

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. SECOND SEMESTER EXAMINATION, MAY 2012

FIRST YEAR

INDUSTRIAL CHEMISTRY (Honours)

Date : 21/05/2012

Time : 11 am – 2 pm

Paper : II

Full Marks : 75

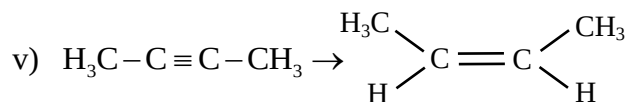
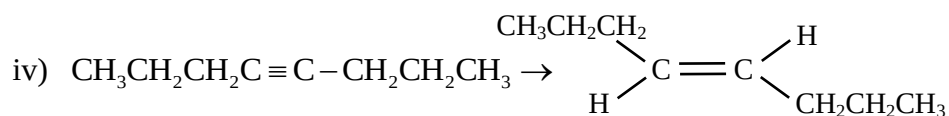
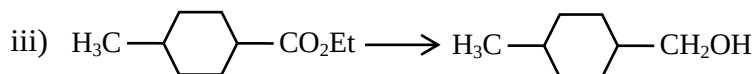
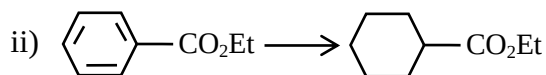
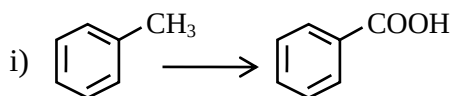
[Use separate Answer Books for each Group]

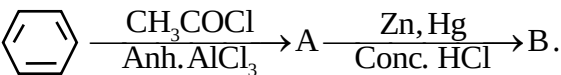
Group - A

Unit – I

(Answer any three questions)

1. a) Suggest a suitable reagent for the following conversions (Reaction not needed) [1×5]



2. a) Synthesize cyclohexene from cyclohexane.
b) Give the alkene products of dehydration of $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$ with relative yields.
c) Complete the reaction : $\text{Me}-\text{C}\equiv\text{CH} + \text{EtMgBr} \rightarrow$ [2+2+1]
3. a) Ozonolysis of one mole of an organic compound produces one mole of glyoxal and two moles of formaldehyde. Identify the compound with proper reason.
b) Predict product (mechanism not required) : $\begin{array}{c} \text{H}_3\text{C} \\ \diagdown \\ \text{C} \\ \diagup \\ \text{H}_3\text{C} \end{array} = \text{CH}_2 \xrightarrow{\text{ICl}} ?$
c) Write the steps for the chain mechanism of the chlorination of methane. [2+1+2]
4. a) Show the steps in industrial preparation of phenol starting with cumene.
b) Convert phenol to aspirin.
c) Write the structures of A and B : $\text{PhCHO} + \text{HCHO} \xrightarrow{\text{NaOH}(50\%)} \text{A} + \text{B}$. [2+2+1]
5. a) Predict product with plausible mechanism: $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \xrightarrow[\text{ii) H}_2\text{O}]{\text{i) Br}_2, \text{P}} ?$
b) Identify A & B for the following reaction :

c) Give an example of a substituent which ortho/para orienting but deactivating in nature. [2+2+1]

6. a) Predict product with plausible mechanism.



- b) Complete the following sequence of reactions : Acetone $\xrightarrow[\Delta]{\text{Ba(OH)}_2}$ A $\xrightarrow{\text{I}_2/\Delta}$ B.

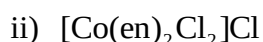
- c) Synthesize m-nitroaniline from nitrobenzene.

[2+2+1]

Unit – II

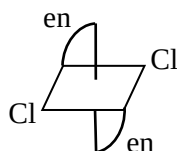
(Answer any two questions)

7. a) Write down the reasons behind chelate effect.
b) Name the following compounds according to IUPAC system.

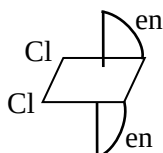


[3+2]

8. a) Discuss how calcium is estimated using EDTA.
b) Write down the characteristics of a metal ion indicator used in complexometric titration.
9. a) Show that the overall stability constant of a complex ML_6 can be written as a product of stepwise stability constants.
b) Discuss the phenomenon of linkage isomerism using an example.
c) Which of the following statements is true and why for the following structures.



(A)



(B)

- i) Both A and B are optically active.
ii) A is optically active but B is not.
iii) B is optically active but A is not.
iv) None is optically active.

[2+2+1]

10. a) Discuss the effect of acidity on redox potential of a system using suitable example.
b) Discuss the role of Zimmermann-Reinhardt solution during the titration of Fe^{+2} ion with KMnO_4 in presence of dilute HCl .

[3+2]

Unit – III

(Answer any three questions)

11. a) Define quantum yield of a reaction. Give an example for low value of quantum yield.
b) Write down a short account on photosensitised reaction.
12. a) Explain using an example how colloidal electrolytes are formed in solution. Discuss the dependence of equivalent conductance of such a colloid with concentration.
b) Define gold number for a colloid.
13. a) Which of the following quantities depend on concentration for an electrolyte and how?
(i) conductance (ii) specific conductance (iii) equivalent conductance and (iv) equivalent conductance at infinite dilution.
b) Conductance of H^+ in aqueous solution is order of magnitude greater than the same for other metal ions. —Explain.
14. a) i) Show that the half life time for an 'n'th order reaction, $t_{1/2} \propto \frac{1}{a^{n-1}}$; 'a' being the initial concentration of the reactant.

[4+1]

- ii) Is the above derivation valid for all 'n' values?
- b) Derive the conditions when a liquid will wet the solid surface. [(2+1)+2]
15. a) i) Draw a typical energy versus reaction coordinate plot for a one step exothermic reaction.
 ii) Show the transition state and the activation energy in the above diagram.
 iii) Explain using the above diagram how would it change in presence of a positive catalyst?
 b) In what way the rate constant is related to temperature? [(2+1+1)+1]
16. a) Starting from Van't Hoff reaction isotherm deduce Nernst's equation for a redox reaction given as $M + ne \rightarrow M^{-n}$.
 b) Given that E° values for Na^+/Na and Cu^+/Cu are $-2.60V$ and $+0.521V$ respectively. Explain whether the following reaction would be spontaneous or not.
 $Na^+ + Cu \rightarrow Na + Cu^+$ [The concentration of Na^+ and Cu^+ both being $0.01gm.equiv/lit$]
 c) Explain what do you mean by standard electrode potential? [2+2+1]

Unit – IV

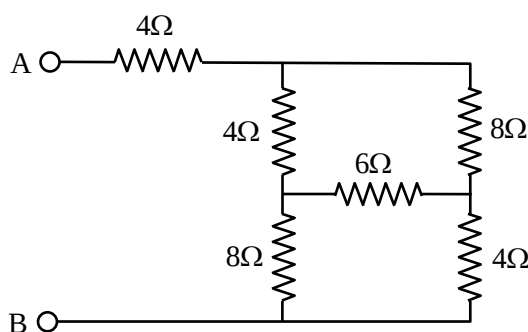
(Answer **any one** question)

17. a) Why does a peak for a particular set of protons in proton NMR split into a multiplet? Give one example.
 b) A compound has a molecular formula C_3H_8O . Assign its structure with the help of following data.
 i) One singlet (hump) at $\delta 2.3$
 ii) Two triplet at $\delta 3.6$
 iii) A sextet at $\delta 1.55$
 iv) Triplet at $\delta 0.9$ [2+3]
18. a) What do you mean by retention factor in chromatography? Can its value be more than 1?
 b) What is the fundamental difference between adsorption and partition chromatography?
 c) Which is the correct increasing polarity order of the solvent?
 i) Petroleum ether < CCl_4 < $CHCl_3$ < H_2O
 ii) H_2O < Petroleum ether < $CHCl_3$ < CCl_4
 iii) $CHCl_3$ < CCl_4 < Petroleum ether < H_2O
 iv) CCl_4 < $CHCl_3$ < Petroleum ether < H_2O [2+2+1]

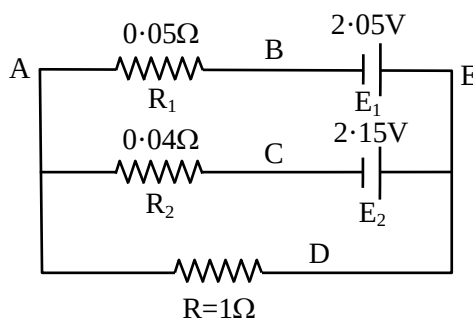
Group – B

(Answer **any three** questions out of 6 questions)

19. a) A 4-pole d.c. motor takes an armature current of $150A$ at $440V$. If its armature circuit has a resistance of 0.15Ω , what will be the value of back e.m.f. at this load? What is speed regulation? [4+1]
 b) How can you control the speed of a d.c. shunt and series motor by controlling its field flux? [5]
 c) i) State Thevenin's Theorem. [1]
 ii) Find out the resistance between the terminals A and B of the given figure: [4]



- d) By using “Superposition Theorem”, find the current in resistance R shown in the figure. Internal resistances of the cells are negligible. [5]



- e) Draw a neat internal drawing of a 4-pole d.c. generator and name its parts. What is the function of the commutator? [4+1]
- f) i) What is the time constant in a series R-C circuit? [1]
 ii) Define peak factor for $v(t) = v_0 \sin wt$. [1]
 iii) How can you generate a.c. (single phase) voltage? [3]

Group – C

(Answer **any three** questions out of 6 questions)

20. a) With neat labeled sketches of the “Glass electrode” and the “Reference Electrode”, explain the working of the pH measuring instrument (pH meter). [5]
- b) Explain why “Cold Junction Compensation” in temperature measurement with a thermocouple, is necessary? How is it achieved? [4+1]
- c) With a neat labeled sketch explain the working of a Bourdon Tube Pressure Gauge. Explain how span adjustment is achieved in this gauge. [4+1]
- d) A corrosive liquid is to be stored in a completely sealed vessel, but its level is to be continuously monitored. Name at least one type of instrument that can measure the level and the measurement recorded. Explain in brief the principle of operation. [5]
- e) Derive an equation for the operating principle of the pitot tube. How are orifice meters and rotameters different from a pitot tube? [5]
- f) Write a short note comparing the differences in the type of information obtained (e.g. shape, size, atomic) while determining molecular and structural information using chromatography, NMR spectroscopy and atomic absorption spectroscopy. [5]

