

Final: Weds, December 13, 10 - 11:50am

Covers: Entire semester.

Bring: * Calculator - know how to use this.
- must be a calculator that you can use to do HW.

Given: Formulas / equations - front sheets class tests
- front sheet final exam.

Review: ~~2020~~ Final 2021 Final All except Q2, Q11, 19-22
20 2022 Final. All except ... Q4, Q22-26

For formulas consult previous reviews.

Quiz 1

Quiz 2 80% - 90%

Quiz 3 90% - 100

Quiz 4 100%

1 Atom emission

An artificial atom has four energy levels as illustrated. The atom can make transitions between any of these energy states.

Level 4 ——— $11.0 \times 10^{-19} \text{ J}$

Level 3 ——— $8.0 \times 10^{-19} \text{ J}$

Level 2 ——— $5.0 \times 10^{-19} \text{ J}$

Level 1 ——— $2.0 \times 10^{-19} \text{ J}$

- Determine the largest energy that any photon emitted by the atom could have.
- Determine the smallest energy that any photon emitted by the atom could have.
- Determine all possible frequencies of light that can be emitted by this atom.

a, b) In general $E_{\text{photon}} = \text{Energy lost by atom.}$

The atom loses energy in a jump. Possibilities are

	energy lost
4 → 3	$3.0 \times 10^{-19} \text{ J}$
4 → 2	$6.0 \times 10^{-19} \text{ J}$
4 → 1	$9.0 \times 10^{-19} \text{ J} \leftarrow \text{largest}$
3 → 2	$3.0 \times 10^{-19} \text{ J}$
3 → 1	$6.0 \times 10^{-19} \text{ J}$
2 → 1	$3.0 \times 10^{-19} \text{ J} \leftarrow \text{smallest}$

c) $\text{frequency} = \frac{\text{energy photon}}{6.63 \times 10^{-34} \text{ J}\cdot\text{s}}$

for $3.0 \times 10^{-19} \text{ J}$ $\text{freq} = \frac{3.0 \times 10^{-19} \text{ J}}{6.63 \times 10^{-34} \text{ J}\cdot\text{s}} = 4.5 \times 10^{14} \text{ Hz}$

$6.0 \times 10^{-19} \text{ J}$ $\text{freq} = \frac{6.0 \times 10^{-19} \text{ J}}{6.63 \times 10^{-34} \text{ J}\cdot\text{s}} = 9.0 \times 10^{14} \text{ Hz}$

$9.0 \times 10^{-19} \text{ J}$ $\text{freq} = \frac{9.0 \times 10^{-19} \text{ J}}{6.63 \times 10^{-34} \text{ J}\cdot\text{s}} = 1.4 \times 10^{15} \text{ Hz}$

wavelength = $\frac{6.63 \times 10^{-34} \text{ J}\cdot\text{s}}{\text{mass} \times \text{speed}}$
particles

width central = $\frac{2 \times \text{wavelength}}{\text{slit width}} \times \text{distance}$

Quiz 5, ~~80%~~ → 80%

Quiz 6. — 90%

General Course Comments

- Main broad course goals: Show that there are systematic ways to understand the natural world e.g.
 - * Newton's Laws
 - * Energy
 - * Quantum Theory
- Claims about how the physical world works can and must be backed up via evidence from observation
 - * Heliocentric solar system \rightarrow observed planetary retrograde motion
 - * Atoms \rightarrow Brownian motion, chemistry
 - * Particle waves \rightarrow particle interference experiments.

- Other physics courses:

Essential learning: Phys 101

Phys 103/103L

Phys 111 General Physics

112 " "

Phys 131 Fundamental Mechanics

132 Electromagnetism and Optics.