Dougherty Valley HS Chemistry - AP
Acid Base – Titration Calculations

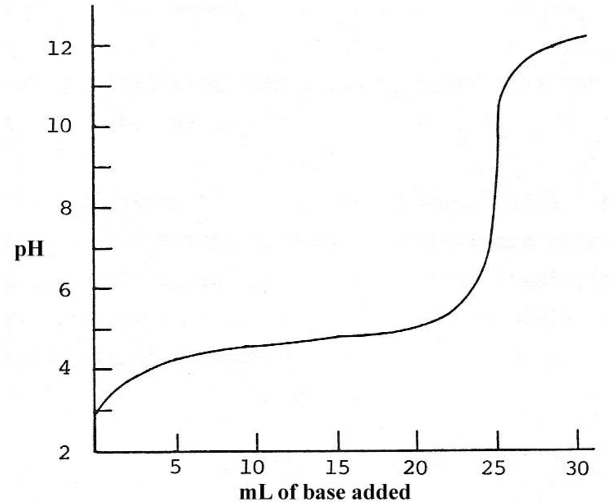
Worksheet #11

Name: **Period:** **Seat#:**

USE BINDER PAPER TO DO YOUR CALCULATIONS. STAPLE TO THIS PAGE

Information from the Curve:

There are several things you can read from the titration curve itself. Consider this titration curve.



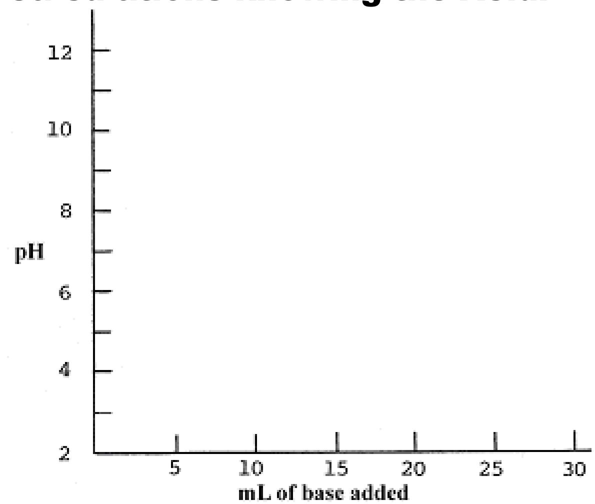
1) This is a _________________(strong/weak) acid titrated with a strong base. The acid is _________________(monoprotic/diprotic). How would the other strength of acid look?
Answer:

2) Place a dot (•) on the curve at the equivalence point. The pH at the equivalence point is _________. Choose a good indicator for this titration, look online or in your book for pH indicator ranges.
Answer:

3) What volume of base was used to titrate theacid solution? _________ mL

4) Place a box (■) on the curve where the pH ofthe solution = the pK_a of the acid.
What is the pH at this point? ________
What is the pK_a of the acid? ________
What is the K_a of the acid? _________

Calculations knowing the Acid:



5) Hydrofluoric acid, HF, has a $K_a = 7.2 \times 10^{-4}$. Calculate the pH of 10.0 mL of a 0.050 <u>M</u> solution of HF. Plot the point on the axes. *<u>2.2</u>*

6) A 0.020 <u>M</u> solution of NaOH is used for the titration. What volume will be needed to reachthe equivalence point? *<u>25ml</u>*

7) Write the net reaction for the neutralization of a solution of HF with a solution of NaOH:
Answer:

8) Calculate the moles of F^- at the equivalence point. *<u>0.0005 mol</u>*
What is the total volume? _________L *<u>0.035L</u>*
The $[F^-]$ at the equivalence point is_________ *<u>0.0143M</u>*

9) Calculate the pH of the solution at the equivalence point. *<u>7.65</u>* Use this information and the answer to question 6 to plot the equivalence point on your graph. Choose a good indicator for this titration look online or in your book for pH indicator ranges.
Answer:

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10) What is the pH halfway to the equivalence point? Plot this point on your graph. *3.14*

11) How many moles of HF are in the original 10.0 mL sample of HF? ________ *0.0005 mol*

12) When only 5.0 mL of 0.020 M NaOH has been added, calculate the moles of HF left and F^- produced.

	HF	OH^-	H_2O	F^-
i			-----	
c			-----	
e			-----	

13) Use Henderson-Hesselbach equation or an ice table to calculate the pH when 5.0 mL of base has been added. Plot this point on your graph. *2.53*

14) When 20.0 mL of 0.020 M NaOH has been added, calculate the moles of HF left and F^- produced.

	HF	OH^-	H_2O	F^-
i			-----	
c			-----	
e			-----	

15) Use the Henderson-Hesselbach equation or anicebox to calculate the pH when 20.0 mL of base has been added. Plot this point on your graph. *3.75*

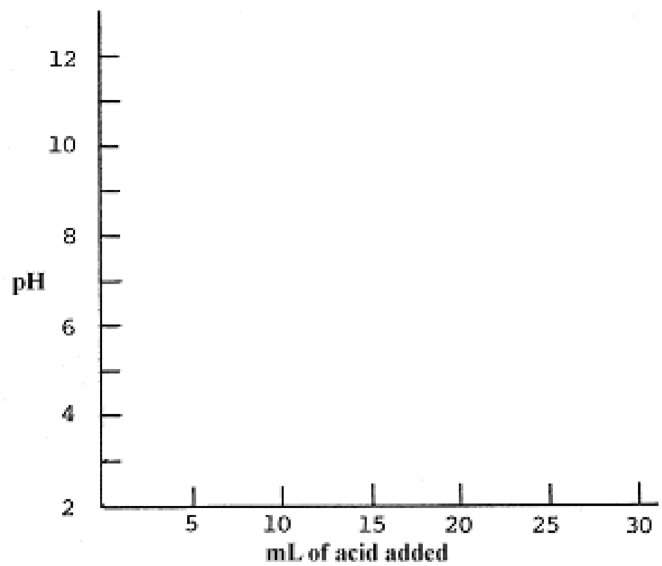
16) When 30.0 mL of base is added, how many moles of OH^- is in excess? ___________ *1x10⁻⁴* The total volume is __________ L. *0.04L* $[OH^-]$ = _________ *0.0025M* pOH =_________ *2.6* pH = _________ *11.4* Plot this point on your graph.

17) Sketch the final titration curve on your graph on the front of this page.

Weak Base-Strong Acid Curve:

A 20.0 mL sample of 0.10 M CH_3NH_2 (methyl amine) is titrated with 0.15 M HCl. The K_b for $CH_3NH_2 = 4.2 \times 10^{-4}$.

Do all the appropriate calculations to sketch a titrationcurve for this titration.



Formulas from the AP Exam:

EQUILIBRIUM

$$K_a = \frac{[H^+][A^-]}{[HA]}$$

$$K_b = \frac{[OH^-][HB^+]}{[B]}$$

$$K_w = [OH^-][H^+] = 1.0 \times 10^{-14} \quad @ \ 25°C$$
$$= K_a \times K_b$$

$$pH = -\log[H^+], \quad pOH = -\log[OH^-]$$

$$14 = pH + pOH$$

$$pH = pK_a + \log\frac{[A^-]}{[HA]}$$

$$pOH = pK_b + \log\frac{[HB^+]}{[B]}$$

$$pK_a = -\log K_a, \quad pK_b = -\log K_b$$

$$K_p = K_c(RT)^{\Delta n},$$

where Δn = moles product gas − moles reactant gas