PHYSICS 6 Exam 2 (2006) SOLUTIONS

I. 1b ; 2d; 3d; 4b; 5d; 6d

II. a) $\lambda_1 = 2L = 2\times10^{-7}$ m $\lambda_2 = 10^{-7}$ m

b) $p_1 = h / \lambda_1 = (4.1\times10^{-15}\ \text{eV}\bullet\text{sec})/(2\times10^{-7}\ \text{m}) = 2.05\times10^{-8}\ \text{eV}\bullet\text{sec/m}$
$p_2 = h / \lambda_2 = 2\times p_1 = 4.1\times10^{-8}\ \text{eV}\bullet\text{sec/m}$

c) $E_1 = p_1^2/2m = (p_1c)^2/(2mc^2)$
$= (2.05\times10^{-8}\ \text{eV}\bullet\text{sec/m} \times 3.0\times10^{8}\ \text{m/s})^2 \div (2\times5.1\times10^{5}\ \text{eV})$
$= 3.71\times10^{-5}$ eV
$E_2 = 4\times E_1 = 14.8\times10^{-5}$ eV

d) $E(\text{photon}) = E_2 - E_1 = 1.1\times10^{-4}$ eV $= hf$
$\lambda = c/f = hc/E(\text{photon}) = 4.1\text{x}10^{-15}\text{eV}\bullet\text{s} \times 3\text{x}10^{8}\text{m/s} \div 1.1\times10^{-4}$ eV
$= 1.1\ \text{x}10^{-2}$ m

III. a) probability for one number 3 in one roll
P = 1/6 = 0.167 or 16.7%

b) prob of getting 4 in one roll = 1/6
So prob of 3 or 4 = 1/6 + 1/6 = 1/3

c) prob for no number 3 in one roll = (1-P) = 5/6 = 0.833 or 83.3%

d) prob for EXACTLY TWO number 3's in 4 rolls:
There are 6 combinations that have two number 3's and two not:
(yes-yes-no-no), (yes-no-yes-no), (yes-no-no-yes),
(no-yes-yes-no), (no-yes-no-yes), (no-no-yes-yes)
each of which has a prob of $(1/6)^2\times(5/6)^2$.
So total prob is $6\times(1/6)^2\times(5/6)^2 = 25/6^3 = 0.116$ or 11.6%

IV. For the short paragraph the grade depends on evidence that you have read the play as demonstrated by your use of some appropriate citations to the text. Your choice should refer to a section of the play in which one or more of the characters addresses the analog of the physics concept. Along with the reference a reason for the connection should be provided. Furthermore, an indication that you have some understanding of the physics concept that is involved is essential.