

Chem 1114 Test 3.

Name _____

Useful information: Formal Charge = $E_{\text{valence}} - (E_{\text{nonbonding}} + \# \text{ bonds})$, $\lambda v = c$, $c = 3.00 \times 10^8 \text{ m/s}$,

$$\lambda = \frac{h}{mv}, \quad \frac{1}{\lambda} = R_H \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right), \quad R_H = 0.01097 \text{ nm}^{-1}, \quad 1 \text{ Hz} = 1/\text{s}, \quad h = 6.626 \times 10^{-34} \text{ Js}, \quad U = f \times \frac{Z_1 Z_2}{d^2}$$

(1)(2 points) What is Hund's Rule?

(2)(4 points) What type of orbital is described by the following quantum numbers?

(a) $n=3, l=2, m_l=1$

(b) $n=1, l=0, m_l=0$

(3)(4 points) Write out the ground state electron configuration for the following atoms or ions (do not use the noble gas shortcut)

(a) Li^+

(b) N

(c) Co

(d) O^{2-}

(4)(2 points) Place the following elements in order from smallest to largest atomic radii.

Cs, F, Mg, S, Fe

(5)(2 points) Which of the following should have the largest first ionization energy?

Li, F, Be, N

(6) (2 points) Place the following in order of increasing electronegativity

Cs, F, Ca, S, Fe

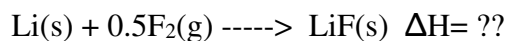
(7)(4 pts) A radio station broadcasts a radio signal with a frequency of 99.5 MHz. What is the wavelength of this radiation? Is it an FM or AM station?

(8)(4 pts) What did Einstein discover about light?

(9)(2 points) Place the following in order of increasing lattice energy.
CsCl, Mg₃N₂, LiBr, MgF

(10)(4 points) An electron in a hydrogen atom falls from the n=6 to the n=5 level. What is the wavelength of light emitted in this process?

(11)(8 points) Create a Born-Haber cycle to find the ΔH for the reaction below using the following information.



F₂ bond dissociation energy = 155 kJ/mole

Li $\Delta H_{\text{sublimation}}$ = 150 kJ/mole

Li(g): E_{i1} = 520 kJ/mole, E_{i2} = 7298 kJ/mole

F(g) Electron Affinity = -328 kJ/mole

U for the reaction is 1036 kJ/mole

(12)(9 points) Draw the Lewis dot structures for the following species. Draw the 3D structure (VSEPR), give the name of the geometry, and the bond angles.

(a) SO₃²⁻

(b) PH₃

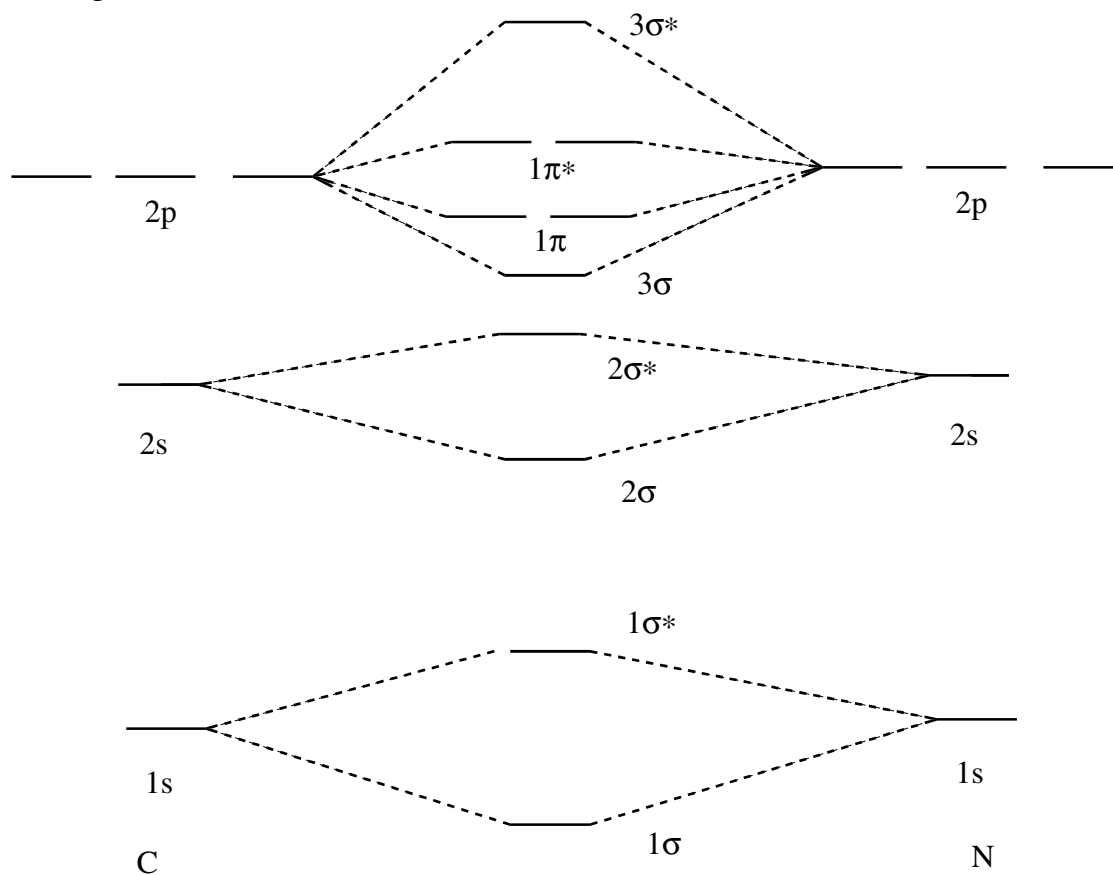
(c) SH_2

(13)(6 points) List the hybridization of the central atom for each of the following species. Draw a sketch of the bonding (valence bond sketch).

(a) PH_3

(b) SH_2

(14)(8 points)



- (a) What is the ground state electron configuration of NO?
- (b) What is the bond order of NO?
- (c) What should have a shortest bond distance, NO, NO⁺ or NO⁻?

(15)(4 points) If a hot piece of metal is dropped into a cup of water, the water heats up. Is the cooling of the metal an exothermic or endothermic process?