

Intermolecular Force & Models Activity¹ CH222 Name _____

Compare liquid samples of the following compounds: $\text{CH}_3\text{CH}_2\text{NH}_2(\text{l})$, $\text{CH}_3\text{CH}_2\text{F}(\text{l})$, and $\text{CH}_3\text{CH}_2\text{OH}(\text{l})$. **Which sample of liquid has the higher boiling point?**

Activity 1. If you and your buddy have a model kit, talk to your neighboring group having the other model kit. a. Each group builds one $\text{CH}_3\text{CH}_2\text{NH}_2$ model.

b. Use your Table of Electronegativity Values of the Elements to determine which atom(s) has/have a partial positive charge (δ^+) and which atom(s) has/have a partial negative charge (δ^-). Determine the ΔEN between the atoms having the δ^+ charge and δ^- charge.

c. Bring the two models closed together. You have three different rubber bands, each representing a different strength IMF. Use the correct rubber band to connect the two $\text{CH}_3\text{CH}_2\text{NH}_2$ models by the primary IMF at the correct atom locations.

d. How many possible different arrangements are there?

c. Identify the IMF. Classify the strength of the IMF as weak, medium, or strong.

d. Sketch two 3D Lewis structures representing the two models and use a dashed line to show the correct location of the IMF.

Activity 2. Talk to your neighboring group having the other model kit. a. Each group builds one $\text{CH}_3\text{CH}_2\text{F}$ model.

b. Use your Table of Electronegativity Values of the Elements to determine which atom(s) has/have a partial positive charge (δ^+) and which atom(s) has/have a partial negative charge (δ^-). Determine the ΔEN between the atoms having the δ^+ charge and δ^- charge.

c. Bring the two models closed together. You have three different rubber bands, each representing a different strength IMF. Use the correct rubber band to connect the two $\text{CH}_3\text{CH}_2\text{F}$ models by the primary IMF at the correct atom locations.

d. How many possible different arrangements are there?

c. Identify the IMF. Classify the strength of the IMF as weak, medium, or strong.

d. Sketch two 3D Lewis structures representing the two models and use a dashed line to show the correct location of the IMF.

Activity 3. Talk to your neighboring group having the other model kit. a. Each group builds one $\text{CH}_3\text{CH}_2\text{OH}$ model.

b. Use your Table of Electronegativity Values of the Elements to determine which atom(s) has/have a partial positive charge ($\delta+$) and which atom(s) has/have a partial negative charge ($\delta-$). Determine the ΔEN between the atoms having the $\delta+$ charge and $\delta-$ charge.

c. Bring the two models closed together. You have three different rubber bands, each representing a different strength IMF. Use the correct rubber band to connect the two $\text{CH}_3\text{CH}_2\text{OH}$ models by the primary IMF at the correct atom locations.

d. How many possible different arrangements are there?

d. Identify the IMF. Classify the strength of the IMF as weak, medium, or strong.

e. Sketch two 3D Lewis structures representing the two models and use a dashed line to show the correct location of the IMF

f. Compare the strength of the IMF between the two $\text{CH}_3\text{CH}_2\text{NH}_2$ models, the two $\text{CH}_3\text{CH}_2\text{F}$ models, and the two $\text{CH}_3\text{CH}_2\text{OH}$ models. Which is stronger? Explain.

g. Which liquid sample has the higher boiling point $\text{CH}_3\text{CH}_2\text{NH}_2$, $\text{CH}_3\text{CH}_2\text{F}$, or $\text{CH}_3\text{CH}_2\text{OH}$? Explain.

Activity 4. Complete the table below. a. Build two models of each compound. Bring the two models close to each other and use the correct rubber band to represent the correct location of the IMF. Identify the IMFs present in each compound. Write your answer in the table.

Molecule	Molc. Weight (g/mol)	Boiling Point ($^{\circ}\text{C}$)	ΔH_{vap} (kJ/mol)	IMFs present	Rank: IMFs Strength
CH_4	16.04	-161.5	8.17		
CH_3Cl	50.49	-23.8	21.5		
CH_2Cl_2	84.93	39.6	28.6		
CH_3OH	32.04				
$\text{CH}_2(\text{OH})_2$	48.04				

b. Draw two 3D Lewis structures for each pair of models close to each other. Use a dashed line to represent the location of the IMF.

c. Estimate the b.p. and ΔH_{vap} for methanol and $\text{CH}_2(\text{OH})_2$ and write your estimate in the table.

d. In the table, rank the relative strengths of the total IMFs present in between two molecules.

e. For each of the following pairs of compounds, circle the liquid that has the higher b.p.
 CH_3Cl or CH_3OH CH_3Cl or CH_2Cl_2 CH_2Cl_2 or $\text{CH}_2(\text{OH})_2$ CH_3OH or $\text{CH}_2(\text{OH})_2$

f. For each of the pairs of compounds above, explain why you choose the compound's liquid sample as having the higher boiling point.

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