Electric Circuits

Suggested Time: 1.2 Hours

What's important in this lesson:

- compare the terms of electric current, voltage, and resistance, to the flow of water in pipes
- design, draw, and build series and parallel circuits that perform a specific job

Complete these steps:

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

2. Get a textbook, either *Science 9, Science Power,* or *Science 9 Concepts and Connections* and get started on the student handout. If you are having difficulty with a section, note this in the section below: Questions for teacher and move on to the next activity in your student handout.

3. Once the student handout is complete check your answers or your teacher will with the Answer Key. Get this checked as being completed on your Course Checklist.

4. Complete the activity on series and parallel circuits.

5. You'll need at least 10-15 minutes to complete the second part of the assessment, a quiz on the material you've reviewed today. If you've got at least that much time ask your teacher for the quiz and hand the quiz in when you're done. If you don't have enough time move on to the Reflective Activity and try the quiz next day.

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

Hand-in the following to your teacher:

1. The lesson quiz.

Student Instruction Sheet: Unit 3 Lesson 2

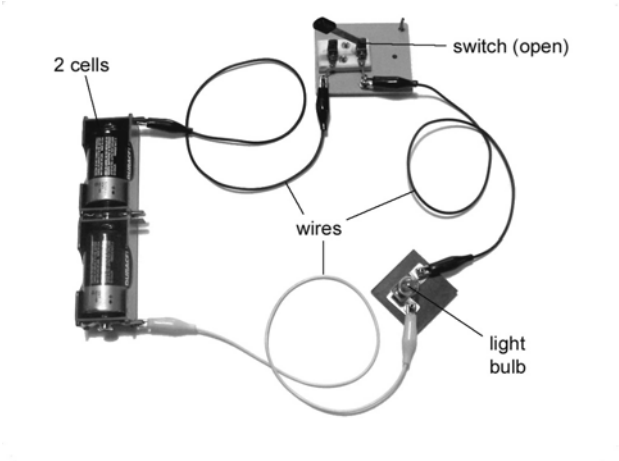
Questions for the teacher:

Diagnostic/Introductory Activity:
Unit 3 Lesson 2

Every electrical circuit has 4 basic parts: source, control device, connectors and a load (a device that convert electrical energy into other forms). Give 3 other examples of sources of electrical energy and 3 examples of loads

Sources
batteries

Load
Light bulbs



Electric Circuits

Electric Circuits

Many people compare the movement of electrical charges in a circuit similar to the movement of water through the plumbing of your house.

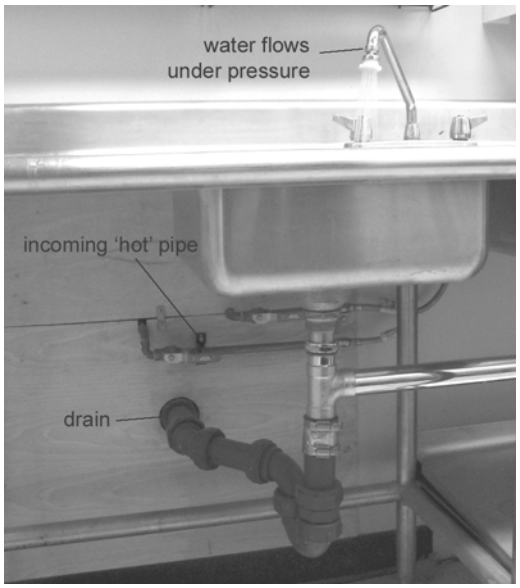


Figure 1 Water flowing in a household

Water under pressure leaves your taps where if aimed at an object such as a sponge, it can move the sponge. After hitting the sponge and converting the energy to the motion of the sponge, the water flows down the drain.

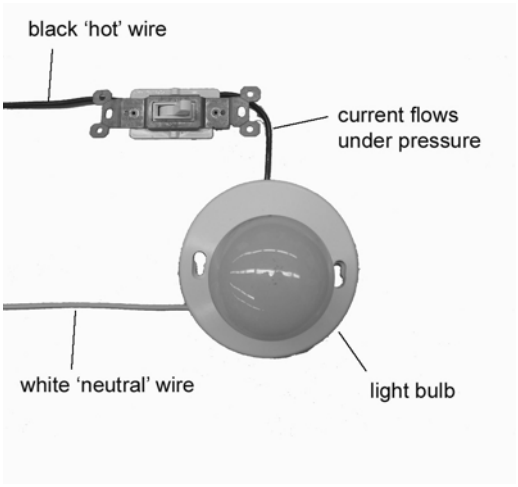


Figure 2 Electrons flowing in a household circuit

Electrical charges (electrons) flow through the black wire and enter a light bulb. Here the electrical energy is converted into light energy (and heat). The spent electrons now return by the white wire to the outlet for more energy

Table 1 Electrical Terms

Term	Definition	Units
voltage	The force (or pressure) that moves electrical charges in circuit	volts (V)
current	The rate of flow of electric charge	amperes (A)
resistance	The slowing down that charges experience as they move through a load	Ohms (Ω)

Student Handout: Unit 3 Lesson 2

Voltage

The voltage (or pressure) in households in North America is 120 V, in Europe the voltage is 220 V. Most cells, AAA, AA, C and D provide about 1.5 V. These can be stacked together to create more voltage such as in a 9 V battery which is made of 6 smaller cells.

1. State a use for each type of cell shown in the diagrams below.

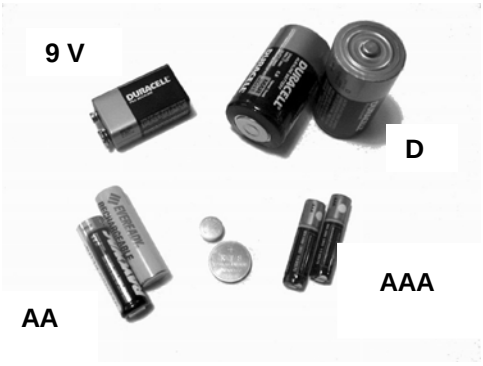


Figure 3 An Assortment of Batteries

AAA	
AA	
D	
9V	
circular	

Electric Current

2. The current for many electrical devices is given in the table below. An electrician decides on the number of circuits (or wires) that need to go into each room based on the projected current demands of the devices in the room. Your task has two parts

(a) List the devices and their current for three rooms (kitchen + two others)
(b) Determine the total current required for that room

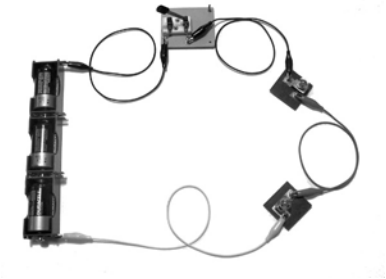
Table 2. Electric Currents

Device	Current (amperes)	Device	Current (amperes)
light bulb (100 W)	0.8	fridge	4.8
light bulb (60 W)	0.5	stove	36.0
light bulb (fluorescent)	0.2	Microwave	7.5
Hair drier	8.5	Clothes drier	10.0
Water heater	27.3	TV	4.1
Computer/monitor	1.7	VCR/DVD	0.5
Stereo	0.8	Clock	0.2
Toaster	13.6	Blender	4.5
Aquarium light/pump	1.6	Phone	0.2
Electric Heater	10.0	Video game	0.5
Coffee Maker	12.0		

Table 3 Room Currents

Kitchen		***Room _____***		***Room _____***	
Stove	*36.0*				
Total		*Total*		*Total*	

Series and Parallel Circuits



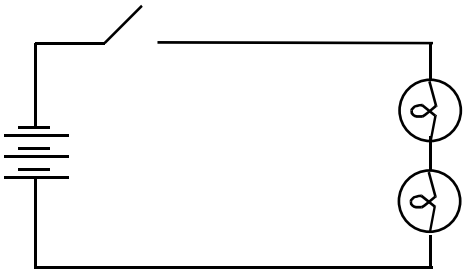
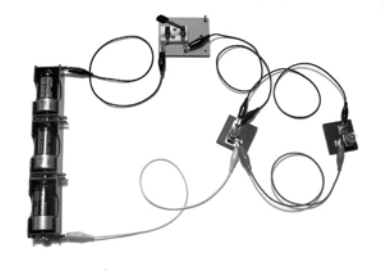


Figure 4 Series Arrangement of Light Bulbs

In a series arrangement there is one path for the movement of electrical charge. Since there is only one path for the charges they must share their energy with the two light bulbs. As a result the bulbs are not very bright.



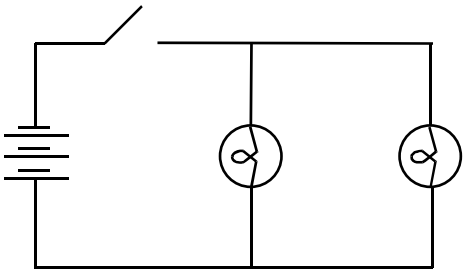


Figure 5 Parallel Arrangement of Light Bulbs

In a parallel arrangement there is more than one path for the charges to flow around the circuit. In this case there are two paths. One path goes through each light bulb and as a result the energy does not need to be shared and both bulbs appear bright.

3. Complete the table below by reading *pg. 143 in Science 9 Concepts and Connections, pg. 354 Science Power,* or *pg. 325 in Science 9.*

Type of Circuit	Number of Paths	Electrical Energy	Devices on/off
series			
parallel			

Consider the diagram below

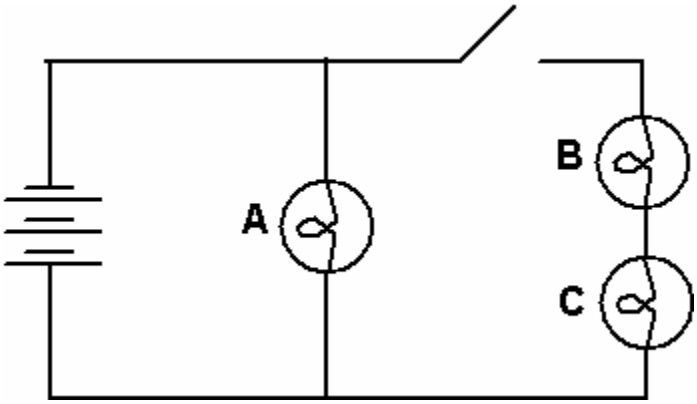


Figure 6 Understanding Circuits

4. How many paths in this circuit?

5. What type of circuit is it?

6. Which bulb(s) would be affected by the switch opening and closing?

7. Which bulb would be the brightest? Explain.

Constructing Series and Parallel Circuits

Using the information in question 3 in your Student Handout, create a series and parallel circuit.

Materials:
2 D cells and holders or 6V lantern battery
4 wires
2 6.2V lantern bulbs and holders

Procedure:

1. Hook up the one bulb in series. Note the brightness.

2. Add a second bulb in series. Use a circuit diagram to help you if necessary.

3. Note bulb brightness when two bulbs are in series.

4. Rearrange the two bulbs so they are now in parallel.

5. Note the brightness of the bulbs.

6. Draw lines on the diagram below to match the description to the correct type of circuit.

A	**B**
Series	• *Has more then one path* • *Shares the electrical energy* • *When one item is turned off, all the items go off*
Parallel	• *All bulbs are bright* • *Has one path to follow* • *Bulbs dim as you add more*

Assessment and Evaluation: Unit 3 Lesson 2

Modified True/False
Indicate whether the sentence or statement is true or false. If false, change the identified word or phrase to make the sentence or statement true.

____ 1. The pressure in a hose or water line is similar to the voltage in an electric circuit.

____ 2. When one light bulb burns out in a series circuit the others stay lit.

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 3. The unit for measuring electric current is the
a. ampere.
b. volt.
c. coulomb.
d. ohm.

____ 4. The unit for measuring "electric pressure" drop is the
a. ampere.
b. volt.
c. coulomb.
d. ohm.

____ 5. What type of battery is needed to run a smoke detector?
a. 12 V
b. 1.5 V
c. 9 V
d. 115 V

____ 6. How do most manufacturers make sure you put the batteries into an appliance the proper way?

a. they are in when you buy the appliance
b. they can be placed in either way
c. a small + and - mark the different terminals
d. they assume most people have enough common sense to get it right

Assessment and Evaluation: Unit 3 Lesson 2

7. Match the term *series* or *parallel* to the following characteristics

statement	series or parallel
(a) electrical energy is shared with each load	
(b) one path	
(c) more than one path	
(d) some devices can be on and others off	
(e) all devices are either on or off	
(f) the electrical energy is not shared	

8. Draw a circuit diagram to show an energy source of two cells connected to three bulbs in parallel. A switch is positioned to turn off one light leaving two always on.

Reflection Activity: Unit 3 Lesson 2

Is your house wired in parallel or in series? Give 4 examples of evidence to support your decision.