Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Second Semester)
(NEP) EXAMINATION, 2025-26
CHEMISTRY
(Organic Chemistry—II)

Paper Code							
B	0	2	0	8	0	2	T

Questions Booklet Series
D

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

(Only for Rough Work)

1. Why are aromatic rings resistant to hydrogenation compared to alkenes ?
   (A) High resonance energy
   (B) Absence of double bonds
   (C) Weak carbon-hydrogen bonds
   (D) Low activation energy

2. In which conditions does the hydrogenation of aromatic rings typically occur ?
   (A) High pressure
   (B) High temperature
   (C) Presence of a catalyst
   (D) All of the above

3. Hydroboration is often followed by oxidation. Which oxidizing agent is typically used in this process ?
   (A) H_2O_2 (Hydrogen peroxide)
   (B) $KMnO_4$ (Potassium permanganate)
   (C) PCC (Pyridinium chlorochromate)
   (D) $Na_2Cr_2O_7$ (Sodium dichromate)

4. What intermediate is formed during hydroboration ?
   (A) Carbocation
   (B) Boronate ester
   (C) Carbanion
   (D) Free radical

5. What is the stereochemistry of hydroboration-oxidation ?
   (A) Anti addition
   (B) Syn addition
   (C) Racemic mixture
   (D) No stereochemistry

6. Which of the following conditions is necessary for the oxidation of aldehydes to carboxylic acids ?
   (A) Acidic or basic medium
   (B) Neutral medium
   (C) Presence of ultraviolet light
   (D) Presence of an enzyme

7. In the oxidation of aldehydes, what is the role of the oxidizing agent ?
   (A) To accept electrons
   (B) To donate hydrogen
   (C) To reduce the aldehyde
   (D) To break carbon-carbon bonds

8. What is the primary product formed when an aldehyde is oxidized ?
   (A) Alcohol
   (B) Ketone
   (C) Carboxylic acid
   (D) Ester

9. The by-product of the Hunsdiecker reaction is typically :
   (A) Water
   (B) Carbon dioxide
   (C) Hydrogen gas
   (D) Methane

10. Which type of reaction mechanism is observed in the Hunsdiecker reaction ?

(A) Nucleophilic substitution

(B) Radical decarboxylation

(C) Electrophilic addition

(D) Elimination

11. The Hunsdiecker reaction is primarily used to prepare which compound ?

(A) Alcohols

(B) Aromatic hydrocarbons

(C) Esters

(D) Alkyl halides

12. Which factor stabilizes the allylic radical in allylic halogenation ?

(A) Inductive effect

(B) Hyperconjugation

(C) Resonance stabilization

(D) Steric hindrance

13. What is allylic halogenation ?

(A) Replacement of a hydrogen atom with a halogen atom at an allylic position

(B) Addition of halogen to an alkene

(C) Substitution at a benzylic position

(D) Conversion of alkene to an alkyne

14. What is the primary reason that free radical rearrangements occur ?

(A) To achieve a lower energy, more stable structure

(B) To form a reactive intermediate

(C) To increase bond length

(D) None of the above

15. Which of the following is an application of free radical rearrangement reactions ?

(A) Polymerization

(B) Isomerization of hydrocarbons

(C) Oxidation reactions

(D) Nucleophilic substitutions

16. What is the key reactive intermediate in free radical rearrangement reactions ?

(A) Carbocation

(B) Carbanion

(C) Free radical

(D) Carbene

17. Which of the following is an example of a free radical rearrangement reaction ?

(A) Claisen rearrangement

(B) Hofmann rearrangement

(C) Wohl-Ziegler bromination

(D) Pinacol rearrangement

18. What is the key feature of a free radical polymerization reaction ?

(A) Stepwise growth of chain

(B) Formation of ionic intermediates

(C) Chain-growth involving free radicals

(D) Use of acid catalysts

19. What is the role of ultraviolet light in a free radical reaction ?

(A) Forms a nucleophile

(B) Breaks covalent bonds to form free radicals

(C) Produces a carbocation

(D) Stabilizes intermediates

20. Free radical chain reactions consist of which main steps ?

(A) Initiation, propagation, termination

(B) Initiation, substitution, condensation

(C) Termination, nucleophilic addition, propagation

(D) Condensation, elimination, initiation

21. What is the driving force for the Von Richter rearrangement ?

(A) Formation of a stable carbocation

(B) Release of nitrogen gas

(C) Formation of a stable carboxylate ion

(D) Increase in entropy

22. What is the key intermediate formed during the Von Richter rearrangement ?

(A) Carbocation

(B) Cyanohydrin

(C) Arylnitroso compound

(D) Imidate intermediate

23. Which type of compounds typically undergo the Sommelet-Hauser rearrangement ?

(A) Quaternary ammonium salts

(B) Alkyl halides

(C) Aromatic ketones

(D) Alkenes

24. What is the product of the Sommelet-Hauser rearrangement ?

(A) Alcohol

(B) Ketone

(C) Substituted aromatic compound

(D) Rearranged amine

25. Which reagent is commonly used to initiate the Sommelet-Hauser rearrangement ?

(A) Sodium hydroxide

(B) Alkali metal amides

(C) Sulfuric acid

(D) Hydrogen peroxide

26. Which functional group commonly participates in SMILE rearrangement reactions ?

(A) Alkyl groups

(B) Aromatic rings

(C) Carbonyl groups

(D) Sulfonyl groups

27. What is a common application of SMILE rearrangement in organic chemistry ?

(A) Synthesis of polymers

(B) Synthesis of heterocyclic compounds

(C) Hydrocarbon cracking

(D) Biochemical pathway activation

28. In SMILE rearrangement, what role does the leaving group generally play ?

(A) Stabilizes the transition state

(B) Acts as a catalyst

(C) Facilitates electron transfer

(D) Increases reaction temperature

29. What influences the rate of a SMILE rearrangement reaction the most ?

(A) Solvent choice

(B) Temperature

(C) Stability of the intermediate carbocation

(D) Type of nucleophile

30. The rate of nucleophilic substitution reactions is higher in the presence of which of the following ?

(A) Electron releasing groups

(B) Electron withdrawing groups

(C) Both electron-withdrawing and releasing groups

(D) None of the above

31. The SN1 reaction is always involving the heterolysis to form carbocation as an intermediate :

(A) Two-step mechanism

(B) A planar carbocation intermediate is produced

(C) Reaction rate is dependent only on the concentration of the substrate

(D) All of the above

32. The step in S_N^1 reaction that is a slow rate-determining step is ..... .

(A) Formation of a transition state

(B) Formation of a racemic mixture

(C) Attack of the nucleophile

(D) All of the above

33. When the nucleophile : OR attacks the RX, which of the following will be the resultant product ?

(A) R –OH

(B) R : CN

(C) ROR

(D) RNHR

34. Which of the following is the correct statement ?

(A) No intermediate is always involved in the S_N^2 mechanism

(B) S_N^2 reactions are a one-step reaction

(C) S_N^2 reaction always follows the second-order kinetics

(D) All of the above

35. What is the halide ion ?

(A) Strong base

(B) Weak acid

(C) Weak base

(D) Strong acid

36. Which of the following is the compound that can be most readily sulphonated ?

(A) Toluene

(B) Nitrobenzene

(C) Benzene

(D) Chlorobenzene

37. The meta directing group is ..... .

(A) $-NHCOCH_3$

(B) $-OCH_3$

(C) –OH

(D) –COOH

38. ..... acts as electrophile in halogenation.

(A) Halonium ion

(B) Sulphonium ion

(C) Nitronium ion

(D) Acylium ion

39. ..... acts as a catalysts in the nitration of benzene.

(A) Conc. H_2SO_4

(B) Dil. HCl

(C) Conc. HCl

(D) Dil. H_2SO_4

40. ..... has the highest activation of the benzene ring.

(A) $-NH_2$

(B) –OH

(C) $-NHCOCH_3$

(D) $-C_6H_5$

41. Diazonium salts are used in which of the following industries ?

(A) Pharmaceutical

(B) Dye

(C) Photography

(D) All of the above

42. Diazonium salts are specifically used as intermediates in the production of which of the following compounds ?

(A) m-Bromotoluene

(B) o-Bromotoluene

(C) p-Bromophenol

(D) o-Bromophenol

43. Which of the following is the not a method of preparation of benzaldehyde ?

(A) Gattermann Koch synthesis

(B) Etard's reaction

(C) Stephan's reaction

(D) Oxidation of secondary alcohol

44. Which of the following is a not a five-membered ring ?

(A) Pyridine

(B) Pyrrole

(C) Furan

(D) Thiophene

45. Which of the following compounds can exhibit geometrical isomerism ?

(A) 1-Hexene

(B) 2-Methyl-2-Pentene

(C) 3-Methyl-1-Pentene

(D) 2-Hexene

46. How will you convert benzene into n-propyl benzene ?

(A) Friedel-Crafts Alkylation

(B) Friedel-Crafts Acylation

(C) Friedel-Crafts Alkylation followed by Clemmensen reduction

(D) Friedel-Crafts Acylation followed by Clemmensen reduction

47. The product of Friedel-Crafts Acylation reactions are ..... .

(A) Alkylbenzene

(B) Alkylamine

(C) Arylketone

(D) Halobenzene

48. Which of the following is not a product of the reaction of benzene with CH_3Cl and $AlCl_3$?

(A) Toulene

(B) Isopropyl benzene

(C) O-xylene

(D) P-xylene

49. The reaction in which benzene reacts with alkyl halide in the presence of a lewis acid as a catalyst to produce alkylbenzene is known as ..... .

(A) Nitration

(B) Halogenation

(C) Friedel-Crafts Acylation

(D) Friedel-Crafts Alkylation

50. Which of the following is rate determining step in electrophilic substitution reaction ?

(A) Generation of electrophile

(B) Attack by an electrophilic reagent on benzene ring

(C) Formation of product

(D) All of the above

51. What is the source of chirality in the sharpless asymmetric epoxidation process ?

(A) Hydrogen Peroxide

(B) Chiral Ligand (like diethyl tartrate)

(C) Sodium Hydroxide

(D) Acetone

52. Sharpless asymmetric epoxidation predominantly works with which functional group ?

(A) Alkenes

(B) Alcohols

(C) Ketones

(D) Aldehydes

53. What is the electrophile in the Michael reaction ?

(A) Alkynes

(B) α, β-unsaturated carbonyl compounds

(C) Aromatic compounds

(D) Halides

54. Which type of compound typically acts as a nucleophile in the Michael reaction ?

(A) Alcohols

(B) Ketones or enolates

(C) Alkenes

(D) Amides

55. What is the Michael reaction primarily used for ?

(A) Oxidation reactions

(B) Formation of carbon-carbon bonds

(C) Reduction reactions

(D) Acid-base neutralization

56. Why is chemoselectivity important in organic synthesis ?

(A) To increase the yield of the desired product

(B) To ensure reactions occur faster

(C) To avoid unwanted byproducts

(D) Both (A) and (C)

57. Which reaction demonstrates high chemoselectivity ?

(A) Friedel-Crafts acylation

(B) Reduction of aldehydes over ketones using $NaBH_4$

(C) Electrophilic aromatic substitution

(D) Nucleophilic substitution

58. Which of the following factors influences chemoselectivity ?

(A) Functional groups present

(B) Reaction conditions

(C) Catalyst used

(D) All of the above

59. What does chemoselectivity refer to ?

(A) Selectivity between different stereoisomers

(B) Preference of one functional group to react over others

(C) Choice of a specific reaction pathway

(D) Isolation of a chemical compound

60. Which of the following is NOT a factor affecting the hydrogenation rate of aromatic rings ?

(A) Nature of the catalyst

(B) Solvent used in the reaction

(C) Aromaticity of the ring

(D) Atomic mass of hydrogen

61. The product of amide hydrolysis under acidic conditions is :

(A) Amine and alcohol

(B) Carboxylic acid and ammonia

(C) Ketone and ammonia

(D) Aldehyde and amine

62. Which of the following conditions generally favour an ene reaction ?

(A) High Pressure

(B) UV Light

(C) High Temperature

(D) Low Temperature

63. The ene reaction typically involves which of the following reactants ?

(A) Diene and Alkene

(B) Alkene and Alkene

(C) Alkene and Allylic Hydrogen

(D) Alkyne and Alkene

64. In which scenario is the Hofmann product favoured over the Zaitsev product ?

(A) When using bulky bases

(B) When using polar protic solvents

(C) In the presence of a strong nucleophile

(D) When the substrate is tertiary

65. Which phenomenon describes a molecule that undergoes rapid rearrangements of its bonds ?

(A) Fluxional Tautomerism

(B) Aromaticity

(C) Hyperconjugation

(D) Resonance

66. Acidic hydrolysis of esters yields :

(A) Alcohol and carboxylic acid

(B) Alcohol and aldehyde

(C) Alcohol and ketone

(D) Alcohol and amide

67. Which of the following is a [5,5]-sigmatropic rearrangement ?

(A) Cope Rearrangement

(B) Aza-Cope Rearrangement

(C) Ene Reaction

(D) None of the above

68. According to Zaitsev's rule, the major product in elimination reactions is typically the :

(A) Less substituted alkene

(B) More substituted alkene

(C) Alkane

(D) Alkyne

69. Stobbe reaction involves the reaction of :

(A) Ketones with hydrazine

(B) Aldehydes with malonic esters

(C) Carbonyl compounds with diethyl succinate

(D) Alcohols with acids

70. Pyrolytic elimination reactions often proceed via which mechanism ?

(A) E1

(B) E2

(C) ElcB

(D) Concerted cyclic transition state

71. In a [3,3]-sigmatropic rearrangement, what reaction is commonly observed ?

(A) Claisen Rearrangement

(B) Diels-Alder Reaction

(C) Friedel-Crafts Reaction

(D) S_N^1 Reaction

72. Perkin reaction is used to synthesize :

(A) α, β-Unsaturated aromatic acids

(B) Alcohols

(C) Alkenes

(D) Esters

73. Which functional group contains a carbon-hetero multiple bond ?

(A) Alkane

(B) Ether

(C) Aldehyde

(D) Alcohol

74. What is the characteristic feature of a sigmatropic rearrangement ?

(A) Formation of a new ring

(B) Migration of a σ-bond

(C) Cycloaddition of alkenes

(D) Loss of a leaving group

75. Which solvent is most suitable for an El reaction ?

(A) Polar protic solvent

(B) Polar aprotic solvent

(C) Non-polar solvent

(D) Dry ether

76. Benzoin condensation involves the reaction of :

(A) Aldehydes using cyanide ion as a catalyst

(B) Ketones using NaOH as a catalyst

(C) Esters using $NaBH_4$ as a catalyst

(D) Nitriles using HCl as a catalyst

77. What type of orbital interaction is required in a supra-supra cycloaddition ?

(A) Antarafacial overlap

(B) Suprafacial overlap

(C) Disrotatory motion

(D) Conrotatory motion

78. In the Mannich reaction, the main product formed is a :

(A) β-Keto acid

(B) β-Hydroxyketone

(C) β-Amino carbonyl compound

(D) α, β-Unsaturated ester

79. A strong base is necessary for which elimination mechanism ?

(A) E1

(B) E2

(C) ElcB

(D) All of the above

80. The Claisen condensation is a reaction between :

(A) Aldehydes and ketones

(B) Esters and ketones

(C) Two esters

(D) Esters and nitriles

81. Which of the following is the best leaving group for elimination reactions ?

(A) –OH

(B) $–NH_2$

(C) –Br

D) $–CH_3$

82. Which reaction is an example of a [4+2] cycloaddition ?

(A) Diels-Alder Reaction

(B) Claisen Rearrangement

(C) Cope Rearrangement

(D) Michael Addition

83. What is the characteristic product of a [4+2] cycloaddition reaction ?

(A) Cyclobutane

(B) Cyclohexene

(C) Benzene

(D) Cycloheptene

84. Which type of substrate is most likely to undergo an El reaction ?

(A) Primary alkyl halide

(B) Secondary alkyl halide

(C) Tertiary alkyl halide

(D) Methyl halide

85. Knoevenagel condensation typically uses which catalyst ?

(A) NaOH

(B) $ZnCl_2$

(C) Piperidine

(D) H_2SO_4

86. Which of the following molecules is most likely to undergo an electrocyclic reaction ?

(A) Benzene

(B) Cyclobutene

(C) Ethene

(D) Cyclopropane

87. The rate of an E2 reaction depends on :

(A) Only the substrate concentration

(B) Only the base concentration

(C) Both substrate and base concentrations

(D) Solvent polarity only

88. Aldol condensation involves the formation of :

(A) Alcohols

(B) Ketones

(C) α, β-Unsaturated carbonyl compounds

(D) Ethers

89. In a 4л-electrocyclic reaction, what motion is favoured under thermal conditions ?

(A) Conrotatory

(B) Disrotatory

(C) Sigmatropic

(D) Antarafacial

90. In elimination reactions, which rule often determines the major product ?

(A) Markovnikov's Rule

(B) Zaitsev's Rule

(C) Le Chatelier's Principle

(D) Pauli's Exclusion Principle

91. The Wittig reaction involves the reaction of a carbonyl compound with :

(A) Ylide

(B) Grignard reagent

(C) Organolithium reagent

(D) Hydrazine

92. What are the frontier molecular orbitals involved in pericyclic reactions ?

(A) *s* and *p* orbitals

(B) HOMO and LUMO

(C) Bonding and Antibonding Orbitals

(D) Atomic Orbitals

93. The ElcB reaction typically involves which type of intermediate ?

(A) Carbocation
(B) Carbanion
(C) Free radical
(D) Oxonium ion

94. Which of the following is an example of an organolithium reagent ?

(A) $LiAlH_4$
(B) PhLi
(C) $NaBH_4$
(D) MgBr

95. What is the primary basis for predicting the outcome of pericyclic reactions using Molecular Orbital Theory ?

(A) Hybridization of orbitals
(B) Woodward-Hoffmann Rules
(C) Resonance Structures
(D) Reaction Coordinate Diagram

96. What is a characteristic feature of the E2 reaction ?

(A) It involves a carbocation intermediate.
(B) It is a one-step, concerted reaction.
(C) It is independent of the base strength.
(D) It occurs only in non-polar solvents.

97. Grignard reagents react with carbonyl compounds to form :

(A) Alcohols
(B) Esters
(C) Nitriles
(D) Carboxylic acids

98. Which molecular orbital theory is commonly used to explain pericyclic reactions ?

(A) VSEPR Theory
(B) Crystal Field Theory
(C) Molecular Orbital Theory
(D) Resonance Theory

99. Which of the following statements about the El mechanism is true ?

(A) It involves a single-step reaction.
(B) It requires a strong base.
(C) It proceeds via a carbocation intermediate.
(D) It follows second-order kinetics.

100. Which metal hydride is commonly used for the reduction of carbonyl compounds to alcohols ?

(A) $NaBH_4$
(B) H_2SO_4
(C) $KMnO_4$
(D) Br_2

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।