028/22

Question Booklet Alpha Code

A

A

Question Booklet Sl. No.

Total Number of Questions : 100 **Time : 90 Minutes**

Maximum Marks : 100

INSTRUCTIONS TO CANDIDATES

1. The Question Paper will be given in the form of a Question Booklet. There will be four versions of Question Booklets with Question Booklet Alpha Code viz. **A, B, C** & **D**.
2. The Question Booklet Alpha Code will be printed on the top left margin of the facing sheet of the Question Booklet.
3. The Question Booklet Alpha Code allotted to you will be noted in your seating position in the Examination Hall.
4. If you get a Question Booklet where the alpha code does not match to the allotted alpha code in the seating position, please draw the attention of the Invigilator IMMEDIATELY.
5. The Question Booklet Serial Number is printed on the top right margin of the facing sheet. If your Question Booklet is un-numbered, please get it replaced by new Question Booklet with same alpha code.
6. The Question Booklet will be sealed at the middle of the right margin. Candidate should not open the Question Booklet, until the indication is given to start answering.
7. Immediately after the commencement of the examination, the candidate should check that the Question Booklet supplied to him/her contains all the 100 questions in serial order. The Question Booklet does not have unprinted or torn or missing pages and if so he/she should bring it to the notice of the Invigilator and get it replaced by a complete booklet with same alpha code. This is most important.
8. A blank sheet of paper is attached to the Question Booklet. This may be used for rough work.
9. **Please read carefully all the instructions on the reverse of the Answer Sheet before marking your answers.**
10. Each question is provided with four choices **(A), (B), (C)** and **(D)** having one correct answer. Choose the correct answer and darken the bubble corresponding to the question number using Blue or Black Ball Point Pen in the OMR Answer Sheet.
11. **Each correct answer carries 1 mark and for each wrong answer 1/3 mark will be deducted. No negative mark for unattended questions.**
12. No candidate will be allowed to leave the examination hall till the end of the session and without handing over his/her Answer Sheet to the Invigilator. Candidates should ensure that the Invigilator has verified all the entries in the Register Number Coding Sheet and that the Invigilator has affixed his/her signature in the space provided.
13. Strict compliance of instructions is essential. Any malpractice or attempt to commit any kind of malpractice in the Examination will result in the disqualification of the candidate.

A

1. What is the shortest wavelength line (in nm) in the Lyman series of hydrogen spectrum ?
   A) 91.2 nm B) 22.6 nm C) 121.5 nm D) 34.2 nm

2. The dipole moment of HCl is 1.03 D and distance between atoms is 127 pm. What is the percentage ionic character of HCl bond ?
   A) 6.09 % B) 60.9 % C) 609.11% D) 16.9 %

3. Calculate the formal charge of S atom in SO_2.
   A) +1 B) –1 C) 0 D) +4

4. Which of the following molecules has highest value of percentage s-character for the central atom ?
   A) XeO_3 B) SF_6 C) BeF_2 D) SF_4

5. Wave functions of electrons in atoms and molecules are called
   A) orbit B) orbitals
   C) probability D) all the above

6. 1 amu = _____ gm.
   A) 1.66×10^{-24} B) 1.66×10^{-19} C) 1.66×10^{-27} D) 1.66×10^{-23}

7. The electronic configuration of an element is $1s^2\ 2s^2\ 2p^6\ 3d^5\ 4s^1$. This represent its
   A) excited state B) ground state
   C) cationic form D) anionic form

8. The set representing correct order of first ionization energy is
   A) K > Na > Li B) Be > Mg > Ca
   C) B > C > N D) Ge > Si > C

9. Halogen that can be easily reduced
   A) I_2 B) Br_2 C) Cl_2 D) F_2

10. The number of P-O-P bonds in cyclic metaphosphoric acid is
    A) zero B) two C) three D) four

11. Which among the following is an organometallic compound ?
    A) Lithium methoxide
    B) Lithium acetate
    C) Lithium dimethylamide
    D) Methyl lithium

12. When excess of ammonia solution is added to $CuSO_4$ solution, _____ is formed.
    A) $[Cu(NH_3)_2]^{2+}$
    B) $[Cu(NH_3)_4]^{+}$
    C) $[Cu(NH_4)_4]^{+}$
    D) $[Cu(NH_3)_4]^{2+}$

13. $K_3[Al(C_2O_4)]$ is called
    A) Potassium aluminooxalate
    B) Potassium trioxalato aluminate(III)
    C) Potassium aluminium(III) oxalate
    D) Potassium trioxalatoaluminate(VI)

14. A compound with molecular mass 112 is transparent in UV spectrum. In infrared spectrum it shows two bands at 2940 and 1464 cm^{-1}. In the NMR it forms a singlet at 8.48δ. Identify the compound.
    A) Cyclooctane
    B) Octane
    C) Heptane
    D) Benzene

15. The complex ion $[Cr(H_2O)]^{2+}$ has d orbital electronic transition with energy of 169 kJ/mol. At what wavelength does the $[Cr(H_2O)]^{2+}$ ion absorb ?
    A) 707.4 nm
    B) 7.07 nm
    C) 2.81 nm
    D) 281 nm

16. The method of electrolytic refining is not suitable for the extraction of
    A) Aluminium
    B) Copper
    C) Mercury
    D) Silver

17. Biological function of carbonic anhydrase and carboxy peptidase A respectively are
    A) Interconversion of CO_2 and carbonates and gene regulation
    B) Gene regulation and hydrolysis of peptide bond
    C) Gene regulation and interconversion of CO_2 and carbonates
    D) Interconversion of CO_2 and carbonates and hydrolysis of peptide bond

18. Match the following :

a. Zn	i. peroxidase
b. Cu	ii. carboxypeptidase
c. Fe	iii. haemocyanin
	iv. nitrogenase

	a	b	c
A)	ii	i	iii
B)	iii	i	ii
C)	ii	iii	i
D)	iv	iii	ii

19. The number of ATP molecules hydrolysed when 3 Na^+ ions pumped out of cell and 2 K^+ pumped into the cell

A) 1 B) 2 C) 4 D) 3

20. In the active sites of many enzymes, metals are coordinated by the aminoacid histidine, which element in histidine donates the electrons that form the coordinate bond ?

A) Carbon B) Oxygen C) Nitrogen D) Sulfur

21. Which of the following is not refined by zone refining method ?

A) Germanium B) Silicon C) Gallium D) Gold

22. Which of the following is correctly matched ?

	Column I	Column II	Column III
A)	$[Cr(CO)_6]$	paramagnetic	Octahedral, sp^3d^2
B)	$[Fe(CO)_5]$	paramagnetic	Trigonal bipyramid, sp^3d
C)	$[Co(CO)_4]^-$	diamagnetic	Tetrahedral, sp^3
D)	$[Ni(CO)_4]$	diamagnetic	Square planar, dsp^2

23. The organometallic compound follows 18 electron rule, the hapticities of two cyclopentadienyl groups are $[W(C_2H_5)_2(CO)_2]$

A) 5 and 5 B) 3 and 5 C) 3 and 3 D) 1 and 5

24. The order of CO bond strengths in following metalhexacarbonyls is likely to be

A) $V(CO)_6^- < Cr(Co)_6 < Mn(CO)_6^+$ B) $Cr(Co)_6 < Mn(CO)_6^+ < V(CO)_6^-$

C) $Mn(CO)_6^+ < Cr(Co)_6 < V(CO)_6^-$ D) $V(CO)_6^- < Mn(CO)_6^+ < Cr(Co)_6$

25. Which of the following is not an organometallic compound ?

A) Ferrocene B) Cis-platin

C) Zieses salt D) Grignard reagent

26. A key feature of Fischer-Tropsch process is

A) hydrocarbon formation B) alkene hydrogenation

C) alkene polymerization D) hydroformylation

27. Accuracy expresses the

A) correctness of an experiment B) feasibility of an experiment

C) deviation from experiment D) reproducibility of an experiment

28. In an experiment values 2.2, 2.3 and 2.4 are obtained while the true value is 4.6. Now if we double each value then

A) Precision is increased but accuracy is decreased

B) Both precision and accuracy are increased

C) Accuracy is increased but precision remains unchanged

D) Both precision and accuracy are decreased

29. The thermogram in differential thermal analysis is a plot of

A) dw/dt Vs Temperature B) ΔT Vs Temperature

C) ΔH Vs Temperature D) T Vs Volume

30. The donor atom in EDTA are

A) Two N and two O B) Two N and four O

C) Four N and two O D) Three N and two O

31. Limiting current in polarography depends on

A) Residual current B) Diffusion current

C) Kinetic current D) All the above

32. The material of cathode in Hollow cathode lamp constructed in AAS

A) Tungsten
B) Quartz
C) Element to be investigated
D) All the above

33. Cell constant is

A) length × area
B) length/area
C) area/length
D) none of the above

34. Olefin hydrogenation of using Wilkinsons catalyst initiates with

A) A phosphine dissociation from [Rh $(PPh_3)_3Cl$]
B) Olefin addition to [Rh $(PPh_3)_3Cl$]
C) A phosphine addition to [Rh $(PPh_3)_3Cl$]
D) Olefin addition to [Rh $(PPh_3)_2Cl$]

35. Free radicals are detected by the

A) Mass spectra
B) CIDNP
C) UV spectra
D) Mossbauer spectroscopy

36. Which of the following reaction undergoes without formation of any intermediate ?

A) S_N1 reaction
B) S_Ni reaction
C) ArS_N1 reaction
D) S_N2 reaction

37. In E2 reaction the dihedral angle of synperiplanar conformation is

A) 0°
B) 90°
C) 120°
D) 180°

38. Which of the following is not an electrophile ?

A) CH_4
B) SO_3
C) Br^+
D) BF_3

39. Homolytic fission for generation of free radical is favoured most in bond

A) C – C
B) O – O
C) C – O
D) C – N

40. Which type of electronic transition can be seen in saturated aldehyde and ketone ?

A) only $n \rightarrow \pi^*$
B) $n \rightarrow \sigma^*$
C) $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$
D) only $\pi \rightarrow \pi^*$

41. For the structure E-1-bromo-1-chloro propene, the correct statement is

A) $-CH_3$ and –Cl are on same side of double bond

B) $-CH_3$ and –Cl are on opposite side of double bond

C) –Br and –H are on opposite side of double bond

D) –Cl and –H are on same side of double bond

42. The correct R-S notation for the structure 3-chlorobutane-2-ol is

A) 1R, 3S B) 1R, 4S C) 2R, 3S D) 2S, 3R

43. An aqueous solution of 6.3 g oxalic acid dehydrate is made upto 250 ml. The volume of 0.1 N NaOH required to completely neutralize 10 ml of this solution is

A) 10 ml B) 20 ml C) 40 ml D) 4 ml

44. Wurtz reaction on a mixture of ethyl iodide and n-propyl iodide does not yield the hydrocarbon

A) n-butane B) n-propane

C) n-pentane D) n-hexane

45. Alcoholic solution of KOH is used for

A) Dehydrogenation B) Dehalogenation

C) Dehydration D) Dehydrohalogenation

46. A complex has a composition corresponding to formula $CoBr_2Cl.4NH_3$. What is the structural formula if conductance measurements show two ions per formula unit ? Silver nitrate solution gives an immediate precipitate of AgCl but no AgBr.

A) $[CoBrCl(NH_3)_4]Br$ B) $[CoCl(NH_3)_4]Br_2$

C) $[CoBr_2Cl(NH_3)_4]$ D) $[CoBr_2(NH_3)_4]Cl$

47. Which among the following is not aromatic ?

A) Cyclopentadienyl anion B) Cycloheptadienyl cation

C) Cyclopentadienyl cation D) Cyclopentadienyl iron

48. Which among the following alkyl halide will react by both S_N1 and S_N2 pathways ?

A) $CH_3 - X$ B) $CH_3 - CH_2 - X$

C) $(CH_3)_2CH - X$ D) $(CH_3)_3C - X$

49. Which of the following reaction cannot be employed to prepare alkyl halides ?

A) Darzen reaction

B) MPV reduction

C) Markonikofs addition of HCl to an unsymmetrical alkene

D) Halogenation of alkenes

50. Aniline reacts with glycerol in presence of sulphuric acid and nitrobenzene as an oxidizing agent. Which among the following statement is more correct ?

A) Bayer Villiger Oxidation and the product is quinoline.

B) Rosenmunds reduction and the product is quinoline.

C) Paal Knoor synthesis and the product is quinoline.

D) Skraup reaction and the product is quinoline.

51. Among the following reactions and the final product, which pair does not match ?

A) Cumene reactions gives phenol and acetone

B) Kolbe-Schmidt reaction gives ortho-hydroxy benzoic acid

C) Fries rearrangement gives methoxybenzoic acid

D) Bischler-Napieralski reaction gives isoquinolines

52. Phenol is dissolved in caustic soda solution along with CO_2 gas at about 398 K and 4 – 7 bar pressure gives which of the following compound ?

A) Sodium phenoxide

B) Cumene hydroperoxide

C) Phthalic acid

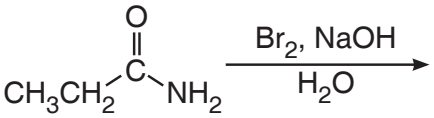
D) None of the above

53. Glycerol on periodic acid oxidation gives

A) HCHO + 2HCOOH B) 2HCHO + HCOOH

C) $2CH_3OH$ + HCOOH D) CH_3OH + 2HCOOH

54. Predict the product of the following reaction.



A) Propylamine B) Ethylamine C) Propanoic acid D) None of these

55. Identify the wrong statement regarding carbocation rearrangement.

A) Tertiary alkyl groups generally undergo 1,2-shifts to the electron-deficient centres more readily than primary and secondary alkyl groups do.

B) The bond breaking and making are concerted in the 1, 2-shift of a methyl group in carbocations.

C) The transition structure for a 1,2-shift to an electron-deficient centre is regarded as a cyclic three-centre two-electron system.

D) The configuration of a carbon centre undergoing a 1,2-shift in a carbocation is not retained.

56. Etard reaction in the following is

A) Oxidation of toluene to benzaldehyde by chromyl chloride

B) Oxidation of toluene to benzaldehyde by alkaline $KMnO_4$

C) Dry distillation of calcium benzoate

D) Reaction of benzene with Cl_2 in the presence of UV light

57. The chlorination of toluene in pressure of ferric chloride gives mostly

A) Meta-chlorotoluene B) Benzyl chloride

C) Dichlorobenzene D) o- and p-chlorobenzene

58. In the nitrating mixture, HNO_3 acts as which among the following ?

A) Base B) Acid

C) Reducing agent D) Catalyst

59. Which of the following is not a correct statement on aromatic electrophilic substitution reactions ?

A) – CN is deactivating and m-directing

B) – Br is activating and o, p-directing

C) – OCH_3 is activating and o, p-directing

D) – NH_2 is activating and o, p-directing

60. Identify the wrong statement.
    A) The base-catalysed α-halogenation of propanone is first order with respect to base.
    B) The rate constant for the base-catalysed α-halogenation of propanone decreases in the order $Cl_2 > Br_2 > I_2$.
    C) The base-catalysed α-halogenation of propanone proceeds easily to give 1, 1, 1-trihalopropanone, an unsymmetric polyhalo ketone.
    D) Polyhalogenation of propanone is difficult under acidic conditions, but the products are the same as those obtained under basic conditions.

61. Identify the product of Knoevenagel reaction.
    A) Primary and secondary amine
    B) Unsaturated acyclic system
    C) Beta keto ester
    D) Acid anhydride

62. Identify the starting reagents in Dieckman Condensation ?
    A) One molecule with an ester towards the end of the molecule
    B) Two molecules of ester
    C) One molecule of ester and enolate
    D) One molecule with two ester towards the end of the molecule

63. Identify the wrong articulation about Claisen condensation.
    A) A β-keto ester is formed and the product undergo further deprotonation by the strong base.
    B) Claisen condensation involves the condensation of two esters in the presence of strong base.
    C) A strong base is required to remove H^+ from an α-H position of the starting ester.
    D) All the above statements are correct

64. A carbonyl compound reacts with an ylide to form an alkene. Identify the reaction.
    A) Aldol reaction
    B) Wittig reaction
    C) Wolf Kishner reaction
    D) Reformatsky reaction

65. Which of the following compounds does not contain an active methylene group ?
    A) Ethylacetoacetate
    B) Diethylmalonate
    C) Diethylfumarate
    D) Cyanoacetic ester

66. The approximate total energy of an ideal monoatomic gas in $kJmol^{-1}$ at 27°C is
A) 1.67 B) 16.7 C) 167 D) 1670

67. At what temperature will helium atoms have the same rms velocity as hydrogen molecule at 300K ?
A) 150K B) 300K C) 450K D) 600K

68. Give the correct statement about the viscosity of liquids.
A) increases with rise in temperature and increases with increase in pressure
B) decreases with rise in temperature and increases with increase in pressure
C) decreases with rise in temperature and decreases with increase in pressure
D) increases with rise in temperature and decreases with increase in pressure

69. The Miller indices of crystal planes that cut through crystal axes at (2a, –3b, –3c) is
A) 2 3 3 B) 3 2 2 C) 3 $\bar{2}$ $\bar{2}$ D) $\bar{3}$ 2 2

70. Number of effective atoms per unit cell in a bcc system is
A) 1 B) 2 C) 3 D) 4

71. The rule that relates the molar heat of vaporisation of a liquid with its normal boiling point is
A) Raoult's B) Henry's C) Trouton's D) Kelvin's

72. Calculate the approximate pOH of 0.03 M solution of HCl at 25°C is
A) 3 B) 7.48 C) 12.48 D) 14

73. If s is solubility of $Al(OH)_3$ in water then it solubility product is
A) s^3 B) $9s^3$ C) $9s^4$ D) $27s^4$

74. A buffer is most effective in the range of pH values between
A) pK –1 and pK +1 B) pK –2 and pK +2
C) pK –3 and pK +3 D) pK – 4 and pK +4

75. In the conversion of nitrogen to ammonia at 400°C, what is the standard Gibbs energy in $kJmol^{-1}$ if the equilibrium constant for the formation of ammonia is 10^{-4} at 1 bar pressure ?
A) 1 B) 10 C) 20 D) 200

76. What is the change in boiling point of water at a 127°C per Pascal if the molar enthalpy of vaporisation is 40 $kJmol^{-1}$ and molar volume change is 30 m^3 mol^{-1} ?

A) 10^{-1} KPa^{-1} B) 10^{-4} KPa^{-1} C) 10^{-6} KPa^{-1} D) 10^{-8} KPa^{-1}

77. Which is not an application of Nernst distribution law ?

A) solvent extraction

B) study of complex ions

C) study of association and dissociation of solute

D) study of partial molar properties

78. 5.2 moles of an ideal gas expand reversibly from a volume of 8 lit to 80 lit at 300K. Calculate the approximate change in entropy in JK^{-1}.

A) 640 B) 100 C) 320 D) 10

79. Work done in a closed system in an adiabatic process is equal to the increase in _____ of the system.

A) Internal energy B) enthalpy

C) entropy D) residual entropy

80. The value of Joule Thomson coefficient for an ideal gas is

A) negative B) positive C) zero D) unpredictable

81. Calculate the approximate entropy change in $JK^{-1}mol^{-1}$ if n-hexane boils at 68.7°C at 1 bar pressure if the molar enthalpy of vaporisation is 28850 $Jmol^{-1}$.

A) 8.4 B) 84.4 C) 844.4 D) 8444

82. Calculate the approximate amount of work if one mole of an ideal gas at 27°C isothermally expands from a volume of 10 lit to 20 lit against a constant external pressure of 1 atm.

A) 10 kJ B) 1 kJ C) 0.10 kJ D) 27 kJ

83. The term for the activity of a gas which serves as a thermodynamic counterpart of gas pressure is

A) ensemble B) phase space C) fugacity D) parachor

84. What percentage of reactant will be left at the end of 25 mins, if the reaction is of first order with a half-life period of 5 mins ?

A) 25 B) 31 C) 3.1 D) 50

85. A possible unit of second order rate constant is

A) s^{-1} B) $Lmol^{-1}s^{-1}$ C) $L^2\ mol^{-2}s^{-1}$ D) $mol\ L^{-1}s^{-1}$

86. In Arrhenius equation, $k = Ae - (E_a/RT)$ the pre exponential factor has the same unit as that of

A) activation energy
B) temperature
C) rate constant
D) time

87. Which of the following is not an assumption in the derivation of Langmuir adsorption isotherm ?

A) Only a monolayer is developed
B) Adsorbed gas behaves ideally
C) Adsorbed gas molecules are localised
D) There is lateral interaction between absorbate molecules

88. The Michalis – Menton mechanism account for the

A) chain polymerisation reaction
B) stepwise polymerisation reaction
C) first order kinetics of gas phase reactions
D) dependence of rate on the concentrations of substrate and enzyme

89. The experimental effect of increase in conductance of a strong electrolyte in aqueous solution to a certain limiting value with increase in potential is called _____ effect.

A) Debye
B) Falkenhagen
C) Walden
D) Wien

90. Calculate the ionic strength of 0.2 molal $BaCl_2$ solution.

A) 0.2 B) 0.4 C) 0.6 D) 0.8

91. The molar ionic conductance of an infinite dilution of LiX is found to be $90\times10^{-4}\ Sm^2mol^{-1}$. Find the ionic conductance of halide ion if that of Li^+ is $30\times10^{-4}\ Sm^2mol^{-1}$.

A) $3\times10^{-4}\ Sm^2mol^{-1}$
B) $120\times10^{-4}\ Sm^2mol^{-1}$
C) $60\times10^{-4}\ Sm^2mol^{-1}$
D) $30\times10^{-4}\ Sm^2mol^{-1}$

92. A zinc rod is dipped in a 0.1 M solution of $ZnSO_4$ at 25°C and if the salt undergoes 100% dissociation, calculate the approximate potential of electrode if the standard potential $E^0(Zn^{2+}/Zn)$ is –0.76V.

A) +0.76 B) –0.76 C) –0.79 D) +0.79

93. Calculate the potential of the cell Zn, Zn^{2+} (1M)|Fe^{2+} (1M); Pt, if the respective standard reduction potential of half-cell are respectively –0.76V and +0.77V.

A) +0.76V B) –0.77V C) +1.53V D) +0.01V

94. The standard electrode potential of quinhydrone electrode can be written as

A) $E_{elec}^{\ 0} = -0.6996 + 0.0591pH$ B) $E_{elec}^{\ 0} = +0.6996 - 0.0591pH$

C) $E_{elec}^{\ 0} = -0.6996 - 0.0591pH$ D) $E_{elec}^{\ 0} = +0.6996 + 0.0591pH$

95. If the rotational constant B of $^{12}C^{16}O$ is 3.8 cm^{-1}, the position of first rotational line in its spectrum in cm^{-1} is

A) 1.9 B) 3.8 C) 7.6 D) 15.2

96. Zero point energy of a simple harmonic oscillator in terms of oscillation frequency $\bar{w}$ cm^{-1} is

A) ½ $\bar{w}$ B) $\bar{w}$ C) 3/2 $\bar{w}$ D) 2 $\bar{w}$

97. In the vibrational Raman spectrum separation of each line from the centre of the excitation line gives the Raman active ____ vibrational frequency of the molecule.

A) hot band B) first overtone

C) second overtone D) fundamental

98. In the electronic spectrum the correct expression for $\bar{v}_{continuum\ limit}$ is _____ (D is the dissociation energy, E_{ex} is the excitation energy and double prime for lower electronic state)

A) $D_0^{II} + E_{ex}$ B) $D_0^{II} - E_{ex}$ C) $D_0^{I} + E_{ex}$ D) None of these

99. In a 60 MHz instrument a chemical shift value of 2 ppm from TMS is equivalent to _____ Hz.

A) 30 B) 60 C) 120 D) 1200

100. The number of lines in the EPR spectrum of $^{12}CF_2H$ radical is

A) 1 B) 2 C) 4 D) 6

Space for Rough Work