4 Two charged metal spheres A and B are isolated in space, as shown in Fig. 4.1.

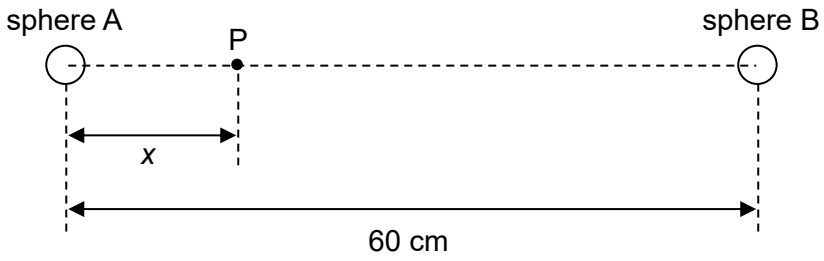

Fig. 4.1

The centres of the spheres are separated by a distance of 60 cm. Point P is at a distance x from the centre of sphere A along the line joining the centres of the two spheres.
The variation with x of the electric potential V at P is shown in Fig. 4.2. The potential at x = 15.0 cm is zero.

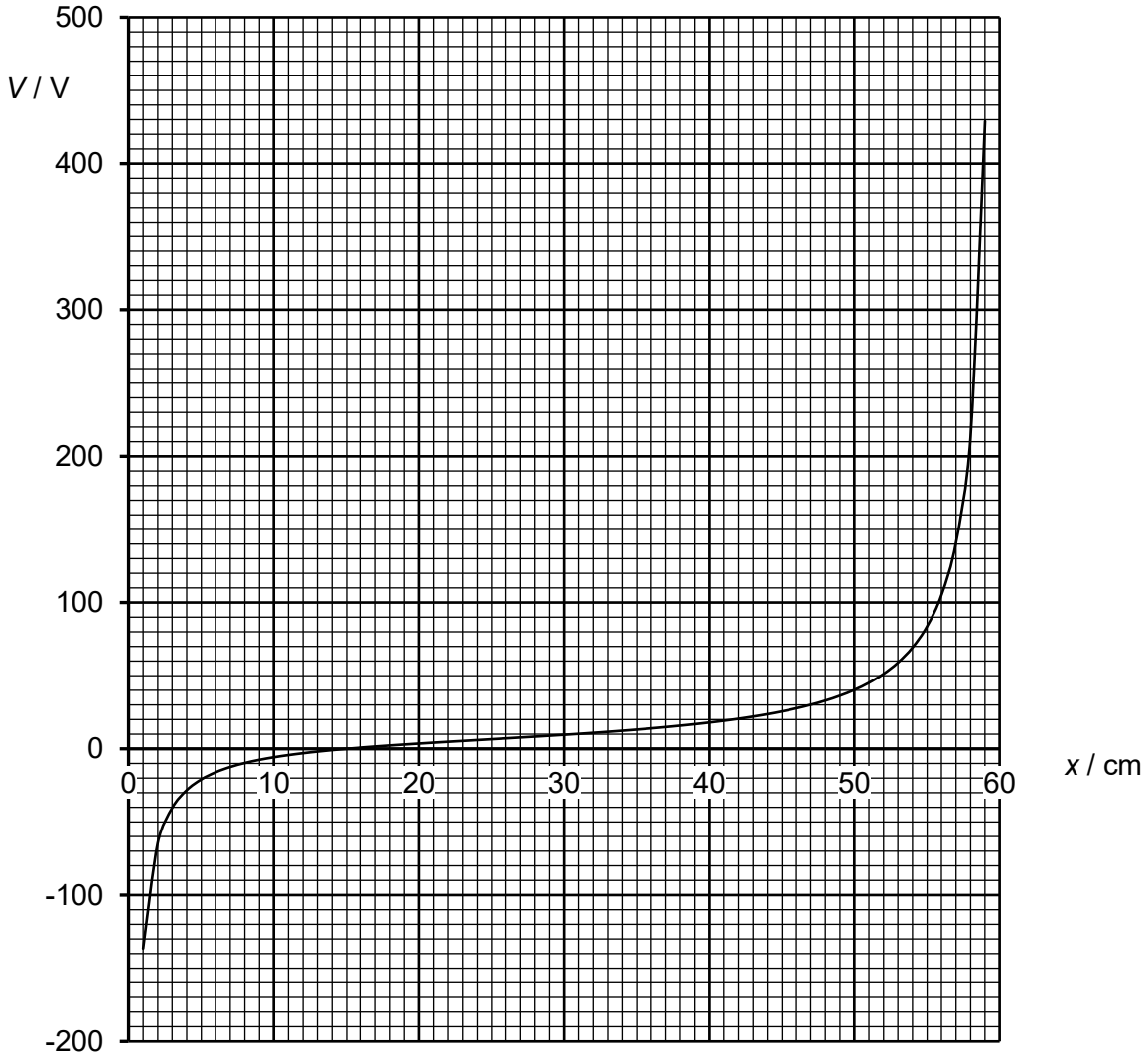

Fig. 4.2

(a) **(i)** Define *electric field strength.*

……..……..

……..……..… [2]

(ii) State the relation between electric field strength E and potential V.

……..……..

……..……..… [1]

(iii) Hence, explain the direction of the electric field at the point P, where x = 15.0 cm.

……..……..

……..……..… [1]

(b) Given that the magnitude of the charge of sphere B is 0.48 nC, determine the charge of sphere A.

charge of sphere A = ... C [3]

(c) An electron moves along the line joining the centres of the two spheres towards sphere B and passes x = 15.0 cm with a speed of 4.0×10^6 m s^{-1}. Calculate the speed of the electron when it reaches x = 57.0 cm.

speed = ... $m\,s^{-1}$ [3]

[Total: 10]