For Examiner's Use

6 An electron travelling horizontally in a vacuum enters the region between two horizontal metal plates, as shown in Fig. 6.1.

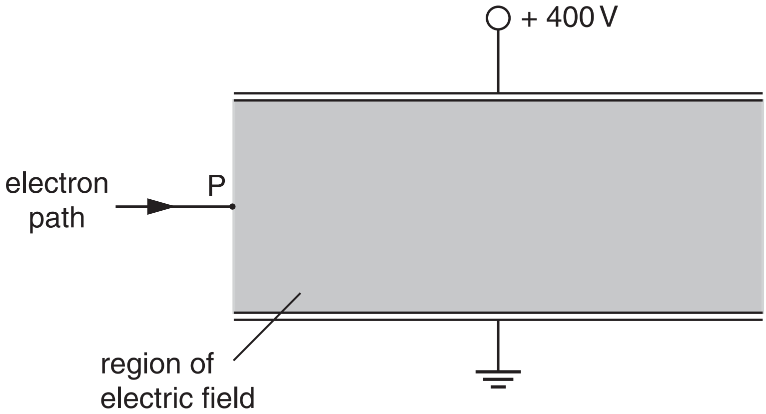

Fig. 6.1

The lower plate is earthed and the upper plate is at a potential of + 400 V. The separation of the plates is 0.80 cm.

The electric field between the plates may be assumed to be uniform and outside the plates to be zero.

(a) On Fig. 6.1,

(i) draw an arrow at P to show the direction of the force on the electron due to the electric field between the plates,

(ii) sketch the path of the electron as it passes between the plates and beyond them. [3]

(b) Determine the electric field strength E between the plates.

E = ... V m^{-1} [2]

(c) Calculate, for the electron between the plates, the magnitude of

(i) the force on the electron,

force = …………………………….. N

(ii) its acceleration.

acceleration = ……………………………… m s^{-2}
[4]

(d) State and explain the effect, if any, of this electric field on the horizontal component of the motion of the electron.

....

....

....[2]

For Examiner's Use

6 Two horizontal metal plates are situated 1.2 cm apart, as illustrated in Fig. 6.1.

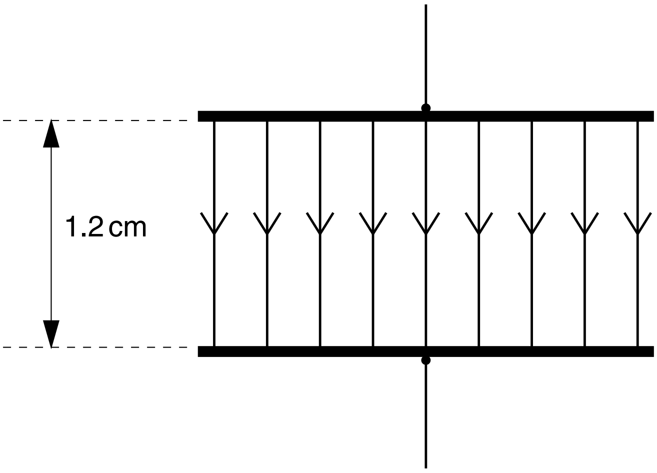

Fig. 6.1

The electric field between the plates is found to be $3.0 \times 10^4\,\mathrm{N\,C^{-1}}$ in the downward direction.

(a) **(i)** On Fig. 6.1, mark with a + the plate which is at the more positive potential.

(ii) Calculate the potential difference between the plates.

potential difference = ... V [3]

(b) Determine the acceleration of an electron between the plates, assuming there is a vacuum between them.

acceleration = ... $\mathrm{m\,s^{-2}}$ [3]

4 A sphere has volume V and is made of metal of density ρ.

(a) Write down an expression for the mass m of the sphere in terms of V and ρ.

....[1]

(b) The sphere is immersed in a liquid. Explain the apparent loss in the weight of the sphere.

....

....

....

....[3]

(c) The sphere in **(b)** has mass 2.0×10^{-3} kg. When the sphere is released, it eventually falls in the liquid with a constant speed of $6.0\,\text{cm}\,\text{s}^{-1}$.

(i) For this sphere travelling at constant speed, calculate

1. its kinetic energy,

kinetic energy = ... J

2. its rate of loss of gravitational potential energy.

rate = ... $\text{J}\,\text{s}^{-1}$ [5]

(ii) Suggest why it is possible for the sphere to have constant kinetic energy whilst losing potential energy at a steady rate.

....

....

....[2]