

**UNIVERSITY COLLEGE TATI (UC TATI)****FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE	: DTC 2083
COURSE	: ANALYTICAL CHEMISTRY
SEMESTER/SESSION	: 1 - 2023/2024
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 up your hands and ask the invigilator.

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

THIS BOOKLET CONTAINS 4 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

- (a) Outline the steps commonly employed in an analytical procedure. (8 marks)
- (b) Calculate the pH of titrant in the titration of 50.0 mL of 0.100M NaOH with 0.200 M HCl at:
- (i) 0 mL (3 marks)
 - (ii) 10.0 mL (3 marks)
 - (iii) 25.0 mL (3 marks)
 - (iv) 30.0 mL (3 marks)
- (c) By referring to (b), sketch the titration curve that obtained from the titration. (5 marks)

QUESTION 2

- (a) Give the definition of the terms below:
- (i) Stationary phase (3 marks)
 - (ii) Mobile phase (3 marks)
 - (iii) Retention time, t_R (3 marks)
- (b) List the detector in gas chromatography. (6 marks)
- (c) In a Gas Chromatography analysis with capillary column (25 m length x 0.32 mm ID; 0.25 μm thickness), the data are recorded as below:

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

According to data, identify:

- (i) The capacity factor, k' , for n-hexane and toluene (2 marks)
- (ii) Number of theoretical plate, N , (by using n-hexane's peak) (2 marks)
- (iii) The height of capillary plate (mm/plate) (2 marks)
- (iv) Resolution, R_s , for n-hexane and toluene's peaks (4 marks)

QUESTION 3

- (a) Solve the gravimetric factor formula for analyte and precipitate below:- (15 marks)

Analyte	precipitate	Gravimetri Factor (GF)
Cl	AgCl	
P ₂ O ₅	Mg ₂ P ₂ O ₇	
Zn	Zn ₂ P ₂ O ₇	
MoS ₃	BaSO ₄	
Pb(C ₂ H ₅) ₄	PbCrO ₄	

- (b) By referring to (a), solve the value for analyte and precipitate. (5 marks)
- (c) 25 mL of phosphoric acid (H₃PO₄) required 20 mL sodium hydroxide (NaOH) by complete neutralization. The concentration of sodium hydroxide (NaOH) solution is 0.5 M and the phosphoric acid is 0.2 M. Identify the following:
- The number of moles of phosphoric acid used (2 marks)
 - The number of moles of sodium hydroxide used (2 marks)
 - The balanced chemical equation take place (1 mark)

Question 4

- (a) Outline the unit operations in gravimetric analysis (8 marks)
- (b) Explain the types of titrimetry analysis procedure. (4 marks)
- (c) A batch of nuclear fuel pellets was weighed to determine if they fell within control guidelines. The weights were 127.2, 128.4, 127.1, 129.0 and 128.1 g. Compute:
- The mean (3 marks)
 - The median (3 marks)
 - The range (3 marks)
 - Standard deviation (4 marks)

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

THE PERIODIC TABLE

		13 IIIA		14 IVA		15 VA		16 VIA		17 VIIA		18 VIIIA	
		B	C	N	O	F	Ne						
		5 10.81 Boron	6 12.01 Carbon	7 14.01 Nitrogen	8 16.00 Oxygen	9 19.00 Fluorine	10 20.18 Neon						
		Al	Si	P	S	Cl	Ar						
		13 26.98 Aluminum	14 28.09 Silicon	15 30.97 Phosphorus	16 32.07 Sulfur	17 35.45 Chlorine	18 39.95 Argon						
		Ga	Ge	As	Se	Br	Kr						
		31 69.72 Gallium	32 72.61 Germanium	33 74.92 Arsenic	34 78.96 Selenium	35 79.90 Bromine	36 83.80 Krypton						
		In	Sn	Sb	Te	I	Xe						
		49 114.82 Indium	50 118.71 Tin	51 121.76 Antimony	52 127.60 Tellurium	53 126.90 Iodine	54 131.29 Xenon						
		Tl	Pb	Bi	Po	At	Rn						
		81 204.38 Thallium	82 207.2 Lead	83 208.98 Bismuth	84 (209) Polonium	85 (210) Astatine	86 (222) Radon						
		Hg	Au	Pt	Ir	Os	Hs						
		80 200.59 Mercury	79 196.97 Gold	78 195.08 Platinum	77 192.22 Iridium	76 190.2 Osmium	108 (265) Hassium						
		Cd	Ag	Pd	Rh	Ru	Rf						
		48 112.41 Cadmium	47 107.87 Silver	46 106.42 Palladium	45 102.91 Rhodium	44 101.07 Ruthenium	104 (261) Rutherfordium						
		Zn	Cu	Ni	Co	Fe	Mt						
		30 65.39 Zinc	29 63.55 Copper	28 58.69 Nickel	27 58.93 Cobalt	26 55.85 Iron	109 (266) Meitnerium						
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