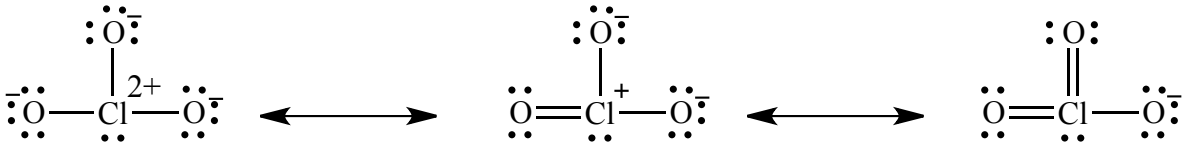
**Homework #9-4:** Problems pg. 380 #52, 57, 61-65

**52 Draw three resonance structures for the chlorate ion, $ClO_3^-$. Show formal charges.**



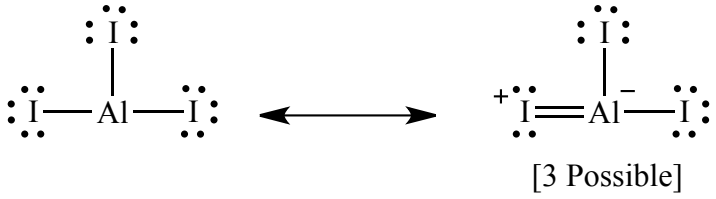

Although the formal charges for the latter two structures are smaller, because the first structure retains the unexpanded octet, it would be the preferred structure, with 3 Cl–O single bonds.

**57 Why does the octet rule not hold for many compounds containing elements in the third period of the periodic table and beyond?**

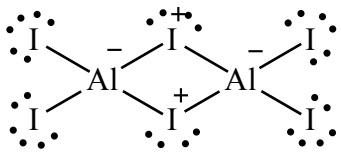
The octet rule doesn't hold for compounds with elements in the 3rd period because the atoms in the 3rd period (and beyond) are large enough to accommodate more than 8 electrons.

**61 The $AlI_3$ molecule has an incomplete octet around Al. Draw three resonance structures of the molecule in which the octet rule is satisfied for both the Al and the I atoms. Show formal charges.**

The resonance structures are




But the true structure is actually



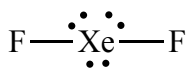
**62 In the vapor phase, beryllium chloride consists of discrete $BeCl_2$ molecules. Is the octet rule satisfied for Be in this compound? If not, can you form an octet around Be by drawing another resonance structure? How plausible is this structure?**

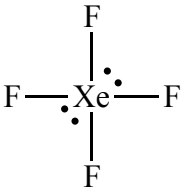
Drawing the structure with single bonds between Be and each of the Cl atoms, the octet rule for Be is *not* satisfied. The Lewis structure is on the left below. An octet of electrons on Be can only be formed by making two double bonds as shown below right.

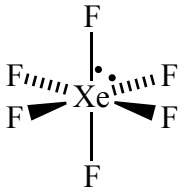
This places a high negative formal charge on Be, and both double bonds and positive formal charges on the Cl atoms. This structure distributes the formal charges counter to the electronegativities of the elements. It is not a plausible Lewis structure.

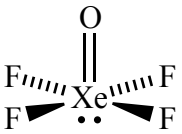
**63 Of the noble gases, only Kr, Xe and Rn are known to form a few compounds with O and/or F. Write Lewis structures for the following molecules: (a) $XeF_2$, (b) $XeF_4$, (c) $XeF_6$, (d) $XeOF_4$, (e) $XeO_2F_4$. In each case Xe is the central atom.**

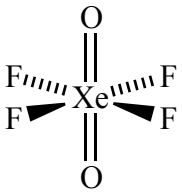
For simplicity, the nonbonding pairs of electrons around the fluorine and oxygen atoms are omitted.

(a) 


(b) 


(c) 

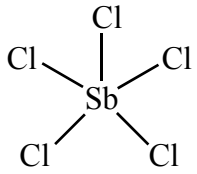

(d) 


(e) 


The octet rule is exceeded in each case.

**64 Write a Lewis structure for $SbCl_5$. Does this molecule obey the octet rule?**

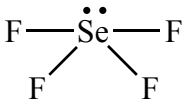
The outer electron configuration of antimony is $5s^2 5p^3$. The Lewis structure is shown below. All five valence electrons are shared in the five covalent bonds. The octet rule is not obeyed. (The electrons on the chlorine atoms have been omitted for clarity.)

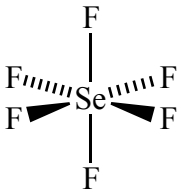



Sb has an expanded octet, so the octet rule is not obeyed.

**65 Write Lewis structures for $SeF_4$ and $SeF_6$. Is the Octet rule satisfied for Se?**

For simplicity, the three, nonbonding pairs of electrons around the fluorine are omitted.




The octet rule is not satisfied for Se in either compound (why not?).