CHM 1045 (11:15 am Lecture) **HOUR TEST 3** **Name _____**
Dr. Light **March 29, 2004** **(please print)**

Check your recitation section:
___Sec. 21 5:30-6:20 pm (Popovic) **___Sec. 24 3:30-4:20 pm (Giunta)**
___Sec. 22 6:30-7:20 pm (Popovic) **___Sec. 25 4:30-5:20 pm (Giunta)**
___Sec. 23 7:30-8:20 pm (Popovic) **___Sec. 26 5:30-6:20 pm (Giunta)**

Please note: The final exam is at a block exam time, and in a different location: 12:30-2:30 pm Monday, April 26, in room 102 Bellamy

This exam consists of 4 pages. Make sure you have one of each. Print your name at the top of each page now. A fifth page contains a periodic chart and some equations and constants you may need. You may tear it off and use it for scratch paper. Show your work on calculations, including unit conversions, and give answers in the correct units and appropriate number of significant figures. **In problems involving molecular and formula weights, you may use values rounded to the nearest 0.1 amu.**
If anything confuses you or is not clear, raise your hand and ask!

Page	**Points**
1	_____
2	_____
3	_____
4	_____
Total	**_____**

Points

(4) 1. For the following four types of electromagnetic radiation, **circle** the one with the longest wavelength, and **underline** the one with the shortest wavelength.

ultraviolet **microwave** **infrared** **x-ray**

(4) 2. For the following types of electromagnetic radiation, **circle** the one with the greatest energy per photon, and **underline** the one with the lowest energy per photon.

infrared **gamma ray** **ultraviolet** **visible**

(6) 3. What is the wavelength of a photon emitted by an excited hydrogen atom when an electron drops from the **fourth** shell (n=4) to the **second** shell (n=2)?

4. The *work function* of an element is the energy necessary to remove an electron from its surface. The work function of copper is 449 kJ/mol.

(4) (a) What is the longest wavelength of light that would have enough energy to eject an electron from copper?

(5) (b) If radiation with a wavelength of 215 nm struck the surface of copper, what is the maximum kinetic energy an emitted electron could have?

(6) 5. Many FSU sports events are carried on **94.9 FM**. The frequency of this signal is 94.9 MHz. (Remember, M stands for **Mega**, or 10^6, and Hz has the units s^{-1}.) Calculate the **wavelength** and **energy** of a photon of radio waves carrying this signal.

(6) 6. Electron microscopes depend upon the wave properties of electrons, and the resolution can be no smaller than the deBroglie wavelength of the electron. What velocity must an electron beam have to achieve a deBroglie wavelength of 2.5 nm, about the width of a molecule of DNA? (The mass of the electron is **9.109×10^{-31} kg**).

(12) 7. Give the **symbol**, and the **number of unpaired electrons** for the atoms with the following electron configurations:

	Symbol	Number of unpaired electrons
$[Ne]3s^2 3p$		
$[He]2s^2 2p^3$		
$[Ar]4s^2 3d^7$		
$[Kr]5s^2 4d^2$		

(12) 8. Give the electron configuration for the following atoms or ions. (You may use either the complete configuration, or the condensed configuration as shown in question 8.)

Ra	Si
Fe	O^{1-}
Ni^{2+}	As

(8) 9. Give the name of the orbital occupied by an electron with the following sets of quantum numbers. If the set is not an allowed set, write **none** in the space.

Orbital	**Quantum numbers**			
_____	n = 4	l = 2	m_l = +1	m_s = +1/2
_____	n = 1	l = 1	m_l = 0,	m_s = -1/2
_____	n = 3	l = 1	m_l = -2	m_s = +1/2
_____	n = 5	l = 3	m_l = +3	m_s = -1/2

(9) 10. In each of the following lists of four atoms or ions, **circle** the largest and **underline** the smallest.

(a) S Na K Cl

(b) Mg K Si Ca

(c) O^{2-} S^{2-} F^{-} Cl^{-}

(9) 11. In each of the following lists of four elements, **circle** the one with the highest ionization energy, and **underline** the one with the lowest ionization energy.

(a) K Li Be Cs

(b) C O Na Li

(c) Al K Ar P

(8) 12. Circle the oxides in the following list which react with water to form **acids**.

SO_2	CaO	Na_2O	ClO
BrO_2	Cu_2O	P_2O_5	K_2O

(4) 13. State the **Pauli Exclusion Principle**.

(3) 14. "When orbitals of equal energy are available, the electron configuration of the lowest energy has the maximum number of unpaired electrons with parallel spins." (In other words, in aufbau, subshells fill singly first, with spins parallel, before an orbital gets two electrons). This statement is known as _____ **rule**.

1A												3A	4A	5A	6A	7A	8A
1 H 1.008	2A																2 He 4.003
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3B	4B	5B	6B	7B	|------	8B	------|	1B	2B	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.4	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 La* 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.03	89 Ac** 227.03	104 Rf (263)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (269)	109 Mt (268)	110 Uun (272)	111 Uuu	112 Uub	113	114 Uuq	115	116 Uuh	117	118 Uuo

*Lanthanides	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
** Actinides	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (254)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

The following constants and equations may be of use:

Rydberg constant = 1.097 x 10^{7} m^{-1}
$1/\lambda$ = 1.097 x 10^{7} m^{-1} ($1/n_1^2 - 1/n_2^2$)
Planck's constant, h = 6.626 x 10^{-34} J-s (or kg-m^2/s)
Speed of light, c = 3.00 x 10^{8} m/s
Energy of 1s orbital in the hydrogen atom = -2.18 x 10^{-18} J (also = Rydberg constant x hc)
λ = **h/mv**
$\Delta x \cdot m\Delta v \geq$ **h/4**π
E = $h\nu$
N = 6.022 x 10^{23} entities/mol