

- 2 (a) Define *electric field strength*.

.....
.....

[1]

- (b) A potential difference of 2.5 kV is applied across a pair of horizontal metal plates in a vacuum, as shown in Fig. 2.1.

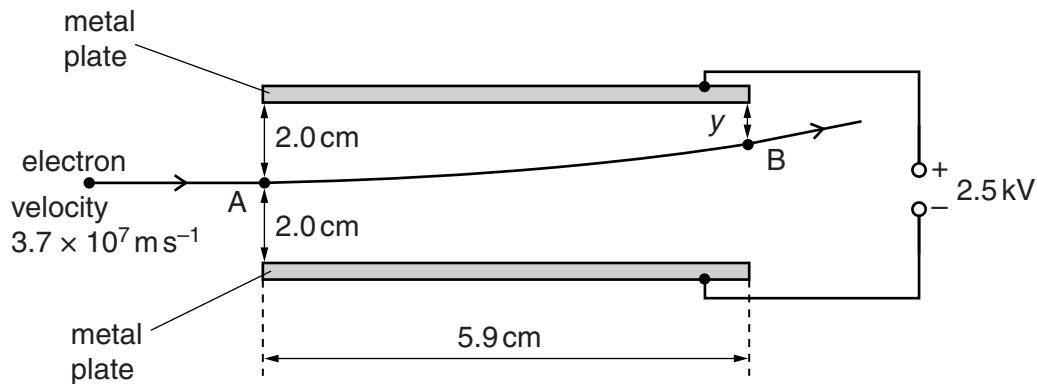


Fig. 2.1 (not to scale)

Each plate has a length of 5.9 cm. The separation of the plates is 4.0 cm. The arrangement produces a uniform electric field between the plates.

Assume the field does not extend beyond the edges of the plates.

An electron enters the field at point A with horizontal velocity $3.7 \times 10^7 \text{ ms}^{-1}$ along a line mid-way between the plates. The electron leaves the field at point B.

- (i) Calculate the time taken for the electron to move from A to B.

time taken = s [1]

- (ii) Calculate the magnitude of the electric field strength.

field strength = NC^{-1} [2]

- (iii) Show that the acceleration of the electron in the field is $1.1 \times 10^{16} \text{ ms}^{-2}$.

[2]

- (iv) Use the acceleration given in (iii) and your answer in (i) to determine the vertical distance y between point B and the upper plate.

$$y = \dots \text{ cm} [3]$$

- (v) Explain why the calculation in (iv) does not need to include the gravitational effects on the electron.

.....
..... [1]

- (vi) The electron enters the field at time $t = 0$.

On Fig. 2.2, sketch graphs to show the variation with time t of

1. the horizontal component v_X of the velocity of the electron,
2. the vertical component v_Y of the velocity of the electron.

Numerical values are not required.

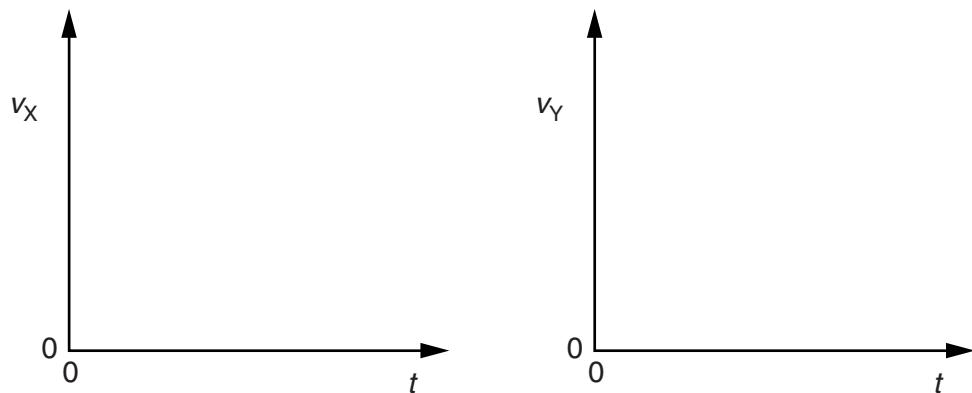


Fig. 2.2

[2]

[Total: 12]