

Potential from fields and equipotentials

AP Physics C (Mechanics and E&M, calculus-based) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test lasts 45 minutes and is marked out of 20. Show every step of calculations, quote answers with units, and write explanations in full sentences. Use $k = 8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$ and $e = 1.60 \times 10^{-19} \text{ C}$.

Level: AP Physics C (Mechanics and E&M, calculus-based) · **Curriculum:** AP PC:E&M Unit 9

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Meaning of potential (2 marks)

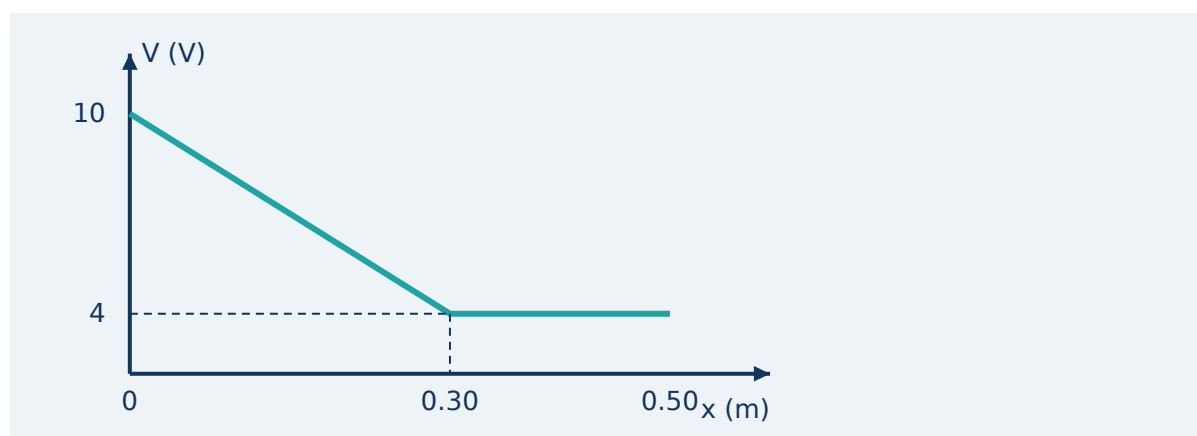
Define electric potential and state what is meant by a potential difference of 12 V between two points.

Question 2 Point charge (2 marks)

Calculate the potential 0.20 m from a -6.0 nC point charge.

Question 3 Reading the graph (3 marks)

The graph shows the potential along the x-axis.



Potential against position.

- Calculate the field for $0 < x < 0.30 \text{ m}$, with its direction. (2 marks)
- Explain what the graph shows about the field for $0.30 \text{ m} < x < 0.50 \text{ m}$. (1 mark)

Question 4 Integrating a field (3 marks)

A field is $E = (4.0 \times 10^3 \text{ V/m}^2)x$ in $+x$. Calculate $V(0.10 \text{ m}) - V(0)$.

Question 5 Equipotentials (2 marks)

Explain why electric field lines cross equipotential surfaces at right angles.

Question 6 Conducting sphere (3 marks)

A conducting sphere of radius 0.10 m carries $+20 \text{ nC}$. Calculate the potential at (a) its surface and (b) its centre, and (c) state E at its centre.

Question 7 Ring on its axis (3 marks)

A ring of radius 0.30 m carries 2.0 nC . Calculate the potential at the point on its axis 0.40 m from its centre, and explain why the answer needs no vectors.

Question 8 Energy of a charge (2 marks)

A proton is released from rest and moves through a potential difference of 500 V . Calculate its speed ($m = 1.67 \times 10^{-27} \text{ kg}$).