Series Circuits

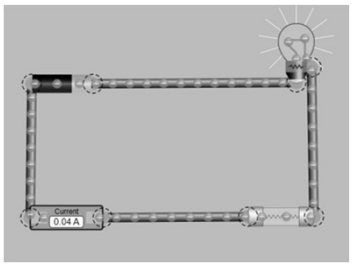
1

Circuits

- Electrical Circuit
  - A set of electrical components that are connected to provide one or more paths for moving charges
  - A closed electrical loop in which charge can flow
  - Must have a high potential (Voltage) and low potential (Voltage) for current to flow

2

Circuit Safety



- Short Circuit
  - A circuit with little or no resistance.
- Fuse
  - A piece of metal that melts when the current in the circuit becomes too great.
- Circuit Breaker
  - A resettable switch that opens when the current in a circuit reaches a set value.

3

Voltage and Circuits

- Voltage is the energy per unit charge supplied by the source of electrical current.
- Any battery or generator is a voltage source.
- A voltage source must be connected to a circuit to produce a current in the circuit.
- Each element in a circuit “uses up” some of the voltage supplied. This is called a voltage drop.

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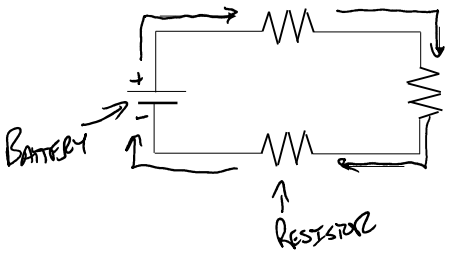
Series Circuits

- Circuits in which there is only one path for the current to take.



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General Rules for Series Circuits

- The current in all parts of the circuit is the same (Constant Current)
- The sum of all the separate voltage drops is equal to the applied voltage(Voltage adds up)
- The total resistance in a series circuit is equal to the sum of the individual resistances
- Ohm's Law can be used for any resistor, or for the entire circuit.

$$V = IR$$

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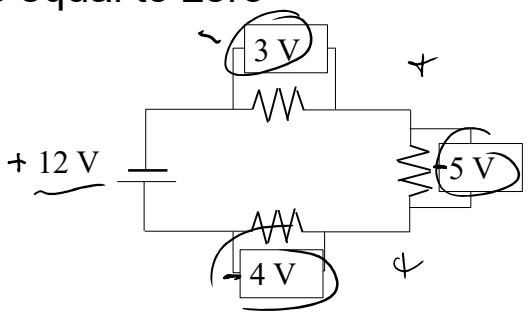
Kirchoff's Second Law

- The sum of all changes in potential in a complete circuit is equal to zero



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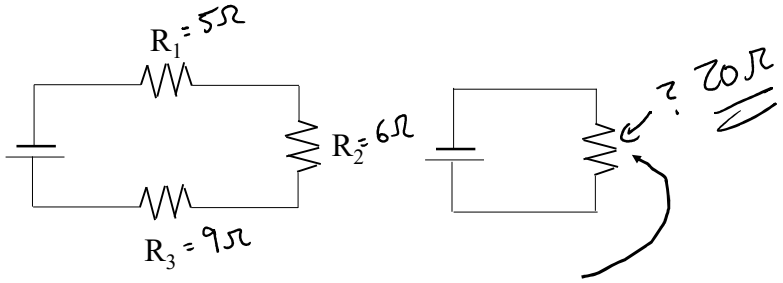
Equivalent Resistance (Series)

- A single resistor that can be placed in a circuit in place of all other resistors in the circuit



$$R_{eq(series)} = R_1 + R_2 + R_3 + \ldots$$

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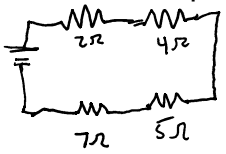
Sample Problem

- A 9.0 V battery is connected to four light bulbs, as shown in the picture. Draw a schematic of the circuit.



- What is the equivalent resistance in the circuit?

$2+4+5+7=18\Omega$

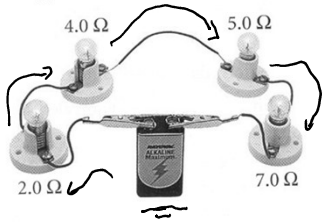
- What is the current in the circuit?

$V=IR \Rightarrow 9=I(18)$

$I=.5$

- What is the voltage dropped across each light?

	V	= I	× R
Batt	9V	.5A	18Ω
R_1	1V	.5	2Ω
R_2	2V	.5	4Ω
R_3	2.5V	.5	5Ω
R_4	3.5V	.5	7Ω



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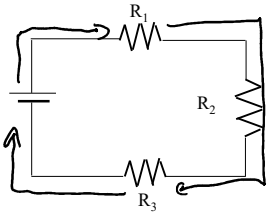
Sample Problem



	V	= I	× R
Batt	144.0 V	3.0A	48Ω
R_1	72V	3.0A	24Ω
R_2	27V	3.0 A	9Ω
R_3	45V	3.0A	15Ω

$45+72+R_2=144$

$R_{EQ}=R_1+R_2+R_3+\cdots$

$48=24+R_2+15$

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