5 Fig. 5.1 below shows an isolated, metal sphere in a region of vacuum that carries a negative electric charge.

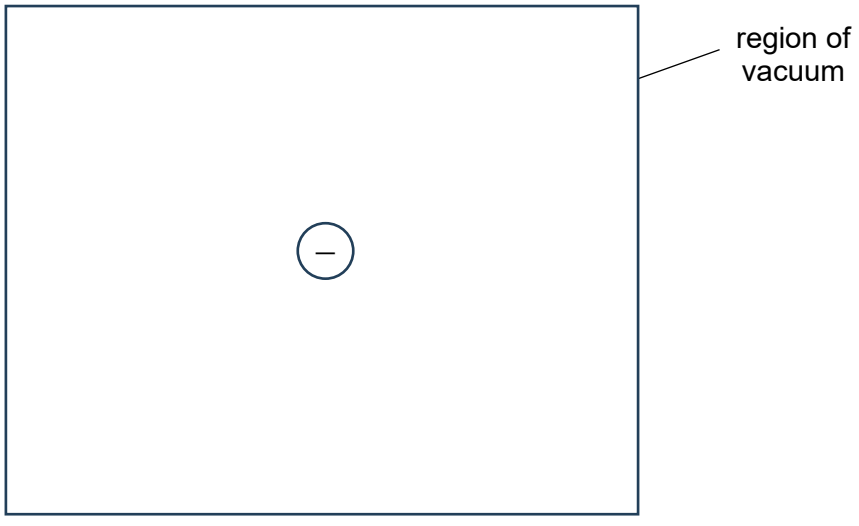

Fig. 5.1 (not to scale)

(a) The electric potential at the surface of the sphere is −1800 V. In the region of vacuum on Fig. 5.1, draw

(i) arrows to represent the electric field pattern outside the sphere [1]

(ii) dotted lines to represent three equipotential surfaces of −1400 V, −1000 V and −600 V outside the sphere. Label the potentials clearly. [1]

(b) On the axes given in Fig. 5.2, sketch a graph to show the variation with distance r from the centre of the sphere of the potential V. The dotted line is drawn at $r = R$ where R is the radius of the sphere.

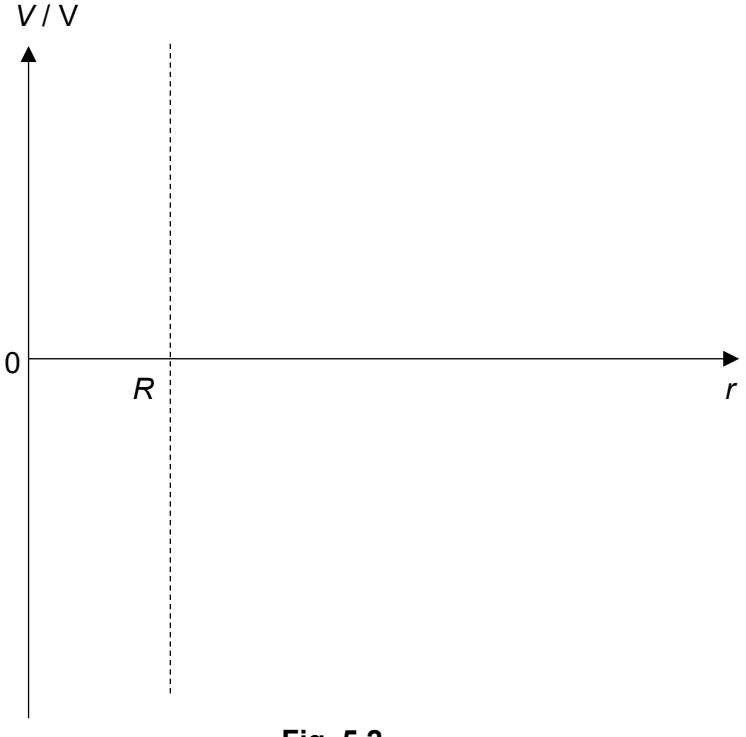

Fig. 5.2 [2]

(c) The sphere carries an electric charge of −9.0 nC and has a radius of 4.5 cm. An electron is initially at rest at the surface of the sphere.

(i) Describe the motion and path followed by the electron as it leaves the surface of the sphere.

.....

.....

.....[2]

(ii) Determine the speed of the electron when it reaches a point a distance 0.30 m from the centre of the sphere.

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

[Total: 8]