

Date: _____

Worksheet: Intermolecular Forces

1. Draw Lewis structures for these molecules. Use δ symbols to indicate bond dipoles. Predict whether there is an overall molecular dipole.
- | | | | |
|---------------------|------------------------|---------------------|---------------------------------|
| a. H ₂ S | bent; polar | d. BrF | linear; polar |
| b. CCl ₄ | tetrahedral; non polar | e. PCl ₅ | trigonal bipyramidal; non-polar |
| c. SO ₂ | bent; polar | | |

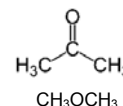
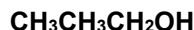
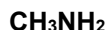
2. Complete the table:

Molecule	Polar or Non?	IMF (check all)		
		LDF	Dipole-dipole	H-bond
CH ₃ CF ₃ (2-carbon backbone)	polar	x	x	
CCl ₄	non	x		
SO ₂	polar	x	x	
BrF	polar	x	x	
CH ₃ CH ₂ NH ₂ (C-C-N backbone)	polar	x	x	x
H ₂ O	polar	x	x	x
PCl ₅	non	x		

3. H₂S, O₂ and CH₃OH all have comparable molecular masses. List the dominant type of IMF for the pure substances, then rank the strength of each compound based on IMFs within the samples (1 = strongest, 2 = in between, 3 = weakest)

Substance	Dominant IMF	Relative strength
H ₂ S	Dipole	2
O ₂	LDF	3
CH ₃ OH	H bond	1

4. Circle all of the species below that **can** form a hydrogen bond. Explain why the other species can't hydrogen bond.



C_2H_6 – non polar therefore only feels LDF

KCl – ionic (some would say super polar); no H-F, H-O, or H-N bonds

CH_3OCH_3 – CO group is polar, but no H is attached to the O

5. Rank the following compounds in order of increasing strength of intermolecular forces (weakest to strongest). Explain your answers.



Order: $N_2 < I_2 < H_2S < H_2O$

N_2 and I_2 are both nonpolar, so they only have London dispersion forces; I_2 has stronger forces because it is larger and has more electrons.

H_2S has dipole-dipole, so it is stronger than I_2 .

H_2O has hydrogen bonding, so it is stronger than H_2S .

6. Rank the following from weakest intermolecular forces to strongest. Explain your answers.



Order: $H_2S < H_2Se < H_2Te < H_2Po$

These compounds are all the same shape, and are all non-polar. Therefore, the difference in London dispersion forces are more important for these compounds. Smallest H_2S = least dispersion forces, largest = H_2Po = strongest dispersion forces.

7. Rank the following in order of increasing boiling point (lowest to highest). Explain your answer.



propane



heptane



pentane

Order: propane < pentane < heptane

All are non-polar. Heptane is largest therefore has strongest LDF.