Seat No. _____          Enrolment No. _____

# THE CHARUTAR VIDYA MANDAL UNIVERSITY
## M.Sc. (ORGANIC CHEMISTRY) – SEMESTER-2
## MAY(REGULAR) 2022 EXAMINATION

**Course Title: Quantum Chemistry**

**Course Code: 101330201**

**Total Printed Pages : 02**

**Date: 05/05/2022**          **Time: 10:30 am to 12:30 pm**          **Maximum Marks: 60**

**Instructions:**
- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

**Q. 1**  Answer the following multiple choice questions.                          **(12)**

(1)  "For a particular value of n energy does not change with position" this kind of motion called_____.
  (a) rotational motion              (b) vibrational motion
  (c) constant of motion             (d) translation motion

(2)  The sum of kinetic energy and potential energy is_____operator.
  (a) Laplacian  (b) Hamiltonian  (c) Momentum  (d) Hermitian

(3)  Which of the following indicates degenerate state?
  (a) $E_{112}$     (b) $E_{221}$        (c) $E_{122}$        (d) $E_{212}$

(4)  In transforming cartesian coordinates into polar coordinates, Y=_____.
  (a) $r\sin\theta\cos\varphi$      (b) $r\sin\theta\sin\varphi$      (c) $r\cos\theta$      (d) $r\sin\theta$

(5)  At the equilibrium point of oscillation, all the energy corresponds to_____.
  (a) Rotational energy              (b) Potential energy
  (c) Kinetic energy                 (d) Total energy

(6)  In Harmonic oscillator if displacement force is 'x' then restoring force is_____.
  (a) $kx$              (b) 0              (c) $-x$            (d) $-kx$

(7)  How many $\pi$-bond present in corrin ring?
  (a) 6              (b) 10              (c) 11            (d) 7

(8)  Deficiency of ___metal lead neuro muscular difuctioning.
  (a) Co              (b) Zn            (c) Mg            (d) Na

(9)  The metal ____ use is essential for formation of haemoglobin normal bone formation.
  (a) Cu              (b) Mg              (c) Ca            (d) Co

(10)  Which one is not a type of primers?
  (a) Sacrificial          (b) Protective          (c) Inhibitive          (d) Barrier

(11)  Which method is not used to prevent corrosion by paint coatings?
  (a) Barriers    (b) Electrical      (c) Chemical        (d) Polarization

(12)  By the removal of oxygen from water system in the _____ pH range, is one of the components required for corrosion would be absent.
  (a) 5.5-6.5        (b) 6.5-8.5        (c) 7.5-9.5        (d) 5.5-7.5

**Q.2** Attempt **any eight** of the following. (16)
    (1)    Derive $(L^2, L+) = $ _____
    (2)    What is orthonormal function?
    (3)    Derive $2^{nd}$ degree of polynomial.
    (4)    Derive energy equation of Harmonic oscillator.
    (5)    Why Cu(I) and Cu(II) ions are EPR active?
    (6)    Write note on physical properties of Vitamin $B_{12}$.
    (7)    Give the sources, requirements and deficiency of Na matal.
    (8)    What are the key points that should be considered for successful coating of steel surface?
    (9)    Explain inhibitive primers.
    (10)  Explain corrosion prevention by paint coating.

**Q. 3**    Write a note on Quantum mechanical tunnelling. (08)

**OR**

**Q.3**  (a)  Explain square of angular momentum and its component (X,Y) commute (08) with each other.

      (b)  Discuss the translation of a cubical box and also write use of box model.

**Q. 4**    Derive Radial equation (08)

**OR**

**Q. 4**    Nitric oxide rotate in XY-plane and free space. (08)
    (1) Calculate energy of first five energy levels and angular momentum.
    (2) Calculate the absorption frequency and wavelength of light absorbed when transition takes place from n=4 to n=5. ( r=1.20 $A^0$).

**Q. 5**    (a) What is bio-inorganic chemistry? Explain biological role of metal in (08) bio-inorganic chemistry.
    (b) Write a noteCytochrome P-450.

**OR**

**Q. 5**    Write a note on Iron-Sulphur proteins. (08)

**Q. 6**    Explain type of corrosion. (08)

**OR**

**Q. 6**    Explain consequences of corrosion. (08)

Seat No. _____                    Enrolment No. _____

**THE CHARUTAR VIDYA MANDAL UNIVERSITY**
**MASTER OF SCIENCE (ORGANIC CHEMISTRY) – SEMESTER 2**
**SUMMER (REGULAR 2020) EXAMINATION**

**Course Title: Organic Chemistry-II**
**Course Code: 101330202**
**Total Printed Pages: 04**
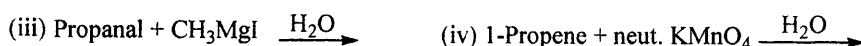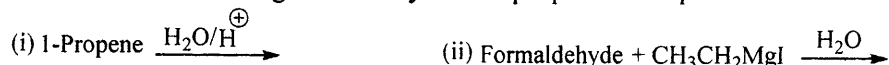**Date: 06/05/2022**          **Time: 10:30 am to 12:30 pm**          **Maximum Marks: 60**

**Instructions:**
- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

**Q. 1**      Answer the following multiple-choice questions.                                    **(12)**

(1)   In stork enamine reaction, enantioselectivity is obtained by_____.
      (a) 2R, 5R-Dimethyl pyrrolidine          (b) 2S, 5S- dimethyl pyrrolidine
      (c) 2R, 5S- Dimethyl pyrrolidine          (d) both (a) & (b)

(2)   Which of the following reactions yields 2-propanol as a product?

(i) 1-Propene $\xrightarrow{H_2O/H^{\oplus}}$                     (ii) Formaldehyde + $CH_3CH_2MgI$ $\xrightarrow{H_2O}$

(iii) Propanal + $CH_3MgI$ $\xrightarrow{H_2O}$               (iv) 1-Propene + neut. $KMnO_4$ $\xrightarrow{H_2O}$

      (a) Only (i) and (ii)          (b) Only (i) and (iii)
      (c) Only (ii) and (iv)          (d) Only (ii) and (iii)

(3)
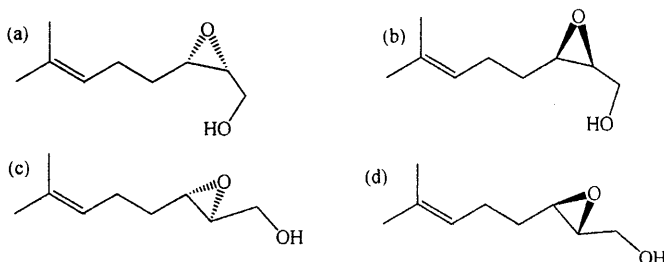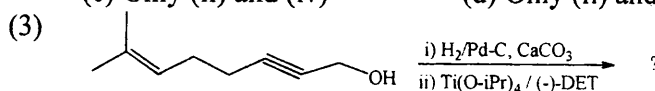


(4)   The oxidation number of carbon-2 in 2-nitro-bute-2-ol is _____.
      (a) 0          (b) +2          (c) -2          (d) +1

(5)   When 2,3-dimethyl-2-butene react with $BH_3$ it gives _____.
      (a) catechol borane          (b) disiarmyl borane
      (c) thexyl borane          (d) tripropyl borane

(6)   Which intermediate is formed in Bamford-Stevens reaction using protic solvent?
      (a) carbocation          (b) carbene          (c) carbanion          (d) nitrene

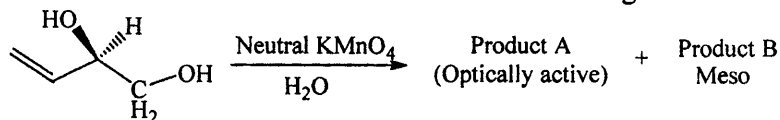(7)   4-Bromo -3E- Octene $\xrightarrow{(C_2H_5)_2CuLi}$ ?
      (a) 4-Ethyl-3(Z)-octene          (b) 4-Ethyl-3(E)-octene
      (c) 5-Ethyl-5(Z)-octene          (d) 5-Ethyl-5(E)-octene
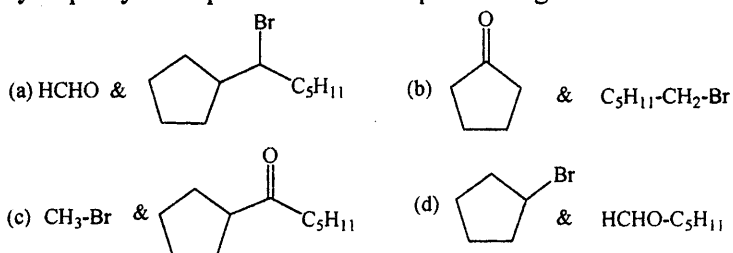
(8) In Peterson reaction, the following β-hydroxy alkyl trimethyl silane in the presence of $BF_3$ yields _____.

C3H7
H
OH

(H3C)3Si
H
C3H7

(a) Z-3-hexene (b) E-3-hexene

(c) Z-4-octene (d) E-4-octene
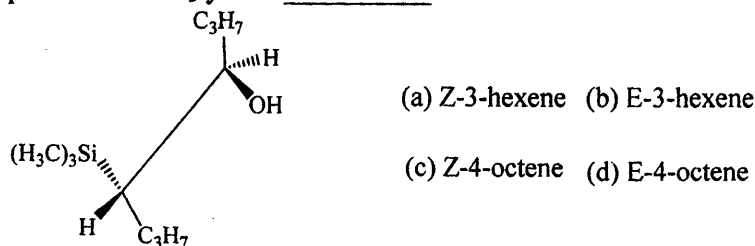
(9) Which of the statements are correct for the following reaction?

HO H
C—OH
H2

Neutral KMnO4 / H2O → Product A (Optically active) + Product B Meso

(i) It is a case of syn-hydroxylation.
(ii) Product A and B form the racemic mixture.
(iii) Product A is an erythro isomer.
(iv) Product B is an erythro isomer.
(a) 1,2 & 4 are correct            (b) 1 & 4 are correct
(c) Only 1 is correct              (d) 1 & 3 are correct

(10) Which of the following pair of compounds can be used to synthesize 2-cyclopentyl-1-heptene with the help of Wittig reaction?
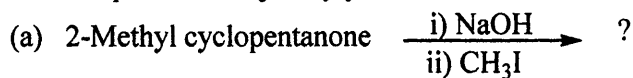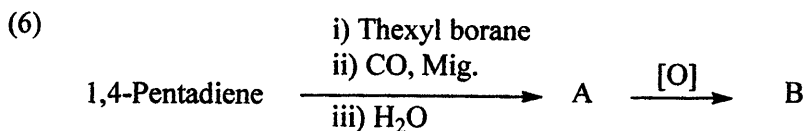
Br
(a) HCHO & [cyclopentyl]—C5H11

O
(b) [cyclopentanone] & C5H11-CH2-Br

O
(c) CH3-Br & [cyclopentyl]—C5H11

Br
(d) [cyclopentyl] & HCHO-C5H11

(11) Which of the following statement is incorrect for the Stork-enamine reaction?
(a) Various nucleophilic reagents can used to form variety of compounds.
(b) α-Alkylation can be performed.
(c) Aldehyde can be effectively alkylated.
(d) Unsymmetrical ketones can be alkylated on a less substituted carbon.

(12) When carboxylic acid is reacted with amine in the presence of DCC, it gives_____.
(a) ester        (b) peracid        (c) ketene        (d) amide

Q.2        Attempt **any eight** of the following.                                    (16)
(1) How Wittig reaction is useful in the synthesis of natural products?
(2) Discuss Vilsmeier-Haack reaction with its mechanism.
(3) Explain the reason for the formation of E-alkene using Julia olefination.
(4) How primary and tertiary alcohol can be synthesised from 2,2-Dimethyl-1-butene?
(5) Give the product and justify your answer for both reactions.

(a) 2-Methyl cyclopentanone $\xrightarrow[\text{ii) CH}_3\text{I}]{\text{i) NaOH}}$ ?

(b) 2-Methyl cyclopentanone $\xrightarrow[\text{ii) CH}_3\text{I}]{\text{i) LDA}}$ ?

(6)

1,4-Pentadiene $\xrightarrow[\text{iii) H}_2\text{O}]{\substack{\text{i) Thexyl borane} \\ \text{ii) CO, Mig.}}}$ A $\xrightarrow{[O]}$ B

(7) "Trans-1,2-cyclohexan-diol reacts at a slower rate with LTA compare to its cis-isomer." Why?

(8) Discuss DMP reagent with its advantages and disadvantages.

(9) Explain how esterification using DCC is advantageous over normal esterification.

(10) What is PTC? Discuss the factors affecting the efficiency of PTC.
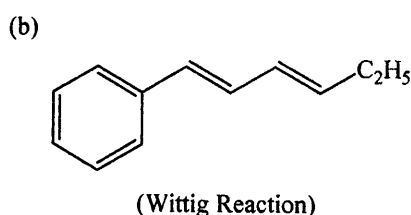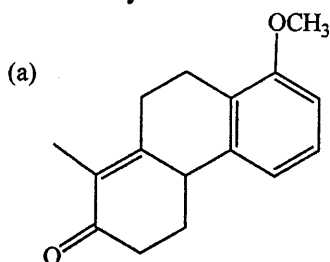
**Q. 3** Do as directed. **(08)**

(a) Complete the reaction with required mechanism.



$\xrightarrow[\text{ii) 2MeLi}]{\text{i) TsNH-NH}_2}$ ?
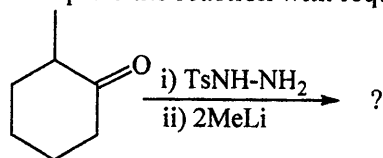
(b) "Low temperature modification of Wittig reaction predominately yields E-alkene even with non-stabilized ylides." Justify the statement.
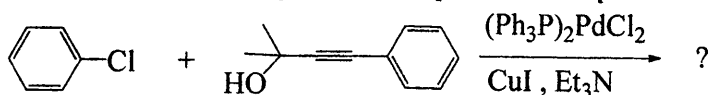
**OR**

**Q.3** Give the synthesis of following molecules as per given direction. **(08)**

(a)



(Robinson Annulation)

(b)



(Wittig Reaction)

**Q. 4** Answer the following. **(08)**

(a) Complete the following reaction, explain each step involved in mechanism.



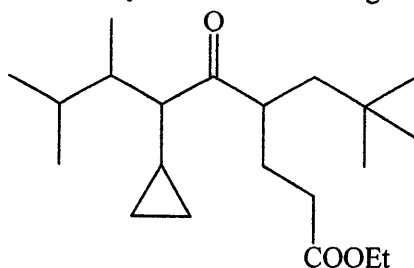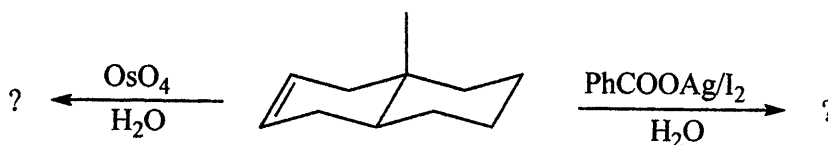(b) Justify that the reaction of allyl borane with aldehyde is enantioselective.

**OR**

**Q. 4** Answer the following. **(08)**

1. Give the synthesis of following compound using Stork-enamine reaction.



2. Give the mechanism and justify your answer with respect to product formed for both reactions.
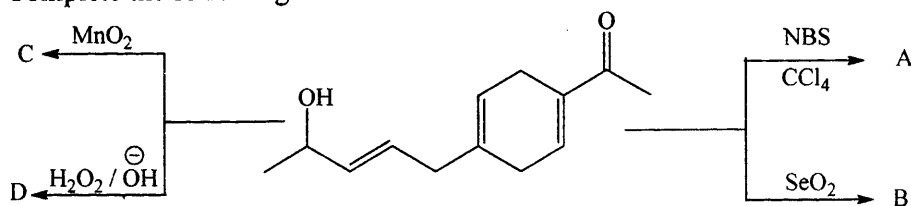


? $\xleftarrow[\text{H}_2\text{O}]{\text{OsO}_4}$ [structure] $\xrightarrow[\text{H}_2\text{O}]{\text{PhCOOAg/I}_2}$ ?

**Q. 5**      Answer the following.                 **(08)**

1. Write a note on Malaprade oxidation.
2. How carboxylic acid and amide can be synthesised using $HgO$?

**OR**

**Q. 5**      Answer the following.                 **(08)**

1. Complete the following reactions.



2. Discuss the detailed reaction mechanism for the reaction of benzene with NBS in aqueous acidic medium.

**Q. 6**      Answer the following.                 **(08)**

1. Arrange the following reagents in decreasing order of their reactivity and justify your answer using appropriate example.
   Grignard reagent, Alkyl lithium & Gilman reagent
2. Complete the following reaction and explain your answer.
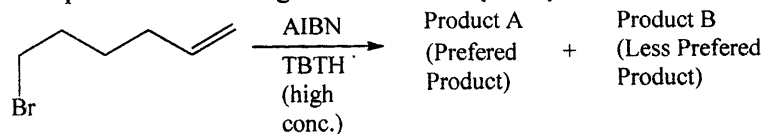


**OR**

**Q. 6**      Answer the following.                 **(08)**

1. Explain Cram's rule by citing suitable example.
2. Discuss the mechanism of reduction of following compounds by $LiAlH_4$.
   a. Butanoic acid          b. Ethyl acetate

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Seat No. _____          Enrollment No. _____

# THE CHARUTAR VIDYA MANDAL UNIVERSITY

## M. Sc. (ORGANIC CHEMISTRY) – SEMESTER 2
### SUMMER (REGULAR) 2022 EXAMINATION

**Course Title: TOPICS IN PHYSICAL CHEMISTRY - II**

**Course Code: 101330203**

**Total Printed Pages : 04**

Date: 7$^{th}$ MAY 2022          Time: 10:30 AM to 12:30 PM          Maximum Marks: 60

**Instructions:**
- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

**Q. 1          Answer the following multiple choice questions.          [12]**

1. Which one of the following statements regarding $V_{max}$ and $K_M$ is false?
   (A) $K_M$ is the concentration of substrate at which the rate of the reaction reaches $V_{max}$.
   (B) $V_{max}$ is the maximum rate at which a particular enzyme-catalysed reaction can proceed.
   (C) A small value of $K_M$ tells us that an enzyme binds strongly to its substrate.
   (D) A large value of $K_M$ tells us that an enzyme shows little specificity for a given substrate.

2. Pick out the **wrong** statement?
   (A) Plug flow reactor is always smaller than mixed reactor for all positive reaction orders for a particular duty.
   (B) For an ideal mixed reactor at steady state, the exit stream has the same composition as fluid within the reactor.
   (C) For a first order consecutive reaction, a tubular flow reactor as compared to a stirred tank reactor provides higher overall selectivity.
   (D) Reaction rate does not decrease appreciably as the reaction proceeds in case of an autocatalytic reaction.

3. When the concentration of reactant molecules is increased, the rate of reaction increases. The best explanation is: As the reactant concentration increases,
   (A) the activation energy increases.
   (B) the average kinetic energy of molecules increases.
   (C) the rate constant increases.
   (D) the frequency of molecular collisions increases.

4. For the rate law, $R = k[A][B]^{3/2}$; the partial order with respect to 'A' is ____, the partial order with respect to 'B' is_____, and the overall reaction order is_____.
   (A) $\frac{3}{2}; 1; \frac{7}{2}$          (B) $1; \frac{3}{2}; \frac{7}{2}$          (C) $1; \frac{3}{2}; \frac{5}{2}$          (D) $\frac{1}{2}; \frac{3}{2}; 3$

5. Which of the following is an example of photochemical reaction?
   (A) Photosynthesis
   (B) Decomposition of HCl
   (C) Decomposition of ammonia
   (D) All of the above

6. Choose the **incorrect** one:
   (A) The order of the reaction is not affected by its stoichiometric coefficient.
   (B) Order of reaction is may be a whole number or fraction.
   (C) Order of a reaction is always a whole number never a fraction.
   (D) Order can only be assessed experimentally.

7. Which of the following statements is not correct about trans-$C_2H_2Cl_2$?
   (A) It has one $C_2$ symmetry element.
   (B) Point group of this molecule is $C_2h$.
   (C) It has one horizontal plane.
   (D) Point group of this molecule is $D_2h$.

8. The molecule $H_2O$ belongs to $C_2v$ point group: so, which one is the correct matrix representation for the $\sigma_{v'}$?

   (A) $\begin{bmatrix} +1 & 0 & 0 \\ 0 & +1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$

   (B) $\begin{bmatrix} -1 & 0 & 0 \\ 0 & 0 & +1 \\ 0 & -1 & 0 \end{bmatrix}$

   (C) $\begin{bmatrix} 0 & 0 & +1 \\ 0 & +1 & 0 \\ +1 & 0 & 0 \end{bmatrix}$

   (D) $\begin{bmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{bmatrix}$

9. The point group for ammonium ion is _____.
   (A) $T_d$
   (B) $C_{3v}$
   (C) $D_{4h}$
   (D) $O_h$

10. Which of the following pair of point group is correct for given pair of molecules?

    

    (i)                    (ii)
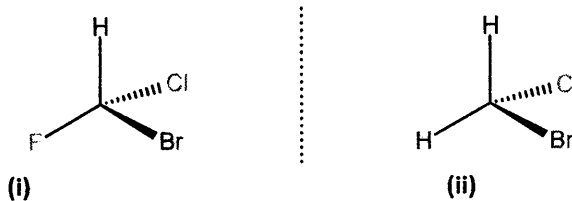
    (A) (i) $C_s$ and (ii) $C_s$
    (B) (i) $C_s$ and (ii) $C_1$
    (C) (i) $C_1$ and (ii) $C_s$
    (D) (i) $C_1$ and (ii) $C_1$

11. The number of degrees of vibrational freedom possessed by acetylene is:
    (A) 9        (B) 4        (C) 6        (D) 7

12. Which of the following vibrational mode of $CO_2$ is IR active?
    (A) Symmetric stretching        (B) Bending mode only
    (C) Asymmetric stretching       (D) Stretching modes only

**Q. 2** Attempt any **EIGHT** of the following. [16]

1. What is competing reaction? Show that $[A] = [A]_0 e^{-(k_1+k_2)t}$
2. Briefly discuss the flash photolysis method.
3. Differentiate elementary reaction and complex reaction.
4. What is Belousov-Zhabotinsky (BZ) reaction? Briefly explain by giving an example.
5. Use the provided initial rate data to derive the rate law for the reaction whose equation is: $OCl^-_{(aq)} + I^-_{(aq)} \rightarrow OI^-_{(aq)} + Cl^-_{(aq)}$

| Trial | $[OCl^-]$ (mol/L) | $[I^-]$ (mol/L) | Initial rate (mol/L/s) |
|---|---|---|---|
| 1 | 0.0040 | 0.0020 | 0.00184 |
| 2 | 0.0020 | 0.0040 | 0.00092 |
| 3 | 0.0020 | 0.0020 | 0.00046 |

Determine the rate law expression and the value of the rate constant k (only for trial:1) with appropriate units for this reaction.

6. Explain by giving the structural example of 'Diborane' ($B_2H_6$), how principle axis can be selected?
7. Nitrogen dioxide, dinitrogen pentoxide and sulphur dioxide have common symmetry elements – elaborate and explain the feature.
8. Distinguish: low and high class symmetry point groups with two suitable examples for each class.
9. Briefly explain the SALS approach for binding in water molecule.
10. How irreducible and reducible representation associated with coordinates in point group of formaldehyde molecule.

**Q. 3** **Answer the followings as direct.** [08]

**A.** The turnover number for an enzyme is known to be 5000 min$^{-1}$. From the following set of data, calculate the $K_M$ and total amount of enzyme present in this experiment.

| [S] (mM) | 1 | 2 | 4 | 6 | 100 | 1000 |
|---|---|---|---|---|---|---|
| $V_0$ ($\mu M.min^{-1}$) | 167 | 250 | 334 | 376 | 498 | 499 |

**B.** What is consecutive reaction? Explain the assumptions to said reactions and obtained the relations: $[A] = [A]_0 e^{-K_1 t}$.

**OR**

**Q. 3** **Answer the followings as direct.** [08]

**A.** What is reversible reaction? Obtained the relation: $ln\left(\frac{m}{m-x}\right) = (k_1 + k_2)t$.

**B.** An solution initially contains a catalytic amount of an enzyme with $K_M$ = 1.5 mM; 0.25 M of substrate and no product. After 45 seconds the solution contains 25 $\mu$M of product. Find the $V_{max}$ and the concentration of product after 2.0 mins.

**Q. 4**  **Answer the followings as direct.**

    **A.** For any reactions how one can determine whether the reaction is [08] kinetically or thermodynamically controlled?

    **B.** Explain the activated complex theory and the steric factor.

**OR**

**Q. 4**  For the photochemical reaction of Hydrogen-Bromine (HBr), prove that [08] rate of reaction is directly proportional to the square root of light intensity along with its limitation.

**Q. 5**  **Answers the following as direct.** [08]

    **A.** Show that for a rotation about z-axis, the transformation matrix is

$$\begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

    **B.** Define the term 'point group' and write the rules for constructing of character table.

**OR**

**Q. 5**  **Answers the following as direct.** [08]

    **A.** Define the term 'symmetry operation' with suitable example. Enlist the symmetry elements and point group with neat sketch of p-dichlorobenzene and phenol molecules.

    **B.** There are 8 symmetry elements for $C_{4v}$ point group. The character table of this point group is shown below. Compute the values of **a, b, c** and **d**.

| ? | E | $2C_4$ | $C_2$ | $2\sigma_v$ | $2\sigma_d$ |
|---|---|---|---|---|---|
| $\Gamma_1$ | 1 | 1 | 1 | 1 | 1 |
| $\Gamma_2$ | 1 | 1 | 1 | -1 | -1 |
| $\Gamma_3$ | 1 | -1 | 1 | 1 | -1 |
| $\Gamma_4$ | 1 | -1 | 1 | -1 | 1 |
| $\Gamma_5$ | 2 | a | b | c | d |
| | | ? | ? | ? | ? |

**Q. 6**  By considering the four characters of E, $C_{2(z)}$, $\sigma_{xz}$ and $\sigma_{yz}$. Show that $\Gamma_v$ [08] has no $A_2$ coefficient. Stipulate the vibrational mode possess by $AB_2$ bent molecule.

**OR**

**Q. 6**  How many vibrational modes are there in the tetrahedral $(AB_4)$ [08] molecule? Show that $\Gamma_h$ has one $A_1$ and one $T_2$ coefficient.

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# THE CHARUTAR VIDYA MANDAL UNIVERSITY

## M. Sc. (ORGANIC CHEMISTRY) – SEMESTER 2
## SUMMER (REGULAR) 2022 EXAMINATION

**Course Title: Analytical Chemistry**

**Course Code: 101330208**

**Total Printed Pages : 04**

**Date: 9ᵗʰ MAY 2022**          **Time: 10:30 AM to 12:30 PM**          **Maximum Marks: 60**

**Instructions:**
- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

**Q. 1**          **Answer the following multiple choice questions.**          **[12]**

1. Prospective validation is carried out while:
   (A) periodically and/or after major changes.
   (B) for production process that has been operating for 6 months.
   (C) during the research and development phase.
   (D) new product is being commissioned on the plant.

2. Sampling means:
   (A) Ultimate part of the matters under study.
   (B) Aliquot of entire materials
   (C) True representative of entire materials under the study.
   (D) Small portion of materials

3. Which of the following is the range of micro analysis analytical techniques?
   (A) $0.01 - 0.1$ gm
   (B) $0.001 - 0.01$ gm
   (C) $0.1 - 1.0$ mg
   (D) $10 - 100$ mg

4. The standard deviation sometimes expresses as relative standard deviation, which is also called _____.
   (A) co-efficient of variance
   (B) significant figure
   (C) range
   (D) average deviation

5. When 1 mg solute dissolved in $10^3$ mL then solution is _____.
   (A) 1 ppb
   (B) 1 ppt
   (C) 1 ppm
   (D) 1 M

6. How many ml of alcohol are required to prepare 10 percent solution from 5 gm of iodine, if density of alcohol is 0.80 gm/cc?
   (A) 45.0 ml
   (B) 85.2 ml
   (C) 56.2 ml
   (D) 95.3 ml

7. The energy of a 5.3 Å X- ray photon is _____.
   (A) $2.34 \times 10^{-16}$ J
   (B) $1.46 \times 10^{-16}$ J
   (C) $3.75 \times 10^{-16}$ J
   (D) $5.3 \times 10^{-16}$ J

8. Which one of the following arrangements for the sequence of the main components of a UV/visible spectrophotometer is **Correct**?
   (A) Light source → Detector → Sample cell → Monochromator → Readout

   (B) Light source → Sample cell → Detector → Monochromator → Readout

   (C) Light source → Monochromator → Sample cell → Detector → Readout

   (D) Light source → Readout → Sample cell → Detector → Monochromator

9. Photon of wavelength 765 nm corresponds to _____.
   (A) 13000 cm$^{-1}$
   (B) 16000 cm$^{-1}$
   (C) 26000 cm$^{-1}$
   (D) 23000 cm$^{-1}$

10. In Gas chromatography, internal diameter of packed column is _____.
    (A) 1 to 2 mm
    (B) 2 to 4 mm
    (C) 4 to 6 mm
    (D) 3 to 5 mm

11. In Gas-liquid phase chromatography, the stationary phase is composed of _____ and the mobile phase is made of _____
    (A) Solid, liquid
    (B) Liquid, liquid
    (C) Liquid, gas
    (D) Solid, gas

12. Select the **correct** statement from the following.
    (A) Paper chromatography is a type of partition chromatography
    (B) A special quality paper is used in paper chromatography
    (C) Chromatography paper contains water trapped in it, which acts as stationary phase
    (D) All of the mentioned

**Q. 2**      Attempt any **EIGHT** of the following.      **[16]**

       1.   Enlist the components of good manufacturing practices.

       2.   Define the acronyms: **NIH, BLA, WSC** and **BIS**.

       3.   Explain the partial and potential validation.

       4.   Define the term significant figure. Recognize the number of significant figure of 0.327. The result of $(25 \times 8.923)/100$ expressed to the correct number of significant figure.

       5.   Mixing together are 5 mL of 1 M solution of substance **A**, 3 mL of 2 M solution of substance **B**, and 2 mL of 4 M solution of substance **C**. Determine the concentration of each solute after mixing the solutions.

       6.   Calculate the standard deviation and coefficient of variation for the following set of data: 9.961, 10.004, 10.002, 9.973, 9.986

       7.   What is electromagnetic wave? Enumerate the components.

       8.   Explain the photoelectric effect.

       9.   Write the factors that governs the choice of paper in paper chromatography.

      10.   Define the term chromatography. Draw the neat and labeled schematic diagram of GC.

**Q. 3**      Classify the analytical techniques in detail and explain how classical method is differing from instrumental methods.    **[08]**

<div align="center"><strong>OR</strong></div>

**Q. 3**      Discuss in detail how to prepare sample and perform the analysis?    **[08]**

**Q. 4**      **Answer the following as direct.**    **[08]**

       **A.** A 0.2500 N solution of KCl is prepared in 200 mL volumetric flask, and its 50.00 mL withdrawn by a pipette. How many grams of KCl should be added to the flask so that the normality of the solution, after adding water to the mark, is 0.500 N? (Consider the Mol. Wt. of KCl is 74.55 gm/mol).

       **B.** Define and distinguish: Random error and Systematic error.

<div align="center"><strong>OR</strong></div>

**Q. 4**      **Answer the following as direct.**    **[08]**

       **A.** Explain the International System of Units with its base unit and prefixes.

       **B.** Determination of Na-level in blood sample gave the following four results: 149.2, 149.4, 149.5, 150.1 miliequi./liter. Calculate the confidence limit for, (a) 90%, (b) 99% confidence levels. The value of **t** for 3 degree of freedom at 90% and 99% confidence level are 2.353 and 5.841 respectively.

**Q. 5**      What do you mean by instrument? Enumerate the basic components of optical instrument. Discuss on source of radiation and sample container of optical instrument.    **[08]**

**OR**

Q. 5          Discuss various detectors used in optical spectroscopy in detail.     **[08]**

Q. 6          What do you mean by separation techniques? Define; evaporation,   **[08]**
filtration, decanting, sublimation with schematic representation.

**OR**

Q. 6          Discuss in detail thin layer chromatography and how it superior than  **[08]**
paper chromatography?

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