75/26

Question Booklet Alpha Code

A

Question Booklet Sl. No.

A

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. The radiant energy emitted or absorbed discontinuously in the form of tiny bundles of energy is known as

   A) Quanta B) Photon C) Radiation D) Wave energy

2. The emission of photoelectrons due to light of a certain frequency is proportional to

   A) Threshold frequency B) Intensity of light

   C) Frequency of light D) Difference in frequency

3. Every orbital in a sub level is singly occupied before any orbital is doubly occupied is suggested by

   A) Pauli B) Aufbau C) Hund D) de Broglie

4. Organize the following based on the ascending order of covalency – LiF, NaCl, NaBr, NaI

   A) LiF < NaCl < NaBr < NaI B) LiF > NaCl > NaBr > NaI

   C) LiF < NaCl < NaBr > NaI D) LiF > NaCl < NaBr < NaI

5. The shape of BeF_2

   A) Bent B) Pyramidal C) Tetrahedral D) Linear

6. Electronegativity is calculated using which of the following scale ?

   A) Pauling scale B) Mulliken scale

   C) Allred-Rochow scale D) All of the above

7. The bond order of CO_2 is

   A) 2 B) 1 C) 0 D) 1.5

8. The inductive effect acts only through

   A) Sigma bond B) Pi bond C) Double bond D) Triple bond

9. The most common nuclear fuel used is

   A) U-234 B) U-239 C) U-235 D) U-238

10. Among the compounds listed, which one exhibits the smallest bond angle within its molecular structure ?

    A) H_2O B) NH_3 C) H_2S D) SO_2

11. Which of the following statement is/are correct for ferrocene ?
    i. The dipole moment of the eclipsed form of ferrocene is zero.
    ii. The dipole moment of the staggered form of ferrocene is non-zero.
    iii. Ferrocene has π delocalized molecular orbitals.
    iv. Ferrocene cannot be hydrogenated under normal conditions, nor does it undergo the Diels-Alder reaction.

    A) i, ii, iii B) i, ii, iv
    C) i, iii, iv D) All of the above

12. Which of the following pairs of compounds has a different Effective Atomic Number (EAN) ?

    A) $Fe(CO)_5$, $Ni(CO)_4$ B) $Ti(CO)_6$, $[Mn(C_2O_4)_3]^{3-}$
    C) $Cr(CO)_6$, $[Co(NH_3)_6]^{3+}$ D) $[Fe(NH_3)_6]^{2+}$, $[Cr(C_2O_4)_3]^{3-}$

13. Ziegler-Natta catalysts are
    i. Heterogeneous catalysts
    ii. Homogeneous catalysts
    iii. Made by treating Titanium tetrachloride with triethyl aluminium
    iv. Catalysts for polymerization of alkenes at atmospheric pressure and ambient temperature.

    A) i, ii, iii B) i, iii, iv C) ii, iii, iv D) All of the above

14. Which of the following statement/s incorrectly describes the role of Zn^{2+} in carbonic anhydrase ?
    i. Carbonic anhydrase catalyses the interconversion of CO_2 and carbonates.
    ii. Carbonic anhydrase cleaves the carbonyl terminal amino acid from a peptide chain.
    iii. Coordinated by two histidine residues, one glutamate and a water molecule.
    iv. Pancreatic digestive enzyme.

    A) i, ii, iii B) i, iii, iv C) ii, iii, iv D) All of the above

15. Which of the following complexes is/are square planar ?
    i. $[PdCl_4]^{2-}$
    ii. $[MnCl_4]^{2-}$
    iii. $[Ni(CN)_4]^{2-}$
    iv. $Ni(CO)_4$

    A) i and iii B) i and iv C) ii and iv D) All of the above

16. Predict the correct order of isoelectronic species
A) $N^{3-} > O^{2-} > F^{-} > Na^{+}$ B) $O^{2-} > F^{-} > Na^{+} > N^{3-}$
C) $F^{-} > Na^{+} > N^{3-} > N^{3-}$ D) $O^{2-} > F^{-} > N^{3-} > Na^{+}$

17. Which statement/s is correct regarding the inert pair effect ?
i. The increased stability of Tl^{+} compared to Tl^{3+}.
ii. Favours a lower oxidation state in heavier p-block elements.
iii. Favours a higher oxidation state in heavier p-block elements.
iv. Down the group, poor shielding effect by intervening d and f electrons.
A) i, ii, iii B) i, ii, iv C) ii, iii, iv D) All of the above

18. Which of the following electronic configurations exhibits Jahn-Teller distortions in an octahedral field ?
A) d^1, d^2, d^4 B) d^1, d^2, d^8 C) d^1, d^4, d^8 D) d^1, d^8, d^9

19. Which of the following is a Pt-based anticancer drug ?
A) Cisplatin B) Vincristine C) Doxorubicin D) Methotrexate

20. Choose the incorrect statements from the following.
i. Ionisation energy is inversely proportional to atomic radius.
ii. The ionisation energy of an atom may be negative.
iii. The ionisation energy of an atom may be positive.
iv. Ionisation energy is the amount of energy required to remove an electron from the outermost shell of an isolated gaseous atom.
A) i, ii, iii B) i, iii, iv C) ii, iii, iv D) All of the above

21. Find the most stable one among the following cations.
A) Methyl cation B) Tertiary butyl cation
C) Isopropyl cation D) Ethyl cation

22. Which among the following rotate plane polarized light ?
i. Enantiomers
ii. Diastereomers
iii. Mesomers
A) i and ii B) i and iii C) ii and iii D) All of the above

23. Find the wrong statement.
A) Cis isomers have high dipole moment
B) Cis isomers are less stable than trans isomer
C) Trans isomers have less solubility
D) Trans isomers have low melting point

24. Boat form of cyclohexane is less stable than the chair form mainly because of repulsion between hydrogens at 1, 4 positions named
    A) Equatorial hydrogens
    B) Axial hydrogens
    C) Flagpole hydrogens
    D) Bowsprit hydrogens

25. In Bimolecular nucleophilic substitution (S_N2), there occurs
    A) Complete retention of configuration
    B) Complete inversion of configuration
    C) 50:50 mixture of enantiomers
    D) Ratio of products formed will depend on the nature of the solvent

26. Which among the following are aromatic ?
    i. Tropylium cation
    ii. Cyclopentadienyl cation
    iii. Cyclopentadienly anion
    A) i and ii B) i and iii C) ii and iii D) All of the above

27. The phenomenon in which enrichment of waterbodies by nitrates and phosphates leading to Algal bloom
    A) Nitrification
    B) Denitrification
    C) Hypertrophy
    D) Eutrophication

28. Among the following, the most toxic form of mercury is
    A) Mercuric ions
    B) Mercurous ions
    C) Methyl mercury
    D) Metallic mercury

29. Drugs used to reduce body temperature is called
    A) Antipyretics
    B) Analgesic
    C) Antibiotics
    D) Antihistamine

30. In petroleum refining which purification technique is widely used ?
    A) Chromatographic technique
    B) Sublimation
    C) Fractional distillation
    D) Extraction with solvents

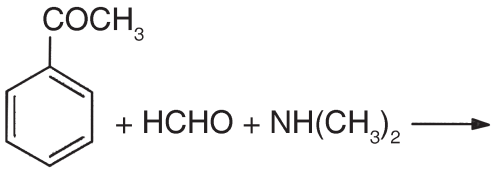
31. Identify the reagent used in Wittig reaction.
    A) Grignard Reagent
    B) Diazonium Salt
    C) Phosphonium Ylide
    D) Hydrazine

32. The major products of Fries rearrangement is formed at _____ positions.

A) Ortho and Para Positions B) Meta Position only

C) Benzylic Position D) Side Chain

33. Identify the product and name of the reaction.



A) $C_6H_5CH_2NHCH_3$, Hofmann Bromamide Reaction

B) $C_6H_5COCH_3$, Friedel-Crafts Reaction

C) $C_6H_5NH_2$, Benzoin Condensation

D) $C_6H_5COCH_2CH_2N(CH_3)_2$, Mannich Reaction

34. The total number of π electrons in naphthalene is

A) 6 B) 8 C) 10 D) 14

35. Gabriel phthalimide synthesis is mainly used for the preparation of

A) Secondary Amines B) Primary Amines

C) Tertiary Amines D) Amides

36. Phenol is more acidic than ethanol because

A) Ethanol is aromatic

B) Phenol contains oxygen

C) Phenoxide ion is resonance stabilized

D) Phenol has higher molecular weight

37. Which catalyst is commonly used in the Friedel-Crafts alkylation reaction ?

A) $FeCl_3$ B) $AlCl_3$ C) H_2SO_4 D) $ZnCl_2$

38. Which one of the compounds is the epimer of glucose ?

A) Mannose B) Fructose C) Sucrose D) Threose

39. Mutarotation proves that glucose exists predominantly in

A) Ketone form B) Open-chain form

C) Cyclic hemiacetal form D) Acid form

40. The starting materials for the preparation of PETP are
    A) Ethylene and Terephthalic Acid
    B) Ethylene Glycol and Terephthalic Acid
    C) Acetylene and Terephthalic Acid
    D) Ethyl Acetate and Terephthalic Acid

41. What is the ratio of root mean square velocities of H_2 at 200 K and that of O_2 at 800 K ?
    A) 1 B) 2 C) 3 D) 4

42. For a certain crystal, the unit cell lengths are all different and the unit cell angles are all perpendicular. Which crystal system does it belong to ?
    A) Cubic B) Monoclinic C) Triclinic D) Orthorhombic

43. Which of the following is expected to be a p-type semiconductor ?
    A) Al doped Si B) As doped Ge C) P doped Si D) Sb doped Ge

44. Which of the following spectroscopic techniques make use of absorption of infrared radiation by the molecules ?
    A) NMR spectroscopy B) Electronic spectroscopy
    C) Vibrational spectroscopy D) Rotational spectroscopy

45. If the volume of the system remains constant in a thermodynamic process, it is called an
    A) Isochoric process B) Isentropic process
    C) Isenthalpic process D) Isothermal process

46. Consider the complete combustion reaction of liquid benzene to gaseous CO_2 and gaseous H_2O as products. The sign of ΔS and ΔG of this reaction would be
    A) positive ΔS, positive ΔG B) positive ΔS, negative ΔG
    C) negative ΔS, positive ΔG D) negative ΔS, negative ΔG

47. Which of the following reactions is expected to have the lowest heat of neutralisation ?
    A) CH_3COOH and NH_4OH B) CH_3COOH and NaOH
    C) HCl and NaOH D) HCl and NH_4OH

48. For the reaction, $2N_2O(g) + N_2H_4(g) \rightleftharpoons 3N_2(g) + 2H_2O(g)$, K_p/K_c is
    A) 1 B) RT C) $(RT)^2$ D) $(RT)^4$

49. When a solid compound AB (s) melts at a particular temperature into liquid AB (l), without undergoing decomposition, it is said to be
    A) Peritectic
    B) Eutectic
    C) Incongruent melting
    D) Congruent melting

50. What structure is the unit cell of NaCl ?
    A) Body centered cubic
    B) Face centered cubic
    C) Primitive cubic
    D) Body centered tetragonal

51. The pH of 0.0001 M HCl is
    A) 4 B) 3 C) 1 D) –1

52. Ostwald's dilution law is applicable to
    A) Strong electrolytes only
    B) Weak electrolytes only
    C) Non-electrolytes
    D) Both strong and weak electrolytes

53. Which of the following is false ?
    A) Molecularity of a reaction can be whole numbers only
    B) A zero-order reaction is one whose rate is independent of concentration
    C) A bimolecular reaction has molecularity equal to 2
    D) Order of a reaction can be whole numbers only

54. Unit of zero order rate constant is
    A) $mol^{-1}dm^3s^{-1}$
    B) $mol\ dm^{-3}s^{-1}$
    C) s^{-1}
    D) $mol^{-2}dm^{-6}s^{-1}$

55. A hypertonic solution has
    A) Higher osmotic pressure than another solution
    B) Equal osmotic pressure with another solution
    C) Lower osmotic pressure than another solution
    D) None of these

56. If the transference number of an anion is 0.7, the transference number of the cation is
    A) 0.7 B) 0.3 C) 1.7 D) 1

57. An example of Oxidation-Reduction electrode is
    A) Silver-Silver chloride electrode
    B) Calomel electrode
    C) Quinhydrone electrode
    D) Hydrogen electrode

58. Identify the point group of Ammonia molecule.

A) C_{2V} B) C_{2h} C) C_{3V} D) C_{3h}

59. In Jablonski diagram, identify the transition that involve a change in spin multiplicity.

A) Fluorescence B) Intersystem crossing

C) Internal conversion D) Absorption

60. Which is the quantum mechanical operator for momentum ?

A) $-\frac{h^2}{8\pi^2 m}\nabla^2$ B) $-\frac{h^2}{8\pi^2 m}\nabla^2 + V$

C) $\frac{h}{2\pi i}\nabla$ D) $\frac{h}{2\pi i}\frac{\partial}{\partial x}$

61. Corrosion resistance of stainless steel is due to

A) Carbon content B) Nickel content

C) Formation of FeO D) Formation of $FeCr_2O_4$

62. Which among the following is/are incorrect in Bayer process for the beneficiation of aluminium from bauxite ?

i. Differences in basic properties of metal ions are exploited.

ii. Al_2O_3 is converted into $[Al(OH)_4]^-$.

iii. Hydroxo anions of Al are heated to yield $Al(OH)_3$.

A) Only i and ii B) Only i and iii

C) Only i D) All of the above

63. Which among the following is/are correct about carbon allotropes ?

i. Graphite is more reactive than diamond.

ii. Conversion of diamond to graphite is thermodynamically favoured.

iii. Hybridization of carbon in fullerene is between sp^2 and sp^3.

iv. At NTP stable phase of carbon is graphite.

A) Only i B) Only i and iii

C) Only i, ii and iii D) All of the above

64. The metal ions present in carboxy peptidase and carbonic anhydrase are

A) Zn and Co respectively
B) Zn and Cu respectively
C) Co and Zn respectively
D) Zn and Zn only

65. Identify the catalyst that converts synthesis gas into hydrocarbons.

A) Wilkinson's catalyst
B) Fischer Tropsch catalyst
C) Ziegler-Natta catalyst
D) Monsanto catalyst

66. Identify the compound that is not principally present in dry cement.

A) Ca_3SiO_5 B) CaO C) $Ca_2(Si_4O_{10})$ D) Ca_2SiO_4

67. Which of the following is correct about the bandgaps of semiconductors ?

A) GaN > Si > GaAs > Ge
B) GaAs > GaN > Si > Ge
C) GaN > GaAs > Si > Ge
D) Ge > Si > GaN > GaAs

68. Which among the following is not in accordance with lyotropic series ?

A) $Ca^{2+} > Ba^{2+}$ B) $Na^{+} > K^{+}$ C) $SO_4^{2-} > Cl^{-}$ D) $ClO_3^{-} > NO_3^{-}$

69. Which of the following statements is/are incorrect about carbon nanotubes ?

i. If zigzag edges are joined, the end carbon atoms will have a chair arrangement.
ii. If armchair edges are joined, the end carbon atoms will have a zigzag arrangement.
iii. If different rows are joined, the nanotube formed will be chiral.

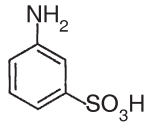
A) Only i and ii
B) Only i
C) Only iii
D) None of the above

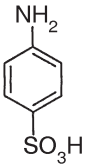
70. Which among the following statements is/are not true about zeolites ?

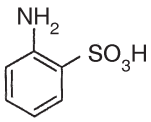
i. They have the ability to hydrate and dehydrate reversibly
ii. They have the ability to exchange their constituent cations
iii. They have both Bronsted and Lewis acid sites
iv. Primary building units are Si and Al containing tetrahedron

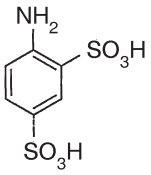
A) Only i and ii
B) Only i and iii
C) None of the above
D) All of the above

71. The major product formed on sulfonating aniline is

A) 

B) 

C) 

D) 

72. Which among the following is an incorrect statement about phthalic anhydride ?
    A) It is obtained by air oxidation of naphthalene
    B) Vanadium pentoxide is used as a catalyst for its production
    C) Its preparation is done industrially from phthalic acid
    D) It is isolated by sublimation

73. Which among these polymer processing methods does not require additional pressure ?
    A) Casting
    B) Thermoforming
    C) Transfer molding
    D) Rotational molding

74. The correct order of steps to obtain an elastomer of desired shape and property is
    A) Vulcanization, molding, compounding, mastication
    B) Compounding, mastication, vulcanization, molding
    C) Mastication, compounding, molding, vulcanization
    D) Molding, vulcanization, mastication, compounding

75. High purity ethanol is obtained by
    A) Flash distillation
    B) Fractional distillation
    C) Differential distillation
    D) Rectification distillation

76. Which among the following is not related to the drying efficiency of a product ?
    A) Specific heat
    B) Diffusivity
    C) Molecular weight
    D) Specific conductivity

77. Which of the following is a banned/restricted chemical ?
    A) Acrolein
    B) Chloropicrin
    C) Acetic anhydride
    D) Trinitrotoluene

78. Which of the following is industrially prepared using esterification process ?
    A) Vinyl acetate
    B) Dioctyl phthalate
    C) Dextrose
    D) Acrolein

79. Which of the following will not be a product when benzoyl chloride is hydrogenated in presence of palladium ? (NB : catalyst is not poisoned)
    A) Benzoic acid
    B) Benzaldehyde
    C) Benzyl alcohol
    D) Toluene

80. Identify the thermometer which works based on change in resistivity on heating.
    A) Pressure spring thermometer
    B) Strip thermometer
    C) Digital thermometer
    D) Glass thermometer

81. Which processing method is best for production of thermally insulating and lightweight packaging materials ?
    A) Injection moulding
    B) Foaming
    C) Transfer moulding
    D) Extrusion

82. A rubber manufacture uses peroxide curing instead of sulfur curing. Which property is most likely to be improved ?
    A) Tackiness
    B) Processability before curing
    C) Elastic recovery at low temperature
    D) High temperature stability

83. Identify the filter that uses backwashing to restore its filtration efficiency.
    A) Sand filter
    B) Activated carbon
    C) HEPA filter
    D) Membrane filter

84. In vacuum distillation, reducing the system pressure leads to
    A) Intermolecular forces become weaker
    B) The density of the liquid decreases
    C) The vapor pressure matches the reduced external pressure
    D) The rate of evaporation becomes independent of temperature

85. The para product predominates over the ortho product during chlorobenzene nitration mostly due to
    A) Reduced steric crowding in the para position
    B) The chlorine atom directs substitution exclusively to the para position
    C) Resonance stabilization of the meta intermediate
    D) Increased reactivity of the chlorine atom during nitration

86. Oxidation of which aromatic derivative results in isophthalic acid ?
A) Para-Xylene B) Ortho-Xylene C) Meta-Xylene D) Mesitylene

87. Electrophilic aromatic sulphonation proceeds through the formation of _____, in contrast to Fischer esterification.
A) Arenium ion B) Carbocation C) Carbanion D) Free radical

88. The fundamental cleaning agent in the majority of domestic detergents is
A) Sodium silicate
B) Sodium nitrate
C) Sodium phosphate
D) Sodium alkylbenzene sulfonate

89. The concentration of a suspension increases while the particle size remains the constant. Which device would produce the highest measured signal ?
A) Polarimeter
B) Nephelometer
C) Manometer
D) Potentiometer

90. Which thermal property is detected by DSC but not directly by TGA ?
A) Thermal degradation
B) Oxidation
C) Thermal dehydration
D) Glass transition

91. Which fraction of crude oil is mainly used as aviation turbine fuel ?
A) Gasoline B) Fuel oil C) Kerosene D) Lubricating oil

92. Which of the following statements regarding fractional distillation are correct ?
1. Separation is based on differences in boiling points.
2. Gasoline is obtained before kerosene.
3. Asphalt is collected from the top of the distillation column.
4. LPG is one of the first products to leave the column.
A) Only 1 and 2 B) Only 1, 2 and 4 C) Only 2, 3 and 4 D) 1, 2, 3 and 4

93. Which of the following statements regarding petroleum sweetening are correct ?
1. Sweetening removes objectionable sulfur compounds.
2. The doctor's process converts mercaptans into disulfides.
3. The copper chloride process is a sweetening process.
4. Sweetening increases the calorific value of petroleum products.
A) Only 1 and 2 B) Only 2, 3 and 4 C) Only 1, 2 and 3 D) 1, 2, 3 and 4

94. The working principle of magneto-hydrodynamics power generators is based on
A) Joule's Law
B) Stefan's Law
C) Curie's Law
D) Faraday's Law of Electromagnetic Induction

95. Which of the following statements about nuclear reactors are correct ?
    1. Control rods regulate the rate of fission.
    2. A moderator slows down fast neutrons.
    3. Uranium-238 is a commonly used isotope as nuclear fuel.
    4. The coolant is used to absorb excess neutrons.

    A) Only 1, 2 and 3 B) Only 2 and 4
    C) Only 1 and 2 D) 1, 2, 3 and 4

96. Which calorimeter is used for gaseous fuels ?
    A) Junker's gas calorimeter B) Bomb calorimeter
    C) Beckmann calorimeter D) Flow calorimeter

97. Proximate analysis of coal does not determine
    A) Moisture B) Volatile matter
    C) Fixed carbon D) Carbon percentage

98. Rotary kilns are widely used in
    A) Cement manufacture B) Oil refining
    C) Sugar production D) Paper manufacture

99. Which of the following statements regarding fluidized bed combustion are correct ?
    1. It provides efficient mixing of fuel and air.
    2. It reduces SO_2 emissions by adding limestone.
    3. It operates at relatively lower temperatures than conventional furnaces.
    4. It produces more NO_x than pulverized coal combustion.

    A) Only 1 and 2 B) Only 1, 2 and 3 C) Only 2, 3 and 4 D) 1, 2, 3 and 4

100. The efficiency of OTEC power generation depends primarily on
    A) Ocean salinity
    B) Wave height
    C) Wind speed
    D) Temperature difference between surface and deep seawater

Space for Rough Work