5

(a)

Define *electric field strength*.

………

……..

……………………………………..…………………….………………………………………………

……[1]

(b)

Fig. 5.1 shows an arrangement used to accelerate an electron and make it travel in a uniform electric field created by two charged parallel plates.

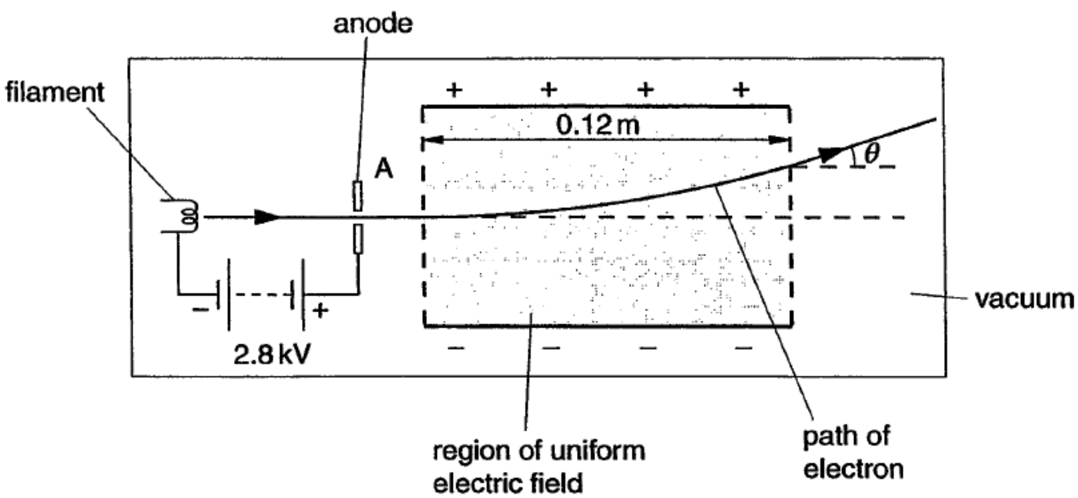

Fig. 5.1

The potential difference between the filament and the anode A is 2.8 kV. The two charged parallel plates create a uniform electric field between them. When the electron is in this field, it experiences a constant force of 3.2×10^{-15} N towards the positive plate. The length of each parallel plate is 0.12 m. The electron emerges from the electric field region at an angle θ.

(i)

Show that the electron is accelerated to a velocity of 3.1×10^7 m s^{-1} by the potential difference between the filament and the anode. [2]

(ii)

Calculate

1. the acceleration of the electron towards the positive plate when it is travelling between the plates,

acceleration = ……………………… m s^{-2} [1]

2. the time taken for the electron to travel the length of the parallel plates,

time = ……….………………… s [2]

3. the speed in the vertical direction of the electron as it exits the region of uniform electric field,

velocity = …………………….m s^{-1} [2]

4. the angle θ.

θ = ………………………. ° [2]

(iii)

Describe and explain how the path of a proton with the same initial velocity of 3.1×10^7 m s^{-1} will differ from that of the electron when it enters the same region of uniform magnetic field.

…….

…….

…….

……[2]

[Total: 12]