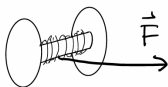
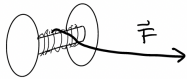


Name _____

Linear Motion	Rotational Motion
m (mass)	I (Moment of Inertia)
d (distance)	θ (angular distance)
v (velocity)	ω (angular velocity)
F (Force)	τ (torque)
$W = F \cos \theta d$ (Work done by Force)	$W_{rot} = \tau \theta$ (Work done by torque)
$KE = \frac{1}{2}mv^2$	$KE_{rot} = \frac{1}{2}I\omega^2$

1. A spool is wound with rope such that the rope winds over the top to the right and then a horizontal force is applied to the rope to the right. Will the spool move **A**: to the right, **B**: to the left, or **C**: will it depend on the situation?



2. Let's have a race between a solid disk and a ring. Both of them have the same mass and same radius and will be released from rest from the same height on an incline plane. Which one would you bet on? **A**: Solid, **B**: Hollow, **C**: Both at same time



3. Suppose we instead race a solid sphere with a cube that just slides down the plane (suppose there is an identical frictionless incline so that we can ignore friction). The cube has the same mass and its length is the same as the diameter of the disk. Which one will reach the bottom first? **A**: Sphere, **B**: Box **C**: Both at same time

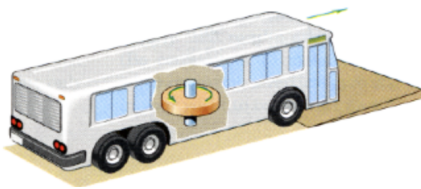


4. Suppose the solid sphere has a mass of 1.5kg and a radius of 0.15m and the plane is inclined such that the height of the disk is 0.3m. What will be the speed of the sphere at the bottom? Compare that to the speed of the cube at the bottom.

5. If you ever need to escape a building, you can wrap a rope around a large disk, tie yourself to the rope and then fall down with the rope unwinding. Explain why this will slow your fall.



6. A flywheel is a large solid disk used to store energy in the form of rotational kinetic energy. In the 1950's Zurich used flywheels to power their buses, called the Gyrobus. The flywheels were 1.5m in diameter and were 1500kg. They usually rotated at 3000rpm (revolutions per minute) to supply energy to an electric motor. Periodically, the flywheel was connected to a power grid which applied a torque to the wheel to speed it up again.



- (a) How much rotational energy is stored in the flywheel when rotating at 3000rpm?
- (b) How much work is needed to get the flywheel spinning at 3000rpm, if it starts from rest?
- (c) If it starts from rest and speeds up to 3000rpm in a time of 30 seconds, what is the flywheel's angular acceleration?
- (d) How many revolutions would it turn through in 30 seconds?
- (e) What is the total torque applied to the flywheel?
- (f) What is the tangential speed of the flywheel at 3000rpm?
- (g) What are some advantages and disadvantages to having a flywheel bus?