Chem103 Assignment No. 3

Atomic Structure

MULTIPLE CHOICE QUESTIONS Select the **one best answer** for each question.

A. Which of the following electromagnetic radiation have wavelengths shorter than visible light?

(i) X-rays
(ii) gamma-rays
(iii) ultraviolet rays
(iv) microwaves
(v) radiowaves

1. i
2. ii
3. iii
4. iv and v
5. iii, iv, and v
6. i, ii, and iii

B. A microwave oven emits radiation of a wavelength of 0.500 cm. What is the frequency of this radiation?

1. 1.67×10^{-11} Hz
2. 6.67×10^{-7} Hz
3. 6.00×10^{8} Hz
4. 1.50×10^{6} Hz
5. 6.00×10^{10} Hz
6. 2.00 Hz

C. A common infrared laser operates at 1.06×10^{3} nm. What is the energy of a photon with this wavelength?

1. 7.02×10^{-40} J
2. 6.25×10^{-28} J
3. 3.54×10^{-15} J
4. 1.87×10^{-19} J
5. 2.83×10^{14} J
6. None of these are correct

D. Compared to 800 nm light, 300 nm light has

1. higher frequency
2. lower frequency
3. lower energy
4. greater intensity
5. both 1 and 4 are correct
6. both 2 and 3 are correct

E. According to experiments concerned with the photoelectric effect, which of the following will increase the kinetic energy of an electron ejected from a metal surface?

i) increasing the wavelength of the light striking the surface
ii) increasing the frequency of the light striking the surface
iii) increasing the number of photons of light striking the surface

1. i) only
2. ii) only
3. iii) only
4. i) and ii)
5. i) and iii)
6. ii) and iii)

F. Suppose you have an electron in a hydrogen atom. The electron is originally in the n = 1 orbit with energy = -2.18 x 10^{-18} J. This electron moves to the n = 3 orbit with energy = -2.42 x 10^{-19} J. What is the energy change in this process?

1. 1.94 x 10^{-18} J
2. -1.94 x 10^{-18} J
3. 2.42 x 10^{-18} J
4. -2.42 x 10^{-18} J
5. 0.111 J
6. There is no energy change

G. An electron emits radiation with frequency = 2.465 x 10^{15} Hz as it falls to the n = 1 orbit. From which orbit did this electron fall?

1. n = 7
2. n = 6
3. n = 5
4. n = 4
5. n = 3
6. n = 2

H. What frequency of radiation would be required to promote an electron from the n = 3 to the n = 6 level in a Bohr hydrogen atom?

1. 2.983 x 10^{14} Hz
2. 2.740 x 10^{14} Hz
3. 2.339 x 10^{14} Hz
4. 1.559 x 10^{14} Hz
5. 7.309 x 10^{14} Hz
6. 4.568 x 10^{14} Hz

I. At what velocity would an electron (mass = 9.1 x 10^{-31} kg) has to move to have a de Broglie wavelength of 555. nm?

1. 4.0 x 10^{-10} m/s
2. 7.6 x 10^{-4} m/s
3. 5.2 x 10^{2} m/s
4. 1.3 x 10^{3} m/s
5. 2.5 x 10^{9} m/s
6. 1.5 x 10^{-15} m/s

J. When n = 3, the values of l can be

1. +3, -3, +2, -2, +1, -1, 0
2. +3, +2, +1, 0
3. +2, +1, 0
4. -2, -1, 0
5. +2, +1, 0, -1, -2
6. None of these are possible

K. When l = 2, the values of m_l can be

1. +3, -3, +2, -2, +1, -1, 0
2. +3, +2, +1, 0
3. +2, +1, 0
4. -2, -1, 0
5. +2, +1, 0, -1, -2
6. None of these are possible

L. An electron **cannot** have quantum numbers n = _____, l = _____, m_l = _____

1. 5, 3, +2
2. 3, 2, -1
3. 3, 0, 0
4. 4, 4, -2
5. 5, 3, +3
6. None of these are possible

M. An electron **cannot** have quantum numbers n = _____, l = _____, m_l = _____

1. 6, 0, +1
2. 5, 4, 0
3. 4, 1, -1
4. 3, 2, +2
5. 1, 0, 0
6. All are possible

N. What type of orbital is designated by n = 3, l = 2, and m_l = -1?

1. 3s
2. 3p
3. 3d
4. 2f
5. 2d
6. 4s

O. What type of orbital is designated by n = 4, l = 0, and m_l = 0?

1. 3s
2. 3p
3. 3d
4. 2f
5. 2d
6. 4s

PROBLEM QUESTION (wt = 3): You can skip the unit for this question but to obtain full credit your answer must have the correct significant digits.

P. A laser used to weld detached retinas produces radiation with a frequency of 4.69×10^{14} s^{-1}. What is the wavelength of this radiation in nm?

ANSWER LIST – Please prepare a list of answers similar to the table below for uploading on the computer in the P-469 lab. You should write this table and the answer to the problem question in the same notebook, where you have worked out these problems and bring it to the lab.

Multiple choice:

No.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Answer															

Problem: _____ Name: _____