Potential Difference (Voltage) – IGCSE Physics Worksheet

Reading Comprehension: Potential Difference (Voltage)

Potential difference, often called voltage, is a measure of how much energy is transferred to each unit of charge in an electrical circuit. It tells us how strongly the circuit pushes electrons around. The greater the potential difference, the more energy each coulomb of charge gains.

Potential difference is measured in volts (V). One volt means that 1 joule of energy is transferred per 1 coulomb of charge. The equation is:

$V = E / Q$

where
V = potential difference (V),
E = energy transferred (J),
Q = charge (C).

A voltmeter is used to measure potential difference. It must be connected in parallel with a component so it can compare the energy of the charge before and after passing through that component.

Potential difference is essential for making current flow. Without a voltage source—such as a battery or power supply—electrons would not move through the circuit. A higher voltage usually produces a larger current, provided the resistance stays the same.

In a series circuit, the total voltage is shared between components. In a parallel circuit, each branch receives the full supply voltage. Understanding potential difference helps explain why bulbs glow brighter at higher voltages and why electrical devices are designed for specific voltage ratings.

Section A: Multiple-Choice Questions

1. Potential difference is defined as: [1 mark]

A. Charge per unit time

B. Energy per unit charge

C. Charge × resistance

D. Current × time

2. The unit of potential difference is: [1 mark]

A. Ampere

B. Coulomb

C. Volt

D. Watt

3. A voltmeter must be connected: [1 mark]

A. In series

B. In parallel

C. In any position

D. Next to the battery only

Section B: Short-Answer Questions

4. A component transfers 30 J of energy when 5 C of charge passes through it.

Calculate the potential difference across the component. [2 marks]

5. Explain why potential difference is needed for current to flow. [2 marks]

6. A battery supplies 12 V. How much energy is transferred when 3 C of charge flows? [2 marks]

Section C: Application Questions

7. Two bulbs are connected in series to a 9 V battery.

The first bulb has 4 V across it.

Calculate the potential difference across the second bulb. [2 marks]

8. In a parallel circuit, each branch receives the full supply voltage.

Explain why bulbs in parallel are brighter than bulbs in series. [3 marks]

Section D: Longer-Answer Question

9. Describe how a voltmeter measures potential difference and explain why it must be connected in parallel. [4 marks]

Answer Key

Section A

1. B

2. C

3. B

Section B

4.

V = E / Q = 30 / 5 = 6 V

5.

Potential difference provides energy to charges, pushing electrons through the circuit.

Without a voltage source, electrons do not move, so no current flows.

6.

E = VQ = 12 × 3 = 36 J

Section C

7.

Total voltage = 9 V

V_2 = 9 - 4 = 5 V

8.

In parallel, each bulb receives the full supply voltage.

This means each bulb gets more energy per coulomb of charge.

As a result, bulbs in parallel are brighter than bulbs in series.

Section D

9. (Model answer)

A voltmeter compares the energy of charge before and after it passes through a component.

To do this, it must be connected in parallel so it can measure the difference in energy between two points.

If it were connected in series, it would change the circuit and give incorrect readings.

Parallel connection ensures accurate measurement of potential difference.