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For Examiner's Use

7 (a) (i) State what is meant by a *field of force*.

.....

.....[1]

(ii) Define *electric field strength*.

.....

.....

.....[2]

(iii) Suggest why, when defining electric field strength, the test particle must be stationary.

.....

.....[1]

(b) (i) State the relation between electric field strength E and potential V.

.....[1]

(ii) Two charged metal spheres A and B, of diameters 18 cm and 12 cm respectively, are isolated in space, as shown in Fig. 7.1.

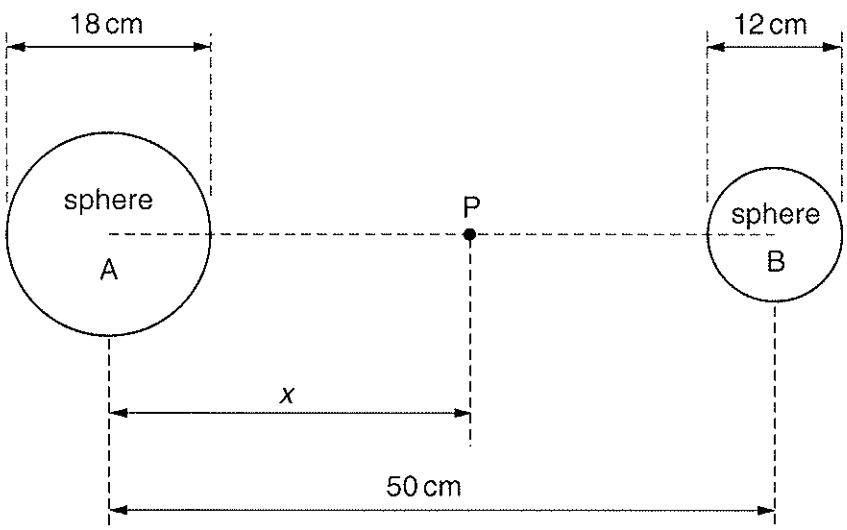

Fig. 7.1

The centres of the spheres are separated by a distance of 50 cm. Point P is at a distance x from the centre of sphere A along the line joining the centres of the two spheres.

The variation with x of the electric potential V at P is shown in Fig. 7.2.

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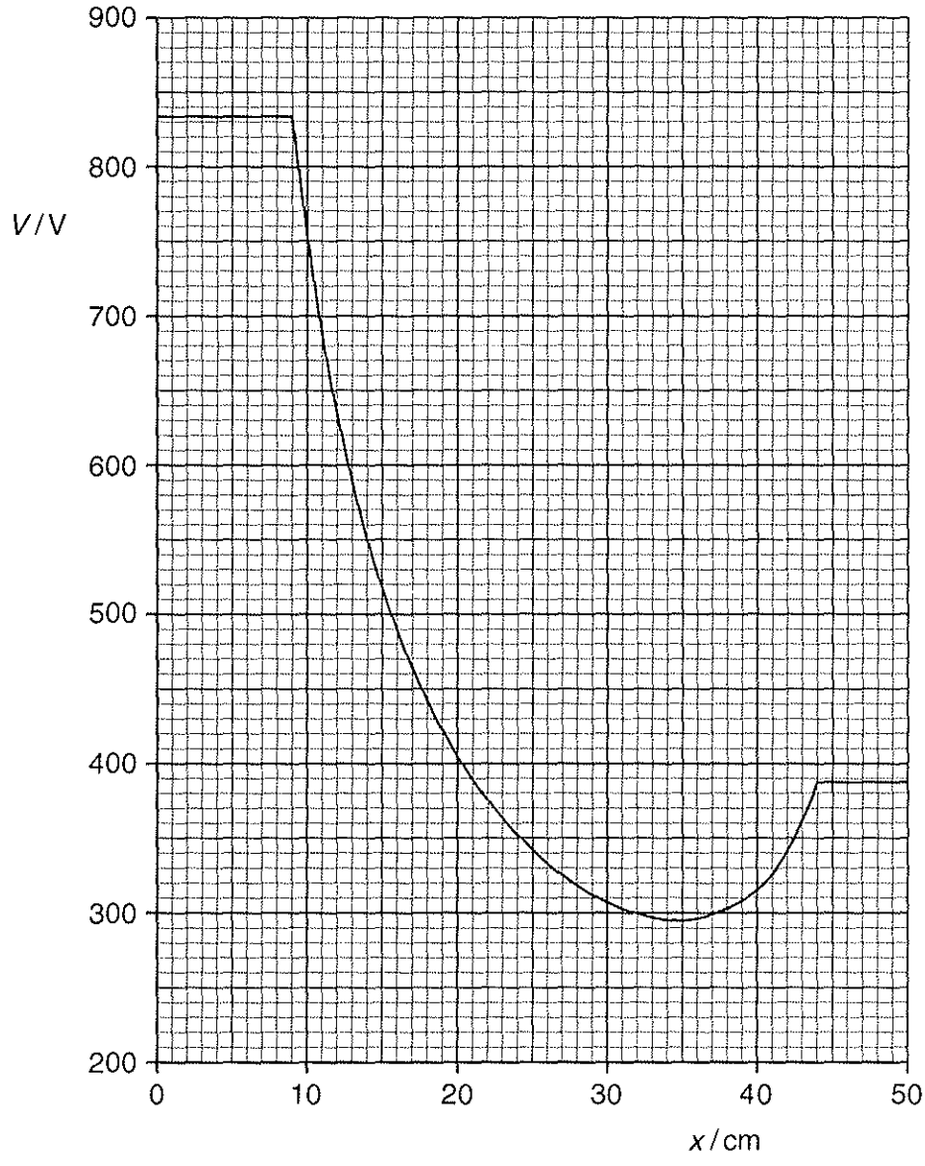

Fig. 7.2

1. State and explain the direction of the electric field at the point P, where $x = 25.0\,\text{cm}$.

.....

.....

.....[2]

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2. Use Fig. 7.2 to determine the force on an electron placed at point P, where $x = 35.0\,\text{cm}$.

force = ... N [3]

3. By making reference to electric fields, explain why the potential is constant for distances between $x = 0$ and $x = 9.0\,\text{cm}$.

.....

.....

.....[2]

(c) A student states that the potential V decreases with distance x for distances between $x = 10\,\text{cm}$ and $x = 25\,\text{cm}$ according to the expression

$$Vx = \text{constant}.$$

(i) Without drawing a graph, use data from Fig. 7.2 to show whether the student is correct.

[3]

(ii) Suggest an explanation for your conclusion in **(i)**.

.....

.....[1]

For Examiner's Use

(d) An electron, initially at rest a long distance from the spheres in **(b)**, approaches the spheres and passes between the two spheres.

(i) Calculate the minimum speed of the electron as it crosses the line joining the centres of the two spheres.

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

(ii) Describe the path of the electron for the minimum speed in **(i)**.

.....

.....

.....[2]

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