

University of Ruhuna- Faculty of Technology
Bachelor of Biosystems Technology Honors Degree
Level 1 (Semester I) Examination, December 2025
Academic year 2024/2025

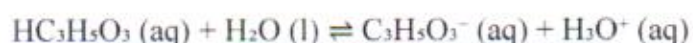
Course Unit: BST 1172 Analytical Chemistry (Written) -Repeat

Duration: 1 and ½ hours

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- Answer only **three (3)** questions. Write your answers in a separate answer book.
- Each question should start on a new page.
- If you answer more than three questions, only the **first three** will be marked.

1. Lactic acid ($\text{HC}_3\text{H}_5\text{O}_3$) is a weak acid commonly used in the food and pharmaceutical industries, with a dissociation constant $K_a = 1.38 \times 10^{-4}$ at 25°C . The dissociation is given by:



- a. Describe an experimental method to determine the acid dissociation constant (K_a) of lactic acid ($\text{HC}_3\text{H}_5\text{O}_3$) in aqueous solution. (20marks)
- b. Calculate the pH of a 0.25 mol L^{-1} lactic acid solution at 25°C . (30 marks)
- c. Determine the pH of a 0.18 mol L^{-1} sodium lactate solution at 25°C . (50 marks)
(At 25°C $K_w = 1.0 \times 10^{-14} \text{ mol}^2 \cdot \text{dm}^{-6}$)

(Total: 100 marks)

2. Phosphoric acid (H_3PO_4) is a triprotic acid commonly used in fertilizers and food additives. A concentrated technical grade solution has the following specifications.

85% w/w H_3PO_4

Density = 1.69 g/mL

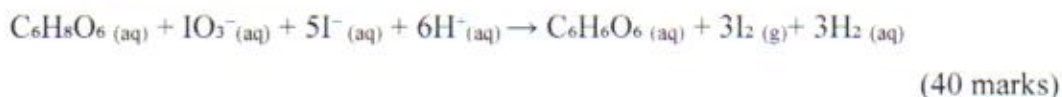
Purity = 90%

- a. Briefly describe difference of Primary standard and Secondary standard solutions with relevant examples. (20 marks)
- b. Calculate the molarity of the concentrated H_3PO_4 solution as provided. (40 marks)
- c. Calculate the volume of the concentrated H_3PO_4 solution required to prepare 750.00 mL of a 0.02 M H_3PO_4 solution. (40 marks)
*(Molar mass of $\text{H}_3\text{PO}_4 = 98 \text{ g} \cdot \text{mol}^{-1}$)

(Total: 100 marks)

3. Answer to all parts

- a. Explain the fundamental difference between accuracy and precision. (20 marks)
- b. Discuss the importance of significant figures in analytical chemistry. (20 marks)
- c. Discuss the sources of errors that can affect accuracy and precision in analytical measurements. (20 marks)
- d. In an iodometric titration, a 0.912 g sample containing ascorbic acid ($C_6H_8O_6$) is dissolved and titrated with $0.0505 \text{ mol L}^{-1}$ KIO_3 in acidic medium with excess KI. The titration requires 24.65 mL to reach the starch endpoint. Calculate the percentage (w/w) of ascorbic acid in the sample. The relevant reaction is:



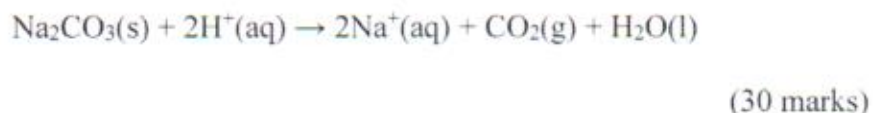
(Total: 100 marks)

4. Industrial wastewater contaminated with sulfuric acid (H_2SO_4) requires neutralization before discharge. Sulfuric acid fully dissociates in two steps in dilute solution. The overall dissociation is as follows.



A 100,000 L batch of wastewater has an initial pH of 2.50.

- a. Calculate the initial concentration of H^+ ions (in mol/L) and the total moles of H^+ present in the wastewater tank. (30 marks)
- b. Determine the mass of solid sodium carbonate (Na_2CO_3 , Molar mass. = 105.99 g/mol) required to completely neutralize the acidic wastewater. The neutralization reaction is:



- c. A buffer solution is prepared by mixing equal volume of 0.25 M ammonia (NH_3) and 0.15 M ammonium chloride (NH_4Cl). Calculate the pH of the buffer. (K_b of $NH_3 = 1.8 \times 10^{-5}$) (40 marks)

(Total: 100 marks)

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