KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: SCH 221

COURSE TITLE: ANALYTICAL CHEMISTRY

DURATION: 2 HOURS

DATE: 12/2/2021 **TIME:** 8:00-10:00A.M

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **4** printed pages. Please Turn Over

Question 1 (30 marks)

a) Outline **eight** steps in an overall analytical procedure. (4marks)

b) State any **five** problems encountered during chemical analysis of a given sample.(5marks)

c) Give three types of systematic (determinate) errors in analytical chemistry. (3marks)

d) State four ways in which errors can be minimized in a chemical analysis. (4marks)

e) State two reasons for carrying out significance tests during chemical analysis. (2marks)

f) The concentration of an additive in a standard sample of gasoline was measured 5 times with the following results: 0.13, 0.11, 0.12, 0.20, and 0.14 % by mass.

i. Determine the median, mean and standard deviation of the data. (6marks)

ii. If the accepted mean value for the standard sample is 0.11 % by mass, are the results for this set of measurements significantly different at the 95% confidence level by the *t*-test? (3marks)

g) State any **three** characteristics of a primary standard. (3marks)

Question two (20 marks)

a) What is meant by gravimetric analysis? (1marks)

b) State **four** advantages offered by gravimetric analysis (4marks)

c) A certain Barium halide exist as an hydrated salt $BaX_2.2H_2O$ where X is the halogen the barium content of the salt can be determined by gravimetric analysis. A sample of the halide 0.265 g was dissolved in $200cm^3$ and excess sulphuric (vi) acid added , the mixture was then heated and held at boiling for 45min. the precipitate barium sulphate was filtered off washed and dried. The mass of the precipitate formed was 0.2533g. Determine the mass number of X. (4marks)

d) What is volumetric analysis? (1 mark)

e) If 40ml unknown dibasic acid requires 30ml of 0.25M NaOH to get to equivalence point find out the molarity of the unknown acid. (4 marks)

f) Distinguish between a Fajans titration and a Volhard titration (2marks)

g) The % by mass of I^- in a 0.6712g sample was determined by a Volhard titration. After adding 50.0 mL of 0.05619 M $AgNO_3$ and allowing the precipitate to form, the remaining silver was back titrated with 0.05322 M KSCN, requiring 35.14 mL to reach the end point. Calculate the %by mass of I^- in the sample.

(4marks)

Question 3 (20 marks)

(a) What is complexometric titration? (1 mark)

(b) Briefly describe four types of complexometric titration. (8 marks)

(c) EDTA is a very unselective reagent because it complexes with numerous doubly, triply and quadruple charged ions.

(i) Briefly describe four method that can be employed to increase the selectivity of an ion of interest from a mixture of metal ions during EDTA reactions (8 marks)

(ii) State three factor influencing EDTA reaction. (3 marks)

Question four (20 marks)

a. State three application of significant tests (3 marks)
b. An exercise was carried out to compare the precisions of analytical measurements being made in two different laboratories. A completely homogeneous sample was supplied to both laboratories and the following analytical results were obtained by the same method.

Laboratory 1	Laboratory 2
4.0	4.7
4.6	5.3
4.3	5.8
4.2	5.0
	4.9

i. Determine the range of analytical results in Laboratory 2. (1marks)

ii. Using the rejection quotient (Q-test), show whether result value 5.8 in Laboratory 2 can be rejected or not. (3marks)

iii. Calculate the mean in each of analytical results in the two Laboratories. (4marks)

i. Calculate the standard deviation in each of analytical results in the two Laboratories. (4marks)

iii. Using F- Test, comment upon the precisions attained in the two laboratories. (2marks)

c. The mean of six determination of copper content in a sample of an alloy was 7.85% with standard deviation, S= 0.13%. Calculate the 95% confidence limit for the true value give that t = 3.182. (3 marks)

F Distribution: Critical Values of F (5% significance level)

ν_1 / ν_2	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20
1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	243.91	245.36	246.46	247.32	248.01
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.42	19.43	19.44	19.45
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.71	8.69	8.67	8.66
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.87	5.84	5.82	5.80
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.64	4.60	4.58	4.56
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.96	3.92	3.90	3.87
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.53	3.49	3.47	3.44
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.24	3.20	3.17	3.15
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.03	2.99	2.96	2.94
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.86	2.83	2.80	2.77
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.74	2.70	2.67	2.65
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.64	2.60	2.57	2.54
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.55	2.51	2.48	2.46
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.48	2.44	2.41	2.39
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.42	2.38	2.35	2.33

t Distribution: Critical Values of *t*

		Significance level					
Degrees of freedom	*Two-tailed test:* / *One-tailed test:*	10% / 5%	5% / 2.5%	2% / 1%	1% / 0.5%	0.2% / 0.1%	0.1% / 0.05%
1		6.314	12.706	31.821	63.657	318.309	636.619
2		2.920	4.303	6.965	9.925	22.327	31.599
3		2.353	3.182	4.541	5.841	10.215	12.924
4		2.132	2.776	3.747	4.604	7.173	8.610
5		2.015	2.571	3.365	4.032	5.893	6.869
6		1.943	2.447	3.143	3.707	5.208	5.959
7		1.894	2.365	2.998	3.499	4.785	5.408
8		1.860	2.306	2.896	3.355	4.501	5.041
9		1.833	2.262	2.821	3.250	4.297	4.781
10		1.812	2.228	2.764	3.169	4.144	4.587
11		1.796	2.201	2.718	3.106	4.025	4.437
12		1.782	2.179	2.681	3.055	3.930	4.318
13		1.771	2.160	2.650	3.012	3.852	4.221
14		1.761	2.145	2.624	2.977	3.787	4.140
15		1.753	2.131	2.602	2.947	3.733	4.073