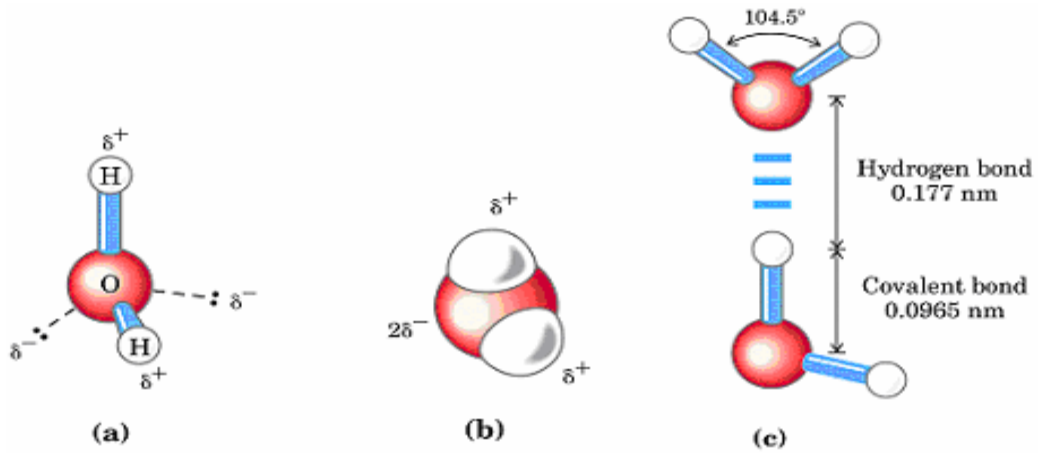
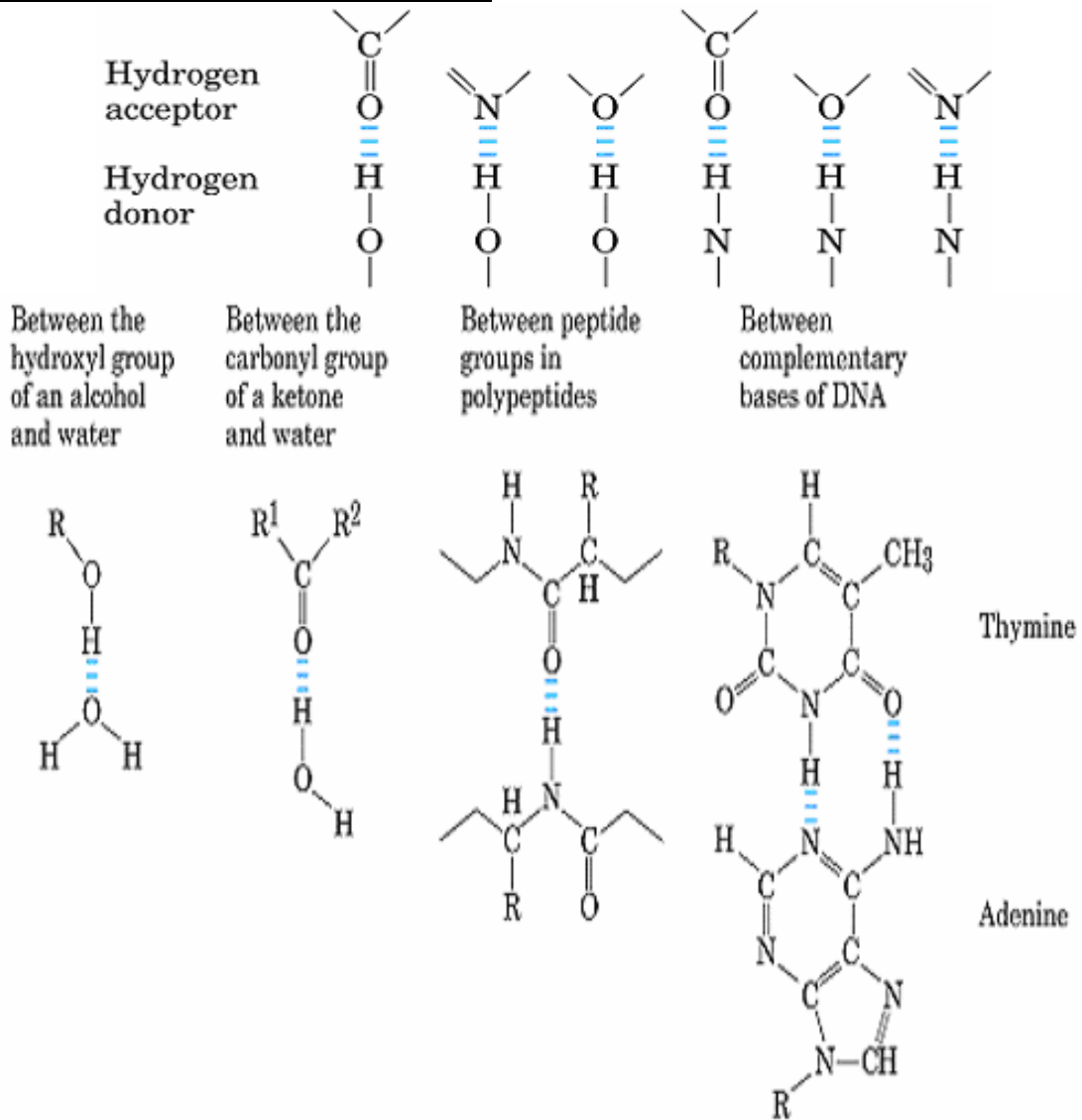


Water



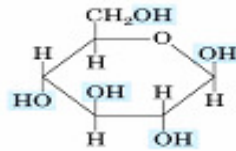
Hydrogen bonds in Biological Systems



**Some Examples of Polar, Nonpolar, and Amphipathic Biomolecules
(Shown as Ionic Forms at pH 7)**

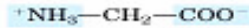
Polar

Glucose

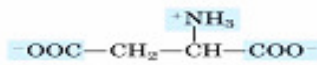


Polar groups
 Nonpolar groups

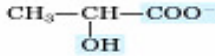
Glycine



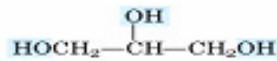
Aspartate



Lactate

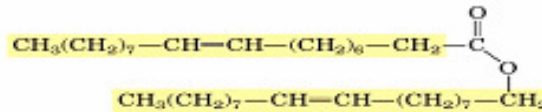


Glycerol



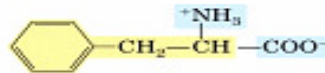
Nonpolar

Typical wax

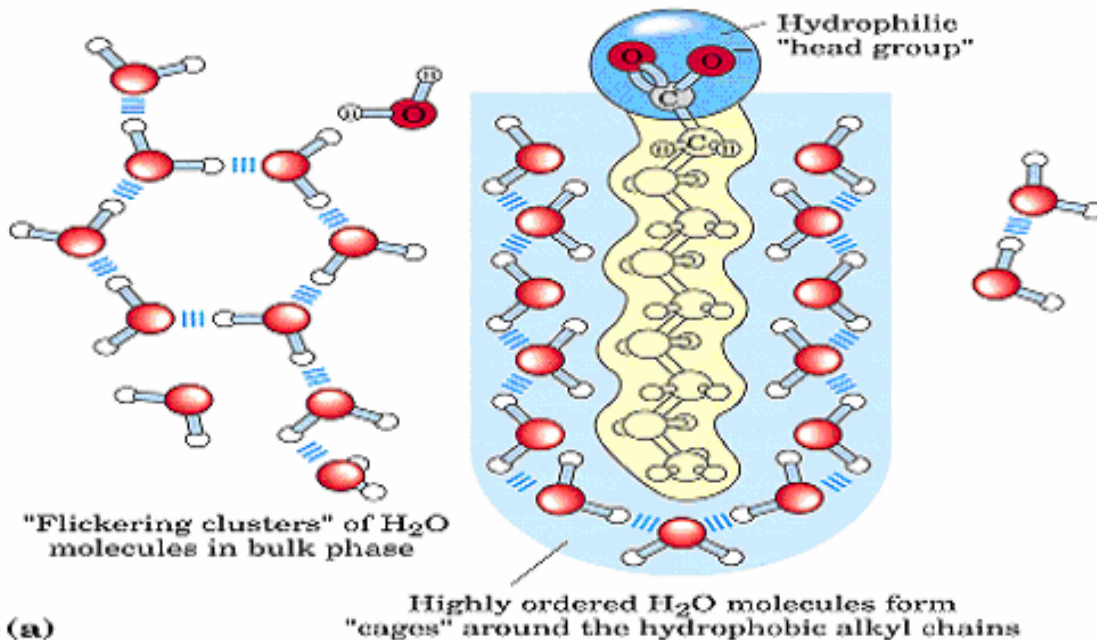
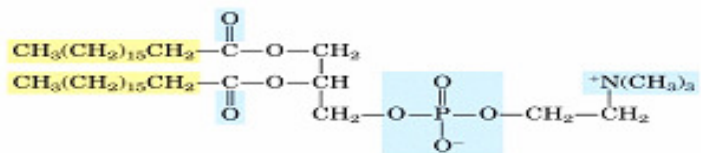


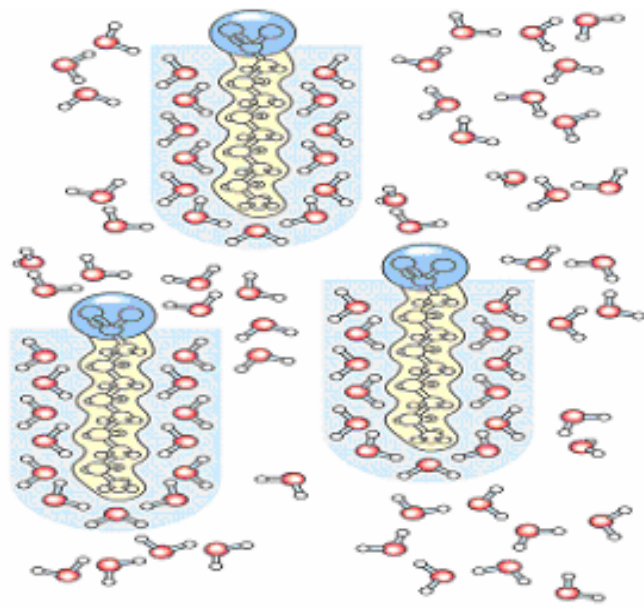
Amphipathic

Phenylalanine



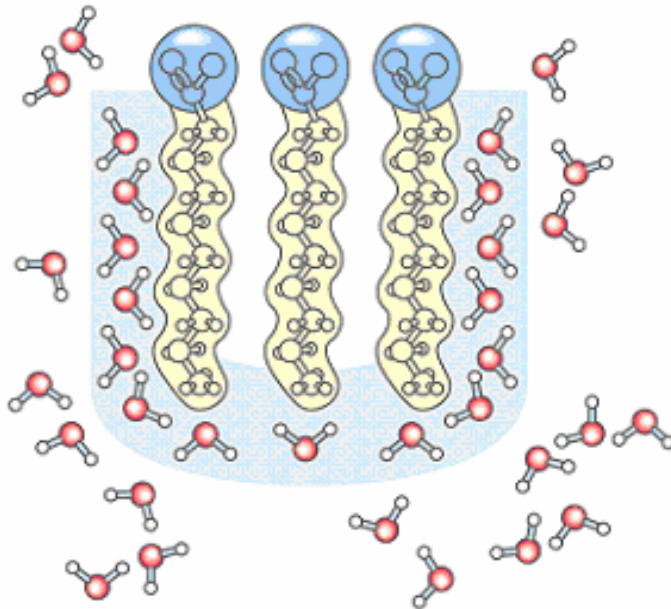
Phosphatidylcholine





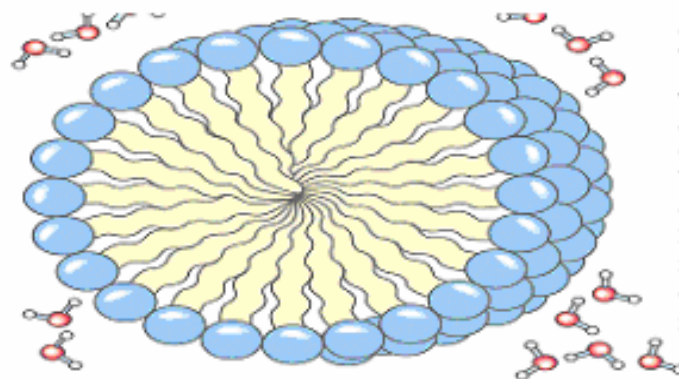
Dispersion of lipids in H₂O

Each lipid molecule forces surrounding H₂O molecules to become highly ordered.



Clusters of lipid molecules

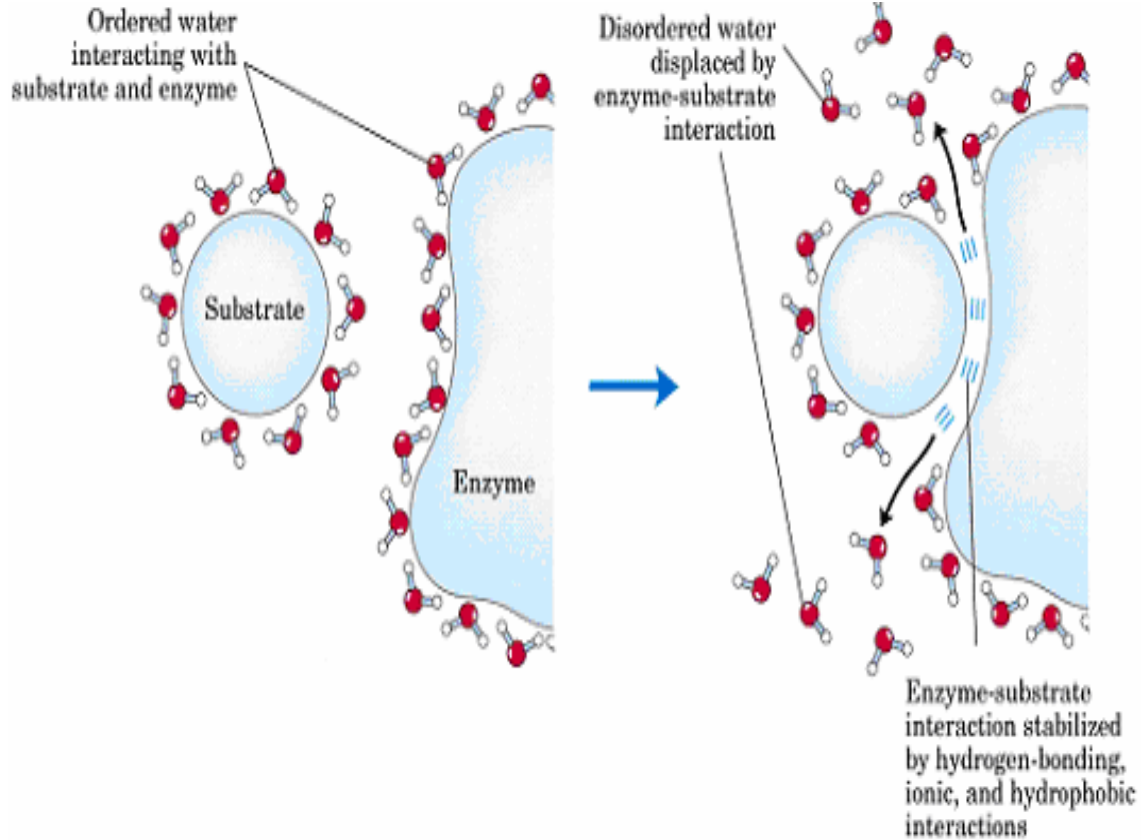
Only lipid portions at the edge of the cluster force the ordering of water. Fewer H₂O molecules are ordered, and entropy is increased.



Micelles

All hydrophobic groups are sequestered from water; ordered shell of H₂O molecules is minimized, and entropy is further increased.

Release of ordered water favours formations of an enzyme substrate complex



Four Types of Noncovalent (“Weak”) Interactions among Biomolecules in Aqueous Solvent

Hydrogen bonds

Between neutral groups



Between peptide bonds



Ionic interactions

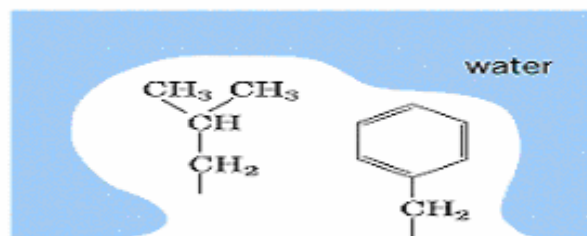
Attraction



Repulsion



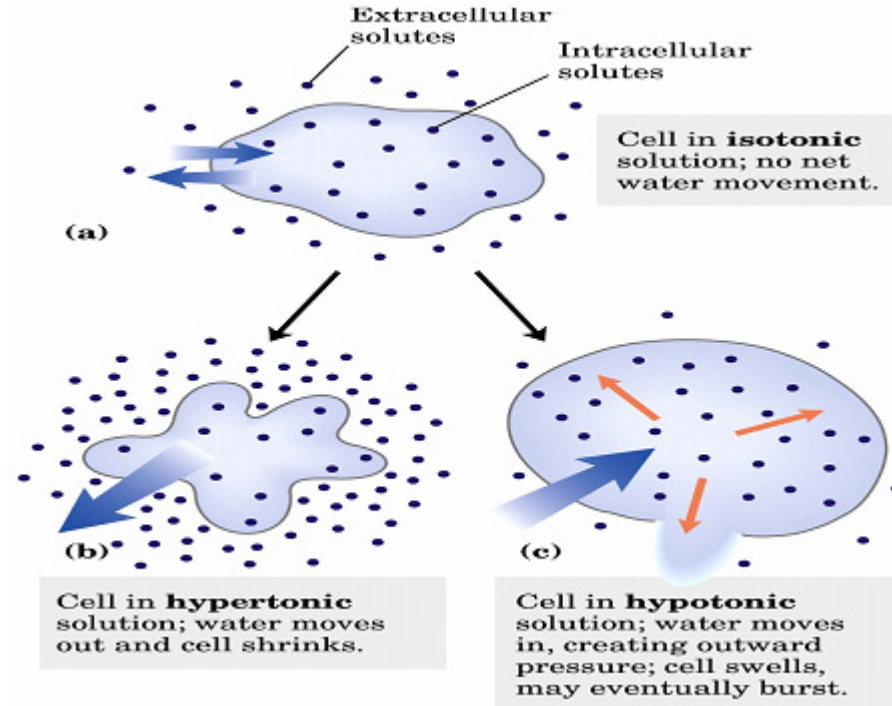
Hydrophobic interactions



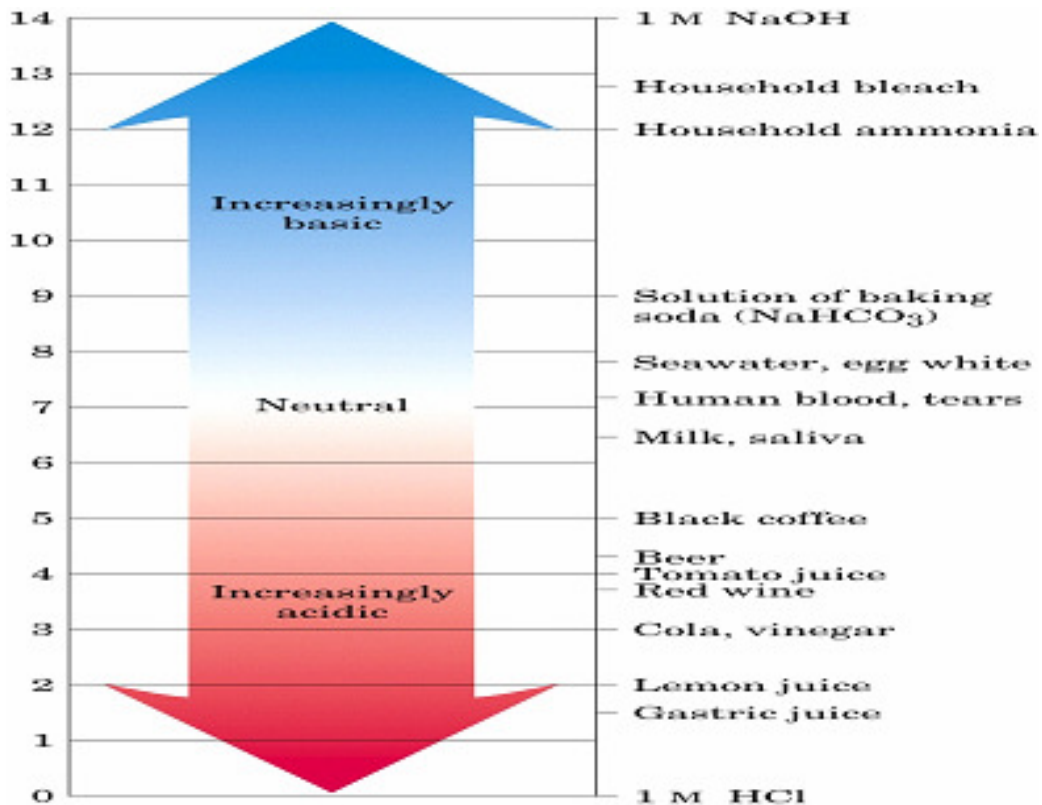
Van der Waals interactions

Any two atoms in close proximity

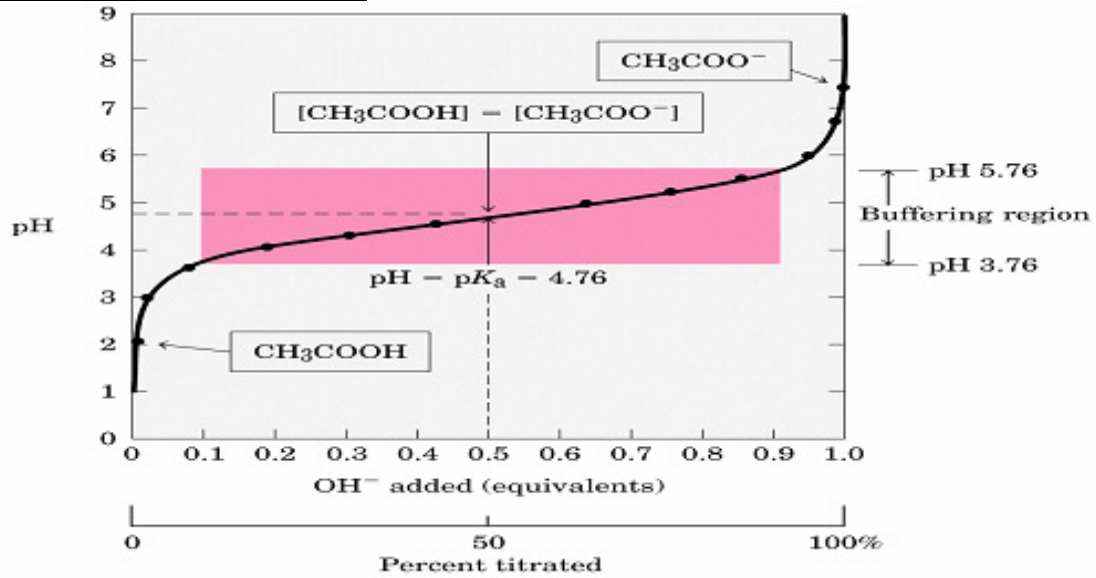
The effect of extracellular osmolarity



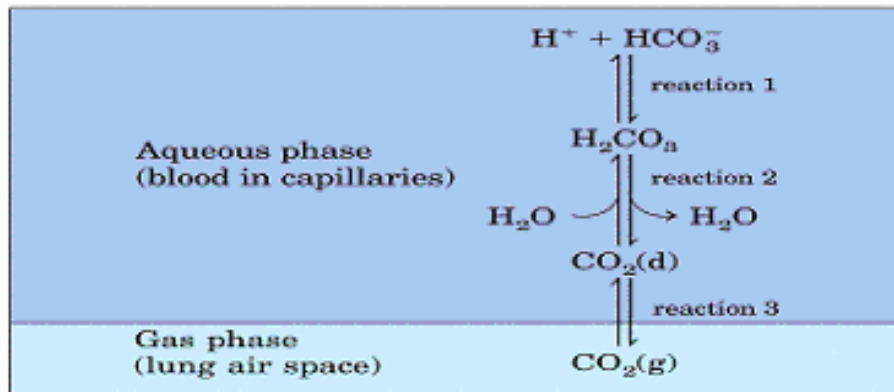
Why is neutral pH = 7?



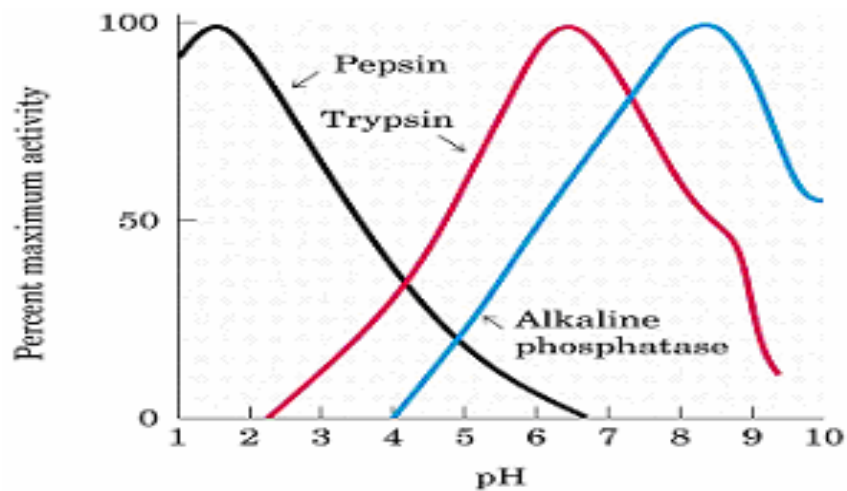
Titration curve of acetic acid



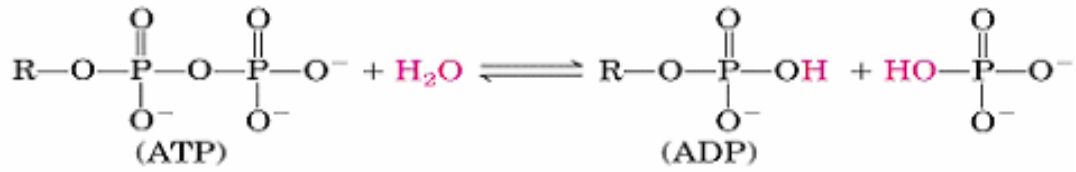
The Bicarbonate Buffer System (pH 7.4)



pH optima of some enzymes

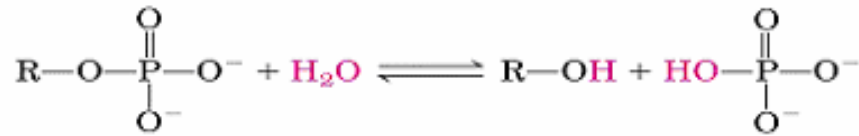


Condensation and hydrolysis reactions



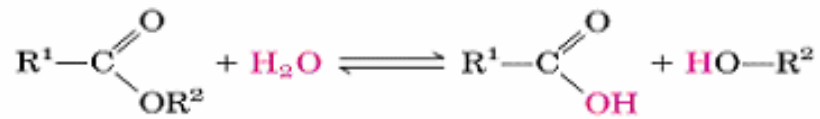
Phosphoanhydride

(a)



Phosphate ester

(b)



Carboxylate ester

(c)



Acyl phosphate

(d)