

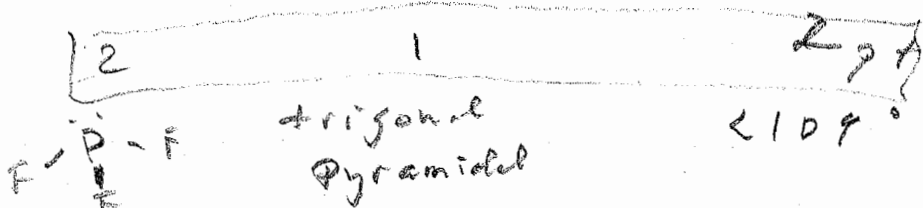
Academic Honesty: The answers on this test are my own and I am using only the allowed set of notes as described in the syllabus. I have not discussed the test questions with anyone before or during the test nor have I seen the test questions prior to the exam. If you violate any of the preceding items or do not sign, your semester grade is a F.

Signature: _____

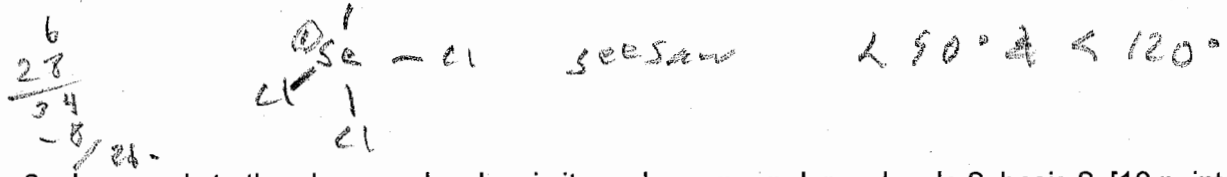
Feel free to adjust the amount of spacing between problems to fit your answer.

1. Sketch the shape of the below (hypothetical ?) molecules; include bond angle(s) and the name of the shape of the molecule. [10 points]

a. PF₃

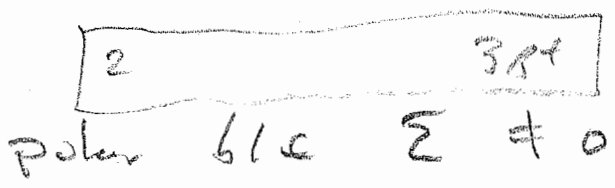


b. SeCl₄

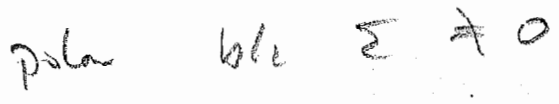


2. In regards to the above molecules, is it a polar or nonpolar molecule? basis? [10 points]

a. PF₃



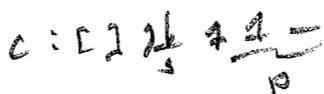
b. SeCl₄



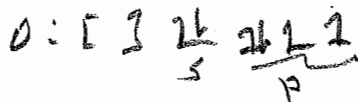
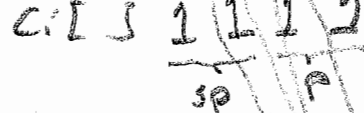
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3. Using valence bond theory, describe the bonds in the below (hypothetical ?) molecules. If hybrid orbitals are needed, then describe its formation. [25 points]

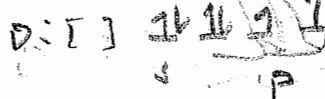
a. Carbon dioxide (10 pt)



excite
 \rightarrow
 hybridize

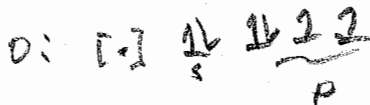


hybridize
 or
 not

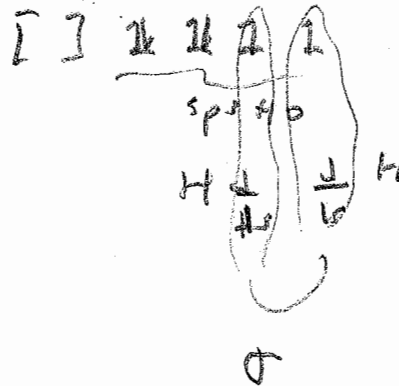


4
 4
 σ : overlap sp HO in C & pAO (or sp²HO) in O
 π : overlap pAO in C & pAO in O

b. Water (10 pt)

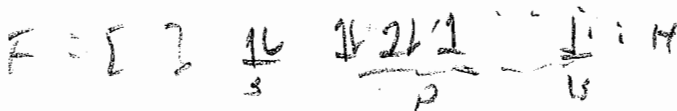


hybridize \rightarrow



6
 overlap sp³HO in O & sAO in H

c. Hydrogen fluoride (5 pt)



overlap pAO in F & sAO in H

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6. In regards to water versus carbon dioxide, _____; basis / rationale ? [20 points]

a. identify the type(s) of IMF in the molecules

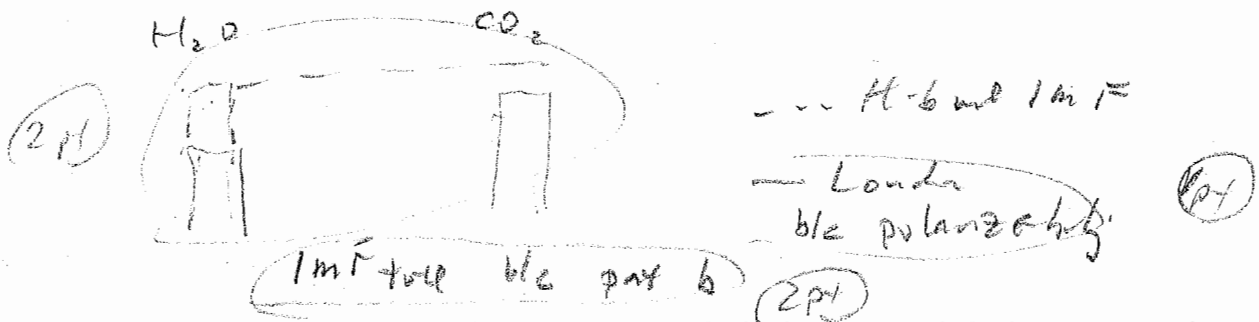
H₂O : ~~H-bond IMF~~
 CO₂ : ~~1pt~~

2 pt
 both have
 London IMF
 b/c polar & nonpolar
 have London

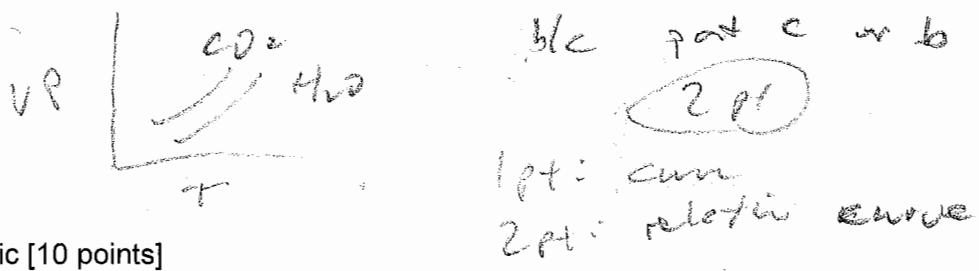
b. what is the relative vapor pressure

1 pt
 4 pt
 CO₂ > H₂O or H₂O < CO₂
 b/c know @ RT, H₂O is liquid, while CO₂ is a gas

c. what is the relative strength of the type(s) of IMF and the total IMF



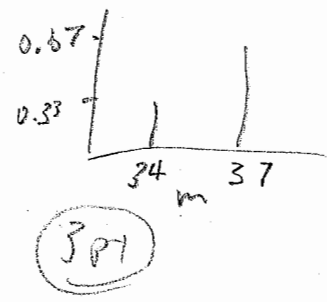
d. sketch the vapor pressure versus temperature graph for both compounds in the same graph and label which is water versus carbon dioxide



5. Old topic [10 points]

A hypothetical (?) atom has two isotopes, ³⁴X and ³⁷X, where the average atomic mass is 36. Sketch / label the mass spectrum of this atom and clearly show the relative height of the signal and provide its basis / rationale.

2 + 3 pt
 i) $\bar{X} = \sum m_i P_i$
 $36 = 34x + 37(1-x)$
 $36 = -3x + 37$
 $x = 0.33$



2 pt
 ii) P₃₇ = 67%