This question paper contains 7 printed pages.

5169A

Your Roll No . . . . . .

B.Sc. (Prog.) / II

J

CH–202: CHEMISTRY

(N.C.: 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)

Use separate answer-sheets for Sections A & B.

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

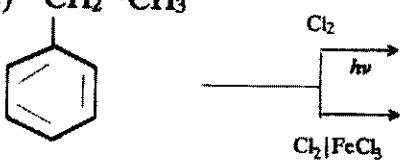
SECTION A Marks : 50

(Organic Chemistry)

Attempt four questions in all including Q. No. 1, which is compulsory.

1. (*a*) Give mechanism and identify the product(s):

(*i*) CH_2-CH_3



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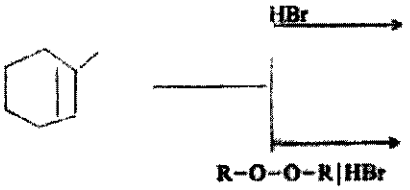
(*ii*) 

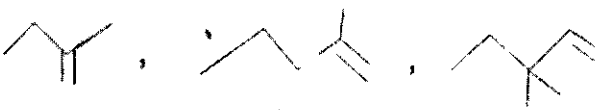
8,6

2. Giving reasons arrange the following in order of increasing reactivity towards—

(*i*) Addition of HCN:

Acetone, acetaldehyde, methyl tert. butyl ketone.

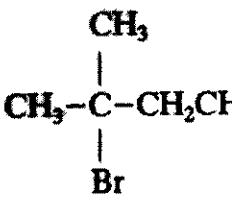
(*ii*) Addition of HCl:



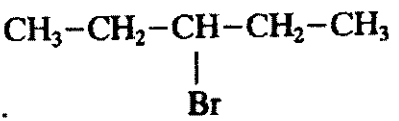
(*iii*) Electrophilic substitution :

Phenol, Benzene, Nitrobenzene

(*iv*) Unimolecular substitution :



$CH_3CH_2CH_2CH_2Br$,



3×4=12

3. Explain why:

(*i*) Benzene in presence of anhy. $AlCl_3$ reacts with neopentyl bromide to give tert. pentyl benzene.

(*ii*) Aryl halides are less reactive than alkyl halides towards nucleophilic substitution reactions.

(*iii*) Dehydration of 1-butanol by conc. H_2SO_4 gives 2-butene instead of 1-butene.

(*iv*) Formation of oximes and other ammonia derivatives of aldehydes and ketones require slightly acidic medium (pH=5−6) for maximum rate, while basic or highly acidic conditions lower the rate . 3×4=12

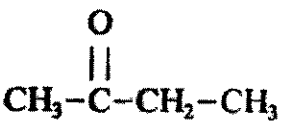
4. (*i*) What are 'Reactive methylene compounds'? Comment on their reactivity taking ethyl aceto-acetate as an example. 6

(*ii*) Predict the products and mechanism involved in cleavage of $(CH_3)_3C-O-CH_3$ with HI. 4

(*iii*) Name an isomer of octane which on chlorination will give only one octyl chloride. 2

5. (*i*) Deduce the structures of following alkenes:

(*a*) Having molecular formula C_8H_{16}, which on ozonolysis yields only



(*b*) Having molecular formula C_9H_{18}, which on ozonolysis gives

(*ii*) Write a reaction to differentiate between the following:

(*a*) Propanal and Propanone

(*b*) Propan-1-ol and propan-2-ol

(*iii*) Write a sequence of reactions to prepare 1,3,5-bromobenzene from benzene. 4,4,4

6. Give mechanism of following name reactions/rearrangements (any *three*):

(*i*) Aldol condensation

(*ii*) Reimer Tiemann reaction

(*iii*) Hoffmann bromamide rearrangement

(*iv*) Gattermann Koch reaction. 4×3=12

SECTION B

Marks : 25

(Physical Chemistry)

Attempt any two questions.

R=8·314 J/K/mol.

7. (*a*) Explain Hittorf's method for determination of transport number of silver ions. 4½

(*b*) At a certain temperature, the saturated solution of AgCl has a specific conductivity $1 \cdot 12 \times 10^{-6}$ s cm^{-1}. The equivalent ionic conductance of Ag^+ and Cl^- ions is 54·3 and 65·50 s cm^2 eq^{-1}, respectively at this temperature. Find the solubility and solubility product of AgCl. 4

(*c*) Define specific conductance, molar conductance and equivalent conductance. Explain why conductivity decreases while equivalent conductivity increases on dilution. 4

8. (*a*) Discuss the potentiometric titration of a strong acid and a strong base. 4

(*b*) What is glass electrode? How is it used to find out *p*H of the solution? 3½

(*c*) The emf of the cell

$$Ag|AgCl(s)|KCl(aq)||Hg_2Cl_2(s)|Hg$$

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is 0·0455 V at 298 K and the temperature coefficient is $3 \cdot 38 \times 10^{-4}$ VK^{-1}. Write down anodic, cathodic and complete cell reaction. Calculate free energy, enthalpy and entropy changes at 298 K. 5

9. (*a*) Derive Clausius-Clapeyron equation. Discuss its importance in phase equilibria. 4

(*b*) Draw a labelled phase diagram of Pb-Ag system. Explain the process of desilverisation using phase diagram. 4

(*c*) The distribution ratio of iodine between carbon disulphide and water is found to be 625. When iodine is distributed between carbon disulphide and 0·125 molar solution of KI, the concentration of iodine in the former layer is found to be 0 1896 mole per litre, the total concentration in the aqueous KI layer is 0·02832 mole per litre What is the concentration of litre? What is the concentration of I_3^- ions in the latter layer? 4 1/2

10. (*a*) With the help of Le-Chatelier's principle, work out the conditions which would favour the following reaction·

(*i*) $N_2(g)+O_2(g) \rightleftharpoons 2NO(g) \quad \Delta H = 180 \cdot 75$ kJ

(*u*) $2SO_2(g)+O_2(g)\rightleftharpoons 2SO_3(g)\ \Delta H=-188{\cdot}30\ kJ$ 4

(*b*) For a reaction in equilibrium, derive the following relation:

$$\Delta G^\circ=-RT\ln K_p \qquad 4_{1/2}$$

(*c*) For dissociation of water, $H_2O\rightleftharpoons H_2(g)+\frac{1}{2}O_2(g)$ at 1500°C, the value of K_p with partial pressure in atmosphere is $1{\cdot}87\times10^{-6}$. Assuming ideal behaviour of gases, calculate the corresponding value of K_c with concentration in moles per litre. 4