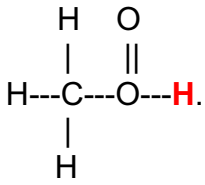
Chem 116: Experiment 9

pH Measurements and The Determination of the pK_a of Acetic (Ethanoic) Acid

The lab is in 2 parts

Part A you measure the pH of various things using long and short range pH papers and a pH meter

Part B you find the pK_a for acetic acid



H is the acidic hydrogen atom

We can write the formula for acetic acid as CH_3COOH

In water there is an equilibrium $CH_3COOH + H_2O \rightleftharpoons H_3O^+ + CH_3COO^-$ acetate ion

if we subtract H_2O from each side, the equation is easier to read

$$CH_3COOH \rightleftharpoons H^+ + CH_3COO^-$$

K_a, the dissociation constant $= \frac{[H^+][CH_3COO^-]}{[CH_3COOH]}$

just as $pH = -\log[H^+]$ so $pK_a = -\log K_a$ but how can we find pK_a

The answer is sneaky. We titrate CH_3COOH with NaOH Here's the equation

1CH_3COOH start with 60 mol why not?	+	1OH^- for every mol you add	------>	1CH_3COO^- 0 at the start	+ H_2O (the Na^+ merely spectate)
this goes down by 1				this goes up by 1	
this is now 60 -30 = **30**		add 30 (which is half 60)		this is now 0 + 30 = **30**	wow, they are the same

so half way through the titration
$[CH_3COOH] = [CH_3COO^-]$

$K_a = \frac{[H^+][CH_3COO^-]}{[CH_3COOH]}$ $K_a = [H^+]$ $pK_a = pH$ Easy

But how are we to find the pH halfway through the titration?

We follow the titration using a pH meter, and we plot pH/volume of NaOH added.