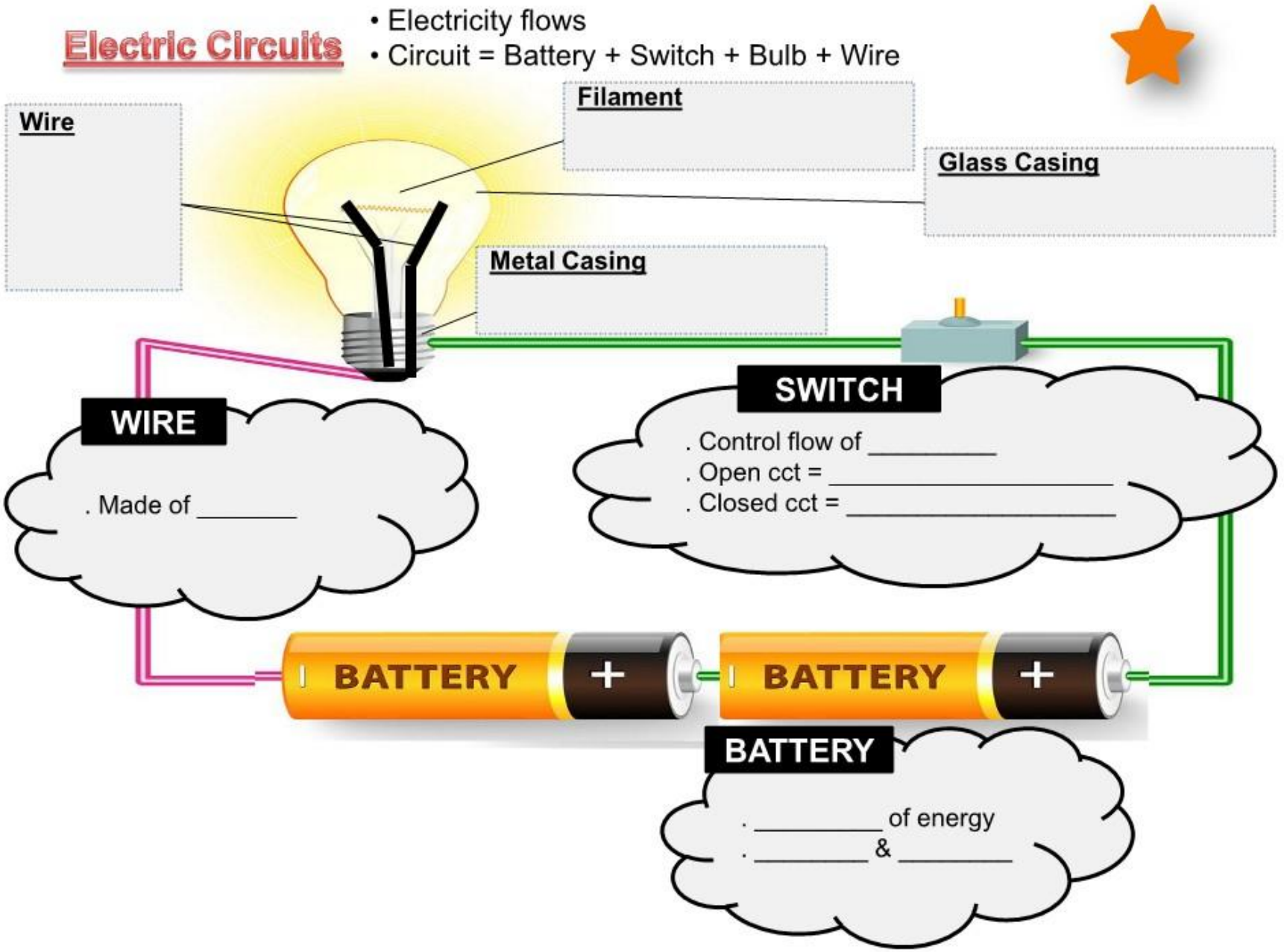
What Is Electricity?

- Form of Energy
- **XL +ve** → generate in power plant (factories, etc)
- **L +ve** → generated in power stations (HDB, Office, etc)
- **S +ve** → stored in batteries

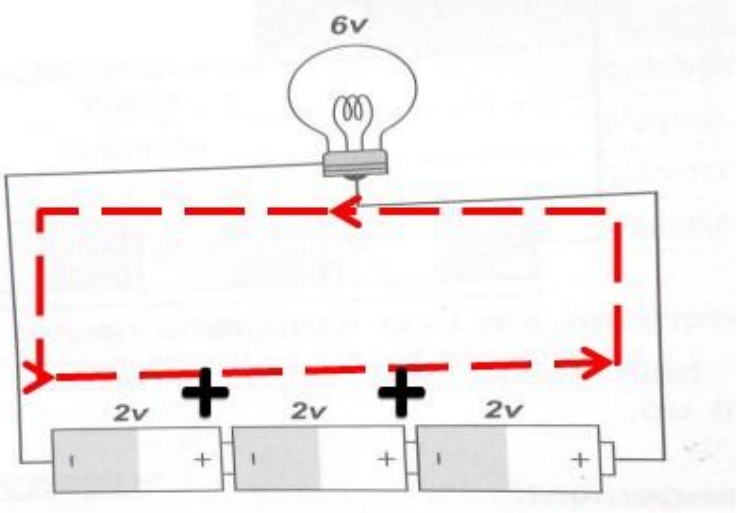
Electric Circuits

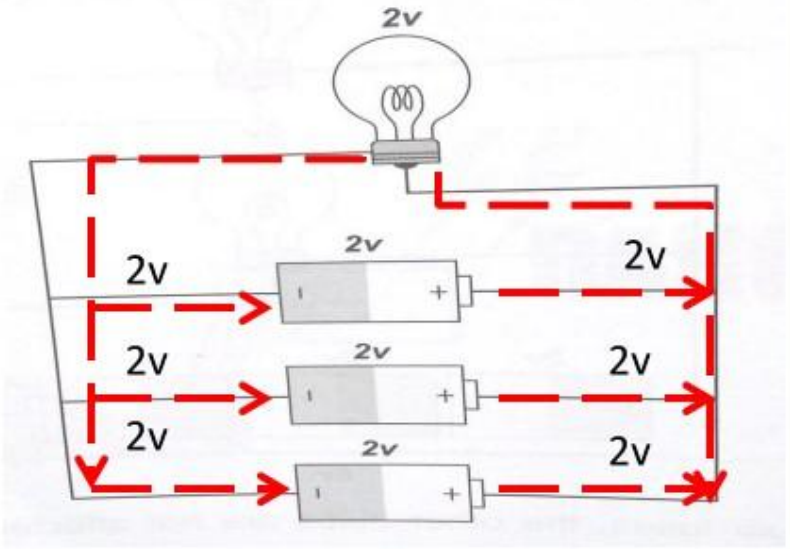
- Electricity flows
- Circuit = Battery + Switch + Bulb + Wire



Arrangement Of Batteries

SERIES	PARALLEL
• 1 electrical pathway •  connected one after another • Voltage add up from batteries (2v + 2v + 2v) = bulb (6v) very bright • **Disadvantage** = Batteries used up faster	• More than 1 electrical pathway • Voltage does not add up , **thus does not effect the brightness of bulb** • **Advantage**= Batteries last longer





Electrical Conductors & Insulators

CONDUCTOR		INSULATORS
Metals	**Non-Metals**	
Copper	Water	Rubber
Silver	Graphite	Paper
Steel	Carbon	Wood
Aluminium	Pencil Lead	Plastic

CONSERVING ELECTRICITY

1. _____
2. _____
3. _____
4. _____

EXPERIMENTS

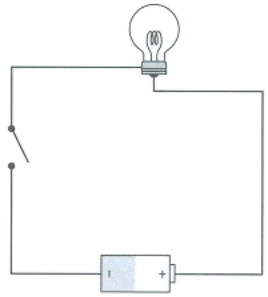
Experiment 1

Materials needed:

- 4 batteries
- 1 bulb
- 1 switch
- Wires

Steps:

1. Set up a simple circuit as shown below.



2. Turn on the switch and observe the brightness of the bulb.
3. Add another battery in series and repeat Steps 1 and 2.
4. Repeat Steps 1 to 3 using 3 and 4 batteries.
   - What can be observed about the brightness of the bulb?

     The bulb becomes brighter each time an additional battery was added.

   - Explain your observation.

     As the batteries were added in a series arrangement, the amount of electric current flowing through the circuit increased, causing the bulb to light up brighter.

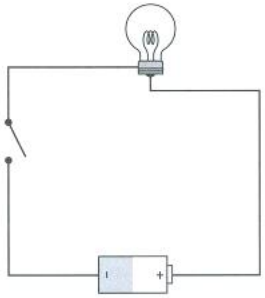
Experiment 2

Materials needed:

- 1 battery
- 3 bulbs
- 1 switch
- Wires

Steps:

1. Set up a simple circuit as shown below.



2. Turn on the switch and observe the brightness of the bulb.
3. Add another bulb and repeat Steps 1 and 2.
4. Repeat Steps 1 to 3 using the third bulb.
   - What can be observed about the brightness of the bulb?

     The bulb becomes dimmer each time an additional bulb is added to the circuit.

   - Explain your observation.

     The electric current flowing through the circuit is shared among the bulbs, thus each bulb has less electric current flowing through it, causing it to be less bright.

EXPERIMENTS

Experiment 3

Notes

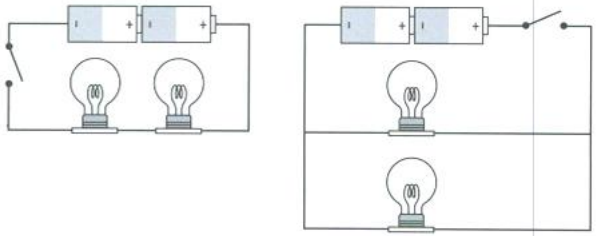
Materials needed:

- 4 batteries
- 4 bulbs
- 2 switches
- Wires

Steps:

1. Set up the simple circuits as shown below.

2. Turn on the switches and observe the brightness of the bulbs.



- What can be observed about the brightness of the bulbs?

  The bulbs in parallel arrangement light up brighter than the bulbs in the series arrangement.

- Explain your observation.

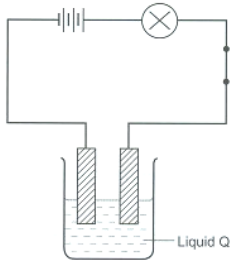
  When the bulbs are arranged in series, the electric current flowing through the circuit is shared between the two bulbs, causing them to be less bright.

  When the bulbs are arranged in parallel, the electric current flowing through the circuit supports the two light bulbs separately, causing them to be brighter.

WORKED EXAMPLES

Example 1

The diagram below shows how a bulb and 3 batteries are connected to 2 metal plates which are dipped into a liquid in the beaker.



(a) The bulb lights up when the switch is closed. What can you conclude about Liquid Q? (1m)

(b) If the metal plates are replaced with 2 pieces of wooden blocks, suggest what would be observed in the bulb. Explain your answer. (2m)

Thought Process:

Topic	:	Electrical systems
Key Concept(s)	:	Conductors of electricity allow electricity to pass through. Insulators of electricity do not allow electricity to pass through. When a switch is closed, electric current can flow through the circuit.
Key Words / Key Phrases	:	(a) conductor of electricity. (b) bulb did not light up, wood is an insulator of electricity, open circuit
Process Skills	:	Observing, Communicating, Inferring, Predicting, Analysing

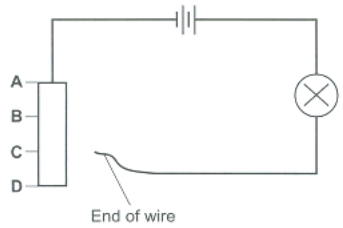
Answers:

(a) Liquid Q is a **conductor of electricity**. (1m)

(b) The **bulb will not light up**. **Wood is an insulator of electricity**, thus it will **create an open circuit**, causing the light bulb to not light up. (2m)

Example 2

Kenneth set up the circuit shown below. As the end of the wire moves along the piece of graphite from Point A to D, the brightness of the bulb decreases.



(a) What can be concluded about graphite? Explain your answer. (2m)

(b) What could be the aim of Kenneth's experiment? (1m)

Thought Process:

Topic	:	Electrical systems
Key Concept(s)	:	Conductors of electricity allow electricity to pass through. When a switch is closed, electric current can flow through the circuit.
Key Words / Key Phrases	:	(a) conductor of electricity, allows electricity to pass through, closed circuit, bulb lights up (b) length of graphite affects brightness of the bulb
Process Skills	:	Observing, Communicating, Comparing, Inferring, Formulating hypothesis

Answers:

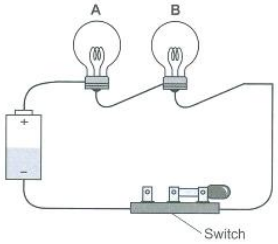
(a) Graphite is a **conductor of electricity**. (1m) It **allows electricity to pass through**, creating a **closed circuit** and causes the **bulb to light up**. (1m)

(b) To find out **if the length of the graphite affects the brightness of the bulb**. (1m)

WORKED EXAMPLES

Example 3

Study the set-up below.



(a) Will Bulb A still light up if Bulb B is removed? Give a reason for your answer. (1m)

(b) Suggest what you can do to make the bulbs in the circuit shine brighter without adding more batteries? (1m)

Thought Process:

Topic	:	Electrical systems
Key Concept(s)	:	There is only one pathway for electricity to flow in a series arrangement. When one bulb fuses, the circuit is broken and the other bulbs will not light up. There is more than one electrical pathway in a parallel arrangement.
Key Words / Key Phrases	:	(a) No, bulbs are arranged in series, creates open circuit when Bulb B is removed (b) bulbs in parallel arrangement
Process Skills	:	Observing, Communicating, Inferring, Predicting, Analysing, Generating possibilities

Answers:

(a) **No**. The **bulbs are arranged in series**. If **Bulb B is removed**, it will **create an open circuit**, thus Bulb A will not light up. (1m)

(b) Arrange the **bulbs in parallel arrangement**. (1m)

Notes