

- 6 Two parallel metal plates X and Y are separated by a distance of 0.041 m, as shown in Fig. 6.1.

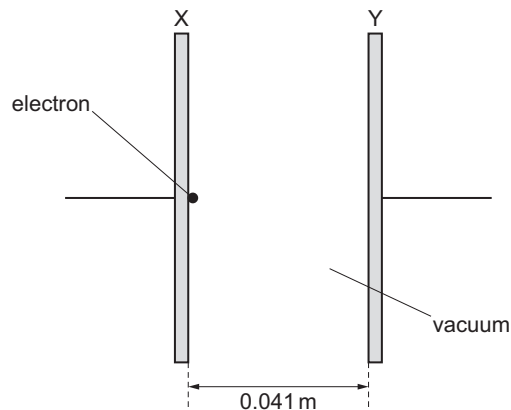


Fig. 6.1

There is a vacuum between the plates. An electron is at rest at the centre of plate X.

A potential difference (p.d.) of 58 kV is applied across the plates. This causes the electron to accelerate towards plate Y.

- (a) On Fig. 6.1, use the symbols + and – to indicate which of plates X and Y is the positive plate and which is the negative plate. [1]
- (b) (i) Calculate the electric field strength  $E$  between the plates. Give a unit with your answer.

$E =$  ..... unit ..... [2]

- (ii) Determine the acceleration of the electron.

acceleration = .....  $\text{ms}^{-2}$  [2]

- (c) Many electrons are now accelerated from rest from plate X to plate Y in Fig. 6.1. When the electrons hit plate Y, the absorption of their kinetic energies results in the emission of electromagnetic waves.

- (i) Show that the minimum wavelength of these electromagnetic waves is 21 pm.

[3]

- (ii) State the region of the electromagnetic spectrum that contains these waves.

..... [1]

- (iii) Explain how these electromagnetic waves may be used to form images of internal body structures.

.....  
.....  
.....  
..... [2]

[Total: 11]