

647510

BSc5CheC501x

Seat No : _____

B.Sc. Semester - 5 (CBCS) Examination
Oct/Nov - 2021 (NEW COURSE)
Inorganic and Industrial Chemistry (Core)

Marks: 70

Time: 2:30 Hours

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

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- Q. 1 (A) Answer the following question. (04)
(1) Find out the degeneracy of a particle moving in a cubic box length at the energy level $E = 9h^2/8ma^2$.
- Q.1 (B) Answer the following questions. (Any two) (10)
(1) Discuss structure of $Fe_2(CO)_9$.
(2) Derive the normalized wave function for a particle moving in one dimensional box.
(3) Discuss different types of CO groups in metal carbonyl.
- Q. 2 (A) Answer the following question. (04)
(1) Give classification of Fertilizers.
- Q. 2 (B) Answer the following questions. (Any two) (10)
(1) Explain Prilling method for the production of ammonium nitrate with process flow diagram.
(2) Discuss different types of cement (any ten).
(3) Discuss ISI specification of cement.
- Q. 3 (A) Answer the following question. (04)
(1) CFSE value of $[Co(CN)_6]^{-3}$ is -26520 cm^{-1} and d orbital splitting energy is 34800 cm^{-1} . Find out pairing energy (P).
- Q. 3 (B) Answer the following questions. (Any two) (10)
(1) Prove that splitting of d-orbitals is approximately half and inverse in tetrahedral complexes as compared to octahedral complexes.
(2) Discuss different types of glass (any ten).
(3) Discuss dry process for hydrogenation of oils.
- Q. 4 (A) Answer the following question. (04)
(1) Draw the structure and write number of bridged and terminal CO group in $Ru_2(CO)_9$ & $Co_4(CO)_{12}$.
- Q. 4 (B) Answer the following questions. (Any two) (10)
(1) If $Ir_4(CO)_{12}$ & $Os_4(CO)_{16}$ follow 18 electron rule then find out number of M-M bonds.
(2) Explain Sindri method for the production of Urea.
(3) Discuss factors affecting the crystal field splitting energy.
- Q. 5 (A) Answer the following question. (04)
(1) Prove that $[NiCl_4]^{-2}$ is tetrahedral while $[Ni(CN)_4]^{-2}$ is square planer.
- Q. 5 (B) Answer the following questions. (Any two) (10)
(1) Explain normalization & orthogonality of wave function of the particle in one dimensional box.
(2) Discuss properties of cement.
(3) Explain Saponification value.

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BSCInoCC5010
B.Sc. Semester - 5 (CBCS) Examination
Oct/Nov. - 2018
INORGANIC AND INDUSTRIAL CHEMISTRY (CORE)

Seat No: 504008
0531185
0531191
Marks: 70

Time: 2:30 Hours

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

- Que-1 (A) Answer the following question. (04)
(1) Differentiate: High spin and Low spin complex with example. (10)
(B) Answer the following questions. (Any two)
(1) Explain splitting of d-orbital in octahedral field with CFSE.
(2) Discuss the factors affecting crystal field stabilization energy.
(3) Splitting energy (Δ_0) of d-orbital in $[\text{Fe}(\text{CN})_6]^{4-}$ is 32500 cm^{-1} and pairing energy is 17500 cm^{-1} . Find out CFSE and Magnetic moment. [$1 \text{ kJ/mole} = 83.7 \text{ cm}^{-1}$]
- Que-2 (A) Answer the following question. (04)
(1) Explain types of CO groups in metal carbonyls. (10)
(B) Answer the following questions. (Any two)
(1) Explain how IR spectroscopy is useful in the study of metal carbonyls.
(2) Explain structure of $\text{Fe}(\text{CO})_5$.
(3) Discuss the nature of M-NO bond in linear metal nitrosyls.
- Que-3 (A) Answer the following question. (04)
(1) Write a note on raw materials used for manufacturing of glass. (10)
(B) Answer the following questions. (Any two)
(1) Derive the Normalized wave function for a particle moving in one dimensional box
(2) Briefly discuss degeneracy.
(3) Discuss different types of glass.
- Que-4 (A) Answer the following question. (04)
(1) Write a note on RCC. (10)
(B) Answer the following questions. (Any two)
(1) Discuss manufacturing of Portland cement with reactions.
(2) Explain setting and hardening of Portland cement with chemical reactions.
(3) Discuss properties of cement.
- Que-5 (A) Answer the following question. (04)
(1) Discuss classification of fertilizer. (10)
(B) Answer the following questions. (Any two)
(1) Explain Sindri method for the production of Urea.
(2) Describe manufacture of normal super phosphate by Den process with flow diagram.
(3) Discuss the role of micro nutrients in plant growth.

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BSCInoCC5010

Seat No: 519665

B.Sc. Semester - 5 (CBCS) Examination

March/April- 2019

INORGANIC AND INDUSTRIAL CHEMISTRY (CORE)

Time: 2:30 Hours

Marks: 70

Instructions:

- All questions are compulsory.
- Figures to the right indicate marks.

- Que-1 (a) Answer the following question. (04)
 Splitting energy of d orbital in $[\text{Fe}(\text{CN})_6]^{4-}$ is 33400 cm^{-1} and pairing energy is 18600 cm^{-1} .
 Find out CFSE and magnetic momentum. (10)
- (b) Answer any two questions. (10)
- Prove that $[\text{Ni}(\text{CN})_4]^{2-}$ is square planer and $[\text{NiCl}_4]^{2-}$ is tetrahedral.
 - Explain splitting of d-orbitals in tetrahedral field.
 - Explain low spin and high spin complexes by pairing energy.
- Que-2 (a) Answer the following question. (04)
 Explain the complex containing bent-nitrosyls. (10)
- (b) Answer any two questions. (10)
- Explain reaction of metal carbonyl with F_2 , H_2 and NO .
 - Explain preparation, properties and structure of $\text{Mn}_2(\text{CO})_{10}$.
 - Explain chemical properties and structure of pentacarbonyl iron.
- Que-3 (a) Answer the following question. (04)
 Explain borosilicate and fiber glass. (10)
- (b) Answer any two questions. (10)
- A particle having $1.67493 \times 10^{-27} \text{ kg}$ mass is moving from the lowest energy level to next level of a cubic box of length 2 \AA . Calculate the wavelength of absorbed energy in A° unit. ($h = 6.626 \times 10^{-34} \text{ joule sec}$, $c = 3 \times 10^8 \text{ m/s}$)
 - Discuss raw materials used for manufacturing of glass.
 - Derive wave equation and energy equation for a particle moving in three dimensional box.
- Que-4 (a) Answer the following question. (04)
 Explain burning step with equation in the manufacturing of cement. (10)
- (b) Answer any two questions. (10)
- Explain mixing of raw material in the manufacturing of cement.
 - Explain ISI specification of cement.
 - Explain mortar, concrete and use of concrete.
- Que-5 (a) Answer the following question. (04)
 Explain role of primary nutrients in plants. (10)
- (b) Answer any two questions. (10)
- Explain manufacturing of urea by sindri process and action of urea as a fertilizer.
 - Explain manufacturing of CaCN_2 .
 - Explain mix fertilizer with grade.

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BSc5CheC501x

Seat No : _____

**B.Sc. Semester - 5 (CBCS) Examination
December -2020 (NEW COURSE)
Inorganic and Industrial Chemistry(Core)**

Time: 1:30 Hours

Marks: 42

Instructions:

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

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- Q. 1 (A) Answer the following question. (4)**
(1) Write note on Degeneracy.
- Q.1 (B) Answer the following questions. (Any two) (10)**
(1) Draw the full structure of $\text{Fe}_2(\text{CO})_9$, $\text{Fe}_3(\text{CO})_{12}$, $\text{Mn}_2(\text{CO})_{10}$, $\text{Ir}_4(\text{CO})_{12}$, $\text{Co}_2(\text{CO})_8$
(2) Explain normalization & orthogonality of wave function of the particle in one dimensional box.
(3) Calculate EAN and 18 electron for $\text{Fe}_2(\text{CO})_9$, $\text{Mn}_2(\text{CO})_{10}$
- Q. 2 (A) Answer the following question. (4)**
(1) Explain burning process in manufacture of cement with figure.
- Q. 2 (B) Answer the following questions. (Any two) (10)**
(1) Explain Sindri Process for the production of Ammonium Sulphate.
(2) Discuss different types of cement.
(3) Discuss manufacturing of normal super phosphate by Den process with flow diagram.
- Q. 3 (A) Answer the following question. (4)**
(1) Differentiate High spin and Low spin complex with example.
- Q. 3 (B) Answer the following questions. (Any two) (10)**
(1) Discuss splitting of d – orbitals in octahedral field with CFSE.
(2) Explain raw materials for manufacturing of glass.
(3) Discuss manufacturing of cotton seed oil by Expression method.
- Q. 4 (A) Answer the following question. (4)**
(1) Explain wet process and dry process for manufacture of cement.
- Q. 4 (B) Answer the following questions. (Any two) (10)**
(1) Explain types of NO in metal nitrosyl.
(2) Explain roll of micro nutrients in plant growth.
(3) Discuss factors affecting the crystal field splitting energy.
- Q. 5 (A) Answer the following question. (4)**
(1) Write note on Iodine value.
- Q. 5 (B) Answer the following questions. (Any two) (10)**
(1) Derive wave and energy equation for a particle moving in three dimensional box.
(2) Discuss setting and hardening of Portland cement with chemical reactions.
(3) Calculate CFSE in Kcal/mol for $[\text{Co}(\text{CN})_6]^{-3}$ where, splitting energy & pairing energy are $34,800 \text{ cm}^{-1}$ & $19,000 \text{ cm}^{-1}$ respectively.

647510

BSCinoCC5010

Seat No : _____

B.Sc. Semester - 5 (Remedial) (CBCS) Examination

Feb/Mar. -2021 (OLD COURSE)

INORGANIC AND INDUSTRIAL CHEMISTRY(CORE)

Time: 1:30 Hours

Instructions:

Marks: 42

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

- Q.1(A) Answer the following question. (04)
1. Discuss splitting of d- orbitals in tetrahedral ligand field.
- Q.1(B) Answer any two questions out of three (10)
1. Discuss the factors affecting splitting energy Δ .
 2. (i) What is a Spectrochemical Series?
(ii) Why Splitting energy Δ_t is less than Δ_o ?
 3. Discuss splitting of d-orbital in octahedral field with CFSE.
- Q.2(A) Answer the following question (04)
1. Discuss the classification of metal carbonyls.
- Q.2(B) Answer any two questions out of three (10)
1. Explain the structure of $\text{Fe}(\text{CO})_5$ with its preparation and properties.
 2. Define metal nitrosyl and explain bonding in metal nitrosyls.
 3. Discuss about the usefulness of IR spectroscopy in the study of metal carbonyls.
- Q.3(A) Answer the following question (04)
1. List the types of glass with their uses.
- Q.3(B) Answer any two question out of three (10)
1. (i) Give chemical properties of glass.
(ii) What is zero point energy? Give its equation for cubic box and rectangular box systems.
 2. Derive energy equation for a particle moving in one dimensional box and explain the terms involved in it.
 3. Derive energy of 1S orbital in a.u. where $\Psi_{1s} = \frac{1}{\sqrt{\pi a_0^3}} e^{-r/a_0}$
- Q.4(A) Answer the following question (04)
1. What is cement? Discuss properties of cement.
- Q.4(B) Answer any two questions out of three (10)
1. Discuss manufacturing process of cement
 2. (i) Write a short note on, "setting and hardening of Portland cement".
(ii) Give comparison between Dry process and Wet process of miring in cement manufacturing.
 3. Give condition of ISI for specification of ordinary Portland cement.
- Q.5(A) Answer the following question (04)
1. Write a short note: plant nutrients and its role
- Q.5(B) Answer any two questions out of three (10)
1. Define the fertilizer. Give its all types of classification.
 2. List the names of nitrogenous Fertilizers and discuss any one manufacturing process of urea with its action as Fertilizer.
 3. List the names of phosphate Fertilizers. Discuss manufacturing process of dimmonium phosphate and the role of phosphate Fertilizers.

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BSCinoCC5010

Seat No : _____

B.Sc. Semester - 5 (CBCS) Examination
Oct/Nov. - 2021(Old Course)
INORGANIC AND INDUSTRIAL CHEMISTRY(CORE)

Time: 2:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
 2. Figures to the right indicate marks.
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- Q. 1 (A) Explain High Spin and Low Spin complexes with examples. [04]
- Q. 1 (B) Answer the following (Any Two) [10]
- (1) Describe: d-orbital splitting in Tetrahedral(T_d) complexes.
 - (2) Describe: d-orbital splitting in Octahedral(O_h) complexes.
 - (3) Explain: Factor affecting on d-orbital splitting energy (Δ_o).
- Q. 2 (A) Answer the following: [04]
- Calculate 18 electrons & EAN for following metal carbonyl:
- (1) $Ni(CO)_4$
 - (2) $Mn(CO)_5$
- Q. 2 (B) Answer the following (Any Two) [10]
- (1) Draw the full structure; find the number of bridge CO & non-bridge CO in $Co_2(CO)_8$
 - (2) Discuss: Linear & bent NO with examples.
 - (3) Discuss: Preparation of various metal carbonyls.
- Q. 3 (A) Answer the following: [04]
- Write a note on degeneracy
- Q. 3 (B) Answer the following (Any Two) [10]
- (1) Write note on: High silica glass and fiber glass.
 - (2) Explain manufacturing process of glass.
 - (3) Derive equation of wave function for particle moving in one dimensional box and show quantization of energy from that.
- Q. 4 (A) Answer the following: [04]
- (1) Explain properties of cement.
- Q. 4 (B) Answer the following (Any Two). [10]
- (1) Explain: Dry process and Wet process for cement.
 - (2) Explain setting and hardening of Portland cement.
 - (3) Explain: RCC and Concrete.
- Q. 5 (A) Answer the following. [04]
- (1) Explain the function of secondary plant nutrients.
- Q. 5 (B) Answer the following (Any Two) [10]
- (1) Explain manufacture of Ammonium Nitrate by prilling method.
 - (2) Explain manufacture of Normal super phosphate with flow diagram.
 - (3) Explain the manufacture of Ammonium Sulphate.

**B.Sc. Semester - 5 (CBCS) Examination
December - 2020 (Old Course)**

INORGANIC AND INDUSTRIAL CHEMISTRY(CORE)

Time: 1:30 Hours

Marks: 42

Instructions:

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

- Que-1 (a) Answer the following question. (04)
 (1) Discuss splitting of d – orbitals in tetrahedral field.
- (b) Answer any two questions out of three. (10)
 (1) Discuss factors affecting splitting energy Δ .
 (2) Give electron configuration of d^1 to d^{10} systems in weak and strong ligand field. Calculate CFSE for d^4, d^5, d^6 and d^7 in both fields.
 (3) Discuss about quenching of orbital angular momentum in 3d-model complexes.
- Que-2 (a) Answer the following question. (04)
 (1) Explain effective atomic number rule.
- (b) Answer any two questions out of three (10)
 (1) Define metal carbonyls and describe its chemical properties.
 (2) Define metal nitrosyls and discuss about compounds containing N^{O+} group.
 (3) Discuss the application of IR spectroscopy in detection of structure of metal carbonyls.
- Que-3 (a) Answer the following question. (04)
 (1) Explain commutative property and commutator of operator with example.
- (b) Answer any two questions out of three. (04)
 (1) Derive normalized wave function for a particle moving in one dimensional box.
 (2) Describe physical and chemical properties of glass.
 (3) Explain briefly : (1) Borosilicate glass, (2) lead glass and (3) Glass wool.
- Que-4 (a) Answer the following question. (04)
 (1) Discuss about the types of cement.
- (b) Answer any two questions out of three (10)
 (1) Explain setting and hardening of Portland cement with chemical conversions.
 (2) Discuss the properties of cement.
 (3) Describe manufacturing of cement with flow chart diagram.
- Que-5 (a) Answer the following question. (04)
 (1) Discuss manufacturing process of calcium cyanamide by electro carbonate method.
- (b) Answer any two questions out of three (10)
 (1) What is phosphate fertilizer? Discuss manufacturing of triple super phosphate with flow chart diagram.
 (2) Discuss about plant nutrients and its role.
 (3) Give manufacturing process of Urea from Ammonium carbamate and give its action as fertilizer.

647510

BSCinoCC5010

Seat No : 523452

B.Sc. Semester - 5 (CBCS) Examination

Oct/Nov.- 2019

INORGANIC AND INDUSTRIAL CHEMISTRY (CORE)

Time: 2:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

- Q. 1 (A) Answer the following question. (4)
(1) Prove that $[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic while $[\text{NiCl}_4]^{2-}$ is paramagnetic.
- Q.1 (B) Answer the following questions. (Any two) (10)
(1) Explain splitting of d-orbital in tetrahedral field with CFSE.
(2) Splitting energy (Δ_0) of d-orbital in $[\text{Co}(\text{CN})_6]^{3-}$ is 33750 cm^{-1} and pairing energy is 18000 cm^{-1} . Find out CFSE and Magnetic moment. [$1 \text{ kJ/mole} = 83.7 \text{ cm}^{-1}$]
(3) Discuss factors affecting the crystal field splitting energy.
- Q. 2 (A) Answer the following question. (4)
(1) Give classification of metal carbonyls.
- Q. 2 (B) Answer the following questions. (Any two) (10)
(1) Discuss metal nitrosyls containing NO^+ as ligand.
(2) Explain structure of $\text{Fe}_2(\text{CO})_9$.
(3) Discuss the usefulness of IR spectroscopy in the study of metal carbonyls.
- Q. 3 (A) Answer the following question. (4)
(1) Write chemical reaction involved in the manufacturing of glass.
- Q. 3 (B) Answer the following questions. (Any two) (10)
(1) Derive the wave and energy equation for a particle moving in three dimensional box.
(2) Discuss different types of glass.
(3) Explain normalization and orthogonality of wave function of the particle in one dimensional box.
- Q. 4 (A) Answer the following question. (4)
(1) Write note on ISI specification of cement.
- Q. 4 (B) Answer the following questions. (Any two) (10)
(1) Discuss Mortars and Concrete.
(2) Explain manufacturing of Portland cement with reactions.
(3) Discuss different types of cement.
- Q. 5 (A) Answer the following question. (4)
(1) Write note on role of micro nutrients in plant growth.
- Q. 5 (B) Answer the following questions. (Any two) (10)
(1) Explain manufacturing of mono ammonium phosphate with flow diagram.
(2) Discuss Sindri method for the production of Urea.
(3) Explain production of NPK fertilizer with flow diagram.

647510

Seat No : _____

BSc5CheC501x
B.Sc. Semester - 5 (Remedial) (CBCS) Examination
Feb/Mar. -2021 (NEW COURSE)
Inorganic and Industrial Chemistry (Core)

Marks: 42

Time: 1:30 Hours

Instructions:

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

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- Q. 1 (A) Answer the following question. (04)
(1) Write note on Degeneracy.
- Q. 1 (B) Answer the following questions. (Any two) (10)
(1) Discuss structure of $\text{Fe}(\text{CO})_5$.
(2) Explain normalization & orthogonality of wave function of the particle in one dimensional box.
(3) Discuss the usefulness of IR spectroscopy in the study of metal carbonyls.
- Q. 2 (A) Answer the following question. (04)
(1) Explain properties of cement.
- Q. 2 (B) Answer the following questions. (Any two) (10)
(1) Explain Sindri Process for the production of Ammonium Sulphate.
(2) Discuss different types of cement.
(3) Discuss manufacturing of normal super phosphate by Den process with flow diagram.
- Q. 3 (A) Answer the following question. (04)
(1) Differentiate High spin and Low spin complex with example.
- Q. 3 (B) Answer the following questions. (Any two) (10)
(1) Discuss splitting of d – orbitals in octahedral field with CFSE.
(2) Explain raw materials for manufacturing of glass.
(3) Discuss manufacturing of cotton seed oil by Expression method.
- Q. 4 (A) Answer the following question. (04)
(1) Write note on RCC.
- Q. 4 (B) Answer the following questions. (Any two) (10)
(1) Explain types of CO group in metal carbonyl.
(2) Explain roll of micro nutrients in plant growth.
(3) Discuss factors affecting the crystal field splitting energy.
- Q. 5 (A) Answer the following question. (04)
(1) Write note on Iodine value.
- Q. 5 (B) Answer the following questions. (Any two) (10)
(1) Derive wave and energy equation for a particle moving in three dimensional box.
(2) Discuss setting and hardening of Portland cement with chemical reactions.
(3) Discuss different types of glass.

647510

BSc5CheC502x

Seat No : _____

**B.Sc. Semester - 5 (CBCS) Examination
December -2020 (NEW COURSE)
Organic Chemistry and Spectroscopy (Core)**

Marks: 42**Time: 1:30 Hours****Instructions:**

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

Q. 1 (A) Answer the following question.**(4)**

- (1) Draw Fischer projection formula for all the four stereoisomers of 3-Bromo-2-Butanol. Specify Erythro and Threo forms and assign R,S Descriptors to each of their asymmetric carbon atoms.

Q.1 (B) Answer the following questions. (Any two)**(10)**

- (1) Explain Hydantoin method for the synthesis of amino acids in detail.
- (2) Explain Bergmann method for synthesis of peptide in detail.
- (3) a. Give synthesis and a use of Dulcin. (3-Marks)
b. What is α amino acid? Give name of main two types (ways) of classification used with an example. (2-Marks)

Q. 2 (A) Answer the following question.**(4)**

- (1) Explain Arndt Eistert reaction in detail.

Q. 2 (B) Answer the following questions. (Any two)**(10)**

- (1) Give synthesis of nicotine by Spath and Bretschneider.
- (2) Give difference between various planes of symmetry.
- (3) Prove with an example of eclipsed ethane that $S_n^n \neq E$ but $S_n^{2n} = E$ when n is odd..

Q. 3 (A) Answer the following question.**(4)**

- (1) What are molecular ion and base peak? Give two important points of mass spectra of alkane.

Q. 3 (B) Answer the following questions. (Any two)**(10)**

- (1) Give synthesis and uses of adrenaline.
- (2) What is magnetic anisotropic effect? Draw only scientific figures showing such effect in ethene, acetylene and 18-Annulene.
- (3) Deduce constitution of the molecules giving following NMR signals.
 - a) For a Fluorine containing organic compound $C\% = 54.5$, $H\% = 2.28$ and Heat density = 66 only one signal is obtained. 1) 7.8δ singlet. Deduce the constitution.
 - b) $C_5H_{10}Br_2$ Two signals are obtained 1) 6H Triplet $\delta = 1$ and 2) 4H Quartet $\delta = 2.4$ Deduce the constitution.

(4)

Q. 4 (A) Answer the following question.

- (1) Give point group of Allene.
- (2) If a molecule belongs to C₂ point group, its enantiomer will havepoint group.
- (3) Give order of C_{3v} point group.
- (4) The point group of the diastereomer of cis-1,2-Dichloroethene is.....

(10)

Q. 4 (B) Answer the following questions. (Any two)

- (1) Draw chair, boat and twist boat conformations of cyclohexane and give their point group.
Also discuss potential energy level diagram for ring inversion.
- (2) Explain constitution of Coniine in detail.
- (3) Explain difference between chemical shift and coupling constant.

(4)

Q. 5 (A) Answer the following question.

- (1) How many signals are obtained for 1-Chloroethene in PMR?
- (2) Give signals with splitting pattern for CH₂D-CH₂-OH.
- (3) How many signals will be obtained for 1-Bromocyclobutane.
- (4) If δ for a H in 100 MHz instrument is 2, its τ in 200 MHz will be

(10)

Q. 5 (B) Answer the following. (Any two)

- (1) Give five reactions of amino acid due both -NH₂ and -COOH functional groups.
- (2) Construct multiplication table for C_{2v} point group.
- (3) For a molecule having mol. Formula C₆H₁₄O, the following NMR signals are obtained. Deduce its constitution.
a) Singlet 0.8 δ (12 sq) b) Doublet 1.1 δ (4.59 sq) c) Singlet 1.8 δ (1.3 sq) d) Quartet 3.4 δ (1.4 sq)

NMR Spectral data

Type	Type of proton	Chemical shifts (approximate) in δ ppm
Primary	R-CH ₃	0.9-1.0
Secondary	R ₂ -CH ₂	1.3-1.5
Tertiary	R ₃ -CH	1.5-1.8
Aromatic	Ar-H	7.0-8.0
Benzylic	Ar-C-H	2.2-3.0
Flourides	HC-F	4.0-4.5
Bromides	HC-Br	2.5-4.0
Alcohols	HC-OH	3.4-4.0
Ethers	HC-OR	3.3-4.0
Aldehyde	R-CHO	9.0-10.0
Hyroxylic	R-OH	1.0-5.5
Phenolic	Ar-OH	4.0-12.0
Enolic	C=C-OH	15.0-17.0

**B.Sc. Semester - 5 (CBCS) Examination
December - 2020 (Old Course)
ORGANIC CHEMISTRY AND SPECTROSCOPY(CORE)**

Marks: 42

Time: 1:30 Hours

Instructions:

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

Q. 1 (A) Answer the following question. (4)

- (1) Give reactions which prove the presence of 5-OH and a carbonyl group as CHO in glucose.

Q.1 (B) Answer the following questions. (Any two) (10)

- (1) Discuss determination of pyranose ring structure of glucose using Periodic acid method.
- (2) Give Kiliani step up and Ruff's degradation reactions for monosaccharides.
- (3) Discuss reaction of glucose and fructose with phenylhydrazine.

Q. 2 (A) Answer the following question. (4)

- (1) What is point group? Construct multiplication table for a molecule with C_{2h} point group.

Q. 2 (B) Answer the following questions. (Any two) (10)

- (1) What is symmetry element? Explain axis of symmetry in detail.
- (2) Taking the example of PCl_5 Prove that $C_n^n = E$ always, but $S_n^{2n} = E$ when n is odd.
- (3) Compare various planes of symmetry.

Q. 3 (A) Answer the following question. (4)

- (1) Give synthesis and uses of saccharine.

Q. 3 (B) Answer the following questions. (Any two) (10)

- (1) Discuss briefly classification of drugs based on various methods with examples.
- (2) Discuss relative basicity of pyrrole, pyridine and aliphatic amines.
- (3) Discuss electrophilic substitution reactions of Furan.

Q. 4 (A) Answer the following questions. (4)

- (1) Assign IR frequencies for different vibrations in $C_6H_5-CH_2-NH_2$ from the following 3100-3040, 1600, 1500, 1460, 3250, 3500 cm^{-1}
- (2) Explain overtone in IR.

Q. 4 (B) Answer the following questions. (Any two) (10)

- (1) Discuss applications of IR Spectroscopy for H bond identification.
- (2) Discuss Curtius rearrangement with mechanism.
- (3) a. Explain finger print region in IR spectroscopy.
b. Organic compound with formula C_7H_5OCl gives following IR bands. Deduce the constitution of the molecule. 3065, 1774 and 1730 cm^{-1} .

(4)

Q. 5 (A) Answer the following question.

(1) Explain Von Braun method for the degradation of cyclic amines

(10)

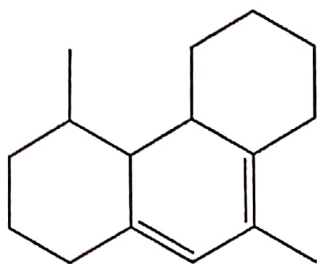
Q. 5 (B) Answer the following questions. (Any two)

(1) Prove that Nicotine is β -Pyridyl- α -Pyrrolidine alkaloid.

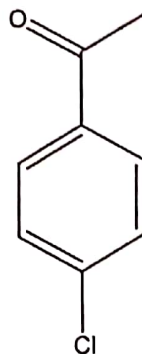
(2) Discuss types of electronic transitions involved in UV spectroscopy.

(3) Calculate λ_{max} for the following

(a)



(b)



Spectral data

3100-3040	C-H str
1600	C=C str in Aromatic
1500	C=C str in Aromatic
1460	C=C str in Aromatic
3250-3500	N-H str

1675	C=O str
3300 cm-1	C-H str

3065	C-H str
1774	C=O str (raised due to Cl)
1730 cm-1.	Fermi resonance band (C=O str and overtone of 872 cm-1 band)

λ_{max} (in nm)

Parent Ring residue R-CO-X	246
heteroannular diene	215
Homoannular diene	253
R=Cl subst at o-position	0
Cl subst at m-position	0
Cl subst at p-position	10
Extra conjugated double bond	30
Cl's form if extra conjugated double bond	39
Exocyclic double bond	5
Exocyclic double bond	5
Ring residue	5
Substitution Ring residue	5
Substitution CH ₃	5

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BSc5CheC502x Seat No : _____
 B.Sc. Semester – 5 (Remedial) (CBCS) Examination
 Feb/Mar. -2021 (NEW COURSE)
 Organic Chemistry and Spectroscopy (Core)

Marks: 42

Time: 1:30 Hours

Instructions:

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

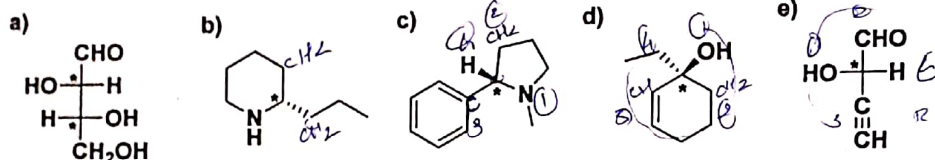
Q-1 A) Answer the following question. [04]

(1) Give the synthesis of thyroxin.

Q-1(B) Answer any two questions out of three. [10]

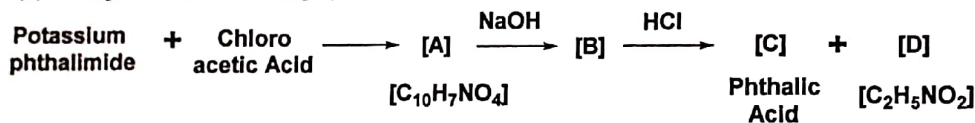
(1) Give the synthesis of dipeptide (Ala-Gly) by Bergemann method and Sneehan's method.

(2) Give R/S notation to chiral centre of following compounds.



(3) (a) Give the synthesis of Saccharin and its uses.

(b) Complete the following synthesis of α -amino acid and give the name of Product. [D].

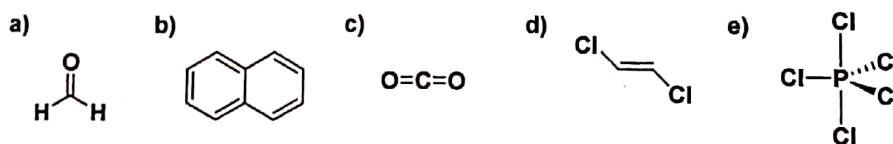


Q-2 A) Answer the following question. [04]

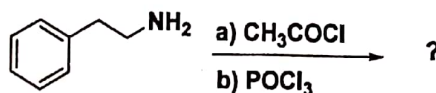
(i) Explain different types of plane of symmetry.

Q-2(B) Answer any two questions out of three. [10]

(1) Give point group and order of the point group of following molecules,



(2) Complete the following reaction with proper Mechanism and also give the Name of reaction.



(3) Find out structure of alkaloid (saturated heterocyclic compound) having molecular weight 127 gm/mole from following statements (define each statement),

- a) Element analysis result, C: 75.52 %; H: 13.47 % and N: 11.01 %,
- b) It form quaternary ammonium salt by consuming two mole of Methyl Iodide,
- c) It undergo oxidation to give pyridine 2-carboxylic acid,
- d) It undergoes Von braun's degradation to give 1,5 dibromooctane (alkaloid + Benzoyl chloride + PBr_5 + low temp., Distillation).

Q-3 (A) Answer the following question. [04]

(1) Explain the factors affecting chemical shift in NMR spectra.

Q-3 (B) Answer any two questions out of three. [10]

- (1) Give the synthesis and uses of Ibuprofen and Chrysodine-G.
- (2) Write a note on "General Fragmentation Modes" in mass spectroscopy.
- (3) Explain 1) NMR spectra of Cyclohexane at different temperature.
2) Deuterium labelling.

Q-4 (A) Answer the following question. [04]

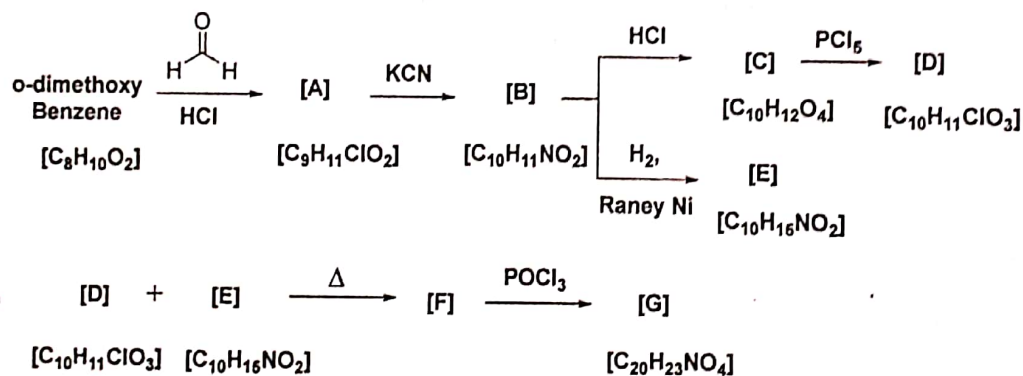
(1) Discuss the different conformation of Cyclohexane and compare it through their potential energy diagram.

Q-4 (B) Answer any two questions out of three. [10]

- (1) Prove that $S_6^3 = i$ & $S_6^6 = E$ by example of staggered Ethane.
- (2) a) Explain shielding and deshielding effect.
b) Why TMS is used as a reference in NMR spectroscopy.
- (3) a) Give the synthesis of Adrenaline by using Catechol and Monochloro acetyl chloride.
b) Give the reaction of Glycine with Ethanol, HNO_2 and Acetic anhydride in pyridine.

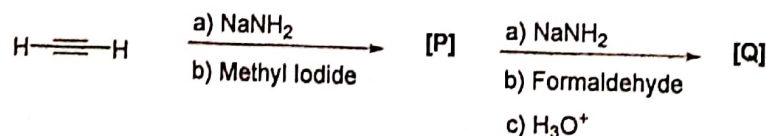
Q-5 (A) Answer the following question. [04]

(1) Complete the following reaction.



Q-5 (B) Answer any two questions out of three. [10]

- (1) Give the possible chain isomer of Pentane and also give the possible signals with multiplicity of each isomer in PMR.
- (2) a) Prove the presence of methylene group in Papaverine.
b) Complete the following reaction.



(3) Give the example of C_{2v} point group and construct its multiplication table.

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Seat No: 504002

B.Sc. Semester - 5 (CBCS) Examination

Oct/Nov. - 2018

ORGANIC CHEMISTRY AND SPECTROSCOPY (CORE)

Marks: 70

Time: 2:30 Hours

Instructions:

- All questions are compulsory.
- Figures to the right indicate marks.

Que-1 (A) Answer the following question. (04)

Explain step-up reaction (Sowden method) ~~2~~

(B) Answer any two questions. (10)

- Explain determination of ring size of glucose by methylation method.
- Explain step-down reaction (Ruff's method).
- What is carbohydrate? Discuss the classification of carbohydrates. ~~3~~

Que-2 (A) Answer the following question. (04)

Give point group of (1) SO_2 (2) $[\text{PtCl}_4]^{2-}$ (3) NH_3 (4) H_3BO_3

(B) Answer any two questions. (10)

- What is plane of symmetry? Explain different types of plane of symmetry with examples.
- Prove that in eclipsed ethane $S_n^k \neq E$ but $S_n^{2k} = E$, When n is odd number.
- Construct multiplication table for C_2V point group.

Que-3 (A) Answer the following question. (04)

Give preparation and uses of (a) Dulcin (p - phenethyl urea) (b) p - Anisyl urea

(B) Answer any two questions. (10)

- Give preparation and uses of (a) Atenolol (b) Orange-II.
- Discuss structure and aromaticity of pyridine.
- Give any two synthesis (a) Pyrole (b) Furan (c) Thiophine.

Que-4 (A) Answer the following question. (04)

Differentiate following pair of compounds using IR spectroscopy,

- Propanoic acid and methylethanoate.
- p - Methylcyanobenzene and p - aminobenzaldehyde.

(B) Answer any two questions. (10)

- Explain in detail: Fundamental modes of vibrations in IR spectroscopy.
- Discuss factors affecting on frequency of $>\text{C}=\text{O}$ band in IR spectroscopy (any five).
- Discuss curtius rearrangement.

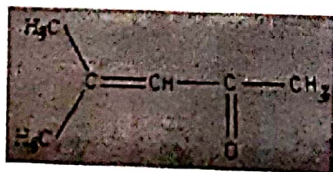
Que-5 (A) Answer the following question. (04)

Discuss in detail: chromophore and auxochrome.

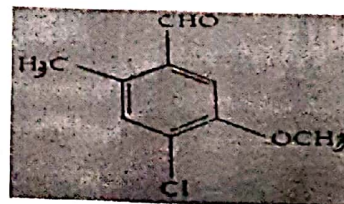
(B) Answer any two questions. (10)

- Explain constitution of coniine.
- Explain Hofmann exhaustive methylation method.
- Calculate λ_{max} for the following molecules,

(i)



(ii)



Spectral Data

U.V.:

Empirical rules for Dienes :

	(A) Homoannular $\lambda = 253 \text{ nm.}$ 30nm.	(B) Heteroannular $\lambda = 215 \text{ nm.}$ 30nm.
Incerments for double bond extending conjugation		
Exocyclic double bond	5	5
Alkyl substitution or ring residue	5	5
 Homocyclic Diene components polar groups:	 39	 39
- OCOCH ₃	0	0
- OR	6	6
- Cl, -Br	5	5
- NR ₂	60	60

(C) Simple Diene :

Parent $\lambda = 253 \text{ nm.}$

Polar groups:

Alkyl subst for ring

Residue	5 nm
- Cl, -Br	17
- OH	5
- OR	5
- NR ₂	60
- SR	30

(D) Empirical Rules for Enones and Dienones :

(a) Z = C

(1) 6 membered ring or acyclic

(2) 5 membered ring

(b) Z = H

(c) Z = OH or OR

(d) Acyclic dienone

Increment for :

Double bond extending conjugation

Alkyl group of ring residue

λ
215
202
207
193
245

30
 α 10
 β 12
18
5
39

		λ or higher		
Exocyclic double bond position				
Homocyclic diene component				
Polar groups	α	β	λ	δ' other
- Cl	15	12	-	-
- OH	35	30	50	-
- OR	35	30	17	50
- NR ₂	-	93	-	31
- O	-	75	-	-
- NHCOR	-	95	-	-
- OCOCH ₂	6	6	-	-
- SR	-	85	-	6
- Br	25	30	-	-
- NO ₂	-	95	-	-

(E) Empirical Rules for Benzoyl Derivative :

Parent Chromophore :

Z = alkyl or ring residue

Z = H

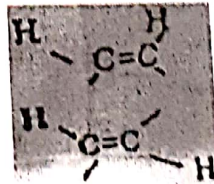
Z = -OH or -OR

Mm
246
250
230

Increment for each substituent	o	m	p
Alkyl or ring residue	3	3	10
-OH; -OCH ₃ -OR	7	7	25
- OH	11	20	78
- Cl	0	0	10
- Br	2	2	15
- NH ₂	13	13	58
- NHCOCH ₂	20	20	45
- NHCH ₃	-	-	73
- N(CH ₂) ₃	20	20	85

Infra - Red Data

Alkene (stretching)	-C-H	2850-2960(v)
Alkene	=C-H	3100-3200(m)
Alkyene	=C-H	3200-3300(s)
Aromatic	ArC-H	3010-3100(m)
Aromatic ring	C=C	1600-1600(v) (two to three)
Alkene	>C=C<	1610-1680(v)
Alkyene	-C=C ² .	2100-2260(s)
Alkene (Bending)	-C(C ₂ H ₃) ₃	1430-1470(m) & 1380-1385(s)
Aldehyde	-C-H	2820-2000(w)&2650 2760(s)
Adehyde	C=O	1740-1720(s)
Ketone	C=O	1725-1710(s)
Carboxylic acid	C=O	1725-1705(s)
Ester	C=O	1750-1730(s)
Amide	C=O	1670-1640(s)
Anhydride	C=O	1810-1860(s)&1740-1790
Alcohols, Ethers, esters, Carboxylic acids, Anydride	C-O	1800-1000(s)
Alchols, Phenols :		
Free	O-H	3650-3600(sh)
Bonded	O-H	3500-3200(b)
Carboxylic acids		
Free	O-H	3500-3650(m)
H-bonded	O-H	2500-3200(b)
amines (stretch)	N-H	1640-1550(m)
Bnding	-N-H	1640-1550(m)
Nitrile	-C=N	2210-2280(s)
Ether	-O-	1070-1150(s)
Alkene bending		-690(s)
Disubstitued Cis.		
Disubstitued Trans.		960-970(s)



Aromatic substitution:

Type C-H out of plane bending
No. of adjacent H atom.

No. of adjacent H atom.	Range cm
5	750(s) & 700(s)
4	750
3	780
2	830
1	850

Time: 2:30 Hours

Instructions:

Marks: 70

1. All questions are compulsory.
2. Figures to the right indicate marks.

Q. 1 (A) Answer the following question.

- (1) Give reactions for the interconversions of glucose to fructose and fructose to glucose. (04)

Q. 1 (B) Answer the following questions. (Any two) (10)

- (1) Discuss determination of pyranose ring structure of glucose using methylation method.
- (2) Discuss osazone formation from glucose and fructose.
- (3) Write shortnote on Mutarotation of glucose.

Q. 2 (A) Answer the following question.

- (1) What is symmetry point group? Give example of molecule belonging to D_{4h} and C_1 point group. (04)

Also give point group for CO and BF_3 molecules.

Q. 2 (B) Answer the following questions. (Any two) (10)

- (1) Construct multiplication table for a molecule with C_{2v} point group.
- (2) Prove with an example that $S_n \neq E$ when n odd.
- (3) Explain and compare different planes of symmetry.

Q. 3 (A) Answer the following question.

- (1) What is drug? Discuss its classification in brief. (04)

Q. 3 (B) Answer the following questions. (Any two) (10)

- (1) Discuss aromaticity of five membered heterocyclic compounds.
- (2) Write a note on relative basicity of pyrrole, pyridine and aliphatic amines.
- (3) Give synthesis of Ibuprofen and Auramine O.

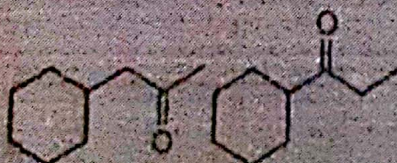
Q. 4 (A) Answer the following question.

- (1) Explain briefly fingerprint region in IR spectroscopy. (04)

Q. 4 (B) Answer the following questions. (Any two) (10)

- (1) Explain Arndt Eistert reaction with mechanism.
- (2) Write a note on fundamental vibrations in IR spectroscopy
- (3) Answer the following:

a. Differentiate the following two structures on the basis of IR spectroscopy



b. An organic compound having molecular $C_7H_7NO_2$ is soluble in water. Find out the structure of the molecule on the basis of the given spectral data: IR: 3430 and 3250 cm^{-1} (doublet), 3550 cm^{-1} , 1730 cm^{-1} , 1680 cm^{-1} , 1650 cm^{-1} , 1590 cm^{-1} , 1490 cm^{-1} , 1280 and 850 cm^{-1} .

Q. 5 (A) Answer the following question.

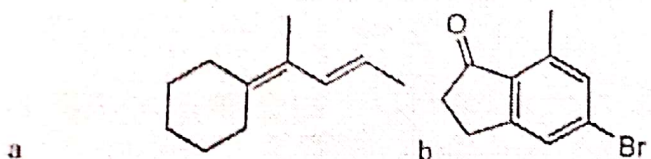
(1) Write synthesis of Papaverine.

Q. 5 (B) Answer the following questions. (Any two)

(1) Explain Hoffmann Exhaustive Methylation for degradation of Alkaloids.

(2) Discuss types of electronic transitions involved in UV spectroscopy.

(3) Calculate λ_{max} for the following



B.Sc. Semester - 5 (CBCS) Examination
Oct/Nov - 2021 (NEW COURSE)
Organic Chemistry and Spectroscopy (Core)

Time: 2:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

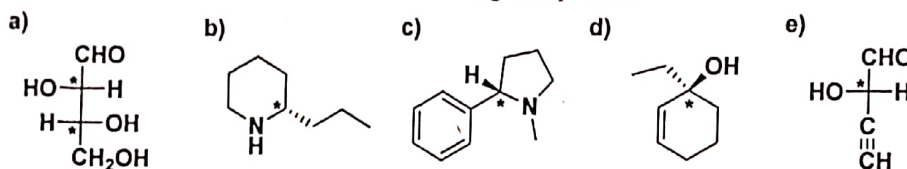
Q-1 A) Answer the following question. [04]

(1) Give the synthesis of thyroxin.

Q-1(B) Answer any two questions out of three. [10]

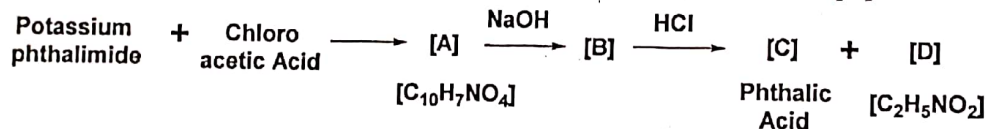
(1) Give the synthesis of dipeptide (Ala-Gly) by Bergemann method and Sneehan's method.

(2) Give R/S notation to chiral centre of following compounds.



(3) (a) Give the synthesis of Saccharin and its uses.

(b) Complete the following synthesis of α -amino acid and give the name [D].

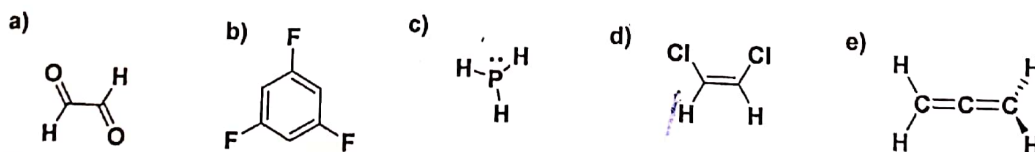


Q-2 A) Answer the following question. [04]

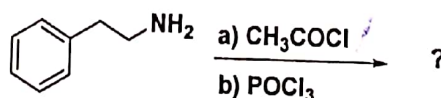
(i) Give the difference between σ_v , σ_h & σ_d .

Q-2(B) Answer any two questions out of three. [10]

(1) Give point group and order of the point group of following molecules,



(2) Complete the following reaction with proper Mechanism and also give the Name of reaction.



- (3) Find out structure of alkaloid (saturated heterocyclic compound) having molecular weight 127 gm/mole from following statements (define each statement),
- a) Element analysis result, C: 75.52 %; H: 13.47 % and N: 11.01 %,
 - b) It form quaternary ammonium salt by consuming two mole of Methyl Iodide,
 - c) It undergo oxidation to give pyridine 2-carboxylic acid,
 - d) It undergoes Von braun's degradation to give 1,5 dibromooctane(alkaloid + Benzoyl chloride + PBr_5 + low temp., Distillation).

Q-3(A) Match the following pair:

[04]

Molecule		No. of PMR signals	
1	2-butanol	a	3
2	1-propene	b	5
3	4-ethylaniline	c	6
4	p-xylene	d	4
		e	2

Q-3 (B) Answer any two questions out of three.

[10]

- (1) Give the synthesis and uses of Ibuprofen and Chrysodine-G.
- (2) Write a note on: Mc-Lafferty rearrangement with example.
- (3) Explain: Magnetic anisotropic effect with two examples.

Q-4(A) Answer the following question.

[04]

- (1) Discuss the different conformation of Cyclohexane and compare it through their potential energy diagram.

Q-4 (B) Answer any two questions out of three.

[10]

- (1) Prove that $S_3^3 = \sigma_H$ & $S_3^6 = E$ by example of eclipsed ethane.
- (2) a) Explain: Deuterium labelling method.
b) Why TMS is used as a reference in NMR spectroscopy?
- (3) a) Give the synthesis of Adrenaline by using Catechol and Monochloro acetyl chloride.
b) Give the reaction of Glycine with Ethanol, HNO_2 and Acetic anhydride in pyridine.

Q-5(A) Answer the following question.

[04]

A quartet observed at 2.870, 2.855, 2.835 & 2.820 δ_{ppm} , if instrument operate at 400MHz then calculate coupling constant in Hz.

Q-5 (B) Answer any two questions out of three.

[10]

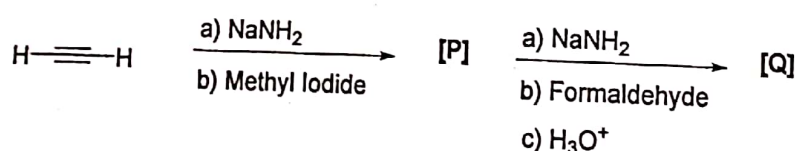
- (1) Determine the structure from following PMR data:

Molecular Mass=146gm/mole, C=74%, H=4.2%

(a) 5H, s, 7.5 δ_{ppm} , (b) 1H, s, 11.5 δ_{ppm}

- (2) a) Prove the presence of methylene group in Papaverine.

b) Complete the following reaction.



- (3) Give the example of C_{2v} point group and construct its multiplication table.

Chemical Shift:

Aldehydic proton:

08.0-10.0 δ_{ppm}

Carboxylic acid proton:

10.0-12.5 δ_{ppm}

Aromatic proton:

6.5-8.5 δ_{ppm}

Allylic proton:

1.5-2.5 δ_{ppm}

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Seat No : _____

B.Sc. Semester - 5 (CBCS) Examination
Oct/Nov. - 2021(Old Course)

ORGANIC CHEMISTRY AND SPECTROSCOPY(CORE)

Marks: 70

Time: 2:30 Hours

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

-
- Q. 1 (A) Answer the following question. (04)
(1) What are carbohydrates? Give difference between Aldose/Ketose and Sugar/Asugar.
- Q.1 (B) Answer the following questions. (Any two) (10)
(1) Give any three general reactions of monosaccharides.
(2) Explain osazone formation from glucose and fructose.
(3) Give Kiliani reaction for the preparation of D-Glucose from D-Arabinose
- Q. 2 (A) Answer the following question. (04)
(1) What is Symmetry element? Give names of symmetry element with symbol and operations associated with it.
- Q. 2 (B) Answer the following questions. (Any two) (10)
(1) Give difference between σ_h , σ_v and σ_d
(2) Give symmetry elements and point group of H_2O and NH_3 .
(3) Construct multiplication table for C_{2h} point group.
- Q. 3 (A) Answer the following question. (04)
(1) Give synthesis and uses of Ibuprofen.
- Q. 3 (B) Answer the following questions. (Any two) (10)
(1) Give Synthesis and uses of Orange II and Chrysodine G.
(2) Give electrophilic substitution reaction of furan.
(3) Discuss relative basicity of pyridine, pyrrole and aliphatic amines.
- Q. 4 (A) Answer the following question. (04)
(1) Which molecular vibrations are considered IR active? Give equation for calculation of degree of freedom for linear and nonlinear molecules.
- Q. 4 (B) Answer the following questions. (Any two) (10)
(1) Explain Arndt Eistert reaction with mechanism and one application.
(2) Write a note on types of modes of fundamental vibrations.
(3) Discuss IR spectra of CO_2 molecule.
- Q. 5 (A) Answer the following question. (04)
(1) Name different types of molecular energies. Give types of molecular transitions possible.
- Q. 5 (B) Answer the following questions. (Any two) (10)
(1) Explain constitution of Coniine.
(2) Give synthesis of nicotine by Spath and Bretschneider.
(3) Explain chromophore and auxochrome.

B.Sc. Semester - 5 (CBCS) Examination

December - 2020 (Old Course)

PHYSICAL AND ANALYTICAL CHEMISTRY(CORE)

Time: 1:30 Hours

Marks: 42

Instructions:

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

- Que-1 (a) Answer the following question. (04)
- (1) Which are the limitations of 1st law of thermodynamics?
 - (2) What mean by "perpetual motion machine of second kind"?
- (b) Answer any two questions out of three. (10)
- (1) What is Carnot theorem? Derive it's mathematical form.
 - (2) Discuss the effect of temperature, volume and pressure on entropy change.
 - (3) (i) If efficiency of a heat engine working in cyclic manner is 0.161. What amount of heat required to produce 1000 joule of work?
(ii) Calculate increase in entropy on mixing of 18.2848 gm of oxygen gas and 0.857 gm of hydrogen gas at NTP. Assuming oxygen and hydrogen gas act as ideal gas at NTP.
- Que-2 (a) Answer the following question. (04)
- (1) Derive criteria for a reaction to be spontaneous or at equilibrium state with respect to change in Gibb's free energy.
 - (2) Calculate degree of freedom for "oil+petrol+Kerosene" system.
- (b) Answer any two questions out of three (10)
- (1) Explain phase – diagram of " $\text{CH}_3\text{COOH}+\text{CHCl}_3+\text{H}_2\text{O}$ " system.
 - (2) Derive equation " $\Delta G^0 = -RT \ln K$ " with the help of Vont Hoff' s isothermal box.
 - (3) (i) Assuming CO_2 as an ideal gas, calculate free energy change, when 1 gm of CO_2 compressed up to 50 atm, from 5 atm at 57°C temperature. $R = 1.987 \text{ Cal/mole}$.
(ii) Derive Vont Hoff' s limiting intergrated equation from $d \ln K / dT = \Delta H/RT^2$.
- Que-3 (a) Answer the following question. (04)
- (1) Explain the deviation from Lambert-Beer's law.
 - (2) Write oxidation half cell reaction on following half cell.
 $\text{Pt}/\text{Cl}_2(\text{g})/\text{HCl}(\text{aq})$
- (b) Answer any two questions out of three. (04)
- (1) Write a short note on primary reference electrode and secondary reference electrode.
 - (2) Explain applications of emf measurements.
 - (3) Explain the laws of photochemistry.
- Que-4 (a) Answer the following question. (04)
- (1) How can reduce polarization of electrode?
 - (2) Write Velcher's rules for EDTA titration.
- (b) Answer any two questions out of three (10)
- (1) Explain nature of plots of "conductance v/s volume of base" of different types of acid-base titrations.
 - (2) Discuss following use of conductometry titration.
 - (i) Determination of hydrolysis constant and degree of hydrolysis.
 - (ii) Determination of dissociation constant of a weak acid.
 - (3) Give short introduction of following terms: (a) Ligand, (b) Chelate, (c) Solubility of EDTA, (d) Masking agent, (e) Concept behind colour change; using metal ion indicator
- Que-5 (a) Answer the following question. (04)
- (1) What is basic difference between "equivalence point" and "end point"?
 - (2) If concentration of aqueous solution of ammonium hydroxide is 0.1M, what is pH of solution? (Dissociation constant of ammonium hydroxide is 1.8×10^{-5})
- (b) Answer any two questions out of three (10)
- (1) Explain Ostwald's indicator principle.
 - (2) Give a brief description on neutralization titration with graph of "poly protic acid v/s strong base" titration.
 - (3) Write a short note on iodometry titration and iodimetry titration.
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BSc5CheC503x

Seat No : _____

B.Sc. Semester - 5 (CBCS) Examination
December -2020 (NEW COURSE)
Physical and Analytical Chemistry (Core)

Time: 1:30 Hours

Marks: 42

Instructions:

1. Figures to the right indicate marks.
 2. There are five questions in the question paper.
 3. Answer any three of the following questions.
-

Q. 1 (A) State the limitations of First Law of Thermodynamics and write the statements of Second Law of thermodynamics. (04)

Q.1 (B) Answer any two questions. (10)

- (1) Derive the equation for efficiency of heat engine and write Carnot theorem.
- (2) Explain the physical significance of entropy.
- (3) Discuss the variation of work function and free energy.

Q. 2 (A) Describe two pair of partially miscible liquid system. (04)

Q. 2 (B) Answer any two questions. (10)

- (1) Explain the precipitation titration by conductometry.
- (2) Describe the titrations of strong acid against weak base and weak acid against strong base by conductometry..
- (3) Explain method to determine solubility of sparingly soluble salt by emf.

Q. 3 (A) Explain Velcher's Law. (04)

Q. 3 (B) Answer any two questions. (10)

- (1) Discuss spectrophotometric titrations.
- (2) Explain Ostwald theory of indicator.
- (3) Describe the indicators of redox titration.

Q.4 (A) When 1 mole of ice at 0°C temperature and 1 atm. pressure is transformed / converted into vapour at 100°C, calculate the change in entropy of ice. (Heat of Fusion of ice at 0°C is 1436 cal/mole, Specific Heat of Water = 1 cal deg⁻¹ gm⁻¹, Heat of vaporization at 100°C is 9720 cal/mole) (04)

Q. 4 (B) Answer any two questions. (10)

- (1) Derive vant Hoff equation and state its applications.
- (2) Discuss reversible and irreversible cell.
- (3) Explain various types of EDTA titration.

Q. 5 (A) A saturated solution of silver chloride AgCl has a conductance $2.28 \times 10^{-6} \text{ S cm}^{-1}$ at 25°C. (04)

The conductance of the water used to prepare this solution is $0.116 \times 10^{-6} \text{ S cm}^{-1}$. The limiting ionic conductivities of the two ions are $\lambda_{\text{Ag}^+} = 61.9 \text{ S cm}^2 \text{ mol}^{-1}$ and $\lambda_{\text{Cl}^-} = 76.3 \text{ S cm}^2 \text{ mol}^{-1}$. Calculate the molar solubility of AgCl.

Q. 5 (B) Answer any two questions. (10)

- (1) If ΔG° for the decomposition of CaCO_3 is 130.2 kJ / mole, calculate pressure of CO_2 gas at 700 K temperature ($R = 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$)
- (2) Explain various types of reversible electrodes.
- (3) Describe Volhard method to determine the end point of precipitation titrations.

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BSc5CheC503x

Seat No : _____

**B.Sc. Semester - 5 (CBCS) Examination
December -2020 (NEW COURSE)
Physical and Analytical Chemistry (Core)**

Time: 1:30 Hours

Marks: 42

Instructions:

1. Figures to the right indicate marks.
 2. There are five questions in the question paper.
 3. Answer any three of the following questions.
-

Q. 1 (A) State the limitations of First Law of Thermodynamics and write the statements of Second Law of thermodynamics. (04)

Q.1 (B) Answer any two questions. (10)

- (1) Derive the equation for efficiency of heat engine and write Carnot theorem.
- (2) Explain the physical significance of entropy.
- (3) Discuss the variation of work function and free energy.

Q. 2 (A) Describe two pair of partially miscible liquid system. (04)

Q. 2 (B) Answer any two questions. (10)

- (1) Explain the precipitation titration by conductometry.
- (2) Describe the titrations of strong acid against weak base and weak acid against strong base by conductometry..
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Q. 3 (B) Answer any two questions. (10)

- (1) Discuss spectrophotometric titrations.
- (2) Explain Ostwald theory of indicator.
- (3) Describe the indicators of redox titration.

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Q. 4 (B) Answer any two questions. (10)

- (1) Derive vant Hoff equation and state its applications.
- (2) Discuss reversible and irreversible cell.
- (3) Explain various types of EDTA titration.

Q. 5 (A) A saturated solution of silver chloride AgCl has a conductance $2.28 \times 10^{-6} \text{ S cm}^{-1}$ at 25°C. The conductance of the water used to prepare this solution is $0.116 \times 10^{-6} \text{ S cm}^{-1}$. The limiting ionic conductivities of the two ions are $\lambda_{\text{Ag}^+} = 61.9 \text{ S cm}^2 \text{ mol}^{-1}$ and $\lambda_{\text{Cl}^-} = 76.3 \text{ S cm}^2 \text{ mol}^{-1}$. Calculate the molar solubility of AgCl. (04)

Q. 5 (B) Answer any two questions. (10)

- (1) If ΔG° for the decomposition of CaCO_3 is 130.2 kJ / mole, calculate pressure of CO_2 gas at 700 K temperature ($R = 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$)
- (2) Explain various types of reversible electrodes.
- (3) Describe Volhard method to determine the end point of precipitation titrations.

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BSCphyCC5030

Seat No : _____

B.Sc. Semester - 5 (CBCS) Examination

Oct/Nov. – 2019

PHYSICAL AND ANALYTICAL CHEMISTRY (CORE)

Time: 2:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

- Q. 1 (A) A Carnot engine operates between 227°C and 27°C by absorbing 1000 cal. from source. Calculate heat given to sink by the engine. (04)
- Q.1 (B) Answer any two questions. (10)
- (1) Explain the concept of entropy.
 - (2) Derive the equation for change of entropy of mixture of ideal gases and prove that it always increases when gases are mixed.
 - (3) If the temperature of 3 moles of ideal gas is increased from 27°C to 327°C , calculate the change in entropy of the gas at constant pressure and constant volume. [$C_p = (5/2) R$]
- Q. 2 (A) At 0°C and 1 atm. pressure specific volume of water and ice is 1.002 ml/gm and 1.0907 ml/gm, respectively. What will be the pressure to decrease the freezing point of water 1°C ? Latent heat of ice is 79.7 cal/gm (1 cal=41.29 ml atm.) (04)
- Q. 2 (B) Answer any two questions. (10)
- (1) Explain the physical significance of work function and free energy.
 - (2) Derive Van't Hoff equation and explain the calculation of change of enthalpy by graph.
 - (3) Discuss phase diagram of formation of one pair of partially miscible liquid of three component liquid system.
- Q. 3 (A) Explain the instrument of colourimeter with diagram (04)
- Q. 3 (B) Answer any two questions. (10)
- (1) Discuss reversible and irreversible cell.
 - (2) State the properties of the standard cell and describe Weston standard cell.
 - (3) Explain any two secondary reference electrodes.
- Q.4 (A) 2.08 gm BaCl_2 was dissolved in 1 lit solution. If the specific conductance of the solution is 0.0062 S cm^{-1} , calculate molar and equivalent conductance of the solution. (04)
(Molecular Wt. of BaCl_2 is 208 gm/mole)
- Q. 4 (B) Answer any two questions. (10)
- (1) State the general properties of metal ion indicators and explain its principle.
 - (2) Describe various types of displacement titration.
 - (3) Explain the measurement of degree of hydrolysis and hydrolysis constant by conductometry.
- Q. 5 (A) Explain the titration curves of titration of polyprotic acid against strong base. (04)
- Q. 5 (B) Answer any two questions. (10)
- (1) Discuss primary and secondary standard of volumetric analysis.
 - (2) Describe the indicators of redox titrations.
 - (3) Describe Mohar method to determine the end point of precipitation titrations.

B.Sc. Semester - 5 (CBCS) Examination

December - 2020 (Old Course)

PHYSICAL AND ANALYTICAL CHEMISTRY(CORE)

Time: 1:30 Hours

Marks: 42

Instructions:

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

- Que-1 (a) Answer the following question. (04)
- (1) Which are the limitations of 1st law of thermodynamics?
 - (2) What mean by "perpetual motion machine of second kind"?
- (b) Answer any two questions out of three. (10)
- (1) What is Carnot theorem? Derive it's mathematical form.
 - (2) Discuss the effect of temperature, volume and pressure on entropy change.
 - (3) (i) If efficiency of a heat engine working in cyclic manner is 0.161. What amount of heat required to produce 1000 joule of work?
(ii) Calculate increase in entropy on mixing of 18.2848 gm of oxygen gas and 0.857 gm of hydrogen gas at NTP. Assuming oxygen and hydrogen gas act as ideal gas at NTP.
- Que-2 (a) Answer the following question. (04)
- (1) Derive criteria for a reaction to be spontaneous or at equilibrium state with respect to change in Gibb's free energy.
 - (2) Calculate degree of freedom for "oil+petrol+Kerosene" system.
- (b) Answer any two questions out of three (10)
- (1) Explain phase – diagram of "CH₃COOH+CHCl₃+H₂O" system.
 - (2) Derive equation " $\Delta G^0 = -RT \ln K$ " with the help of Vont Hoff's isothermal box.
 - (3) (i) Assuming CO₂ as an ideal gas, calculate free energy change, when 1 gm of CO₂ compressed up to 50 atm, from 5 atm at 57°C temperature. R = 1.987 Cal/mole.
(ii) Derive Vont Hoff's limiting intergrated equation from $d \ln K / dT = \Delta H / RT^2$.
- Que-3 (a) Answer the following question. (04)
- (1) Explain the deviation from Lambert-Beer's law.
 - (2) Write oxidation half cell reaction on following half cell.
Pt/Cl₂(g)/HCl(aq)
- (b) Answer any two questions out of three. (04)
- (1) Write a short note on primary reference electrode and secondary reference electrode.
 - (2) Explain applications of emf measurements.
 - (3) Explain the laws of photochemistry.
- Que-4 (a) Answer the following question. (04)
- (1) How can reduce polarization of electrode?
 - (2) Write Velcher's rules for EDTA titration.
- (b) Answer any two questions out of three (10)
- (1) Explain nature of plots of "conductance v/s volume of base" of different types of acid-base titrations.
 - (2) Discuss following use of conductometry titration.
(i) Determination of hydrolysis constant and degree of hydrolysis.
(ii) Determination of dissociation constant of a weak acid.
 - (3) Give short introduction of following terms: (a) Ligand, (b) Chelate, (c) Solubility of EDTA, (d) Masking agent, (e) Concept behind colour change; using metal ion indicator
- Que-5 (a) Answer the following question. (04)
- (1) What is basic difference between "equivalence point" and "end point"?
 - (2) If concentration of aqueous solution of ammonium hydroxide is 0.1M, what is pH of solution? (Dissociation constant of ammonium hydroxide is 1.8×10^{-5})
- (b) Answer any two questions out of three (10)
- (1) Explain Ostwald's indicator principle.
 - (2) Give a brief description on neutralization titration with graph of "poly protic acid v/s strong base" titration.
 - (3) Write a short note on iodometry titration and iodimetry titration.
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BSCphyCC5030

Seat No: _____

B.Sc. Semester - 5 (CBCS) Examination

Oct/Nov. - 2018

PHYSICAL AND ANALYTICAL CHEMISTRY (CORE)

Time: 2:30 Hours

Marks: 70

Instructions:

- All questions are compulsory.
- Figures to the right indicate marks.

- ARCK
- Que-1 (A) State two criteria (characteristics) and two examples of spontaneous process. (04)
- (B) Answer any two questions. (10)
- Discuss Carnot cycle and derive the equation for efficiency of heat engine.
 - Derive the equations for change in entropy of ideal gas.
 - 2 gm of solid is heated from 27° C to 37° C temperature. If the specific heat of the solid is 0.5 cal/gm, calculate change in the entropy of the solid.
- Que-2 (A) When 5 mole of ideal gas is reversibly and isothermally compressed at 127° C, its final volume, is half of the initial volume of the gas. Calculate change in free energy of the gas. (R = 8.314 J K mol⁻¹) (04)
- (B) Answer any two questions. (10)
- Derive van't Hoff reaction isotherm equation by equilibrium box method.
 - Derive Clapeyron - Clausius equation.
 - Discuss various types of two components partially miscible liquid pair.
- Que-3 (A) Explain the Weston standard cell with diagram. (04)
- (B) Answer any two questions. (10)
- Describe various types of reversible electrodes.
 - Explain spectrophotometric titration.
 - The electrochemical cell is Pt/Sn⁺², Sn⁺⁴ // Fe⁺², Fe⁺³ / Pt. Write the cell reaction and calculate its equilibrium constant. E° (Fe⁺³, Fe⁺²) = 0.77 V and E° (Sn⁺⁴, Sn⁺²) = 0.15 V.
- Que-4 (A) Define specific conductance and equivalent conductance and explain the relation between them. (04)
- (B) Answer any two questions. (10)
- Explain the conductometric titrations of strong acid against strong base and mixture acid and weak acid against strong base.
 - Describe various types of EDTA titration.
 - The specific conductivity of saturated solution of AgCl is 1.12 x 10⁻⁶ S cm⁻¹. The equivalent ionic conductivity of Ag⁺¹ and Cl⁻¹ ions is 54.3 and 65.5 S cm² equiv⁻¹, respectively, Calculate the solubility of AgCl in gm/lit (Molecular weight of AgCl is 143.5 gm/mole)
- Que-5 (A) Explain Ostwald's indicator principle. (04)
- (B) Answer any two questions. (10)
- Discuss the titration curve of strong acid against strong base.
 - Explain iodometry and iodimetry titrations.
 - Describe Fajan's method to determine the end point of precipitation titration.
