5 An isolated spherical conductor has charge q, as shown in Fig 5.1.

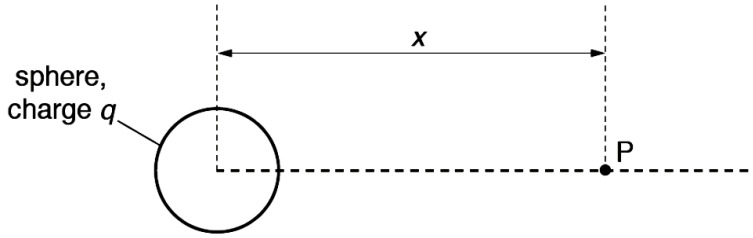

Fig. 5.1

Point P is a movable point with a distance of x from the centre of the sphere. The variation with distance x of the electric potential V at a point P due to the charges on the sphere is shown in Fig. 5.2.

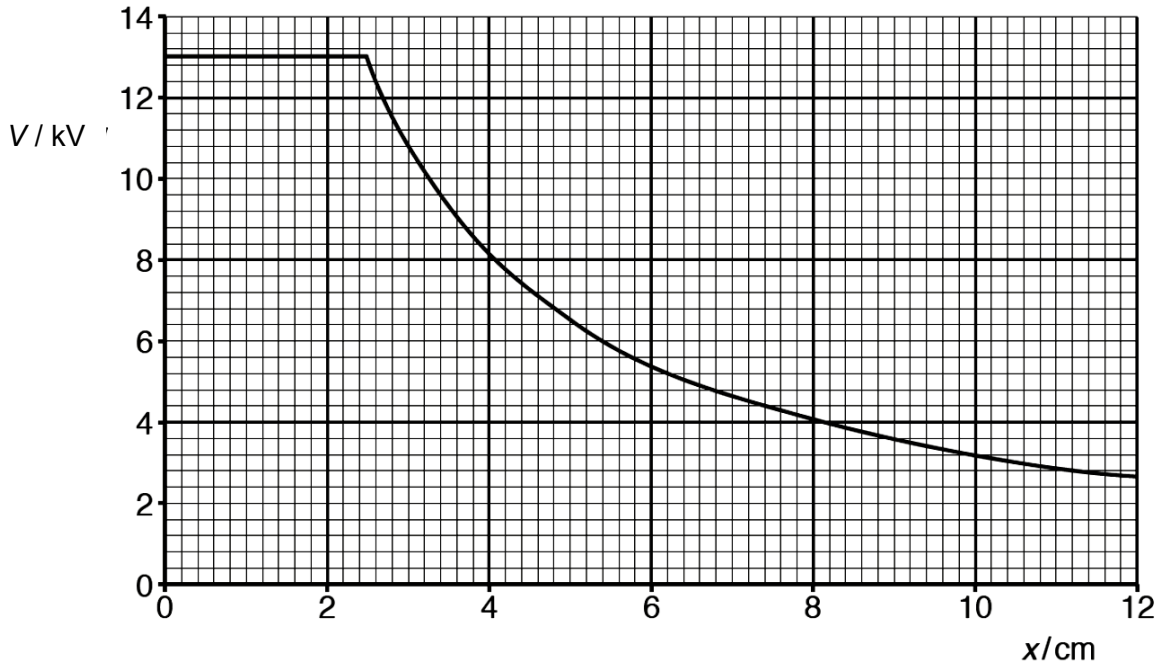

Fig. 5.2

(a) By making reference to the electric field, explain why the potential is constant for x = 0 cm to x = 2.5 cm.

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(b) Use Fig. 5.2 to determine the acceleration of a proton at point P where x = 5.0 cm.

acceleration = ... m s^{-2} [3]

(c) Describe and explain the variation of the speed of the proton when it moves from x = 5.0 cm to x = 9.0 cm.

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(d) If the proton has a speed of 1.3×10^5 m s^{-1} initially at x = 5.0 cm, calculate the speed of the proton when it is at x = 9.0 cm.

speed = ……..m s^{-1} [3]

[Total: 10]