

Assignment 3

Question #1

Bonding

A researcher in Germany named Driess recently reported a square planar arsonium cation, $[\text{AsR}_4]^+$. Assuming a point group of D_{4h} , use group theory to determine what orbitals may be used for the sigma bonding. From your answer, what kind of hybrid orbitals would be used to make such a molecule according to VBT and how do these compare to the hybrids that you would expect for a normal arsonium cation.

Question #2

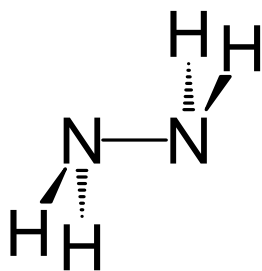
More Bonding

Use group theory to determine what orbitals may be used for (i) the sigma bonding and (ii) the pi bonding in AsF_5 in its most stable geometry. Remember to split the pi bonding into axial, equatorial parallel, and equatorial perpendicular components.

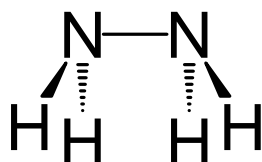
Question #3

Character Tables and Vibrational Spectroscopy

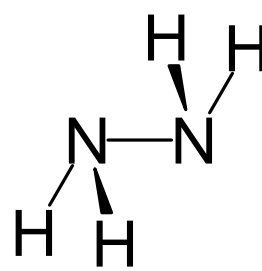
Determine the number of vibrational modes that will be observed in (a) an Infrared experiment and (b) a Raman experiment for hydrazine ($\text{H}_2\text{N}-\text{NH}_2$) in each of the following conformations - each one has a different point group:



(a)



(b)



(c)