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
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 ____________ 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, \( F_{\text{net}} = ________________________ \).

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 _________________________ reaction.” 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
Uniform Circular Motion: Crash Course Physics #7:

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**


3. Newton knew that however the gravitational force worked, it would probably behave like ________________ net force on an object. It would be equal to that object’s 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 describes 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 \( a_{\text{tan}} = \) ______________________.
"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 __________________ 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 force of the wall on the ladder is ________________.

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:

\[
V_{\text{max}} = \pm \sqrt{\frac{k}{m}} \cdot \text{amplitude}
\]

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:

\[
X = \text{amplitude} \cdot \cos(\omega t)
\]

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 you 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 or 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:

\[
\text{dB} = 10 \log \left( \frac{I}{I_0} \right)
\]

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 ___________________________. 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.
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 _________________.

7. Any two resistors in parallel have ________________ voltage drop. The current through each branch, though, is _________________.

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 ________________.