F: Electric Potential Graphs 1 Name _____

Goal of this problem set:
Represent a circuit with a graph of electric potential.

Electric Potential Graphs

A *electrical potential graph* is a type of diagram that illustrates how voltage, current, and resistance work.

Electric Potential

Electric potential is the amount of potential energy a unit charge has a particular point.

Potential Difference

Potential Difference is a more mathematical term for *voltage*.

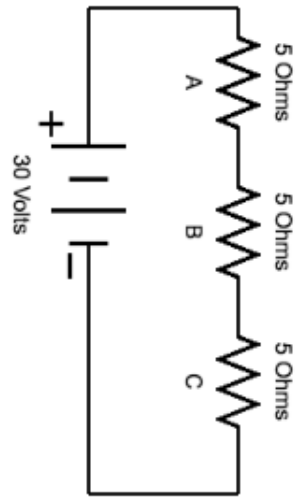
It represents the amount of potential energy that is lost or gained by a unit charge as it passes a particular circuit element (such as a battery or a resistor).

From now on, instead of saying "voltage," we will say "potential difference!"
However, remember that the unit of potential difference is still called "volts."

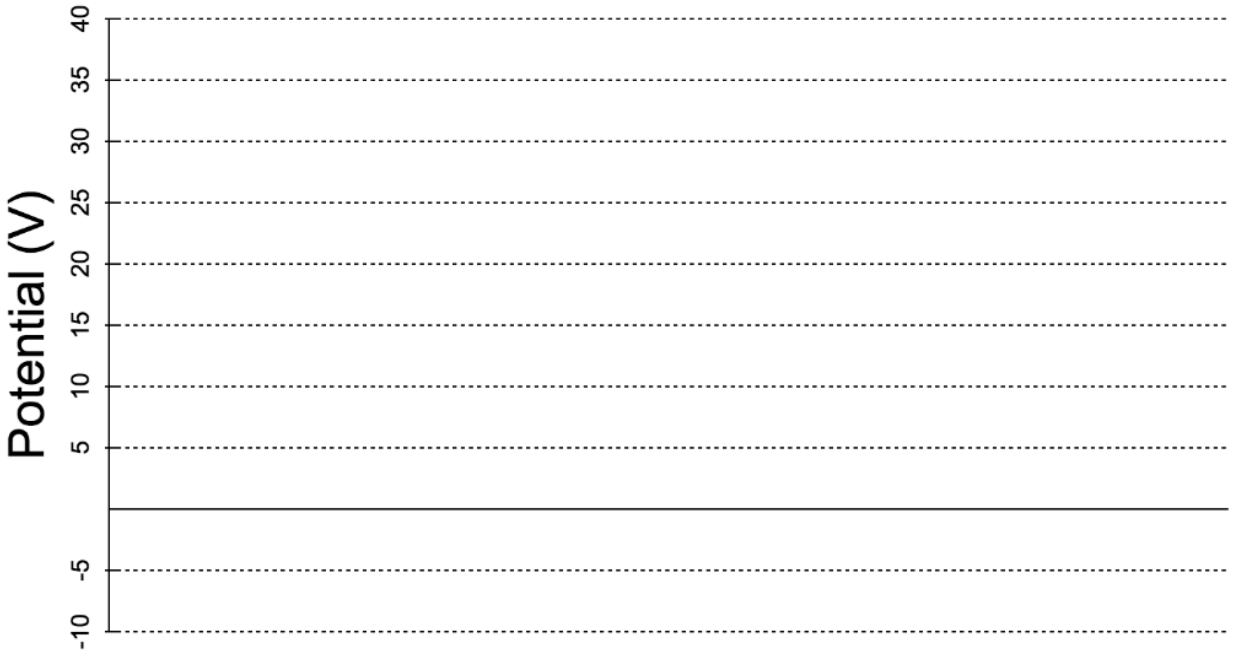
Part 1: How to Draw an Electric Potential Graph for a Simple Series Circuit:

1. Solve for the voltage, current, and resistance of each circuit element. This time, however, voltage is called *potential difference*.
2. "Electric Potential" in volts is the label on the Y-axis. The X-axis is unlabeled, but roughly represents the position within a circuit.
(These graphs are more conceptual than rigorously mathematical.)
3. Start with a potential of 0. The battery is represented by an upward sloped line of the correct potential difference.
4. After the battery, draw a short horizontal line segment. Each resistor is represented by a downward-sloped line of the correct potential difference, and followed by a horizontal line segment.
5. Upon reaching the bottom, draw a horizontal line back to your starting point, indicating the circuit is circular.
6. Label each upward or downward-sloped segment as the battery or as a resistor.
7. Draw arrows on each segment indicating the direction of the current on that segment. Next to one of the arrows, indicate the magnitude of the current.

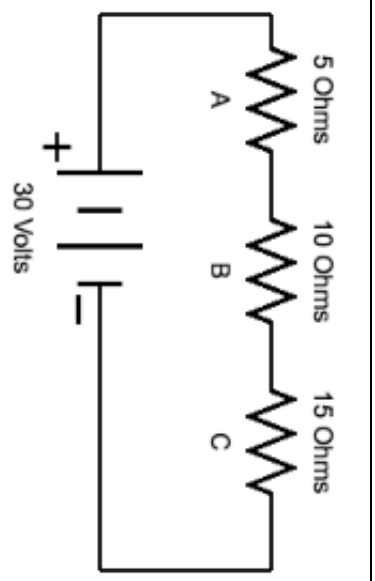
Problem F.1: A 30 Volt battery is connected to three 5-Ohm resistors in series. Solve all elements of the circuit and draw a diagram of the electric potential within the circuit.



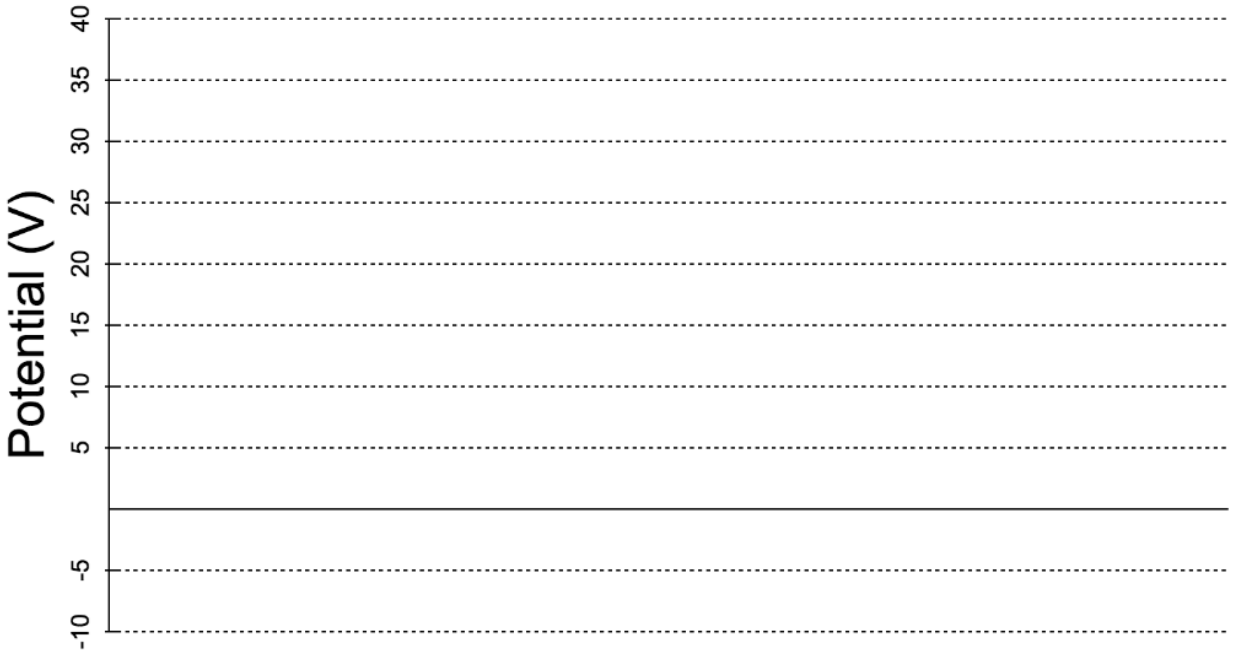
	A	B	C	Total
Potential Difference (V)				
Current (A)				
Resistance (Ω)				



Problem F.2: A 30-volt battery is connected to a 5 Ohm, 10 Ohm, and 15 Ohm resistor in series. Solve for all elements of the circuit and draw a diagram of the electric potential within the circuit.



	A	B	C	Total
Potential Difference (V)				
Current (I)				
Resistance (Ω)				



Part 2: Drawing an Electric Potential graph for a Simple Parallel Circuit:

1. Solve for the voltage, current, and resistance of each circuit element. This time, however, voltage is called *potential difference*.
2. "Electric Potential" in volts is the label on the Y-axis. The X-axis is unlabeled, but roughly represents the position within a circuit.
(These graphs are more conceptual than rigorously mathematical.)
3. Start with a potential of 0. The battery is represented by an upward sloped line of the correct potential difference.
4. After the battery, draw a short horizontal line segment. Each resistor is represented by a downward-sloped line to the bottom of the graph. (Because, in a parallel circuit, the voltage drop of each resistor is equal to the voltage of the battery.) Between the downward sloped lines representing the resistors, draw a horizontal line segment.
5. Upon reaching the bottom of each drop, draw a horizontal line back to your starting point indicating the circuit is circular.
6. Label each upward or downward-sloped segment as the battery or as a resistor.

Steps 7 – 9: Indicating the current:

7. For each of the resistors, indicate the *current flowing through that resistor* by drawing an arrow and writing the amount of current on each downward slope.

8. Indicate the current flowing through the battery by drawing an arrow on the upward slope and indicating the amount of current.

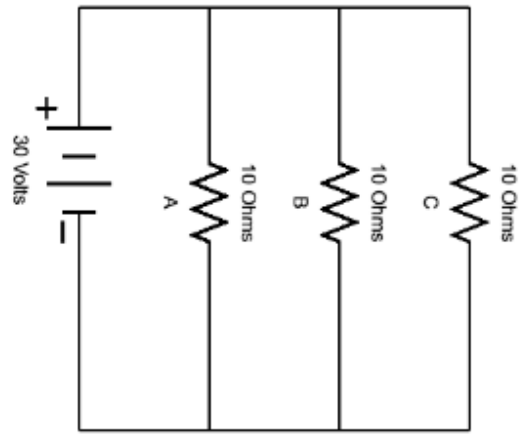
9. Use the **junction rule** to determine the current on each segment of the circuit:

Junction Rule:

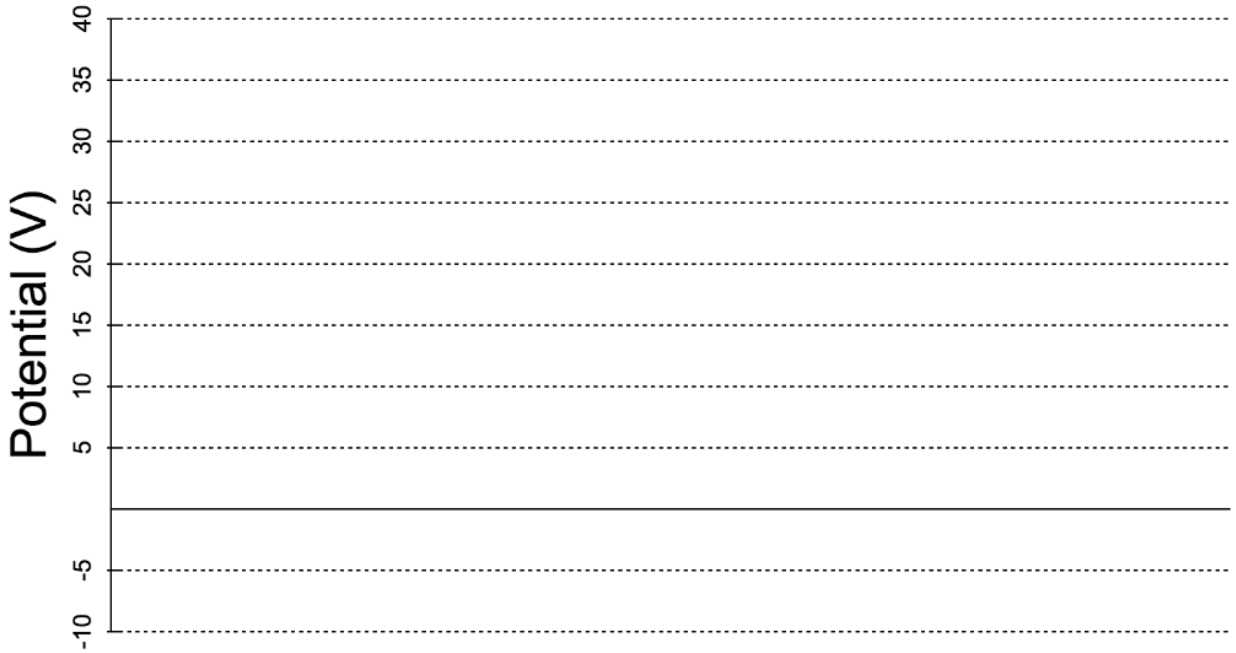
The total amount of current going into a junction is equal to the total amount of current coming out of a junction.

On wires with no junction, the current is always constant.

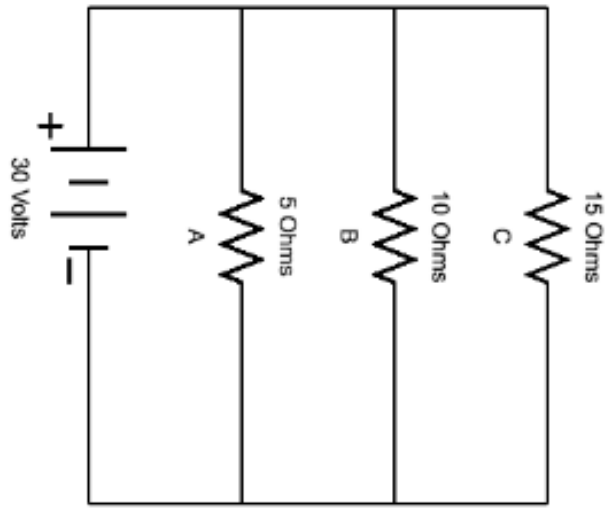
Problem F.3. A 30 Volt battery is connected to three 10 Ohm resistors in parallel. Solve for the potential difference, current and voltage of each element, and draw an electric potential diagram. For each segment of the electric potential diagram, indicate the current within that segment.



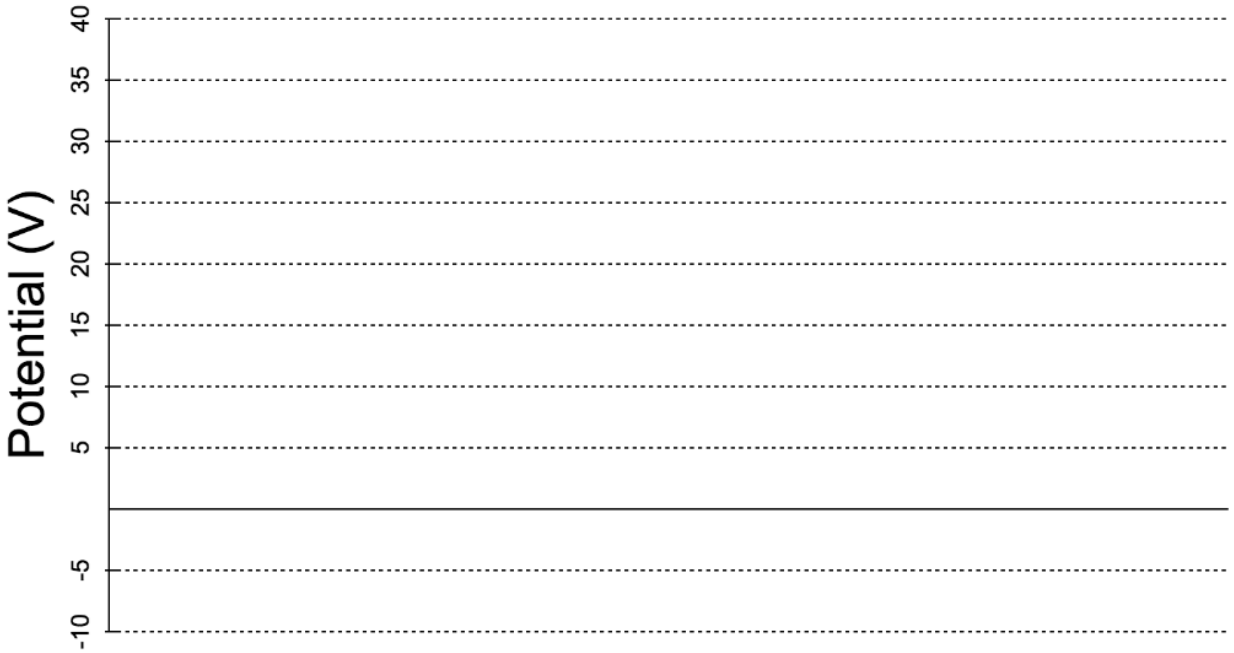
	A	B	C	Total
Potential Difference (V)				
Current (I)				
Resistance (Ω)				



Problem F.4: A 30 Volt battery is connected to a 5 Ohm resistor, a 10 Ohm resistor, and a 15 Ohm resistor in parallel. Solve for the potential difference, current and voltage of each element, and draw an electric potential diagram. For each segment of the electric potential diagram, indicate the current within that segment.

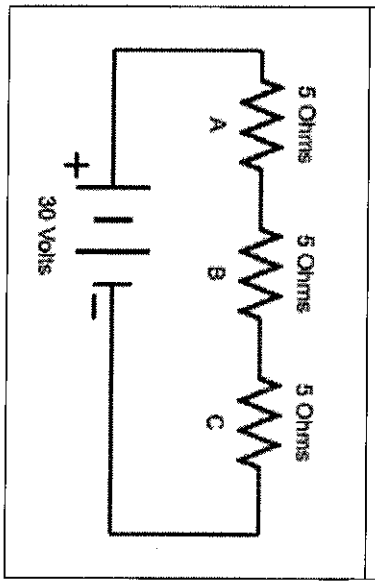


	A	B	C	Total
Potential Difference (V)				
Current (I)				
Resistance (Ω)				

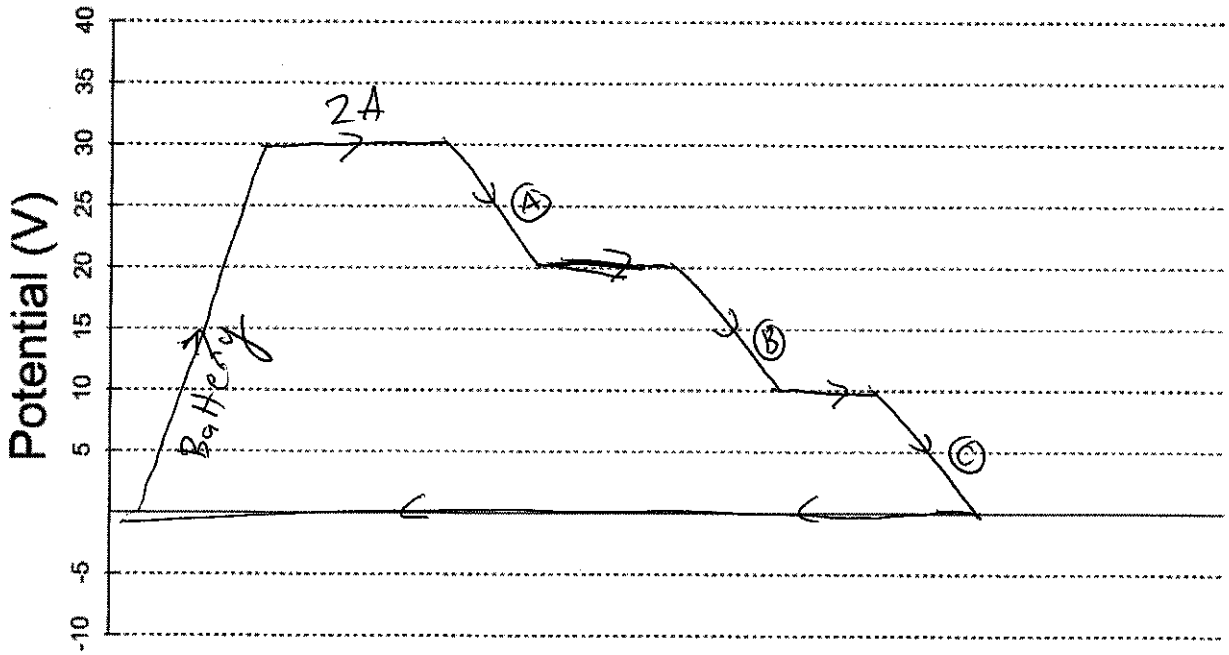


 Name Answer

Problem F.1: A 30 Volt battery is connected to three 5-Ohm resistors in series. Solve all elements of the circuit and draw a diagram of the electric potential within the circuit.

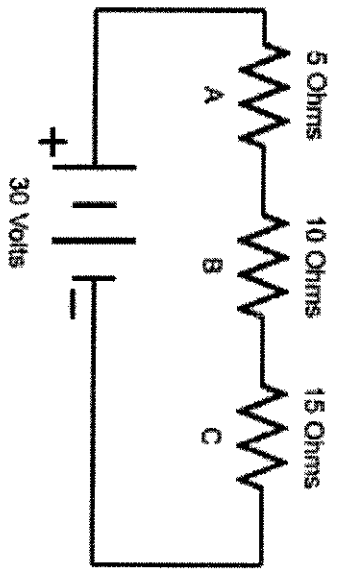


	A	B	C	Total ~~(battery)~~
Potential Difference (V)	10	10	10	30
Current (A)	2	2	2	2
Resistance (Ω)	5	5	5	15

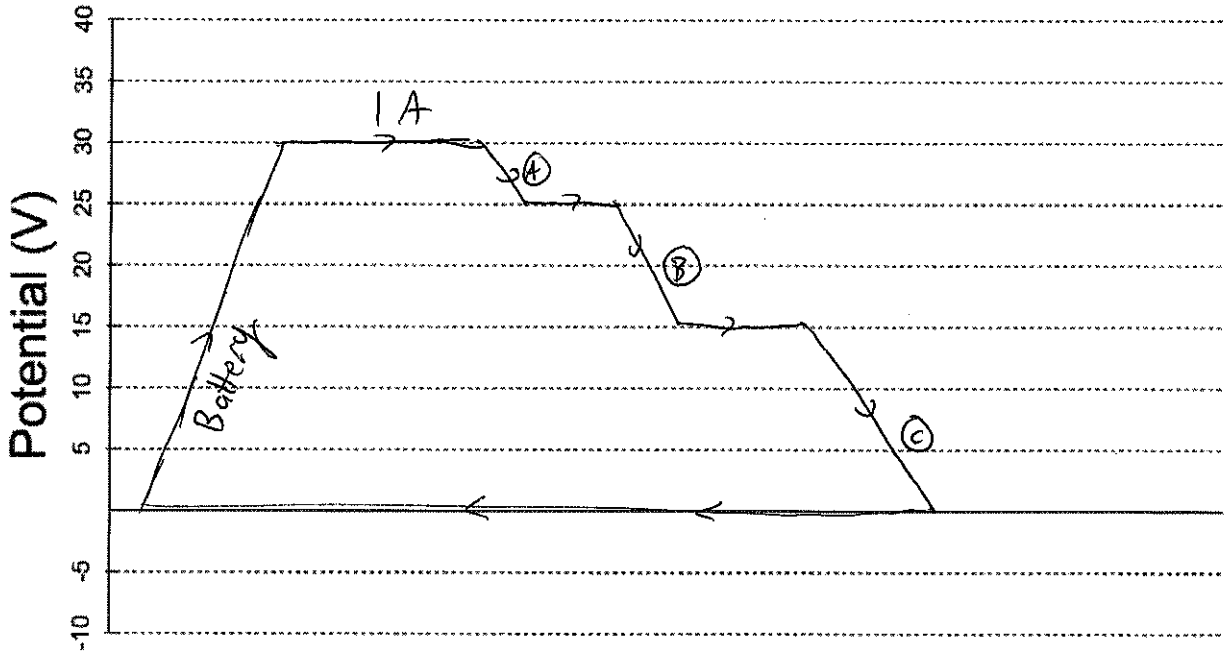


 Name Answer

Problem F.2: A 30-volt battery is connected to a 5 Ohm, 10 Ohm, and 15 Ohm resistor in series. Solve for all elements of the circuit and draw a diagram of the electric potential within the circuit.

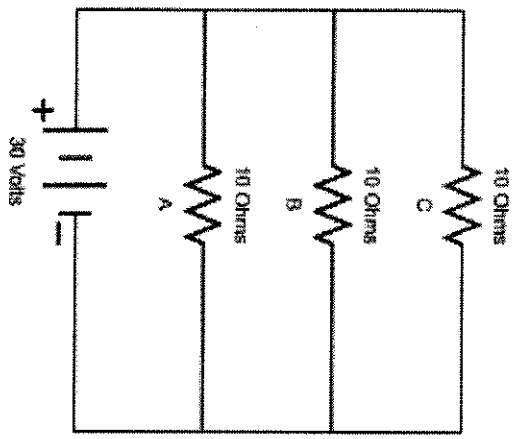


	A	B	C	Total ~~(battery)~~
Potential Difference (V)	5	10	15	30
Current (I)	1	1	1	1
Resistance (Ω)	5	10	15	30

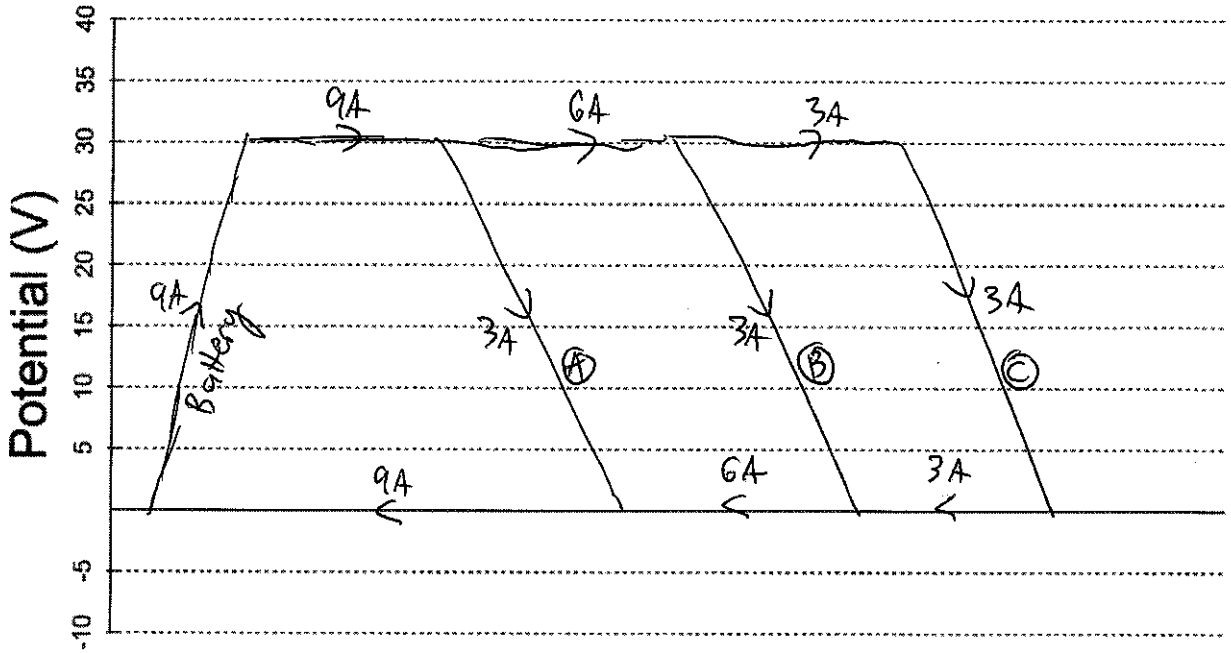


 Name Answer

Problem F.3. A 30 Volt battery is connected to three 10 Ohm resistors in parallel. Solve for the potential difference, current and voltage of each element, and draw an electric potential diagram. For each segment of the electric potential diagram, indicate the current within that segment.

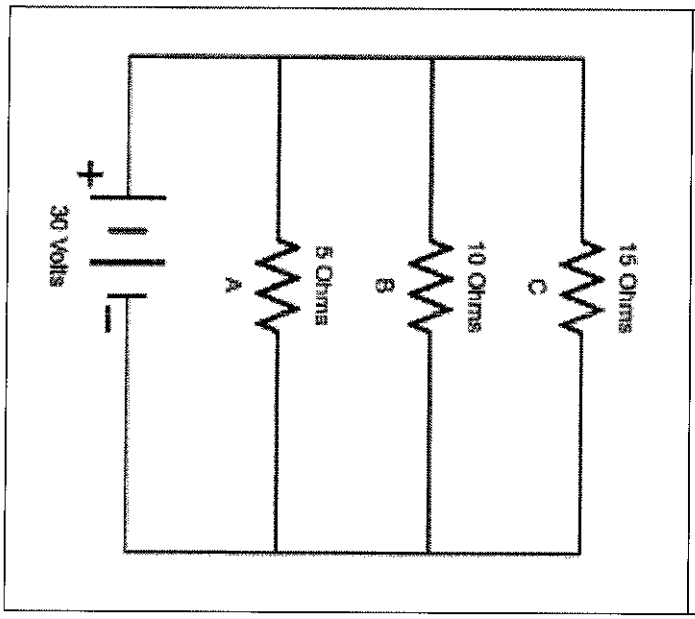


	A	B	C	Total ~~(battery)~~
Potential Difference (V)	30	30	30	30
Current (I)	3	3	3	9
Resistance (Ω)	10	10	10	3.3



 Name Answer

Problem F.4: A 30 Volt battery is connected to a 5 Ohm resistor, a 10 Ohm resistor, and a 15 Ohm resistor in parallel. Solve for the potential difference, current and voltage of each element, and draw an electric potential diagram. For each segment of the electric potential diagram, indicate the current within that segment.



	A	B	C	Total ~~(battery)~~
Potential Difference (V)	30	30	30	30
Current (I)	6	3	2	11
Resistance (Ω)	5	10	15	2.72