KS3

Science club

– combatting climate change

ACTIVITY PACK

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INTRODUCTION

The activities in this pack are intended for use in an after-school science club and are ideal for fostering a love of science among your aspirational key stage 3 students. There are eight sessions, allowing a few weeks for students to settle in to their new school routine if you decide to begin science club in the autumn term.

The pack includes a PowerPoint poster that you can use to promote your science club around the school or in science lessons.

The eight sessions include 11 hands-on experiments to do at school, as well as teacher demos and video clips, plus practical activities for students to try at home.

Each session or pair of sessions includes a PowerPoint containing:

- images that can be used as starter activities and for inspiration
- activity instructions
- links to video clips that either show students how to carry out the experiment or provide further information
- discussion questions.

For all except the final two sessions, this Word document also contains:

- a list of the materials required (and whether the equipment needs to be set up in advance by a lab technician)
- teaching notes
- the video links from the PowerPoint
- answers to fact-based questions from the PowerPoint
- a glossary of scientific vocabulary from the session (where appropriate). The science content of the experiments is aligned with the key stage 3 science curriculum.

All the activities are related to the theme of combatting climate change. They and the video clips provide insights into the principles behind a) well-established technologies that are still being improved and b) new inventions and cutting-edge technologies that can help us to solve the climate crisis. The aim is not to dwell on the problems but rather to explore potential solutions offered by science and technology – and, hopefully, to inspire your students to become the inventors, engineers and climate scientists of the future.

Do you want to get hands-on with science and help save the planet?

Join the club!

KS3 SCIENCE CLUB

When: On [day] at [time]
starting on [date]
Where: In [place]
How: To find out more and to sign up, ask [person]

Looking forward to seeing you there!

BATTERY-POWERED

A fruit battery

Instructions:

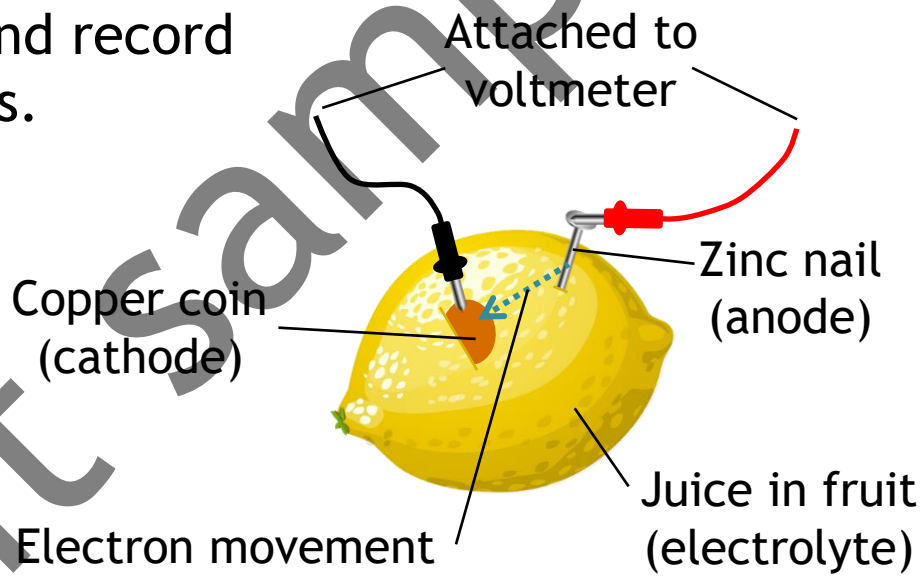
- Roll the citrus fruit against the table or workbench, pressing gently with the palm of your hand to release the juice.
- A slit has been cut on one side of the fruit. Insert the copper coin halfway in.
- Insert the nail into the other side (halfway in).
- Attach the wires to the croc clips at one end and the voltmeter at the other.
- Attach one clip to the coin and the other to the voltmeter.
- Record the voltage (the potential energy in the fruit).

BATTERY-POWERED

A fruit battery

Repeat for each of the fruit and record your results in a table like this.

Fruit	Voltage
Lemon	
Orange	
Grapefruit	
Tomato	



Test your fruit battery

Don't believe it's really electricity? Try lighting an LED!

You'll need to connect several citrus fruit in series to have enough power. Follow the instructions in this video.

BATTERY-POWERED

Something to think about

1. What is the role of the metals (copper and zinc)?
   - ↳ These are the electrodes. Chemical reactions take place at the electrodes.
2. What energy transfers occur in this battery?
   - ↳ Chemical energy stored in the battery is transferred into electrical energy in the copper wires.
3. Why does a battery need an electrolyte?
   - ↳ The electrolyte allows the charge to move in the solution.
4. What causes the voltmeter to show a reading?
   - ↳ A flow of electricity.

Session 2 outline

BATTERY-POWERED

Here, students learn about how batteries work and how this well-established technology is still the focus of intense research.

A list of the scientific vocabulary used in this session is provided at the end of the teaching notes and PowerPoint.

→ Aims

- To become familiar with the structure of batteries
- To apply some of the key words associated with batteries
- To understand the role of the technology in a sustainable energy supply.

→ Materials required

Activity:

- Two A4-size metal plates: one copper, one aluminium
- Two wires and croc clips
- Ammeter/multimeter.

Practical:

- Several different citrus fruits (e.g. lemon, orange, grapefruit), tomato – one of each per pair of students, with a coin-sized slit cut in each
- Copper coins – one per pair
- Galvanised/zinc nails – one per pair
- Wires – two per pair
- Croc clips – two per pair
- Voltmeter – one per pair
- LEDs (optional) – one per pair.

→ Risk assessment / Health and safety guidance

Always consult appropriate risk assessments.

Make sure you count the nails out and in at the start and end of the session.

Activity: Acceptable at the time of writing, but please check the most recent H&S guidelines.

→ Preparation and set-up time

Some lab technician support is needed to supply apparatus.

Teaching notes

Activity and resource	Timing	Guidance
Starter: SLIDE 1	2 mins	Introducing batteries: Question: What do you think this object is? Answer: This is the 'Baghdad battery'. It is about 2 000 years old and consists of a clay jar, a cylinder of copper and an iron rod. When filled with a weak acid, it produces 1 volt! The true purpose of the Baghdad battery remains uncertain – it may have been used for electroplating.
Main session activities: **Activity** SLIDE 2 SLIDE 3 **Practical** SLIDES 4-6	10 mins 35 mins	Body battery: Place the metal plates side by side but not touching. Attach them to the voltmeter using wires. Ask a student to place a hand on each plate. A current is created, as seen on the ammeter. Question: Is there a similarity between this and the structure of the Baghdad battery? Answer: They both use two different metals. The sweat on our hands is like the acid in the Baghdad battery. Question: How does the body battery work? Answer: See slide 3. Compare again with Baghdad battery: two different metals (electrodes) and a fluid (electrolyte) are used to create a flow of electrical current in batteries. Fruit battery: Students work in pairs. They test different fruits and note how much potential energy (voltage) was produced. They record class results and find the mean for each fruit. A blank results table is provided on p.12. Pairs of students could then group together to connect several citrus fruits in series and use them to light an LED, following the instructions in this video: www.youtube.com/watch?v=WNx-bwlTATI (1:26 mins) Using the examples of the Baghdad battery, body battery and fruit battery, students identify 'electrode' and 'electrolyte' and explain their purpose in a battery.

Science words used in this session

Ampere or amp	The unit used to measure the flow of electricity (like metres for distance or degrees centigrade for temperature).
Ammeter	A device for measuring the flow of electricity.
Battery	A way of storing energy. It uses chemical reactions to generate electricity.
Current	The flow of electricity. It is caused by the movement of negative particles (electrons).
Electrode	A metal rod that an electric current can flow through into an electrolyte. For electricity to flow, you need a positively charged electrode (anode) and a negatively charged electrode (cathode).
Electrolyte	A liquid that electricity can flow through (from two electrodes, one positively charged and one negatively charged).
Electrons	Tiny negatively charged particles.
Potential energy	Energy that is stored in something (for example, in chemicals that can be used to make electricity, in an elastic band, in an object that is at the top of a slope or in nuclear fuel).
Volt	The unit used to measure electric potential energy (like metres for distance or degrees centigrade for temperature).
Voltage	The amount of electric potential energy (how much electricity a substance can generate).
Voltmeter	A device for measuring voltage (electric potential energy).