4 **(a)** Define *electric field strength* at a point.

....

.... [2]

(b) Two charged metal spheres A and B, each of diameter 0.16 m, are isolated in space as shown in Fig. 4.1.
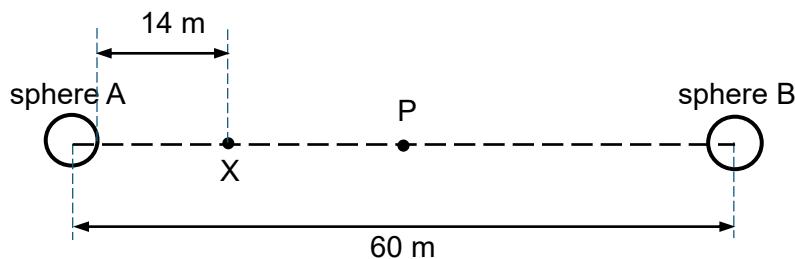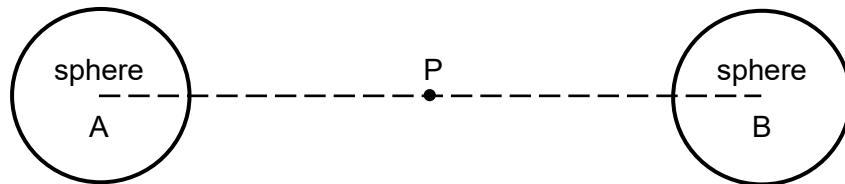

Fig. 4.1 (not to scale)

The centres of the spheres are separated by a distance of 60 m. Point P is at the mid-point along the line joining the centres of the two spheres.

Each sphere carries a charge of −0.040 nC.

(i) In Fig. 4.2, sketch the pattern of electric field lines in the region surrounding the spheres.

Fig. 4.2 (not to scale)

[2]

(ii) Determine the magnitude and direction of the electric field strength at point X, 14 m from the surface of sphere A along the line joining the centres of the spheres.
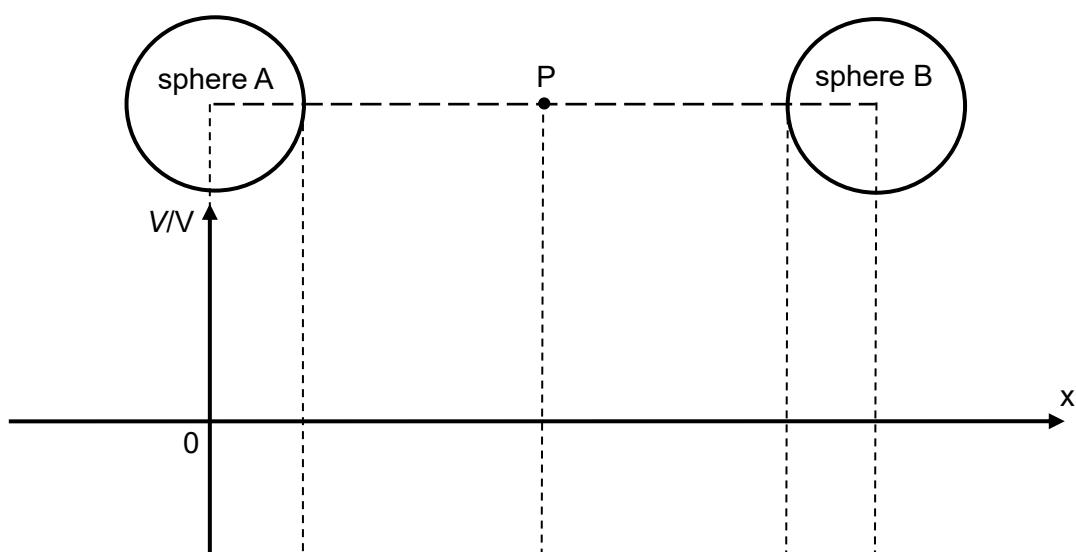
magnitude of electric field strength   = ... N C^{-1}

direction of electric field strength   = ... [3]

(c) **(i)** Calculate the potential at point P.

potential   = ... V   [1]

(ii) Hence or otherwise, without further calculation, sketch on Fig. 4.3 a graph to show the variation with displacement x along the line of centres, of potential V between the centres of the spheres.

Fig. 4.3

[2]