General Chemistry w/ Dr. M

Today Wednesday 3/1 — Section 16.6 - 16.9, Quiz 3

Thursday 3/2 — Expt 7 Laptops! Excel spreadsheet from Expt 6

Friday 3/3 — No Class!

Is it a buffer?

(A) 0.20 mol HF + 24 g NaF to make 500 mL

$24\,g\,NaF \times \frac{1\,mol\,NaF}{41.99\,g\,NaF} \times \frac{1\,mol\,F^-}{1\,mol\,NaF} = .57\,mol\,F^-$ — Buffer

(B) 15 g $NaC_2H_3O_2$ + 20 mL $HC_2H_3O_2$ diluted to 1.00 L

$15\,g\,NaC_2H_3O_2 \times \frac{1\,mol}{82.03\,g} \times \frac{1\,mol\,C_2H_3O_2^-}{1\,mol} =$ → 1 M — Buffer

(C) 0.40 mol NaOH + 1.00 L 0.75 M benzoic acid (HBz) — Buffer

1.00 L × 0.75 mol/L = 0.75 mol acid − 0.4 mol SB = 0.35

0 mol base + 0.4 mol SB = 0.40

(D) 0.30 mol HCl + 0.25 mol $KClO_2$ in 100.0 mL H_2O

0.25 mol $KClO_2$ wb − 0.30 mol SA = −.05 — Not a Buffer

(E) 1 scoop of NaH_2PO_4 + 2 scoops Na_2HPO_4 in part of water

$H_2PO_4^-$ + HPO_4^{2-}

wa cwb — Buffer

(F) 0.25 mol HNO_3 + 0.45 mol $KC_2H_3O_2$ in ~2 L H_2O

0.45 mol $KC_2H_3O_2$ wb − 0.25 mol SA = 0.2 mol wb

0 mol cwa + 0.25 mol SA = .25 mol cwa

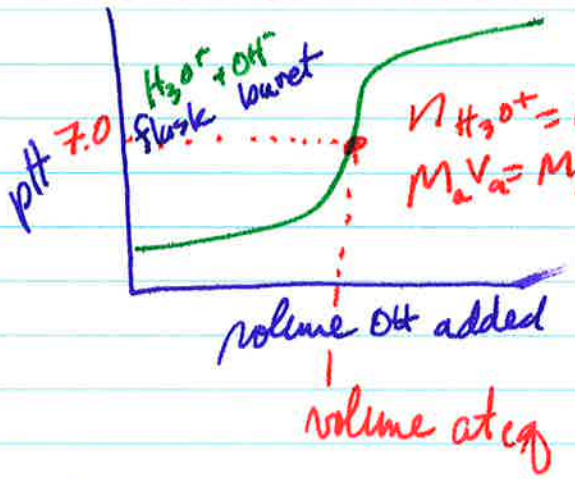
Buffer

Buffer recipes

Recipe 1 mix wa + cb $pH = pK_a + \log\left(\frac{n_{wb}}{n_{wa}}\right)$

Recipe 2 ~~mix~~ React wa + OH^- (LR) $pH = pK_a + \log\left(\frac{n_{mol} + n_{OH^-}}{n_{wa} - n_{OH^-}}\right)$

Recipe 3 ~~mix~~ ~~React~~ wb + H_3O^+ (LR) $pH = pK_a + \log\left(\frac{n_{wb} - n_{H_3O^+}}{n_{mol} + n_{H_3O^+}}\right)$



for Sa + Sb titration At eq pt pH = 7

Everywhere else, we do a NICE aka

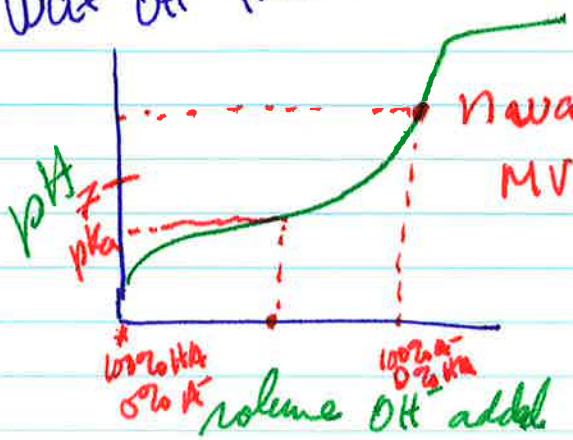
$n \quad H_3O^+ + OA^- \longrightarrow 2H_2O$

I $n = m_w$ $n = mw$

C ↑ LR?? ↑

E ← if H_3O^+ is the excess $H_3O^+ = \frac{n_{H_3O^+}}{Vol_{H_3O^+}}$

Weak OH⁻ titration



Recipe 2 buffer

$$pH = pKa + \log\left(\frac{0\,mol + n_{OH^-}}{n_{wa} - n_{OH^-}}\right)$$

$$n_{OH^-} = M_{OH^-} * V_{OH^-}$$

$$n_{wa} = M_{wa} * V_{wa} \quad \text{or} \quad n_{wa} = \frac{M_{wa}}{MM_{wa}}$$

pKa is on the graph
at 1/2 - way to equiv pt
$pH = pKa + \log(1)$
$pH = pKa$

Suppose 25.00 mL of HA is titrated with 0.1141M NaOH and it takes 20.08 mL to reach the endpt.
① what is [HA]?

$$M_{HA} V_{HA} = M_{OH^-} V_{OH^-}$$

$$M_{HA}\, 25.00 = 0.1141 \frac{mol}{L} \times 20.08\,mL$$

$$[HA] = M_{HA} = 0.0916\,mol/L$$

② Where do you find pKa? → at $\frac{20.08}{2}$ mL OH^-

$V_{OH^-} = 10.04$

$pKa = 4.08$ (slightly made up)

③ What is the pH after 8.00 mL OH^- added?

$$pH = pK_a + \log\left(\frac{0\ mol + n_{OH^-}}{n_{HA} - n_{OH^-}}\right)$$

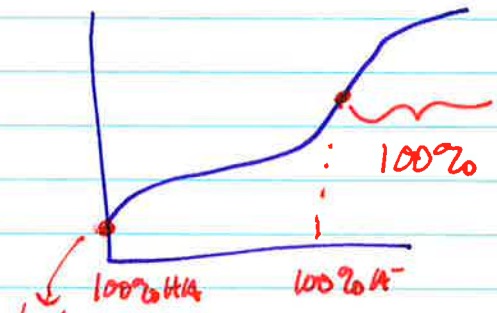
$$= 4.05 + \log\left(\frac{0\ mol + 0.000913}{.00229 - 0.000913}\right)$$

$$= 3.90$$

$n_{HA} = M_{HA} \times V_{HA}$

$= 0.0916\ \frac{mol}{L} \times 0.0250\ L$

$= 0.00229\ mol$



before any OH^- added → Ka MICE problem (400 mL)

At eq pt, how to determine pH (> 7)

100% A^-

$[A^-] = \frac{n_{A^-}}{Vol_{tot}}$ $n_{A^-} = 0.0916\ mol$ $Vol_{tot} = 250\ mL + 20.08\ mL$

Ch 15 weak base problem, K_b, MICE 400 mL

	A^-	+ H_2O	⇌	OH^-	+	HA
I	2.032 mol/L					
C	−X			+X		+X
E						

$K_b^{A^-} = K_w / K_a^{HA}$