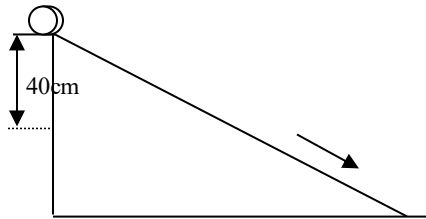


PHY1010 (2020/21)
Tutorial Sheet 7
Rotational Work, Energy, and Momentum

01*. A force of 2.2 N acts tangentially to the rim of a solid 52 kg disk that has a radius of 32 cm. (a) How long does it take to accelerate the disk (rotating about its usual axis) from rest to 210 rev/min? (b) Through how many revolutions does it rotate during this time? [83.1 s; 145 rev]

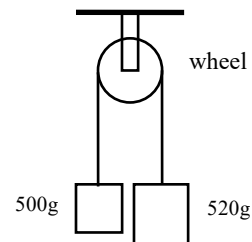
02*. A cylinder of radius 24 cm is mounted on a horizontal axis coincident with the cylinder's axis. A cord is wound on the cylinder, and a 100 g mass is hung from it. After being released, the mass drops 180 cm in 1.50 s. Find the moment of inertia of the cylinder and the tension in the cord while the mass is falling. [0.0295 kg.m²; 0.820 N]

03*. A wheel of radius 6 cm and a radius of gyration of 5.0 cm starts from rest and rolls down a slope. (a) What is the linear speed when it reaches a point 40 cm vertically lower than its starting point? (b) How fast is it rotating (in rev/s) at that time? [2.15 m/s; 5.71 rev/s]

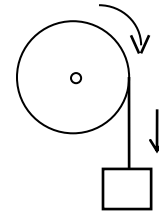


04*. A children's merry-go-round consisting of an essentially uniform 150 kg solid disk, is rotating at 15 rev/min about a vertical axis. The radius of the disk is 6 m. If an 80 kg person quickly sits down on the edge, what is its new angular speed? [7.26 rev/min]

05*. The system is released from rest. (a) How fast is the frictionless wheel ($I = 0.0050 \text{ kg.m}^2$, $r = 7.0 \text{ cm}$) turning after the 520 g mass has fallen 2.0 m? (b) How long does it take the mass to drop this far? [8.05 rad/s; 7.46 s]



06*. A wheel of radius 6cm is mounted so as to rotate about a horizontal axis through its centre. A string of negligible mass wrapped round its circumference carries a mass of 200 g attached to its free end. When allowed to fall, the mass descends through 100cm in 5 seconds. Calculate the angular acceleration of the wheel, its moment of inertia, and the tension in the cord. [1.33 rad/s², 0.0875 kg.m², 1.944 N]



07. A disk is made to roll without slipping up an incline making 30° with the horizontal. If the speed at the bottom of the incline was 2 m/s, how high up the incline will the disk travel before rolling back down again. Neglect rolling friction. Use the method of conservation of energy. [0.612 m]

