M.Sc. CHEMISTRY
First Semester (Repeat)
ANALYTICAL CHEMISTRY
(MSC - 104)

Duration: 3Hrs.   **Full Marks: 70**

Part-A (Objective) =20
Part-B (Descriptive) =50

(PART-B: Descriptive)
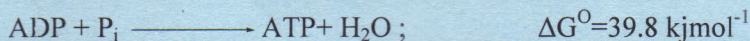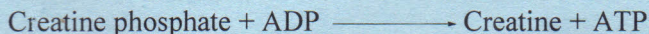
Duration: 2 hrs. 40 mins.   **Marks: 50**

Answer any *four* from *Question no*. 2 to 8
***Question no*. 1 is compulsory.**

1. (a) Define equivalent mass of an oxidizing agent.   (2)

   (b) The value of ΔG^O for the following reactions are given.   (2)

   Creatine phosphate + $H_2O \longrightarrow$ Creatine + P_i; $\Delta G^O = -43.5$ kjmol^{-1}

   $ADP + P_i \longrightarrow ATP + H_2O$; $\Delta G^O = 39.8$ kjmol^{-1}

   Calculate the ΔG^O_{net} for the following reaction-

   Creatine phosphate + ADP $\longrightarrow$ Creatine + ATP

   (c) Draw the TGA plot for hydrated calcium oxalate.   (2)

   (d) Calculate the results of the following expression: (2)

   $(21.3 \pm 0.1)(17.6 \pm 0.02)$

   (e) Write briefly about the classification of analytical methods.   (2)

2. (a) What do you mean by a standard solution? Explain with example what a primary standard is and what a secondary standard is.   (3)

   (b) Calculate the number of mmoles contained in 300 mg of an organic compound of molecular formula $C_7H_6O_2$.   (2)

   (c) (i) Calculate the molar concentration of NO_3^- ion in a solution prepared by mixing 200 mL of 0.25 M KNO_3 and 300 mL of 0.20 M $Ca(NO_3)_2$ solution. $[NO_3^{-1} = 62$ gmol$^{-1}]$ (3)

(ii) What is the pc weight of Ag in 8.4g sample of AgCl of 80% purity? (Atomic mass of $1Ag = 108g/mol$) (2)

3. (a) Two sets of results in mg/Lit; One obtained by a standard method and other by a new method are given below: (5)

Standard method: 30   25   22   23   35   31   33

New method: 25   26   28   30   24   28   22

Determine whether precision of new method differs significantly from that of standard method or not. The critical value of F for 7 degrees of freedom is 1.56.

(b) Write three differences between accuracy and precision. (3)

(c) What is confidence limit? Give mathematical expression for it. (2)

4. (a) How can you predict the following stages of a reaction by comparing the value of K_c and Q_c when- (3)

(i) Net reaction proceed in forward direction.

(ii) Net reaction proceed in backward direction.

(iii) No net reaction occurs.

(b) Match column I with column II. (5)

Column I	Column II
(i) Equilibrium	(a) $\Delta G > 0$, $K < 1$
(ii) Spontaneous	(b) $\Delta G = 0$
(iii) Nonspontaneous	(c) $\Delta G° = 0$
	(d) $\Delta G < 0$, $K > 1$

(c) Write the relationship between Solubility (S) and K_{SP} for the electrolyte $Ca_3(PO_4)_2$. (2)

5. (a) Explain the principle and instrumentation in Differential Thermal Analysis. (5)

(b) Draw and explain the DTA curve for Sulphur. (5)

6. (a) An acidified solution of Fe^{+2} is titrated with 0.03 (M) $KMnO_4$ solution. If the titration required 22.4 mL, how many mg of Fe^{+2} are in solution? (at mass of Fe = 55.8 g/mole) (3)

(b) Calculate the normality of a Na_2CO_3 solution containing 1.06 g Na_2CO_3 in 200 mL (2)

(c) Write about determinate errors and indeterminate errors. (including all classification) (5)

7. (a) Mention the instrumentation involved in Inductively Coupled Plasma – Atomic Emission Spectroscopy. (5)

(b) (i) What will happen to the number of moles of SO_3 in equilibrium with SO_2 and O_2 in each of the following cases in the reaction? (2+3=5)

$$2SO_3\,(g) \rightleftharpoons 2SO_2\,(g) + O_2\,(g) \,;\, \Delta H° = 197 \text{ kJ}$$

a. Oxygen gas is added

b. The pressure is increased by decreasing the volume of the reaction container.

c. The temperature is decreased.

d. Gaseous sulfur dioxide is removed.

(ii) Mention the conditions required for getting favorable yield of ammonia in Haber process.

8. (a) What do you understand by quantitative and qualitative analysis? Write briefly about gravimetric and volumetric analysis. (6)

(b) Write briefly about the decomposition and dissolution of the samples. (4)

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