

Session 4 Worksheet

Physical Properties and Intermolecular Forces: A Better, Comprehensive Guide

Increasing Interaction Strength

Physical Properties

For this class we are talking about _____ and _____

Intermolecular Forces

Ion-Ion:

- Typically observed in _____ and _____
- Both mp and bp are _____

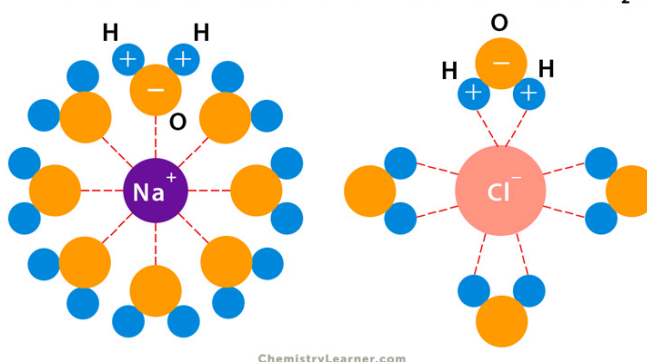
Covalent Bonds:

- An intermolecular force _____ the compound itself
- Considered _____ because of the _____ of electrons

Ion-Dipole:

- The interaction of a _____ and the _____ charge of an _____

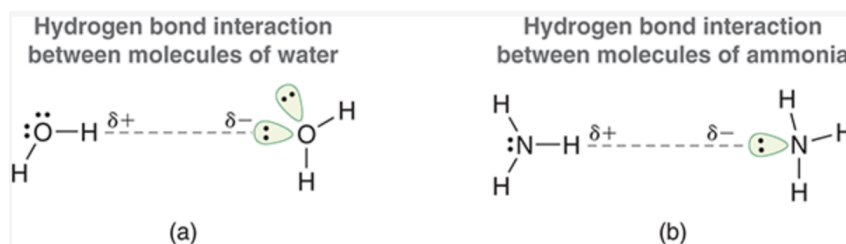
Sodium Chloride (NaCl) Dissolved in Water (H_2O)



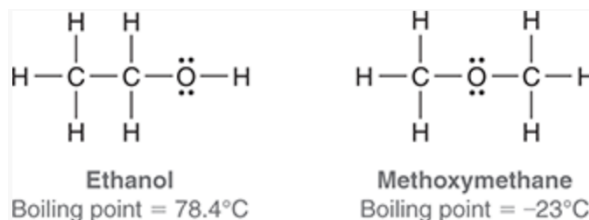
Hydrogen Bonding:

- Not technically a “bond”, more like another form of attraction

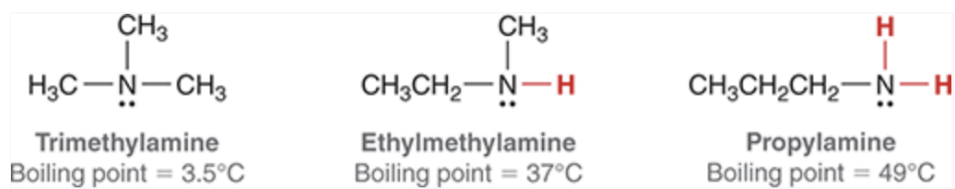
A hydrogen is connected to an _____ (_____)



How does this affect bp & mp?



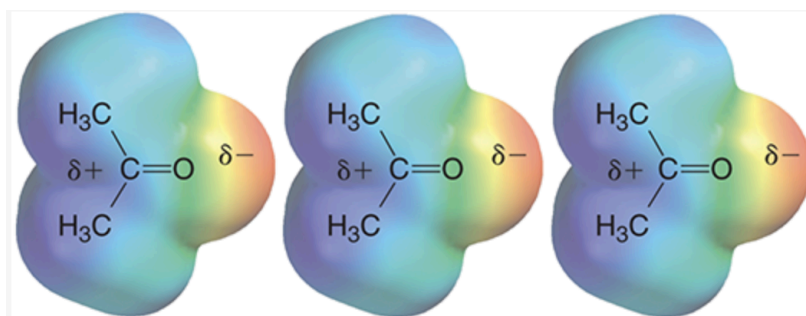
Ethanol has a higher bp because it has a hydrogen bonded to, versus Methoxymethane, which only has a _____ bond



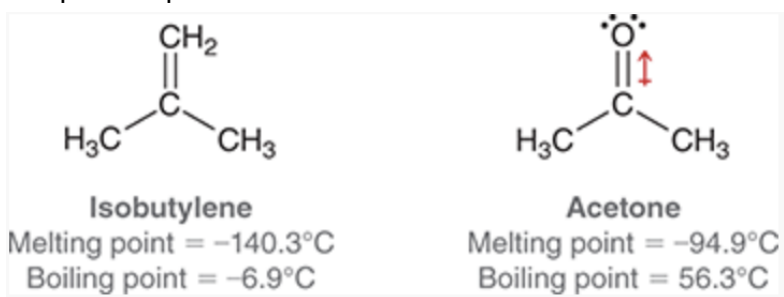
Notice how as more hydrogens are bonded to the Nitrogen atom, the _____ the bp gets

Dipole-Dipole:

The resulting _____ between two dipoles



How does this affect bp and mp?



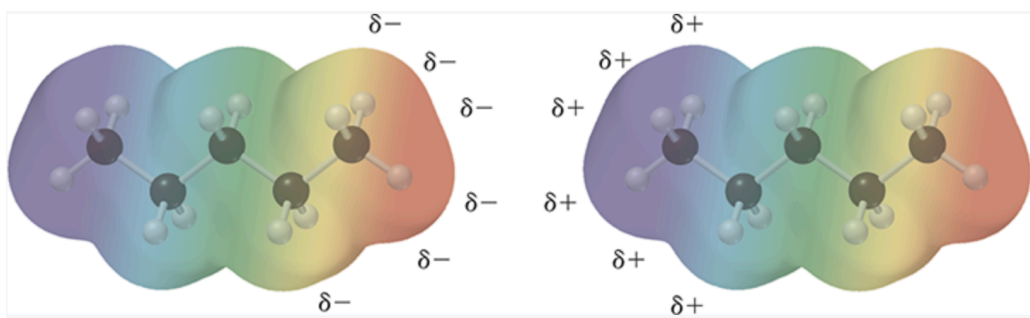
Isobutylene lacks _____, so the mp and bp are much lower compared to Acetone, which has _____

London Dispersion Forces:

A consideration of the _____ and _____ charges on a whole molecule, rather than the entire atom

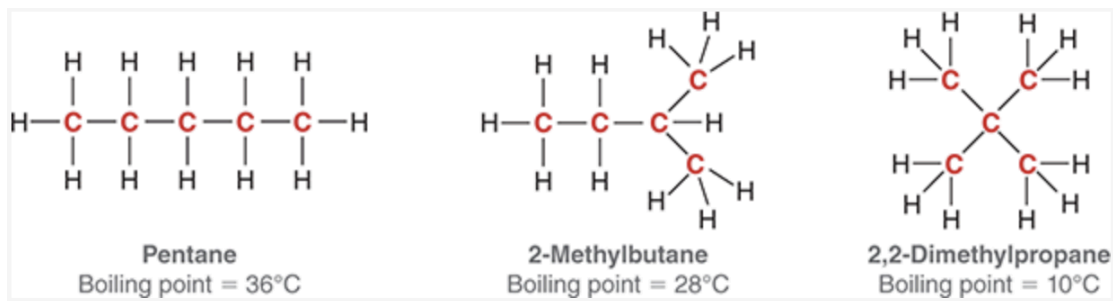
Usually observed in large _____

This force is transient, or _____



How does this affect bp and mp?

The _____ the carbon chain, the _____ higher the bp



The more _____, the _____ the bp

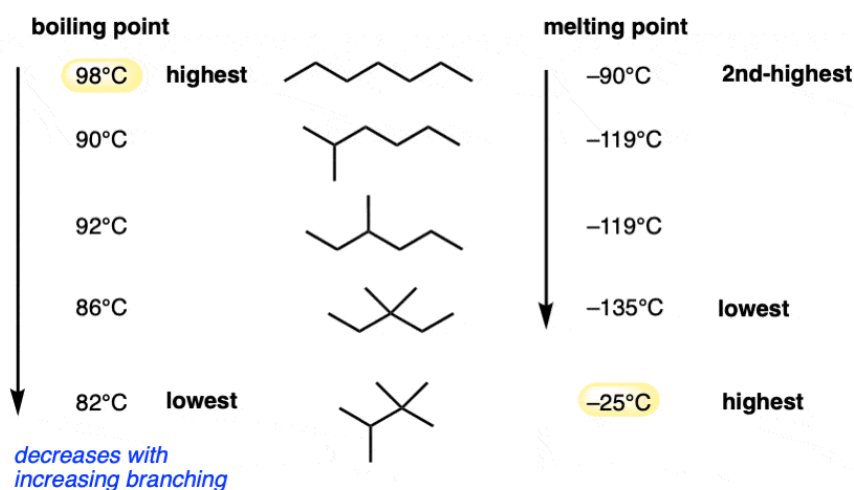
Melting Point

We've been talking about boiling point up until here; however, melting point properties have different requirements

- When it comes to branching, **generally**, the most branched structure will have a _____ melting point (there are exceptions)

- This is largely due to _____ and the ability of the molecules to _____

Boiling and Melting Points For Some Isomers of Heptane (C₇H₁₆)



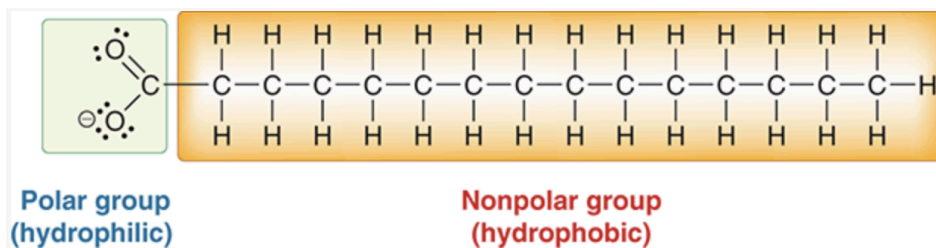
Solubility

“Like dissolves like”

Polar compounds will dissolve _____ compounds

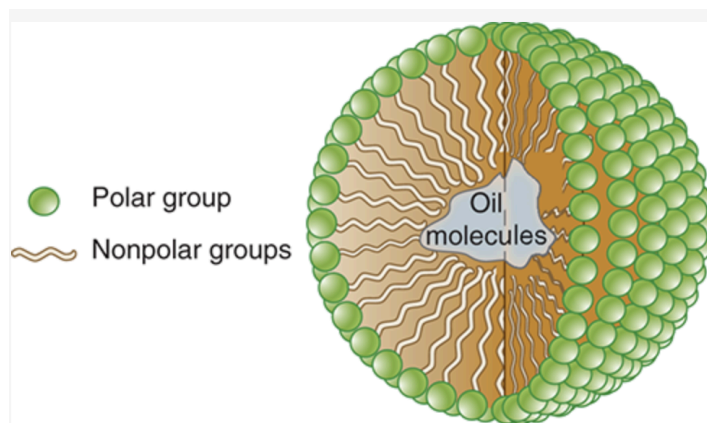
Non-polar compounds will dissolve _____ compounds

Determining Solubility: at least _____ dissolves in _____ for the compounds to be soluble to each other



Because soap has both a polar and non-polar group, it can form a structure called a

_____ to “wash” away an oil molecule, while also being soluble in water



Practice Questions

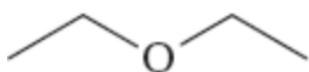
1. Which of the following compounds has the higher boiling point?

- A. CH_3OH
- B. NaCl
- C. Benzene
- D. $\text{CH}_3\text{CH}_3\text{Cl}$

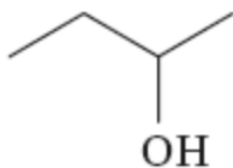
2. What compound will be soluble in Water?

- A. Cyclohexane
- B. $\text{CH}_3\text{CH}_2\text{OH}$
- C. CCl_4
- D. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$

3. Rank the compounds in order of decreasing boiling point



I



II



III

- A. $\text{II} < \text{I} < \text{III}$
- B. $\text{I} < \text{II} < \text{III}$
- C. $\text{III} < \text{II} < \text{I}$
- D. $\text{III} < \text{I} < \text{II}$

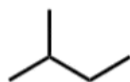
4. What intermolecular force is present in all molecules?

- A. Hydrogen Bonding
- B. Ion-Dipole
- C. London Dispersion
- D. Dipole-Dipole

5. What is the boiling point and melting point relationship between the following compounds?



n-pentane



2-methylbutane



2,2-dimethylpropane

- A. N-pentane has the highest melting point and boiling point
- B. 2,2-dimethylpropane has the highest melting point, and n-pentane has the highest boiling point
- C. 2-methylbutane has the highest melting point, and 2,2-dimethylpropane has the highest boiling point
- D. 2,2-dimethylpropane has the highest boiling point, and n-pentane has the highest melting point