

NAME: _____
STUDENT NUMBER: _____

SECTION: _____

CHM 1045, 2001
General Chemistry I. – Gelb

Homework #10 (due 11/27/2001) Total: 10 points.

Read the questions carefully! You must **show your work** and use the correct number of significant figures in order to receive full credit for numerical problems. Remember to also put your name, number and recitation section on it! Attach additional sheets if necessary.

1. (1 point.)

(a) Write a balanced chemical equation for the combustion of ethanol (gas).

(b) Calculate the heat of combustion of ethanol by using ΔH_f^0 data from Appendix C. Assume that the water produced in the reaction remains in the gas phase.

(c) Estimate the heat of combustion of ethanol by using the bond-energy data in Table 9.1. Compare with the result from (b).

2. (1 point.) Use the heat of formation data of $\text{ClF}_3(g)$ and the bond energy data given in Table 9.1 to estimate the dissociation energy of a single Cl—F bond. Also calculate the average of the Cl—Cl and F—F bond energies; compare the two results.

3. (1 point.) For each of the following formulas and geometries, give an example of a chemically reasonable molecule or ion. Draw it and its Lewis structure.

(a) AB_3 (planar)

(b) AB_3^{2-} (planar)

(c) AB_6^- (octahedral)

(d) AB_4^+ (tetrahedral)

4. (2 points.) Draw the Lewis structure, assign formal charges to each atom, and predict the geometry of the following ions:

(a) chlorite ion

(b) sulfate ion

(c) oxalate ion

(d) thiocyanate ion

5. (1 point.) For each of the following, give the number of electron groups around the central atom and name the geometry.

(a) PF_3

(b) SO_2Cl_2

(c) BrF_3

(d) SiH_4

6. (1 point.) For each of the following, name the geometry, draw the molecule, and describe any distortions of the “ideal” VSEPR structure due to substituent size, lone pairs, etc.

(a) TeH_2

(b) AsF_3

(c) CFCl_3

(d) OF_2

7. (1 point.) For each of the following, name the geometry, draw the molecule, assign the direction (if any) of the dipole *on each bond* and draw the direction of the dipole moment of the entire molecule.

(a) N_2O

(b) NF_3

(c) CH_2O

(d) PCl_5

8. (1 point.) For each of the following, draw all the reasonable resonance structures and an “average” structure, and assign formal charges to each atom in each structure.



9. (1 point.) Ozone (O_3) has a dipole moment of 0.52 Debye.

(a) What conclusion can you draw regarding the structure of ozone, purely from this information?

(b) What Lewis structures are possible for ozone? Assign formal charges for each atom.

(c) On the basis of VSEPR theory and your answers to (a) and (b), predict the geometry of the ozone molecule.