Roll No. .....

Question Booklet Number

O. M. R. Serial No. | | | | | | | |

M. Sc. (Fourth Semester)

(NEP) EXAMINATION, 2025-26

CHEMISTRY

(Bioinorganic And Supramolecular Chemistry)

Paper Code							
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Questions Booklet Series
C

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. The Radioactive isotope widely used as a diagnostic imaging agent in nuclear is medicine for various organs is :

(A) Iron-59

(B) Technitium-99m

(C) Cobalt-60

(D) Gold-198

2. Which compound is first converted to xanthine by xanthine oxidase ?

(A) Adenine

(B) Guanine

(C) Cytosine

(D) Hypoxanthine

3. Aluminum hydroxide is used as :

(A) Antimalarial

(B) Antacid

(C) Antiviral

(D) Antibiotic

4. The biological function of Cytochrome P-450 is :

(A) O_2 Transport

(B) Oxidation of alkene

(C) O_2 Storage

(D) Conversion of Xanthine to Uric acid

5. Calcium gluconate is used to treat :

(A) Hypercalcemia

(B) Hypocalcaemia

(C) Asthma

(D) Diabetes

6. Which metal is essential for insulin storage in pancreas ?

(A) Iron

(B) Gold

(C) Silver

(D) Zinc

7. Which metal is present in the anticancer drug carboplatin ?

(A) Gold

(B) Copper

(C) Iron

(D) Platinum

8. In the catalytic cycle of Cu, Zn-SOD, what happens to the copper ion during the first step of superoxide dismutation ?

(A) It is reduced from Cu^{2+} to Cu^{+}

(B) It is oxidized from Cu^{+} to Cu^{2+}

(C) It is replaced by zinc ion

(D) It remains in the Cu^{2+} state

9. Which metal compound is used as an X-ray contrast agent ?

(A) Calcium carbonate

(B) Zinc chloride

(C) Iron oxide

(D) Barium sulphate

10. Which of the following is a classic biological example of supramolecule ?

(A) Glucose

(B) Caffeine

(C) DNA (Double Helix)

(D) Ethanol

11. Magnesium hydroxide is commonly used as :

(A) Antacid

(B) Antibiotic

(C) Antidepressant

(D) Antibiotic

12. Silver sulfadiazine is mainly used for :

(A) Cancer treatment

(B) Hypertension

(C) Burn infections

(D) Diabetes

13. Which metal is present in ferrous sulfate used to treat anemia ?

(A) Iron

(B) Calcium

(C) Copper

(D) Zinc

14. The drug auranofin used in rheumatoid arthritis contains which metal ?

(A) Gold

(B) Iron

(C) Nickel

(D) Zinc

15. The leaving groups in cisplatin are :

(A) Ammonia ligands

(B) Chloride ligands

(C) Platinum ion

(D) Water molecules

16. The geometry of cisplatin allows formation of :

(A) 180° crosslinks

(B) 90° intrastand

(C) Linear adducts

(D) Triple helix DNA

17. Cisplatin primarily binds to which position of guanine ?

(A) N1

(B) N3

(C) N6

(D) N7

18. The trans isomer of cisplatin is less effective because :

(A) It is unstable

(B) It cannot enter cells

(C) It forms less effective DNA crosslinks

(D) It is insoluble

19. The lower chloride concentration inside cell favors :

(A) Precipitation

(B) Dimerization

(C) Deactivation of cisplatin

(D) Aquation of cisplatin

20. Activation of cisplatin inside the cell occurs via :

(A) Photolysis

(B) Oxidation

(C) Reduction

(D) Hydrolysis (aquation)

21. Cisplatin forms the most common DNA adduct with :

(A) Adenine-Thymine

(B) Cytosine-Guanine

(C) Adjacent Guanine bases

(D) Thymine-Thymine

22. The anticancer activity of cisplatin is mainly due to :

(A) RNA intercalation

(B) DNA crosslinking

(C) Micro tube stabilization

(D) Protein alkylation

23. Cisplatin belongs to which class of coordination compound ?

(A) Octahedral complex

(B) Square planar

(C) Tetrahedral

(D) Linear complex

24. A complex used as anticancer drug is :

(A) Trans- $[Pt(NH_3)_2(NO_2)_2]$

(B) Cis- $[Pt(NH_3)_2(NO_2)_2]$

(C) Trans- $[Pt(NH_3)_2Cl_2]$

(D) Cis- $[Pt(NH_3)_2Cl_2]$

25. Which metal is used in radioactive cancer therapy (Radiotherapy) ?

(A) Cobalt

(B) Sodium

(C) Aluminium

(D) Potassium

26. Which of the following metals can strongly bind to atoms in nucleic acid bases ?

(A) Hg^{2+}

(B) K^{+}

(C) Ca^{2+}

(D) Na^{+}

27. The interaction between metal ions and nucleic is important for :

(A) Protein synthesis only

(B) Lipid metabolism

(C) Cell membrane formation

(D) DNA replication and trans-cription

28. Metal ion help nucleic acids to :

(A) Remove nitrogen bases

(B) Decrease structural stability

(C) Neutralize negative charge on phosphate groups

(D) Break hydrogen bonds permanently

29. Which technique is commonly used to study metal-DNA interactions ?

(A) UV-Visible spectroscopy

(B) NMR spectroscopy

(C) X-ray spectroscopy

(D) All of the above

30. Which site in nucleic acid bases commonly coordinates with metal ions ?

(A) Carbon atoms

(B) Oxygen atoms

(C) Nitrogen atoms

(D) Hydrogen atoms

31. The binding of metal ion can cause :

(A) DNA denaturation

(B) DNA stabilization

(C) DNA cleavage

(D) All of the above

32. Xanthine oxidase catalyzes the conversion of xanthine into :

(A) Ammonia

(B) Uric acid

(C) Urea

(D) Hypoxanthine

33. Metal ions interact with nucleic acids mainly through :

(A) Hydrogen bonding with bases

(B) Covalent bonding with sugars

(C) Electrostatic interaction with phosphate groups

(D) Peptide bond formation

34. The negative charge of DNA mainly arises from :

(A) Phosphate backbone

(B) Nitrogen bases

(C) Hydrogen bond

(D) Sugar molecule

35. The oxidation state of Fe in transferrin is :

(A) + 2

(B) + 4

(C) 0

(D) + 3

36. Transferrin receptor is mainly present on :

(A) Platelets

(B) Red blood cells

(C) Actively dividing cell

(D) Plasma protein

37. Transferrin is synthesized mainly in the :

(A) Kidney

(B) Liver

(C) Spleen

(D) Bone marrow

38. Each molecule of transferrin can bind how many Fe^{3+} ions ?

(A) 4

(B) 1

(C) 2

(D) 3

39. The protein responsible for iron transport in blood is :

(A) Transferrin

(B) Ferritin

(C) Albumin

(D) Hemosiderin

40. Which protein acts as an acute phase reactant ?

(A) Hemoglobin

(B) Myoglobin

(C) Transferrin

(D) Ferritin

41. Ferritin can store approximately how many iron atoms ?

(A) 100

(B) 1000

(C) 10000

(D) 4500

42. Ferritin stores iron in which oxidation state ?

(A) + 3

(B) 0

(C) + 2

(D) + 1

43. Ferritin is mainly found in :

(A) Plasma

(B) Urine

(C) Liver, spleen and bone marrow

(D) Lymph

44. The primary function of ferritin is :

(A) Iron transport in plasma

(B) Iron storage inside cell

(C) Oxygen transport

(D) Iron excretion

45. Vitamin D promotes calcium absorption in the intestine in its active form that is :

(A) Cholecalciferol

(B) Ergocalciferol

(C) Calcitriol

(D) Calcidiol

46. In blood coagulation, Ca^{2+} functions as :

(A) Enzyme

(B) Cofactor

(C) Hormone

(D) Substrate

47. The calcium-binding protein responsible for muscle contraction regulation is :

(A) Calmodulin

(B) Troponin C

(C) Myosin

(D) Actin

48. The major intracellular store of Ca^{2+} in Eukaryotic cell is :

(A) Mitochondria

(B) Lysosome

(C) Endoplasmic reticulam

(D) Nucleus

49. Deficiency of Calcium is caused by :

(A) Goiter

(B) Rickets

(C) Osteoporosis

(D) Scurvy

50. Which of the following is NOT a iron containing metalloenzyme ?

(A) Catalase

(B) Peroxidase

(C) Cytochrome P-450

(D) Xanthine oxidase

51. What reaction does the enzyme catalase catalyze ?

(A) $2H_2O_2 \rightarrow O_2 + 2H_2O$

(B) $CO_2 + H_2O_2 \rightarrow H_2CO_3$

(C) Glucose + $O_2 \rightarrow O_2 + H_2O$

(D) $H_2O + O_2 \rightarrow H_2O_2$

52. In the reaction catalyzed by catalase, what is the substrate ?

(A) Oxygen

(B) Water

(C) Hydrogen peroxide

(D) Carbon dioxide

53. Which cofactor/prosthetic group is required for the activity of catalase ?

(A) Zn

(B) Mn

(C) Heme

(D) NADP

54. A deficiency of Vitamin B_{12} primarily leads to :

(A) Scurvy

(B) Rickets

(C) Pernicious anemia

(D) Beriberi

55. Oxidation state of Co in Vitamin B-12 in super reduced state is :

(A) + 3

(B) + 2

(C) 0

(D) + 1

56. Oxidation state of Co in Vitamin B-12 in reduced state is :

(A) + 3

(B) + 2

(C) 0

(D) + 1

57. What is the primary catalytic function of Superoxide dismutase ?

(A) Conversion of hydrogen peroxide to water and oxygen

(B) Dismutation of superoxide into oxygen and hydrogen peroxide

(C) Reduction of lipid peroxides to alcohol

(D) Synthesis of glutathione from amino acids

58. Which metal ion is found at the center of the corrin ring in the vitamin B_{12} ?

(A) Iron

(B) Magnesium

(C) Cobalt

(D) Copper

59. Zinc containing metalloenzyme is :

(A) Carbonic Anhydrase

(B) Carboxypeptidase

(C) Both (A) and (B)

(D) None of the above

60. Gold based compounds like Auranofin are clinically are used for the treatment of :

(A) Hypertension

(B) Rheumatoid arthritis

(C) Diabetes

(D) Tuberculosis

61. Which metal complex is used as a contrast agent in Magnetic Resonance Imaging ?

(A) Iron carbonyl

(B) Zinc gluconate

(C) Gadolinium(III) Complexes

(D) Silver Nitrate

62. Copper enzyme is :

(A) Xanthine oxidase

(B) Coenzyme vitamin B_{12}

(C) Superoxide dismutase

(D) None of the above

63. Which of the following platinum-based drugs are primarily used to treat various types of cancers by binding to DNA ?

(A) Auranofin

(B) Cisplatin

(C) Barium Sulfate

(D) Gadolinium

64. Which protein is responsible for the mineralization of calcium in bones ?

(A) Troponin C

(B) Parvalbumin

(C) Hydroxyapetite

(D) Osteocalcin

65. CASR is the abbreviation of :

(A) Calcium Sensing Receptor

(B) Calcium Separating Ratio

(C) Calcium Suppressor Ratio

(D) None of the above

66. In the crown ether 12-crown-4, what do numbers represent ?

(A) 12 atoms in the ring, 4 of which O atom

(B) 4 rings of 12 atoms each

(C) 12 molecular weight and 4 carbon atoms

(D) 12 oxygen and 4 carbons

67. What type of guest would a crown ether (e.g. 18 - crown - 6) most effectively bind ?

(A) Anions

(B) Neutral molecules

(C) Zwitter ions

(D) Cations (like K^+)

68. Who is considered one of the "fathers" of superamolecular chemistry and coined the term in 1978 ?

(A) Jean-Marie-Lehn

(B) Robert Grubbs

(C) Linus Pauling

(D) Ahmed Zewail

69. Superamolecular chemistry is primarily defined as :

(A) The study of covalent bonds

(B) The study of atomic nuclei

(C) Chemistry beyond the molecule

(D) Solid-state physics

70. Nonactin is in ionophorous antibiotic, it specifically binds with :

(A) Na^+ ion

(B) K^+ ion

(C) Na^+ and K^+ ion

(D) Any alkali metal ion

71. What is the repeating unit in the structure of 12-crown-4 (crown ether) ?

(A) $–N–CH_2–CH_2–$

(B) $–O–CH_2–CH_2–$

(C) $–S–CH_2–CH_2–$

(D) $–CH_2–CH_2–$

72. Which of the following is an anion receptor ?

(A) Crown ether

(B) Corboxypeptidase

(C) Cryptand

(D) Valinomycin

73. Superamolecules calixarene contain :

(A) NH groups

(B) COOH groups

(C) OH groups

(D) None of the above

74. Two strands in DNA are held together by :

(A) Electrostatic Force

(B) Covalent bond

(C) Van der Waals' forces

(D) Hydrogen bond

75. Cryptand – 2,2,2 is more effectively complementary to :

(A) Li^+

(B) K^+

(C) Na^+

(D) Cs^+

76. Crown ether and Cryptate :

(A) Both have N and O donor atom

(B) Both are polycyclic

(C) Have O and N donor atom respectively

(D) Cryptate is a weaker complexing agent than crown ether

77. Electrides are formed from :

(A) Crown ether

(B) Cryptate

(C) Clathrate

(D) Cavitate

78. Low transferrin levels are commonly seen in :

(A) Blood loss

(B) Iron deficiency

(C) Pregnancy

(D) Chronic disease

79. Protein responsible for transport of iron in bacteria is :

(A) Transferrin

(B) Ferritin

(C) Siderophore

(D) None of the above

80. The Metal atom present in Cytochrome P-450 is :

(A) Fe

(B) Co

(C) Ni

(D) Mn

81. The oxidation state of Mo in Xanthine oxidase enzyme in reduced state is :

(A) 6

(B) 4

(C) 5

(D) 2

82. The metal atom present in xanthine oxidase is :

(A) Mo

(B) Fe

(C) Co

(D) Ni

83. Which of the following has the highest affinity for iron ?

(A) Ferritin

(B) Transferrin

(C) Hemoglobin

(D) Siderophore

84. Which of the following is a well known siderophore ?

(A) Hemoglobin

(B) Myoglobin

(C) Enterobactin

(D) Albumin

85. Siderophores bind iron is in which form ?

(A) + 2

(B) + 4

(C) 0

(D) + 3

86. In catalase, the fifth position of active site is occupied by :

(A) S atom of Cysteine

(B) N atom of Histidine

(C) O atom of Tyrosine

(D) O atom of Glutamic acid

87. The metal atom present in Peroxidase is :

(A) Zn

(B) Fe

(C) Co

(D) Ni

88. The enzyme which removes C-terminal amino acid from a peptide is :

(A) Carbonic anhydrase

(B) Carboxypeptidase

(C) Zymase

(D) All of the above

89. Self-assembly is also called as :

(A) Nanite

(B) Folding

(C) Molecular machine

(D) Macromolecular

90. Types of bonding that takes place in superamolecules is :

(A) Covalent

(B) Ionic

(C) Non-covalent interactions (Hydrogen bonding, van der Waals, etc.)

(D) Coordinate bond

91. Amongst the following, the group that is bound to the metal ion in coenzyme B_{12} is :

(A) Methyl

(B) Hydroxyl

(C) Cyanide

(D) Adenosyl

92. Oxidation state of Co in Vitamin B_{12} is :

(A) + 3

(B) + 2

(C) + 1

(D) 0

93. The ligand system present in Vitamin B_{12} is :

(A) Porphyrin ring

(B) Crown ether

(C) Phthalocyanin

(D) Corrin ring

94. Superoxide dismutase contains the metal ions :

(A) Zn (II) and Ni (II)

(B) Cu (II) and Zn (II)

(C) Ni (II) and Co (III)

(D) Cu (II) and Fe (II)

95. Carboxypeptidase contains :

(A) Zn (II) and Hydrolysis of CO_2

(B) Zn (II) and Hydrolysis of Peptide bond

(C) Mg (II) and Hydrolysis of CO_2

(D) Mg (II) and Hydrolysis of Peptide bond

96. Oxidation state of Molybdenum in Xanthine oxidase enzyme is :

(A) 4

(B) 6

(C) 0

(D) 2

97. Xanthine oxidase enzyme contains :

(A) 2Mo $3Fe_2S_2$ 2FAD

(B) Mo $4Fe_2S_2$ 2FAD

(C) 2Mo $4Fe_2S_2$ FAD

(D) 2Mo $4Fe_2S_2$ 2FAD

98. Carbonic Anhydrase catalyzes :

(A) Interconversion of CO2 and HCO_3^-

(B) Hydrolysis of Peptide bond

(C) Dismutation of O_2^-

(D) None of the above

99. Carbonic Anhydrase contains :

(A) Zn (II)

(B) Cu (II)

(C) Ni (II)

(D) Fe (II)

100. The geometry of Cu and Zn in Superoxide dismutase respectively is :

(A) Square planar and Tetrahedral

(B) Square pyramidal and Tetrahedral

(C) Tetrahedral and Square planar

(D) Square planar and Square pyramidal

(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।