

# Unit 4E Lighting it up

## Focus – control: electrical, computer

### ABOUT THE UNIT

In this unit, children apply knowledge about electric circuits that they have acquired in science in a purposeful way. They learn to design and make something that will shine light *eg a table lamp, a light in a room, or one that lights up a poster, a Christmas tree or a display*. The children will also need to consider what kind of lights are switched on and off by remote control *eg in a corridor or in a home so that it looks lived in*. While many of the designing and making skills will be used, there will be two particular focuses. The children should be encouraged to define a set of clear specifications for the light by considering who will use it, and the conditions under which it might be used. They may also use ICT tools to support their research into a range of lights and to control their light, switching it on and off when required.

Unit 4D 'Alarms' is an appropriate alternative to this unit. The alarms can be controlled through the use of a simple switch, a control box or computer program.

### PRIOR LEARNING

It is helpful if the children have:

- constructed simple electric circuits and rectified any faults that occur
- cut and joined a variety of materials, including reclaimed materials
- learnt how the components work and used simple tools to connect these together

This unit builds on Units 2A 'Vehicles', 2C 'Winding up' and 3C 'Moving monsters' and children's earlier experiences of working with reclaimed materials. It builds on Science Units 2F 'Using electricity' and 4F 'Circuits and conductors', which focus on using electricity and electric circuits and conductors.

### VOCABULARY

In this unit, children will use words and phrases relating to:

- designing *eg user, specific, plan, labelled drawings, decide, list, classify, specification, design criteria*
- making *eg clip, rectify, fault, screw, join, connect*
- knowledge and understanding *eg electricity, circuit, battery, battery holder, bulb, bulb holder, wire, insulation, crocodile connector, aluminium foil, switch, reflector, energy, control, automatic*

### RESOURCES

- a collection of lights for a variety of purposes
- Internet connection and list of appropriate websites for research purposes
- batteries
- battery holders (if cylindrical batteries are used), bulbs, bulb holders, LEDs, crocodile connectors, lengths of connecting wire, aluminium foil
- paper fasteners, paper clips, drawing pins, selection of suitable sheet materials, construction card, sticky tape
- adhesives, reflective materials, scissors, staplers
- wire stripper and cutter, small electrical screwdriver
- appropriate control box, control program

### EXPECTATIONS

#### at the end of this unit

*most children will:*

have reinforced their understanding of how a simple battery-operated circuit works and how this can be controlled by employing different kinds of switches, including those operated by a control box or program; have made something which lights up, identifying the specific needs of a chosen user and evaluating it against design criteria

*some children will not have made so much progress and will:*

have made a basic light, not necessarily related to the needs of the user, in which the bulb lights up by a switch provided by the teacher

*some children will have progressed further and will:*

have considered a wider range of specialist functions for their light *eg improved reflection for the light bulb, developed waterproof qualities*; have used a complex control program or a light sensor and produced a light which is innovative and aesthetically pleasing

## LEARNING OBJECTIVES

CHILDREN SHOULD LEARN

## POSSIBLE TEACHING ACTIVITIES

### INVESTIGATIVE, DISASSEMBLY AND EVALUATIVE ACTIVITIES (IDEAs)

- that lights are designed with the particular needs of the user in mind and that these needs can vary widely
  - that lights can be switched on and off using remote control or a control device
  - that lights are made out of a variety of materials suited to a particular purpose
- Ask the children to investigate a collection of lights *eg cycle lights, table lamps, torches, miners' head lights, camping table lamps*. *How is the light reflected? How does the switch work? How many batteries are used? What type are they? What would happen if you connected the light to a control device? What materials have been used and why? What shape is it and why? Does the base provide stability? Can you adjust it in any way?*
  - Discuss the circumstances in which each light is used and relate these to the particular features of its design *eg a light to light up a display, a night light for a baby, a student who needs a light at a table, a security light*. *How does the designer take account of individual differences/preferences when designing a product to be used by the general public?*
  - Through investigation and explanation, help the children to understand how a light works, identifying key features *eg bulb, reflector, battery, switch, casing*. If possible, take apart a light to discover how it is made, noting especially how the complete circuit is made using a switch. Investigate how lights are designed to be safe.

### FOCUSED PRACTICAL TASKS (FPTs)

- safety when using electricity
  - to make a simple circuit, incorporating a battery, light bulb, different switches and connecting wires in a safe manner
  - how to find a fault in a simple circuit and to correct it
  - that a variety of metals will conduct electricity
  - to use ICT *eg the Internet, CD-ROM* to acquire information for their research into different types of lights
  - how to program a simple control device or use a control box/program
- Talk to the children about appropriate safety issues.
  - Show the children how to make a simple electric circuit using a battery, bulb, switch and connecting wires.
  - Teach the children that a variety of metal components can be used as part of a circuit.
  - Ask the children to make a variety of switches by using simple classroom materials *eg card, plastic, aluminium foil, paper fasteners, paper clips*.
  - Ask the children to make switches that work in different ways *eg when you press them, when you slide them*.
  - Revise using ICT tools *eg Internet, CD-ROM* for research. Ask the children to use these tools to help them find out about different kinds of light.
  - Practise making a device turn on and off in a pre-chosen sequence, using a control box/program.
  - Children could investigate the reflective qualities of some materials which might be used as reflectors.

### DESIGN AND MAKE ASSIGNMENT (DMA)

#### Design and make a new type of light that you can control and that satisfies certain needs of the person who will use it

- that identification of a particular combination of needs can result in a design for a light which has not existed before
  - to use their research to support their design
  - that plans for a new product can be made using drawings with labels
  - to check their product is safe
  - to evaluate their work both during and at the end of the assignment
- Ask the children to:
- ★ think of a purpose for their light. *Who are you going to design for? What activity is your light for? What must it do to be successful? How will you meet users' needs? Why will you want to control your light?*
  - ★ list the needs of someone using the light *eg*:
    - *the light should shine a beam on a page of a book*
    - *the light should be bright enough to light up a room*
    - *the light needs a heavy base for stability*
  - ★ discuss appearance, function, safety and reliability. *How will the people use what you are designing? What could go wrong? How could you make it safe? What details can you include from your research?*
  - ★ prioritise the specification, listing first the essential elements followed by those that are important but not essential
  - ★ make their plans for the light by modelling in 3D or labelling a drawing to show:
    - the materials to be used for different parts of the light
    - how the circuit will be included
    - the kind of switch to be used
    - what kind of additional control they will use
  - ★ evaluate their light by considering how well it works and meets the needs of the user they have identified. *How well does this work? Will it do what you intend it to? How can you improve it? What do you need to change? Why? What do the users say about your product? How accurate is the control box/program which has been used? Is it really appropriate to use a controlling device with this light?*

- essential activities
- ★ assignment stages (all are essential)
- optional activities

## LEARNING OUTCOMES

### CHILDREN

- identify the features of commercially available lights which make them suitable for a specific purpose and user
- identify examples of lights which are switched on and off by remote control or control devices
- describe how a light and switches work
- identify materials used to make the lights and why they might have been chosen

- understand and use safe practices
- make a bulb light up in a simple electric circuit
- make their own switch and know how to place it in a circuit to control the bulb
- name the electrical components being used
- use ICT to acquire information about a range of lights
- use a control box/program

- apply what they have learnt through IDEAs/FPTs in their designing and making
- identify a number of specific needs of a user in this context and prioritise these needs in a specification
- design and make a product which takes into account some of the needs of a user
- make a labelled drawing which shows the key features of a product that has not yet been made
- control the light through the use of a control box/program
- evaluate the light against original design criteria and identify some modifications they have made to the light, including the safety of the product

## POINTS TO NOTE

### Links to this unit

**Design and technology:** Units 6C 'Fairground'; 6D 'Controllable vehicles'

**Science:** Unit 6G 'Changing circuits (short unit)'

**Information technology:** Units 5E 'Controlling devices'; 6C 'Control and monitoring – What happens when...?'

**Mathematics:** Handling data (set, subset, probable, certain, uncertain)

**Literacy:** The listing and labelling activities could be linked with text-level work on note making and presenting information in term 2. Support the evaluation of the light by the use of a writing frame to prompt ideas

### Content

- The inclusion of computer control or the use of a control box in year 4 is appropriate for some schools at the present time, but it is recognised that not all schools will be at this stage of development. It may be that some schools change the order of the units and do Unit 5A 'Musical instruments' in year 4 and Unit 4D/4E in year 5.
- Have a wide variety of lights for the children to investigate. This will help them to consider a wide variety of situations in which people use lights.
- Encourage the children not to copy a light that they have already seen. You might ask them to make a completely 'new' light or a 'light of the future'.
- The lights could be made from a variety of materials, reclaimed or otherwise.
- Circuits are best made by using battery holders and bulb holders to secure these components.
- Wires or strips of aluminium foil will make adaptable connectors which could be fixed in place with sticky tape or other suitable means.
- A simple circuit mounted on a board will provide a class resource which children can use to help them when fault finding.
- Children should use a control box or a computer program.

### Class management

The children could work in pairs for the design and make assignment and produce one product. They would need to come to a shared understanding about users and their needs. They could then use another way of controlling their light *eg the use of a control box*.

It is anticipated that some IDEAs and the FPTs could be carried out in science sessions *eg making a simple circuit*.

### Health and safety

When carrying out a risk assessment for this activity, teachers will need to consider the materials, tools and equipment being used.

In addition, the following points should be noted:

- explain to children that they should not experiment with mains electricity and should use batteries in commercially available appliances only when supervised by an adult
- it is inadvisable to use rechargeable batteries for home-made circuits – in the event of a short circuit they could get very hot and cause injury

### Out-of-school activities and homework

Children could investigate a range of lights that they have at home or have seen in the community. Ask them to identify those worked by remote control. The children could use labelled drawings to show their shape, size, the materials from which they are made, how they work and why they need to be worked by remote control.

