

## Year 4 Design and Technology: Electrical Systems – Block E How useful are switches?

- 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 different types of switches and how they are used	Create a simple game involving an interruption in a circuit

At the end of this block, pupils will ...	
Know:	Be able to:
<p>A switch is an interruption in a circuit</p> <p>Switches are widely used in a range of products</p>	<p>Incorporate different types of switches into circuits to perform a function</p>



Samuel Bagno  
Inventor of the motion sensor, 1950

In this block, pupils will learn how different types of switches work within electrical circuits and how these can be used to perform a function in a product.

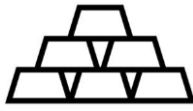
CUSP Design & Technology Long term sequence	Block A	Block B	Block C	Block D	Block E	Block F
Year 1	Mechanisms	Structures	Food and Nutrition	Understanding Materials	Textiles	Food and Nutrition
Year 2	Textiles	Food and Nutrition	Mechanisms	Understanding Materials	Food and Nutrition	Structures
Year 3	Textiles	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:

## Y4 Electrical Systems – Block E

Pupils will be able to:

- name sources of electrical energy: batteries, mains power, rechargeable batteries



Prior Learning

- identify common appliances that use electricity
- name the basic components of an electrical circuit: bulb, battery, motor, buzzer

### Design or Technology History:

Samuel Bagnó (1906 – 1967)

The first motion sensor that acted as a burglar alarm was invented in the 1950s by Samuel Bagnó. Using technology that was developed during World War II and his military knowledge of radar, Bagnó developed a device that used ultrasonic waves and the Doppler effect – the difference in the frequency of waves of a moving object – to detect motion in a room.

### Links to Literature:

*The Big Book of Science Ideas* by Freya Hardy

*The History of Toys* by Helen Cox Cannons

### Materials:

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

Tin foil and wire coat hangers or other conductive wire

Cardboard (recycled, where possible) and drawing pins

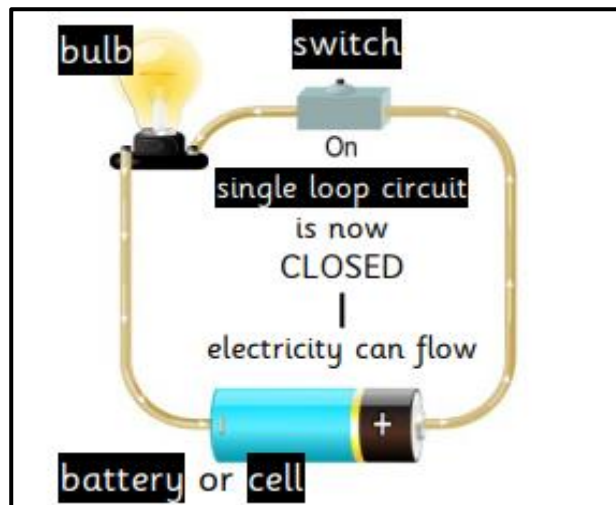
Range of products that use switches

### 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.



electrical  
components



battery or power cell



bulb



motor



switch



buzzer

**conductors** – materials that **allow** electricity to flow



aluminium



copper



graphite



steel

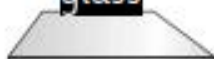


tap water

**insulators** – materials that **do not** allow electricity to flow



air



glass



wood



rubber



paper



plastic

## Supporting Images 2: Y4 Electrical Systems – Block E, Lesson 1



# Point of explanation:

## Y4 Electrical Systems – Block E

Core Knowledge	Explanation
switch	A switch is a device for making or breaking the connection in an electrical circuit.
circuit	An electrical circuit is a complete path of wires and equipment along which an electric current flows.
component	A component is one of the parts of an electrical circuit such as a bulb, battery or switch.
current	A current is the movement of water, air or electricity in a particular direction.





Technical Vocabulary	Definition
interruption	an occasion when someone or something stops something from happening for a short period
unbroken	continuous with no pauses
conductor	a material that allows electricity to pass through it
multi-purpose	having many different uses

**Link to Video:** <https://vimeo.com/685860508/a5ca92403d>

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

# Point of delivery:

## Y4 Electrical Systems – Block E

Revisiting prior learning 	Taught content 	Point of practice 	Point of reflection 
<p>1. Mains power, batteries and rechargeable batteries are sources of electrical energy</p> <p>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 opens and closes a circuit</p> <p>Materials such as aluminium and copper are good conductors of electricity</p>	<p>Teach pupils that a switch is a control mechanism used to interrupt the flow of electricity in a circuit</p> <p>Explain that switches are useful because they allow us to turn appliances on and off</p> <p>Give examples of switches that have more than one function</p> <p>Teach pupils that some switches can vary the speed, volume or degree of light provided by appliances</p> <p>Build simple circuits to include a switch</p>	<p>Introduce the key question for this unit: <b>How useful are switches?</b> Through questioning, ascertain pupils' knowledge of electricity and circuits. Pupils should be able to identify some appliances that are powered by electricity, construct simple circuits and name their components, and recognise some materials that are good conductors and insulators of electricity. Pupils should also be able to explain that a lamp will light only if it is connected to a complete, unbroken circuit. Refer to the Knowledge Note to reinforce the key vocabulary that pupils will need to use in this unit.</p> <p>Show pupils a range of switches (rotary, trigger, press button, hidden, lever, safety etc.) and remind pupils that a switch is a control mechanism that interrupts the flow of electricity (current) in a circuit.</p> <p>Discuss the usefulness of switches in relation to some common appliances such as torches, radios and mains lights. Pose the question to pupils: why are switches necessary?</p> <p>Explain that some switches have more than one function and give some examples (dimmer switches, volume control dials etc.).</p> <p>Provide pupils with components to build their own simple circuit with a switch in it. Prompt pupils to draw their circuit and annotate the diagram with a definition of a switch and an explanation of how a switch works.</p> <p>Encourage pupils to make a record of what they have learnt about different types of switches and how they work.</p>	<p>Can identify different types of switches</p> <p>Can give examples of appliances that have switches</p> <p>Can explain how a switch works</p> <p>Can explain why switches are necessary</p> <p>Can build a simple circuit with a switch</p> <p>Can make an accurate record of key concepts, using sentences and diagrams</p>

### Questions for assessment

**What** is a circuit?

**How** many appliances can you think of that have switches?

**What** is a current?

**How** many types of switches can you identify?





**What** is a switch and what is its function?

**Why** is it necessary to interrupt the flow of electricity to appliances?



# Point of delivery:

## Y4 Electrical Systems – Block E

Revisiting prior learning 	Taught content 	Point of practice 	Point of reflection 
<p>2. A switch is a control mechanism used to interrupt the flow of electricity in a circuit</p> <p>Switches are useful because they allow us to turn appliances on and off</p> <p>Some switches have more than one function</p> <p>Some switches can vary the speed, volume or degree of light provided by appliances</p> <p>Build simple circuits to include a switch</p>	<p>Explore appliances that have different kinds of switches and how they work</p> <p>Draw a simple circuit diagram for an electrical appliance</p> <p>Explain the different purposes of switches: efficiency, safety and functionality</p> <p>Explore appliances that have more than one switch and investigate their purposes, such as to vary volume, light and heat</p>	<p>Recap what pupils have learnt about switches and their functions. Provide a range of products or images of products that have different switches for pupils to explore.</p> <p>Show and discuss the following:</p> <ul style="list-style-type: none"> <li>electrical drill – contains a trigger switch where the speed of the drill can be adjusted according to the degree of pressure applied to the trigger</li> <li>food processor – contains a rotary switch which varies the speed of the motor inside the appliance</li> <li>torch – contains a simple push button switch that turns the light on and off</li> <li>toys – some soft toys contain hidden switches</li> <li>industrial machinery – some machines have separate on and off buttons which light up and have protective covers to reduce the risk of the machine being turned on or off by mistake</li> <li>motion sensor light – some security lights have sensors rather than physical switches that trigger the light to turn on</li> </ul> <p>Explain that some switches are used for efficiency (a torch has a switch because it is not efficient to have a torch always lit), some for safety (a kettle has a switch that automatically turns the kettle off when the water reaches boiling point because it would be unsafe for the kettle to be constantly heating up) and some for functionality (a hairdryer has switches to turn the appliance on and off but also to adjust its heat and speed).</p> <p>Instruct pupils to create a table of products, the type of switch they have and the purpose of the switch. Pupils could work in pairs or groups to complete this.</p> <p>Model how to draw the circuit that matches a given product, such as a torch, and annotate it to show the switch and its purpose.</p> <p>Pupils then select and explore a product that has more than one switch (e.g. a power switch and a volume switch). Prompt pupils to draw an annotated diagram of the product and write a short explanation of how the switches work and what they do.</p> <p>Pupils then complete Vocabulary Task 2.</p>	<p>Can explain the purpose and function of a range of switches</p> <p>Can identify why certain types of switches are used in specific appliances</p> <p>Can identify appliances that use switches for efficiency, those that have switches for safety reasons, and those that have switches to perform functions other than purely turning an appliance on or off</p> <p>Can draw a simple circuit for an appliance such as a torch</p> <p>Can explain, using annotated drawings, the function of different switches on a particular appliance</p>

### Questions for assessment



**What** is the difference between a trigger and rotary switch?

**Why** might a motion sensor be used for an outside light?

**What** type of appliance is likely to have more than one switch?





**Why** does a toaster / television / stereo have more than one switch?

**What** would happen if appliances did not have switches?

**How** many appliances can you think of that have more than one switch?

# Point of delivery:

## Y4 Electrical Systems – Block E

Revisiting prior learning 	Taught content 	Point of practice 	Point of reflection 
<p>3. Appliances have different types of switches, depending on their purpose and function</p> <p>Different switches are used for efficiency, safety and functionality</p> <p>Some appliances have more than one switch to enable the electrical flow to be interrupted and varied</p>	<p>Explore types of switches in a range of toys and games</p> <p>Explore how some games incorporate an interruption to an electrical current, which effectively acts as a switch</p> <p>Model how to make simple games that incorporate an interruption to an electrical current</p> <p>Demonstrate how insulating materials can be used to break the flow of an electrical current</p>	<p>Remind pupils of the key question for this unit: <b>How useful are switches?</b></p> <p>Prompt pupils to recall and explain what they have learnt about switches and their functions.</p> <p>Give pupils a range of toys to explore and ask them to sort them according to whether they use electricity. Instruct them to sort the toys again, according to whether they contain switches. Challenge pupils to identify the types of switches the toys have.</p> <p>Show pupils how to make a simple electrical game by creating a wire shape connected into a circuit with a buzzer. (Refer to teacher video for guidance). Explain that, essentially, the game acts as a switch because when the loop touches the wire shape, the circuit is completed and the buzzer sounds. When the loop is not touching the wire shape, the circuit is broken, and the buzzer cannot sound.</p> <p>Model creating the Piranha Lake game (refer to teacher video for instructions). Challenge pupils to explain how the game works.</p> <p>Give pupils time to create and play their own game based on the one modelled. Explain how the interruption in the circuit acts as a switch.</p> <p>Prompt pupils to make annotated drawings of the game they have created, ensuring they label the key components and explain how the game works.</p> <p>Pupils evaluate their games, using questions in Vocabulary Task 2 as their guide.</p>	<p>Can identify which toys and games use electricity and which do not</p> <p>Can identify different ways in which an electrical current is broken in different games and toys</p> <p>Can explain how a simple electrical game works</p> <p>Can explain how insulating material is used to break a circuit in a game</p> <p>Can create their own game based on the model provided</p> <p>Can make annotated drawings of their game, and explain how their game works and how it acts as a switch</p>

### Questions for assessment



**What** would happen if you made the game from wire coated in plastic?

**Why** is aluminium foil used for the lake in the Piranha Lake game?

**How** are insulating materials used in the game to break the circuit?

**How** does the wire game act as a switch?

**How** does your game interrupt the flow of electricity?

**How** could you incorporate a light into your game?

**What** would happen if fabric was used for the lake?



# Oracy and Vocabulary: Y4 Electrical Systems – Block E

## Task 1:

You have learnt that for a bulb to light, it needs to be connected into a circuit that allows for a continuous flow of electrical energy.  
Make a list of synonyms for the word *continuous*.

Synonyms for *continuous*

Next ...

Make a list of antonyms for the word *continuous*.

Antonyms for *continuous*

Exploration:



What types of switches does a toaster have?  
Why does it have more than one type of switch?

Think of the electrical appliances you use every day.  
Make a list of them and the types of switches they have.  
Do they all have the same type of switch?

## Task 2:

Work with a partner to answer the questions below.



Explain verbally and then in writing the steps you followed to make your game.



Explain some of the decisions you made when designing and making your game.



How is your game like the Piranha Lake game? How does your game work?




Mark on the scale how effective your game is as a switch to interrupt the flow of electricity.





Write some instructions for how to make your game. Note any difficulties you faced and what you would do differently next time.




# Vocabulary: Y4 Electrical Systems – Block E

OWN-it	Analyse 
<p><b>Underline</b> the part of this word that means <i>many</i>.</p> <p>multi-purpose</p>	
<p><b>Underline</b> the part of this word that means <i>around</i>.</p> <p>circuit</p>	
<p><b>Underline</b> the part of this word that means <i>among or between</i>.</p> <p>interruption</p>	

KNOW-it	Define 
<p><b>Tick</b> true or false.</p> <p>A switch is a mechanism that interrupts a flow of electrical energy.</p> <p><input type="button" value="true"/> <input type="button" value="false"/></p>	
<p><b>Write</b> two different definitions for the word <i>current</i>.</p> <p><input type="text"/> <input type="text"/></p>	
<p><b>Write</b> two different definitions for the word <i>circuit</i>.</p> <p><input type="text"/> <input type="text"/></p>	

LINK-it	Connect 
<p><b>Write</b> a synonym for <i>unbroken</i>.</p> <p><input type="text"/></p>	
<p><b>Write</b> the word that is the opposite of an electrical <i>conductor</i>.</p> <p><input type="text"/></p>	
<p><b>Tick</b> the synonyms of the word <i>component</i>.</p> <p><input type="checkbox"/> part <input type="checkbox"/> whole <input type="checkbox"/> piece</p>	

USE-it	Use in context 
<p><b>Tick</b> the box if the word <i>circuit</i> has been used correctly in this sentence.</p> <p>The car made eight laps of the <i>circuit</i> before it broke down.</p> <p><input type="checkbox"/></p>	
<p><b>Write</b> a sentence that includes these words: circuit    bulb    unbroken</p> <p>_____ _____</p>	
<p><b>Use</b> the word <i>multi-purpose</i> in a sentence.</p> <p>_____ _____ _____</p>	

# Knowledge Note:

## Y4 Electrical Systems – Block E

Year 4: Electrical Systems  
*How useful are switches?*



### Core content:

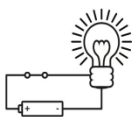
Learn how different types of switches work within electrical circuits.  
Learn how switches can be used to perform a function in a product.

### Technical vocabulary:

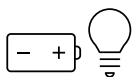
**Switch** – a device for making or breaking the connection in an electrical circuit.



**Circuit** – a complete path of wires and equipment along which an electric current flows.



**Component** – one of the parts of an electrical circuit such as a bulb or battery.



**Current** – the movement of water, air or electricity in a particular direction.



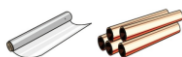
**Interruption** – an occasion when someone or something stops something from happening for a short period.



**Unbroken** – continuous with no pauses.



**Conductor** – a material that allows electrical energy to pass through it.



**Multi-purpose** – having many different uses.



### Connections:

Samuel Bagno (1906 – 1967)  
American inventor



Year 4: Electrical Systems  
*How useful are switches?*



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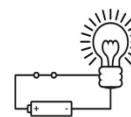
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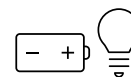
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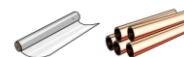
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### Connections:

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American inventor



# Exemplification: Y4 Electrical Systems – Block E

## How useful are switches?

Ascertain pupils' knowledge of electricity and circuits

Prompt pupils to identify key components such as bulbs, buzzers and switches

Explore a range of switches and challenge pupils to explain their functions

Provide pupils with components to build their own simple circuit with a switch in it

Prompt pupils to draw their circuit and annotate the diagram with a definition of a switch and an explanation of how a switch works

### Y4 Electrical Systems – Block E

①



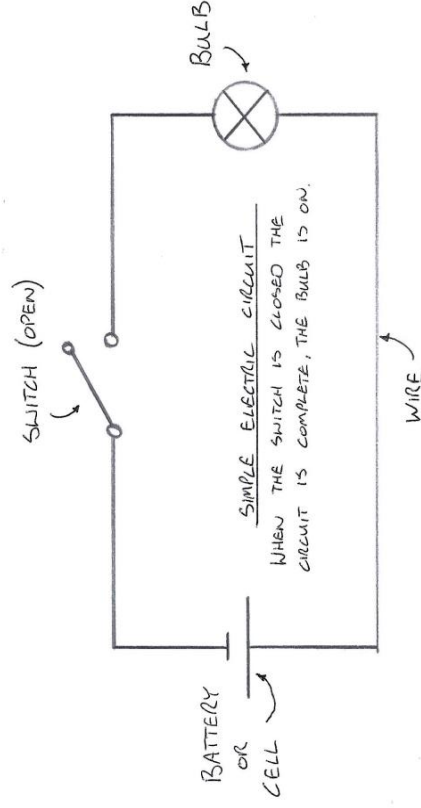
Kettle - The appliance boils water. Switch on by pushing the switch down. The switch will automatically turn off when the water boils.



Hair dryer - The appliance heats and blows air to dry hair. The sliding switches turn on the fan and the heating element.



Lamp - The appliance lights an area. The switch turns the lamp on and off.



Challenge pupils to identify appliances that are powered by electricity and controlled by switches

Pose questions to pupils:

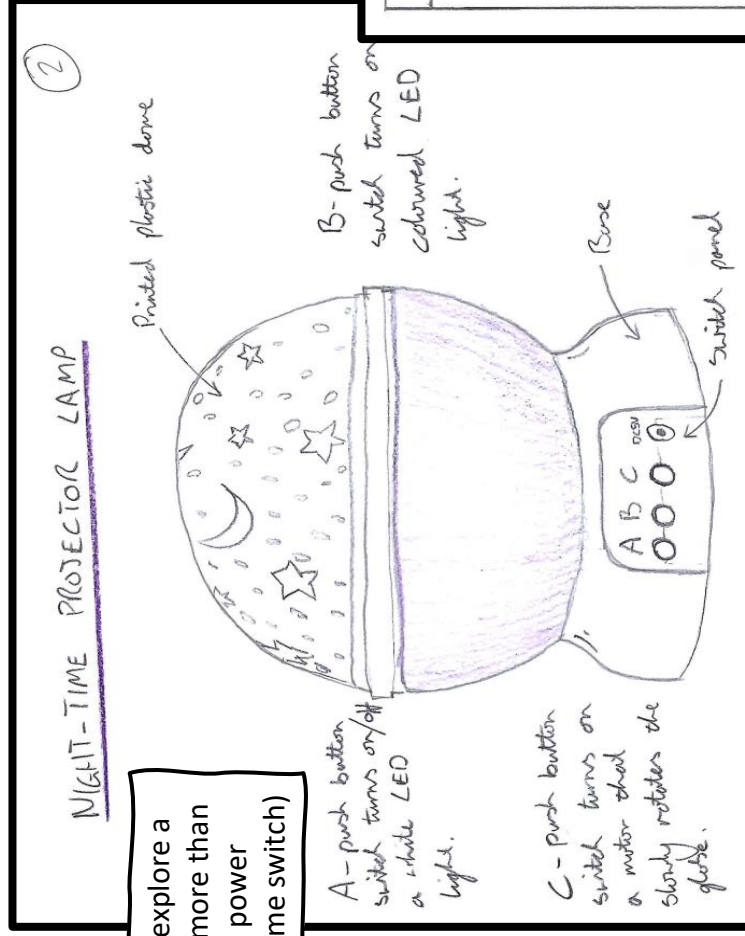
Why do appliances need to have switches?

What is the difference between a trigger and a push button switch?

Are switches only necessary for safety purposes?

# Exemplification: Y4 Electrical Systems – Block E

## How useful are switches?



Instruct pupils to create a table of products, the type of switch they have and the function or functions of the switch

PRODUCT	SWITCH	PURPOSE
OVEN	Rotary, multi-function	Rotate the switch to turn the oven on to different settings.
TOASTER	Sliding lever	Push the lever down to turn on the toaster. Switch is on a timer, automatically turns off.
TORCH	Push button	Turns the torch on and off. Must be robust, and easy to use in the dark, tactile.
HAIR DRYER	Sliding switch	Activates two things at same time. A fan to blow air and a heating element to heat air.

Prompt pupils to draw an annotated diagram of the product and write a short explanation of how the switches work and what they do

Pupils select and explore a product that has more than one switch (e.g. a power switch and a volume switch)



# Exemplification: Y4 Electrical Systems – Block E

## How useful are switches?

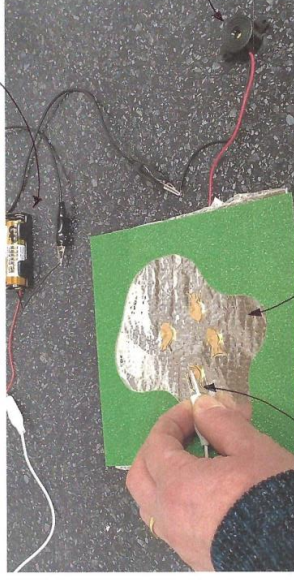
Provide a selection of games and toys and challenge pupils to identify those that are powered by electricity and those that are not

Ask pupils to identify which of the toys have switches and explain the functions the switches perform

Explore how some games incorporate an interruption to an electrical current which effectively acts as a switch

Show pupils how to make the *Piranha Lake* game and prompt them to explain how it works

PIRANHA LAKE GAME



To Play Several fish are swimming in the lake, one is a piranha. If the piranha is caught, the buzzer will sound. If other fish are caught, the buzzer will not sound. Gamers take it in turn to catch a fish. The aim is not to catch the piranha.

### Evaluation

The game generally works quite well however some issues occurred:

1. All wire connections must be checked and good.
2. The 'fish' must have adequate insulation using plastic tape under the pin.
3. Sometimes the foil does not make good contact with the piranha.
4. Crocodile clips can be fiddly to use.

### Improvements

- o Use a copper plate or sheet for the lake for better conductivity.
- o Sand paper the underside of the piranha for better contact.
- o For the fish use plastic-coated drawing pins, better insulation.
- o Solder all connections.
- o Use bigger tweezers to catch the fish.

Challenge pupils to make their own version of the game, record annotated drawings of it and suggest ways in which their game could be improved

Task 2

- o We first decided to use a buzzer in our game instead of a lamp or motor.
- o The buzzer would sound when the switch is activated.
- o The circuit will be complete when the wire from the battery touches the uninsulated drawing pin. This pin is the switch.
- o The insulated pins are the 'dummy' fish.
- o The foil lake is connected to the battery.
- o The game is quite effective as a switch but it can vary with size of tape on the pins and connection with the foil lake to the battery.

Pose questions to pupils such as:

Is aluminium foil the best material to use for conductivity?

How could you make a light come on as well as a buzzer sound when the piranha is caught?

How could you improve the electrical insulation of the fish?