Section B

Answer **one** question from this Section in the spaces provided.

8 (a) Explain what is meant by an *electric field*.

.....

..... [1]

(b) The charges on an isolated metal sphere are uniformly distributed on its surface. Fig. 8.1 shows a positively charged metal sphere A.

On Fig. 8.1, draw the charge distribution on the sphere and the electric field around it.

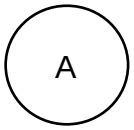

Fig. 8.1 [1]

(c) A negatively charged metal sphere B is brought close to the positively charged metal sphere A as shown in Fig. 8.2. The charge on metal sphere B is twice that of the charge on metal sphere A.

On Fig. 8.2, draw the charge distribution on the spheres and the electric field around the spheres.

Fig. 8.2 [3]

(d) Point P is at a distance *x* from the centre of sphere A along the line joining the centres of the two spheres as shown in Fig. 8.3. The radius of A and B is 15 mm and the distance between the centres of the spheres is 80 mm.

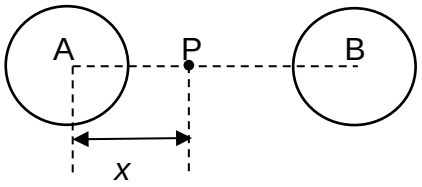

Fig. 8.3

The variation with *x* of the electric potential *V* at P is shown in Fig. 8.4.

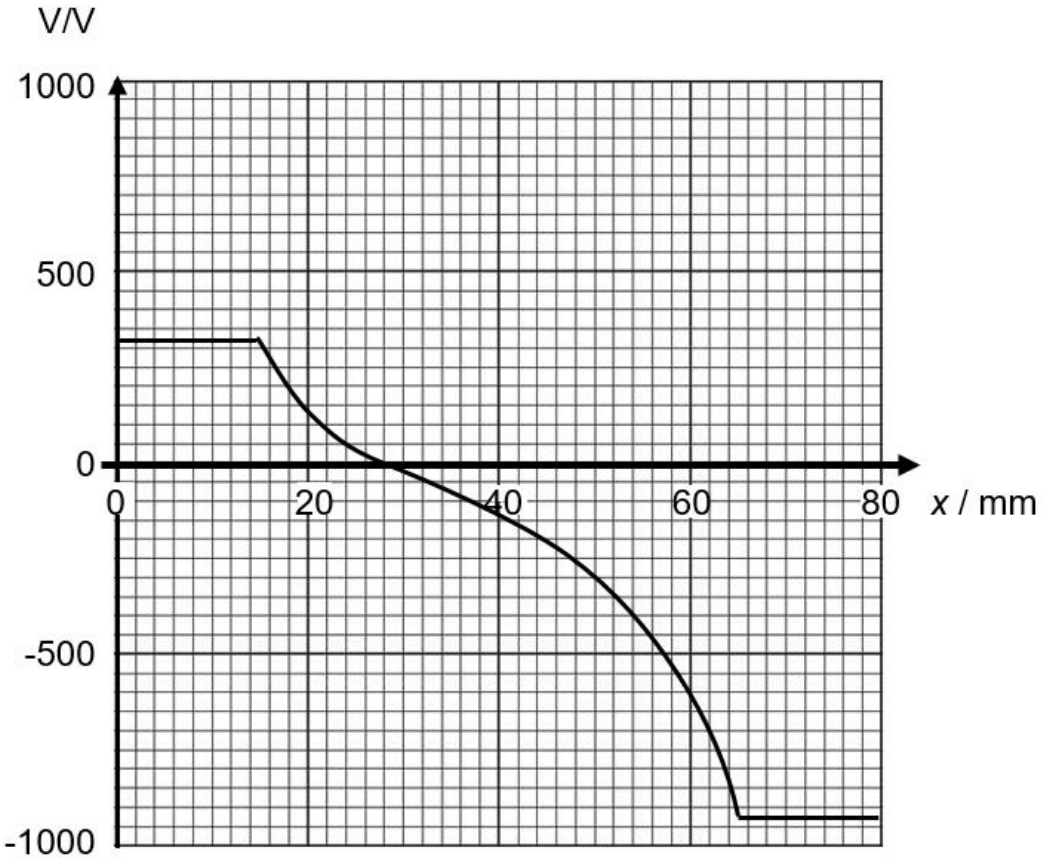

Fig. 8.4

(i) Determine the magnitude of the electric field strength at P where *x* = 40 mm.

magnitude of the electric field strength = ... V m^{-1} [2]

(ii) An electron is initially at rest at point P where x = 40 mm.

1. Describe and explain the motion of the electron as it travels 20 mm along the line joining the centres of the spheres.

[3]

2. Determine the speed of the electron when it has travelled 20 mm along the line joining the centres of the spheres.

speed of electron = ... m s^{-1} [3]

(e) An electron is projected along the line XY into a region of uniform electric field between two charged parallel plates of length 20.0 cm separated by 8.0 cm, as shown in the Fig. 8.5. The potential difference between the two plates is 200 V. Between the plates, the electron travels along a curved path and exit the region between the plates at point Q which is 3.0 cm from the line XY.

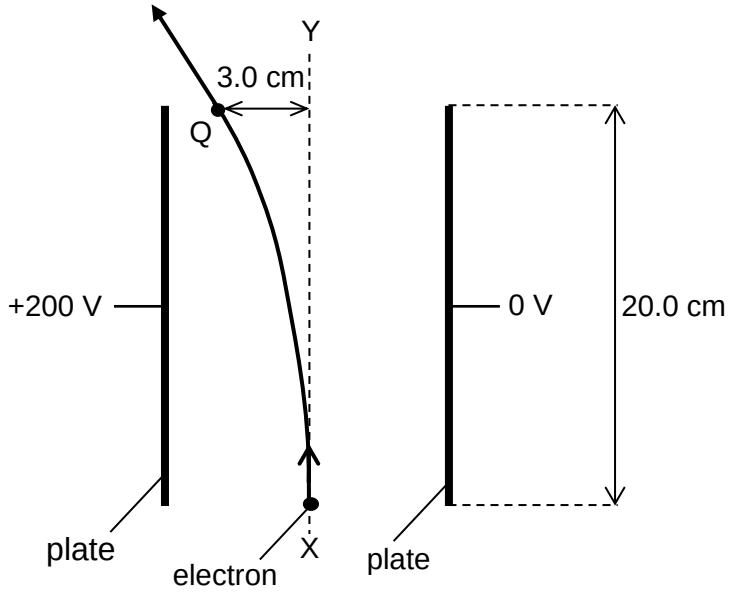

Fig. 8.5

(i) Calculate the electric field strength between the two plates.

electric field strength = ... V m^{-1} [1]

(ii) Calculate the initial speed of the electron projected into the electric field.

speed = ... m s^{-1} [4]

(iii) A proton is now projected into the same electric field and with the same velocity as that of the electron.

Explain why the deflection of the proton is much lesser compared to the deflection of the electron.

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..... [2]

[Total: 20]