B.Sc. (Prog.) / II

B

Paper CH–202 : CHEMISTRY

(Admissions of 2007 and before)

Time : 3 hours Maximum Marks : 75

(Write your Roll No. on the top immediately
on receipt of this question paper.)

You are allowed to use any type of calculato,
except mobile calculators but you cannot
share it. However, log tables will be
provided, if asked for.

SECTION A Marks : 50

(*Organic Chemistry*)

Attempt four questions in all including Q. No. 1,
which is compulsory and carries 14 marks.

1. (a) An aromatic compound A (C_6H_7N) is basic in
nature. The compound A on heating with $CHCl_3$
and KOH solution gives an offensive smelling
compound B. The compound A reacts with
bromine water to give C ($C_6H_4NBr_3$). The
compound A on reaction with acetic anhydride in
presence of a base gives D (C_8H_9NO). Identify A,
B, C and D and, also explain the reactions. 10

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   (b) Explain the following:

      (i)   Methylene group in diethyl malonate is very reactive.

      (ii) Chlorobenzene is o/p-directing.   4

2. (a) How will you synthesise the following (any four):

      (i)   o-nitrotoluene from benzene

      (ii) 2-octanone from 2,3-dimethyl-2-nonene

      (iii) Chlorobenzene from aniline

      (iv) Benzyl chloride from benzene

      (v) p-Bromoacetanilide from aniline.   8

  (b) Compare SN_1 and SN_2 reactions.   4

3. (a) What is the product formed when 1-butene is treated with:

      (i) $Hg(OAc)_2$, H_2O and then $NaBH_4$.

      (ii) B_2H_6 and then $H_2O_2 / \overset{\ominus}{O}H$.   4

  (b) Suggest a chemical test to distinguish between any three of the following:
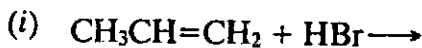
      (i)   1-butyne and 2-butyne

      (ii) Propanal and propanone

      (iii) Crotonic acid and propanoic acid

      (iv) Formic acid and acetic acid.   6

(c) In electrophilic substitution reactions, aniline reacts faster than nitrobenzene. Explain.   2

4. (a) Discuss the major addition products of the following reactions:

(i) $CH_3CH=CH_2 + HBr \longrightarrow$

(ii) $H_3C-CH=CH_2+HBr+$ Benzoyl Peroxide $\rightarrow$

4

(b) Predict the product(s) of periodic acid oxidation of any *two* of the following:

(i) $HOCH_2CH_2OH$

(ii) 1,2-cyclopentandiol

(iii) $CH_3CH_2CH(OH)CH(OH)CH_2CH_3$ 4

(c) Arrange any *two* of the following in decreasing order, of reactivity towards electrophilic substitution reactions:

(i)   Benzene, toluene, nitrobenzene, bromobenzene

(ii) Phenol, o-nitrophenol, m-nitrophenol, benzene
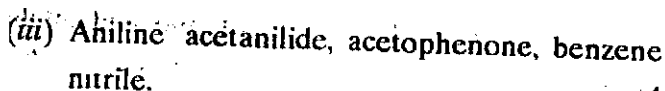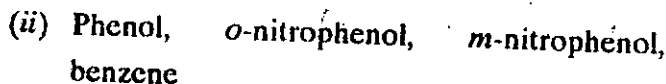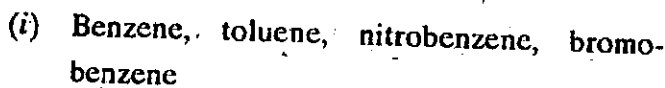
(iii) Aniline acetanilide, acetophenone, benzene nitrile.   4

5. (a) Write a short note on Claisen condensation *or* Benzoin condensation.   4
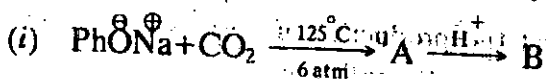
(b) How will you synthesise any *two* of the following from either ethylacetoacetate or diethylmalonate:

   (i) 4-methyl uracil
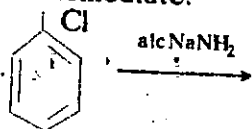
   (ii) Succinic acid

   (iii) Ethyl methyl ketone.   4

(c) Identify the reaction and, predict the products of the reactions:

   (i) $Ph\overset{\ominus}{O}\overset{\oplus}{N}a + CO_2 \xrightarrow[6\,atm]{125°C} A \xrightarrow{H^+} B$ 2

   (ii) Give the product and name of the reaction intermediate:

   alc NaNH$_2$ 2

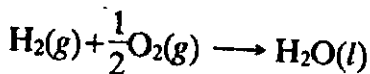### SECTION B
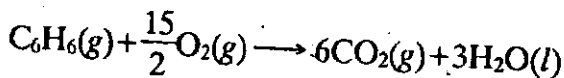### (*Physical Chemistry*)
Marks : 25

Attempt any two questions.

6. (a) Define equivalent and molar conductance. What is the effect of dilution on them?

  (b) How will you find out the solubility and solubility product of sparingly soluble salts, conducto-metrically?

  (c) The transference numbers of ions in $1.000N$ KCl were determined by the moving boundary method using $0.80N$ BaCl$_2$ as indicator electrolyte, with a current of 0.0142 amp, the time required for the

boundary to sweep through a volume of 0.1205 cm^3 was 1675 seconds. What are the transport numbers of K^+ and Cl^-? $3_{1/2}, 3_{1/2}, 5_{1/2}$

7. (a) Write a short note on glass electrode.

(b) What will be the EMF of Zn electrode immersed in $0.1M$ $ZnSO_4$ solution at 298 K, assuming that $ZnSO_4$ is fully ionised in the solution? Given that standard electrode potential of Zn is -0.76 V.

(c) What do you understand by activity and activity coefficient? Define.

(d) How can an electrochemical cell be used to find out ΔG, ΔH and ΔS of a reaction? Explain.

$3_{1/2}, 3, 2_{1/2}, 3_{1/2}$

8. (a) Derive thermodynamically the expression of the law of chemical equilibrium.

(b) Calculate the equilibrium constant of a reaction at 300 K if ΔG° at this temperature for the reaction is 29.29 kJ mol^{-1}. (R$=8.314$ J K^{-1} mol^{-1}.)

(c) State and define Le Chateliers principle. Use this to find out the favourable conditions for the reaction:

$$H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(l)$$

$$\Delta H^0_{298} = -285.84 \text{ kJ}$$

$$C_6H_6(g) + \frac{15}{2}O_2(g) \longrightarrow 6CO_2(g) + 3H_2O(l)$$

$$\Delta H^0_{298} = -3301.51 \text{ kJ}$$

$3_{1/2}, 4_{1/2}, 4_{1/2}$

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9. (a) Derive an expression for the Gibb's phase rule for non-reactive system.

(b) Derive Clausius-Clapeyron equation and use this to plot phase diagram of water system.

(c) State Nernst's distribution law.

(d) How much lactic acid will be extracted from 100 ml of a $0 \cdot 8$ molar solution of lactic acid in $CHCl_3$ by shaking with 100 ml of H_2O

(i) in one step

(ii) when equal amount of H_2O was used in two steps?

Given that distribution coefficient of lactic acid between $CHCl_3$ and H_2O is $0 \cdot 0203$.

$2_{1/2}, 4, 2, 4$