Marks

Question 25 (6 marks)

A pair of parallel metal plates, placed in a vacuum, are separated by a distance of 5.00×10^{-3} m and have a potential difference of 1000 V applied to them.

(a) Calculate the magnitude of the electric field strength between the plates. **1**

$E = \frac{V}{d}$

$E = \frac{1000}{5 \times 10^{-3}} = 2 \times 10^5 \text{ V m}^{-1}$

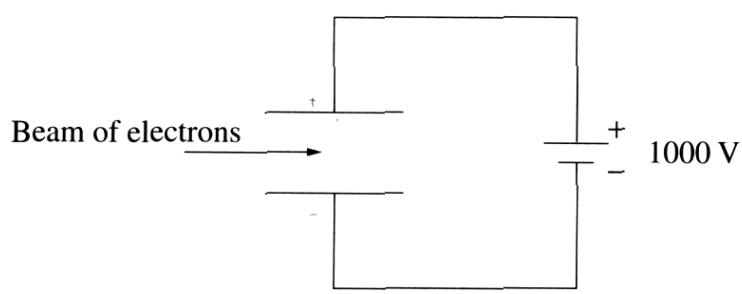
(b) Calculate the magnitude of the electrostatic force acting on an electron between the plates. **1**

$F = qE$

$F = 2 \times 10^5 \times 1.602 \times 10^{-19}$

$F = 3.2 \times 10^{-14} \text{ N}$

(c) A beam of electrons is fired with a velocity of 3.00×10^6 m s^{-1} between the plates as shown. A magnetic field is applied between the plates, sufficient to cancel the force on the electron beam due to the electric field. **4**



Calculate the magnitude and direction of the magnetic field required between the plates to stop the deflection of the electron beam.

$F_m = qvB \qquad F_e = qE$

$qvB = qE$

$3 \times 10^6 \times B = 2 \times 10^5$

$B = 0.067 \text{ T}$ (3 de pls)

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