

Make your own! Switches and building electrical circuits

Lesson 4

Electricity
north west

Bringing energy to your door



Overview

Building on their understanding of simple electrical circuits, pupils explore switches and their effect, and how to build a switch. They are then challenged to create an object which successfully uses a circuit. (Note: this lesson includes an activity to build a parallel and series circuit if required for more challenge. This is part of the National Curriculum at KS3).

Learning outcomes

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We will be able to:

- apply our learning about different aspects of electricity from previous lessons
- explain the effect and use of switches in an electrical circuit
- build our own switches using a variety of materials
- design and build something that uses an electrical circuit

With circuit equipment: For this lesson, teachers will need to prepare resources with which pupils can build and experiment with building electrical circuits. There should be enough provided for each small group, and batteries should be pre-tested to ensure they are working.
Resources to include: wires, cells (batteries), crocodile clips, bulbs, buzzers, motors.

Note: If pupils are working at home, or if circuit equipment is not available, use Worksheet 1: Building an electrical circuit.

Starter activity

Slide No. 3-4

Recap on previous learning by revealing different words on the slide and asking pupils to explain the words, or what they know about them.

Examples of responses could include:

- conductor: a material that allows electricity to pass through
- insulator: a material that doesn't allow electricity to pass through

- circuit: a loop that allows electricity to flow through
- mains electricity: electricity from a plug socket
- cell: stores electricity e.g. a battery
- alternative energy: a way to make electricity without fossil fuels; wind, hydropower, tidal energy
- safety indoors: e.g. touching sockets; water/liquid; adaptor overload; changing lightbulbs
- safety outdoors: overhead wires; not climbing pylons; danger notices; not entering electrical substations



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- saving electricity; e.g. switching off/unplugging appliances; shorter shower; energy saving bulbs; kettle
- heat, light, movement, sound: four things that electricity can be converted into

Show the circuits on slide 4: ask pupils to tell you if they will work or not, and to explain why. Emphasise the learning point that a circuit needs to be unbroken to allow electricity to flow through. Can anyone explain the new symbol in Circuit 4? (a switch)

Core activities

Slide No. 5

With circuit equipment: In pairs or small groups, ask pupils to build a circuit that will either light a bulb, move a motor or work a buzzer – they can choose which, but they should demonstrate that they understand how to make a complete circuit.

When pupils have built their circuits, give each group a switch, and ask them:

- what is this?
- what do you think it does? (encourage them to try and give a scientific explanation)

Demonstrate how to attach a switch to a circuit, then ask pupils to do the same with theirs. Ask them to experiment to see what happens when they turn the switch on or off, and ask if they know why this happens. Does it make a difference where in the circuit they put the switch?

Pupils should be able to explain that a switch opens or closes a circuit – i.e. it creates a break in a circuit when open, then ‘fixes’ or completes the circuit when closed.

Why do pupils think a switch is useful in a circuit (e.g. to turn off a light; save electricity; for safety)?

Without circuit equipment: For pupils working at home, or if there are limited or no resources available, use Worksheet 1 to cut out the components of an electrical circuit and ask pupils to do the above task.

Extension: series circuits and parallel circuits

If further challenge is needed, provide pupils with Worksheet 2: Series and parallel circuits. There is a video to support with this under Resources.

Resources

Worksheet 1: Building an electrical circuit

Resources used to create circuits: wires, cells (batteries), crocodile clips, bulbs, buzzers, motors

Switches (to hand out separately)

Additional resources: BBC Teach ‘Circuits’ video
<https://www.bbc.co.uk/programmes/p0128qd0>

BBC Teach How to draw electrical symbols and diagrams: <https://www.bbc.co.uk/bitesize/topics/zq99q6f/articles/zs7g4j6#zc9sv4j>



Watch our video to find out more about series, parallel and variable resistor circuits and how they work with Fran, our Bright Sparks facilitator: **PLACEHOLDER LINK**



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Slide No. **6**

Using what they already know about conductors, ask pupils to work in pairs or groups of three to build their own switches using different materials with split pins. They should use the switch in a circuit to light a bulb, sound a buzzer or move a motor. They could also alternate different objects to test the strength of different switches e.g. is the same material strong enough to power the bulb and a buzzer?

Ask them to work, challenge pupils to find out more about the materials' properties as conductors, e.g.:

- which one works the best
- which has the strongest properties
- which would be most suitable for different uses
- which is the easiest to use/most adaptable
- are different materials better in powering different things (e.g. bulb vs. motor)?

They can use Worksheet 3 to record their findings.

When all pairs/groups have finished, ask volunteers to present their findings to the class.

Resources

Worksheet 3: Experimenting with switches

Additional resource to demonstrate a split pins switch: <https://redernelectronics.co.uk/diy-switches/>

Resources used to create circuits, as above: wires, cells (batteries), crocodile clips, bulbs, buzzers, motors, Switches, Split pins

Variety of objects and materials to use as conductors e.g. hairgrips; paper clips; coins; foil; blunt cutlery;

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Slide No. **7-8**

Challenge pupils to make an object which incorporates an electrical circuit, using everything that they have learned over the last four lessons. They will have to consider a number of criteria for their build, as outlined on slide 6. Pupils can create their own ideas, or if preferred you could give them options such as:

- a toy with moving parts (e.g. a clown with light-up nose/bow-tie spin; a car with moving wheels; a game with a buzzer for particular squares; a toy windmill with moving sails)
- a card with movement/light/sound (e.g. car wheels go round; candles light up; bell dings)

Encourage pupils to sketch out their ideas first, and to test the ideas they have, following the considerations on slide 7:

- what is the object for?
- which materials will they choose?
- which components will they use in the circuit?
- what will the electricity generate (sound; light; heat; movement)?
- how will they make sure it is safe?
- can it be sustainable/how could it save energy?

If suitable to your cohort, challenge pupils to focus on one particular aspect of the design for example, creating an object which is energy saving, or the most sustainable, or has the brightest light/loudest buzzer.

Pupils will also need to draw their circuit using electrical symbols. They should use Worksheet 4 to record their designs.



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Resources

Worksheet 4: My electrical design

A variety of materials for pupils to use in their designs e.g. card; boxes; plastic bottles; colouring pens/pencils; egg boxes; fabric; conductor and insulator materials

All electrical circuit components

Plenary

Slide No. 9-10

Ask pupils to evaluate one another's objects against the criteria they used for design and building. How could objects be improved?

If you haven't done so in the other lessons, or in addition, return to the baseline/starter activity from the beginning of Lesson 1. In a different colour, ask pupils to write or draw all the things they now know about electricity that they didn't know at the beginning of the series of lessons. This will demonstrate to them and to you how much their learning and knowledge about electricity has progressed.

Extension ideas: The activity could be extended further, for example in the following ways:

- Pupils present their design and describe the design and testing process
- Pupils create an advert for their object
- Pupils challenge one another to design their object using the plans they have drawn up
- Hold a class competition for the best design and working object

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