

# Unit 4C Torches

## Focus – control: electrical

### ABOUT THE UNIT

This unit enables children to apply knowledge about electric circuits that they acquire in science in a purposeful way by designing and making a simple torch. While all the designing and making skills will be used, there will be a particular emphasis on defining a set of clear specifications for the torch by considering who will use it and the conditions under which it might be used. The children also consider how the torch can be controlled by designing and making their own switch.

This unit can be adapted by using an alternative context for the children's designing and making assignment eg *lighting a room or a house, lighting up a poster or a display*.

Unit 4D 'Alarms' is an appropriate alternative to this unit.

### PRIOR LEARNING

It is helpful if the children have:

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

This unit builds on Units 2A 'Vehicles', 2C 'Winding up', 3C 'Moving monsters' and working with reclaimed materials.

It also 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*
- making eg *clip, rectify fault, screw, connect, join*
- knowledge and understanding eg *electricity, circuit, battery, battery holder, bulb, bulb holder, wire, insulation, crocodile connector, aluminium foil, switch, reflector, energy*

### RESOURCES

- a collection of torches, lights and lamps for a variety of purposes
- batteries (the 4.5 volt 'flat' batteries are easily connected in a circuit), battery holders (if cylindrical batteries are used), bulbs, bulb holders, crocodile connectors, lengths of connecting wire, aluminium foil
- paper fasteners, paper clips, drawing pins, selection of suitable sheet materials, construction card, sticky tape
- adhesive, reflective materials, scissors, stapler
- wire stripper and cutter, small electrical screwdriver

### 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 switch; have made a torch, 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 torch, not necessarily related to the needs of a user, in which the bulb lights up by means of a switch provided by the teacher

*some children will have progressed further and will:*

have considered a wider range of specialist functions for the torch they have made eg *means of storage, improved reflection for the light bulb, water-proof qualities* and produced a torch that is innovative, aesthetically pleasing and ergonomically sound

**LEARNING OBJECTIVES**

**POSSIBLE TEACHING ACTIVITIES**

**LEARNING OUTCOMES**

**POINTS TO NOTE**

CHILDREN SHOULD LEARN

CHILDREN

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

- simple safety when using electricity
- that torches are designed with the particular needs of the user in mind and that these needs can vary widely
- that commercially available torches contain a simple circuit involving metal connectors which do not necessarily have to be wires
- that torches are made of a variety of materials suited to the purpose for which they are employed

- Ask the children to investigate a collection of torches, cycle lamps and other battery-powered lights eg *pocket torches, 'miners' head lamps, rear bicycle lamps, camping table lamps. How does the casing stay together? How is the light reflected? How does the switch work? How many batteries are used? What type are they? What materials have been used and why? Are there any special surface textures? What shape is it and why? How heavy is it?*
- Discuss the circumstances in which each light is used and relate this to the particular features of its design eg a *'Pools' coupon collector who visits houses in winter, the milk deliverer, a caving enthusiast, a cyclist. How does a designer take account of individual differences of a person's anatomy (eg hand size) when designing a product to be used by the general population? Where do they get information from about body sizes?* Children could do a survey of head/hand sizes to highlight the need for adjustment within the specification of a product.
- Explain to the children how a torch works, identifying the key features eg *bulb, reflector, battery, switch, casing*. If possible take apart an old torch to discover how it is made, especially the way a complete circuit is made using a switch. Investigate how the torches are designed to be safe.
- Discuss the advantages/disadvantages of disposable products eg *torches*. Discuss the life-cycle of a torch, showing the materials used from source to disposal.
- Children could find out about Morse code and try sending simple messages to one another.

- identify the features of a commercially available torch which make it suitable for a specific purpose and user
- describe how the torch works
- know some simple principles about the safe use of electricity

**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)

**Content**

- Provide the children with as wide a variety of lights as possible to investigate. Then they will consider a wide variety of situations in which people use lights.
- Encourage the children not to copy a light they have already seen. You might ask them to make a completely 'new' light or a 'light of the future'.
- The casings could be made by the children using 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.

**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 the users and their needs.
- It is anticipated that some IDEAs and the FPTs could be carried out in science sessions.

**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
- care should be taken when disassembling torches as they may have sharp edges

**Out-of-school activities and homework**

Children could investigate torches that they have at home and use labelled drawings to show their shape, size, the materials from which they are made and how they work.

**FOCUSED PRACTICAL TASKS (FPTs)**

- how to make a simple circuit incorporating a battery, light bulb, switch and connecting wires in a safe manner
- how to find a fault in a simple circuit and correct it
- that a variety of metals in different forms will conduct electricity

- Show the children how to make a simple electrical circuit using a battery, bulb, switch and connecting wires.
- Teach the children that a variety of metal components can be used as part of the circuit.
- Ask the children to make a variety of hand-made 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*.
- The children could investigate the reflective qualities of some materials which might be used as a torch reflector.
- The children could explore a variety of 'casings' for a torch and ways in which the batteries, switch and bulb might be fixed inside. Include reclaimed card boxes, tubes, plastic bottles, 3D geometric shapes made from nets of card, etc.
- The children could investigate finishing techniques for a torch case.

- 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 simple electrical components being used
- understand what the safety implications are for bulbs and batteries

**DESIGN AND MAKE ASSIGNMENT (DMA)**

**Design and make a new type of battery-powered light which 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 torch which has not existed before
- that the 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 situation in which a battery-powered light might be of use. (Avoid the use of the word 'torch' at this stage.) *Who are you going to design for? What activity is your light for? What must it do to be successful? How will you meet your user's needs?*
  - ★ list the needs of someone using the light eg:
    - *the light should shine a beam onto the page of a book*
    - *the light should have a case which doesn't fall over on uneven ground*
    - *the switch should only stay on when the light is being held by someone*
  - ★ discuss appearance, function, safety and reliability. *How will the people use what you are designing? What could go wrong? What must your product not do? How could you make it safer? Are there different ways of making this? Which would give the best results?*
  - ★ prioritise the specification, listing first the essential elements and those that are important (but not essential)
  - ★ make their plans for the light by labelling a drawing to show:
    - the materials to be used for different parts of the light
    - how the circuit will be arranged inside the casing
    - the kind of switch to be used.
  - ★ As the project proceeds and once the products have been made, ask the children to evaluate their model by considering how well it works and meets the needs of the user that 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? How will this meet the needs of the user? What do the users say?*

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

- 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 in a specification
- design and make a product which takes into account some of the needs of the potential user
- make a drawing with labels which show the key features of a product that has not yet been made
- evaluate their light against the original design criteria and identify some modifications to the light that they have made, including safety of the product

