

CHAPTER 8- PROBLEM SET

1. What is the Lewis symbol for each of the following atoms or ions? **(a)** K, **(b)** As, **(c)** Sn^{2+} , **(d)** N^{3-} .
2. NaCl and KF have the same crystal structure. The only difference between the two is the distance that separates cations and anions. (a) The lattice energies of NaCl and KF are given in Table 8.2. Based on the lattice energies, would you expect the Na-Cl or the K-F distance to be longer? (b) Use the ionic radii given in Figure 7.8 to estimate the Na-Cl and K-F distances.
3. (a) Does the lattice energy of an ionic solid increase or decrease (i) as the charges of the ions increase, (ii) as the sizes of the ions increase? (b) Arrange the following substances not listed in Table 8.2 according to their expected lattice energies, listing them from lowest lattice energy to the highest: MgS, KI, GaN, LiBr.
4. Using only the periodic table as your guide, select the most electronegative atom in each of the following sets: (a) Na, Mg, K, Ca; (b) P, S, As, Se; (c) Be, B, C, Si; (d) Zn, Ge, Ga, As.
5. Arrange the bonds in each of the following sets in order of increasing polarity: (a) C-F, O-F, Be-F; (b) O-Cl, S-Br, C-P; (c) C-S, B-F, N-O.
6. Write Lewis structures for the following: (a) H_2CO (both H atoms are bonded to C), (b) H_2O_2 , (c) C_2F_6 (contains a C-C bond), (d) AsO_3^{3-} , (e) H_2SO_3 (H is bonded to O), (f) NH_2Cl .
7. Write Lewis structures that obey the octet rule for each of the following, and assign oxidation numbers and formal charges to each atom: (a) OCS, (b) SOCl_2 (S is the central atom), (c) BrO_3^- , (d) HClO_2 (H is bonded to O).
8. Predict the ordering, from shortest to longest, of the bond lengths in CO, CO_2 , and CO_3^{2-} .
9. Draw the Lewis structures for each of the following molecules or ions. Identify instances where the octet rule is not obeyed; state which atom in each compound does not follow the octet rule; and state how many electrons surround these atoms: (a) NO, (b) BF_3 , (c) ICl_2^- , (d) OPBr_3 (the P is the central atom), (e) XeF_4 .
10. (a) Use bond enthalpies to estimate the enthalpy change for the reaction of hydrogen with ethylene: $\text{H}_2(\text{g}) + \text{C}_2\text{H}_4(\text{g}) \rightarrow \text{C}_2\text{H}_6(\text{g})$
(b) Calculate the standard enthalpy change for this reaction, using heat of formation.

11. Calculate the formal charge on the indicated atom in each of the following molecules or ions: (a) the central oxygen atom in O_3 , (b) phosphorus in PF_6^- , (c) nitrogen in NO_2 , (d) iodine in ICl_3 , (e) chlorine in $HClO_4$ (hydrogen is bonded to O).