4 **(a)** Define *electric potential* at a point.

……..

…….....[2]

(b) Two charged solid metal spheres A and B are situated in a vacuum. Their centres are separated by a distance of 40 cm, as shown in Fig. 4.1. The charge on A is 3.2 nC and the charge on B is −1.6 nC. Point P is at a distance *x* from the centre of sphere A along the line joining the centres of the two spheres.

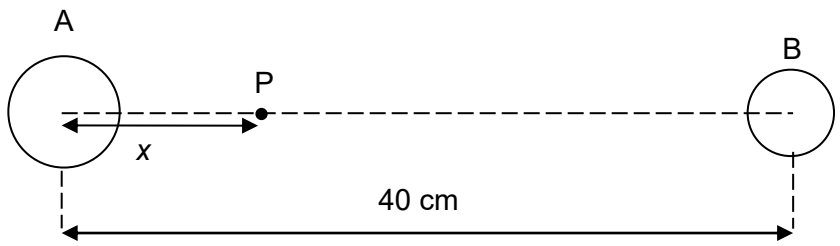

Fig. 4.1 (not to scale)

The variation with *x* of the electric potential *V* is shown in Fig. 4.2. V_1 is the potential inside sphere A and $-V_2$ is the potential inside sphere B.

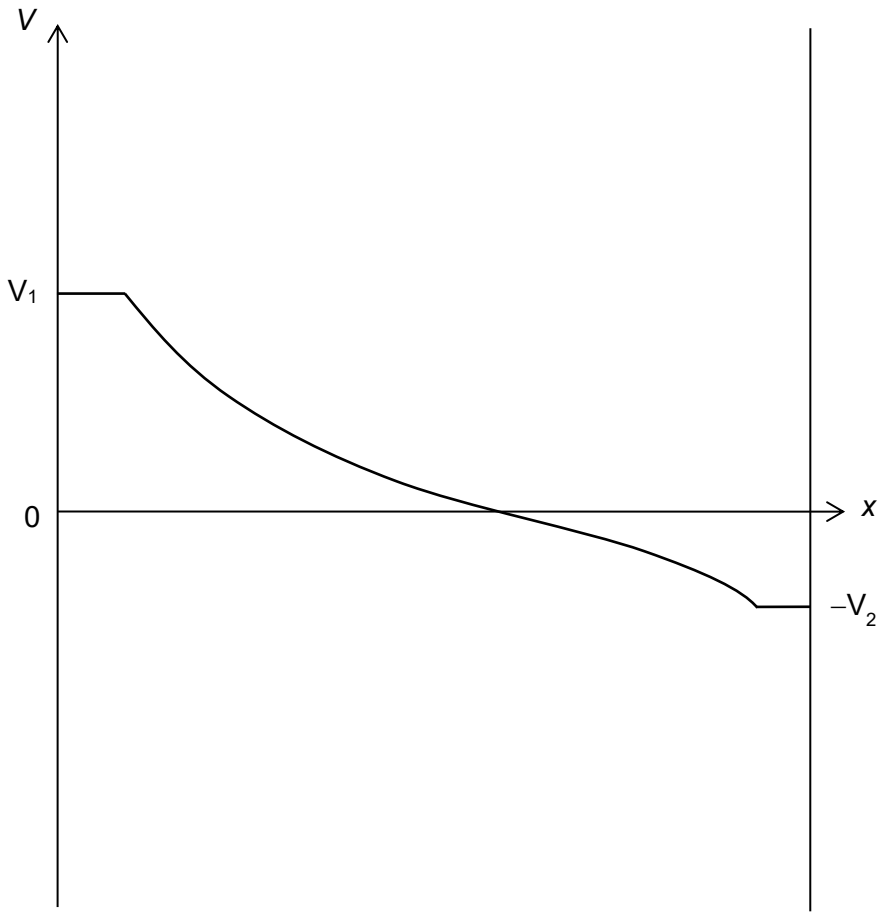

Fig. 4.2

(i) State a feature of the graph that is related to the magnitude of the electric field strength.

……

…… [1]

(ii) Sketch in Fig. 4.3, the variation with *x* of the electric field strength *E*.

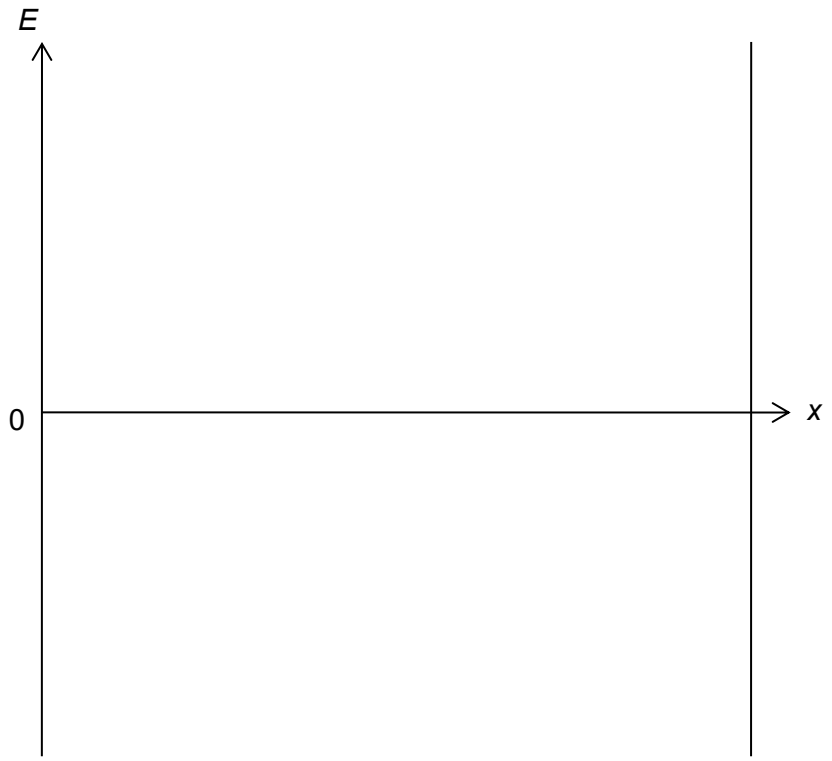

Fig. 4.3

[3]

(iii) Calculate the value of x where $V = 0$.

x = …….m [2]

(iv) Sketch on Fig. 4.2 how V will change if the magnitude of the charges on both A and B are doubled. [2]

(c) Fig. 4.4 shows a small charged particle at a point X in a uniform electric field. The particle experiences an electric force F of 5.0×10^{-7} N. The grid lines are at intervals of 1.0 cm.

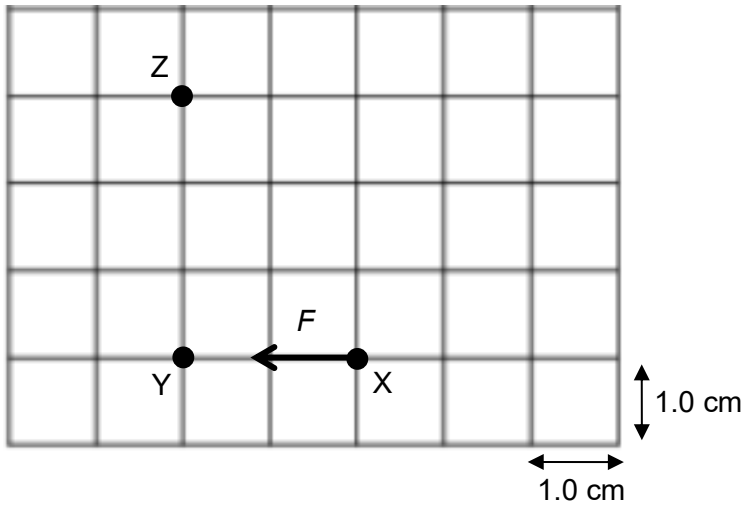

Fig. 4.4 (not to scale)

The particle carries a charge of 2.5×10^{-11} C and point X is at a potential of +200 V.

(i) Determine the work done by the electric force F if the particle is moved

1. from X to Y,

work done = ... J [1]

2. from X to Z.

work done = ... J [1]

(ii) Calculate the potential at point Y due to the uniform field.

potential = ... V [3]

[Total: 15]

Please turn over for Section B.

Section B

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