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2M2M21350   (Pages : 2)   Reg. No:...........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Second Semester M.Sc. Degree Examination, March/April 2021
MCH2C05 – Group Theory and Chemical Bonding
(2020 Admission onwards)

Time: 3 hours   Max. Weightage :30

Section A Short Answer
Answer 8 Questions out of 12.
Each question carries a weightage of 1

1. All cyclic groups are Abelianbut all Abelian groups are not cyclic. Why?

2. State great orthogonality theorem? describe its importance

3. What are the importance of character tables in group theory

4. Construct character table for C_2V point group

5. What are vanishing and non–vanishing integrals

6. What is SALC and how it is constructed using projection operator

7. What is projection operator? What are its significance

8. What are group orbitals? Give example

9. State and explain Born – Oppenheimer approximation. What are its significances

10. Draw MO diagram for NO and calculate its bond order

11. State and explain non-crossing rule

12. What is meant by free valence? How it is calculated for Carbon

(8 x 1 = 8 weightage)

Section B Short Essay
Answer 4 Questions out of 7.
Each question carries a weightage of 3

13. How we can solve linear equations by the method of matrices

14. What do you mean by reduction formula and how it can be used for the reduction of reducible representations

15. How Mulliken symbols are assigned for irreducible representations?

16. Explain mutual exclusion principle of the IR and Raman modes of a centrosymmetric molecule by group theory

17. Construct MO diagram for HCHO (C_2V point group) and find the possible electronic transitions

18. How we can construct hybrid orbitals using group theory

19. Construct the wave functions for the sp^2 hybrid orbitals and predict the structure

(4 x 3 = 12 weightage)

Section B Essay
Answer 2 Questions out of 4.
Each question carries a weightage of 5

20. Explain briefly on various symmetry operations present in molecules and how this will help for obtaining the point group of that molecule.

21. Obtain the normal modes of vibration for NH_3 and H_2O molecules

C_{2v}	E	C_2	$\sigma_v(xz)$	$\sigma_v'(yz)$			
A_1	1	1	1	1	z	x^2, y^2, z^2	
A_2	1	1	−1	−1	R_z	xy	
B_1	1	−1	1	−1	x, R_y	xz	
B_2	1	−1	−1	1	y, R_x	yz	

C_{3v}	E	$2C_3$	$3\sigma_v$			
A_1	1	1	1	z	x^2+y^2, z^2	
A_2	1	1	−1	R_z		
E	2	−1	0	$(x, y)(R_x, R_y)$	(x^2-y^2, xy)	

22. Outline the solution for the Schrodinger equation for H_2 molecule using valence bond theory. Also, explain how it changes with the singlet and triplet state

23. Obtain the π molecular orbitals of 1,3-butadiene using Huckel Molecular Orbital (HMO) theory and find the π bond order between all carbon atoms.

(2 x 5 = 10 weightage)

2M2M21351 (Pages : 2) Reg. No:...........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Second Semester MSc Degree Examination, March/April 2021
MCH2C06 – Coordination Chemistry
(2019 Admission onwards)

Time: 3 hours

Max. Weightage :30

Section A Short Answer
Answer 8 Questions out of 12.
Each question carries a weightage of 1

1. Differentiate between facial and meridional isomers with examples.

2. $[Ni(tetramine)_3]^{2+}$ or $[Ni(en)_3]^{2+}$, which is more stable and why?

3. Give any two limitations of Sidgwick theory.

4. Explain the hybridisation involved and magnetic property of $[ZnCl_4]^{2-}$.

5. Which type of transitions is involved in MnO_4^-?

6. Discuss how magnetic susceptibility of paramagnetic materials vary with temperature.

7. Explain the infrared spectra of $[Cu(NH_3)_4]$ complex.

8. With the help of NMR spectroscopy, explain the formation of Copper Schiff base complex.

9. Explain Fuoss-Eigen equation.

10. What are labile and inert complexes?

11. What are prompt and delayed reactions?

12. What are metal complex sensitizers?

(8 x 1 = 8 weightage)

Section B Short Essay
Answer 4 Questions out of 7.
Each question carries a weightage of 3

13. What is EDTA? What is its denticity? Account for the stability of M-EDTA complex according to thermodynamic aspects.

14. Explain in detail the different factors affecting the crystal field splitting in metal complexes.

15. Discuss orbital contribution to magnetic moment of complexes with examples.

16. Explain Mossbauer Spectroscopy with examples.

17. Explain the two theories of trans effect

18. Explain Photoisomerisation and photoracemisation reactions.

19. Account for the cis-trans isomerism in coordination complexes.

(4 x 3 = 12 weightage)

Section B Essay
Answer 2 Questions out of 4.
Each question carries a weightage of 5

20. Account for Molecular orbital theory in complexes. Discuss on MO diagram of octahedral, tetrahedral and square planar complexes.

21. Explain how Infrared spectra is helpful in the structural elucidation of metal complexes by giving suitable examples.

22. Discuss in detail the different mechanisms involved in ligand substitution reactions in metal complexes.

23. Explain in detail the photochemical reaction of metal complexes.

(2 x 5 = 10 weightage)

2M2M21352   (Pages : 2)   Reg. No:..........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Second Semester M.Sc Degree Examination, March/April 2021

MCH2C07 – Reaction Mechanisms in Organic chemistry

(2020 Admission onwards)

Time: 3 hours   Max. Weightage :30

Section A Short Answer
Answer 8 Questions out of 12.
Each question carries a weightage of 1

1. Propose a mechanism for the solvolysis of 3-bromo-2,3-dimethylpentane in ethanol.

2. Give two examples each for E^i elimination and conjugate elimination.

3. Explain the stereochemistry of E2 elimination reaction to form an alkene.

4. Write the examples for the formation and reactions involving nitrene intermediate.

5. Discuss the Ritter reaction.

6. Write the mechanism of Ene reaction.

7. Identify the product and write the mechanism of thermal isomerisation of 3-hydroxyhexa-1,5-diene.

8. What product would be formed upon irradiation of cyclopentene and cyclopent-2-ene-1-one. Write the mechanism?

9. What is mean by photoxygenation?

10. Write a brief note on Hoffmann-Loeffler-Freytag reactions.

11. Rationalize that the Barton reaction is an example of a remote functionilization.

12. Discuss the structure of steroids.

(8 x 1 = 8 weightage)

Section B Short Essay
Answer 4 Questions out of 7.
Each question carries a weightage of 3

13. (a) The solvolysis of   in acetic acid would be expected to be faster. Why? (b) Discuss $S_{RN}1$ reaction and write the mechanism.   (1+2)

14. Predict the product of elimination of HBr from meso and dl pair of 1,2-dibromo-1,2-diphenylethane. Justify your answer.

15. Discuss the stability, generation and reactions of carbanion.

16. Identify the reagents and write the tandem steps involved in the following conversion.

17. How would you employ base catalyzed reaction for the preparation of the following compound and write the mechanism of the reaction.
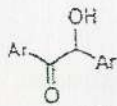

18. Explain stereochemistry and regioselectivity of Diels Alder reaction by citing suitable example.

19. Demonstrate the structural elucidation of Quinine.

(4 X 3 = 12 weightage)

Section B Essay
Answer 2 Questions out of 4.
Each question carries a weightage of 5

20. a) Discuss the effect of (i) Substrate structure, (ii) Nature of nucleophile, and (iii) Solvent on aliphatic nucleophile substitutions.

b) Write the mechanisms and show the expected products of reaction of

p-Bromotoluene and sodium amide.   (3 + 2)

21. Write the mechanism of the following reaction.

a) Darzen. b) Reformatsky c) Knoevenagel, d) Cannizzaro and e) Wittig .

22. Discuss

(a) Norish I and II photocleavage, (b) Photorearrangement of cyclohexadienone,

(c) Intermolecular photoreduction and

(d) Photoreaction used to make three-membered ring.   (2+1+1+1)

23. What are salient steps involved in synthesising following molecule during the total synthesis of Reserpine?
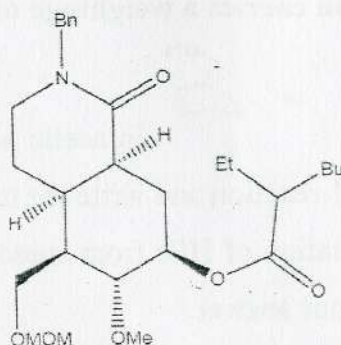
(2 X 5 = 10 weightage)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Second Semester M.Sc Degree Examination, March/April 2021

MCH2C08 – Electrochemistry, Solid State Chemistry & Statistical TD

(2020 Admission onwards)

Time: 3 hours   Max. Weightage :30

Section A Short Answer
Answer 8 Questions out of 12.
Each question carries a weightage of 1

1. Write electrode reaction in calomel electrode. Why it is selected as a reference electrode

2. What is oxygen over voltage

3. Write down the Tafel equation. Explain the terms

4. Write down the electrode reaction for H_2-O_2 under acidic conditions

5. List the seven crystal systems

6. How cooper pair formation contributes to the conductivity

7. Define Piezoelectric effect

8. What is meant by birefringence

9. Find characteristic temperature of HCl, fundamental vibrational

10. Explain equipartition principle

11. Write down the expression for entropy in terms of partition function

12. Compare the properties of Bosons and Fermions

(8 x 1 = 8 weightage)

Section B Short Essay
Answer 4 Questions out of 7.
Each question carries a weightage of 3

13. The e. m. f. of the cell Pt│H2(1b)│HCl (.01M)│AgCl$_s$│Ag , was 0.3524 V at 25 °C. Calculate the mean ionic acticity coeffecient of 0.01M HCl. The standard potential of Cl-│AgCl│Ag is 0.2224 V

14. Discuss principles of polarography

15. Derive Butler-Volmer equation and its significance

16. Draw stereographic projection for mmm

17. Give a short note on Band theory of solids

18. What is Hall effect. give two applications?

19. Discuss Debye modification of heat capacity of solids

(4 x 3 = 12 weightage)

Section B Essay
Answer 2 Questions out of 4.
Each question carries a weightage of 5

20. Derive Debye Huckel Limiting law, discuss its significance

21. Discuss briefly imperfections in solids

22. Derive

    (a) vibrational partition function

    (b) internal energy in terms of partition function

    (c) S = klnw

23. Apply Fermi Dirac statistics for electrons in metals and explain.

(2 x 5 = 10 weightage)