Current and Voltage

Suggested Time: 1.2 Hours

What's important in this lesson:

- demonstrate knowledge of electrical safety procedures when planning and carrying out investigations
- collect and graph data, to determine the relationship between voltage and current in a simple circuit with a light bulb and a motor

Complete these steps:

1. Complete the Diagnostic/Introductory Activity. Get this checked as being completed on your Course Checklist.

2. Complete the pre-lab activities in the student handout and get your teacher to check your answers

3. Proceed with the investigation described in the handout. Be sure to get your teacher to check the circuit before turning it on and taking any measurements. Your teacher will probably need to explain the correct method to connect the two meters.

4. Complete the observations, analysis and conclusions sections of your student handout. When finished hand in the student handout.

5. Complete the Reflective Activity. Get this checked as being completed on your Course Checklist.

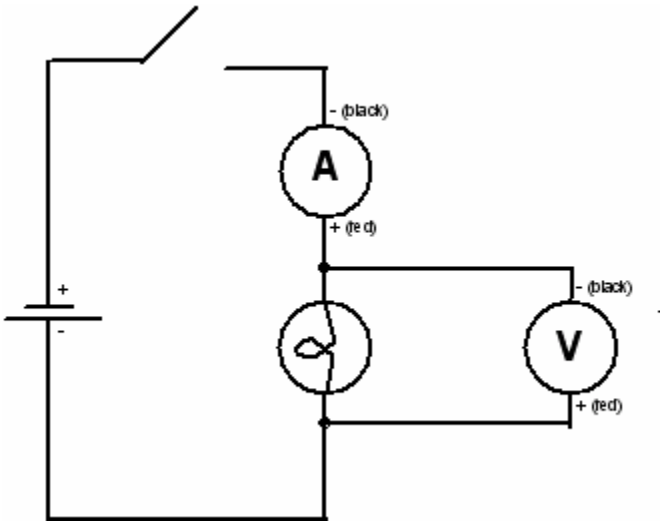
Hand-in the following to your teacher:

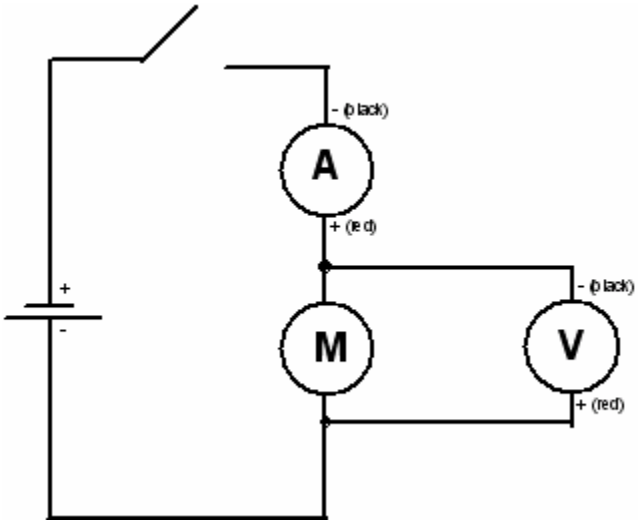
1. The student handout with the completed investigation.

Questions for the teacher:

Diagnostic/Introductory Activity:
Unit 3 Lesson 4

Beside each diagram list the equipment you'll need to do today's investigation. Use *pg. 263 in Science 9: Concepts and Connections, pg. 334 of Science power,* or *pg. 545 Science 9.*





Current and Voltage

Recall that voltage is similar to the pressure that water experiences in a pipe and electric current is similar to the flow of water in the pipe. In this investigation you will discover how voltage and current are measured and related.

Pre-Lab
In order to become familiar with some of the equipment and safety issues read pages *262-264 in Science 9 Concepts and Connections, pg. 600-602 in Science Power or pages 544-546 Science 9* and fill in the following blanks.

1. When handling electrical equipment, make sure your hands are _____.
2. Only operate your circuit once it has been checked by your _____.
3. When attaching wires to a meter use a _____ wire to connect with positive terminal and _____ wire to connect with negative terminal.
4. Always _____ the switch before adding meters or new devices to your circuit.
5. Meters may be _____ (providing a digital readout out) or _____ (providing a moving needle on a scale).
6. If an analogue voltmeter (or ammeter) is connected incorrectly the needle would try to move to the _____. This means you should reverse the meter connections.
7. In the diagram below you have an analogue voltmeter that is connected to a circuit using the 0-15 V scale. Read these meters and place the reading below each meter.

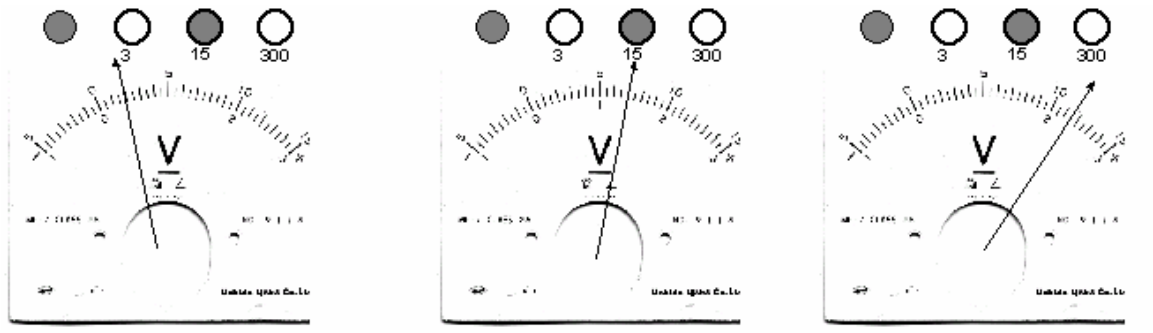


Figure 1 Reading an Analogue Voltmeter

Question:
If one increases the voltage of the source by adding more cells, what will happen to the electric current?

Prediction: (make a prediction and give your reason(s) why)

Part 1: Light Bulb
Materials: (see diagram below and make a list. If you need help check your textbook.

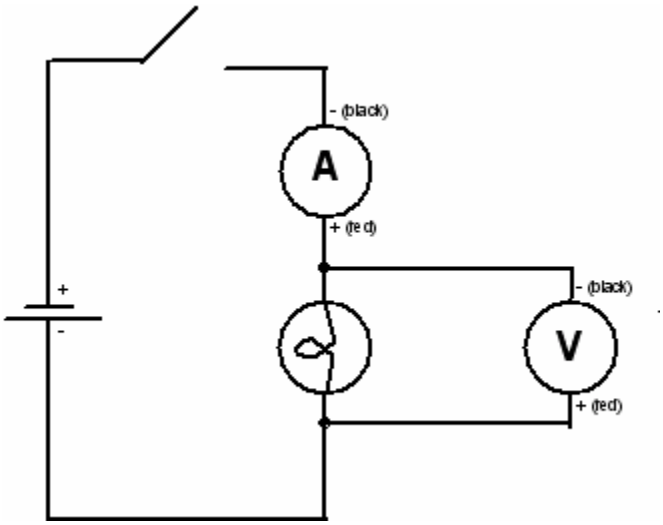


Figure 2 Setup for Part 1: Light Bulb

Procedure

1. Construct the circuit shown in Figure 1. The ammeter and voltmeter will remain in the same position for the entire investigation. Pay particular attention to the connections to both the voltmeter and ammeter. Ask your teacher to inspect the circuit before you start.
2. Close the switch and record the voltmeter and ammeter readings in a table of your own design.
3. Repeat the experiment using 2, 3, and 4 D cells. Record all measurements in your observation table.

Observations
Design your own table to collect all 4 trials. (an example of a good table is on page 273 in *Science 9:Concepts and Connections*). Use the headings: number of cells in series, voltage, current.

Part 2: Motor
Materials *(see diagram below and make a list. If you need help, check your textbook.*

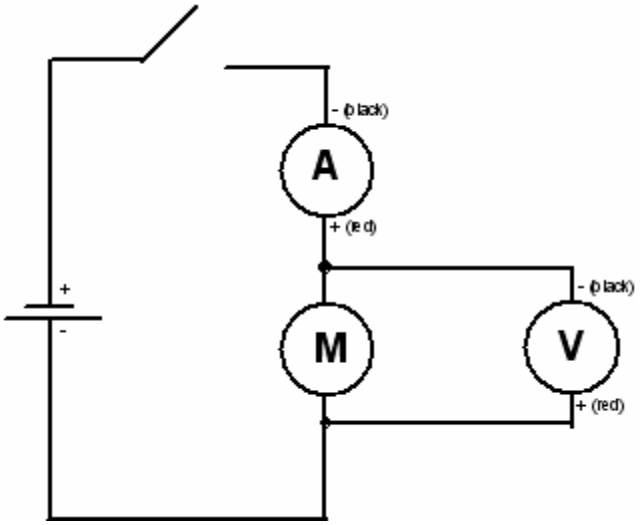


Figure 3 Setup for Part 2: Motor

Procedure

1. Construct the circuit shown in Figure 1. The ammeter and voltmeter will remain in the same position for the entire investigation. Pay particular attention to the connections to both the voltmeter and ammeter. Ask your teacher to inspect the circuit before you start.
2. Close the switch and record the voltmeter and ammeter readings in a table of your own design.

3. Repeat the experiment using 2, 3, and 4 D cells. Record all measurements in your observation table.

Observations

Design your own table to collect all 4 trials. (for an example of good table see *pg 273 in Science 9:Concepts and Connections* or *pg 553 in Science 9*)

Analysis

1. On a single sheet of graph paper, plot graphs of voltage versus current. Plot voltage on the vertical axis and the current on the horizontal axis. Your graph will have two lines, one for the light bulb and one for the motor. (for an example of well designed graph see *pg 273 in Science 9:Concepts and Connections* or *pg 553 in Science 9* - Remember to choose a scale so most of the page is filled)

2. Resistance is described as the slowing down of electron flow by a device. Which device, the light bulb or motor has the most resistance? The device with the highest resistance would slow the electrons the most.

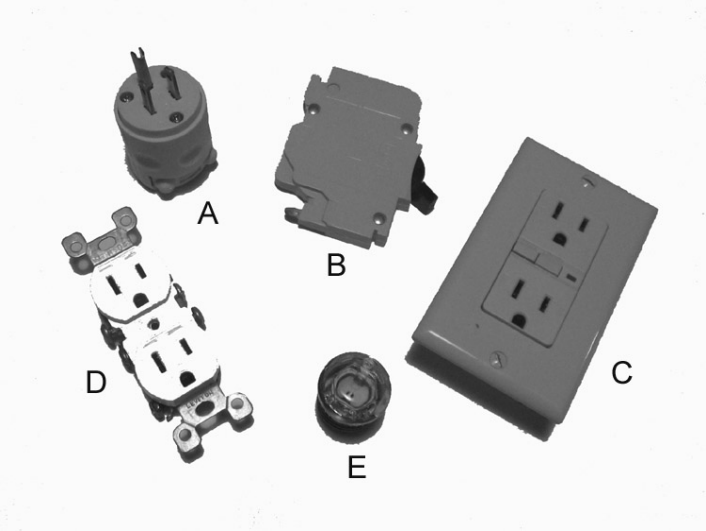
Conclusion: (answer the question at the beginning of the lab, and give some evidence for your answer).

Performance Task Rubric ~ Voltage and Current Report

Categories	Level 4	Level 3	Level 2	Level 1	R
Question and Hypothesis	Questions is precise Hypothesis provides both prediction and appropriate explanation	Question is precise Hypothesis provides prediction with limited explanation	Question is precise Hypothesis provides prediction with no explanation	Question lacks focus Hypothesis provides prediction	Question is present Hypothesis is not present
Data Collection Observation	Data tables have units, headings and efficiently organize data from trials	Data tables have efficiently organize data from trials	Data tables contain all data from trials	Data from trials has been recorded	Little or no data appears to have been recorded
Analysis	Student accurately presents voltage and current in fully labeled line graph Student identifies the device with the greatest resistance	Student accurately presents voltage and current in line graph Student identifies the device with the greatest resistance	Student accurately presents voltage and current in line graph Student does not correctly identify the device with the greatest resistance	Student presents voltage and current in line graph with some errors Student does not attempt to identify device with greatest resistance	And fails to present data in graph
Conclusion	Student accurately identifies affect and states conclusion with reference to experimental data	Student accurately identifies affect and states conclusion concisely	Student identifies affect and states conclusion	Student identifies and states and inaccurate trend	Student fails to identify any trend

Relfection Activity: Unit 3 Lesson 4

Your home has many safety devices that control the amount of electrical current going through them. Can you name them? Check your answers using the figures on pages 159-161 in *Science 9: Concepts and Connections.*



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