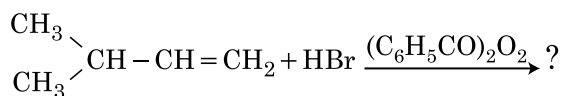## Section - A (Chemistry)

51. The following solutions were prepared by dissolving 10 g of glucose ($C_6H_{12}O_6$) in 250 ml of water (P_1), 10 g of urea (CH_4N_2O) in 250 ml of water (P_2) and 10 g of sucrose ($C_{12}H_{22}O_{11}$) in 250 ml of water (P_3). The right option for the decreasing order of osmotic pressure of these solutions is :
(1) $P_1 > P_2 > P_3$
(2) $P_2 > P_3 > P_1$
(3) $P_3 > P_1 > P_2$
(4) $P_2 > P_1 > P_3$

52. Which one among the following is the correct option for right relationship between C_P and C_V for one mole of ideal gas ?
(1) $C_P - C_V = R$
(2) $C_P = RC_V$
(3) $C_V = RC_P$
(4) $C_P + C_V = R$

53. The major product formed in dehydrohalogenation reaction of 2-Bromo pentane is Pent-2-ene. This product formation is based on ?
(1) Hund's Rule
(2) Hofmann Rule
(3) Huckel's Rule
(4) Saytzeff's Rule

54. An organic compound contains 78% (by wt.) carbon and remaining percentage of hydrogen. The right option for the empirical formula of this compound is : [Atomic wt. of C is 12, H is 1]
(1) CH_2
(2) CH_3
(3) CH_4
(4) CH

55. Zr (Z = 40) and Hf (Z = 72) have similar atomic and ionic radii because of :
(1) diagonal relationship
(2) lanthanoid contraction
(3) having similar chemical properties
(4) belonging to same group

56. Which of the following reactions is the metal displacement reaction ? Choose the right option.
(1) $Cr_2O_3 + 2Al \xrightarrow{\Delta} Al_2O_3 + 2Cr$
(2) $Fe + 2HCl \rightarrow FeCl_2 + H_2\uparrow$
(3) $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2\uparrow$
(4) $2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$

57. The structures of beryllium chloride in solid state and vapour phase, are :
(1) Linear in both
(2) Dimer and Linear, respectively
(3) Chain in both
(4) Chain and dimer, respectively

58. The **incorrect** statement among the following is :
(1) Most of the trivalent Lanthanoid ions are colorless in the solid state.
(2) Lanthanoids are good conductors of heat and electricity.
(3) Actinoids are highly reactive metals, especially when finely divided.
(4) Actinoid contraction is greater for element to element than Lanthanoid contraction.

59. Ethylene diaminetetraacetate (EDTA) ion is :
(1) Unidentate ligand
(2) Bidentate ligand with two "N" donor atoms
(3) Tridentate ligand with three "N" donor atoms
(4) Hexadentate ligand with four "O" and two "N" donor atoms

60. A particular station of All India Radio, New Delhi, broadcasts on a frequency of 1,368 kHz (kilohertz). The wavelength of the electromagnetic radiation emitted by the transmitter is : [speed of light, $c = 3.0 \times 10^8 \, ms^{-1}$]
(1) 219.2 m
(2) 2192 m
(3) 21.92 cm
(4) 219.3 m

61. **Statement I :**
Acid strength increases in the order given as HF << HCl << HBr << HI.
Statement II :
As the size of the elements F, Cl, Br, I increases down the group, the bond strength of HF, HCl, HBr and HI decreases and so the acid strength increases.
In the light of the above statements, choose the **correct** answer from the options given below.
(1) Both **Statement I** and **Statement II** are false.
(2) **Statement I** is correct but **Statement II** is false.
(3) **Statement I** is incorrect but **Statement II** is true.
(4) Both **Statement I** and **Statement II** are true.

62. Noble gases are named because of their inertness towards reactivity. Identify an **incorrect** statement about them.

(1) Noble gases have very high melting and boiling points.

(2) Noble gases have weak dispersion forces.

(3) Noble gases have large positive values of electron gain enthalpy.

(4) Noble gases are sparingly soluble in water.

63. The major product of the following chemical reaction is :

$$\begin{array}{c} CH_3 \\ \\ CH_3 \end{array}\!\!\!> CH-CH=CH_2 + HBr \xrightarrow{(C_6H_5CO)_2O_2} ?$$

(1) $\begin{array}{c} CH_3 \\ \\ CH_3 \end{array}\!\!\!> CH-CH_2-CH_2-O-COC_6H_5$

(2) $\begin{array}{c} CH_3 \\ \\ CH_3 \end{array}\!\!\!> CH-\underset{\underset{Br}{|}}{CH}-CH_3$

(3) $\begin{array}{c} CH_3 \\ \\ CH_3 \end{array}\!\!\!> CBr-CH_2-CH_3$

(4) $\begin{array}{c} CH_3 \\ \\ CH_3 \end{array}\!\!\!> CH-CH_2-CH_2-Br$

64. The molar conductance of NaCl, HCl and CH_3COONa at infinite dilution are 126.45, 426.16 and 91.0 S cm^2 mol^{-1} respectively. The molar conductance of CH_3COOH at infinite dilution is. Choose the right option for your answer.

(1) 390.71 S cm^2 mol^{-1}

(2) 698.28 S cm^2 mol^{-1}

(3) 540.48 S cm^2 mol^{-1}

(4) 201.28 S cm^2 mol^{-1}

**65.** The compound which shows metamerism is :

(1) C_3H_8O

(2) C_3H_6O

(3) $C_4H_{10}O$

(4) C_5H_{12}

66. The correct sequence of bond enthalpy of 'C–X' bond is :

(1) $CH_3-F > CH_3-Cl > CH_3-Br > CH_3-I$

(2) $CH_3-F < CH_3-Cl > CH_3-Br > CH_3-I$

(3) $CH_3-Cl > CH_3-F > CH_3-Br > CH_3-I$

(4) $CH_3-F < CH_3-Cl < CH_3-Br < CH_3-I$

67. Choose the correct option for graphical representation of Boyle's law, which shows a graph of pressure vs. volume of a gas at different temperatures :

(1)

(2)

(3)

(4)
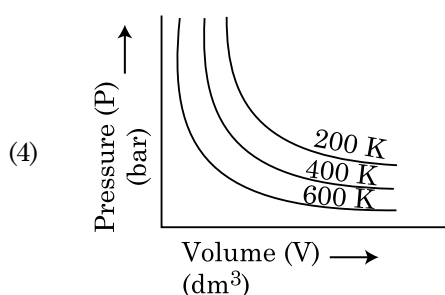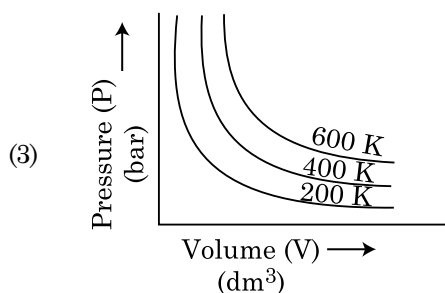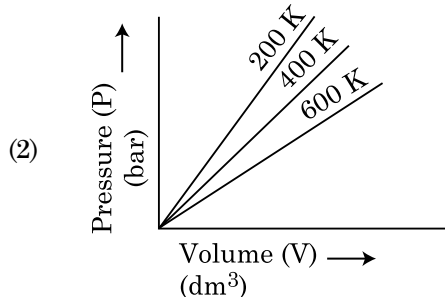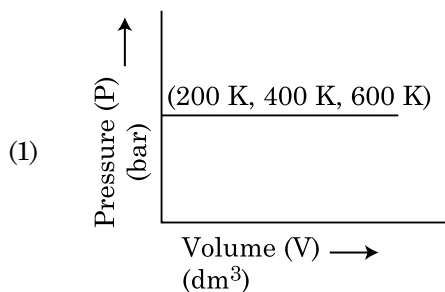
68. Right option for the number of tetrahedral and octahedral voids in hexagonal primitive unit cell are :

(1) 6, 12

(2) 2, 1

(3) 12, 6

(4) 8, 4

69. Given below are two statements :

Statement I :

Aspirin and Paracetamol belong to the class of narcotic analgesics.

Statement II :

Morphine and Heroin are non-narcotic analgesics.

In the light of the above statements, choose the **correct** answer from the options given below.

(1) Both **Statement I** and **Statement II** are false.

(2) **Statement I** is correct but **Statement II** is false.

(3) **Statement I** is incorrect but **Statement II** is true.

(4) Both **Statement I** and **Statement II** are true**.**

70. Dihedral angle of least stable conformer of ethane is :

(1) 180°

(2) 60°

(3) 0°

(4) 120°

71. Which one of the following methods can be used to obtain highly pure metal which is liquid at room temperature ?

(1) Chromatography

(2) Distillation

(3) Zone refining

(4) Electrolysis

72. Match **List - I** with **List - II**.

List - I		List - II	
(a)	PCl_5	(i)	Square pyramidal
(b)	SF_6	(ii)	Trigonal planar
(c)	BrF_5	(iii)	Octahedral
(d)	BF_3	(iv)	Trigonal bipyramidal

Choose the **correct** answer from the options given below.

(1) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

(2) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

(3) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

(4) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)

73. Tritium, a radioactive isotope of hydrogen, emits which of the following particles ?

(1) Alpha (α)

(2) Gamma (γ)

(3) Neutron (n)

(4) Beta (β^-)

74. Which one of the following polymers is prepared by addition polymerisation ?

(1) Nylon-66

(2) Novolac

(3) Dacron

(4) Teflon

75. What is the IUPAC name of the organic compound formed in the following chemical reaction ?

$$\text{Acetone} \xrightarrow[\text{(ii) } H_2O, \, H^+]{\text{(i) } C_2H_5MgBr, \text{ dry Ether}} \text{Product}$$
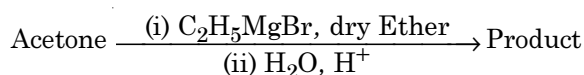
(1) pentan-2-ol

(2) pentan-3-ol

(3) 2-methyl butan-2-ol

(4) 2-methyl propan-2-ol

76. The RBC deficiency is deficiency disease of :

(1) Vitamin B_6

(2) Vitamin B_1

(3) Vitamin B_2

(4) Vitamin B_{12}

77. Identify the compound that will react with Hinsberg's reagent to give a solid which dissolves in alkali.

(1) $CH_3-CH_2-\overset{..}{N}H-CH_3$

(2) $CH_3-CH_2-\overset{..}{N}H_2$

(3) $CH_3-CH_2-\underset{\underset{CH_3}{|}}{\overset{..}{N}}-CH_2-CH_3$

(4) $CH_3-CH_2-\overset{..}{N}O_2$

78. Among the following alkaline earth metal halides, one which is covalent and soluble in organic solvents is :

(1) Strontium chloride

(2) Magnesium chloride

(3) Beryllium chloride

(4) Calcium chloride

79. The correct structure of 2,6-Dimethyl-dec-4-ene is :

(1)

(2)

(3)

(4)
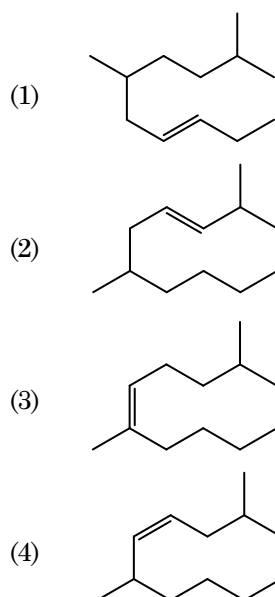
80. The correct option for the number of body centred unit cells in all 14 types of Bravais lattice unit cells is :
(1)   5
(2)   2
(3)   3
(4)   7

81. The right option for the statement "Tyndall effect is exhibited by", is :
(1)   Glucose solution
(2)   Starch solution
(3)   Urea solution
(4)   NaCl solution

82. The pK_b of dimethylamine and pK_a of acetic acid are 3.27 and 4.77 respectively at T (K). The correct option for the pH of dimethylammonium acetate solution is :
(1)   5.50
(2)   7.75
(3)   6.25
(4)   8.50

83. BF_3 is planar and electron deficient compound. Hybridization and number of electrons around the central atom, respectively are :
(1) sp^3 and 6
(2) sp^2 and 6
(3) sp^2 and 8
(4) sp^3 and 4

84. The maximum temperature that can be achieved in blast furnace is :

(1)   upto 2200 K

(2)   upto 1900 K

(3)   upto 5000 K

(4)   upto 1200 K

85. For a reaction A→B, enthalpy of reaction is -4.2 kJ mol^{-1} and enthalpy of activation is 9.6 kJ mol^{-1}. The correct potential energy profile for the reaction is shown in option.

(1)

(2)

(3)

(4)
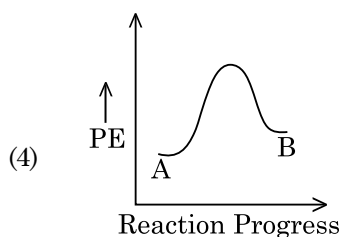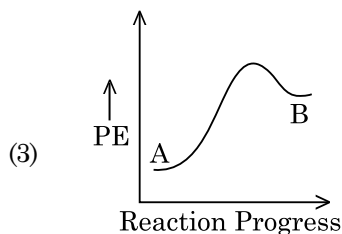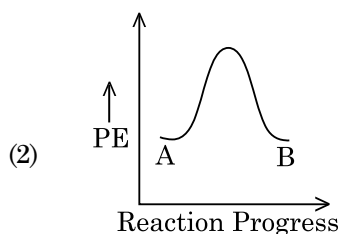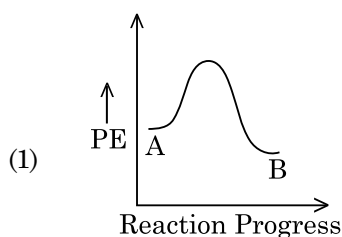
Section - B (Chemistry)

86. Match **List - I** with **List - II**.

List - I		**List - II**	
(a)	$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$	(i)	Acid rain
(b)	$HOCl(g) \xrightarrow{h\nu} \overset{\bullet}{O}H + \overset{\bullet}{C}l$	(ii)	Smog
(c)	$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$	(iii)	Ozone depletion
(d)	$NO_2(g) \xrightarrow{h\nu} NO(g) + O(g)$	(iv)	Tropospheric pollution

Choose the **correct** answer from the options given below.

(1) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

(2) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)

(3) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)
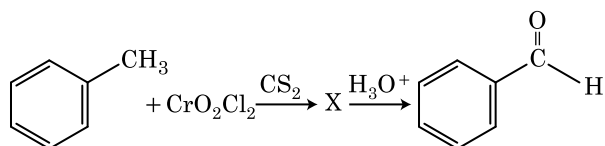
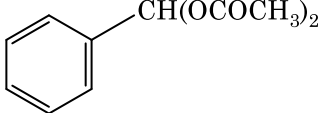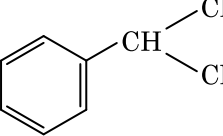(4) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)
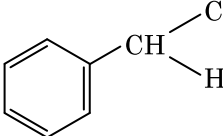
87. Match **List - I** with **List - II**.
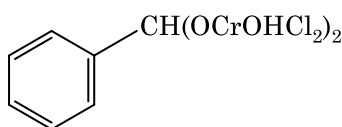
List - I		**List - II**	
(a)	$\xrightarrow[\underset{CuCl}{Anhyd.AlCl_3/}]{CO, HCl}$	(i)	Hell-Volhard-Zelinsky reaction
(b)	$R - \overset{O}{\underset{\|}{C}} - CH_3 + NaOX \longrightarrow$	(ii)	Gattermann-Koch reaction
(c)	$R - CH_2 - OH + R'COOH \xrightarrow{Conc.\ H_2SO_4}$	(iii)	Haloform reaction
(d)	$R - CH_2COOH \xrightarrow[\text{(ii) } H_2O]{\text{(i) } X_2/\text{Red P}}$	(iv)	Esterification

Choose the **correct** answer from the options given below.

(1) (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv)

(2) (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)

(3) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

(4) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

88. The intermediate compound 'X' in the following chemical reaction is :

(1) $CH(OCOCH_3)_2$ (on benzene ring)

(2) $CH \begin{smallmatrix} Cl \\ Cl \end{smallmatrix}$ (on benzene ring)

(3) $CH \begin{smallmatrix} Cl \\ H \end{smallmatrix}$ (on benzene ring)

(4) $CH(OCrOHCl_2)_2$ (on benzene ring)

89. Which of the following molecules is non-polar in nature ?

(1) CH_2O

(2) $SbCl_5$

(3) NO_2

(4) $POCl_3$

90. $CH_3CH_2COO^-Na^+ \xrightarrow[\text{Heat}]{\text{NaOH, + ?}} CH_3CH_3 + Na_2CO_3$.

Consider the above reaction and identify the missing reagent/chemical.

(1) Red Phosphorus

(2) CaO

(3) DIBAL-H

(4) B_2H_6

91. In which one of the following arrangements the given sequence is not strictly according to the properties indicated against it ?

(1) $H_2O < H_2S < H_2Se < H_2Te$: Increasing pK_a values

(2) $NH_3 < PH_3 < AsH_3 < SbH_3$: Increasing acidic character

(3) $CO_2 < SiO_2 < SnO_2 < PbO_2$: Increasing oxidizing power

(4) $HF < HCl < HBr < HI$: Increasing acidic strength

92. From the following pairs of ions which one is not an iso-electronic pair ?

(1) Na^+, Mg^{2+}

(2) Mn^{2+}, Fe^{3+}

(3) Fe^{2+}, Mn^{2+}

(4) O^{2-}, F^-

93. The reagent 'R' in the given sequence of chemical reaction is :
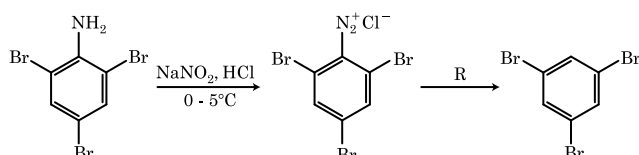
(1) CH_3CH_2OH

(2) HI

(3) CuCN/KCN

(4) H_2O

94. Match **List - I** with **List - II**.

List - I		List - II
(a) $[Fe(CN)_6]^{3-}$	(i)	5.92 BM
(b) $[Fe(H_2O)_6]^{3+}$	(ii)	0 BM
(c) $[Fe(CN)_6]^{4-}$	(iii)	4.90 BM
(d) $[Fe(H_2O)_6]^{2+}$	(iv)	1.73 BM

Choose the **correct** answer from the options given below.

(1) (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i)

(2) (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)

(3) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

(4) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

95. The correct option for the value of vapour pressure of a solution at 45°C with benzene to octane in molar ratio 3 : 2 is :

[At 45°C vapour pressure of benzene is 280 mm Hg and that of octane is 420 mm Hg. Assume Ideal gas]

(1) 168 mm of Hg

(2) 336 mm of Hg

(3) 350 mm of Hg

(4) 160 mm of Hg

96. The slope of Arrhenius Plot $\left(\ln k \text{ v/s } \dfrac{1}{T} \right)$ of first order reaction is -5×10^3 K. The value of E_a of the reaction is. Choose the correct option for your answer.

[Given R = 8.314 $JK^{-1}mol^{-1}$]

(1) 83.0 kJ mol^{-1}

(2) 166 kJ mol^{-1}

(3) -83 kJ mol^{-1}

(4) 41.5 kJ mol^{-1}

97. For irreversible expansion of an ideal gas under isothermal condition, the correct option is :
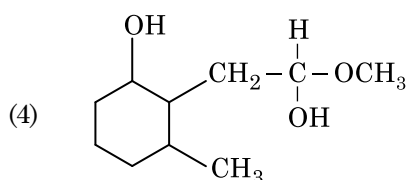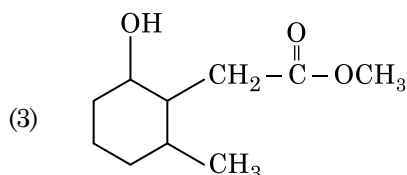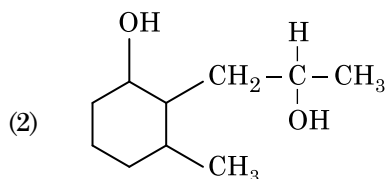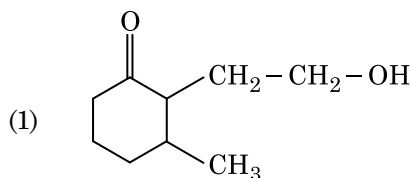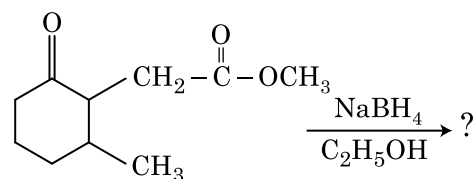
(1) $\Delta U \neq 0$, $\Delta S_{total} \neq 0$

(2) $\Delta U = 0$, $\Delta S_{total} \neq 0$

(3) $\Delta U \neq 0$, $\Delta S_{total} = 0$

(4) $\Delta U = 0$, $\Delta S_{total} = 0$

98. Choose the correct option for the total pressure (in atm.) in a mixture of 4 g O_2 and 2 g H_2 confined in a total volume of one litre at 0°C is :

[Given R = 0.082 L atm $mol^{-1}K^{-1}$, T = 273 K]

(1) 2.602

(2) 25.18

(3) 26.02

(4) 2.518

99. The product formed in the following chemical reaction is :

(1)

(2)

(3)

(4)

100. The molar conductivity of 0.007 M acetic acid is $20 \text{ S cm}^2 \text{ mol}^{-1}$. What is the dissociation constant of acetic acid ? Choose the correct option.

$$\left[\begin{array}{l} \Lambda^\circ_{H^+} = 350 \text{ S cm}^2 \text{ mol}^{-1} \\ \Lambda^\circ_{CH_3COO^-} = 50 \text{ S cm}^2 \text{ mol}^{-1} \end{array} \right]$$

    (1) $2.50 \times 10^{-4} \text{ mol L}^{-1}$

    (2) $1.75 \times 10^{-5} \text{ mol L}^{-1}$

    (3) $2.50 \times 10^{-5} \text{ mol L}^{-1}$

    (4) $1.75 \times 10^{-4} \text{ mol L}^{-1}$