

STEP III, 1999, Q11

- 11 Calculate the moment of inertia of a uniform thin circular hoop of mass m and radius a about an axis perpendicular to the plane of the hoop through a point on its circumference.

The hoop, which is rough, rolls with speed v on a rough horizontal table straight towards the edge and rolls over the edge without initially losing contact with the edge. Show that the hoop will lose contact with the edge when it has rotated about the edge of the table through an angle θ , where

$$\cos \theta = \frac{1}{2} + \frac{v^2}{2ag}.$$



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