**CHE-2060 VSEPR Molecular Geometry Worksheet Key**

This week’s lab will require the ‘Practical VSEPR’ Table, a periodic table, an atomic model set and some patience and teamwork.

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| **Formula** | **# Bonds** | **# e- Pairs** | **Hybrid** | **Molecular geometry** | **Angles (°)** | **Dipole?** |
| BeCl2 | 2 | 0 | sp | Linear | 180 | No |
| BF3 | 3 | 0 | sp2 | Trigonal planar | 120 | No |
| SnCl2 | 2 | 1 | sp2 | Bent | 120 | Yes |
| CH4 | 4 | 0 | sp3 | Tetrahedral | 109.5 | No |
| NH3 | 3 | 1 | sp3 | Trigonal pyramidal | 109.5 | Yes |
| H2O | 2 | 2 | sp3 | Bent | 109.5 | Yes |
| PCl5 | 5 | 0 | sp3d | Trigonal bipyramidal | 120, 90 | No |
| **SF4** | 4 | 1 | sp3d | Saw horse | 120, 90 | Yes |
| **BrF3** | 3 | 2 | sp3d | T-shaped | 90, 180 | Yes |
| XeF2 | 2 | 3 | sp3d | Linear | 180 | No |
| SF6 | 6 | 0 | sp3d2 | Octahedral | 90 | No |
| IF5 | 5 | 1 | sp3d2 | Square based pyramid | 90 | Yes |
| **XeF4** | 4 | 2 | sp3d2 | Square planar | 90 | no |

NOTE: Columns 2 & 3 refer to the number of bonding electron pairs & lone electron pairs, respectively, on the molecule’s central atom.

**Part A:**

For each of the molecules listed in the table above:

1. Draw a Lewis bond structure – include all valence electrons;
2. Count & record the number of bonding electron pairs (Note: count single, double & triple bonds as one bonding pair.);
3. Count & record the number of free electron pairs (lone pairs);
4. If possible, record the type of orbital hybridization;
5. Use the ‘practical VSEPR table’ to determine molecular geometry & bond angles;
6. Determine whether the molecule has an overall molecular dipole.

**Part B:**

For each ‘bolded’ molecules in the table:

1. Build a model;
2. Determine whether any geometric isomers are possible;
3. Do the models or isomers have a dipole moment;
4. Which isomer do you think is preferred by VSEPR?

**Part C:**

Resonance structures – draw resonance structures for each & determine hybridization of the central atom for the molecules listed below.

1. N3-1
2. CO3-2
3. NO3-1
4. BF4-1

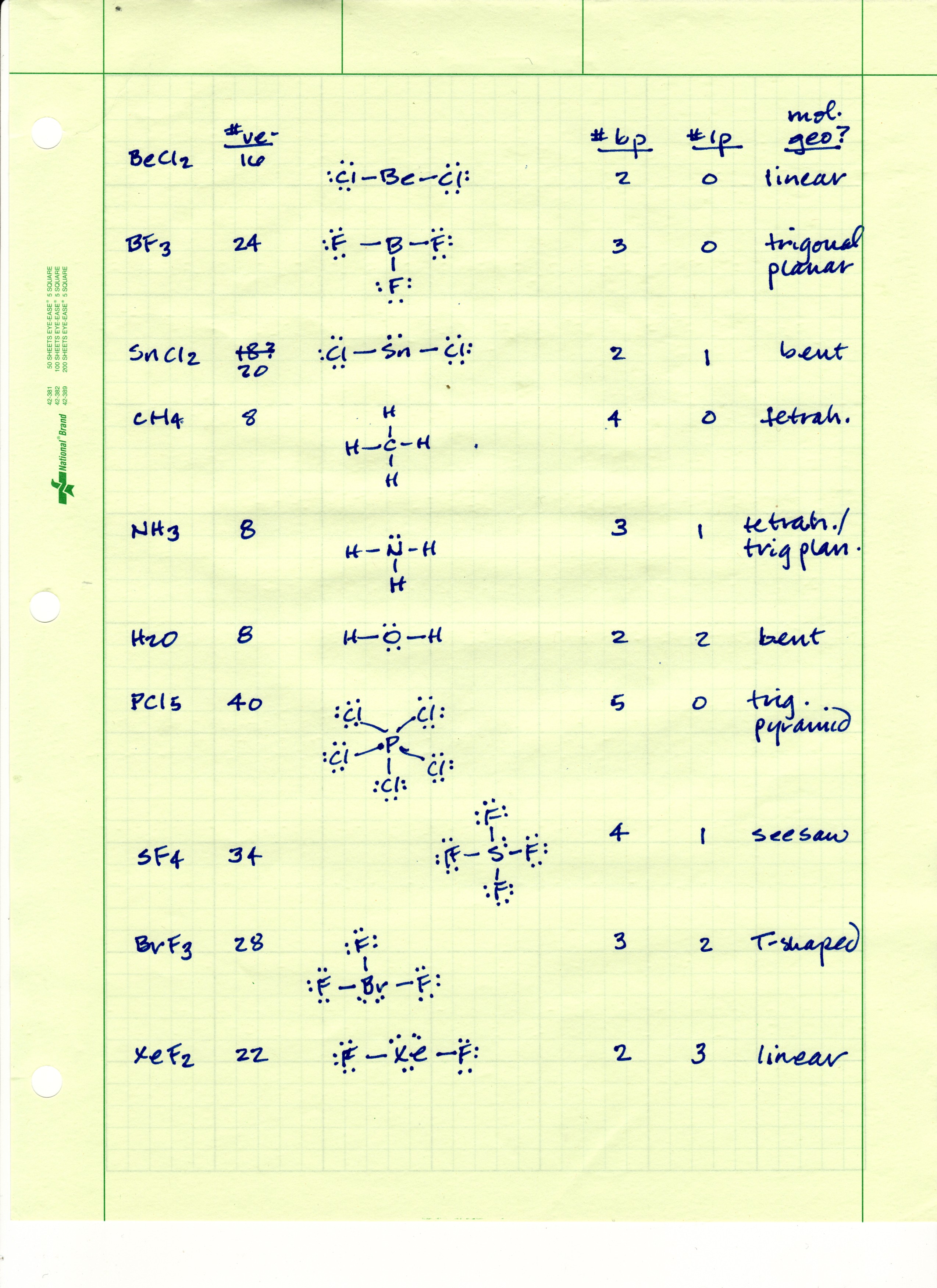
**Part D:**

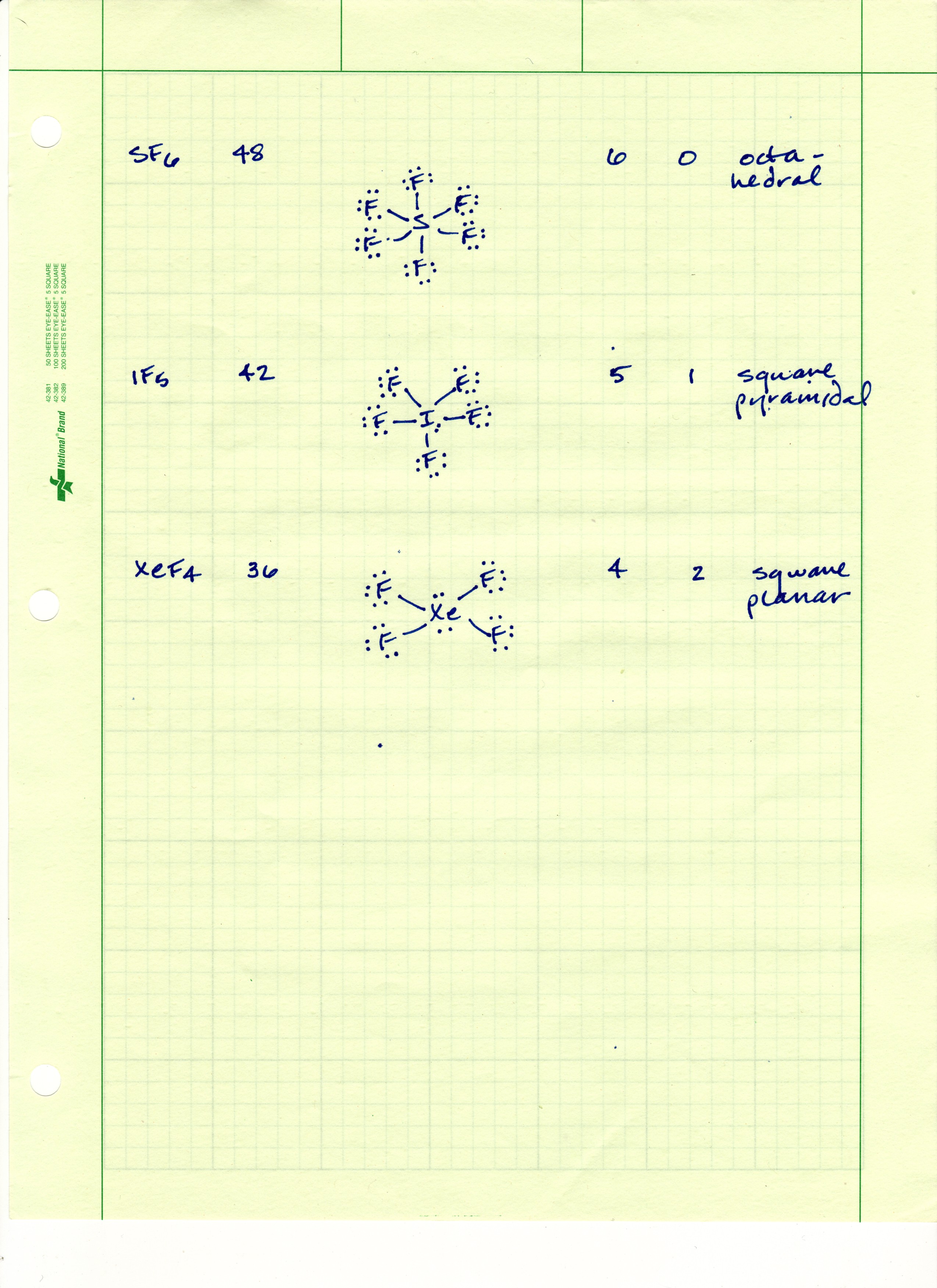
Since lone electron pairs (lp) are larger than bonding electron pairs (bp), interactions between lone pairs are very repulsive. Repulsion: lp-lp > lp-bp > bp-bp.

For each molecule listed here, draw Lewis structures & state how bond angles are probably distorted from the normal or expected bond angles.

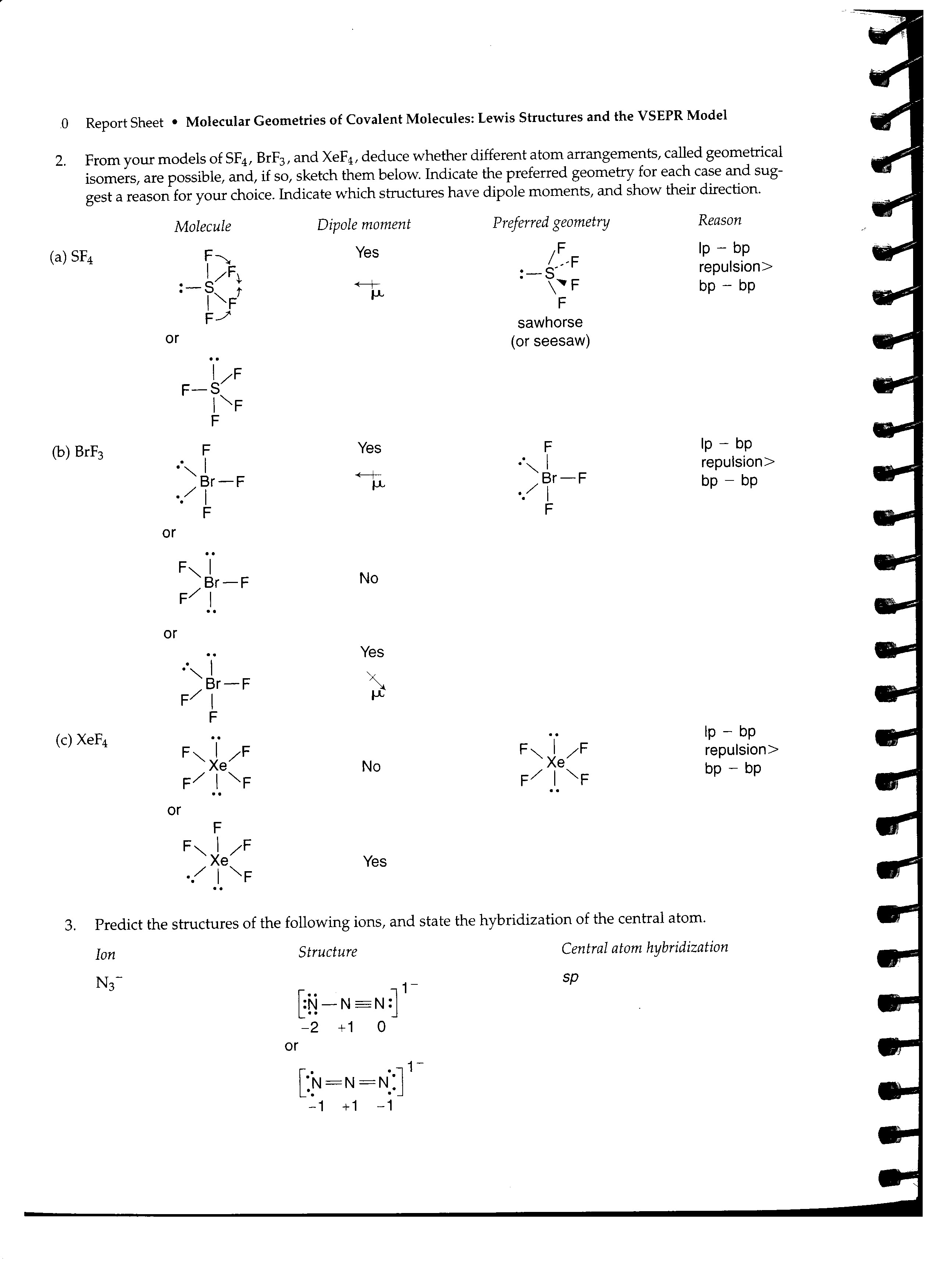
1. OF2
2. SCl2
3. PF3

**Part A:**

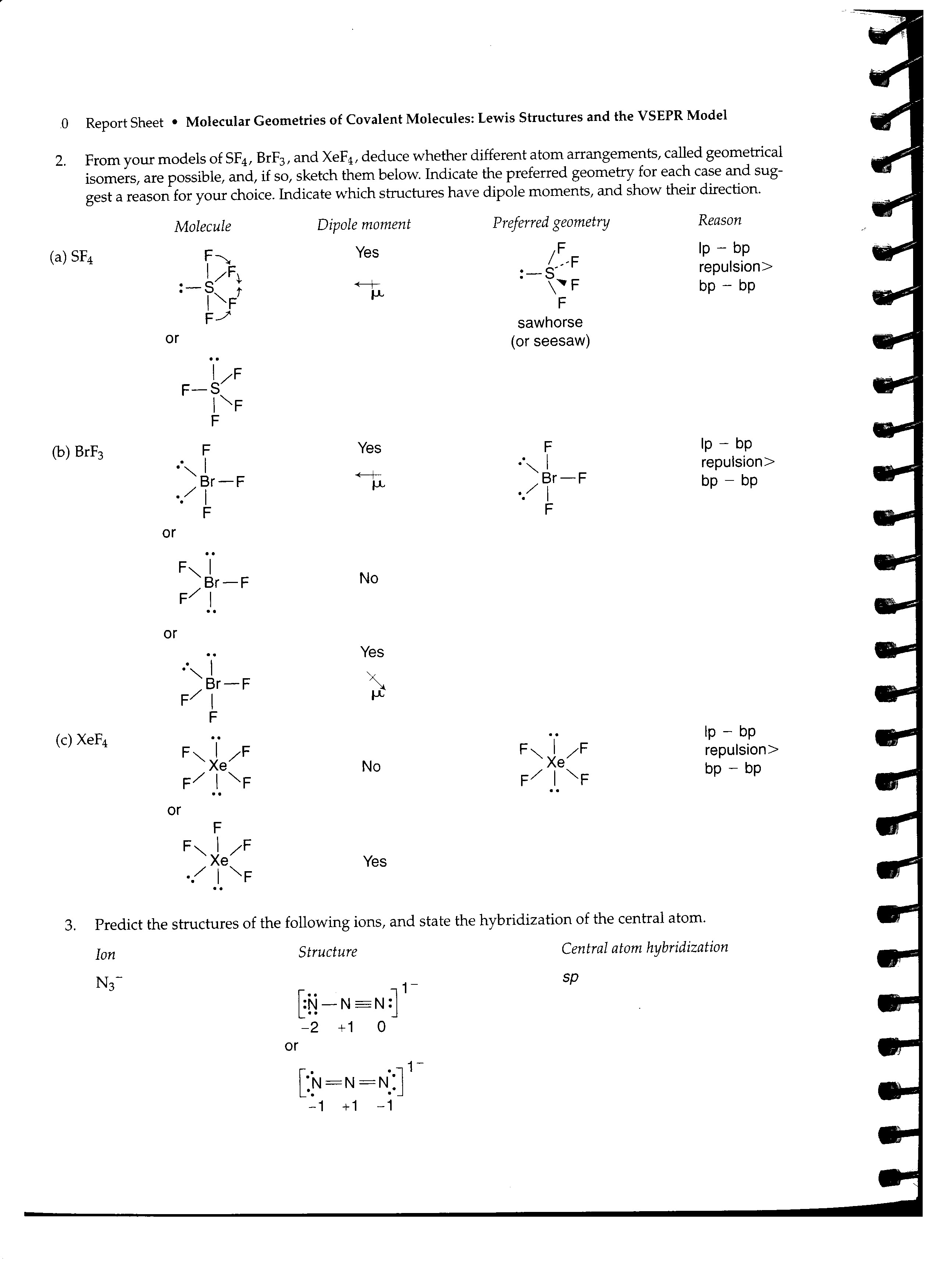
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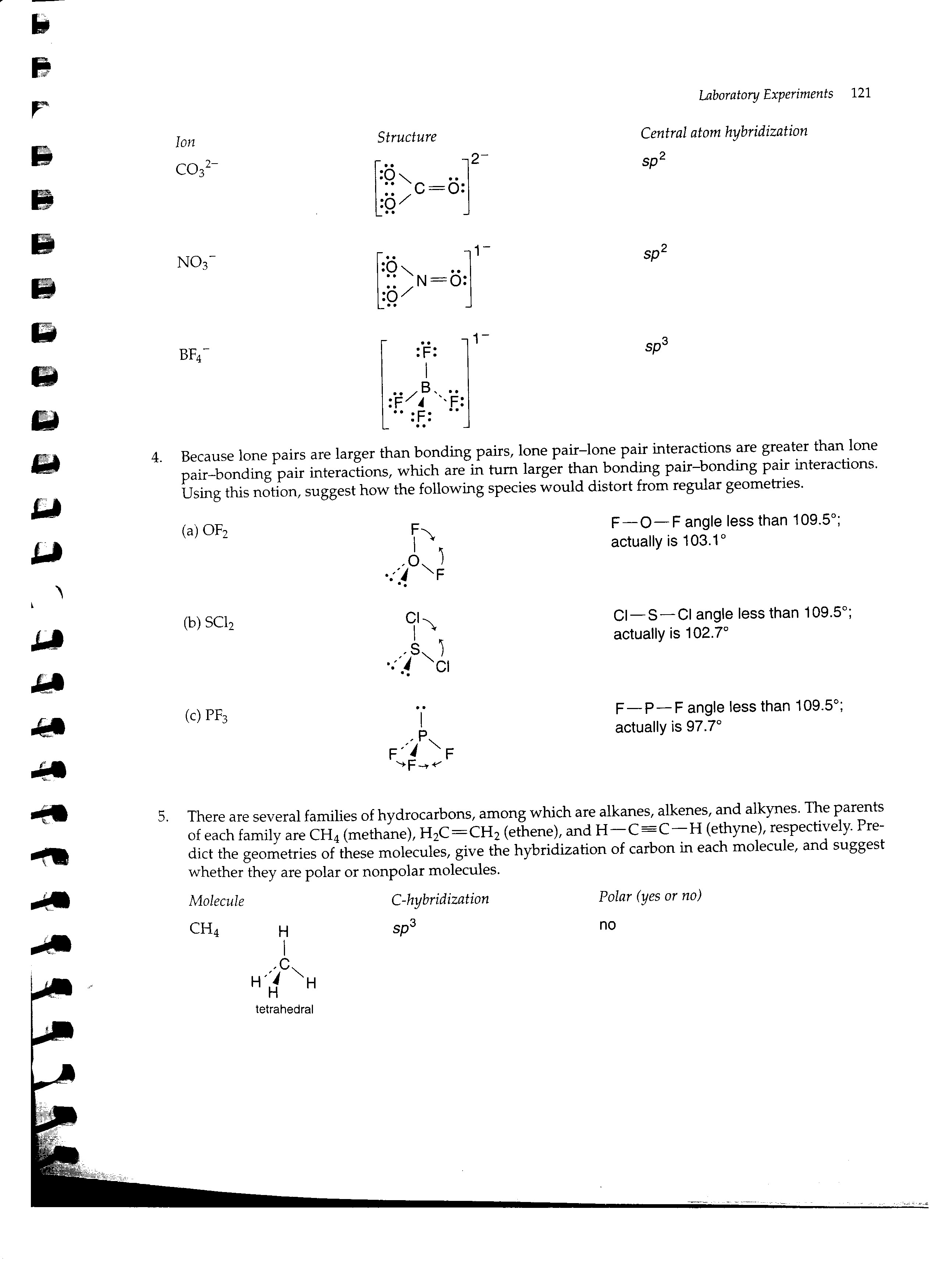
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**Part B:**

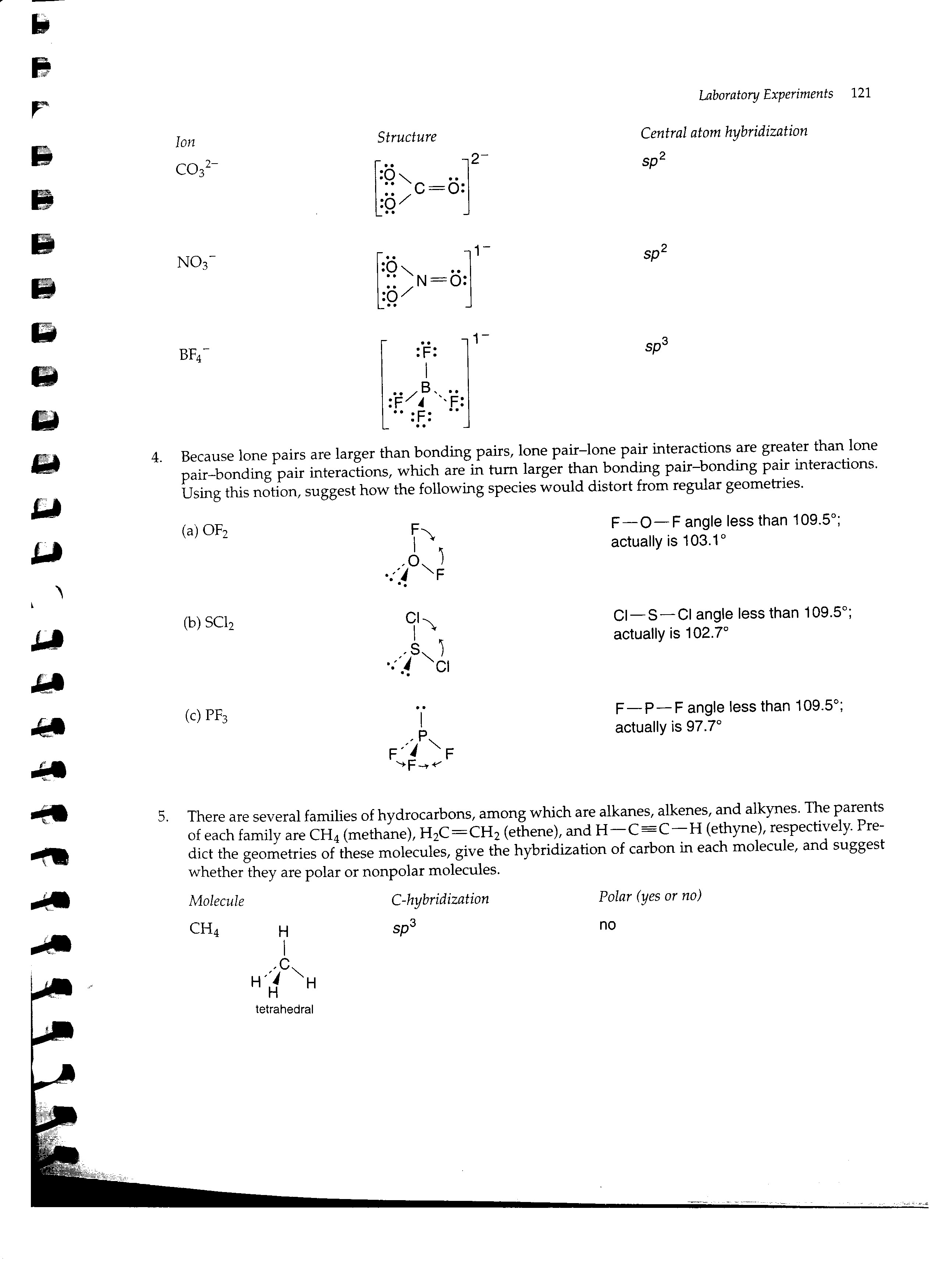
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**Part C:**

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**Part D:**

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Roughly 1 pt per question.