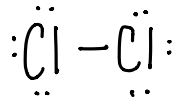
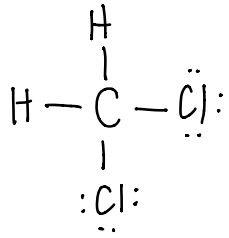
General Chemistry I

PLI #13 06/23/21

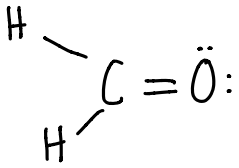
1. Write Lewis structures that obey the octet rule:
   a. Cl_2



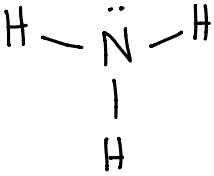
   b. CH_2Cl_2



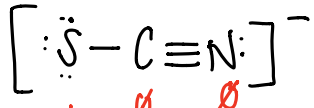
   c. H_2CO

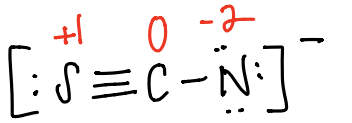


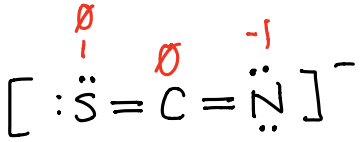
   d. NH_3



2. Draw resonance structures and select the most stable one for $(SCN)^-$.

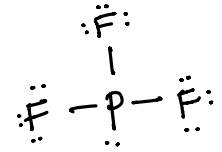
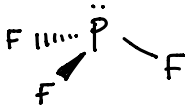
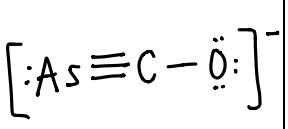
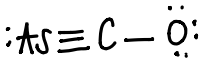
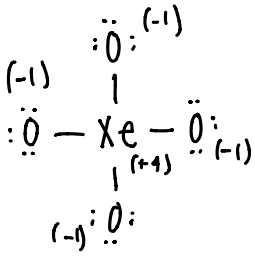
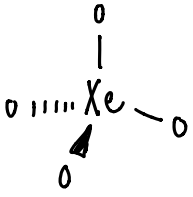
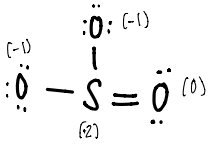
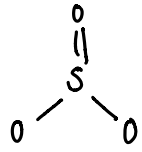






excepted valence # - actual bonded #

3. The central atom has been underlined. Do not break the octet rule. Indicate formal charges when nonzero for each Lewis structure. Draw the predicted molecular geometry on basis of VSEPR theory.

Molecular formula	Lewis structure (including formal charges)	Electron geometry name	Molecular structure	Approximate bond angles
$\underline{P}F_3$		Tetrahedral		< 109.5°
$As\underline{C}O^-$		Linear		180°
$\underline{Xe}O_4$		Tetrahedral	 tetrahedral	109.5°
$\underline{S}O_3$		trigonal planar		120°

4. Consider the elements N, Mg, O, F, Al
    a. Write the noble gas electron configurations for each elements.

N: $[He]2s^2 2p^3$

Mg: $[Ne]3s^2$

O: $[He]2s^2 2p^4$

F: $[He]2s^2 2p^5$

Al: $[Ne]3s^2 3p^1$

    b. Arrange the elements in order of increasing atomic radius.

$F < O < N < Al < Mg$

    c. Arrange the elements in order of increasing ionization energy.

$Al < Mg < O < N < F$

- Al has an e^- in a higher energy orbital than Mg
- N has a half filled 2p subshell (stable)

5. Write the noble gas electron configuration and determine whether it is diamagnetic or paramagnetic.
    a. Al

$[Ne]3s^2 3p^1$ paramagnetic

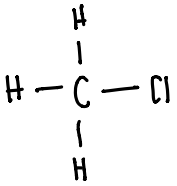
    b. S^{2-}

$[Ar]$ diamagnetic

    c. Fe^{3+}

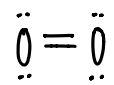
$[Ar]3d^5$ paramagnetic

6. Draw the following Lewis dot structures
    a. CH_3Cl

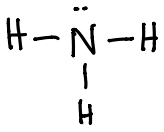


    b. HCN

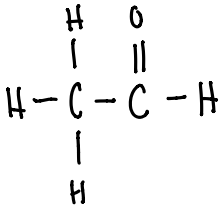
c. Oxygen (O_2)



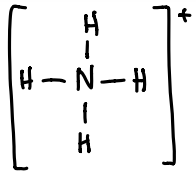
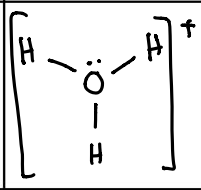
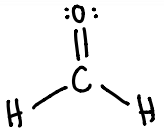
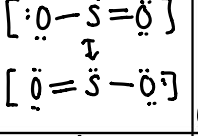
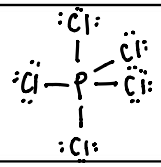
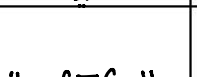
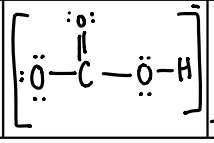
d. Ammonia (NH_3)



e. C_2H_4O

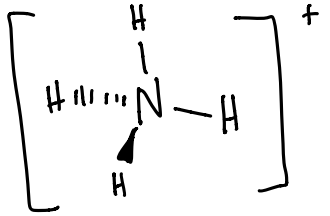


7. **Fill out the following table!**

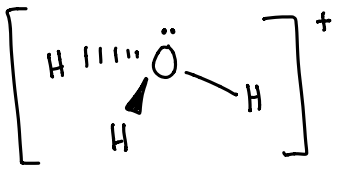
Molecule	Lewis Structure	Electron Pair Geometry	Molecular Geometry	Bond Angles	Polar or Nonpolar?
Ammonium ion NH_4^+ 5 4 -1 = 8e⁻		tetrahedral	tetrahedral	109.5°	non-polar
Hydronium ion H_3O^+ 3 6 -1 = 8e⁻		tetrahedral	trigonal pyramidal	< 109.5°	polar
CH_2O 4 2 6 = 12e⁻		trigonal planar	trigonal planar	120°	polar
SO_2 6 12 = 18e⁻		trigonal planar (3 bonding/e⁻ site)	bent	< 120°	polar
PCl_5 5 35 = 40e⁻		trigonal bipyramidal	trigonal bipyramidal	90°, 120°, 180°	non-polar
C_2H_2 8+2 = 10 e⁻		linear	linear	180°	non-polar
HCO_3^- 1 4 18 +1 = 24e⁻		- trigonal planar & - tetrahedral (C-O-H)	trigonal planar & bent (C-O-H)	120° < 109.5°	polar

Draw Molecular Geometry:

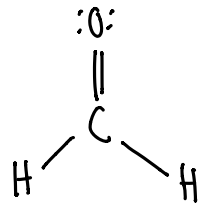
Ammonium:



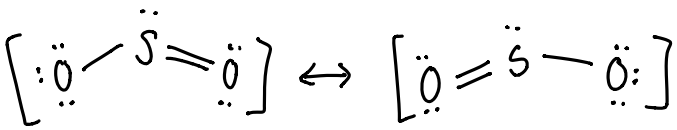
Hydronium:



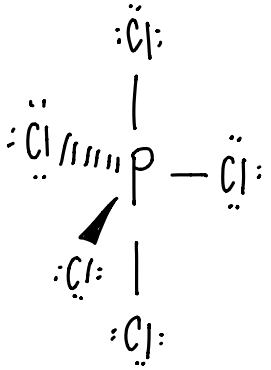
CH_2O:



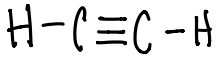
SO_2:



PCl_5:



C_2H_2:



HCO_3^-: