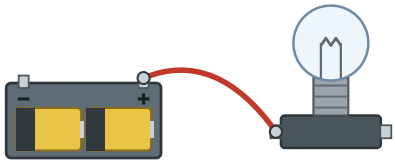
Circuit doctor: fix the circuits and test the materials

Name: Class: Date:

Four students built a circuit to light a bulb, and none of the bulbs lit. For each circuit, write what is wrong and how to fix it. Then draw one of the circuits, fixed, as a circuit diagram.

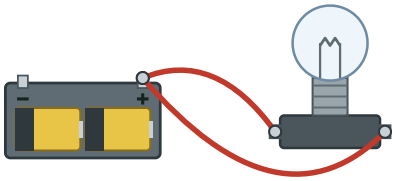
PART 1 Why won't it light?



A **Zoe says:** *"One wire takes the electricity from the battery to the bulb."*

What is wrong?

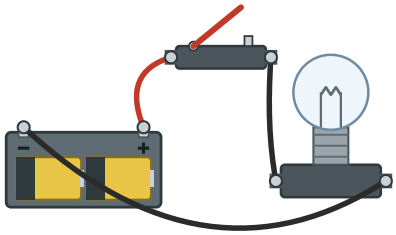
The fix:



B **Kai says:** *"I used two wires, so it must be a circuit."*

What is wrong?

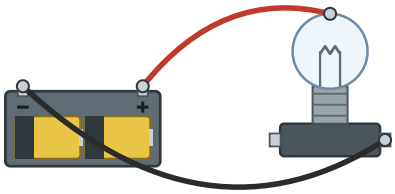
The fix:



C **Lena says:** *"Everything is joined up, so the switch doesn't matter."*

What is wrong?

The fix:



D **Omar says:** *"The wire is touching the bulb, so it is connected."*

What is wrong?

The fix:

PART 2 Draw circuit C, fixed, as a circuit diagram

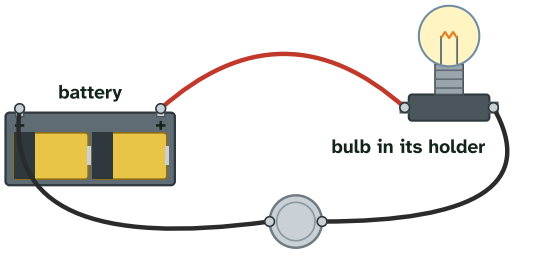
Use the symbols in the key. Draw the wires as straight lines with square corners, and draw the switch closed, the way it has to be for the bulb to light.



PART 3 Conductor or insulator?

Aim: To sort ten things from the classroom into conductors and insulators with a battery and bulb tester.

Each group needs: a battery of two cells in a holder; a torch bulb in a holder; three leads with clips; and ten things to test: a piece of copper wire, a steel paper clip, a strip of aluminium foil, a 5 cent coin, a pencil sharpened at both ends, a plastic ruler, a rubber band, a wooden stick, a glass marble and a strip of paper.



the gap: hold the two clips on the thing you are testing

> **Safety.** Use the battery only, never electricity from a power point. Never join the two ends of the battery with a wire or a metal object on its own: that is a short circuit, and the wire and the battery get hot. Unclip everything when you finish.

1. Join a lead from the battery's + end to one terminal of the bulb holder. Join a second lead from the other terminal of the bulb holder to a spare clip, and a third lead from the battery's – end to another spare clip. The gap between the two spare clips is where each thing goes.
2. Touch the two spare clips together. The bulb should light. If it doesn't, check every joint before you go on.
3. Before you test each thing, predict whether it is a conductor or an insulator and write your prediction in the table.
4. Hold the two clips firmly against the thing. For the pencil, hold them on the lead, not on the wood or the paint; a short pencil stub, or the clips a few centimetres apart on the lead, gives the clearest glow.
5. Write what the bulb does: bright, dim or off. Then decide: a conductor lets current through, so the bulb lights, even dimly; an insulator doesn't, so the bulb stays off.

Thing to test	Made of	Prediction	Bulb: bright, dim or off	Conductor or insulator
Copper wire	copper (a metal)			
Paper clip	steel (a metal)			
Foil	aluminium (a metal)			
5 cent coin	metal			
Pencil lead	graphite (carbon)			
Ruler	plastic			
Rubber band	rubber			
Stick	wood			
Marble	glass			
Paper strip	paper			

1. What do the conductors have in common? Which conductor is the odd one out, and what was different about the bulb when you tested it?

2. Ash says pencil lead must be an insulator because it isn't a metal. Use your result to explain what is wrong with that.

3. A lead has a copper core inside a plastic cover. Use your results to explain why each material was chosen.