Unit 6 Practice - ANSWERS

1. In each pair of bonds, predict which is shorter. Support your answers.

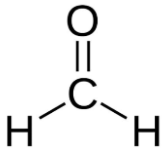
   a. B–Cl bond
   - Cl in common
   - B and Ga are in the same family.
   - B is in the 2nd row
   - Ga is in the 4th row, so a larger atom with an extra shell. Lower Zeff.

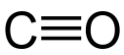
   b. P-O bond
   - P in common
   - S and O are in the same family.
   - O is in the 2nd row
   - S is in the 3rd row, so a larger atom with an extra shell. Lower Zeff.

   c. C-O bond
   - O in common
   - Sn and C are in the same family.
   - Sn is in the 5th row so a larger atom with an extra shell. Lower Zeff.

   d. C=O bond
   - C in common.
   - N and O are all in the same row, and so they all have the same number of shells.
   - However, as you go to the right on the periodic table, EN increases, as does Zeff.
   - Therefore, C=O will have smaller bonds because higher Zeff in oxygen.

2. In which molecule is this bond shorter? In which molecule is it stronger? Why?





   The triple bond in carbon monoxide is both shorter and stronger than the double bond in formaldehyde. At this point, see it as more electrons are being shared and so there is a stronger attraction to the nucleus. However, it has more to do with sigma and pi bonds which will be developed in the next unit.

3. For each of the following pairs of bonds:

   a. C–O C–N

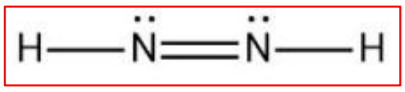
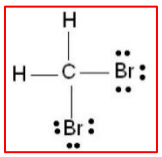
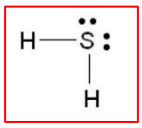
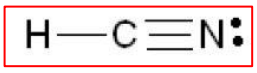
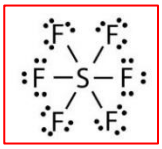
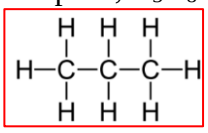
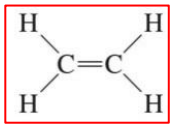
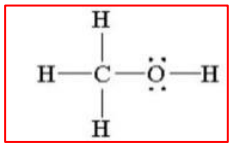
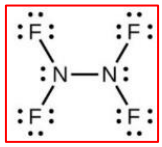
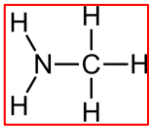
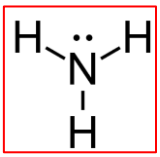
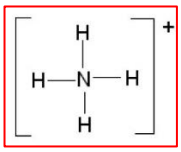
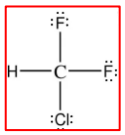
   +δ -δ +δ -δ

   C in common.
   O is more to the right on the periodic table than N.
   O has a higher Zeff, and more attraction for shared electrons.
   C-O is more polar.

b. P–Br P-Cl
+δ -δ +δ -δ
P in common.
Cl is higher in the family than Br.
Cl has a higher Zeff, and more attraction for shared electrons.
P-Cl is more polar.

4. Classify the identified bond in the following molecules as ionic, polar covalent, or nonpolar covalent:
   a. Si-Cl bond in $SiCl_3$
      Cl is higher and more to the right on the PT than Si, therefore it is more EN.
      Polar covalent bond.
   b. Ca-F bond in CaF_2
      Calcium is a metal and fluorine is a nonmetal. EN very different. Ionic.

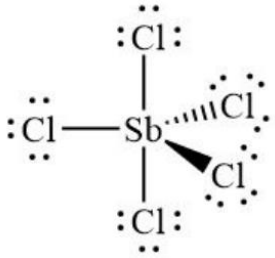
5. Choose 5 molecules from the **List of Lewis Structures**.

N_2H_2 	CH_2Br_2 	H_2S 	HCN 
SF_6 	Propane, C_3H_8 	Ethene, C_2H_4 	Methanol, CH_3OH 	N_2F_4 
Methylamine, CH_5N 	Ammonia, NH_3 	Ammonium, NH_4^+ 	$CHClF_2$ 

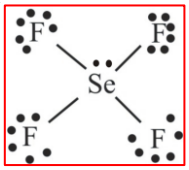
6. Write Lewis structures for all the species in this reaction:

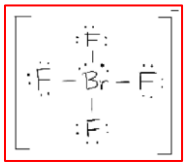
$AlCl_3$	+	Cl^-	→	$AlCl_4^-$
3 + 3(7) = 24		7 + 1 = 8		3 + 4(7) + 1 = 32

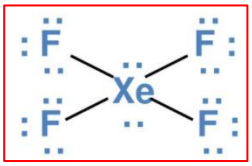
7. $SbCl_5$:
No because since antimony is in the 5th row, it is a large atom, and it can accommodate more than 8 valence electrons (expanded octet).



8. Expanded octet: SeF_4, BrF_4^-, XeF_4

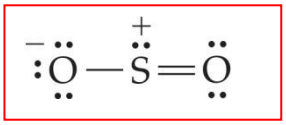




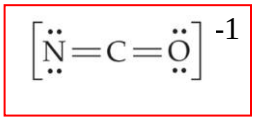


9. SO_2 and $(CNO)^{-1}$:
Formal charge = Group # - # bonds – # Nonbonding electrons

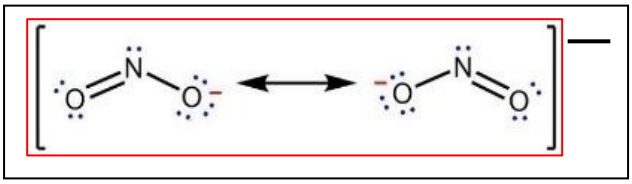
For sulfur: 6 – 3 – 2 = +1
For single bonded oxygen: 6 – 1 – 6 = -1
For double bonded oxygen: 6 – 2 – 4 = 0



For N: 5 – ½ (4) – 4 = -1
For C: 4 – ½ (8) – 0 = 0
For O: 6 – ½ (4) – 4 = 0



10. Resonance structures for nitrite ion:
11.



FC N = group # - (# bonds) – (# le)
= 5 – 3 – 2
= 0
FC O (=) = group # - (# bonds) – (# le)
= 6 – 2 – 4
= 0
FC O (-) = group # - (# bonds) – (# le)
= 6 – 1 – 6
= -1

FC N = = 0
FC O (=) = 0
FC O (-) = -1