RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2015

FIRST YEAR

Date : 21/05/2015 **INDUSTRIAL CHEMISTRY (Honours)**

Time : 11 am – 2 pm Paper : II Full Marks : 75

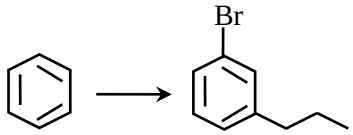
[Use a separate Answer book for each Group]

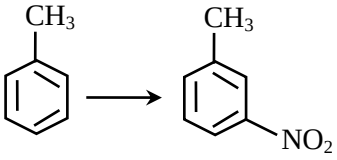
Group – A

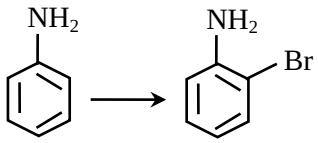
Unit - I

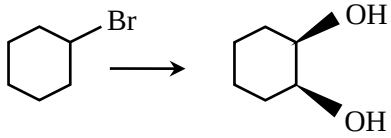
(*Answer **any three** of the following*)

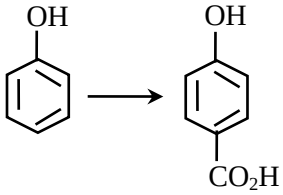
1. Complete the following conversions (more than one step) : [5×1]

a) 

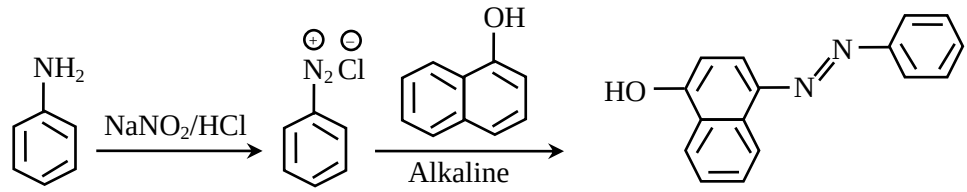
b) 

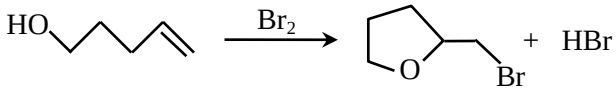
c) 

d) 

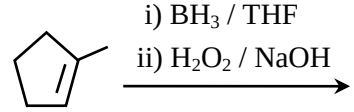
e) 

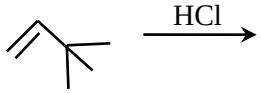
2. Provide the detailed mechanism for the following transformations : [2×2·5]

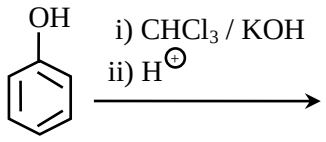
a) 

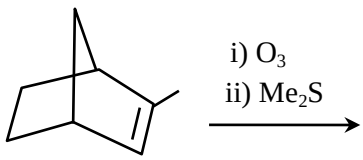
b) 

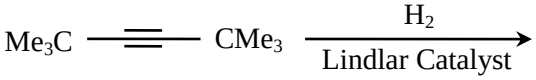
3. Predict the product with stereochemistry (if applicable) of the following reactions. [5×1]

a) 

b) 

c) 

d) 

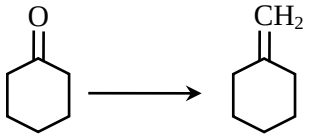
e) 

4. a) How will you carry out the following conversion? [3]

$$Ph-CHO \xrightarrow{??} Ph-CH=CH-CO_2H$$

b) Write down the final product with plausible mechanism : $CH_3CHO + 4HCHO \xrightarrow{OH^{(-)}} ?$ [2]

5. a) Complete the following conversion with proper mechanism. [3]



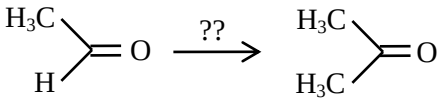
b) Write the structure of the product of the following reaction and explain :

$$(Me_2CH)_2C=O \xrightarrow[(ii)\ H_3O^+]{(i)\ Me_2CHMgBr} ? \qquad [Me \equiv -CH_3]$$ [2]

6. a) Give the mechanism of alkaline hydrolysis of the following esters in ordinary water (H_2O^{16}) and indicate the distribution of O^{18} in the products in each case. [2×1·5]

i) $Ph-\overset{\overset{O}{||}}{C}-\overset{18}{O}-Et$ ii) $Me-\overset{\overset{O}{||}}{C}-\overset{18}{O}-Bu^t$ $[Et \equiv -CH_2CH_3; Bu^t = -CMe_3]$

b) Execute the following conversion : [2]



Unit - II

(*Answer **any two** of the following*)

7. a) State the reasons behind 'chelate effect'. [3]

b) What do you mean by inner metallic complex of second order? Give an example. [2]

8. a) Give IUPAC names of the following compounds : [2]

i) $[Co(NH_3)_6][Cr(CN)_6]$

ii) $Na[Co(CO)_4]$

b) Explain the following reaction : [3]

$$K_2[Pd(SCN)_4] + bpy \xrightarrow{-78°C} \text{Orange yellow Pd} - \text{product} \xrightarrow{\text{heated to } 150°C} \text{Pd-product}$$

changes to light yellow

9. a) Show that the overall stability constant of a complexation reaction can be written as a product of stepwise stability constants. [2]

b) Explain how hardness of water can be determined using Na_2H_2EDTA. [3]

10. a) In 1·0(N) H_2SO_4 medium, calculate the red-ox potential values at the following three stages of titration of 0·1(N) Fe^{2+} with 0·1(N) $KMnO_4$: [3]

i) 25 ml Fe^{2+} + 24·95 ml $KMnO_4$

ii) 25 ml Fe^{2+} + 25 ml $KMnO_4$

iii) 25 ml Fe^{2+} + 25·05 ml $KMnO_4$

[Given : $E^o_{Fe^{3+}/Fe^{2+}} = 0\cdot77$ volt and $E^o_{MnO_4^-/Mn^{2+}} = 1\cdot51$ volt]

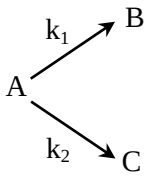
b) During estimation of iron by $K_2Cr_2O_7$ solution Fe^{3+} is reduced to Fe^{2+} by Stannous chloride solution. Explain why is this process mercuric chloride solution is added all at a time to remove slight excess of Sn^{2+}. [2]

Unit - III

(*Answer **any three** of the following*)

11. a) On the basis of Einstein law justify : Quantum yield may be greater or less than 1. [2]

b) An uranyl oxalate actinometer is irradiated for 15 minutes with light of wavelength 4350 Å and oxalic acid equivalent to 12cc of 0·001 molar $KMnO_4$ is found to have been decomposed. The quantum efficiency of the actinometer at this wavelength being 0·58, find out the average intensity of the light used in (i) ergs per sec. and (ii) quanta per sec. [3]

12. a)  Show that at time t, $\frac{[B]_t}{[C]_t} = \frac{k_1}{k_2}$. [3]

b) A first order gaseous reaction is 25% complete in 30 minutes at 227°C and in 10 minutes at 237°C. Calculate the energy of activation. [2]

13. a) What is Schulze-Hardy rule? Explain how Al^{3+} and Na^{+} affect differently on the coagulation property of a lyophobic sol. [3]
    b) Define contact angle. What is the full form of SDS. [2]

14. a) Give that unit of surface tension. [0·5]
    b) Write notes on : (i) Zero order reaction (ii) Zeta potential (iii) Photon [3×1·5]

15. State and Explain Kohlrausch Law of Independent Migration Number. Draw the conductometric titration graph of CH_3COOH vs NaOH.

    The specific conductance of a saturated solution of AgCl is $1{\cdot}55\times10^{-6}$ ohm^{-1}cm^{-1}. The mobilities of Cl^{-} and Ag^{+} are $5{\cdot}6 \times 10^{-4}$ and $6{\cdot}8 \times 10^{-4}$ cm^{2}sec^{-1} volt^{-1} respectively. Calculate the solubility product of AgCl. [2+1+2]

16. a) The equivalent conductance of a weak monobasic acid at infinite dilution is 388·5 mhos.cm^2 equiv^{-1} at 25°C. Find the specific conductance of 0·1(M) solution; the degree of dissociation of which is 6%. [2]
    b) Derive the relation between ionic mobility and ion conductance. [3]

Unit - IV

(*Answer **any one** of the following*)

17. a) What do you mean by chromatography? [2]
    b) Define R_f factor in TLC. [2]
    c) mention two applications of HPLC. [1]

18. a) Write down the advantages of GC. [1]
    b) ^{12}C and ^{16}O are NMR-inactive-nuclei. —Why? [1]
    c) In which region of the electromagnetic radiation the NMR spectra are observed? [1]
    d) Name one detector in HPLC. [1]
    e) Mention two differences between normal phase HPLC and Reversed phase HPLC. [1]

Group – B

Unit – V

(*Answer **any three** of the following*)

19. An alternative current varying sinusoidally with a frequency of 50Hz has an RMS value of 20A. Write down the equation for the instantaneous value and find out this value (a) 0·0025 seconds (b) 0·0125 seconds after passing through a positive maximum value. At what time, measured from the positive maximum value, will the instantaneous current be 14·14A? [5]

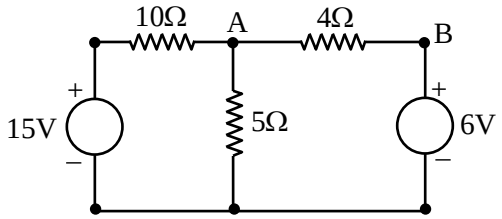
20. Draw a neat sketch of a 3 point d.c motor starter and explain the functions of the 'OLC' and the 'NVC'. [5]

21. A separately excited d.c generator, when running at 1200 rpm supplies 200 amps at 125 V to a circuit of constant resistance. What will be the current when the speed is dropped to 1000 rpm and the field current is reduced to 80%? Armature resistance is $0{\cdot}04\Omega$ and the total drop at the brush is 2V. Ignore saturation and armature reaction. [5]

22. A dc circuit with 6V, having resistance, capacitance & inductance in series. Derive equation for growth and decay of current. [5]

23. Discuss the "Maximum Power Transfer" Theorem and show that maximum power is transferred when $R_L = R_i$, where R_L is the load resistance and R_i is the internal resistance of the circuit. [5]

24. Applying Thevenins theorem, calculate the current through 4Ω resistance of the following circuit. [5]



Unit – VI

(*Answer **any three** of the following*)

25. Draw a neat sketch of 'c' Bourdon type pressure gauge and name the parts. What errors can be encountered during the calibration of this gauge? Do we need cooling of cold junction with ice? [5]

26. Why is cold junction compensation required for a thermo couple? [5]

27. Explain the following terms with respect to a resistance thermometer. [5]
    (a) Accuracy (b) Repeatability (c) Time Response (d) Self Heating (e) Stability

28. Explain the working of a magnetic flowmeter with the help of a neat, labled sketch. [5]

29. Explain the working of a displacer type level measuring device with the help of a neat labled sketch. Can we use U-tube for level meter?

30. Answer **any five** questions : [5×1]
    a) What is back lash error?
    b) What is meant by Gauge Pressure and Absolute pressure? Give the relation between them.
    c) Name any two common materials used for making a Bourdon Tube.
    d) What is the most common material used for making a R.T.D?
    e) What is thermopile?
    f) What is the Dynamic characteristics of any instrument?
    g) Distinguish between Indicators, Recorders and monitors.
    h) Name any two type of 'Panel Boards'.
    i) Name some materials of construction of good thermocouple.

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