Electricity:

Ros Currie

Sequence of practical lessons

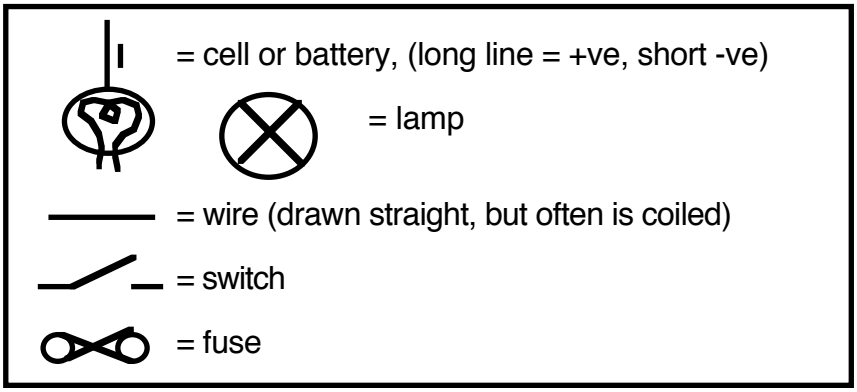
[Lessons must be done in this order. If short of time, shorten lesson #3 and combine with #4.]

Session #1

Discuss matter made up of atoms with a nucleus and electrons orbiting (which can have +ve or-ve charge).
Static electricity - demo pen and tissue paper, or hair. (NB tricky if humid!) Attraction of opposites - so +ve attracted to -ve.
Currents - concept of electrons bumping each other in a long line, like billiard balls. Flow from -ve to +ve terminals.
Show equipment, learn names, rules for taking and returning gear, what it is used for. Learn terminology.
Teach symbols needed

NB: two cells in series look like this:

Learn these symbols for homework.



Session #2

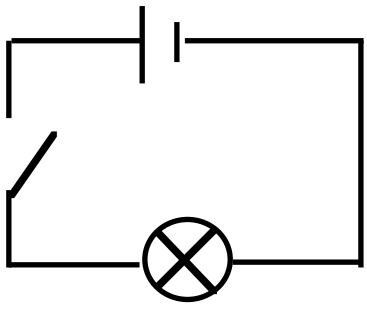
Making a simple circuit, and learning to read a circuit diagram.
Revise symbols and rules for issuing and returning equipment.

Put children in groups of 3. Send up for equipment first, then start constructing circuit. (Draw on chart or on blackboard)

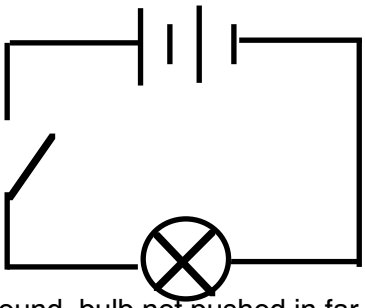
Equipment needed:

2 cell holders
2 cells
1 switch
1 lamp holder
1 bulb
4 pieces of wire

Circuit 1



Circuit 2



When successful with first (ie can switch light on and off), try second with two cells in series.

Teach problem solving for when circuit does not work.

Try: metal not contacting metal, batteries wrong way round, bulb not pushed in far enough, switch wired up wrongly... teach chn to trace the path of current as they check.

Session #3

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Discuss conductors (electrical current passes through them) and insulators (electricity doesn't go through, or conducts very poorly). Predict what will conduct, and what won't (metals usually good, plastics vary, rubber won't - also discuss water being a most efficient conductor, hence safety issue).

Have some thin examples of conductors and insulators (**try them out yourself first!!!**) and ask children to make up second circuit from last session (ie 2 cells in series) again. When it is working, give them conductors and insulators to try out to test their predictions. Record results briefly on rough paper to share later.

Sharing session to go over conductor/insulator categories, and general problem solving skills.

Useful strategy: When a group has a problem, instead of fixing it, call rest of class to look at it and suggest a solution.

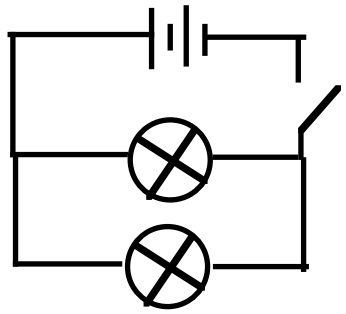
Session #4

Extra practice with making circuits.

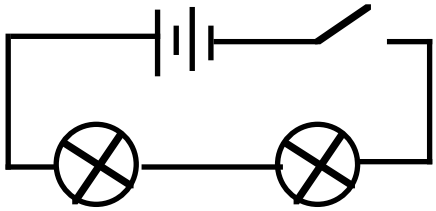
First construct circuit 2 from session #2.

Next construct circuits shown to right. When circuit 3 is working, remove one of the bulbs. What happens? (Other one should stay going because circuit isn't broken.)

Circuit 3.



Circuit 4.



Now construct circuit 4. When working, remove one bulb. What happens? (Other one should go out, because there is now a break in the circuit.)

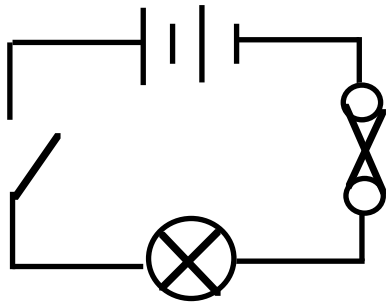
Circuit 3 has the lamps in parallel, and circuit 4 in series, just as the cells in both circuits are in series. Discuss effects of this, and implications in a house (if one bulb blows, do all lights in house go out?)

Session #5

Blowing a fuse, with 2-way switch extension activity.

Construct circuit 2, and test that it works.

Circuit 5.



Now add in a fuse to result in circuit 5. Place a single strand of steel wool across the fuse holder in order to complete the circuit. The lamp should light up. Now open the switch to turn it off, introduce a fault in the circuit by putting a wire from one terminal on the lamp to the other terminal (thus bypassing the lamp), and close the switch to complete the circuit. The fuse should now burn through.

Discuss why we need fuses and their modern equivalent, circuit breakers. (Cheaper and safer to blow a fuse if there is a surge of current in a circuit than it is to blow an appliance.)

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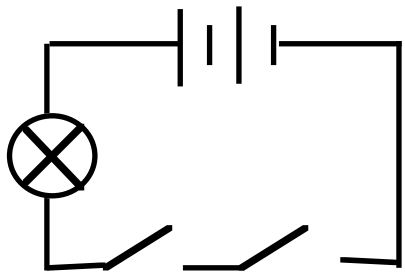
Extension activity for capable groups - construct a 2-way switching circuit.

Circuit 6.



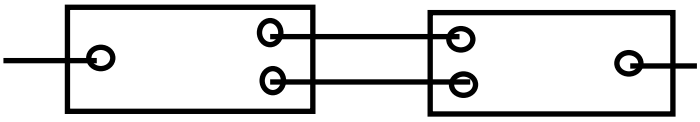
Instructions for children:

Use 2 cells, 2 cell holders, 2 switches, one lamp holder and one bulb, and wire.

Make the circuit on the right so that one switch can be at the top of the stairs, and one at the bottom. Pretend to turn the light on at the bottom with one switch, then off again at the top with the second switch. Now pretend to be another person doing the same thing in the same order. Does it still work?

NB - trap for unwary players!

It may look as though it works if you simply go switch A to B, B to A. You must go A to B, then A to B again to test it properly. Wiring must look like diagram below:



General guidelines for teachers:

1. Have circuits already drawn up on charts or on board, and list all the equipment needed for each circuit, so that groups only take what they need.

2. Have all equipment laid out in boxes (separate boxes for each object type) under your nose at the front of the room, before lesson starts.

3. Organise strict routines for laying out gear, collecting and returning gear. Have monitors to check and count it **before** ending the session, so that children know they are accountable for missing equipment. **Never** leave it lying round the room - it is too attractive, and will be "appropriated" by enterprising types!!

4. The room may need to be reorganised - a useful layout is a floor space for explanations and feedback, and tables in groups of four, making separate work areas for each group. Chairs are a nuisance - it is best to work standing up.

5. If you aren't confident, try every experiment yourself before you work with the children. If you don't understand what you are doing, it is really hard to help children in difficulty.

6. In general, don't tell children why their circuit won't work. Help them to devise strategies for figuring it out for themselves.