FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Degree Examination, November 2016

CH3C07 - Physical Chemistry II

(2015 Admission onwards)

Max. Time: 3 hours   Max. Weightage: 36

Section A

Answer all questions

Each question carries 1 weightage

1. Show that molecular partition function is the product of the partition function for the various degrees of freedom.

2. Rationalize third law of thermodynamics using statistical concept.

3. Define rotational temperature. What is its significance?

4. 'Electrons would never follow Maxwell Boltzmann Statistics'. Justify the statement.

5. Explain the terms local equilibrium and steady state with reference to irreversible thermodynamics.

6. Define Soret coefficient. Explain its significance.

7. Distinguish between primary and secondary salt effect.

8. Explain why conventional methods are inadequate for studying fast reactions.

9. Explain the term potential energy surfaces.

10. Distinguish between "activation controlled" and "diffusion controlled" reactions.

11. Explain the term isosteric heat of adsorption.

12. What is the principle of Auger spectroscopy?

13. Distinguish between specific and general acid catalysis.

14. Explain the effect of pH on enzyme catalysed reactions.
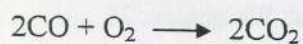
$14 \times 1 = 14$ Weightage

Section B

Answer any Seven questions.

Each question carries 2 weightage.

15. Derive an equation for the rotational partition function.

16. Describe the Einstein's theory of heat capacity of atomic crystals.

17. Discuss briefly the "free volume theory" of liquids.

18. Derive an equation for the rate of entropy production in a system with heat transport only.

19. Explain briefly Rice Herzfeld mechanism of organic decomposition reactions.

20. Following absolute rate theory derive an expression for the rate constant of a bimolecular reaction.

21. Explain the principle of crossed molecular beams.

22. Using one of the models, discuss oscillating chemical reactions.

23. Discuss briefly any one experimental method for studying solid surfaces.

24. Compare the Langmuir-Hinshelwood and Eley-Rideal mechanism using the reaction

$$2CO + O_2 \longrightarrow 2CO_2$$

$7 \times 2 = 14$ Weightage

Section C

Answer any Two questions.

Each question carries 4 weightage.

25. Formulate Bose Einstein distribution law. Explain the application of Bose Einstein condensation to liquid helium.

26. Define Electro kinetic phenomena. How would you rationalize electrokinetic properties using irreversible thermodynamics?

27. a) Give an account of the Lindemann theory of gaseous unimolecular reactions. Discuss the success and limitations of the theory.

b) Explain the general features of chain reactions. Derive an expression for the branching chain reactions and deduce the conditions for the explosion limits.

28. a) Derive BET adsorption isotherm.

b) For the adsorption of N_2 on a solid (one gram) at 75K, the BET isotherm has an intercept of 0.034 and a slope of 1.23×10^{-2}. The cross sectional area of N_2 is $0.16nm^2$. Calculate the surface area of the solid?

$2 \times 4 = 8$ Weightage

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Degree Examination, November 2016

CH3C08 - Inorganic Chemistry II

(2015 Admission onwards)

Max. Time: 3 hours   Max. Weightage: 36

Part A

(Answer *all* questions. Each question carries *1 weightage*)

1. Write the ground term symbols for Vanadium (III) and Cobalt (II).

2. Explain why hexaaquamanganese (II) ion is pale pink colour.

3. $[FeF_6]^{3-}$ is colorless whereas $[CoF_6]^{3-}$ is coloured. Explain.

4. How does antiferromagnetic property vary with temperature? Explain.

5. Calculate the spin only magnetic moment for (a) $K_4[Mn(CN)_6]$ and (b) $[Cr(H_2O)_6] SO_4$

6. What is cis effect?

7. What are anation reactions?

8. What are metal complex sensitizers?

9. Write Fuoss-Eigen equation? Explain the terms.

10. Explain photoaquation reaction with an example.

11. How ESR spectroscopy can be used to distinguish between Cu (I) and Cu (II) in complexes? Explain.

12. How Zeise's salt prepared? Give its structure.

13. What are carbyne complexes? Give one example.

14. What are metalloenzymes? Give one example.

(14×1=14 weightage)

Part B

(Answer any *seven* questions. Each question carries *2 weightage*)

15. Discuss the charge transfer transition. How is it differ from d-d transition?

16. Explain the principle of determination of magnetic susceptibility of a complex by Gouy method?.

17. Discuss the theories of trans effect.

18. Explain Taube mechanism of electron transfer reactions in complexes.

19. Discuss the special characteristics of vitamin B₁₂ which differentiate it from other vitamins.

20. Write a note on photochemical reactions of chromium complexes.

21. Write a note on metal carbene complexes.

22. Discuss the role of Na, K and Ca in biological system.

23. State and explain 18-electron rule as applied to organometallic compound.

24. How IR spectroscopy can be used to identify terminal and bridging carbonyl groups in metal complexes?

(7×2=14 weightage)

Part C
(Answer any *two* questions. Each question carries *4 weightage*)

25. Discuss the different mechanisms of substitution reactions in octahedral complexes.

26. How ferrocene is synthesized? Give its structure, bonding and properties.

27. Discuss the general structural features of Fe-S proteins and their role in biological systems.

28. Discuss the principle involved in Mossbauer spectroscopy. How is it useful in the study of iron complexes?

(2×4=8 weightage)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Degree Examination, November 2016

CH3E01 - Synthetic Organic Chemistry

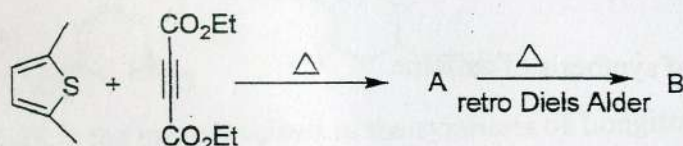(2015 Admission onwards)

Max. Time: 3 hours   Max. Weightage: 36

PART A

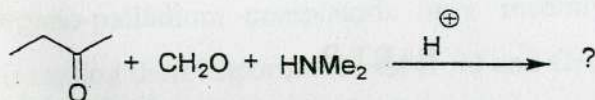(*Answer* all *questions. Each question carries* 1 *weightage*)

1. How will you bring about the following conversion successfully using a suitable protecting group?
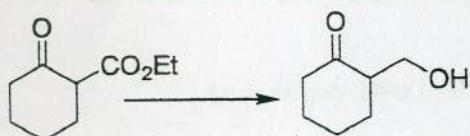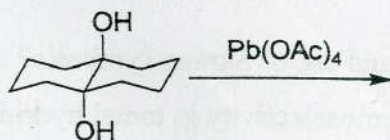

2. Give the products **A** and **B** of the following reaction

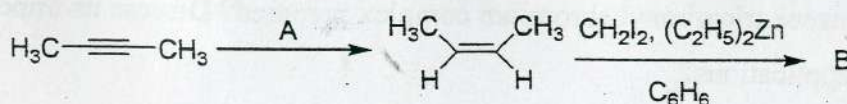3. Predict the product of the following reaction :-

4. Show how nucleophilic and electrophilic nitrogen species are used in making C–N bonds.

5. How would you synthesize isoquinolines by Bischler-Napieralski synthesis?

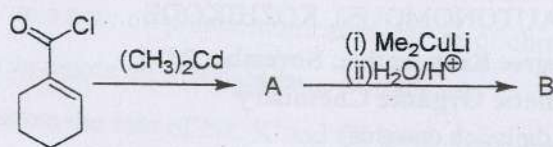6. Indicate the expected products of the following reaction:-
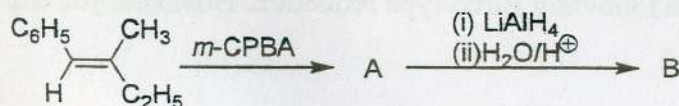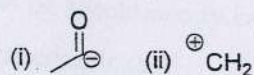

7. Predict the product of the following reaction :

8. Suggest the suitable reagent **A** and product **B** for the following reaction

9. Give the products **A** and **B** of the following reaction

10. Suggest a suitable synthetic reagent for the following synthons:-

(i)   (ii)

11. Give an application of 1,3-dipolar addition reaction for the synthesis of cyclic compound.

12. Write an example of organo iron (Fe) reagent and indicate its use.

13. Discuss the mechanism by which tri-n-butyl tin hydride (Bu_3SnH) bring about the following synthetic transformation.
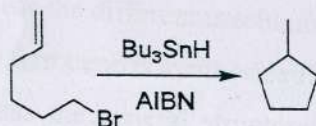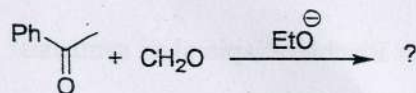

14. Discuss any one method of synthesis of caffeine.
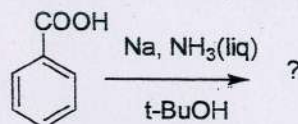
$(14 \times 1 = 14 \text{ weightage})$

PART B

*(Answer any **seven** questions. Each question carries **2** weightage)*

15. Predict the product for the following reaction and suggest a suitable mechanism.

16. Predict the product in the following Birch-type reduction. How will you explain the formation of the product?


17. What is the mechanism and use of Skraup synthesis?

18. Write a brief note on chemoselectivity in metal hydride reductions.

19. Illustrate the use of SeO_2 and **NBS** in functionalisation of organic compounds.

20. How is benzene tricarbonyl chromium complex prepared? Discuss its important synthetic applications?

21. Describe the salient steps in the synthesis of cephalosporins.

22. Suggest a synthetic method each for guanine and thymine heterocycles.

23. Indicating the umpolung synthon and reagent, give the retrosynthetic analysis and the corresponding synthesis of the following compound:
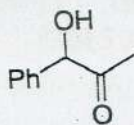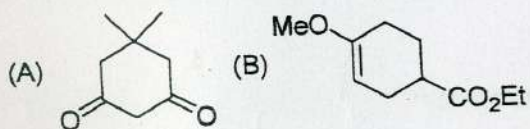

24. Briefly explain the general strategy of protecting amino groups and carboxyl groups in organic synthesis?

$(7 \times 2 = 14$ weightage)

PART C

(*Answer any* **two** *questions. Each question carries 4 weightage*)

25. Use retrosynthetic analysis to suggest synthesis of the following:

(A)   (B)

26. Outline the steps involved in the synthesis of Longifolene and discuss the key steps involved in it.

27. Organo-palladium compounds have recently found extensive usage. Justify by discussing their important **C–C, C–O** and **C–N** bond forming reactions.

28. Explain the general methods for the synthesis of the following heterocycles:-

   (i)   Oxazole

   (ii)   Furanones

   (iii) Caffeine and

   (iv)   Pyrazine

$(2 \times 4 = 8$ weightage)