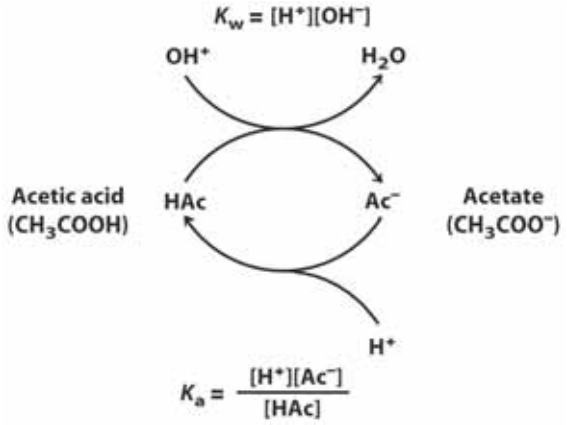
Chem 431A-Lecture 4 9/28/07
admin:
(1) sign attendance sheet.
(2) give Quiz#1 at 10:25 am

lecture:

(0) Last time:

Review acids and bases.



(1) Blood is buffered in part by bicarbonate-carbonic acid buffer.

$H_2CO_{3=}$is a diprotic acid with pKa's: 6.35, 10.45

How does it work?

Write the overall equation:

$$H_2CO_3 \overset{6.4}{\Leftrightarrow} HCO_3^- \overset{10.4}{\Leftrightarrow} CO_3^{2-}$$

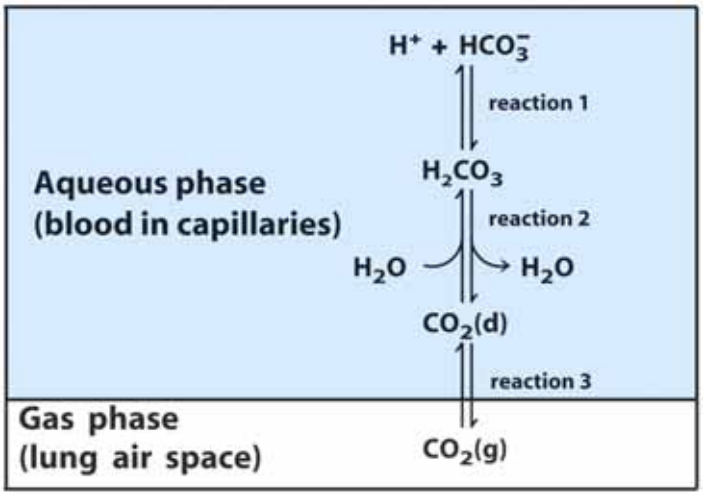
Determine the location of the pH of the cell in the above?

Which species is most dominant?

Which species is 2nd most dominant?

What is the pH of a solution of pure sodium bicarbonate, Na_2CO_3.

What is the ratio of the base/acid?



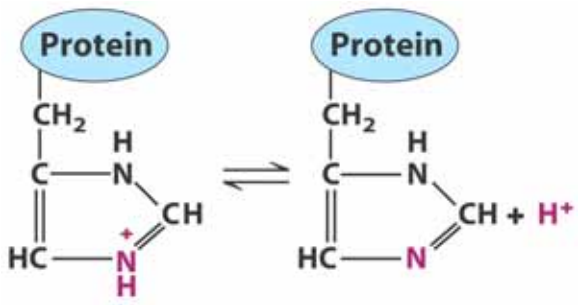
What is the way of adjusting this ratio?

Quick way: lungs

$H_2CO_3 \Leftrightarrow H_2O + CO_2(g)$

Slow way: kidneys

HCO_3^- (plasma) ⇔ HCO_3 (urine)



Role of pH in the enzymes:

Suppose the protonated form of the protein is the active enzyme. And the acidic group has a pK_a of 3.5, what is the expected graph of activity vs pH?

What types of enzymes would be like this?

What if the basic form is the active enzyme?

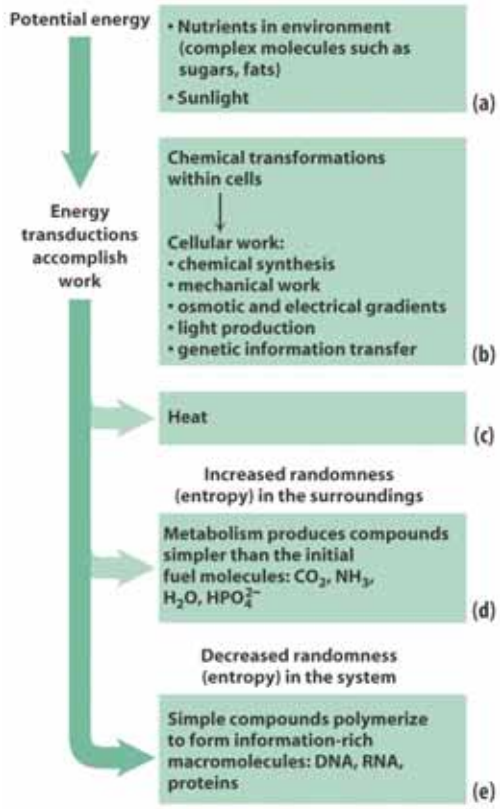
What if active form must have 2 groups HA (pKa = 5) and B (pKa of HB^+ = 8) what is the expected graph of activity vs pH?

Bioenergetics introduction:

Thermodynamics:
-concise, elegant and rigorous description of the various forms of energy and how tit affects matter on the macroscopic level as opposed to the molecular level. (it deals with large amounts of matter (compared to

the molecule) and therefore represents something like an average effect.
With thermodynamics, can determine if a physical process is possible.

It is essential to understand why molecules fold to their native conformations for instance, how metabolism becomes possible even if we can't make it happen in test tube…etc. In biochem, we are often concerned with describing conditions under which process occur **spontaneously**.



Let us review some of the basic elements of thermodynamics:

1st law of thermodynamics:

Energy is conserved! For a process, the change in energy is

$\Delta E = E_f - E_i = q - w$

where E = internal energy of the system;
q = heat absorbed by the system, and
w =work done by the system.

If q >0 that means endothermic
and if q <0, then exothermic!

Units are: 1 J = 1 kg-m/s^2 ;
1 cal = heat to raise 1 g water 1°C (from 14.5°-15.5°C), 4.18 j = 1 cal.
1 dietary Calorie = 1000 calories = 1 kcal.

Other units we need: R = gas contant = 8.314 J/molK or = 1.99 cal/mol K.
T = in kelvins.