InkPhysics

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

NAVY SCREEN EDITION

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SECTION A · Warm-up

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

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

A3 A charge of 2.0×10^{-6} C experiences a force of 6.0×10^{-3} 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 5.3×10^{-11} m from the proton. Calculate the electrostatic force between them ($e = 1.60 \times 10^{-19}$ 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 μC charge and a −2.0 μC 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 1.0×10^{4} N C^{-1}. Calculate the acceleration it experiences ($e = 1.60 \times 10^{-19}$ C, $m_e = 9.11 \times 10^{-31}$ kg). [4]

C2 A point charge of 8.0×10^{-9} 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 $+2.0 \times 10^{-9}$ 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]