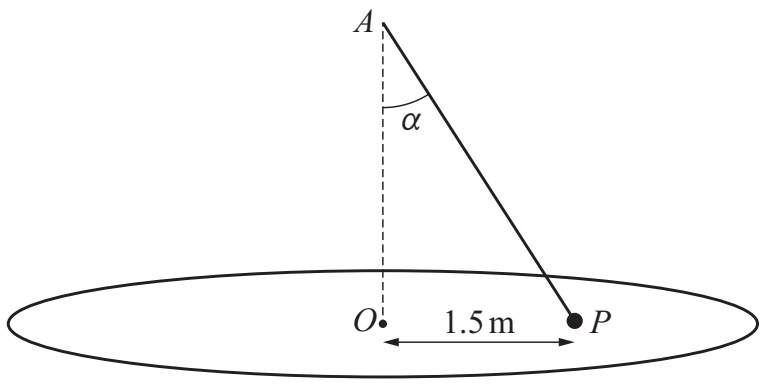
3



A rough horizontal disc, centre O, rotates with constant angular speed ω rad s^{-1}. A particle P of mass 1.6 kg lies on the disc at a distance 1.5 m from O, and is attached to a point A vertically above O by a light elastic string. The string has natural length 2 m, modulus of elasticity 32 N and makes an angle α with the vertical OA (see diagram). Particle P moves in a horizontal circle also at a constant angular speed ω rad s^{-1}. Particle P is on the point of slipping in the direction OP. The coefficient of friction between the particle and the disc is 0.5.

(a) Given that the tension in the string is 8 N, show that $\sin\alpha = 0.6$. [2]

(b) Find the number of revolutions per minute made by the disc and the particle P. [5]