

**PHY 100S – THE MAGIC OF PHYSICS**  
**Spring Term, 2013**

**HOMEWORK #5**

- DUE:** **By 11:00 AM, Friday, April 5, 2013 in the Drop Boxes**  
Late penalty = 5% per day (which also applies to weekend days) for a maximum of 7 days, after which homework will not be accepted. The final late due date is thus 11:00 AM, Friday, April 12.
- DROP BOXES:** The completed homework assignment should be submitted in the *Drop Box for your tutorial section*. There are six Drop Boxes – one for each tutorial section, clearly labelled. The Drop Boxes are located in the basement of the Burton tower of the McLennan Physics building.
- TEXTBOOK:** All questions are taken from the textbook, *Physics: Concepts and Connections, Fifth Edition*, by Art Hobson, Pearson Education (2010).
- INSTRUCTIONS:** (1) Make sure your name and student number, and the name of your tutor are on your submitted homework, preferably on all pages in case a page comes loose. Staple all pages together.  
(2) Show all your reasoning and work legibly, and draw a box around the final answer where applicable.
- MARKING:** Marks will be given for reasoning, as well as for final answers. Each question is worth 2 marks. Total marks = 20.

**QUESTIONS:**

**Chapter 12, Conceptual Exercises 11/12, 24, 32/24**

- 11/12. Suppose a red light beam has a variable intensity, or brightness. As you increase the intensity, do the energies of the individual photons increase, decrease, or remain the same? As you increase the intensity, does the number of photons emitted each second increase, decrease, or remain the same?
24. If an electron travelling through a double-slit apparatus strikes directly behind slit A, is it correct to say that the electron came through slit A?
- 32/34. In the double-slit experiment with electrons, are there any points where we can predict that an electron will certainly not hit? Would your answer be any different if we were talking about photons instead of electrons?

### Chapter 13, Conceptual Exercises 2, 28, 30

2. If Planck's constant were smaller than it is, how would the uncertainty principle be affected? What if Planck's constant were zero?
28. If a very accurate measurement of an atom's mass could be made in an excited state and in its ground state, would any difference be found? (Hint: Remember  $E = mc^2$ )
30. Among the 10 quantum jumps between the five energy levels of hydrogen shown in Figure 13.21, which one creates the lowest-frequency photon?

### Chapter 14, Conceptual Exercises 2, 6, 14, 22

2. Which force is stronger between two protons separated by  $10^{-10}$  m (the size of an atom), the electric force or the strong force? What evidence do you have for your answer?
6. How do the masses of  $^1\text{H}$ ,  $^2\text{H}$ , and  $^3\text{H}$  compare? How do their charges compare?
14. Can a hydrogen nucleus emit an alpha particle? Explain.
22. Earth is about 4.5 billion years old. Roughly how much  $^{235}\text{U}$  was there on the newly formed Earth as compared with today? (See Table 14.1)