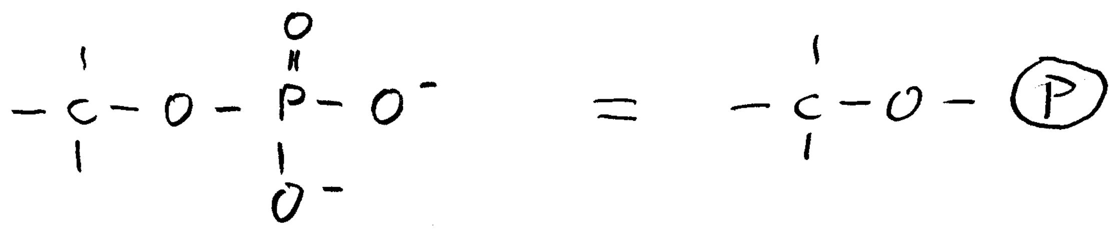
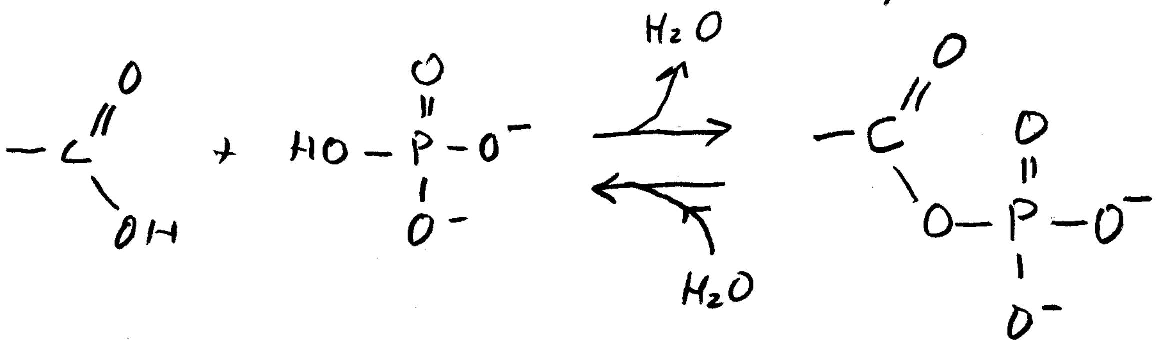
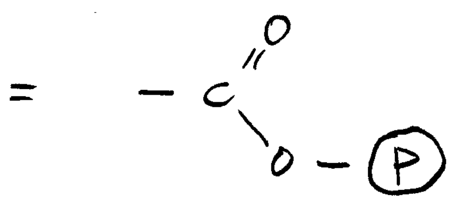
These $-PO_3^{--}$ groups make big electric fields and deform proteins. Many proteins become active enzymes only when certain $-PO_3^{--}$ groups are added (by kinases) or removed (by phosphatases).

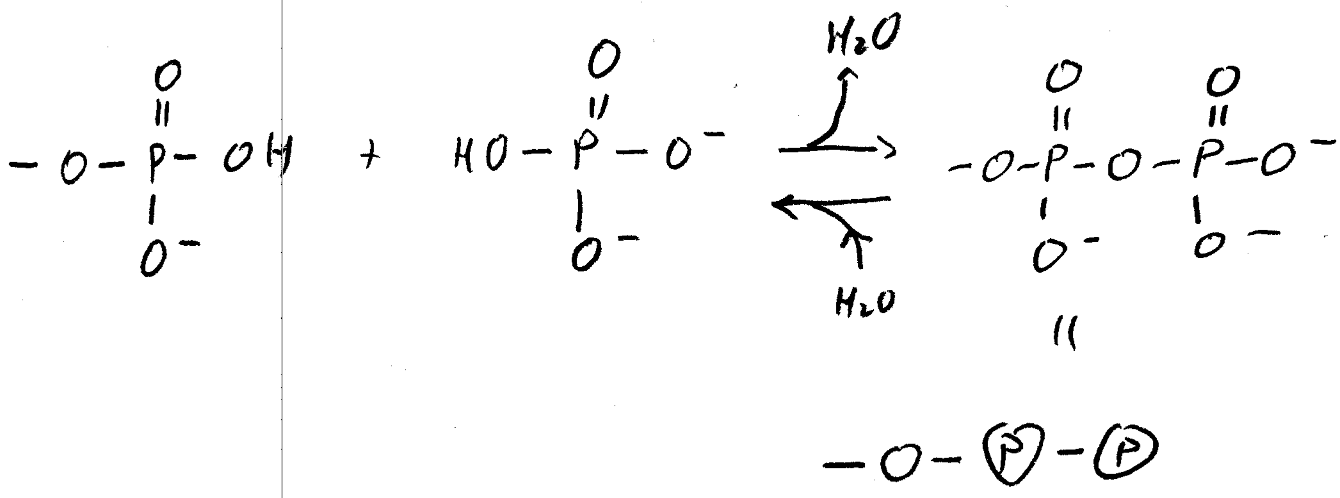


A phosphate and a carboxyl group (or two) makes an acid anhydride

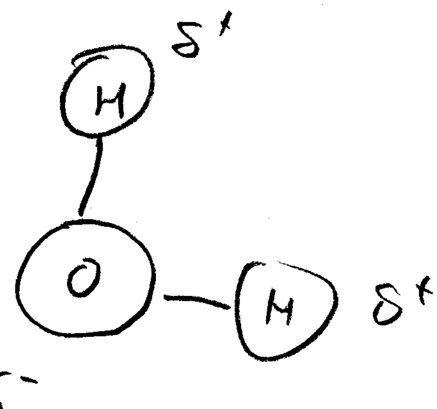




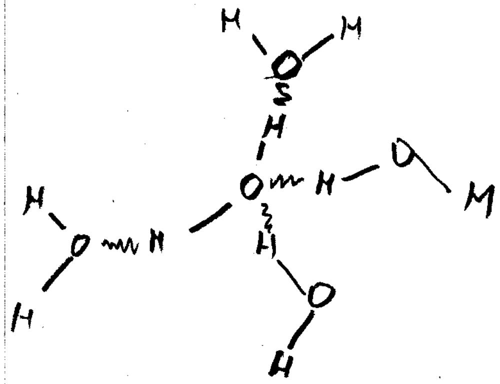
this is an acyl phosphate bond (= carboxylic - phosphoric acid anhydride); it has energy, big time.



ATP has three (P) groups — it is the fuel source of cells.

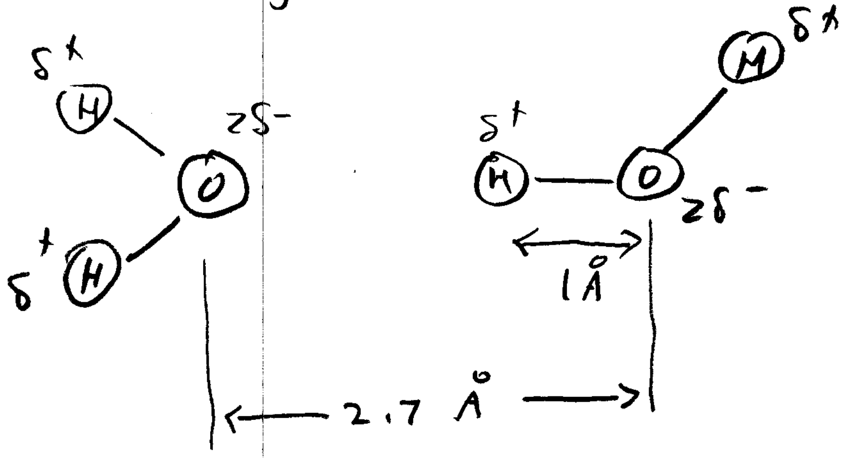


At 37°C, 15% of H_2O's form "flickering clusters"

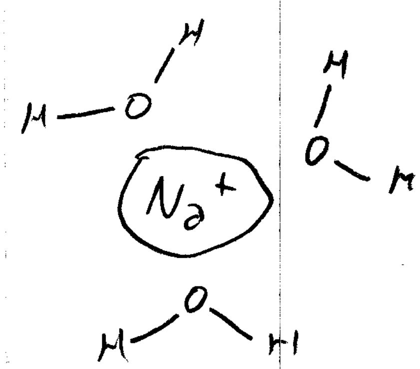


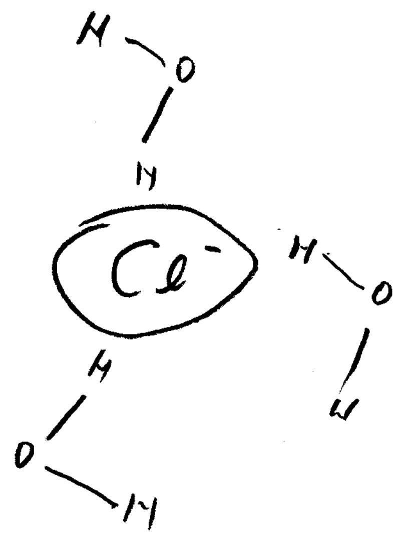
Ice does not flicker, so it swells.

H-bonds join these H_2O's



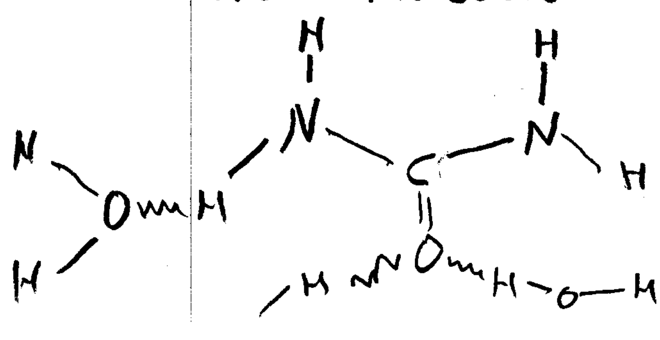
Substances that easily dissolve in water are <u>hydrophilic</u>. They are ions or polar molecules.





This is how salt dissolves in water.

Polar molecules like urea form H-bonds with H_2O.



Molecules formed by non-polar bonds often are insoluble in H_2O and are called <u>hydrophobic</u>.

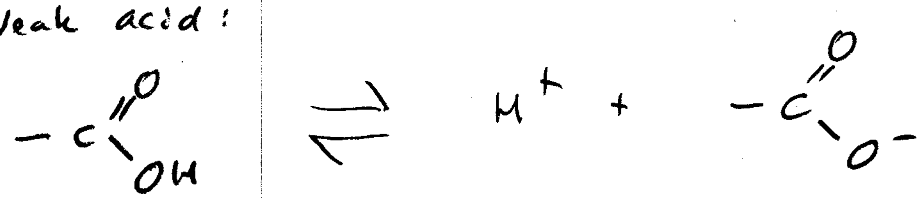
Most hydrocarbons are hydrophobic.

Sugar is a <u>solute</u> in the <u>solvent</u> water. Pepsi.

Acids:

Strong acid $HCl \rightarrow H^+ + Cl^-$ in water

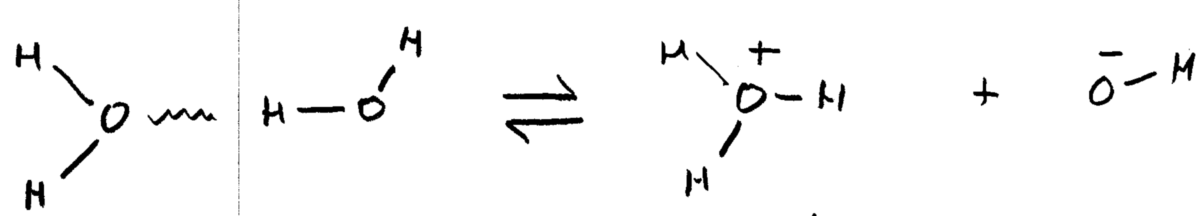
Weak acid:



in water.

reversible

Protons can jump from one H_2O to another:



hydronium ion

This is often written as

$$H_2O \rightleftharpoons H^+ + OH^-$$

Pure water has $[H^+] = 10^{-7} M$ and $[OH^-] = 10^{-7} M$.

Here "M" means molar i.e. moles / liter i.e.

6.022×10^{23} molecules / liter = 1 M.

$$pH = -\log_{10} [H^+]$$

Square brackets means concentration in moles / liter. A liter is 1 kg of H_2O = 10^3 cc of H_2O.

Bases reduce $[H^+]$ in water solutions.

$$NH_3 + H^+ \longrightarrow NH_4^+$$

ammonia

$$NaOH \longrightarrow Na^+ + OH^-$$

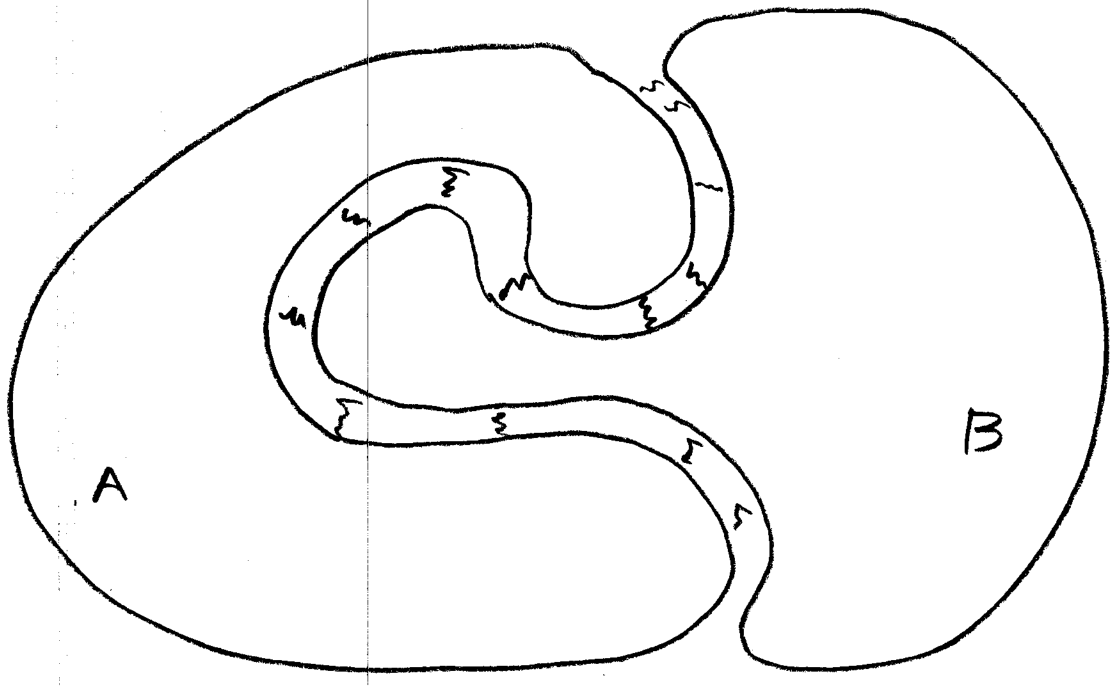
the OH^- takes protons from the solution

Weak bases:

$$-NH_2 + H^+ \rightleftharpoons -NH_3^+$$

amino group

Weak chemical bonds.



The shapes are crucial,

These weak bonds can be ionic, H, vdWaals, or "hydrophobic."

Hydrogen bonds:

are key to holding proteins and nucleic acids together.

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