COMBINED COMPETITIVE (PRELIMINARY) EXAMINATION, 2012

Serial No.

CHEMISTRY
Code No. 04

A

Time Allowed : Two Hours

Maximum Marks : 300

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.

2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C OR D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE RESPONSE SHEET.

3. You have to enter your Roll Number on this Test Booklet in the Box provided alongside. *DO NOT* write *anything else* on the Test Booklet.

   Your Roll No.
   _____

4. This Booklet contains 120 items (questions). Each item comprises *four* responses (answers). You will select *one* response which you want to mark on the Response Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each item.

5. In case you find any discrepancy in this test booklet in any question(s) or the Responses, a written representation explaining the details of such alleged discrepancy, be submitted within three days, indicating the Question No(s) and the Test Booklet Series, in which the discrepancy is alleged. Representation not received within time shall not be entertained at all.

6. You have to mark all your responses ONLY on the separate Response Sheet provided. *See directions in the Response Sheet.*

7. All items carry equal marks. Attempt ALL items. Your total marks will depend only on the number of correct responses marked by you in the Response Sheet.

8. Before you proceed to mark in the Response Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Response Sheet as per instructions sent to you with your Admit Card and Instructions.

9. While writing Centre, Subject and Roll No. on the top of the Response Sheet in appropriate boxes use **"ONLY BALL POINT PEN"**.

10. After you have completed filling in all your responses on the Response Sheet and the examination has concluded, you should hand over to the Invigilator only the Response Sheet. You are permitted to take away with you the Test Booklet.

ROUGH WORK

1. The presence of three unpaired electrons in the nitrogen atom can be explained by :
   (A) the Pauli exclusion principle   (B) the Aufbau principle
   (C) the Hund rule   (D) the Heisenberg uncertainty principle

2. The orbital with zero angular momentum is :
   (A) s   (B) p
   (C) d   (D) f

3. Which of the following pairs have the identical electronic configurations ?
   (A) Se^{2-} and Kr   (B) Mn^{2+} and Cr^{3+}
   (C) Na^+ and Cl^- (D) Ni and Zn^{2+}

4. Which of the following has largest radius ?
   (A) O^{2-} (B) Mg^{2+}
   (C) Na^+ (D) F^-

5. Increasing order of electron affinity is :
   (A) $N < O < Cl < Al$ (B) $O < N < Al < Cl$
   (C) $Al < N < O < Cl$ (D) $Cl < N < O < Al$

6. In going from left to right in a period :
   (A) the basic nature of the oxides increases
   (B) acidic nature of oxides decreases
   (C) the basic nature of the oxides decreases
   (D) no gradation in the nature of oxides is observed

7. The first ionization potential of the following elements is in the order :
   (A) $C < N < O < F$ (B) $C > N > O > F$
   (C) $C < N > O < F$ (D) $C < N > O > F$

8. Which one of the following ion is paramagnetic ?
   (A) Mg^{2+} (B) Fe^{2+}
   (C) Cu^+ (D) Sc^{3+}

9. The ratio of the radius of the nuclides He_2^4 and H_1^1 is :
   (A) 4
   (B) 2
   (C) 3
   (D) 1.6

10. The missing fission product in the reaction

    $^{235}_{92}U + ^1_0n \rightarrow ^{146}_{57}La + ... + 3\left(^1_0n\right)$ is :

    (A) $^{86}_{35}Br$
    (B) $^{87}_{35}Br$
    (C) $^{87}_{32}Ge$
    (D) $^{89}_{35}Br$

11. Which of the following isotopes is used in the diagnosis and treatment of thyroid-gland-related disease ?
    (A) ^{127}I
    (B) ^{131}I
    (C) ^{136}I
    (D) ^{138}I

12. An atom of $^{298}U_{92}$, after the adsorption of a slow neutron, undergoes fission to form two fragments $^{139}Xe_{54}$ and $^{94}Sr_{38}$. What other particles produced ?
    (A) Alpha particles
    (B) Beta particles
    (C) Neutron
    (D) Positron

13. In nuclear reactor, chain reaction is controlled by introducing :
    (A) Cd rod
    (B) Fe rod
    (C) Pt rod
    (D) Graphite rod

14. Which of the following hybrid orbitals has the highest value of electronegativity ?
    (A) sp^3
    (B) sp^2
    (C) sp
    (D) dsp^2

15. Which molecule has zero dipole moment ?
    (A) CH_2Cl_2
    (B) BF_3
    (C) NF_3
    (D) ClO_2

16. The molecule that has linear structure is :
    (A) CO_2
    (B) NO_2
    (C) SO_2
    (D) H_2O

17. According to molecular orbital theory which of the following statements with respect to magnetic character and bond order is correct regarding O_2^+ ?

    (A) Paramagnetic and bond order $< O_2$
    (B) Diamagnetic and bond order $< O_2$
    (C) Paramagnetic and bond order $> O_2$
    (D) Diamagnetic and bond order $> O_2$

18. The correct order of hybridization of the central atom in the following molecule, NH_3, $[PtCl_4]^{2-}$, PCl_5, BCl_3 :

    (A) sp^3, dsp^2, dsp^3, sp^3
    (B) sp^3, dsp^2, dsp^3, sp^2
    (C) sp^2, sp^3, d^2sp^2, sp^3
    (D) sp^3, d^2sp^3, dsp^3, sp^2

19. Which is the correct order of increasing acidity ?

    (A) $H_3PO_2 < H_3PO_3 < H_3PO_4$
    (B) $HClO_2 < HClO_3 < HClO_4$
    (C) $HI < HBr < HCl < HF$
    (D) $HF < H_2O < NH_3 < CH_4$

20. The main function of roasting is :

    (A) to remove the volatile impurities
    (B) to oxidize the metal
    (C) to reduce the metal oxide
    (D) to make a slag

21. Which of the following is the thermite reaction ?

    (A) $MgCO_3 + SiO_2 \rightarrow MgSiO_3 + CO_2$
    (B) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
    (C) $3Mn_3O_4 + 8Al \rightarrow 9Mn + 4Al_2O_3$
    (D) $2PbO + PbS \rightarrow 3Pb + SO_2$

22. Mond's process is used to extract :

    (A) Fe
    (B) Co
    (C) Ni
    (D) Pt

23. In the electrochemical process for Al extraction, the electrolyte used is :

    (A) $Al(OH)_3$ in NaOH solution
    (B) a molten mixture of Al_2O_3, Na_3AlF_6 and CaF_2
    (C) a molten mixture of $Al_2(SO_4)_3$ and $Al(OH)_3$
    (D) a molten mixture of Al_2O_3, $Al_2(SO_4)_3$

24. Which of the following is used as a moderator in nuclear reactor ?

    (A) Hard water
    (B) Heavy water
    (C) Deuterium
    (D) Deionized water

25. Which of the metal ion is present in the haemoglobin, an oxygen carrier in the human body ?

(A) Mg^{2+}

(B) Fe^{3+}

(C) Cu^{2+}

(D) Fe^{2+}

26. Which of the following complex is used as an anti-cancer drug for treating several types of malignant tumours ?

(A) cis - $[Pt\,(NH_3)_2\,Cl_2]$

(B) trans - $[Pt\,(NH_3)_2\,Cl_2]$

(C) cis - $[Pt\,(NH_3)_4\,Cl_2]^{2+}$

(D) trans - $[Pt\,(NH_3)_4\,Cl_2]^{2+}$

27. Fe^{3+} can be distinguished from Fe^{2+} by using a reagent (A) which develops a red colour with Fe^{3+} due to the formation of a compound (B). The reagent (A) and the product (B) are, respectively :

(A) $K_4[Fe(CN)_6]$ and $K_3[Fe(CN)_6]$

(B) NH_4CNS and $K_3[Fe(SCN)_6]$

(C) 8-hydroxy-quinoline (oxime) and $[Fe(oxime)_3]$

(D) Na_2HPO_4 and $FePO_4$

28. $K_2[HgI_4]$ is useful for detecting :

(A) NO_3^-

(B) PO_4^{3-}

(C) Cl^-

(D) NH_4^+

29. In qualitative group analysis, group IV metal ions can be precipitated out from the solution of a salt mixture by treating the solution with :

(A) H_2S in HCl medium

(B) H_2S in NH_3 medium

(C) NH_4Cl and NH_3

(D) $(NH_4)_2CO_3$ in NH_3 medium

30. In the brown-ring test for the nitrate ion, the brown ring appears due to the formation of :

(A) $FeSO_4 \cdot NO$

(B) $[Fe(H_2O)_5NO]^+$

(C) $[Fe(H_2O)_5NO]^{2+}$

(D) $[Fe(H_2O)_5NO]^{3+}$

31. Both geometrical and optical isomerisms are shown by :

(A) $[Co(en)_2Cl_2]^+$

(B) $[Co(NH_3)_4Cl_2]^+$

(C) $[Co(en)_3]^{3+}$

(D) $[Co(NH_3)_5Cl]^{2+}$

32. One mole of the complex compound $Co(NH_3)_5Cl_3$ gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with two moles of $AgNO_3$ solution to yield two moles of AgCl. The structure of the complex is :

(A) $[Co(NH_3)_3Cl_3]\,2NH_3$

(B) $[Co(NH_3)_5Cl]\,Cl_2$

(C) $[Co(NH_3)_4Cl_2]\,Cl \cdot NH_3$

(D) $[Co(NH_3)_4Cl]\,Cl_2 \cdot NH_3$

33. The EAN of cobalt in the complex ion $[Co(en)_2Cl_2]^+$ is :
   (A) 27   (B) 33
   (C) 24   (D) 36

34. In standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by iodometry, the equivalent weight of $K_2Cr_2O_7$
   is :
   (A) molecular weight of $K_2Cr_2O_7/2$ (B) molecular weight of $K_2Cr_2O_7/3$
   (C) molecular weight of $K_2Cr_2O_7/6$ (D) same as molecular weight of $K_2Cr_2O_7$

35. The oxidation number of sulphur in S_8, SO_2, S_2F_2 and H_2S respectively are :
   (A) 0, +4, +1, –2   (B) 0, +2, +2, +2
   (C) +1, +4, –2, +2   (D) 0, +4, –2, +2

36. Which of the following shows paramagnetism ?
   (A) N_2 (B) O_2
   (C) F_2 (D) Zn^{2+}

37. Zr and Hf have almost equal atomic and ionic radii because of :
   (A) diagonal relationship   (B) lanthanide contraction
   (C) actinide contraction   (D) same period

38. The hybridization of Xe in XeF_2 is :
   (A) sp^3 (B) sp
   (C) sp^3d (D) sp^2

39. Which compound acts as an oxidising as well as reducing agent ?
   (A) MnO_2 (B) CrO_3
   (C) Al_2O_3 (D) SO_2

40. The correct order of magnetic moments is :
   (A) $[MnCl_4]^{2-} > [CoCl_4]^{2-} > [Fe(CN)_6]^{4-}$
   (B) $[MnCl_4]^{2-} > [Fe(CN)_6]^{4-} > [CoCl_4]^{2-}$
   (C) $[Fe(CN)_6]^{4-} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$
   (D) $[Fe(CN)_6]^{4-} > [MnCl_4]^{2-} > [CoCl_4]^{2-}$

41. The alkyne which will react with $KMnO_4$ to give pyruvic acid :
   (A) Ethyne   (B) Propyne
   (C) Butyne   (D) 2-Pentyne

42. Arrange the following in the decreasing order of reactivity in electrophilic substition reactions :
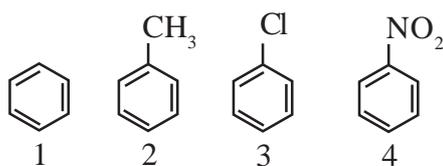
(A) $1 > 2 > 3 > 4$

(B) $2 > 1 > 3 > 4$

(C) $3 > 4 > 1 > 2$

(D) $2 > 3 > 1 > 4$

43. Which of the following has been arranaged in order of decreasing stability ?

(A) $CH_3^+ > CH_3 - CH_2^+ > (CH_3)_2CH^+ > (CH_3)_3C^+$

(B) $(CH_3)_3C^+ > (CH_3)_2CH^+ > CH_3 - CH_2^+ > CH_3^+$

(C) $(CH_3)_2CH^+ > CH_3 - CH_2^+ > CH_3^+ > (CH_3)_3C^+$

(D) $CH_3 - CH_2^+ > (CH_3)_2CH^+ > CH_3^+ > (CH_3)_3C^+$

44. Arrange the following acids in the decreasing order of acidity (I) CH_3COOH (II) FCH_2COOH (III) $ClCH_2COOH$ (IV) $BrCH_2COOH$:

(A) $I > II > III > IV$

(B) $II > III > I > IV$

(C) $II > III > IV > I$

(D) $IV > III > II > I$

45. During the reaction

$$CH_3CONH_2 \xrightarrow{P_2O_5} CH_3CN$$
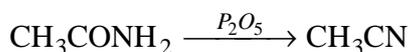
The hybridization state of carbon changes from :

(A) sp^3 to sp

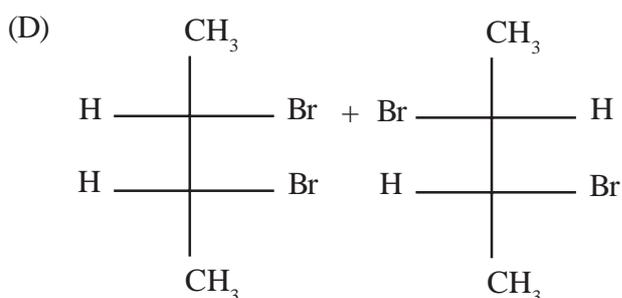(B) sp^3 to sp^2

(C) sp^2 to sp^3

(D) sp^2 to sp
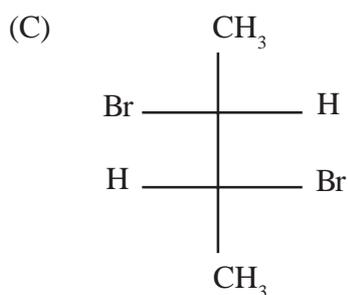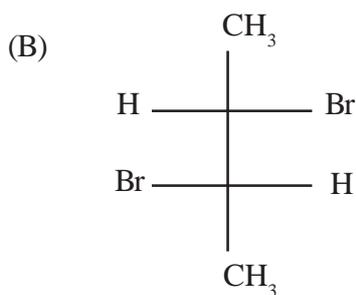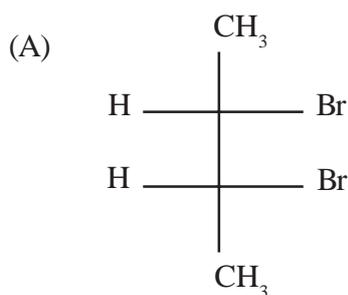
46. Which of the following is not a nucleophile ?

(A) CN^-

(B) OH^-

(C) NH_3

(D) BF_3

47. The reaction, $H_2C = CH_2 + H_2 \xrightarrow[250-300^\circ C]{Ni} CH_3 - CH_3$ is called :

(A) Wurtz reaction

(B) Kolbe's synthesis

(C) Wulf-Kishner reduction

(D) Sabatier and Senderen's reaction

48. In the presence of a peroxide, which of the following hydrogen halide undergoes addition reaction with propene in an anti-Markovnikov fashion ?
   (A) HF
   (B) HCl
   (C) HBr
   (D) HI

49. But-2-yne is allowed to react with H_2 in the presence of Lindlar catalyst. The major product formed is :
   (A) cis-but-2-ene
   (B) trans-but-2-ene
   (C) butane
   (D) mixture of cis and trans but-2-ene

50. 2-Bromopentane on heating with sodium ethoxide in ethanol gives the following major product :
   (A) pent-1-ene
   (B) cis-pent-2-ene
   (C) trans-pent-2-ene
   (D) mixture of cis and trans-pent-2-ene

51. Trans-but-2-ene + Br_2 gives :

(A)
```
        CH₃
         |
   H ————————— Br
         |
   H ————————— Br
         |
        CH₃
```

(B)
```
        CH₃
         |
   H ————————— Br
         |
   Br ———————— H
         |
        CH₃
```

(C)
```
        CH₃
         |
   Br ———————— H
         |
   H ————————— Br
         |
        CH₃
```

(D)
```
        CH₃                        CH₃
         |                          |
   H ——————— Br    +    Br ——————————— H
         |                          |
   H ——————— Br         H ——————————— Br
         |                          |
        CH₃                        CH₃
```

52. Which of the following is the most stable alkene ?
   (A) $R_2C = CR_2$
   (B) $R_2C = CHR$
   (C) $R - CH = CH_2$
   (D) $H_2C = CH_2$

53. The increasing order of reactivity of halides, ethyl chloride (I), isopropyl chloride (II), ter-butyl chloride (III) in SN^1 reactions is :
(A) I < III < II
(B) I < II < III
(C) I > II > III
(D) I > III > II

54. Which of the following reagents can convert acetic acid into ethanol ?
(A) Sn + HCl
(B) H$_2$ + Pt
(C) LiAlH$_4$ + ether
(D) H$_2$ + Ni

55. An organic compound 'X' is oxidized by using acidified K$_2$Cr$_2$O$_7$. The product obtained reacts with phenyl hydrazine but does not give silver mirror test. The possible structure of 'X' is :
(A) CH$_3$COCH$_3$
(B) (CH$_3$)$_2$CHOH
(C) CH$_3$CH$_2$CH$_2$ – OH
(D) CH$_3$CHO

56. The alcohol which gives the most stable carbocation during dehydration is :
(A) 2-methyl-1-propanol
(B) 2-methyl-2-propanol
(C) 1-butanol
(D) 2-butanol

57. The most stable conformation of 1,2-dimethylcyclohexane is :
(A) Diequatorial-trans-1,2-dimethylcyclohexane
(B) Diaxial-trans-1,2-dimethylcyclohexane
(C) Equatorial-axial-cis-1,2-dimethylcyclohexane
(D) Boat conformation

58. Clevage of ether linkage takes place by concentrated acids. The reactivity of acids decreases in the order :
(A) HI > HBr > HCl
(B) HCl > HBr > HI
(C) HBr > HI > HCl
(D) HBr > HCl > HI

59. The reactivity of alcohols with the Lucas reagent decreases in the order :
(A) Allyl alcohol > Secondary alcohol > Primary alcohol
(B) Secondary alcohol > Allyl alcohol > Primary alcohol
(C) Primary alcohol > Secondary alcohol > Allyl alcohol
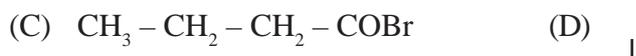(D) Secondary alcohol > Primary alcohol > Allyl alcohol

60. No. of acidic hydrogen in 1-butyne :

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

61. A mixture of benzaldehyde and formaldehyde on heating with aqueous NaOH gives :

(A) Sodium benzoate and methyl alcohol

(B) Sodium formate and benzyl alcohol

(C) Sodium formate, benzyl alcohol and methyl alcohol

(D) Soidum benzoate, benzyl alcohol and methyl alcohol

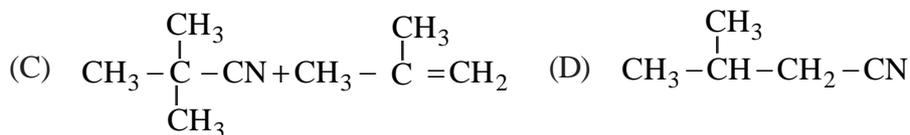62. The appropriate reagent for the transformation

is :
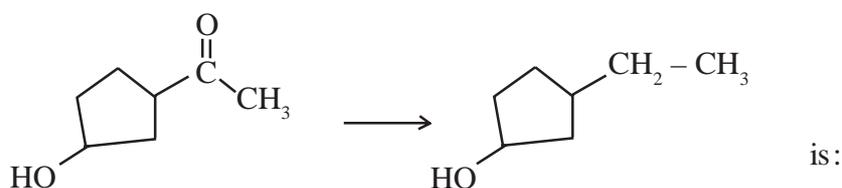
(A) LiAlH$_4$
(B) NH$_2$NH$_2$, KOH
(C) H$_2$/Ni
(D) NaBH$_4$

63. For obtaining butan-2-one from acetyl chloride which of the following reagents can be used ?

(A) CH$_3$CH$_2$MgBr
(B) CH$_3$CH$_2$Li
(C) (CH$_3$CH$_2$)$_2$CuLi
(D) Na in dry ether

64. To distinguish between 2-pentanone and 3-pentanone, which reagent can be used ?

(A) NaOH/I$_2$
(B) K$_2$Cr$_2$O$_7$/H$^+$
(C) Zn – Hg, HCl
(D) LiAlH$_4$

65. A carbonyl compound reacts with HCN to form cyanohydrin which on hydrolysis forms a racemic mixture of d-hydroxy acid. The carbonyl compound is :

(A) acetone
(B) formaldehyde
(C) diethyl ketone
(D) acetaldehyde

66. When H$_2$C = CH – COOH is reduced with LiAlH$_4$, the compound obtained will be :

(A) CH$_3$CH$_2$COOH
(B) CH$_3$CH$_2$CHO
(C) CH$_3$CH$_2$CH$_2$ – OH
(D) H$_2$C = CHCH$_2$ – OH

67. Butanoic acid when reacted with bromine in the presence of phosphorus forms :

(A) $CH_3 - CH_2 - \underset{\underset{Br}{|}}{CH} - COOH$

(B) |

(C) $CH_3 - CH_2 - CH_2 - COBr$

(D) |

68. In the reaction $\overset{|}{\underset{|}{}} - $. The product X is :

(A) $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CN$

(B) $CH_3 - \overset{\overset{CH_3}{|}}{C} = CH_2$

(C) $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CN + CH_3 - \overset{\overset{CH_3}{|}}{C} = CH_2$

(D) $CH_3 - \overset{\overset{CH_3}{|}}{CH} - CH_2 - CN$

69. The best method to prepare cyclohexane, from cyclohexanol is by using :

(A) Conc. $HCl + ZnCl_2$

(B) Conc. H_3PO_4

(C) HBr

(D) Conc. HCl

70. The decreasing order of basicity of amines as follows :

(A) $NH_3 > CH_3 - NH_2 > (CH_3)_2NH > (CH_3)_3N$

(B) $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3$

(C) $(CH_3)_2NH > CH_3NH_2 > NH_3 > (CH_3)_3N$

(D) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$
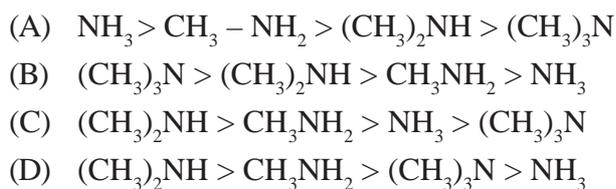
71. The reaction of $CHCl_3$ with alcoholic KOH and P-toluidine forms :

(A) CH_3—⟨ ⟩— CN

(B) CH_3—⟨ ⟩— N_2Cl

(C) CH_3—⟨ ⟩— NC

(D) CH_3—⟨ ⟩— NH_2, CHO

72. In the following reaction

conc. HNO_3 + conc. H_2SO_4 → X

The structure of major product X is :

(A)

(B)

(C)

(D)

73.
    $N_2^+Cl^-$ + Reagent $\xrightarrow{heat}$ OH

The reagent is :

(A) H_3PO_2, H_2O (B) H_2O, H^+

(C) Cu/HCl   (D) $NaNO_2$, HCl

74. Products of the following reaction are :

$CH_3C \equiv CCH_2CH_3 \xrightarrow[373 - 383\,K]{KMnO_4,\ KOH}$

(A) $CH_3COOH + CO_2$ (B) $CH_3COOH + CH_3CH_2COOH$

(C) $CH_3CHO + CH_3CH_2CHO$ (D) $CH_3COOH + CH_3COCH_3$

75. Diastereomers, differing in configuration about C – I are called :

(A) Epimers   (B) Anomers

(C) Enantiomers   (D) Conformers

76. The compound $(CH_3)_2 - C = CH - CH_3$ on reaction with $NaIO_4$ in the presence of $KMnO_4$ gives :

(A) CH_3COCH_3

(B) $CH_3COCH_3 + CH_3COOH$
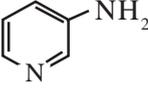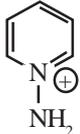
(C) $CH_3COCH_3 + CH_3CHO$

(D) $CH_3CHO + CO_2$

77. The helix structure of proteins is stabilized by :

(A) Peptide bonds

(B) Hydrogen bonds

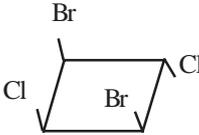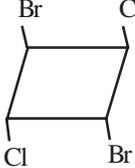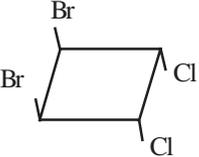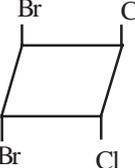(C) Disulphide bonds

(D) van der Waals forces

78. In the reaction
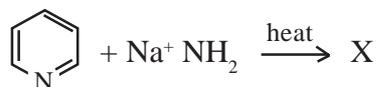
The product X is :

(A)
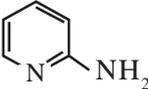
(B)

(C)

(D) no reaction

79. The number of signals obtained for cyclohexane at $-70°C$ in NMR spectra :

(A) 1

(B) 2

(C) 3

(D) 6

80. Which of the following structures is chiral ?

(A)

(B)

(C)

(D)

81. Which of the following is an extensive property ?
    (A) Pressure   (B) Volume
    (C) Temperature   (D) Density

82. Maximum work is obtained when the gas is allowed to expand :
    (A) isothermally and irreversibly   (B) isothermally and reversibly
    (C) adiabatically and reversibly   (D) freely into vacuum

83. The relation between equilibrium constant (K) and standard free energy (G°) is :
    (A) $\Delta G^\circ = RT \ln K$ (B) $\Delta G^\circ = - RT \log k$
    (C) $\Delta G^\circ = - RT \ln K$ (D) $K = e^{-\Delta G^O/2.303\,RT}$

84. The free energy change with change of pressure and temperature is given by equation :
    (A) $dG = VdP - SdT$ (B) $dG = SdT - VdP$
    (C) $dG = VdP + SdT$ (D) $dG = dH - TdS$

85. A reaction is non-spontaneous when :
    (A) ΔH is –ve, ΔS is +ve   (B) ΔH is +ve, ΔS is –ve
    (C) ΔH is –ve, ΔS is –ve   (D) ΔH is +ve, ΔS is +ve

86. The heat released when NH_4OH and HCl neutralise is :
    (A) 13.7 Kcal   (B) >13.7 Kcal
    (C) <13.7 Kcal   (D) None of these

87. The ratio of the rate of diffusion of He and CH_4 under identical conditions of pressure and temperature is :
    (A) 4   (B) 2
    (C) 1   (D) 0.5

88. At high pressure, the van der Waals' equation is written as :
    (A) $(P + a/V_m^2)\,(V_m - b) = RT$ (B) $PV_m = RT - a/V_m$
    (C) $PV_m = RT + Pb$ (D) $PV_m = RT$

89. Out of given concentrations terms which is the best way to represent the concentration normality, molarity, ppm, molality ?
    (A) Normality   (B) Molarity
    (C) Ppm   (D) Molality

90. At 10°C, the osmotic pressure of urea solution is 500 mm. The solution is diluted and the temperature is raised to 25°C. The osmotic pressure of dilute solution is 105.3 mm at 25°C. The extent of dilution can be shown as :

(V_i and V_f are initial and final volumes of solution)

(A) $V_f = V_i$ (B) $V_f = 5\,V_i$

(C) $V_f = \dfrac{1}{5}\,V_i$ (D) $V_f = 6\,V_i$

91. The calomel electrode is reversible with respect to :

(A) Hg (B) H^+

(C) Hg^+ (D) Cl^-

92. Four Faradays of electricity was passed through aqueous solutions of $AgNO_3$, $NiSO_4$, $FeCl_3$ and $PbCl_4$ kept in four vessels using inert electrodes. The ratio of moles of Ag, Ni, Fe and Pb deposited will be :

(A) $12:6:4:3$ (B) $12:4:6:3$

(C) $4:3:2:1$ (D) $1:2:3:4$

93. The decreasing order of equivalent conductance of alkalimetal halides at infinite dilution is :

(A) $LiCl > NaCl > KCl > CsCl$ (B) $CsCl > KCl > NaCl > LiCl$

(C) $KCl > CsCl > NaCl > LiCl$ (D) $LiCl > KCl > NaCl > CsCl$

94. The pH of 10^{-8} molar solution of HCl in water is :

(A) 8 (B) -8

(C) between 7 and 8 (D) between 6 and 7

95. The pH of a solution of the salt of weak acid and weak base is given by :

(A) $pH = \dfrac{1}{2}(PK_w + PK_a + \log c)$ (B) $pH = \dfrac{1}{2}(PK_w + PK_a - PK_b)$

(C) $pH = \dfrac{1}{2}(PK_w - PK_b - \log c)$ (D) $pH = \dfrac{1}{2}(PK_w - PK_a - PK_b)$

96. The solubility of a sparingly soluble metal halide MX_2 in water is $1 \times 10^{-4}\,M$. Its solubility product is :

(A) $1 \times 10^{-8}\,M^3$ (B) $1 \times 10^{-4}\,M^3$

(C) $4 \times 10^{-12}\,M^3$ (D) $1 \times 10^{-12}\,M^3$

97. A standard hydrogen electode has zero electrode potential because :

   (A) Hydrogen is easiest to oxidise

   (B) The electrode potential is assumed to be zero

   (C) Hydrogen atom has only one electron

   (D) Hydrogen is lightest element

98. For a reversible reaction if the concentrations of the reactants are doubled at a definite temperature, then equilibrium constant will :

   (A) be doubled   (B) become half

   (C) become one-fourth   (D) remain the same

99. Variation of K with temperature as given by Van't Hoff equation can be written as :

   (A) $\log \dfrac{K_2}{K_1} = -\dfrac{\Delta H}{2.303}\left[\dfrac{1}{T_1} - \dfrac{1}{T_2}\right]$

   (B) $\log \dfrac{K_2}{K_1} = \dfrac{\Delta H}{2.303}\left[\dfrac{1}{T_2} - \dfrac{1}{T_1}\right]$

   (C) $\log \dfrac{K_2}{K_1} = -\dfrac{\Delta H}{2.303}\left[\dfrac{1}{T_2} - \dfrac{1}{T_1}\right]$

   (D) The equilibrium does not depend on temperature

100. The equilibrium constant of the reaction $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ is 50. If the volume of the container is reduced to one half of its original volume, the equilibrium constant will be :

   (A) 25   (B) 50

   (C) 75   (D) 100

101. Rate of physical adsorption increases with :

   (A) decrease in temperature   (B) increase in temperature

   (C) decrease in pressure   (D) decrease in surface area

102. Which of the following graph represent adsorption isostere :

(A) (B)

(C) (D)
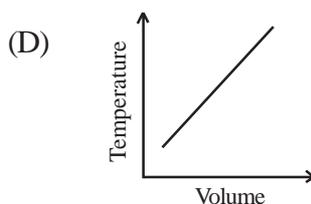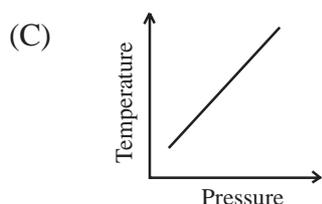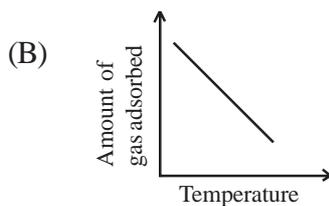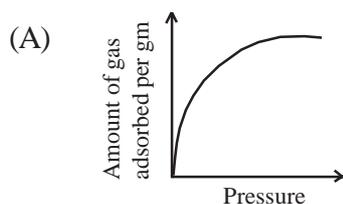
103. The role of a catalyst in a reversible reaction is to :
    (A) increase the rate of forward reaction
    (B) increase the rate of backward reaction
    (C) alter the equilibrium constant of a reaction
    (D) allow the equilibrium to be achieved quickly

104. The enzyme is completely ineffective temporarily :
    (A) at very high temperature   (B) at extremely low temperature
    (C) during chemical reaction   (D) under atmospheric pressure

105. Fog is a colloidal solution of :
    (A) gas in a liquid   (B) liquid in a liquid
    (C) liquid in a gas   (D) solid in a gas

106. Which is called micelle ?
    (A) AS_2O_3 sol   (B) Na_2CO_3 solution
    (C) Sodium stearate concentrated solution   (D) Sb_2S_3 sol

107. In the coagulation of a positive sol, the coagulation power of K_2SO_4 (I), Na_3PO_4 (II), $K_4[Fe(CN)_6]$ (III) and NaCl (IV) is in the order :
    (A) I > II > III > IV   (B) II > I > III > IV
    (C) III > II > I > IV   (D) IV > I > II > III

108. To separate and identify the ions in a mixture that may contain Pb^{2+}, Cu^{2+}, and Mg^{2+}. Use the reagents H_2S, HCl and NaOH. They should be added in the order :
   (A) HCl, H_2S, NaOH
   (B) H_2S, HCl, NaOH
   (C) HCl, NaOH, H_2S
   (D) NaOH, H_2S, HCl

109. The most important buffer in the blood consists of :
   (A) HCl and Cl^-
   (B) H_2CO_3 and HCO_3^-
   (C) H_2CO_3 and Cl^-
   (D) HCl and HCO_3^-

110. In the first order reaction, the concentration of the reactants is reduced to 25% in one hour. The half life period of the reaction is :
   (A) 2 hrs
   (B) 4 hrs
   (C) 1/2 hr
   (D) 1/4 hr

111. The temperature dependence of rate constant (K) of a chemical reaction is written in terms of Arrhenius equation $K = Ae^{-E_a/RT}$. Activation energy (E_a) of the reaction can be calculated by plotting :
   (A) $\log K$ vs T
   (B) $\log K$ vs $\dfrac{1}{T}$

   (C) K vs T
   (D) K vs $\dfrac{1}{\log T}$

112. Consider the chemical reaction,
   $$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$
   The rate of reaction can be expressed in terms of time derivative of concentration of $N_2(g)$, $H_2(g)$, $NH_3(g)$.
   (A) $\text{Rate} = -\dfrac{d(N_2)}{dt} = -\dfrac{1}{3}\dfrac{d(H_2)}{dt} = \dfrac{1}{2}\dfrac{d(NH_3)}{dt}$

   (B) $\text{Rate} = -\dfrac{d(N_2)}{dt} = -3\dfrac{d(H_2)}{dt} = 2\dfrac{d(NH_3)}{dt}$

   (C) $\text{Rate} = \dfrac{d(N_2)}{dt} = \dfrac{1}{3}\dfrac{d(H_2)}{dt} = \dfrac{1}{2}\dfrac{d(NH_3)}{dt}$

   (D) $\text{Rate} = -\dfrac{d(N_2)}{dt} = -\dfrac{d(H_2)}{dt} = \dfrac{d(NH_3)}{dt}$

113. For a zero order reaction the plot of concentration of reactant versus time is :

(A)

(B)

(C)

(D)
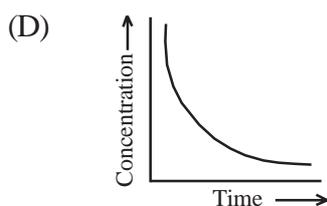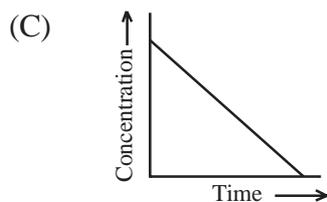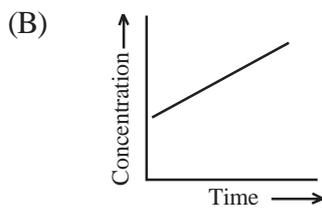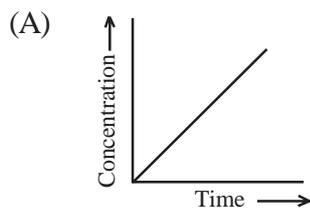
114. For water system in the phase diagram, degree of freedom at triple points is :

(A) 2   (B) 1

(C) 0   (D) 3

115. The temperature at which a compound melts into a liquid of the same composition as the solid is called the :

(A) congruent melting point   (B) incongruent melting point

(C) peritectic temperature   (D) metastable point

116. If the concentration of CrO_4^{2-} ions in a saturated solution of silver chromate is 2×10^{-4}, the solubility product of silver chromate is :

(A) 4×10^{-8} (B) 8×10^{-12}

(C) 16×10^{-12} (D) 32×10^{-12}

117. The rate constant for the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ is $3.0 \times 10^{-5} sec^{-1}$. If the rate is 2.4×10^{-5} M sec^{-1}, then the concentration of N_2O_5 (in μ) is :

(A) 1.4   (B) 1.2

(C) 0.04   (D) 0.8

118. The root mean square velocity of one mole of a monoatomic gas having molecular mass M is μ_{rms}. The relation between the average kinetic energy (E) of the gas and μ_{rms} is :

(A) $\mu_{rms} = \sqrt{\dfrac{3E}{2M}}$

(B) $\mu_{rms} = \sqrt{\dfrac{2E}{3M}}$

(C) $\mu_{rms} = \sqrt{\dfrac{2E}{M}}$

(D) $\mu_{rms} = \sqrt{\dfrac{E}{3M}}$

119. Aluminium oxide may be electrolysed at 1000°C to furnish Al metal (atomic mass = 27 amu). The cathode reaction is : $Al^{3+} + 3e \rightarrow Al$. How much electricity is required to prepare 5.12 kg of Al by this method ?
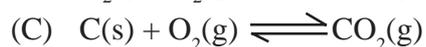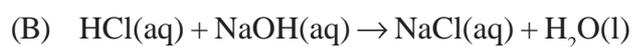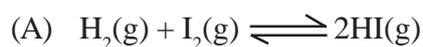
(A) 5.49×10^7 coulomb

(B) 1.83×10^7 coulomb

(C) 5.49×10^4 coulomb

(D) 5.49×10^{10} coulomb

120. For which change $\Delta H \neq \Delta U$?

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

(B) $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$

(C) $C(s) + O_2(g) \rightleftharpoons CO_2(g)$

(D) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

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