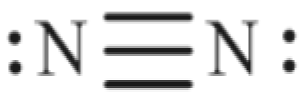
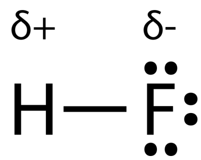
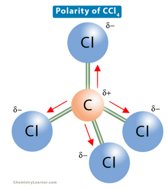
SCH Structure, Forces and Properties Quiz
Answer Section

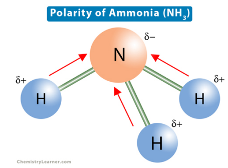
SHORT ANSWER

1. a &b when drawing structures use solid and dashed wedges as needed to show 3D. (The below images don't as these were the clearest to show dipoles but didn't have wedges)









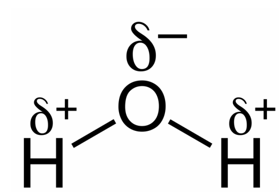
$N_{2(g)}$ - linear, non-polar
$HF_{(g)}$, linear, polar
$CCl_{4(g)}$, tetrahedral, non-polar as its symmetrical and vectors cancel
$NH_{3(g)}$ trigonal pyramidal, polar as its non-symmetrical and vectors do NOT cancel

c. HF and NH3 will be largely removed as both are polar and will therefore dissolve in water since it is also polar and will attract with dipole interactions. In addition, they will both hydrogen bond with water, increasing their solubility.

2. Theoretically, ionic compounds consist of very large numbers of positive and negative ions attracting one another in a regular geometric three-dimensional arrangement called a crystal lattice. (non-directional bonding)

3. - all electrons are very close to each other around the central atom
 - so to minimize the strong repulsion generated, bonding and non-bonding (lone) pairs of electrons become arranged three-dimensionally as far apart as possible

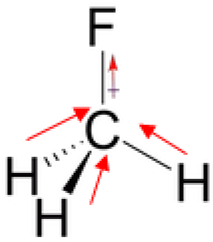
4. Water molecule is a bent shape, oxygen is slightly negative.



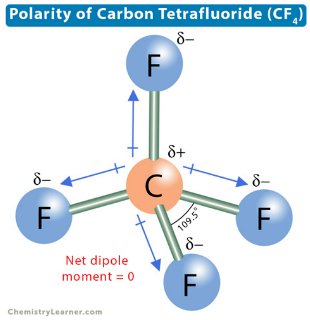
The molecule is polar and therefore has slightly positive and negative ends of the molecule. These dipoles will be attracted/repelled by the charged object causing the water to bend.

5. since there are only two atoms in any bond, there is only 1 possible alignment between the two atoms so the additional bonds must be in the same region (the other pairs of electrons in the multiple bond can be considered parallel to each other) and are have the same effect on shape as a single bond, just ONE AREA of electrons around central atom.

6. a. Both molecules have a tetrahedral structure. This shape is symmetrical in all directions so molecules with the same atom around the central atom will be symmetrical molecules, however, molecules with different atoms around the central atom will NOT be symmetrical.. Therefore, even though the CF_4 molecule contains four polar bonds, there is no positive end and negative end; therefore the molecule itself is not polar. However, the CH_3F molecule contains only one C-F bond. The F draws electrons from the rest of the molecule as well, forming a partial negative charge at its end, and leaving the hydrogens with partial positive bonds.



molecular dipole



b.The difference in melting points is explained by the difference in van der Waals forces affecting the attraction of the molecules to one another. Both molecules will have the comparitively weak London dispersion forces resulting from momentary dipoles. However, CF_4 is non-polar molecules whereas CH_3F is a polar molecule with positive and negative dipoles. These dipoles result in dipole-dipole intermolecular forces which are stronger that London dispersion forces alone, resulting in a higher melting point as more energy is required to separate the more strongly attracted molecules

NOTE: Neither molecule has hydrogen bonding. The presence of F and H does NOT create H-bonding as they are NOT bonded together. H-F bond would have hydrogen bonding but F-C-H does not. .

7. The molecules form a ordered crystal through hydrogen bonding that spaces the molecules farther apart than when they were in a liquid. This makes ice less dense than water allowing it to float.

8. Both compounds are ionic and will have high melting points and will be soluble in water. Both compounds have the same magnitude of charges (1), but KBr is composed of larger ions. It will therefore be easier to separate the larger ions because the attractions between electrons and the nuclei of opposite ions is not as strong. Therefore, KBr will have a lower melting point and higher solubility that LiF.

9. When a molecule is composed of atoms of different electonegativities, that result in polar bonds that are not symmetrical, thus forming slightly negative and slightly positive ends of the molecule the molecule interacts with other polar molecules resulting in forces of attraction between the oppositely charged ends.