

HONORS: Intermolecular Forces Worksheet

1. Why are the intermolecular attractions in $\text{H}_2\text{O}_{(g)}$ weaker than the attractions in $\text{H}_2\text{O}_{(l)}$ or $\text{H}_2\text{O}_{(s)}$?

B/c the particles are more spread out \rightarrow weaker HB

2. Consider the following: Br_2 (Mass of 159.81 g), Ne (Mass of 20.18 g), HCl (Mass of 36.46 g), and N_2 (Mass of 28.01 g). (Hint: Mass may not be the only factor involved! :-))

- a. Which of the above would have the largest London dispersion forces? Why?

Br_2 - more mass = more e^- = more repulsion

- b. Which of the above would have the largest dipole-dipole attractions? Why?

HCl - the others aren't polar

3. Which of the following molecules would exhibit hydrogen bonding: methane (CH_4), ammonia (NH_3), methyl fluoride (CH_3F), or dihydrogen monosulfide (H_2S)? Explain why!

Ammonia - HB only occurs w/ H bonded to N, O, or F

4. List the type(s) of intermolecular forces that are present in each of the following examples:

Compound	Intermolecular Forces	Compound	Intermolecular Forces
HBr	LDF DD	H_2O	LDF DD HB
I_2		CH_2Cl_2	DD
CS_2		C_2H_6	
NH_3	DD HB	ClF_3	DD
H_2S	\downarrow DD	CH_3COOH	\downarrow DD HB

5. Use your understanding of intermolecular forces to explain why: (Hint: You may need to calculate molecular masses!)

- a. ICl boils at 97°C , while Br_2 boils at 59°C .

ICl has DD whereas Br_2 only has LDF DD > LDF

- b. CHCl_3 boils at 61°C while CHBr_3 boils at 150°C .

CHBr_3 has more mass so stronger LDF = more IMFs

6. For each of the following, select the molecule that you would expect to have the higher boiling point and explain your reasoning: (Hint: You may need to calculate molecular masses!)

- a. HF or HCl

HF b/c it has HB (the strongest IMF)

- b. CH_4 or C_3H_8

C_3H_8 b/c while they are both nonpolar, it has a greater mass = greater e^- repulsion

7. List the substances BaCl_2 , H_2 , CO , HF , and Ne in order of increasing boiling points and explain how you arrived at your answer.

H_2 , Ne , CO , HF , BaCl_2

LDF only (so based on mass) < DD < HB < Ionic Bond

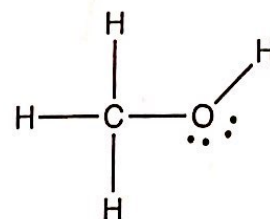
8. How can we use intermolecular forces to explain the fact that chlorine is a gas at room temperature, while bromine is a liquid, and iodine is a solid?

Br + I have greater masses than Cl so they will be held together stronger = liquid/solid

9. Arrange the following in order of increasing melting point: RbF , CO_2 , CH_3OH (Methanol), CH_3Br . Explain how you arrived at your answer.

CO_2 , CH_3Br , CH_3OH , RbF

nonpolar (LDF only) < Polar (LDF + DD) < Polar (HB) < Ionic



10. **Challenge:** If you lived in Alaska, would it be better to keep methane (CH_4), propane (C_3H_8), or butane (C_4H_{10}) in an outdoor storage tank during the winter? Explain your answer.