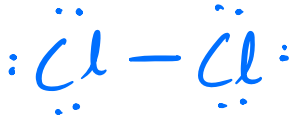
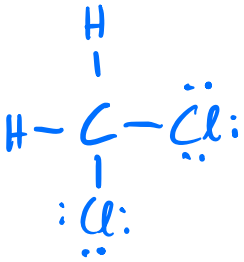
CHEM 103
R&R 13
18 June 2024
Adapted from a 23 June 2021 document

1. Write Lewis structures that obey the octet rule:

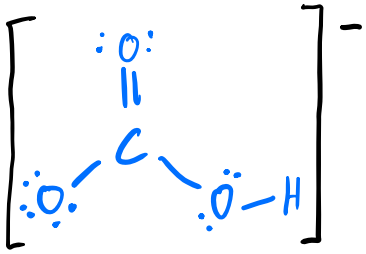
a. Cl_2



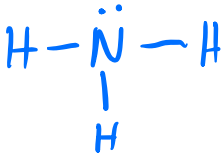
b. CH_2Cl_2



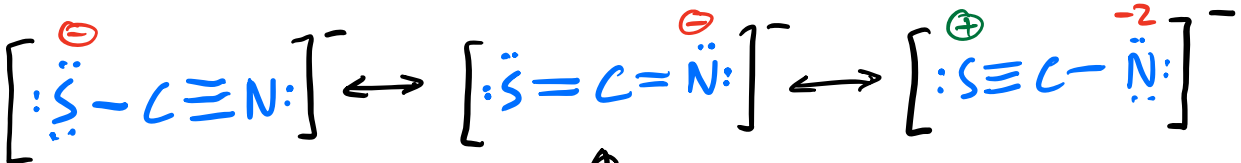
c. HCO_3^-



d. NH_3



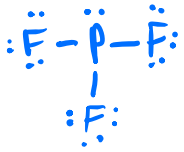
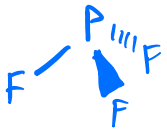
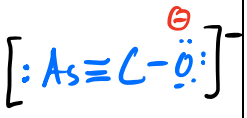
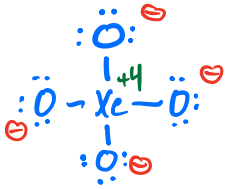
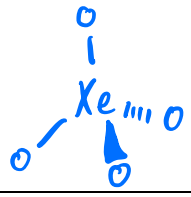
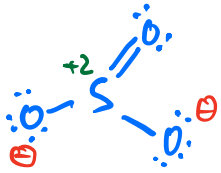
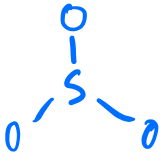
2. Draw resonance structures and select the most stable one for SCN^-.



most stable.

Tied for fewest nonzero formal charges, and N is more electronegative than S.

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 the basis of VSEPR theory.

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

4. Consider the elements N, Mg, O, F, Al

a. Write the noble gas notation ground state electron configurations for each element.

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.

$F < O < N < Al < Mg$

within a period, greater Z_{eff} = smaller radius

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

$Al < Mg < O < N < F$

Al has an e^- in a higher-energy subshell

N is an exception b/c $2p^3$ is an especially stable configuration.

5. Write the noble gas notation ground state electron configuration and determine whether it is diamagnetic or paramagnetic.

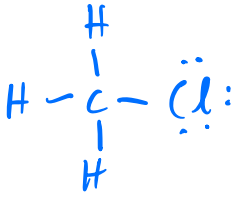
a. Al $[Ne]3s^2 3p^1$; paramagnetic

b. S^{2-} $[Ar]$; diamagnetic

c. Fe^{3+} $[Ar]\,3d^5$; paramagnetic

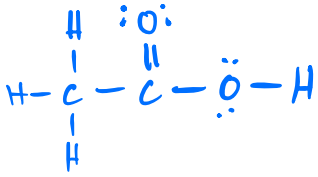
6. Draw the Lewis dot structures for the following molecules:

a. CH_3Cl



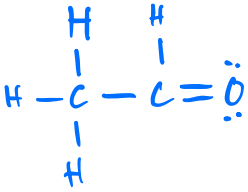
b. HCN

c. CH_3COOH

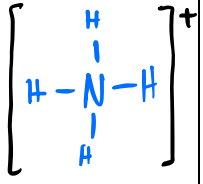
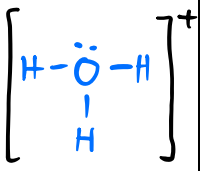
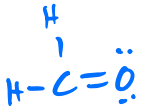
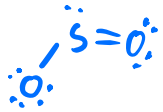
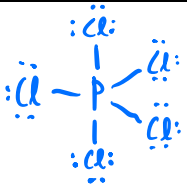
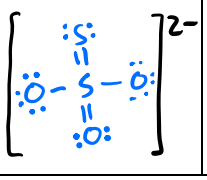


d. Oxygen

e. C_2H_4O

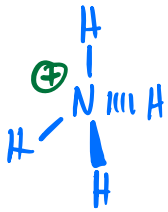


7. Fill out the table in reference to the central atom, then draw the molecular geometry.

Molecule	Lewis structure	Electron pair geometry name	Molecular geometry name	Bond angles	Polar or nonpolar?
Ammonium ion		tetrahedral	tetrahedral	109.5°	nonpolar
Hydronium ion		tetrahedral	trigonal pyramidal	$\angle$109.5°	polar
CH_2O		trigonal planar	trigonal planar	120°	polar
SO_2		trigonal planar	bent	$\angle$120°	polar
PCl_5		trigonal bipyramidal	trigonal bipyramidal	90°; 120°	nonpolar
C_2H_2		linear	linear	180°	nonpolar
Challenge: $S_2O_3^{2-}$ "thiosulfate"		tetrahedral	tetrahedral	109.5°	(barely) polar

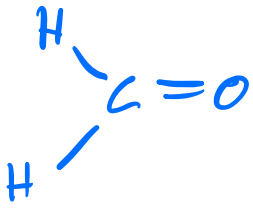
Draw the molecular geometry here below! (Include resonance forms if applicable.)

NH_4^+:

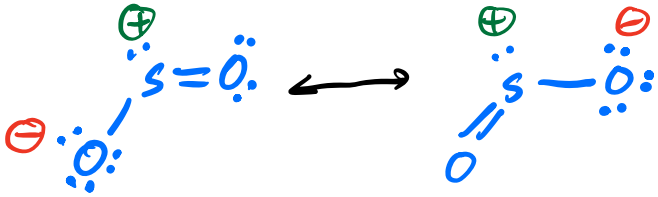


H_3O^+:

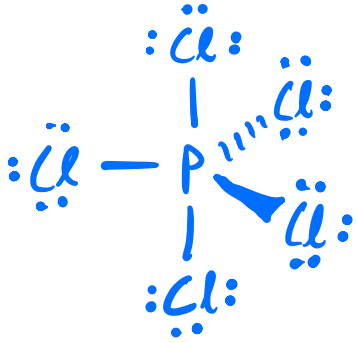
CH_2O:



SO_2:

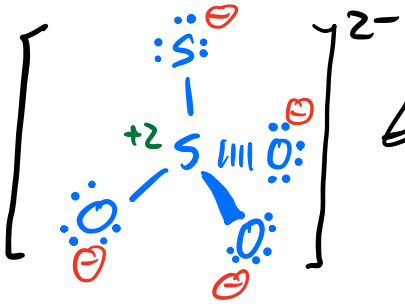


PCl_5:



C_2H_2:

$S_2O_3^{2-}$:



Way too many resonance forms to draw