# Announcements – Lecture XIX – Tuesday, Nov 27th

1. Lab 6 … Saturday, December 1st, 1:00-4:00 pm ISB 155/160 A-E

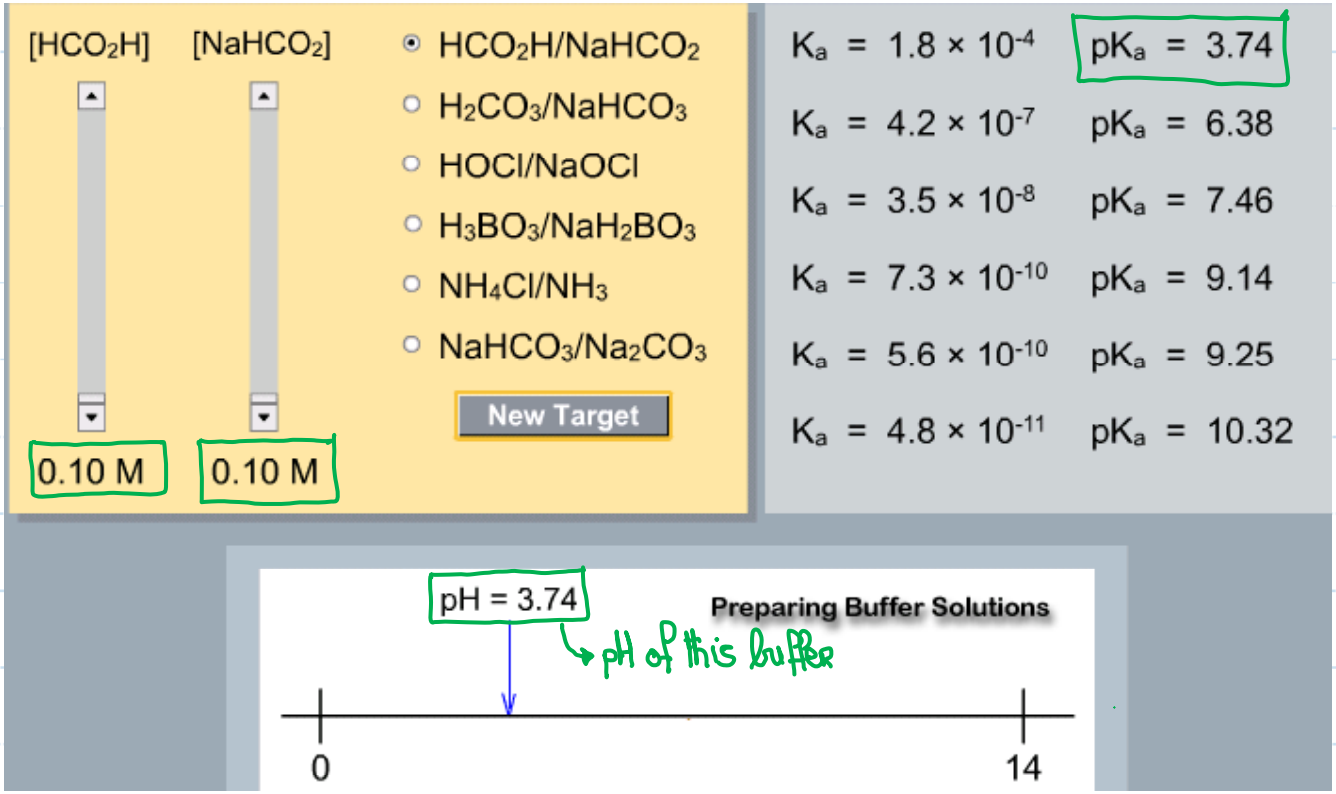
2. Exam III … Thursday, December 6th, ISB 135, 12:45-2:15pm
   3 or 4 questions will be taken from Lab Owls 3, 4 and 5.

3. Final Exam … Wednesday, December 12th, ISB 135, 8:00-10:00am
   Final Review … Sunday, December 9th, ISB 135, 1:00-3:00pm

## 8.10 What Are Buffers? – Making an Optimal Buffer Solution – pH and pKa

See class web site to see whether this holds true for other buffer systems

When [Acid] = [C.Base], the pH of the buffer is equal to the pKa of the acid.




When choosing a buffer system one usually selects one whose pKa is closest to the desired pH.

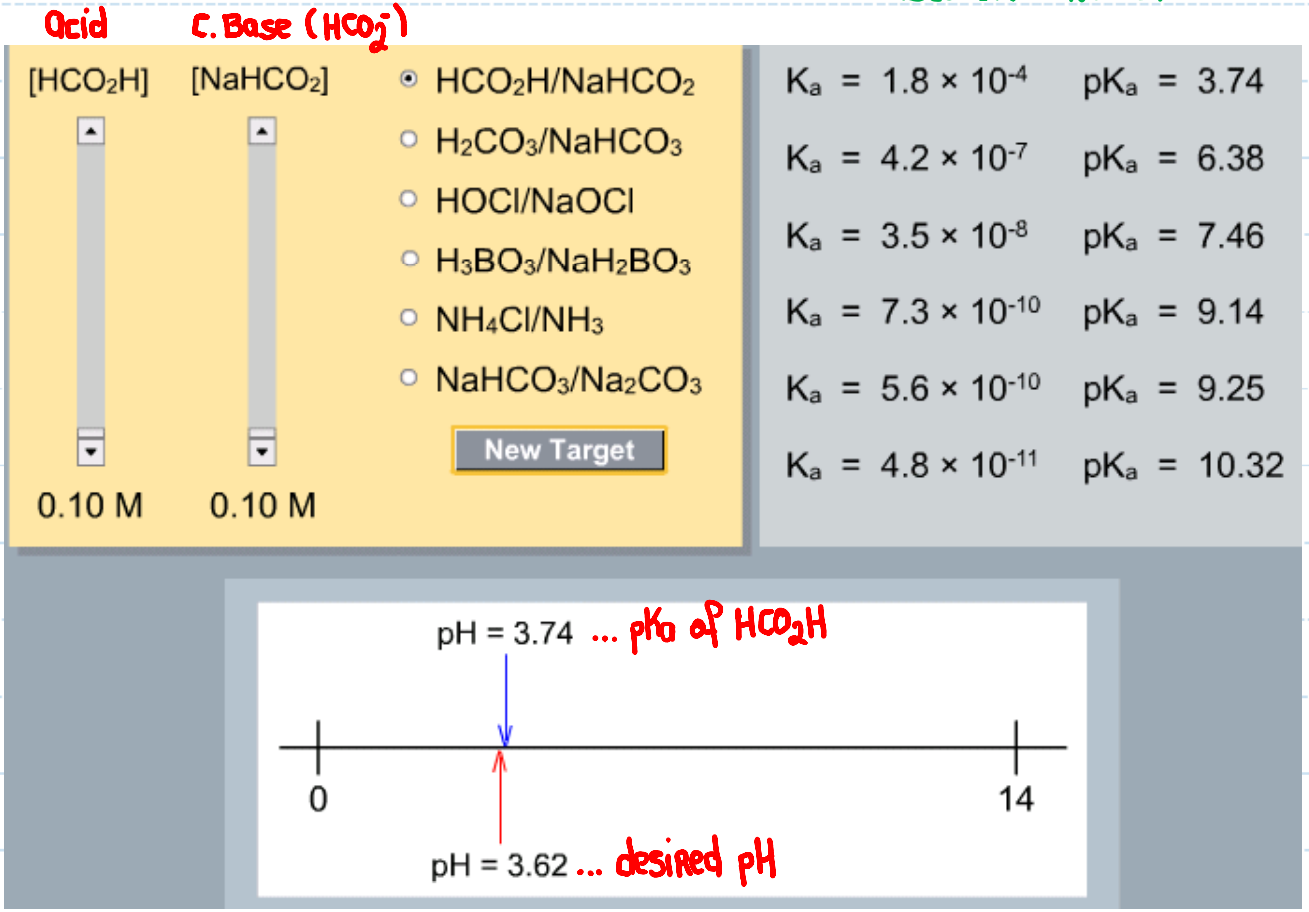
## 9.10 What Are Buffers? – Making an Optimal Buffer Solution

### Adjusting the pH of a Buffer

See class web site

Optimal pH

$\frac{[\text{Acid}]}{[\text{C.Base}]} \approx 0.1$ to 10




Since the desired pH is more acidic than the pKa ... increase the [ ] of the acid.

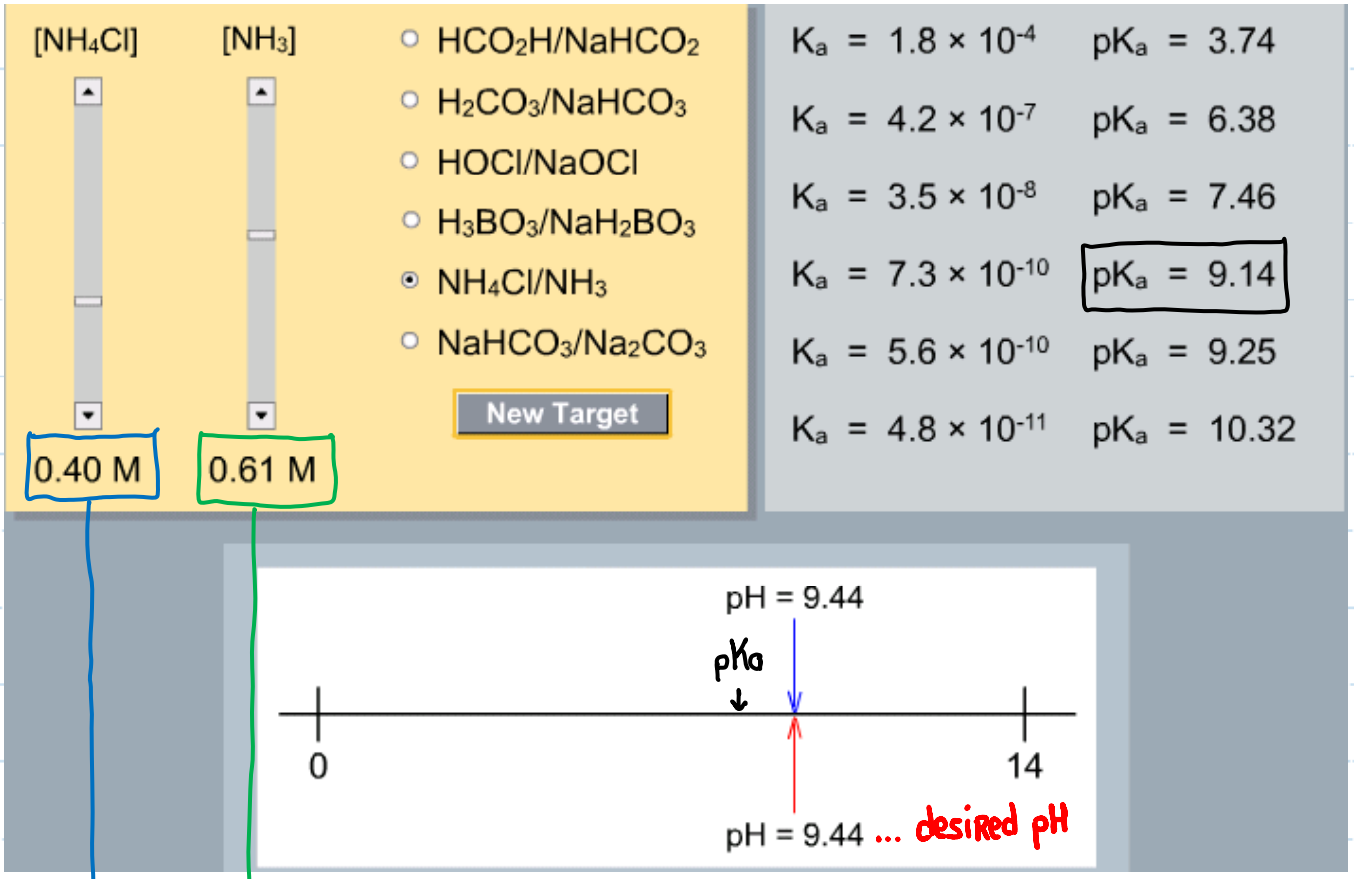
$[HCO_2H] \uparrow$, pH ↓

$[HCO_2^-] \uparrow$, pH ↑

## 8.10 What Are Buffers? – Making an Optimal Buffer Solution

### Buffer Capacity

$NH_4^+$ (acid) C. Base




→ Maximum concentration of $OH^-$ that can be removed.

↳ Maximum concentration of $H_3O^+$ that can be removed

## 8.10 What Are Buffers? – Identifying Buffer Solutions

How many of the following aqueous solutions are buffers? 3!

a) 0.24 M HI + 0.18 M NaI ✗ ... HI is a strong acid

d) 0.10 M $CH_3COOH$ + 0.18 M $CH_3COOK$ ✓ ... Weak acid and its conjugate base

c) 0.27 M $NH_4Br$ + 0.31 M $NH_3$ ✓ ... Weak acid and its conjugate base

b) 0.34 M $NH_4NO_3$ + 0.39 M $NaNO_3$ ✗ ... $NO_3^-$ is not the conjugate base of $NH_4^+$

d) 0.10 M HCl + 0.21 M NaF ✓!

SA + WB = 100%

$H_3O^+ + F^- \rightarrow H_2O(l) + HF(aq)$

0.1M 0.21M → 0.11M 0.1M

After Reaction 0.1M HF and 0.11M $F^-$ Remain!

## 8.10 What Are Buffers? – How Do They Resist Drastic pH Changes

(d)

A 1L solution contains 0.25 mol of NaCN and 0.15 mol of HCN.

1. Increase significantly
2. Increase slightly
3. Decrease significantly
4. Decrease slightly
5. Increase
6. Decrease


a) Addition of 0.1 mol of HCl will case the [HCN] to –

5. $H_3O^+ + CN^- = HCN(aq) + H_2O(l)$

b) Addition of 0.1 mol of HCl will case the pOH to –

2. pH ↓ slightly with the addion of $H_3O^+$ ... pH + pOH = 14 ... pOH ↑ slightly

c) Addition of 0.1 mol of NaOH will case the [HCN] to –

6. $OH^- + HCN(aq) = H_2O(l) + CN^-$

d) Addition of 0.2 mol of NaOH will case the pH to –

1. Buffer capacity exceeded ... pH will increase significantly.