3 **(a)** State Coulomb's Law.

……

……

…… [1]

(b) Two charged metal spheres A and B are situated in a vacuum, as illustrated in Fig. 3.1.

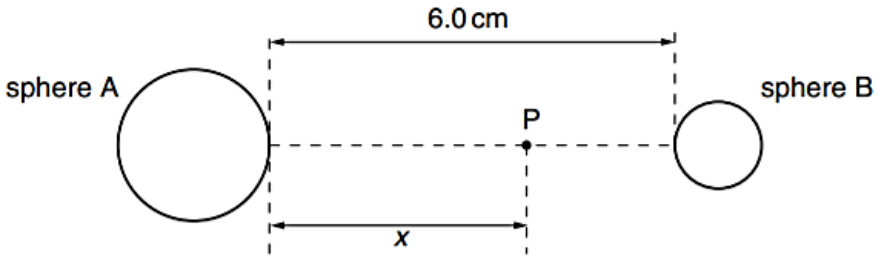

Fig. 3.1

The shortest distance between the surfaces of the spheres is 6.0 cm.

A movable point P lies along the line joining the centres of the two spheres, a distance *x* from the surface of sphere A.

The variation with distance *x* of the electric field *E* at point P is shown in Fig. 3.2.

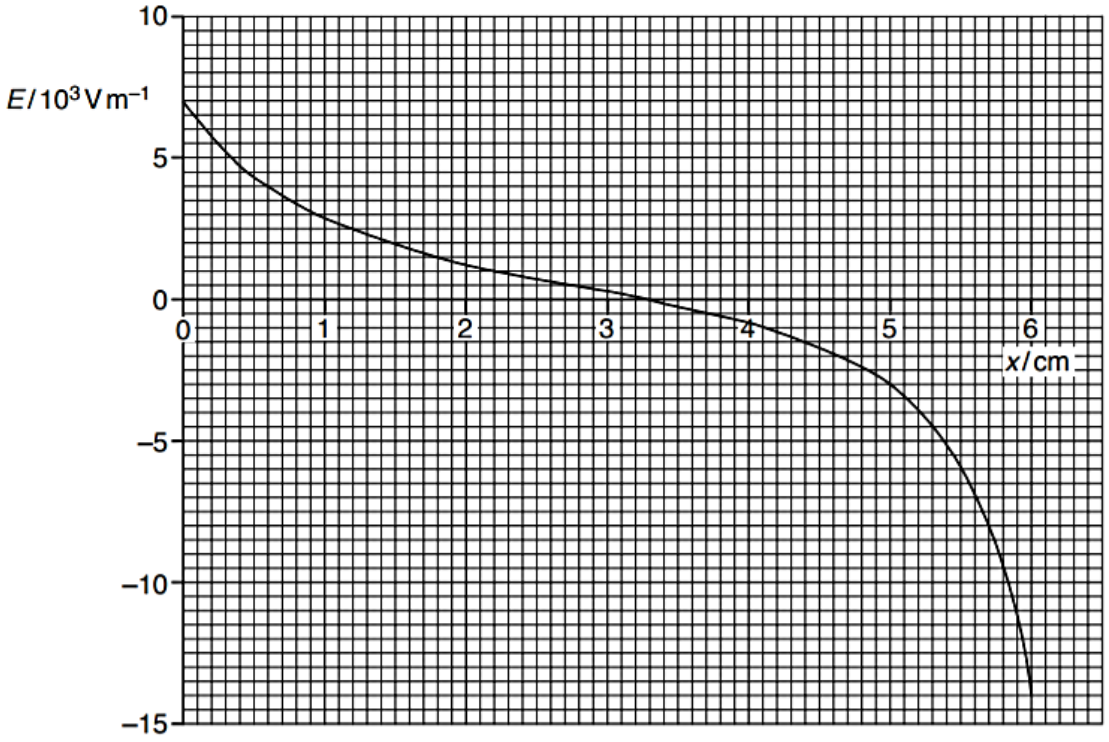

Fig. 3.2

A proton is at rest at point P when x = 5.0 cm.

Use data from Fig. 3.2 to estimate the speed of the proton at x = 3.3 cm.

speed = …….. m s^{-1} [3]

(c) A charge of +5.0 μC is shot through a small hole at **A** into a region between two parallel metal plates separated by a distance d and connected to a d.c. voltage source. One metal plate is at a potential of +100 V, and the charge emerges from another hole at **B** as shown in Fig. 3.3 below.

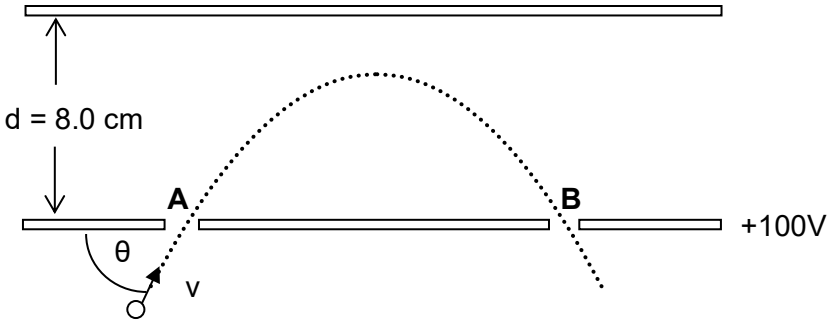

Fig. 3.3

(i) The electric field between the plates is found to be 2500 V m^{-1}.

Determine the potential of the other metal plate.

potential = …….. V [2]

(ii) Sketch a possible trajectory of the charge on Fig. 3.4 when the upper plate is moved further away from the lower plate.

Label this trajectory **E**.

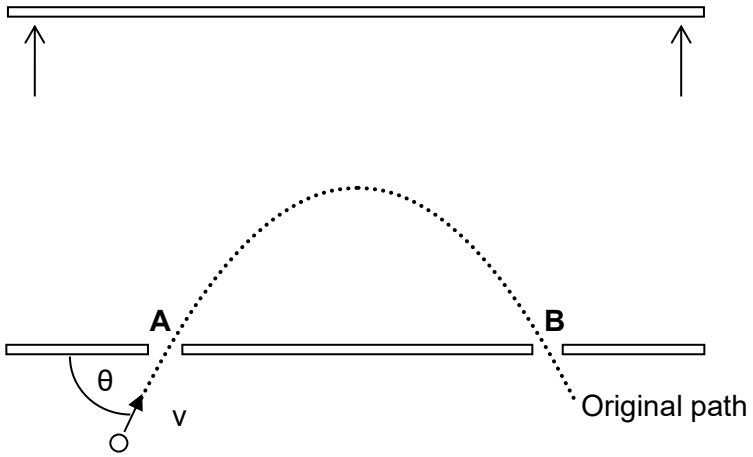

Fig 3.4

[1]

(d) Two identical spherical drops of water, each carrying a charge of $+1.0 \times 10^{-11}$ C and with electric potential of 500 V on its surface, combine to form a single spherical drop.

Determine the approximate potential on the surface of the new drop formed.

potential = …….. V [3]