

Determination of pKa of Acetic Acid

Spoken Tutorial Project

<https://spoken-tutorial.org>

National Mission on Education through ICT

<http://sakshat.ac.in>

Madhuri Ganapathi

Snehalatha Kaliappan

IIT Bombay

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Learning Objectives



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- ▶ Titrate 0.1 M CH_3COOH with 0.1 M $NaOH$



Learning Objectives

- ▶ Titrate 0.1 M CH_3COOH with 0.1 M $NaOH$
- ▶ Estimate the equivalence point for the titration using an indicator



Learning Objectives



Learning Objectives

- ▶ Find the equivalence point by the **pH titration method**



Learning Objectives

- ▶ Find the equivalence point by the **pH titration** method
- ▶ Draw the titration curve to determine the **pH** at the half-equivalence point



System Requirement



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▶ **Ubuntu Linux v18.04**



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- ▶ **ChemCollective Vlabs v2.1.0**



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- ▶ **ChemCollective Vlabs v2.1.0**
- ▶ **Java v11.0.8**



Pre-requisites



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▶ ChemCollective Vlabs interface



Pre-requisites

- ▶ **ChemCollective Vlabs interface**
- ▶ **For the prerequisite tutorials, please visit this website**
<https://spoken-tutorial.org>



Dissociation of a Weak Acid



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Henderson-Hasselbalch Equation



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▶ $K_a = [H^+][A^-]/[HA]$



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▶ $pK_a = \log K_a$



Dissociation of a Weak Acid

Henderson-Hasselbalch Equation

- ▶ $K_a = [H^+][A^-]/[HA]$
- ▶ $pK_a = \log K_a$
- ▶ $pH = pK_a + \log \{[A^-]/[HA]\}$



Dissociation of a Weak Acid

Henderson-Hasselbalch Equation

- ▶ $K_a = [H^+][A^-]/[HA]$
- ▶ $pK_a = \log K_a$
- ▶ $pH = pK_a + \log \{[A^-]/[HA]\}$
- ▶ $pH = pK_a$ (at half-equivalence point)



Calculations



$$[\text{CH}_3\text{COOH}] = 9.869 \times 10^{-2}$$

$$[\text{CH}_3\text{COO}^-] = 1.314 \times 10^{-3}$$

$$[\text{H}_3\text{O}^+] = 1.314 \times 10^{-3}$$

$$K_a = [\text{CH}_3\text{COO}^-][\text{H}_3\text{O}^+]/[\text{CH}_3\text{COOH}]$$



Calculations

$$K_a = (1.314 \times 10^{-3} \times 1.314 \times 10^{-3}) / 9.869 \times 10^{-2}$$

$$K_a = 1.75 \times 10^{-5}$$

$$pK_a = -\log K_a = -\log(1.75 \times 10^{-5})$$

$$pK_a = 4.757$$



Summary

- ▶ Titrated 0.1 M CH_3COOH with 0.1 M $NaOH$
- ▶ Estimated the equivalence point for the titration using an indicator



Summary

- ▶ Found the equivalence point by **pH titration** method
- ▶ Drawn the titration curve to determine the **pH** at half-equivalence point



Assignment



Assignment

1. **Titrate 0.1 M NaOH against 0.1 M Cl_2CHCOOH**



Assignment

1. **Titrate 0.1 M NaOH against 0.1 M Cl_2CHCOOH**
2. **Estimate the pH at the endpoint**



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3. **Find K_a and pK_a values**



Assignment

1. **Titrate 0.1 M NaOH against 0.1 M Cl_2CHCOOH**
2. **Estimate the pH at the endpoint**
3. **Find K_a and $\text{p}K_a$ values**
4. **Draw the graph to find the half-equivalence and equivalence points**



About the Spoken Tutorial Project

- ▶ Watch the video available at https://spoken-tutorial.org/What_is_a_Spoken_Tutorial
- ▶ It summarises the Spoken Tutorial project
- ▶ If you do not have good bandwidth, you can download and watch it



Spoken Tutorial Workshops

The Spoken Tutorial Project Team

- ▶ Conducts workshops using spoken tutorials
- ▶ Gives certificates to those who pass an online test
- ▶ For more details, please write to contact@spoken-tutorial.org



Forum for specific questions

- ▶ **Questions in THIS Spoken Tutorial?**
- ▶ **Visit <https://forums.spoken-tutorial.org>**
- ▶ **Choose the minute and second where you have the question**
- ▶ **Explain your question briefly**
- ▶ **The Spoken Tutorial project will ensure an answer**

You will have to register to ask questions



Acknowledgements

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