Circuit Math 3 Name _____

A. Non-traditional information circuit problems.
Typically, when presented with problems on electrical circuits, the known information is the voltage of the battery and the resistance of each resistor, because these pieces of information can easily be read of the side of the batteries and resistors. However, it will help you better understand the logical rules of electric circuits if you can solve problems with different pieces of information. For each of the following circuits with a battery and three resistors, solve the problem below:

[Note: This is largely a mathematical exercise, so I selected numbers that would make the math work out in integers of simple decimals. My hope is that you can do this without a calculator. Because I wanted to pick numbers that wouldn't require a calculator, many of the circuits have very high voltage and current, and if they were built in real life would be extremely dangerous! This is one time you should be happy to get a math problem that's just a math problem!]

A.1. Series Circuit:

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)		**2**	**4**	
Current (A)		**2**		
Resistance (Ω)	**6**			
Power (W)				

A.2. Series Circuit:

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)		**6**	**6**	**21**
Current (A)				
Resistance (Ω)		**2**		
Power (W)				

Circuit Math 3 Name _____

A.3. Series Circuit:

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)		**14**	**6**	**22**
Current (A)				
Resistance (Ω)				
Power (W)		**28**		

A.4. Series Circuit:

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)		**3**	**1**	
Current (A)				
Resistance (Ω)			**2**	**12**
Power (W)	**1**			

A.5. Parallel Circuit

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)		**18**		
Current (A)			**6**	
Resistance (Ω)	**6**			
Power (W)		**54**		

A.6. Parallel Circuit

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)				
Current (A)				**3**
Resistance (Ω)		**15**		**5**
Power (W)	**15**		**15**	

Circuit Math 3 Name _____

A.7. Parallel Circuit

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)				
Current (A)		**4**		**16**
Resistance (Ω)	**2**	**4**		
Power (W)				

A.8. Parallel Circuit

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)				
Current (A)			**4**	
Resistance (Ω)	**14**			
Power (W)	**56**			**196**

A.9. Parallel Circuit

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)				
Current (A)	**1**	**1**		**4**
Resistance (Ω)				
Power (W)			**32**	

Circuit Math 3 Name _____

Part B: Solving Circuit Problems Algebraically

Theoretical physicist are scientists and mathematicians who construct theories that explain how the universe functions. They rarely work with actual numbers, because to explain the universe you must use the most general methods. Thus, it is important to learn to how to solve physics problems algebraically, with *symbols* for numbers.

"In terms of"
This phrase is used very frequently when describing algebraic physics problems.

To solve for "A in terms of B and C" means you derive an equation
A = _____
in which the right side of the equation includes only B, C, numbers, operations (like plus, minus, square root, or log), and known constants (like the speed of light, the charge of an electron, the mass of a proton, etc.).

To solve for "J in terms of K, L ,and M" means you derive an equation
J = _____
in which the right side of the equation includes of K, L, M, numbers, operations, and known constants.

<u>Solving Ohm's Law Algebraically</u>

V = IR

B.1 Solve for current in terms of voltage and resistance.

B.2 Solve for resistance in terms o current and voltage.

<u>Solving Ohm's Law and the power formula algebraically.</u>

V = IR P = IV

Solve for each variable in terms of the known quantities. Two of the answers will be the equations themselves!

B.3 Variable: voltage Known quantities: current, power

B.4 Variable: voltage Known quantities: current, resistance

B.5 Variable: voltage Known quantities: resistance, power

B.6 Variable: power Known quantities: current, voltage

B.7 Variable: power Known quantities: current, resistance

Circuit Math 3 Name _____

B.8 Variable: power Known quantities: voltage, resistance

B.9 Variable: current Known quantities: voltage, resistance

B.10 Variable: current Known quantities: power, resistance

B.11 Variable: current Known quantities: voltage, power

B.12 Variable: Resistance Known quantities: voltage, power

B.13 Variable: Resistance Known quantities: voltage, current

B.14 Variable: Resistance Known quantities: current, power

Dimensional Analysis

Coming Soon!

Solving Full Circuits Algebraically

When solving a full circuit algebraically,

You have a series circuit with two identical resistors. The potential difference of the battery is ΔV and the resistance of each resistor is R. Determine all relevant quantities for this circuit algebraically by filling in the following table.

	Resistor A	Resistor B	Total (Battery)
Potential Difference			
Current			
Resistance			
Power			

Coming Soon:
Conservation of Energy and Dimensional Analysis!

Coming Soon: More Algebraic Circuit Problems!

Circuit Math 3 Name _____

Answers:

A.1. Series Circuit:

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)	*12*	*2*	*4*	*18*
Current (A)	*2*	*2*	*2*	*2*
Resistance (Ω)	*6*	*1*	*2*	*9*
Power (W)	*24*	*4*	*8*	*36*

A.2. Series Circuit:

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)	*9*	*6*	*6*	*21*
Current (A)	*3*	*3*	*3*	*3*
Resistance (Ω)	*3*	*2*	*2*	*7*
Power (W)	*27*	*18*	*18*	*63*

A.3. Series Circuit:

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)	*2*	*14*	*6*	*22*
Current (A)	*2*	*2*	*2*	*2*
Resistance (Ω)	*1*	*7*	*3*	*11*
Power (W)	*4*	*28*	*12*	*44*

A.4. Series Circuit:

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)	*2*	*3*	*1*	*6*
Current (A)	*0.5*	*0.5*	*0.5*	*0.5*
Resistance (Ω)	*4*	*6*	*2*	*12*
Power (W)	*1*	*1.5*	*0.5*	*3*

Circuit Math 3 Name _____

A.5. Parallel Circuit

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)	*18*	*18*	*18*	*18*
Current (A)	*3*	*3*	*6*	*12*
Resistance (Ω)	*6*	*6*	*3*	*1.5*
Power (W)	*54*	*54*	*108*	*216*

A.6. Parallel Circuit

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)	*15*	*15*	*15*	*15*
Current (A)	*1*	*1*	*1*	*3*
Resistance (Ω)	*15*	*15*	*15*	*5*
Power (W)	*15*	*15*	*15*	*45*

A.**7.** Parallel Circuit

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)	*16*	*16*	*16*	*16*
Current (A)	*8*	*4*	*4*	*16*
Resistance (Ω)	*2*	*4*	*4*	*1*
Power (W)	*128*	*64*	*64*	*256*

A.8. Parallel Circuit

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)	*28*	*28*	*28*	*28*
Current (A)	*2*	*1*	*4*	*7*
Resistance (Ω)	*14*	*28*	*7*	*4*
Power (W)	*56*	*28*	*112*	*196*

Circuit Math 3 Name _____

A.9. Parallel Circuit

	Resistor A	Resistor B	Resistor C	Total
Voltage (V)	*16*	*16*	*16*	*16*
Current (A)	*1*	*1*	*2*	*4*
Resistance (Ω)	*16*	*16*	*8*	*4*
Power (W)	*16*	*16*	*32*	*64*