

Roll. No.

Question Booklet Number

O.M.R. Serial No.

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

CHEMISTRY

(Heterocyclic Chemistry)

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)

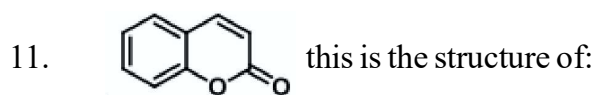
परीक्षार्थियों के लिए निर्देश :

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 :

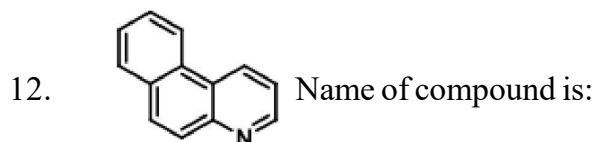
(शेष निर्देश अन्तिम पृष्ठ पर)

1. Which of the following is true about the Hantzsch-Widman system?
 - (A) It only applies to monocyclic compounds
 - (B) It applies to both monocyclic and polycyclic compounds
 - (C) It applies only to polycyclic compounds
 - (D) It is used exclusively for aliphatic compounds
2. The prefix "aza" in nomenclature represents:
 - (A) Oxygen
 - (B) Sulfur
 - (C) Nitrogen
 - (D) Phosphorus
3. The priority order of heteroatoms in nomenclature is:
 - (A) $N > O > S$
 - (B) $O > N > S$
 - (C) $S > O > N$
 - (D) $O > S > N$
4. A bicyclic system with a shared edge is called:
 - (A) Spiro system
 - (B) Fused system
 - (C) Bridged system
 - (D) Isolated system
5. What is the systematic name for a five membered ring containing one sulfur and one nitrogen atom?
 - (A) Thiirane.
 - (B) Pyrrolidine
 - (C) Oxazepine
 - (D) Thiazole
6. In a fused bicyclic system, which ring is considered the parent ring?
 - (A) The smaller ring
 - (B) The larger ring
 - (C) The ring with more heteroatoms
 - (D) Both rings are considered equal
7. What is the systematic name for a fused bicyclic system consisting of a benzene ring fused to a pyridine ring?
 - (A) Pyridobenzene
 - (B) Benzopyridine
 - (C) Benzene-pyridine
 - (D) Pyridobenzene
8.  name of compound is:
 - (A) 1,2,5-triazine
 - (B) 1,5,3-triazine
 - (C) 1,3,5-triazine
 - (D) 1,4,5-triazine
9. Which of the following is an example of monocyclic heterocycles?
 - (A) Pyrrole
 - (B) Indole
 - (C) Quinoline
 - (D) Benzofuran

10. The suffix "-azine" indicates:
- (A) One nitrogen in 6-membered ring
 - (B) Two nitrogens in 6-membered ring
 - (C) Three nitrogens in 6-membered ring
 - (D) Four nitrogens in 6-membered ring



- (A) Quinoline
- (B) Isoquinoline
- (C) Coumarin
- (D) Indole



- (A) Benzo[F] quinoline
- (B) Benzo[D] quinoline
- (C) Benzo[C] quinolone
- (D) Benzo[A] quinoline

13. Aromatic heterocycles must satisfy:
- (A) Only Hückel's rule
 - (B) Only planarity
 - (C) Both Hückel's rule and planarity
 - (D) Neither Hückel's rule nor planarity

14. Dewar resonance energy is based on:
- (A) π electron energy only
 - (B) Both σ and π electron energies
 - (C) σ electron energy only
 - (D) Nuclear energy

15. Thiophene shows aromaticity because it has:
- (A) 4π electrons
 - (B) 6π electrons
 - (C) 8π electrons
 - (D) 10π electrons

16. Empirical resonance energy is:
- (A) Calculated from heats of hydrogenation
 - (B) Calculated from bond energies
 - (C) Calculated from MO theory
 - (D) Calculated from NMR data

17. The order of basicity is:
- (A) Pyridine > Imidazole > Pyrrole
 - (B) Pyrrole > Imidazole > Pyridine
 - (C) Pyrrole > Pyridine > Imidazole
 - (D) Imidazole > Pyridine > Pyrrole

18. Most common hetero atoms found in heterocyclic compounds are:
- (A) C, H, O
 - (B) C, H, N
 - (C) C, H, S
 - (D) N, O, S

19. The HOMO-LUMO gap in aromatic heterocycles is:
- Always large
 - Always small
 - Zero
 - Variable depending on structure
20. Pyrrole is less basic than pyridine because the lone pair of electron on nitrogen atom in Pyrrole:
- is a part of delocalised π molecular orbitals
 - is not a part of delocalised π molecular orbitals
 - reside in sp^2 hybrid orbitals
 - reside in sp hybrid orbitals
21. The most reactive position in furan for electrophilic substitution is:
- Position 2
 - Position 3
 - Position 4
 - Position 5
22. Which of the following best describes keto enol tautomerism?
- Migration of a hydrogen atom between two carbon atoms
 - Reversible migration of a hydrogen atom and a double bond between a heteroatom and an adjacent carbon atom
 - Formation of an enolate ion under basic condition
 - Substitution of a hydrogen atom by an electrophile
23. Tautomerism in 2-hydroxypyridine involves:
- Keto-enol equilibrium
 - Amino-imino equilibrium
 - Lactam-lactim equilibrium
 - Ring-chain equilibrium
24. Why do aromatic compound show diamagnetic susceptibility exaltation?
- Due to presence of a heteroatom
 - Because of external magnetic field interaction
 - Due to circulation of π electrons creating an opposing magnetic field
 - Because of their ability to undergo substitution reactions
25. Bond angle strain in cyclopropane is due to:
- sp^3 hybridization requiring 109.5°
 - sp^2 hybridization requiring 120°
 - sp hybridization requiring 180°
 - No specific hybridization
26. The ring strain in aziridine is:
- Less than cyclopropane
 - Equal to cyclopropane
 - Greater than cyclopropane
 - Zero

27. Torsional strain arises from:
- Bond angle deformation
 - Eclipsing interactions
 - Ring puckering
 - Lone pair repulsion
28. 1,3-diaxial interactions cause:
- No effect on stability
 - Ring expansion
 - Ring stabilization
 - Ring destabilization
29. Criteria of aromaticity in heterocyclic compound depends upon:
- Chemical behaviour-
Electrophilic aromatic substitution
 - Structural bond length-equalisation due to cyclic delocalisation
 - Energetic-enhanced stability (resonance) and magnetic ring current effect
 - All of the above
30. The anomeric effect is due to:
- Electrostatic interactions
 - Orbital interactions
 - Steric hindrance
 - Bond length changes
31. N-methylpiperidine shows:
- Slow inversion
 - Rapid inversion
 - No inversion
 - Variable inversion rate
32. Pyramidal inversion refers to:
- Ring flipping
 - Nitrogen inversion
 - Carbon inversion
 - Oxygen inversion
33. The barrier to ring inversion in cyclohexane is highest for which type of substituents?
- Hydrogen atom
 - Small alkyl groups
 - Large alkyl groups
 - Halogens
34. The Baeyer strain theory explains:
- Torsional strain
 - Steric strain
 - Bond angle strain
 - Electronic strain
35. The preferred conformation of cyclohexane is:
- Chair
 - Boat
 - Twist-boat
 - Planar
36. Intermolecular nucleophilic-electrophilic interactions are:
- Neutral
 - Variable
 - Repulsive
 - Attractive

37. The principle of heterocyclic synthesis involves:
- Only cyclization reactions
 - Only cycloaddition reactions
 - Both cyclization and cycloaddition reactions
 - Neither cyclization nor cycloaddition reactions
38. Pyridine reacts with H_2 in presence of Pt to give
- Pyridinium salt
 - Pyridine
 - Piperidine
 - Picolines
39. The Diels-Alder reaction is an example of:
- [2+2] cycloaddition
 - [3+2] cycloaddition
 - [4+2] cycloaddition
 - [4+4] cycloaddition
40. 1,3-dipolar cycloaddition involves:
- 1,3-dipole and alkene
 - 1,3-dipole and alkyne
 - 1,3-dipole and carbonyl
 - All of the above
41. The Paal-Knorr synthesis produces:
- Pyrroles and furans
 - Pyridines
 - Pyrimidines
 - Pyrazines
42. The Hantzsch synthesis is used for:
- Pyrroles
 - Pyridines
 - Pyrimidines
 - Pyrazoles
43. The Biginelli reaction produces:
- Pyrroles
 - Pyridines
 - Dihydropyrimidines
 - Pyrazoles
44. The Fischer indole synthesis involves:
- Phenylhydrazine and ketone
 - Aniline and aldehyde
 - Pyrrole and benzene
 - Furan and amine
45. In the synthesis of pyridazines, which reaction pathway involves the condensation of hydrazine with α , β -unsaturated compounds?
- Fischer indole synthesis
 - Biginelli reaction
 - Paal-Knorr Synthesis
 - Robinson Allulation
46. Ring-rearrangement metathesis (RRM) involves:
- Breaking and forming C=C bonds
 - Breaking and forming C-C bonds
 - Breaking and forming C-N bonds
 - Breaking and forming C-O bonds

47. The condensation of α -halophenols with thiourea, produces benzothiazines. What would be the key step for this reaction?
- (A) Hetero Diels-Alder Reaction
(B) Biginelli reaction
(C) Fischer indole synthesis
(D) Knorr-Pyrrole Synthesis
48. Electrocyclization follows:
- (A) Woodward-Hoffmann rules
(B) Baldwin rules
(C) Markovnikov rules
(D) Zaitsev rules
49. Aziridines are:
- (A) 6-membered rings with nitrogen
(B) 5-membered rings with nitrogen
(C) 4-membered rings with nitrogen
(D) 3-membered rings with nitrogen
50. Aziridines are synthesized by:
- (A) Gabriel synthesis
(B) Wenker synthesis
(C) Both a and b
(D) Neither a nor b
51. Oxiranes are:
- (A) 
(B) 
(C) 
(D) 
52. Oxirane ring also called:
- (A) Ethylene oxide
(B) α,β -epoxyethane
(C) 1,2-oxidoethane
(D) All of the above
53. Oxetanes are synthesized by:
- (A) Paterno-Büchi reaction
(B) Williamson synthesis
(C) Gabriel synthesis
(D) Fischer synthesis
54. The molecular formula of Oxetane is:
- (A) C_2H_5N
(B) C_2H_4O
(C) C_3H_6O
(D) C_3H_6S
55. Which of the following solvent is heterocyclic compound ?
- (A) diglyme
(B) THF
(C) DMF
(D) DMSO

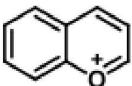
56. The heteroatoms involve in formation of thietanes are.
- Oxygen
 - Halogen
 - Nitrogen
 - Sulphur
57. Arrange the process in right sequence of formation of Aziridines.
- Chloronitrosation, cyclization & reduction.
 - Cyclization, chloronitrosation & reduction.
 - Chloronitrosation, reduction & cyclization
 - Reduction, cyclization & chloronitrosation
58. Epoxides can be converted to aziridines using:
- Ammonia
 - Sodium azide followed by reduction
 - Both (A) and (B)
 - Neither (A) nor (B)
59. The ring-opening in the case of 2-phenyl oxetane yields a product which arises through the intermediary of the benzylic carbocation ions.
- $C_6H_5CH(Cl)CH_2CH_2OH$
 - $C_4H_9CH(Cl)CH_2CH_2OH$
 - $C_6H_{11}CH(Cl)CH_2CH_2OH$
 - $C_6H_5CH_2CH(Cl)CH_2OH$
60. Aziridines undergo ring opening with:
- Nucleophiles only
 - Electrophiles only
 - Both nucleophiles and electrophiles
 - Neither nucleophiles nor electrophiles
61. Pyrylium salts have:
- Neutral charge
 - Positive charge
 - Negative charge
 - Variable charge
62. Pyrylium salts are prepared from:
- 1,5-diketones and acids
 - 1,4-diketones and acids
 - 1,3-diketones and acids
 - 1,6-diketones and acids
63. α -pyrones loses CO_2 upon photolysis gives:
- Cyclopentadiene
 - Cyclohexadiene
 - Cyclotetradiene
 - Cyclobutadiene
64. Which of these is true statement?
- 4-pyrones have greater degree of aromaticity than 2-pyrones
 - 2-pyrones have greater degree of aromaticity than 4-pyrones
 - Both have same degree of aromaticity
 - Both are non-aromatic in nature

65. Pyridinium salts are:
- (A) Unreactive
 - (B) Equally reactive as pyridine
 - (C) Less reactive than pyridine
 - (D) More reactive than pyridine

66. Thiopyrylium salts are:
- (A) More stable than pyrylium salts
 - (B) Less stable than pyrylium salts
 - (C) Equally stable as pyrylium salts
 - (D) Unknown compounds

67. Chromones are:
- (A) Benzofuran derivatives
 - (B) Benzopyran derivatives
 - (C) Benzothiophene derivatives
 - (D) Benzopyrrole derivatives

68. The synthesis of chromones by Allan Robinson method uses:
- (A) Phenol and acetic acid
 - (B) Benzene and acetic anhydride
 - (C) O-Hydroxyacetophenone and acid anhydride
 - (D) O-Hydroxybenzaldehyde and acetone

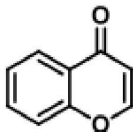
69.  Name of the compound

is:

- (A) Chromone
- (B) Coumarin
- (C) 1-benzopyrylium
- (D) 2-benzopyrylium

70. The reaction of pyridine with chloroform and a base (e.g., potassium tert-butoxide) yields:

- (A) 2,4,6-trichloropyridine
- (B) 2,4,6-tribromopyridine
- (C) 2,4,6-trifluoropyridine
- (D) 2,4,6-trichloropyridinium salts

71.  this is the structure of:

- (A) Chromone
- (B) Coumarin
- (C) 1-benzopyrylium
- (D) 2-benzopyrylium

72. Maltol is a:

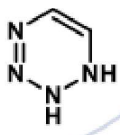
- (A) Pyridone derivative
- (B) γ -pyrone derivative
- (C) α -pyrone derivative
- (D) Coumarin derivative

73. Pyrimidine and Pyrazine have nitrogens at positions:

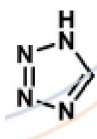
- (A) 2,3 and 1,2 respectively.
- (B) 1,2 and 1,4 respectively.
- (C) 1,3 and 1,4 respectively.
- (D) 1,4 and 2,3 respectively.

74. Triazines have:

- (A) Two nitrogens
- (B) Three nitrogens
- (C) Four nitrogens
- (D) Five nitrogens

75. The basicity order of diazines is:
- Pyrimidine > Pyrazine > Pyridazine
 - Pyrazine > Pyrimidine > Pyridazine
 - Pyridazine > Pyrazine > Pyrimidine
 - All are equally basic
76. Melamine is a:
- Triazine derivative
 - Pyrimidine derivative
 - Tetrazine derivative
 - Pyrazine derivative
77. 1,2,3-triazines are than 1,3,5-triazines.
- More acidic
 - Less acidic
 - More basic
 - Less basic
78. 1,2,4,5-Tetrazine is:
- Aromatic
 - Non-aromatic
 - Anti-aromatic
 - Variable aromaticity
79. Pyrazine is a membered nitrogen containing heterocyclic compound.
- six, three
 - five, three
 - five, two
 - six, two
80. Thiazines contain:
- Nitrogen and oxygen
 - Oxygen and sulfur
 - Nitrogen and sulfur
 - Two nitrogens
81. Which of the following diazines can undergo electrophilic aromatic substitution reactions?
- Pyridazine
 - Pyrimidine
 - Pyrazine
 - All of the above
82. The IUPAC name of the compound
- 
- is:
- 3H-tetrazine
 - 2H-tetrazine
 - 1H-tetrazine
 - 4H-tetrazine
83. The reaction of pyridazine with hydroxylamine (NH₂OH) in the presence of a base results in the formation of:
- Pyridazine N-oxide.
 - Pyridazine-2,3-dicarboxylic acid.
 - Pyridazine-2,5-dicarboxylic acid.
 - Pyridazine-2,3,5,6-tetracarboxylic acid.

84. The compound below is known as



- (A) Tetrazine
- (B) Tetrazole
- (C) Tetrazidine
- (D) Tetrazipine

85. Which one of the following is a seven membered heterocyclic compounds?

- (A) Azepine
- (B) Diazines
- (C) Pyrones
- (D) Oxetanes

86. The synthesis of azepines involves:

- (A) Ring expansion reactions
- (B) Cyclization reactions
- (C) Both ring expansion and cyclization
- (D) Neither method

87. Diazepines contain:

- (A) One nitrogen
- (B) Two nitrogens
- (C) Three nitrogens
- (D) No nitrogen

88. Oxepines are :

- (A) 6-membered rings with oxygen
- (B) 5-membered rings with oxygen
- (C) 8-membered rings with oxygen
- (D) 7-membered rings with oxygen

89. C_6H_6S is the molecular formula of:

- (A) Thiozole
- (B) Thiazines
- (C) Thiopines
- (D) Thiazepines

90. The valence isomerization of oxepin gives:

- (A) Furan
- (B) Phenol
- (C) Cycloheptatrienone
- (D) Benzene oxide

91. Thiepine contains..... Sulphur atom in a Membered ring:

- (A) One, seven
- (B) Two, eight
- (C) Three, six
- (D) Four, seven

92. Thiopines are:

- (A) More stable than oxepines
- (B) Less stable than oxepines
- (C) Equally stable as oxepines
- (D) Unknown compounds

93. Which of the following heterocyclic compounds having a seven-membered ring with two nitrogen atoms

- (A) Diazocines
- (B) Diazepines
- (C) Dioxocines
- (D) Dithiocines

94. Thiazepines find applications in which of the following fields?
- (A) Pharmaceuticals
(B) Agrochemicals
(C) Materials science
(D) All of the above
95. 1,5-Diazocines show:
- (A) Ring inversion
(B) Nitrogen inversion
(C) Both ring and nitrogen inversion
(D) No inversion
96. What will be formed when 1,2-dichlorobenzene react with 1,4-diazepines?
- (A) 1,2-diazepines
(B) 1,3-diazepines
(C) 1,4-diazepines
(D) 2,4-diazepines
97. Heteroatom present in the pyrrole, furan and thiophene are Respectively.
- (A) N, S, O
(B) N, O, S
(C) O, N, S
(D) S, O, N
98. The nitrogen atom in the pyrrole and pyridine molecule is:
- (A) sp^2 hybridised
(B) sp^3 hybridised
(C) sp hybridised
(D) None of the above
99. Which of the following is a heterocyclic compound?
- (A) Benzene
(B) Chloroform
(C) Aniline
(D) Furan
100. Which of the following is a six membered heterocyclic compound?
- (A) Pyrrole
(B) Furan
(C) Pyridine
(D) Thiophene

ROUGH WORK

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।