

Contemporary Physics I – HW 1

HW 1

Due October 6, 2006

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) Consider a 3kg block at rest. What is the speed of the block if you apply a momentum of:

- a. 600 kg m/s ?
- b. 10^9 kg m/s ?
- c. If the 10^9 kg m/s impulse were applied over the course of a year, what is the average force on the block in Newtons?

2) Normally, I'll want you truncate your calculations after about 3 decimal places. For the following, however, please answer with 8 significant digits.

- a. What is the γ factor for a particle traveling 300,000 m/s?
- b. What fraction of the speed of light is that?
- c. Imagine another particle traveling 0.999 the speed of light (0.999c). What is the γ factor for *that* particle?

3) Let's do some work with vectors. You have the following vectors:

$$\vec{u} = \langle 3, 0, 4 \rangle$$

$$\vec{v} = \langle -2, 1, 0 \rangle$$

Compute the following:

- a. $3\vec{u}$
- b. $2\vec{u} - 3\vec{v}$
- c. $\vec{u} \cdot \vec{v}$
- d. $|\vec{u}|$
- e. $\sqrt{\vec{u} \cdot \vec{u}}$
- f. What is the angle between \vec{u} and \vec{v} .

4) Using whatever resource you need to find the appropriate masses and distances, please compute the following forces:

- a. The gravitational force between you and the earth (assume the distance between the two to be the radius of the earth).
- b. The gravitational force between the earth and the sun.
- c. The gravitational force between the earth and the moon.