

Charges, coulomb's law and electric potential

Physics grades 11-12 (A Level · IB · Class 11-12) · Test

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

This test covers field strength, Coulomb's law, uniform fields, potential and energy. Use $k = 8.99 \times 10^9 \text{ N m}^2/\text{C}^2$, $e = 1.60 \times 10^{-19} \text{ C}$ and $m_e = 9.11 \times 10^{-31} \text{ kg}$. Show your working and give each result with its unit.

Level: Physics grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** IB D.2

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

Question 1 Defining field strength (2 marks)

Define electric field strength and state one unit for it.

Question 2 Two charged spheres (3 marks)

A $+5.0 \text{ nC}$ sphere and a -3.0 nC sphere are 6.0 cm apart in air.

- Calculate the magnitude of the force between them. (2 marks)
- State whether the force is attractive or repulsive and explain why. (1 mark)

Question 3 Changing the distance (2 marks)

The force between two point charges is $1.8 \times 10^{-3} \text{ N}$ when they are 2.0 cm apart. Calculate the force when they are 6.0 cm apart.

Question 4 Field between plates (3 marks)

Two parallel plates 3.0 cm apart have a potential difference of 900 V .

- Calculate the electric field strength between them. (1 mark)
- Calculate the force on a 1.5 nC charge between the plates. (2 marks)

Question 5 Field lines (2 marks)

Explain why two electric field lines can never cross, and what the spacing of the lines shows.

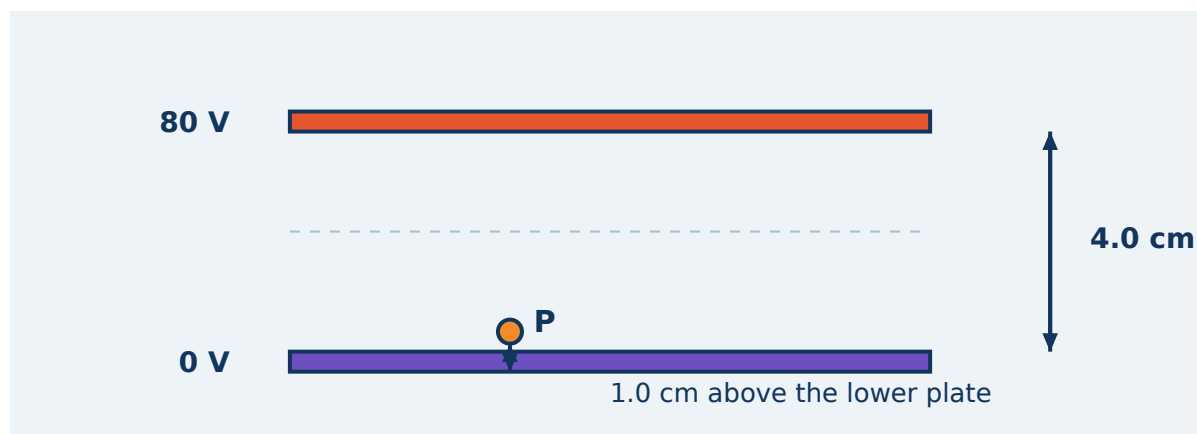
Question 6 Electron gun (3 marks)

An electron is accelerated from rest through a potential difference of 2.5 kV.

- Calculate the kinetic energy gained, in joules. (1 mark)
- Calculate the speed of the electron. (2 marks)

Question 7 Potential between plates (2 marks)

The diagram shows two plates with potentials of 80 V (top) and 0 V (bottom).



Plates for question 7 (the diagram is not to scale).

Calculate the potential at P and the field strength between the plates.

Question 8 Potential of a point charge (3 marks)

A small sphere carries +5.0 nC.

- Calculate the electric potential at 0.25 m from its centre. (2 marks)
- Calculate the work needed to bring a proton from infinity to that point. (1 mark)