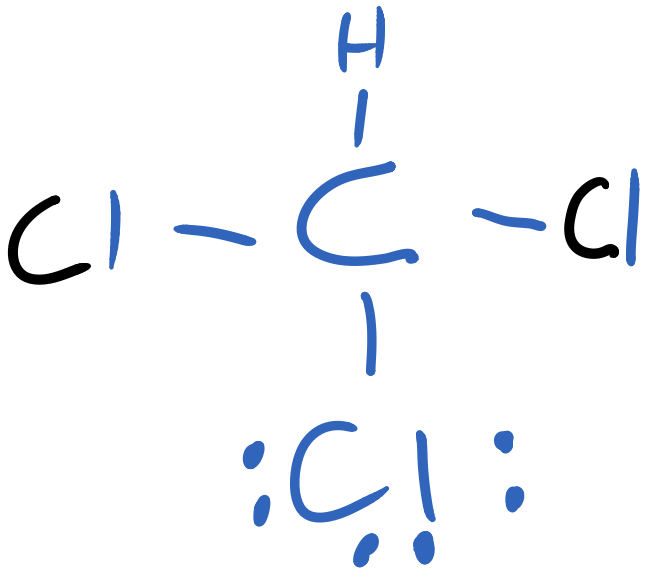
Recitation 1 Intermolecular Forces Name:_____

Piece #1 Consider chloroform ($CHCl_3$). Draw the Lewis Dot Structure of chloroform?



Piece #2 What is the molecular geometry of chloroform?

Carbon is the central atom with 4 electron groups and no lone pairs: tetrahedral.

Piece #3 For EACH bond in chloroform, identify whether it is “polar”, “non-polar” or “ionic”.

The distinction is based on electronegativity:

C – 2.5

H – 2.1

Cl – 3.0

The difference between C and H is only 0.4, so these bonds are considered “non-polar”.

The C-Cl bond has a delta E.N = 3.0-2.5 = 0.5, so it is “polar”

Piece #4 Is chloroform (the entire molecule) polar, non-polar, or ionic?

The entire molecule is weakly “polar”, there is nothing to fully cancel the polarity of the C-Cl bond in that 4th direction. You cancel it fairly completely in the plane of the 3 chlorines. But it doesn’t completely cancel.

Piece #5 What types of intermolecular forces is chloroform capable of generating?

Van der Waal’s (London Dispersion) Forces – EVERYTHING has those

Dipole-Dipole forces – the dipoles are there for 3 of the bonds. Dipole forces are very local.

Puzzle #1 Rank the following molecules from highest boiling point to lowest boiling point based on the anticipated intermolecular forces of each:

NH_3, H_2O, CH_4, CH_3Cl, LiCl

LiCl is ionic, so it is highest boiling

H_2O (hydrogen bonding)

NH_3 (hydrogen bonding)

CH_3Cl (heavier, Van der Waal's)

CH_4 (lighter, Van der Waal's)

Now, you might wonder why NH_3 is lower than H_2O. I mean, doesn't NH_3 have 3 H-bonds rather than 2 for water? It does, but they can't all overlap. If you make the model, at most you can get 1 H-bond to overlap at a time [put the H on the N and the N on the H]