HW 4

Due October 26, 2007

Please answer all questions clearly and concisely. While you need not transcribe the question completely, it should be clear from your answer alone what you are talking about.

You are strongly encouraged to discuss the homework with your classmates, but you must complete the written homework by yourself, and of course, the material you submit must be your own.

Remember, show all of your work!

1. I drop a 0.1 kg ball from a height of 10m (assuming no air resistance).
   (a) How much work does gravity do on the ball on its way to the ground?
   (b) What is the speed of the ball when it hits the ground?
   (c) Using your projectile motion equations (not using energy), how long did the ball take before hitting the ground?
   (d) At constant acceleration, and only using your result from part c), what will the speed of the ball be when it hits the ground? Compare this answer to that found in part b.
2. Consider a 5 kg block moving at 2/3c.
   (a) What is the momentum of the block?
   (b) What is the rest energy of the block?
   (c) What is the Kinetic energy of the block? (**Hint:** do *not* use the relation you learned in high school.)
   (d) If I then do $5 \times 10^{17} J$ of work on the block (admittedly, quite a lot – it's about the same amount of radiant energy the earth gets from the sun every 3 seconds), what will its speed be afterwards?
3. A Neutron decays into a proton, an electron, and an antineutrino (which has small enough mass that you may assume it to be zero for this problem).
   (a) How much energy is released in a neutron decay? You should look up the masses of the relevant particles in the book.
   (b) Assuming all of the energy releaesd goes into the kinetic energy of the electron, how fast will the electron be traveling?
4. 5.P.57
5. 5.P.61
6. 5.P.62