Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Sc(H)/MOL/Micro, BT, GE/SEM-3/CH-301/2009-10

2009

CHEMISTRY

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *five* of the following : $5 \times 2 = 10$

   i) Condition for spontaneity of any process ΔG =

   a) O b) +ve

   c) –ve d) can't say.

   ii) Entropy change in an adiabatic irreversible process is

   a) 0 b) > 0

   c) < 0 d) none of these.

   iii) Condition for equilibrium is

   a) $\partial G = 0$ b) $\partial G_{T, V} = 0$

   c) $\partial G_{P, V} = 0$ d) $\partial G_{P, T} = 0$.

iv) Correct sequence of increasing order of hydrolysis is

a) $RCONH_2$ < RCOOR < RCOCl

b) RCOOR < $RCO\ NH_2$ < RCOCl

c) RCOCl < RCOOR < $RCONH_2$

d) none of these.

v) Buffer capacity of an acidic buffer is maximum when

a) $pH = pK_a$ b) $pH = pK_b$

c) $pH > pK_a$ d) $pH > pK_b$.

vi) The reaction is spontaneous if the cell potentail is

a) Positive b) Negative

c) Zero d) Infinite.

vii) Gibbs free energy change is

a) path function b) state function

c) intensive property d) all of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \infty 5 = 15$

2. What is primary kinetic salt effect ? What will be the effect on rate constant of the following reaction, with an increase in ionic strength ?

$2I^- + S_2O_8^{2-} \varnothing I_2 + 2SO_4^{2-}$. 2 + 3

3. Give the mechanism of esterification of any carboxylic acid by $A_{AC}2$ mechanism. Why is the name $A_{AC}2$? 4 + 1

4. Give a comparative account of oxygen family with respect to hydride. 5

5. Standard reduction potential of the electrodes Cu^{2+} | Cu and Ag^{+} | Ag are 0·337 and 0·799 volts respectively. Write down Nernst equation for each electrode. Construct a cell using these two electrodes and calculate the standard e.m.f. of the cell. 2 + 2 + 1

6. a) Write short notes on Williamson's synthesis for preparation of ethers.

   b) Discuss the synthesis of Alanine by using Gabriel's phthalimide synthesis. 3 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 ∞ 15 = 45

7. What are the different processes associated with Carnot cycle ? Write down the expression of efficiency [η] for the cycle explaining all the terms used. Can we reach at efficiency = 1, interpret from efficiency expression ? Can we practice Carnot cycle in real life ? Draw the Carnot cycle in PV diagram mentioning physical parameters at each state. Discuss the origin of work in Carnot cycle. Deduce Gibbs-Helmohotz equation. 1 + 1 + 2 + 1 + 3 + 2 + 5

8. For the reaction, $N_2 + O_2 \times 2NO$, $\Delta G^\circ = 22000 - 2{\cdot}5\ T$. Determine the value of Kp at 2000 K. Write van't Hoff's reaction isotherm for gaseous systems. Frorm this equation, establish the relation $\Delta G^\circ = -RT \ln Kp$ [ΔG° = standard free energy change]. What is the effect of addition of inert gas at constant pressure & constant volume on the equilibrium of gaseous reactions ? 5 + 2 + 2 + 6

9. Deduce Nerst equation for electrochemical cells. What is Standard Hydrogen Electrode ? Define galvanic cell & electrolytic cell. Write the cell reactions and *emf* equations for the cell.

   $Zn \mid Zn^{2+} \mid\mid Cu^{2+} \mid Cu \mid$. Name one reference eletrode.

   5 + 2 + 3 + 4 + 1

10. Give a comparative account of F, Cl, Br, I, with respect to electronic configuration, elemental state, oxidation state, hydrides, halides, oxides and oxoacids. 15

11. Write the equation and discuss the reaction : $3 \infty 5$

    a) Acid chloride is reduced with hydrogen

    b) Alkyl cyanide is reduced with stannous chloride and hyrodchloric acid and then steam distilled

    c) Carbonyl compounds are subjected to react with hydrazoic acid in presence of concentrated sulphuric acid.

    d) Acetone is treated with hydrochloric acid.

    e) Benzaldehyde and acetaldehyde react in presence of dilute alkali.