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.

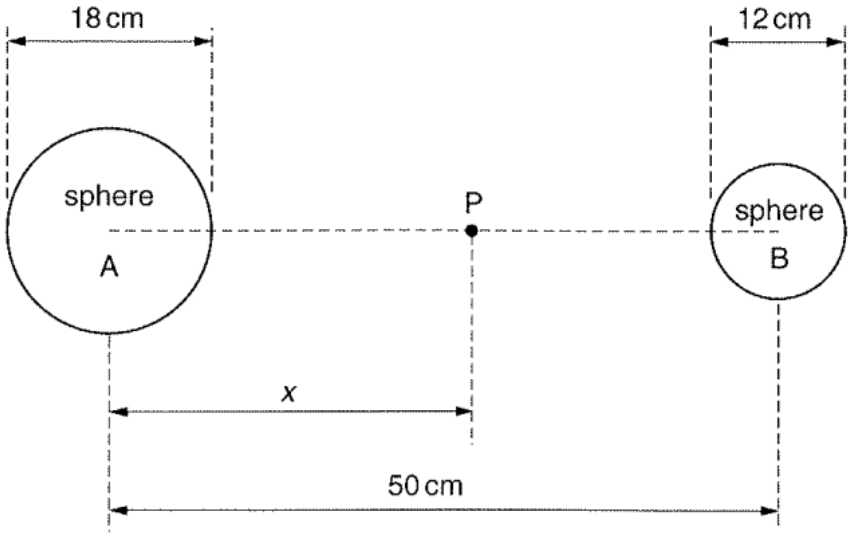

Fig. 7.1

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.

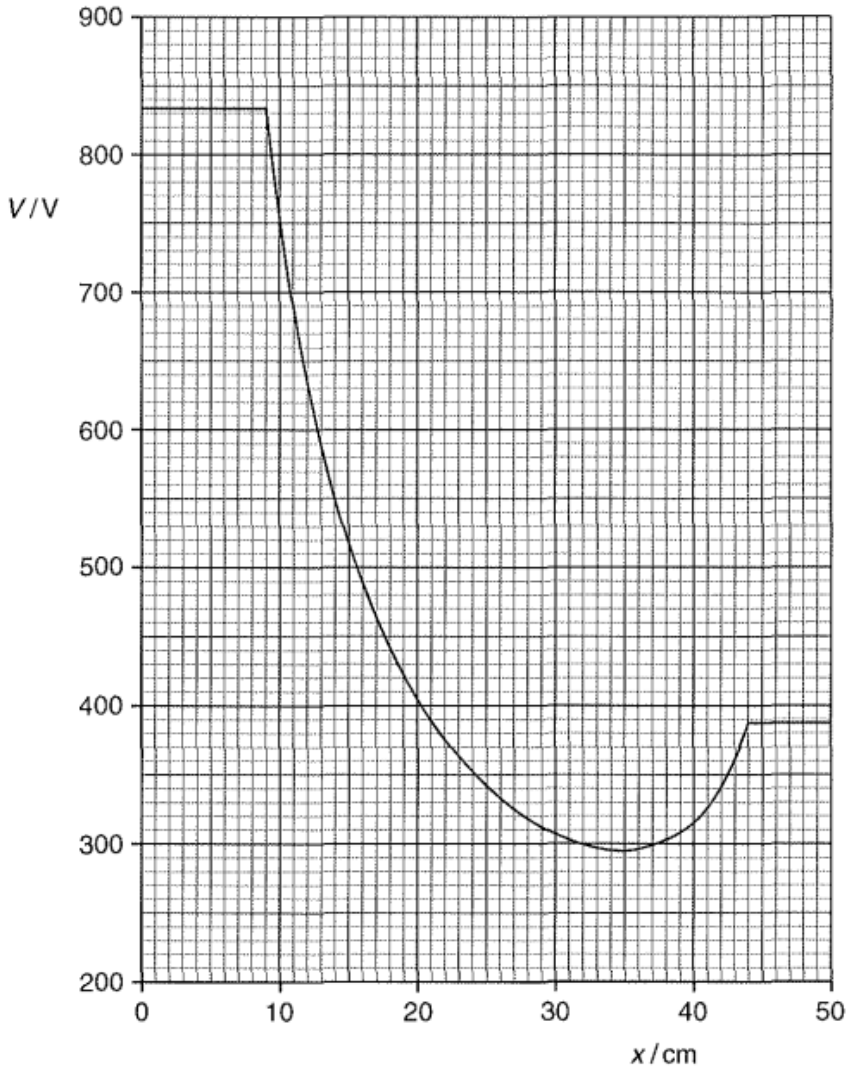

Fig. 7.2

1. State and explain the direction of the electric field at the point P, where x = 25.0 cm .

.....

.....

..... [2]

2. Use Fig. 7.2 to determine the force on an electron placed at point P, where *x*= 35.0 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 cm.

.....

.....

..... [2]

(c) A student states that the potential *V* decreases with distance *x* for distances between *x* = 10 cm and *x* = 25 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]

(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]

[Total: 20]