TOPIC 5 Power it up

About this topic

Curriculum link: Year 4, Electricity

SUMMARY:

Children revisit some uses of electricity and the importance of safety before constructing simple circuits. Understanding how to change a circuit by changing its components makes up the third part of this topic, leading in a final application of knowledge and skills when the children design and make an alarm using their knowledge of circuits.

UNITS:

- 5.1: Living with electricity
- 5.2: Let's make circuits
- 5.3: Conducting investigations

ACTIVITY RESOURCES:

- 5.1: Which source?
- 5.2: Changing circuits
- 5.3: Lemon battery

ONLINE RESOURCES:

PowerPoint presentation: Power it up
Interactive activity: Power it up
CPD video: Power it up
Pupil video: Power it up
Word mat: Power it up
Editable Planning: Power it up
Topic Test: Power it up

Learning objectives

This topic covers the following learning objectives:

- Identify common appliances that run on electricity.
- Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.
- Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery.
- Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.
- Recognise some common conductors and insulators and associate metals with being good conductors.

Working scientifically skills

This topic develops the following working scientifically skills:

- Ask relevant questions and using different types of scientific enquiries to answer them – setting up simple practical enquiries, comparative and fair tests.
- Gather, record, classify and present data in a variety of ways to help in answering questions.
- Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables.

CROSS-CURRICULAR LINKS

This topic offers the following cross-curricular opportunities:

English

- Produce instructions for their models and games.
- Instructions on how to wire a plug.
- Extended writing – create a biography of Edison, Joseph Swan.
- Creative writing – 'The day the electricity…'
- Produce a poster persuading children to stay safe around electricity.
- Keep a diary of using electrical appliances.
- Produce a 'Save energy' leaflet.
- Produce a poster for 'Switch it off week'.
- Create an electricity vocabulary crossword.

Numeracy and mathematics

- Venn diagrams appliances that use mains and batteries.
- Calculate energy bills.
- Read information from SMART meter.
- Bar graph of electrical appliances use.
- Survey solar panels around the locality.

Computing / ICT

- Create posters and leaflets.
- Create a video on how to wire a plug.
- Research historical figures and timelines.

Design and technology

- Use programme for creating a poster or leaflet.
- Design, make, test and evaluate:
  - A flashing headdress or a cyclists headlamp.
  - Question and answer boards.
  - Pictures and models incorporating an electrical circuit.
  - A burglar alarm.
  - A digestive system game.

Art

- Electrical storm picture.
- Lighting designs, e.g. lampshades, lamps.
- Lumieres and light festivals, research art work and create own, e.g. glass jar lamps.
- Stained glass patterns.

History

- Create a timeline of electrical inventions.
- When was the first electric street light – compare with today.
- Research Alesandro Volta and batteries.
- Research Joseph Swan and Thomas Edison.
- Locate power stations, wind farms, solar panel farms locally and nationally.

PSHE

- Health and safety at home and outdoors.

Drama

- Role-play electricity in a circuit – show it to children in assembly.

Teacher subject knowledge

Electricity is the most useful form of energy. It can be transformed into other forms of energy relatively easily. It makes things turn using motors, heats and lights up places like our homes, and produces sound in loudspeakers.

Most mains electricity is produced in power stations and carried to users by overhead power lines. Power stations use coal, oil, gas or nuclear fuel to heat water, produce steam, drive a turbine and turn a generator to produce electricity.

Batteries contain chemicals which react in a special way to produce an electric current. The current from a lemon battery is very small and will not light a bulb. But several fruit batteries will light a small LED. A potato can power a special clock, which can be purchased quite easily online.

Voltage indicates the amount of energy delivered by a source of electricity. The voltage of the most common household batteries varies from around 1.5V to 12V, but some specialist batteries can be much higher. Mains electricity in this country is 230V. Overhead power cables carrying sufficient supply for thousands of users can carry voltages as high as 400,000V. The children may be aware of the term ‘voltage’, but they do not need to know about this in depth.

Completely pure water does not conduct electricity, but when impurities that are present in our normal water supply get into it or when mixed with the salt on our skin, it does conduct. This is why you must never turn on the lights with wet hands. The spark produced by the flicking of the light switch will travel through the body, giving us a shock as it goes to earth.

There are two types of circuit. A series circuit has all its components wired into one simple circuit: all the components are one after another, as in a series on television.

A parallel circuit is one with different branches which behave like mini-circuits and can work independently of each other. Only simple series circuits are investigated in Key Stage 2.

Conventional bulbs contain a filament made from wire. As electrons flow through the wire,

they encounter resistance. It's like lots of people trying to squeeze through a small doorway. The more people or the smaller the gap, the more resistance felt. When a wire is very thin, it has a large resistance. The electrons get hot as they try to move through it (just as people do going through a small doorway!) and we can feel this. If it gets very hot, it glows – as in the filament of a light bulb.

When investigating the changing of components in a circuit, the brightness of a bulb depends on the current or number of electrons passing through it. The more bulbs you have, the slower the electricity flows because the battery 'runs out of push', so the electrons flow more slowly, due to the resistance through the wires, and the bulbs, so the dimmer the light. The opposite is true of adding more batteries (the electricity flows faster).

The batteries must be connected in series with positive terminals connected to negative ones. If a battery is reversed, its value is regarded as negative. So, if three batteries are connected in series and one is reversed, this will be equivalent to one battery.

Metals are good conductors of electricity. Most non-metals do not conduct electricity. They are insulators. The rest of the information here is for your understanding but not the children at this stage.

All materials are made of atoms, but metals are special. Instead of each atom being a separate entity (for the sake of neatness this is how we can picture them), metal atoms have electrons which are not tied to one particular atom. They are free to move within the metal in a 'sea' and this movement of electrons is what produces an electric current.

Non-metals do not have these free electrons, so a current cannot pass through a non-metal.

The exception is graphite, which conducts electricity but is a form of carbon. Carbon is a non-metal that can exist in different forms. One form is diamond, which is an insulator as it doesn't have free electrons.

CHILDREN'S MISCONCEPTIONS

Children might think…

- That electricity from batteries is not dangerous.
- That wires are made of plastic (as they are coated in it).
- That all metals conduct electricity.
- That a bulb uses the electricity.
- That both ends of the battery produce electricity.
- That the first bulb in a circuit will be brighter than the second in a circuit.

Children already know…

- That electricity makes things work.
- That you need wires for electricity to work.
- That batteries produce electricity.
- That electricity can be dangerous.
- That batteries are safe to use in the classroom.

SCIENTIFIC VOCABULARY

You can download a Word mat of essential vocabulary for this topic from *My Rising Stars*.

battery: a portable electricity supply

bulb: part of a circuit that gives out light

cell: the scientific name for a battery

circuit: the path followed by an electric current. Electricity must flow in a circuit to do useful work

components: the items that make up a circuit

conductor: a material that transmits electricity in the wall and through wires

insulator: a material through which electricity cannot flow

mains: the electricity that comes from a socket

rechargeable: a battery that we can put 'electricity' back into

switch: a component that turns a circuit on and off

terminals: the ends of the battery. One is negative and one is positive

wires: used to connect components together

Make a lemon battery

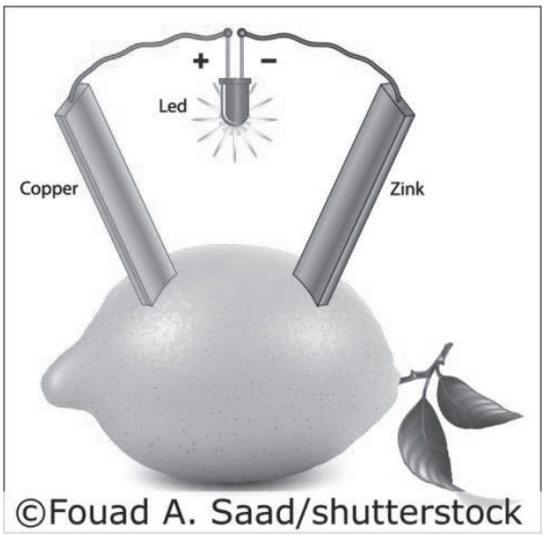
SWITCHED ON Science Second Edition

Look at the picture.

What materials do you need to make a lemon battery?

How would you prove it makes electricity?

What else would you need to show it really makes electricity?



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