UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang Akademik 2002/2003

September 2002

KAA 501 – Quality Control In Chemistry

Time : 3 hours

Please make sure this paper consists of SIX printed pages before anwering the questions.

SECTION A
Questions 1, 2 and 3 are **COMPULSORY.**

SECTION B
Choose 2 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) Write a short essay on the use of Hazard Analysis Critical Control Point (HACCP) in food manufacturing. The essay should include, among others the following:

   - The purpose of introducing HACCP in food manufacturing.
   - The important elements in the preparation of HACCP.
   - The differences between HACCP Scheme and laboratory quality control scheme.

   (b) Explain the relationship between a laboratory accreditation scheme, such as SAMM and HACCP.

(20 marks)

.../2-

2. (a) A Quality Control Officer in company **Y** manufacturing mineral water is assigned to examine 15,200 bottles inside a store.

(i) Determine the number of samples to be collected.

(ii) Supposing the samples need to be inspected by attribute method. Describe in details three methods of sampling by attributes.

(iii) Which method from (ii) is considered most appropriate? Why?

(8 marks)

(b) The results obtained from the examination carried out in 2(a) is shown as follows:

Number of bottles	%Ca	%K	pH
86	*x*	*y*	*y*
25	*y*	*y*	*x*
10	*y*	*x*	*y*
4	*x*	*x*	*y*

x below expected level
y conforms with standard

(i) How many percent do not conform with the requirement?

(ii) How many nonconformities per 100 bottles?

(8 marks)

(c) Earlier studies have shown that a double type sampling plan is required and that an Acceptance Quality Level (AQL) of 1% is desired. Work out for the numbers of bottles accepted and rejected.

(4 marks)

3. You are a consultant to an analytical laboratory that has major problems in equipment maintenance. Many of their equipments breakdown regularly.

(a) Describe the use of any two appropriate tools of the magnificent seven in statistical process control for you to find the root cause of this problem.

(7 marks)

(b) The manager of this laboratory decides to replace his atomic absorption spectrophotometer, provides various factors that he should consider in trying to aid his decision making.

(6 marks)

(c) If one of the laboratory problems is incorrect analytical results, provide an advice to the manager of various possibilities that may contribute to this unacceptable problem.

(7 marks)

4. Briefly describe or discuss the following:

(a) Good record keeping in Laboratory Report Books is among the important element of intellectual property management.

(b) The differences between the terms, standard material, reference material and control sample.

(c) The important elements in the preparation of a generic laboratory accreditation scheme.

(d) The differences and commonalities found in ISO 17025 and SAMM.

(20 markah)

5. (a) In organic synthesis, the nature of the impurities is not important. Substantiate this statement by giving two common chemicals to support your answer.

(5 marks)

(b) Describe the criteria in selecting the following chemicals, apparatus and equipments:

(i) Solvent for digesting indium.

(ii) Glass window for infrared spectroscopy.

(iii) Container for pesticide residues.

(iv) Stirrer for acids.

(v) Electronic balance.

(10 marks)

(c) The preventive measures are more cost-effective in comparison with curative methods when maintaining a big and costly instrument. Do you agree with this statement? Explain.

(5 marks)

6. Two species A and B give overlapping UV peaks at wavelengths 215 nm, 220 nm and 225 nm. Given the data below, provide regression equation for A and B using the method of inverse least square technique for multiple regression.

Solution data

Species	Concentration, moles per liter		
	Soln 1	Soln 2	Soln 3
A	0.00013	0.0	0.00013
B	0.0	0.00004	0.00004

Absorbance data

Wavelength	Absorbance		
	Soln 1	Soln 2	Soln 3
215 nm	0.0997	0.0191	0.1189
220 nm	0.3128	0.1124	0.4252
225 nm	0.2892	0.1096	0.3988

(20 marks)

7. Several food samples were analyzed for lead . The analysis took one week for each batch of samples. Included in each batch were two samples of NB Bovine Liver which has a certified lead value of 0.34 ppm. The data generated from this process are tabulated below. Use the data to generate X-bar control chart and indicate whether the process was under statistical controlled situation or not.

Week	Lead Level, ppm			
	Observed		Mean	Range
1	0.287	0.334	0.310	0.047
2	0.280	0.280	0.280	0.000
3	0.324	0.347	0.336	0.023
4	0.311	0.313	0.312	0.002
5	0.320	0.296	0.308	0.024
6	0.327	0.324	0.326	0.003
7	0.353	0.330	0.342	0.023
8	0.278	0.305	0.292	0.027
9	0.408	0.372	0.390	0.036
10	0.317	0.313	0.315	0.004
11	0.357	0.327	0.342	0.030
12	0.324	0.351	0.338	0.027
13	0.332	0.354	0.343	0.022

(20 marks)

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Type of sampling plan	Cumulative sample size	Acceptable quality levels (normal inspection)																	Cumulative sample size
		<0.065	0.065	0.10		0.15	0.25	0.40	0.65	1.0	1.5		2.5		4.0		6.5	>6.5	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	200	▽	0 1	Use code letter K	Use code letter N	Use code letter M	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	△	200
Double	125	▽	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	△	125
	250						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		250
Multiple	50	▽	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	△	50
	100						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		100
	150						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		150
	200						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		200
	250						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		250
	300						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		300
	350						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		350
		<0.10	0.10		0.15	0.25	0.40	0.65	1.0	1.5		2.5		4.0		6.5		>6.5	
		Acceptable quality levels (tightened inspection)																	

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter P).
\# = Acceptance not permitted at this sample size.

Sampling plans For sample