This question paper contains 5 printed pages.]

5175 *Your Roll No. .....*

B.Sc. Sem.-I **B**

ANALYTICAL CHEMISTRY – Paper ACPT - 101

(Basic Principles of Laboratory Operations)

Time : 3 Hours *Maximum Marks : 70*

(Write your Roll No. on the top immediately on receipt of this question paper.)

*Attempt **five** questions in all. Question No. **1** is compulsory. Use of calculators is not permitted.*

1. (a) Give a flow diagram showing steps in quantitative analysis.

(b) Calculate the p-value for each ion in a solution that is

(i) 2.0×10^{-3} M in NaCl and 5.4×10^{-4} M in HI.

(ii) 8×10^{-8} M in $Zn(NO_3)_2$ and 5.6×10^{-7} M $d(NO_3)_2$.

(c) The analysis of a calcite sample yielded CaO percentage of 55.95, 56.00, 56.04, 56.08 and 56.23. The last value appears anomalous, should it be

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retained or rejected ? Apply the required test to explain your answer.

(2+3+5)

2. (a) Describe the principle of the analytical balance.

(b) Why are electronic balances subject to fewer errors or mechanical failures than the mechanical balances ?

(c) Give at least three rules that one must observe while weighing with any type of analytical balance.

(d) What do you understand by the term 'weighing by difference' ?

(e) What are the advantages and limitations of using a glass electrode ?

(6+1+3+2+3)

3. (a) Define precision and accuracy. Explain with the help of a diagram.

(b) What is the difference between systemic errors and random errors ?

(c) Differentiate between absolute uncertainty and relative uncertainty.

(d) Calculate the mean and standard deviation of the following set of analytical results 12.96, 13.05, 12.81 and 12.75.

(4+3+3+5)

4. (a) Distinguish between qualitative analysis and quantitative analysis. Give examples.

(b) List five common measuring techniques employed in analytical chemistry. Briefly describe any two of them.

(c) What is a blank ?

(d) What is a calibration curve ?

(3+5+3+4)

5. Give in detail all the steps required to calculate the following :-

(a) What is the formal concentration of NaCl when 32.0g are dissolved in water and diluted to 0.500L ?

(b) How many grams of perchloric acid, $HClO_4$, are contained in 37.6g of 70.5% wt% ? Aqueous perchloric acid ?

(c) Give in detail with reasons how you will :-

(i) Calculate the pH of an aqueous 0.1 M NaOH solution at 25°C.

(ii) Calculate the pH of an aqueous solution of 0.1M HCl solution at 25°C.

(d) Describe a sintered glass crucible.

(3+3+6+3)

6. (a) Define molarity. Differentiate between Analytical molarity and Equilibrium molarity.

(b) What are constant errors ? Explain with the help of an example how a constant error will become serious as the size of the quantity measured decreases.

(c) Describe in detail the preparation of 500 mL of 1.0 N HCL from a stock solution containing 37.0% HCl, density of the reagent is 1.19 g/ml.

(d) Calculate the uncertainty in the number of millimoles of chloride contained in 250.0ml. of a sample where three different aliquots of 25.00ml. are titrated with silver nitrate with the following results : 37.68, 38.62, 37.75ml. The molarity of the silver nitrate solution is 0.1168 ± 0.0002M

3+3+6+3

Table for Q test

No. of measurements,n	Confidence level 95%	Confidence level 99%
3	0.94	0.99
4	0.77	0.89
5	0.64	0.78
6	0.56	0.70
7	0.51	0.64
8	0.47	0.59
9	0.44	0.58
10	0.41	0.53

Values of t for various levels of probability

Deg. of freedom	80%	90%	95%	99%	99.8%
1	3.08	6.31	12.7	63.7	31.8
2	1.89	2.92	4.30	9.92	22.3
3	1.64	2.35	3.18	5.84	10.2
4	1.53	2.13	2.78	4.60	7.17
5	1.48	2.02	2.57	4.03	5.89

Table below gives values for F at 95% confidence level

V_2 \ V_1	1	2	3	4	5	6	7	8	9	10
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35