



## UNIVERSITY COLLEGE TATI (UC TATI)

## FINAL EXAMINATION QUESTION BOOKLET

COURSE CODE	: DTC 2083
COURSE	: ANALYTICAL CHEMISTRY
SEMESTER/SESSION	: 2- 2024/2025
DURATION	: 3 HOURS

Instructions:

1. This booklet contains 4 questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

**DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO**

**THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE**

**QUESTION 1**

- (a) Explain the definition of analytical chemistry. (2 marks)
- (b) Classify the differences between qualitative and quantitative analysis. (2 marks)
- (c) Construct the steps commonly employed in analytical procedure. Briefly describe each step. (6 marks)
- (d) The results for a batch of student are collected to determine their grade in examination. The marks are 87, 67, 88, 90, 43, 56, 88, 90, 76, 56, 77, 81, 73 and 52. Calculate
- i. The mean (2 marks)
  - ii. The median (2 marks)
  - iii. The range (2 marks)
  - iv. The standard deviation (3 marks)
  - v. The standard deviation of the mean (3 marks)
  - vi. The relative standard deviation of the mean (in percent) of the individual results (3 marks)

**QUESTION 2**

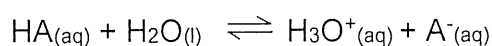
- (a) Identify the steps in gravimetric analysis (8 marks)
- (b) Differentiate the two types of gravimetric analysis (4 marks)
- (c) An iron is analyzed for Ferum content by converting the Ferum to  $\text{Fe}_2\text{O}_3$  and weighing it. If a 2.54 g sample yields  $\text{Fe}_2\text{O}_3$  weighing 0.865 g, determine
- The percent  $\text{FeO}_2$  in the sample (4 marks)
  - The percent of Ferum (4 marks)
- (d) Compute the molar solubility of  $\text{AgCl}$  in
- Water (2 marks)
  - 0.10 M  $\text{KCl}$  solution.  $K_{\text{sp}}$  for  $\text{AgCl}$  is  $1.7 \times 10^{-10}$  (3 marks)

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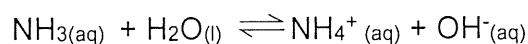
**QUESTION 3**

- (a) A solution contains 2.65 g of anhydrous  $\text{Na}_2\text{CO}_3$  in 200 ml of solution. Find the concentration of the solution in mol/L. (3 marks)

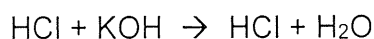
- (b) A 0.233 M solution of weak acid. HA has a pH of 4.22. Compute the value of  $K_a$ . (6 marks)



- (c) A 3.42 g of ammonia was dissolving in 750 ml water.  $K_b$  for ammonia solution  $3.13 \times 10^{-5}$ .



- i. Find the concentration of ammonia. (4 marks)
- ii. Show the calculation for pH of the solution. (6 marks)
- (d) A 18.50 ml of potassium hydroxide solution was neutralized by 25 ml of hydrochloric acid solution containing 7 mol/L. The potassium hydroxide solution was diluted into 10 v/v % with water. Calculate the mass of the potassium hydroxide in this experiment. (6 marks)



## ANALYTICAL CHEMISTRY (DTC 2083)

## QUESTION 4

(a) Illustrate the schematic diagram for Gas chromatography (5 marks) equipment and label the components.

(b) In a Gas Chromatography analysis with capillary column (25 m length x 0.32 mm ID; 0.25  $\mu\text{m}$  thickness), the data are recorded as below: (10 marks)

Solution or mixture	Retention time. $t_R$	Relative peak area	Peak base width
Methanol ( $t_0$ )	18.0 s	-	-
<i>n</i> -hexane	1.98 min	16.4	0.19 min
Toluene	2.224 min	45.2	0.23
<i>n</i> -dodecane	7.93 min	30.2	0.79

According to data, determine

- Number of theoretical plate,  $N$ , (by using *n*-hexane's peak)
- The height of capillary plate (mm/plate)
- Resolution,  $R_s$ , for *n*-hexane and toluene's peaks

Given formula:  $H = N/L$

$$N = 16 (t_R/w)^2$$

$$\text{Resolution} = \Delta t_R/w_{\text{avg}}$$

(c) Interpret the function of the following components in a flame atomic absorption spectrometer. (10 marks)

- Hollow cathode lamp
- Nebulizer
- Monochromator
- Detector
- Output devices

-----End of question-----

APPENDIX

THE PERIODIC TABLE

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