1.3 Potential difference

Learning objectives

After this topic you will be able to:

- describe what is meant by potential difference
- describe how to measure potential difference
- describe what is meant by the rating of a battery or bulb.

A doctor can use a defibrillator to start someone's heart if it stops. Defibrillators produce a large potential difference (sometimes called a voltage), much bigger than a battery can produce.

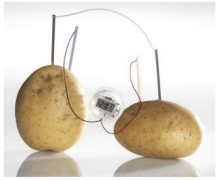
▲ You can save someone's life with a big potential difference.

What is potential difference?

The cell or battery provides the push to make charges move. The push is called a **potential difference**, or p.d. for short.

- The potential difference across a cell tells you about the size of the force on the charges.
- The potential difference also tells you how much energy can be transferred to the components in the circuit by the charges.

▲ Batteries come in different shapes and sizes.



▲ In a potato cell a chemical reaction between the metals and the potato produces a potential difference.

Measuring potential difference

You measure potential difference using a **voltmeter**.

- Potential difference is measured in **volts**.
- The symbol for volts is V. For example, the potential difference across the cell opposite is 6 V.

You can measure the potential difference of a cell by connecting a voltmeter across it. This is also called the **rating**.

A Name the meter that you use to measure potential difference.

▲ You connect a voltmeter either side of the component.

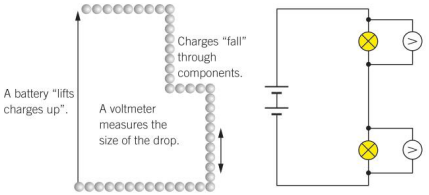
You can measure the potential difference across a component in a circuit using a voltmeter.

B State the unit of potential difference.

Circuit components such as bulbs also have a rating. The bulb in the circuit on the opposite page has a rating of 6 V. It is designed to work at a potential difference of 6 V, and no higher.

'Potential difference' or 'voltage'?

Sometimes people talk about the '**voltage**' of a cell or battery. It is better to talk about potential difference. You can think of a circuit as being a bit like this:



▲ You can think of the battery 'lifting' up the charges. In the circuit above the voltmeters would read the same.

Modelling electric circuits – part 2

You can use the rope model when you are thinking about potential difference. In the rope model:

- The person pulling the rope is like the battery.
- A bigger potential difference across the cell would come from the 'battery' person pulling harder.

Are bigger batteries better?

A student wants to collect some data about the size of batteries and the potential difference across each one. Write a plan that they could use to collect the data.

Key Words

potential difference, voltmeter, volts, rating, voltage

Foul Fact

Mary Shelley wrote *Frankenstein* after finding out that Louis Galvani made dead frogs' legs move using a battery in 1818.

Summary Questions

1 Copy and complete the sentences below.

The potential difference of a cell or battery tells you the size of the _____, and how much _____ can be transferred by the charges. You measure potential difference or p.d. with a _____. The _____ of a battery tells you the p.d across it, and the _____ on a bulb tells you the p.d. at which it is designed to work.

(5 marks)

2 A student connects a circuit with a cell, an ammeter, and a buzzer and listens to the buzzer. She adds another cell.

a Describe and explain what happens to the current. *(2 marks)*

b Describe and explain what happens if she turns one of the cells around. *(2 marks)*

3 A lot of people get current and potential difference (or voltage) mixed up. Use a model to explain the difference in detail.

(6 marks)