3.  (b)     An insulating sphere with a diameter of 1.0 m carries a uniform charge density of $5\,\text{nC m}^{-3}$ throughout its entire volume. A small tunnel is drilled along a diameter of the sphere. A small particle with mass 1.0 $\mu g$ and carrying charge $-0.05\,\text{nC}$ is placed at one end of the tunnel and released. Calculate:

    (i)     the time taken by the particle to move to the other end of the tunnel.
    (ii)    the speed of the particle when it reaches the centre of the sphere.

[7 marks]