

6. (a) A charged insulating sphere of radius  $R$  has a uniform positive charge density  $\rho$  throughout its entire volume. A very narrow tunnel is drilled along the sphere's diameter. A charged particle of mass  $m$  carrying a charge  $-q$  is placed at one end of the tunnel and released. Describe the subsequent motion of the charged particle. What is the speed of the particle when it passes through the centre of the sphere?

[6 marks]