RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

SECOND YEAR

B.A./B.SC. FOURTH SEMESTER (January – June), 2012

Mid-Semester Examination, March 2012

Date : 19/03/2012   **CHEMISTRY (Honours)**

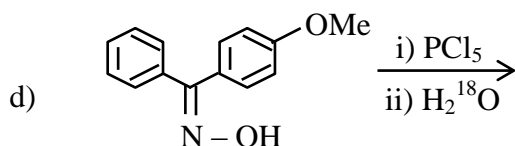Time : 2 pm – 4 pm   Paper : IV   Full Marks : 50
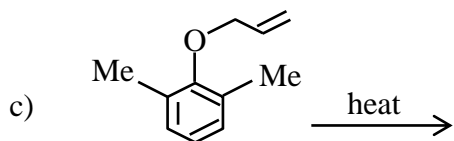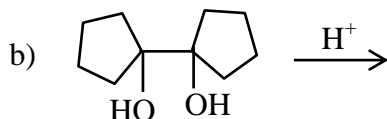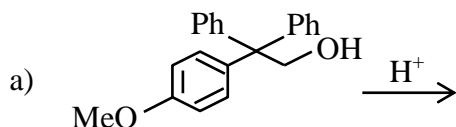
[Use separate Answer Books for each group]
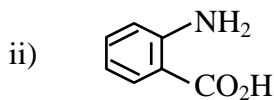
Group – A

(Answer **any two** questions)
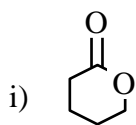
1. What products would you expect from the following reactions?   [2×4]

    a)
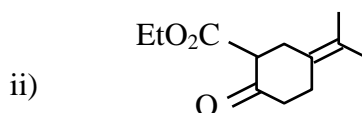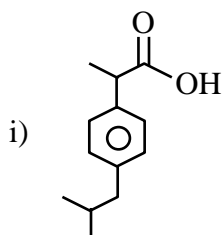
    b)

    c)

    d)

2. a) Outline routes involving rearrangement reactions to the following :   [2×2]
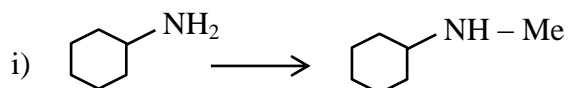
    i)   ii)

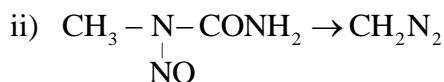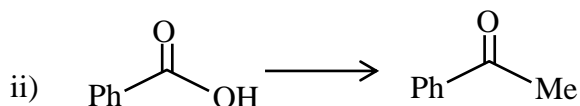   b) Give retrosynthetic analysis and efficient synthesis of the following compounds :   [2+2]

    i)   ii)

3. a) Carry out the following conversions. Give mechanism.   [2×2]

    i)

ii) $\underset{\underset{NO}{|}}{CH_3 - N - CONH_2} \rightarrow CH_2N_2$

b) Carry out the following conversions. Mechanism is not necessary. [2×2]

i)

ii)
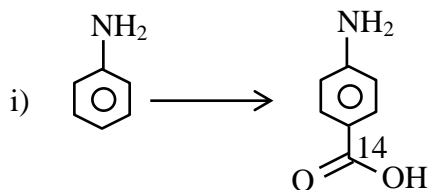
Group – B

(Answer **any two** questions)

4. a) What is Ziegler-Natta catalyst? Using this catalyst what will be the dimerisation product of propene? [2]

b) How Unipositive Aluminium is obtained. [1]

c) Complete the following reaction :

$B_2O_3 + NH_3(g) \rightarrow$ [1]

d) Write down the anomalies of Fluorine. [2]

e) Write notes on (<u>any one</u>) [3]
i) Halides   ii) Hydrides of Halogens

5. a) Amongst the Halogens which one is the strongest oxidising agent and why? [2]

b) In polar solvents solution of Iodine appears brown but in nonpolar solvents becomes violet — Explain. [2]

c) $\Delta G°$ for the hydrolysis of CCl_4 is more negative than that of $SiCl_4$; yet $SiCl_4$ readily hydrolyses but CCl_4 does not. —Explain [3]

d) Among halides of silicon, SiF_4 is incompletely hydrolysed. —Justify. [2]

6. a) Give concise accounts of silicones. [3]

b) Give the explanation for strong bonding of diborane. [2]

c) Explain the chemical inertness of nitrogen. [2]

d) Comment on the heat of formation nitrogen trihalides. [2]

Group – C

7. Answer **any two** questions :

a) Derive the relation between ionic mobility and ionic conductance. [4]

b) i) The specific conductance of 0·1M NaOH solution is 0·221 $ohm^{-1}cm^{-1}$. When an equal volume of 0·1M HCl solution is added to it, the specific conductance falls to 0·0056 $ohm^{-1}cm^{-1}$. Find out for NaCl in the resultant solution. [2]

ii) Plot specific conductance against conductance at different concentrations of an electrolyte in solution. What is the nature of the plot and what information can one obtain from this plot? [2]

c) i) A moving boundary experiment is done to measure the transport number of Li^+ in a 0·01 mol L^{-1} solution of LiCl. In a tube having a cross-sectional area of 0·125 cm^2, the boundary moves by 7·3 cm in 1490 seconds, using a current of 1·8 mA. Calculate t^+. [2]

ii) Arrange the following ions in solution in the increasing order of ionic mobility— Na^+, K^+, Li^+. Give reasons for your answer. [2]

8. Answer **any two** questions :

a) i) "The de Broglie wavelength of the electron moving in the first orbit of the hydrogen atom (Bohr model) is equal to the circumference of the orbit." Justify. [2]

   ii) Arrive at the Rayleigh-Jeans formula from Planck's equation for black-body radiation and explain the terms. [2]

b) i) An X-ray light is scattered from a free electron, which was at rest initially at angle, ϕ. Show that [2]

$$p_{el}^2 c^2 \big/ h^2 = v^2 + v'^2 - 2vv'Cos\phi$$

   ii) Write down the Planck's equation for black-body radiation and explain the spectral distribution curve. [2]

c) i) UV light of wavelength 743.7 A° from a Ne discharge tube falls on a photocathode made of Ni for which work-function is 4.1 eV. Calculate the maximum velocity of electron to reach the anode. [2]

   ii) Comment on the nature of the Compton shift for X-ray, γ-ray and microwave radiation. Explain in favour of your comment. [2]

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