US 110 Exam 3. November 18, 2005

Name_____

You must show all work for credit. By submitting this assignment, I certify that I have neither given nor received unauthorized aid.

Useful Information: $\lambda\nu=c$, $c=3{,}00 \times 10^8$ m/s

(1)(4 pts) A radio station broadcasts a radio signal with a frequency of 1100 kHz. What is the wavelength of this radiation? Is it an FM or AM station?

(2)(2 pts) Put the following atoms in order from smallest to largest:

K, Ca, Rb, F, Cl

(3) (4 pts) Define the following:

(a) Hund's Rule

(b) The Aufbau Principle

(4)(4 points) Answer the following questions about quantum numbers.

(a) If l=4, how many electrons can the subshell hold?

(b) How many electrons can the n=3 shell hold (all subshells combined)?

(5)(2 points) Draw a picture of the orbital with the following quantum numbers: n=4, l=2, m_l=-1.

(6)(2 points) Place the following in the order of increasing electronegativity:
Cs, As, Ca, S, He

(7)(2 points) Place the following in the order of increasing size:
P, Cl, P^{3-}, Cl^-

(8)(2 points) Which third row element should have the highest 3rd ionization energy?

(9)(2 points) Place the following in the order of increasing electron affinity:
B, Ga, N, Ba, Cs

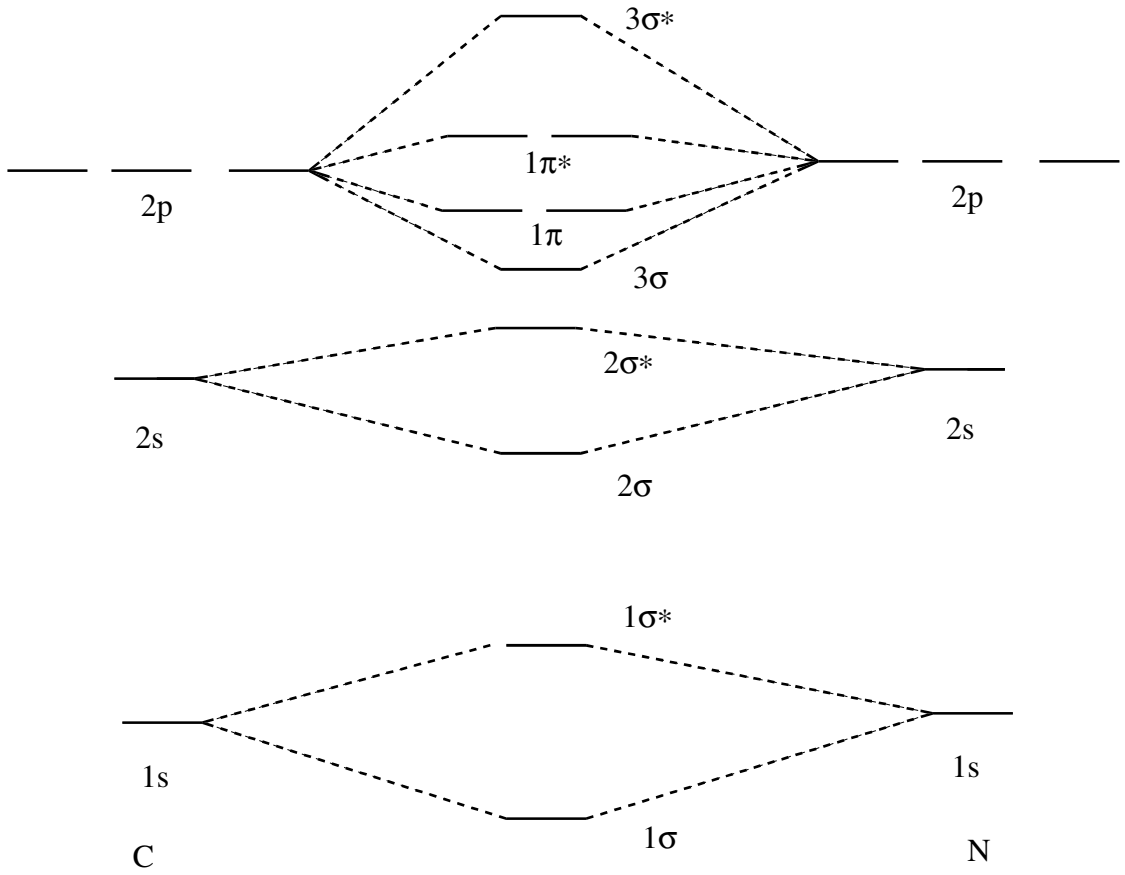
(10)(4 points) Draw the best Lewis dot structure(s) for SO_4^{2-}. Remember formal charge considerations.

(11)(8 points) Draw the Lewis dot structures for the following species. Draw the 3D stucture (VSPER) and give the name of the geometry. Then, list the hybridization of the central atom.

(a) PF_6^-

(b) SN_2

(12)(6 points)



(a) What is the ground state electron configuration of CN?

(b) What is the bond order of CN?

(c) What should have a shortest bond distance, CN, CN^+ or CN^-?

(13)(4 points) Using the MO diagram in problem 12, write the ground state molecular orbital configurations for the following diatomic molecules and ions

(a) NO^-

(b) OF

(14)(8 points) Create a Born-Haber cycle to find the ΔH for the reaction below using the following information.

$Mg(s) + F_2(g) \text{ -----> } MgF_2(s)$ $\Delta H = ??$

F_2 bond dissociation energy = 155 kJ/mole

Mg $\Delta H_{sublimation}$ = 146 kJ/mole
Mg (g): E_{i1} = 782 kJ/mole, E_{i2} = 1451 kJ/mole
F(g) Electron Affinity = -328 kJ/mole
U for the reaction is 1950 kJ/mole

Extra Credit (4 points): Determine the wavelength of an electron for each of the following situations.

(a) The electron has a velocity of 300,000 m/s

(b) The electron has a velocity of 300 m/s

(c) Is the electron more wavelike or more particle-like at high velocities? Why?