3 Two charged metal spheres A and B are situated in a vacuum. The distance between the centres of the spheres is 12.0 cm, as shown in Fig. 3.1.

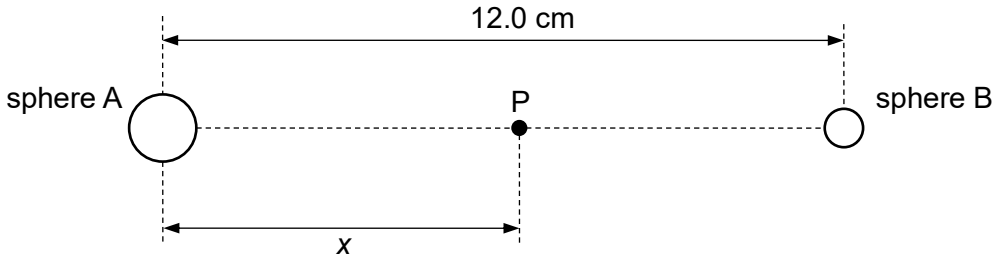

Fig. 3.1

The charge on each sphere may be assumed to be a point charge at the centre of the sphere. Point P is a variable point that lies on the line joining the centres of the spheres and is distance *x* from the centre of sphere A.

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

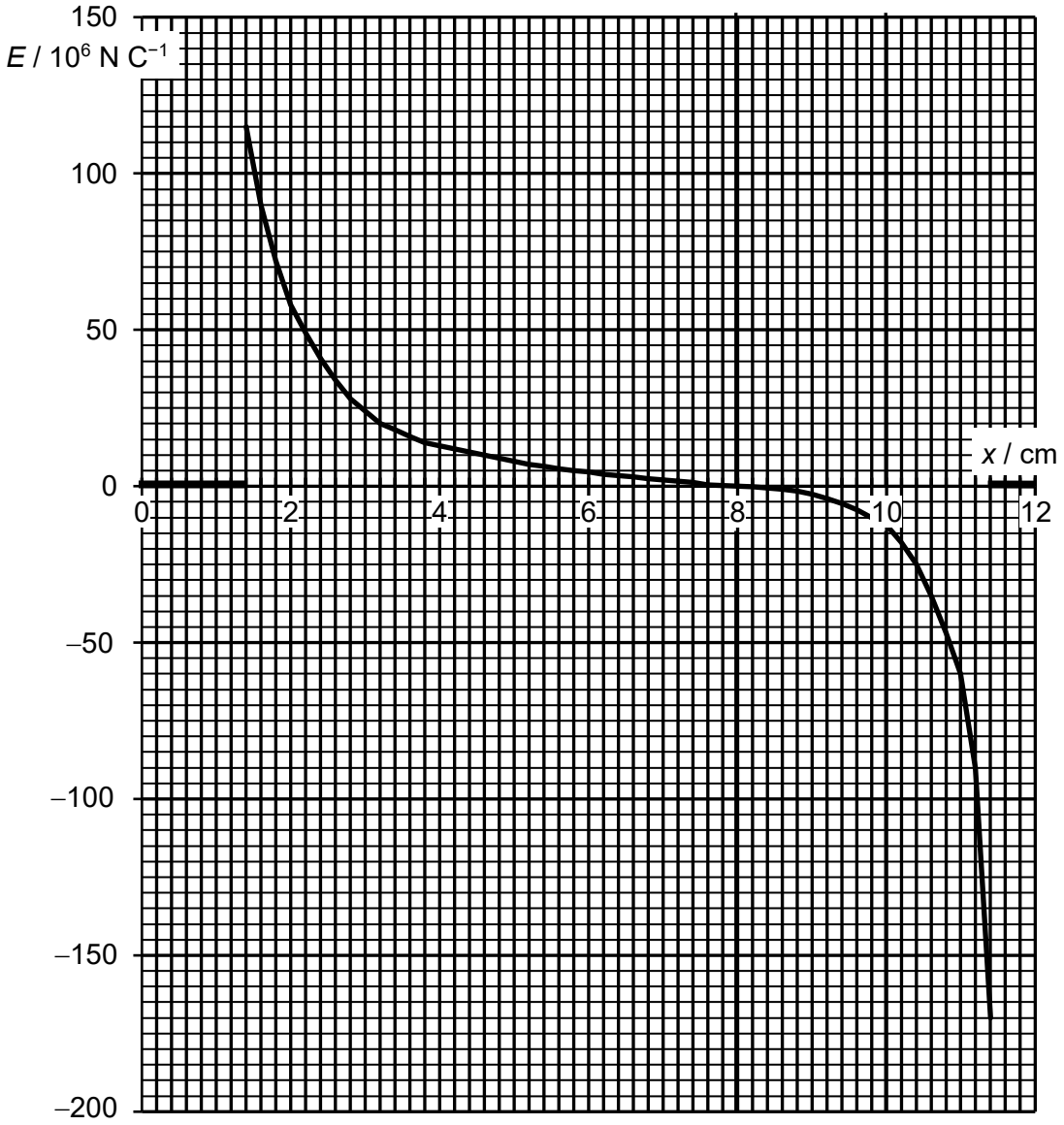

Fig. 3.2

(a) State the evidence provided by Fig. 3.2 that the spheres are conductors.

……

…… [1]

(b) The sphere A is positively charged.

(i) State and explain the polarity of sphere B.

.....

.....

.....

..... [2]

(ii) Use Fig. 3.2 to determine the ratio $\frac{\text{charge on sphere A}}{\text{charge on sphere B}}$.

ratio = ... [2]

(c) (i) State, in words, the relation between electric field strength and electric potential.

..... [1]

(ii) A point charge of $-2.0\ \mu C$ is moved by an external force from $x = 2.0$ cm to x = 8.0 cm, along the line joining the centres of the spheres.

Use Fig. 3.2 to estimate the work done by the external force.

work done = ... J [3]