7 Fig. 7.1 shows an electron with a horizontal velocity of 1.5×10^7 m s^{-1} entering the region between two horizontal plates which are 40 mm apart and 80 mm long. The upper plate is at a potential of +40 V and the lower plate is at a potential of –40 V.

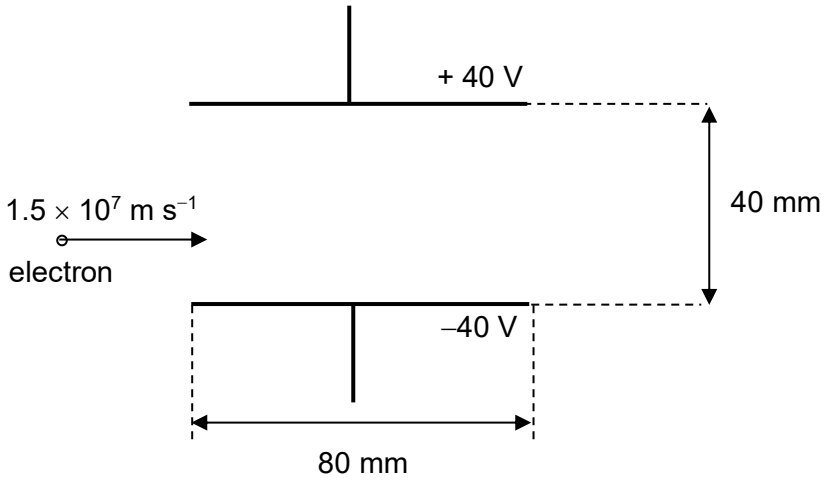

Fig. 7.1

(a) Determine the magnitude of the electric field strength in the region between the plates.

field strength = ……..... V m^{-1} [1]

(b) Determine the magnitude of the acceleration of the electron in the region between the plates.

acceleration = ……..... m s^{-2} [2]

(c) Show that the vertical component of the velocity of the electron as it emerges from the plates is 1.9×10^6 m s^{-1}.

[2]

(d) Determine the angle θ through which the electron has been deflected as a result of passing between the plates.

angle θ = ……..... ° [1]

(e) After passing through the plates, the electron enters the region of magnetic field B of flux density 1.62×10^{-4} T at an angle θ, as found in **(d)**, and goes into helical motion of radius R, as shown in Fig. 7.2.

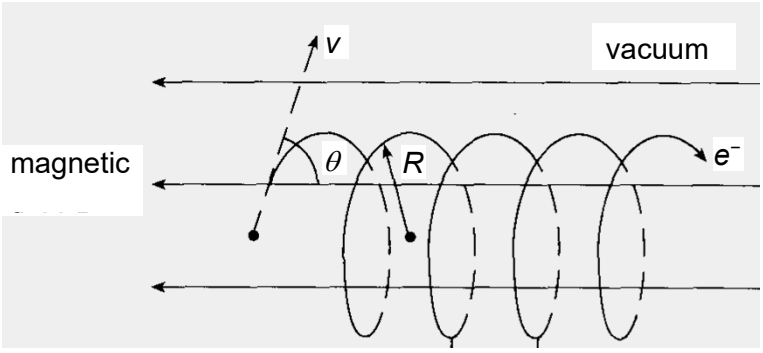

Fig. 7.2

(i) Calculate the radius R of the helical path.

R = ……..... m [3]

(ii) Calculate the time taken for the electron to complete one revolution of the helical motion.

time = ……..... s [2]