CSE(P) 2015

CHEMISTRY

KTM–08–XV

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

Subject Code : 0 8

Test Booklet No. : 00852

TEST BOOKLET

CHEMISTRY

Time Allowed : 2 (Two) Hours **Full Marks : 200**

INSTRUCTIONS

1. The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Subject Code shall be written legibly and correctly in the space provided on the Answer Sheet with black ball pen.
2. **Space provided for Series in the Answer Sheet is not applicable for Optional Subject. So the space shall be left blank.**
3. All questions carry equal marks. Your total marks will depend only on the number of correct responses marked by you in the Answer Sheet.
4. No candidate shall be admitted to the Examination Hall/Room 20 minutes after commencement of distribution of the paper. The Supervisor of the Examination Hall/Room will be the time-keeper and his/her decision in this regard is final.
5. No candidate shall leave the Examination Hall/Room without prior permission of the Supervisor/ Invigilator. No candidate shall be permitted to hand over his/her Answer Sheet and leave the Examination Hall/Room before expiry of the full time allotted for each paper.
6. No Mobile Phone, Pager, etc., are allowed to be carried inside the Examination Hall/Room by the candidates. Any Mobile Phone, Pager, etc., found in possession of the candidate inside the Examination Hall/Room, even if on off mode, shall be liable for confiscation.
7. No candidate shall have in his/her possession inside the Examination Hall/Room any book, notebook or loose paper, except his/her Admission Certificate and other connected paper permitted by the Commission.
8. Complete silence must be observed in the Examination Hall/Room. No candidate shall copy from the paper of any other candidate, or permit his/her own paper to be copied, or give, or attempt to give, or obtain, or attempt to obtain irregular assistance of any kind.
9. After you have completed filling in all your responses on the Answer Sheet and the Examination has concluded, you should hand over to the Invigilator *only the Answer Sheet.* You are permitted to take away with you the Test Booklet.
10. Violation of any of the above Rules will render the candidate liable to expulsion from the Examination Hall/Room and disqualification from the Examination, and according to the nature and gravity of his/her offence, he/she may be debarred from future Examinations and Interviews conducted by the Commission for appointment to Government Service.
11. Smoking inside the Examination Hall/Room is strictly prohibited.
12. **This Test Booklet contains one page for Rough Work at the end.**

SEAL

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[No. of Questions : 100]

CHEMISTRY

SEAL

1. The element with atomic number 54 exists in which group of the periodic table?

(A) Group 18

(B) Group 1

(C) Group 9

(D) Group 4

2. Be and Al exhibit some similarity in chemical behaviour. This is because

(A) they belong to the same group of the periodic table

(B) they show diagonal relationship

(C) they belong to the same period of the periodic table

(D) they are transitional elements

3. Which among the following metal ions exhibits the highest magnetic moment?

(A) Cr^{3+}

(B) Fe^{3+}

(C) Cu^{2+}

(D) Sc^{3+}

4. The four quantum numbers of the two electrons of He atom are

	n	l	m_l	s
Electron–1	1	0	0	$+\frac{1}{2}$
Electron–2	1	0	0	$-\frac{1}{2}$

The difference of the quantum numbers of the two electrons of He atom is due to

(A) Aufbau principle

(B) Bohr's atomic model

(C) Pauli's exclusion principle

(D) Heisenberg's uncertainty principle

5. Which one of the following is in the correct increasing order of electron affinity?

(A) F < N < O < Li

(B) Mg < Ca < Sr < Ba

(C) I < Br < F < Cl

(D) Li < Na < K < Cs

6. Which one of the following is the least electronegative element?

(A) Chlorine

(B) Oxygen

(C) Fluorine

(D) Sodium

7. Which one of the following has the highest value of ionic radius?

(A) S^{2-}

(B) Cl^{-}

(C) Al^{3+}

(D) Na^{+}

8. The first ionization potential of an element X is 10·5 eV. The value of electron gain enthalpy of X^+ ion would be

(A) +21·0 eV

(B) −21·0 eV

(C) −10·5 eV

(D) −31·5 eV

9. Which of the following elements belong to the same group of the periodic table?

(A) Atomic numbers = 3, 10, 19, 37

(B) Atomic numbers = 4, 20, 38, 56

(C) Atomic numbers = 2, 10, 17, 36

(D) Atomic numbers = 9, 16, 34, 35

10. In which of the following molecules all the bonds are not equal?

(A) BF_3

(B) SF_6

(C) CH_4

(D) BrF_3

11. Which among the following is the correct increasing trend of bond order?

(A) $O_2^{2-} < O_2^- < O_2 < O_2^+$

(B) $O_2^+ < O_2 < O_2^- < O_2^{2-}$

(C) $O_2^- < O_2^{2-} < O_2^+ < O_2$

(D) $O_2^{2-} < O_2 < O_2^+ < O_2^-$

12. The total number and types of bonds in acetylene molecule are

(A) one sigma and one pi

(B) two sigma and two pi

(C) three sigma and one pi

(D) three sigma and two pi

13. Which one of the following is not isostructural with CCl_4?

(A) NH_4^+

(B) CH_4

(C) SF_4

(D) CH_3Cl

14. Which one of the following represents correctly the increasing order of C—O bond length for carbonate anion, carbon monoxide and carbon dioxide?

(A) $CO < CO_3^{2-} < CO_2$

(B) $CO_3^{2-} < CO < CO_2$

(C) $CO < CO_2 < CO_3^{2-}$

(D) $CO_3^{2-} < CO_2 < CO$

15. In a regular trigonal bipyramidal MX_5 structure, the number of X—M—X bonds at 180° angle is

(A) one

(B) two

(C) three

(D) five

16. Which one of the following has the smallest bond angle?

(A) NH_3

(B) CH_3^+

(C) SbH_3

(D) CO_2

17. Which one of the following possesses the highest number of lone pairs of electrons around the central atom?

(A) OF_2

(B) H_2O

(C) XeF_4

(D) I_3^-

18. Which one of the following molecules has the highest dipole moment?

(A) BF_3

(B) CO_2

(C) NF_3

(D) NH_3

19. Which one of the following molecules has a T-shaped structure?

(A) ClF_3

(B) BrF_3

(C) NH_3

(D) CH_4

20. When $CaCO_3$ is heated, CO_2 is given off. In metallurgical operation, this process is termed as

(A) smelting

(B) roasting

(C) calcination

(D) reduction

21. Which one of the following is an ore of copper?

(A) Calamine

(B) Malachite

(C) Bauxite

(D) Magnetite

22. Which one among the following is an alloy of copper?

(A) German silver

(B) Duralumin

(C) Stainless steel

(D) Magnalium

23. Which one of the following molecules has the sp^2 hybridization of the central atom?

(A) CH_4

(B) BF_3

(C) NH_3

(D) C_2H_2

24. The high density of water compared to ice is due to

(A) hydrogen bonding interactions

(B) dipole-dipole interactions

(C) dipole-induced dipole interactions

(D) dipole induced-dipole induced interactions

25. Solvay process converts which one of the following into soda ash?

(A) Brine

(B) Caustic soda

(C) Sodium bicarbonate

(D) Sodium oxide

26. The process of smelting involves reduction of metal oxides with

(A) carbon

(B) carbon dioxide

(C) magnesium

(D) aluminium

27. Bronze is an alloy of

(A) Cu and Zn

(B) Cu, Zn and Sn

(C) Cu, Zn and Ni

(D) Zn and Sn

28. Prussian blue is obtained by mixing together aqueous solution of Fe^{3+} salt with

(A) ferricyanide

(B) ferrocyanide

(C) hydrogen cyanide

(D) sodium cyanide

29. The complex formed in the brown ring test for detection of NO_3^- is

(A) $[Fe(H_2O)_5(NO)]SO_4$

(B) $[Fe(H_2O)_5(NO_3)]SO_4$

(C) $[Fe(H_2O)_5(SO_4)]NO_3$

(D) $[Fe(H_2O)_5(NO_2)]SO_4$

30. Which of the following is the relationship among the elements ${}^{77}_{33}As$, ${}^{78}_{34}Se$ and ${}^{79}_{35}Br$?

(A) Isotopes

(B) Isobars

(C) Isoelectronic

(D) Isotones

31. Identify the missing product of the reaction

$${}^{235}_{92}U + n \rightarrow \gamma + ?$$

from among the following.

(A) ${}^{236}_{92}U$

(B) ${}^{234}_{92}U$

(C) ${}^{239}_{92}U$

(D) ${}^{243}_{95}Am$

32. $^{176}_{83}Bi$ is a member of Group 15 in the periodic table. If Bi emits two α-particles followed by four β-particles, then what would be the position of the daughter element in the periodic table?

(A) Group 11

(B) Group 18

(C) Group 9

(D) Group 15

33. What is the binding energy per nucleon in helium atom (^4_2He) if the mass defect is equal to 0·030380 a.m.u.?

(A) 7·07 MeV

(B) 28·29 MeV

(C) 17·07 MeV

(D) 70·74 MeV

34. The ratio of charge and mass would be greater for

(A) proton

(B) electron

(C) neutron

(D) alpha particle

35. Which among the following is the correct order of increasing reactivity of halogens with alkanes?

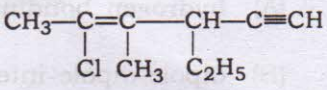
(A) $I_2 < Br_2 < Cl_2 < F_2$

(B) $Br_2 < Cl_2 < F_2 < I_2$

(C) $F_2 < Cl_2 < Br_2 < I_2$

(D) $Br_2 < I_2 < Cl_2 < F_2$

36. Which one among the following is the correct IUPAC name of the given compound?



(A) 2-Chloro-4-ethyl-3-methyl hept-2-en-6-yne

(B) 6-Chloro-4-ethyl-5-methyl hept- 1-yne-5-ene

(C) 6-Chloro-4-ethyl-5-methyl hept-5-en-1-yne

(D) 2-Chloro-4-ethyl-3-methyl hept-6-yne-2-ene

37. Which one of the following compounds exhibits geometrical isomerism?

(A) C_2H_5Br

(B) $(CH)_2(COOH)_2$

(C) CH_3CHO

(D) $(CH_2)_2(COOH)_2$

38. When propionic acid is treated with aqueous sodium bicarbonate, CO_2 is liberated. The C of CO_2 comes from

(A) CH_3 group

(B) COOH group

(C) CH_2 group

(D) bicarbonate ion

39. Which one of the following cannot reduce Fehling's solution?

(A) Formic acid

(B) Formaldehyde

(C) Acetic acid

(D) Acetaldehyde

40. An example of a disaccharide is

(A) glucose

(B) fructose

(C) lactose

(D) starch

41. Fats and oils are which derivatives of glycerol?

(A) Monoesters

(B) Diesters

(C) Triesters

(D) Tetraesters

42. The name of the general reaction

$$R_2CuLi + RX \xrightarrow{\text{ether}} R-R' + RCu + LiX$$

for preparation of alkanes is

(A) Corey-House reaction

(B) Wurtz reaction

(C) Sabatier-Senderens reaction

(D) Berthelot's reaction

43. Alkyl halide is converted into alcohols by

(A) elimination

(B) halogenation

(C) addition

(D) substitution

44. On heating C_2H_2 in red-hot copper tubes, which one of the following compounds is formed?

(A) Ethylene

(B) Benzene

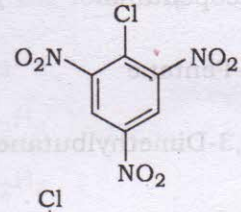
(C) Ethane

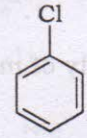
(D) Methane

45. Which one of the following exhibits the least reactivity towards nucleophilic substitution reaction?

(A) CH_3Br

(B) $(CH_3)_3C-I$

(C) 

(D) 

46. Rosenmund reduction is used for the synthesis of

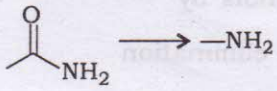
(A) CH_3-CHO

(B) CH_3-O-CH_3

(C) CH_3-CH_2-I

(D) CH_3-COOH

47. The transformation



is known as

(A) Friedel-Crafts reaction

(B) Schmidt reaction

(C) Hofmann bromamide degradation

(D) Kolbe's synthesis

48. Which one of the following produces only one isomer during monochlorination reaction?

(A) Isobutane

(B) Neopentane

(C) *n*-Pentane

(D) 2,3-Dimethylbutane

49. The optical inactivity of *meso*-tartaric acid is due to

(A) presence of plane of symmetry

(B) presence of rotation axis of symmetry

(C) absence of chiral carbon center

(D) absence of any symmetry element

50. An organic compound reacts with ammoniacal silver nitrate solution to form a white precipitate. The compound is

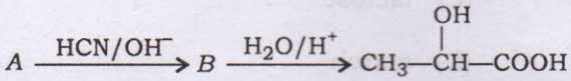
(A) $CH_3—CH=CH—CH_3$

(B) $CH_3—CH_2—C\equiv CH$

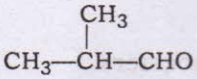
(C) $CH_3—CH(Cl)—CH_2—CH_3$

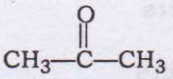
(D) $CH_3—C\equiv C—CH_3$

51. Identify *A* in the following reaction sequence :



(A) CH_3CHO

(B) 

(C) 

(D) $CH_3—CH_2—OH$

52. Which one of the following compounds will form when ethyl bromide reacts with sodium ethoxide?

(A) Ethanal

(B) Propane

(C) Methoxyethane

(D) Diethylether

53. Few carbohydrates react positively with Benedict's and Tollens' reagents. They can be categorized as

(A) non-reducing sugars

(B) reducing sugars

(C) disaccharides

(D) oxidizing sugars

54. Fructose is

(A) aldohexose

(B) ketohexose

(C) aldopentose

(D) ketopentose

55. The relation between glucose and fructose is which one of the following?

(A) Enantiomers

(B) Aldohexoses

(C) Functional isomers

(D) Non-reducing sugars

56. Carbohydrates are classified as D or L depending upon the configuration of the highest numbered asymmetric carbon atom in comparison with

(A) starch

(B) chiral centers

(C) glyceraldehydes

(D) glucose

57. The possible number of acyclic isomers for C_6H_{10} is

(A) 5

(B) 6

(C) 7

(D) 8

58. The compound which has the least hindered rotation about carbon-carbon bond is

(A) ethane

(B) ethylene

(C) acetylene

(D) hexachloroethane

59. A gas decolorizes alkaline $KMnO_4$ solution but does not give precipitate with ammoniacal $AgNO_3$ solution. Identify the gas from among the following.

(A) C_2H_2

(B) C_2H_4

(C) C_2H_6

(D) C_6H_6

60. Among the following, the alkene which on ozonolysis yields aldehyde as the only product, is

(A) 1-butene

(B) 2-butene

(C) propene

(D) 2-methylprop-1-ene

61. Among the following alkyl halides, the one hydrolyzed by S_N1 mechanism is

(A) CH_3CH_2X

(B) $CH_3CH_2CH_2X$

(C) $(CH_3)_2CHX$

(D) $(CH_3)_3C-X$

62. Ethanol can be distinguished from methanol by

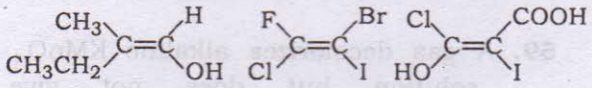
(A) I_2 + NaOH

(B) Tollens' reagent

(C) Lucas reagent

(D) Fehling's solution

63. The *E-Z* nomenclature of the isomers



is respectively

(A) *Z, E, Z*

(B) *Z, Z, E*

(C) *E, E, Z*

(D) *E, Z, E*

64. An organic compound *X*, on treatment with acidified $K_2Cr_2O_7$, gives a compound *Y* which reacts with I_2 and sodium carbonate to form iodomethane. The compound *X* is

(A) CH_3CHO

(B) CH_3OH

(C) CH_3COCH_3

(D) $CH_3CHOHCH_3$

65. The number of molecules of phenylhydrazine with which a glucose molecule reacts to yield osazone is

(A) one

(B) two

(C) three

(D) four

66. The work done during the expansion of a gas from volume 2 m^3 to 4 m^3 under a constant external pressure of 2 pascal is

(A) – 4 J

(B) 8 J

(C) – 2 J

(D) 0 J

67. Which one of the following is not considered as a state function in thermodynamics?

(A) Enthalpy

(B) Internal energy

(C) Heat

(D) Gibbs' free energy

68. The heat capacity of a system can be represented by

(A) dq / dT

(B) $dq \times dT$

(C) $dT \times (1 / dq)$

(D) dV / dT

69. If 5 kJ of heat is absorbed by a system and 280 J of work is done by the system, then the change in internal energy of the system would be

(A) – 275 J

(B) 4720 J

(C) 285 J

(D) 47 J

70. The correct expression for the work done in reversible isothermal expansion of an ideal gas is

(A) $-nRT \ln (V_2 / V_1)$

(B) $-nRT \ln (V_1 / V_2)$

(C) $-nR \ln (V_1 / V_2)$

(D) $-2 \cdot 303\, nRT \ln (P_2 / P_1)$

71. The heat of formation of NH_3 in the reaction

$$N_2 (g) + 3H_2 (g) \rightarrow 2NH_3 (g)$$
$$\Delta H = -92 \cdot 38 \text{ kJ}$$

is

(A) $-92 \cdot 38 \text{ kJ mol}^{-1}$

(B) $-277 \cdot 14 \text{ kJ mol}^{-1}$

(C) $-46 \cdot 19 \text{ kJ mol}^{-1}$

(D) $-23 \cdot 10 \text{ kJ mol}^{-1}$

72. van der Waals' equation of real gases used two constants a and b to incorporate two modifications into ideal gas equation. The constant b corresponds to

(A) intermolecular attraction of gas molecules

(B) average kinetic energy of gas molecules

(C) bimolecular collision

(D) individual volume of gas molecules

73. For one mole of an ideal gas, $C_P - C_V$ value is equal to

(A) $1 \cdot 44R$

(B) $1 \cdot 66R$

(C) R

(D) $1 \cdot 89R$

74. Which of the following concentrations of NaCl solution could exert osmotic pressure of 10·02 atm at 32 °C?

(A) 1·2 mol/lit

(B) 0·4 mol/lit

(C) 0·2 mol/lit

(D) 0·73 mol/lit

75. Which of the following concentration methods is used during the calculation of elevation of boiling point of solution due to non-volatile impurities?

(A) Normality

(B) Molarity

(C) Molality

(D) Formal solution

76. For the reaction

$$2A_2B\,(g) \rightleftharpoons 2A_2\,(g) + B_2\,(g)$$

K_c at 27 °C is 2×10^{-5} mol /lit. The value of K_p is nearly equal to

(A) $4 \cdot 9 \times 10^{4}$

(B) $4 \cdot 9 \times 10^{-4}$

(C) $4 \cdot 9 \times 10^{-2}$

(D) $2 \cdot 8 \times 10^{-10}$

77. The correct unit of K_p for the equilibrium

$$N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2NH_3\,(g)$$

is

(A) atm^2

(B) atm^{-2}

(C) atm

(D) $N\,m^{-2}$

78. The $K_p\,/K_c$ value for the equilibrium

$$H_2\,(g) + I_2\,(g) \rightleftharpoons 2HI\,(g)$$

is

(A) $(RT)^{1/2}$

(B) RT

(C) $1/(RT)$

(D) 1·0

79. For a reaction which is second order with respect to a reactant, how would the rate of the reaction be affected if the concentration of the reactant is reduced to $\frac{1}{4}$th?

(A) The rate is increased to 4 times

(B) The rate is reduced to $\frac{1}{4}$th times

(C) The rate is reduced to $\frac{1}{16}$th times

(D) The rate remains the same

80. The unit of rate constant for a second-order reaction is

(A) mol^{-1} lit sec^{-1}

(B) mol lit^{-1} sec^{-1}

(C) mol^2 lit^2 sec^{-1}

(D) sec^{-1}

81. For the reaction

$$\frac{1}{2}A_2 + B_2 \rightarrow 3C + 2D$$

which of the following does not express the reaction rate?

(A) $+\frac{1}{2}\frac{d[A_2]}{dt}$

(B) $-\frac{d[B_2]}{dt}$

(C) $+\frac{1}{3}\frac{d[C]}{dt}$

(D) $\frac{1}{2}\frac{d[D]}{dt}$

82. A reaction starts with 1·0 mol/lit of initial concentration of reactant. After 60 minutes, the concentration of the reactant becomes 0·5 mol/lit and after 120 minutes, the concentration of the reactant is further reduced to 0·25 mol/lit. The order of the reaction is

(A) Zero

(B) Second

(C) Third

(D) First

83. Which of the following patterns is related to the change in equivalent conductance (Λ_{eq}) of weak electrolytes with dilution?

(A) Λ_{eq} increases linearly with dilution

(B) Λ_{eq} increases slowly and becomes zero at high dilution level

(C) Λ_{eq} decreases slowly with dilution

(D) Λ_{eq} increases slowly and exhibits a steep rise at high dilution level

84. The molar conductance of ionic solution depends upon

(A) mole fraction of the solution

(B) molality of the solution

(C) molarity of the solution

(D) normality of the solution

85. A solution of $CuSO_4$ is electrolyzed for 20 minutes with a current of 2 ampere (atomic mass of copper is 63·5 g and one faraday is approximately equal to 96500 C). The mass of copper deposited at the electrode is

(A) 0·79 g

(B) 1·57 g

(C) 31·5 g

(D) 2·5 g

86. The conductance of $1\,cm^3$ volume of a solution is known as

(A) equivalent conductance

(B) specific conductance

(C) resistivity

(D) normal conductance

87. The SI unit of molar conductance of an electrolyte is

(A) $S\,m^2\,mol^{-1}$

(B) $S\,m^2\,equiv^{-1}$

(C) $S\,m^{-2}\,mol$

(D) $S\,m^{-1}$

88. The charge carried by $3{\cdot}01 \times 10^{23}$ number of electrons is

(A) 2 faraday

(B) 1 faraday

(C) 0·5 faraday

(D) 2·5 faraday

89. What is the degree of freedom for the following equilibrium?

$N_2O_4\,(g) \rightleftharpoons 2NO_2\,(g)$

(A) 2

(B) 1

(C) 0

(D) 3

90. A colloidal system having liquid as dispersion medium and gas as dispersed phase is classified as

(A) foam

(B) emulsion

(C) gel

(D) aerosol

91. If a dilute solution of a silver salt is added to excess of dilute KI solution, what type of sol would be produced?

(A) Negatively charged sol

(B) Positively charged sol

(C) Neutral sol

(D) Unstable sol

92. The optical property of colloid is associated with

(A) gold number

(B) Hardy-Schulze rule

(C) cataphoresis

(D) Tyndall effect

93. An example of a shape selective catalyst is

(A) ZSM-5

(B) Ziegler-Natta catalyst

(C) Pd deposited on $BaSO_4$

(D) Fe/Mo

94. The pH of an aqueous solution of $NaNO_3$ is

(A) 0

(B) 3·0–5·0

(C) 8·0–9·0

(D) 7

95. The enthalpies of all elements in their standard state are

(A) unity

(B) zero

(C) less than 0

(D) different for each element

96. For a process to occur under adiabatic conditions, the correct condition is

(A) $\Delta T = 0$

(B) $\Delta P = 0$

(C) $q = 0$

(D) $w = 0$

97. The pH of a solution of hydrochloric acid is 4. The molarity of the solution is

(A) 0·4

(B) 0·04

(C) 0·001

(D) 4·0

98. The reaction between H_2 and Br_2 to form HBr is an example of

(A) zero order

(B) first order

(C) second order

(D) fractional order

99. The process of osmosis is a diffusion of solvent

(A) from solution to solvent

(B) from solvent to solution

(C) from concentrated solution to dilute solution

(D) from sol to solvent

100. If the pH of a solution is increased from 3 to 6, its H^+ ion concentration would be

(A) reduced to half of original value

(B) doubled

(C) reduced by thousand times

(D) increased by thousand times