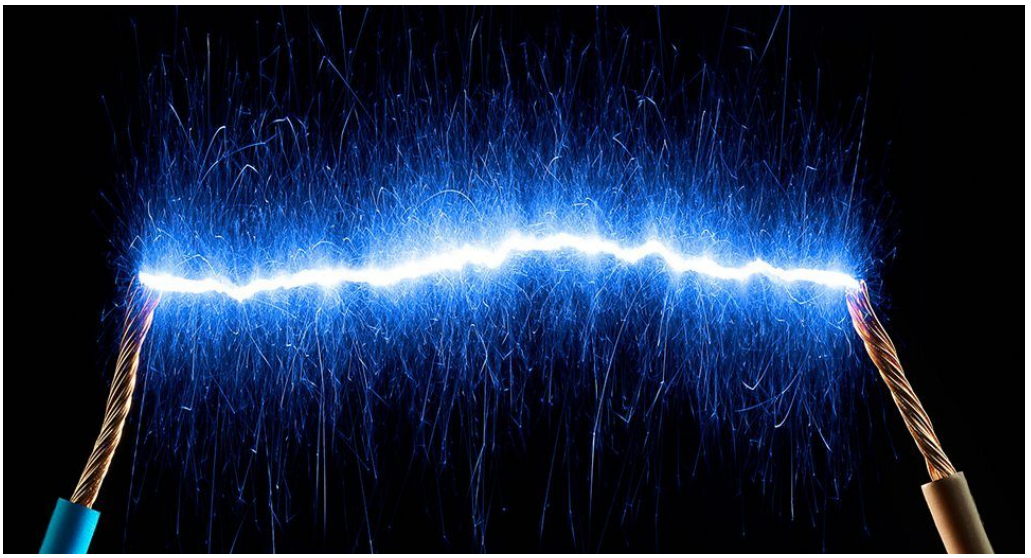
Science

Low Voltage

Atlantic Academy Portland
an Aspirations Academy

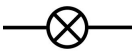
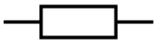
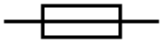
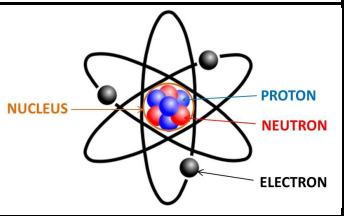


Year 6 - Summer 1

Name:_____

Class:_____

Year 6 Science Knowledge Organiser - Summer 1 - Electricity

1	**Battery (Cell)**	A device that stores and produces electricity from chemical cells.	
2	**Bulb**	A lamp in which a glow is produced by the heating of a wire by an electric current.	
3	**Wire**	A wire is a long thin piece of metal that is used to carry electric current.	
4	**Buzzer**	A buzzer or beeper is an audio signalling device	
5	**Motor**	An electric motor converts electricity into mechanical motion.	
6	**Electrical Flow**	A battery or power outlet creates the electromotive force that makes a current of electrons flow.	
7	**Electric Current**	The flow of electric charge through a material. The standard unit for electric current is the ampere.	
8	**Direct Current (DC)**	A type of current that only flows in one direction.	
9	**Switch**	a switch is a device used to make or break a connection in a circuit so you can turn power on and off to something.	
10	**Connect**	To join a connection in an electrical circuit.	
11	**Disconnect**	To break the connection in an electrical circuit.	
12	**Electric circuit**	A collection of electronic components connected by a conductive wire that allows for electric current to flow.	
13	**Electrical Conductor**	A material that allows the free flow of electric charge. Copper wiring is the most widely used electrical conductor.	
14	**Electrical Insulator**	A material in which an electric charge does not flow freely and does not conduct the flow of electric current.	
15	**Resistor**	A basic electronic component that prevents the flow of electric current.	
16	**Fuse**	An electrical device that can interrupt the flow of electrical curren when it is overloaded.	
17	**Atom**	The basic building blocks of all matter.	
18	**Nucleus**	The central part of an atom.	
19	**Protons**	Part of the atom with a positive electrical charge.	
20	**Neutrons**	Part of the atom with no electrical charge.	
21	**Electrons**	Part of the atom with a negative electrical charge.	
22	**Biomass-fired Power Stations**	Biomass, in the form of sewage, is turned into dried pellets which are burned with coal in a power station to produce heat. The heat produces steam to power electricity generators.	
23	**Wind Turbine**	A turbine uses wind to make electricity. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity. The electricity is sent through transmission and distribution lines to a substation, then on to homes, business and schools.	
24	**Tidal Energy**	Tidal energy is energy produced by the tides of the ocean. Tides are produced by the pull of gravity from the Moon as well as the spin of the Earth. There is a lot of energy in the movement of that much water.	
25	**Hydroelectricity**	Hydroelectricity is the term referring to electricity generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water.	
26	**Solar Panels**	Solar cells convert light energy into electricity. Solar cells are also called photovoltaic cells.	

KO Quiz: / 5 Date: _____

LESSON ONE: It's electrifying!

Retrieval Practice

What I already know about electricity.	Questions I still have about electricity.
•	•
•	•
•	•
•	•
•	•
•	•

Outcomes	Key Vocabulary
Identifying scientific evidence that has been used to support or refute ideas or arguments in the context of the major discoveries made by scientists in the field of electricity.	Electricity, Thomas Edison, Nikola Tesla, Alessandro Volta, Michael Faraday, home, alternating current, direct current, battery, cell.
Knowledge needed	
Changes of materials and electricity has been previously taught in Years 4 and 5.	

Whiteboard Activity
Look at the questions on the presentation and decide which letter gives the correct answer. Write the letter on your whiteboard and wait for 1, 2, 3 and show me! How many are you going to get right?

Independent Task
How have we come to learn about electricity and how to use it?

Read the comprehension sheet on the next page and answer questions about the fascinating scientists and their amazing discoveries.

In modern life, we use electricity on a daily basis and do not think anything of it. We take it for granted. However, for most of human history electricity was not known about so how and why did that change? Read on!

We Ancient Greeks knew that rubbing amber would make light objects attract to it. We thought it became magnetic.

What they were actually observing was static electricity!

While we did not know that electric currents existed, we were aware of shocks from a fish. We called it 'Thunderer of the Nile'.

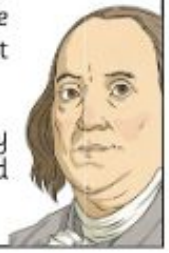
Ancient Egyptians thought that electric fish were 'protectors' of other fish. Electric fish were written about by the Ancient Greeks, Romans and Arab Scholars.

It was not until hundreds of years later in the 1600's that **William Gilbert** studied and distinguished between magnetism of metals and static electricity. He used the Greek word for amber – 'elektron' – and invented a new Latin word – electricus.

Benjamin Franklin was the first person to study electricity in depth. One of his most important findings was proving that lightning was electrical (it had been thought of as different up until then). He flew a kite during a storm, to which he had attached a key. When the kite was indeed hit by lightning, he felt electric sparks from the key.

He was very fortunate not to be electrocuted! This is not an experiment that needs to be repeated!!

He was also the first to store electricity and knew it consisted of positive and negative charges.



Alessandro Volta invented the first battery – which was known as the 'voltaic pile' as it was made of layers of zinc and copper which was either combined with sulphuric acid or saltwater brine to create an electric current.

Volta's name was also the basis for the following words:

Voltage: This is the electric force that causes free electrons to move from one atom to another.

Volt: Is the unit of measurement for Voltage (written as V).

The voltaic pile was hugely important as it allowed an electric current to be released steadily and efficiently. Therefore it was now possible to use an electric current as a form of power for other objects.

Michael Faraday used Volta's discoveries and was able to make an electric current move by using a magnet inside a wired coil. He was able to build an electric motor and generator!

Thomas Edison invented the modern lightbulb. While lightbulbs were not a new idea, he did improve on the previous designs which were not useful as they did not stay lit for very long.

Lewis Latimer worked for Edison and invented a filament (the metal part that you can see in lightbulbs, through which the electric current passes) which enabled Edison's lightbulb to stay lit for a long time.

From these electrical inventions, many others followed and changed the way we live our everyday lives!

Read each question carefully and answer questions in **sentences**.

1. What does the word 'electricus' mean?

_____

2. What key discoveries did the following scientists make? (Pick only **one**)

William Gilbert _____

Alessandro Volta _____

Michael Faraday _____

Thomas Edison _____

Lewis Latimer _____

3. Did Thomas Edison invent the lightbulb?

_____

_____

4. Name two modern appliances that use electricity and explain why you think they are useful.

_____

_____

5. The voltaic pile ensured a steady electric current. Why did this lead to the wider use of electricity?

_____

_____

6. How are the AC and DC currents different? Include **two** examples.

_____

_____

_____

_____

7. Who won the war of the currents and why?

_____

_____

_____

_____

Exit Ticket

How has electricity impacted our lives?

Write the name of the item into the correct column, are they non-electrical or electrical appliances?

Carpet Beater

Ice Box Refrigerator

Washing Machine

Scythe

Fridge

Wash Board

Vacuum Cleaner

Typewriter

Lawnmower

Printer

Non-Electrical Appliance		Electrical appliance	
Candle		Bulb	

KO Quiz: / 5 Date: _____

LESSON TWO: Circuits and symbols

Retrieval Practice:

What is a circuit? _____

_____

What parts do all circuits contain? _____

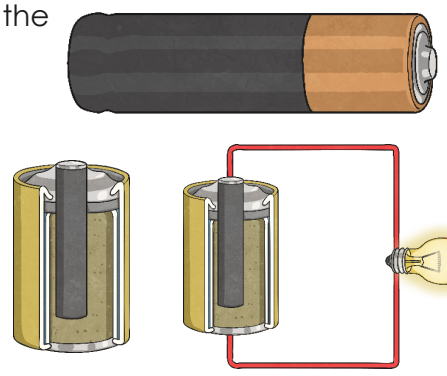
_____

Can you draw a circuit which includes a bulb?

Outcomes	**Key Vocabulary**
Use recognised symbols when representing a simple circuit in a diagram by recognising and drawing scientific circuit symbols accurately.	Bulb, battery, cell, wires, switch, motor, buzzer, scientific, informal, circuit, diagram.
Knowledge needed	
Children will have learnt the parts of a circuit in the Year 4 Electricity Unit.	

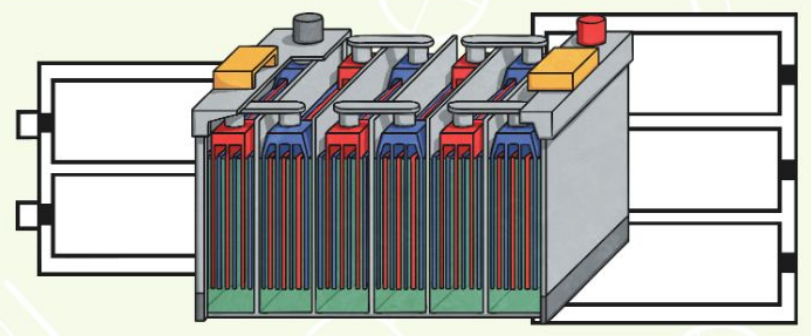
Everybody Reads

In everyday language we call a single cell a 'battery' but this is not the correct scientific usage.
Scientifically, this is a cell.
It is a single unit, containing two electrodes and an electrolyte.



Electrodes are charged electrical conductors inside a cell. Each cell has one positive and one negative electrode.
An **electrolyte** is a chemical that reacts with the electrodes to produce an electrical current.

A battery is the scientific name for a collection of cells joined together.



The above diagrams show single cells in individual cases linked together.
Some larger batteries, such as car batteries, contain the multiple cells inside one case.

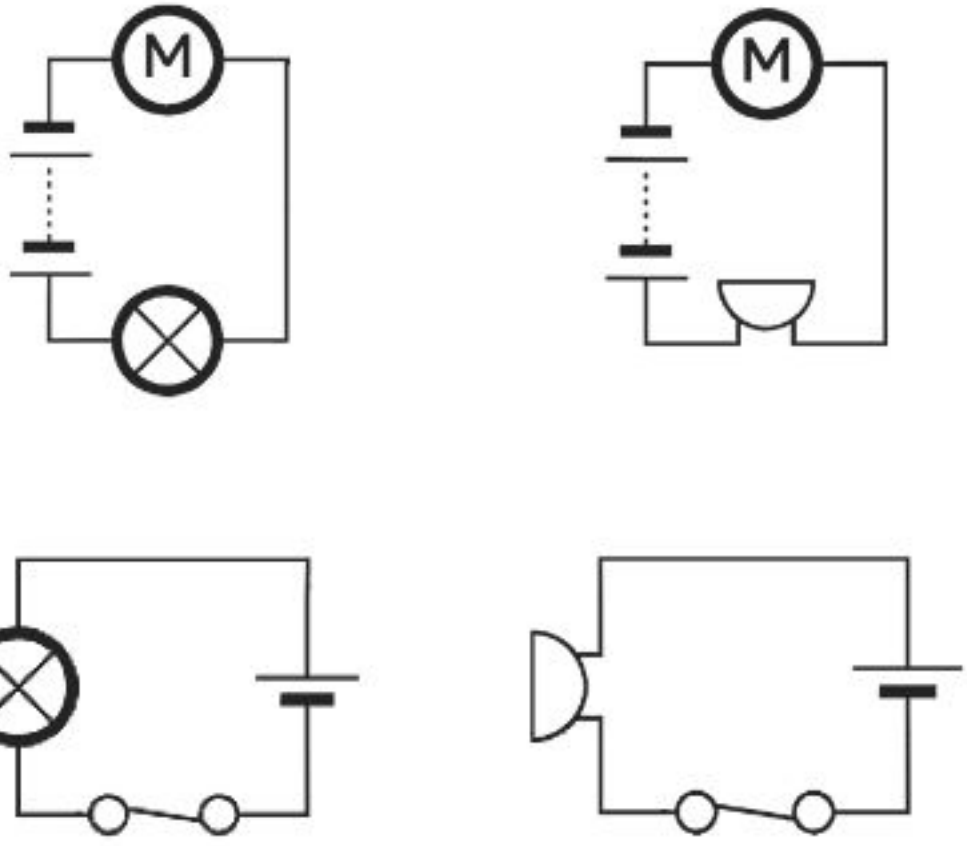
Whiteboard task 1
Look at the presentation and match the parts of a circuit with their scientific symbols. Draw them on your board.

How many did you get right?

Whiteboard task 2
Look at the screen for 1 minute and memorise the symbols. When I close the board down, how many can you draw from memory? Get ready to show your boards!

Independent Tasks

Look at the circuits below and label each part.



Draw the following circuit using the scientific circuit symbols.

1. Circuit should contain: a bulb, a cell and an open switch.

2. Circuit should contain: a battery and two motors.

3. Circuit should contain: a buzzer, two batteries and a closed switch.

Exit Ticket

How many circuit symbols can you recall? Write down the part of the circuit which matches the symbols that you see on the presentation.

Question	Answer	Question	Answer
1		6	
2		7	
3		8	
4		9	
5			

KO Quiz: / 5 Date: _____

LESSON THREE: Volts

Do Now: Vocabulary Practice

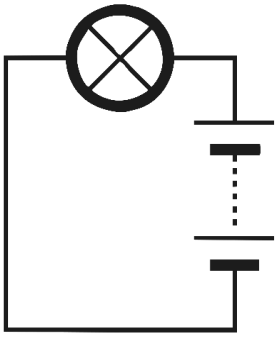
i	a	a	c	u	r	r	e	n	t	m	b
v	o	l	t	a	g	e	f	i	n	u	a
a	l	o	t	l	d	y	t	f	l	r	t
e	e	u	l	e	i	i	e	b	l	r	t
r	z	d	t	l	r	o	s	v	e	o	e
e	z	n	i	t	e	n	l	o	w	t	r
z	u	e	u	o	c	c	a	r	e	o	y
z	b	s	c	s	t	h	i	t	r	m	p
u	g	s	r	o	d	i	t	g	i	i	v
b	e	d	i	s	o	n	e	s	w	n	h
y	t	i	c	i	r	t	c	e	l	e	g
s	s	e	n	t	h	g	i	r	b	o	p

electricity	cell
alternating	circuit
direct	bulb
current	wire
battery	Edison
voltage	motor
brightness	buzzer
loudness	Tesla

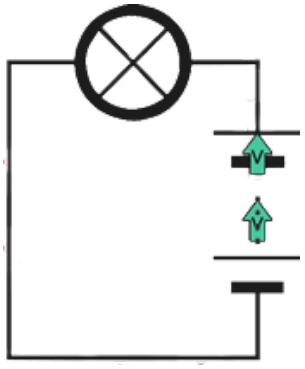
Outcomes	**Key Vocabulary**
Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit by observing and explaining the effect of different voltages in a circuit.	Voltage, circuit, bulb, wires, cell, battery, buzzer, motor, switch, circuit diagram, brightness, loudness, increase, decrease.
Knowledge needed	
Children will have learnt how to draw circuits using circuit symbols in Lesson 2.	

Everybody Watches

Watch the clip to find out more about current and voltage
(https://www.bbc.co.uk/bitesize/clips/zvy7tfr)



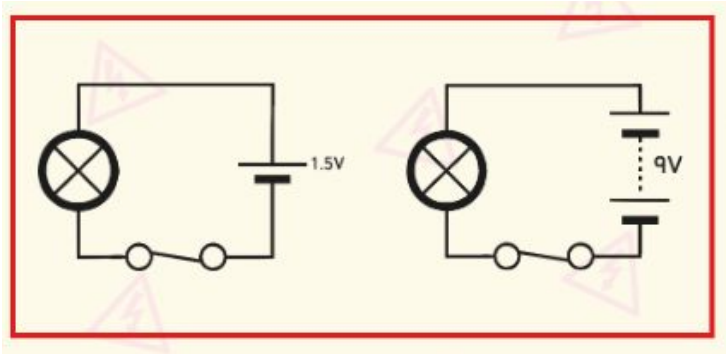
Current:
This is the steady flow of electrons.
This is measured in amperes (amps)



Voltage:
This is the force that makes the electric current flow.
This is measured in volts (V)
The greater the voltage, the more current will flow.

These are examples of cells and the voltage they contain.

Labelling Volts



What do you notice about the position of the label for the voltage in the diagrams?

What Difference Do the Volts Make?

We are going to make a prediction together about what will happen to a bulb, motor or buzzer depending on the voltage of the cell or battery.
With your partner, discuss what difference you would expect (e.g. bulb will get brighter, it will increase in brightness, the brightness will stay the same).

Group Task

Method

- Make a simple circuit with a bulb in it.
- Predict what effect it will have on the bulb.
- Begin with no cell in the circuit and observe what happens.
- Add the cells to the circuit and observe what happens each time.
- Repeat the above steps, for the buzzer and motor.

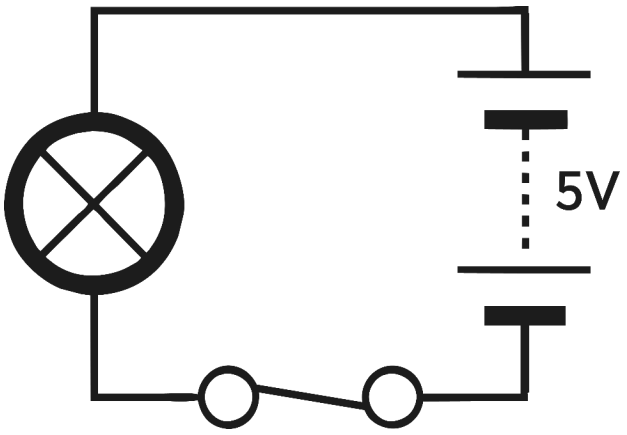
Bulb	0V	1.5V	3.0V	4.5V
Prediction				
Results				

Buzzer	0V	1.5V	3.0V	4.5V
Prediction				
Results				

Motor	0V	1.5V	3.0V	4.5V
Prediction				
Results				

Exit Ticket - Talk Task

What would happen to an electrical appliance that requires 3V if it were powered by a 5V cell or battery?



KO Quiz: / 5 Date: _____

LESSON FOUR: Electrifying Investigation Part 1

Look through what you have completed in your booklet so far and complete any blank pages. If you were absent, read the **Everybody reads** sections and write **ABSENT BUT READ** in **purple pen** and sign your name.

If you **complete all** of your feedback, on your whiteboard write 5 questions about electricity for another person in the class to answer.

Outcomes	**Key Vocabulary**
Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary by investigating the relationship between wire length and the brightness of bulbs or the loudness of buzzers.	Bulbs, cell, battery, buzzers, investigation, plan, fair test, comparative test, practical enquiry, wire, length.
Knowledge needed	
Children will have learnt to draw circuit diagrams using circuit symbols in lesson 2.	

Talk Task
Does **wire length** affect how components in a circuit work?
Discuss this question with your talk partner and predict

- what difference it might make
- to which component/part of the circuit.

Group Task
You will need to think of a question to answer and to predict what you think will happen. In order to carry out the investigation you will need to choose which type of investigation is the most appropriate to answer your question.
The three main types of investigations are:

1. Practical Enquiry: a simple practical enquiry is one where you just observe what happens.

2. Comparative Test: in a comparative test you have to:
   a) Record observations at **regular intervals of time**.
   b) Compare results.
   c) Spot patterns.

3. Control Test: A fair test is the same as a comparative test but with the addition of a **control (group)**. The **control (group)** is to detect what happens without changing the **independent variable.**

Making your test fair
In order to make sure that you carry out a fair test, which means that your results are accurate and can be trusted, then you need to be clear about your:

- **independent variable (what you will change and compare)**
- **dependent variable (what you will measure – there should only be one dependent variable)**
- **controlled variables (these are aspects of the investigation you will keep the same so that they don't affect your results because you end up measuring their effect).**

Practical Enquiry

Key Words:

bulb, cell, battery, buzzer, wire, length, function, components, variation

Question: Does wire length affect how components in a circuit work?

Prediction: _____

Equipment:

_____

_____

Method

_____

_____

_____

_____

_____

_____

_____

Exit Ticket

Swap your Electricity Investigation Activity Sheet with another group to check through.

1.Read through the sheet carefully.
2.Discuss any parts of the investigation that you think need changing.
3.Be clear about what needs changing and how it should be changed
4. Make changes in purple pen.

KO Quiz: / 5 Date: _____

LESSON FIVE: Electrifying Investigation Part 2

Do now: Exam Style Question
Circuits and sensors

(a) Class 6D makes different circuits using the same type of bulbs, motors with fans and cells (batteries).

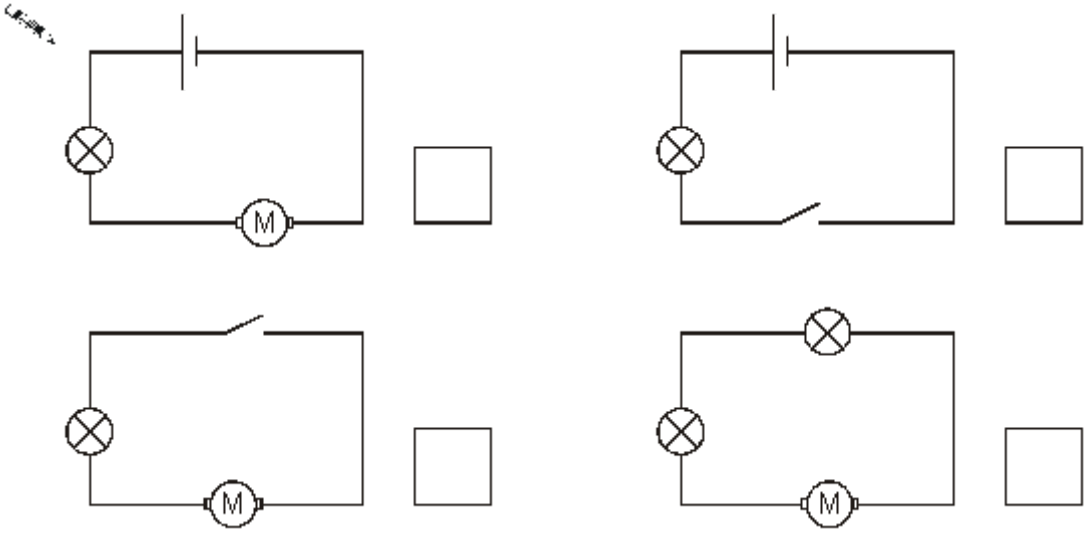
(i) Tick **ONE** box to show the circuit in which the bulb or bulbs are brightest.

(ii) Explain why the circuit you chose has the brightest bulb or bulbs.

.....

.....

(b) Tick **ONE** box to show which circuit diagram below is correct for circuit 3.



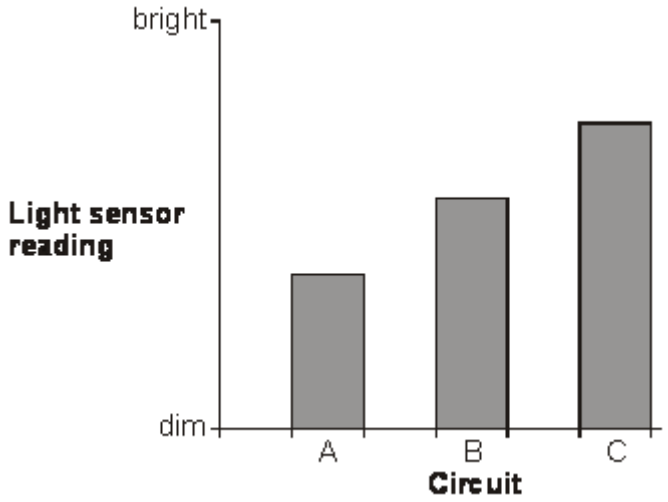
(c) Each of the circuits made by class 6D has one cell.

Complete the sentence below to explain the effect on the bulbs of adding a second cell to circuit 1.

The bulbs will .....

(d) Class 6D made three new circuits. They used a light sensor to measure the brightness of one of the bulbs in each circuit.

The sensor gave the results on the graph below.



Write **A**, **B** or **C** next to each circuit below to show which circuit gave each light sensor reading on the graph.

circuit ..... **circuit** ..... **circuit** .....

Outcomes	**Key Vocabulary**
Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs. Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations by conducting an investigation, presenting and report findings on the effect of wire length on the brightness of bulbs or the loudness of buzzers.	Bulbs, cell, battery, buzzers, investigation, plan, fair test, comparative test, practical enquiry, wire, length.
Knowledge needed	
Children will have planned their investigation in lesson 4.	

Everybody Reads

Degrees of Trust

Scientists conduct lots of investigations which have a big impact on living things. For example, scientists conduct investigations that tell us what type of food humans should eat and what chemicals are safe to use on plants.

Because we act on scientific data, we need to make sure that we have a high degree of trust in it before making our conclusions. This is particularly true if we are going to recommend that others act or behave in a particular way based on our results.

Talk Task
How can we ensure there is a high degree of trust in our results?

Degrees of Trust

- Be Objective: Have you reported the results honestly? Have you included all the results even when they did not match your prediction? Did you have a control group?
- Accuracy: Was your measuring equipment accurate?
- Reproducibility: Can your investigation be repeated? Have you repeated your results? Did you get the same or very similar results?
- Consensus: This does not mean that all the data has to show the exact same results, but if the majority of other investigations show results that are the same or very similar then we can have a higher degree of trust in our results. If your results are completely different to all the other data sets for similar investigations, then it is necessary to consider why that is.
- Sample Size: this is how many were included in your investigation. The more data you have the more likely it is to show the 'real' picture.

Which of these should you bear in mind while conducting your investigation?
What will you do to ensure you can have a high degree of trust in your results?

Conducting your experiment and recording your results

- Think about how you will record your results.
    - What is the best way to do this?
    - What categories do you need?
- While you conduct your investigation, you may need to make changes and adjustments. Make a note of these.
- Ensure that you check equipment is working properly. Create a circuit and check that the battery is not flat or the bulb has blown its filament!
- Repeating the results. Repeating results ensures that your results are more precise. By repeating the investigation, you can check if the results were precise the first time around. If the results are very different then it would indicate a problem with how you conducted your investigation.
- If you repeat your investigation, you will need to decide how to record this.

Create your results table and draw it in the box below.

Was your prediction correct? _____

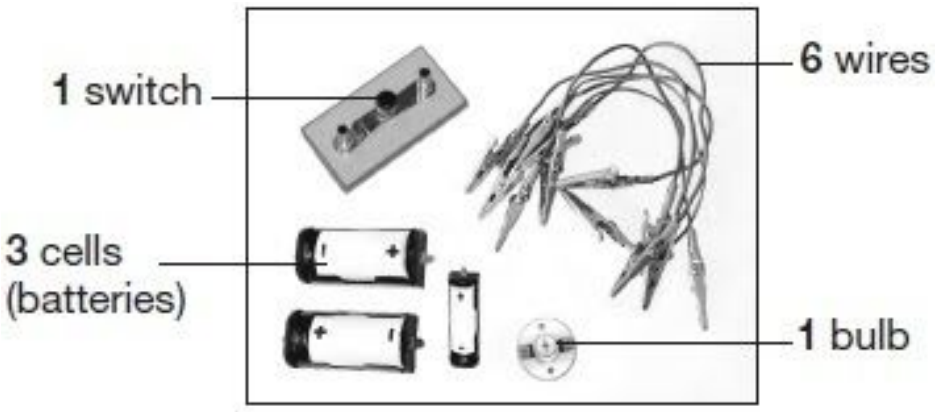
Conclusion:

In what way did you establish a high degree of trust in your results? Explain.

What would you do differently next time?

Exit Ticket

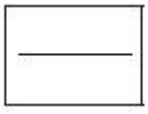
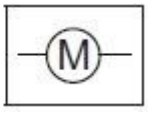
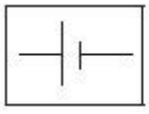
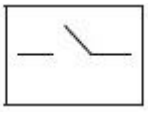
(a) Lena has this equipment:



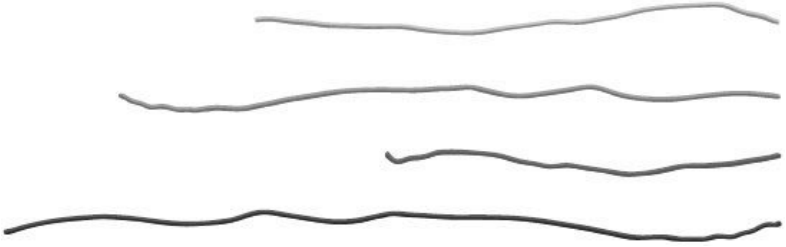
Tick THREE boxes to show which questions Lena could investigate using only the equipment shown above.
Tick THREE boxes.

Do different cells affect the brightness of a bulb?	☐
How many bulbs can be lit by one cell?	☐
Does the number of cells affect the brightness of a bulb?	☐
Does the number of switches affect the brightness of a bulb?	☐
Does the direction of cells affect the brightness of a bulb?	☐

(b) Draw FOUR lines to match the electrical components to their symbols.

Electrical component	bulb	wire	cell	switch
Symbol				

(c) Lena collected these wires.
The wires are made of different metals.



Lena says, 'I want to know if the wires made of different metals will change the brightness of the bulb in the circuit.'
What must Lena do to the wires to make her test fair?

_____

(d) Lena makes her test fair.
Tick TWO boxes to show the two pieces of evidence Lena should collect for her results.
Tick TWO boxes.

how quickly the bulb lights up	☐	how bright the bulb is	☐
how many wires there are	☐	what metals the wires are made of	☐

KO Quiz: / 5 Date: _____

LESSON SIX: Electrifying Investigation Part 3

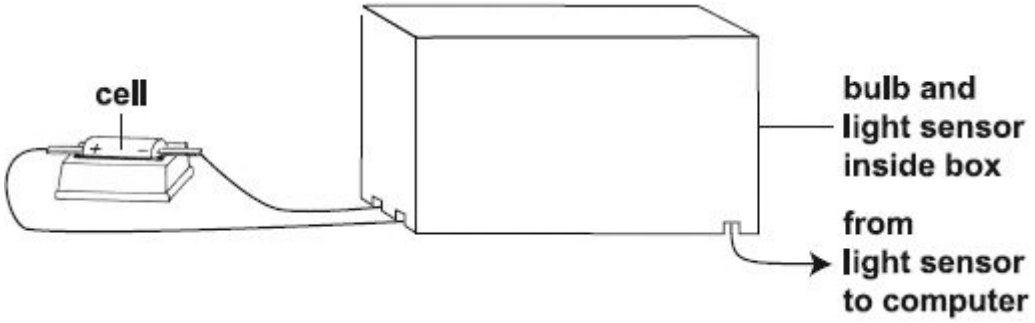
Do now: Exam Style Question

(a) Abida makes a circuit with a bulb, cell and wire.
Complete the diagram of Abida's circuit below by drawing the symbol for a cell and connecting the cell in the circuit.

(b) Name the piece of equipment that Abida could add to her circuit so she can turn the bulb on and off.

.....

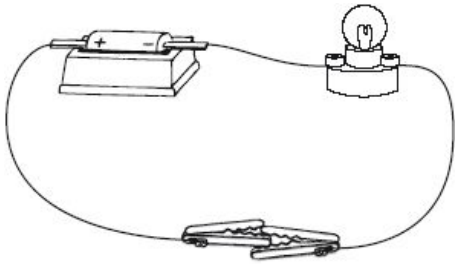
(c) Abida wants to measure the brightness of the bulb in her circuit.
She puts the bulb and a light sensor under a box.
The light sensor measures the brightness of the bulb.



Tick ONE box to show why Abida puts both the bulb and light sensor inside the box.

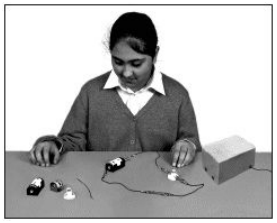
so the bulb is insulated	☐	so she does not measure light from other sources	☐
so the bulb lights up more brightly	☐	so the light from the bulb cannot be seen	☐

(d) Abida uses the sensor to measure the brightness of the bulb in the circuit below.



She wants to find out if she can change the brightness of the bulb in her circuit.
Each time she adds one object between the clips, the bulb lights up.

Abida measures the brightness of the bulb for each object.



Then she takes the object out again.
How will the brightness of the bulb change when Abida correctly adds each object to her circuit?

Tick ONE box in each row of the table.

Object	The bulb…		
used	will be dimmer.	will not change.	will be brighter.
copper wire			
a motor			
another cell			
another bulb			

Outcomes	**Key Vocabulary**
Using test results to make predictions to set up further comparative and fair tests by planning and conducting a further investigation.	Bulbs, cell, battery, buzzers, investigation, plan, fair test, comparative test, practical enquiry, wire, length.
Knowledge needed	
Children will have planned an initial investigation in lesson 4 and conducted it in lesson 5.	

Group Task
Look back at the results and conclusions from the last lesson. Remind yourselves of what you said you would do differently next time.

Making Predictions From Results
Question: Does wire length affect how components in a circuit work?
Prediction: The longer the wire, the brighter the bulb will become.
Conclusion: I found out that the longer the wire, the dimmer the bulb became.
In order to make predictions from this result we need to include it in our new prediction.

We could focus on:
1. the component (bulb, wire)

2. the effect caused by the length of the wire (takes longer for electrons to flow around the circuit)

If we **chose 1**. The component (bulb, wire), a prediction based on this could be as follows:
Adding cells will make bulbs glow more brightly even if the wire length is long.
- We are going to test the same lengths of wire as we did before.
- We are going to do a comparative test with different numbers of batteries.

How is this based on the results?
- The results showed the length of wire did have an effect on the brightness of the bulb.
- We are testing to see if the number of batteries can change the effect of the bulbs dimming when the wire is long or if it makes no difference.
- We are checking to see if there are other components that make more of a difference in this situation or counteract the effect of the wire length.

If we **chose 2**. the effect caused by the length of the wire, a prediction based on this could be as follows:

The longer the wire, the duller the buzzer noise will be.

- I will keep everything in my investigation the same except changing the bulb to a buzzer.

How is this based on the results?

- The results showed that the longer the wire, the dimmer the bulb became.
- We are making this prediction as we assume that just as the bulb dimmed, the longer the wire, the less noise a buzzer will make.
- We are testing to see if the length of wire affects the buzzer in the same way it did the bulb.

Conducting your experiment and recording your results

- Think about how you will record your results.
    - What is the best way to do this?
    - What categories do you need?
- While you conduct your investigation, you may need to make changes and adjustments. Make a note of these.
- Ensure that you check equipment is working properly. Create a circuit and check that the battery is not flat or the bulb has blown its filament!
- Repeating the results. Repeating results ensures that your results are more precise. By repeating the investigation, you can check if the results were precise the first time around. If the results are very different then it would indicate a problem with how you conducted your investigation.
- If you repeat your investigation, you will need to decide how to record this.

Group Task

Practical Enquiry

Key Words:

bulb, cell, battery, buzzer, wire, length, function, components, variation

Question: Does wire length affect how components in a circuit work?

Prediction: _____

Equipment:

Method

Create your results table and draw it in the box below.

Exit Ticket

Was your prediction correct? _____

Conclusion:

In what way did you establish a high degree of trust in your results? Explain.

What would you do differently next time?