A particle P of mass m is attached to one end of a light inextensible string of length a. The other end of the string is attached to a fixed point O. The string is held taut with OP horizontal. The particle P is projected vertically downwards with speed $\sqrt{\frac{1}{3}ag}$ and starts to move in a vertical circle. P passes through the lowest point of the circle and reaches the point Q where OQ makes an angle θ with the downward vertical. At Q the speed of P is $\sqrt{kag}$ and the tension in the string is $\frac{11}{6}mg$.

(a)   Find the value of k and the value of $\cos\theta$.   [4]

At Q the particle P becomes detached from the string.

(b)   In the subsequent motion, find the greatest height reached by P above the level of the lowest point of the circle.   [4]