

## #2 Circular Motion: Torque and Angular Momentum

Equations:  $\tau = F_{\perp} \times d$        $L = mvr$        $I_{\text{cyl}} = \frac{1}{2} mr^2$        $I_{\text{rolling hoop}} = mr^2$        $a_c = v^2/r$

- 1) What is the torque applied to a nut if a 55N force is put on the wrench handle perpendicular to the handle at a distance of 12.3cm from the end?
- 2) If a torque of 350 Nm is applied to a handle 0.85m away from the center of rotation, then what is the perpendicular force on the handle?
- 3) If a force of 65N is applied to a handle at a 30° angle from the handle 0.21m away from the center of rotation, then what is the value for the torque produced?
- 4) If a board is set on a fulcrum, and a 30.2kg object is set 0.25m away from the fulcrum on one side, then how far from the fulcrum on the other side does a 20.9kg object need to be placed to balance?
- 5) What is the net torque produced if a 4.3kg object is placed 2.3m from the fulcrum and on the opposite side a 1.2kg object is placed 5.2m away?
- 6) How far away from the fulcrum does a 3.3kg object need to be placed if other the other side there are two different masses, one is 1.1kg at a distance of 3.6m, and the other is a 4.5kg object at a distance of 5.8m?
- 7) What is the moment of inertia for a cylinder that has a mass of 52g and a radius of 6.2cm?
- 8) What is the moment of inertia of a hoop rolling down a ramp that has a mass of 1.2kg and a radius of 1.2m?
- 9) What is the angular momentum of a small spinning object that has a mass of 45g, a linear velocity of 3.2m/s, and as at a constant radius of 0.23m?
- 10) What is the final linear velocity of a 3.5kg object rotating at a radius of 1.1m, if initially it was spinning with a velocity of 4.3m/s at a radius of 3.2m?
- 11) If the centripetal acceleration on an object is 3.82m/s<sup>2</sup> at a radius of 0.86m, and the angular momentum is equal to 8.3 kgm<sup>2</sup>/s, then what is the mass of the object?

### Answers

- 1) 6.765 Nm
- 2) 411.8N
- 3) 6.825 Nm
- 4) 0.36m
- 5) 36.5 Nm
- 6) 9.11m
- 7)  $9.99 \times 10^{-5} \text{ kg m}^2$
- 8) 1.73 kg m<sup>2</sup>
- 9) 0.033 kg m<sup>2</sup>/s
- 10) 12.5m/s
- 11) 4.58kg