CET (PG)–2018

Important : Please consult your Admit Card / Roll No. Slip before filling your Roll Number on the Test Booklet and Answer Sheet.

Roll No.   *(In Figures)*   *(In Words)*

O.M.R. Answer Sheet Serial No.

Signature of the Candidate : ....

Subject : M.Sc. (Hons. School/2 Years Course)–CHEMISTRY

Time : 90 minutes]   [Maximum Marks : 75

No. of Questions : 75]   [Total No. of Printed Pages : 16

DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO
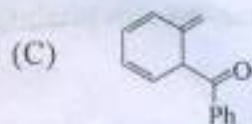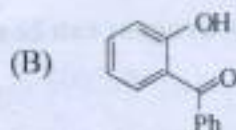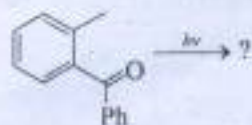
INSTRUCTIONS :

1. Write your Roll No. on the Question Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Subject and Series Code of Question Booklet on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball Point / Black Gel Pen.**
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. To open the Question Booklet remove the paper seal gently when asked to do so.
5. Please check that this Question Booklet contains **75** questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of test.
6. Each question has four alternative answers (A, B, C, D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point / Black Gel Pen.**
7. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Sheet. No marks will be deducted in such cases.
8. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the questions given in the Question Booklet.
9. Negative marking will be adopted for evaluation i.e., 1/4th of the marks of the question will be deducted for each wrong answer. A wrong answer means incorrect answer or wrong filling of bubble.
10. For calculations, use of simple log tables is permitted. Borrowing of log tables and any other material is not allowed.
11. For rough work only the sheets marked "<u>Rough Work</u>" at the end of the Question Booklet be used.
12. The Answer Sheet is designed for **computer evaluation**. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e., not following the instructions completely, shall be of the candidate only.**
13. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
14. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so, would be expelled from the examination.
15. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistance or found giving or receiving assistance or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/Observer whose decision shall be final.
16. **Telecommunication equipment such as pager, cellular phone, wireless, scanner, etc., is not permitted inside the examination hall. Use of calculator is not allowed.**

1. Phenolic esters on heating with $AlCl_3$ give o- and p-acyl phenol. This is termed as :

   (A) Favorski rearrangement
   (B) Beckmann rearrangement
   (C) Fries rearrangement
   (D) Wolff rearrangement

2. Product of the rapid photochemical reaction of following aromatic carbonyl compound is :

   (A)

   (B)

   (C)

   (D)

3. With molecular formula $C_9H_{11}Cl$, assign the plausible structure to the compound from the following sets of NMR data :

   (i) Quintet (δ 2.15) 2H
   (ii) Triplet (δ 2.75) 2H
   (iii) Triplet (δ 3.38) 2H
   (iv) Singlet (δ 7.22) 5H

   (A)

   (B)

   (C)

   (D)
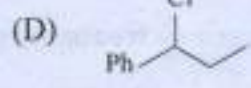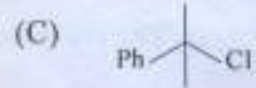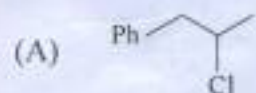
4. Ozonolysis of butene-1 followed by reduction with Zn/CH_3COOH gives :

   (A) Acetaldehyde and formaldehyde
   (B) Acetaldehyde and acetone
   (C) Acetone and formaldehyde
   (D) Propionaldehyde and formaldehyde

5. The 1°, 2° and 3° alcohols can be differentiated using following test :

   (A) Hinsberg's test
   (B) Azo dye test
   (C) Beilstein test
   (D) Victor Mayer's test

3

6. Using Woodward-Fieser rules the λ_{max} for the following compound is :

(A) 270 mµ
(B) 298 mµ

(C) 242 mµ
(D) 264 mµ

7. Ketones containing α-hydrogens can be transformed into alkylated ketones via :

(A) Enamine
(B) Free radical

(C) Carbocation
(D) Enol

8. When propyne is bubbled through an acidified solution containing mercuric ions, the prod
formed is :

(A) Propene
(B) Propanone

(C) Propanal
(D) Propanoic acid

9. Neutral organic species containing a divalent carbon atom having a sextet of electrons
known as :

(A) Benzyne
(B) Nitrenes

(C) Carbenes
(D) Carbanions

10. Esters having α-hydrogen on treatment with strong base gives β-ketoesters. The react
is termed as :

(A) Acyloin condensation
(B) Claisen condensation

(C) Aldol condensation
(D) Stobbe condensation

11. The most stable conformation of *n*-butane is :

(A) Staggered-anti
(B) Fully eclipsed

(C) Gauche or skew
(D) Partially eclipsed

12. Treatment of ethyl benzene with $Br_2/h\nu$ produces :

   (A) 1-Bromo-2-phenylethane
   (B) 1-Bromo-1-phenylethane
   (C) 1, 1-Dibromo-2-phenylethane
   (D) 1, 1-Dibromo-1-phenylethane

13. Name the reaction which leads to following conversion :

   (A) Birch reduction
   (B) Wittig reaction
   (C) Dieckmann reaction
   (D) Clemmensen reduction

14. Silver salt of carboxylic acid on decomposition with Br_2/CCl_4 gives :

   (A) Bromoalcohols
   (B) Bromoacid
   (C) Dibromoethane
   (D) Alkylbromide

15. 1, 2-Butadiene is an example of :

   (A) Isolated dienes
   (B) Cumulated dienes
   (C) Conjugated dienes
   (D) Separated dienes

16. Benzene diazonium chloride on treatment with hypophosphorus acid in the presence of cuprous ions furnishes :

   (A) Benzene
   (B) Phenol
   (C) Aniline
   (D) Toluene

17. Planner cyclic compounds having (4n) π electrons and completely conjugated double bonds are defined as :

   (A) Anti-aromatic compounds
   (B) Aromatic compounds
   (C) Non-aromatic compounds
   (D) Homo-aromatic compounds

18. Thiophene on reaction with HCHO and HCl gives :

(A) 2,5-Dihydrothiophene
(B) 2-Chloromethylthiophene
(C) 2-Chloromercurithiophene
(D) 2-Acetylthiophene

19. Which of the following is a sweetening agent ?

(A) Fructose
(B) Starch
(C) Sucrose
(D) Maltose

20. Number of milligrams of potassium hydroxide required to neutralise one gram of the fat or oil is defined as :

(A) Saponification value
(B) Iodine value
(C) Acid value
(D) Reichert-Meissl value

21. Following conversion belongs to :

$$RCOOH \xrightarrow[HN_3]{H_2SO_4} RNH_2 + CO_2$$

(A) Benzoin condensation
(B) Reimer-Tiemann reaction
(C) Schmidt rearrangement
(D) Pinacol-Pinacolone rearrangement

22. $\nu C = O_{str}$ absorption band in the Infra-red spectrum of propanal appears at :

(A) 3000-3320 cm^{-1}
(B) 1720-1740 cm^{-1}
(C) 1500-1575 cm^{-1}
(D) 735-770 cm^{-1}

23. Which of the following is not present in DNA ?

(A) Uracil
(B) Thymine
(C) Adenine
(D) Guanine

24. Bakelite polymer can be synthesized from :

(A) Phenol and caprolactum
(B) Ethylene glycol and phthalic acid
(C) Adipic acid and hexamethylene diamine
(D) Phenol and formaldehyde

25. $(C_2H_5)_2Zn$ on reaction with acetyl chloride gives :

(A) Butane

(B) Butanoic acid

(C) Butanone

(D) Butene

26. Which of the following combination of orbitals is not permissible ?

(A) $n = 3, 1 = 2, m = 0, s = -1/2$

(B) $n = 5, 1 = 0, m = 0, s = 1/2$

(C) $n = 2, 1 = 1, m = 0, s = 1/2$

(D) $n = 4, 1 = 3, m = -3, s = 0$

27. Calculate the effective nuclear charge at the outer boundary of copper atom :

(A) 3.85

(B) 4.35

(C) 1.3

(D) 13.05

28. Which of the following has highest ionic mobility in aqueous solution ?

(A) Li^+

(B) Na^+

(C) K^+

(D) Cs^+

29. Which of the following is a non-linear molecule/ion ?

(A) CS_2

(B) $SnCl_2$

(C) NO_2^+

(D) $ZnCl_2$

30. Which of the following molecules can be condensed due to London forces ?

(A) CH_4

(B) H_2O

(C) HCl

(D) NH_3

31. Calculate the probable coordination number of Rb^+ in RbI (ionic radii of Rb^+ and I^- are 1.47 and 2.16 Å, respectively) :

(A) 3

(B) 4

(C) 6

(D) 8

32. Which of the following produces allylene upon hydrolysis ?

(A) Be_2C

(B) Mg_2C_3

(C) CaC_2

(D) Al_4C_3

33. What is the oxidation state of S in peroxodisulphuric acid ?

(A) +4

(B) +5

(C) +6

(D) +7

34. Calculate theoretical value of magnetic moment of Cr^{2+} ion :

(A) 4.90

(B) 3.87

(C) 5.92

(D) 1.73

35. Which of the following has M-M quadruple bond ?

(A) Re_3Cl_{12}

(B) $[W_2Cl_9]^{3-}$

(C) Nb_2Cl_{10}

(D) $[Mo_2Cl_8]^{4-}$

36. Which of the following isomerization(s) is shown by $[Pt(NH_3)_4][PtCl_4]$?

(A) Coordination isomerism

(B) Coordination position isomerism

(C) Coordination and polymerization isomerism

(D) Polymerization isomerism

37. Which of the following statements is incorrect about the valence bond theory ?

(A) It is based upon the mixing of orbitals of appropriate energy

(B) It partially explains formation of outer and inner orbital complexes

(C) It did not explain kinetic stability of Cr and Co complexes

(D) It explains origin of electronic spectra of coordination complexes

38. Which of the following forms double sulphates ?

(A) Sm

(B) Gd

(C) Ho

(D) Tm

39. Choose strongest acid from the following :

(A) $[Cr(H_2O)_6]^{2+}$

(B) $[Fe(H_2O)_6]^{2+}$

(C) $[Sc(H_2O)_6]^{2+}$

(D) $[Ca(H_2O)_6]^{2+}$
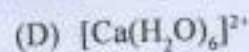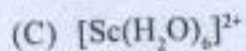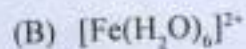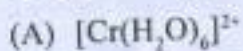
40. Choose a compound from the following with zero oxidation number of carbon :

(A) Diamond

(B) Carbon dioxide

(C) Acetylene

(D) Ethane

41. Which of the following is a non-coordinating solvent ?

(A) Ammonia

(B) Acetonitrile

(C) Carbon tetrachloride

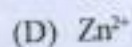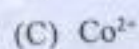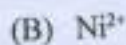(D) Sulphur dioxide

42. Calculate CFSE of $[Co(NH_3)_6]^{3+}$ ion :

(A) $-4\,Dq$
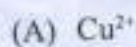
(B) $-24\,Dq + 2P$

(C) $-2.4\,Dq + 2P$

(D) $-18\,Dq + 2P$

43. Which of the following forms most stable complexes ?

(A) Cu^{2+}

(B) Ni^{2+}

(C) Co^{2+}

(D) Zn^{2+}

44. Which of the following is used as a catalyst for the hydrogenation of alkenes ?
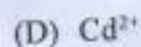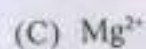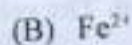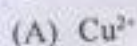
(A) Ziegler Natta catalyst

(B) Organotin compounds

(C) Ferrocene

(D) Wilkinson's catalyst

45. Which of the following metal ions activates the conversion of ATP to ADP in biological systems ?

(A) Cu^{2+}

(B) Fe^{2+}

(C) Mg^{2+}

(D) Cd^{2+}

46. Which of the following consists of heteromorphic $p\pi$-$d\pi$ bonding ?

(A) B_2H_9

(B) $(NPCl_2)_3$

(C) $B_3N_3H_6$

(D) Benzene

47. Pick a soft acid from the following :

(A) HI

(B) $Al(CH_3)_3$

(C) BCl_3

(D) Carbene

48. Calculate number of microstates for d^8 system :

(A) 45

(B) 120

(C) 10

(D) 252

49. Choose a ferromagnetic substance from the following :

(A) MnO

(B) MnO_2

(C) NiO

(D) CrO_2

50. Which of the following is toxic to biological systems ?

(A) Zn

(B) Pb

(C) Cu

(D) Fe

51. The molar conductivity at infinite dilution of $Al_2(SO_4)_3$ is 858 S cm² mol⁻¹. Calculate molar ionic conductivity of Al^{3+} ion given that $\lambda^0(SO_4^{2-}) = 160$ S cm² mol⁻¹ :

(A) $160\ S\ cm^2\ mol^{-1}$

(B) $189\ S\ cm^2\ mol^{-1}$

(C) $698\ S\ cm^2\ mol^{-1}$

(D) $1018\ S\ cm^2\ mol^{-1}$

52. The rate of a third order reaction, $3A \to P$ is r. On doubling the concentration of the reactant, the new reaction rate, R is obtained. The relationship between r and R is :

(A) $R = r$

(B) $R = 8r$

(C) $R = r + 2$

(D) $R = 2r$

53. For the reaction, $3A \rightarrow B + 2E$, if $-\dfrac{d[A]}{dt} = k_a [A]^2$; $\dfrac{d[B]}{dt} = k_b [A]^2$; $\dfrac{d[E]}{dt} = k_e [A]^2$, then the correct relation between k_a, k_b and k_e is :

(A) $k_a = k_b = k_e$

(B) $k_a = \dfrac{k_b}{3} = k_e$

(C) $3k_a = k_b = 2k_e$

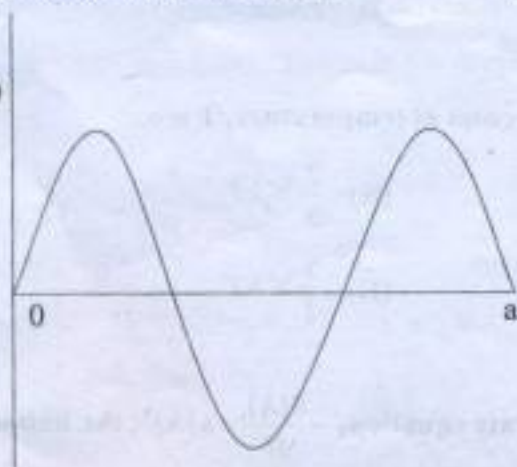(D) $\dfrac{k_a}{3} = k_b = \dfrac{k_e}{2}$

54. In AgBr, there can occur :

(A) Only Schottky defect

(B) Only Frenkel defect

(C) Both Schottky and Frenkel defect

(D) None of these

55.

The given wavefunction graph in one-dimensional box of length, a corresponds to energy equal to (where, m is mass of particle) :

(A) $3h^2/8ma^2$

(B) $2h^2/8ma$

(C) $9h^2/8ma^2$

(D) $2h/8ma^2$

56. Activity coefficient calculated using Debye-Huckel law are always :

(A) Less than zero

(B) Greater than one

(C) Equal to one

(D) Less than one

57. Which of the following terms are constant in microcanonical ensembles ?

(A) N, V and E remains constant

(B) μ, P and T remains constant

(C) N, V and T remains constant

(D) N, P and E remains constant

58. The equilibrium constant of a reaction doubles on raising the temperature from 25°C to 35°C. Calculate $\Delta H°$ for the reaction (in KJ mol^{-1}) :
   (A) 52.89
   (B) 0
   (C) 60.5
   (D) 46.3

59. No. of vibrational degree of freedom in benzene :
   (A) 6
   (B) 2
   (C) 31
   (D) None of the above

60. What is the constant volume heat capacity of an ideal monoatomic gas is (in unit J K^{-1} mol^{-1}) ?
   (A) 12.47
   (B) 6.1
   (C) 0
   (D) Infinite

61. Average kinetic energy of the gas molecules at temperature, T is :
   (A) $\frac{2}{3} RT$
   (B) $\frac{2}{3} N_0 kT$
   (C) $\frac{3}{2} N_0 RT$
   (D) $\frac{3}{2} N_0 kT$

62. For a third order reaction having the rate equation, $-\frac{d[A]}{dt} = k[A]^3$; the half life time period, $t_{1/2}$ is :
   (A) proportional to the initial concentration of reactant
   (B) inversely proportional to the square of the initial
   (C) proportional to the square of the initial concentration of reactant
   (D) inversely proportional to the square root of the initial concentration of reactant

63. Which of the following show most probable distribution of N particles among the various energy levels according to Bose-Einstein statistics ?
   (A) $n_i = g_i/[\exp(\alpha - \beta E_i)] - 1$
   (B) $n_i = g_i/[\exp(\alpha - \beta E_{i*})] + 1$
   (C) $n_i = g_i/[\exp(\alpha + \beta E_i)] + 1$
   (D) None of the above

64. Which of the following groups has highest IR absorption frequencies ?
   (A) C—H
   (B) C—Cl
   (C) C—F
   (D) C—Br

65. Calculate the degree of hydrolysis of 0.10 M solution of sodium acetate at 25°C. Given $K_a = 1.75 \times 10^{-5}$ and $K_w = 1.008 \times 10^{-14}$:

(A) 7.5×10^{-5}

(B) 2.758×10^{-19}

(C) 5.76×10^{-12}

(D) 0

66. The no. of atoms contained within the unit cell for the diamond lattice :

(A) 1

(B) 2

(C) 6

(D) 8

67. For a first order reaction $A \longrightarrow B$, the reaction rate at reactant concentration of 0.01 M is found to be 2×10^{-5} mol $L^{-1}s^{-1}$. The half-life period of the reaction is (in seconds) :

(A) 34.5

(B) 300

(C) 346.5

(D) Does not find

68.
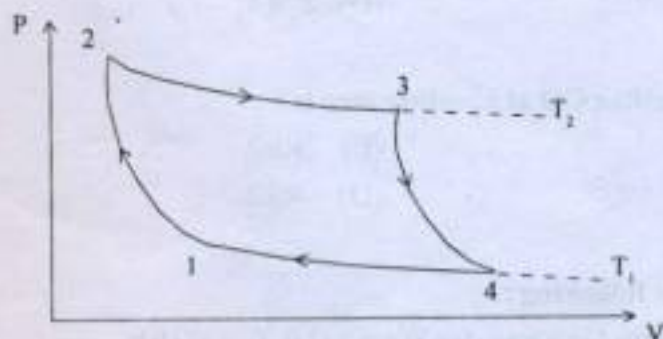
The figure above describes a Carnot engine work. Which path shows adiabatic compression ?

(A) 3 to 4

(B) 4 to 5

(C) 1 to 2

(D) 4 to 1

69. A Carnot engine operates at 55% efficiency. If the temperature of reject steam is 105°C, then calculate the absolute temperature (in Kelvin) of input system :

(A) 880

(B) 105

(C) 840

(D) 165

70. Consider the following statement :

(1) Entropy of the universe is continually increasing

(2) Total entropy change for a reversible isothermal cycle is zero

(3) $\Delta S_{MIX} = 0$ for ideal gas

(4) Entropy is unavailable work

Correct statement is :

(A) (1), (2), (3), (4)

(B) (1), (2), (3)

(C) (1), (2), (4)

(D) (1), (4)

71. Calculate the pOH of 0.03 M aqueous solution of HCl at 25°C :

(A) 1.52

(B) 3.5

(C) 7

(D) 12.48

72. The coefficient of performance of perfect refrigerator working reversibly between the temperature T_h and T_c is given by :

(A) $(T_c - T_h)/T_c$

(B) $(T_h - T_c)/T_c$

(C) $T_c/(T_h - T_c)$

(D) $T_h/(T_h - T_c)$

73. The molar entropy of crystalline CO at absolute zero is :

(A) zero

(B) 2Rln2

(C) Rln2

(D) –Rln2

74. The correct statement of the following :

(1) The BOYLE temperature for a van der Waal gas is $T_n = a/2Rb$

(2) The inversion temperature is given by equation $T_i = 2a/Rb$

(3) The Joule-Thomson coefficient for an ideal gas is zero

(4) H_2 and He show cooling at ordinary temperature

(A) Only (2)

(B) (2), (3)

(C) (1), (2), (3)

(D) (1), (2), (3), (4)

75. Choose the correct criterion of spontaneity in term of the properties of the system alone :

(A) $(dS)_{T, P}$ less than zero

(B) $(dS)_{H, P}$ less than zero

(C) $(dG)_{T, V}$ less than zero

(D) $(dS)_{U, V}$ greater than zero