

General Chemistry I
Chapter 7 Example Problems

1. Alarm systems employ the photoelectric effect. Typically, a light beam is aimed at a sample of Na, producing a photoelectric current. An intruder blocks the beam, thereby turning off the current, and triggering the alarm. Given that the work function of Na is $4.41 \times 10^{-19} \text{ J particle}^{-1}$, what wavelengths of light (in nm) can be used in the alarm system?

2. (a) Calculate the frequency (in s^{-1}) of light emitted when He^+ undergoes a transition from the $n = 6$ to the $n = 4$ state. (b) Calculate the wavelength (in nm) ~~and wavenumber (in cm^{-1})~~ of this light. (c) Classify the color of light being emitted.

3. (a) How many subshells (or sublevels) exist with a principal quantum number of $n = 4$? Label each by its value of n and the letter designation for l . (b) How many orbitals make up the $n = 4$ shell? (c) How many electrons can occupy the $n = 4$ shell?

REVISED: Additions to your handout are in red

4. Are the following combinations of quantum numbers allowed? If not, propose a change in one of the quantum numbers that would correct the problem.
- (a) $n = 2; l = 0, m_l = -1, m_s = -1/2$
 - (b) $n = 4; l = 3; m_l = -1, m_s = 0$
 - (c) $n = 3; l = 1; m_l = 0, m_s = +1/2$
 - (d) $n = 5; l = 2; m_l = +3, m_s = +1/2$
 - (e) $n = 3; l = 3; m_l = -2, m_s = -1/2$