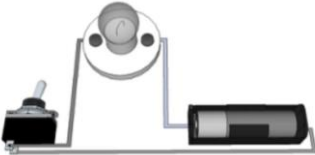
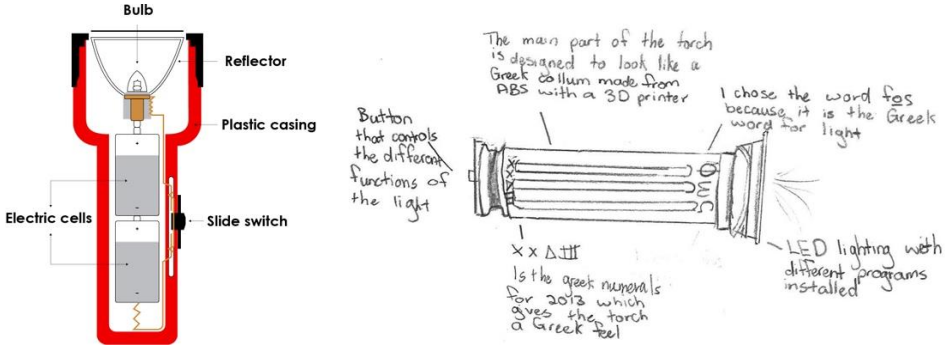




Year Group: 4	Term: Spring 2 2022	Teacher: Hannah Jones	Subject lead: Catherine O'Neill Edwards	Overview: Electrical Systems – Simple Circuits and switches Design and make a torch	Key End Points: By the end of this unit children will be able to: <ul style="list-style-type: none"> - Create a homemade switch - Create a prototype and know what a prototype is for - Know what an annotated diagram is and how this is different to a labelled diagram 	
Links to other learning: Festivals of light Seasons Time zone and day light saving	Relevant Prior Learning: Science: Y3 light, Y4 electricity	Future Learning: Y6: mechanical gears and pulleys	High Quality Text: Hand Shadows Activity Book for Kids Next Activity	Risk Assessment: No light source should be aimed at a face. Looking directly into light sources can cause harm to the eyes. Always have dry hands when using electrical equipment. Never put batteries near mouth and store safely at home. When handling electrical components, children should be aware of breakable bulbs, bulbs that do not match the battery voltage and short circuits. Plan with children what to do in the event of a breakage e.g. stand still and shout for help – don't try to pick it up themselves https://www.bbc.co.uk/bitesize/clips/z8x2tfr https://www.youtube.com/watch?v=q5ApVIDCEjc button battery dangers – watch this video as a teacher.	Teacher CPD: Please read the DATA project on a page sheets attached at the end of this plan prior to teaching. https://www.youtube.com/watch?v=qTJdZsx7nvU video to watch on a huge ranges of switches https://www.youtube.com/watch?v=zorqwY2a8gI explains short circuits - Read Y3 autumn 1 science planning on light and Y4 autumn 1 science planning electricity to see what the children have already learned - See teacher CPD document 'how to make homemade switches'	
Learning Intention	Lesson Outline (Key Questions in colour)			Resources	Vocabulary	Lowest 20% Adaptations
I can create a switch that controls a circuit	<p>Before lesson read Teacher CPD 'how to make homemade switches'. This is a DT lesson. In DT we design and make to solve problems. During this unit of work we are going to design, make and evaluate a torch. To do this we need to remember some key knowledge we have already learned in Science. Recap prior learning: Discuss and explain what these words mean: light source artificial light source natural light source reflector opaque transparent translucent circuit components (cells, wires, bulbs, switches and buzzers) conductors insulators</p> <p>Recap difference between mains and battery powered electricity. As a torch is battery powered we are going to explore some products that use batteries. What is a circuit? A complete path that electricity can flow around. Repeat several times and throughout the lesson.</p> <p>Discuss, investigate and, where practical, disassemble (take apart) different examples of relevant battery-powered products.. Have question prompts on tables and encourage discussion: Where and why they are used? How does the product work? What are its key features and components? How does the switch work? Is the product manually controlled or controlled by a computer? What materials have been used and why? How is it suited to its intended user and purpose? Does it have a switch? How does the switch work?</p> <p>• Give out electrical components and ask children to make a simple bulb circuit with a switch. What is a switch? A switch controls the flow of electrical current in a circuit. Repeat three times in different voices and again throughout the lesson. Ask them to and try out the different types of switches and encourage discussion about how they work. • If a</p>			<p>Wide variety of battery powered products for the children to look at and explore. Preferably with different types of switches</p> <p>Powerpoint 'types of homemade switches'</p> <p>Teacher CPD 'How to make homemade switches'</p> <p>https://www.tts-group.co.uk/switch-pack/1003747.html?cgid=Primary-Science-Electricity pack</p> <p>https://www.tts-group.co.uk/slide-switch/1003744.html</p> <p>Circuit kits (cells, wires, bulbs) Variety switches Card Paper clips</p>	<p>Switch Maintained momentary Circuit Cell Bulb Wire Closed Open Flow Electricity Current</p> <p>slide switch, reed switches, magnet switch, toggle switches, push to make switches, basic switches</p>	

	<p>child makes a short circuit – use this as a teaching point (see teacher CPD video). <i>Common misconception: electricity takes the shortest path – it does not; it takes the path of least resistance</i></p> <p>After exploration, explain there are two main types of switches: Maintained or momentary. What do you think each means? A maintained switch is light a light switch it stays on or off. A momentary switch would be like a door bell – it is activated with the switch is ‘switched’ but released when the switch is released. <i>Common misconception: all switches turn something on and close the circuit... example where this is not the case if the front door of the school, this has a circuit and the electricity keeps the door shut and locked. The key fobs that the staff have momentarily release the switch and open the circuit allowing the door to unlock.</i> Discuss the switches they have used... which are maintained or momentary. Ask children for every day products that use both types of switches.</p> <p>Name the types of switches that the children have investigated: slide switch, reed switches, magnet switch, toggle switches, push to make switches, basic switches</p> <p>Ask children which of the components in the circuit are input devices e.g. switches, and which are output devices e.g. bulbs and buzzers.</p> <p>- In books children record a variety of switches they have investigated labelling them maintained or momentary. Ask them to draw a labelled diagram using rules for label lines (not a circuit diagram as this isn’t taught until year 6)</p>  <p>• Next task: Ask the children to experiment and explore making a variety of switches by using simple classroom materials e.g. card, corrugated plastic, aluminium foil, paper fasteners and paper clips. Encourage children to make switches that operate in different ways e.g. when you press them, when you turn them, when you push them from side to side. Ask the children to test their switches in a simple series circuit (see teacher CPD resources for this)</p> <p>- Children then stick the switches they have made in their books and label them (ruler for straight lines) and annotate with any notes.</p> <p>Exit pass: My favourite switch is _____ because _____ The switch that is most suitable for a torch is _____ because _____</p>	<p>Spilt pins Empty circular plastic Bottles Foil</p>		
<p>I can make a prototype</p>	<p>Prior to this lesson read the ‘How to make a flash light’ sheet This is a DT lesson. In DT we design and make to solve problems.</p> <p>Recap on prior learning: What is a circuit? <i>A complete path that electricity can flow around. What is a switch?</i> <i>A switch controls the flow of electrical current in a circuit.</i></p> <p>During this unit of work we are going to design, make and evaluate a torch. Recap on learning from last lesson... which types of switches can you remember? Which switch are you going to use in your torch?</p> <p>Display/write ‘Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose).’ On the board. This is a design brief... it tells you WHAT, we are making, WHO we are making it for and WHY we are making it.</p> <p>Do we have all the information we need for our design brief? No. We only know WHAT we are making – our product. Without it having a user or a purpose this isn’t DT because it wouldn’t be solving a problem - so let’s find out who we are making it for and why! Reveal that the user is going to be themselves so they will get to use the torch and keep it at the end of the unit – so they want them to be really high quality! We now know the product and the user. Let’s find out the purpose... (invite a member of early years staff to come in and present purpose)... You are going to be showing children in early years hand shadow puppets. We are going to make our own torches, learn some hand shadow puppets and then you can show the children in early years.</p> <p>Our design brief now is ‘To design, make and evaluate a torch to make hand shadow puppets for the children in early years. Do we now know our product, purpose and user? Children write design brief in their books.</p> <p>Today we are going to make prototypes. What is a prototype? <i>A prototype is a simple model that lets you test your ideas. Repeat in three different voices and throughout lesson.</i> Today we are all going to make a (or several) prototype of</p>	<p>‘How to make a flash light’ sheet</p> <p>Circuit kits (cells, wires, bulbs)</p> <p>Variety switches</p> <p>Card</p> <p>Paper clips</p> <p>Spilt pins</p> <p>Empty circular plastic</p> <p>Bottles</p> <p>Foil</p> <p>Variety boxes</p> <p>Tubes</p> <p>Torch kits</p> <p>Card</p> <p>Sellotape</p> <p>Masking tape</p> <p>Glue</p>	<p>Prototype Design brief Product User Purpose</p>	

	<p>a torch (including staff). We will then have a good look at everyone's work and see if there are improvements we can make – DT is all about solving problems.</p> <p>Have a range of materials and resources out on the tables and encourage children to create prototypes. They must have a switch in their prototype. The housing has to be solid and stable. They don't need to have a working model however, the prototype needs to be stable and be able to house the switch and other circuit elements.</p> <p>Once prototypes are complete, children walk around room and look at other prototypes looking for things that worked well and things that could be better. Then reflect on their own prototype. (adult to take photo of each prototype to go in books later).</p> <p>In books record what a prototype is, strengths of their prototype and things they will change before their final product A prototype is _____. From creating my prototype, I have identified that I want to keep _____. I now know that I will change: _____</p> <p>Discuss difference between a labelled diagram and an annotated diagram. Share images below. Labels identify the main parts, annotations give us some more information.</p>  <p>In books children draw an annotated diagram of their intended product. Note: use a ruler for lines.</p>	Stapler		
I can make a product that meets a design brief	<p>This is a DT lesson. In DT we design and make to solve problems.</p> <p>Recap on prior learning: What is a circuit? A complete path that electricity can flow around. What is a switch? A switch controls the flow of electrical current in a circuit. What is a prototype? A prototype is a simple model that lets you test your ideas.</p> <p>This lesson children will make their products. Recap on design brief and ask children to revisit the learning they did from the previous lesson... changes they will make after creating their prototypes and their designs for their final product. Children need to take care when creating their final product as the final product must work, must be safe and must be sturdy.</p> <p>This lesson can span two lessons if the children need more time to finish their designs as we want them to be completed to a high standard.</p>	cells, wires, bulbs Variety switches Card Paper clips Spilt pins Empty circular plastic Bottles Foil Variety boxes Tubes Card Sellotape Masking tape Glue Stapler	Product Finish Quality Sturdy purpose	

<p>I can use my product for the purpose it was created for.</p> <p>I can evaluate my product.</p>	<p>This is a DT lesson. In DT we design and make to solve problems.</p> <p>Recap on prior learning: What is a circuit? A complete path that electricity can flow around. What is a switch? A switch controls the flow of electrical current in a circuit. What is a prototype? A prototype is a simple model that lets you test your ideas.</p> <p>Revisit design brief Design, make and evaluate a torch for myself to do a hand shadow puppet show for F2. Give out photocopies of some of the pages from <i>Hand Shadows Activity Book for Kids</i>. Children practice various shadow hand puppets before inviting early years in. The hall will be dark with lights off and all blinds drawn.</p> <p>Photograph/video the torches in use with the younger children. Stick these photographs in the children's book and ask children to evaluate their work by answering the following question in full sentences explaining why:</p> <p>Did your product work? Did the product look like your final design? Does your product look good? Is your product sturdy? Is your product safe? What switch did you use and why? What is the best thing about your product? What would you change next time? How much would you give your product out of 5?</p>	<p>Torches made by children</p> <p>Book: <i>Hand Shadows Activity Book for Kids</i>.</p>	<p>Evaluation</p> <p>Strength</p> <p>Improve</p> <p>change</p>	
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1. Year Groups

Year 3/4

2. Aspect of D&T

Electrical systems

Focus

Simple circuits and switches

3. Key learning in design and technology

Prior learning

- Constructed a simple series electrical circuit in science, using bulbs, switches and buzzers.
- Cut and joined a variety of construction materials, such as wood, card, plastic, reclaimed materials and glue.

Designing

- Gather information about needs and wants, and develop design criteria to inform the design of products that are fit for purpose, aimed at particular individuals or groups.
- Generate, develop, model and communicate realistic ideas through discussion and, as appropriate, annotated sketches, cross-sectional and exploded diagrams.

Making

- Order the main stages of making.
- Select from and use tools and equipment to cut, shape, join and finish with some accuracy.
- Select from and use materials and components, including construction materials and electrical components according to their functional properties and aesthetic qualities.

Evaluating

- Investigate and analyse a range of existing battery-powered products.
- Evaluate their ideas and products against their own design criteria and identify the strengths and areas for improvement in their work.

Technical knowledge and understanding

- Understand and use electrical systems in their products, such as series circuits incorporating switches, bulbs and buzzers.
- Apply their understanding of computing to program and control their products.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?

siren for a toy vehicle reading light noise-making toy nightlight illuminated sign torches table lamp lighting for display hands-free head lamp buzzer for school office other – specify

7. Links to topics and themes

Homes Travel and Holidays Cities
Emergency Vehicles School Business
Enterprise Light and Dark other – specify

5. Intended users

themselves younger children older children
teenagers parents grandparents friends
school general public other – specify

8. Possible contexts

home school leisure culture
enterprise environment sustainability
local community other – specify

10. Investigative and Evaluative Activities (IEAs)

- Discuss, investigate and, where practical, disassemble different examples of relevant battery-powered products, including those which are commercially available e.g. *Where and why they are used? How does the product work? What are its key features and components? How does the switch work? Is the product manually controlled or controlled by a computer? What materials have been used and why? How is it suited to its intended user and purpose?*
- Ask children to investigate examples of switches, including those which are commercially available, which work in different ways e.g. push-to-make, push-to-break, toggle switch. Let the children use them in simple circuits e.g. *How might different types of switches be useful in different types of products?*
- Remind children about the dangers of mains electricity.

12. Focused Tasks (FTs)

- Recap with the children how to make manually controlled, simple series circuits with batteries and different types of switches, bulbs and buzzers. Discuss which of the components in the circuit are input devices e.g. switches, and which are output devices e.g. bulbs and buzzers.
- Demonstrate how to find a fault in a simple circuit and correct it, giving pupils opportunities to practise.
- Use a simple computer control program with an interface box or standalone control box to physically control output devices e.g. bulbs and buzzers.
- Ask the children to make a variety of switches by using simple classroom materials e.g. card, corrugated plastic, aluminium foil, paper fasteners and paper clips. Encourage children to make switches that operate in different ways e.g. when you press them, when you turn them, when you push them from side to side. Ask the children to test their switches in a simple series circuit.
- Teach children how to avoid making short circuits.

14. Design, Make and Evaluate Assignment (DMEA)

- Develop a design brief with the children within a context which is authentic and meaningful.
- Discuss with children the purpose of the battery-powered products that they will be designing and making and who they will be for. Ask the children to generate a range of ideas, encouraging realistic responses. Agree on design criteria that can be used to guide the development and evaluation of the children's products, including safety features.
- Using annotated sketches, cross-sectional and exploded diagrams, as appropriate, ask the children to develop, model and communicate their ideas.
- Ask the children to consider the main stages in making and testing before assembling high quality products, drawing on the knowledge, understanding and skills learnt through IEAs and FTs.
- Evaluate throughout and the final products against the intended purpose and with the intended user, drawing on the design criteria previously agreed.

6. Purpose of products

safety and security hobbies and interests
utility pleasure advertising gift
energy saving for sale other – specify

9. Project title

Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose)
To be completed by the teacher. Use the project title to set the scene for children's learning prior to activities in 10, 12 and 14.

11. Related learning in other subjects

- **Science** – know how to construct simple series circuits and have a basic understanding of conductors, insulators and open and closed switches.
- **Spoken language** – participate in discussion and evaluation of battery-powered products. Ask relevant questions to extend knowledge and understanding. Build their technical vocabulary.

13. Related learning in other subjects

- **Science** – know how to construct simple series circuits and have a basic understanding of conductors, insulators and open and closed switches.
- **Computing** – design, write and debug programs that accomplish specific goals, including controlling physical systems.
- **Spoken language** – asking questions to check understanding, develop technical vocabulary and build knowledge.

15. Related learning in other subjects

- **Spoken language** – maintain attention and participate actively in collaborative conversations, staying on topic and initiating and responding to comments. Develop understanding through speculating, hypothesising, imagining and exploring ideas.
- **Science** – know how to construct simple series circuits and have a basic understanding of conductors, insulators and open and closed switches.
- **Computing** – design, write and debug programs that accomplish specific goals, including controlling physical systems.
- **Art and design** – using and developing drawing skills.

16. Possible resources

handling collection of battery-powered electrical products
switches including toggle, push-to-make and push-to-break

aluminium foil, paper fasteners, paper clips, card, corrugated plastic, reclaimed materials, finishing materials and media

buzzers, bulbs, bulb holders, zinc carbon or zinc chloride batteries, battery holders, wire, automatic wire strippers
suitable control program with interface box or standalone control box
right/left handed scissors, PVA glue, cutting mats

17. Key vocabulary

series circuit, fault, connection, toggle switch, push-to-make switch, push-to-break switch, battery, battery holder, bulb, bulb holder, wire, insulator, conductor, crocodile clip

control, program, system, input device, output device

user, purpose, function, prototype, design criteria, innovative, appealing, design brief

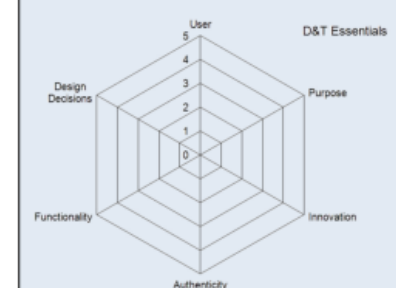
18. Key competencies

problem-solving teamwork negotiation
consumer awareness organisation motivation
persuasion leadership perseverance
other – specify

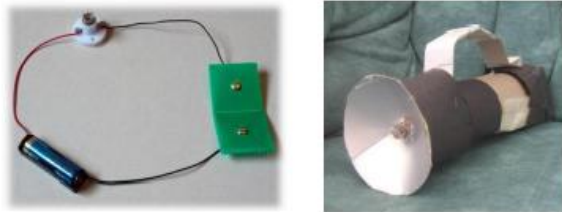
19. Health and safety

Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

20. Overall potential of project



Instant CPD



Tips for teachers

- ✓ This project should be undertaken either around the same time or soon after electricity is covered in science.
- ✓ Use a selection of images of existing battery-powered products to add to the actual products that children investigate and evaluate.
- ✓ Check the condition of the batteries prior to activities.
- ✓ Stress the need for making secure connections.
- ✓ To reduce the number of requests for help, model the fault-finding process: check all the connections, ensure that bulbs are screwed in tightly and ensure that components are correctly connected.
- ✓ Have a 'working' circuit set up so that children can test suspect components.
- ✓ Some components (e.g. buzzers) need to be connected the right way round in a circuit, ensuring positive and negative match the poles of the battery.
- ✓ Make sure bulbs and batteries match e.g. 1.5v bulb with a 1.5v battery.
- ✓ Do not use rechargeable batteries.
- ✓ CLEAPS recommend zinc carbon and zinc chloride batteries for Primary schools, not rechargeable, lithium of alkaline as these can overheat if short circuited. Button batteries are not recommended for younger children.

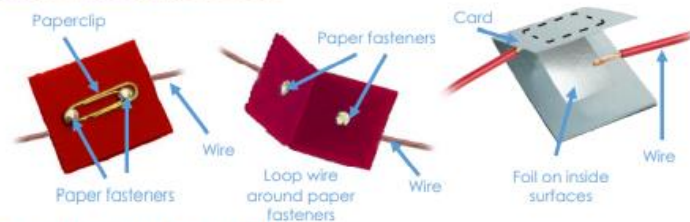
Useful resources at www.data.org.uk

- [Torches, Lamps and Lanterns](#)
- [Developing Handmade Switches](#)
- [Night lights \(links to literacy\)](#)
- [Handmade Switches Helpsheet](#)
- [Alarming Vehicles](#)

Making secure connections



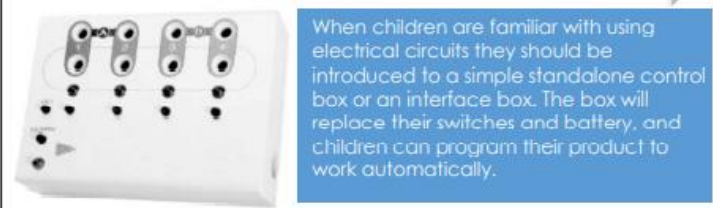
Handmade switches



Commercial switches



Standalone control box



When children are familiar with using electrical circuits they should be introduced to a simple standalone control box or an interface box. The box will replace their switches and battery, and children can program their product to work automatically.

Designing, making and evaluating a night light for a brother, sister or friend

An iterative process is the relationship between a pupil's ideas and how they are communicated and clarified through activity. This is an example of how the iterative design and make process might be experienced by an individual pupil during this project:

THOUGHT	ACTION
What sort of night light shall I make and who will it be for? What parts will it have? How will it appeal to the user?	Discussing ideas, drawing annotated sketches, cross-sectional and exploded diagrams, generating design criteria.
What switch will work best for my night light?	Discussing ideas, modeling possible electrical circuits.
How will I make the base, casing and shade?	Discussing, exploring and trialling materials.
Who will I work with? How long will it take? What order will I work in?	Negotiating, developing and agreeing a plan of action.
More thoughts... appraising, reflecting, refining.	More actions... assembling, testing and modifying.
More thoughts... appraising, reflecting, refining.	More actions... assembling, testing and modifying.
Will the night light meet the needs of the user and achieve its purpose?	Evaluating the nightlight with the intended user and against design criteria.

Glossary

- **Circuit** – path through which electricity passes.
- **Conductor** – a material which allows an electric current to pass through it.
- **Insulator** – a material which does not easily allow electric current to pass through it.
- **Prototype** – a model made to test whether a design will work.
- **Push-to-break switch** – a switch turned off by pressing it.
- **Push-to-make switch** – a switch turned on by pressing it.
- **Reed switch** – a switch operated by a magnet.
- **Toggle switch** – a switch operated when a lever is pressed.
- **System** – a set of related parts or components that together achieve a desired outcome.
- **Output devices** – components that produce an outcome e.g. bulbs and buzzers.
- **Input devices** – components that are used to control an electrical circuit e.g. switches.