Science 9

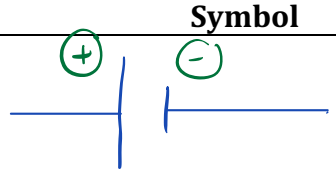
Physics IV

Name:
Date:
Block:

1. **Circuit Diagrams**
2. **Ohm's Law**

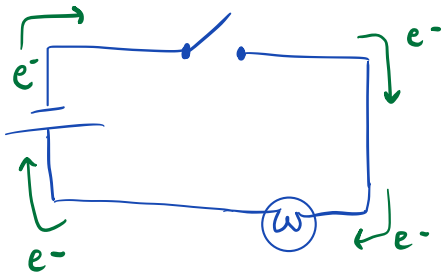
Circuit Diagrams

Parts of a circuit and its connections to each other can be represented through a variety of symbols. These symbols help to indicate where each component of the circuit is placed with respect to each other.

Component		Symbol	Function
Source	Cell		Provides the power source
	Battery		
Conducting Wire			Allows electricity to flow from one device to another
Resistor/Load (object)			Controls the flow of current to other components
Switch	Open		Electrical current is off so electricity cannot pass through
	Closed		Electrical current is on so electricity can pass through
Lightbulb			A type of load that is able to change electrical energy into light and thermal energy
Ammeter			Used to measure the amount of current flowing through the circuit
Voltmeter			Used to measure the amount of voltage passing through the load

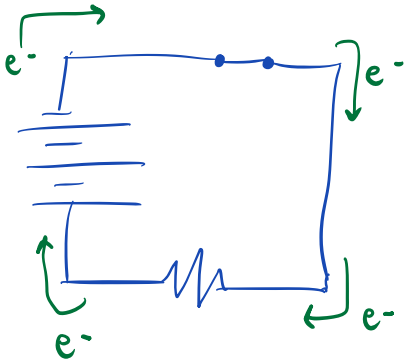
We can use these circuit symbols in order to represent how circuits are connected together.

Example: Draw a circuit that has a cell, an open switch and one light bulb all connected in one pathway.

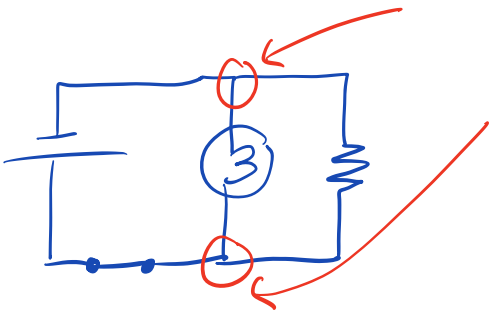


* Circuit diagrams are rectangular (use a ruler)

Example: Draw a circuit that has a battery, a closed switch and a resistor connected in one pathway.



Example: Draw a circuit that has a cell and a closed switch on the main pathway, a light bulb on another pathway and a resister on a third pathway.



Junction points exist is parallel circuits
↳ allow current to travel down a separate pathway

Work on Circuit Diagrams Practice

Science 9

Circuit Diagrams Practice

Name:
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1. Draw the circuit diagram symbol for each component given below

   a. A closed switch

   b. An open switch 

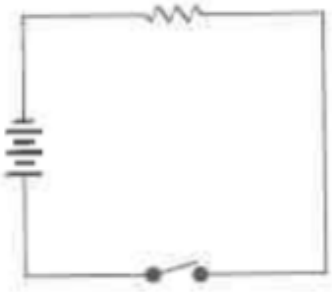
   c. Conducting wire

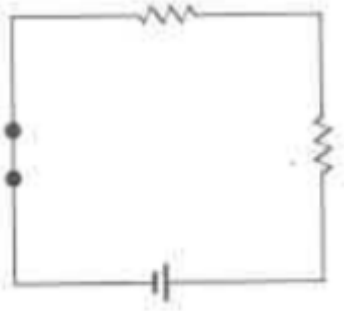
   d. Cell 

   e. Battery 

   f. Load 

2. Use the circuit diagrams below to answer the questions that follow

A 

B 

   a. In which circuit is current not flowing? Provide your reasoning

   A - the switch is open, so there is no continuous pathway for the current to flow

   b. In which circuit is the source a battery?

   A

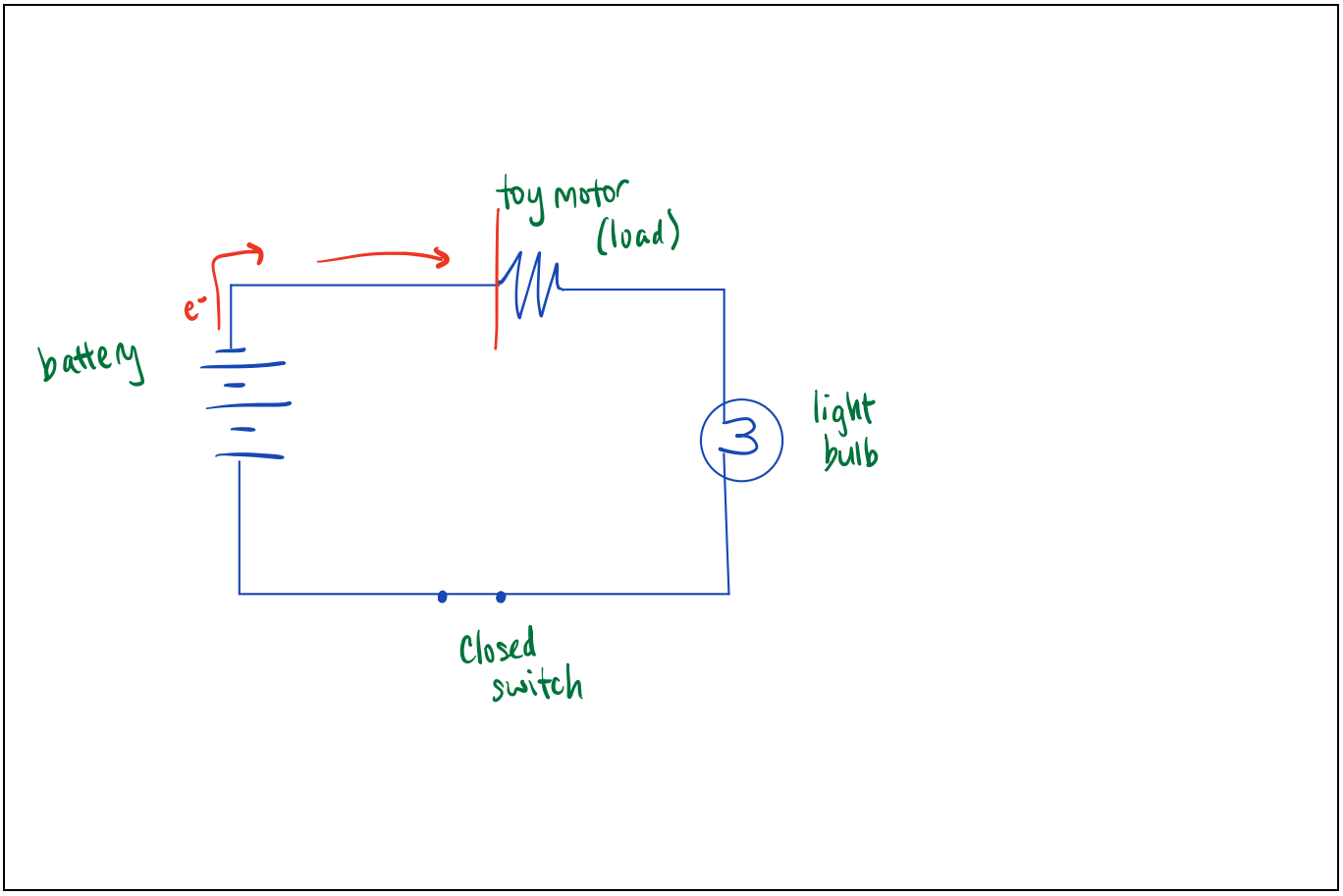
   c. Which circuit has more loads?

   B

   d. Which source most likely has a higher electrical potential difference (voltage)? Explain

   A - there are more sources and fewer loads

3. Draw a circuit diagram for a closed circuit with a battery, a toy motor, a light bulb, and a switch



In the diagram above, what would happen to the light bulb if the toy motor breaks and stops running? Explain.

If the toy motor breaks, it will cause a break in the circuit, resulting in the electrons not being able to flow through. This stops the current, which will result in the light bulb not working

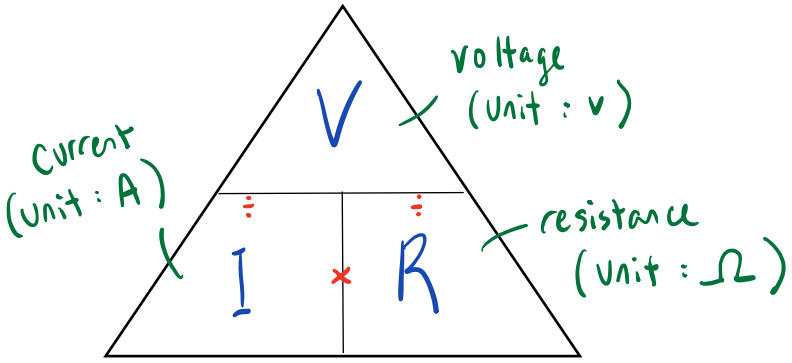
Ohm's Law

Ohm's law is formula that describes the relationship between voltage, current, and resistance in an electrical circuit.

$V = I \times R$

V: voltage I: current R: resistance

We are able to rearrange around Ohm's Law in order to calculate for each of the three variables.



$V = I \times R$

$I = \frac{V}{R}$

$R = \frac{V}{I}$

Example: The filament of a light bulb has a resistance of 20.0 Ω. A 5.0 V battery is used in the circuit. What is the current?

Step 1: Identify the known values ✓

Step 2: Write the equation ✓

Step 3: Replace the known values ✓

Step 4: Solve ✓

Step 5: Label with units ✓

$R = 20.0\ \Omega$
$V = 5.0\ V$
$I = ?\ A$

$I = \frac{V}{R}$

$= \frac{5.0\ V}{20.0\ \Omega}$

$= \boxed{0.25\ A}$

Example: If the current of a circuit is 10.0 A and voltage from the battery is 20.0 V. How much resistance is needed in the load?

Step 1: Identify the known values

Step 2: Write the equation

Step 3: Replace the known values

Step 4: Solve

Step 5: Label with units

$I = 10.0\ A$
$V = 20.0\ V$
$R = ?\ \Omega$

$R = \frac{V}{I}$

$= \frac{20.0\ V}{10.0\ A}$

$= \boxed{2.0\ \Omega}$

Work on Ohm's Law Practice

Science 9

Ohm's Law Practice

Name:
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1. An alarm clock draws 0.500 A of current when connected to a 120.0 volt circuit. Calculate its resistance.

V =

I =

R =

2. A subwoofer needs a household voltage of 110.0 V to push a current of 5.5 A through its coil. What is the resistance of the subwoofer?

V =

I =

R =

3. A walkman uses a standard 1.5 V battery. How much resistance is in the circuit if it uses a current of 0.01A?

V =

I =

R =

4. A circuit contains a 1.5 volt battery and a bulb with a resistance of 3.0 ohms. Calculate the current.

V =

I =

R =

5. What current flows through a hair dryer plugged into a 120.0 Volt circuit if it has a resistance of 25.0 ohms?

V =

I =

R =

6. What happens to the current in a circuit if a 1.50-volt battery is removed and is replaced by a 3.00-volt battery?

V =

I =

R =

7. If a toaster produces 12.0 ohms of resistance in a 120.0-volt circuit, what is the amount of current in the circuit?

V =

I =

R =

8. A 12.0 Volt car battery pushes charge through the headlight circuit resistance of 10.0 ohms. How much current is passing through the circuit?

V =

I =

R =

9. How much voltage would be necessary to generate 10.0 amps of current in a circuit that has 5.00 ohms of resistance?

V =

I =

R =

10. An electric heater works by passing a current of 100.0 A though a coiled metal wire, making it red hot. If the resistance of the wire is 1.100 ohms, what voltage must be applied to it?

V =

I =

R =

11. A light bulb has a resistance of 5.0 ohms and a maximum current of 10.0 A. How much voltage can be applied before the bulb will break?

V =

I =

R =

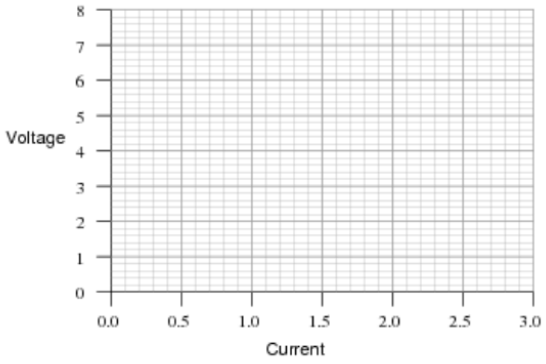
12. What happens to the current in a circuit if a 10.0 Ω resistor is removed and replaced by a 20.0 Ω resistor?

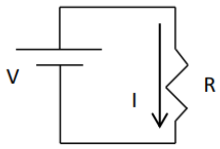
V =

I =

R =

13. Suppose you did a lab with this simple circuit and got the following data. Plot the points of the provided graph.





Voltage (V)	Current (A)
0.65	0.12
1.41	0.29
2.55	0.51
3.28	0.67
4.11	0.81
6.15	1.23

a) What mathematical relationship do you see between voltage and current?

b) Is the resistance constant?

14. Solve for the unknown in each of these circuits.