

Honor Statement:

On my honor and character, I confirm that I am adhering to all academic codes of conduct. This includes, but not limited to: not consulting with any other students or individuals during the exam time, not using any other websites/textbooks besides the ebook and CCLE, not using any apps/communication platforms whatsoever.

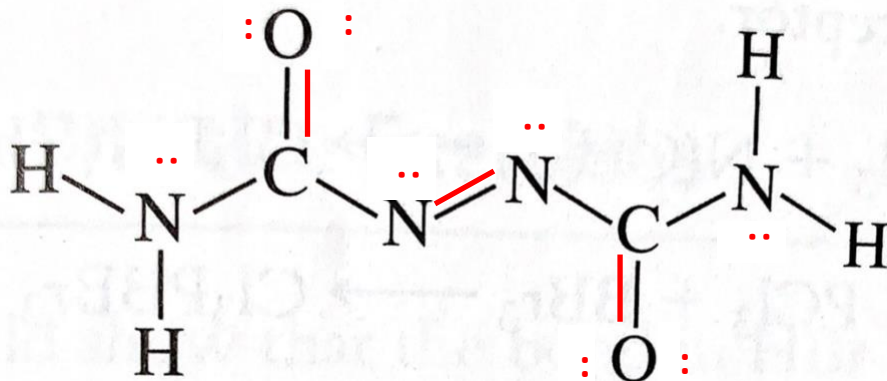
Sign here:



FOR GRADESCOPE PURPOSES, DRAW LONE PAIRS OF
ELECTRONS AS DOTS, NOT AS LINES.

Have a periodic table and calculator ready to go!!!

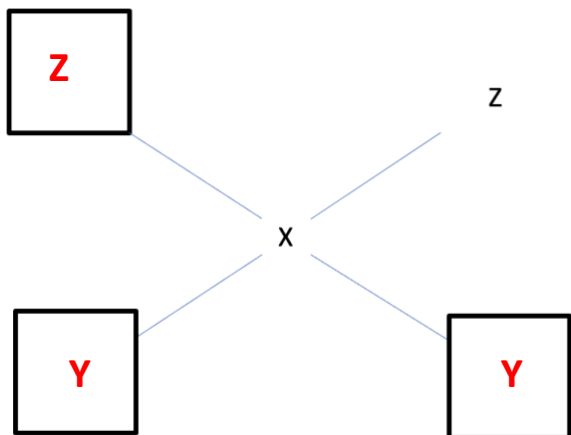
1. The following compound is used as a foaming agent in the polymer industry. (27 pts)



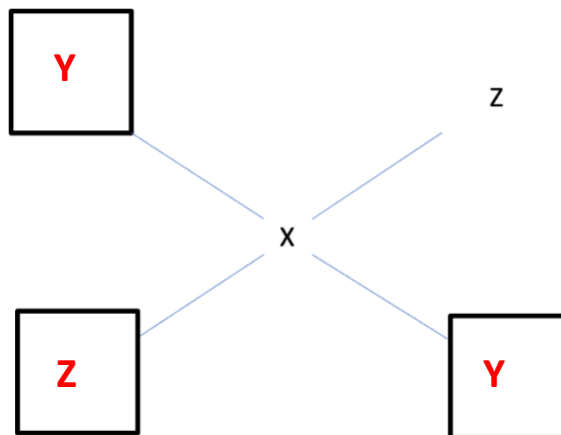
Complete the Lewis structure of this molecule as required in order to determine the geometry, hybridization, and approximate bond angle around the following inner atoms. Ignore any possible resonance effects.

	Molecular Geometry	Hybridization	Bond Angle (use <, > or =)
Leftmost N	Trigonal pyramid	Sp ³	< 109.5
Leftmost C	Trigonal planar	Sp ²	= 120
2 nd N from left	bent	Sp ²	< 120

2. Imagine a square planar molecule, XY_2Z_2 , in which X is the central atom and Z is more electronegative than Y. Draw two possible structures, one which is polar and one which is nonpolar. Write in "Z" or "Y" in the remaining boxes for each structure. (12 pts)

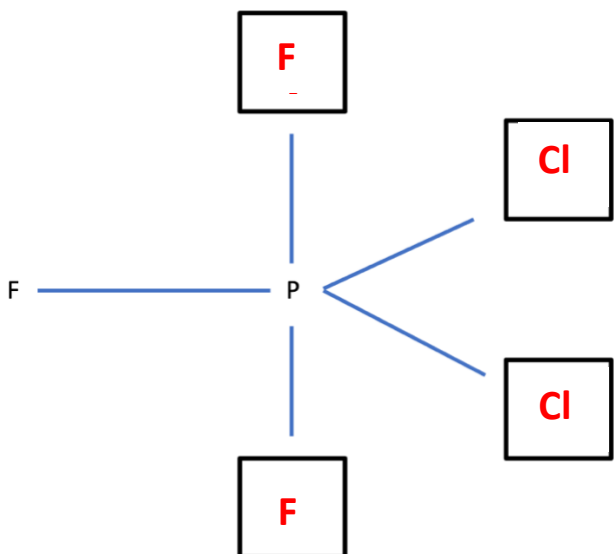


Structure 1 (POLAR)



Structure 2 (NONPOLAR)

3. Fill in the remaining "F" and "Cl" atoms in the boxes below for the compound where two chlorines and three fluorines are attached to a central phosphorous atom. EXPLAIN YOUR ANSWER. If no explanation is provided, then no credit. Brief phrases will suffice! (16 pts)



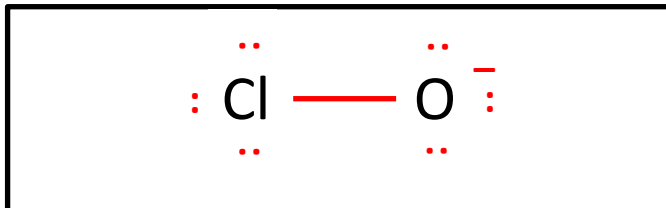
Your Explanation:

Chlorine is a larger atom than fluorine. In the equatorial position, there are fewer 90° interactions than in the axial positions.

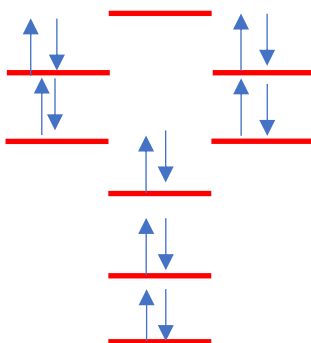
In other words, in the equatorial position, the large Cl atoms have a smaller amount of repulsion with nearby electron groups.

4. The active ingredient in commercial laundry bleach is NaClO.

a) Draw the best Lewis structure of the anion ClO^{1-} in the box below. For GScope purposes, "Cl" and "O" have been written for you already. (17 pts)



b) Draw the MO diagram of ClO^{1-} . *Hint:* In this ion, the valence orbitals of chlorine behave like $n = 2$ orbitals. Ignore any differences in electronegativities. Although the MO diagram will not be scored, draw it in the space below in order to answer the questions that follow.



The bond order is (circle one): $\frac{1}{2}$ **1** 1.5 2 2.5 3

The anion is (circle one): paramagnetic **diamagnetic**

c) ClO^{1-} is very water soluble. Explain which part of the water molecule interacts with which part of ClO^{1-} . Brief statements **and/or** illustrations will suffice.

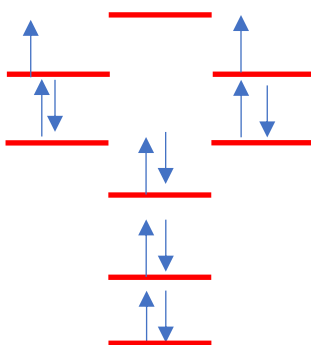
The hydrogen end of water will interact with the oxygen end of ClO^- . The oxygen end of water will interact with the Cl end of ClO^- .

5. Using MO theory, rank the following chemical species by bond strength. Write a "1" for the strongest bond, "2" for the second strongest, "3" for the third strongest, and "4" for the weakest.

(16 pts)

O_2	O_2^{1-}	O_2^{1+}	O_2^{2-}
2	3	1	4

Use the space below for your MO work. Even though your MO's will not be officially scored, you need to still show some work.



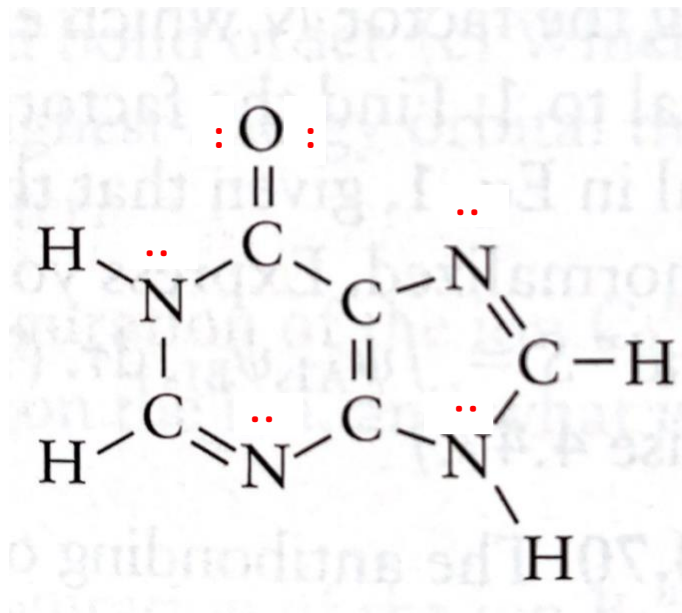
O_2 BO = 2 (MO diagram shown)

	O_2^{1-}	O_2^{1+}	O_2^{2-}
BO =	1.5	2.5	1

BO is proportional to bond strength.

6. The following is one compound involved in the genetic code.

(12 pts)



Answer the following questions about this compound (ignore any possible resonance):

Total number of lone electron pairs:

Total number of π bonds:

Total number of unhybridized carbon $2p$ orbitals:

Total number of σ bonds: