RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2016

FIRST YEAR [BATCH 2015-18]

Date : 18/05/2016 **INDUSTRIAL CHEMISTRY (Honours)**

Time : 11 am – 3 pm **Paper :** II Full Marks : 75

[Use a separate Answer Book for <u>each group</u>]

<u>Group – A</u>

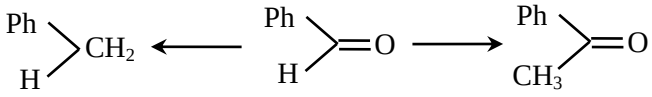
<u>Unit - I</u>

Answer <u>any three</u> questions from question nos. <u>1 to 5</u> : (3 × 5)

1. Complete the following conversions. (2 + 1 + 2)

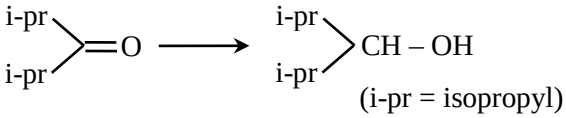
a) 

b) 

c) 

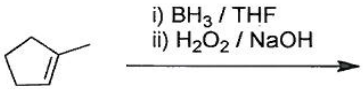
2. Complete the following transformations with detailed mechanism. (2 × 2.5)

a) 

b) 

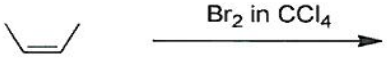
(i-pr = isopropyl)

3. Predict the product with stereochemistry (if applicable) of the following reactions. (1 + 1 + 1 + 1+1)

a) 

b) $Me_3C \equiv CMe_3 \xrightarrow[\text{Lindlar Catalyst}]{H_2}$

c) $CH_3 - CH = CH_2 \xrightarrow[NaBH_4]{\text{i) } Hg(OAC)_2} \xrightarrow[\text{ii) } H_2O]{}$

d) 

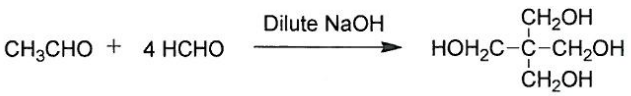
e) $CH_3 - \overset{O}{\overset{\|}{C}} - NH_2 \xrightarrow[\Delta]{KOH,\ Br_2}$

4. a) Write the mechanism for acid catalysed esterification of mesitoic acid. (2)

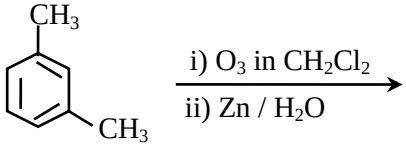
b) What do you mean by intramolecular cannizaro reaction. Explain with an example. (2)

c) Ester hydrolysis is done in both acid and basic medium where as esterification reaction is only done by acidic medium. Explain. (1)

5. a) Provide mechanistic explanation of the following transformations. (2.5)



b) Write the products with proper mechanism. (2.5)



Unit - II

Answer <u>any two</u> questions from question nos. <u>6 to 9</u> : (2 × 5)

6. a) What do you mean by primary valence and secondary valence of a metal ion and also write down the characteristic features of the primary valence and secondary valence of the metal ion? (3)
   b) Write the name of the complex given below according to IUPAC-2005 nomenclature. (1+1)
   $[Co(NH_3)_6][Cr(CN)_6]$ and $[Co(H_2O)(NH_3)_5]Cl_2$

7. a) Define and explain the role of masking and demasking agents in the estimation of iron and copper from their mixture. (3)
   b) Bariumdiphenylaminesulphonate (BDS) is not a suitable indicator for the titration between Fe^{+2} and MnO_4^-. Explain. (2)

   $E^0 Fe^{+3} / Fe^{+2} = 0.77v$; $E^0 Mn0_4^- / Mn^{2+} = 1.51v$

8. a) What is inner metallic complex of first order and second order? Give one example for each of them. (2)
   b) Write the characteristic features for a good metal indicator. (2)
   c) Give examples of ambident ligands. (1)

9. a) Explain the change of molar conductance when glycine is added to an aqueous solution of $CuSO_4$. (2)
   b) Give examples for co-ordination isomerism, ionisation isomerism, Linkage isomerism. (3)

Unit - III

Answer <u>any three</u> questions from question nos. <u>10 to 14</u> : (3 × 5)

10. a) Alcohol on glass will easily spread over the surface, whereas mercury on glass will not spread. Explain properly interm of contact angle. (2)
    b) A capillary tube of internal diameter 0.2 mm is dipped into water. When water rises to 15 cms. Calculate surface tension of water. (assume contact angle as zero) (3)

11. a) What are the differences between lyophilic and lyophobic solvents. (2)
    b) When propionaldehyde is irradiated with light of $\lambda = 3020\,\text{Å}$, it is decomposed to carbon monoxide

    $CH_3CH_2CHO + h\upsilon \longrightarrow CH_3CH_3 + CO$

    The quantum yield of the reaction 0.54 and the light energy absorb is 15000 erg mol in given time. Find out the number of moles of carbon monoxide formed in that time. (3)

12. a) For the reaction, $2\,NO + Cl_2 \longrightarrow 2NOCl$, if the concentration of both reactants doubled, the rate increases eight fold. But on doubling the concentration of chloride alone, the rate only doubles. What is the order of the reaction w.r. to nitric oxide? (3)
    b) What should be the graphical representation of opposing reaction when $k_1 / k_2 = 2$. (2)

13. a) Write down Arrhenius equn. relating velocity constant of a reaction and represent graphically. (2)
    b) The rate constant of a certain reaction is found to be doubled when temperature is raised from 27^0c to 37^0c. Calculate the activation energy of that reaction. (3)

14. a) Derive the 'Nernst equation' for a electrochemical cell. (2)
    b) What do you mean by ionic mobility? (1)
    c) Equivalent conductance at infinite dilution of HCl, NaCl an CH_3COONa are 426.2, 126.5 and 91 $ohm^{-1}\,cm^2$ respectively. Calculate equivalent conductance of CH_3COOH at infinite dilution. (2)

Unit - IV

Answer <u>any one</u> question from question nos. <u>15 & 16</u> : (1 × 5)

15. a) What do you mean by adsorption and partition chromatography? (1)
    b) Name the internal standard to be used for running NMR experiment in aqueous medium. (1)

c) Among $^{4}He_{2}$ and $^{15}N_{7}$ which one will show NMR? Explain. (1)

d) Differentiate between Normal phase HPLC and Reversed phase HPLC. (2)

16. a) What are the applications of HPLC? (2)

b) What is R_f factor? (1)

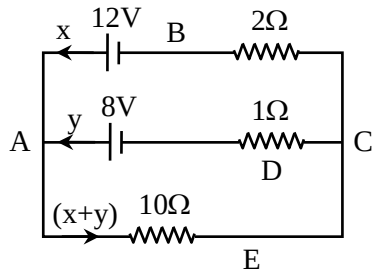
c) What is chemical shift in NMR spectroscopy? (1)

d) What is the advantage of TMS as an internal reference for doing NMR experiment particularly in non-aqueous solvent? (1)

Group – B
Unit-I

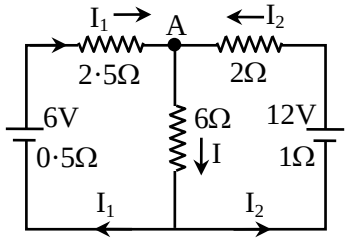
Answer <u>any three</u> questions from question nos. <u>18 to 22</u> : [3×5]

18. a) Two batteries A and B are connected in parallel and load of 10Ω is connected across their terminals. A has an e.m.f. of 12V and an internal resistance of 2Ω; B has an e.m.f. of 8V and an internal resistance 1Ω. Use Kirchhoff's laws to determine the values and directions of the currents flowing in each of the batteries and in the external resistance. Also determine the potential difference across the external resistance. (3)

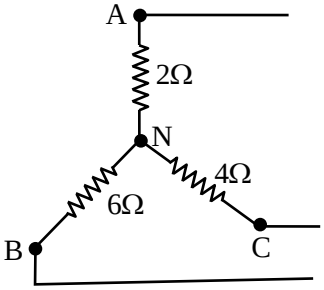


b) Define Maximumm Power Transfer Theorem. (2)

19. a) In the given figure let the battery e.m.f.s be 6V and 12V, their internal resistances 0.5Ω and 1Ω. The values of the other resistances as indicated. Find the different currents flowing in the branches and voltage across 6Ω resistor. Use superposition theorem for solving the problem. (3)

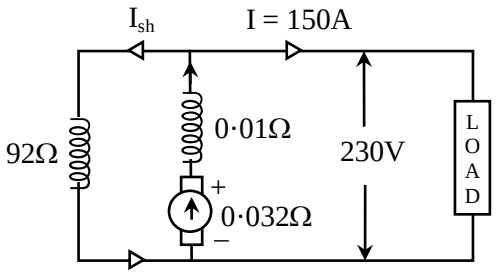


b) Find any <u>two</u> values of resistance in between $\overline{AB}$ or $\overline{BC}$ or $\overline{CA}$. (2)



20. In a long shunt compound generator the terminal voltage is 230V when generator delivers 150A. (5)
Determine (i) Induced e.m.f. (ii) Total power generated
(iii) Distribution of this power
    a) Power lost in armature
    b) Power lost in series field
    c) Power dissipated in shunt field winding
    d) Power delivered to load

It is given that shunt field, series field and armature resistances are 92Ω, 0.01Ω and 0.032Ω respectively.



21. a) What is Crest Factor and find its value. (2)

    b) An 8 pole d.c. shunt generator with 778 wave-connected armature conductors and running at 500 rpm supplies a load of 12.5Ω resistance at terminal voltage of 250V. The armature resistance is 0.24Ω and the field resistance is 250Ω. Find the armature current, the induced e.m.f. and the flux per pole. (3)

22. a) A coil has its resistance value 4Ω and impedance value is 5Ω, then what is the value of power factor. (2)

    b) Draw the external characteristics of a d.c. shunt generator (output voltage / load current). Explain with a circuit diagram the experimental set up for plotting the external characteristics. (3)

Unit-II

Answer <u>any three</u> questions from question nos. <u>23 to 27</u> : [3×5]

23. Explain, with the help of neat diagrams, the advantage of using a 3 wire measuring system/circuit for a Pt – 100 RTD over a 2 wire measuring system/circuit. (5)

24. With a neat labelled sketch explain the construction of a common thermo couple along with its insulation, protection and terminal head. (5)

25. With a neat sketch, write the working principle of a radiation pyrometer or optical pyrometer. (5)

26. What do you mean by variable area type flowmeter? Write the working principle of Orifice meter. (5)

27. Explain in short (in a couple of lines) any 5 of the following: (5)

    a) Compensating Cable
    b) Cold Junction Compensation
    c) Backlash error in Pressure Gauges
    d) Time response of a thermometer
    e) Self heating error of a RTD
    f) Thermo pile
    g) Static characteristics
    h) Capacitance type level measurement for conducting liquids.

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