



Developed with funds provided by the National Science Foundation

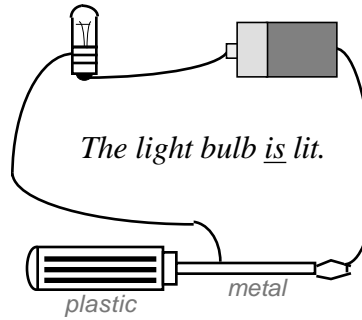
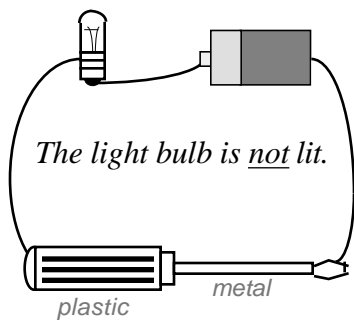
Some items on this assessment were drawn from existing databases of items, such as released items from the TIMSS.

NAME \_\_\_\_\_

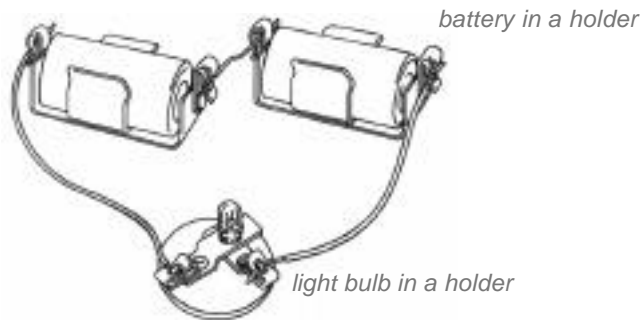
DATE \_\_\_\_\_

1. Kareem's flashlight is not working. The flashlight uses two batteries. How could he test the batteries to see if they both still have energy? *You may circle more than one answer.*
- a) Separately test each battery in a circuit with a light bulb.
  - b) Put both batteries in the same circuit at the same time with a light bulb.
  - c) Put both batteries in an identical flashlight and see if it works.
  - d) See whether the same flashlight works with different batteries.

The drawings show two different circuits, each containing a screwdriver with a plastic handle.

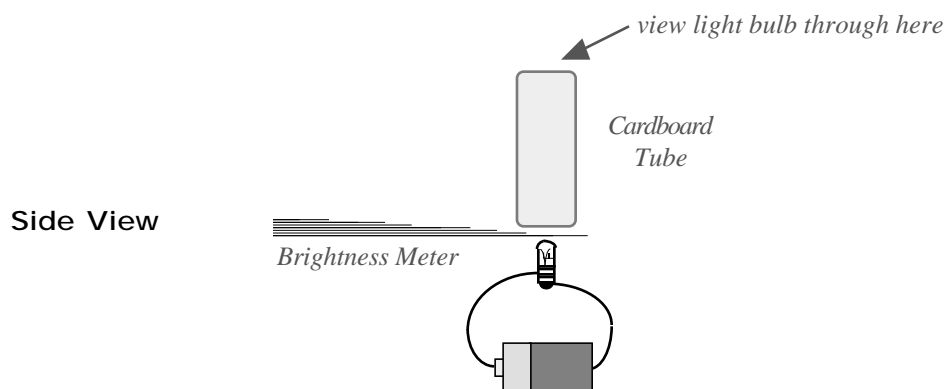


2. What is the best claim you could make from the observations of the light bulb? *Circle only one answer.*
- a) Electricity cannot flow through a screwdriver.
  - b) Electricity cannot flow through the handle of a screwdriver.
  - c) Electricity cannot flow through plastic.
  - d) Electricity cannot flow through some circuits.



3. When Becky built the circuit shown, the light bulb did not light. What could she check to find out why the bulb did not light. *You may circle more than one answer.*
- a) Check the batteries to see if they are dead.
  - b) Check the batteries to make sure they are facing the same direction.
  - c) Check the light bulb to make sure it has a good connection in its holder.
  - d) Check to see that the wires between the battery and the light bulb holder are connected.

To measure the brightness of a light bulb in a circuit, Ramone used a brightness meter with layers of paper. The drawing shows where to place the brightness meter to measure the brightness of a light bulb.



The table shows what Ramone observed with the brightness meter.

Number of layers of paper	Can I still see the light?
1	Yes
2	Yes
3	Yes
4	No
5	No

4. The brightness of a light bulb is the number of layers of paper through which the light could **last** be seen. What was the brightness of the light bulb Ramone tested? *Circle only one answer.*
- a) 2 layers
  - b) 3 layers
  - c) 4 layers
  - d) 5 layers
5. What questions could the brightness meter help Ramone investigate? *You can circle more than one answer.*
- a) Are these light bulbs the same brightness?
  - b) Will these light bulbs be bright?
  - c) Does the battery determine the brightness of a light bulb?
  - d) Do batteries of different types light a light bulb?
  - e) Do light bulbs of different types give off the same amount of light?

Helen used a brightness meter to observe the brightness of a bulb in a circuit in which she changed the number of light bulbs. With one light bulb in the circuit, she observed a brightness of 14 layers; with four light bulbs in the circuit the brightness of one bulb was 1 layer; with three light bulbs in the circuit the brightness was 2 layers; and with two light bulbs in the circuit the brightness of one bulb was 5 layers.

6. Which table below shows the best organization of Helen's data? *Circle only one answer.*

a)

1	14
4	1
3	2
2	5

b)

1 light bulb	14 layers	2 light bulbs	5 layers
3 light bulbs	2 layers	4 light bulbs	1 layers

c)

Number of Light Bulbs	Brightness (layers)
1	14
4	1
3	2
2	5

d)

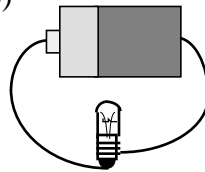
Number of Light Bulbs	Brightness (layers)
1	14
2	5
3	2
4	1

7. Jarod is investigating electric circuits. He built a circuit with one battery and one light bulb. What should he record in his notebook? *Circle only one answer.*

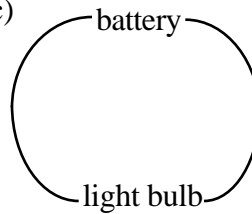
a)



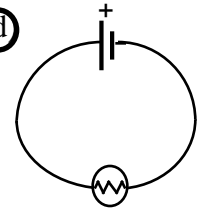
b)



c)



d)

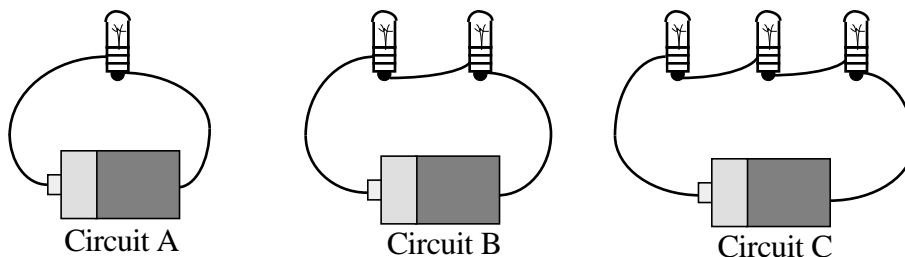


Jarod and Taneesha wanted to know how the amount of *voltage* in a circuit affected the *brightness* of a light bulb. To investigate, they each built a circuit with one light bulb and one battery of the same type. Then, they each kept adding more batteries to the circuit in order to increase the voltage. Each time they made a new circuit, they each used brightness meters to measure the brightness of the light bulb. Their measurements are shown in the table.

Number of Batteries	Voltage (volts)	Number of Light Bulbs	<i>Jarod</i>	<i>Taneesha</i>
			Brightness (layers)	Brightness (layers)
1	1.5	1	10	11
2	3	1	18	20
3	4.5	1	19	29
4	6	1	21	38

8. What brightness did Jarod measure in the circuit powered by 3 volts? *Circle only one answer.*
- 2 layers
  - 4.5 layers
  - 18 layers
  - 19 layers
9. What is the best claim that Jarod can make from his data? *Circle only one answer.*
- The more circuits you make, the more batteries you need.
  - The more light bulbs you put in a circuit, the brighter the light.
  - The more batteries you put in a circuit, the brighter the light.
  - The more voltage you have in a circuit, the brighter the light.
10. Jarod and Taneesha's data were quite different except for the brightness readings with one battery. What is the most likely reason for the difference? *Circle only one answer.*
- Jarod used a different type of light bulb, except for the first reading.
  - Jarod used batteries that were not at full strength, except for the first one he used.
  - Jarod did not use his brightness meter correctly, except for the first reading.
  - Jarod used different wires, which affected his light bulb when there were multiple batteries.

Jada's class wanted to know how the amount of *resistance* in a circuit affected the *brightness* of a light bulb. The drawings show the circuits they made, with more light bulbs in a circuit giving it more resistance. Each group in the class made all the circuits shown, using new batteries and light bulbs of the same type. They measured a light bulb's brightness using standard brightness meters with 10 layers.



The table shows the data from each group in the class.

All groups measured brightness using standard brightness meters of 10 layers.

	Circuit A Brightness (layers)	Circuit B Brightness (layers)	Circuit C Brightness (layers)
Group 1	18	9	5
Group 2	17	7	3
Group 3	15	7	4
Group 4	18	8	3
Jada's Group	10	8	5

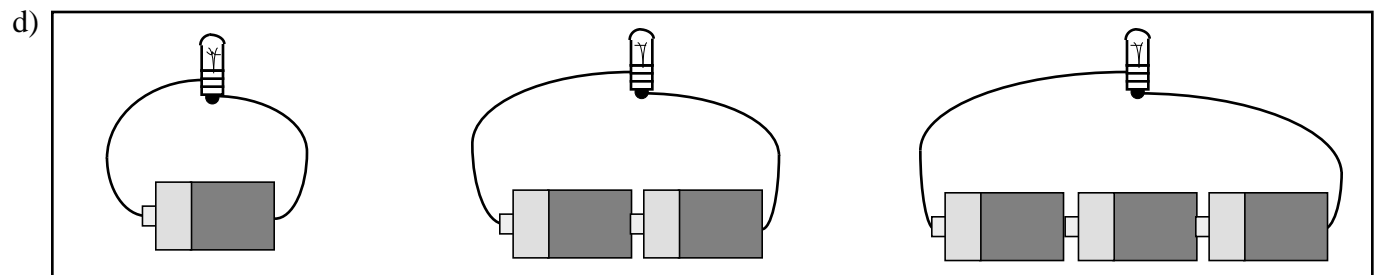
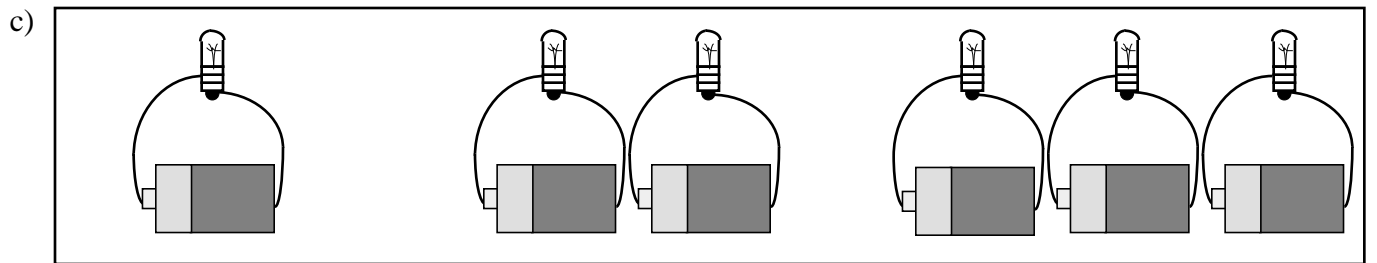
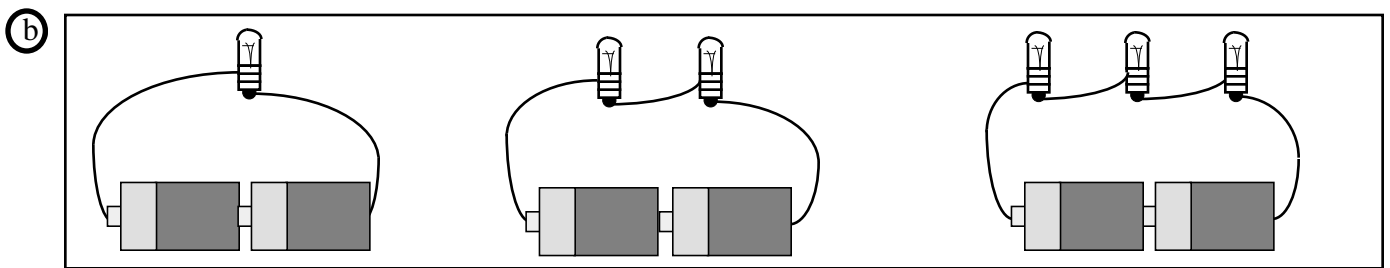
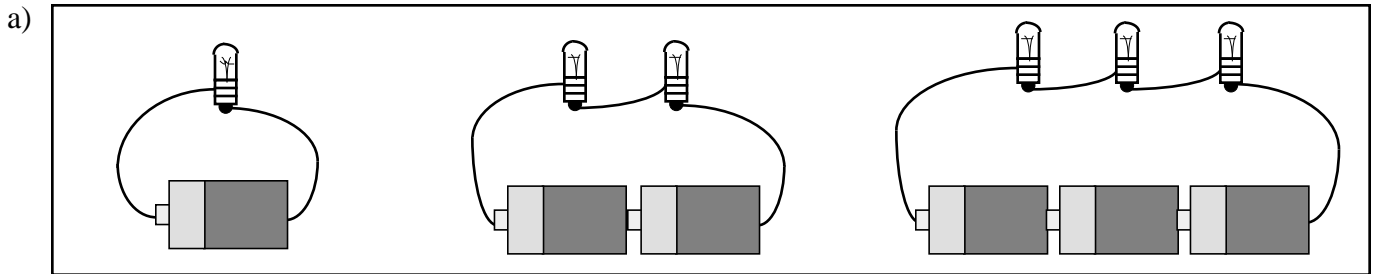
11. For Group 3, what was the brightness of the light bulb in Circuit C? *Circle only one answer.*
- 3 layers
  - 4 layers
  - 7 layers
  - 15 layers
12. Which statement makes the best claim about the data in the table? *Circle only one answer.*
- With more trials, the light bulbs in a circuit get less bright.
  - With more batteries in a circuit, the light bulbs are brighter.
  - With more light bulbs in a circuit, the light bulbs are not as bright.
  - With more resistance in a circuit, the light bulbs are not as bright.
13. Jada thinks there may be an error with her group's data for Circuit A because it was so different from the other groups' data. What is the most likely reason for the difference? *Circle only one answer.*
- Jada's brightness meter was too narrow.
  - Jada's brightness meter had missing sheets.
  - Jada's group used only one brightness meter.
  - Jada's group used a brightness meter with thinner paper.

Tamara used a brightness meter to test the brightness of light bulbs in different circuits. In each circuit, she used new batteries and the same type of light bulb.

14. Tamara wants to test her idea that:

*The brightness of a light bulb **decreases** as more light bulbs are added to a circuit.*

Circle the best set of circuits for Tamara to use to investigate her idea. *Circle only one answer.*

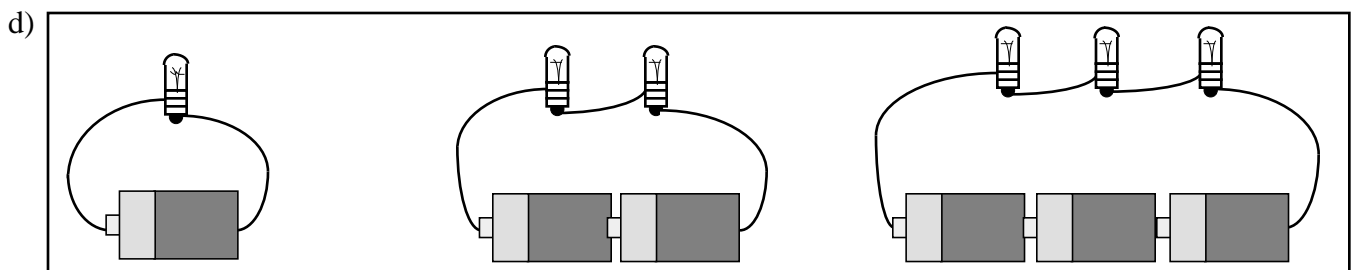
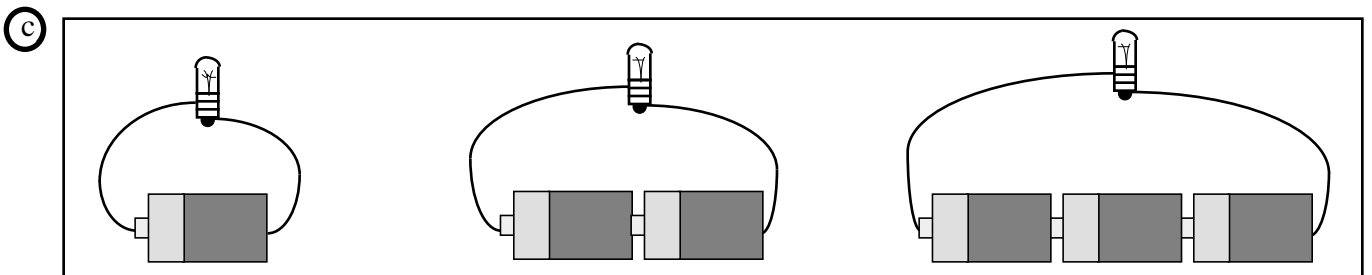
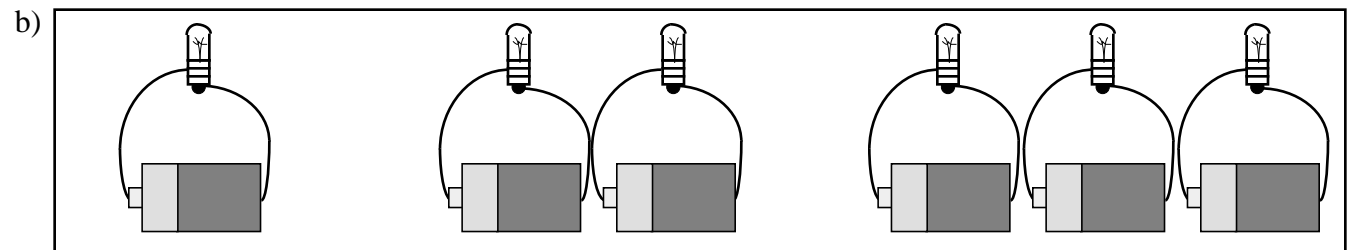
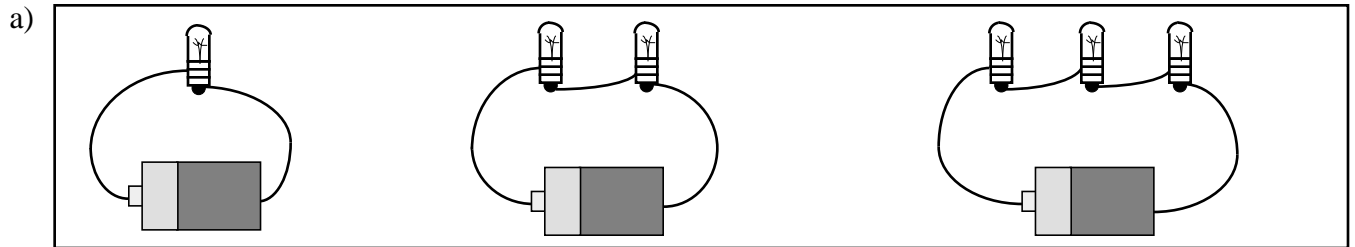


Abdul used a brightness meter to test the brightness of light bulbs in different circuits. In each circuit, he used new batteries and the same type of light bulb.

15. Abdul wants to test his idea that:

*Adding batteries to an electric circuit **increases** the brightness of a light bulb in that circuit.*

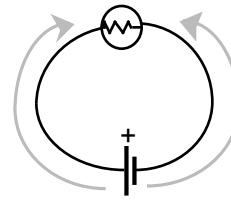
Circle the best set of circuits for Abdul to use to investigate his idea. *Circle only one answer.*



## Thinking about Electricity

8

The diagram at the right shows Christa's model of the flow of electricity in a circuit with one battery and one light bulb. The key shows what the symbols in her diagram represent.



Key:

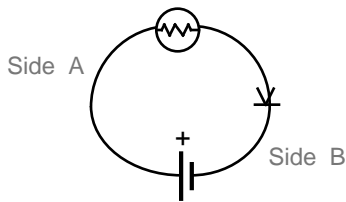
	battery
	light bulb
	wire

	diode
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Christa can test her model by using a **diode** because a diode allows electricity to flow only in a particular direction.

The symbol for a diode contains an arrow, which shows the direction electricity is allowed to flow. If the diode is placed in a direction that is opposite to the actual flow of electricity, then electricity will not flow in the circuit.

Christa's plan for the first test of her model was to place a diode in Side B of the circuit, in the position shown in the diagram.



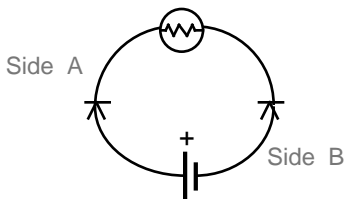
16. In what direction will the diode in Side B allow electricity to flow? *Circle only one answer.*

- a) From the battery to the bulb.
- b) From the bulb to the battery.
- c) Cannot tell from the information given.

17. If Christa's model is accurate, what would she predict she would observe when she tested this circuit? *Circle only one answer.*

- a) The light would light.
- b) The light would not light.
- c) She cannot predict from her model because this is not a test of it.

Before testing the circuit, Christa changed her mind. She thought using two diodes in the circuit at the same time was a better test of her model. The diagram shows where she placed each diode.



18. How does the placement of the diodes compare to Christa's model? *Circle only one answer.*

- a) They allow electricity to flow in the same direction as her model.
- b) They allow electricity to flow in a direction that is opposite to her model.

19. If the bulb does not light, what should Christa conclude? *Circle only one answer.*

- a) The flow in Side A of the circuit is from the bulb to the battery.
- b) The flow in Side B of the circuit is from the bulb to the battery.
- c) The flow in Sides A and B is from the bulb to the battery.
- d) There is not enough data to conclude anything at this time.

20. If the bulb does not light, what is best for Christa to do next to further test her ideas about the flow of electricity? *Circle only one answer.*

- a) Reverse the direction of both diodes, and observe again.
- b) Remove Side A diode, and observe again.
- c) Remove Side B diode, and observe again.
- d) Remove Side B diode, reverse Side A diode, and observe again.