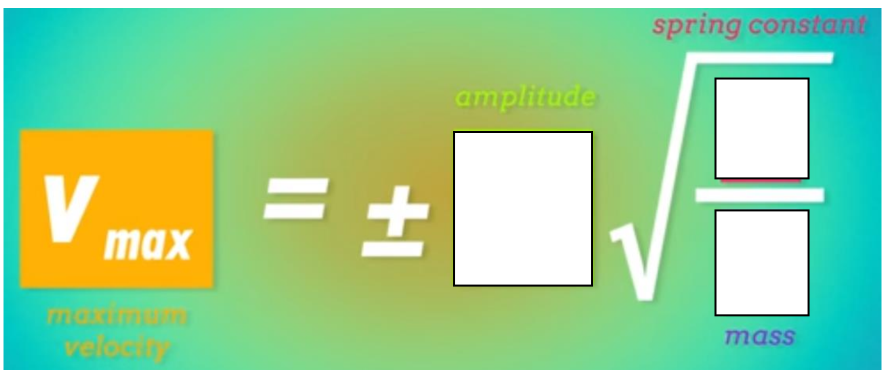
2. _________________________ harmonic motion is when oscillations follow a particular, consistent pattern.

3. The points where the ball is not moving are the turning points. The distance from one turning point to where the system is at equilibrium is the __________________________.

4. The equation for the “moment of turning point”, when all of the energy is potential energy is: _______________. The energy is one half the spring constant times the amplitude squared.

5. At the equilibrium point, the potential energy is _______________ and it kinetic energy is at a maximum. This amount of energy can be calculated as ___________________________.

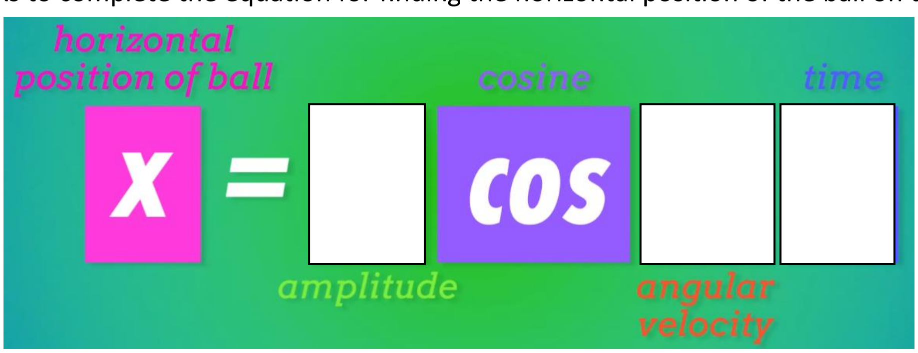
6. Fill in the blanks to complete the equation for the maximum velocity of the ball on the spring:



6. Mathematically speaking, simple harmonic motion is very similar to ______________________________ motion.

7. The ___________________________ is the number of revolutions the marble makes around the ring per second.

8. Fill in the blanks to complete the equation for finding the horizontal position of the ball on the spring:



9. For an object in simple harmonic motion, the graph of its position versus time is a ______________________.

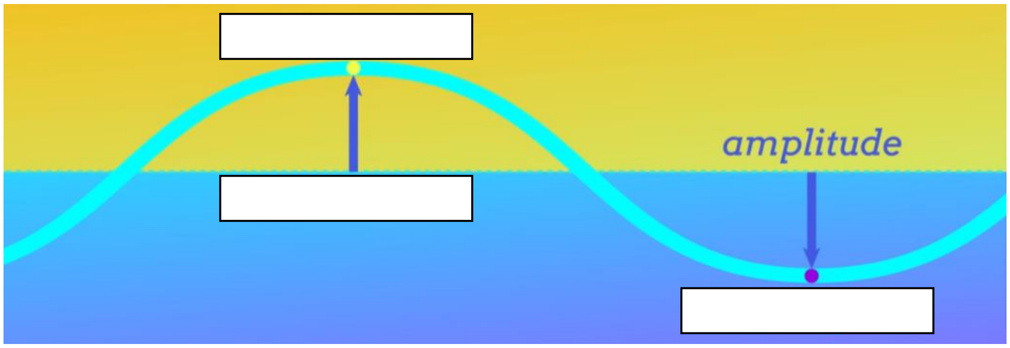
10. Resonance can increase the amplitude of an oscillation by applying force at just the right __________________.

11. The designers of the Millennium Bridge didn’t account for **VERTICAL** **HORIZONTAL** oscillations.

“Traveling Waves: Crash Course Physics #17”:

1. Often, when something about the physical world changes, the information about that disturbance gradually moves ___________________________, away from the source, in every direction. As the information travels, it makes a ____________________________ shape.

2. Label the wave below with the following: crest, trough, amplitude.



3. If you multiply the wavelength (λ) by the frequency you get the wave’s speed: V = _______________

4. The wave’s speed only depends on the _________________________ its travelling through.

5. A ______________________________ wave is what happens when you move the end of the rope back and forth one time. One lonely crest travels through the rope.

6. A _______________________________ wave is what happens when you keep moving the rope back and forth.

7. Sinusoidal waves are such that if your put them on a graph they’d look like the graph of ________________.

8. In ____________________________ waves, the oscillation is perpendicular to the direction the wave is travelling.

9. In ____________________________ waves, the oscillation is parallel to the direction the wave is travelling.

10. All waves transport _______________________________ when they travel.

11. A wave’s energy is proportional to its ____________________________ squared.

12. When the end of a rope is fixed, the wave will be reflected back, but as a _________________, not a crest.

13. If you send two identical pulses along a rope, one from each end. When the two pulses overlap, they combine to make one crest with a higher amplitude. This is ________________________________ interference.

14. If you do the same thing as #13, but this time one wave is a crest and the other is a trough, when they overlap the rope will be flat as the waves cancel each other out. This is _______________________________ interference.

"Sound: Crash Course Physics #18":

1. Sound is a ___________________________ that travels through a medium, like air or water.

2. Sound is a __________________________________ wave.

3. Physicists sometimes describe sound waves in terms of the movement of particles in the air, what's known as a ________________________________ wave. Sounds waves also cause the air to expand and compress, so they are also referred to as ______________________________ waves.

4. Pitch can be high or low, and it corresponds to the '________________________________' of the wave. Air that's vibrating more times per second will have a **HIGHER** **LOWER** pitch.

5. Sounds that are too high in pitch for humans to hear are called _______________________________.

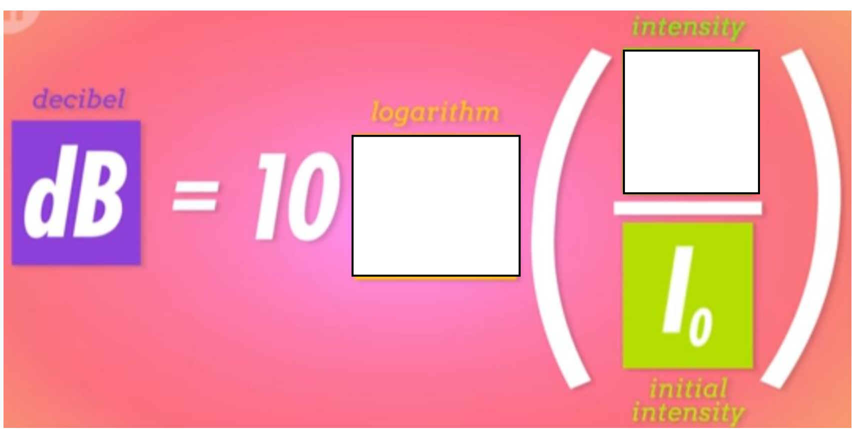
6. If you increase the ____________________________ of a sound, you increase its loudness.

7. Below __________ picowatt per square meter, sounds are just too soft for us to detect them. And although we will hear sounds above a watt per square meter, they tend to ___________________ our ears.

8. Generally a sound wave needs to have ____________ times the intensity to sound twice as loud to us.

9. We use units called ____________________________ to measure sounds. It is a logarithmic scale, so each notch on the scale is ________________ times more intense than the notch below it.

10. Fill in the boxes for the equation for determining how many decibels a sound is:



11. The rock concert (standing near the speakers) is _____________________dB.

12. As a source of a sound moves toward you, the pitch increases. This is known as the ______________________. This effect isn't only observed in sound, but ___________________________ as well.

"The Physics of Music: Crash Course Physics #19":

1. String instruments work when a string is pulled and ___________________________ the air.

2. Sound is a wave, a longitudinal wave. String, wave, and brass instruments use a different kind of wave, a _____________________________________. This is a wave that looks like it isn't moving. Its ________________ may change, but it isn't travelling anywhere. They are the result of reflection and __________________________.

3. Standing waves with different ________________________ correspond to different musical notes.

4. Label the nodes and antinodes:

5. The nodes **DO** **DON'T** oscillate.

6. The nature of the standing waves depends a lot on what the ______________ of these strings or pipes look like.

7. The most basic kind of standing wave, with one peak that moves from crest to trough is known as the ______________________________ (1^{st}) harmonic. It's the simplest standing wave you can have, with the fewest nodes. Other, more complex standing waves, ___________________________, build on the fundamental, adding a node and an antinode.

8. The fundamental and the overtones make up _____________________________. Every node and antinode pair added increases the harmonic.

9. A standing wave's frequency is expressed as f= _____________________. The frequency of the fundamental wave is best expressed as f = ________________________.

10. The frequency of middle C on a piano is _____________________________.

11. A standing wave with two loose ends is different from one with two fixed ends in that it has _____ antinodes and _________ node.

12. In a standing wave with one fixed and one loose end (like in a pan flute) has a ____________ at one end and an _______________________ at the other. Because of this, a pipe with one open end and one closed end can't have ____________________ numbered harmonics.

“Electric Charge: Crash Course Physics #25”:

1. ____ occurs when an object obtains a net amount of positive or negative electric charge, creating an imbalance that wants to be returned to equilibrium.

2. Like charges **REPEL** **ATTRACT**

3. Moving electrons are called _____________________ electrons. They reside in an atom’s outer shell as _______________ electrons and are easily plucked off and carried around when acted upon by an ‘outside force’.

4. Materials that are ____________________________ let free electrons move freely around the solid.

5. An overall negative charge means that the object has **TOO MANY** **TOO FEW** electrons.

6. In the process of charging by friction, no new charges were created. This is known as the law of conservation of _____________________________. It says that you can never create a net electric charge. Instead, charge can only ______________ from one place to another.

7. In the process of polarization, we’ve ___________________ the charge in order to create an imbalance of charge within in object.

8. Connecting a charged object to the ground creates a way for the charged object to leak that charge into the Earth. This is called _______________________________________.

9. The force on charged particles is measured in ________________________. To find it, we need to know the charge (q) in units of _________________________ (C). The charge (q) can have both positive and negative values. 1 electron has a charge of $-1.6x10^{-19}$ C. This value is known as the ________________________ charge (e).

10. The equation for Coulomb’s Law is ____.

11. Coulomb’s constant (k) depends on medium surrounding the charges. This is mostly air, or maybe a vacuum, making the constant ___________________________________.

12. What is the force between two negative charges that are 1 nanometer apart? ___________________________. The answer is positive, meaning that the charges **REPEL** **ATTRACT** each other.

“Electric Current: Crash Course Physics #28”:

1. ________________________________ is the total amount of charge passing through a wire over a period of time.

2. Electric charge flows from _____________________ voltage to ______________________ voltage.

3. The voltaic cell uses chemical reactions to create an electric potential difference between two pieces of different metals known as _________________________________. When the two electrodes are connected, **current** begins to flow. Today _____________________________ operate under the same principle as the first voltaic cell.

4. We can determine the current with the equation __________________________. It is measured in coulombs per second, or ________________________________.

5. In a circuit, the flow of negatively charged electrons in one direction is _________________________ the flow of positively charged particles in the opposite direction.

6. Conventionally speaking, current flows from the ________________ terminal to the ________________ terminal.

7. The impedance of the flow of electrons in a circuit is known as _________________. It is measured in Ohms (Ω).

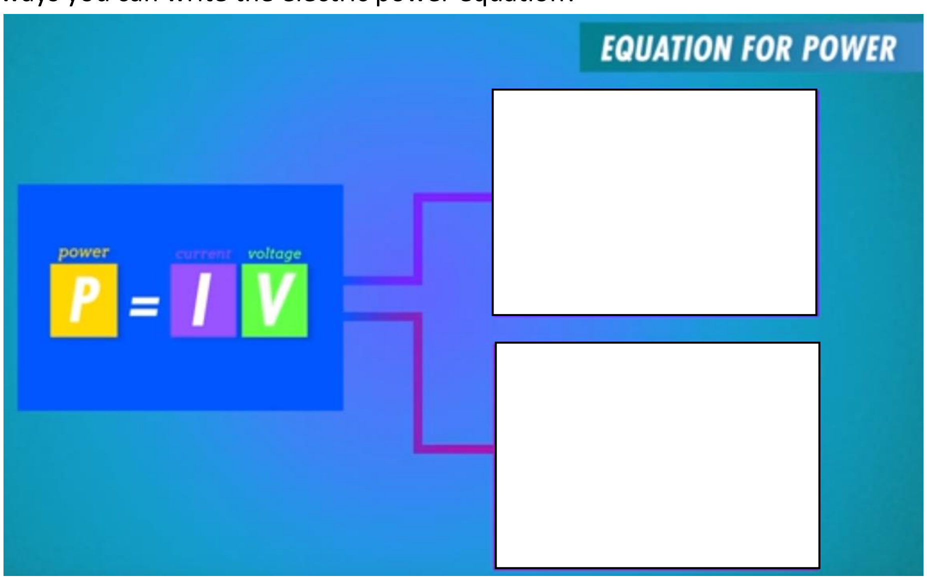
8. Ohm’s Law assumes that resistance is constant and expresses voltage in the equation _____________________.

9. If you can make certain conductive materials extremely cold, you can bring their resistance to zero. These materials are known as __________________________________.

10. Write the equation for electric power: ___________________________________. These units are in _________.

11. Power is a function of current through and ______________________ across a resistor.

12. What are two ways you can write the electric power equation?



"DC Resistors & Batteries: Crash Course Physics #29":

1. In direct current circuits, current flows constantly out of a battery in ____________ direction.

2. An ideal battery provides a _________________________ voltage to a circuit, powered by its conversion of stored chemical energy to electrical energy. Scientists say that the battery is a source of ________________ force.

3. ___________________________________ is the real voltage you get when you measure the actual voltage between the terminals of the battery, getting a value that's less than our ideal EMF potential. You calculate this voltage with the equation ____.

4. When at least two resistors are connected in the same path, they are connected in **series**. Any devices connected in series have **THE SAME** **DIFFERENT** current flowing through them, however they each have **THE SAME** **DIFFERENT** voltages dropping across them. According to the conservation of energy, the total voltage supplied to the system is equal to the sum of ____________ the voltage drops across the circuit.

5. When multiple resistors are configured so that the current splits into many branches from a single source, they are said to be connected in ___________________________.

6. The principle known as the **conservation of charge** states that all the current flowing to the junction where the path splits is _________________________ all the current flowing out of the same junction.

7. For every branch in a parallel connection, the voltage is _________________ no matter what the resistance is.

8. For a series connection, the current is **THE SAME** **DIFFERENT** for all resistors and the voltage drop changes. For a parallel connection, the voltage is **THE SAME** **DIFFERENT** for all resistors and the current changes.

9. The equivalent resistance for a parallel setup of resistors will be _________________ than any one of the resistors in the circuit.

10. Any additional branch in the parallel system will serve to **INCREASE** **DECREASE** the total resistance of the system and **INCREASE** **DECREASE** the amount of current through the entire circuit.

11. As you add more bulbs in series, the brightness **INCREASES** **DECREASES** with each additional bulb.

12. The outlets in your house are connected in **SERIES** **PARALLEL**.

"Circuit Analysis: Crash Course Physics #30":

1. One of the best ways to understand how electricity works in a system is through _________________________: the process of breaking down a circuit into its key components and studying each one to see what it can tell you about the others.

2. When you have a large system, the goal is to simplify everything down to _____________ resistor which will have the equivalent resistance of _________ these resistors combined.

3. The 1st step is to find the resistors in a series. You can collapse them down to a single resistor by __________________ their resistances.

4. To find the equivalent resistance of the resistors in parallel, use the equation ____________________________.

5. What is the current in the circuit shown? _____________________________

6. If two resistors are in series, then the current flowing through them is **THE SAME** **DIFFERENT**.

7. Any two resistors in parallel have **THE SAME** **A DIFFERENT** voltage drop. The current through each branch, though, is **THE SAME** **DIFFERENT**.

8. To measure voltage, use a tool called a ____________________________ and attach it in __________________.

9. To measure current, use a device called an _________________________ and attach it in __________________.