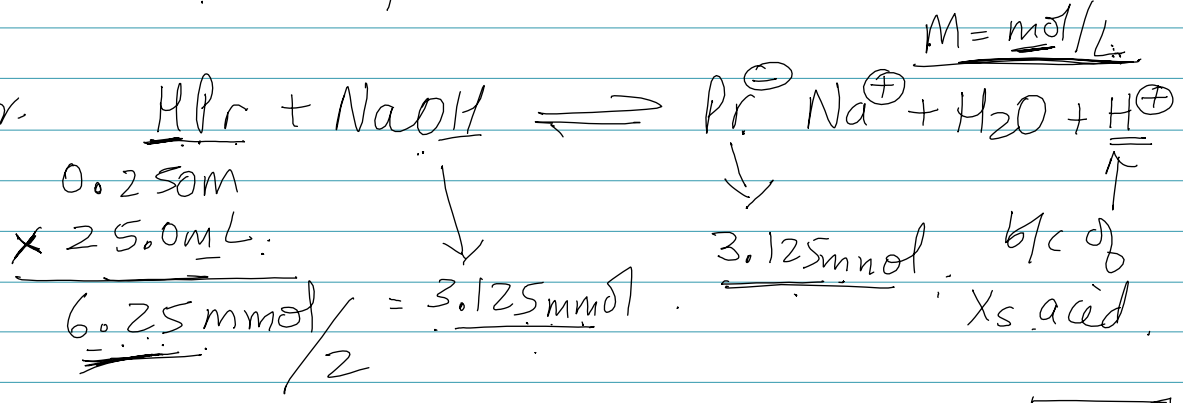


Sept 2013

Acid-Base Eq (14) Titration WA + SB.

Calculate the pH of the titration of 25.0 mL of 0.250 M $\text{CH}_3\text{CH}_2\text{COOH}$ ($K_a = 1.3 \times 10^{-5}$) with 0.330 M NaOH at
 (a) half neutralization pt and (b) at equivalence pt.

Ans
 (a) half neutr.
 at half pt
 only $\frac{1}{2}$ HPr
 is neutral.
 so only $\frac{1}{2}$ of
 NaOH



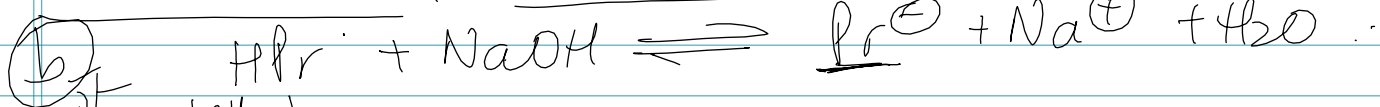
$$K_a = 1.3 \times 10^{-5} = \frac{(3.125 \text{ mmol}) [\text{H}^+]}{(3.125 \text{ mmol})}$$

[no vol of NaOH reqd.]

at half pt.

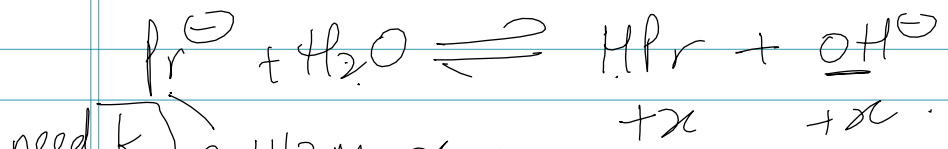
$$K_a = 1.3 \times 10^{-5} = [\text{H}^+]$$

$$pK_a = \text{pH} = \boxed{4.89}$$



(at eq. pt
 mol HPr = mol NaOH.)
 no H_2O
 only Pr^- in soln

6.25 mmol 6.25 mmol 6.25 mmol
 $\text{total vol} = 25 + 18.9 \text{ mL} = 43.9 \text{ mL}$
 $\text{molarity of Pr}^- = \frac{6.25 \text{ mmol}}{43.9 \text{ mL}} = 0.142 \text{ M}$



need K_b
 $0.142 \text{ M} - x$

$$K_b = 7.69 \times 10^{-10} = \frac{x^2}{(0.142 - x)}$$

$x = 1.05 \times 10^{-5}$

ignore conc. OH^-

$$p\text{OH} = -\log 1.05 \times 10^{-5} = 4.98$$

$$* \text{pH} = 14 - 4.98 = \boxed{9.02}$$

$* 43.9 \text{ mL}$
 $= 0.142 \text{ M}$
 $* K_b = \frac{1 \times 10^{-14}}{1.3 \times 10^{-5}}$
 $= 7.69 \times 10^{-10}$