**A Multidimensional Approach to Carbodiphosphorane-Bismuth Coordination Chemistry: Cationization, Redox-Flexibility, and Stabilization of a Crystalline Bismuth Hydridoborate**

Please complete these guiding questions to *Inorganic Chemistry* **2022**, *61*, 19452-19462. <https://doi.org/10.1021/acs.inorgchem.2c03337>

1. This article discusses the synthesis of a variety of carbodiphosphorane (CDP) -bismuth complexes.

a) The carbodiphosphorane ligands are a type of carbone. Draw the structure of the carbone (Figure 2(a)), including orbitals, and compare and contrast this functional group to the structure of the carbene (R2C:), a widely used ligand in coordination chemistry.

(b) What is the formal charge on carbon in the carbone? Show how this charge is derived from the formula used when writing Lewis structures.

(c) The carbone can interact with a metal center using either a single dative or a double dative bond. According to the covalent bond classification method (CBC), assign the ligand classification to each of these modes of bonding.

(d) Complete the table below using the CBC method. Assume that the carbone ligand interacts with the metal through a single dative bond.

|  |  |
| --- | --- |
|  | Compound **1** |
| carbone CBC ligand classification (see (c) above) |  |
| Cl CBC ligand classification |  |
| MLlXxZz classification |  |
| Valence number / oxidation state of Bi |  |
| Ligand bond number |  |

2. Write the electron configurations for:

(a) Bi

(b) Bi(I)

(c) Bi(III)

3. On page 19454, the authors describe compound **1** (co-crystallized with CH2Cl2) as having a “distorted see-saw geometry.”

(a) Cite data from Figure 3 caption to support that compound **1** has a see-saw geometry.

(b) Describe the *trans* carbone effect.

4. Compare the crystal structures for the variations of compound **5** in Figure 4. Which of the anions is least coordinating? Hypothesize why this particular anion is able avoid coordinating to the Bi center.

5. For compound **6**[BPh4], briefly describe the types of spectroscopic analyses used to establish the presence of the H on C1 in H-CDP.

6. Why did the authors cite reference 47 on page 19460?