

Unit 4D Alarms

Focus – control: electrical

ABOUT THE UNIT

In this unit, children develop an understanding of simple electrical control through the designing and making of an alarm system. They are also introduced to the idea of feedback. The designing and making assignment involves an alarm system to protect a valuable artefact which has been brought into the classroom. The children could experiment with the use of a control program.

This unit could be adapted to focus on an alternative context which includes a system which does not produce movement eg *lighting a house/room, headlights on a vehicle.*

Unit 4C 'Torches' and Unit 4E 'Lighting it up' are appropriate alternatives to this unit.

PRIOR LEARNING

It is helpful if the children have:

- used construction materials eg *wood, card* and appropriate adhesives
- built simple series electric circuits and rectified faults that occur
- learnt how the components work and used simple tools required to connect these together

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

It also builds on Science Units 2F 'Using electricity' and 4F 'Circuits and conductors', which focus on using electricity, electric circuits and conductors.

VOCABULARY

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

- designing eg *prototype, labelled drawings, communicate, model*
- making eg *join, circuit, alarm, rectify fault, connection*
- knowledge and understanding eg *circuit, toggle switch, push-to-break, push-to-make, reed switch, tilt switch, rocker switch, slide switch, micro switch, feedback, am, pm, timer, control, sensor, input, output, switch on/off, wait*

RESOURCES

- press switch, toggle or rocker switch, slide switch, push-to-make switch, push-to-break switch, reed switch and magnet, tilt switch (non mercury), micro switch
- buzzer
- lamp, lamp holder
- LED (light emitting diode), batteries, battery holder, battery clip
- wood, card, coloured paper, fabrics
- adhesives
- suitable control programs or programmable chip
- simple control interface

EXPECTATIONS

at the end of this unit

most children will:

have drawn on their understanding of simple electrical circuits and switches to help them generate ideas about their alarm; have produced a labelled drawing to communicate their ideas to others; have joined components and cut and shaped materials with some precision to help assembly; have joined the materials of their device using a range of appropriate techniques; have used a control program to activate their alarm

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

have needed support to identify the specific purpose for their alarm; have used given techniques and tools to create their product

some children will have progressed further and will:

have evaluated their alarm system by comparing it with their design intentions and suggested ways of improving it

LEARNING OBJECTIVES

POSSIBLE TEACHING ACTIVITIES

CHILDREN SHOULD LEARN

INVESTIGATIVE, DISASSEMBLY AND EVALUATIVE ACTIVITIES (IDEAs)

- what alarm systems are used for
 - never to use mains electricity in their work
 - the ways in which different types of switches can be activated
- Discuss examples of alarm systems – where and why they are used *eg to provide information, to warn of danger, to prevent damage, to keep things safe.*
 - Remind children of the dangers of mains electricity.
 - Ask children to investigate some examples of commercially produced switches which work in different ways *eg slide, reed, tilt, push-to-make, push-to-break*. Let the children take these apart where appropriate to see how they work, and use them in simple circuits. Talk about how different types of switches might be useful in different types of alarm systems.

FOCUSED PRACTICAL TASKS (FPTs)

- that actions can be made to occur as a direct result of other actions
 - how different switches work
 - about possible output warning devices
 - how to use a control program
- Discuss with the children how 'feedback' is an essential part of a control system *eg the feeling of pain will cause someone to take their fingers away from a hot surface; a sensor above an automatic door senses a person's approach, causing the door to open.*
 - Show the children how to make simple circuits with batteries and a wide variety of different types of switches, bulbs, buzzers or bells.
 - Children could explore how different types of switches might be used *eg push-to-make to detect someone treading on something; push-to-break to detect someone lifting something; tilt to detect movement of something; and also switches to turn on and off.*
 - Allow the children time to gain an understanding of how the program works, experimenting with inputs and outputs.

DESIGN AND MAKE ASSIGNMENT (DMA)

Design and make an alarm that will protect something

- how to generate ideas, considering the purposes for which they are designing
 - how to explore, develop and communicate aspects of their design by modelling their ideas in a variety of ways
 - how to consider reliability when developing proposals
 - how electrical circuits can be used to achieve functioning results
 - how to control their alarm using a control box/program
 - how to evaluate their products carrying out appropriate tests
- ★ Discuss with the children the task of making an alarm that will protect something *eg a valuable exhibit on display in the classroom*. For this type of task, children can bring in an item from home for display.
 - ★ Ask the children to make prototypes of their ideas first, which they then develop into high-quality products. They should use labelled drawings to inform others about their ideas.
 - ★ Ask the children to explain how they will make their alarm, and the sequence in which they will make it. They will need to consider the circuit and the type of switch they will use. Encourage the children to discuss the progress of their work and evaluate any changes they make with others.
 - ★ Ask the children to use a control box/program to make their alarm work.
 - ★ Emphasise the quality of their design and, at the end of the assignment, the alarms can be tested *eg by the children trying to move each other's items from the display without the alarm going off.*

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

LEARNING OUTCOMES

CHILDREN

- recognise the uses to which alarm systems can be put
 - understand the dangers of mains electricity
 - understand that different switches work in different ways
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- use and understand the word 'feedback'
 - produce a range of working circuits using different kinds of switches
 - use a computer control program to control outputs eg *LEDs, bulbs, buzzers*
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- apply what they have learnt through IDEAs/FPTs in their designing and making
 - develop working prototypes of their design solution
 - produce a design sheet for the final product
 - discuss and finalise their design
 - create the alarm system
 - use a control box/program
 - evaluate the effectiveness of their system

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 3A 'Combining text and graphics', 5E 'Controlling devices', 6C 'Control and monitoring – What happens when ...?'

Mathematics: Number (sequence, predict)

Literacy: Identifying the sequence of activities for making the alarm could be extended into the task of writing instructions. The features of instructional texts are a focus of work of *The National Literacy Strategy: Framework for teaching* in year 4, term 1

Content

- Use a range of examples eg *home burglar alarms, car alarms, microwave timers and alarm clocks.*
- Tilt switches and reed switches used in conjunction with magnets may well be unfamiliar to the children, but will provide good solutions to this problem.
- Circuits could be made using crocodile clips, twisted wire and/or insulating tape or could be joined with a connector strip, but are much more reliable if joints are soldered.
- The movement of the valuable item could result in some audible (buzzer) or visual (lamp) feedback.

Class management

- The IDEAs and FPTs could be incorporated into circuit work undertaken in science.
- The children could work in small groups (three or four children) investigating eg *different switches*. They could make posters to illustrate their findings about how the switches work and could feed back their findings to each other.
- Some children could use any of the switches they have encountered. Some children may find such choice daunting and would benefit from being given more direction.
- Children could work in pairs to control their alarms.

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
- do not use rechargeable batteries for this work – in the event of a short circuit they could get very hot and cause injury

Out-of-school activities and homework

Children could gather information about alarm systems, circuits and switches using library books, CD-ROM and the Internet, if these are available.

