3. SUSTAINABLE FUEL: MAIN BEAM

1 - 1.5 HOURS

Children construct a simple electric circuit with a lightbulb and investigate how they can make the light shine more brightly.

TYPE OF ENQUIRY

Problem solving

Comparative/fair tests

OBJECTIVES

Associate the brightness of a bulb with the number and voltage of cells used in a circuit. (Y6 Electricity)

Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. (UKS2 Working Scientifically)

SCIENCE VOCABULARY

cell, wire, voltage, bulb

RESOURCES

(per group of four, unless otherwise stated))

- **Activity Sheet 4**
- **PowerPoint presentation:** Main Beam
- 3 AA 1.5v zinc carbon or zinc chloride batteries
- 3 single AA battery holders
- 4 crocodile clip wires
- Bulb in holder
- Data loggers OR
- Lux meter app on tablet or similar (optional)
- Kitchen roll inner cardboard tube (optional)

SAFETY GUIDANCE

Zinc chloride or zinc carbon batteries must be used.

For comprehensive safety guidance regarding use of batteries in the classroom, the CLEAPSS guidance document Batteries for practical circuit work has up to date advice.

PRIOR KNOWLEDGE/EPERIENCE

Children should have had some experience of setting up simple practical enquiries, comparative and fair tests.

TOP TIP

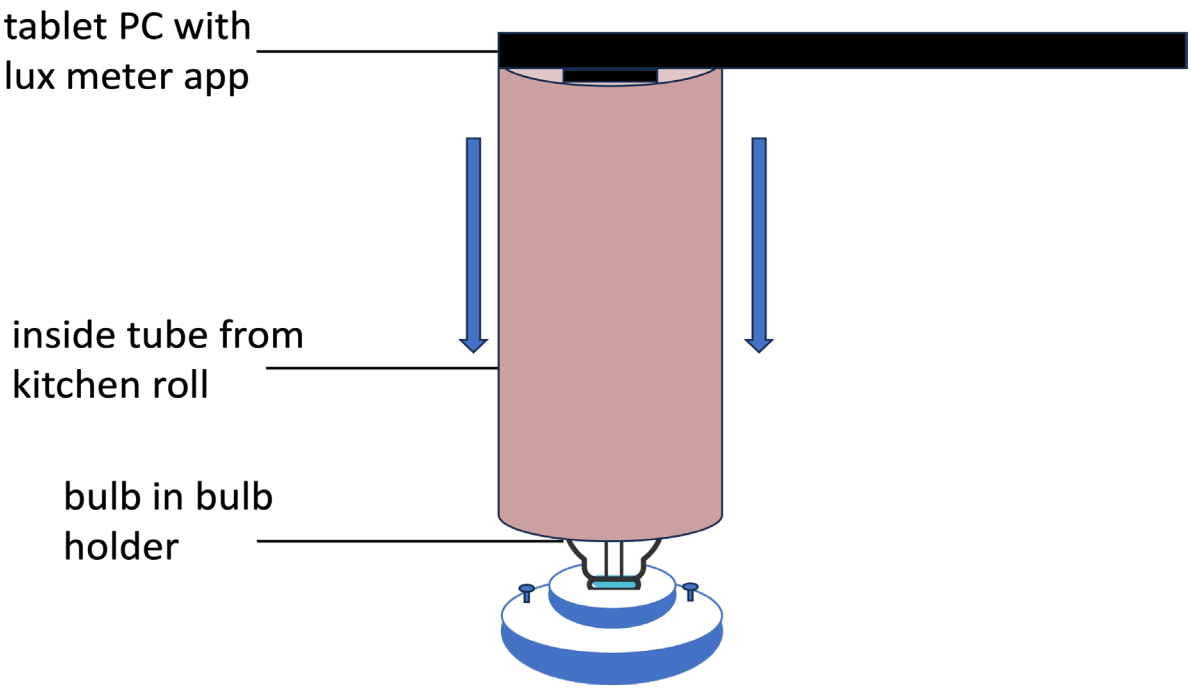
The activity requires children to construct a simple circuit, so depending on the children's confidence in building circuits, it may be worthwhile exploring circuits ahead of the main activity to refresh their memories about how they work.

ACTIVITY NOTES

Re-visit **Activity Sheet 4**; the letter from scientist Emily Nesling, who is developing fuel cells to find more sustainable ways of generating electricity for electric vehicles. The letter asks for children to help Emily find out how she can make a car's headlights shine more brightly.

Children construct a simple circuit containing one AA cell and a bulb. The bulb will light but will not be very bright. Following a period of exploration with one cell, children should be given access to additional 1.5v cells (up to 3 per group – maximum of 4.5v) to continue their investigation to find out if adding more cells to their circuit will increase the brightness of the bulb.

As more cells are added to the circuit, the bulb will be visibly brighter but using data loggers with light sensors or a lux meter app will enable groups to measure the brightness and generate data for use when reporting their findings. Placing the inside tube from a kitchen roll over the bulb ensures an accurate measurement of the light from the bulb without ambient light affecting readings.



The data collected will support children's explanations of their results. Groups can decide how to collect, record and present their observations, measurements and findings.

Use the Main Beam presentation to explain to children that some applications need higher voltages than others, so scientists need to find ways to increase the voltage generated using fuel cells. For instance, vehicles carrying heavier loads such as buses and lorries, require more fuel than vehicles carrying lighter loads such as cars and motorbikes.

Hydrogen fuel cells are very thin, so scientists layer many cells on top of each other to generate higher voltages. Similarly, adding more cells to a circuit increases the brightness of a bulb.

The diagram on the presentation slide shows the various 'slices' which make up a hydrogen fuel cell. All of these 'slices' are extremely thin so that lots of cells can be grouped together and fit inside a car leaving enough room for people.

QUESTIONS FOR THINKING

- How can we get the bulb to shine more brightly?
- How did increasing the voltage/number of cells affect the brightness of the bulb?
- Why did higher voltage/more cells mean the bulb could shine more brightly?
- Why is it important for hydrogen fuel cells to be used instead of burning fossil fuels to get electricity?

INDUSTRY LINKS AND AMBASSADORS

If you can find a scientist with relevant expertise who can visit your classroom, you could ask them to provide some added motivation to your class by setting the initial challenge to the children either in person or by personalising the letter on **Activity Sheet 4**. You could also ask them to bring along some sample fuel cells to show the class, parts of the fuel cell, or images and videos showing the cells in use either in a lab test or in real vehicles.

If you live near to any companies involved in hydrogen fuel cell development or production, you may even be able to arrange a visit to their site to meet the STEM professionals working to develop this exciting technology and see it first-hand.