

BOWEN UNIVERSITY, IWO, OSUN STATE
COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE
INDUSTRIAL CHEMISTRY PROGRAMME
2022/2023 B.SC DEGREE FIRST SEMESTER EXAMINATION

Course Code: CHM 417

Course Title: Analytical Chemistry

Date: /02/2023

Credits: 3

Time Allowed: 2½ hours

INSTRUCTIONS (a) Answer two questions from Sections A and one question from section B.

(b) Answer each question on a fresh page .

SECTION A

Question 1

- a) Define Error. (2 marks)
- b) Explain different methods that can be used to minimize errors. (8 marks)
- c) An analyst determined the glucose level in serum by two different electroanalytical methods of Potentiometry and Coulometry. Both methods were used to analyse the serum from the six patients in order to eliminate patient – to – patient variability. Do the following results confirm a difference in the two methods at 95% confidence level? (15 marks)

Patient	Potentiometry Glucose (mg/L)	Coulometry Glucose (mg/L)
1	1044	1028
2	720	711
3	845	820
4	800	795
5	957	935
6	650	639

Question 2

- a) Differentiate between electrode potential and cell potential. (2 marks)
- b) Draw the diagram of the cell represented by the notation:
 $Zn(s) | Zn^{2+}(a_1) || Cu^{2+}(a_2) | Cu(s)$ (5 marks)
- c) For the cell: $Fe(s) | FeBr_2(0.010 M) || NaBr(0.050 M) | Br_2(l) | Pt(s)$, write a balanced equation for the half-cell reaction at each electrode and calculate the cell potential (Standard oxidation potential of $Fe^{2+} = 0.44V$ and standard reduction potential of $Br^- = 1.078V$). Indicate whether the redox reaction in the cell is spontaneous under the given conditions. (10 marks)

- d) Describe potentiometric titration and how the equivalence point is determined (use relevant diagrams where necessary). (8 marks)

Question 3.

a) A sample of kerosene is known to contain 0.123% of Sulphur (i.e., $\mu_0 = 0.123\%$). A new procedure was developed by a Chemist and the procedure when used to analyse the same kerosene mentioned above gave the following results for % Sulphur: 0.112, 0.118, 0.115 and 0.119. Can this new procedure be described as giving a reliable result? (12 marks)

b) i. Define electroanalytical methods. (2 marks)

ii. Describe at least five different types of electroanalytical methods. (5 marks)

c) Consider the following redox reaction.



i) Write a balanced equation for the oxidation and reduction half reactions. (3 marks)

ii) Write the line notation for a cell based on this redox reaction. (3 marks)

SECTION B

Question 4

a) Discuss some biological uses of air. (4marks)

b) Highlight some Materials analysis techniques. (5marks)

c) Why does the Conductivity of the Solution Rise Quickly after the Equivalence Point? Give answer with an illustration.

(4marks)

d) What is the Principle behind Conductometric Titrations? (2marks)

e) Explain why water is generally regarded as a universal solvent (10 marks)

Question 5

a) Suggest two reasons why the electrolysis of Aluminium oxide is an expensive process. (4marks)

b) State Faraday's laws of electrolysis. (4marks)

c) Differentiate between unicellular and multicellular organisms (7mark)

(d) Briefly describe five various branches of medicine. (5marks)

e) With the aid of diagram, discuss a soil horizon. (5marks)

Values of t for Various Levels of Probability					
Degrees of Freedom	80%	90%	95%	99%	99.9%
1	3.08	6.31	12.7	63.7	637
2	1.89	2.92	4.30	9.92	31.6
3	1.64	2.35	3.18	5.84	12.9
4	1.53	2.13	2.78	4.60	8.61
5	1.48	2.02	2.57	4.03	6.87
6	1.44	1.94	2.45	3.71	5.96
7	1.42	1.90	2.36	3.50	5.41
8	1.40	1.86	2.31	3.36	5.04
9	1.38	1.83	2.26	3.25	4.78
10	1.37	1.81	2.23	3.17	4.59
15	1.34	1.75	2.13	2.95	4.07
20	1.32	1.73	2.09	2.84	3.85
40	1.30	1.68	2.02	2.70	3.55
60	1.30	1.67	2.00	2.62	3.46
∞	1.28	1.64	1.96	2.58	3.29

G. Green