

- 1** 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 making an angle α with the downward vertical, where $\cos \alpha = \frac{2}{3}$. The particle P is projected perpendicular to OP in an upwards direction with speed $\sqrt{3ag}$. It then starts to move along a circular path in a vertical plane.

Find the cosine of the angle between the string and the upward vertical when the string first becomes slack. [4]

[illegible]