Homework 2

1.In a gaseous KCl molecule, the internuclear distance is 2.67×10^{-10} m. Using data from Appendix F and neglecting the small, short-range repulsion between the ion cores of K^+ and Cl^-, estimate the dissociation energy of gaseous KCl into K and Cl atoms (in kJ mol^{-1}).

2. Estimate the percent ionic character of the bond in each of the following diatomic molecules, based on the dipole moment.

	Bond Length (Å)	Dipole Moment (D)
ClO	1.573	1.239
KI	3.051	10.82
TlCl	2.488	4.543
InCl	2.404	3.79

3. Draw Lewis electron dot diagrams for the following species, indicating formal charges and resonance diagrams where applicable.
(a) H_3NBF_3 (b) CH_3COO^- (acetate ion) (c) HCO_3^- (hydrogen carbonate ion)

4. Methyl isocyanate, which was involved in the disaster in Bhopal, India, in 1984, has the chemical formula CH_3NCO. Draw its Lewis diagram, including resonance forms. (**Note:** The N atom is bonded to the two C atoms.)

5. The two compounds nitrogen dioxide and dinitrogen tetraoxide are introduced in Section 3.13.
(a) NO_2 is an odd-electron compound. Draw the best Lewis diagrams possible for it, recognizing that one atom cannot achieve an octet confguration. Use formal charges to decide whether that should be the (central) nitrogen atom or one of the oxygen atoms.
(b) Draw resonance forms for N_2O_4 that obey the octet rule. The two N atoms are bonded in this molecule

6. (a) Predict the geometry of the $SbCl_5^{2-}$ ion, using the VSEPR method.
(b) The ion $SbCl_6^{3-}$ is prepared from $SbCl_5^{2-}$ by treatment with Cl^-. Determine the steric number of the central antimony atom in this ion, and discuss the extension of the VSEPR theory that would be needed for the prediction of its molecular geometry.