

# Determination of pKa of Acetic Acid

**Spoken Tutorial Project**

**<https://spoken-tutorial.org>**

**National Mission on Education through ICT**

**<http://sakshat.ac.in>**

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# Learning Objectives



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- ▶ Titrate 0.1 M  $\text{CH}_3\text{COOH}$  with 0.1 M  $\text{NaOH}$



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- ▶ Titrate 0.1 M  $\text{CH}_3\text{COOH}$  with 0.1 M  $\text{NaOH}$
- ▶ 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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- ▶  $K_a = [H^+][A^-]/[HA]$
- ▶  $pK_a = \log K_a$



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## 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



$$[CH_3COOH] = 9.869 \times 10^{-2}$$

$$[CH_3COO^-] = 1.314 \times 10^{-3}$$

$$[H_3O^+] = 1.314 \times 10^{-3}$$

$$K_a = [CH_3COO^-][H_3O^+]/[CH_3COOH]$$



# 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



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1. **Titrate 0.1 M  $\text{NaOH}$  against 0.1 M  $\text{Cl}_2\text{CHCOOH}$**



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1. **Titrate 0.1 M  $\text{NaOH}$  against 0.1 M  $\text{Cl}_2\text{CHCOOH}$**
2. **Estimate the pH at the endpoint**
3. **Find  $K_a$  and  $pK_a$  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](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](mailto: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**





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