

Kirkcaldy High School



BGE Science

The House

Electricity

Name: _____

Class: _____

Teacher: _____

Expectations and Outcomes Learner Evaluation

Topic: Electricity

Experience and Outcomes	Date Completed (dd/mm/yy)	Evaluation How happy are you with it? (☺ ? ☹)
I can state the two types of charge		
I can describe what happens when two charges are next to each other		
I can explain static electricity in terms of charge		
I can identify the symbols for components in an electrical circuit.		
I can draw simple electrical circuits.		
I can describe what a series circuit is.		
I can build a series circuit.		
I can describe the difference between a parallel and a series circuit.		
I can build a parallel circuit		
I can understand switches in circuits.		
I can use circuit diagrams to build switches in circuits.		
I can define voltage and current		
I can state how current and voltage are measured		
I can build a chemical cell		
I can investigate the effect of changing metals on output voltage.		
I can describe how to make a fruit battery		
I can complete an experiment to investigate the best fruit for making batteries		

Static Electricity

Starter

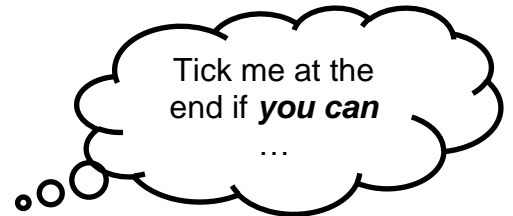
Write down everything you know about electricity:

Learning Intentions

- I am learning about static electricity

Success Criteria

- I can state the two types of charge
- I can describe what happens when two charges are next to each other



Positive and Negative Charges

All substances are made of _____. These are often called particles.

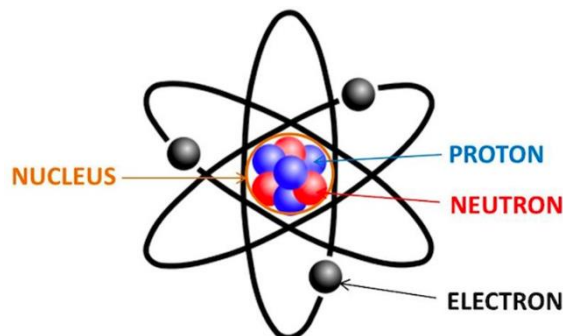
Atoms contain even smaller particles called _____, _____ and

_____. Protons have a _____ charge, electrons have a _____ charge and neutrons have _____ charge.

_____ charge.

If an atom **gains** an electron it becomes _____ charged.

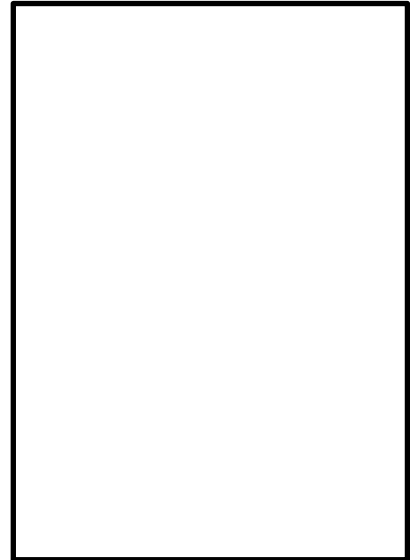
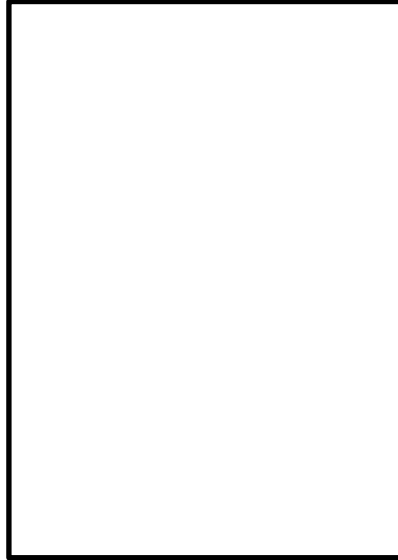
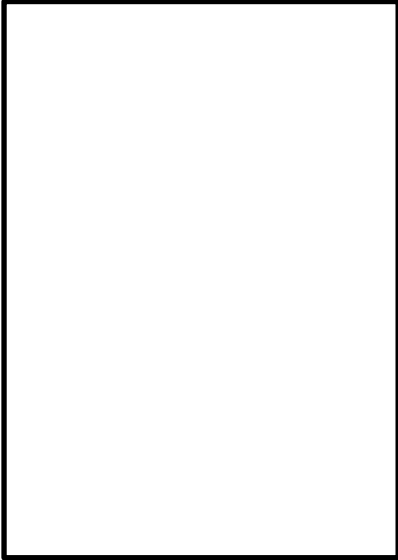
If an atom **loses** an electron it becomes _____ charged.



Static Electricity

Aim:

Method:



Results:

1. What happens with the pen and paper?

2. What happens with the hair and the balloon?

3. What happens with the rods?

4. Try to explain your answers to the above questions

Conclusion:

Charges that are the _____ repel (push away) from each other.

Charges that are _____ attract (move towards) each other.

Static Electricity (Van de Graaff)

Starter

1. State the two types of charge.

2. Describe what happens when two charges are next to each other.

Learning Intentions

- I am learning about static electricity

Success Criteria

- I can explain static electricity in terms of charge



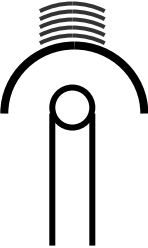
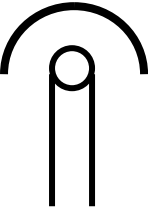
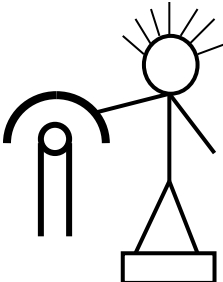
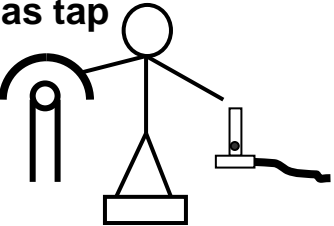
Van de Graaff Generator

A Van de Graaff generator produces _____, which makes your hair stand on end. Static electricity is caused when _____ are transferred from one insulator to another by friction. This causes an uneven number of protons and electrons in a material.

Aim:

Method:

Results:

Experiment	Describe what you saw	Explain why
Foil cups 		
Sawdust 		
Hair 		
Gas tap 		

Conclusion:

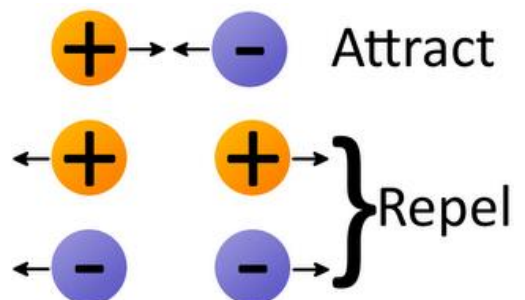
When two different materials are _____ together they become electrically charged.

Electrically charged objects can _____ small objects.

A _____ charged object and a _____ charged object will attract.

Two positively charged objects will _____

Two negatively charged objects will _____



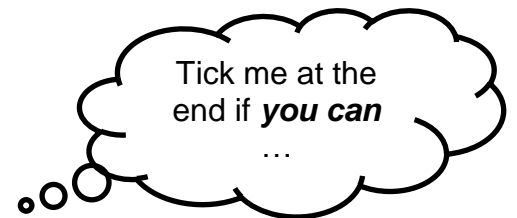
Electrical circuits

Starter

When you flip a light switch on, the room instantly lights up. How do you think the switch tells the light bulb to turn on? Write or draw your answer below:

Learning Intentions

- I am learning about drawing electrical circuits.



Success Criteria

- I can identify the symbols for components in an electrical circuit.
- I can draw simple electrical circuits.

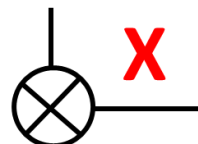
Circuit Diagrams

When you are drawing a circuit diagram, there are some basic rules to follow:

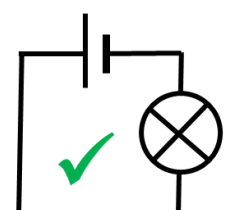
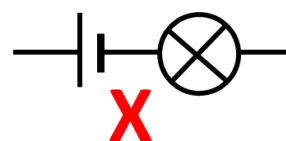
Connecting wires are drawn with a ruler...











Wires turn corners, components don't...



The battery is usually on the top line of the diagram, on its own.



Electrical symbols

Component Name	Picture	Symbol
Cell		
Battery (of cells)		
Connecting wire		
Lamp		
Switch		
Resistor		
Ammeter		
Voltmeter		

Circuit diagrams

Components	Circuit diagram
Cell and a lamp	
Cell, lamp and a resistor	
Battery, resistor, lamp and switch	

Series circuits

Starter:

1. What symbol do we use to represent a bulb?

2. What symbol do we use to represent a battery?

3. What symbol do we use to represent a switch?

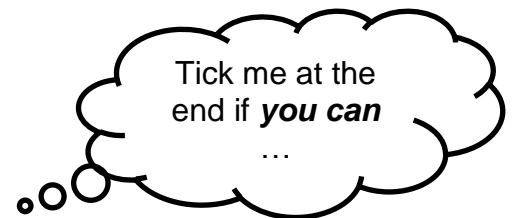
4. When we draw wires, what do we need to use?

Learning Intentions

- I am learning about series circuits.

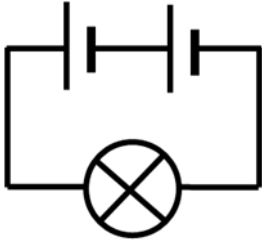
Success Criteria

- I can describe what a series circuit is.
- I can build a series circuit.



Lamps in a Series Circuit

Draw and build each of these series circuits and answer the questions.

Components	Circuit diagram
<p>2 Cells and 1 lamp</p>	
<p>2 cells and 2 lamps</p>	

2 cells and 3 lamps

1. What happens when you add more lamps to your circuit?

2. Try to explain your answer to question 1.

3. (a) What happens when you unscrew one of the bulbs?

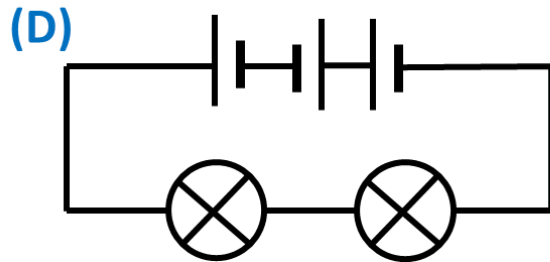
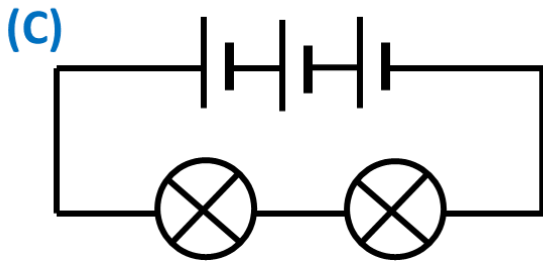
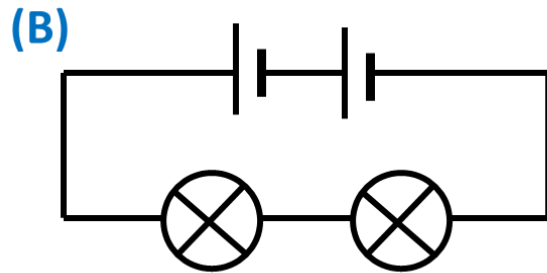
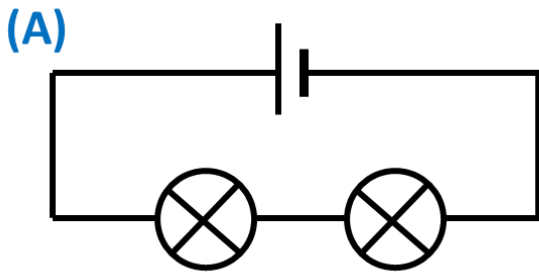
(b) Does it matter which bulb you unscrew?

4. Try to explain your answer to question 3.

This circuit has only ONE loop. This is called a _____ **CIRCUIT**.

Cells (extension)

Build each of these circuits and answer the questions.



Careful with this one!

1. What happens to the lamps when you add more cells?

2. What happens when you turn one cell around?

3. Try to **explain** your answers to questions 1 and 2.

Parallel circuits

Starter:

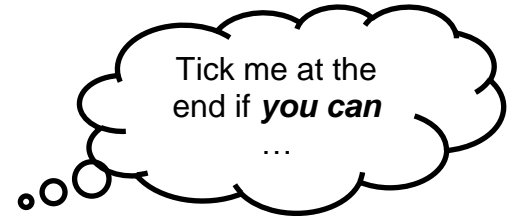
1. What happened to the brightness of the lamps when we added more cells to the series circuit?

2. Why?

3. What do we mean by a 'series circuit'?

Learning Intentions

- I am learning about parallel circuits.

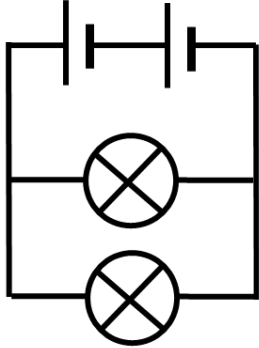


Success Criteria

- I can describe the difference between a parallel and a series circuit.
- I can build a parallel circuit.

Lamps in a Parallel Circuit

Draw and build each of these parallel circuits and answer the questions.

Components	Circuit diagram
<p>2 cells and 2 lamps</p>	
<p>2 cells and 3 lamps</p>	

Lamps in Circuits 2

Build each of these circuits and answer the questions.

1. What happens when you add more lamps to **this** circuit?

2. (a) What happens when you unscrew one of the bulbs?

- (b) Does it matter which bulb you unscrew?

3. Try to explain your answer to question 2.

This circuit has more than one loop. This is called a _____ **CIRCUIT**.

Switches in circuits

Starter:

1. What happened when we unscrewed one of the bulbs in the parallel circuit?
Explain why.

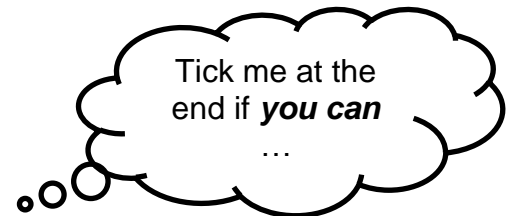
2. Describe the difference between series and parallel circuits.

Learning Intentions

- I am learning about switches in circuits.

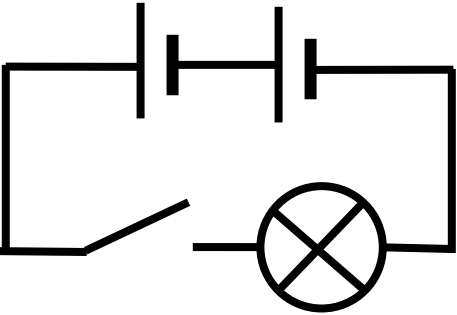
Success Criteria

- I can understand switches in circuits.
- I can use circuit diagrams to build switches in circuits.



Switches in Circuits

Draw and build each of these circuits and answer the questions.

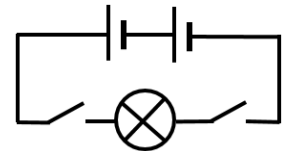
Components	Circuit diagram
<p>2 cells, 1 lamp, 1 switch in series.</p>	
<p>2 cells, 1 lamp, 2 switches in series.</p>	

2 cells, 1 lamp, 2 switches in parallel.

1. What do you have to do to light the bulb in each circuit?

2. Try to explain your answer to question 1.

3. Does it matter what “side” the switches are on? Eg:



4. Give an example of a situation where you would want to use:
(a) two switches in **series** to make a device work?

(b) two switches in **parallel** to make a device work?

The Doorbell Circuit Challenge

Your task is to design a doorbell system for a person with hearing difficulties. There are three challenges below.

With your partner, talk about your challenge, and decide what you are going to do. Each pair will:

- a. Build the working circuit
- b. Draw a circuit diagram on a sheet of A4 paper, using correct circuit symbols
- c. Describe how the circuit works (what does each component do).

CHALLENGE 1

When in their living room, the person must know if the **front doorbell** has been pressed.

CHALLENGE 2

The house has a doorbell at the front door and the back door.

Redesign your circuit to let the person know whether the **front or back doorbell** is rung.

Draw the circuit diagram after your teacher checks your circuit.

Does your circuit tell you **what** doorbell – front or back – was rung?

CHALLENGE 3

Extend the system so that it could work in two different rooms.

You will have to report back to the rest of the class what you have done, and how your design works.

Measuring Voltage and Current

Starter

1. When two switches are in a series circuit, how do we make the lamp work?

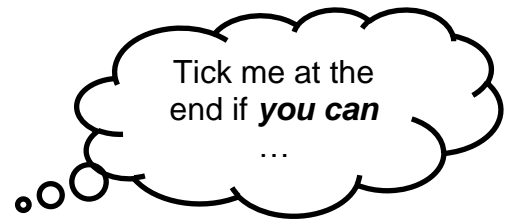
2. When two switches are in parallel, how do we make the lamp work?

Learning Intentions

- I am learning about voltage and current

Success Criteria

- I can define voltage and current
- I can state how current and voltage are measured



Current

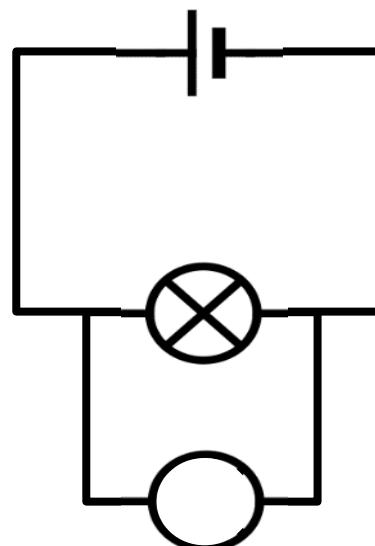
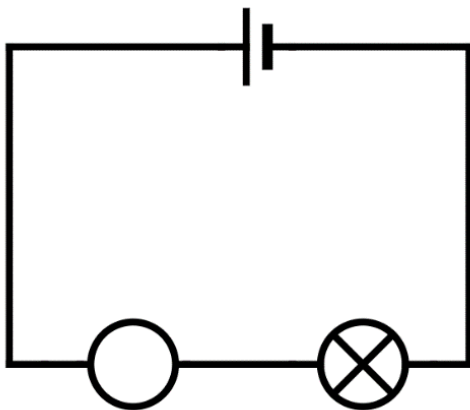
Electric _____ is the rate of flow of electrons.

Current is measured using an _____.

Voltage is the electric push from a battery. It is the energy given to the charges in the circuit.

Voltage is measured using a _____.

Complete the diagrams:



Effect of Number of Cells on Current

Aim:

Method:

Results:

Number of cells	Current (A)
1	
2	
3	

Conclusion: *What is the answer to your aim?*

Evaluation: *How could you improve your experiment?*

Effect of Number of Cells on Voltage

Aim:

Method:

Results:

Number of cells	Output Voltage (V)
1	
2	
3	

Conclusion: *What is the answer to your aim?*

Evaluation: *How could you improve your experiment?*

Chemical cells

Starter

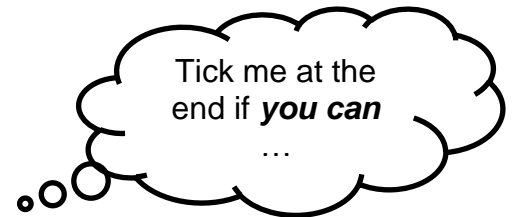
Describe what happens to the output voltage as we increase the number of cells in a circuit.

Learning Intentions

- I am learning about chemical cells

Success Criteria

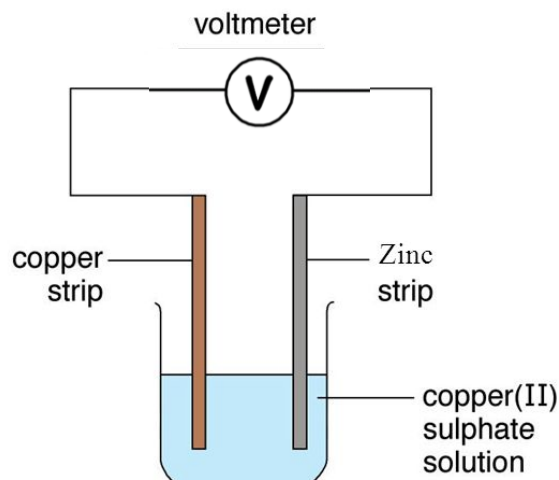
- I can build a chemical cell
- I can investigate the effect of changing metals on output voltage.



Chemical cells

A cell/battery contains chemicals which give _____. When you use a battery the _____ energy changes into _____ energy.

A simple chemical cell is made using 2 different _____ (electrodes) and an _____ (a solution which contains charge particles which is used to complete the circuit).



Investigating Chemical Cells

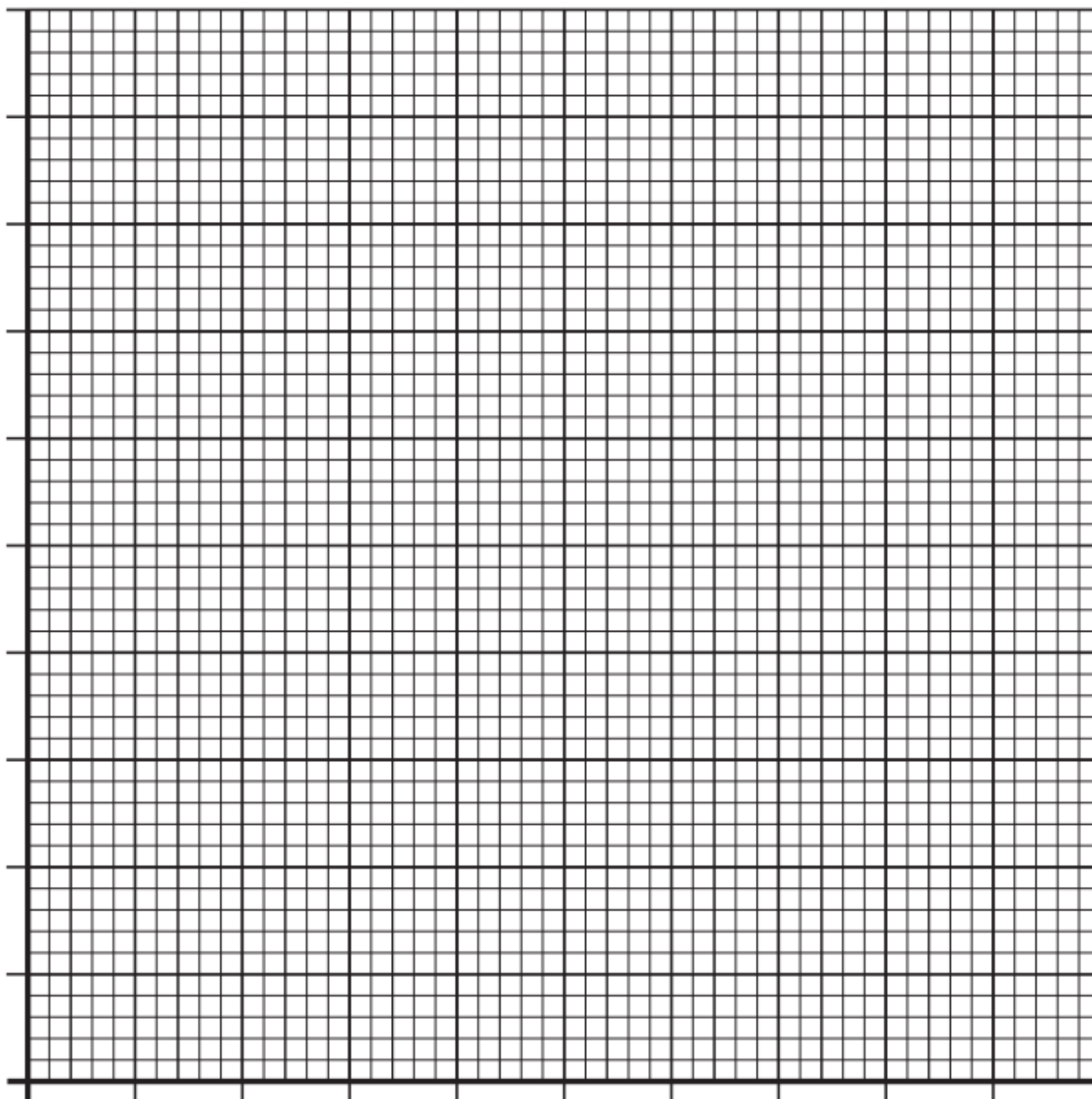
Aim:

Method:

Results:

Metal	Output Voltage (V)
Magnesium	
Tin	
Aluminium	
Lead	
Nickel	

Draw a bar graph of your data:



Conclusion: *What is the answer to your aim?*

Evaluation: *How could you improve your experiment?*

Fruit Cell Batteries

Starter

1. In chemical cells, which type of energy is chemical energy converted into?

2. Describe what a chemical cell is made up of.

Learning Intentions

- I am learning how to investigate fruit batteries

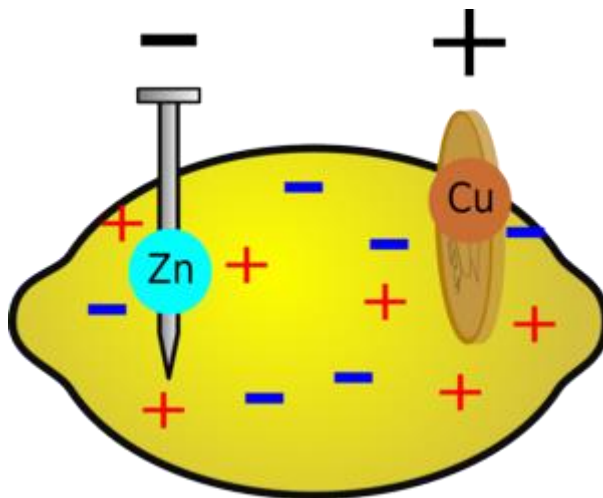
Success Criteria

- I can describe how to make a fruit battery
- I can complete an experiment to investigate the best fruit for making batteries



Fruit Batteries

In a fruit battery, the fruit juice is the _____ (a liquid that conducts). This allows the electric current or charged particles called _____ flow through it to complete the circuit.



Investigating Fruit Cell Batteries

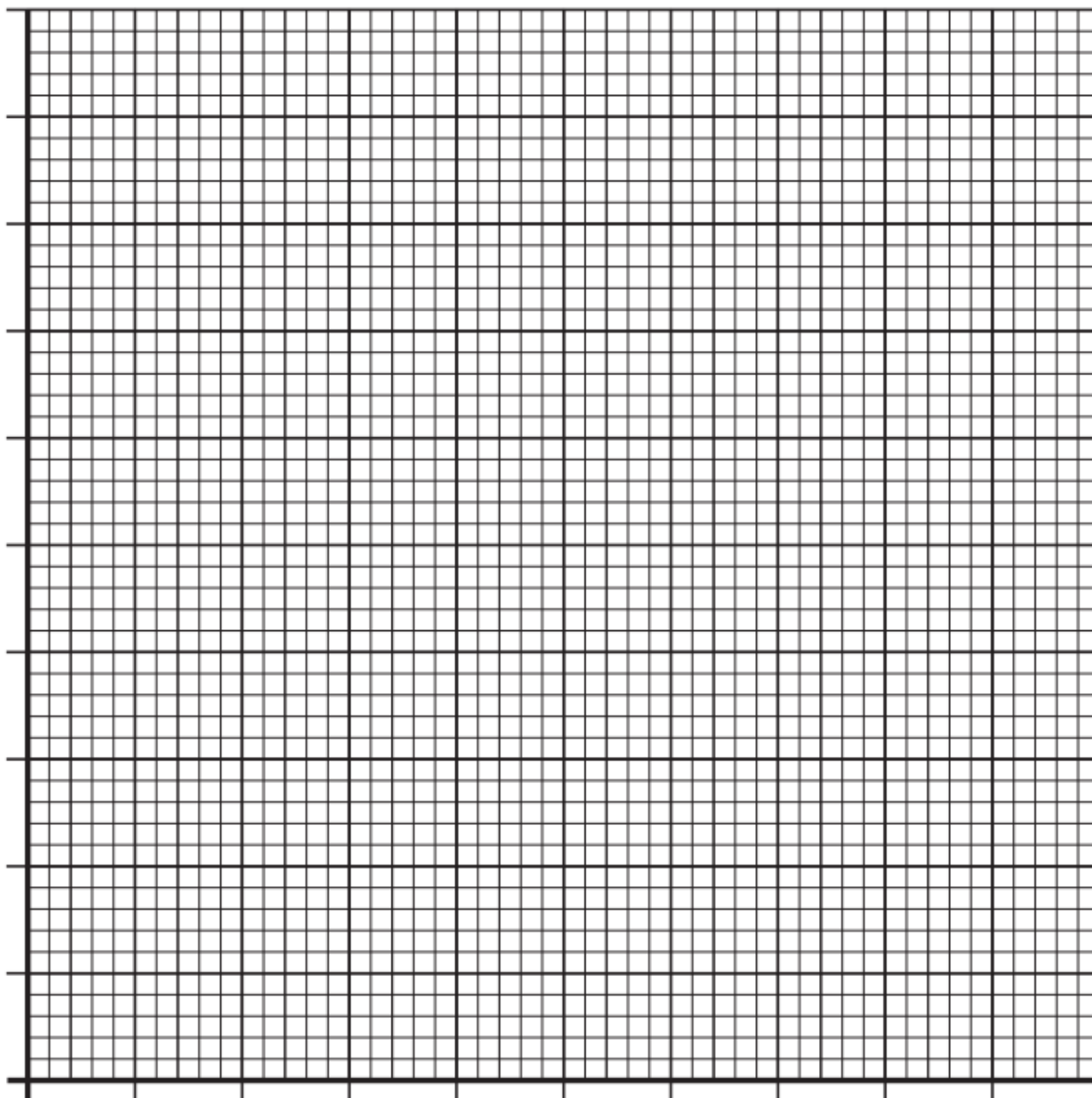
Aim:

Method:

Results:

Type of Fruit	Output Voltage (V)			
	Replicate 1	Replicate 2	Replicate 3	Average
Lemon				
Orange				
Grapefruit				
Tomato				
Kiwi				

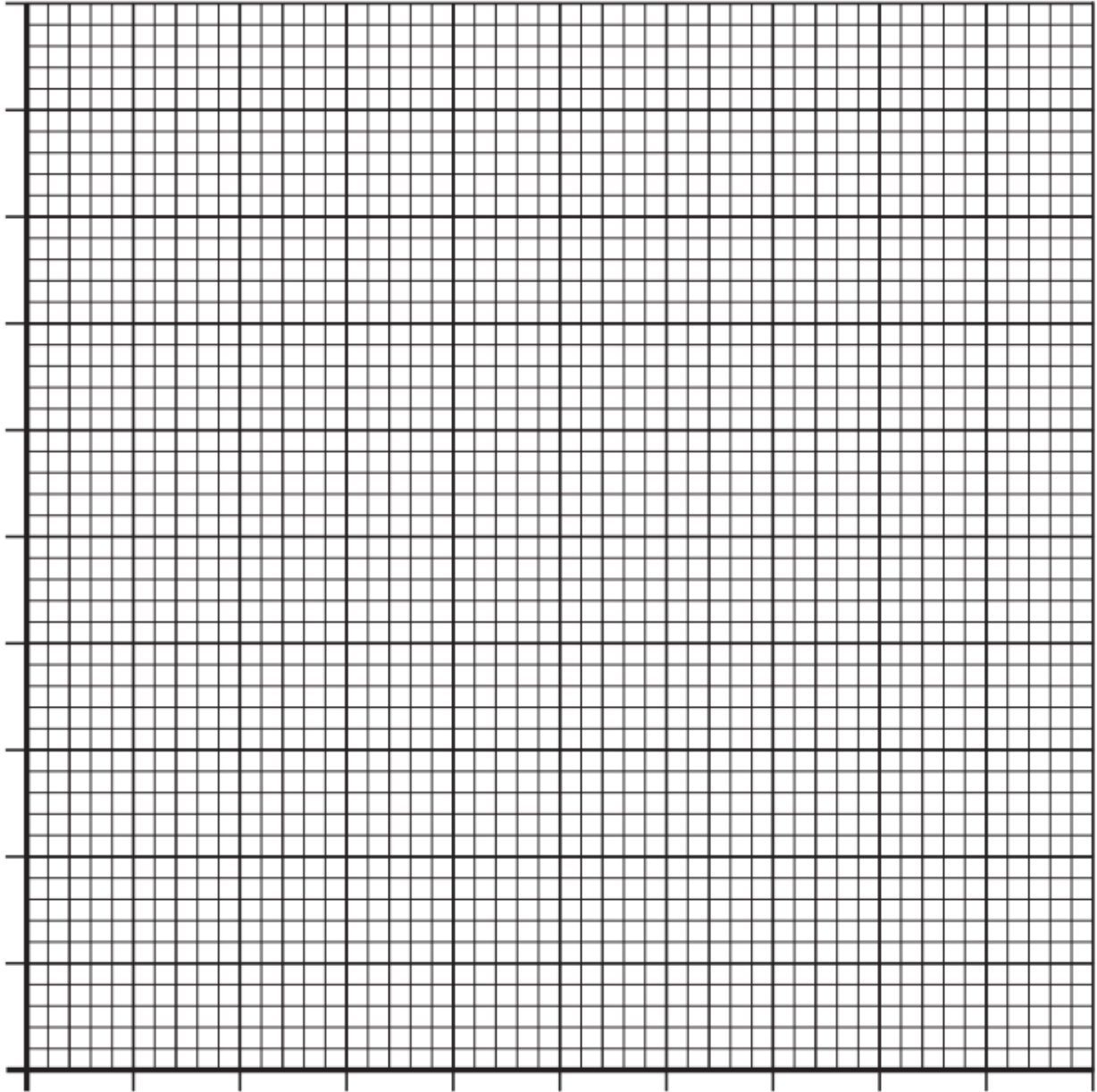
Draw a bar graph of your data ...



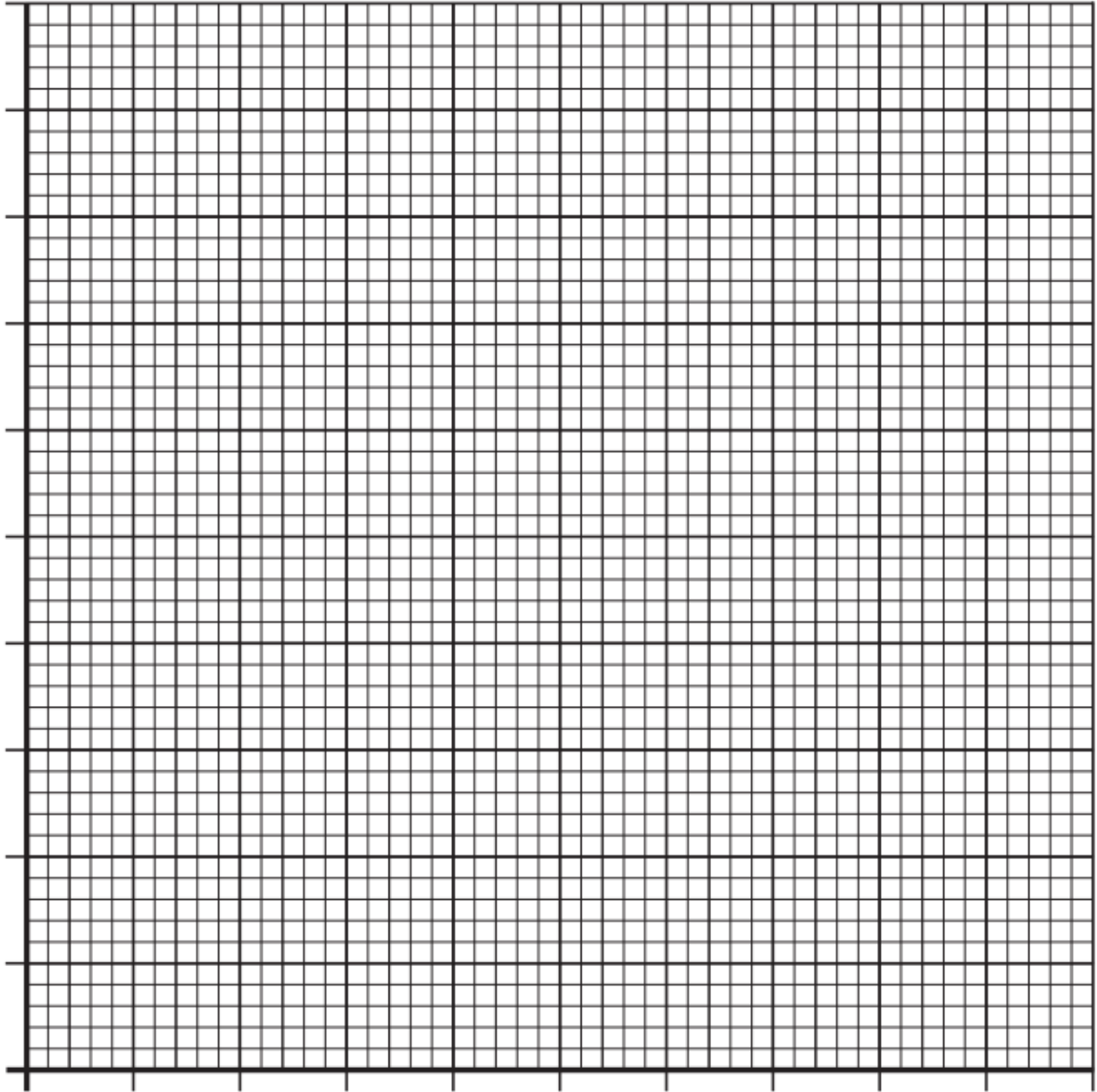
Conclusion: *What is the answer to your aim?*

Evaluation: *How could you improve your experiment?*

Additional graph paper for numeracy tasks:



Additional graph paper for numeracy tasks:



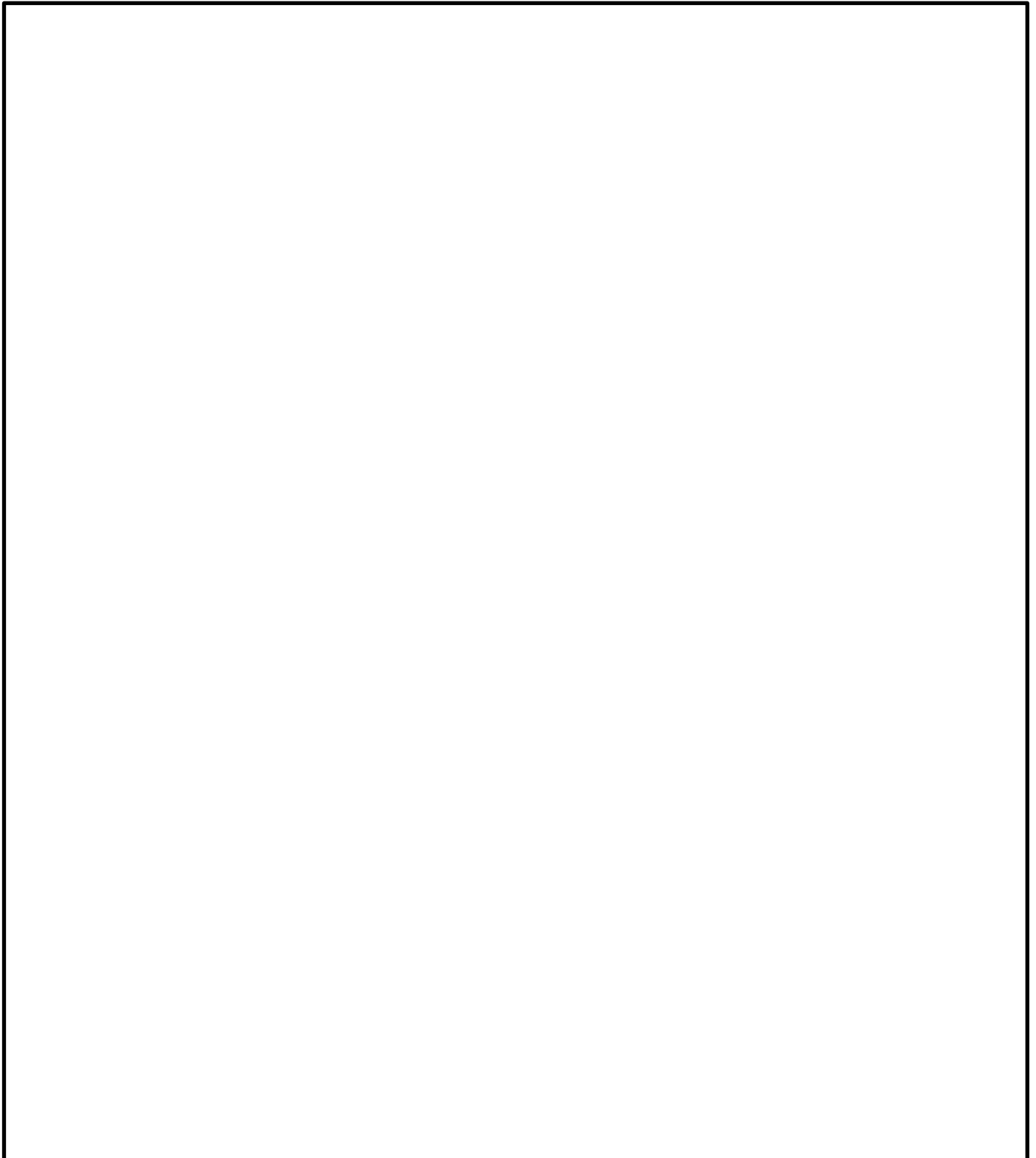
Extension Tasks

Doorbell Circuit Challenge – Extension

You should individually create an advertisement for your new doorbell system for the hard of hearing.

It should include:

- What your system is for
- A circuit diagram
- An explanation of how it works
- What improvements could be made

A large empty rectangular box with a black border, intended for students to draw their circuit diagrams, write explanations, and create advertisements for their doorbell systems.

Lightning Literacy Task

What is lightning?

Lightning is a bright flash of electricity produced by a thunderstorm. All thunderstorms produce lightning and are very dangerous. If you hear the sound of thunder, then you are in danger from lightning. Lightning kills and injures more people each year than hurricanes or tornadoes; between 75 to 100 people.

What causes lightning?

Lightning is an electric current. In a thundercloud, many small bits of ice (frozen raindrops) bump into each other as they move around in the air. All of those collisions create an electric charge. After a while, the whole cloud fills up with electrical charges. Positive charge forms at the top of the cloud and negative charge at the bottom of the cloud. Since opposite charges attract, that causes a positive charge to build up on the ground beneath the cloud. The ground's positive charge concentrates around anything that sticks up, such as mountains, people, or single trees. The charge coming up from these points eventually connects with a charge reaching down from the clouds and - zap - lightning strikes!

What causes thunder?

Thunder is caused by lightning. When a lightning bolt travels from the cloud to the ground it actually opens up a little hole in the air, called a channel. Once the lightning has gone the air collapses back in and creates a sound wave that we hear as thunder. The reason we see lightning before we hear thunder is because light travels faster than sound.

How do you know if lightning is nearby?

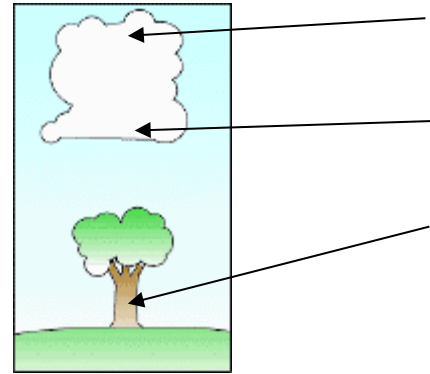
If you see dark clouds, then lightning could be present, but the best thing you can do is to listen for thunder. If you hear thunder, then you need to go indoors or get in a car. Don't be outside, where lightning could strike! If your hair stands on end or your skin starts to tingle, lightning maybe about to strike. Get down on your hands and knees and keep your head tucked in. Do not lie flat, because it can give lightning a better chance of striking you.

Use the passage to answer the questions:

1. What is lightning produced by?
2. Name two other weather effects named in Paragraph 1.
3. In America, how many people are killed or injured by lightning each year?

4. How many different types of charge are mentioned in Paragraph 2? Name them.

5. Use information in Paragraph 2 to label the different parts of the diagram with the type of charge you find there.



6. Explain why we see lightning before we hear thunder.

7. Describe two ways you can stay safe if a thunderstorm is close.

8. In Paragraph 2, the writer describes lightning as “an electric current.” You know from your lessons that electric current is the movement of electric charge. Use other information in paragraph 2 to explain why the writer was able to describe lightning as an electric current.

Electricity

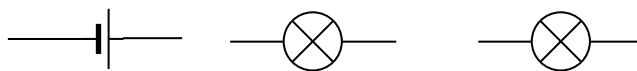
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S	E	I	R	E	S	O	R	O	A	S	R	E	O
R	S	U	O	V	O	L	T	A	G	E	S	T	L
C	O	R	T	L	S	I	C	O	R	M	E	E	T
S	C	T	S	R	I	L	G	E	R	E	R	R	M
C	T	I	S	O	O	S	S	C	G	N	T	L	E
U	N	I	T	I	T	N	N	W	N	R	U	I	T
R	E	E	U	A	S	O	S	O	I	L	A	T	E
R	O	C	S	C	T	E	S	U	T	T	L	H	R
E	E	S	E	I	R	S	R	R	E	O	C	L	C
N	C	L	E	E	T	I	U	R	C	S	R	H	H
T	L	E	M	C	V	O	C	E	E	S	C	P	E

STATIC
 AMMETER
 CIRCUITS
 SERIES
 NEUTRONS
 CHARGE
 VOLTAGE
 VOLTMETER
 ELECTRICITY
 PARALLEL
 ELECTRONS
 SWITCH
 RESISTOR
 PROTONS
 CURRENT

Draw a comic strip on one of the topics. Ask your teacher for ideas.

Extra Questions

1. Using these three components, and as many wires as necessary, draw circuit diagrams following all the circuit diagram rules and then answer the questions:



a) draw a series circuit

b (i) What would happen if you added another lamp in series?

(ii) What would happen if one lamp is unscrewed?

c) draw a parallel circuit

(i) What would happen if you added another lamp in parallel?

(ii) What would happen if one lamp is unscrewed?

2. Read this description of a circuit.

“A battery is connected to a bulb. The bulb is connected to a resistor. The resistor is connected to a switch. The switch is connected back to the battery.”

Using the correct circuit symbols, draw the circuit diagram

