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

……..

……. [2]

(b) Two point charges A and B are separated by a distance of 12.0cm in a vacuum, as illustrated in Fig. 4.1.

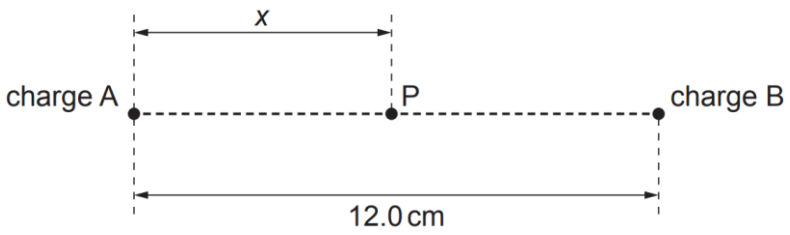

Fig. 4.1

The charge of A is $+2.0 \times 10^{-9}$ C.

A point P lies on the line joining charges A and B. Its distance from charge A is *x*.

The variation with distance *x* of the electric potential *V* at point P is shown in Fig. 4.2.

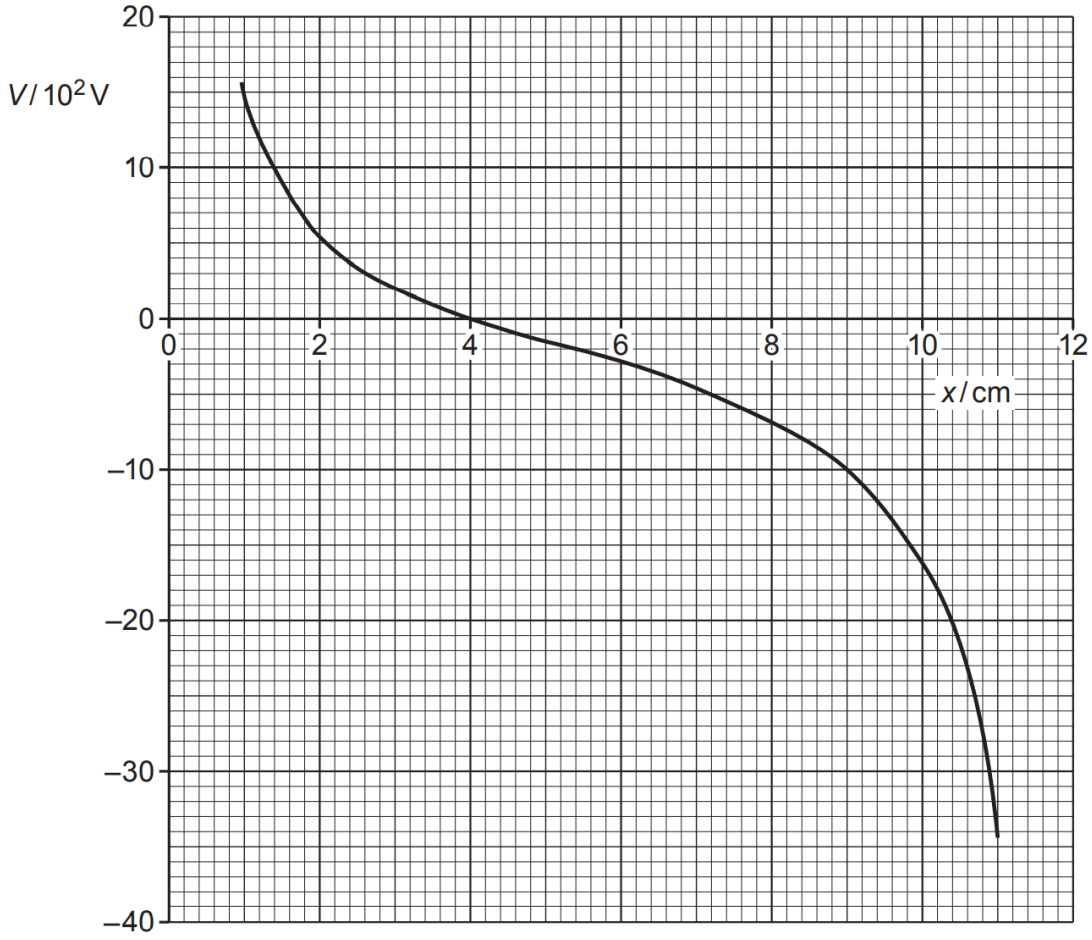

Fig. 4.2

(i) Using Fig. 4.2, determine the charge of B.

charge = ... C [2]

(ii) An alpha-particle (mass 4*u*, charge +2*e*) moves along the line joining point charges A and B in Fig. 4.1.

The alpha-particle moves from the position where x = 9.0 cm and just reaches the position where x = 3.0 cm.

Calculate the speed v of the alpha-particle at the position where x = 9.0 cm.

v = ... m s^{-1} [2]

(c) **(i)** State what is meant by an *electric field*.

.....

..... [1]

(ii) State one similarity and one differences between an electric field due to a point charge and the gravitational field due to a point mass.

similarity: .....

.....

.....

difference: .....

.....

.....

[2]

(d) An isolated solid metal sphere of radius 0.15m is situated in a vacuum, as illustrated in Fig. 4.3.

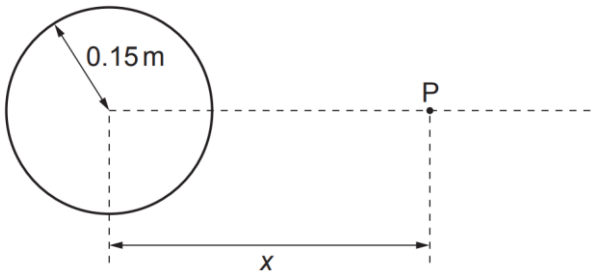

Fig. 4.3

The electric field strength at the surface of the sphere is 84 V m^{-1}.

Determine:

(i) the charge Q on the sphere

charge = …… C [1]

(ii) the electric field strength at a distance 0.10 m from the centre of the sphere.

electric field strength = …… N C^{-1} [1]