CS/B.Sc.(H)/MOL.BIO./MICRO BIO/BT/GE/SEM-3/CH-301/2012-13

# 2012
# 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 *ten* of the following :

                                                        $10 \times 1 = 10$

   i)   Which one is more acidic ?

        a)   $CH_3COOH$              b)   $ClCH_2COOH$
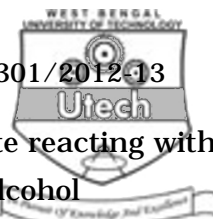
        c)   $Cl_2CHCOOH$           d)   HCOOH.

   ii)  When Ca-salt of acetic acid is dry distrilled they
        produce

        a)   Acetaldehyde           b)   Formaldehyde

        c)   Acetic acid            d)   Acetone.

   iii) In HVZ reaction the reagents are

        a)   Red P and $Br_2$       b)   $PBr_3$

        c)   Al and $I_2$           d)   Both (a) and (b).

3246                                            [ Turn over

iv) Acetic anhydrides produce methyl acetate reacting with

    a) Methyl alcohol      b) Ethyl alcohol

    c) Acetyl chloride      d) Never produces ester.

v) $(CH_3)_2 C = CHCOCH_3$ is

    a) Aldol      b) Mesityl oxide

    c) Pinacol      d) None of these.

vi) In the following reaction which one would be the product ?

$$R_2 O + H_2 O \xrightarrow{Na,\ ethanol}$$

    a) $R_2 CO$      b) $R_2 CHOH$

    c) $RCO_2 R$      d) None of these.

vii) $LiAlH_2$ does not reduce

    a) – CHO      b) – CO –

    c) – COCl      d) – C = C –

viii) Acid strength of alcohols will be in the order

    a) primary > $s$ > $t$      b) $s$ > $t$ > primary

    c) $t$ > $s$ > primary      d) none of these.

ix) The element with highest electron affinity among the halogens is

    a) F      b) Cl

    c) Br      d) I.

x) Most basic element is

    a) F      b) Cl

    c) Br      d) I.

xi) $o$–cresol is

    a) 2-methyl phenol      b) 3-methyl phenol

    c) 4-methyl phenol      d) none of these.

xii) Conjugate base of $HPO_4^{2-}$ is

    a) $H_2 PO_4$      b) $H_2 PO^{4-}$

    c) $PO_4^{3-}$      d) none of these.

## GROUP – B

### ( Short Answer Type Questions )

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

2. Prove that the condition of spontaneity and equilibrium is $\Delta G \leq 0$.

3. Discuss significance of entropy. What is the relation of entropy with temperature ?        $3 + 2$

4. Write short notes on any *two* :        $2 \times 2\frac{1}{2}$

   a) Reimer-Tiemann reaction.
   b) Lederer-Manasse reaction
   c) Back dye test.

5. How will you produce *m*-amino phenol ? What is backbite and how is it produced ?        $3 + 2$

6. Write the factors on which the strength of acid depends. Explain why acid strength of HI > HF.        $3 + 2$

7. Write the relation between ionic strength and activity coefficient. What is primary kinetic salt effect ?        $2 + 3$

## GROUP – C

### ( Long Answer Type Questions )

Answer any *three* of the following.        $3 \times 15 = 45$

8. Derive the efficiency of a reversible engine working in Carnot cycle between $T_1$ and $T_2$ and temperature where $T_1 > T_2$ . What is the best efficiency of an engine working between 20°C and – 10°C ? Write the maximum limit of efficiency of an engine. Discuss how the efficiency of Carnot engine may be increased. Calculate the change of entropy when 7 mole of nitrogen heated from 300 K to 500 K at constant volume ( $C_v = 5$ ).        $5 + 2 + 2 + 3 + 3$

9. State Le Chatelier's principle and on the basis of the principle explain the effect of pressure, catalyst, conentration and inert gas addition at equilibrium. For a reaction, $\Delta H = 9710$ cals, $\Delta S = 26$ eu. Calculate the temperatrue at which the system is at equilibrium. Write van't Hoff isochore and state its application. Free energy increases with increase in temperature at constant pressure. Justify or criticise. Predict the sign of the entropy change with explanation for the reaction $3H_2 + N_2 \rightarrow 2NH_3$ .

$2 + 5 + 2 + 2 + 2 + 2$
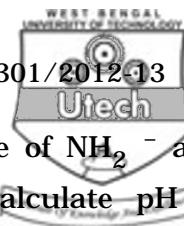
10. Discuss Lewis acid-base concept. Which one of $NH_2^-$ and $PH_2^-$ is better base toward proton ? Calculate pH of solution prepared by diluting 20 ml 0.1 ( M ) HCl to one litre. What is buffer ? Write mechanism of buffer action. Prove that buffer capacity is maximum at half neutralization point.

$$3 + 2 + 2 + 1 + 3 + 4$$

11. Derive Henderson equation. A buffer solution contains 0.1 ( M ) acetic acid and 0.1 ( M ) acetate per litre. Calculate pH of the buffer solution. What change of pH occurs when 0.01 ( M ) HCl is added to the solution ( Given, pKa = 4.74 ). Derive the expression of pH for ammonium chloride solution and determine pH of 0.02 ( M ) solution where pKb = 4.74.

$$4 + 2 + 2 + 4 + 3$$

12. Write notes on the following : $7\dfrac{1}{2} + 7\dfrac{1}{2}$

   a) Claisen Schmidt reaction

   b) Knoevenagel reaction.

13. Compare S, Se and Te with respect to formation of allotropy, oxidation state, hydrides, halides, oxides and derived acids.

14. Mention the final product and discuss ( any *three* ) :    3 × 5

   i)   $CH_3\ C \equiv N \xrightarrow{\ SnCl_2 /\ HCl\ }$ ?

   ii)  $CH_3\ COCH_3 + NH_2\ NH_2 \longrightarrow$ ?

   iii) $2HCHO + NaOH \longrightarrow$ ?

   iv)  $RCOCH_3 + I_2 + OH^- \longrightarrow$ ?

   v)   $C_6\ H_5 CHO + HCHO + NaOH \longrightarrow$ ?