Recitation 4.3 Mass Moment of Inertia, Rotational Energy, Torque

**Task 1.** The final team project is right around the corner. Think about who you want as a team member. Each team will have 3 or 4 students.

**Task 2.** Concept questions.

A force is applied to a dumbbell for a certain period of time, first as in (a) and then as in (b).

1. In which case does the dumbbell acquire the greater rotational speed?
   a. case (a)
   b. case (b)
   c. no difference
   d. It depends on the rotational inertia of the dumbbell

2. In which case does the dumbbell acquire the greater energy?
   a. case (a)
   b. case (b)
   c. no difference
   d. It depends on the rotational inertia of the dumbbell

Follow-up question: If there was a difference, where did the additional kinetic energy come from?

3. The following are three pictures of a cylinder rotating about a different axis.

   ![Cylinders](image)

   A. In which case is the mass moment of inertia the largest?
      a. case (a)
      b. case (b)
      c. case (c)
      d. the mass moment of inertia is the same in all cases
      e. can not know (need more data)

   B. In which case is the rotational kinetic energy the smallest?
      a. case (a)
      b. case (b)
      c. case (C)
      d. the rotational kinetic energy is the same in all cases
      e. can not know (need more data)

**Task 3.** Answer the following questions:

1. Flywheel: The flywheel has a diameter of 0.75 in., a thickness of 0.13 in., a density of 490 lb/ft³. Calculate the mass and mass moment of inertia.
2. A dumbbell consists of 2 pint masses. One mass is 2 kg and the other is 1 kg. These masses are attached to a rod of length 0.6 m. The mass of the rod is -.5 kg.

Calculate the rotational mass moment of inertia of the dumbbell if:

(a) It is rotating about an axis perpendicular to the rod and going through the center of mass.

(b) It is rotating about an axis perpendicular to the rod and going through the 2 kg mass.

3. In order to loosen a lug nut, Professor Schleter (mass = 82 kg) stands on the end of a 0.6 m long socket wrench that is at an angle of 10° from the horizontal. What is the magnitude of the torque Professor Schleter applies to the lug nut?

4. A solid sphere is rolling with a speed of 4.6 m/s. How far up a 10° incline can this solid sphere roll?