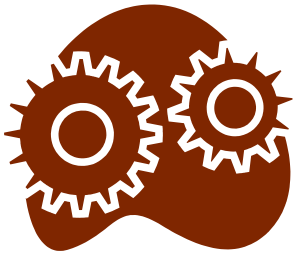
DAY 12

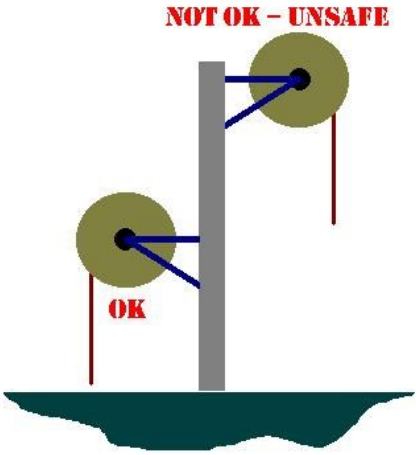
Homework Assignment (see syllabus for homework collection information)

1. A 125 lb woman who is trying to change a tire fits a 10 inch long lug wrench to her wheel nuts and tries to loosen the nuts. They won't budge so she stands on the wrench. How much torque does she apply to the nut? The nut still won't budge so she slips a 3 ft long piece of pipe over the wrench and stands on it again. This time the nut turns. How much toque did she apply to the nut?



2. Two gears, one of which has a diameter 50% larger than the other, are accelerating. If the angular acceleration of the smaller gear is 2 RPM/sec, what is the angular acceleration of the larger gear?

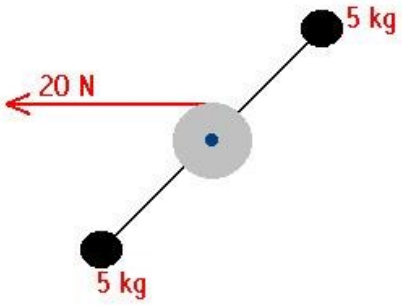
3. Find the moment of inertia of a CD – a disk of mass 20 g and diameter 12 cm. HINT – consult a moment of inertias table.



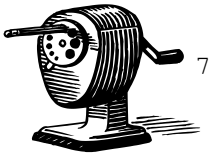
4. A building supply store has to store spools of chain so that customers can pull off the length they want and have it cut to length. It is safe to have the spool mounted just above the ground, but unsafe to have the spool mounted higher – even if the mounts are strong. Describe in detail what can happen in the latter case that makes a higher position so unsafe. Use rotation concepts.

5. Two 5 kg masses are connected by an arm that measures 5 ft from end to end. In the middle of the arm is a low-friction pivot point. A lightweight pulley 2 ft in diameter is mounted at the pivot point, with a cord wrapped around the pulley. The cord is pulled with a steady 20 N tension.

   How long before the masses achieve a tangential speed of 40 mph?



6. A 250 lb man stands at one end of a diving board. The diving board is held in place by bolts located at the end the man is not standing on and by an adjustable rubber roller located 2/5 of the way from the man to bolted end of the board. Calculate the force present at the rubber roller.



7. A woman cranking a pencil sharpener exerts a steady force of 2 lbs on the end of the crank, which measures 3 inches in length. If she cranks at a rate of 2 rev/sec, calculate the torque and power she is generating. Give answers in metric SI units.

8. A rolling body has both translational and rotational kinetic energy. Show that the total KE of a rolling hoop of mass m rolling at speed v given by $KE = mv^2$. Then derive KE formulas for a rolling solid sphere and a rolling solid cylinder.

9. An object that slides down a frictionless incline of height h will have a speed of $v=(2gh)^{1/2}$ at the bottom of the incline. Determine the speed that a hoop that rolls without sliding will have at the bottom of an incline of height h. Repeat for a solid sphere and a solid cylinder.

10. If you released a sphere, and cylinder, and a hoop from the top of an incline, which would get to the bottom first? Last? Explain.