CHEM 202 Quiz 6.1

1. \( \text{OH} \) has higher boiling point because it can hydrogen bond. \( \text{Cl} \) cannot hydrogen bond.

2. CH3-CH2-CH2-CH2-I because the van der Waals forces increase with increasing mass.

3. a) S-F > S-Cl > S-Br
   The electronegativity increase from Br<Cl<F. The electronegativity difference between the atoms increases going form Br to Cl to F. Thus the polarity increases in the same order.

3 b) HF > HCl > \( \text{H}_2 \)
   \( \text{H}_2 \) is the least polar because it does not have a permanent dipole. HCl does have a permanent dipole but is less polar than HF because the electronegativity difference in HF is greater.

4. Ethanol dissolves in water because it can form hydrogen bonds with the water. The polarized O-H bond which is present in the molecules enables the H-bonding.

5. K-K < N-N = Cl-Cl < O-O. Higher the electronegativity of the atoms higher the HOMO-LUMO band gap energy.
CHEM 202 Quiz 6.2

1. CCl₄ has the highest van der Waals forces and CH₄ has the lowest because these forces increase with the atomic weight of the molecules.

2. I₂ because it is more massive than Br₂.

3.

<table>
<thead>
<tr>
<th>Molecule</th>
<th>Central Atom</th>
<th>Hybridization</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂O</td>
<td>O</td>
<td>sp³</td>
</tr>
<tr>
<td>CCl₄</td>
<td>C</td>
<td>sp³</td>
</tr>
<tr>
<td>N₂</td>
<td>N</td>
<td>sp</td>
</tr>
<tr>
<td>HCN</td>
<td>C</td>
<td>sp</td>
</tr>
</tbody>
</table>

4. BeCl₂ > H₂O > NH₃ > Cl₂

5. Sulfur is more likely to be an insulator because it is a non-metal. The HOMO-LUMO band gap energy would be the highest for sulfur because the electronegativity is the largest among the given choices (X = 2.5)
3.

The second molecule has higher boiling temperature because there is a permanent dipole. The dipole for the first molecule cancels out because it is symmetrical.
1. H \rightarrow HF

\[ \sigma^* \] (anti-bonding)

1s

\( \begin{array}{c}
\downarrow \\
\\text{non-bonding} 2p
\end{array} \)

\( \begin{array}{c}
\downarrow \\
\sigma \text{ (bonding)}
\end{array} \)

The **HOMO–LUMO** transition will be from the non-bonding \( 2p \rightarrow \sigma^* \).

The electronegativity of sulfur is less than that of fluorine. Hence HS will have the lower **HOMO–LUMO** band-gap energy.

2. Cu → conductor
He → insulator
Si → semi-conductor
Fe → conductor
Ge → semi-conductor
Ar → insulator