Problem Set 8

1) $\nu = \frac{c}{\lambda}$ $\quad c = 3.00 \times 10^{8} \frac{m}{s}$

$89.7 \times 10^{6}\ s^{-1}$

$89.7 \times 10^{6}\ s^{-1} = \frac{3.00 \times 10^{8} \frac{m}{s}}{\lambda}$

$\lambda = 3.34\ m$

2) a. $E = \frac{hc}{\lambda} = \frac{(6.626 \times 10^{-34}\ J \cdot s)(3.00 \times 10^{8}\ \frac{m}{s})}{486.1 \times 10^{-9}\ m}$

$= 4.09 \times 10^{-19}\ J$

b. $4.09 \times 10^{-19}\ J \times 6.022 \times 10^{23} = 2.46 \times 10^{5}\ J$

3) e) Heisenberg

4) $\lambda = \frac{h}{m\nu} = \frac{(6.626 \times 10^{-34}\ \frac{kg \cdot m^2}{s^2}\ s)}{(0.04\ kg)(20.0\ \frac{m}{s})}$

$= 8.29 \times 10^{-25}\ nm$

5) $\lambda = \frac{h}{m\nu} = \frac{(6.626 \times 10^{-34}\ \frac{kg \cdot m^2}{s^2}\ s)}{(9.1 \times 10^{-31}\ kg)(7.0 \times 10^{6}\ \frac{m}{s})}$

$= 1.0 \times 10^{-10}\ m$

6) c) Pauli

7) Co (Z=27): $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$

8) Ca (Z=20) $1s^2 2s^2 2p_x^2 2p_y^2 2p_z^2 3s^2 3p_x^2 3p_y^2 3p_z^2 4s^2$

9)

1s	2s	$2p_x$	$2p_y$	$2p_z$
↑↓	↑↓	↑	1	1

10)

1s	2s	$2p_x$	$2p_y$	$2p_z$	3s	$3p_x$	$3p_y$	$3p_z$
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑	1

2 unpaired

11) Cr y Cu

12)

1s	2s	$2p_x$	$2p_y$	$2p_z$	3s	$3p_x$	$3p_y$	$3p_z$	4s	3d	3d	3d	3d	3d
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	1	1	1	1	1	1

6 unpaired

13) 3s 4s 3d 4p 5s 6s 4f

14) a. No; $m_s = \frac{1}{2}; -\frac{1}{2}$

b. No; $\ell = 0 \ldots n-1$

c. Yes

d. No; $m_\ell = -1, 0, 1$

e. No; $m_\ell = 0$

f. Yes

20) In Bohr's model, the e^-s orbit around the nucleus at a fixed distance. In Schrodinger's concept, an orbital is a quantum mechanical model of the atom ~~describing~~ that represents the ~~distribution of an e^-~~ probable distribution of an e^- around the nucleus.

15) 1 number (n) describe a principal level
2 numbers (n, l) describe a sublevel
3 numbers (n, l, m_l) describe an orbital
4 numbers (n, l, m_l, m_s) describe an electron

a. O
b. S
c. N
d. E
f. O
g. S

16) a. $2n^2$
b. 5 orbitals

17) a. n sublevels
b. n^2 orbitals

18) "Estado raso" → ground energy state → lowest energy
"Estado excitado" → excited energy state → higher energy

Excited ___1___
ground ___1___
↑ Absorb a photon to transition from lowest to higher energy state
When photon is released then the e^- returns to the ground state.

19) n = 1, l = 0 (s orbital), 1 orbital, 2 e^-
(1 sublevel; 2 sublevels)
n = 2, l = 0, +1, 4 orbitals, 8 e^-
n = 3, l = 0, 1, 2, 9 orbitals, 18 e^-
3 sublevels,