1) Shown below is a molecular orbital scheme for heteronuclear diatomic molecules. 

(Figure taken from Harris and Bertolucci's "Symmetry and Spectroscopy")

For the following molecular species, use the above shown MO diagram to determine for each
• which atom corresponds to A, and which to B, on the scheme and why?
• the electronic configuration
• the bond order
• magnetic properties (will it be paramagnetic or diamagnetic and why?)

a) BF   b) CN⁻   c) CO⁺   d) NO⁺   e) CF

2) Molecular species which have the same number and type of valence electrons are said to be isoelectronic with one another. For example, CO and N₂ are isoelectronic with one another as can be seen by their electronic configurations. Of the five molecular species in question 1, which are isoelectronic with one another and why?

3) Understanding the difference in their electronic configurations, rationalize the difference in the bond length and bond enthalpy of the CN and CN⁺ molecular species, as well as the difference between NO and NO⁺.

<table>
<thead>
<tr>
<th>Molecule</th>
<th>Bond Length (Å)</th>
<th>Bond Enthalpy (kJ/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN</td>
<td>1.1718</td>
<td>787</td>
</tr>
<tr>
<td>CN⁺</td>
<td>1.1727</td>
<td>544</td>
</tr>
<tr>
<td>NO</td>
<td>1.0619</td>
<td>1060</td>
</tr>
<tr>
<td>NO⁺</td>
<td>1.150</td>
<td>678</td>
</tr>
</tbody>
</table>

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4) Consider the layer sequence below to the left for a compound containing Ni and As.
   a) What is the empirical formula for the compound? Show how you "counted" atoms.
   b) What is the coordination number and geometry of each type of atom in the structure?

5) Consider the layer sequence above to the right for a compound containing Mo and S.
   a) What is the empirical formula for the compound? Show how you "counted" atoms.
   b) What is the coordination number and geometry of each type of atom in the structure?
   c) This compound, like graphite, is a well-known solid state lubricant. What feature of the structure can account for this slippery property?