1. (4 points) State the number of $\sigma$ and $\pi$ bonds in each of the following structures.
   
   a. Number of $\sigma$ bonds = _____  Number of $\pi$ bonds = ________
      
      \[
      \begin{array}{c}
      H \\
      C=\overset{\cdots}{C}=C \\
      H
      \end{array}
      \]

   b. Number of $\sigma$ bonds = _____  Number of $\pi$ bonds = ________
      
      \[
      \begin{array}{c}
      H-C\equiv C \\
      C=\overset{\cdots}{C}=C \\
      H
      \end{array}
      \]

2. (10 points) Draw Lewis structures for the following species and indicate the formal charge on each atom.
   
   a. NO$_5^-$
      
      \[
      \begin{array}{c}
      H \cdots C\equiv C \\
      C=\overset{\cdots}{C}=C \\
      H
      \end{array}
      \]

   b. IF$_5$
      
      \[
      \begin{array}{c}
      H \cdots C\equiv C \\
      C=\overset{\cdots}{C}=C \\
      H
      \end{array}
      \]
3. (25 points) State the number of electron domains, the electron-domain geometry, the molecular geometry, the polarity (polar or nonpolar), and the hybridization about the central atom for each of the following species.

<table>
<thead>
<tr>
<th>Species</th>
<th># electron-domains</th>
<th>Electron-domain geometry</th>
<th>Molecular geometry</th>
<th>Polar or Nonpolar? (P/NP)</th>
<th>Hybridization</th>
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</table>
4. (5 points) 75.0-g of Ne gas is confined to a container of volume 45.5-L at a temperature of 100 °C. What is the pressure of the Ne? **SHOW YOUR WORK.**

5. (5 points) The temperature of the container in Problem 4 is changed to 275 °C. What is the new pressure of the Ne? **SHOW YOUR WORK.**

6. (5 points) A 55.0-L vessel contains 4.52 mol of CO₂, 2.35 mol of O₂, and 5.12 mol of N₂ at a temperature of 45.0 °C. Find the total gas pressure in the vessel and the partial pressures of each of the components in the vessel.
7. (9 points) Air bags in cars generate N\textsubscript{2} quickly to inflate using the chemical reaction:

\[ \text{2 NaN}_3 (s) \rightarrow \text{2 Na (s)} + \text{3 N}_2 (g) \]

Let’s work a problem step-by-step to see how many grams of NaN\textsubscript{3} would be required to generate 40.0-L of N\textsubscript{2} at a pressure of 1.25-atm and a temperature of 28.0 °C. **SHOW YOUR WORK**

a. How many mol of N\textsubscript{2} are to be generated in this problem?

b. For the number of mol of N\textsubscript{2} you found in part a, how many mol of NaN\textsubscript{3} would be required to form that much N\textsubscript{2}?

c. Based on your answer to part b, how many grams of NaN\textsubscript{3} are required to generate the number of mol of N\textsubscript{2} indicated in part a?

Potentially Useful Information for this test:

\[ PV = nRT \]

\[ \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \]

\[ R = 0.8206 \text{ L·atm/mol·K} \]