

Electrical Circuits Design Project Assessments/Teacher Masters: Table of Contents

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Rubric 1: Circuits and Current

	Criterion A	Criterion B	Criterion C
	Circuits include a power source, an electric load, and connectors.	For an electric current to flow, there must be a complete path around the circuit and back to the power source.	Circuits can transform electrical energy into other forms of energy such as motion, light, heat, and sound.
4 - Exceeds Expectations Explores content beyond the level presented in the lessons.	Understands at a secure level (see box below) and finds examples of circuits in everyday situations.	Understands at a secure level (see box below) and can describe whether or not a wide variety of circuits follow a complete path.	Understands at a secure level (see box below) and looks for ways that electrical energy is transformed into other forms of energy in everyday situations.
3 - Secure (Meets Expectations) Understands content at the level presented in the lessons and does not exhibit misconceptions.	Is able to identify the power source, the load, and the connections in a circuit.	Knows when a circuit includes a complete path (is closed) and when it does not (is open).	Identifies when electrical energy is transformed into motion, light, heat, and sound.
2 - Developing (Approaches Expectations) Shows an increasing competency with lesson content.	Knows that circuits include certain components, but is unable to correctly identify them all.	Knows that electric current will not flow unless a circuit follows a complete path (is closed), but is not always able to tell when this occurs.	Knows that circuits can transform electrical energy into other types of energy, but does not identify specific transformations.
1 - Beginning Has no previous knowledge of lesson content.	Doesn't know that circuits include important components.	Doesn't know that for electric current to flow, there must be a complete path in a circuit.	Doesn't know that circuits can transform electrical energy into other forms of energy.

Rubric 2: Circuit Symbols and Schematics

	Criterion A	Criterion B
	Schematics are drawings that represent circuits.	Symbols in schematics represent a circuit's power source, electric load, wires, and switches.
4 - Exceeds Expectations Explores content beyond the level presented in the lessons.	Understands at a secure level (see box below) and draws schematics that represent different types of circuits.	Understands at a secure level (see box below) and can apply their understanding to draw schematics of complex circuits.
3 - Secure (Meets Expectations) Understands content at the level presented in the lessons and does not exhibit misconceptions.	Knows that schematics represent circuits and can draw them.	Correctly draws and uses symbols for a circuit's power source, electric load, wires, and switches.
2 - Developing (Approaches Expectations) Shows an increasing competency with lesson content.	Knows that schematics are drawn to represent circuits, but is not sure how to draw them.	Correctly draws and places some, but not all of the symbols in a circuit schematic.
1 - Beginning Has no previous knowledge of lesson content.	Doesn't know that schematics are drawn to represent circuits.	Is unable to correctly draw or place symbols in a circuit schematic.

Checklist: Planning and Implementing a Design

Teacher Assessment

Determine whether the following elements are evident in student's approach to designing and building a circuit. You might assign one point for each criterion the child demonstrates. You can add specific observations or comments in the space below each criterion.

Name _____

Date _____

Criteria:

_____ A. Considers and explains project goals and criteria while creating a design.

_____ B. Evaluates whether the circuit meets the project criteria at various stages of development.

_____ C. Redesigns or improves upon a design based on peer or teacher input, or other factors.

_____ D. Accepts the trial and error nature of the design process.

Name _____ Date_____

Self-Assessment: Planning and Implementing a Design

Think about the process of planning and building your circuit and answer the following questions.

1. How many of the project criteria did you think about when you made your design?

All of the criteria

Some of the criteria

None of the criteria

2. Did you check whether your circuit met the project criteria at different points?

Yes

No

3. When you built your circuit, how did you feel about trying things out, making changes, and then trying again until you and your group finished it?

Great

OK, but a little frustrated

Very frustrated

4. How many of the project criteria did your circuit meet?

All of the criteria

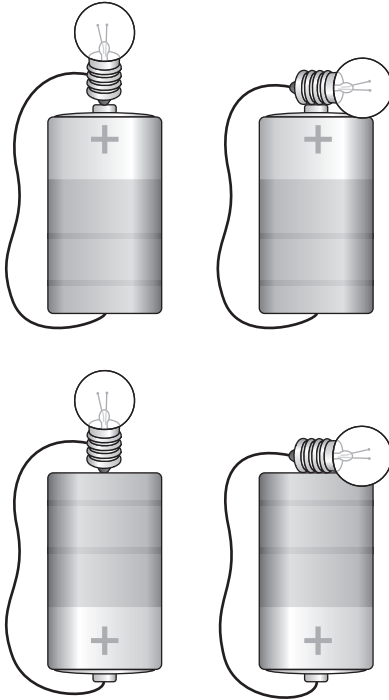
Some of the criteria

None of the criteria

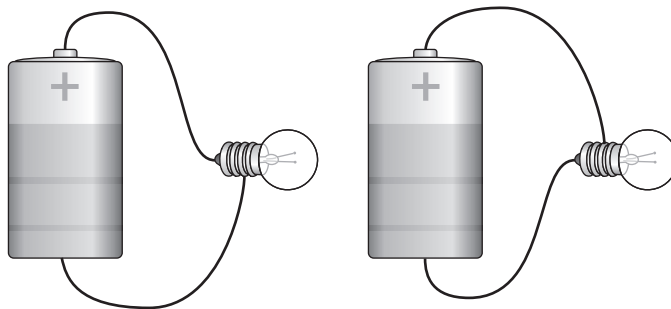
5. If you had more time to work on your circuit design, how would you change it?
Explain your answer.

Simple Circuit Examples

One wire configurations:



Two wire configurations:



Name: _____ **Date:** _____

Simple Circuit Drawings

Draw more than one way to light the bulb. Can you do it with one wire? Can you do it with two wires? How many different ways can you think of?

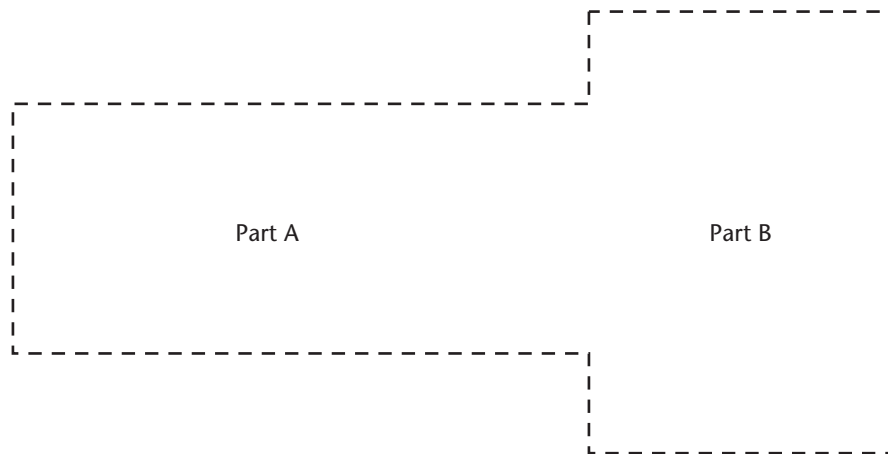
Building a Bulb Holder

Materials:

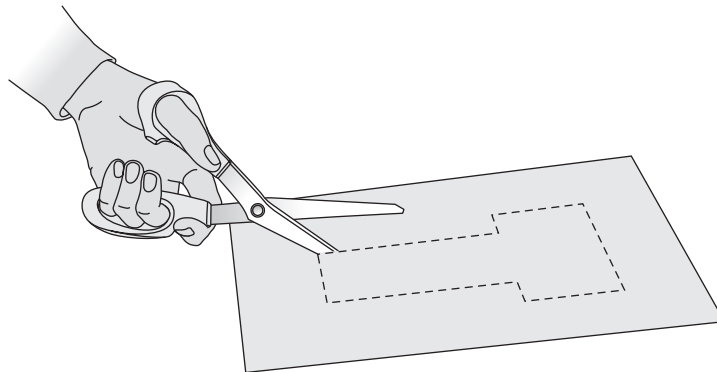
- Cardboard, thin, 15 cm x 6 cm (6 in x 2 1/4 in)
- Aluminum foil, 6 cm x 4 cm (2 1/4 in x 1 1/2 in)
- Scissors
- Glue stick
- Push pin
- Pen
- Light bulb
- Tape

Directions:

1. Cut out the shape below.

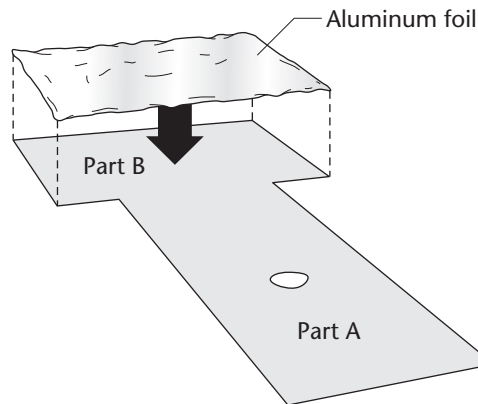


2. Lay the shape on top of the cardboard, use the pen to trace around it, and then cut out the piece of cardboard.

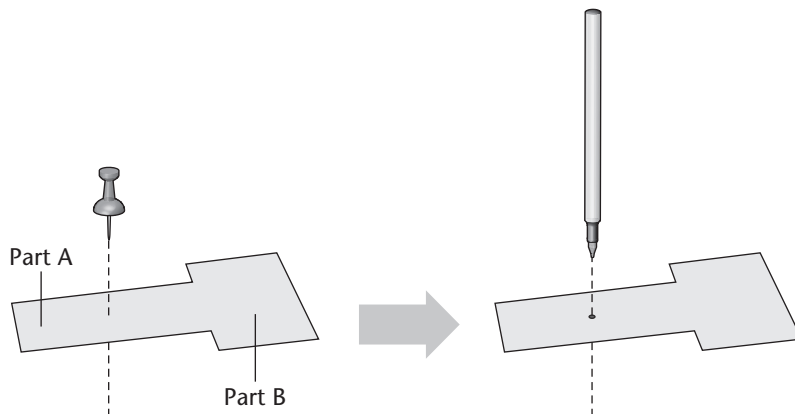


Building a Bulb Holder

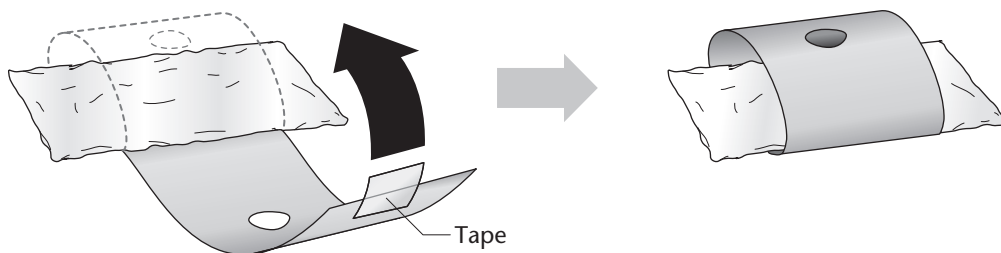
3. Glue the piece of aluminum foil onto part B of bulb holder.



4. Use a push pin to poke a hole near the middle of part A. Use a pen to widen the hole.



5. Make sure the hole is large enough for a bulb to fit into it. Then loop part A around the backside of part B. Tape it into place.



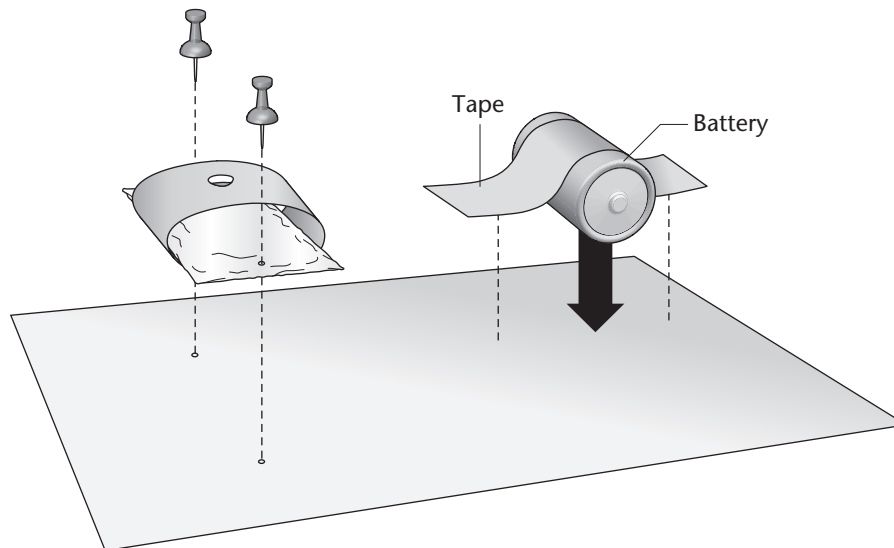
Using Bulb Holders

Materials:

- Bulb holder
- Light bulb
- Cardboard, 20 cm x 15 cm (8 in x 6 in)
- Battery, C or D cell
- 2 brads
- Push pin
- Pen
- 2 connecting wires (stripped on each end), 15 cm (6 in) long
- Electrical tape

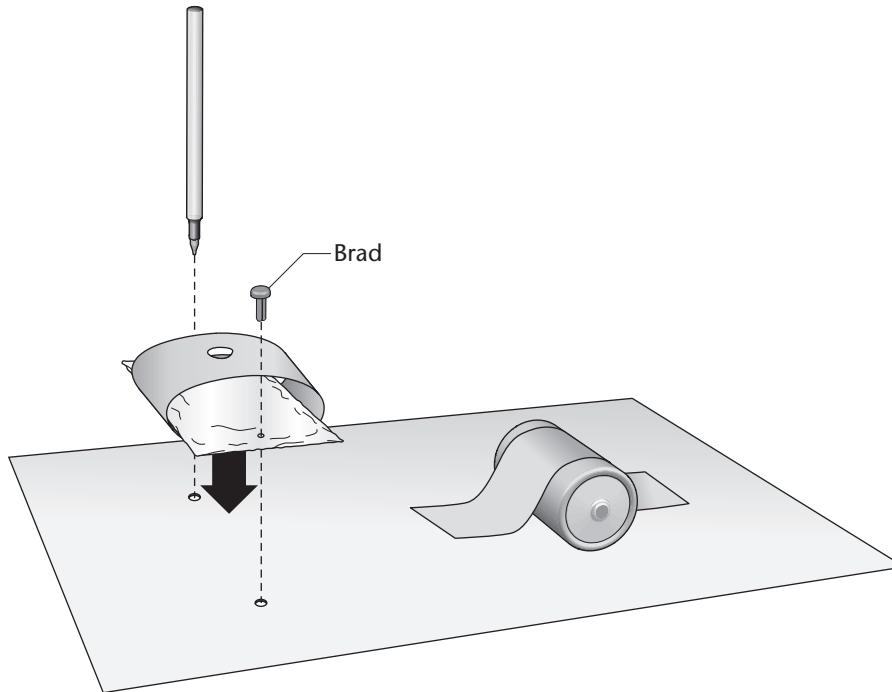
Directions:

1. Attach the battery to the cardboard circuit board by taping it down near a narrow side of the cardboard.
2. Prepare to attach the bulb holder to the cardboard circuit board by using a push pin to poke holes in the bulb holder and the cardboard circuit board below.



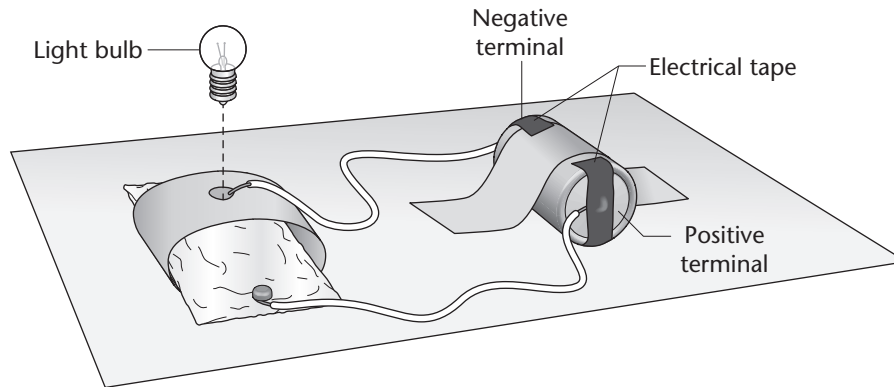
Using Bulb Holders

3. Use the tip of a pen to widen the holes and then use brads to lock the bulb holder in place on the circuit board.



Using Bulb Holders

4. Tape one end of a connecting wire to a terminal of the battery. Wrap the other end around a bulb holder brad.
5. Tape one end of the other connecting wire to the battery's other terminal. Lay the other end into the bulb holder hole.



6. Place the bulb into the bulb holder. Make sure the bottom of the bulb is touching the aluminum foil.

Name: _____ Date: _____

Circuit Symbols and Schematics

Symbols



Battery



More than one battery



Connecting wire



Electric load

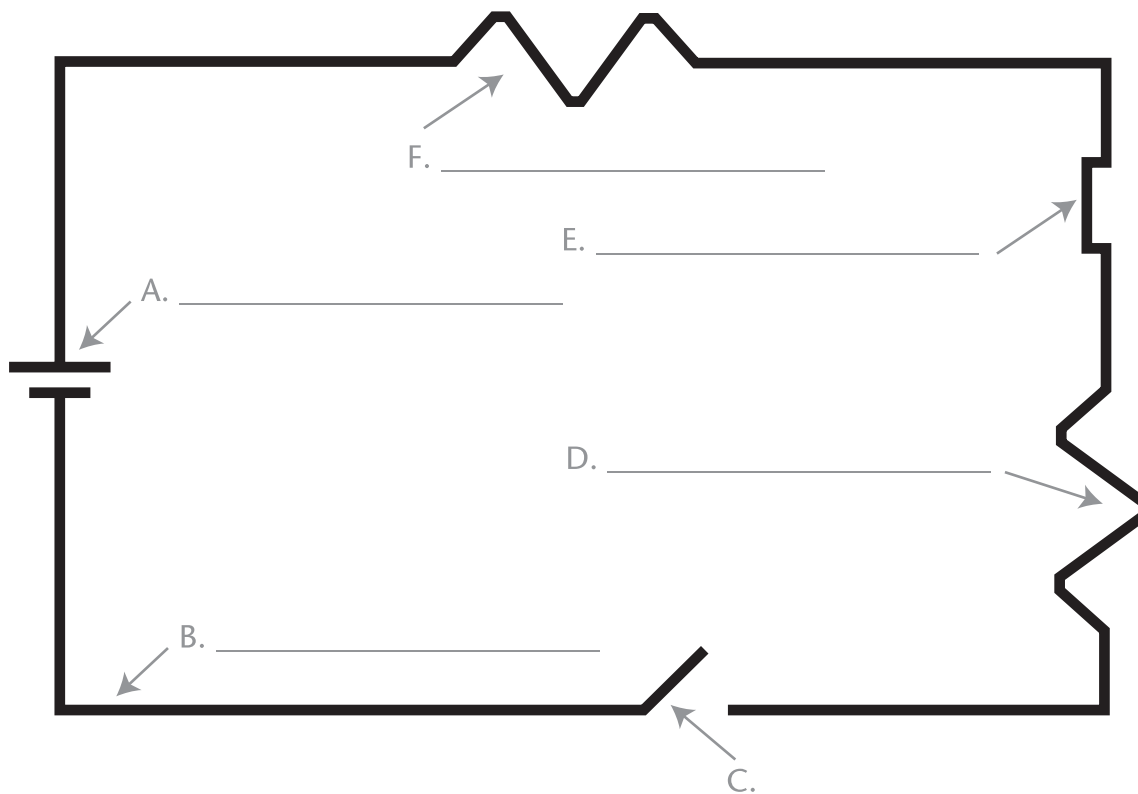


Switch (open)



Switch (closed)

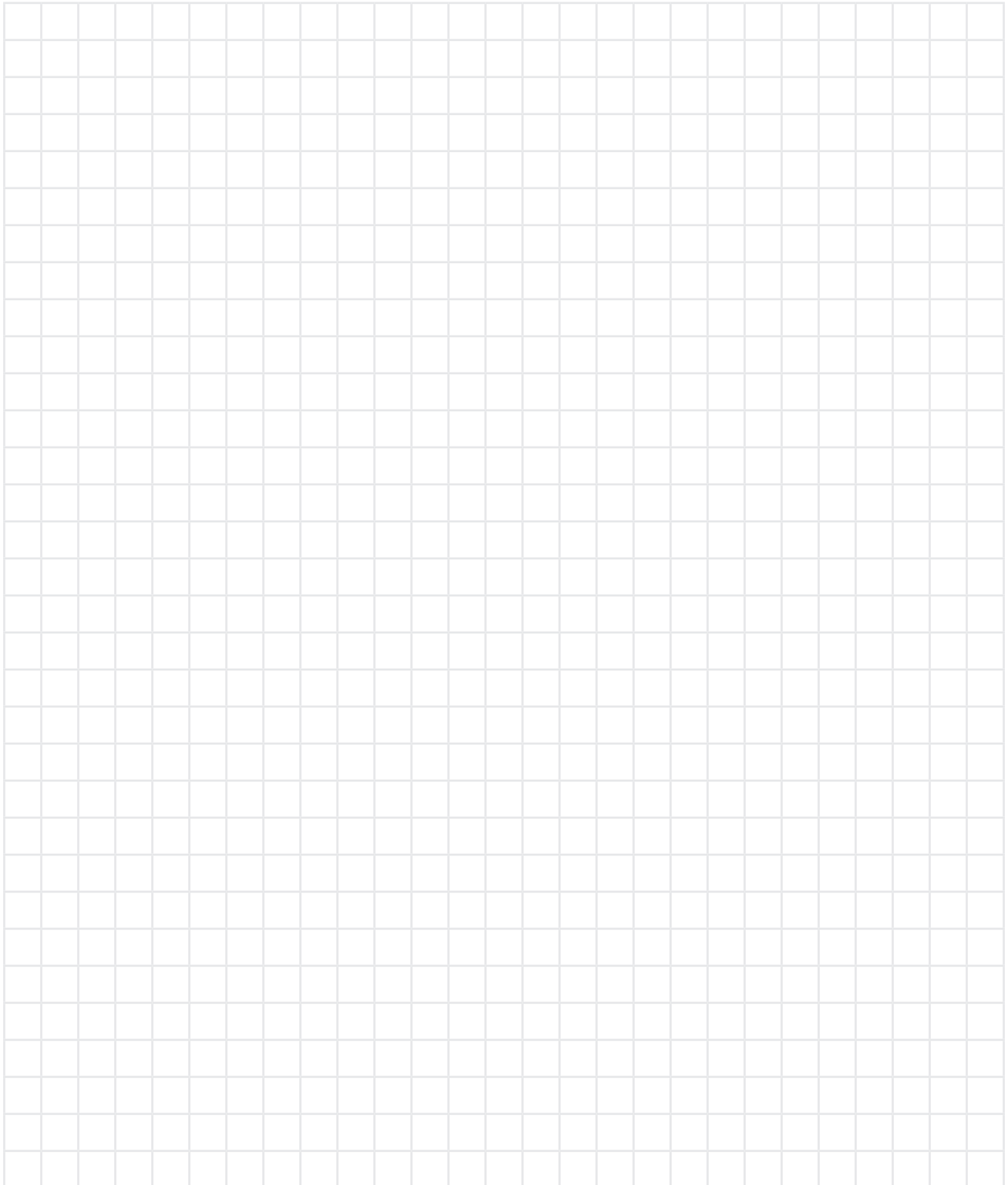
In the schematic below, label the symbols at each letter with their correct names:



Name: _____ Date: _____

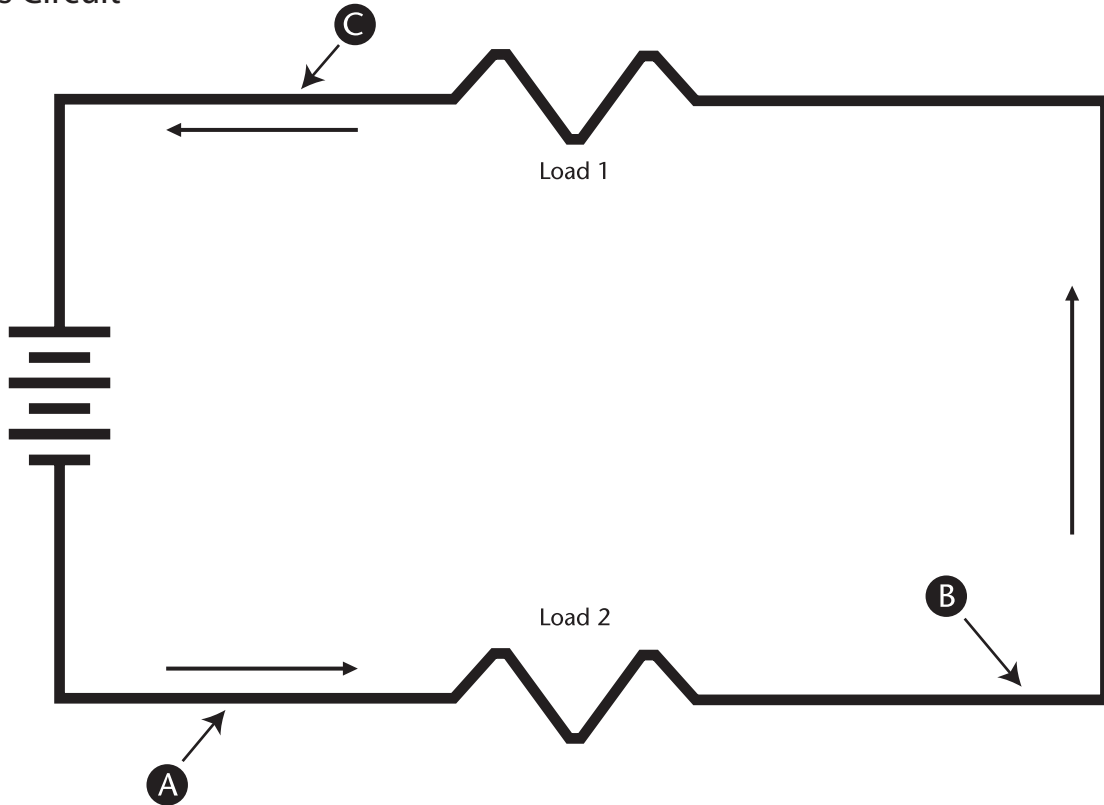
Circuit Symbols and Schematics

Draw and label a schematic of your bulb holder circuit.

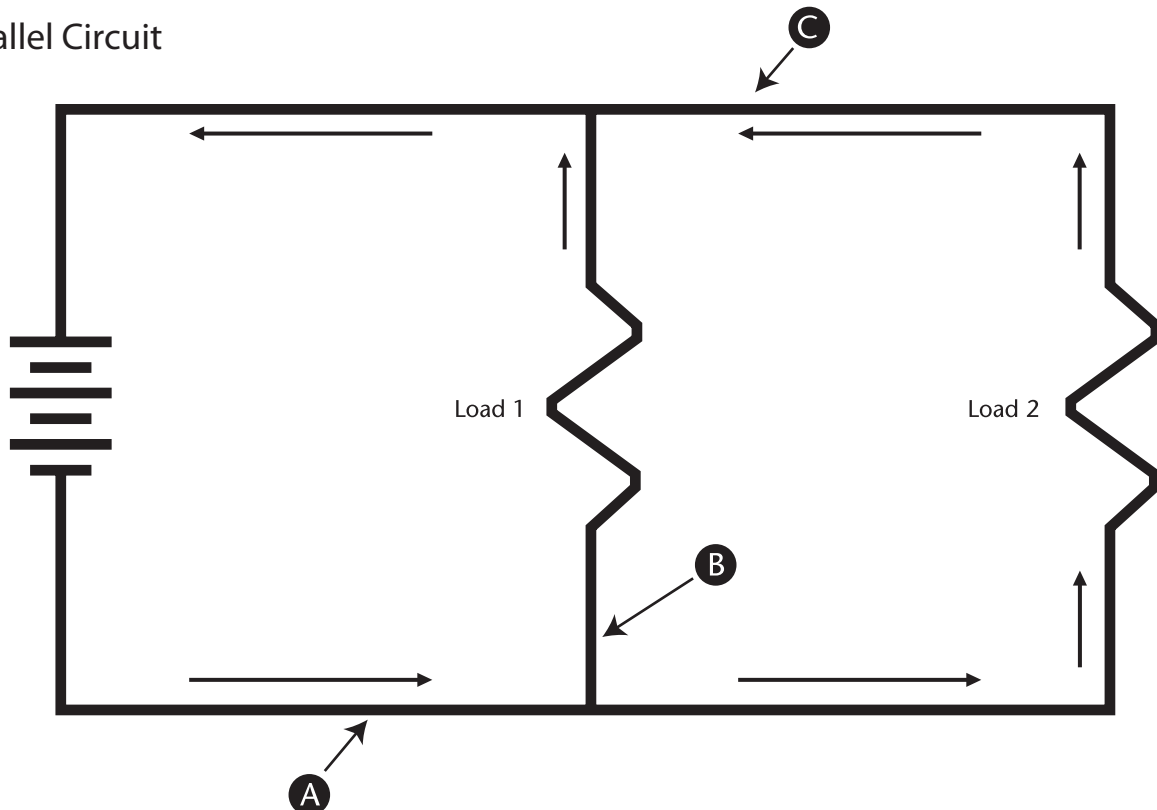


Circuit Types

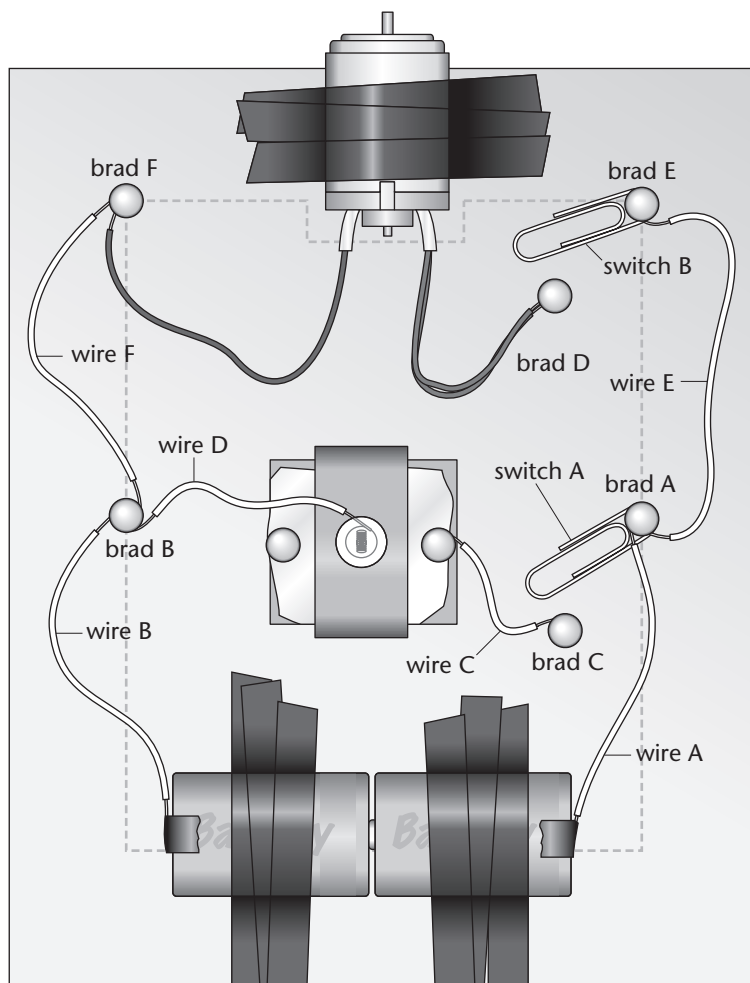
Series Circuit



Parallel Circuit



Parallel Circuit Model



Building a Parallel Circuit

Note: Use the Teacher Master “Parallel Circuit Model” to guide you as you build your parallel circuit.

Materials:

- Cardboard circuit board, 20 cm x 15 cm (8 in x 6 in)
- 2 batteries, C or D cell
- Bulb holder with bulb (from session 2)
- Electric motor
- 6 connecting wires
- Electrical tape
- 8 brads
- Push pin
- Pen
- 2 paper clips

First connect the Bulb Holder:

1. Tape the batteries next to each other near one edge of the cardboard circuit board.
2. Attach the bulb holder to the cardboard circuit board (See the Teacher Master “Using Bulb Holders” for directions.)
3. Attach the brads A, B, and C to the circuit board. Make sure brads A and C are close enough together that a paper clip could connect them.
4. Tape one end of wire A to one side of the battery. Wrap the other end of wire A around brad A.
5. Tape one end of wire B to the other side of the battery. Wrap the other end of wire B around brad B.
6. Wrap wire C around brad C. Wrap the other end around the brad holding down the bulb holder.
7. Wrap wire D around brad B. Wrap the other end around the bulb.
8. Place the bulb in the bulb holder.

Building a Parallel Circuit

Then connect the electric motor:

1. Tape the motor onto the opposite edge of the cardboard from the batteries.
2. Attach the brads D, E, and F to the circuit board. Make sure brads D and E are close enough together that a paper clip could connect them.
3. Wrap one end of wire E around brad A. Wrap the other end around brad E.
4. Wrap one end of wire F around brad B. Wrap the other end around brad F.
5. Wrap the end of one motor wire around brad D. Wrap the end of the motor's other wire around brad F.

Then add the switches:

1. Wrap one end of a paper clip around brad A.
2. Leave the paper clip's other end free.
3. Wrap one end of a paper clip around brad E.
4. Leave the paper clip's other end free.

Circuit Criteria

The circuit the groups design, build, and demonstrate must satisfy the following criteria:

1. It must include at least two electric loads in its design.
2. It must include at least one switch in its design.
3. It must be able to do something useful.

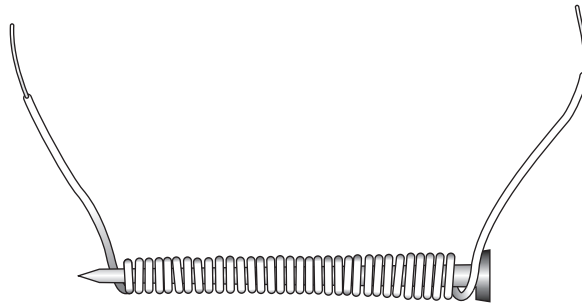
Building Electromagnets

Materials for an electromagnet:

- Bolt or nail, approximately 5 cm (2 in) long
- Length of wire, approx. 60 cm (2 ft) long

Directions to build an electromagnet:

1. Strip about 2 cm (3/4 in) of insulation from each wire end.
2. Wrap the wire around the bolt or nail as follows:
 - a. Leave about 5 cm (2 in) of wire at each end.
 - b. Wrap the wire tightly and evenly in a single coil



Name: _____ Date: _____

Circuit Materials and Schematic

List the materials required to build the circuit:

Describe what the circuit will accomplish:

Draw and label a schematic of your circuit. Use another page if needed.

