

Chem 1104 - 2018 Summer Problem Set #7

1. Calculate the wavelength in meters of electromagnetic radiation with a frequency of 5.5×10^{15} Hz.
2. The photoelectric effect consists of the emission of electrons from the surface of a metal when the metal is exposed to light. A photon with a minimum energy of 3.87×10^{-19} J is necessary to eject an electron from the metal barium. a) What frequency and wavelength(in nanometers) corresponds to this value? b) Will blue light with a wavelength of 450 nm work?
3. a) What is the de Broglie wavelength (in meters) of a baseball weighing 145 g and travelling at 156 km/h(must convert to m/s)?
b) Calculate the mass(in mg) of a flying mosquito with a de Broglie wavelength of 3.10×10^{-31} m and speed of 1.38 m/s?
4. a) What is the wavelength (in nanometers) of electromagnetic radiation which corresponds to the transition from the $n = 6$ level to the $n = 1$ level in the hydrogen atom?
b) A hydrogen atom emits electromagnetic radiation with a wavelength of 434.0 nm when an electron moves from an outer energy level to the $n = 2$ level. What energy level is the electron initially located?
5. a) Calculate the uncertainty in the velocity of a 1.00 g particle if the uncertainty in the position is 0.0100 nm.
b) Calculate the uncertainty in the position of a proton(mass = 1.67×10^{-24} g) if the uncertainty in the velocity of the proton is 1.00 m/s.
6. Write the electron configuration for the following atoms and ions using both the complete notation and shorthand notation. a) Ba; b) Pb; c) Nb^{2+} ; d) Xe; e) Lu^+
7. State the number of unpaired electrons for each of the species in Question #6 and determine if they are paramagnetic or diamagnetic.
8. State the orbital that corresponds to the following quantum numbers:
a) $n = 2, l = 1, m_l = 1$; b) $n = 4, l = 3, m_l = -2$; c) $n = 3, l = 2, m_l = -1$; d) $n = 5, l = 1, m_l = 1$
9. Why can't an electron have the following quantum numbers?
a) $n = 2, l = 2, m_l = 1$; b) $n = 3, l = 0, m_l = 3$; c) $n = 5, l = -2, m_l = 1$

Answer Set for Chem 1104-2018 Summer Problem Set #7

1. $\lambda = 5.5 \times 10^{-8} \text{ m}$

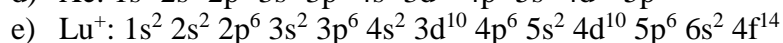
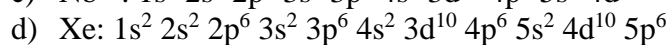
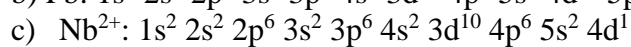
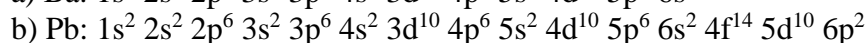
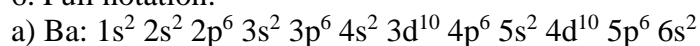
2.a) $\nu = 5.99 \times 10^{14} \text{ Hz}$, $\lambda = 500 \text{ nm}$; b) yes

3.a) $\lambda = 1.06 \times 10^{-34} \text{ m}$; b) mosquito weighs 1.55 mg.

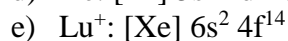
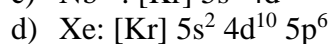
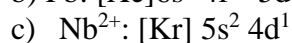
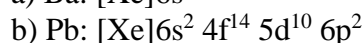
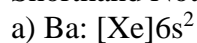
4.a) $\lambda = 93.75 \text{ nm}$; b) $n = 5$.

5.a) $5.28 \times 10^{-21} \text{ m/s}$; b) 31.6 nm

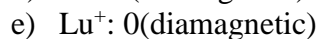
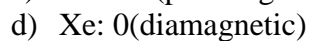
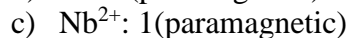
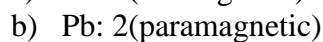
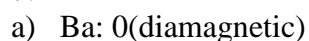
6. Full notation:



Shorthand Notation:



7.



8. a) 2p; b) 4f; c) 3d; d) 5p

9. a) l can not exceed $n-1$. For $n = 2$, $l = 0, 1$.

b) For $l = 0$, m_l must be 0.

c) The orbital quantum number(l) must be positive integers or zero.