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

.....

.....

.....[2]

(b) Two positively charged metal spheres A and B are situated in a vacuum, as shown in Fig. 5.1.

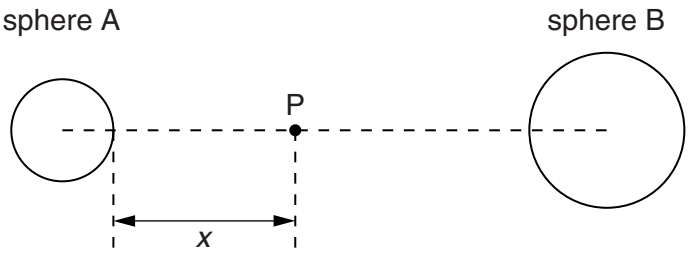

Fig. 5.1

A point P lies on the line joining the centres of the two spheres and is a distance *x* from the surface of sphere A.

The variation with *x* of the electric potential *V* due to the two charged spheres is shown in Fig. 5.2.

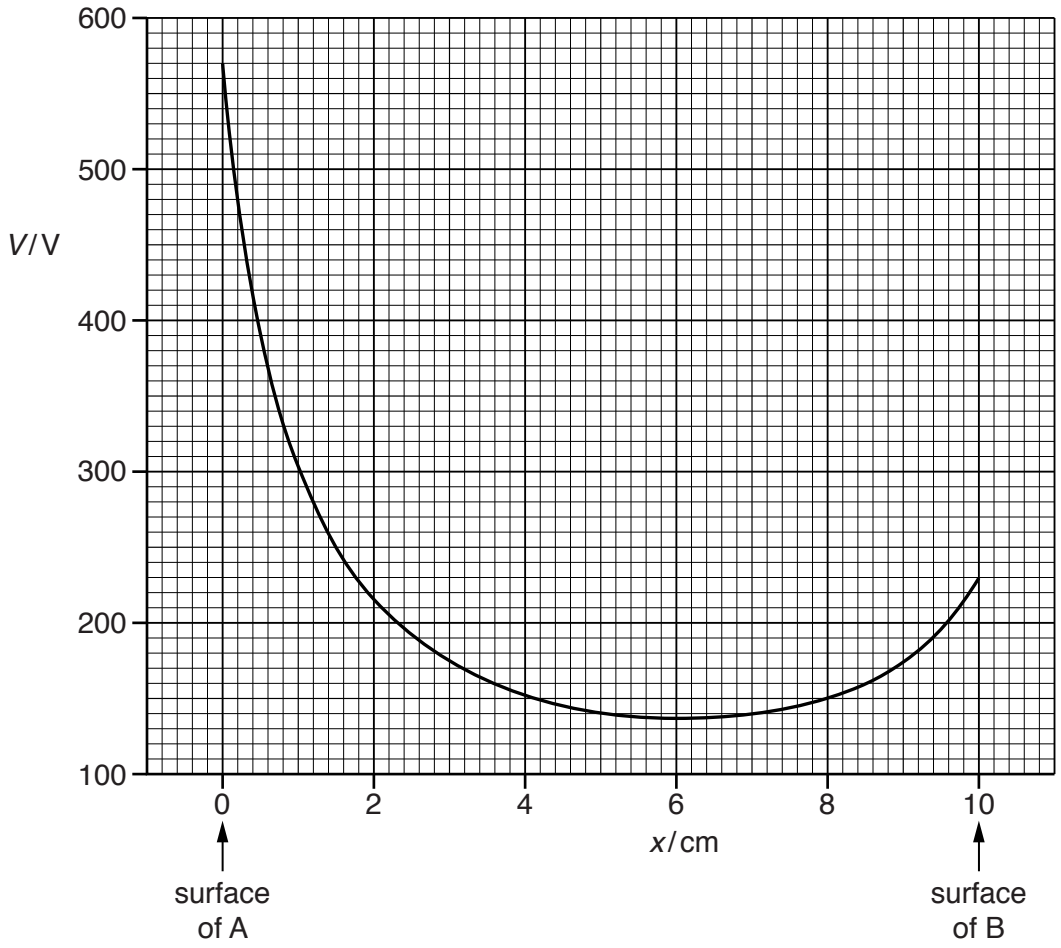

Fig. 5.2

(i) State how the magnitude of the electric field strength at any point P may be determined from the graph of Fig. 5.2.

.....

.....[1]

(ii) Without any calculation, describe the force acting on a positively charged particle placed at point P for values of x from $x = 0$ to $x = 10\,\text{cm}$.

.....

.....

.....

.....[3]

(c) The positively charged particle in **(b)(ii)** has charge q and mass m given by the expression

$$\frac{q}{m} = 4.8 \times 10^{7}\,\text{C kg}^{-1}.$$

Initially, the particle is at rest on the surface of sphere A where $x = 0$. It then moves freely along the line joining the centres of the spheres until it reaches the surface of sphere B.

(i) On Fig. 5.2, mark with the letter M the point where the charged particle has its maximum speed. [1]

(ii) **1.** Use Fig. 5.2 to determine the potential difference between the spheres.

potential difference = ... V [1]

2. Use your answer in **(ii) part 1** to calculate the speed of the particle as it reaches the surface of sphere B.
Explain your working.

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