

Intermolecular Forces and Organic Compounds

*listed weakest → strongest

Klein 1.12-1.14

1. Important intermolecular forces:

a) induced dipole-induced dipole

-due to transient areas of high and low electron densities cause _____

-a.k.a. _____ or _____

-weakest of all intermolecular forces: _____ kJ/mol

-longer, thinner alkanes (less branching) will have _____ induced dipole-induced dipole interactions (_____, the ability to distort an electron cloud, is a characteristic that contributes to stronger intermolecular forces.....analogy: electron flash mobs)

-only intermolecular force with _____; will be present in interactions of all _____ as well.

e.g. n-decane vs. 3,3-diethyl-hexane (both 10 C's)

b) dipole-dipole interactions

-slightly stronger at _____ kJ/mol

-need bonds with dipole moments, e.g.

-dipoles _____ to hold molecules together

-e.g. b.p. comparison: acetone= _____ °C; isobutylene= _____ °C

c) hydrogen bonding (H-bonding)

-stronger still at _____ kJ/mol

-a special kind of dipole-dipole interaction between....

-H-bond acceptors: _____

-H-bond donors: _____

*Bond strength impacted by:

(1) bond polarity affects H-bond strength:

example: $\text{CH}_3\text{CH}_2\text{OH}$, b.p.= _____ °C vs. $\text{CH}_3\text{CH}_2\text{NH}_2$, b.p.= _____ °C

(2) molecules with more possible H-bonding will have stronger intermolecular forces

-example, intermolecular force strength:

....and this results in a higher b.p.

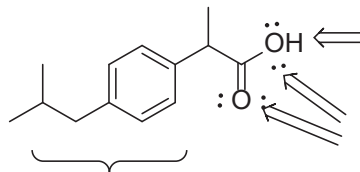
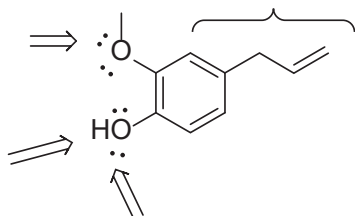
$\text{CH}_3\text{CH}_2\text{N}(\text{H})\text{CH}_2\text{CH}_3$, bp= _____ °C vs. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$, bp= _____ °C

illustrated....

Analyzing intermolecular forces in organic molecules:

eugenol (lab activity in 2013)

ibuprofen



2. Impact of intermolecular forces

a) boiling point: _____ intermolecular forces $\rightarrow$ _____ boiling point

b) solubility: “ _____ ”; that’s all you need to know!

-examples

$\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$ in H_2O ? soluble or not?

$\text{CH}_3\text{CO}_2\text{H}$ in H_2O ? soluble or not?

$\text{CH}_3\text{CH}_2\text{OH}$ in H_2O ? soluble or not?

$\text{CH}_3\text{CH}_2\text{NH}_2$ in H_2O ? soluble or not?

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ (hexane) in H_2O ?

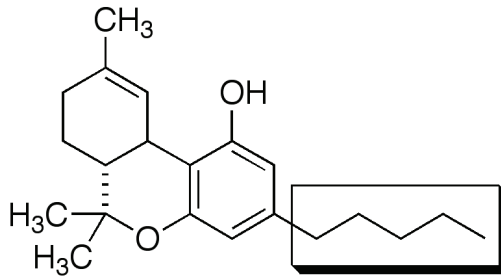
General characterization:

-hydrophobic/lipophilic = _____ $\rightarrow$ _____

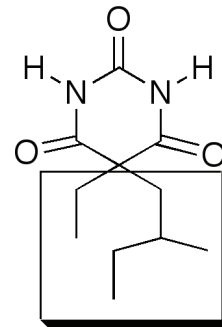
-hydrophilic (lipophobic) = _____ $\rightarrow$ _____

c) intermolecular interactions in biology/biochemistry

(1) Molecules/drugs passing through cell membranes or other barriers and dissolving in aqueous solutions



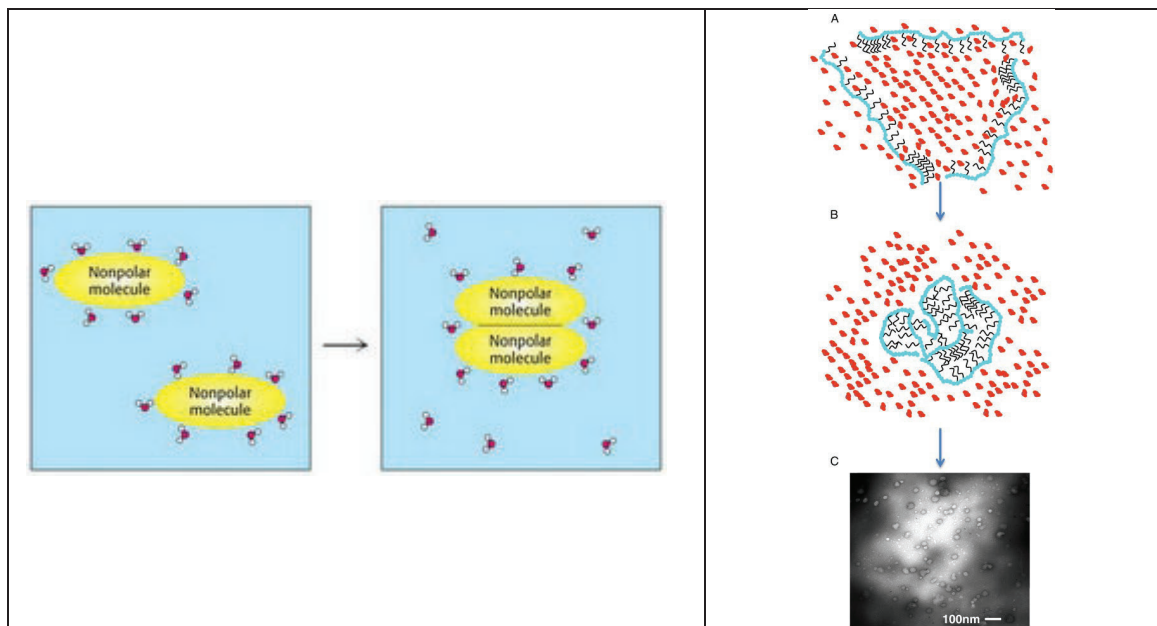
**Tetrahydrocannabinol or THC
(Marihuana Active Component)**



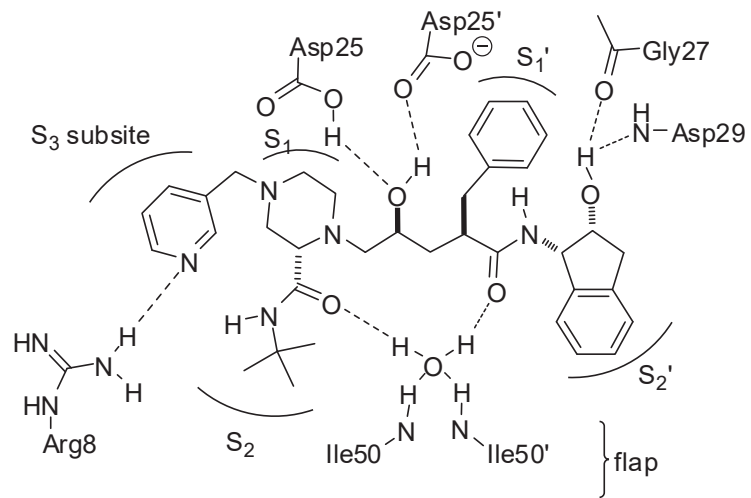
**Pentothal
(Barbiturate)**

(2) Enzymes + substrates or ligand + receptor

**Key interaction: _____



-indinavir (Crixivan), Merck, 1996
-PDB crystal structure: 2R5P



Crixivan's Interactions in HIV-2 proteases active site