Tuesday, March 04, 2014
10:21 AM

Thinking Like a Chemist About Equilibrium & Acids and Bases

UNIT 6 DAY 8 RAQ

What are we going to learn today?

REVIEW
JES A121A
Equilibrium
Behavior of Acids/Bases:
Aqueous Solutions
Neutralization Reactions

IMPORTANT INFORMATION

Class announcements about exam procedures:

- Students MUST go to the correct exam room.
- No bags, no graphing calculators, no phones, no extra calculators provided
- Write name 3 places on exam (MC, FR and signature on scantron)
- Students must be prepared to turn the exam in when they get in line: scratch pages stuffed into MC, photo ID out
- For a quieter exam, bring earplugs (not earphones)
- Mark your multiple-choice answers on your scantron and your exam paper. We will grade only the scantron, but marking on your test copy will allow you to see what you missed after it is handed back.

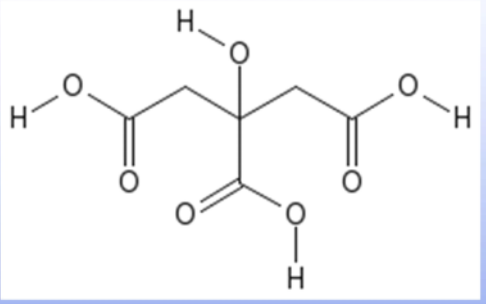
POLL: CLICKER QUESTION

Thinking about the UNIT 6 EXAM material, I have a good sense of what I understand and don't understand.

A) Not True of Me AT ALL
B) Somewhat Not True
C) I'm not sure how I would know if I'm ready for the Exam
D) Moderately True of Me
E) Very True of Me

QUIZ: CLICKER QUESTION

Polyprotic Acid



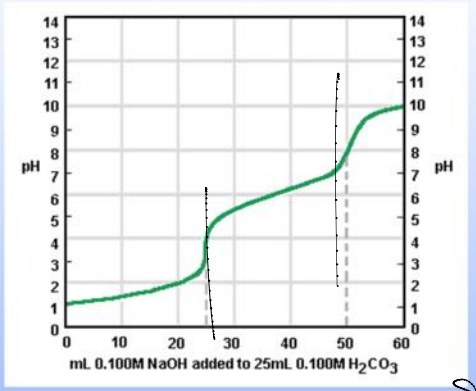
$Ka_1 = 7.4 \times 10^{-4}$

$Ka_2 = 1.7 \times 10^{-5}$

$Ka_3 = 4.0 \times 10^{-7}$

At pH = 10 will the acid be fully protonated or fully deprotonated?
a)Protonated
b)Deprotonated
c)Can't tell

Titration of a polyprotic



Two equivalence points
Diprotic H_2A

Principles of Chemistry II

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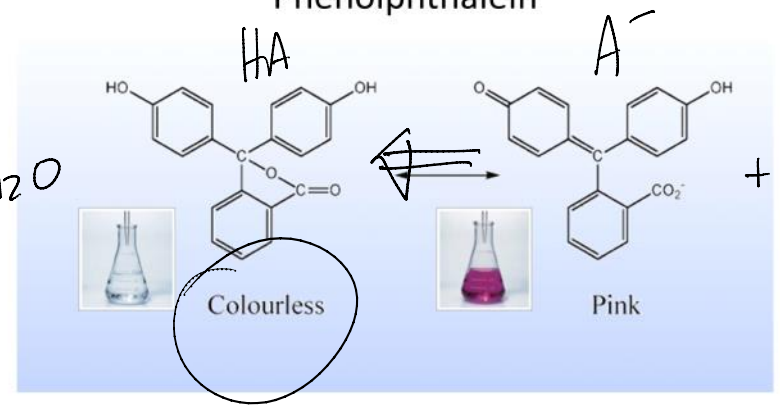
Phenolphthalein



Explain to a neighbor how, if this is a non-spontaneous change, the indicator ever changes color. Be prepared to share you answer.

$$K_a = \frac{[A^-][H_3O^+]}{[HA]}$$ small #

What happens to a system at equilibrium when you change the environment?

$\uparrow CO_2(g) \rightarrow CO_2(aq)$

$\uparrow CO_2(aq) + H_2O \rightarrow H_2CO_3(aq)$

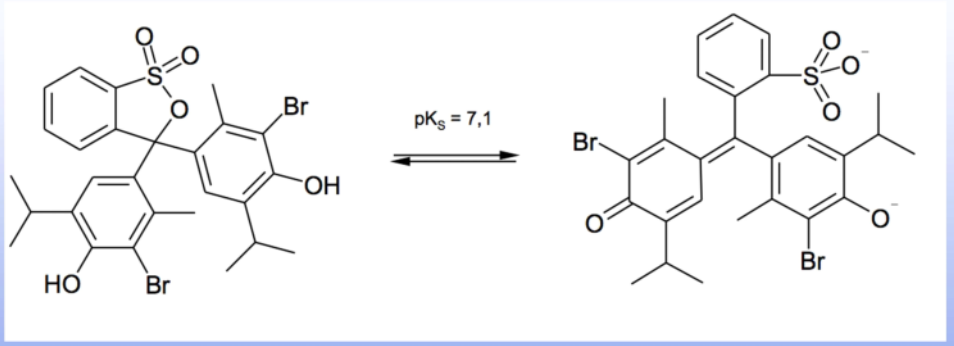
$H_2O(l) + \uparrow H_2CO_3(aq) \rightarrow H_3O^+(aq) + HCO_3^- \uparrow$

TEST

$BTB + \uparrow H_3O^+ \rightarrow BTBH^+ + H_2O$

protonated!

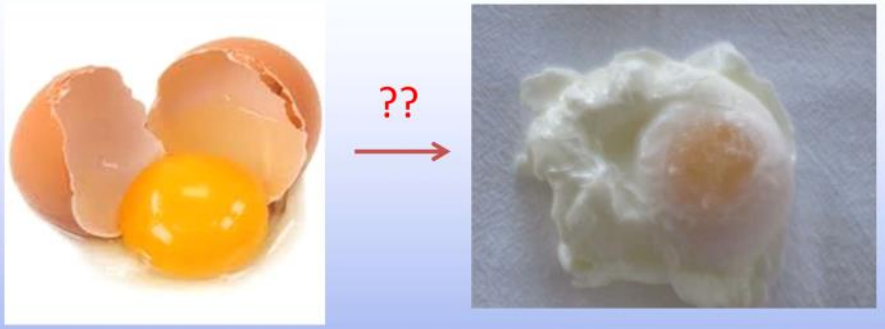
Chemical Equilibrium
pH indicator Bromothymol Blue, pKa = 7.1



Protonated form
yellow

Deprotonated form
blue

What is happening to the egg in the acid?



Egg = proteins + water

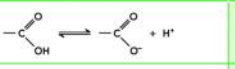
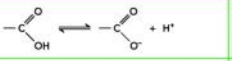
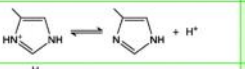
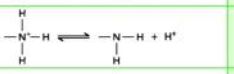
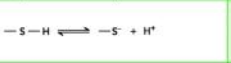
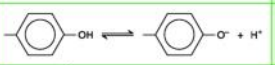
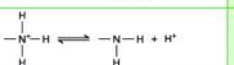
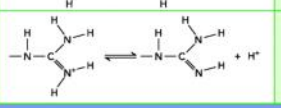
We are changing the structure of the proteins

Why? The are all protonating

If the pH < pKa

an acid/base will be protonated

Proteins = poly-peptides =
covalently linked amino acids

Group	Acid ⟷ Base + H⁺	pK_a
Terminal carboxyl		3.1
Aspartic acid or glutamic acid		4.4
Histidine		6.5
Terminal amino		8.0
Cysteine		8.5
Tyrosine		10.0
Lysine		10.0
Arginine		12.0

Which are protonated at
pH = 0?

Play a "Know your solution" game

Work with a couple of neighbors.
Clicker questions will come periodically.
Someone will explain what is going on!
If you know this cold, you are in really GREAT shape for the exam.

POLL: CLICKER QUESTION

The pH of 1.0 M Aniline is:

A) 11.3
B) 9.3
C) 7.3
D) 4.7
E) 2.7

POLL: CLICKER QUESTION

acidic salt

The pH of 0.25 M anilinium chloride is:

R $C_6H_5NH_3^+ + H_2O \rightarrow H_3O^+ + C_6H_5NH_2$

I

C

E

A) 11.4
B) 9.4
C) 7.4
D) 4.6
E) 2.6

find Ka from $K_a = \frac{K_w}{K_b}$

POLL: CLICKER QUESTION

The pH of a solution with .1 M aniline and 0.25 M anilinium chloride is:

Buffer

A) 11.4
B) 9.6
C) 7.6
D) 4.2
E) 2.4

$pOH = pK_b + \log\frac{[BH^+]}{[B]}$

or

$pH = pK_a + \log\frac{[A^-]}{[HA]}$

POLL: CLICKER QUESTION

The pH of a solution with 0.5 moles of HCl added to 1 Liter of 1 M aniline is:

A) 11.6
B) 9.6
C) 7.6
D) 4.6
E) 2.6

weak base + strong acid → salt

$C_6H_5NH_2 + HCl \rightarrow C_6H_5NH_3Cl$

1 mol .5 mol

−.5 mol .5 mol +.05 mol

.5 mol .5 mol

resulting sol'n contains .5 M $C_6H_5NH_2$ and .5 M $C_6H_5NH_3Cl$

POLL: CLICKER QUESTION

The pH of a solution with 0.01 moles of HCl added to 1 Liter of .1 M Aniline and 0.25 M Anilinium chloride is::

A) 11.1
B) 9.9
C) 7.1
D) 4.1
E) 2.1

$pOH = pK_b + \log \frac{[BH^+]}{[B]}$

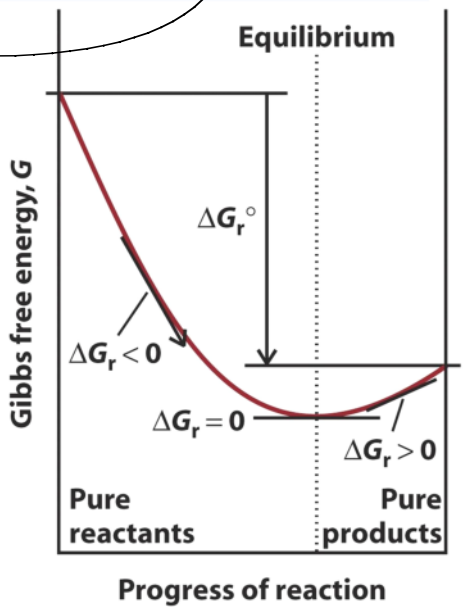
$pOH = 9.42 + \log \frac{(.26)}{(.09)}$

$pOH = 9.9$

	$C_6H_5NH_2$	+ HCl →	$C_6H_5NH_3^+$
I	.1	.01	.25
C	−.01	−.01	+.01
E	.09	Ø	.26

Interpreting K and $\Delta_r G°$

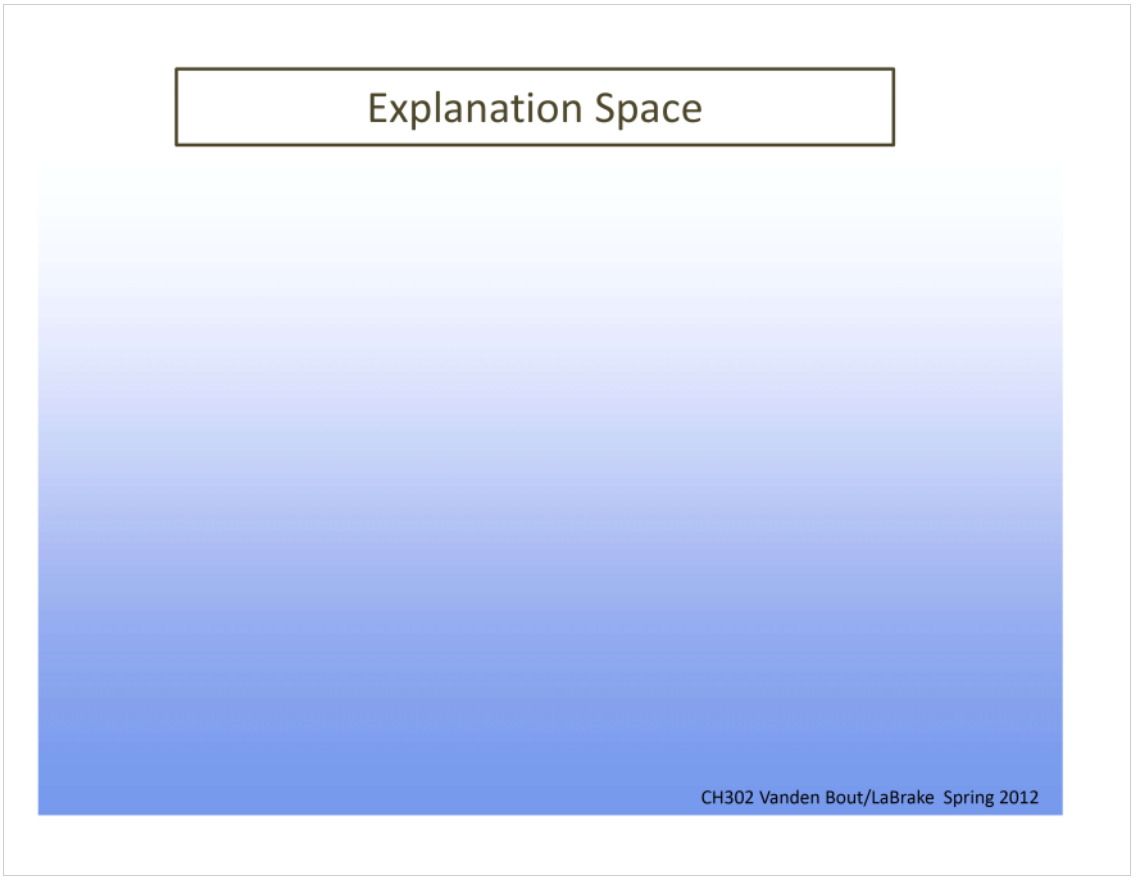
ΔG_r difference in molar free energy of products and reactants at *any* definite fixed composition of reactants and products



What did we learn today?

REVIEW for EXAM

Chemical Equilibria – Concepts
Acid – Base Chemistry
Determine pH of various solutions
Indicators
pH Curves


Explanation Space
CH302 Vanden Bout/LaBrake Spring 2012