Assignment 5

(Rotational Motion)

Exercise 1

An oxygen molecule consists of two oxygen atoms whose total mass is $5.3 \times 10^{-26} \, kg$ and whose moment of inertia about an axis perpendicular to the line joining the two atoms, midway between them, is $1.9 \times 10^{-46} \, kg.m^2$. From these data, estimate the effective distance between the atoms.

Exercise 2:

Two blocks are connected by a light string passing over a pulley of radius 0.15m and moment of inertia I. The blocks move (towards the right) with an acceleration of 1.00 m/s² along their frictionless inclines (see Fig).

a) Draw free-body diagrams for each of the two blocks and the pulley.
b) Determine F$_{TA}$ and F$_{TB}$ the tensions in the two parts of the string.
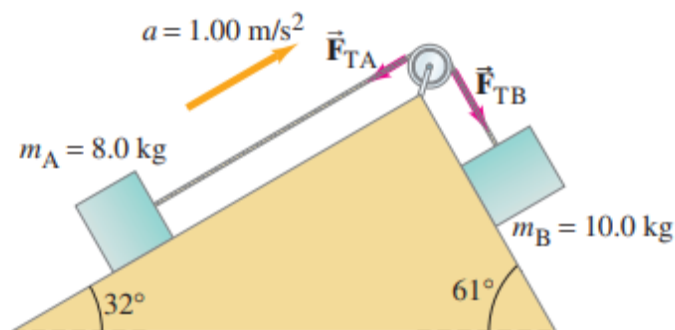c) Find the net torque acting on the pulley, and determine its moment of inertia, I.

Figure 1

Exercise 4:

a) What is the angular momentum of a figure skater spinning at 2.8 rev/s (1rev=2·πrad) with arms in close to her body, assuming her to be a uniform cylinder with a height of 1.5m, a radius of 15 cm, and a mass of 48 kg?

b) How much torque is required to slow her to a stop in 5.0s, assuming she does not move her arms?