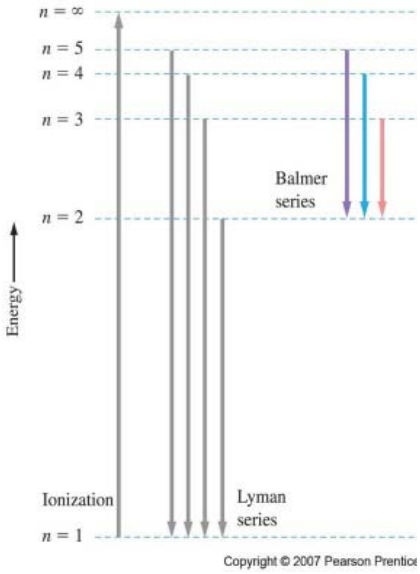
CHEM 131 **Name** _____
Quiz 1 – Jan. 20, 2012

Complete the following problems. You must show your work to receive full credit. Show your answers to the correct number of significant figures with the correct units.

1. Without doing any detailed calculations, indicate which of the following electronic transitions in a hydrogen atom results in the emission of light of the longest wavelength. (a) n = 4 to n = 3, (b) n = 2 to n = 1, (c) n = 6 to n = 1, (d) n = 3 to n = 2. Justify your answer. (8 pts)

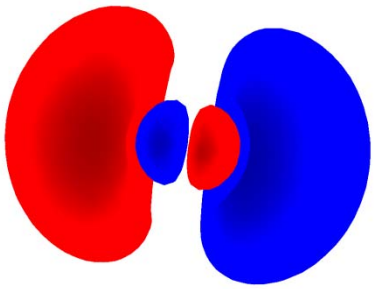
Since energy is inversely proportional to wavelength, the longest wavelength transition corresponds to the lowest energy. So, of our four choices, which should have the lowest energy? It might be easiest to think of the energy level diagram at the right. The n=6 to n = 1 transition would have the largest energy, because the difference between n is the greatest. The other transitions have the same difference in n, so we have to look harder. As n increases, the separation between successive values for n decreases, meaning the levels is closer in energy. **Therefore, we would expect the n=4 to n=3 transition to have the lowest energy.** You could also do a calculation to confirm this using the following equation for the four combinations of n.



$$\Delta E = -R_H\left(\frac{1}{n^2_{final}} - \frac{1}{n^2_{initial}}\right)$$

2. Sketch an example of each of the two orbitals below. For each orbital indicate the number of radial and angular nodes. (8 pts)

These are examples of the types of representations I would expect to see.

Orbital	n = 3, ℓ = 0	n = 3, ℓ = 1
Sketch	**This is a 3s orbital** 	**This is a 3p orbital** 
Number of Radial Nodes	**n – ℓ – 1 = 2**	**n – ℓ – 1 = 1**
Number of Angular Nodes	**ℓ = 0**	**ℓ = 1**

3. Using spectroscopic notation, write the electron configuration for the following species. Indicate the number of unpaired electrons in each. (3 points each)

a. phosphorous

electron configuration:	$1s^2 2s^2 2p^6 3s^2 3p^3$ or [Ne] $3s^2 3p^3$
# of unpaired electrons:	3

b. bromine

electron configuration:	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$ or [Ar] $4s^2 3d^{10} 4p^5$
# of unpaired electrons:	1

c. uranium

electron configuration:	[Rn]$7s^2 5f^4$ or [Rn]$7s^2 6d^1 5f^3$
# of unpaired electrons:	4

Possibly Useful Information

$h = 6.63 \times 10^{-34}$ Js	$c = 3.00 \times 10^{8}$ m/s	$R_H = 2.179 \times 10^{-18}$ J/atom
$E = h\nu$	$\nu\lambda = c$	$\Delta E \bullet \Delta(mv) > h$
$H\psi = E\psi$	$E = -\frac{R_H}{n^2}$	$\Delta E = -R_H\left(\frac{1}{n_{final}^2} - \frac{1}{n_{initial}^2}\right)$

1 1A												13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1 H 1.00794	2 2A																2 He 4.00260
3 Li 6.941	4 Be 9.01218											5 B 10.811	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.1797
11 Na 22.9898	12 Mg 24.3050	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	13 Al 26.9815	14 Si 28.0855	15 P 30.9738	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.9961	25 Mn 54.9381	26 Fe 55.847	27 Co 58.9332	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.9059	40 Zr 91.224	41 Nb 92.9064	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.906	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.757	52 Te 127.60	53 I 126.904	54 Xe 131.29
55 Cs 132.905	56 Ba 137.327	57 *La 138.906	72 Hf 178.49	73 Ta 180.948	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.025	89 †Ac 227.028	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (271)	111 Rg (272)							

*Lanthanide series	58 Ce 140.115	59 Pr 140.908	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.967
†Actinide series	90 Th 232.038	91 Pa 231.036	92 U 238.029	93 Np 237.048	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)