7 (a) Define electric field strength at a point.

....

.... [2]

(b) An electron is initially stationary in a vacuum. It is accelerated horizontally in a uniform electric field of $3.0 \times 10^5\,NC^{-1}$ over a distance of 1.0 cm.

By considering energy changes calculate the final horizontal velocity v of the electron.

v = ... $m s^{-1}$ [3]

(c) The electron from part **(b)** now travels at a constant horizontal velocity.

It enters a uniform electric field between two 10 cm long, horizontal plates which are separated by a distance of 5.0 cm.

Outside the region between the plates there is no electric field.

(i) On Fig. 7.1 draw field lines to represent the pattern and direction of the electric field. [2]

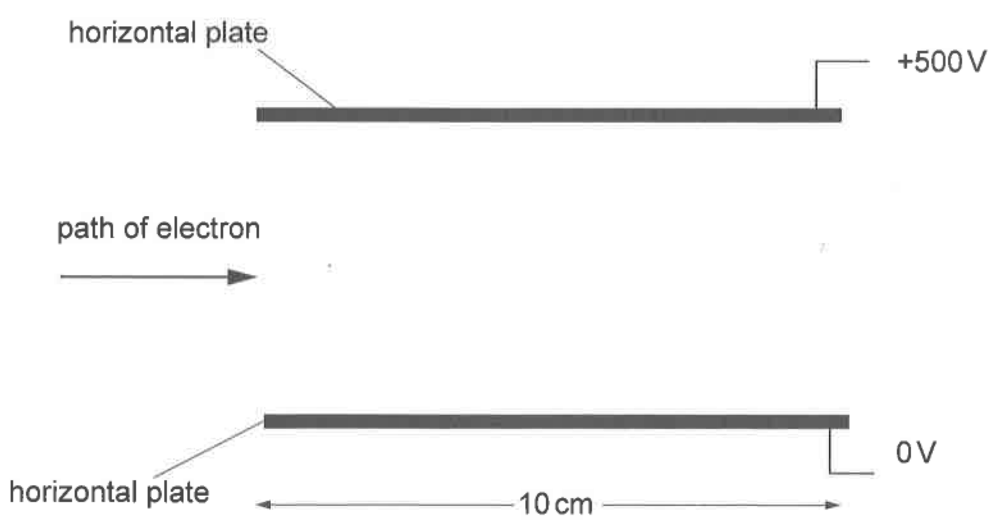

Fig. 7.1

(ii) When passing between the plates, the electron accelerates in a direction perpendicular to its initial path. The electric field strength E is given by the equation:

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

where V is the potential difference between the plates and d is the separation of the plates.

Show that the force to charge ratio of the electron is given by the equation:

$$F/e = 1.0 \times 10^{4}\,\mathrm{N\,C^{-1}}$$

[2]

(iii) Calculate the acceleration of the electron and state its direction.

acceleration = ... $\mathrm{m\,s^{-2}}$

direction ....

[2]

(iv) Calculate the perpendicular displacement of the electron from its initial path as it leaves the region between the two metal plates.

displacement = ... m [4]

(d) (i) Sketch the path of the electron on Fig. 7.1 as it passes through the electric field and after it leaves the electric field.

[3]

(ii) Explain why the path of the electron is not noticeably affected by gravity.

....

.... [1]

(e) The current caused by N electrons moving through the apparatus each second is 0.15A.

Calculate N.

N = ... [1]

[Total: 20]