


# Year 6 Design and Technology: Electrical Systems – Block E

## Can switches perform more than one function?

- This block is set in the context of the CUSP Science unit ‘Electricity’.
- The outline and structure of the block is as follows:

| Lesson 1  | Lesson 2  | Lesson 3   |
|---|---|--|
| Revisit switches and circuits and the associated vocabulary | Explore how multiple switches and components can be included in a circuit | Incorporate multiple switches and components into a product to meet a design brief |

| At the end of this block, pupils will ...                                 |   |
|---|---|
| Know:   | Be able to:   |
| More than one switch can be used to change the functionality of a product | Use switches to adapt a product in response to a design brief |



Albert Sadacca (1901 – 1980)  
Inventor of Christmas tree lights

In this block, pupils will learn how switches can be combined with electrical components in different ways to change the functionality of a product.

| CUSP Design & Technology Long term sequence | Block A            | Block B            | Block C            | Block D                 | Block E            | Block F            |
|---|--------------------|--------------------|--------------------|-------------------------|--------------------|--------------------|
| Year 1                                      | Mechanisms         | Structures         | Food and Nutrition | Understanding Materials | Textiles           | Food and Nutrition |
| Year 2                                      | Textiles           | Food and Nutrition | Mechanisms         | Understanding Materials | Food and Nutrition | Structures         |
| Year 3                                      | Textiles           | Food and Nutrition | Mechanisms         | Food and Nutrition      | Systems            | Structures         |
| Year 4                                      | Food and Nutrition | Mechanisms         | Textiles           | Structures              | Electrical Systems | Food and Nutrition |
| Year 5                                      | Food and Nutrition | Systems            | Textiles           | Mechanisms              | Structures         | Food and Nutrition |
| Year 6                                      | Food and Nutrition | Mechanisms         | Food and Nutrition | Structures              | Electrical Systems | Textiles           |

# Point of reference:

## Y6 Electrical Systems – Block E

Pupils will be able to:

- construct simple electrical circuits and name the components
- recognise that a switch opens and closes a circuit



Prior Learning

- give reasons for variations in how components function in a circuit
- use recognised symbols when representing a simple circuit

### Design or Technology History:

Albert Sadacca (1901 – 1980)

Albert Sadacca is credited with popularising electric Christmas tree lights for private use. At the age of 15, after a fire in New York City which was started by candles suspended in a tree, Sadacca adapted the novelty lighting that his parents sold for use in Christmas trees. In 1925, Sadacca's company, enjoying success in the new Christmas light business, proposed that several companies then competing for the market join together as a trade organisation. The name of the organisation was The National Outfit Manufacturer's Association. The association merged into a single company the following year and began several decades of dominance in the rapidly growing Christmas lighting market as the NOMA Electric Company.

### Links to Literature:

*A World of Discovery* by Richard Platt

*Great Inventors from A – Z* by Valter Vogato

*Using Electricity* [www.curriculumvisions.com](http://www.curriculumvisions.com) (teacher resource)

### Materials:

Electrical components, e.g. battery packs, wires, motors, bulbs, buzzers, range of switch types

Cardboard tubes

Masking tape

Range of products that use switches

### Health and Safety:

This block requires pupils to use: batteries, bulbs, motors and other electrical components. Teachers should ensure that they follow their own school's risk assessments and policies for using the necessary materials and equipment. Pupils should be taught about how to use equipment and materials safely and responsibly as part of these lessons.

### Working as a Designer

| Design  | Make   | Evaluate  | Apply   |
|---|--|---|---|
| The art or process of deciding how something will look or work. | Create something by combining materials or putting parts together. | Form an opinion of the value or quality of something after careful thought. | Use something or make something work in a particular situation. |

# Point of explanation:

## Y6 Electrical Systems – Block E

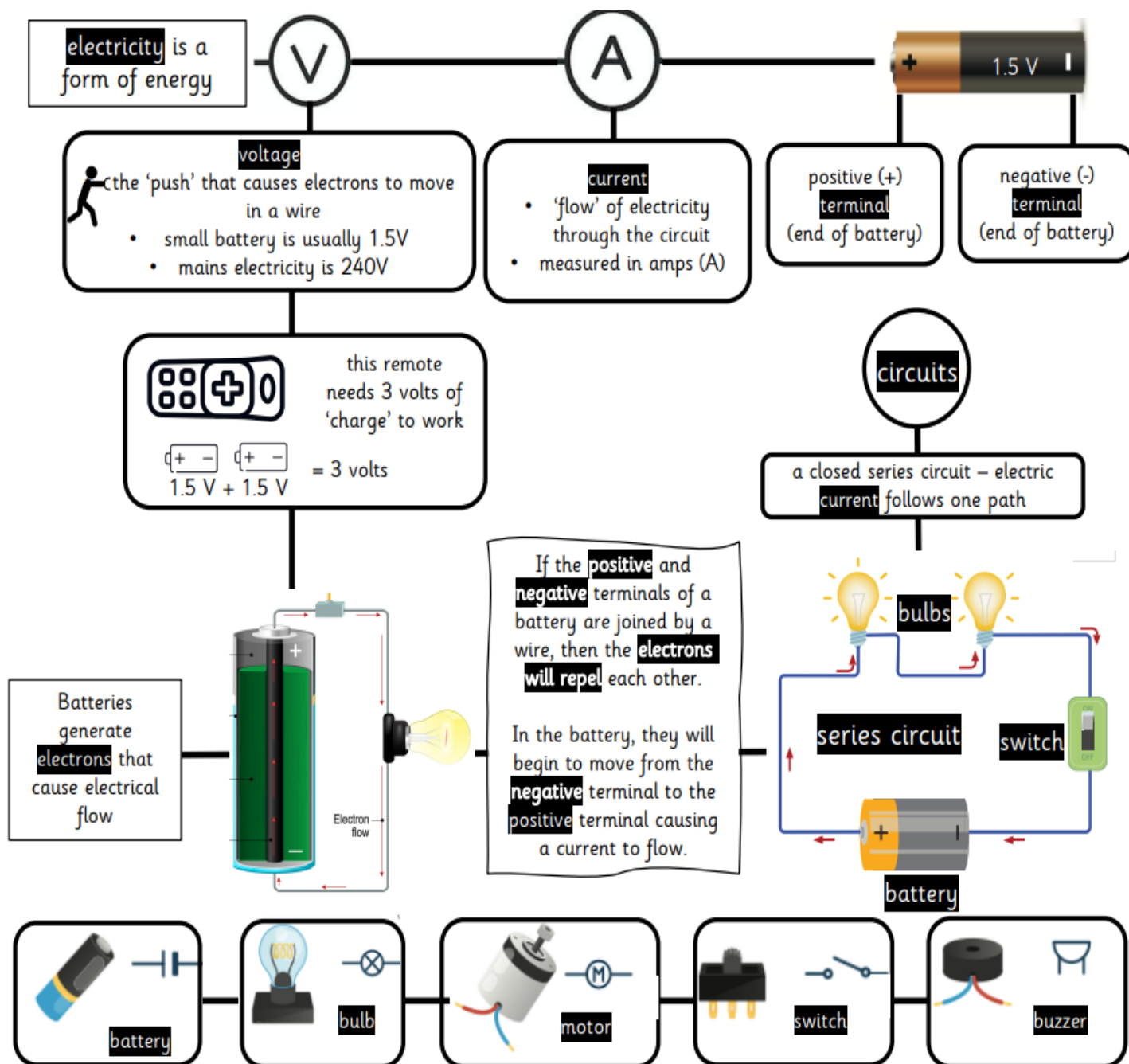
| Core Knowledge   | Explanation   |
|------------------|---|
| switch           | A switch is a device for making or breaking the connection in an electrical circuit.  |
| parallel circuit | In parallel circuits, electrical components are connected alongside one another, forming extra loops. Since there are different loops, the current will split as it leaves the cell and pass through one of the loops. In a parallel circuit, if a lamp breaks or a component is disconnected from one parallel wire, the components on different branches keep working. And, unlike a series circuit, the lamps stay bright if you add more lamps in parallel. |
| series circuit   | In a series circuit, components are connected in one loop. The electrical current passes through all the different components, one after the other, without any branches. If a lamp breaks or a component is disconnected, the circuit is broken and all the components stop working.   |
| component        | A component is one of the parts of an electrical circuit such as a bulb, battery or switch.   |

| Technical Vocabulary | Definition   |
|----------------------|--|
| functionality        | the purpose that something is designed for or expected to perform  |
| multi-function       | having many different functions  |
| brief                | a written description of what a new project or product should do, what is needed to produce it, how long it will take etc. |
| simultaneous         | happening or being done at exactly the same time   |

**Link to Video:** <https://vimeo.com/687965628/3103352989>




- Explanation and demonstration of taught content
- Lesson by lesson guidance
- Exemplification of techniques and outcomes

# Supporting Images: Y6 Electrical Systems – Block E, Lesson 1







# Point of delivery:

## Y6 Electrical Systems – Block E

| Revisiting prior learning   | Taught content    | Point of practice   | Point of reflection    |
|--|--|--|---|
| <p>1. Batteries, bulbs, motors, switches and buzzers are components of electrical circuits</p> <p>A continuous flow of electrical energy is needed to enable an appliance to work</p> <p>A switch is a control mechanism used to interrupt the flow of electricity in a circuit</p> <p>Some switches have more than one function</p> | <p>Explore types and functions of switches in a range of products</p> <p>Identify switches that have a single function and those that are multi-purpose</p> <p>Suggest reasons why specific switches have been used in particular appliances</p> <p>Draw circuit diagrams to represent a circuit including a bulb or buzzer and a switch</p> <p>Make accurate recordings</p> | <p>Introduce the key question for this unit: <b>Can switches perform more than one function?</b> Through questioning, ascertain pupils' prior knowledge and understanding of electricity and circuits. Pupils should be able to construct simple circuits and use symbols to represent the components. They should be able to give reasons for variations in the performance of components in a circuit. For example, increasing the voltage of the power source will affect the speed of a motor; adding multiple bulbs to a series circuit will result in each bulb being dimmer.</p> <p>Refer to the Knowledge Note to reinforce the key vocabulary that pupils will need to use in this unit and the supporting images to revisit prior learning.</p> <p>Instruct pupils to build a series circuit containing just one switch and a bulb or buzzer. Challenge pupils to draw a circuit diagram to represent what they have made. Ask pupils to explain how the switch works.</p> <p>Provide images of a range of switches found in common appliances. Challenge pupils to describe each switch and compare products with more than one switch and those where one switch performs more than one function. For example:</p> <ul style="list-style-type: none"> <li>• an electric toothbrush has a simple on / off switch which operates a small motor to rotate the brush. The switch needs to be robust because it is used daily, and it needs to be suitable for use in damp conditions.</li> <li>• a hand-held vacuum has a trigger switch that needs to be manually kept on for the duration of use. The switch operates the suction of the cleaner but also a rotating brush.</li> <li>• an oven switch in the form of a dial has several functions; it turns the oven on, but the switch can be set to different modes.</li> </ul> <p>(Refer to teacher video for more examples.)</p> <p>Introduce pupils to Albert Sadacca, who invented Christmas tree lights, and examine some examples of switches used in this product. Some have a simple on / off push button switch, some have a series of switches to operate different lighting arrangements, whilst others have a single switch which allows you to select a lighting feature.</p> <p>Encourage pupils to make drawings and notes to show what they have learnt about switches and the comparisons they have made between switches that have a single purpose and those that are multi-functional.</p> | <p>Can recall key vocabulary and concepts relating to electricity</p> <p>Can name components and build a simple series circuit</p> <p>Can draw a circuit diagram using recognised symbols</p> <p>Can explain the type and function of a range of switches</p> <p>Can identify switches that are multi-functional and those that are not, from a given selection</p> <p>Can make accurate recordings of their findings</p> |





# Point of delivery:

## Y6 Electrical Systems – Block E

| Revisiting prior learning   | Taught content   | Point of practice   | Point of reflection   |
|--|---|--|--|
| <p>2. There are different types of switches</p> <p>Some switches perform one function only, whilst others are multi-functional</p> <p>A circuit diagram is a graphical representation of an electrical circuit</p> | <p>Build circuits according to specific criteria, using a range of components</p> <p>Define the term <i>simultaneous</i></p> <p>Explore and build circuits that will allow components to work independently of each other and simultaneously (series and parallel)</p> <p>Identify the circuits required for everyday appliances</p> <p>Draw circuit diagrams to represent those circuits (series and parallel)</p> | <p>Recap learning from the previous lesson and through questioning and discussion elicit pupils' understanding of switches and their different functions.</p> <p>Provide a range of circuit components and challenge pupils, in pairs or groups, to build a circuit with two components (for example, a buzzer and a light).</p> <p>Once this has been achieved, set further challenges.</p> <ul style="list-style-type: none"> <li>Can pupils make both the buzzer and light work simultaneously?</li> <li>Can pupils make both components work independently of each other?</li> </ul> <p>Discuss with pupils the circuits they have made and explain the difference between series and parallel circuits. Ask pupils to draw circuit diagrams to demonstrate their solutions to the challenge questions.</p> <p>Look at some more examples of everyday products and prompt pupils to predict what the circuit model could be, based on the functionality of the appliance.</p> <ul style="list-style-type: none"> <li>Show pupils a kettle and demonstrate how one switch is used to heat the element of the kettle but the same switch also triggers a light to show the kettle is on.</li> <li>Demonstrate how one switch on a hairdryer can be moved to multiple positions. The switch turns the hairdryer on, the element heats up and the fan blows the air simultaneously. The hairdryer can be turned up to be more powerful and the degree of heat can also be adjusted.</li> <li>Show pupils a child's light projector lamp (refer to teacher video). This product has multiple switches which could all be turned on at the same time so that the lamp lights and the dome rotates. Alternatively, each function can operate independently.</li> </ul> <p>Prompt pupils to make drawings of a selected appliance and the accompanying circuit diagram.</p> <p>Pupils then complete Vocabulary Task 1.</p> | <p>Can describe different types of switches and identify their functions</p> <p>Can build circuits where components work independently of each other and simultaneously</p> <p>Can draw series and parallel circuit diagrams</p> <p>Can predict the type of circuit required for a specified appliance</p> <p>Can draw a diagram to represent the electrical circuit for a specified appliance</p> |

# Point of delivery:

## Y6 Electrical Systems – Block E

| Revisiting prior learning    | Taught content    | Point of practice    | Point of reflection   |
|---|--|---|--|
| <p>3. Series circuits are where components are connected together in one loop</p> <p>If one component fails or is turned off in a series circuit then none of the components will work</p> <p>In series circuits, components work simultaneously</p> <p>Parallel circuits are where components are connected in separate loops</p> <p>If one component is switched off in a parallel circuit, the rest of the components will still work</p> <p>In parallel circuits, components work independently of each other</p> | <p>Identify the difference between series and parallel circuits</p> <p>Define the term <i>brief</i></p> <p>Apply knowledge of circuits and switches to design and make a product to fulfil a design brief</p> <p>Explain how a product works and the circuits involved</p> <p>Identify and explain the advantages and disadvantages of the functionality of different products</p> | <p>Remind pupils of the key question for this unit: <b>Can switches perform more than one function?</b> Invite pupils, based on what they have learnt so far, to answer this question.</p> <p>Recap the circuits the pupils made in the previous lesson and encourage them to explain how they managed to get components to work simultaneously and independently of each other. Establish, through questioning and discussion, that series circuits allow for components to work simultaneously, whereas parallel circuits are required in order to be able to operate components separately.</p> <p>Split the class into three groups and set the following challenges:</p> <p>Group A: Torch or fan<br/>Pupils work in pairs to construct a simple combination torch / fan product that can function as either a torch or a fan.</p> <p>Group B: Torch and fan<br/>Pupils work in pairs to construct a simple combination torch / fan product where both functions run simultaneously.</p> <p>Group C: Torch or fan or both<br/>Pupils work in pairs to construct a simple combination torch / fan product where either both functions work simultaneously, or they can be isolated.</p> <p>Once constructed, challenge pupils to explain how their product works. Prompt them to make drawings and notes in their portfolios. As a class, debate the advantages and disadvantages of each model.</p> <p>Pupils then complete vocabulary Task 2.</p> | <p>Can explain the difference between series and parallel circuits and how these can be applied to perform specific functions</p> <p>Can apply knowledge of circuits and switches to build a simple multi-function product</p> <p>Can explain how they have made the torch and fan work simultaneously, independently or both</p> <p>Can identify the advantages and disadvantages of different models</p> |

# Point of delivery:

## Y6 Electrical Systems – Block E

### Questions for assessment



#### Lesson 1:

**What** does multi-function mean?

**What** is a component?

**True or false?** A series circuit can only contain two components.

**What** are the symbols for a bulb, buzzer and switch?

**Why** do some appliances need switches that perform more than one function?

**How** many functions does the switch on a hairdryer perform?

### Questions for assessment



#### Lesson 2:

**What** does simultaneous mean?

**How** can you make a buzzer and light work simultaneously?

**What** type of circuit is needed to make a buzzer and light work independently of each other?

**Name** an appliance that has a switch that performs only one function.

**What** might the circuit for a kettle look like?

**Is** it always beneficial to have a switch that performs various functions rather than a number of switches, each performing one function?

### Questions for assessment



#### Lesson 3:

**What** is the difference between a parallel circuit and a series circuit?

**Why** are mains lights in a house connected in a parallel circuit?

**Do** we always want components to function independently of each other?

**What** is a design brief?

**How** does your product work?

**How** does your product fulfil the design brief?




# Oracy and Vocabulary: Y6 Electrical Systems – Block E

**Task 1:** Sort the words according to whether they are used to describe things happening at the same time or in a series. Use a dictionary to help you.

concurrently  
simultaneously  
consecutively  
sequentially  
successively  
synchronously

happening at the  
same time

happening in series




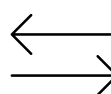

**Exploration:** 

- Can you use one switch to make two components work independently of each other?
- How can you stop three bulbs becoming dimmer when they are all switched on?


.....


**Task 2:** Discuss your product with a partner.  
Use these prompts and questions to guide your discussion.





|  |   |
|--|---|
| Explain how your product works.  |  |
| Are you satisfied that your product fulfils the brief?   |  |
| Explain how you have connected the components to make the light and fan work simultaneously, independently or both.  |  |
| What changes or improvements would you make to your product?<br>How could you hide the circuitry of your product?<br>How could you improve the aesthetics of your product? |  |
| Design a poster to advertise your product, emphasising its functionality.  |  |

# Vocabulary: Y6 Electrical Systems – Block E

|  |   |
|--|---|
| OWN-it   | Analyse  |
| Underline the part of this word that means <i>beside</i> . |   |
| parallel   |   |
| Add a prefix to change the meaning of <i>function</i> .    |   |
| ----- function   |   |
| Write four words that contain the root <i>multi</i> .      |   |
| <div></div>  | <div></div>   |
| <div></div>  | <div></div>   |

|  |  |
|--|--|
| KNOW-it  | Define  |
| Tick the correct meaning of <i>parallel circuit</i> .                                      |  |
| <div>Electrical components are connected alongside one another, forming extra loops.</div> |  |
| <div>Electrical components are connected in one loop.</div>                                |  |
| Write a definition of the word <i>simultaneous</i> .                                       |  |
| <div></div>  |  |
| Tick yes or no.  |  |
| Does <i>component</i> mean the same as element?  |  |
| <div>yes</div>   | <div>no</div>  |

|   |   |
|---|---|
| LINK-it   | Connect  |
| Write a <i>synonym</i> of <i>simultaneous</i> .                 |   |
| <div></div>   |   |
| Circle the odd one out.   |   |
| series    bulb    switch  |   |
| Circle the word that is not a synonym of <i>functionality</i> . |   |
| cause<br>use<br>purpose   |   |

|   |  |
|---|--|
| USE-it  | Use in context  |
| Use the following words in a sentence of your own.                            |  |
| <i>parallel    component</i>  |  |
| <div></div>   |  |
| <div></div>   |  |
| Circle true or false.   |  |
| All these sentences use the word <i>brief</i> correctly.                      |  |
| 1. In <i>brief</i> , the meeting was a disaster.                              |  |
| 2. It was my <i>brief</i> to make sure the details of the task were recorded. |  |
| 3. The finished product did not fulfil the <i>brief</i> .                     |  |
| Use the phrase <i>series circuit</i> correctly in a sentence.                 |  |
| <div></div>   |  |
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# Knowledge Note:

## Y6 Electrical Systems – Block E

### Year 6: Electrical Systems

*Can switches perform more than one function?*



#### Core content:

Learn how switches can be combined with electrical components in different ways to change the functionality of a product.

#### Technical vocabulary:

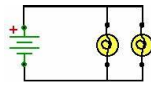
**Switch** – a device for making or breaking the connection in an electrical circuit.



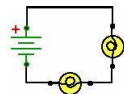
**Component** – one of the parts of an electrical circuit.



**Parallel circuit** – electrical components are connected alongside one another, forming extra loops. If a component is disconnected from one parallel wire, the components on different branches keep working.



**Series circuit** – components are connected in one loop. If a component is disconnected, the circuit is broken and all the components stop working.



**Functionality** – the purpose that something is designed for or expected to perform.



**Multi-function** – having many different functions.



**Brief** – a written description of what a new project or product should do, what is needed to produce it, how long it will take etc.



**Simultaneous** – happening or being done at the same time.



#### Connections:

Albert Sadacca (1901 – 1980)  
American inventor of Christmas tree lights



### Year 6: Electrical Systems

*Can switches perform more than one function?*



#### Core content:

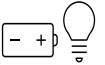
Learn how switches can be combined with electrical components in different ways to change the functionality of a product.

#### Technical vocabulary:

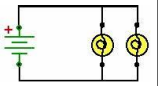
**Switch** – a device for making or breaking the connection in an electrical circuit.



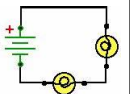
**Component** – one of the parts of an electrical circuit.



**Parallel circuit** – electrical components are connected alongside one another, forming extra loops. If a component is disconnected from one parallel wire, the components on different branches keep working.



**Series circuit** – components are connected in one loop. If a component is disconnected, the circuit is broken and all the components stop working.



**Functionality** – the purpose that something is designed for or expected to perform.



**Multi-function** – having many different functions.



**Brief** – a written description of what a new project or product should do, what is needed to produce it, how long it will take etc.

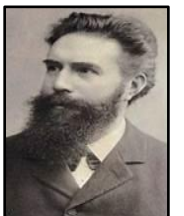


**Simultaneous** – happening or being done at the same time.



#### Connections:

Albert Sadacca (1901 – 1980)  
American inventor of Christmas tree lights

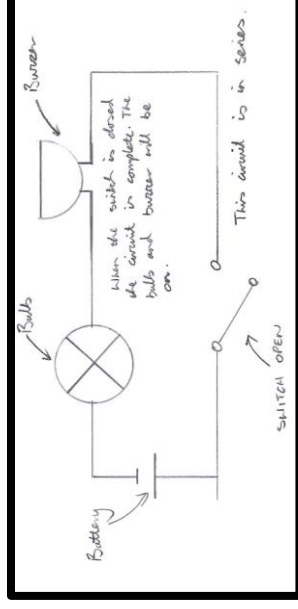


# Exemplification: Y6 Electrical Systems – Block E

## Can switches perform more than one function?

Instruct pupils to build a series circuit containing just one switch and a bulb or buzzer

Challenge pupils to draw a circuit diagram and explain how the switch works

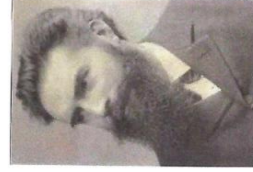


Provide a range of circuit components and challenge pupils to build a circuit with two components (for example a buzzer and a bulb)

Pose questions to pupils:

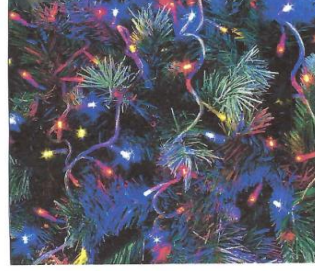
How can you make both the buzzer and bulb work simultaneously?

How can you make the buzzer and bulb work independently of each other?



Albert Sadacca (1901-1980)

Sadacca invented electric Christmas tree lights. According to legend, at the age of 15, after a fire in New York City started by candles in a tree, Sadacca adapted novelty lighting his parents sold for use in Christmas trees.



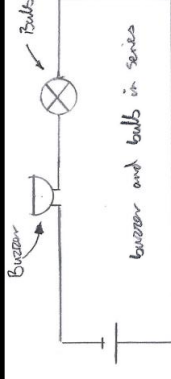
### Christmas light switches

Modern lights have different operating switches.

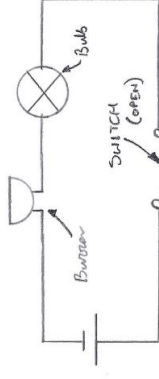
- \* A simple on/off push button
- \* A row of switches for different settings
- \* A single switch that controls through different light settings

Introduce pupils to Albert Sadacca who invented Christmas tree lights and examine some examples of switches used in this product

②

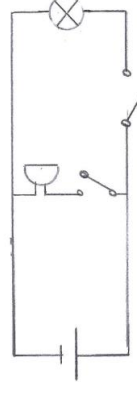


Challenge 1: Make a circuit with a buzzer and a light bulb.



Challenge 2: Make the buzzer and light work simultaneously.

Switch turns buzzer and bulbs on and off simultaneously.



Challenge 3: Make the buzzer and light work independently of one another.

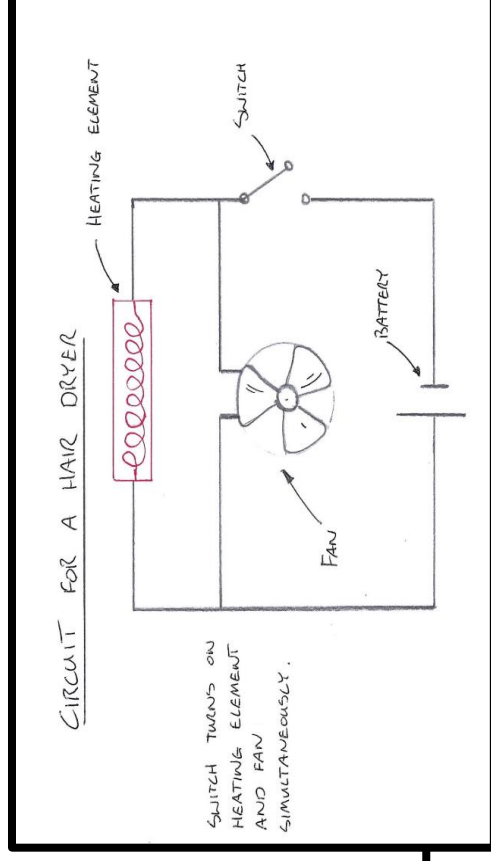
# Exemplification: Y6 Electrical Systems – Block E

## Can switches perform more than one function?

Look at some examples of everyday products and prompt pupils to predict what the circuit model could be based on the functionality of the appliance

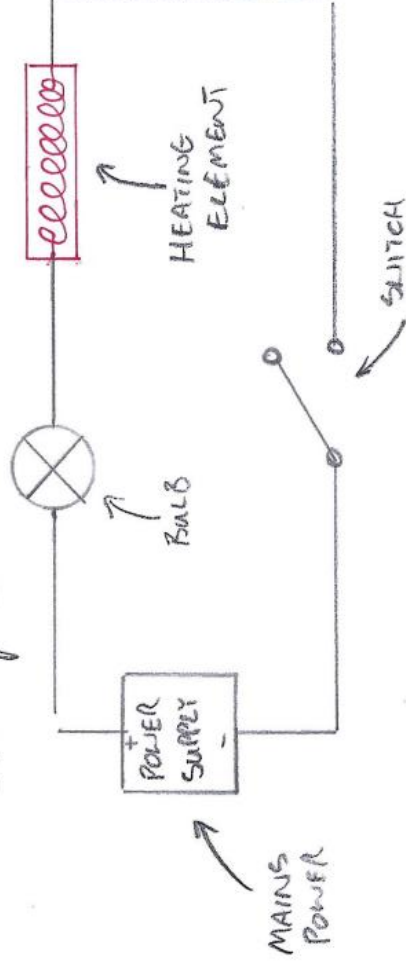


Prompt pupils to make drawings of a selected appliance and the accompanying circuit diagram



Kettle

The Kettle has a heating element and an indicator light that come on at the same time. It could use a circuit like in Challenge 2.



Pose questions to pupils such as:

Are multi-function switches always best?

Which appliances have switches that perform more than one function?

Which appliances might use a series circuit?



# Exemplification: Y6 Electrical Systems – Block E

## Can switches perform more than one function?

Can Switches Perform More Than One

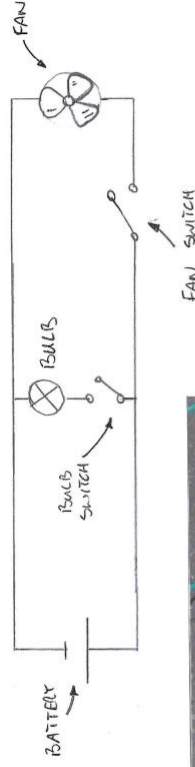
Function?

Torch / Fan Project

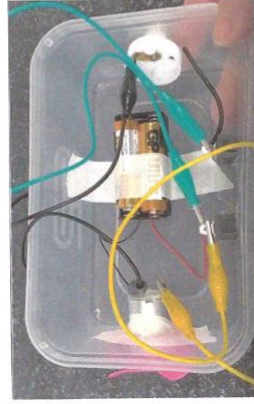
In this project the brief was to design and make a product that has a torch and fan facility. This product uses two switches so that the following functions can be performed:

1. Torch on only.
2. Fan on only.
3. Torch and fan on simultaneously.

The circuit diagram for the torch/fan:



The circuit was made and put into a take-away container to provide a housing. Holes were cut into the sides for components to be mounted and function outside of the box. Tape was used to secure components in place.



Prompt pupils to explain how their product works and evaluate its effectiveness

Challenge pupils to apply their knowledge of circuits and switches to design and make a product to fulfil a design brief



### EVALUATION

- The torch/fan did perform the function in the brief. The torch and fan would work independently and together.
- The circuit was found to be delicate and could be improved with more permanent wiring.
- The wiring was bulky and took up room. It could be made to be more compact.
- It was noticed that the torch dimmed and the fan slowed when on together.

The switches used in this project were simple on/off switches. In this situation each switch controlled one component so they could be seen as performing one function. However, by having two switches in operation there were four possible combinations of functions achieved. Using different circuits it would be possible to have both fan and torch to come on with one switch. Another possible circuit using two switches could have a torch which would only function when the fan was running. Switches can perform many functions.

As a class debate the benefits and disadvantages of each model