

KEY

Intermolecular Force Worksheet

Identify the strongest intermolecular force present in pure samples of the following substances:

SO ₂ dipole-dipole	H ₂ O hydrogen bond	CH ₂ Cl ₂ dipole-dipole
SCO dipole-dipole	PCl ₃ dipole-dipole	SO ₃ LDF
N ₂ LDF	CCl ₄ LDF	H ₂ S dipole-dipole
SO dipole-dipole	N ₂ H ₂ hydrogen bonding	BH ₃ LDF
CH ₄ O dipole-dipole	SiH ₂ O dipole-dipole	

1. Identify the strongest intermolecular force operating in the condensed phases of the following substances. Fully explain how you determined this.

a. Cl ₂ LDF nonpolar molecule	b. CO dipole-dipole polar bond polar molecule
c. SO ₂ dipole-dipole Bent ; polar	d. CH ₂ Cl ₂ dipole-dipole polar molecule $\begin{matrix} H & H \\ & \\ H-C & -C-Cl \end{matrix}$
e. HF hydrogen bonding H-F H-bond	g. CH ₃ -O-CH ₃ dipole-dipole $\begin{matrix} H & & H \\ & & \\ H-C & -O- & C-H \\ & & \\ H & & H \end{matrix}$ H not bonded to O polar molec.

2. Based on the intermolecular forces present, predict the relative boiling points of each of the substances below. Arrange each series of substances in order of increasing boiling point. State your reasons for the order you use (identify the forces and explain how they affect the boiling point).

a. dimethyl ether (CH₃OCH₃), ethanol (CH₃CH₂OH), and propane (CH₃CH₂CH₃)
 $\begin{matrix} H & H & \text{polar} \\ | & | & \\ H-C & -O- & C-H \text{ dip-dip} \end{matrix}$
 $\begin{matrix} H & H & \text{H-bonds} \\ | & | & \\ H-C & -C- & O-H \end{matrix}$
 $\begin{matrix} H & H & H & \text{nonpolar} \\ | & | & | & \\ H-C & -C- & C-H & \text{LDF} \\ | & | & | & \\ H & H & H & \end{matrix}$
 propane < dimethyl ether < ethanol b/c LDF < D-D < H-b

b. Br₂, Cl₂, I₂

Cl₂ < Br₂ < I₂ all are nonpolar so LDF only. Increase in strength as mass increases

3. For each pair of substance identify the substance that is likely to have the higher vapor pressure. Explain your reasoning.

a. CO₂ or SO₂
 nonp polar CO₂ > Vaporspress SO₂ LDF < D-D

weaker force

b. CH₃OH or CH₃-O-CH₃

H-bond

dip.

CH₃-O-CH₃ > CH₃OH
 vapor press.