TEST: Moved to Thursday 2\textsuperscript{nd}  

\textbf{i-clicker question}  

B) CH\textsubscript{3}OH- Has the strongest dipole moment  

\textbf{Dipole moment} has to do with where the electrons prefer to spend most of their time (on which atom). The electrons prefer to spend time on the most electronegative atom or bond. 
- Strength of the dipole moment depends on the strength of the bonds between atoms in a molecule  

\textbf{Non polar molecule}- Dipole moments cancel each other ex: CCl\textsubscript{4} Electrons are evenly distributed around the molecule  

\textbf{Polar molecule}- Electrons are not evenly distributed around molecule, there is a non zero dipole moment.  

- When figuring out dipole moment it is helpful to write out the Lewis structure  

\textbf{Explaining macroscopic behavior by particle level interactions}  

- Matter changes because of energy being added or removed  

H\textsubscript{2}O is a small molecule with large dipoles  
Dipole- Dipole attractions are predominately polar  

London Dispersion Forces  
CCl\textsubscript{4} - small molecule with nearly zero dipoles  

Liquid particles slide past each other, random  
Solid particles vibrate together, repeating patterns  

Long range order- Long distance away from molecule you are looking at  
Solids are long range order  

\textbf{Particle level: Materials composed of Molecules}  

Molecules of a liquid occupy similar amount of space as in a solid except are a little more spread out
Melting- Molecules overcome attractions in the solid state
   Molecules vibrate faster as you raise the temperature slowly
   If you raise the temperature slowly have even energy distribution molecules will
   break off all together instead of one at a time

Particle level: Materials composed of Ions
To change an ion to a solid: have to overcome intermolecular attractions
In a lattice structure: Ions occupy lattice sites ex: NH₄⁺

Particle level: Materials composed of metal atoms
- Metal core structure occupy each lattice site
- Core structure: Nucleus and electrons not in the valence shell. (valence shell=outer shell
   of electrons)

Force that hold units together in condensed states of matter: The basic idea
Condensed State (solid/liquid): Particles close enough together and they can interact with
   each other
   - Gases are never in the condensed state

Strength
Ion- The greater the charge the more strength between ions
Molecule- In a polar molecule the strength is due to the strength of the dipole moment
   In a non polar molecule the strength is due to the size of the molecule: larger
   molecule more strength

Ion-Ion attractions
Further apart the radius between ions: Weaker attractions
Ex: MgCl₂ has weaker attractions that NaCl
The radius increases because shells are being added to the atom

Explaining macroscopic behavior by reasoning based on ion-ion attractions
Larger lattice energy: Larger melting point
Lattice energy: Amount of energy to break apart a lattice solid and turn it into a liquid
LiF: Lattice energy 1037, Melting point 848
LiI: Lattice energy 761, Melting point 459
Explaining macroscopic behavior by reasoning based on dipole-dipole attractions

- The stronger the dipole moment: Stronger boiling point

HF attractions are stronger than HCl because F is more electronegative than Cl

When looking for the strength of the bond polarity: Look at the difference in electronegativity (N, O, F, Cl- elements with the strongest electronegativity)

Some dipole-dipole interactions are very strong

Hydrogen Bonding: DNA, RNA, Proteins

H₂O – has a high boiling point because of its two O-H polar bonds
O-H bond is a form of hydrogen bonding

More about non-polar – non-polar attractions

London Dispersion forces are greater when electrons are more polarizable
Larger molecules- larger London Dispersion forces

Explaining macroscopic behavior by reasoning about intermolecular forces

<table>
<thead>
<tr>
<th></th>
<th>Melting Points</th>
</tr>
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<tbody>
<tr>
<td>C₁₁H₂₃COOH</td>
<td>44 C</td>
</tr>
<tr>
<td>C₁₃H₂₇COOH</td>
<td>58 C</td>
</tr>
<tr>
<td>C₁₃H₃₁COOH</td>
<td>63 C</td>
</tr>
<tr>
<td>C₁₇H₃₅COOH</td>
<td>70 C</td>
</tr>
</tbody>
</table>

In molecules with similar molecular weights: Melting points increase due to London Dispersion forces

London Dispersion forces
Weak: Small molecules
Strong: Large molecules