

2. Draw the *electron dot structure* for the following compounds. Also give the following information:
- the electron pair and molecular geometries*
 - the polarity of the molecule* (polar or not)
 - the hybridization on the central atom*
 - whether or not there is resonance*
 - the number of sigma and pi bonds in the molecule.*



3. The energy required to dissociate the Cl_2 molecule is 239 kJ/mol. If the dissociation of a Cl_2 molecule were accomplished by the absorption of a single photon whose energy was exactly the quantity required, what would be its wavelength (in meters)?

4. Multiple choice. Write the *best answer on the line*.

____ i. In molecular orbital theory, a bonding orbital has an energy that is _____ than the energy of the atomic orbitals from which it came.

- a. higher b. lower c. the same d. none of the above

____ ii. A molecule that has 5 total groups of electrons and 1 group of non-bonding electrons has a central atom that has what hybridization?

- a. sp b. sp² c. sp³ d. sp³d

____ iii. A molecule that has linear molecular geometry and trigonal bipyramidal electron geometry has how many lone pairs?

- a. 1 b. 2 c. 3 d. 3.5

____ iv. A molecule that has a zero bond order is:

- a. unstable b. very stable c. no way to tell d. none of the above.

____ v. When a bond is formed, energy is:

- a. all over b. absorbed c. released d. both a and b

____ vi. Which of the following molecular geometries is polar (assume all outer atoms are the same)?

- a. tetrahedral b. trigonal planar c. linear d. square pyramidal

____ vii. A molecule with 6 total groups of electrons and 5 bonding groups has a molecular geometry that is:

- a. linear b. square planar c. square pyramidal d. trigonal pyramidal

____ viii. Period three and higher atoms can form “expanded octets” because they have:

- a. special abilities b. d-orbitals c. p-orbitals d. s-orbitals

____ ix. Molecules that have all electrons paired are:

- a. paramagnetic b. diamagnetic c. stupid d. not possible

____ x. A molecule’s polarity is determined by:

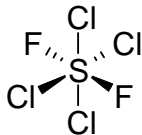
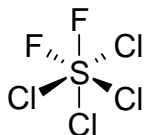
- a. unbonded electrons b. geometry c. polar bonds d. all of the above

5. Miscellaneous questions.

a. Arrange the following atoms in order of *decreasing size*: Cl, Cs, Li, He

b. Arrange the following ions in order of *increasing size*: N^{3-} , O^{2-} , F^- , Cl^-

c. Which molecule should be *less polar* (Circle correct answer):



d. Arrange the following in order of *increasing electron affinity energy*: F, Cl, I, Br

6. Draw resonance formulas of the nitric acid molecule, HNO_3 (The hydrogen is attached to one of the oxygens, not the central atom). What is the geometry about the N atom? What is the hybridization on N? Use bond energies and one Lewis formula for HNO_3 to estimate ΔH_f° for $\text{HNO}_{3(g)}$. The actual value of ΔH_f° for $\text{HNO}_{3(g)}$ is -135 kJ/mol, which is lower than the estimated value because of stabilization of HNO_3 by resonance. The *resonance energy* is defined as $\Delta H_f^\circ(\text{estimated}) - \Delta H_f^\circ(\text{actual})$. What is the resonance energy of HNO_3 ?

7. Draw the *molecular orbital energy level diagram* for O_2^- and O_2^{2-} . Decide *which is more stable* based on bond order.