

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2017

FIRST YEAR [BATCH 2016-19]

INDUSTRIAL CHEMISTRY (Honours)

Date : 18/05/2017

Time : 11 am – 3 pm

Paper : II

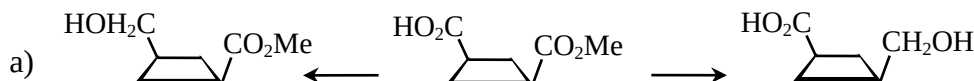
Full Marks : 75

Unit – I

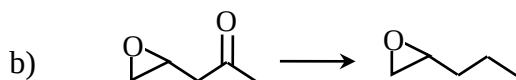
Answer any five questions from Question Nos. 1 to 8 :

[5×5]

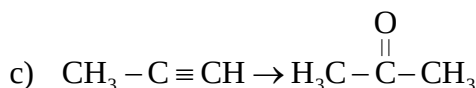
1. Complete the following transformations :



[2]

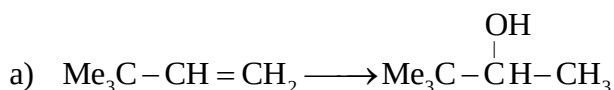


[1·5]

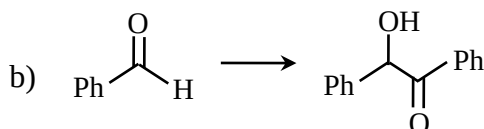


[1·5]

2. Complete the following transformations with detailed mechanism.

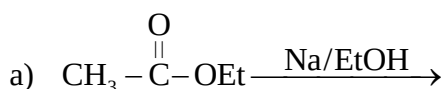


[2·5]

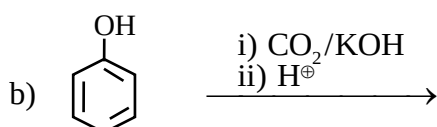


[2·5]

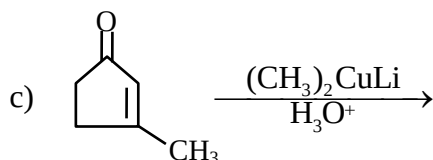
3. Predict the product with stereochemistry (if applicable) of the following reactions.



[2]



[1·5]



[1·5]

4. a) O-nitro benzaldehyde undergoes benzoin condensation but p-nitrobenzaldehyde does not. Explain.

[1·5]

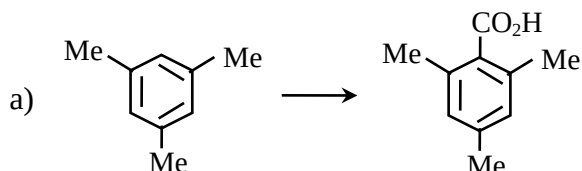
b) Why only HBr addition to unsymmetrical double bond exhibits peroxide effect?

[1]

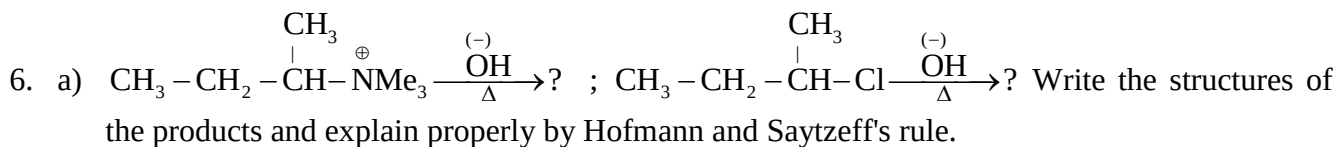
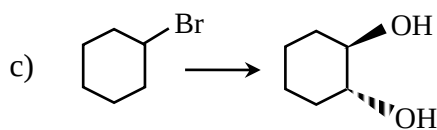
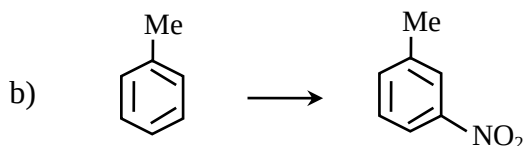
c) Write the products of hydrolysis of (S)-2-bromopropanoate with high and low concentration of hydroxide ion. Justify the stereochemistry of product formation in both cases.

[2·5]

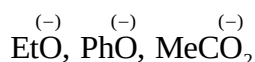
5. Carry out the following transformations (more than one step)



[2]



b) Arrange the following nucleophiles in increasing order of nucleophilicity with proper reason.



[2]

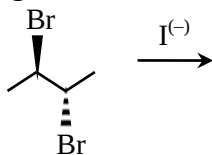
7. a) Mesityric acid does not give esterification product in normal condition but in presence of strong acid in cold condition it gives the product. Explain properly. [1·5]

b) Why hydrated form of tri-chloroethanal is stable? [1·5]

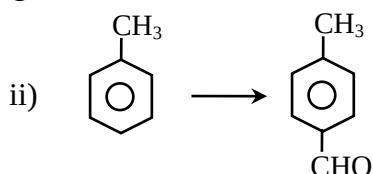
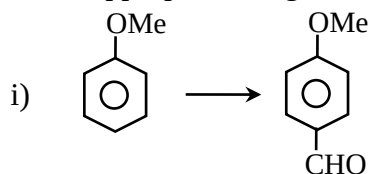
c) Why formation of cyclic ketal is easier than the acyclic one? [2]

8. a) Cis-4-t-butyl cyclohexyl p-tosylate undergoes E^2 reaction with NaOEt/EtOH at 75°C while its trans-isomer does not. Explain. [1·5]

b) Write the product of the following reaction with detailed mechanism. [1·5]



c) Write appropriate reagents for the following conversions. [2]



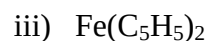
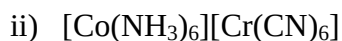
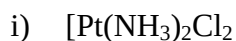
Unit – II

Answer any five questions from Question Nos.9 to 16 :

[5×5]

9. a) Write down the IUPAC name of the following (any two) :

[2×1]



b) What are masking and demasking reagents? How are they used in complexometry titration for the quantitative determination of metal ions in a mixture? [1+2]

10. a) Write down the formula of (i) tetraammineaquachlorocobalt(III) chloride and (ii) tetraamminecobalt(III)- μ -hydroxo- μ -amido-tetramminecobalt(III) ion. [2]

b) How many isomers are possible of the compound : $[\text{Pt}(\text{NH}_3)(\text{NO}_2)(\text{Cl})(\text{Br})]$? Write the structure of each isomer. [3]

11. a) Chelates are more stable than the non-chelated complexes. —Justify. [2]

b) Derive the relation between the stepwise stability constant with the overall stability constant of the complex of formula ML_6 , where L = monodentate ligand. [3]

12. a) Arrange the acidity order of BF_3 , BCl_3 and BBr_3 with proper explanation. [2]
 b) Explain the basicity order of primary, secondary and tertiary amines in gas phase as well as aqueous solution. [3]
13. a) What are the basic characteristics of hard and soft species according to HSAB concept? [2]
 b) Calculate the pH of the solutions : [2×1.5]
 i) 0.1 (N) NH_4OH ii) 0.1 (N) NH_4Cl
 Given K_b for ammonia = 1.8×10^{-5} .
14. a) What is the basicity of H_3BO_3 ? H_3BO_3 is a very weak acid for which no suitable indicator is available but in presence of glycerol it can be titrated easily. —Explain. [1+3]
 b) Mixture of HSO_3F and SbF_5 is stronger acid than HSO_3F^- explain. [1]
15. a) Explain disproportionation and comproportionation reactions with examples. [2]
 b) What is Latimer diagram and what is its utility? [2]
 c) Why KCl is used as salt bridge to eliminate liquid junction potential? [1]
16. Define formal potential. Explain the effect of complex formation and precipitation on formal potential with examples. [1+4]

Unit - III

Answer any five questions from Question Nos. 17 to 24 :

[5×5]

17. a) What is pre-exponential factor? Is it temperature dependant or not? Explain. [1]
 b) The specific rate constant for the second order neutralization of nitropropane by a base is given by $\log K = 11.899 - \frac{3163}{T}$ where conc. is in mole/lit and time in mins. If initial conc. of both reactant is 0.005 (M). Find the values of E and $t_{1/2}$ for this reaction at 25°C. $R = 1.987 \text{ cal/}^\circ\text{mol}$. [4]
18. a) Show the kinetics of acid catalyst reaction. Also explain it at two different conditions. [4]
 b) What is promoter? [1]
19. a) Derive the rate equation, related to Michaelis Menten theory of Enzyme activity and show, $r_0 = k_3[E_0]$. [4]
 b) What is turnover number? [1]
20. a) What is photosensitized reaction and give example. [2]
 b) A gas, when exposed to radiation 3310 Å undergoes decomposition, and per kilocalorie of light energy absorbed 0.0230 mole of the gas is decomposed. Find quantum efficiency.
 [1 cal = 4.18×10^7 ergs; $h = 6.62 \times 10^{-27}$ ergs. sec] [3]
21. a) What is Chemiluminiscence? [1]
 b) Write down all the steps of Hydrogen Bromine reaction. [2]
 c) What is the difference between thermal and photochemical equilibrium? [2]
22. a) Why liquid wet the surface of some solid while others do not? Explain by contact angle. [2]
 b) A liquid 'A' has half the surface tension and twice the density of liquid 'B' at a certain temp. If in a capillary, the rise is 10 cm for 'A', what will be the rise of 'B' at same temperature? [3]

23. a) Discuss how surface tension of a liquid varies with temperature. [2]
 b) What is CMC? Discuss critically about the detergent action in cleaning organic dirt. [1+2]
24. a) State Kohlrausch's law of equivalent conductance. [1]
 b) Molar conductances of BaCl_2 , H_2SO_4 and HCl at infinite dilutions are x_1 , x_2 and x_3 respectively. What will the equivalent conductance of BaSO_4 at infinite dilution? [2]
 c) What is the value of E_{cell} for the system $\text{Cr} | \text{Cr}^{3+} (0.1\text{M}) || \text{Fe}^{2+} (0.01\text{M}) | \text{Fe}$, Given $E^0 \text{Cr}^{3+} | \text{Cr} = -0.74\text{ V}$ and $E^0 \text{Fe}^{2+} | \text{Fe} = -0.44\text{ V}$. [2]

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