Honors Review ch. 4

1. State the four quantum numbers, then explain the possible values they may have and what they actually represent.

Principal Quantum #, represents Energy Level, n = 1, 2, 3, 4, ...
Angular Momentum #, represents Shape, l = n-1 l=0 s l=1 p l=2 d l=3 f
Magnetic Quantum #,

2. State the number of possible electrons described by the following quantum numbers

a. n = 3, l = 0 3s → 2 electrons
b. n = 3, l = 1

c. n = 3, l = 2, ml = -1 → 2 electrons
d. n = 5, l = 0, ml -2, ms -1/2

3. Give the n and l values for the following orbitals

a. 1s n=1 l=0
b. 3s n=3 l=0
c. 2p n=2 l=1
d. 4d n=4 l=2
e. 5f n=5, l=3

4. What are the m_l values for the following types of orbitals?

a. s $m_l = 0$

b. p $m_l = -1, 0, +1$
c. d $m_l = -2, -1, 0, +1, 2$
d. f $m_l = -3, -2, -1, 0, 1, 2, 3$

6. How many possible orbitals are there for n = ; how many electrons?

a. 4 n^2 $4^2 = 16$ orbitals $2n^2 = 2(4)^2 = 32$ electrons
b. 6 n^2 $6^2 = 36$ $2(6)^2 = 72$ electrons

7. Write the electron configurations (practice the long and the shortcut way and orbital notation)

a. He $1s^2$, [He] 1s ↑↓
b. V $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$ [Ar] $4s^2 3d^3$
c. Ni $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$ [Ar] $4s^2 3d^8$
d. Cu $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$ [Ar] $4s^2 3d^9$
e. Br

[Ar] $4s^2 3d^{10} 4p^5$

8. Draw a violation for each of the Rules (use orbital notation to demonstrate this)

a. Hund's Rule –

3p ↑↓ ↑ ___ should be 3p ↑ ↑ ↑

b. Pauli's Exclusion Principle

1s ↑↑ should be → 1s ↑↓

c. Aufbau's Principle

2s ↑↓ should be → 2s ↑
1s ↑ 1s ↑↓

9. Electromagnetic radiation was detected with a frequency of 3×10^{10} Hz. What is the wavelength of this wave?

$c = \lambda \nu$

$3 \times 10^8 / 3 \times 10^{10} = \lambda$

$\boxed{\lambda = .01\,m}$

10. What color has the longest wavelength?

Red (lowest energy)

11. What is the frequency of UV light that has an energy of 2.39×10^{-18} J?

$E = h\nu$

$2.39 \times 10^{-18} = 6.626 \times 10^{-34} \cdot \nu$

$\boxed{3.61 \times 10^{15}\,Hz = \nu}$

12. What is the wavelength and frequency of photons with an energy of 1.4×10^{-21} J?

$E = h\nu$

$1.4 \times 10^{-21}\,J = 6.626 \times 10^{-34}\,\nu$

$\boxed{\nu = 2.1 \times 10^{12}\,Hz}$

$c = \lambda \nu$

$3 \times 10^8 = \lambda \cdot 2.1 \times 10^{12}$

$E = \frac{hc}{\lambda}$

$\boxed{1.4 \times 10^{-4}\,m}$

13. What is the energy of a light that has 434 nm?

$434\,nm \times \frac{1\,m}{10^9\,nm} = 4.34 \times 10^{-7}\,m$

$E = \frac{h \cdot c}{4.34 \times 10^{-7}}$

$\boxed{E = 4.58 \times 10^{-19}\,J}$

14. Describe the relationship between the variables Energy, wavelength and frequency.

E is directly related to ν and inversely related to λ. λ + ν are inversely related

15. Know the constants for the speed of light equation and the energy equation.

$c = 3.00 \times 10^8\,m/s$ $h = 6.626 \times 10^{-34}\,J \cdot s$

16. Understand the concepts behind the flame test and gas discharge tubes.