

# ACET Junior Academies

## Scheme of Work for Design Technology

### Y4 Electrical Systems - Simple circuits and switches



**About this unit:** In this unit pupils will learn about battery powered electrical products. They will explore a range of battery powered products to investigate the components required and how they work. Children will use their learning from Science to make a range of simple circuits and will investigate using different types of switch to control their circuit. Pupils will learn to identify and correct faults in electrical circuits and will discuss the dangers of mains electricity. Pupils will design an electrical product for an intended user and purpose. They will apply their learning from the unit to construct and control their circuit and will evaluate their completed products, judging the extent to which they have met the original design criteria.

**Final piece ideas:** Torches, reading light, night light, hands-free head lamp, light up picture (link Science - Electricity)

**Inventor Link:** Ben Franklin, William Gilbert, Alessandro Volta

#### Unit structure

1. Investigate and Evaluate: How do battery powered products work?
2. Focused Tasks: How do you create a simple circuit?
3. Designing: What could I make and how could I make it?
4. Making: Can I make the product I have designed?
5. Finishing: Is my product finished?

#### Links to previous and future National Curriculum units

- UKS2 - Electrical systems - More complex switches and circuits.

6. Evaluating: What went well? How could I improve my product?

### 1: Investigate and Evaluate: How do battery powered products work?

Links to previous learning	Knowledge and second order concepts	Skills, Concepts and Vocabulary:	Assessment criteria:	Curricular links:
<p>Pupils will have constructed a simple series electric circuit in science, using bulbs, switches and buzzers. Pupils will have cut and joined a variety of construction materials, such as wood, card, plastic, reclaimed materials and glue.</p>	<p><b>Substantive knowledge:</b> (<i>What students should know.</i>) That there are a range of battery powered products that have been designed, produced and evaluated. Know who designed products and when and where they were made. Know the purpose of different electrical products. Know what materials products are made from. That battery powered products can be operated manually or by a computer.</p> <p><b>Second order concepts:</b> (<i>What students should understand</i>) Evaluation Purpose Function</p> <p>Example</p>	<p><b>Skills</b></p> <ul style="list-style-type: none"> <li>Evaluate existing products, considering how well they have been made, the materials chosen, whether they work, how they have been made and if they are fit for purpose.</li> <li>Identify who designed a product, and when and where it was produced.</li> <li>Identify the materials products are made from, and whether the product can be recycled or reused.</li> </ul> <p><b>Key Vocabulary/concepts:</b> <a href="https://20353.stem.org.uk/Nuffield%20Glossary2/index.html">https://20353.stem.org.uk/Nuffield%20Glossary2/index.html</a></p> <p>Evaluate, user, purpose, design, product, function, switch, toggle switch, push-to-make switch, push-to-break switch, battery-</p>	<p><b>Can your children:</b> Explore a range of battery-powered products. Understand the purpose of products and their intended user. Identify who made the products and when they were made. Understand how different kinds of switches are used in products. Identify the materials products are made from and explain why they have been chosen. Express opinions about products based on design and use.</p>	<p><b>Horizontal:</b> Science - constructing circuits Spoken Language - participate in discussion with adults and peers. Ask relevant questions to extend knowledge and understanding.</p> <p><b>Vertical:</b></p>



powered, mains electricity,  
disassemble

**Suggested activities:**

Discuss and investigate different examples of battery-powered products. If possible, provide examples that pupils can disassemble.  
Use questions to develop understanding e.g. *What is the product? Where and why is it 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?*  
Provide a range of switches which work in different ways for pupils to investigate, e.g. push-to-make, push-to-break, toggle switch. Pupils explore using them in simple circuits to explore how different types of switches could be useful in different types of product.  
Throughout the lesson, remind pupils of the dangers of mains electricity.  
Pupils complete an evaluation of a chosen product(s), using appropriate language to explain how a product works.  
Children could research inventors linked to the topic e.g. Ben Franklin, William Gilbert, Alessandro Volta

**Resources:**

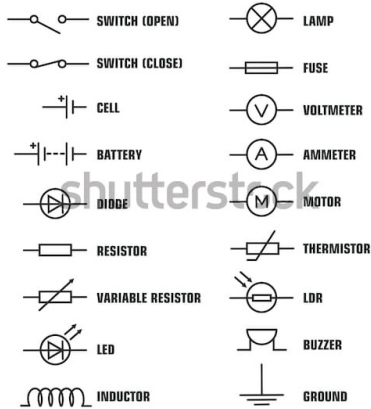
Collection of battery powered electrical products, switches including toggle, push-to-make and push-to-break

**Useful links:**

Could introduce a famous inventor that created a circuit. Possible Ben Franklin and his theory of the lightning and the key. Can the children discuss whether his theory was successful? Why?  
<https://www.mentalfloss.com/article/66551/tru-e-story-behind-ben-franklins-lightning-experiment>  
<https://www.bbc.co.uk/bitesize/topics/zj44jxs>  
<https://www.dkfindout.com/uk/science/electricity/>  
<http://www.mrjennings.co.uk/teacher/DT/D&T%20Lower%20KS2%20project%20sheets.pdf>

**2: Focused Tasks: How do you create a simple circuit?**

Links to previous learning	Knowledge and second order concepts	Skills, Concepts and Vocabulary:	Assessment criteria:	Curricular links:
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<p>Pupils will have explored and evaluated a range of battery-powered products. They will understand the purpose and intended user of products. Pupils will be able to explain how different types of switch can be useful in different products. They will have used different types of switch in series circuits.</p>	<p><b>Knowledge:</b>  <b>Substantive knowledge:</b>  <i>(What students should know.)</i>          Develop and use knowledge of how to construct a simple circuit          That electrical systems have an input and an output          That there are a variety of types of switch which work in different ways to operate battery powered products          Know and use technical vocabulary relevant to the project.</p> <p><b>Second order concepts:</b>  <i>(What students should understand)</i>          Input          Output          Process</p> <p><b>ELECTRICAL CIRCUIT SYMBOLS</b></p>  <p><small>www.shutterstock.com · 1477140695</small></p>	<p><b>Skills</b></p> <ul style="list-style-type: none"> <li>• Understand how learning from Science and maths can be used to help design and make products that work</li> <li>• Know how simple electrical circuits and components can be used to create functional products</li> <li>• that mechanical and electrical systems have an input, process and output</li> <li>• Use a range of materials and components</li> <li>• Work safely and accurately with a range of tools</li> <li>• Assemble, join and combine materials and components with some accuracy, using a range of techniques.</li> <li>• Know and use the correct technical vocabulary for the projects they are undertaking</li> </ul> <p><b>Key Vocabulary/concepts:</b>          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</p>	<p><b>Can your children:</b>          Make a simple series circuit using batteries, different types of switches, bulbs and buzzers? Identify and understand input and output devices. Identify and correct faults in circuits. Make different types of switch using classroom materials and evaluate each.</p>	<p><b>Horizontal:</b>          Science - constructing simple circuits; basic understanding of conductors, insulators and open and closed switches. Spoken language - Ask relevant questions to extend knowledge and understanding.</p> <p><b>Vertical:</b></p>
<p><b>Suggested activities:</b>          Pupils manually make controlled simple series circuits with batteries and different types of switches, bulbs and buzzers. Discuss the components in the circuit, identifying the input devices e.g. switches, and the output devices, e.g. bulbs and buzzers.</p>		<p><b>Resources:</b>          Variety of switches, foil, paper fasteners, paper clips, card, plastic, reclaimed materials, buzzers, bulbs, bulb holders,</p>	<p><b>Useful links:</b>  <a href="https://www.dkfindout.com/uk/science/electricity/">https://www.dkfindout.com/uk/science/electricity/</a></p>	

<p>Demonstrate and provide opportunity for pupils to identify and correct faults in circuits. Ensure pupils work strategically to identify faults, testing one component at a time e.g. <i>What could the fault be? How could we check if the fault is with the battery/bulb/buzzer/switch/wire? What needs to be replaced? How do we know the replacing part works?</i></p> <p>Ask pupils to make a simple circuit and test with a variety of switches from classroom materials, e.g. card, plastic, foil, paper fasteners, paper clips. What do they deduce from these materials? Challenge them to make switches that operate in different ways e.g. by pressing them, turning them, pushing from side to side. Pupils test their switches in simple series circuits.</p> <p>Within the lesson, teach children about short circuits and how to avoid making them.</p>	<p>battery holders, batteries, wires</p>	<p><a href="https://www.tes.com/teaching-resource/making-a-circuit-3002538">https://www.tes.com/teaching-resource/making-a-circuit-3002538</a></p> <p><a href="https://www.bbc.co.uk/bitesize/topics/zq99q6f">https://www.bbc.co.uk/bitesize/topics/zq99q6f</a></p> <p><a href="https://www.bbc.co.uk/bitesize/topics/zq99q6f/resources/1">https://www.bbc.co.uk/bitesize/topics/zq99q6f/resources/1</a></p> <p><a href="http://www.mrjennings.co.uk/teacher/DT/D&amp;T%20Lower%20KS2%20project%20sheets.pdf">http://www.mrjennings.co.uk/teacher/DT/D&amp;T%20Lower%20KS2%20project%20sheets.pdf</a></p>
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### 3: Designing: What could I make and how could I make it?

Links to previous learning	Knowledge and second order concepts	Skills, Concepts and Vocabulary:	Assessment criteria:	Curricular links:
<p>Pupils will understand that battery powered products have circuits operated by switches. Pupils will understand how circuits work and the role of the switch in the circuit. They will have investigated making different types of switches in circuits and will have evaluated each one, identifying the kinds of products each type of switch is useful for.</p>	<p><b>Substantive knowledge:</b> (<i>What students should know.</i>)</p> <p>That products need to be designed before they are made. That designers consider the needs and wants of a user. That products are according to design criteria. That a design brief outlines the aims of a design that is needed. That design criteria are the standards the finished product must meet. That a design proposal is a response to a design brief That the order of making needs to be planned</p> <p><b>Second order concepts:</b> (<i>What students should understand</i>) Design brief</p>	<p><b>Skills</b></p> <ul style="list-style-type: none"> <li>• Describe the purpose of their product</li> <li>• Explain how particular parts of their product work</li> <li>• Gather information about the needs and wants of the user</li> <li>• Develop their own design criteria and use to inform their ideas</li> <li>• Generate realistic ideas, considering the purposes for which they are designing.</li> <li>• Communicate ideas through labelled drawings from different views showing specific features.</li> </ul>	<p><b>Can your children:</b> Generate realistic ideas based on the needs of the user? Communicate ideas through sketches and diagrams? Order the main stages of making?</p>	<p><b>Horizontal:</b> Spoken language - Participate in discussion and collaborative conversations to develop ideas. Listen and respond appropriately to adults and peers. Science - know how to construct and control a simple circuit using switches. Art and Design - use drawing and</p>

	<p>Design criteria Design proposal</p>	<ul style="list-style-type: none"> <li>• Select from a wider range of tools, equipment, materials and components</li> <li>• Plan and record the order of their work.</li> </ul> <p><b>Key Vocabulary/concepts:</b> user, purpose, design, product, function, switch, toggle switch, push-to-make switch, push-to-break switch, battery-powered, mains electricity, annotated sketch, cross-sectional diagram, exploded diagram</p>		<p>sketching skills to develop and communicate ideas</p>
<p><b>Suggested activities:</b></p>		<p><b>Resources:</b></p>	<p><b>Useful links:</b></p>	
<p>Set a context which is authentic and meaningful and share a design brief for the product they will make e.g. a hands free head torch, a lamp, a picture with light up stars etc.</p> <p>Discuss the purpose of the battery powered products that they will be designing, making and evaluating, and who they will be for. Pupils generate a range of ideas through discussion.</p> <p>Agree on design criteria that can be used to guide the development and evaluation of the projects, including safety features.</p> <p>Pupils use labelled drawings from different views, to develop, model and communicate their ideas. Pupils consider e.g. <i>What will you need to include in your design? How can you improve it? What materials will you use? How will you make sure your product works well and has the right appearance?</i></p> <p>Pupils complete a design proposal, detailing the tools, equipment and materials they will use and the order in which they will make the product through. This could be done through flow charts or storyboards or through writing a list of instructions.</p>		<p>Sketch pads, Annotations</p>	<p><a href="http://www.mrjennings.co.uk/teacher/DT/D&amp;T%20Lower%20KS2%20project%20sheets.pdf">http://www.mrjennings.co.uk/teacher/DT/D&amp;T%20Lower%20KS2%20project%20sheets.pdf</a></p>	

#### 4: Making: Can I make the product I have designed?

Links to previous learning	Knowledge and second order concepts	Skills, Concepts and Vocabulary:	Assessment criteria:	Curricular links:
<p>Pupils will have identified the product they are going to make. They will have a clear understanding of the purpose of the product and of needs and wants of the intended user. Pupils will have developed a design brief and a set of design criteria to guide the development of their products. They will have a clear understanding of the order in which they will make the product.</p>	<p><b>Knowledge:</b>  <b>Substantive knowledge:</b>  <i>(What students should know.)</i>            That design proposals and criteria are used to guide the making process.            The importance of evaluating ongoing work.  <b>Second order concepts:</b>  <i>(What students should understand)</i>            Functionality            Aesthetics            Evaluate</p>	<p><b>Skills</b></p> <ul style="list-style-type: none"> <li>• Use a range of materials and components</li> <li>• Work safely and accurately with a range of tools.</li> <li>• Measure, mark out, cut and shape a range of materials and components using appropriate tools, equipment and techniques with some accuracy.</li> <li>• Assemble, join and combine materials and components with some accuracy, using a range of techniques.</li> </ul> <p><b>Key Vocabulary/concepts:</b>            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,</p>	<p><b>Can your children:</b>            Select tools and materials according to functional properties and aesthetic qualities. Use their knowledge of circuits to build a simple series circuit for their product. Choose an appropriate switch for their product. Test circuits, identify faults and correct.</p>	<p><b>Horizontal:</b>            Science - Choose suitable materials based on properties to make products; construct and control simple series circuits using switches. Spoken language - ask questions to develop knowledge and understanding.</p> <p><b>Vertical:</b></p>
<b>Suggested activities:</b>		<b>Resources:</b>	<b>Useful links:</b>	
<p>Remind pupils of the design brief and give them opportunity to revisit their design proposals and plans. Remind children to test their circuit before committing to their final piece.</p> <p>Pupils collect the materials and tools required for their circuits. Pupils use knowledge from previous lessons and from science to construct their circuits. Once constructed, pupils should test their circuits to identify any faults. Pupils use their knowledge and skills from previous lessons to identify where a fault is and to correct it before completing their product.</p> <p>Encourage the children to evaluate their developing products by referring to the design criteria, considering the intended purpose and user. Encourage</p>		<p>Variety of switches, foil, paper fasteners, paper clips, card, plastic, reclaimed materials, buzzers, bulbs, bulb holders, battery holders, batteries, wires</p>	<p><a href="http://www.mrjennings.co.uk/teacher/DT/D&amp;T%20Lower%20KS2%20project%20sheets.pdf">http://www.mrjennings.co.uk/teacher/DT/D&amp;T%20Lower%20KS2%20project%20sheets.pdf</a></p>	



pupils to identify why things have gone wrong and use their knowledge and skills to solve problems. Pupils could record changes made to overcome problems or any improvements made on their plans.			
5: Finishing: Is my product complete?			
Links to previous learning	Knowledge and second order concepts	Skills, Concepts and Vocabulary:	Assessment criteria:
Pupils will have produced a working circuit for their product. They will have tested the product and identified and corrected any faults.	<p><b>Substantive knowledge:</b> (What students should know.) That products need to be finished to a high quality to make them appealing to the intended user. Know a range of techniques suitable for the product they are creating. The importance of evaluating evolving work.</p> <p><b>Second order concepts:</b> (What students should understand) Finish Appeal</p>	<p><b>Skills</b></p> <ul style="list-style-type: none"> <li>Choose from and use a wide range of finishing techniques to strengthen and improve the appearance of their product with some accuracy, including the use of ICT</li> </ul> <p><b>Key Vocabulary/concepts:</b> Finish/finishing, appearance, appealing, aesthetics,</p>	<p><b>Can your children:</b> Apply a range of finishing techniques suitable for the product they are making? Evaluate their developing products and use problem solving skills when things go wrong?</p>
<b>Suggested activities:</b>		<b>Resources:</b>	<b>Useful links:</b>
Refer to design brief and proposals. Pupils use finishing techniques to complete their products, referring to the design brief and their design proposals. Pupils continue to evaluate their work e.g. <i>Which finishing technique are you using? Why are you choosing this technique? How does your chosen finish meet the needs of the intended user?</i>		Finishing resources, e.g. paper, glue, pens, paint,	<a href="http://www.mrjennings.co.uk/teacher/DT/D&amp;T%20Lower%20KS2%20project%20sheets.pdf">http://www.mrjennings.co.uk/teacher/DT/D&amp;T%20Lower%20KS2%20project%20sheets.pdf</a>



## 6: Evaluating: What worked well and what could I do to make it even better?

Links to previous learning	Knowledge and second order concepts	Skills, Concepts and Vocabulary:	Assessment criteria:	Curricular links:
<p>Children will have generated and developed ideas for their product. They will have explored different battery-powered products and designed a product with an intended purpose for an intended user. They will have practised making simple series circuits containing switches and will have explored different types of switch. They will have evaluated their evolving work and overcome problems using problem solving skills.</p>	<p><b>Substantive knowledge:</b> (What students should know.) That evaluations identify the strengths and areas for development in a product. That products change and evolve through evaluations.</p> <p><b>Second order concepts:</b> (What students should understand) Evaluate Develop</p>	<p><b>Skills</b></p> <ul style="list-style-type: none"> <li>• Use their design criteria to evaluate their product identifying both strengths and areas for development</li> <li>• Consider the views of others to improve their work</li> </ul> <p><b>Key Vocabulary/concepts:</b> Evaluate, design criteria, design brief, innovative, user, purpose, function, product, ideas, appeal, finish, improve</p>	<p><b>Can your children:</b> Use their design criteria to evaluate their product by judging the extent to which it suits the purpose and meets the needs of the intended user. Identify both the strengths of the product and the areas for development?</p>	<p><b>Horizontal:</b> Spoken language - ask questions to develop knowledge and understanding. Give clear responses to questions. Consider the views of others. Science - Plants; nutrition Writing - produce a written evaluation of the finished product using appropriate headings/subheadings using appropriate technical and sensory vocabulary</p> <p><b>Vertical:</b></p>
<b>Suggested activities:</b>		<b>Resources:</b>	<b>Useful links:</b>	
<p>Pupils evaluate their final products against the design criteria. They consider the extent to which the product meets the needs of the intended user and suits the intended purpose. Allow children to show and demonstrate their product to their peers. Where possible allow feedback from the intended user. <i>Does the product suit the purpose? Does it suit the intended user? Is it easy to operate? How well has the product been finished? Are the materials</i></p>		<p>Completed products Evaluation sheet</p>	<p><a href="http://www.mrjennings.co.uk/teacher/DT/D&amp;T%20Lower%20KS2%20project%20sheets.pdf">http://www.mrjennings.co.uk/teacher/DT/D&amp;T%20Lower%20KS2%20project%20sheets.pdf</a></p>	

*suitable for the product? How could the product be improved/made more appealing?*

Pupils complete an evaluation for their own product.