Physics 9 February 5, 2008

Assignment #2

Reading: Romer – Chapters 2 and 3.

Laboratory: We meet in 201 Merrill on Thursday, February 7, for our first in-class laboratory, ***Testing Conservation of Energy***. Your write up of this laboratory should be turned in along with this problem assignment on Thursday, February 14.

Problems: Romer - 2.3, 2.6, 2.17, 3.18, 3.19

Q1 – You have a 10 kg suitcase. When you pick up the suitcase it is 0.1 m above the floor.

a) How much work do you do when you pick up the suitcase?

b) You have to carry your suitcase a distance of 100 m to the check-in at the airport. Neglecting friction, how much work do you do when you carry your suitcase to the check-in?

c) How much work do you do when you set the suitcase down?

Q2 – It takes a horizontal force of 300 N to push a stalled automobile along a road at a constant speed.

a) How much work must you do to push this automobile a distance of 5.0 m?

b) In this motion, how much work is done by friction?

Q3 – Run up the longest staircase you can find as fast as you can. There is a good one at the entry to Merrill that goes up several floors. Time how long it takes you to run up the stairs.

a) Estimate how high you have risen in climbing the stairs.

b) How much have you increased your potential energy?

c) What is the average power (in Watts) that your muscles must have generated in order for you to ascend the stairs.

Q4 – Go to the gym and find one of the aerobic machines (bicycles, tread mills or elliptical trainers) that can display both your power in Watts and the total number of Calories you have burned. Try to operate the machine such that you maintain a constant power.

a) What machine did you use? Record your power, the time you maintained it and the total number of Calories you burned during that time.

b) Combine your measurements of power and time to figure out how many Joules of work you have done.

c) Convert the number of Calories that you burned into Joules.

d) The exercise machine must assume that you convert chemical energy (in Calories) into mechanical work with some efficiency. The efficiency is defined to be the ratio of the work out divided by the chemical energy in. Based upon your data, approximately what efficiency does the machine assume for you?

e) You probably find that most of the chemical energy has not been converted into mechanical energy. Where has the rest of the chemical energy gone?