Homework #7

due 11/15/05

1. A $2,000$ kg car going 15 m/s hits a $3,000$ kg car going 30 m/s head on. The cars stick together after the collision, and the wreck skids to a halt.

(a) What is the speed of the combined wreck just after the collision?

(b) How much energy is converted into heat during the collision?

(c) How much energy is converted into heat during the time that the wreck skids to a halt?

2. A 0.5 kg wood block is attached to the ceiling by a 2.5 m long string. A 10 g bullet is fired horizontally into the block with an initial speed of 15 m/s. The bullet becomes embedded into the block.

(a) What is the speed of the block just after the bullet becomes embedded in it?

(b) How much energy was converted into heat by the bullet being stopped in the block?

(c) When the bullet and block swing together, what is the maximum vertical height reached by the block?

3. A marble of mass 10 g going 1.5 m/s collides elastically with a marble of mass 20 g initially at rest. What is the final speed of the lighter marble after the collision? Which direction is it going?

4. A cannon is perched on a 10 m high cliff at the edge of the ocean. It fires a cannonball at an initial angle of 30° above the horizontal with an initial speed of 150 m/s. What is the final speed of the cannonball when it hits the ocean? *Hint:* If you are writing down constant acceleration equations, you are working too hard! Use conservation of energy.

5. Estimate the temperature difference between the water at the top and the bottom of Niagra falls, which is 176 feet high. (See sections 17.8 and 17.9 in your book.)