

10.5 Electric Potential

Name: _____ Class: _____ Date: _____ **Total: 11 marks**

KEY WORDS electric potential • potential difference • electric field

Objective

Build the skills to answer exam questions on **electric potential**.

You must be able to:

- define **electric potential** (voltage) as potential energy per unit charge, $V = U/q$
- calculate the potential due to point charges, $V = k\frac{q}{r}$
- relate the **potential difference** to the work needed to move a charge
- connect the field to the potential (the field points toward decreasing potential)

1 Key knowledge and worked examples

Study these first. Each one shows the method for a question type used later.

■ **Electric potential**

$V = \frac{U}{q}$, measured in volts – the potential energy per unit charge. For a point charge, $V = k\frac{q}{r}$, a **scalar** (just add potentials).

■ **Work and potential difference**

$W = q\Delta V$ to move a charge q through a potential difference ΔV .

■ **Field and potential**

The electric field points from **high** to **low** potential.

2 Practice

2.1 Find the potential 0.30 m from a +6.0 μC charge ($k = 8.99 \times 10^9$). [2]

2.2 State whether electric potential is a scalar or a vector quantity. [1]

2.3 Find the work needed to move a +2.0 μC charge through a potential difference of 100 V. [2]

3 Exam-style questions

3.1 Electric potential is [1]

- ☐
- A potential energy per unit charge

B force per unit charge

C charge per unit energy

D field $\times$ distance only

3.2 The electric field points in the direction of [1]

- ☐
- A increasing potential

B decreasing potential

C zero potential

D constant potential

3.3 A +3.0 μC charge sits at the origin.

(a) Find the potential 0.20 m from it. [3]

(b) Find the potential energy of a +1.0 μC charge placed there. [1]