KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: SCH 122

COURSE TITLE: ANALYTICAL CHEMISTRY

DURATION: 2 HOURS

DATE: 13/05/2022 **TIME: 9:00AM-11:00AM**

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

ii. Using the rejection quotient (Q-test), show whether result value 35.07 in Laboratory 2 can be rejected or not. [2mks]

iii. Calculate the mean in each of analytical results in the two Laboratories. [4mks]

iv. Calculate the standard deviation in each of analytical results in the two Laboratories [4mks]

f) Using F- Test, comment upon the precisions attained in the two laboratories. [3mks]

Question 3

a) What is common ion effect? **[1mk]**

b) The solubility product of Magnesium hydroxide $Mg(OH)_2$, in water is $2x10^{-11}mol^2/dm^6$

Calculate the solubility of $Mg(OH)_2$ in;

i. Pure water **[3mks]**

ii. 0.1M sodium hydroxide solution at 298k. **[3mks]**

d) With relevant examples differentiate between the following terms as used in coordination chemistry;

i. Oxidation number and Coordination Number of a central metal atom **[4mks]**

ii. Monodentate ligands and bidentate ligands **[4mks]**

e) Give the IUPAC names of the following coordination complexes **[5mks]**

i. $[CuCl_4]^{2-}$

ii. $[Co(NH_3)_5CO_3]Cl$

iii. $[Cr(H_2O)_4Cl_2]Cl$

iv. $[Mn(CO)_5Cl]^+$

v. $K_3[Fe(CN)_6]$

Question 4

a) What is meant by gravimetric analysis? [1mk]

b) Explain **four** advantages offered by gravimetric analysis [4mks]

c) A 2.0g sample of limestone was dissolved in hydrochloric acid and all the ca present in the sample was converted to Ca^{2+}. Excess Ammonium oxalate, $(NH4)_2C_2O_4$ solution was added to the solution to precipitate the Ca^{2+} ions as calcium oxalate. The precipitate was filtered, dried and weighed to a constant mass of 2.43g. Determine the percentage by mass of calcium in the limestone sample (Ca= 40, O=16, C=12). [6mks]

d) EDTA is one of the chelating agents in complexometric titrations.

i. What is a chelating agent? [1mk]

ii. Name **four** types of complexometric titrations [4mks]

iii. State the **four** factors influencing EDTA reactions [4mks]

Question 5

(a) State 3 factors that affect the distribution coefficient in solvent extraction. [3mks]

(b) What is meant by the following terms [3mks]

i. elution

ii. stationary phase

iii. mobile phase

(c) Explain the difference between the working mechanism of size exclusion and ion exchange chromatography [4mks]

(d) The distances travelled by five compounds and the solvent front after a TLC separation on silica gel were as follows:

Compound Distance travelled,	Cm
solvent	12.5
methyl stearate	9.1
Cholesterol	1.5
a-tocopherol (vitamin E)	5.6
squalene (hydrocarbon)	10.3

i. Calculate the Rf values of each compound. [8mks]

ii. Explain how the Rf values of a compound are affected, if the TLC plate is allowed to remain in the developing chamber after the solvent front has reached the top of the TLC plate [2mks]

F Distribution Tables

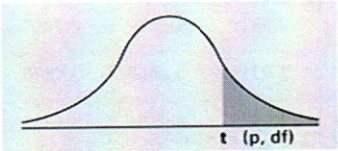
/	df_1=1	2	3	4	5	6	7	8	9	10	12
df_2=1	161.4476	199.5000	215.7073	224.5832	230.1619	233.9860	236.7684	238.8827	240.5433	241.8817	243.9060
2	18.5128	19.0000	19.1643	19.2468	19.2964	19.3295	19.3532	19.3710	19.3848	19.3959	19.4125
3	10.1280	9.5521	9.2766	9.1172	9.0135	8.9406	8.8867	8.8452	8.8123	8.7855	8.7446
4	7.7086	6.9443	6.5914	6.3882	6.2561	6.1631	6.0942	6.0410	5.9988	5.9644	5.9117
5	6.6079	5.7861	5.4095	5.1922	5.0503	4.9503	4.8759	4.8183	4.7725	4.7351	4.6777
6	5.9874	5.1433	4.7571	4.5337	4.3874	4.2839	4.2067	4.1468	4.0990	4.0600	3.9999
7	5.5914	4.7374	4.3468	4.1203	3.9715	3.8660	3.7870	3.7257	3.6767	3.6365	3.5747
8	5.3177	4.4590	4.0662	3.8379	3.6875	3.5806	3.5005	3.4381	3.3881	3.3472	3.2839
9	5.1174	4.2565	3.8625	3.6331	3.4817	3.3738	3.2927	3.2296	3.1789	3.1373	3.0729
10	4.9646	4.1028	3.7083	3.4780	3.3258	3.2172	3.1355	3.0717	3.0204	2.9782	2.9130
11	4.8443	3.9823	3.5874	3.3567	3.2039	3.0946	3.0123	2.9480	2.8962	2.8536	2.7876
12	4.7472	3.8853	3.4903	3.2592	3.1059	2.9961	2.9134	2.8486	2.7964	2.7534	2.6866

Critical values for Dixon's Q-Test for 3 different confidence levels

N	Q90%	Q95%	Q99%
3	0.941	0.97	0.994
4	0.765	0.829	0.926
5	0.642	0.71	0.821
6	0.56	0.625	0.74
7	0.507	0.568	0.68
8	0.468	0.526	0.634
9	0.437	0.493	0.598
10	0.412	0.466	0.568
11	0.392	0.444	0.542
12	0.376	0.426	0.522

(90)

t –DistributionTable



df/p	0.40	0.25	0.10	0.05	0.025	0.01
1	0.324920	1.000000	3.077684	6.313752	12.70620	31.82052
2	0.288675	0.816497	1.885618	2.919986	4.30265	6.96456
3	0.276671	0.764892	1.637744	2.353363	3.18245	4.54070
4	0270722	0.740697	1.533206	2.131847	2.77645	3.74695
5	0.267181	0.726687	1.475884	2.015048	2.57058	3.36493
6	0.264835	0.717558	1.439756	1.943180	2.44691	3.14267
7	0.263167	0.711142	1.414924	1.894579	2.36462	2.99795
8	0.261921	0.706387	1.396815	1.859548	2.30600	2.89646
9	0.260955	0.702722	1.383029	1.833113	2.26216	2.82144
10	0260185	0.699812	1.372184	1.812461	2.22814	2.76377
11	0259556	0.697445	1.363430	1.795885	2.20099	2.71808
12	0259033	0.695483	1.356217	1.782288	2.17881	2.68100
13	0.258591	0.693829	1.350171	1.770933	2.16037	2.65031
14	0.258213	0.692417	1.345030	1.761310	2.14479	2.62449
15	0.257885	0.691197	1.340606	1.753050	2.13145	2.60248
16	0257599	0.690132	1.336757	1.745884	2.11991	2.58349
17	0.257347	0.689195	1.333379	1.739607	2.10982	2.56693
18	0.257123	0.688364	1.330391	1.734064	2.10092	2.55238
19	0.256923	0.687621	1.327728	1.729133	2.09302	2.53948
20	0.256743	0.686954	1.325341	1.724718	2.08596	2.52798
21	0.256580	0.686352	1.323188	1.720743	2.07961	2.51765
22	0256432	0.685805	1.321237	1.717144	2.07387	2.50832
23	0256297	0.685306	1.319460	1.713872	2.06866	2.49987
24	0.256173	0.684850	1.317836	1.710882	2.06390	2.49216
25	0.256060	0.684430	1.316345	1.708141	2.05954	2.48511
26	0.255955	0.684043	1.314972	1.705618	2.05553	2.47863
27	0.255858	0.683685	1.313703	1.703288	2.05183	2.47266
28	0.255768	0.683353	1.312527	1.701131	2.04841	2.46714
29	0.255684	0.683044	1.311434	1.699127	2.04523	2.46202
30	0.255605	0.682756	1.310415	1.697261	2.04227	2.45726
z	0.253347	0.674490	1.281552	1.644854	1.95996	2.32635
CI	———	———	80%	90%	95%	98%