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

.....

.....

.....

[1]

(b) Two charged metal spheres A and B are situated in a vacuum, as illustrated in Fig. 4.1.

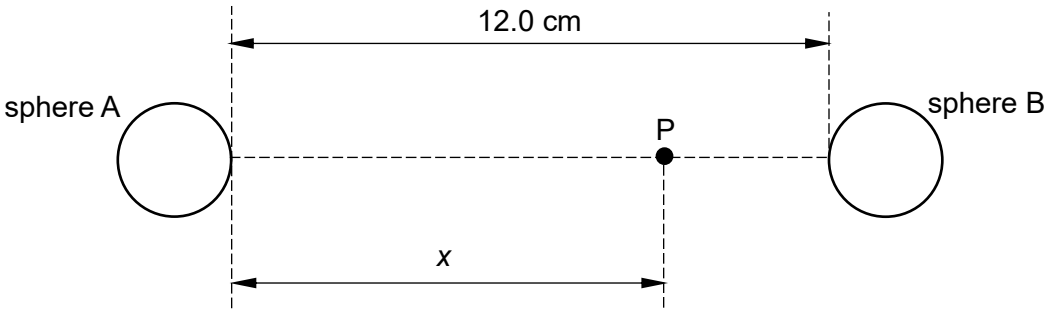

Fig. 4.1

The shortest distance between the surfaces of the spheres is 12.0 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 strength *E* at point P is shown in Fig. 4.2.

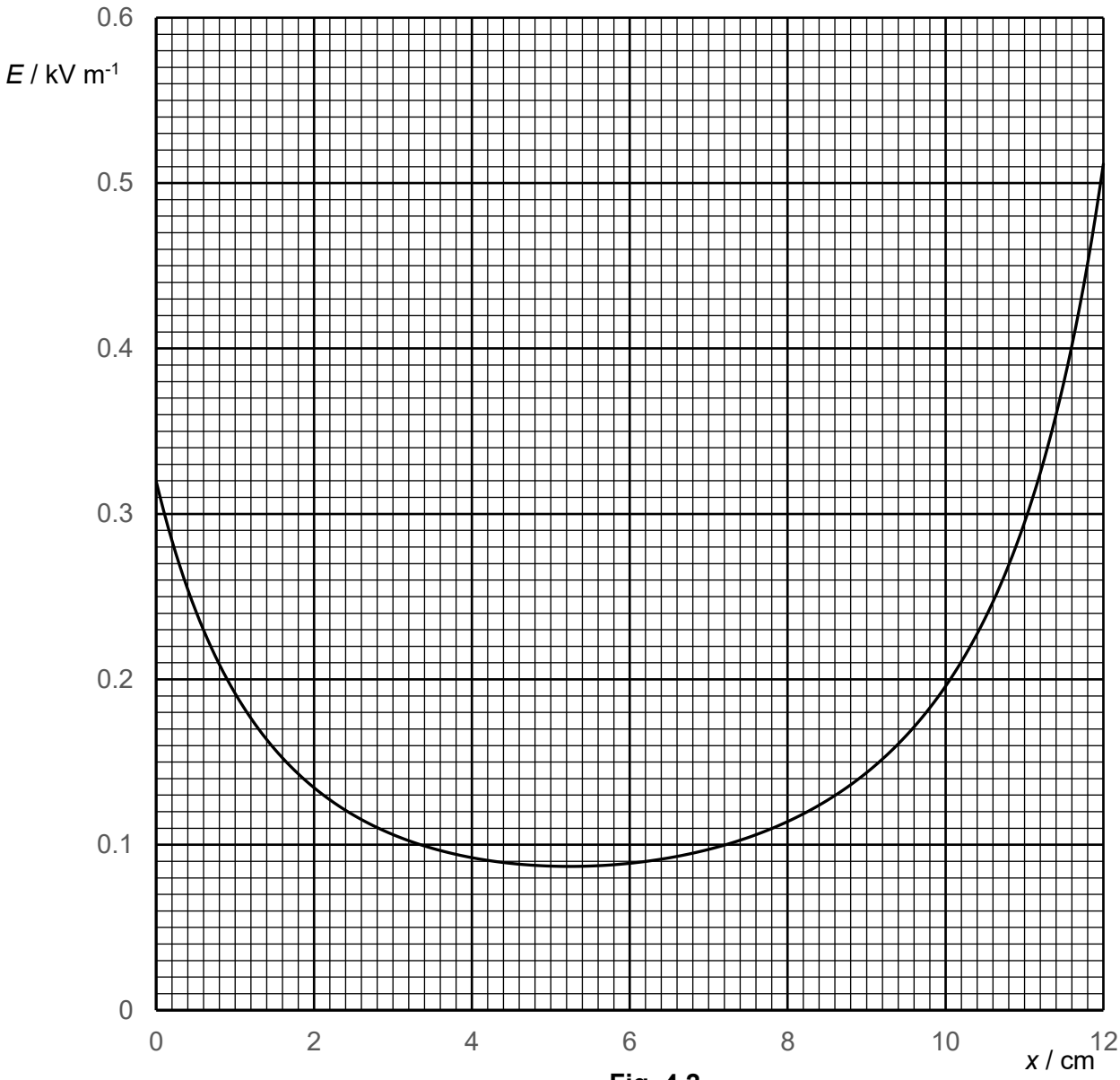

Fig. 4.2

(i) Using Fig. 4.2, comment on the magnitude and polarity of the charge of sphere A and sphere B.

.....

.....

.....

.....

[2]

(ii) A proton is at point P where its acceleration is at a minimum. Use data from Fig. 4.2 to determine the acceleration of the proton.

acceleration = ... m s^{-2} [2]

(c) The variation with distance *x* of the electric potential V at point P is shown in Fig. 4.3.

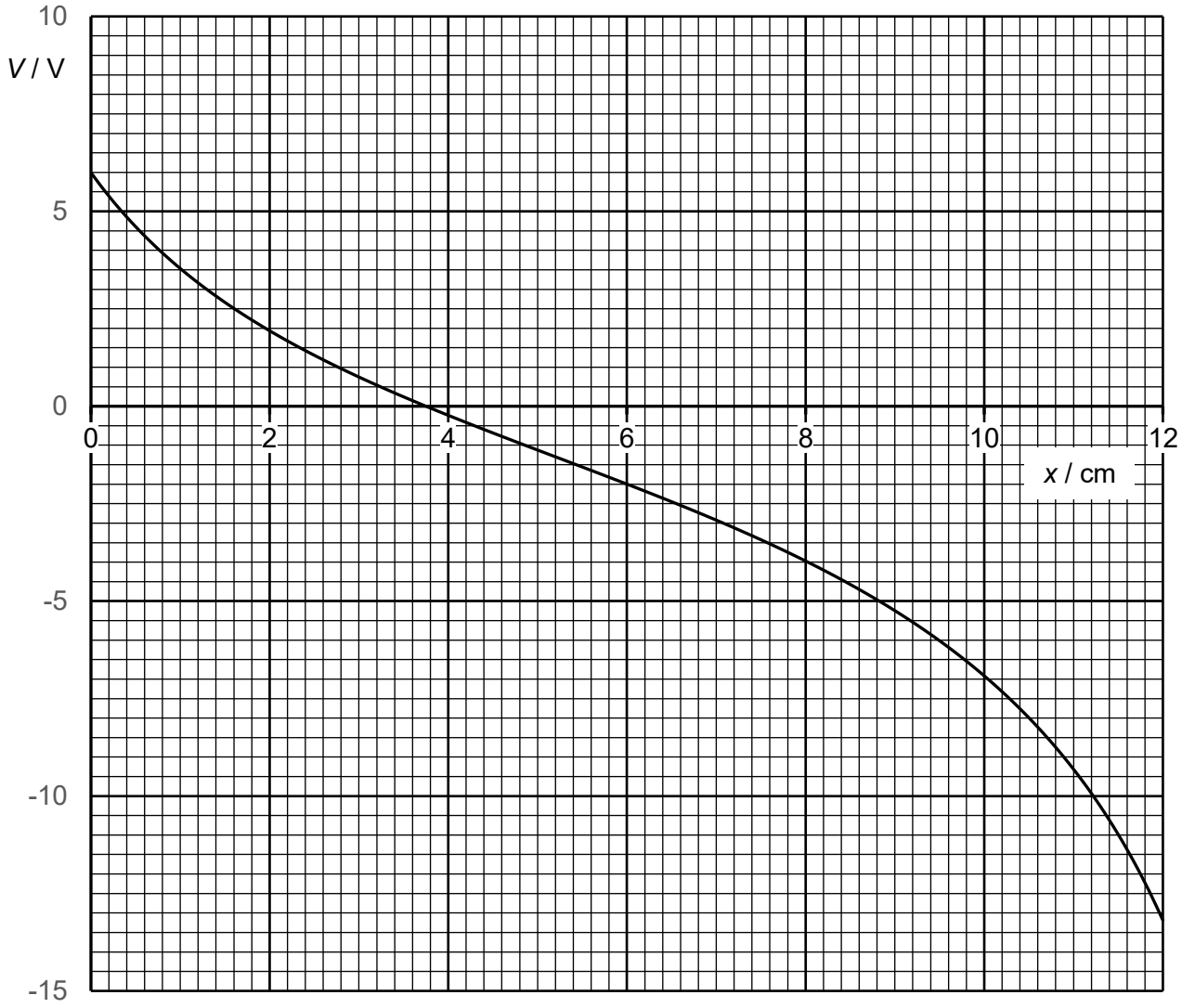

Fig. 4.3

(i) State, in words, the relationship between electric potential at point P and electric field strength at point P.

.....

.....

.....

[1]

(ii) A proton is initially at rest on the surface of sphere A and moves along the line joining the centres of the two spheres to reach maximum speed at point P.

Use data from Fig. 4.3 to determine the maximum speed of the proton.

maximum speed = ... m s^{-1} [3]

[Total: 9]