RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous Degree College with P.G. Section under University of Calcutta)

B.A./B.SC. SECOND SEMESTER EXAMINATION, MAY 2011

FIRST YEAR

Date : 24/05/2011

INDUSTRIAL CHEMISTRY

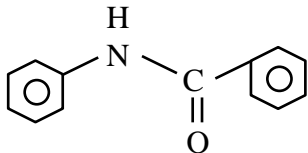Time : 11am – 2pm

Paper : II

Full Marks : 75

[Use separate Answer Scripts for each group]
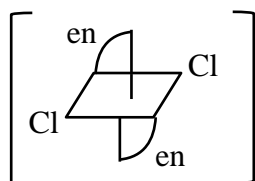
Group – A

Unit – I
(Answer any three questions)

1. Synthesize the following compounds :
   a) Allyl chloride from propane
   b) Propionic acid from ethyl bromide
   c) Acetophenone from benzene   [2+2+1]

2. a) Give open chain stereochemical structures of D(+)-glucose and D(–)fructose.
   b) Both glucose and fructose react with Tollen's reagent— Explain why.
   c) What do you mean by mutarotation? Explain with an example.   [2+1+2]

3. a) Between pyridine and pyrrole which one does undergo nitration at 3-position and why?
   b) Magnitude and direction of dipole moment of pyrrole is quite different from those of furan. Explain.   [3+2]

4. a) Carry out the conversions : PhH $\rightarrow$ *m*-Nitroaniline.
   b) Comment on the relative rate of monobromination of the following compounds and assign reason for the order— (i) $PhCH_3$ (ii) $PhNH_2$
   c) Determine the position of electrophilic substitution in the following compound with reason.   [2+2+1]

5. a) How many different dipeptides can be synthesized from glycine and alanine?
   b) What do you mean by isoelectric point? From the following pK_a values calculate the isoelectric point of alanine.
   $pK_{a1} = 2·34$ & $pK_{a2} = 9·60$
   c) Explain the term denaturation of proteins.   [2+2+1]

6. a) Write down the mechanistic pathway of formation of osazone.
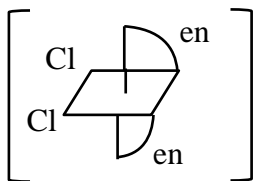   b) Synthesize Phenol from benzene.   [3+2]

Unit – II
(Answer any two questions)

7. a) Show that the overall stability constant for a complex of the type MLx can be represented by
   $K = k_1. k_2. k_3 …k_x$
   b) Discuss the effect of $[H^+]$ on redox potential of a system using a suitable example.   [2+3]

8. a) Give the IUPAC name of the following complexes :
   (i) $Fe[(H_2O)_5NO]SO_4$ (ii) $[Pt(Py)_4][PtCl_4]$

   b) Write down the reason behind chelate effect.   [2+3]

9. a) Which of the statement is true for the following compounds.

        (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.

   b) What are redox indicators? Illustrate with a specific example.

   c) Calculate the equivalent weight of $KMnO_4$ with respect to its mol. wt. M in acid solution.   [2+2+1]

10. a) Explain why Cu^{+2} is precipitated as CuS in Gr.II, but Zn^{+2} is not precipitated there.

    b) Describe how you can estimate Ca^{2+} ion using EDTA.   [2+3]

Unit – III
(Answer any <u>three</u> questions)

11. a) Explain the factor on which the formation of oil in water type emulsion or water in oil type emulsion depends.

    b) Explain using an example how colloidal electrolytes are formed in solution. Discuss the dependence of equivalent conductance of such a colloid with concentration.   [2+3]

12. a) State Hardy-Schulze rule for colloids

    b) One Einstein energy is

    i) $E = \dfrac{2 \cdot 859}{\lambda} \times 10^5 \, cal \, mol^{-1}$

    ii) $E = \dfrac{2 \cdot 859}{\lambda} \times 10^5 \, Kcal \, mol^{-1}$

    iii) $E = \dfrac{2 \cdot 859}{\lambda} \times 10^5 \, Jmol^{-1}$

    iv) $E = \dfrac{2 \cdot 859}{\lambda} \times 10^5 \, KJmol^{-1}$

    c) Which of the following statements is true :
    i) It is the secondary reaction in which absorption of radiation takes place.
    ii) It is the primary reaction in which absorption of radiation takes place.
    iii) The absorption of radiation takes place in both the primary and secondary reactions.
    iv) None of the above.

    d) The quantum yield, ϕ, of photochemical reaction is expressed as—

    i) $\phi = \dfrac{\text{no. of molecules decomposed or formed}}{\text{no. of photons of radiation energy absorbed}}$

    ii) $\phi = \dfrac{\text{no. of molecules activated}}{\text{no. of photons of radiation energy absorbed}}$

    iii) $\phi = \dfrac{\text{no. of molecules of reactants}}{\text{no. of photons of radiation energy absorbed}}$

    iv) none of the above   [2+1+1+1]

13. a)   Illustrate the term transport number of an ion.
    b)   The speed ratio of silver and nitrate ions in a solution of silver nitrate electrolysed between silver electrods is 0·916. Find the transport number of the two ions.
    c)   Deduce the unit of equivalent conductance. [2+2+1]

14. a)   What do you meant by the term 'conductometric titration'?
    b)   Explain the conductometric titration curves when
        i)   strong acid is titrated with a weak base.
        ii)   weak acid is titrated with a strong base. [1+2+2]

15. a)   Give an example of photo induced chain reaction. Illustrate with all the steps involved.
    b)   Define gold number for a colloid. [3+2]

16. a)   Explain the phenomenon of rise of water in a glass capillary dipped in water.
    b)   Write notes on Brownian movement. [3+2]
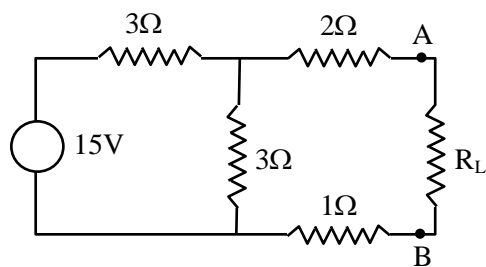
Unit – IV
(Answer any one question)

17. a)   In NMR spectra, the chemical shift values for methyl protons of the methyl halides are in the following order
        $CH_3Br(2·65)$, $CH_3Cl(3·10)$, $CH_3F(4·26)$ Justify
    b)   For proton NMR studies, the accepted reference used is tetramethylsilane. Give reasons behind it.
    c)   What if R_f? [2+2+1]

18. Write a short account on high performance liquid chromatography. [5]

Group – B
(Answer any three questions)

19. a)   State Nortons Theorem.
    b)   In the network shown in the figure, find the value of R_L such that maximum possible power will be transferred to R_L. Find also the value of maximum power and the power supplied by the source under these conditions. [1+4]

20. A 230 V d.c shunt motor runs at 800 rpm and takes armature current of 50A. Find the resistance that is to be added to the field circuit to increase speed to 1000 rpm at an armature current of 80A. Assume flux proportional to field current. Armature resistance = 0·15Ω and field winding resistance = 250Ω. [5]

21. With a neat sketch explain Ward-Leonard System of speed control of a d.c motor. [5]

22. An alternating current varying sinusoidally with 50Hz has an RMS value of 20A.
    Write down the equation for the instantaneous value and find this value at—
    a)   0·0025 seconds
    b)   0·0125 seconds
    after passing through the positive maximum value. [5]

23. A 4-pole, 220 V, d.c shunt generator has an armature resistance of 1 ohm, shunt field resistance of 220 ohms. The generator supplies power to a 10 ohm resistor. Calculate the generated e.m.f of the generator if the load voltage is to be maintained at 220 volts. Assume contact drop at brushes = 2 volts.

24. Find out the rms value and the average value of a periodic function $v(t) = V_0 \sin \omega t$ [2·5+2·5]

Group – C

(Answer any <u>three</u> questions)

25. a) Write short notes on
      (i) Accuracy   (ii) Sensitivity
   b) Differentiate between static characteristics of instruments and their dynamic characteristics.   [2+3]

26. List four direct methods of measuring liquid level in a chemical process industry. Explain any one of them in detail.   [2+3]

27. Draw a two-lead measuring circuit using a resistance thermometer. Explain why a three-lead measuring circuit is preferred over a two-lead circuit.   [1+4]

28. Explain, with a neat labelled sketch, how flow rate of liquid is measured using magnetic flow meter. [3+2]

29. With a neat labelled sketch, explain how the various calibration adjustments are done in a Bourdon Tube Pressure Gauge.   [3+2]

30. a) Name an instrument that can be used for qualitative & quantitative measurement of a liquid mixture containing Benzene, Toluene & Xylene.
   b) With a neat labelled sketch explain the working of any one detector used in chromatography.   [1+4]