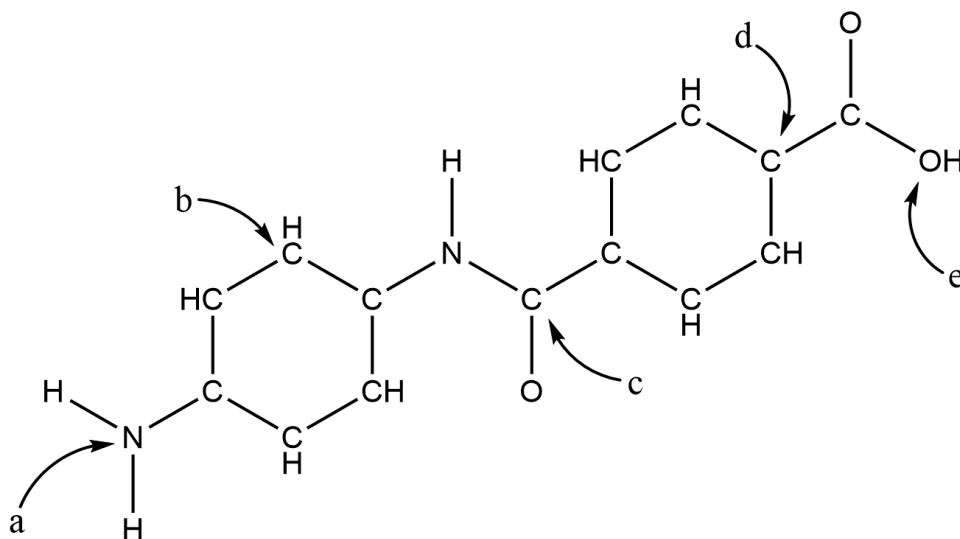CHEM 103
R&R 15
21 June 2024
Adapted from a 25 June 2021 document

1.

a. Complete the structure above by adding bonds and lone pairs. Every atom will have a complete octet and formal charge of zero. What is the hybridization of the atoms marked (a) through (e)?

  a: b: c: d: e:

b. How many σ bonds are in the structure above? How many π bonds?

c. Circle all of the polar bonds.

d. What are the bond angles at atoms (a) through (e)?

 a: b: c: d: e:

2. Complete the following table:

Number of regions of high e⁻ density	Electron pair geometry name	Hybridization	Angle btwn electron density regions	Total hybrid orbitals	Number of p orbitals left over
2					
3					
4					

3. Fill out the following table:

Name & Lewis structure	3D Structure	Electron pair geometry name	Molecular geometry name	Hybridization of each central atom	Polarity of molecule
Ammonia					
H_2O_2					
SF_5^-					
BH_2^-					
HCN					

4. Balance the following reaction. Then, using bond dissociation enthalpies from the book, lecture slides, or an online source, calculate the bond dissociation enthalpy of the O-F bond. The ΔH_{rxn} = -318 kJ mol^{-1}.

$$OF_2 \text{ (g)} + H_2O \text{ (g)} \rightarrow O_2 \text{ (g)} + HF \text{ (g)}$$
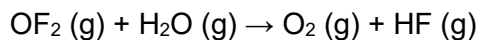
5. Draw a likely spatial orientation of a single water molecule with a single molecule of NaCl.

6. True or False:

a. The principal quantum number (n) associated with an f orbital must be ≥4.

b. For an electron to go from a lower energy level to a higher energy level, a photon must be absorbed.

c. The freezing of water is an endothermic process.

d. The first ionization energy of Li is less than the second ionization energy of Li.

e. The electronegativity of H is less than that of Mg.

f. Cation are always larger than the neutral atom of the same element.

7. Name three atoms or ions that are described by the electron configuration: $[Ar]4s^23d^{10}4p^5$