Acid-Base Titration
Activity Sheet

In this activity you will run the TITRAFC4 program. This program displays titration curve for the titration of a strong or weak acid with a strong base. The titration curve shows the change in pH with the addition of the strong base to the acid solution.

Download the TITRAFC4 program to your TI-83/84 calculator. Run this program and answer these questions.

a. The pH _____ (increases or decreases) as the base is added to the acid. The biggest change in pH occurs near the _____ point.

b. Complete the following table for a titration of 50 mL of 0.10 M acid with 0.10 M base. (You will need to exit the program and use GRAPH and TRACE to get these values.)

mL base	pH Strong Acid (K_a = 1000)	pH Weak Acid (K_a = 0.0001)
0		
25		
50		
60		

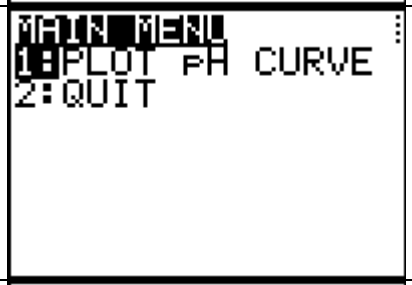
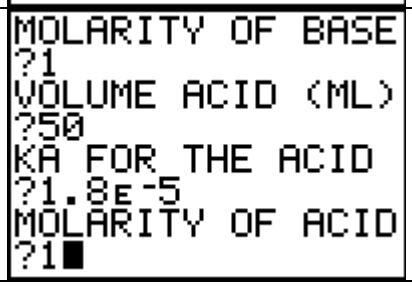
c. The initial pH of a strong acid is _____ (larger than, smaller than, or the same as) a weak acid of the same concentration.

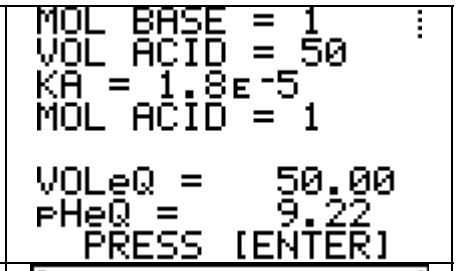
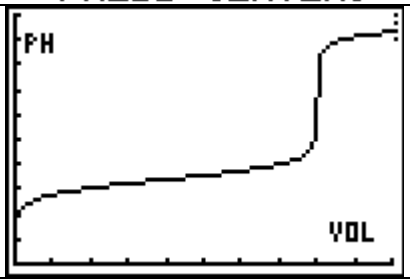
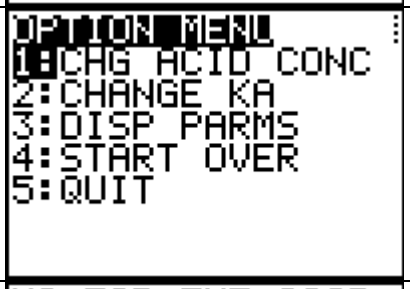
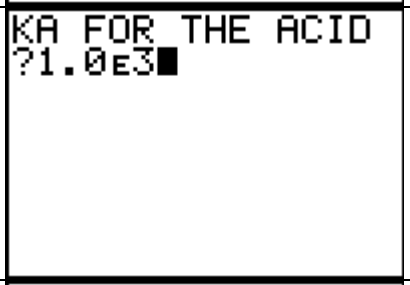
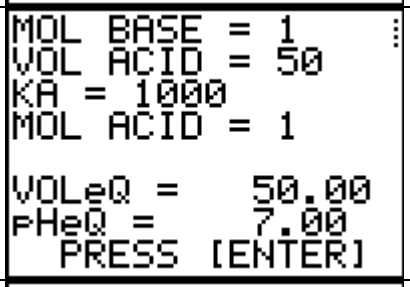
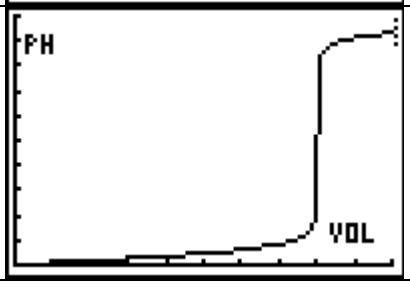
d. The pH of a strong acid at the equivalence point is _____ (larger than, smaller than, or the same as) a weak acid of the same concentration.

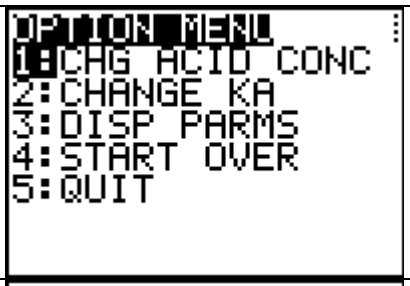
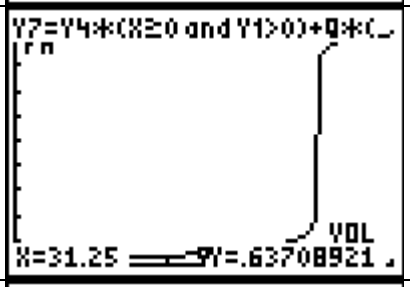
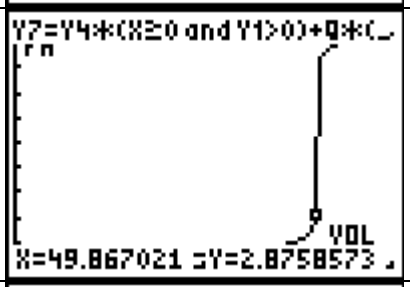
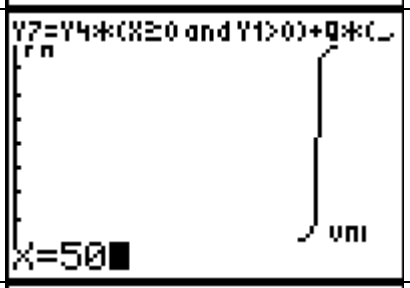
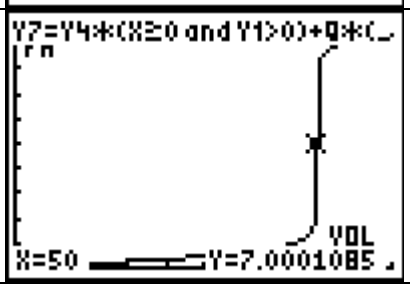
e. The mL of base to reach the equivalence point of a strong acid is _____ (larger than, smaller than, or the same as) that required for a weak acid of the same concentration.

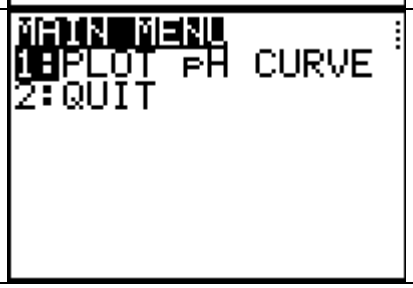
f. If the equivalence point occurs at 50 mL, the halfway point occurs at 25 mL. How does the H^+ concentration compare to K_a of a weak acid at the halfway point?

Acid-Base Titration
Technology Guide

1. Follow the instructions in Appendix C in the Modern Chemistry textbook to download the TITRAFC4 program to your TI-83/84 calculator.	
2. Press the PRGM key and arrow down to the TITRAFC4 program.	
3. Press ENTER twice.	
4. Press ENTER. Select option 1 by pressing 1 (or ENTER).	
5. Enter the molarity of the base, e.g. 1 M.	
6. Press ENTER. Enter the volume, acid ionization constant, K_a, and the molarity of the acid as shown on the calculator screen shot.	

7. Press [ENTER]. Based upon the entered information the program calculates the volume and the pH at the equivalence point.	
8. Press [ENTER] and observe the titration curve. This graph shows the change in pH with the addition of the base to the acid solution.	
9. Press [ENTER].	
10. To change the acid ionization constant press [2] (or [▼] and [ENTER]). If we enter 1.0E3 for K_a the titration curve for a strong acid will be displayed.	
11. Press [ENTER]. (Note the pH at the equivalence point and compare this value to the previous one.)	
12. Press [ENTER] and observe the strong acid titration curve.	

13. Press ENTER.	
14. Exit the program by pressing 5 (or ▼▼▼▼ and ENTER).	
15. If you would like to explore the titration curve further you can press GRAPH and then TRACE. This shows that the pH is 0.637 after 31.25 mL of base have been added.	
16. Use the arrow keys to determine the volume of base just before the dramatic change in pH at the equivalence point. Note that at 49.867 mL the pH is 2.88 and at 50.532 mL the pH has jumped to 11.72.	
17. Press 5 0	
18. and then ENTER to observe the pH after 50 mL of base have been added. Using the arrow keys or entering a number will allow you to determine the pH for any amount of base added.	

19. To return to the home screen press [2nd][QUIT].	
20. If you wish to rerun the program, a shortcut is to press [2nd][ENTRY] (which brings back the last entry). Note that [ENTRY] is above the [ENTER] key.	
21. Press [ENTER] [ENTER] to start the program. Note to the student: this program stores seven equations in Y_1, Y_2, …, Y_7; if you select 2:QUIT at this point then the program will clear these seven equations (and the graph) from your calculator.	

Answers

a. increases, equivalence
b.

mL base	pH Strong Acid	pH Weak Acid
0	1.0	2.51
25	1.48	4.00
50	7.0	8.35
60	11.96	11.96

c. smaller than
d. smaller than
e. same as
f. equal to K_a