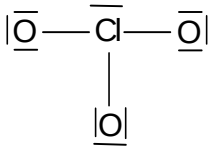
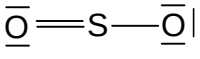
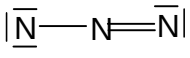
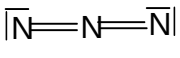
Practice Assignment-5

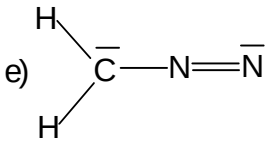
1. Assign formal charges to the following species

a) 

b) 

c) 

d) 

e) 

2. Which of the following molecule will have a resultant dipole moment? Explain using lewis structure?

a) F_2 b) OCS c) CH_2Cl_2 d) NF_3 e) ClF_3 f) BF_3

g) NO_2 h) XeO_3

3. What are the expected shapes and bond angles in a molecule having VSEPR formula?

a) AX_5 b) AX_2 c) AX_3 d) AX_2E_2 e) AX_3E_2

4. Using Lewis structure and VSEPR theory, predict the shapes of following molecules:

i. SO_2
ii. O_3
iii. Cl_2
iv. OSF_2
v. O_2SF_2
vi. PF_4^+
vii. PF_4^-

5. Predict the bond angles in each of the following cases

I_3^-, ICl_3, IO_4^-, ICl_2^-, ICl_2^+, ICl_4^-, ICl_4^+

6. Trifloroamine oxide NF_3O, reacts with antimony pentaflouride SbF_5, to produce the ionic salt $NF_2O^+SbF_6^-$, in anhydrous hydrogen fluoride at –95 o C. Write the lewis structure and predict the shape of each ion in the salt.

7. How many σ & π bonds are present in each of the following molecules ?

i. CH_2O ii. C_4H_2 iii. $CH_3CO_2CH_3$ iv. $CH_2{=}CH{-}CN$

v. $CH_2{=}C{=}CHCH_3$ vi. CH_3CH_2OH vii. CH_2CO

viii $CH_3OCH{=}CHCH_3$

8. In the following isoelectronic species specify which atom if any bear a formal charge :
   1. $\overline{N}{\equiv}\overline{N}$
   2. $\overline{C}{\equiv}\overline{N}$
   3. $\overline{C}{\equiv}\overline{C}$
   4. $\overline{N}{\equiv}\overline{O}$
   5. $\overline{C}{\equiv}\overline{O}$

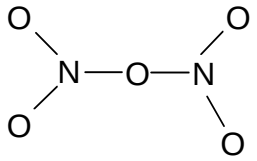
9. Repeat the above exercise for the following :
   - $\overline{\underline{O}}{=}C{=}\overline{\underline{O}}$
   - $\overline{\underline{O}}{=}N{=}\overline{\underline{O}}$
   - $\overline{\underline{N}}{=}N{=}\overline{\underline{O}}$
   - $\overline{\underline{C}}{=}N{=}\overline{\underline{O}}$
   - $\overline{\underline{N}}{=}C{=}\overline{\underline{O}}$

10. Given below are the connectivities of four isomers of CH_3NO. Only the hydrogen atoms have not been shown, you are supposed to give the final structures, complete with the hydrogen atoms such that none of the atoms in any of the structures have a formal charge.
    - $C{-}N{=}O$
    - $O{-}C{=}N$
    - $C{=}N{-}O$
    - $O{=}C{-}N$

11. Write down the lewis structures for the following :
    1. $SeOCl_2$
    2. CSe_2
    3. $GaCl_4^-$
    4. C_2^{2-}
    5. $POBr_3$

6. IF_2^+
7. NO^+
8. IF_6^+
9. ICN
10. Si_2H_6

12. The connectivity of the gaseous N_2O_5 is shown as below :



There are two different NO bond lengths : 1.18 A^o and 1.36 A^o.
Indicate which is which ?

13. Give the lewis structures of the two possible isomers of S_2F_2.
14. Indicate the nature of sulphur to nitrogen bond in F_3SN. (i.e single , double & triple).
15. Some of these statements regarding molecular shape are always true and not. Identify those that are not always true and explain why they are not :
    1. Diatomic molecules have a linear shape.
    2. Molecules in which four atoms are bonded to the same central atom have a tetrahedral shape.
    3. Molecules with a planar shape consist of three atoms (triatomic).
    4. Molecules with a nonmetal of the second period as the central atom cannot have an octahedral shape.
16. Draw the Lewis structure of two different molecules having the formula C_3H_4. Is either of these molecules linear.
17. Draw plausible lewis structure and arrange in order of increasing dipolemoment of the molecules NH_3, NCl_3, NF_3.
18. Draw the lewis structure of the following common open chain organic compounds. If there are more than one structures possible. Write down the structures of all of them.
    1. C_2H_6O
    2. C_2H_4O
    3. $C_2H_4O_2$
    4. $C_3H_6O_2$
    5. $C_3H_4O_2$
    6. C_2H_5NO
    7. C_3H_9N
    8. C_3H_7N
    9. C_3O_2

10. C_4H_6

19. Write down the lewis structure of all possible isomers of C_7H_9N, which contains a benzene ring.
20. write down the lewis structure of H_2SO_4, H_3PO_4, H_3PO_3, H_3PO_2, $HBrO_3$?

Self Test Questions :

1. The highest electronegativity of the following is for an atom of
    a. S
    b. Cs
    c. Si
    d. Al
2. Of the following, the bond with the greatest percent ionic character is
    a. F – F
    b. Cl – F
    c. Al – F
    d. C – O
3. Of the following species, the one containing a triple covalent bond is
    a. NO_3^-
    b. CN^-
    c. CO_2
    d. $AlCl_3$
4. The formal charge of the O atoms in the ion $[\ |\overline{O}{=}N{=}\overline{O}|\ ]^+$ is
    a. –2
    b. –1
    c. 0
    d. +1
5. In the ammonium ion NH_4^+
    a. The four H atoms are situated in the corners of the square
    b. All the bonds are ionic
    c. All the bonds are coordinate covalent
    d. The shape is that of tetrahedron
6. The bond angle in SeH_2 is best described as
    a. Between 190 ° and 120°
    b. Less than in SH_2
    c. Less than in SH_2 but not less than 90 °
    d. Less than 90°
7. Which of the following molecules contain an atom which uses sp^2 hybridized orbitals to form covalent bonds?
    a. PCl_5

b. N_2
c. SO_2
d. He_2

8. In compounds containing C,H and O
    a. All OH bonds are π bonds
    b. All Ch bonds are σ bonds
    c. All CC bonds consist of a σ bond and a π bond.
    d. All CC bonds are π bonds
9. All the following molecules are linear except one. That one is
    a. SO_2
    b. CO_2
    c. NO
    d. HCN
10. The greatest bond length among the following diatomic molecules is found in
    a. O_2
    b. N_2
    c. Cl_2
    d. I_2