No. of Pages. 16

Code No.	Y – 3043

Register Number :

Name :

Time : 2 Hours

Max.Marks : 100

Entrance Examination for Admission to the P.G. Courses in the Teaching Departments, 2026

CSS

CHEMISTRY/CHEMISTRY WITH SPECIALIZATION IN RENEWABLE ENERGY/CHEMISTRY WITH SPECIALIZATION IN FUNCTIONAL MATERIALS

GENERAL INSTRUCTIONS

1. The Question Paper is having 100 Objective Questions, each carrying one mark.
2. The answers are to be marked **only** in the "**OMR Sheet**" provided.
3. **Negative marking** : **0.25 marks** will be deducted for each wrong answer .

INSTRUCTIONS FOR FILLING THE OMR SHEET

- The OMR sheet should not be folded or crushed.
- Use only blue/black ball point pen to fill the circles.
- Use of pencil is strictly prohibited.
- Circles should be darkened completely and properly.
- Cutting and erasing on this sheet is not allowed.
- Do not leave any stray marks on the sheet.
- Do not use marker or white fluid to hide the mark.
- WRONG METHODS

CORRECT METHOD

Choose appropriate answer from the options in the questions.

(100 × 1 = 100 marks)

1. What is the Flame colour of sodium?
   A. Blue
   B. Green
   C. Yellow
   D. Red

2. Colour in transition metal complexes is due to:
   A. s-p transition
   B. d-d transition
   C. f-f transition
   D. Charge transfer

3. The species with the highest effective nuclear charge is:
   A. O^{2-}
   B. F^{-}
   C. Na^{+}
   D. Mg^{2+}

4. The bond order of NO^+ is:

A. 2 B. 2.5

C. 3 D. 3.5

5. Which complex is optically active?

A. $[Co(NH_3)_6]^{3+}$ B. $[Co(en)_3]^{3+}$

C. $[PtCl_4]^{2-}$ D. $[Ni(CN)_4]^{2-}$

6. Froth flotation is used for which type of ores?

A. Oxides B. Sulphide

C. Halides D. Nitrides

7. Lanthanide contraction leads to:

A. Increase in size B. Similar radii of 4d and 5d

C. Decrease in density D. Loss of electrons

8. A radioactive sample has half-life 10 days. What fraction remains after 30 days?

A. 1/2 B. 1/4

C. 1/8 D. 1/16

9. Which of the following is a Lewis acid?

A. NH_3 B. H_2O

C. BF_3 D. OH^-

10. Alkali metals dissolve in liquid ammonia to form:

A. Metal ions only B. Solvated electrons

C. Ammonium ions D. Hydrides

11. Greenhouse gas among the following:

A. CO_2 B. N_2

C. O_2 D. He

12. Photochemical smog contains:

A. SO_2 B. PAN

C. CO_2 D. NH_3

13. Which polymer is biodegradable?

A. PVC B. PET

C. PHBV D. Polystyrene

14. In CO, highest occupied molecular orbital (HOMO) is mainly on:

A. Carbon B. Oxygen

C. Both equally D. None

15. Which has the smallest bond angle?

A. NH_3 B. H_2O

C. CH_4 D. BF_3

16. Which has highest covalent character?

A. NaCl B. $MgCl_2$

C. KCl D. $AlCl_3$

17. Good Conductors have:

A. Large band gap B. Small band gap

C. No band gap D. Infinite gap

18. Pyrex glass contains:

A. B_2O_3 B. Na_2O

C. MgO D. K_2O

19. Give the Shape of IF_7:

A. Octahedral B. Pentagonal bipyramidal

C. Tetrahedral D. Square planar

20. What is the hybridization of XeF_4?

A. sp^3 B. sp^3d

C. sp^3d^2 D. dsp^2

21. C-14 dating is used for determining the age of _____.

A. Rocks
B. Living organisms
C. Fossils
D. Metals

22. Which of the following is a top-down method used in synthesis of nanoparticles?

A. Sol-gel
B. Ball milling
C. Chemical reduction
D. Precipitation

23. C_{60} is also called:

A. Graphite
B. Diamond
C. Buckminsterfullerene
D. Graphene

24. Which is used in Haber process?

A. Fe
B. Cu
C. Zn
D. Al

25. In acidic medium, $KMnO_4$ is reduced to:

A. MnO_2
B. Mn^{2+}
C. MnO_4^{2-}
D. Mn metal

26. Which shows anomalously high second ionization enthalpy?

A. Cr
B. Mn
C. Fe
D. Cu

27. Which has highest magnetic moment?

A. Fe^{3+}
B. Co^{2+}
C. Mn^{2+}
D. Ni^{2+}

28. What is the General electronic configuration of lanthanides?

A. $[Xe]4f^{1-14}\,5d^{0-1}\,6s^2$
B. $[Ar]3d^{1-10}\,4s^2$
C. $[Kr]4d^{1-10}\,5s^2$
D. $[Rn]5f^{1-14}\,6d^1\,7s^2$

29. Radioactive decay of actinides ultimately leads to which metal?

A. Iron
B. Lead
C. Uranium
D. Gold

30. Choose the ambidentate ligand among the following:

A. CN^-
B. NH_3
C. H_2O
D. Cl^-

31. What is the correct name of $[Co(NH_3)_6]\ Cl_3$?

A. Hexaammine cobalt (III) chloride
B. Hexaammine cobalt (II) chloride
C. Ammine cobalt (II) chloride
D. Cobalt (III) ammine chloride

32. Which complex is expected to be diamagnetic?

A. $[Fe(H_2O)_6]^{2+}$
B. $[Fe(CN)_6]^{2-}$
C. $[CoCl_4]^{2-}$
D. $[Mn(H_2O)_6]^{2+}$

33. Which complex is expected to undergo Jahn-Teller distortion?

A. $[Cu(H_2O)_6]^{2+}$
B. $[Zn(H_2O)_6]^{2+}$
C. $[Fe(CN)_6]^{3-}$
D. $[Ni(CN)_4]^{2-}$

34. Which among the following does NOT obey the 18-electron rule?

A. $Ni(CO)_4$
B. $Fe(CO)_5$
C. $Cr(CO)_6$
D. $V(CO)_6$

35. What is the structural component of the heme group in haemoglobin?

A. A porphyrin ring coordinated to Fe
B. A protein chain containing Fe
C. A lipid-bound iron center
D. A carbohydrate-bound iron complex

36. cis-2-buene and trans-2- butene are _____.

A. enantiomers
B. diastereomers
C. positional isomers
D. identical

37. You are given a sample containing acetophenone and propionaldehyde. Which among the following reactions can be used to detect the presence of acetophenone alone?

A. Heating with 2,4-dintrophenyl hydrazine
B. Treating with NaOH and Iodine
C. Molisch's test
D. Tollen's test

38. Homolytic bond cleavage results in formation of:

A. Ions
B. Free radicals
C. Molecules
D. Complexes

39. What is the correct IUPAC name of the compound $(CH_3)_3C-Br$?

A. 2-bromopropane
B. tert-butyl bromide
C. 2-bromo-2-methylpropane
D. 1-bromo-2- methylpropane

40. Which acid is strongest?

A. CH_3COOH
B. $CH_2ClCOOH$
C. $CHCl_2COOH$
D. CCl_3COOH

41. Which compound shows maximum hyperconjugation stabilization?

A. Ethene
B. Propene
C. Isobutene
D. 2-methyl-2-butene

42. What type of reaction is Diels-Alder reaction?

A. Substitution reaction
B. Radical reaction
C. Cycloaddition reaction
D. Elimination reaction

43. The major product formed when 1-bromobutane reacts with NaOEt in ethanol is:

A. But-1-ene
B. But-2-ene
C. Butane
D. Ethoxybutane

44. In monosubstituted cyclohexane, the most stable conformer has substituent in:

A. Axial position
B. Equatorial position
C. Both equally stable
D. Boat form

45. The dihedral angle in eclipsed conformation of ethane is:

A. 60°
B. 90°
C. 0°
D. 120°

46. Which compound is optically inactive due to internal compensation?

A. d-lactic acid
B. meso-tartaric acid
C. glyceraldehyde
D. racemic mixture of d and 1 lactic acid

47. Which compound shows axial chirality?

A. Biphenyl
B. Ethanol
C. Methane
D. Benzene

48. Which dye will show the most intense colour?

A. molecule with isolated double bonds
B. molecule with extended conjugation
C. molecule with only σ-bonds
D. Small molecule

49. Which condition favors photochemical electrocyclic ring closure of 4π system?

A. Conrotatory motion
B. Disrotatory motion
C. No rotation
D. Radical pathway

50. Which of the following is aromatic according to Hückel's rule?

A. Cyclobutadiene
B. Cyclooctatetraene
C. Cyclopentadienyl anion
D. Cyclopropenyl anion

51. What is the major product when ethylene glycol is treated with periodic acid (HIO_4)?

A. Ethanol
B. Formaldehyde
C. Ethanoic acid
D. Methanol

52. What is the major product formed in Reimer-Tiemann reaction of phenol?

A. Salicylic acid
B. Benzaldehyde
C. o-hydroxybenzaldehyde
D. p-hydroxy benzaldehyde

53. An alkene on reaction with ozone followed by treatment with Zn and water gave acetone and propionaldehyde. Identify the alkene _____.

A. 2-methyl-2-pentene
B. 3-methyl-2-pentene
C. 2-methyl-1-pentene
D. 2-methyl-2-butene

54. What is the product when cyanomethane is hydrolyzed under acidic conditions?

A. Methanol
B. Ethanoic acid
C. Acetone
D. Ethanamine

55. What is the product when sodium benzoate is subjected to Kolbe electrolysis?

A. Benzene
B. Biphenyl
C. Toluene
D. Phenol

56. Which of the following compounds will give a positive Carbylamine (Isocyanide) test?

A. $(CH_3)_2NH$
B. $(CH_3)_3N$
C. $C_6H_5NH_2$
D. $(C_2H_5)_2NH$

57. What is the major product when nitrobenzene is reduced in acidic medium (Sn/HCl)?

A. Aniline
B. Azobenzene
C. Hydrazobenzene
D. Nitrobenzene unchanged

58. Which compound gives same osazone as glucose?

A. Fructose
B. Ribose
C. Galactose
D. Mannose

59. Which polysaccharide has β-1,4 linkage?

A. Starch
B. Glycogen
C. Maltose
D. Cellulose

60. Which compound is an active methylene compound?

A. Ethane
B. Acetone
C. Ethyl acetoacetate
D. Benzene

61. Which reaction has highest atom economy?

A. Substitution reaction
B. Addition reaction
C. Elimination reaction
D. Rearrangement

62. Which reaction is used for synthesis of quinoline?

A. Fischer synthesis
B. Skraup synthesis
C. Paal-Knorr
D. Hantzsch

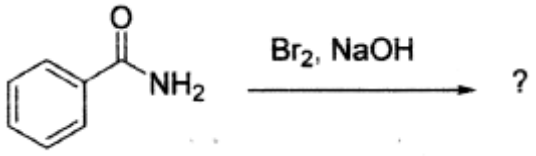
63. Which drug is an antipyretic?

A. Paracetamol
B. Sulphapyridine
C. Chloroquine
D. Ampicillin

64. Which protecting group is used in peptide synthesis?

A. Benzyl group
B. Carbobenzoxy
C. Methyl group
D. Ethyl group

65. Predict the product of the reaction



A. Quaternary Bromobenzene
B. Benzoic acid
C. Aniline
D. Benzoyl bromide

66. Which terpene has cyclic structure?

A. Geraniol
B. Citral
C. Limonene
D. Isoprene

67. Which polymer is thermoplastic?

A. Bakelite
B. Epoxy
C. PVC
D. Phenol resin

68. Which compound shows 3 signals in NMR?

A. Ethyl bromide
B. Toluene
C. Acetaldehyde
D. Ethanol

69. In Mass spectrometry which isotopic pattern indicates bromine?

A. 3:1
B. 1:1
C. 2:1
D. 4:1

70. A compound shows: Mass spectrum: M^1 = 74 IR : Strong peak at 1740 cm^1 ^1H NMR: δ 1.2. (3H, triplet), δ 4.1 (2H, quartet), δ 2.0 (3H, singlet) Identify the compound.

A. Ethyl acetate
B. Acetic acid
C. Propanal
D. Acetone

71. Which of the following is the correct relation for critical temperature?

A. Tc = 8a/27Rb
B. Tc =a/2Rb
C. Tc = Rb/a
D. Tc = 27Rb/8a

72. At what temperature will RMS velocity of O_2 double from its value at 300 K?

A. 600 K
B. 900 K
C. 1200 K
D. 150 K

73. Give the total number of Bravais lattices is:

A. 7
B. 14
C. 12
D. 8

74. Which defect is due to missing ions?

A. Frenkel defect
B. Schottky defect
C. F-centre
D. Interstitial defect

75. Which liquid crystal has layered structure?

A. Nematic
B. Smectic
C. Cholesteric
D. Isotropic

76. Isotonic solutions have:

A. Same osmotic pressure
B. Same concentration
C. Same volume
D. Same temperature

77. A solution containing 3 g solute in 250 g water shows $\Delta Tb = 0.104$ K. Kb = 0.52 K kg mol^{-1}. Calculate molar mass.

A. 30 g mol^{-1}
B. 60 g mol^{-1}
C. 90 g mol^{-1}
D. 120 g mol^{-1}

78. Which law is used to determine limiting molar conductance of weak electrolytes?

A. Raoult's law
B. Kohlrausch's law
C. Boyle's law
D. Henry's law

79. Activity coefficient is unity for which of the following?

A. Ideal solutions
B. Strong electrolytes
C. Weak electrolytes
D. Concentrated solutions

80. Which of the following represents a galvanic cell?

A. Electrolysis of Cu
B. Daniell cell
C. Electroplating
D. Electrolysis of water

81. What is the major product formed in a hydrogen-oxygen fuel cell?

A. Hydrogen peroxide
B. Water
C. Oxygen
D. Carbon dioxide

82. Which of the following is a path function?

A. Enthalpy
B. Internal energy
C. Heat
D. Temperature

83. Calculate the work done when 1 mole of an ideal gas expands isothermally at 300 K from 10 L to 20 L. (R = 8.314 J mol^{-1} K^{-1})

A. 1728 J
B. 2000 J
C. 2500 J
D. 3000 J

84. What happens to entropy during melting of ice?

A. Decreases
B. Increases
C. Remains constant
D. Becomes zero

85. What is fugacity?

A. Real pressure
B. Infinite pressure
C. Zero pressure
D. Effective pressure

86. For a reaction, $\Delta G = -20$ kJ mol^{-1} at 300 K and $\Delta H = -50$ kJ mol^{-1}. Calculate ΔS

A. -100 J K^{-1} mol^{-1}
B. $+100$ J K^{-1} mol^{-1}
C. -233 J K^{-1} mol^{-1}
D. $+233$ J K^{-1} mol^{-1}

87. Which of the following shows residual entropy?

A. NaCl
B. CO
C. He
D. H_2

88. Which of the following particles obey Pauli's exclusion principle?

A. Bosons
B. Fermions
C. Photons
D. Classical particles

89. Which type of excitation occurs in microwave spectroscopy?

A. Electronic
B. Vibrational
C. Rotational
D. Nuclear

90. Selection rule for vibrational transition is:

A. $\Delta v = 0$
B. $\Delta v = \pm 1$
C. $\Delta v = \pm 2$
D. $\Delta v = \pm 3$

91. A molecule is Raman active but IR inactive. The molecule is most likely:

A. CO
B. HCl
C. CO_2
D. NO

92. Relative to which standard is chemical shift measured in NMR spectroscopy.

A. Water
B. Benzene
C. TMS
D. Methanol

93. Which method is used to measure magnetic susceptibility?

A. Spectroscopy
B. Gouy method
C. Calorimetry
D. Titration

94. What is the point group of BF_3?

A. C_3v B. D_3h

C. C_2v D. Td

95. Which operator corresponds to momentum?

A. $-i\hbar$ d/dx B. $i\hbar$ d/dx

C. $\hbar^2$ d^2/dx^2 D. $-\hbar$ d/dx

96. Which electrolyte will have the lowest coagulating power for a negatively charged sol?

A. NaCl B. $CaCl_2$

C. $AlCl_3$ D. $FeCl_3$

97. Which of the following increases Physisorption?

A. Increase in temperature

B. Increase in pressure

C. Decrease in surface area

D. Decrease in concentration

98. Which reaction shows constant rate?

A. First order B. Second order

C. Third order D. Zero order

99. What type of azeotrope shows minimum boiling point?

A. Negative deviation B. Positive deviation

C. Ideal solution D. Non-volatile solution

100. What type of interaction is involved in the Raman effect?

A. Elastic scattering B. Inelastic scattering

C. Absorption D. Emission

ROUGH WORK

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