Phys 112 2019

Final Review

Final Review:

Final Time: Weds 15 May 10 am → 11:50 am

Exam covers: All material from semester - Comprehensive

Bring:
* Total of 4 single side 3" x 5" cards
* Calculator

Study: Previous exams including previous finals

2012 v1 and v2 - all questions

2013 all questions

Current Grades - update to include all but final
- final provides 150pts /600
- use syllabus as guide for grade breakdown
  - need a B? Need 79% (78.5%) → 471pts /600pts
  → use current grade...

This review only covers Ch 28,29. For other chapters, consult previous reviews.

Ch 28.2 → 28.6 $E_{photon} = hf = hc/\lambda$. $E_{photon} = |\Delta E_{system}|$ $\lambda = h/mv$

$E_n = \frac{h^2}{8mL^2} n^2$ (particle in box)

Quiz 1 90%

Example: Electrons are fired through identical single slit arrangements in two separate experiments. In both cases the slit width is 1.50×10^{-7} m. The electrons strike a screen / detectors that is 1.25 m from the slit. In experiment A the width of the central bright spot is 2.00×10^{-3} m. In experiment B it is [illegible], i.e 6.00×10^{-3} m. What is the ratio of the speed of the electrons in A to that of B, i.e V_A / V_B.

Answer: The electrons undergo single slit diffraction. The width of the diffraction pattern central max is

$$W = \frac{2\lambda L}{a} \Rightarrow \lambda = \frac{Wa}{2L}$$

Then $\lambda = \frac{h}{mv}$. $\Rightarrow v = \frac{h}{m\lambda}$

Experiment A:

$$\lambda_A = \frac{wa}{2L} = \frac{2.00 \times 10^{-3}\,m \times 1.50 \times 10^{-7}\,m}{2 \times 1.25\,m} = 1.20 \times 10^{-10}\,m$$

$$V_A = \frac{h}{m\lambda_A} = \frac{6.63 \times 10^{-34}\,J \cdot s}{9.11 \times 10^{-31}\,kg \times 1.20 \times 10^{-10}\,m} = 6.06 \times 10^{6}\,m/s$$

Experiment B

$$\lambda_B = \frac{wb}{2L} = \frac{6.00 \times 10^{-3}\,m \times 1.50 \times 10^{-7}\,m}{2 \times 1.25\,m} = 3.60 \times 10^{-10}\,m$$

$$V_B = \frac{h}{m\lambda_B} = \frac{6.63 \times 10^{-34}\,J \cdot s}{9.11 \times 10^{-31}\,kg \times 3.60 \times 10^{-10}\,m} = 2.02 \times 10^{6}\,m/s$$

So $V_A / V_B = \frac{6.06 \times 10^{6}\,m/s}{2.02 \times 10^{6}\,m/s} = 3$

We can show algebraically that the ratio is exactly inverse to that of the central max widths.

Quiz 2 → Typo λ_4

→ 90% → 0

Chapter 29.1 → 29.6

$E_n = \frac{-13.6\,eV}{n^2}$ (Hydrogen) $n = 1, 2, 3, \ldots$

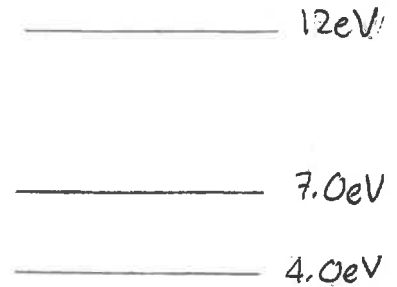
$\ell = 0, 1, 2, \ldots, n-1$

$m = -\ell, -\ell+1, \ldots, \ell-1, \ell$

$m_s = +\frac{1}{2}, -\frac{1}{2}$.

Quiz 3 = 70%

Example: An atom has the illustrated energy level structure.



a) Light with wavelength 310nm is incident on the atom. Will it absorb any of this?

b) Determine the shortest wavelength of light emitted by the atom

c) Could an electron with energy 3.5eV excite the atom?

Answers: a) $E_{ph} = \frac{hc}{\lambda} = \frac{6.63\times10^{-34}\,J\cdot s \times 3.0\times10^{8}\,m/s}{3.10\times10^{-9}\,m}$

$= 6.41\times10^{-19}\,J$

$= 6.41\times10^{-19}\,J \quad \frac{1eV}{1.6\times10^{-19}\,J}$

$= 4.00eV$

No, there is no 4.00eV transition between levels

b) Need largest $E_{ph} = \frac{hc}{\lambda}$ for smallest λ. Thus need largest $|E_{system}| = |12eV - 4.0eV| = 8.0eV$

$\Rightarrow \quad 8.0eV \times 1.6\times10^{-19}\,J/eV = \frac{hc}{\lambda}$

$\Rightarrow \quad 1.3\times10^{-18}\,J = \frac{6.63\times10^{-34}\,J\cdot s \times 3.0\times10^{8}\,m/s}{\lambda}$

$\Rightarrow \lambda = 1.55\times10^{-7}\,m = 155nm$

c) Yes, if the atom were originally in 4.0eV it could absorb 3.0eV and reach the 7.0eV level