COMMON P. G. ENTRANCE TEST – 2024 (CPET-2024)

Test Booklet No. : 00025

Subject Code : 05

Hall Ticket No. :

Subject : CHEMISTRY

TEST BOOKLET

Time Allowed : 60 Minutes

Full Marks : 80

: INSTRUCTIONS TO CANDIDATES :

1. The Test Booklet contains **16** pages including the cover page and **80** (Question Nos. 1 to 80) multiple choice questions.

2. DO NOT break open the seal of the Test Booklet until the invigilator instructs to do so.

3. The candidates must check discrepancy, if any (like up-printed or torn or missing pages or missing questions) in the Test Booklet immediately after breaking the seal of the Test Booklet. If detected, the invigilator may be requested to replace the same.

4. Candidates are required to fill up and darken the **Hall Ticket No., Test Booklet Serial No.** and OMR Answer Sheet Serial No. in attendance sheet carefully. Wrongly filled in OMR Answer Sheet is liable for rejection.

5. Each question has four choices / answers marked (A), (B), (C), (D). Candidate has to select the most appropriate choice / answer to each question and darken the oval completely against the question number provided in the OMR Answer Sheet.

6. Indicate only one choice / answer from the options provided by darkening the appropriate oval in the OMR Answer Sheet. More than one response to a question shall be treated as a wrong answer.

7. Use only **Black Ball Point Pen** for darkening the oval for answering.

8. All the questions are compulsory and they carry equal marks. The total marks scored by a candidate depends on the number of correct choices / answers darkened in the OMR Answer Sheet. There will be no negative marking for wrong answers.

9. No candidate shall be allowed to leave the Examination Hall / Room till all OMR Answer Sheets have been collected by the invigilator.

10. On completion of the entrance test, the original OMR Answer Sheet be handed over to the invigilator. Candidates are allowed to take the second copy of the OMR Answer Sheet along with the used Test Booklet for reference.

11. Candidates are not allowed to carry any personal belongings including electronic devices such as scientific calculator, cell phones, headphones, earbuds, or any other type of devices that allow communication of any kind inside the Examination Room / Hall.

12. The candidates are advised not to scribble or make any mark on the OMR Answer Sheet except marking the answers at the appropriate places and filling up the details required. Rough work, if any, may be done in the blank sheet(s) provided at the end of the Test Booklet.

13. Any malpractice / use of unfair means will lead to your disqualification from the entrance test / admission process and may also lead to appropriate legal action as deemed fit.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

SEAL

1. Sodium chloride heated in sodium vapour shows _____ color.

   (A) Yellow

   (B) Greenish yellow

   (C) Violet

   (D) Bluish yellow

2. Solutions of alkali and alkaline earth metals in liquid ammonia conducts electricity :

   (A) Electronically

   (B) Electrolytically

   (C) Partly electronically and partly electrolytically

   (D) Non conducting

3. The standard emf of the Daniel cell is 1.1 V. Then the equilibrium constant (log k) is :

   (A) 18.6

   (B) 37.2

   (C) 0

   (D) 3.3

4. For an ideal gas $(\partial V/\partial S)_p =$

   (A) RT/PC_p

   (B) RT/C_p

   (C) C_p/T

   (D) C_v/P

5. Criteria for spontaneity is :

   (A) $(dS)_{E,V} < 0$

   (B) $(dH)_{S,P} < 0$

   (C) $(dA)_{T,V} = 0$

   (D) $(dG)_{P,V} > 0$

6. Which of the following photochemical reaction has highest quantum yield (φ) ?

   (A) Photochemical combination between hydrogen and chlorine

   (B) Photochemical combination between hydrogen and bromine

   (C) Photochemical combination between hydrogen and iodine

   (D) Photochemical degradation of acetaldehyde

7. A plot of Z (compressibility factor) is a function of pressure at $0°C$ for N_2, yields Z :

   (A) Less than unity at high pressure and greater than unity at low pressure

   (B) Less than unity at all pressures

   (C) Higher than unity at all pressures

   (D) Less than unity at low pressure and greater than unity at high pressure

8. Which of the following gases show maximum deviation from ideal behavior at $^{\circ}C$?

   (A) H_2 (B) CO_2

   (C) CH_4 (D) N_2

9. The compressibility factor for CO_2 at 273 K and 100 atm is 2.007. Then the volume occupied by 0.1 mole of CO_2 is :

   (A) $4.5 \times 10^{-6}\,m^3$ (B) $4.5 \times 10^{6}\,m^3$

   (C) $4.5 \times 10^{6}\,cm^3$ (D) $4.5 \times 10^{-6}\,cm^3$

10. The wavelength associated with an electron (having velocity of 20 ms^{-1}) is :

   (A) 3.6×10^{-5} mm   (B) 3.6×10^{-5} cm

   (C) $36\,\mu m$ (D) 360 nm

11. Which of the following quantum number is not derived from Schrodinger's wave equation for H-atom ?

   (A) n   (B) ℓ

   (C) m   (D) s

12. In a black body radiation experiment, with increasing temperature the λ_{max} of emitted radiation _____.

   (A) Shifts towards higher wavelength

   (B) Shifts towards shorter wavelength

   (C) Remains constant

   (D) Causes decrease in intensity

13. The number of radial nodes associated with a 3d orbital is :

   (A) 0   (B) 1

   (C) 2   (D) 3

14. The spin quantum number of a free electron is :

   (A) $\pm 1/2$ (B) $+1/2$

   (C) $-1/2$ (D) $1/2$

GO – 36/15   (4)   (Continued)

15. Given sublimation energy (S), Ionization energy (I), Dissociation energy (D), Electron affinity (E_a), Lattice energy (U_c) and Formation energy (ΔH_f), then the correct expression for the formation of NaCl is :

(A) $\Delta H_f = S+I+1/2\ D\ -E_a -U_c$

(B) $\Delta H_f = S+I-1/2\ D\ -E_a -U_c$

(C) $\Delta H_f = S-I+1/2\ D\ -E_a -U_c$

(D) $\Delta H_f = S+I+1/2\ D\ +E_a -U_c$

16. For a reaction $xA \rightarrow$ Product(s), the half life period ($t_{1/2}$) of a reaction of nth order is related to the initial concentration (a) of A, by :

(A) $t_{\frac{1}{2}}$ is proportional to ($1/a^{n-1}$)

(B) $t_{\frac{1}{2}}$ is proportional to ($1/a^{n}$)

(C) $t_{\frac{1}{2}}$ is proportional to (a^{n-1})

(D) $t_{\frac{1}{2}}$ is proportional to (a^{n})

17. The manufacture of ammonia by Haber process utilizes :

(A) Ni as catalyst and Fe as promoter

(B) Fe as catalyst and Mo as promoter

(C) Fe as catalyst and Ni as promoter

(D) Fe as catalyst

18. Which of the following statements is CORRECT ?

(A) The relative lowering of vapor pressure is dependent on the nature of the solute only.

(B) The relative lowering of vapor pressure is dependent on the nature of the solvent only.

(C) The relative lowering of vapor pressure is dependent on the mole fraction of the solute only.

(D) The relative lowering of vapor pressure is dependent on the temperature and mole fraction of the solute only.

19. An aqueous solution contains 20×10^{-3} kg of glucose per dm^3. Assuming the solution to be ideal, the osmotic pressure at 298 K is _____ ?

(A) 2.718 atm

(B) 27.18 atm

(C) 0.2718 atm

(D) 1.0 atm

20. A 5.13% solution of cane sugar is isotonic with 0.9% solution of an unknown solute. The molar mass of the solute is :

(A) 320 g.mol^{-1}

(B) 3200 g.mol^{-1}

(C) 620 g.mol^{-1}

(D) 60 g.mol^{-1}

21. Given the following aqueous solutions at 300 K, 1 M sucrose; 1 M NaCl ; 1 M BaCl$_2$ and 1 M Phenol. Assuming the electrolytes are completely ionized and phenol is dimerized, which solution will show highest colligative property ?

(A) 1 M sucrose

(B) 1 M NaCl

(C) 1 M BaCl$_2$

(D) 1 M Phenol

22. For the reaction N$_2$(g) + 3H$_2$(g) $\leftrightarrow$ 2NH$_3$(g) + Heat, which of the following statements is TRUE ?

(A) Increase in temperature favors ammonia formation.

(B) Temperature has no effect on ammonia formation.

(C) Increase in temperature favors dissociation of ammonia.

(D) Decrease in temperature favors dissociation of ammonia.

23. A plot of Kp vs 1/T is :

(A) A straight line passing through origin with slope $\Delta H^o/2.303$ R

(B) A straight line with slope $\Delta H^o/2.303$

(C) A straight line with slope - $\Delta H^o/2.303$

(D) A straight line with slope - 2.303ΔH^o

24. Which of the following equilibria is not affected by pressure change ?

(A) PCl$_5$ $\leftrightarrow$ PCl$_3$ + Cl$_2$

(B) N$_2$ + O$_2$ $\leftrightarrow$ 2NO

(C) O$_3$ $\leftrightarrow$ O$_2$

(D) NO$_2$ $\leftrightarrow$ N$_2$O$_4$

25. The distribution of I$_2$ in following solvents holds good for distribution law :

(A) Between benzene and tolune

(B) Between carbon disulphide and water

(C) Between carbon tetrachloride and water

(D) Both (B) and (C)

(6)

26. The ionic radii of Na^+, Mg^{2+} and Al^{3+} follow the order _____ and it is due to _____.

   (A) $Na^+ > Mg^{2+} > Al^{3+}$, increased charge on the nucleus

   (B) $Na^+ > Mg^{2+} > Al^{3+}$, increased charge on the ions

   (C) $Al^{3+} > Na^+ > Mg^{2+}$, increased charge on the nucleus and ions

   (D) $Na^+ > Mg^{2+} > Al^{3+}$, increased charge on the nucleus and ions

27. The factors that affect ionization energy is :

   (A) The size of atom   (B) The charge on the nucleus

   (C) Screening effect   (D) All of these

28. According to Mulliken the relationship between electronegativity, Ionization energy (I) and electron affinity (E) is :

   (A) Electronegativity = (I + E)/2   (B) Electronegativity = (I – E)/2

   (C) Electronegativity = 2 (I + E)   (D) Electronegativity = 2 (I – E)

29. Which of the following metal ions is found in carboxypeptidase metalloenzyme ?

   (A) Cu(II)   (B) Co(II)

   (C) Zn(II)   (D) Mn(II)

30. The low spin transition metal complexes are preferred by :

   (A) First and second row transition elements

   (B) Second and third row transition elements

   (C) First and third row transition elements

   (D) Second row transition elements

31. Which of the followings is not a ligand ?

   (A) NH_3 (B) Cl^-

   (C) NO^+ (D) None of these

32. Effective atomic number of Fe in $[Fe(CN)_6]^{3-}$ is :

   (A) 26   (B) 35

   (C) 29   (D) 36

33. Sodium bis (thiosulphato) argentite(I) is :

(A) $Na_3[Ag(S_2O_3)_2]$
(B) $Na[Ag(S_2O_3)_2]$

(C) $Ag_3[Na(S_2O_3)_2]$
(D) $Ag[Na(S_2O_3)_2]$

34. $CrCl_3 6H_2O$ best shows _____ isomerism.

(A) Linkage
(B) Ionization

(C) Hydrate
(D) Coordination

35. Barfoed's reagent used for general test of monosaccharides, has chemical composition of :

(A) Neutral Copper(II) acetate solution

(B) Aqueous Copper(II) acetate solution

(C) Acidic Copper(II) acetate solution

(D) Basic Copper(II) acetate solution

36. Dilute HCl, a most commonly laboratory reagent provided in general students laboratory has s concentration of _____.

(A) 1M
(B) 2M

(C) 4M
(D) 6M

37. Which of the halide ion can etch glass ?

(A) Iodide
(B) Bromide

(C) Chloride
(D) Fluoride

38. Borax bead test is usually performed to detect _____ salts.

(A) Sodium, Postassium, Copper
(B) Potassium, Barium, Iron

(C) Iron, Copper, Manganese
(D) Iron, Copper, Magnesium

39. A pure pink mass remained in the charcoal cavity during cobalt nitrate test indicates presence of _____ oxide.

(A) Aluminium
(B) Magnesium

(C) Zinc
(D) Barium

40. H_3PO_4 is a tribasic acid at $25^\circ C$, the order of pK values follow the order :

(A) $pK_1 > pK_2 > pK_3$

(B) $pK_3 > pK_2 > pK_1$

(C) $pK_1 = pK_2 > pK_3$

(D) $pK_1 = pK_2 = pK_3$

41. Beryl is an important mineral of beryllium, has the chemical formulae of :

(A) $Al_2Be_3(SiO_3)_6$

(B) $Be_3Al_2(SiO_2)_6$

(C) $Be(SiO_2)_2Al_2O_3$

(D) $Be_3Al_2(SiO_3)_6$

42. The Ziegler-Natta system is _____ and the active metal species in a fibrous form of _____.

(A) Homogeneous and $TiCl_3$

(B) Heterogeneous and $TiCl_3$

(C) Homogeneous and $TiCl_4$

(D) Heterogeneous and $TiCl_4$

43. Wacker process uses _____ as catalyst.

(A) $PtCl_2$

(B) $PtCl_4$

(C) Pd

(D) $PdCl_2$.

44. Which of the following statements is not TRUE with respect to silicones ?

(A) Silicones are resistant to heat and most of the chemicals.

(B) Silicones are good electrical insulators.

(C) Silicones can be used as foaming agents.

(D) Silicones have non-stick properties.

45. The hybridization seen in $[PtCl_4]^{2-}$ is :

(A) sp^3

(B) sp^2d

(C) spd^2

(D) dsp^2

46. The bonding patterns found in salicyaldehyde is :

(A) Covalent and intermolecular H-bonding

(B) Covalent and ionic

(C) Covalent and intramolecular H-bonding

(D) Covalent, Ionic and H-bonding

47. The frequency and wavenumber associated with a IR radiation having wavelength of 10 μm is :

(A) $3 \times 10^{13} s^{-1}$ and $10^{-5} m^{-1}$

(B) $3 \times 10^{12} s^{-1}$ and $10^{-1} m^{-1}$

(C) $1 \times 10^{13} s^{-1}$ and $10^{-6} m^{-1}$

(D) $1 \times 10^{11} s^{-1}$ and $10^{-1} m^{-1}$

48. Which of the following radiations can cause changes in electronic energy levels within molecules ?

(A) Infrared

(B) Ultraviolet

(C) Microwaves

(D) Ultraviolet-visible

49. Predict the λ_{max} for a $\pi \to \pi^*$ absorption band in the UV-spectrum of _____.
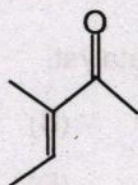

(A) 227 nm

(B) 237 nm

(C) 230 nm

(D) 232 nm

50. Molar absorptivity has the unit of :

(A) $L\,mol^{-1}$

(B) Dimensionless

(C) $L\,mol^{-1}\,cm^{-1}$

(D) $Mol\,L^{-1}\,cm^{-1}$

51. Which of the following statement(s) TRUE with respect to IR of CO_2 ?

(A) All symmetric stretching and bending modes are IR active.

(B) All stretching modes are IR active.

(C) Asymmetric stretching and bending modes are IR active.

(D) CO_2 is IR inactive.

52. The selection rule of observing vibrational energy level transition is :

(A) $\Delta V = \pm 1$

(B) $\Delta V = \pm 1, \pm 2, \pm 3$

(C) $\Delta V = 0, \pm 1$

(D) $\Delta V = 0$

53. The $\upsilon_{C=O}$ stretching absorption of HCHO, CH_3CHO, CH_3COCH_3 are in the order :

    (A) $HCHO > CH_3COCH_3 > CH_3CHO$ (B) $CH_3COCH_3 > HCHO > CH_3CHO$

    (C) $HCHO > CH_3CHO > CH_3COCH_3$ (D) $CH_3CHO > CH_3COCH_3 > HCHO$

54. Comparative stretching vibrations of free hydroxyl group, inter-molecularly hydrogen bonded hydroxyl group and intra-molecularly hydrogen bonded hydroxyl groups follows the order :

    (A) Free > Intra- > Inter-   (B) Inter- > Intra- > Free

    (C) Free > Intra- = Inter-   (D) Intra- > Free > Inter-

55. Nuclear magnetic resonance involves transition between _____ energy levels and _____ energy is required for the transition.

    (A) Nuclear and Radio frequency

    (B) Nuclear spin and Microwave frequency

    (C) Nuclear and visible frequency

    (D) Nuclear spin and Radio frequency

56. Magnetogyric (γ) ratio is the ratio between :

    (A) Nuclear spin (s) and nuclear angular momentum(I)

    (B) Nuclear magnetic moment (μ) and nuclear angular momentum (I)

    (C) Nuclear precessional frequency (υ) and nuclear angular momentum (I)

    (D) Nuclear spin (s) and nuclear precessional frequency (υ)

57. The aldehyde proton usually appears in the δ value range of :

    (A) 2.0 – 3.6   (B) 6.0 – 7.0

    (C) 3.0 – 7.0   (D) 9.0 – 10.0

58. In methyl acetate (CH_3COOCH_3) protons appear at δ = _____ and _____ respectively.

    (A) 2.0 and 3.6   (B) 0.9 and 1.2

    (C) 4.2 and 5.1   (D) 0.9 and 4.2

59. Which of the following statements is TRUE ?

(A) The base peak is always the molecular ion peak.

(B) Base peak corresponds to a fragment of the molecule.

(C) The intensity of the molecular ion peak is 100%.

(D) Mass spectra are always collected from a gaseous sample.

60. Mass spectra of 1-decanol through chemical ionization results in base peak at m/e :

(A) 157

(B) 141

(C) 158

(D) 112

61. The most common stationary phase used in thin layer chromatography is :

(A) SiO_2

(B) ZrO_2

(C) TiO_2

(D) Al_2O_3

62. The relationship between retention factor (k) and retardation factor (R_F) in thin layer chromatography is :

(A) $k = 1 - R_F$

(B) $k = R_F - 1$

(C) $k = (1 - R_F)/R_F$

(D) $k = R_F/(1 - R_F)$

63. Which of the following statements is not CORRECT with respect to green chemistry ?

(A) Microwave assisted reactions can be considered as clean and green.

(B) Supercritical carbon dioxide is not a green solvent.

(C) Solid state reactions are not green.

(D) Dichloromethane can be considered as a green solvent.

64. Identify X, Y and Z in the following transformation :

$$C_6H_5OH \xrightarrow{X} C_6H_5O^-(CHCl_2) \xrightarrow{Y} C_6H_5O^-(CHO) \xrightarrow{Z} C_6H_5OH(CHO)$$

(A) X = $CHCl_3$, NaOH ; Y = NaOH ; Z = HCl

(B) X = CH_2Cl_2, NaOH ; Y = NaOH ; Z = HCl

(C) X = $CHCl_3$; Y = NaOH ; Z = HCl

(D) X = HCl, NaOH ; Y = NaOH ; Z = HCl

65. The name of the following compound is :

$$
\begin{array}{c}
CH_3 \\
H \text{——} OH \\
H \text{——} Br \\
CH_3
\end{array}
$$
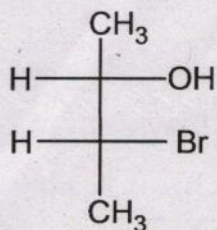
(A) (2R, 3S)-3-bromobutan-ol

(B) (2S, 3R)-3-bromobutan-ol

(C) Meso-3-bromobutan-ol

(D) 2-bromo-3-hydroxy-butan-ol

66. An unknown compound on ozonolysis gives acetaldehyde and benzophenone. Identify the compound :

(A) 1,2-diphenylpropene

(B) 1,1-diphenylpropene

(C) 2-phenyl-2-hexene

(D) 1,2-diphenylhexene

67. The α-helix is a common form of _____ of proteins.

(A) Primary structure

(B) Tertiary structure

(C) Secondary structure

(D) Quarternary structure

68. Which dyes become linked to the fiber by chemical reactions ?

(A) Acid dyes

(B) Direct dyes

(C) Disperse dyes

(D) All dyes

69. Prussian blue has the chemical formulae :

(A) $Na_4[Fe(CN)_6]$

(B) $Fe_4[Fe(CN)_6]_3$

(C) $Fe_3[Fe(CN)_6]_2$

(D) NaCNS

70. Which of the following tests is not confirmatory test for phenol ?

(A) Reaction with $FeCl_3$ solution

(B) Reaction with Br_2 water

(C) Phthalein test

(D) Reaction with sodium hydrogen carbonate solution

71. The *p-*, *sec-* and *tert*-alcohols can be differentiated on the basis of their behavior towards :

    (A) Hot acidic $K_2Cr_2O_7$ solution

    (B) Acidic $K_2Cr_2O_7$ solution

    (C) Basic $K_2Cr_2O_7$ solution

    (D) Neutral $K_2Cr_2O_7$ solution

72. Which of the following compound(s) is anti-aromatic ?

    (A) Anthracene

    (B) Cyclopropenyl cation

    (C) Furan

    (D) Cyclopropenyl anion

73. How many π-electrons are there in an anti-aromatic compound ?

    (A) $4n + 4$

    (B) $4n$

    (C) $2n + 2$

    (D) $4n + 2$

74. For a compound to be aromatic, how many π-electrons must be in π-cloud ?

    (A) Even number

    (B) Odd number

    (C) An odd number of pairs

    (D) An even number of pairs

75. Which of the followings is not a nucleophile ?

    (A) H_2O

    (B) ROH

    (C) BF_3

    (D) RNH_2

76. When 2-bromobutane is treated with alc.KOH, the product formed is _____.

    (A) 1-butene

    (B) 2-butene

    (C) Mixture of 1-butene and 2-butene

    (D) 3-butene

77. The least stable carbocation among the following :

    $C_6H_5CH_2^-$, $(CH_3)_3C^-$, CCl_3^- and CH_3^- is :

    (A) $C_6H_5CH_2$

    (B) $(CH_3)_3C^-$

    (C) CCl_3^-

    (D) CH_3^-

78. Which of the following compounds does not give a secondary alcohol upon reaction with methylmagnesium bromide ?
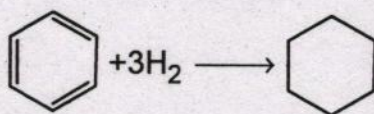
    (A) 3-methylpentanal   (B) Ethyl benzoate

    (C) 4,4-dimethylcyclohexanone   (D) 4-heptanone

79. Predict the major product of the following reaction :
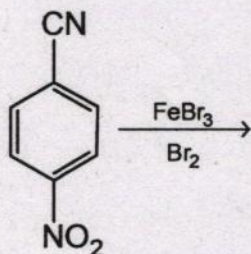
    (A) 2,6-Dibromo-nitrobenzonitrile   (B) 3,5-Dibromo-nitrobenzonitrile

    (C) 2-bromo-4-nitrobenzonitrile   (D) 3-bromo-4-nitrobenzonitrile
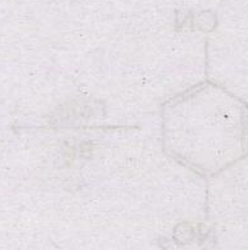
80. Identify the reaction conditions for the following transformation :

    (A) Ni, 200° C, High pressure   (B) Ni, 200° C

    (C) Ni, High pressure   (D) Fe, 200° C, High pressure

———— ❖ ————

SPACE FOR ROUGH WORK