

Titration of a Strong Acid versus a Weak Acid

What is the difference between a **strong** acid and a **weak** acid?

• _____

Purpose

- to compare the titration of weak acid versus a strong acid with NaOH

Materials

- 0.10 mol/L HCl and CH₃COOH
- pipets
- 4 large test tubes
- 8 small test tubes
- 10 mL graduated cylinder
- Orange IV indicator
- Methyl Orange indicator

Preparation of Serial Dilutions

Test Tube	Procedure	Concentration
1	Put 10.0 mL of 0.10 M HCl into test tube 1	
2	Pipet 1.0 mL of 0.10 M HCl from test tube 1 into test tube 2 plus 9.0 mL of water	
3	Pipet 1.0 mL from test tube 2 into test tube 3 plus 9.0 mL of water	
4	Pipet 1.0 mL from test tube 3 into test tube 4 plus 9.0 mL of water	

Sample Calculation of Concentration of HCl in Test Tube 2:

Procedure 1:

- Split each large test tube into 2 small test tubes each.
- Add a drop of indicator Orange IV into each of the first set of test tubes.
- Add a drop of indicator Methyl Orange to each of the second set of test tubes.

Sample Calculation of pH of Test Tube 1 using $\text{pH} = -\log [\text{H}^+]$

Test Tube	Concentration of [HCl]	Concentration of [H ⁺]	Colour with Orange IV	Colour with Methyl Orange	pH
1					
2					
3					
4					

Procedure 2:

- Pipet 3.0 mL of 0.10 mol/L CH₃COOH into small Test Tube 5A
- Add a drop of Orange IV
- Pipet 3.0 mL of 0.10 mol/L CH₃COOH into small Test Tube 5B
- Add a drop of Methyl Orange

Test Tube		
5A	Colour with Orange IV	
5B	Colour with Methyl Orange	

pH of 0.10 mol/L CH₃COOH _____

Procedure 3: Titration of HCl

- place 20 drops of 0.10 mol/L HCl in Test Tube 6
- add 1 drop of BTB
- add 0.10 M NaOH drop by drop until green approx. pH 7

Number of drops _____

Procedure 4: Titration of CH₃COOH

- place 20 drops of 0.10 mol/L CH₃COOH in Test Tube 7
- add 1 drop of BTB
- add 0.10 M NaOH drop by drop until green approx. pH 7

Number of drops _____

Class Results

Test Tube	Average Number of drops of NaOH to turn green
0.10 M HCl	
0.10 M CH ₃ COOH	

1) Write the equation for the ionization of HCl:

2) Write the equation for the ionization of CH₃COOH:

3) Compare and contrast HCl and CH₃COOH?

What is the same about them? What is different?

Justify your answer using evidence from the lab.

4) Write the equations for the titration of each acid with the NaOH:

HCl(aq) _____

CH₃COOH(aq) _____

5) Why is a titration done? What does a titration determine?

6) Compare and contrast the titration of HCl and CH₃COOH.

Think about what adding each drop of NaOH does.

What is different about the two acids?

Does the result of the 2 titrations depend on the concentration of the acids or their pH?

Justify using evidence from the lab.
