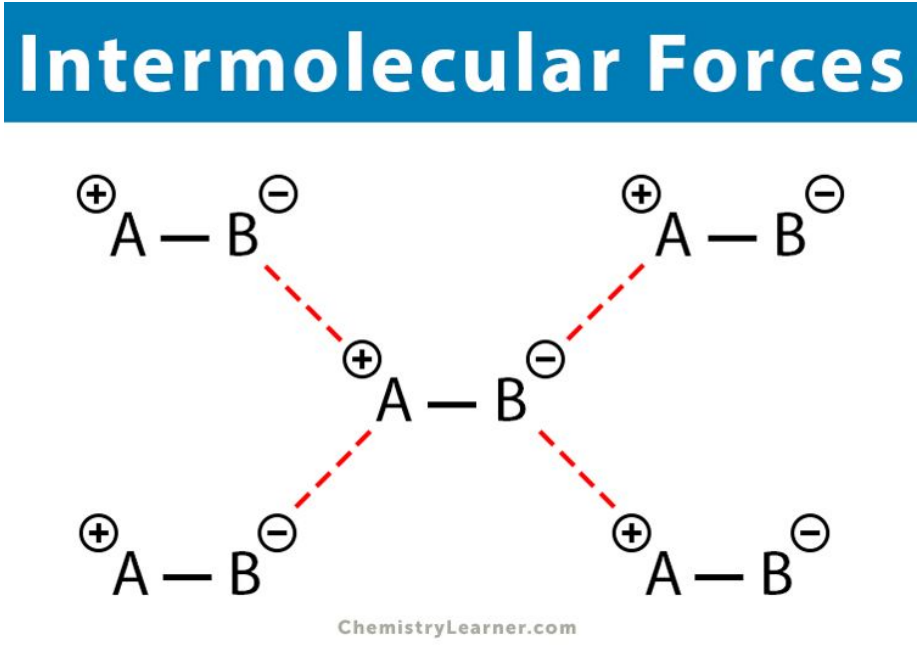
Unit 4 Slides

Intermolecular Forces

Intermolecular forces*

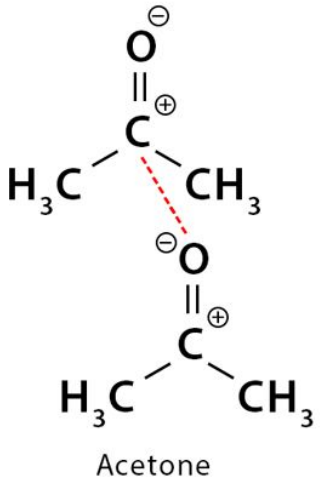
The forces of attraction or repulsion between two separate molecules



Dipole-dipole interactions*

forces that exist when two molecules have dipoles and have a resulting partial charge that interacts with an opposing partial charge of another molecule

Occurs between polar molecules

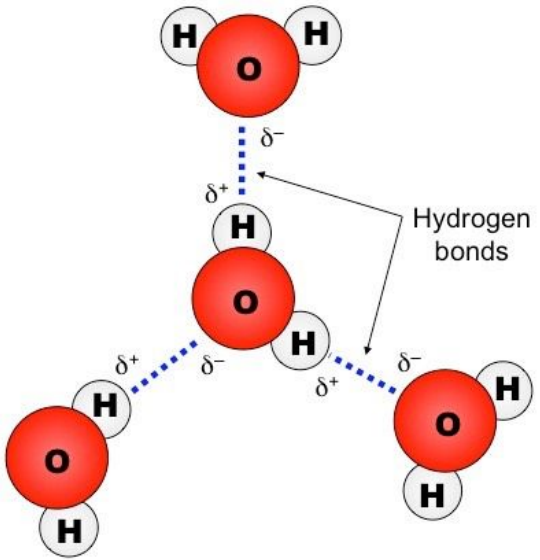


Acetone

Hydrogen bonding*

A specific kind of dipole-dipole interactions that exists between molecules where hydrogen is bonded to fluorine, oxygen, or nitrogen (F, O, N)

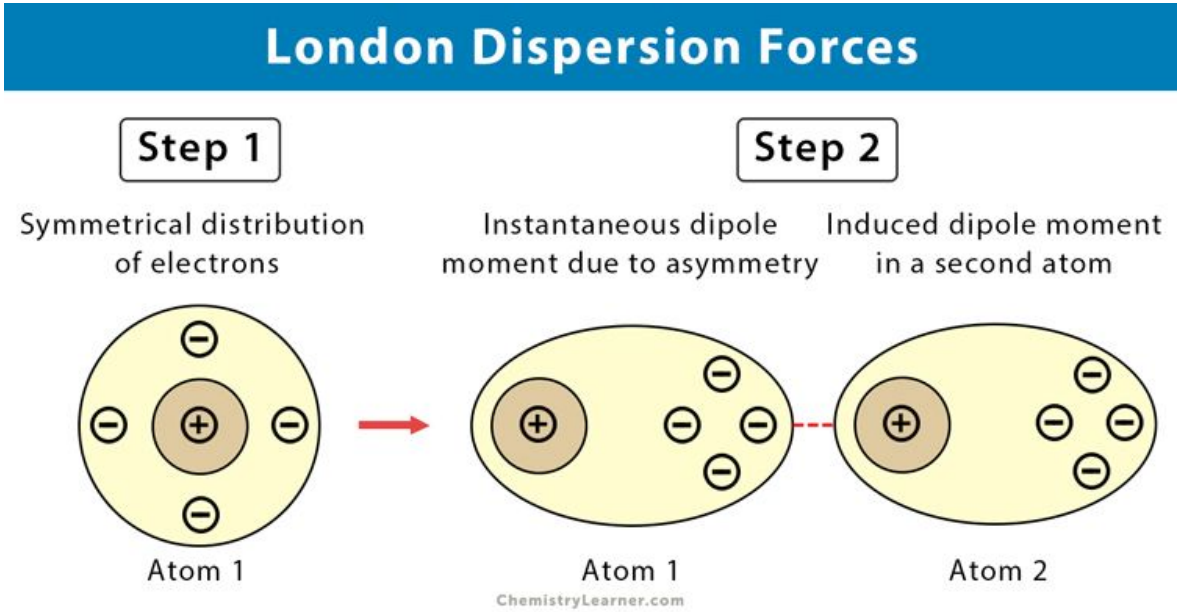
NOT AN ACTUAL BOND



London dispersion forces*

Forces that exist due to temporary dipoles caused by electron movement

Exists between all molecules



Let’s practice! What forces exist between 2 molecules of H_2O

ABC Corners

A. Dipole-dipole
B. Hydrogen bonding
C. London dispersion forces

Let’s practice! What forces exist between 2 molecules of H_2

ABC Corners

A. Dipole-dipole
B. Hydrogen bonding
C. London dispersion forces

Let’s practice! What forces exist between 2 molecules of NH_3

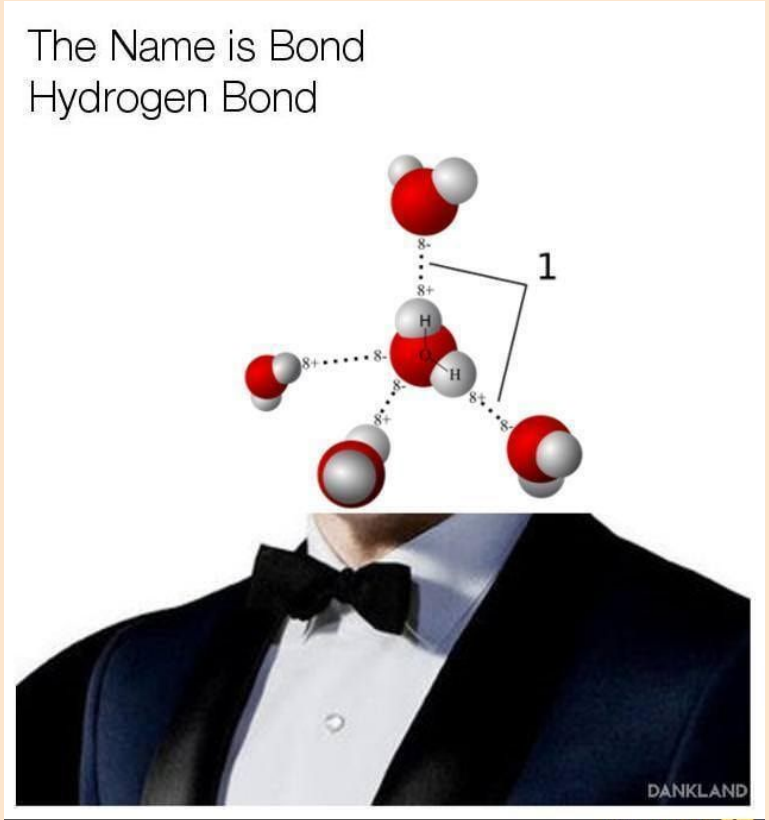
ABC Corners

A. Dipole-dipole
B. Hydrogen bonding
C. London dispersion forces

Exit ticket

What intermolecular forces are present between two molecules of PCl_3?

Complete your bellwork on goformative



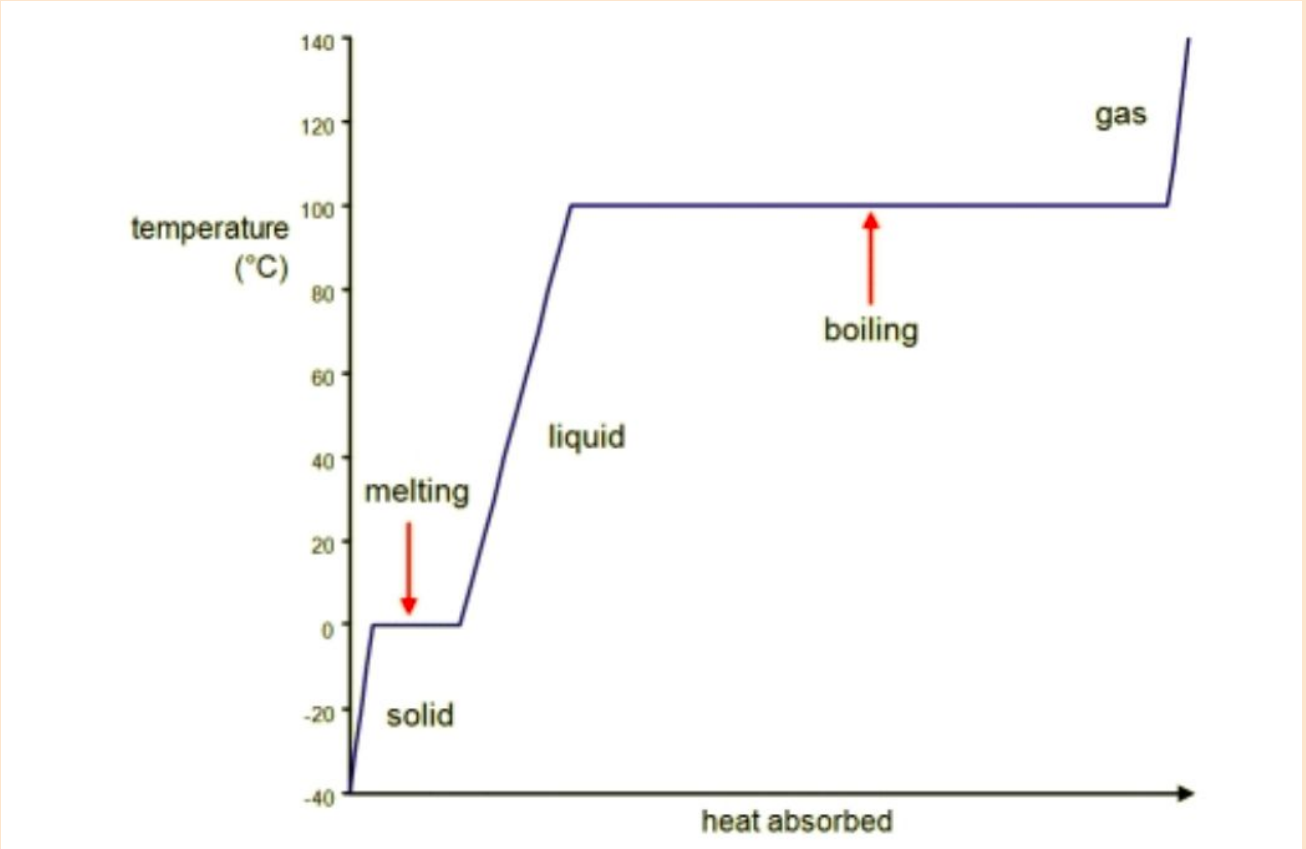
Read the first page of your lab handout with your group

Boiling point

In order for a substance to boil, enough energy has to be added to break any intermolecular forces

The stronger the intermolecular forces, the higher the boiling point

Heating curve



Surface tension

the tension of the surface film of a liquid caused by the attraction of the particles in the surface layer by the bulk of the liquid, which tends to minimize surface area

Stronger intermolecular forces results in higher surface tension

Evaporation rates

Evaporation: liquid to gas

Evaporation rate: the rate at which a material evaporates

Stronger intermolecular forces result in slower evaporation rates

Fill in the chart for Station A with your group

B. Polarity of liquids

What did we discover?

Did acetone or ethanol evaporate faster?

What intermolecular forces does acetone have? Ethanol?

Which intermolecular force will be stronger?

What did we discover?

Did water or isopropanol have a higher surface tension?

What IMFs are present in water? Isopropanol?

Which intermolecular force do we think is stronger?

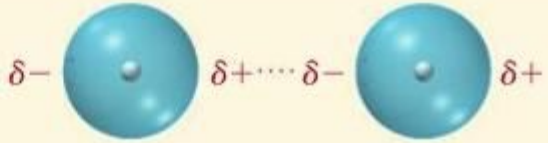
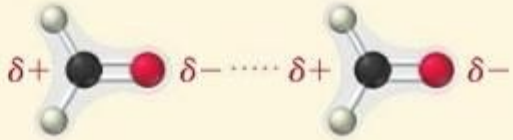
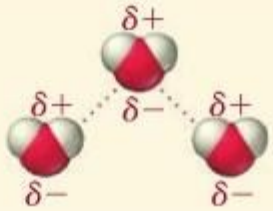
What did we discover?

Which compound had the highest boiling point? The lowest?

What intermolecular force do they have?

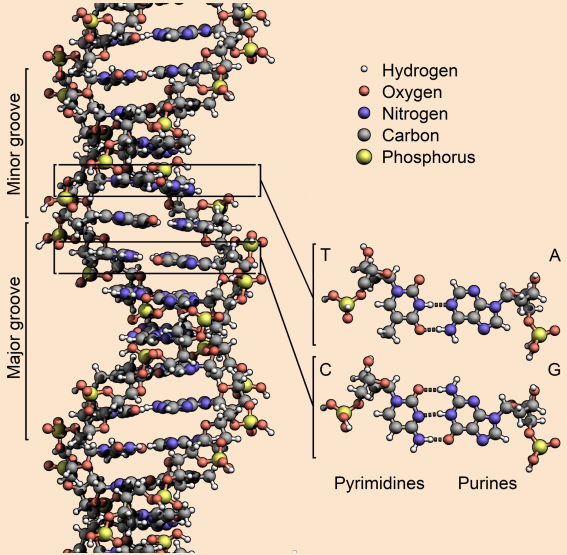
What intermolecular force is the strongest?

TABLE 11.4 Types of Intermolecular Forces

Type	Present in	Molecular perspective	Strength
Dispersion	All molecules and atoms		
Dipole–dipole	Polar molecules		
Hydrogen bonding	Molecules containing H bonded to F, O, or N		

Does this trend make sense?

Raise your hand if the phenomenon article you read talked about hydrogen bonding



Exit ticket

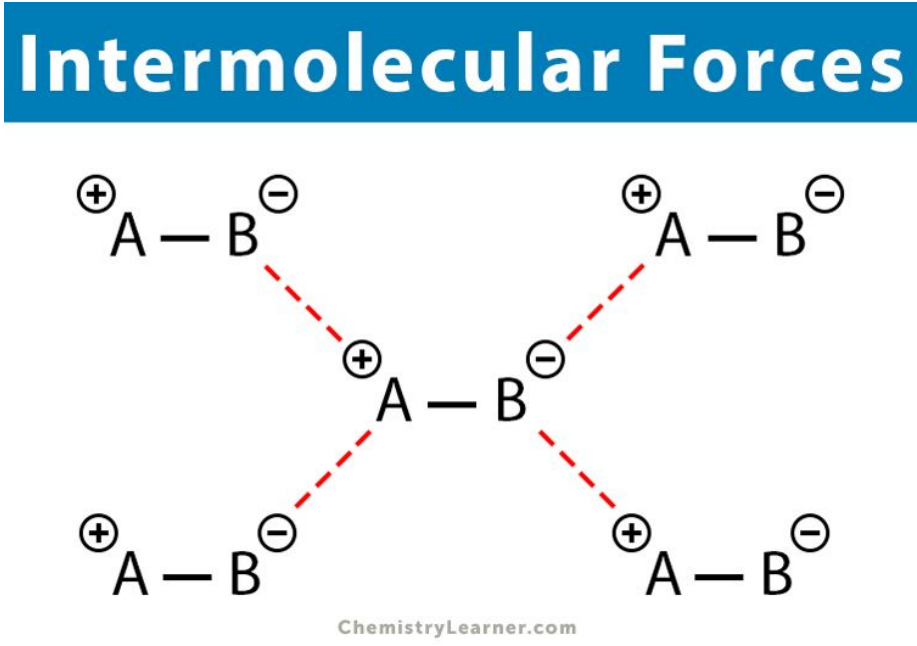
1. What is the strongest molecular force found in water?

2. What is the strongest molecular force found in CO?

Write this on the back of your packet!

Intermolecular forces*

The forces of attraction or repulsion between two separate molecules



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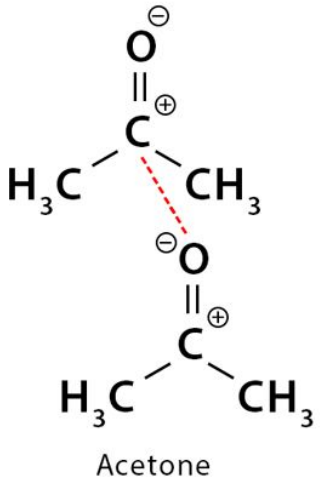

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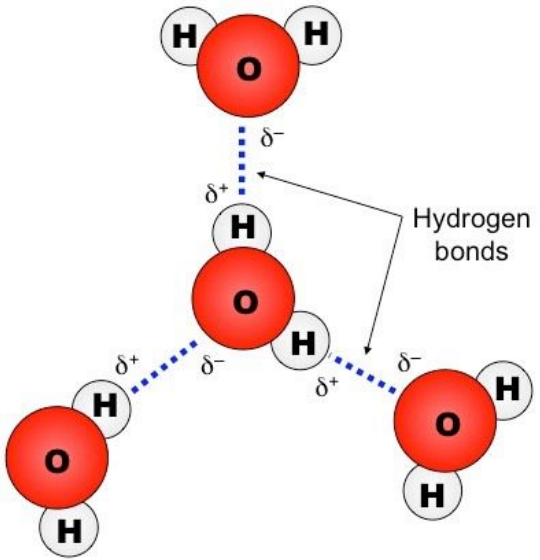

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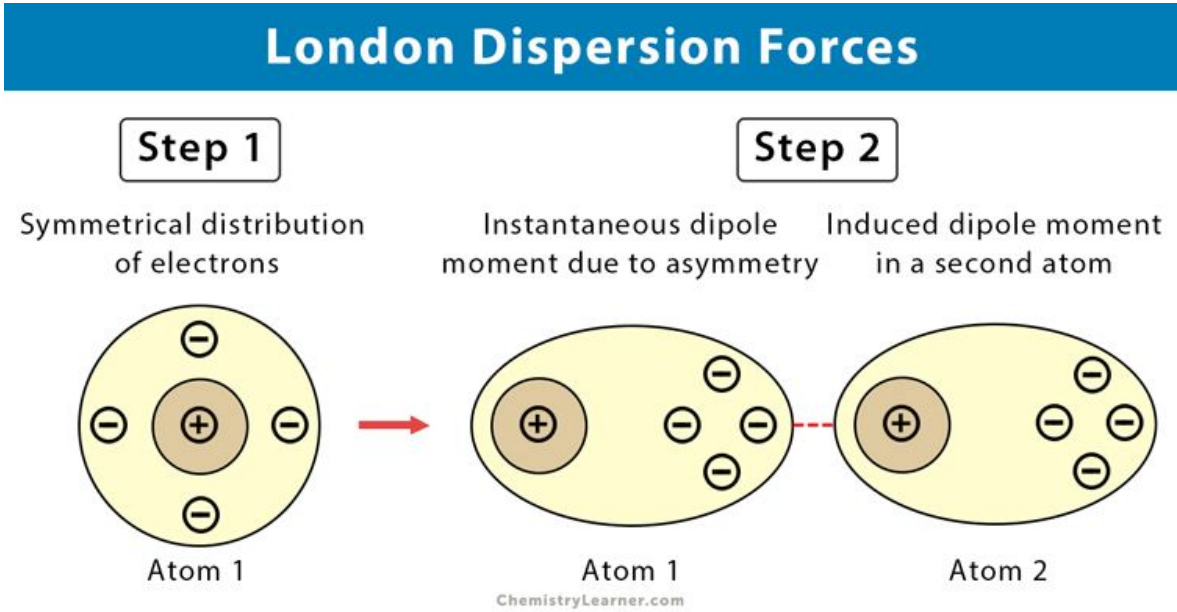
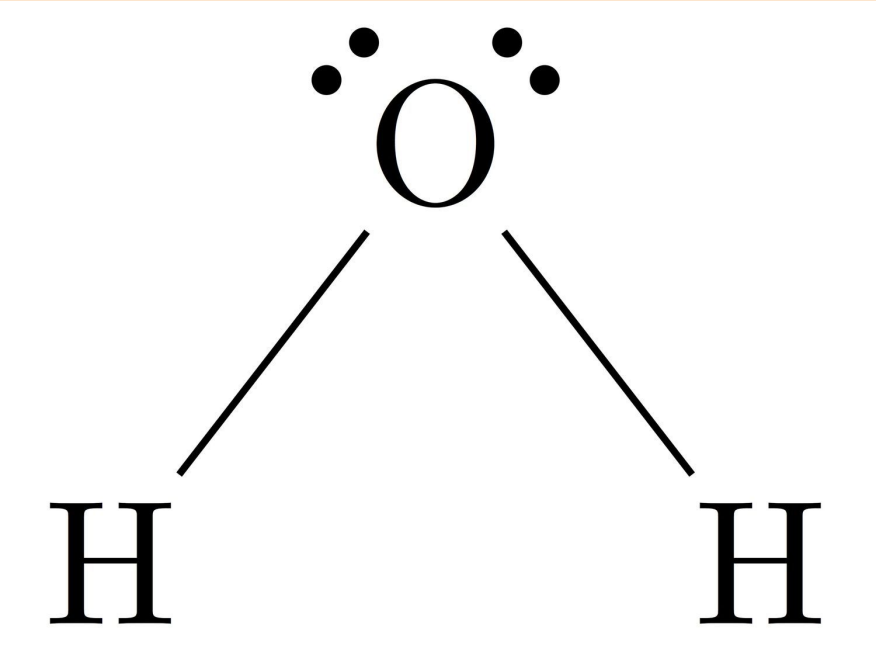
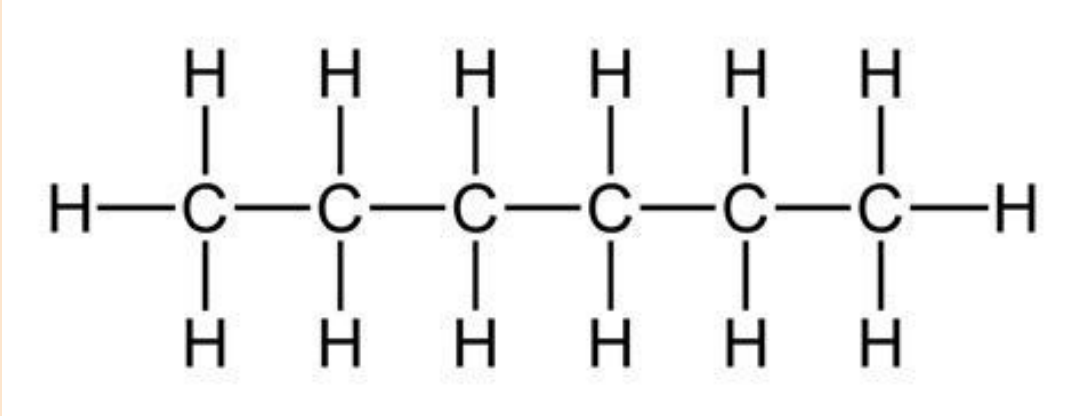


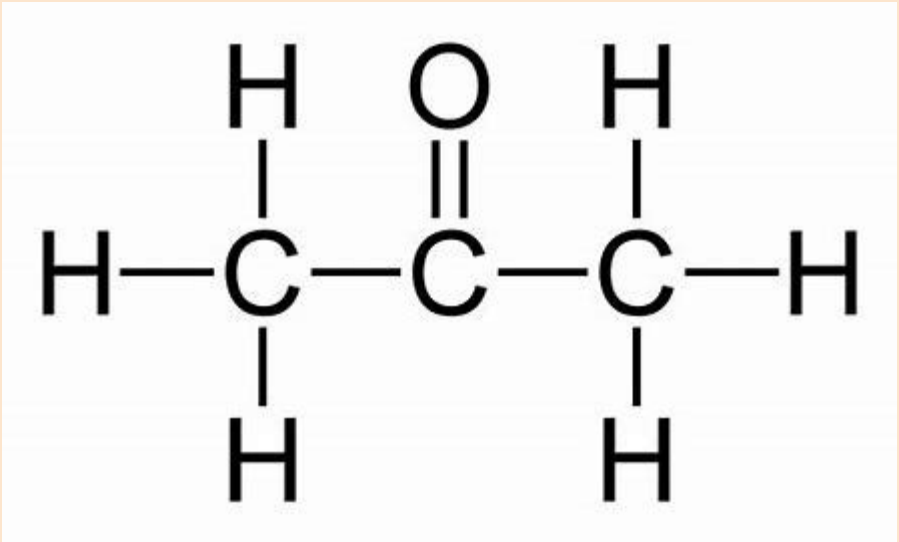
Water



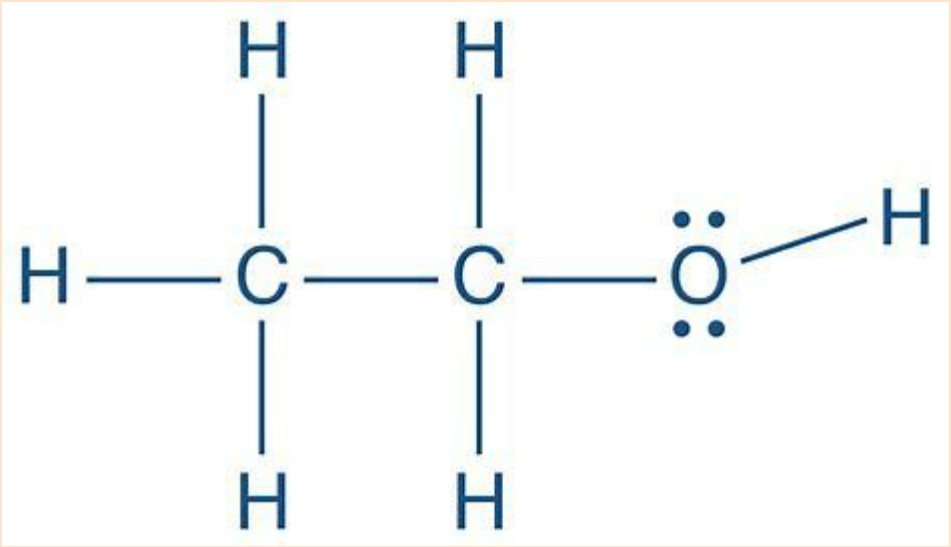
Hexane



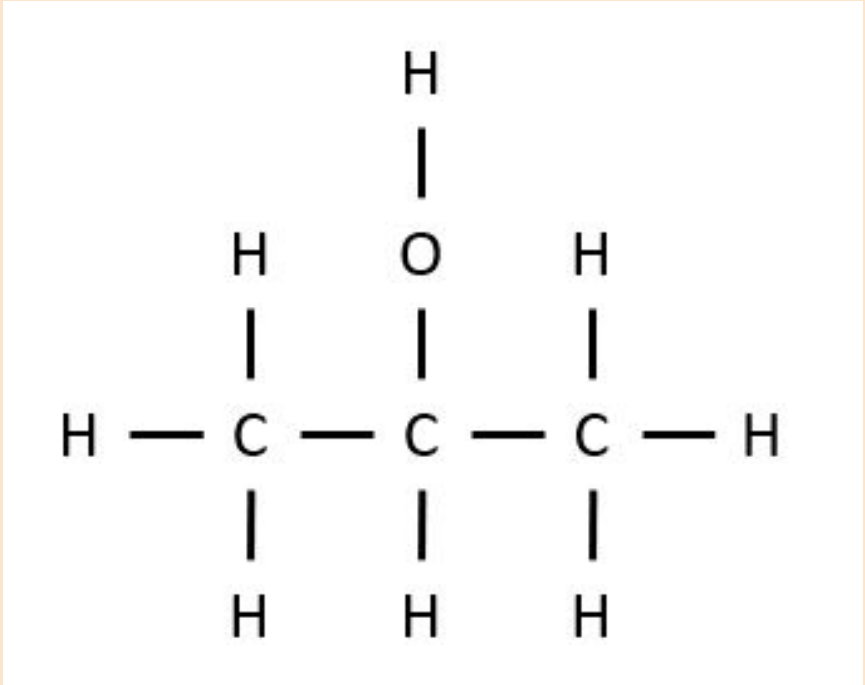
Acetone



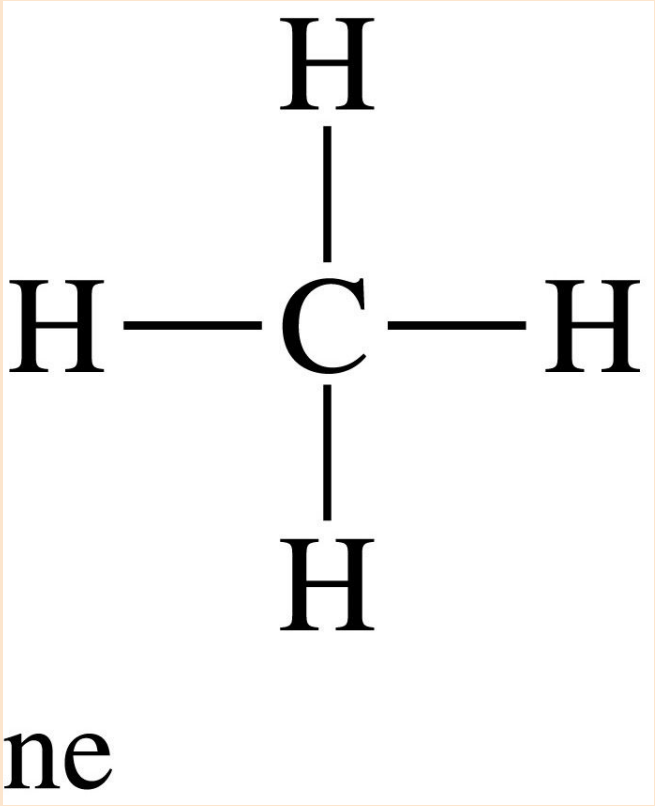
Ethanol



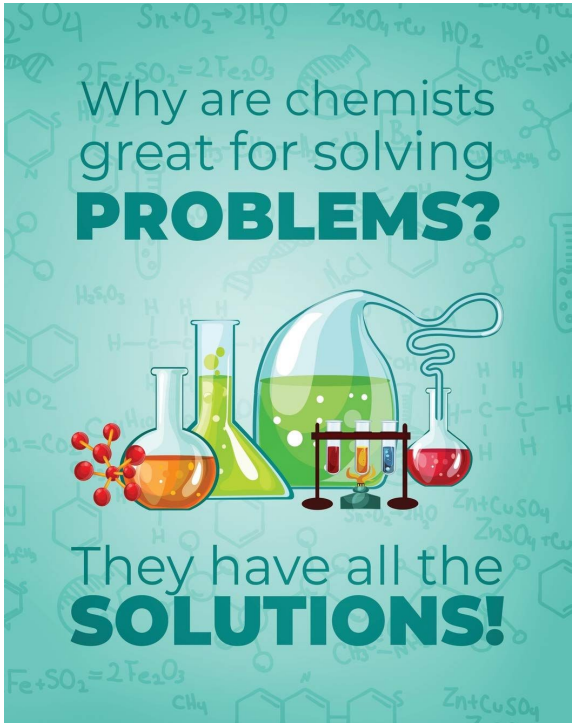
Isopropanol



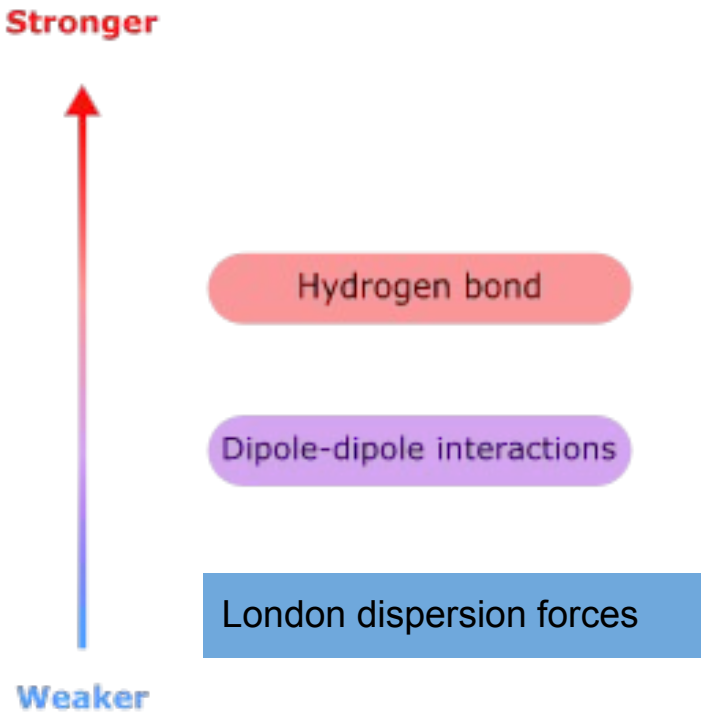
Methane



Complete the 11/8 Chemistry GoFormative



Strength of intermolecular forces



Stronger intermolecular forces

- Have higher boiling points
- Have increased surface tension
- Take longer to evaporate (lower evaporation rates)

Polarity of liquids

Whiteboard Practice: Write down the IMF’s

NH_3

Whiteboard Practice: Write down the IMF's

CH_4

Whiteboard Practice: Write down the IMF's

CO_2

Whiteboard Practice: Write down the IMF's

CF_2I_2

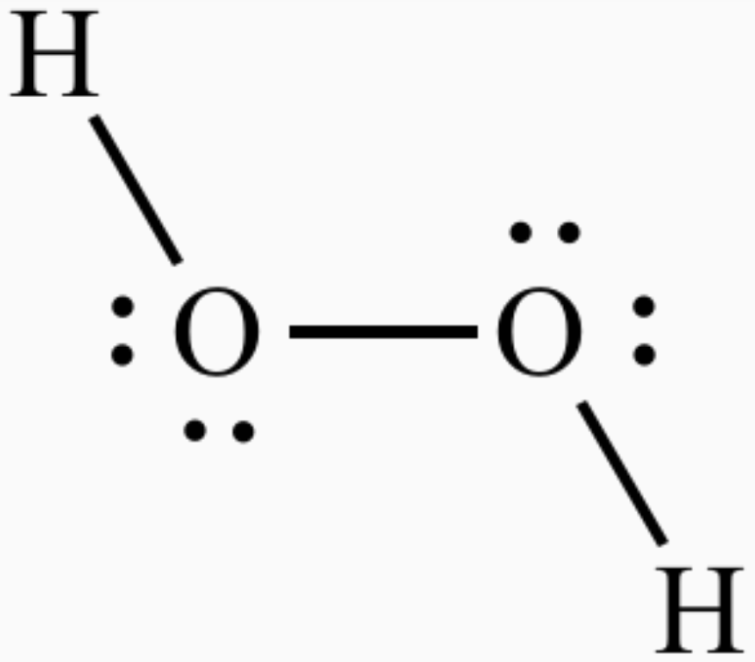
Whiteboard Practice: Write down the IMF’s

NH_4^+

Whiteboard Practice: Write down the IMF's

SO_2

Whiteboard Practice: Write down the IMF's



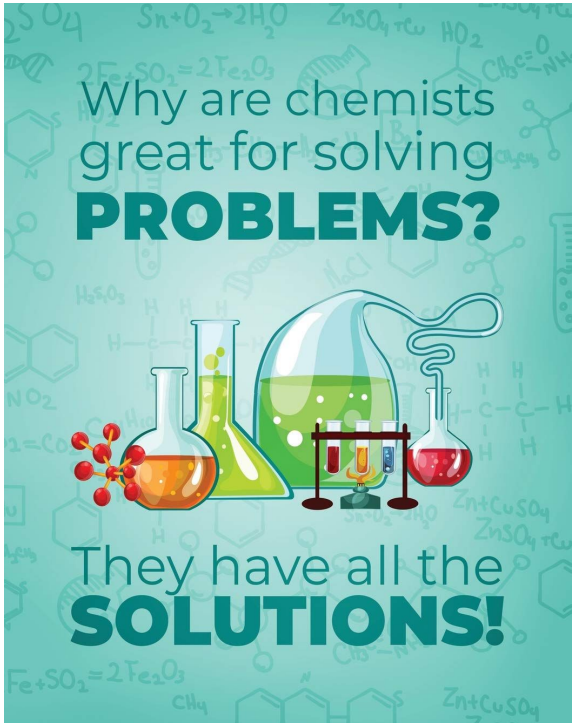
Jeopardy

https://jeopardylabs.com/play/imfs-14

1 member of your team will hold up the whiteboard with your team's answer when I say so

Intermolecular forces day 4

Complete your bellwork on formative



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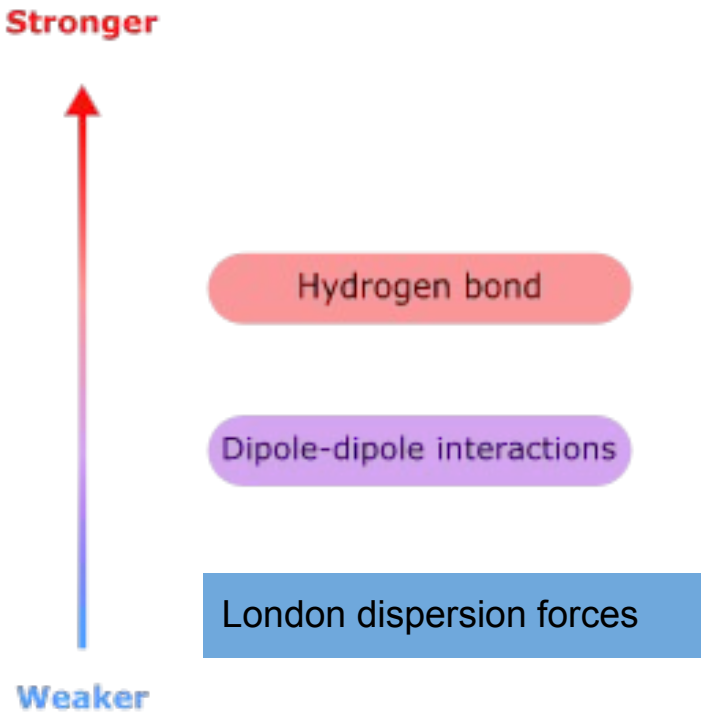

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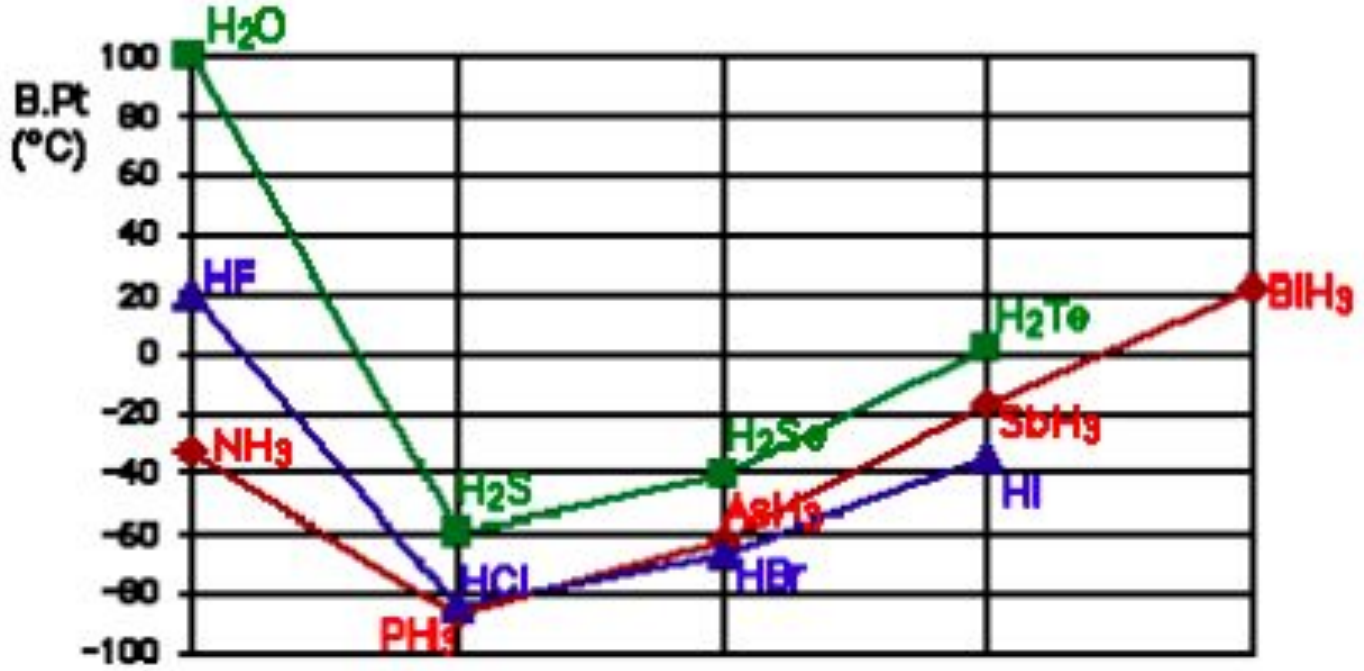
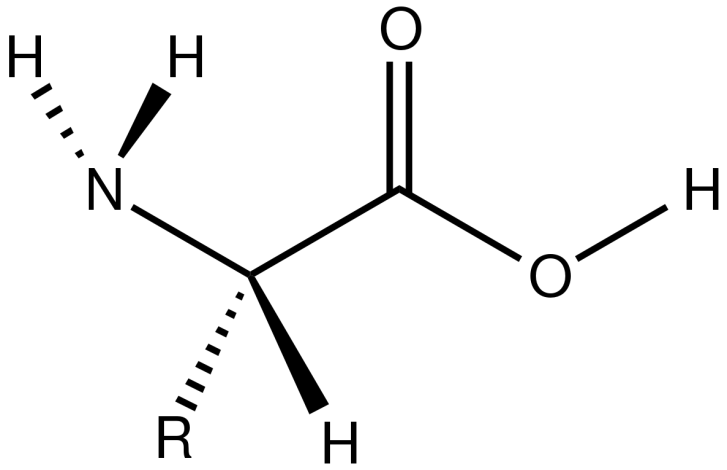
Evidence for hydrogen bonding:

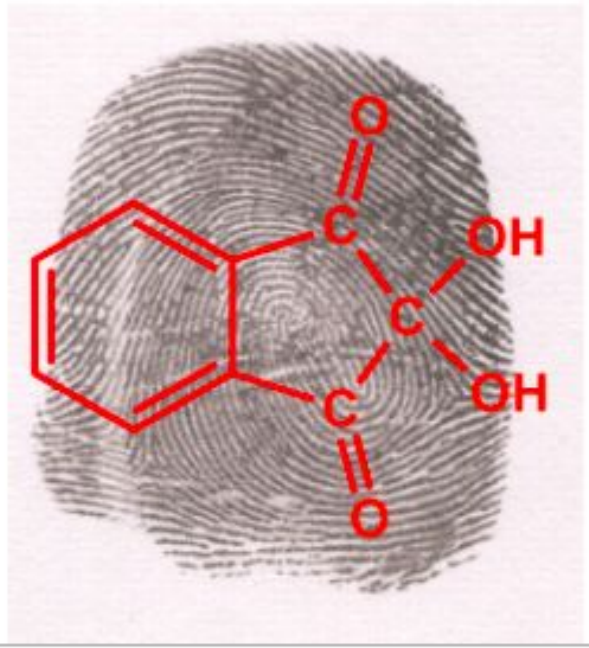


Card sort

Ninhydrin

Some fingerprinting powders do not chemically bond to latent prints and instead rely on intermolecular forces to stick to the print

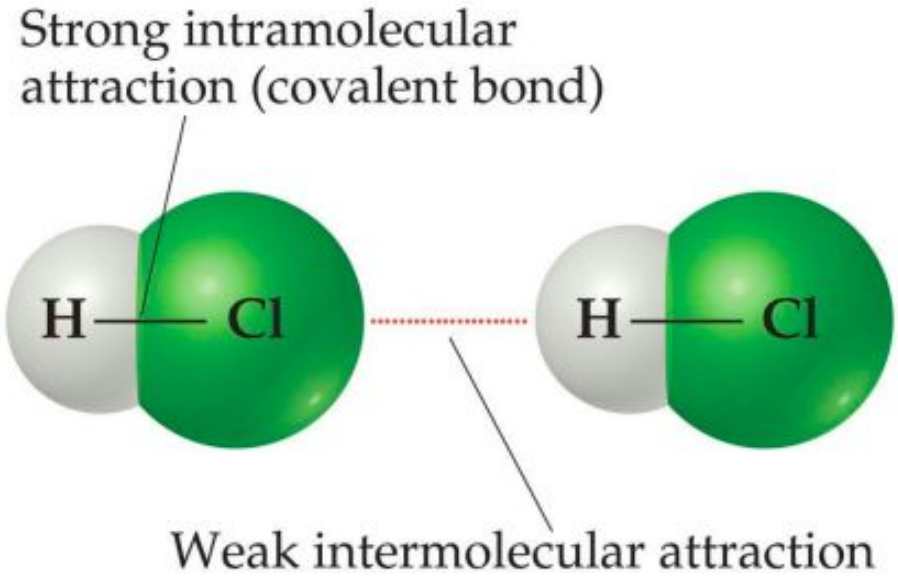




https://pubs.acs.org/doi/full/10.1021/ed400597u

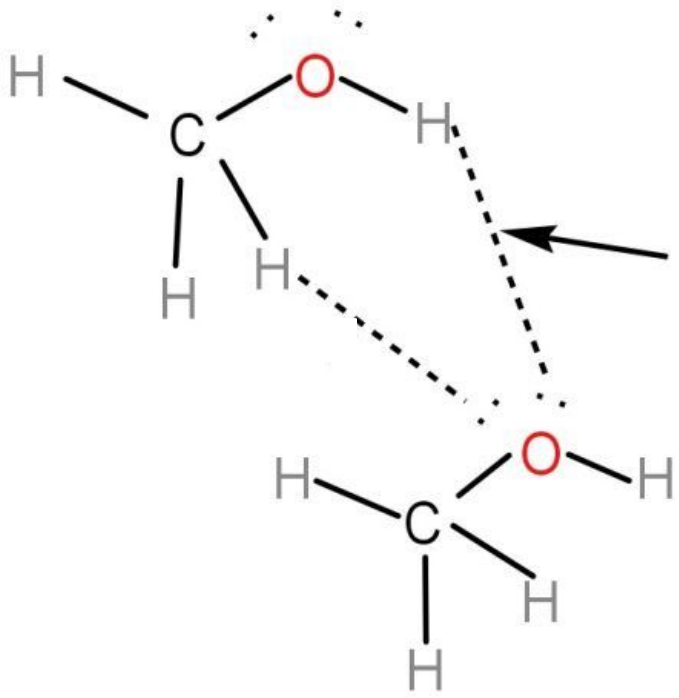
Bonds vs intermolecular forces. What do you notice?

Bond type	Dissociation energy (kJ)
Covalent	**1675**
Hydrogen bonds	**50-67**
Dipole-dipole	**2 - 8**
London Dispersion Forces	**< 4**

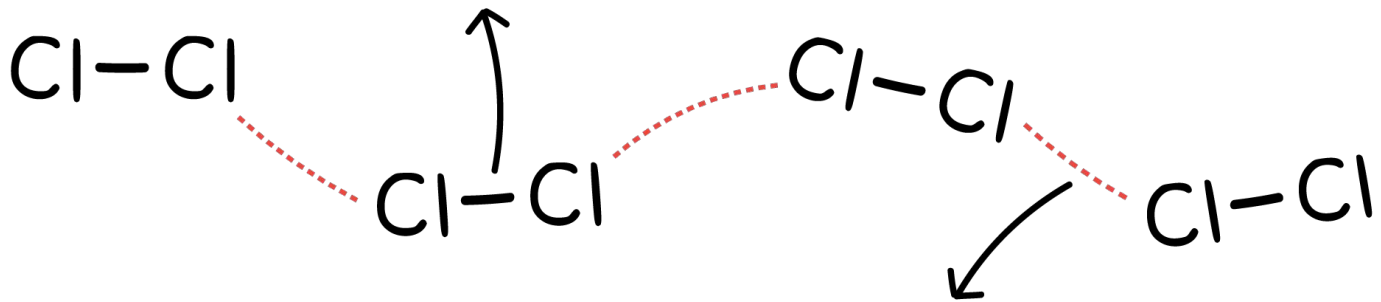


Intermolecular forces are **weaker** than intramolecular forces (e.g. ionic, metallic, or covalent bonds)

The arrow displays what kind of intermolecular force



The arrow displays what kind of intermolecular force



Project

- Create your citations on easybib
- Citations will be turned in on Teams
- One pager has to be on paper NOT the computer

Jeopardy

https://jeopardylabs.com/play/imfs-14

Final Jeopardy Question- List all IMF's that you know for sure are present based on the information below

Molecule A: Bond angles of 107.5 The types of elements in this compound are unknown

Molecule B: Bond angles of 109.5

Molecule C: H_2

Molecule D: The shape of this molecule is trigonal pyramidal. The center molecule is nitrogen.