Draw a titration curve for the titration of 300 mM NaOH into 500 mL of 26 mM pyrimidium (pka 5.25). Make sure to label the x and y axis for the three important points we talked about in class.

Calculate the pH if 15 mL of 250 mM NaOH is added to 750 mL of 20 mM pyridium.
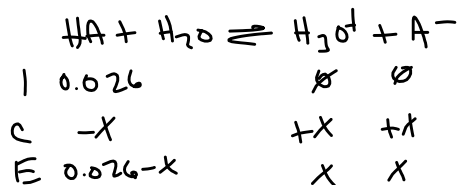
Calculate the pH if 25 mL of 1.00 M HCl is added to a solution 200 mL of 300 mM pyridinium buffered at pH 6.0.

Draw a titration curve for the titration of 300 mM NaOH into 500 mL of 26 mM pyrimidium (pka 5.25). Make sure to label the x and y axis for the three important points we talked about in class.

Initial pH: $[HA] = 0.026 M$

$$HA + H_2O \rightleftharpoons H_3O^+ + A^-$$

	HA		H_3O^+	A^-
I	0.026		$\varnothing$	$\varnothing$
C	$-X$		$+X$	$+X$
E	$0.026-X$		X	X

Volume @ Eq. Pt.

$$\frac{0.5L \mid 0.026 mol}{\mid L} = 0.013 \, mol \, HA$$

need $0.013 \, mol \, OH^- \dfrac{L}{0.3 mol} = 0.043 \, L$

$$\boxed{43.3 \, mL}$$

$$10^{-5.25} = \frac{X^2}{0.026-X}$$

$$\varnothing = X^2 + 10^{-5.25}X - 1.46 \times 10^{-7}$$

$$X = [H_3O^+] = 3.79 \times 10^{-4} \quad \boxed{PH = 3.42}$$

V @ ½ Eq. Pt.

$$43.3 \div 2 = 21.67 \, mL$$

PH @ ½ Eq. Pt

$$PH = PKa = 5.25$$

PH @ Eq. Pt.

$$[A^-] = \frac{0.013 \, mol}{0.5L + 0.0433} = 0.0239 M$$

← Volume NaOH added

← Mols Ac⁻ converted by HAc + NaOH

$pK_b = 14 - 5.25 = 8.75$

$$Ac^- + H_2O \rightleftharpoons HAc + OH^-$$

	Ac^-		HAc	OH^-
I	0.024		$\varnothing$	$\varnothing$
C	$-X$		$+X$	$+X$
E	$0.024-X$		X	X
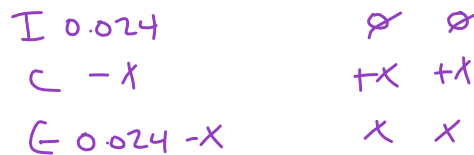
$$K_5 = 10^{-8.75} = \frac{X^2}{0.024-X} = \frac{X^2}{0.024}$$

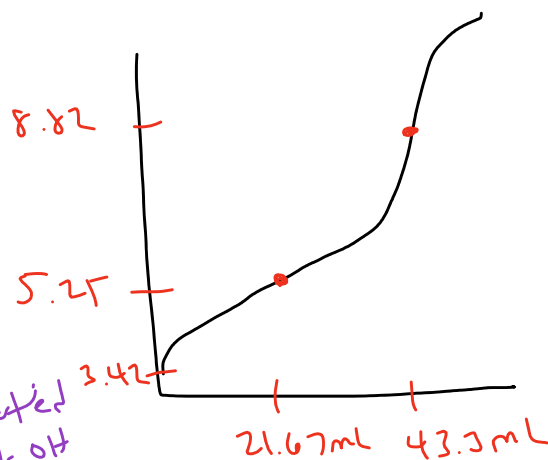$$\frac{0.024}{1000} = 2.4 \times 10^{-5} > 10^{-8.75}$$

shortcut ok
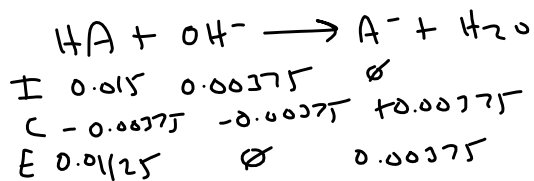
$$X = [OH^-] = 6.53 \times 10^{-6}$$

$$POH = 5.18$$

$$\boxed{PH = 8.82}$$

8.82 —

5.25 —

3.42 —

21.67 mL   43.3 mL

Calculate the pH if 15 mL of 250 mM NaOH is added to 750 mL of 20 mM pyridium.

NaOH : $\dfrac{0.015\,L}{}\Big|\dfrac{0.25\,mol}{L} = 0.00375$

Pyridium : $\dfrac{0.75\,L}{}\Big|\dfrac{0.02\,mol}{L} = 0.015\,mol$

$[HA] = \dfrac{0.01125\,mol}{0.75+0.015} = 0.0147\,M$

$[A^-] = \dfrac{0.00375\,mol}{0.75+0.015} = 0.0049\,M$

$$HA + OH^- \longrightarrow A^- + H_2O$$

I	0.015	0.00375	0
C	-0.00375	-0.00375	+0.00375
E	0.01125	0	0.00375

$pH = 5.25 + \log \dfrac{0.0049}{0.0147}$

$\boxed{pH = 4.77}$

Calculate the pH if 25 mL of 1.00 M HCl is added to a solution 200 mL of 300 mM pyridinium buffered at pH 6.0.

0.025 mol HCl

Need to know initial amount of A^- & HA

$[Total] = 300 = [HA] + [A^-]$

$[A^-] = 300 - [HA]$

$6.0 = 5.25 + \log \dfrac{300-HA}{HA}$

$5.623 = \dfrac{300 - HA}{HA}$

$[HA] = 45.29\,mM$

$[A^-] = 300 - 45.29 = 254.71\,mM$

$$HA + H_3O^+ \longrightarrow A^- + H_2O$$

I	0.051	0.025	0.0091
C	-0.025	-0.025	+0.025
E	0.026	0	0.0341
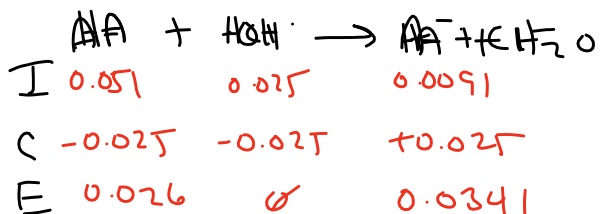
$[A^-] = \dfrac{0.026\,mol}{0.2L+0.025L} = 0.116\,M$

$[HA] = \dfrac{0.0341\,mol}{0.225\,L} = 0.152\,M$

$\dfrac{0.2\,L}{}\Big|\dfrac{0.04529\,mol}{L} = 0.0091\,mol\,HA$

$\dfrac{0.2\,L}{}\Big|\dfrac{0.25471\,mol}{L} = 0.051\,mol\,A^-$

$pH = 5.25 + \log \dfrac{0.116}{0.152}$

$\boxed{pH = 5.13}$