

Roll. No.

Question Booklet Number

O.M.R. Serial No.

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M.Sc. (SEM.-IV) (NEP) (SUPPLE.) EXAMINATION, 2024-25

CHEMISTRY

(Organic Synthesis)

Paper Code

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Question Booklet
Series

A

Time : 1 : 30 Hours

Max. 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.
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 :

(Remaining instructions on last page)

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, उसे तुरन्त बदल लें।
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 छानना है। उत्तर को OMR उत्तर-पत्रक में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

(शेष निर्देश अन्तिम पृष्ठ पर)

1. Which of the following organometallic reagents is commonly used in nucleophilic addition to carbonyl compounds?
 - (A) Grignard reagent
 - (B) Organosilane
 - (C) Organoborane
 - (D) Organocuprate
2. Which metal is involved in the formation of a Grignard reagent?
 - (A) Lithium
 - (B) Magnesium
 - (C) Zinc
 - (D) Copper
3. What is the general formula of a Grignard reagent?
 - (A) RMgBr
 - (B) RLi
 - (C) RZnX
 - (D) R_2CuLi
4. Which solvent is typically used in Grignard reagent reactions?
 - (A) Water
 - (B) Methanol
 - (C) Diethyl ether
 - (D) Acetone
5. What is the major drawback of using Grignard reagents?
 - (A) They are explosive
 - (B) They are unreactive
 - (C) They are highly moisture-sensitive
 - (D) They are toxic
6. Which organometallic compound is commonly prepared by direct reaction of an alkyl halide with lithium?
 - (A) R_2Zn
 - (B) R_2CuLi
 - (C) RLi
 - (D) RMgBr
7. Organolithium reagents are generally _____ than Grignard reagents.
 - (A) Less reactive
 - (B) More reactive
 - (C) Equally reactive
 - (D) Inert
8. Which metal is used to prepare organozinc reagents?
 - (A) Li
 - (B) Mg
 - (C) Zn
 - (D) Cu

9. Which reaction uses organozinc reagents for carbon-carbon bond formation?
 - (A) Wurtz reaction
 - (B) Reformatsky reaction
 - (C) Friedel-Crafts acylation
 - (D) Kolbe reaction
10. Gilman reagents are also known as:
 - (A) Organoboranes
 - (B) Organocuprates
 - (C) Organosilanes
 - (D) Organozincs
11. Which of the following is a Gilman reagent?
 - (A) RLi
 - (B) R_2Mg
 - (C) R_2CuLi
 - (D) R_3B
12. What is the oxidation state of copper in Gilman reagent (R_2CuLi)?
 - (A) 0
 - (B) +1
 - (C) +2
 - (D) -1
13. Which metal is used in the Suzuki coupling reaction?
 - (A) Ni
 - (B) Pd
 - (C) Cu
 - (D) Fe
14. Which organometallic compound participates in the Negishi coupling?
 - (A) Organoboron
 - (B) Organolithium
 - (C) Organozinc
 - (D) Organosilicon
15. Heck reaction involves the coupling of aryl halides with:
 - (A) Alkanes
 - (B) Alkenes
 - (C) Alkynes
 - (D) Alcohols
16. In Stille coupling, the organometallic partner is based on which element?
 - (A) B
 - (B) Sn
 - (C) Si
 - (D) Zn

17. The active catalytic species in the Heck reaction is:
(A) Pd(0)
(B) Ni(II)
(C) Cu(I)
(D) Fe(III)
18. Which of the following is NOT typically involved in transition metal catalyzed cross coupling?
(A) Pd
(B) Fe
(C) Cu
(D) Na
19. Organosilanes are typically used in which type of reaction?
(A) Oxidation
(B) Cross-coupling
(C) Nucleophilic addition
(D) Peterson olefination
20. Which compound is commonly used in the synthesis of alcohols via hydroboration oxidation?
(A) B₂H₆
(B) BH₃·THF
(C) BB_{r3}
(D) NaBH₄
21. The mechanism of hydroboration involves:
(A) Radical substitution
(B) Electrophilic addition
(C) Concerted syn addition
(D) Nucleophilic elimination
22. Which of the following elements form π -backbonding organometallic complexes?
(A) Na
(B) Fe
(C) B
(D) Si
23. Which metal catalyzes Kumada coupling?
(A) Zn
(B) Pd
(C) Ni
(D) Fe
24. Which reagent is commonly used in the hydrosilylation of alkenes?
(A) R₃SiH
(B) SiCl₄
(C) NaSiH₃
(D) B₂H₆

25. Which of the following organometallic species is the least nucleophilic?
- RLi
 - RMgBr
 - R₂CuLi
 - R₃SiH
26. Oxidation in organic chemistry generally involves:
- Gain of hydrogen
 - Loss of oxygen
 - Loss of hydrogen or gain of oxygen
 - Gain of electrons
27. Which of the following best defines an oxidation process?
- Increase in C-H bonds
 - Decrease in oxidation state
 - Increase in the number of C-O bonds
 - Conversion of ketone to alcohol
28. Which reagent is commonly used for the epoxidation of alkenes?
- PCC
 - m-CPBA
 - DIBAL-H
 - LiAlH₄
29. Which of the following is not a typical outcome of alkene oxidation?
- Epoxide formation
 - Dihydroxylation
 - Cleavage to carbonyls
 - Hydrogenation
30. Ozonolysis of an alkene typically gives:
- Alcohols
 - Ketones and/or aldehydes
 - Carboxylic acids
 - Epoxides
31. Which oxidant is used in the Sharpless asymmetric dihydroxylation of alkenes?
- RuO₄
 - OsO₄
 - KMnO₄
 - Pb(OAc)₄
32. Which functional group is most easily oxidized?
- Tertiary alcohol
 - Ketone
 - Primary alcohol
 - Ether
33. What is the product of oxidation of a primary alcohol with Jones reagent?
- Aldehyde
 - Ketone
 - Carboxylic acid
 - Ester

34. Which of the following reagents oxidizes secondary alcohols to ketones?
- (A) NaBH_4
 (B) KMnO_4
 (C) PCC
 (D) LiAlH_4
35. Which oxidant selectively oxidizes primary alcohols to aldehydes without over-oxidation?
- (A) KMnO_4
 (B) PCC
 (C) H_2CrO_4
 (D) Jones reagent
36. Vicinal diols can be cleaved oxidatively using:
- (A) PCC
 (B) NaBH_4
 (C) Periodic acid (HIO_4)
 (D) LiAlH_4
37. Which reagent oxidizes aldehydes to carboxylic acids?
- (A) PCC
 (B) NaBH_4
 (C) Tollens' reagent
 (D) DIBAL-H
38. Which of the following does not oxidize ketones?
- (A) KMnO_4
 (B) Chromic acid
 (C) PCC
 (D) O_3
39. Which of the following groups is hardest to oxidize?
- (A) Primary alcohol
 (B) Aldehyde
 (C) Tertiary alcohol
 (D) Secondary alcohol
40. Oxidation of activated benzylic C–H (such as toluene) with KMnO_4 gives:
- (A) Benzyl alcohol
 (B) Benzaldehyde
 (C) Benzoic acid
 (D) Styrene
41. Which reagent oxidizes unactivated C–H bonds selectively under mild conditions?
- (A) m-CPBA
 (B) RuO_4
 (C) NaIO_4
 (D) H_2O_2
42. Which of the following oxidants can convert amines to nitroso or nitro compounds?
- (A) PCC
 (B) KMnO_4
 (C) m-CPBA
 (D) HNO_3

43. What is the product of oxidizing a sulfide ($R-S-R$) with a mild oxidant like H_2O_2 ?
- (A) Disulfide
(B) Thiol
(C) Sulfoxide
(D) Sulfone
44. Further oxidation of a sulfoxide leads to:
- (A) Sulfide
(B) Sulfone
(C) Thiol
(D) Disulfide
45. Which of the following can oxidize hydrazines ($R-NH-NH_2$) to azo compounds?
- (A) O_3
(B) PCC
(C) H_2CrO_4
(D) $Pb(OAc)_4$
46. Which high-valent metal oxide is a strong oxidant, especially for diols and alcohols?
- (A) RuO_4
(B) $NiCl_2$
(C) $CuCl$
(D) $FeSO_4$
47. Ruthenium tetroxide is typically generated in situ using:
- (A) $RuCl_3 + NaIO_4$
(B) $RuO_2 + H_2O_2$
(C) $RuBr_3 + O_3$
(D) $RuO_4 + H_2O$
48. Iodobenzene diacetate ($PhI(OAc)_2$) is classified as:
- (A) A Lewis acid
(B) An oxidizing hypervalent iodine reagent
(C) A reducing agent
(D) A peroxide
49. Which reagent is used to oxidize alkenes to vicinal diacetates in presence of acetic acid?
- (A) $TI(NO_3)_3$
(B) OsO_4
(C) $PhI(OAc)_2$
(D) m-CPBA
50. Which reagent can oxidize alcohols and cleave 1,2-diols but is toxic and rarely used today?
- (A) $PhI(OAc)_2$
(B) $KMnO_4$
(C) $TI(NO_3)_3$
(D) PDC

51. Reduction in organic chemistry typically involves :
- (A) Loss of hydrogen
(B) Gain of oxygen
(C) Gain of hydrogen or loss of oxygen
(D) Loss of electrons
52. Catalytic hydrogenation of an alkene typically uses:
- (A) LiAlH_4
(B) H_2 with Pd/C
(C) PCC
(D) KMnO_4
53. Which of the following reduces alkenes to alkanes?
- (A) H_2/Pt
(B) NaBH_4
(C) PCC
(D) OsO_4
54. What is the product of reducing an alkyne with Lindlar's catalyst?
- (A) Alkane
(B) Trans-alkene
(C) Cis-alkene
(D) Diene
55. Which reagent is used for the dissolving metal reduction of alkynes?
- (A) H_2/Pd
(B) Na/NH_3
(C) LiAlH_4
(D) Zn/HCl
56. Reduction of an aromatic ring under Birch conditions yields:
- (A) Fully saturated ring
(B) A trans-alkene
(C) 1,4-cyclohexadiene
(D) No reaction
57. Which reagent is typically used to reduce aldehydes to primary alcohols?
- (A) PCC
(B) LiAlH_4
(C) CrO_3
(D) AgNO_3
58. NaBH_4 reduces which of the following functional groups effectively?
- (A) Carboxylic acids
(B) Amides
(C) Aldehydes and ketones
(D) Esters
59. LiAlH_4 reduces esters to:
- (A) Aldehydes
(B) Alcohols
(C) Ketones
(D) Acids

60. Which of the following carbonyl compounds is most resistant to reduction by NaBH_4 ?
- (A) Aldehyde
(B) Ketone
(C) Carboxylic acid
(D) Acyl chloride
61. Which reducing agent is selective for converting acid chlorides to aldehydes?
- (A) LiAlH_4
(B) DIBAL-H
(C) NaBH_4
(D) H_2/Pt
62. Which reducing agent can reduce nitriles to primary amines?
- (A) PCC
(B) DIBAL-H
(C) LiAlH_4
(D) NaBH_4
63. Catalytic hydrogenation of nitrobenzene typically gives:
- (A) Phenol
(B) Aniline
(C) Benzaldehyde
(D) Benzene
64. Which group is reduced by Zn/HCl in acidic medium?
- (A) Ketone
(B) Nitro group
(C) Alcohol
(D) Amide
65. Reduction of azo compounds typically gives:
- (A) Amines
(B) Alcohols
(C) Carboxylic acids
(D) Alkenes
66. Which of the following can reduce an oxime to an amine?
- (A) PCC
(B) Zn/AcOH
(C) KMnO_4
(D) DMP
67. Cleavage of C–O or C–N single bonds by hydrogenation is known as:
- (A) Hydrolysis
(B) Hydrogenolysis
(C) Dehydrogenation
(D) Isomerization
68. Which reagent can perform hydrogenolysis of benzyl ethers?
- (A) KMnO_4
(B) H_2/Pd
(C) NaBH_4
(D) PCC

69. Which condition is used for the hydrogenolysis of esters to alcohols?
- (A) H_2/Pd under high pressure
 (B) NaBH_4 in methanol
 (C) PCC in CH_2Cl_2
 (D) Na/NH_3
70. Which reagent selectively reduces epoxides to alcohols under basic conditions?
- (A) PCC
 (B) LiAlH_4
 (C) KMnO_4
 (D) DIBAL-H
71. Which part of the epoxide is attacked by LiAlH_4 during reduction?
- (A) Less substituted carbon
 (B) More substituted carbon
 (C) Oxygen atom
 (D) Both ends equally
72. Which reducing agent does not typically reduce esters or acids?
- (A) NaBH_4
 (B) LiAlH_4
 (C) Red-Al
 (D) DIBAL-H
73. Red-Al (sodium bis(2-methoxyethoxy)aluminum hydride) is stronger than:
- (A) NaBH_4
 (B) LiAlH_4
 (C) DIBAL-H
 (D) H_2/Pt
74. Which of the following reduces carboxylic acids directly to alcohols?
- (A) NaBH_4
 (B) PCC
 (C) LiAlH_4
 (D) DIBAL-H
75. Reduction of acyl chlorides with H_2 and Lindlar catalyst gives:
- (A) Alcohol
 (B) Aldehyde
 (C) Alkane
 (D) Ketone
76. In a rearrangement reaction, the migrating group typically moves from:
- (A) One molecule to another
 (B) A functional group to a solvent
 (C) One atom to another within the same molecule
 (D) A carbon to a metal catalyst
77. Migratory aptitude refers to:
- (A) Stability of leaving group
 (B) Tendency of a group to undergo elimination
 (C) Ability of a group to migrate during rearrangement
 (D) Rate of hydrolysis

78. In general, the order of migratory aptitude is:
- (A) $H < Ph < Alkyl$
 - (B) $H > Aryl > Alkyl$
 - (C) $Alkyl > H > Aryl$
 - (D) $Aryl > Alkyl > H$
79. Which effect refers to the preference for a group to migrate based on its original orientation?
- (A) Inductive effect
 - (B) Memory effect
 - (C) Hyperconjugation
 - (D) Anchimeric assistance
80. The Pinacol–Pinacolone rearrangement involves:
- (A) Alkene formation
 - (B) Ketone to alcohol conversion
 - (C) Diol to ketone rearrangement
 - (D) Amide to amine conversion
81. In the Pinacol rearrangement, which intermediate is formed first?
- (A) Carbene
 - (B) Carbocation
 - (C) Enolate
 - (D) Epoxide
82. The rearrangement of pinacol to pinacolone is induced by:
- (A) Base
 - (B) Acid
 - (C) Light
 - (D) Oxidant
83. In the Wagner–Meerwein rearrangement, the driving force is:
- (A) Formation of a more stable carbocation
 - (B) Reduction of carbonyl group
 - (C) Intramolecular hydrogen bonding
 - (D) Loss of water
84. Wagner–Meerwein rearrangement is typically seen in:
- (A) Aldehydes
 - (B) Alkenes
 - (C) Alcohols under acidic conditions
 - (D) Amines under basic conditions
85. The Demjanov rearrangement involves reaction of amines with:
- (A) Sulfuric acid
 - (B) Nitrous acid
 - (C) $KMnO_4$
 - (D) $NaBH_4$

86. In the Demjanov rearrangement, the key intermediate is:
- Carbocation
 - Nitrene
 - Free radical
 - Carbene
87. Benzil–Benzilic acid rearrangement involves migration of:
- Alkyl group
 - Aryl group
 - Carbonyl group
 - Carboxyl group
88. The Benzilic acid rearrangement is base-catalyzed and proceeds via:
- Carbanion intermediate
 - Carbocation intermediate
 - Nitrene intermediate
 - Radical intermediate
89. The Beckmann rearrangement converts:
- Alcohol to ketone
 - Oxime to amide
 - Ketone to oxime
 - Amide to amine
90. The migrating group in the Beckmann rearrangement is:
- Anti to –OH group
 - Syn to –OH group
 - Random
 - Always phenyl
91. Which acid is typically used in Beckmann rearrangement?
- Nitric acid
 - Sulfuric acid
 - Acetic acid
 - Chromic acid
92. Hofmann rearrangement transforms:
- Aldehyde to acid
 - Ketone to amide
 - Amide to amine
 - Acid to alcohol
93. The Hofmann rearrangement involves formation of:
- Isocyanate intermediate
 - Oxonium ion
 - Carbene
 - Alkene

94. In Curtius rearrangement, the starting compound is:
- (A) Amide
 - (B) Carboxylic acid
 - (C) Acid chloride
 - (D) Acyl azide
95. Curtius rearrangement gives:
- (A) Alcohol
 - (B) Aldehyde
 - (C) Amine
 - (D) Ether
96. The rearrangement step in the Curtius rearrangement proceeds via:
- (A) Radical
 - (B) Nitrene
 - (C) Carbocation
 - (D) Carbanion
97. Schmidt rearrangement involves reaction of carboxylic acids or ketones with:
- (A) Hydrazine
 - (B) HNO_3
 - (C) HCl
 - (D) Hydrazoic acid
98. Product of Schmidt rearrangement of a carboxylic acid is:
- (A) Alcohol
 - (B) Aldehyde
 - (C) Ketone
 - (D) Amine
99. Baeyer–Villiger rearrangement transforms a ketone into a(n):
- (A) Amine
 - (B) Ester
 - (C) Alcohol
 - (D) Nitrile
100. In Baeyer–Villiger rearrangement, the migrating group is:
- (A) From the more hindered side
 - (B) The group with better migratory aptitude
 - (C) Always phenyl
 - (D) Random

ROUGH WORK

Example :

Question :

Q.1 (A) ● (C) (D)

Q.2 (A) (B) ● (D)

Q.3 (A) ● (C) (D)

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 & 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.

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)

प्रश्न 2 (A) (B) ● (D)

प्रश्न 3 (A) ● (C) (D)

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ०एम०आर० 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. ओ०एम०आर० 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 में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैल्कुलेटर, 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 प्रश्नपुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरिज की दूसरी प्रश्नपुस्तिका प्राप्त कर लें।