UNIT 12 HOMEWORK BEFORE SESSION ONE

➡**SmartPhysics:** *View the Prelecture 14 "Rotational Kinematics and Moment of Inertia" before the class and answer the checkpoint questions. (The online Homework is due the next day.)*

UNIT 12 HOMEWORK AFTER SESSION ONE

➡**SmartPhysics:** *View the Prelecture 15 "Parallel Axis Theorem" before the class of next session and answer the checkpoint questions. (The online Homework is due the next day.)*

• *Finish Activity Guide Entries for Session 1*

• *Work supplemental problems SP12-1, SP12-2 and SP12-3*

SP12-1) A racing car travels on a circular track of radius 250 m. If the car moves with a constant speed of 45 m/s, find (a) the angular speed of the car and (b) the magnitude and direction of the car's acceleration.

SP12-2) A tractor is travelling at 20 km/h through a row of corn. The radii of the rear tires are 0.75 m. Find the angular speed of one of the rear tires with its axle taken as the axis of rotation.

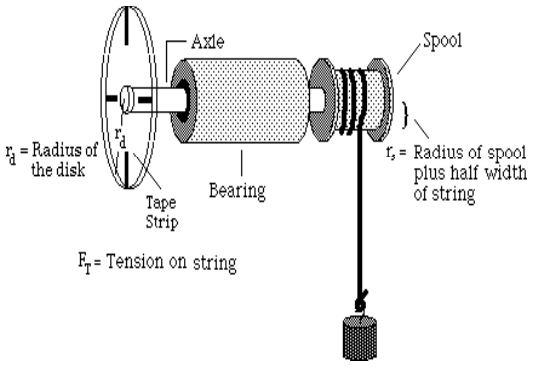
SP12-3) Sharon pulls on a rod mounted on a frictionless pivot with a force of 125 N at a distance of 87 cm from the pivot. Roger is trying to stop the rod from turning by exerting a force in the opposite direction at a distance of 53 cm from the pivot. What is the magnitude of the force he must exert?

UNIT 12 HOMEWORK AFTER SESSION TWO

➡**SmartPhysics:** *View the Prelecture 16 "Rotational Dynamics" before the class of next session and answer the checkpoint questions. (The online Homework is due the next day.)*

• *Work supplemental problem SP12-4* (Problem SP12-4 will help you prepare for the experiment to be done during the next class session.)

SP12-4) (20 pts) A small spool of radius r_s and a large Lucite disk of radius r_d are connected by an axle that is free to rotate in an almost frictionless manner inside of a bearing as shown in the diagram below.



A string is wrapped around the spool and a mass m, which is attached to the string, is allowed to fall. (See next page)

(a) Draw a free body diagram showing the forces on the falling mass, m, in terms of m, g and F_T.

(b) If the magnitude of the linear acceleration of the mass, m, is measured to be a, what is the equation that should be used the calculate the tension, F_T, in the string (i.e., what equations relates m, g, F_T and a)? **Note:** In a system where $F_T - mg = ma$, if $a << g$ then $F_T \approx mg$.

(c) What is the torque, τ, on the spool-axle-disk system as a result of the tension, F_T, in the string acting on the spool?

(d) What is the magnitude of the angular acceleration, α, of the rotating system as a function of the linear acceleration, a, of the falling mass and the radius, r_s, of the spool?

(e) If the rotational inertia of the axle and the spool are neglected, what is the rotational inertia, I, of the large disk of radius r_d as a function of the torque on the system, τ, and the magnitude of the angular acceleration, α?

(f) What is the theoretical value of the rotational inertia, I_d, of a disk of mass M and radius r_d in terms of M_d and r_d?

UNIT 12 HOME WORK AFTER SESSION THREE

➡ **SmartPhysics:** *View the Prelecture 19 "Angular Momentum" before the class of next session and answer the checkpoint questions. (The online Homework is due the next day.)*

- *Finish Unit 12 Entries in the Activity Guide* (Due before class)