

Intermolecular Forces Worksheet

Answers are on page 3 & 4. **Do the problems on your own BEFORE looking at the answers.**

1. Predict the molecular shape of each of the following:

- a. H₂S _____
- b. CCl₄ _____
- c. SO₂ _____
- d. BrF _____
- d. PCl₅ _____

2. List **all** types of IMFs that would occur in each of the following (you should have a good enough understanding of electronegativities to answer all of these, except maybe SO₂, without look up the electronegativity numbers).

- a. CH₃CF₃ _____
- b. CCl₄ _____
- c. SO₂ _____
- d. BrF _____
- e. (CH₃)₃N _____
- f. PCl₅ _____

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.

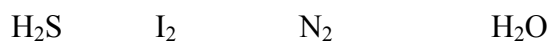
(1 = strongest, 2 = in between, 3 = weakest).

Substance	IMF	Relative Strength
HBr		
O ₂		
CH ₃ OH		

4. Circle all of the species below that can form a hydrogen bond in its pure form. Explain why the other species couldn't hydrogen bond.



5. Rank the following compounds from weakest intermolecular forces to strongest. Justify your answers.



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



Intermolecular Forces Worksheet **Answers**

1. Predict the molecular shape of each of the following:

- a. H₂S **bent**
- b. CCl₄ **tetrahedral**
- c. SO₂ **bent (lone pair on S, two double bonds)**
- d. BrF **no shape**
- d. PCl₅ **trigonal bipyramidal**

2. List **all** types of IMFs that would occur in each of the following (you should have a good enough understanding of electronegativities to answer all of these, except maybe SO₂, without look up the electronegativity numbers).

- a. CH₃CF₃ **dispersion, dipole-dipole**
- b. CCl₄ **dispersion**
- c. SO₂ **dispersion, dipole-dipole**
- d. BrF **dispersion, dipole-dipole**
- e. (CH₃)₃N **dispersion, dipole-dipole**
- f. PCl₅ **dispersion**

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	IMF	Relative Strength
HBr	dipole-dipole	2
O ₂	dispersion	3
CH ₃ OH	hydrogen bonding	1

4. Circle all of the species below that can form a hydrogen bond in its pure form. Explain why the other species couldn't hydrogen bond.



C_2H_6 does not have O, N or F

KCl is ionic and does not have any hydrogens

In CH_3OCH_3 the H's are not directly bonded to the O

5. Rank the following compounds from weakest intermolecular forces to strongest. Justify your answers.



N_2 and I_2 are nonpolar, so they only have dispersion forces; I_2 has stronger forces because it is larger

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. Justify your answers.



These compounds are all the same shape. Although H_2S is slightly more polar than the others, it is not very polar so it has very weak dipole-dipole forces. Therefore, the difference in dispersion forces are more important for these compounds. H_2Po is the largest and, therefore, has the strongest dispersion forces.

This prediction agrees with experimental data. See figure 12.14 comparing boiling points of these compounds.