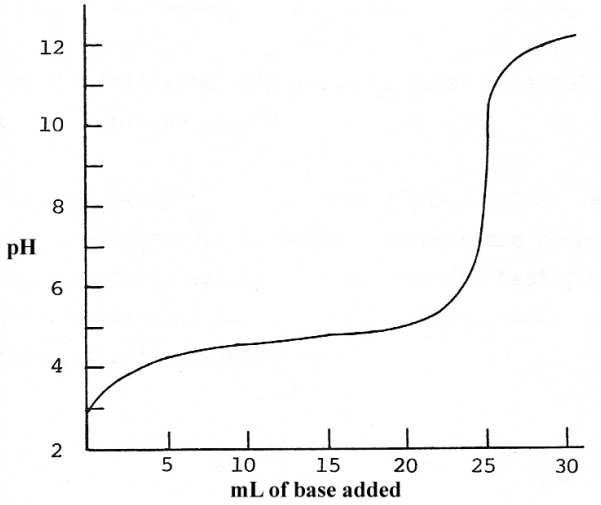
Name: _____ Per: ____ Seat: ____

Dougherty Valley HS AP Chemistry
Acid-Base Reactions
CALCULATIONS

WORKSHEET #10

Information from the Curve:

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



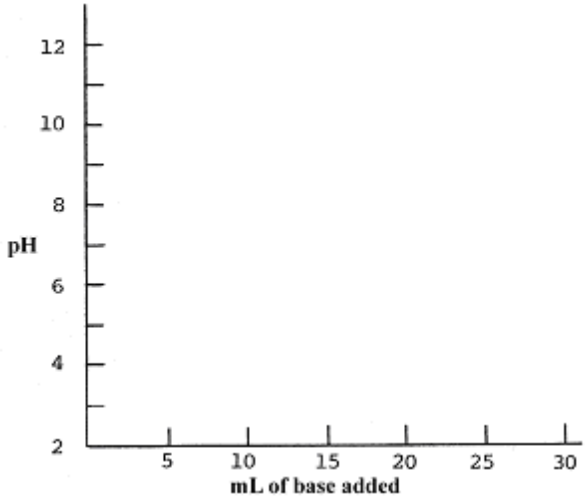
1. This is a _____ (strong/weak) acid titrated with a strong base. The acid is _____ (monoprotic/diprotic). How would the other strength of acid look?

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 from Figure 17.11 on page 810 of your textbook.

3. What volume of base was used to titrate the acid solution? _____ mL

4. Place a box (■) on the curve where the pH of the 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 M solution of HF. Plot this point on the axes. (**2.2**)

6. A 0.020 M solution of NaOH is used for the titration. What volume will be needed to reach the equivalence point? (**25ml**)

7. Write the net reaction for the neutralization of a solution of HF with a solution of NaOH.
   _____

8. Calculate the moles of F^- at the equivalence point. (**0.0005 mol**) What is the total volume? _____ L (**0.035L**) The $[F^-]$ at the equivalence point is _____ (**0.0143M**)

9. Calculate the pH of the solution at the equivalence point. Use this information and the answer to question 6 to plt the equivalence point on your graph. Choose a good indicator for this titration from Figure 17.11 on page 810 of your textbook. (**7.65**)

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

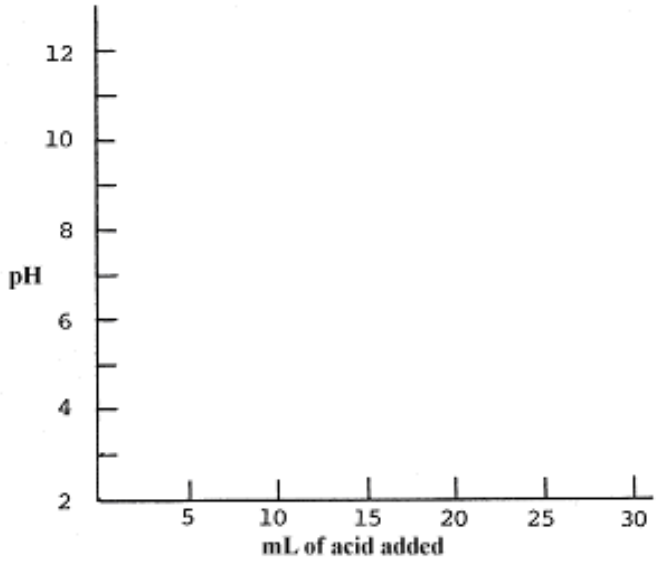
16. When 30.0 mL of base is added, how many moles of OH^- is in excess? _____ (**$1E^{-4}$**)
The total volume is _____ L. (**0.04L**)
$[OH^-]$ = _____ (**0.0025M**)
pOH = _____ (**2.6**) pH = _____ (**11.4**) Plot this point on your graph.

17. Sketch the titration curve on your graph.

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 = 4.2×10^{-4}.

Do the appropriate calculations to sketch a titration curve for this titration.



Formulas from the AP Exam:

EQUILIBRIUM

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

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

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

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

$$14 = pH + pOH$$

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

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

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

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

where Δn = moles product gas − moles reactant gas