



Chemistry 4

- **iClicker 11A**
- **Non-covalent bonds**
 - **ionic**
 - **van der Waals**
- **Hydrophilic and Hydrophobic**
- **Predicting interactions**
- **iClicker 11B**

- **Due in Lab this week**
 - **Pre-Lab 4**
 - **LEGO Meiosis lab report**
- **Register your iClicker** → course website

want to form a study group w/fellow Bio 111 Students?

meet after class at the top of the auditorium



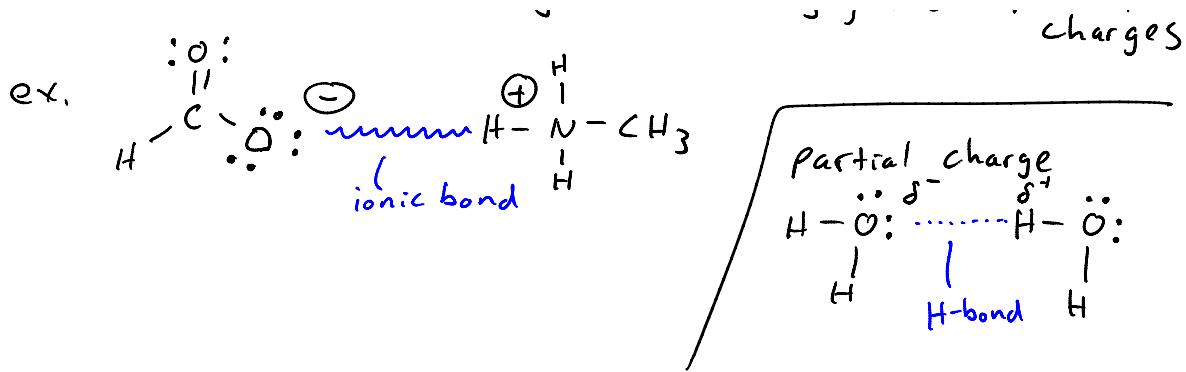
- Exam Information
- Last names starting with A through E
 - 11th Floor of Healy
- Last names starting with F through Z
 - Lipke (here)

Summary

- Covalent bonds
 - polar $\text{O}^{\cdot\cdot}-\text{H}$
 - non-polar $\text{C}^{\cdot}-\text{H}$
- H-bonds δ^+ δ^-
- Ionic
- van der Waals

Ionic / electrostatic bonds (for Bio III)

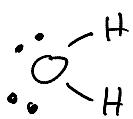
- not due to very different EN's between atoms
- are due to unlike charges attracting
 - full charges attracting . not partial



Van der Waals bonds (VdW)

- possible between any 2 atoms
- weakest bond / interactions
- always present between 2 molecules but only important when nothing else is possible
- due to interactions between random transient polarization of molecules
→ random fluctuations in the e⁻ cloud

Water



- O-H bonds are very polar

- can make H-bonds

- water can form non-covalent bonds w/ parts of molecules that:

a) can make H-bonds

or b) are charged = ions (stronger interactions than H-bond)

hydrophilic
water loving

- water can not form strong bonds w/ parts of molecules that are non-polar (VdW)
ex. C-H

hydrophobic

water hating

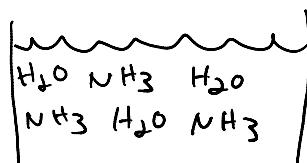
Hydrophobic effect

- in water hydrophobic parts of molecules tend to cluster w/ hydrophobic parts of other molecules → to avoid contact w/ water

ex. NH₃ is hydrophilic

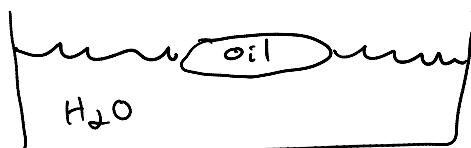
| oil is hydrophobic

ex. NH_3 is hydrophilic
add water $\rightarrow \text{NH}_3$ will dissolve



NH_3 makes H-bonds with H_2O

oil is hydrophobic
- forms droplets in H_2O
- does not dissolve
oil-oil bonds (VDW)
will not make oil-water bonds

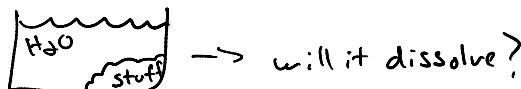


no interactions interest oil in H_2O

Relative bond strength (in Bio111)

Strongest $\xrightarrow{\hspace{1cm}}$ weakest
covalent ionic Hydrogen bonds hydrophobic effect VDW

Predictions \rightarrow will a molecule dissolve in H_2O ?



\rightarrow will it dissolve?

Competing forces

hydrophobic effect

\rightarrow won't dissolve

vs. stuff-H₂O bonds

H-bonds

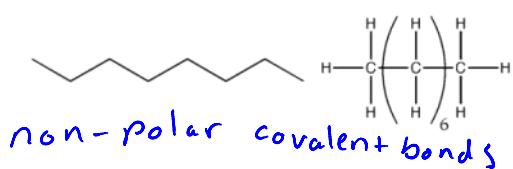
\rightarrow will dissolve

note: Since the hydrophobic effect is weak, only a few strong H_2O -stuff bonds are needed to make "Stuff" dissolve

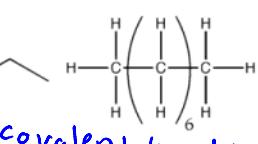
Hydrophobic and Hydrophilic molecules

Abbreviated Structure

octane



Complete Structure

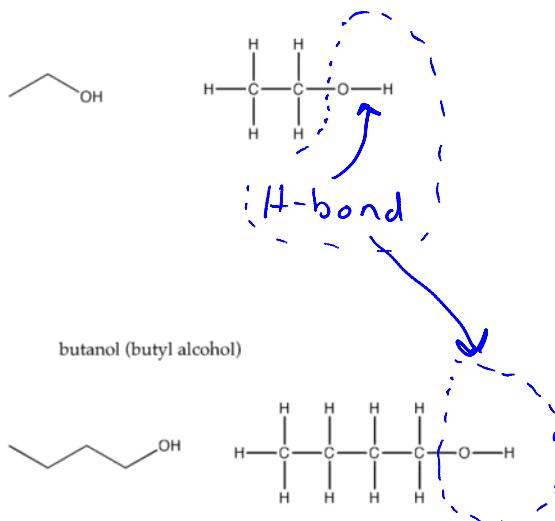


Cartoon



hydrophobic \rightarrow no H bonds, not ionic
not soluble in H_2O

ethanol (ethyl alcohol)



more soluble \uparrow relative solubility
predict \downarrow less soluble

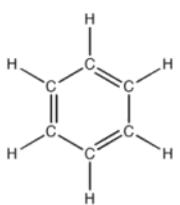
soluble

actual

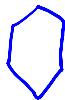


not soluble

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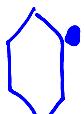
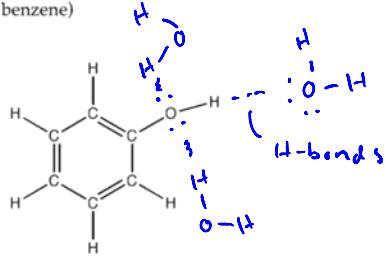
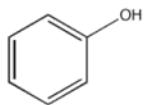
Abbreviated StructureComplete StructureCartoon

not hydrophilic



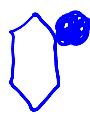
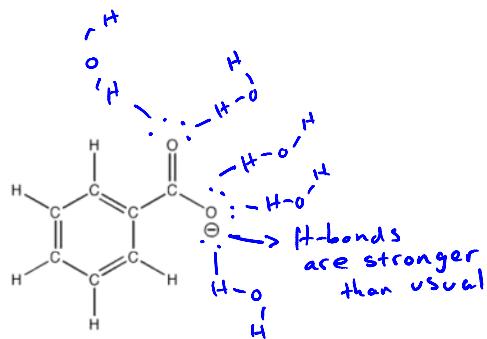
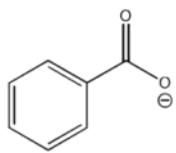
\rightarrow insoluble

phenol (hydroxy benzene)



partly soluble

benzoic acid



very soluble

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