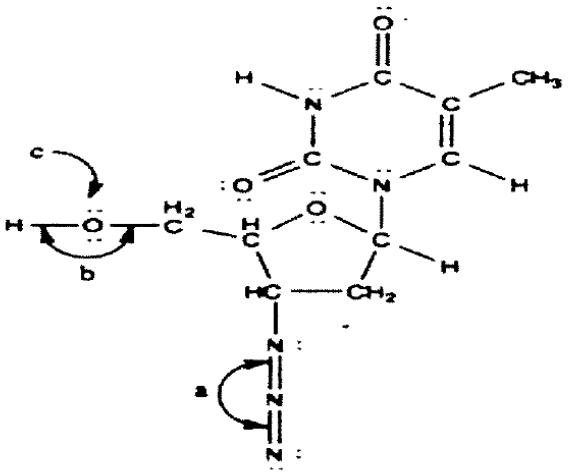
General Chemistry I
PLI Sheet 16
June 28, 2021

1. **One of the first drugs to be approved for use in treatment of HIV/AIDS was azidothymidine (AZT). The complete Lewis structure of AZT is shown below:**



   a. **How many carbon atoms are sp^3 hybridized?**
   b. **How many carbon atoms are sp^2 hybridized?**
   c. **Which atom is sp hybridized?**
   d. **How many σ bonds are there?**
   e. **How many π bonds are in the molecule?**
   f. **What is the bond angle marked a?**
   g. **What is the bond angle marked b?**
   h. **What is the hybridization of atom c?**
   i. **What is the bond order of the central N in a?**

2. **Each of the following molecules contains at least one multiple (double or triple) covalent bond. Give a plausible Lewis structure for:**

OCS	CH_3CHO	F_2CO	Cl_2SO	C_2H_2

3. **Which of the following molecules would you expect to be polar?**

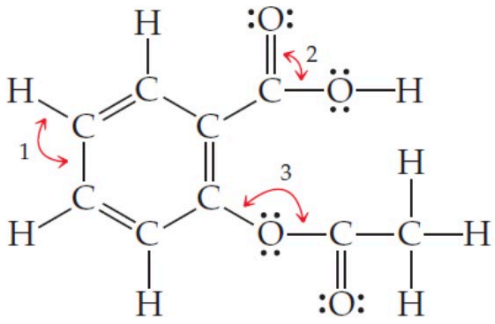
(a) NH_3 (b) H_2S (f) OCS (e) POF_3

(d) SO_3 (e) CS_2 (c) C_2H_4 (g) $SOCl_2$ (h) SiF_4

4. **Estimate ΔH_{rxn} for the following unbalanced reaction using bond dissociation enthalpy values.**

$$\boldsymbol{CH_4(g) + O_2(g) \rightarrow CH_3OH(g)}$$

5. **Acetylsalicylic acid, better known as aspirin, has the Lewis structure:**

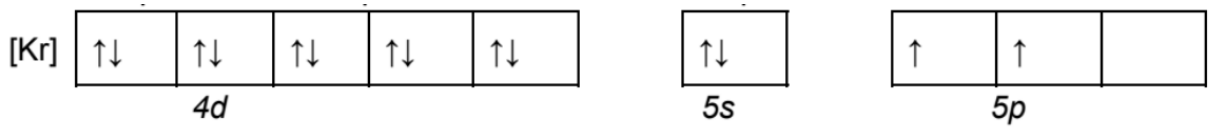


   a. **What are the approximate values of the bond angles labeled 1, 2, and 3?**

   b. **What hybrid orbitals are used about the central atom of each of these angles?**

   c. **How many σ bonds are in the molecule? How many?**

6. **What is a possible set of quantum numbers for an unpaired electron in the orbital box diagram below?**



   a. n=1, l=1, m_l = -1, m_s = +½
   b. n=4, l=2, m_l = -1, m_s = -½
   c. n=5, l=2, m_l = -2, m_s = +½
   d. n=5, l=0, m_l = 0, m_s = -½
   e. n=5, l=1, m_l = -1, m_s = +½

   What element is this?

7. Using the molecular orbital (MO) model, please:

a) Label each orbital and fill in the MO diagrams:
b) Calculate the bond order:
c) Identify each species as diamagnetic or paramagnetic:

Li_2 N_2