

$$F_e = \frac{k \cdot q_1 \cdot q_2}{d^2}$$

$$\Delta V = I \cdot R$$

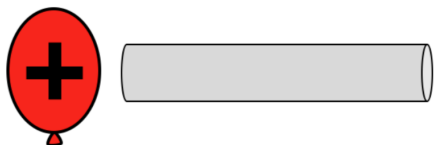
$$P = \frac{\Delta V^2}{R}$$

1. A student is experimenting with neutral objects: a balloon and their own hair. They rub the two together and the balloon becomes charged negatively and the hair becomes charged positively.
 - a. What is the relationship between protons and electrons BEFORE the objects are rubbed together?
 - b. What is the relationship between protons and electrons AFTER the objects are rubbed together?
 - c. How did the balloon become charged?

2. Define conductors and insulators and give examples.

	Conductors	Insulators
Definition		
Examples		

3. Opposite charges _____, like charges _____.
4. Objects 1 and 2 attract each other with an electrostatic force of 27.0 units. If the charge of Object 1 is two-thirds the original value AND Object 2 is doubled AND the distance separating Objects 1 and 2 is tripled, then the new electrostatic force will be _____ units.
5. A positively charged balloon is brought near to a neutral, metal bar. When it is held near, what does the charge distribution on the metal bar look like?



In this situation, the metal bar is _____.

Tap to select or deselect answers. *Select all that apply.*

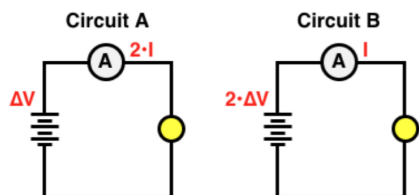
- ☐ positively-charged ☐ negatively-charged
☐ polarized ☐ electrically neutral

6. Describe, specifically how current is related to:
 - a. Voltage:
 - b. Resistance:
7. What is the direction of electron flow? What is the direction of conventional current?

8. Describe how these factors will result in higher or lower resistance.

	Higher Resistance	Lower Resistance
Thickness of Wire		
Length of Wire		
Material		
Temperature		

9. The current in Circuit A is two times the current in Circuit B. The battery of Circuit A has one-half the voltage of the battery in Circuit B. In which circuit will the bulb be the brightest? Show work to support your claim.



10. An automobile headlight with a resistance of 30Ω is placed across a 12-V battery. What is the current in the circuit? (Answer: 0.4A)

11. A motor with an operating resistance of 32Ω is connected to a voltage source. The current in the circuit is $3.8A$. What power is developed by the motor? (*Answer: $462.08W$*)
12. A $75-W$ lamp is connected to $120V$. What is the resistance of the lamp? (*Answer: 192Ω*)

$$V = IR$$

$$P = VI = I^2R = \frac{V^2}{R}$$

$$R_{Total} = R_1 + R_2 + R_3 + \dots \text{in series}$$

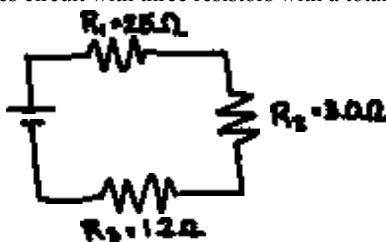
parallel

$$\frac{1}{R_{Total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots \text{in}$$

1. Fill in the following chart, organizing characteristics of series and parallel circuits:

	Series	Parallel
How it Looks		
Voltage		
Current		
Equivalent Resistance		
Features		

2. A series circuit with three resistors with a total potential difference of $6V$. Find the missing values and draw the direction of the current.



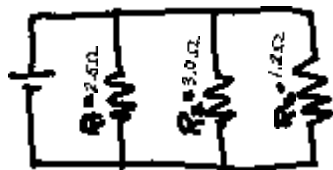
Total Resistance: _____

Total Current: _____

Total Voltage: _____

	Resistance	Current	Voltage	Power
R_1				
R_2				
R_3				

3. A parallel circuit with three resistors with a total potential difference of $6V$. Find the missing values and draw the direction of the current.



Total Resistance: _____

Total Current: _____

Total Voltage: _____

	Resistance	Current	Voltage	Power
R_1				
R_2				
R_3				

4. Compare and contrast the circuits from #2 and #3. What was the same and what was different? What causes these differences?

5. A wire with a total resistance of 60Ω is cut into 5 equal pieces. If these 5 pieces of wire are then arranged in parallel, what will the new total resistance be?

6. A series circuit has 4 resistors with equal resistance and a total potential difference of 9V. Draw the circuit and determine the resistance of each resistor if the current is 0.31A.

7. A parallel circuit has 3 resistors with equal resistance and a total potential difference of 4.5V. Draw the circuit and determine the resistance of each resistor if the current is 3.38A.