UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Year 2003/2004

October 2003

KAA 501 – Quality Control in Chemistry

Time : 3 hours

Please make sure this paper consists of TEN printed pages before answering the questions.

SECTION A
Questions 1, 2 and 3 are COMPULSORY.

SECTION B
Choose TWO questions from questions No. 4 - 7.

Answer FIVE questions. Only the first five questions answered by the candidate will be marked.

SECTION A

1.   (a)   (i)   Describe the importance and the type of inspection in the sampling plan for fertilizers from a manufacturing factory.

(6 marks)

(ii)   Differentiate between the sampling operation and analysis by using an appropriate example.

(4 marks)

(b) Mr Muthu is an officer in a cooking oil manufacturing company who responsible to ascertain whether the manufacturing of cooking oil is acceptable or not.

The inspection on the presence of **A, B** and **C** components carried out on 2,500 units had been recorded. The results with regards to the number of units which deficient in **A, B** or **C** components are shown as follows:

Unit number	A	B	C
50	✓	✗	✗
12	✗	✓	✗
7	✗	✗	✓
21	✗	✓	✓

Whilst ✓ sign indicates the component fulfill the acceptance level, the ✗ sign suggests that it is not accepted or deficient.

(i) How much percent nonconformity?

(ii) How much non-conformities per 100 units?

(iii) Suggest the minimum number of samples to be taken for inspection.

(10 marks)

2. You are asked to analyze the level of DDT, a pesticide, in sediments collected from the bottom of a lake. Discuss in detail the necessary quality controls that are required for this purpose. Pick a suitable equipment that you think fit for the purpose and explain your selection based on various factors discussed in class.

(20 marks)

3. Hazard Analysis Critical Control Point (HACCP) quality system which is widely used in the food processing industry has proven to be a comprehensive product quality assurance system.   There are views which indicate what such similar principles can be further adapted to the traditional medicine   OR   the food supplement manufacturing facilities.

Write an essay to discuss the potential use of HACCP to the above said industries. Your essay must include issues such as the following :

- The main elements of HACCP can be adapted to the traditional medicine and food supplement manufacturing facilities.

- Advantages and benefits found in HACCP system

- The expertise and knowledge enhancement of staff in the implementation of HACCP system.

- Involvement of a laboratory control system as a support to the HACCP.

- Relationship between a system which gives emphasis on product quality control scheme and the HACCP system.

(20 marks)

SECTION B

4. (a) Study on the trace metal M in a river has been carried out. The results are shown as follows:

Sample	Concentration, ppm			
1	0.32	0.30	0.29	0.33
2	0.28	0.26	0.29	0.28
3	0.30	0.27	0.29	0.26
4	0.34	0.30	0.31	0.30
5	0.29	0.28	0.30	0.33
6	0.25	0.26	0.31	0.33

(i) Calculate : standard deviation for each sample, value of between-sample estimate and value of within-sample estimate.

(ii) Explain the two characteristics which affect the sample variance

(16 marks)

(b)   Categorize the type of the following examples with an appropriate reason.

(i)   Cans of foods kept in a lorry.

(ii)   Air surrounding the Penang International Airport.

(4 marks)

5.   An aquaculture farm took water from a stream and returned it after it has been circulated through the fish ponds. The owner thought that this technique would not pollute the stream since there was little organic matter in the effluent. He then sent the influent and effluent water samples for BOD analysis and the results are given in the table below:

| Influent BOD	Effluent BOD
10.2	9.7
10.7	9.0
10.5	10.2
9.9	10.3
9.0	10.8
11.2	11.1
11.5	9.4
10.9	9.2
8.9	9.8
10.6	10.2

(i)   Are there outliers within each set of given data ?   Perform the analysis using modified z score method.

(ii)   Show whether there is a pollution or not caused by the ponds using the method of null hypothesis.
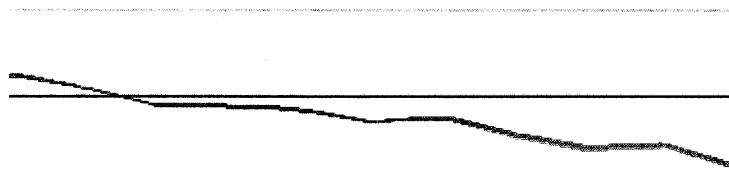
(20 marks)

6.   (a)   Two examples of control charts are given below. States specific pattern exhibited by each chart. Suggest possible causes that create that specific pattern

(i)

(ii)
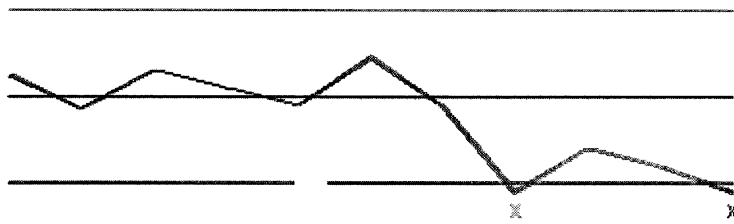
(8 marks)

(b)   Cation Exchange Capacity (CEC) values (mmol/kg) of a control sample is determined in duplicate. Develop X-bar and R-bar control charts using the data provided. Comments on the control charts obtained based on the stability of the analytical process.

| 1	2
10.1	9.7
10.7	10.2
10.5	11.1
9.8	10.3
9.0	10.1
11.0	10.6
11.5	10.7
10.9	9.5
8.9	9.4
10.0	9.6

(12 marks)

7. Write a short explanation for the following statements :

   (a)   Continuous training and the elevation of the human resources skills is one of the important aspects of all form of quality management system as practiced by accredited laboratories.

   (b)   The relationship between a quality laboratory management system and the organisation's effort to manage its intellectual property.

   (c)   Laboratory management can be classified into three main issues, i.e.   (i) Prior to Analysis,   (ii)   During the Analysis and   (iii)   Post Analysis. Describe the salient points as per required by an accredited laboratory.

   (d)   The main elements in the preparation of a generic accredited laboratory.

   (e)   Differences between the scheme accredited for ISO 17025 and ISO G 25.

   (20 marks)

oooOooo

FACTORS FOR COMPUTING LIMITS FOR X BAR AND R CHARTS

Sample Size	For Averages	For Ranges		Standard Deviation
n	A_2	D_3	D_4	d_2
2	1.88	0	3.29	1.13
3	1.02	0	2.58	1.69
4	.73	0	2.28	2.06
5	.58	0	2.11	2.33
6	.48	0	2.00	2.53
7	.42	0	1.92	2.70
8	.37	.14	1.87	2.85
9	.34	.18	1.82	2.97
10	.31	.31	1.78	3.08
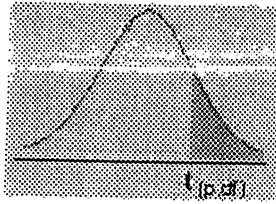
df\p	0.40	0.25	0.10	0.05	0.025	0.01	0.005	0.0005
1	0.324920	1.000000	3.077684	6.313752	12.70620	31.82052	63.65674	636.6192
2	0.288675	0.816497	1.885618	2.919986	4.30265	6.96456	9.92484	31.5991
3	0.276671	0.764892	1.637744	2.353363	3.18245	4.54070	5.84091	12.9240
4	0.270722	0.740697	1.533206	2.131847	2.77645	3.74695	4.60409	8.6103
5	0.267181	0.726687	1.475884	2.015048	2.57058	3.36493	4.03214	6.8688
6	0.264835	0.717558	1.439756	1.943180	2.44691	3.14267	3.70743	5.9588
7	0.263167	0.711142	1.414924	1.894579	2.36462	2.99795	3.49948	5.4079
8	0.261921	0.706387	1.396815	1.859548	2.30600	2.89646	3.35539	5.0413
9	0.260955	0.702722	1.383029	1.833113	2.26216	2.82144	3.24984	4.7809
10	0.260185	0.699812	1.372184	1.812461	2.22814	2.76377	3.16927	4.5869
11	0.259556	0.697445	1.363430	1.795885	2.20099	2.71808	3.10581	4.4370
12	0.259033	0.695483	1.356217	1.782288	2.17881	2.68100	3.05454	4.3178
13	0.258591	0.693829	1.350171	1.770933	2.16037	2.65031	3.01228	4.2208
14	0.258213	0.692417	1.345030	1.761310	2.14479	2.62449	2.97684	4.1405
15	0.257885	0.691197	1.340606	1.753050	2.13145	2.60248	2.94671	4.0728
16	0.257599	0.690132	1.336757	1.745884	2.11991	2.58349	2.92078	4.0150
17	0.257347	0.689195	1.333379	1.739607	2.10982	2.56693	2.89823	3.9651
18	0.257123	0.688364	1.330391	1.734064	2.10092	2.55238	2.87844	3.9216
19	0.256923	0.687621	1.327728	1.729133	2.09302	2.53948	2.86093	3.8834
20	0.256743	0.686954	1.325341	1.724718	2.08596	2.52798	2.84534	3.8495
21	0.256580	0.686352	1.323188	1.720743	2.07961	2.51765	2.83136	3.8193
22	0.256432	0.685805	1.321237	1.717144	2.07387	2.50832	2.81876	3.7921
23	0.256297	0.685306	1.319460	1.713872	2.06866	2.49987	2.80734	3.7676

27	0.255858	0.683685	1.313703	1.703288	2.05183	2.47266	2.77068	3.6896
28	0.255768	0.683353	1.312527	1.701131	2.04841	2.46714	2.76326	3.6739
29	0.255684	0.683044	1.311434	1.699127	2.04523	2.46202	2.75639	3.6594
30	0.255605	0.682756	1.310415	1.697261	2.04227	2.45726	2.75000	3.6460
inf	0.253347	0.674490	1.281552	1.644854	1.95996	2.32635	2.57583	3.2905