CHAPTER 9 QUESTIONS

Try solving these questions *before* viewing the narrated answers online.

1. Using VSEPR theory, deduce the geometries for I_3^- and BrF_4^+. Show all your work, and name the shapes of both ions.

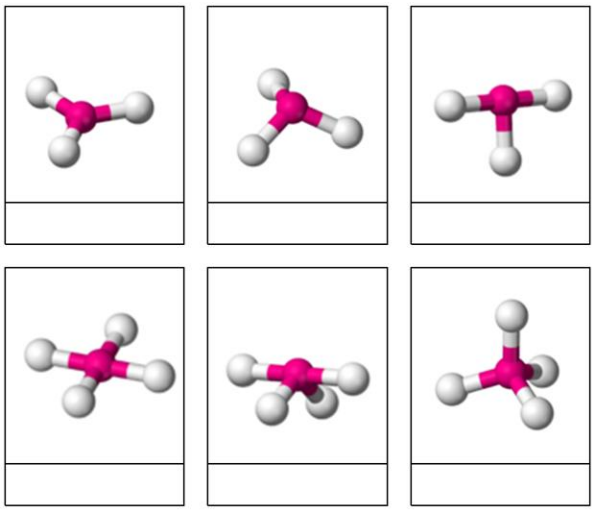
2. Carry out a VSEPR analysis of NCl_3 and answer the questions a – c below.

a) The arrangement of the electron pairs (both bonding and non-bonding) around the N atom is:

b) The Cl-N-Cl bond angle(s) in NCl_3 are approximately:

c) The orbital hybridization around the N atom is described as:

3. What is the hybridization of the central atom in each of the structures below?



4. Which of the following statements concerning orbital hybridization is CORRECT?

a) Water molecules are bent (V-shaped) because the oxygen atom is sp^2 hybridized.

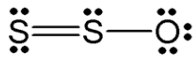
b) Six atomic orbitals must be combined to make a set of sp^3d^2 hybrid orbitals.

c) For an sp^3d hybridized atom with fewer than five bonding electron domains, the non-bonding electron pairs are in the axial position(s).

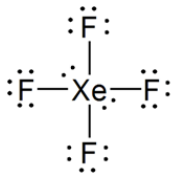
d) The carbon atoms in hydrocarbons are all sp^3 hybridized.

e) The carbon atoms in benzene (C_6H_6) are all sp hybridized.

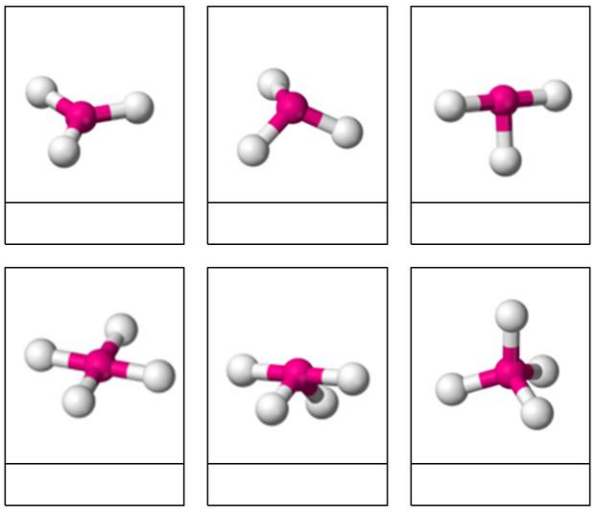
5. Complete the table:

	Lewis structure	Electron domain shape	Hybrid-ization	Molecular shape (name *and* sketch)
S_2O				
SeF_3^+			sp^3	
$SnCl_6^{2-}$		octa-hedral		

6. Complete the table:

	Lewis structure	Electron domain shape	Hybrid-ization	Molecular shape (name *and* sketch)
ClO_2			sp^3	
XeF_4				
$SeCl_4$		trigonal bipyra-midal		

7. Indicate whether each molecule is polar or non-polar. If it is polar, draw an arrow to show the direction of the overall dipole moment (central atom least electronegative).



8. Draw three-dimensional structures of PCl_3 and PCl_5, and name the orbital hybridization used to describe the bonding in each. Then explain why one has a dipole moment and one does not. Draw a circle around the one with a non-zero dipole moment.

9. The Lewis structure for the hydrogen cyanide molecule is given below. Draw and label all the orbitals that make up the sigma (σ) bonding framework of HCN in the localized electron model of bonding. Clearly show how the orbitals overlap to form a bond. As a separate drawing, do the same for the pi (π) bonding system of HCN.

10. Draw the bonding orbitals used in the formation of all the sigma (σ) and pi (π) bonds (including those to the H atoms) for the molecule "ketene imine" ($H_2C=C=NH$) clearly showing how the orbitals overlap to form the bonds. You will need to decide on the orbital hybridization of each atom and proceed from there. Clearly label all the orbitals and sigma (σ) and pi (π) bonds and show all the bonding and non-bonding electrons.