96 3-Way Switch

Purpose

To explore ways to turn a lightbulb on or off from either one of two switches.

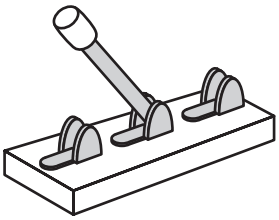
Required Equipment/Supplies

2.5-V DC lightbulb with socket
connecting wire
2 single-pole double-throw switches
2 1.5-V size-D dry cells connected in series in a holder

Discussion

Frequently, multistory homes have hallways with ceiling lights. It is convenient if you can turn a hallway light on or off from a switch located at either the top or bottom of the staircase. Each switch should be able to turn the light on or off, regardless of the previous setting of either switch. The same arrangement is often adopted in a room with two doors. In this activity, you will see how simple, but tricky, such a common circuit really is!

Procedure



Single Pole
Double-Throw Switch

Step 1: Examine a 3-volt battery (formed from two 1.5-volt dry cells with the positive terminal of one connected to the negative terminal of the other). Connect a wire from the positive terminal of the battery to the center terminal of a single-pole double-throw switch. Connect a wire from the negative terminal of the same battery to one terminal of the lightbulb socket. Connect the other terminal of the lightbulb socket to the center terminal of the other switch.

Step 2: Now interconnect the free terminals of the switches so that the bulb turns on or off from either switch. That is, when both switches are closed in either direction, moving either switch from one side to the other will always turn an unlit bulb on or a lit bulb off.

Devise working circuit.

Step 3: Draw a simple circuit diagram of your successful circuit.

Diagram 3-way switch.

Activity

Reverse polarity of battery.

Step 4: The polarity of a battery can be reversed in a circuit by switching the connections to the positive and negative terminals. Predict whether your successful circuit will work if you reverse the polarity of the battery.

prediction: _____

Now reverse the polarity and record the result.

result: _____

Interchange battery and bulb.

Step 5: Predict whether your successful circuit will work if you reconnect the circuit so that the battery is where the lightbulb is now, and vice versa.

prediction: _____

Now try it and record your results.

results: _____

Analysis

An ordinary switch has an "on" setting, which closes the circuit at that point, and an "off" setting, which opens the circuit at that point. On the switches you used in this activity, what function do the two "closed" settings on each switch have? Can either setting keep the circuit open independently of how the other switch is set?

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