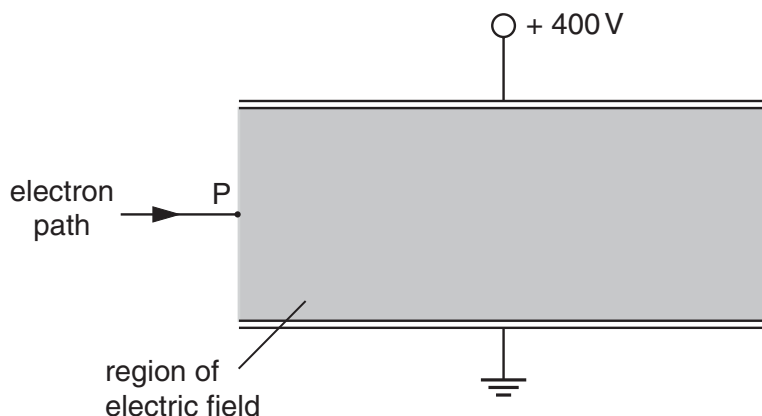


- 6 An electron travelling horizontally in a vacuum enters the region between two horizontal metal plates, as shown in Fig. 6.1.



**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.

$$E = \dots\dots\dots \text{ V m}^{-1} \quad [2]$$

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

(i) the force on the electron,

force = ..... N

(ii) its acceleration.

acceleration = .....  $\text{m s}^{-2}$   
[4]

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

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

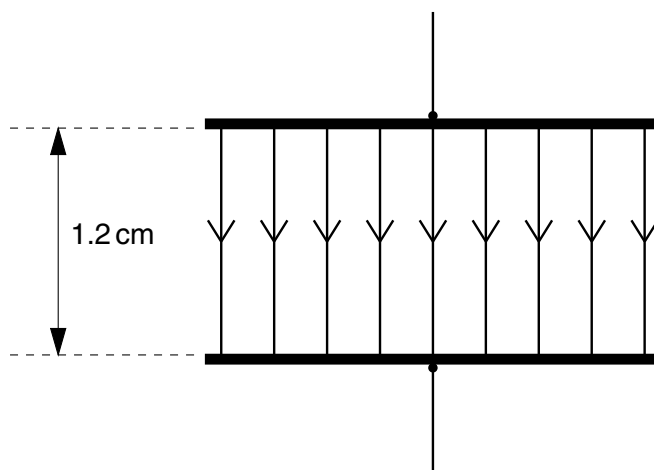


Fig. 6.1

The electric field between the plates is found to be  $3.0 \times 10^4 \text{ N C}^{-1}$  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 = .....  $\text{m s}^{-2}$  [3]

4 A sphere has volume  $V$  and is made of metal of density  $\rho$ .

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

.....[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  $2.0 \times 10^{-3} \text{ kg}$ . When the sphere is released, it eventually falls in the liquid with a constant speed of  $6.0 \text{ cm s}^{-1}$ .

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

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kinetic energy = ..... J

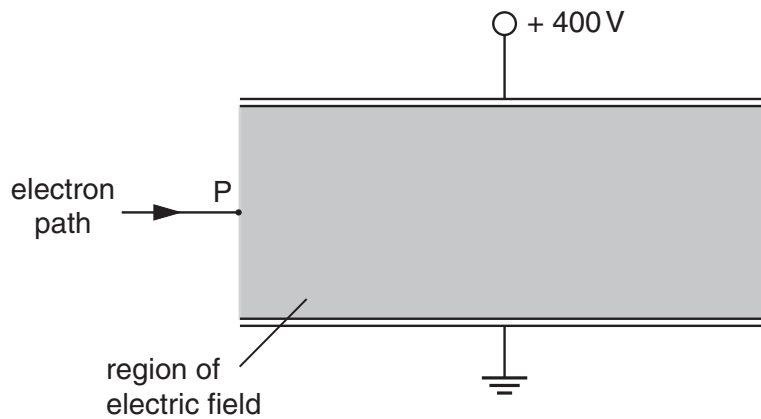
2. its rate of loss of gravitational potential energy.

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

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

.....  
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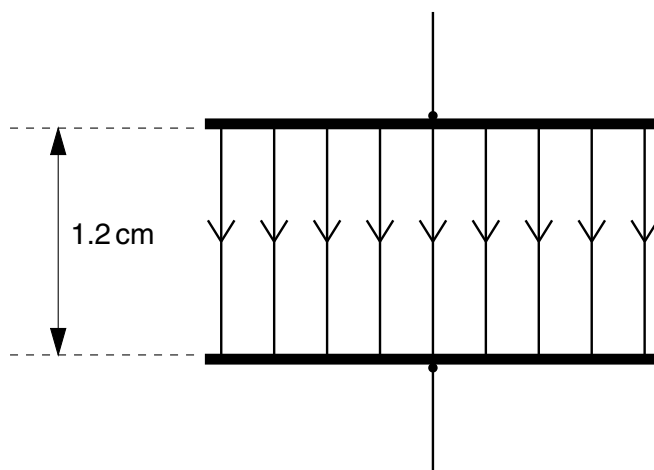
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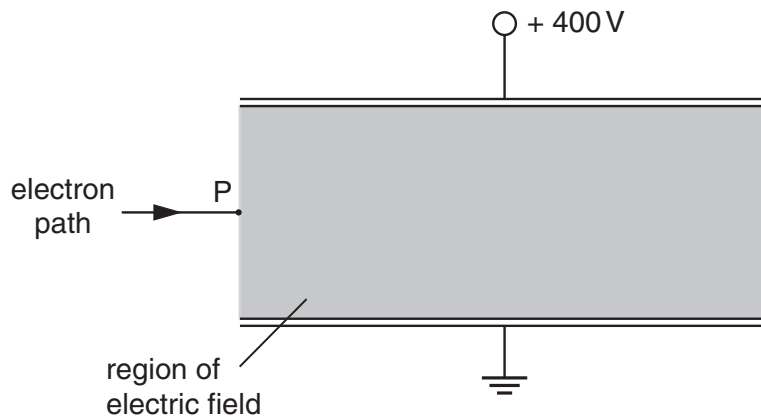
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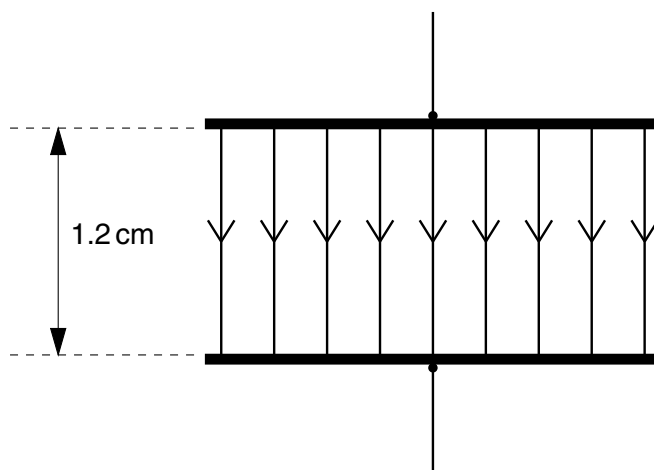
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