

Series Circuits

Series Circuit

- A series circuit is a circuit or portion of a circuit that has only a single conducting path for the electricity to follow.
- If the circuit is broken anywhere along the path the flow of electricity will stop.
- Total resistance in a circuit is the sum of the resistance of all the resistors in the circuit.

$$R_T = R_1 + R_2 + R_3 + \dots$$



Analyzing Series Circuits


1. Draw current and voltage arrows.
 - Current arrows show the direction of current flow (from positive to negative) and have colored in heads.
 - Voltage arrows point to the higher potential (J/C) and face in the opposite direction of the current arrow when drawn across a resistor and in the same direction as the current arrow when drawn across a battery.

Analyzing Series Circuits

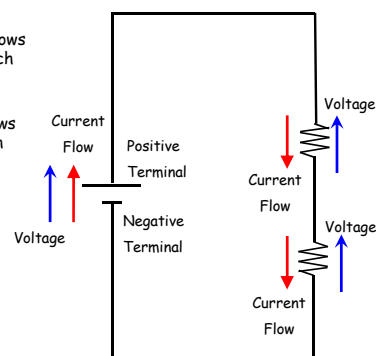
2. If you can, determine V_{AB} (voltage of the battery), I (total current), and R_T (total resistance).
 3. Fill in any given information and use Ohm's law ($V = IR$) to solve for any unknown information.
- **DO NOT TRY TO FILL IN THE BLANKS ON YOUR HOMEWORK IN ORDER.**

Circuit Diagrams

- **VERY IMPORTANT STUFF**
 - **Current arrows** have colored in heads. **ALWAYS** drawn as if current is flowing from the positive terminal to the negative terminal of the battery.
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- **Voltage arrows** point toward the higher potential.
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- For a battery: same direction as the current flow
 - For a resistor: opposite direction from the current arrow.

The symbol for a resistor 

1. Draw Current Arrows at battery and each resistor.
2. Draw Voltage Arrows at battery and each resistor.
3. Label each current arrow and voltage arrow with known values



Sample

Sketch a circuit containing a 3 V battery and a 45 Ω Resistor.

What is the current at the 45 Ω resistor?

$$V = IR$$

$$3V = I (45 \Omega)$$

$$I = 0.067 A$$

Sample

1. Draw **current** and **voltage** arrows.
2. Label known ($V_{AB} = 12 V$)
3. Calculate R_T
 $\Rightarrow (R_T = 2 \Omega + 3 \Omega + 1 \Omega = 6 \Omega)$
4. Use $V_{AB} = (I_1)(R_T)$ to determine I_1
 $\Rightarrow (12V = I_1 6\Omega \quad I_1 = 2A)$
5. Label all of the current arrows as 2A since they are all in series.
6. Use Ohm's Law ($V = I R$) at each resistor to get the voltage drops

7. Determine the following:

$V_{CB} = 4 V$
 $V_{DC} = 6 V$
 $V_{CA} = -8 V$
 $I_1 = 2 A$
 $R_T = 6 \Omega$

Practice

$V_{AB} = 18 V$
 $V_{CB} = 6 V$
 $V_{DC} = 9 V$
 $V_{CA} = -12 V$
 $I_1 = 3 A$
 $R_T = 6 \Omega$

Practice

$V_{AB} = 42 V$
 $V_{BC} = -24 V$
 $V_{DC} = 6 V$
 $V_{CA} = -18 V$
 $V_{AD} = 12 V$
 $I_1 = 3 A$
 $R_T = 14 \Omega$