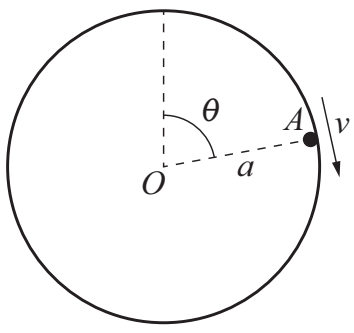
4



A fixed smooth spherical shell has centre O and radius a. A particle of mass m moves in complete vertical circles on the smooth inner surface of the shell, where the plane of the circular motion is vertical and passes through O. The particle has speed v when it is at point A, where OA makes an angle θ with the upward vertical through O, and $\cos\theta = \frac{1}{18}$ (see diagram).

(a) Show that $v \geqslant \frac{1}{3}\sqrt{26ag}$. [5]

It is given that $v = \frac{1}{3}\sqrt{26ag}$.

(b) Find, in terms of m and g, an expression for the greatest possible value of the normal reaction between the shell and the particle. [3]