**6** Two solid metal spheres A and B, each of radius 1.5 cm, are situated in a vacuum. Their centres are separated by a distance of 20.0 cm, as shown in Fig. 6.1.

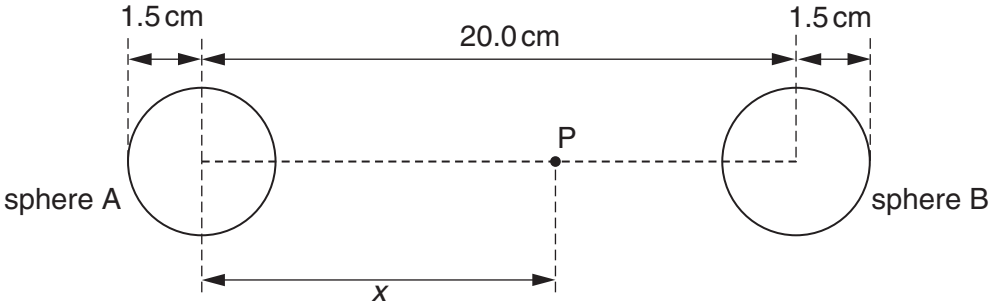


**Fig. 6.1** (not to scale)

Both spheres are positively charged.

Point P lies on the line joining the centres of the two spheres, at a 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. 6.2.

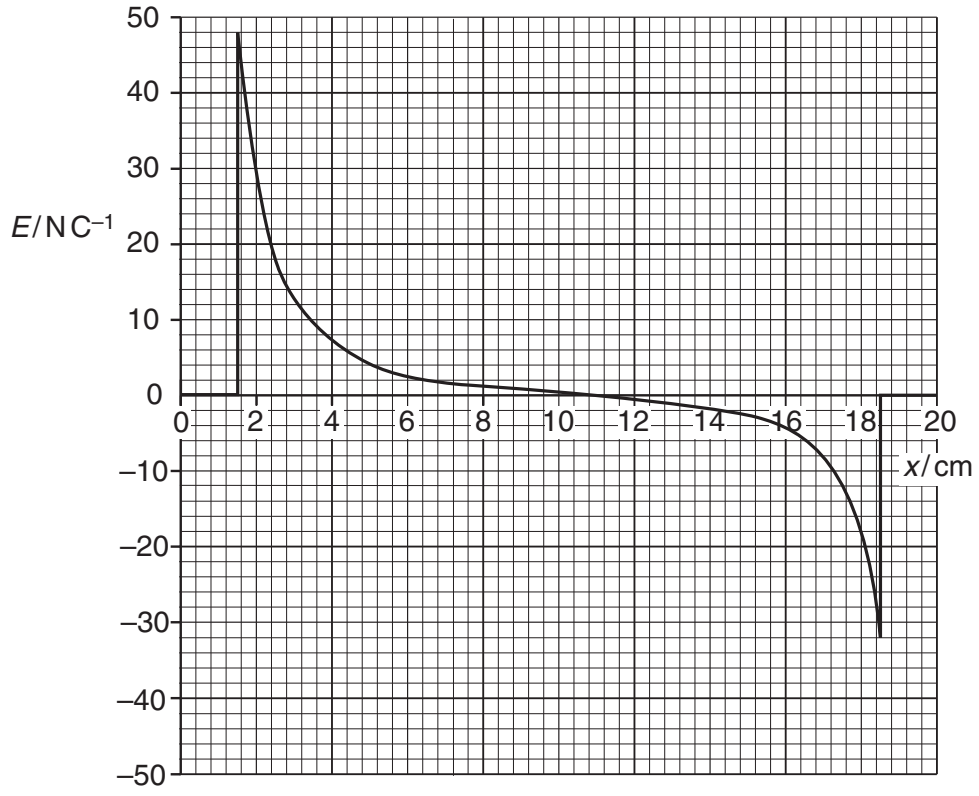


**Fig. 6.2**

**(a)** Use Fig. 6.2 to determine the ratio

$$\frac{\text{magnitude of charge on sphere A}}{\text{magnitude of charge on sphere B}}.$$

Explain your working.

ratio = .....[3]

**(b)** The variation with distance $x$ of the electric potential $V$ at point P is shown in Fig. 6.3.

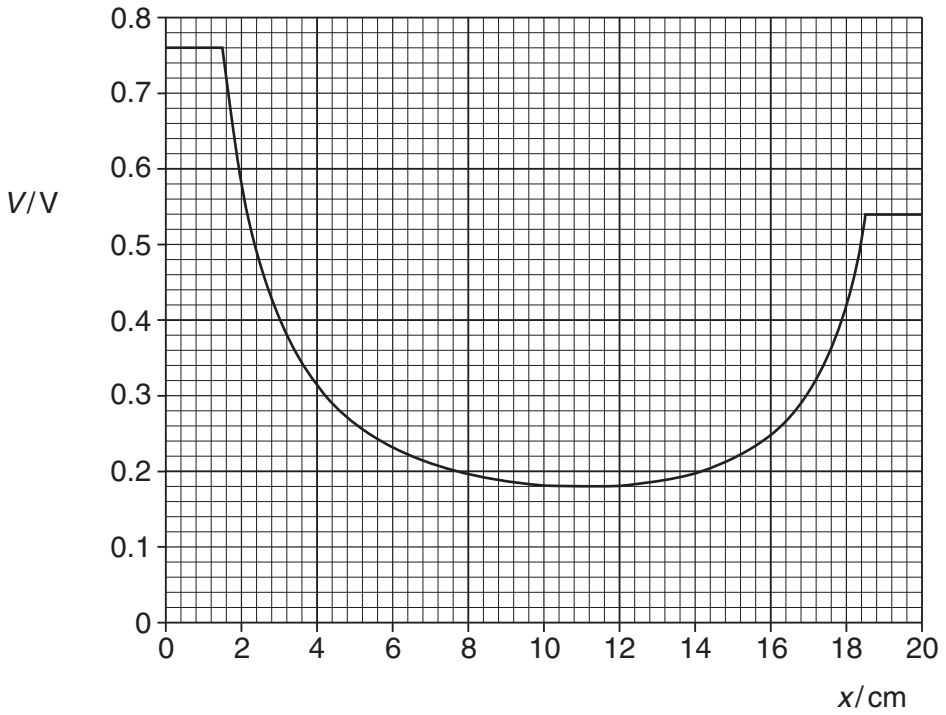


**Fig. 6.3**

An $\alpha$-particle is initially at rest on the surface of sphere A.
The $\alpha$-particle moves along the line joining the centres of the two spheres.

Determine, for the $\alpha$-particle as it moves between the two spheres,

**(i)** its maximum speed,

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

**(ii)** its speed on reaching the surface of sphere B.

speed = ..... $m\,s^{-1}$ [2]

[Total: 8]