



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 :

$$5 \propto 2 = 10$$

- i) Condition for spontaneity of any process $\Delta G =$

- a) O b) +ve
c) -ve d) can't say.

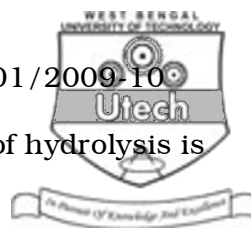
- ii) Entropy change in an adiabatic irreversible process is

- 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) $\partial G_{P,T} = 0.$

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



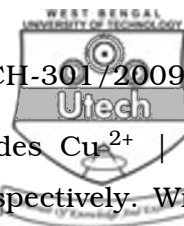
- iv) Correct sequence of increasing order of hydrolysis is
- $\text{RCONH}_2 < \text{RCOOR} < \text{RCOCl}$
 - $\text{RCOOR} < \text{RCO NH}_2 < \text{RCOCl}$
 - $\text{RCOCl} < \text{RCOOR} < \text{RCONH}_2$
 - none of these.
- v) Buffer capacity of an acidic buffer is maximum when
- $\text{pH} = \text{pK}_a$
 - $\text{pH} = \text{pK}_b$
 - $\text{pH} > \text{pK}_a$
 - $\text{pH} > \text{pK}_b$
- vi) The reaction is spontaneous if the cell potential is
- Positive
 - Negative
 - Zero
 - Infinite.
- vii) Gibbs free energy change is
- path function
 - state function
 - intensive property
 - all of these.

GROUP – B

(Short Answer Type Questions)

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

- What is primary kinetic salt effect ? What will be the effect on rate constant of the following reaction, with an increase in ionic strength ?
 $2\text{I}^- + \text{S}_2\text{O}_8^{2-} \rightarrow \text{I}_2 + 2\text{SO}_4^{2-}$ 2 + 3
- Give the mechanism of esterification of any carboxylic acid by $\text{A}_{\text{AC}}2$ mechanism. Why is the name $\text{A}_{\text{AC}}2$? 4 + 1
- Give a comparative account of oxygen family with respect to hydride. 5



5. Standard reduction potential of the electrodes $\text{Cu}^{2+} | \text{Cu}$ and $\text{Ag}^+ | \text{Ag}$ 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

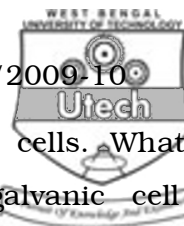
GROUP – C

(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, $\text{N}_2 + \text{O}_2 \rightleftharpoons 2\text{NO}$, $\Delta G^\circ = 22000 - 2.5 T$. Determine the value of K_p at 2000 K. Write van't Hoff's reaction isotherm for gaseous systems. From this equation, establish the relation $\Delta G^\circ = -RT \ln K_p$ [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

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



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.

$\text{Zn} \mid \text{Zn}^{2+} \parallel \text{Cu}^{2+} \mid \text{Cu}$. Name one reference electrode.

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 ∞ 5

- a) Acid chloride is reduced with hydrogen
- b) Alkyl cyanide is reduced with stannous chloride and hydrochloric 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.

=====