Your Name_____Section_____

HOMEWORK #5 - 8.01 MIT - Prof. Kowalski

Due 4:00PM Thursday Oct. 9, 2003

Topics: Friction, circular dynamics, and Work-Kinetic Energy

Any following problems designated with a bold number indicate problems from Young and Freedman 11th edition.

6. 5.80

7. 5.86

8. 5.90

9. 5.104

5. Work on Sliding Box – 5 points

A box of mass M is initially at x0 = 0 sliding along the horizontal x-axis with velocity v0. It is observed to stop at x1 due to friction. Write down the work-energy relationship, substitute in variables given above, and thereby find the work, Wf done *on* the box by friction, Note: you do not know the coefficient of friction; this problem uses only Wf and Ff as unknowns.

a) Express Wf in terms of Ff and other given variables.
b) Express Wf in terms of the friction force, Ff, and find the magnitude of Ff.
c) Find the time that the box takes to stop, eliminating Ff, Wf, and M from your answer

A person now pushes on the box against the force of friction, sliding it to point x2 where it has speed v1.
d) Find the work done by the person on the box (no Wf in your answer, please).

6. U-Control Model Airplane

A u-control airplane of mass M is attached by control wires of length L (and negligible mass) to the "pilot" who controls the lift provided by the wing. (The wires control the plane's elevator.) The plane's engine keeps it moving at constant speed v.

a. Find the total tension T in the wires when the plane is flying in a circle at an altitude such that the wires make an angle θ with the ground. Remember that the wings can provide lift only in the direction perpendicular to their area, i.e. in a direction perpendicular to the wires. Think carefully before selecting the angle of your coordinate system.
b. The plane will go out of control and crash if the tension is not maintained in the control wires. Given a particular speed of the plane, v, is there some angle θ_{crirt} which you would advise the pilot not to exceed?
c. If possible, exhibit a speed vsafe, at which the plane would be safe at any angle.