1) For each of the following: a) find the number of valence electrons; b) draw the Lewis Structure (include all resonance structures); c) calculate the formal charge for each atom in each molecule and add it to the Lewis Structure; d) fill in the remainder of the information requested in the table.

<table>
<thead>
<tr>
<th></th>
<th>a) SO$_2$</th>
<th>b) SO$_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18 e$^-$</td>
<td>26 e$^-$</td>
</tr>
<tr>
<td></td>
<td><img src="image1" alt="Lewis Diagram for SO$_2$" /></td>
<td><img src="image2" alt="Lewis Diagram for SO$_3$" /></td>
</tr>
<tr>
<td></td>
<td>Name: sulfur dioxide</td>
<td>Name: sulfur trioxide</td>
</tr>
<tr>
<td></td>
<td>Electron pair geometry: triangular planar</td>
<td>Electron pair geometry: triangular planar</td>
</tr>
<tr>
<td></td>
<td>Molecular geometry: bent</td>
<td>Molecular geometry: triangular planar</td>
</tr>
<tr>
<td>c)</td>
<td>SO$_3^{-2}$</td>
<td>d) CO$_3^{-2}$</td>
</tr>
<tr>
<td></td>
<td>26 e$^-$</td>
<td>24 e$^-$</td>
</tr>
<tr>
<td></td>
<td><img src="image3" alt="Lewis Diagram for SO$_3^{-2}$" /></td>
<td><img src="image4" alt="Lewis Diagram for CO$_3^{-2}$" /></td>
</tr>
<tr>
<td></td>
<td>Name: sulfite</td>
<td>Name: carbonate</td>
</tr>
<tr>
<td></td>
<td>Electron pair geometry: tetrahedral</td>
<td>Electron pair geometry: triangular planar</td>
</tr>
<tr>
<td></td>
<td>Molecular geometry: triangular pyramidal</td>
<td>Molecular geometry: triangular planar</td>
</tr>
</tbody>
</table>

The Lewis structures are shown in the images linked above.
e) $\text{IO}_4^-$

- Electron pair geometry: tetrahedral
- Molecular geometry: tetrahedral

Name: iodate

f) $\text{NO}_2$

- Electron pair geometry: triangular planar
- Molecular geometry: bent

Name: nitrogen dioxide

g) $\text{HOCl}$

- Electron pair geometry: tetrahedral
- Molecular geometry: bent

h) $\text{I}_3^-$

- Electron pair geometry: triangular bipyramidal
- Molecular geometry: linear

i) $\text{PF}_5$

- Electron pair geometry: triangular bipyramidal
- Molecular geometry: triangular bipyramidal

j) $\text{BeCl}_2$

- Electron pair geometry: linear
- Molecular geometry: linear
2) Find the error in each of the following Lewis structures. Circle the error and redraw the structure so that it is correct.

![Lewis structures images]

3) Identify two elements that can represent “X” if X has one lone pair in the molecule XBr₄.

**Group 6: S, Se**

*Moore, Stanitski, and Jurs: Chapter 8: 35 (explain why), 39, 64, 79, 85, 91, 95 Chapter 9: 22, 26*

35 a) B-Cl; Boron has a smaller atomic radius than gallium

b) C-O; Carbon has a smaller atomic radius than tin
c) P-O; Oxygen has a smaller atomic radius than sulfur
d) C=O Oxygen has a smaller atomic radius than carbon

39) ![C=O structures image] C≡O of carbon monoxide takes more energy to break than the C=O of formaldehyde
64) Br-Br = 228 pm / 2 = 114 pm radius Br
C-Br = 191 pm – 114 pm = 77 pm C
C-C 77pm + 77pm = 154 pm radii or atoms are approximately the same in similar molecules

85)
O=O \{ double bond of O
O=C \} single bond to O
O-H \} larger atomic radius
O-O \} smaller atomic radius

Chapter 9

22)
a) SCl2
\[ \text{Cl} \quad \text{Cl} \]
~104°
b) \[ \text{N} \quad \text{N} \quad \text{O} \]
~180°
c) \[ \text{H} \quad \text{N} \quad \text{C} \quad \text{N} \quad \text{H} \]
#1 120°
#2 ~107°
d) \[ \text{H} \quad \text{C} \quad \text{O} \quad \text{H} \]
#1 109°
#2 ~104°

91) changed the connectivity of the atoms

95)
\[ 20 \text{ e}^- \]

26)
\[ \text{ClF}_2^+ \quad 20\text{ e}^- \]
\[ \text{Cl} \quad \text{F} \quad \text{F} \quad \text{Cl} \quad \text{F} \]
tetrahedral
tetrahedral
< 109.5°

\[ \text{ClF}_2^- \quad 22\text{ e}^- \]
\[ \text{F} \quad \text{Cl} \quad \text{F} \quad \text{F} \]
triangular bipyramidal
180°