KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER
SUPPLEMENTARY/SPECIAL EXAMINATIONS

FOR THE DEGREE OF B.SC (CHEMISTRY)

COURSE CODE: SCH 221

COURSE TITLE: ANALYTICAL CHEMISTRY I

DATE: 18/1/2022 **TIME: 2-4PM**

INSTRUCTIONS TO CANDIDATES:

Answer **question ONE** and **any TWO** of the remaining

KIBABII observes ZERO tolerance to examination cheating

Question 1 [30 Marks]

i. Differentiate between accuracy and precision [4 Marks]
ii. Discuss the importance of standard deviation in analytical measurements [4 Marks]
iii. Describe gross error and highlight two characteristics [5 Marks]
iv. Differentiate between systematic and random errors [4 Mark]
v. List three ways to eliminate systematic errors [3 Marks]
vi. Explain the importance of fundamental analysis [3 Marks]
vii. Describe two types of samples [4 Marks]
viii. List three fields where analytical data may be utilized [3 Marks]

Question 2 [20 Marks]

i. Differentiate between end point and equivalence point [4 Marks]
ii. A solution of approximately 0.1 M HCl is standardized with Na_2CO_3. 0.1472 g of Na_2CO_3 requires 23.7 mL of the HCl to reach endpoint. The HCl is then used to titrate a solution of NaOH. 25.0 mL of the base solution is titrated to endpoint by 15.9 mL of the acid. Determine the concentration of NaOH. [16 Marks]

Question 3 [20 Marks]

i. Explain the difference between titrimetric and gravimetric analysis [4 Marks]
ii. A 0.649-g sample containing only K_2SO_4 (174.27 g/mol) and $(NH_4)_2SO_4$ (132.14 g/mol) was dissolved in water and treated with $Ba(NO_3)_2$ to precipitate all sulfate as $BaSO_4$ (233.39 g/mol). If 0.977 g of precipitate was formed, what is the mass percent K_2SO_4 in the sample? [12 Marks]
iii. The reaction between ethanol and an organic acid (eg ethanoic acid) takes about 6 hours at boiling point. The reaction achieves a conversion of approximately 70%. Comment of the suitability of this reaction as a titration reaction. [4 Marks]

Question 4 [20 Marks]

i. Describe the process of crystallization [8 Marks]
ii. The analysis of % CaO present in a $CaCO_3$ resulted in the following data after several analyses. 56.04, 55.95, 56.23, 56.08 and 56.00.

a. Determine the standard deviation and variance of the data [5 Marks]
b. Identify the statistical test to be applied in the validation of all data points [2 Marks]
c. Determine whether the data contains outliers and whether or not they should be eliminated [5 marks]

Question 5 [20 Marks]

i. Discuss the importance of defining an analytical problem [4 Marks]
ii. Explain the importance of designing an experimental procedure before beginning any analysis [4 Marks]

iii. List any factors to consider when designing an experimental procedure [6 Marks]

iv. List three analytical methods which apply electromagnetic radiation [6 Marks]

Table of Critical Values of Q

N	Q_{crit} (CL:90%)	Q_{crit} (CL:95%)	Q_{crit} (CL:99%)
3	0.941	0.970	0.994
4	0.765	0.829	0.926
5	0.642	0.710	0.821
6	0.560	0.625	0.740
7	0.507	0.568	0.680
8	0.468	0.526	0.634
9	0.437	0.493	0.598
10	0.412	0.466	0.568

PERIODIC TABLE OF THE ELEMENTS

1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1 H 1.008																	2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.1	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.30											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 59.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.91	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 *La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.2	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.02	89 †Ac 227.03	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (271)	111 Rg (272)							