

**Problem Set for Chapter 10—Due Wednesday, November 21, 2001 (note change)**

Note: You should always indicate all non-zero formal charges on Lewis structures. However, formal charges are often left off stereochemical formulas.

1. (15 points total) For each of the following species, do the following:
  - (i) Draw the Lewis structure. Include multiple resonance structures if they are required by the symmetry of the species.
  - (ii) Write down the coordination number and steric number for the central atom of each structure, and then name the shape of the molecule.
  - (iii) Draw the stereochemical formula.(a)  $\text{PF}_3$ ; (b)  $\text{TeH}_2$ ; (c)  $\text{PF}_6^-$ ; (d)  $\text{ClO}_2^-$ ; (e)  $\text{GeH}_4$ .
  
2. (15 points total) For each of the following species, do the following:
  - (i) Draw the Lewis structure. Include multiple resonance structures if they are required by the symmetry of the species.
  - (ii) Write down the coordination number and steric number for the central atom of each structure, and then name the shape of the molecule.
  - (iii) Draw the stereochemical formula.
  - (iv) Write down the ideal bond angles (*e.g.* ideal:  $\theta(\text{H-O-H}) = 109.5^\circ$ ).
  - (v) Writing an inequality, note any expected deviations from ideal bond angles (*e.g.* reality:  $\theta(\text{H-O-H}) < 109.5^\circ$ ). (If you do not expect any deviations, note that as well.) You need not justify your answers.(a)  $\text{AsF}_3$ ; (b)  $\text{PCl}_4^+$ ; (c)  $\text{SF}_2$ .
  
3. (8 points) Classify the eight species in #1 and #2 as polar or nonpolar. You need not justify your answers.
  
4. (15 points) For the following species:
  - (i) Draw the Lewis structure. Include multiple resonance structures if they are required by the symmetry of the species.
  - (ii) Write down the coordination number and steric number for the central atom of each structure, and then name the shape of the molecule.
  - (iii) **Draw the stereochemical formula.**(a)  $\text{BeF}_2$ ; (b)  $\text{ClF}_2^+$ ; (c)  $\text{SnCl}_2$ ; (d)  $\text{XeF}_2$ ; (e)  $\text{XeF}_4$

[Problem Set continues on the back side]

5. (11 points) For the compound  $\text{SOF}_4$ , do the following:
- Draw the Lewis structure.
  - Determine the central atom's coordination number and steric number, and the compound's shape.
  - Draw the stereochemical formula. If relevant, label atoms as equatorial (eq) and axial (ax) to facilitate completing parts (iv) and (v).
  - Write down the ideal bond angles. (Hint: There are four angles.)
  - Writing inequalities, note any deviations from ideal bond angles.
  - Explain the expected deviations from the ideal bond angles.
6. (9 points) For each of the following valence electron configurations of a homonuclear diatomic molecule or molecular ion, do the following:
- Identify the element X, Q, or Z.
  - Determine the bond order.
  - Classify the species as paramagnetic or diamagnetic.
- (a)  $X_2: (\sigma_{2s})^2 (\sigma^*_{2s})^2 (\sigma_{2p_z})^2 (\pi_{2p_x})^2 (\pi_{2p_y})^2 (\pi^*_{2p_x})^1 (\pi^*_{2p_y})^1$
- (b)  $Q_2^-: (\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2p_x})^2 (\pi_{2p_y})^1$
- (c)  $Z_2^{2+}: (\sigma_{2s})^2 (\sigma^*_{2s})^2 (\sigma_{2p_z})^2 (\pi_{2p_x})^2 (\pi_{2p_y})^2 (\pi^*_{2p_x})^1 (\pi^*_{2p_y})^1$
7. (20 points) Problem 10.51 in your text (p. 384).
8. (12 points) Problem 10.92 in your text (p. 387).

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**Note that for your next homework assignment (due on November 30), you are being assigned one additional problem: 10.37. (See your syllabus for the other assigned problems.)**