



QUESTION WORKBOOK

Coulomb's law and electric field strength

Electric fields · Year 13

AQA 3.7.3.1, 3.7.3.2 · CIE 18.1, 18.2, 18.3, 18.4 · OCR A 6.2.1, 6.2.2, 6.2.3

10 questions · 30 marks

PRINT EDITION

SECTION A · Warm-up

A1 State Coulomb's law for the force between two point charges. [2]

A2 Two point charges of $2.0 \mu\text{C}$ are 0.10 m apart. Calculate the force between them ($k = 8.99 \times 10^9 \text{ N m}^2 \text{ C}^{-2}$). [2]

A3 A charge of $2.0 \times 10^{-6} \text{ C}$ experiences a force of $6.0 \times 10^{-3} \text{ N}$ in an electric field. Calculate the field strength using $E = F/Q$. [2]

SECTION B · Standard

B1 In a hydrogen atom the electron is about $5.3 \times 10^{-11} \text{ m}$ from the proton. Calculate the electrostatic force between them ($e = 1.60 \times 10^{-19} \text{ C}$). [4]

- B2** Two parallel plates 0.050 m apart have a potential difference of 2000 V across them. Calculate the uniform field strength between them, and the force on a 3.0×10^{-6} C charge placed in it. [3]

- B3** Calculate the electric field strength at a distance of 0.20 m from a point charge of 5.0×10^{-9} C, using $E = kQ/r^2$. [3]

- B4** A $+3.0 \mu\text{C}$ charge and a $-2.0 \mu\text{C}$ charge are 0.15 m apart. Calculate the magnitude of the force between them and state whether it is attractive or repulsive. [3]

SECTION C · Stretch

- C1** An electron enters a uniform field of strength $1.0 \times 10^4 \text{ N C}^{-1}$. Calculate the acceleration it experiences ($e = 1.60 \times 10^{-19} \text{ C}$, $m_e = 9.11 \times 10^{-31} \text{ kg}$). [4]

- C2** A point charge of $8.0 \times 10^{-9} \text{ C}$ sets up a field. Calculate (a) the field strength at 0.30 m from it and (b) the force this exerts on a small $+2.0 \times 10^{-9} \text{ C}$ test charge placed there. [4]

- C3** Describe the path of a charged particle that enters a uniform electric field at right angles to the field lines, and explain its shape. [3]