

Field maps, voltage and energy per unit charge

AP Physics 2 (algebra-based) · Test

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

This test covers electric fields, field lines, potential, equipotentials and energy at AP Physics 2 level. Use $k = 8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$ and $e = 1.60 \times 10^{-19} \text{ C}$. A calculator is allowed. Show every step and include units on numerical answers.

Level: AP Physics 2 (algebra-based) · **Curriculum:** AP P2 Unit 10

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

Question 1 Force from a field (2 marks)

At a point the electric field is $4.0 \times 10^3 \text{ N/C}$.

- State the definition of electric field. (1 mark)
- Calculate the force on a 5.0 nC charge at that point. (1 mark)

Question 2 Field and potential (3 marks)

A $+2.0 \text{ nC}$ point charge is in air. Calculate the electric field and potential at 0.50 m , and give the direction of the field. (3 marks)

Question 3 Parallel plates (2 marks)

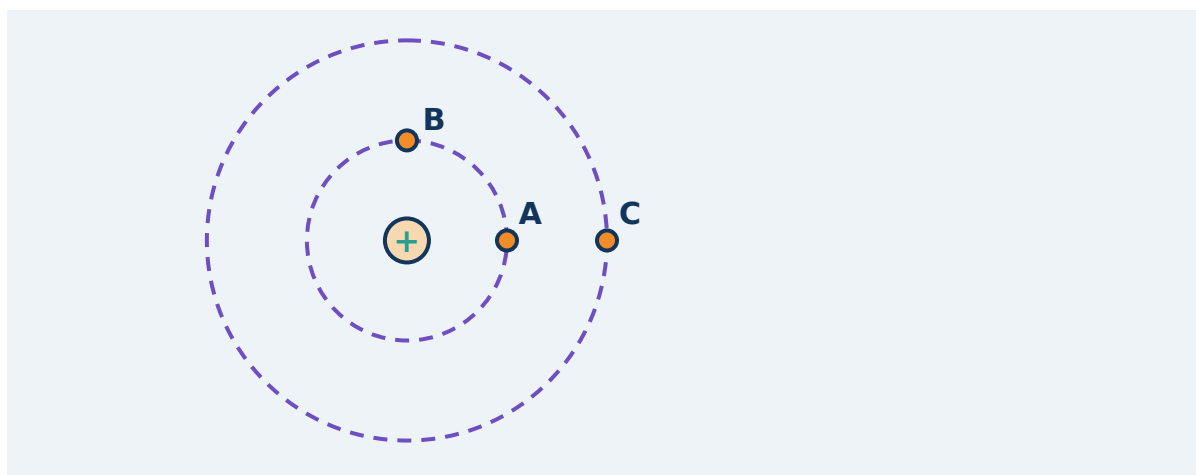
Two parallel plates 5.0 mm apart have a potential difference of 250 V . Calculate the field between them. (2 marks)

Question 4 Accelerated electron (3 marks)

An electron is accelerated from rest through 800 V . Use $e = 1.60 \times 10^{-19} \text{ C}$ and $m = 9.11 \times 10^{-31} \text{ kg}$. Calculate the kinetic energy gained and the final speed. (3 marks)

Question 5 Moving along an equipotential (3 marks)

A positive charge is at the centre of two equipotential circles (shown). Points A and B are on the inner circle and C is on the outer one.



Points A and B lie on the inner equipotential; C lies on the outer one.

- State the work done by the field when a charge moves from A to B and justify. (2 marks)
- State whether the work done by the field moving a $+q$ charge from A to C is positive or negative. (1 mark)

Question 6 Inside a conductor (3 marks)

Explain why the electric field is zero inside a metal conductor in electrostatic equilibrium and where the excess charge is found. (3 marks)

Question 7 Proton energy change (2 marks)

A proton moves from a point at 50 V to a point at 150 V. Calculate the change in its electric potential energy and state whether it increases or decreases. (2 marks)

Question 8 Force on an electron (2 marks)

An electron is in a uniform field that points to the right. State the direction of the force on it and the way it moves in terms of potential. (2 marks)