# Physics ~ Learning Guide Name: _____

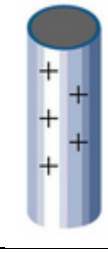
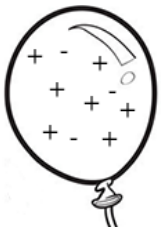
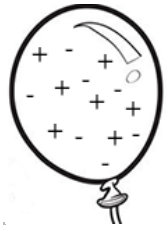
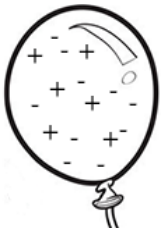
## *Instructions:*

Using a pencil, complete the following notes as you work through the related lessons. Show ALL work as is explained in the lessons. You are required to have this package completed BEFORE you write your unit test. Do your best and ask questions if you don't understand anything!

### *Electrostatics*

1. Neutrons have _____ charge, while protons are _____, and electrons are _____.
2. Within an atom, the _____ are able to move significantly, while the _____ and _____ can't.
3. Electrons are attracted to _____ charges.
4. Electrons are repelled by _____ charges.
5. An object has no net charge (ie. is neutral) if the number of _____ and _____ are equal.
6. When am object is negatively charged, it's due to excessive _____.
7. When an object is positively charged, it's due to missing _____.
8. Electrons are *( repelled by / attracted to)* the positive pole on a battery *(circle one).*
9. Electrons are *( repelled by / attracted to)* the negative pole on a battery *(circle one).*
10. An _____ can detect a charge, but can't determine if it's positive or negative.
11. An electrical charge can build up when a bunch of _____ are built-up on an object (negative charge) OR if the object loses a bunch of _____ (positive charge).
12. If a built-up charge isn't moving, we call it _____ electricity (due to the lack of any movement).
13. When a charge is discharged to the Earth, whether through a water pipe or wire or the ground itself, we call it _____.
14. When you are charged, your hair stands up because like charges _____ so each hair is trying to get away from other hairs and your head.
15. Charging involving rubbing is called "charging by _____", charging by contact is called "charging by _____", and charging without any touch is called "charging by _____.

16. Consider the following items. Each positive represents billions of protons, while each negative represents billions of electrons.

| Rod-A | Rod-B | Balloon-A | Balloon-B | Balloon-C |
|---|---|---|---|---|
|  |  |  |  |  |
| | | | neutral | |

a) Complete the bottom two rows of the table above (positive, negative, or neutral).

b) If Rod-A touches Balloon-B, describe (in pictures or steps) what would happen?

c) If Balloon-C is brought close to Balloon-B, describe (in pictures or steps) what would happen?

d) If Rod-B touches Balloon-A, describe (in pictures or steps) what would happen?

17. Consider the "Static Charge Media" as you answer the following (Show all charges):
    a) When you rub a balloon on the sweater, _____ move from the sweater to the balloon. This leaves the balloon _____-charged and the sweater _____-charged. This is called charging by _____.
    b) Once charged, bring the balloon close to the wall. As it moves close to the wall, the _____ in the wall are repelled by the charged balloon. This is because _____-charges repel. Creating the charge on the wall without touching it is called charging by _____.
    c) If you rub both balloons on the sweater (charging them both), then bring them close to the sweater, you'll see the balloons _____ (attract or repel) each other, but at the same time be _____(attracted or repelled) to/by the sweater (picking different parts of the sweater to stick to).

18. When you electrically "ground" something, what exactly are you doing?

19. Describe how a Van de Graph generator works. Show as a labelled diagram, describing its charging process.

20. Provide an example of static electricity found in your daily life that is unwanted.

21. Provide an example of a device that requires static electricity to function

22. Prior to a lightning strike, describe where and how the charges build up in the clouds.

23. Charging an object without physically transferring electrons is known as **charging by induction**. Explain how a thundercloud can **induce** a charge on the earth. Describe some hazards.

## *Circuits:*

1. What is current? What are the units of current?

2. Explain how conventional current would be defined differently if early scientists understood that the current they were "working with" really was.

3. Why are electrons, rather than protons, the principle carriers of charge in metal wires?

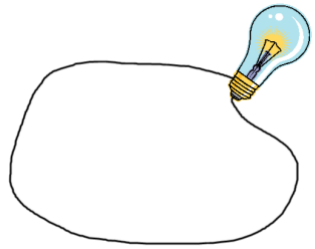
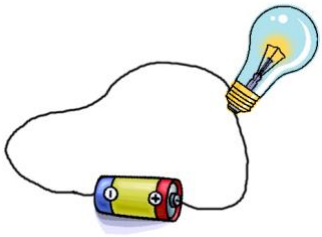
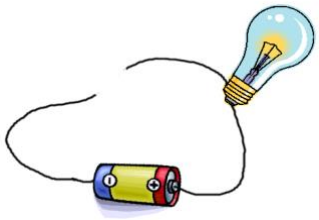
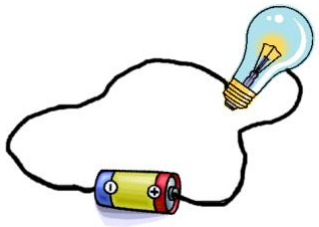
4. How is a conductor different than an insulator?

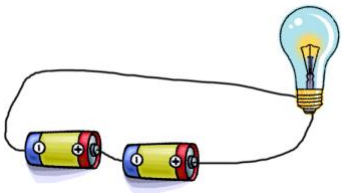
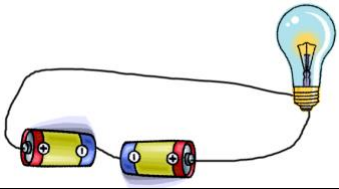
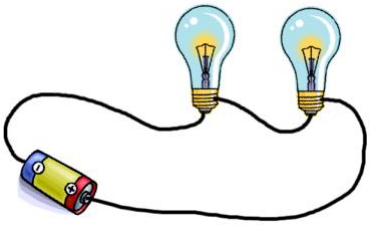
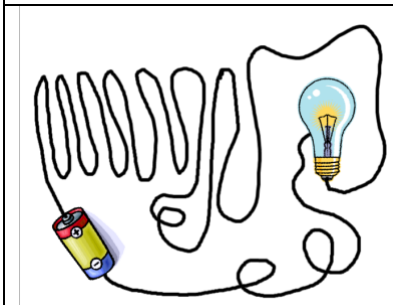
5. Provide examples of 3 good conductors and describe some typical applications of each.

6. Provide examples of 3 good insulators and describe some typical applications of each.

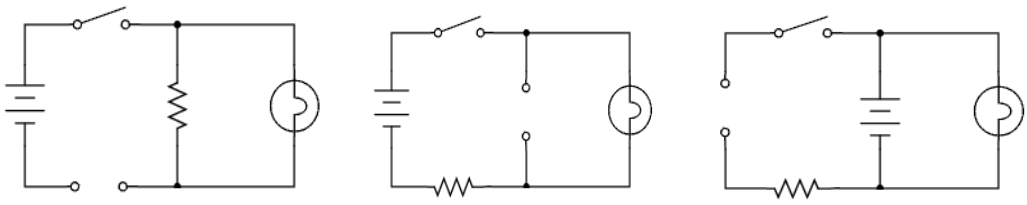
7. Resistors are most often used in a circuit for either _____ or _____.

8. Which of the circuits below will be effective in lighting the lightbulb. Explain why or why not in the box on the right.

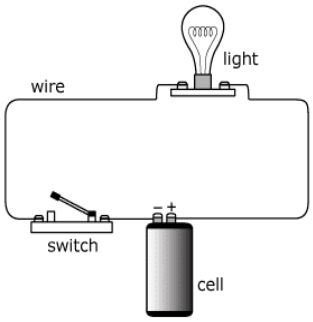
| ***Circuit*** | ***Bulb Lights? YES or NO*** | ***Why or Why Not?*** |
|---|---|---|
|  | | |
|  | | |
|  | | |
|  | | |
|  | | |

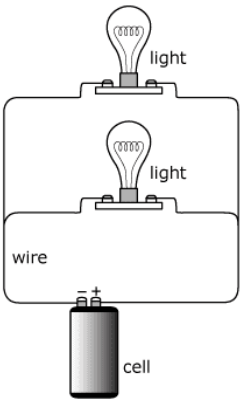
| | | |
|---|---|---|
|  | | |
|  | | |
|  | | |
|  | | |
|  | | |

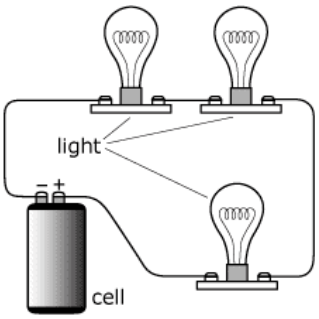
9. Would the light turn on if the switch was closed in the following circuits? Draw arrows showing any expected current.



10. Draw a schematic for each of the following diagrams (below each):




11. Show how to make a circuit where two switches both need to be closed in order for the light to turn on. Include a schematic and some explanation.

12. Explain how to make a circuit where either of two switches has to be closed in order for the light to turn on. Include a schematic and some explanation.

13. Use the "Circuit Construction" media to answer the following questions:
    a) Build a simple series circuit that consists of 6-7 pieces of wire, 1 switch, 1 light bulb, and 1 battery (voltage source). In order to complete the circuit, the red circles at the end of each must overlap. Please note that the light bulb also has TWO circles. Your circuit is complete and working when the light comes on and the blue dots begin moving. Draw a schematic of the circuit below:

    b) What are the blue dots representing? How does this relate to current?

    c) If you right-click on the battery, you can adjust the voltage of the battery. Describe the effect this has on the working circuit.

    d) If you right-click on the bulb, you can adjust the resistance of the bulb. How does this change your working circuit?

14. A light bulb has 120 Ω of resistance. When switched on (in a house with 110 V), what is the current running through it?

15. A typical toaster (110 Volts) has a current of 7 Amps when toasting. What is the resistance?

16. Include a diagram and explanation to describe why a voltmeter needs to be VERY high resistance.

17. Include a diagram and explanation to describe why an ammeter needs to be VERY low resistance.

18. If the voltage across a circuit is held constant while the resistance doubles, what changes occur in the circuit?

19. A small light bulb is connected to a 6 V battery and draws 2 A of current. What is the net resistance of the bulb?

20. A motor with an operating resistance of 32 Ω is connected to a voltage source. The current in the circuit is 1.5 A. What is the voltage of the source?

21. Determine the amount of current going through a 50 Ω; resistor with a voltage of 120 V.

22. A wire-wound resistor has a resistance of 200 ohms. What voltage applied between the terminals will produce a current of 0.08 amperes?

## *Circuit Protection:*

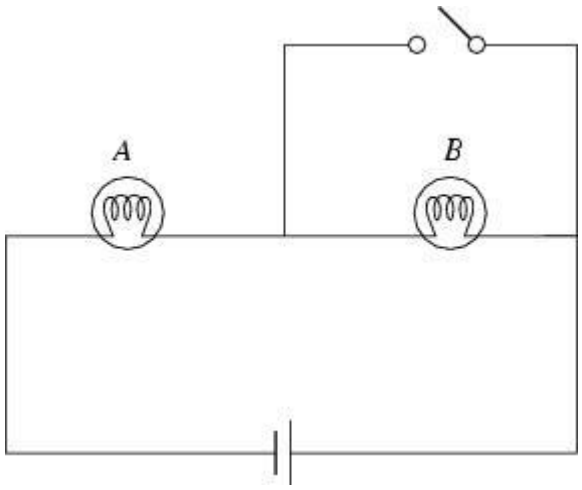
1. What is the main purpose of a fuse?

2. Draw the shape of a fuse you can find in your family car.

3. Describe the difference between fuses and circuit breakers.

4. What is meant when we refer to a “short circuit?”

5. If the switch is closed, light _____ (A or B) will get brighter, while light _____(A or B) will get much dimmer (turn off). Draw arrows below showing where the majority of current goes when the switch is open. Then, draw dotted arrows showing where the majority of current goes when the switch is closed.



6. For the simulation activity in 3.3: Fuse, attach a picture or screenshot of your created circuit that included the 120 Volts and (possibly) a new fuse.

7. How did you determine if you needed a new fuse? Describe your thinking process.

8. Maybe to determine if the current was too high, you used the simulation to check the current on the new circuit with 150 Volts. The simulation actually calculated the current using Ohms Law!
   Using Ohms Law, calculate what the current would be in the circuit in the country you are visiting when your hair dryer is plugged in.

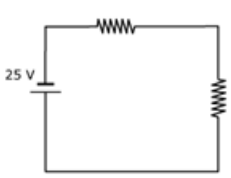
## *Series & Parallel:*

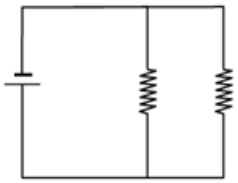
1. Resistors added in series _____ the overall resistance.
2. Resistors added in parallel _____the overall resistance.
3. Devices in series have the same _____ running through them.
4. Devices in parallel have the same _____ drop across them.
5. Use some sort of water-flow, water-slide, or traffic-jam analogy to explain/remember the previous 4 results. Draw and explain in detail.

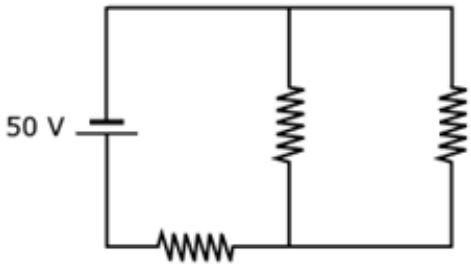
6. What is the main wiring plan for houses to ensure that each receptacle and light socket is the same voltage (ie. approx. 120 V)? Include a schematic and some explanation.

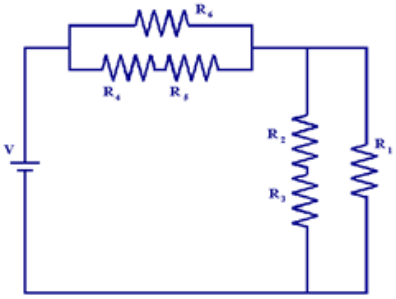
7. Explain how a string of Christmas lights in series can use a single blinking bulb to make the whole string blink. Include a schematic and some explanation.

8. For each circuit below, circle the parallel resistors with a solid line and label them with a "P." Circle the resistors in series with a dotted circle and label them with an "S." Note that in the second two, you'll have circles within circles, so try to show them clearly.

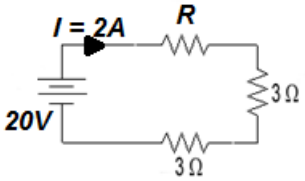




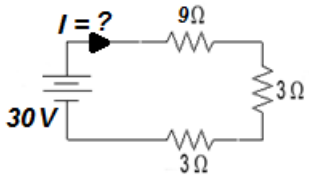

9. A current of 2A flows through the series circuit below when a voltage of 20V is present as shown:




a. Use Ohm`s Law to determine the overall (equivalent) resistance of the circuit above. Show all work.

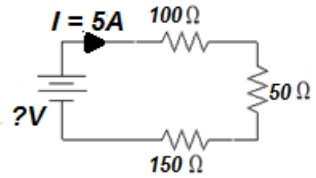
b. Determine the unknown resistance, R, based on your answer above.

10. What is the current flowing through the following circuit?



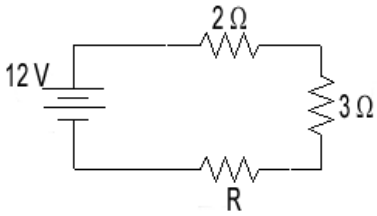

Show all work:

11. What must be the voltage if a current of 5A flows through the circuit shown below.

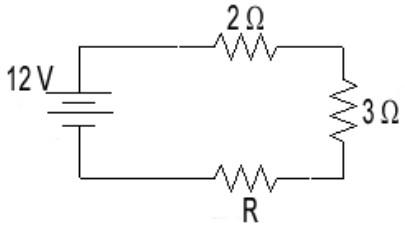



Show all work:

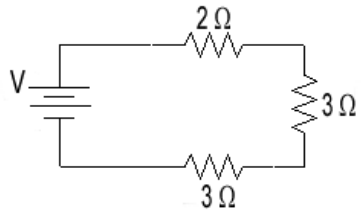
12. If the current flowing through the following circuit was 2 Amps, what is the resistance R?



13. What is the current flowing through the following circuit if R = 11 Ω?




14. What is the voltage, V, if the current flowing in the following circuit is 3.75 A?

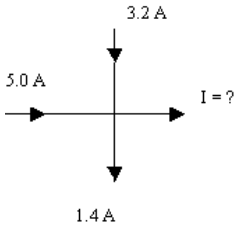


## *Kirchoff's Laws:*

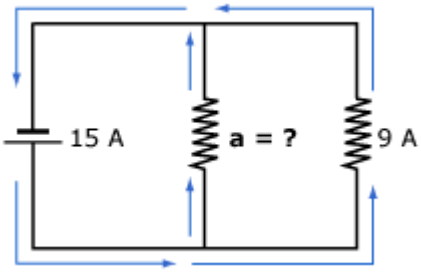
1. What is an easy-to-remember summary for each of Kirchoff's laws?

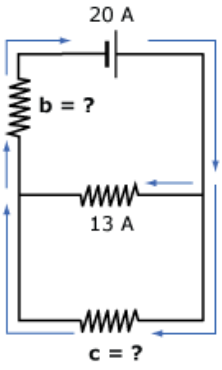
2. The voltage provided by the battery for the circuit powering two lamps in series is 6V. If one of the lamps has a voltage of 2V, what is the voltage across the other?

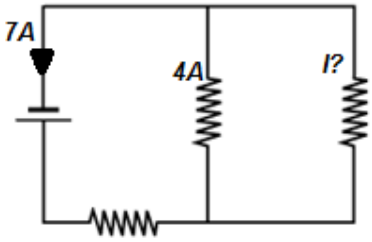
3. What is the unknown current, I, in the following circuit?

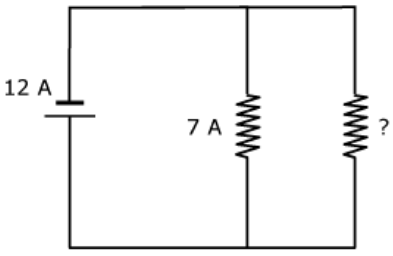



4. Determine the missing current(s) in each circuit.



5. Determine the missing voltages in the following circuits.