CHEM101/3, D1 **Quiz Review Questions** 2010 09 27
HT

1. The operation of conventional fluorescent lights involves transitions of electrons in mercury atoms. The most prominent line of the Hg spectrum is at 253.652 nm. Other lines are at 365.015, 435.833 and 1013.975 nm.

   a. Which line represents the most "energetic line"?

   b. What is the frequency, ν, and energy, E, for this line.

   c. In what region of the general EMR spectrum are each of the above lines found?

2. An electron moves at a speed of 6.00×10^6 m/s with an uncertainty of 1%. What is the uncertainty in its location?

3. The yellow color of the sodium flame test is due to emission of photons at λ = 589 nm. What is the apparent mass of these photons? (Hint: Planck & Einstein)

4. Give all possible m_l values for orbitals with the following quantum numbers:

   a.) ℓ=2 b.) n=1 c.) n=4, ℓ=3

5. Explain briefly why each of the following is not a possible set of quantum numbers

   a.) n=2, ℓ=2, m_ℓ=0 ; b.) n=3, ℓ=0, m_ℓ=1 ; c.) n=3, ℓ=0, m_ℓ= -2

6. What is the max. number of orbitals that can be identified by each of the following sets of quantum numbers?

   a.) m_ℓ=0, n=4, ℓ=3 ; b.) n=5, ℓ=1 ; c.) n=7, ℓ=5 ; d.) n=4, ℓ=2, m_ℓ= -2

7. What is the shortest wavelength photon that a an excited H atom can emit? Calculate & Explain.

8. How many orbitals can have the following quantum number or letter designation?

   a.) 3p, b.) 4p, c.) $4p_x$, d.) n=5, e.) 6d, f.) 5d, g.) 7s

9. The following are hypothetical situations.

   a.) What is the "point probability" of finding a 1s electron at a distance y=d if the probability at x=d is $1x10^{-4}$? What is the probability of finding the electron at z=0.5d, greater or smaller.?

   b.) Assume that the probability of finding a $2p_x$ electron at x=d is $1x10^{-3}$. What is the probability of finding this electron at y=d ?, at z=d ?

10. A ground state H atom absorbs a photon of wavelength 94.91 nm to reach a higher energy level (excited state). Subsequently, the excited atom returns to ground state in a 2-step process by emitting 2 photons in sequence, First, an intermediate level is reached by emission of a "1281 nm" photon. The second photon is emitted when the electron returns from the intermediate level to the ground state.

    a.) What higher level did the atom reach? (n=?)

    b.) What intermediate level was attained? (n=?)

    c.) What is the wavelength of the second photon emitted?

11. Write "standard" and "orbital filling" notations for each of the following:

    a.) Mg, b.) Si, c.) P d.) O^{2-}, e.) Zn^{2+}, f.) Cu, g.) Cr^{3+}

    Use the "shorthand, core" notation. Also write an isoelectronic species for each of the 7 cases.

12. How many unpaired electrons are present in

    a.) Ti^{2+} b.) Fe^{3+} c.) Co^{2+} d.) Fe^{2+}, e.) Cu+

13. Arrange the following atoms in order of a.) increasing size , b.) first ionization energy

    Al, B, C, K, Na

14. a.) Which has the largest (absolute) electron affinity: Se, Cl or Br?

    b.) Which has the largest size: O^{2-}, F^-, F

    c.) Place the following in order of increasing radius: Na, O^{2-}, N^{3-}, F^-.

15. A particular metal surface has a "work function" (binding energy for electrons) = 3.69 x 10^{-19} J. The material is subjected to an experiment to test the photoelectric effect. What will be the speed of the emitted electrons if the wavelength of the light used is a.) 300nm b.) 600 nm?