

Questions

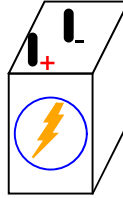
Question 1

In the simplest terms you can think of, define what an electrical *circuit* is.

file 00017

Question 2

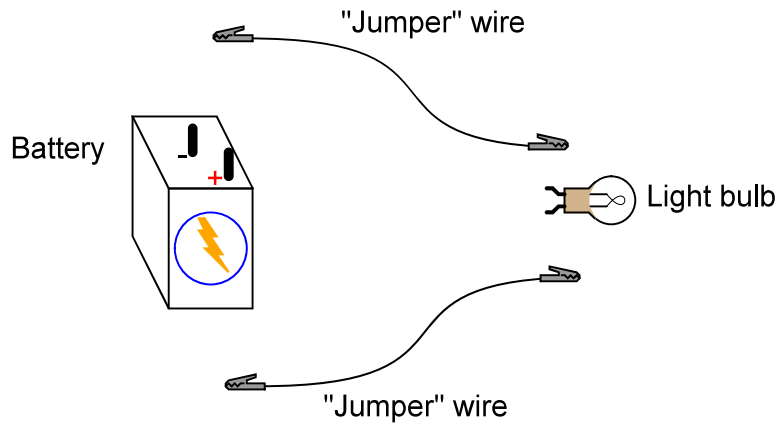
Given a battery and a light bulb, show how you would connect these two devices together with wire so as to energize the light bulb:



file 00001

Question 3

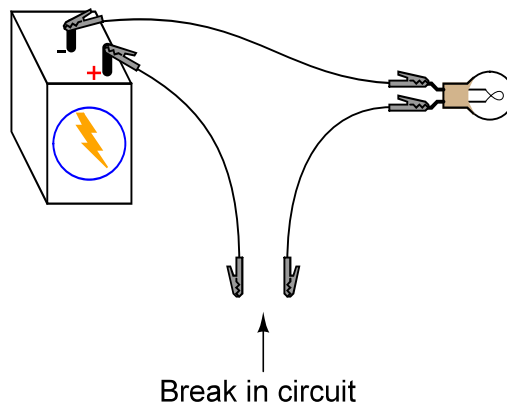
Build a simple electric circuit using a battery as the electrical energy *source*, and a small light bulb as the electrical *load* (I suggest using a 6-volt "lantern" battery and a miniature incandescent light bulb rated for either 6 or 12 volts). Use "jumper" wires with metal clips at the ends to join these two electrical devices together:



After connecting the components together properly so the light bulb lights up, answer the following questions:

- What conditions must be met for the light bulb to light up?
- What happens if the circuit is "broken"?
- Does it matter where the circuit is "broken"?

Then, add a third jumper wire to the circuit so you have a ready "break" to experiment with:



Try bridging this "break" with various materials, and note whether or not the light bulb lights up:

- Paper
- Steel paper clip
- Gold ring
- Rubber eraser
- Pencil lead (graphite)

Also, try touching the jumper wire ends together along their plastic exteriors, rather than at the metal "clip" ends. Does the light bulb light up when you do this?

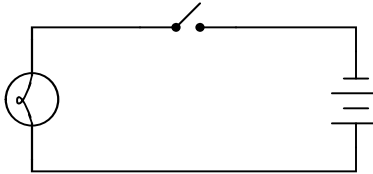
Explain what this experiment demonstrates about the electrical *conductivity* of the various substances listed as well as the plastic coating of the jumper wires. Also explain why electrical wires are provided with that plastic coating, instead of being bare metal. Finally, explain what this experiment has taught you about electric circuits in general.

file 01697

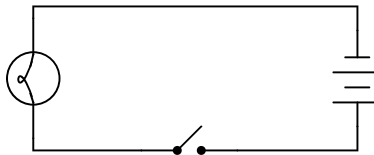
Question 4

What difference will it make if the switch is located in either of these two alternate locations in the circuit?

Switch on negative side of circuit



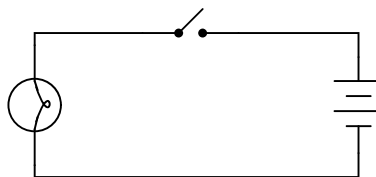
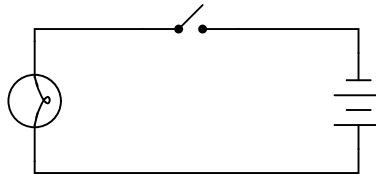
Switch on positive side of circuit



file 00014

Question 5

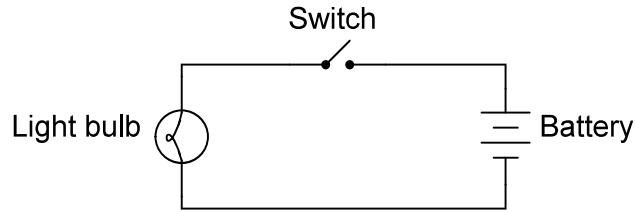
What difference will it make if the battery in this circuit is reversed in direction?



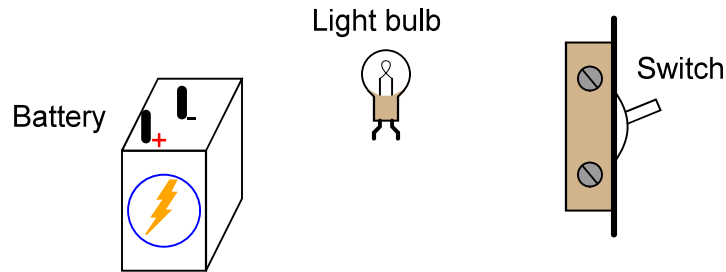
file 00076

Question 6

Examine this schematic diagram:



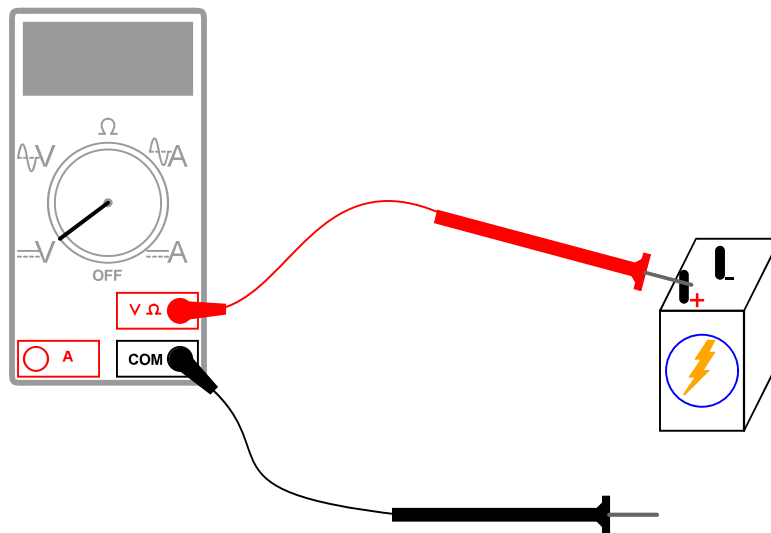
Now, without moving the following components, show how they may be connected together with wires to form the same circuit depicted in the schematic diagram above:



file 00069

Question 7

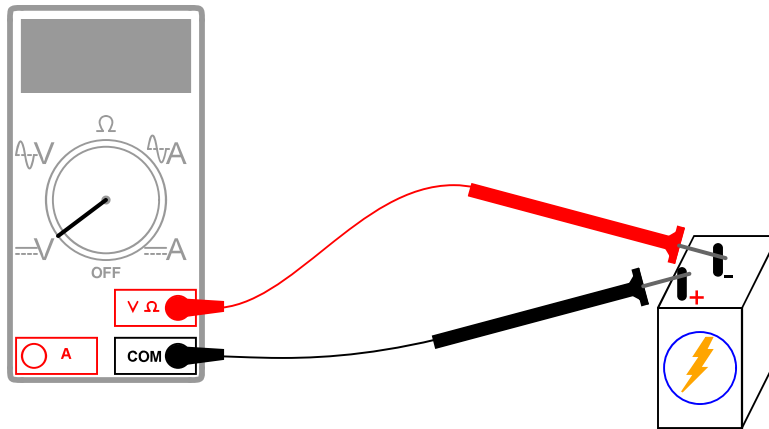
What will this voltmeter register when connected to a battery as shown (assume a battery voltage of 6 volts)? Explain your answer.



file 00020

Question 8

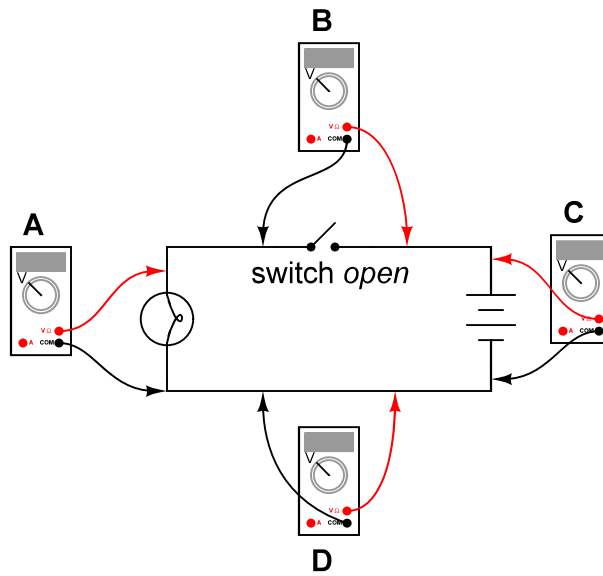
What will this voltmeter register when connected to a battery as shown (assume a battery voltage of 6 volts)? Explain your answer.



file 00021

Question 9

Determine what these four voltmeters (A, B, C, D) will register when connected to this circuit in the following positions (assume a battery voltage of 6 volts):

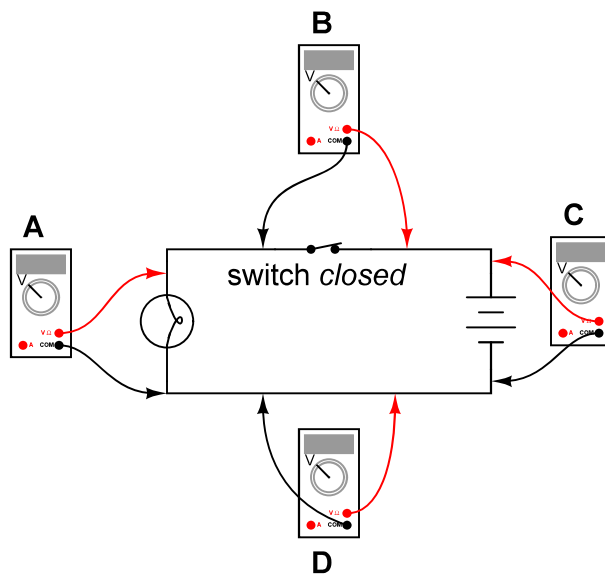


- Voltmeter A =
- Voltmeter B =
- Voltmeter C =
- Voltmeter D =

file 00015

Question 10

Determine what these four voltmeters (A, B, C, D) will register when connected to this circuit in the following positions (assume a battery voltage of 6 volts):

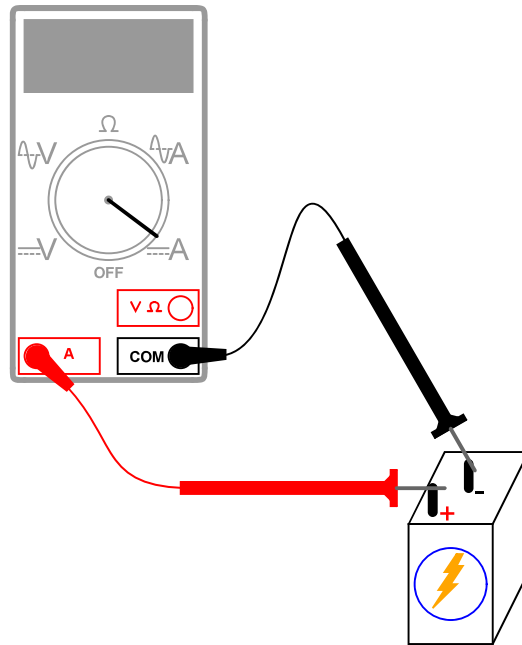


- Voltmeter A =
- Voltmeter B =
- Voltmeter C =
- Voltmeter D =

file 00016

Question 11

Why is it a very bad idea to connect an ammeter directly across a voltage source, like this?

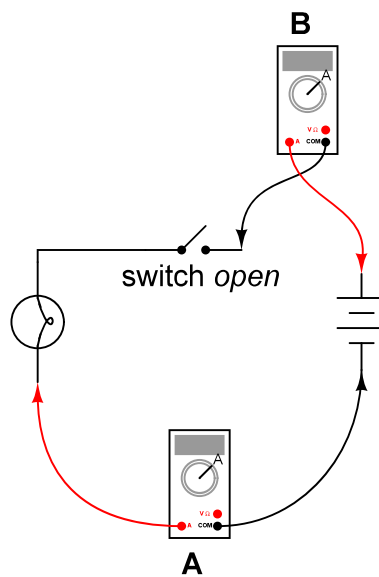


file 00070

Question 12

In this circuit, is the light bulb lit? Why or why not?

Also, compare the relative indications of the two ammeters (which ammeter registers the greatest amount of current, and which ammeter registers the least amount of current, or do they both register the same amount of current?).

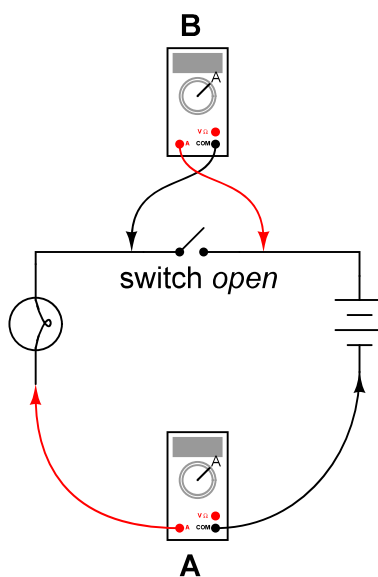


file 00023

Question 13

In this circuit, is the light bulb lit? Why or why not?

Also, compare the relative indications of the two ammeters (which ammeter registers the greatest amount of current, and which ammeter registers the least amount of current, or do they both register the same amount of current?).

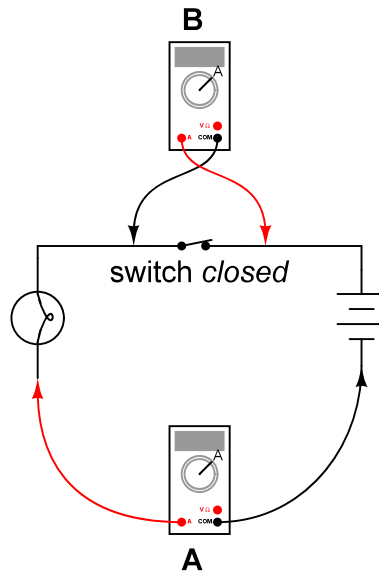


file 00025

Question 14

In this circuit, is the light bulb lit? Why or why not?

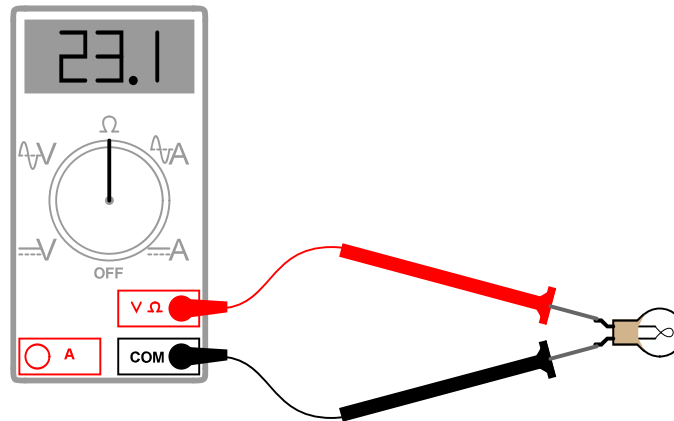
Also, compare the relative indications of the two ammeters (which ammeter registers the greatest amount of current, and which ammeter registers the least amount of current, or do they both register the same amount of current?).



file 00029

Question 15

Explain how an ohmmeter is able to measure the resistance of a component (in this case, a light bulb) when there is no battery or other source of power connected to it:



Also, identify the reading you would expect the ohmmeter to indicate if the light bulb were burnt out (failed "open").

file 00101

Question 29

Shown here is the schematic symbol for a *resistor*:



What is the purpose of a resistor? What function does it perform? Also, draw an illustration of what a real resistor looks like.

[file 00059](#)

Question 30

Resistors are sometimes represented in electrical and electronic schematic diagrams by a symbol other than this:

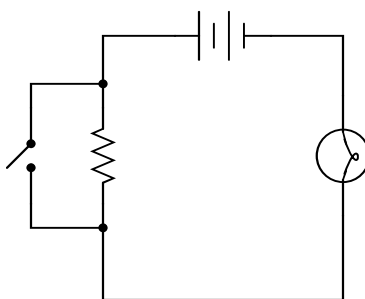


Draw this other symbol next to the one shown above.

[file 00060](#)

Question 31

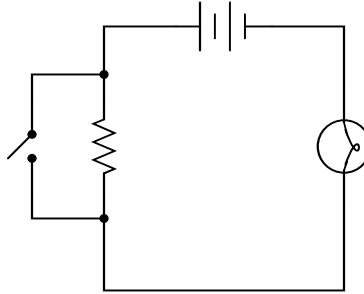
What will the light bulb do when the switch is open, and when the switch is closed?



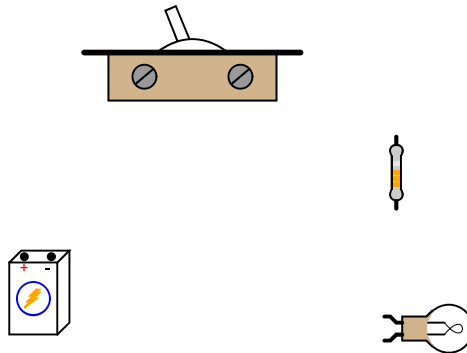
[file 00058](#)

Question 32

Examine this schematic diagram:



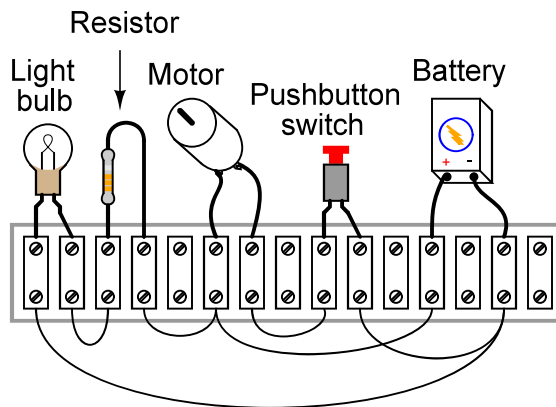
Now, without moving the following components, show how they may be connected together with wires to form the same circuit depicted in the schematic diagram above:



file 00067

Question 33

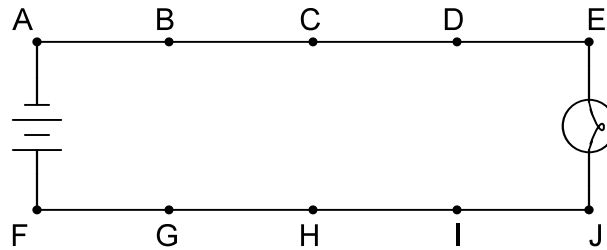
From observation of this circuit (with components attached to a "terminal strip"), draw an appropriate schematic diagram:



file 00115

Question 34

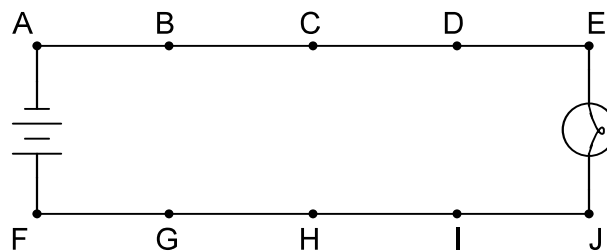
In this circuit, where would you expect to measure full battery voltage (between what pairs of test points)?



file 00119

Question 35

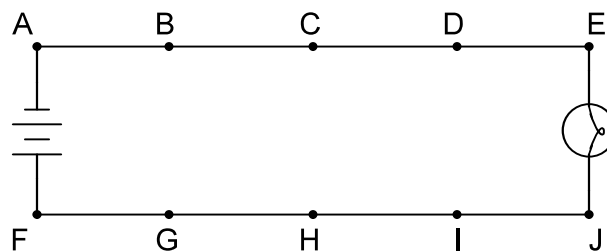
In this circuit, where would you *not* expect to measure significant voltage (between what pairs of test points)?



file 00120

Question 36

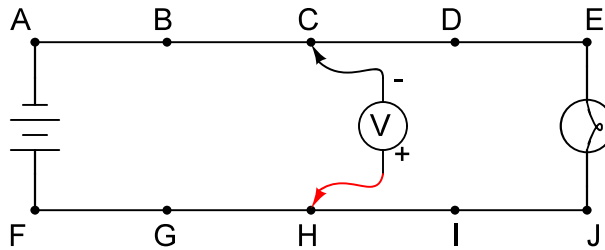
Suppose this battery and light bulb circuit failed to work. Using nothing but a voltmeter, how would you check the circuit to determine where the problem is located? Note: the letters indicate "test points" along the wiring where you may probe with the circuit with your voltmeter.



file 00118

Question 37

Suppose this battery and light bulb circuit failed to work:

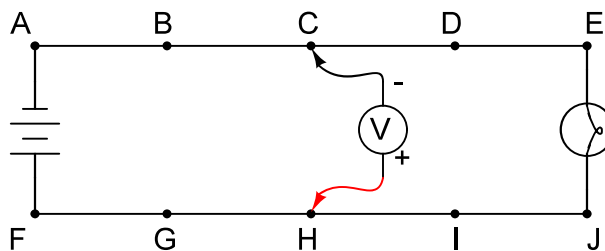


Using a voltmeter, a technician measures full battery voltage between the points C and H. What does this single measurement indicate about the condition of the circuit? Be as specific as you can.

[file 00122](#)

Question 38

Suppose this battery and light bulb circuit failed to work:

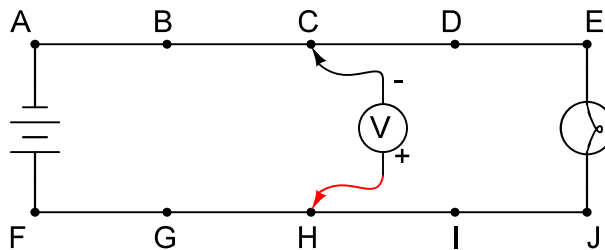


Using a voltmeter, a technician measures full battery voltage between the points C and H. The result of this single measurement indicates which half of the circuit there is a definite problem in. What would you recommend as the *next* voltmeter measurement to take in troubleshooting the circuit, following the same "divide in half" strategy?

[file 00124](#)

Question 39

Suppose this battery and light bulb circuit failed to work:

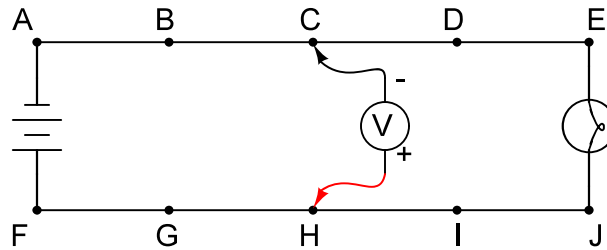


Using a voltmeter, a technician measures 0 volts between the points C and H. What does this single measurement indicate about the condition of the circuit? Be as specific as you can.

[file 00123](#)

Question 40

Suppose this battery and light bulb circuit failed to work:

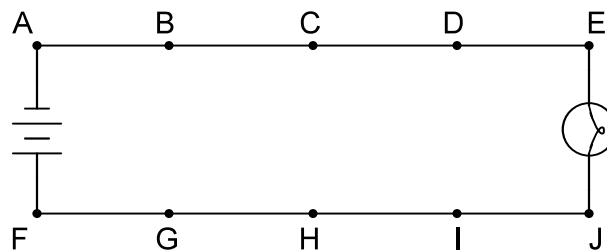


Using a voltmeter, a technician measures 0 volts between the points C and H. The result of this single measurement indicates which half of the circuit there is a definite problem in. What would you recommend as the *next* voltmeter measurement to take in troubleshooting the circuit, following the same "divide in half" strategy?

[file 00125](#)

Question 41

Suppose this battery and light bulb circuit failed to work:



Using nothing but a voltmeter, a technician measures voltage between the following sets of points:

- Between A and C: 0 volts
- Between D and G: 12 volts
- Between E and J: 0 volts
- Between B and E: 12 volts

From these voltage measurements, what can you tell about the condition of the battery, wiring, and light bulb? Be as specific as you can.

Challenge question: identify which of the four measurement are unnecessary in determining the precise location of the fault in this circuit.

[file 00121](#)