PhyzLab: Open and Short Case

an investigation of faulty circuits

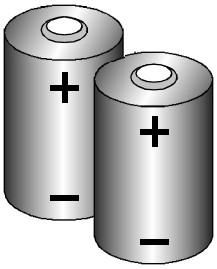
PERIOD	1.		
	2.		
GROUP	3.		
	4.		

• Questions •

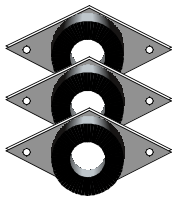
What are **open circuits** and **short circuits**? What happens if you add a stray wire to a series or parallel circuit?

• Apparatus •

___ 2 1.5 V batteries
___ 3 magnetic battery connectors (optional)
___ 2 mini light bulbs (6.3 V)
___ 1 socket for each bulb
___ 5 connecting wires
___ DC ammeter, range:~5 A

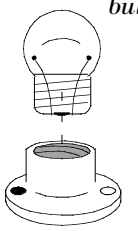


1.5 V batteries

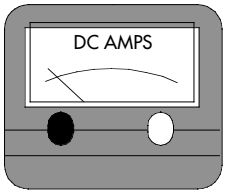


magnetic battery connectors

mini light bulb



mini bulb socket

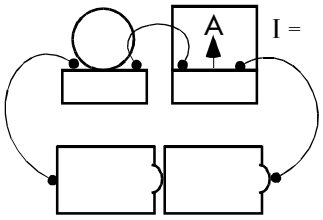


DC ammeter

• Procedure •

1. THE NORMAL CIRCUIT

Construct a circuit with two batteries, one bulb in socket, an ammeter (use a range such as 0–5 A or 0–10 A as opposed to a lower range), and three wires. If the circuit is working, there will be a reading on the ammeter. Indicate the current near the ammeter in the diagram to the right.



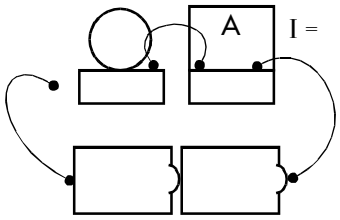
Normal Circuit

a. The batteries are connected in ___series ___parallel.

b. The bulb and ammeter are connected in ___series ___parallel.

2. THE OPEN CIRCUIT

a. Prediction. What change—if any—will occur if one of the wires connected to the bulb socket is disconnected from its terminal? What will the bulb and ammeter show? PREDICT BEFORE OBSERVING!



Open Circuit

b. Observation. What actually happens? (Describe, draw the needle on the ammeter and record its reading.)

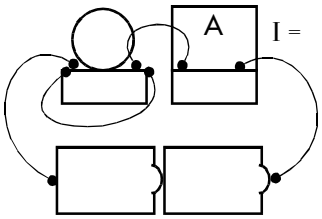
c. This is called an **open circuit.** Compared to the normal circuit, ___more ___less ___the same amount of current flows in an open circuit. Why is this?

d. The battery will last a ___long time or a ___short time in an open circuit.

3. THE SHORT CIRCUIT

a. Construct the normal circuit described in part 1 above.

b. Prediction. What change—if any—will occur if another wire is connected to both terminals of the bulb as shown to the right? What will the bulb and ammeter show? PREDICT BEFORE OBSERVING!



Short Circuit

c. Observation. What actually happens? (Describe, draw the needle on the ammeter and record its reading.)

d. This is called a **short circuit.** Compared to the normal circuit, ___more ___less ___the same amount of current flows in a short circuit. Why is this?

e. The battery will last a ___long time or a ___short time in a short circuit.

4. OPEN AND SHORT: A CONSIDERATION OF RESISTANCE

a. In which case was more electromotive force (voltage) applied to the circuit? (Electromotive force is provided by the battery arrangement.)

___Normal ___Open ___Short ___Same for all

b. Compared to the normal circuit, how much current flows in the **open** circuit?

___More ___Less ___The same

c. Compared to the normal circuit, how much current flows in the **short** circuit?

___More ___Less ___The same

d. Draw three slides: one representing the normal circuit, one representing the open circuit, and one representing the short circuit. You know the relative elevations of the slides from your evaluation of electromotive force in part 4.a. and you know the relative inclines of the slides from your evaluation of current in parts 4.b. and 4.c.

e. After drawing the diagrams, rank the slides in order from shortest to longest run length.

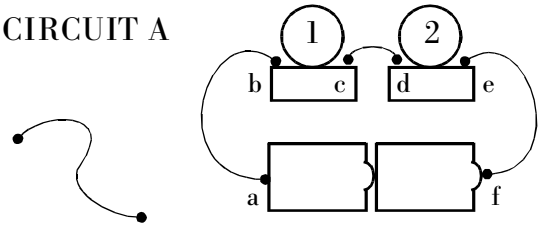
f. What can you conclude about the electrical resistance in an open circuit?

g. What can you conclude about the electrical resistance in a short circuit?

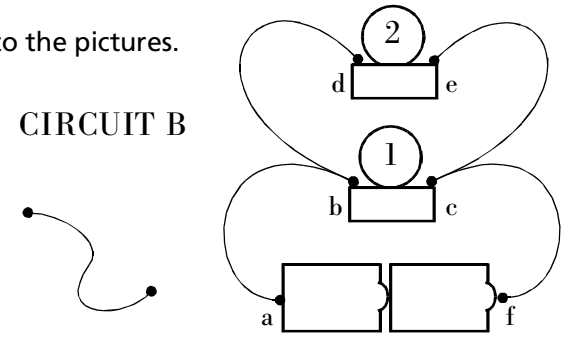
5. EAT MY CIRCUITS-HAVING-LITTLE-RESISTANCE

Circuit A is a series circuit, circuit B is a parallel circuit. Refer to the pictures.

CIRCUIT A



CIRCUIT B



a. Predictions. What will happen if the points indicated are connected with an **additional** connecting wire? The normal conditions for both circuits are that both bulbs 1 and 2 are lit. Make predictions and observations regarding the status of bulbs 1 and 2. If the bulb is on, circle it (O), if the bulb is off, cross it out (X).

b. Observations. Connect the series circuit (Circuit A). Make observations using the same notation used for predictions. Then connect the parallel circuit (Circuit B) and make observations. **Important observation note: if a bulb dims significantly or takes a few moments to go out after a connection has been made, it is considered to be out (X).**

ORIGINALLY	**Circuit A:**	(1)	(2)	**Circuit B:**	(1)	(2)

Connection	A Predictions		A Observations		B Predictions		B Observations	
a to b	1	2	1	2	1	2	1	2
b to c	1	2	1	2	1	2	1	2
c to d	1	2	1	2	1	2	1	2
d to e	1	2	1	2	1	2	1	2
e to f	1	2	1	2	1	2	1	2
f to a	1	2	1	2	1	2	1	2
a to c	1	2	1	2	1	2	1	2
a to d	1	2	1	2	1	2	1	2
a to e	1	2	1	2	1	2	1	2
b to d	1	2	1	2	1	2	1	2
b to e	1	2	1	2	1	2	1	2