46. Consider the molecules CH_4, NH_3 and H_2O. Which of the given statements is false ?

(1) The H –C–H bond angle in CH_4, the H–N–H bond angle in NH_3, and the H–O–H bond angle in H_2O ar all greater than 90°

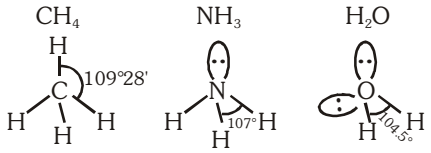
(2) The H–O–H bond angle in H_2O is larger than the H–C–H bond angle in CH_4.

(3) The H–O–H bond angle in H_2O is smaller than the H–N–H bond angle in NH_3.

(4) The H–C–H bond angle in CH_4 is larger than the H–N–H bond angle in NH_3.

Ans. (2)

Sol.



47. In the reaction

$$H\text{–}C{\equiv}CH \xrightarrow[(2)\,CH_3CH_2Br]{(1)\,NaNH_2\,/\,liq.NH_3} X \xrightarrow[(2)\,CH_3CH_2Br]{(1)\,NaNH_2\,/\,liq.NH_3} Y$$

X and Y are :

(1) X = 1-Butyne ; Y = 3-Hexyne

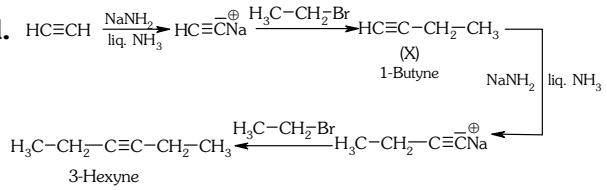
(2) X = 2-Butyne ; Y = 3-Hexyne

(3) X = 2-Butyne ; Y = 2-Hexyne

(4) X = 1-Butyne ; Y = 2-Hexyne

Ans. (1)

Sol.



48. Among the following, the correct order of acidity is

(1) $HClO_3 < HClO_4 < HClO_2 < HClO$

(2) $HClO < HClO_2 < HClO_3 < HClO_4$

(3) $HClO_2 < HClO < HClO_3 < HClO_4$

(4) $HClO_4 < HClO_2 < HClO < HClO_3$

Ans. (2)

Sol. Acidic strength $\propto$ EN $\propto$ +ve O.S.

$HClO < HClO_2 < HClO_3 < HClO_4$

+1 +3 +5 +7

49. The rate of a first-order reaction is 0.04 mol $\ell^{-1}s^{-1}$ at 10 seconds and 0.03 mol $\ell^{-1}s^{-1}$ at 20 seconds after initiation of the reaction. The half-life period of the reaction is :

(1) 24.1 s (2) 34.1 s

(3) 44.1 s (4) 54.1 s

Ans. (1)

Sol. $$K = \frac{2.303}{(t_2 - t_1)} \log \frac{(a - x_1)}{(a - x_2)}$$

$$K = \frac{2.303}{(20 - 10)} \log \left(\frac{0.04}{0.03} \right)$$

$$K = \frac{2.303 \times 0.1249}{10}$$

$$\frac{2.303 \times \log 2}{t_{1/2}} = \frac{2.303 \times 0.1249}{10}$$

$$t_{1/2} = \frac{0.3010 \times 10}{0.1249} = 24.1 \text{ sec}$$

50. Which one of the following characteristics is associated with adsorption ?

(1) ΔG is negative but ΔH and ΔS are positive

(2) ΔG, ΔH and ΔS all are negative

(3) ΔG and ΔH are negative but ΔS is positive

(4) ΔG and ΔS are negative but ΔH is positive

Ans. (2)

Sol. Adsorption is spontaneous process,

so ΔG = negative

Adsorption is exothermic process,

so ΔH = negative

In adsorpiton entropy decreases,

so ΔS = negative

so ΔG, ΔH and ΔS all are negative

51. In which of the following options the order of arrangement does not agree with the variation of property indicated against it ?

(1) $Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$ (increasing ionic size)

(2) B < C < N < O (increasing first ionisation enthalpy)

(3) I < Br < Cl < F (increasing electron gain enthalpy)

(4) Li < Na < K < Rb (increasing metallic radius)

Ans. (2 & 3)

Sol. (2) B < C < N < O (given I.P. order)

B < C < O < N (correct)

(3) I < Br < Cl < F (given ΔH_{eg} order)

I < Br < F < Cl (Correct)

52. Which of the following statements is false ?
(1) Mg^{2+} ions form a complex with ATP
(2) Ca^{2+} ions are important in blood clotting
(3) Ca^{2+} ions are not important in maintaining the regular beating of the heart.
(4) Mg^{2+} ions are important in the green parts of plants.

Ans. (3)

Sol.

53. Which of the following statements about hydrogen is **incorrect** ?
(1) hydrogen has three isotopes of which tritium is the most common.
(2) Hydrogen never acts as cation in ionic salts
(3) Hydronium ion, H_3O^+ exists freely in solution
(4) Dihydrogen does not act as a reducing agent

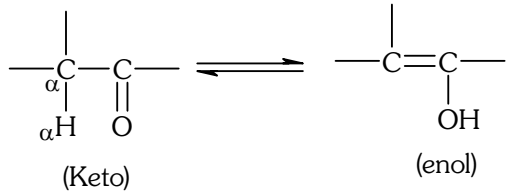
Ans. (1 & 4)

Sol.

54. The correct statement regarding a carbonyl compound with a hydrogen atom on its alphacarbon,is :-
(1) a carbonyl compound with a hydrogen atom on its alpha-carbon never equilibrates with its corresponding enol.
(2) a carbonyl compound with a hydrgen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as aldehyde-ketone equilibration.
(3) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as carbonylation.
(4) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as keto-enol tautomerism.

Ans. (4)

Sol. Keto-enol Tautomerism



(Keto) (enol)

55. MY and NY_3, two nearly insoluble salts, have the same K_{sp} values of 6.2×10^{-13} at room temperature. Which statement would be **true** in regard to MY and NY_3 ?
(1) The molar solubilities of MY and NY_3 in water are identical.
(2) The molar solubility of MY in water is less than that of NY_3
(3) The salts MY and NY_3 are more soluble in 0.5 M KY than in pure water.
(4) The addition of the salt of KY to solution of MY and NY_3 will have no effect on their solubilities.

Ans. (2)

Sol. $MY \rightarrow K_{sp} = s^2 = 6.2 \times 10^{-13}$

$s = \sqrt{6.2 \times 10^{-13}}$

$s = 7.87 \times 10^{-7}$ mol L^{-1}

$NY_3 \rightarrow K_{sp} = 27\ s^4 = 6.2 \times 10^{-13}$

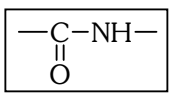
$$s = \left(\frac{6.2 \times 10^{-13}}{27}\right)^{1/4}$$

$s = 3.89 \times 10^{-4}$ mol L^{-1}

$\therefore$ molar solubility of NY_3 is more than MY in water.

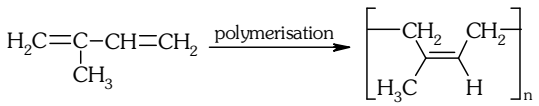
56. In a protein molecule various amino acids are linked together by :
(1) α-glycosidic bond
(2) β-glycosidic bond
(3) peptide bond
(4) dative bond

Ans. (3)

Sol. Peptide bond 

57. Natural rubber has
(1) All cis-configuration
(2) All trans-configuration
(3) Alternate cis-and trans-configuration
(4) Random cis-and trans-configuration

Ans. (1)

Sol. 

Isoprene cis-polyisoprene

58. Match items of **Column I** with the items of **Column II** and asign the correct code :

	Column-I		Column-II
(a)	Cyanide process	(i)	Ultrapure Ge
(b)	Froth floatation process	(ii)	Dressing of ZnS
(c)	Electrolytic reduction	(iii)	Extraction of Al
(d)	Zone refining	(iv)	Extraction of Au
		(v)	Purification of Ni

Code :

	(a)	(b)	(c)	(d)
(1)	(iv)	(ii)	(iii)	(i)
(2)	(ii)	(iii)	(i)	(v)
(3)	(i)	(ii)	(iii)	(iv)
(4)	(iii)	(iv)	(v)	(i)

Ans. (1)

Sol.

59. Which one of the following statements is correct when SO_2 is passed through acidified $K_2Cr_2O_7$ solution ?

(1) The solution turns blue

(2) The solution is decolourized

(3) SO_2 is reduced

(4) Green $Cr_2(SO_4)_3$ is formed

Ans. (4)

Sol. $K_2Cr_2O_7 + SO_2 + H_2SO_4$
$\rightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O$
green colour

60. The electronic configurations of Eu(Atomic No 63), Gd(Atomic No 64) and Tb (Atomic No. 65) are

(1) $[Xe]4f^76s^2$, $[Xe]4f^8\ 6s^2$ and $[Xe]4f^85d^16s^2$

(2) $[Xe]4f^75d^16s^2$, $[Xe]4f^7\ 5d^1\ 6s^2$ and $[Xe]4f^96s^2$

(3) $[Xe]4f^65d^16s^2$, $[Xe]4f^75d16s^2$ and $[Xe]4f^85d^16s^2$

(4) $[Xe]4f^76s^2$, $[Xe]4f^75d^16s^2$ and $[Xe]4f^96s^2$

Ans. (4)

Sol.

61. Two electrons occupying the same orbital are distinguished by

(1) Principal quantum number

(2) Magnetic quantum number

(3) Azimuthal quantum number

(4) Spin quantum number

Ans. (4)

Sol. Two electrons occupying the same orbital differ by spin quantum number.

62. Which copper is heated with conc. HNO_3 it produces

(1) $Cu(NO_3)_2$ and NO_2

(2) $Cu\ (NO_3)_2$ and NO

(3) $Cu(NO_3)_2$, NO and NO_2

(4) $Cu(NO_3)_2$ and N_2O

Ans. (1)

Sol. $Cu + 4HNO_3\ (conc.) \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

63. Which of the following reagents would distingusih cis-cyclopenta-1,2-diol from the trans-isomer?

(1) Acetone

(2) Ozone

(3) MnO_2

(4) Aluminium isopropxide

Ans. (1)

Sol. $\Delta G = \Delta H - T.\Delta S$

For, $\Delta H < 0$ and $\Delta S > 0$, ΔG = –ve (always)

$\therefore$ spontaneous at all temperatures.

64. The correct thermodynamic conditions for the spontaneous reaction at all temperatures is

(1) $\Delta H < 0$ and $\Delta S = 0$

(2) $\Delta H > 0$ and $\Delta S < 0$

(3) $\Delta H < 0$ and $\Delta S > 0$

(4) $\Delta H < 0$ and $\Delta S < 0$

Ans. (3)

Sol. $\Delta G = \Delta H - T.\Delta S$

For, $\Delta H < 0$ and $\Delta S > 0$, ΔG = –ve (always)

$\therefore$ spontaneous at all temperatures.

65. Lithium has a bcc structure. Its density is 530 kg m^{-3} and its atomic mass is 6.94 g mol^{-1}. Calculate the edge length of a unit cell of Lithium metal. ($N_A = 6.02 \times 10^{23}\ mol^{-1}$)

(1) 154 pm (2) 352 pm

(3) 527 pm (4) 264 pm

Ans. (2)

Sol. $\rho = \dfrac{Z \times M}{N_A \times a^3}$

For bcc structure

$Z = 2$, $\rho = 530\ kg\ m^{-3} = 0.530\ g\ cm^{-3}$

$$0.530 = \frac{2 \times 6.94}{6.02 \times 10^{23} \times a^3}$$

$a^3 = 4.348 \times 10^{-23}\ cm^3$

$a = 3.52 \times 10^{-8}\ cm$

$a = 352\ pm$

66. Which one of the following orders is correct for the bond dissociation enthalpy of halogen molecules?

(1) $I_2 > Br_2 > Cl_2 > F_2$

(2) $Cl_2 > Br_2 > F_2 > I_2$

(3) $Br_2 > I_2 > F_2 > Cl_2$

(4) $F_2 > Cl_2 > Br_2 > I_2$

Ans. (2)

Sol. $C\ell_2 > Br_2 > F_2 > I_2$

$\downarrow$

due to high ℓp-ℓp repulsion

67. Which of the following is an analgesic ?

(1) Novalgin

(2) Penicillin

(3) Streptomycin

(4) Chloromycetin

Ans. (1)

Sol. Novalgin used as analgesic

68. Equal moles of hydrogen and oxygen gases are placed in a container with a pin-hole through which both can escape. What fraction of the oxygen escapes in the time required for one-half of the hydrogen to escape ?

(1) 1/8 (2) 1/4

(3) 3/8 (4) 1/2

Ans. (1)

Sol. $n_{H_2} = n_{O_2}$ and $t_{H_2} = t_{O_2}$

According to Graham's law

$$\frac{r_{H_2}}{r_{O_2}} = \sqrt{\frac{M_{O_2}}{M_{H_2}}} \Rightarrow \frac{v_1 / t_1}{v_2 / t_2} = \sqrt{\frac{32}{2}}$$

$$\frac{1/2}{1/x} = \sqrt{16} = 4$$

$$\frac{x}{2} = 4$$

$\therefore x = 8$

$\therefore$ Fraction of $O_2 = 1/8$

69. Consider the nitration of benzene using mixed conc. H_2SO_4 and HNO_3. If a large amount of $KHSO_4$ is added to the mixture, the rate of nitration will be:-

(1) faster (2) slower

(3) unchanged (4) doubled

Ans. (2)

Sol. Slower, as large amount of HSO_4^- will decrease ionisation of H_2SO_4 that result in lesser ionisation of nitric acid and lesser formation of nitronium ion $[NO_2^+]$

70. Predict the correct order among the following :-

(1) lone pair- lone pair > lone pair - bond pair > bond pair - bond pair

(2) lone pair - lone pair > bond pair - bond pair > lone pair - bond pair

(3) bond pair - bond pair > lone pair - bond pair > lone pair - lone pair

(4) lone pair - bond pair > bond pair - bond pair > lone pair - lone pair

Ans. (1)

Sol.

71. The product obtained as a result of a reaction of nitrogen with CaC_2 is :-

(1) $Ca(CN)_2$ (2) CaCN

(3) $CaCN_3$ (4) Ca_2CN

Ans. (Bonus) (Question should beBonous)

Sol. $CaC_2 + N_2 \rightarrow CaCN_2 + C$

72. Consider the following liquid - vapour equilibrium.

Liquid $\rightleftharpoons$ Vapour

Which of the following relations is **correct** ?

(1) $\frac{d\ell nG}{dT^2} = \frac{\Delta H_v}{RT^2}$

(2) $\frac{d\ell nP}{dT} = \frac{-\Delta H_v}{RT}$

(3) $\frac{d\ell nP}{dT^2} = \frac{-\Delta H_v}{T^2}$

(4) $\frac{d\ell nP}{dT} = \frac{\Delta H_v}{RT^2}$

Ans. (4)

Sol. Clausius - Clapeyron's equation

$$\frac{d\ln P}{dT} = \frac{\Delta H_V}{RT^2}$$

73. Match the compounds given in column I with the hybridisation and shape given in column II and mark the **correct** option.

Column-I		**Column-II**	
(a)	XeF_6	(i)	Distorted octahedral
(b)	XeO_3	(ii)	Square planar
(c)	$XeOF_4$	(iii)	pyramidal
(d)	XeF_4	(iv)	Square pyramidal

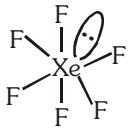
Code :-

	(a)	**(b)**	**(c)**	**(d)**
(1)	(i)	(iii)	(iv)	(ii)
(2)	(i)	(ii)	(iv)	(iii)
(3)	(iv)	(iii)	(i)	(ii)
(4)	(iv)	(i)	(ii)	(iii)

Ans. (1)

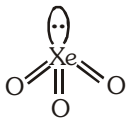
Sol.

XeF_6



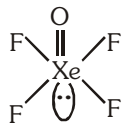
distorted octahedral

XeO_3



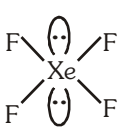
Pyramidal

$XeOF_4$



Square pyramidal

XeF_4



Square planar

74. Which of the following has longest C–O bond length? (Free C–O bond length in Co is 1.128Å).

(1) $Ni(CO)_4$

(2) $[Co(CO)_4]^{\ominus}$

(3) $[Fe(CO)_4]^{2-}$

(4) $[Mn(CO)_6]^{+}$

Ans. (3)

Sol. $[Fe(CO)_4]^{2-}$

Since metal atom is carrying maximum –ve charge therefore it would show maximum synergic bonding as sa resultant C–O bond length would be maximum.

75. The pressure of H_2 required to make the potential of H_2-electrode zero in pure water at 298 K is :-

(1) 10^{-14} atm

(2) 10^{-12} atm

(3) 10^{-10} atm

(4) 10^{-4} atm

Ans. (1)

Sol. $2H^+(aq) + 2e^- \rightarrow H_2(g)$

$$\therefore E = E^0 - \frac{0.0591}{2}\log\frac{P_{H_2}}{[H^+]^2}$$

$$0 = 0 - 0.0295 \log \frac{P_{H_2}}{(10^{-7})^2}$$

$$\frac{P_{H_2}}{(10^{-7})^2} = 1$$

$$P_{H_2} = 10^{-14} \text{ atm}$$

76. The addition of a catalyst during a chemical reaction alters which of the following quantities ?

(1) Entropy

(2) Internal energy

(3) Enthalpy

(4) Activation energy

Ans. (4)

Sol. The addition of catalyst during a chemical reaction alters the activation energy.

77. The ionic radii of A^+ and B^- ions are 0.98×10^{-10}m and 1.81×10^{-10} m. The coordination number of each ion in AB is :-

(1) 6 (2) 4

(3) 8 (4) 2

Ans. (1)

Sol. radii ratio $= \frac{r_+}{r_-} = \frac{0.98 \times 10^{-10}}{1.81 \times 10^{-10}} = 0.54$

radii ratio is in between 0.414 to 0.732

so, coordination number is 6

78. Which is the **correct** statement for the given acids?

(1) Phosphinic acid is a diprotic acid while phosphonic acid is a monoprotic acid

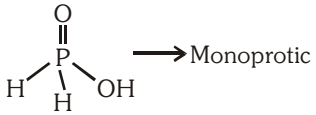
(2) Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid

(3) Both are triprotic acids

(4) Both are diprotic acids

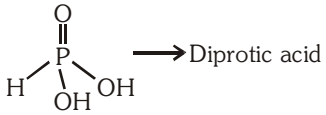
Ans. (2)

Sol. Phosphinic acid (H_3PO_2)



→ Monoprotic

Phosphonic acid (H_3PO_3)



→ Diprotic acid

79. Fog is colloidal solution of :-

(1) Liquid in gas

(2) Gas in liquid

(3) Solid in gas

(4) Gas in gas

Ans. (1)

Sol. Fog is a colloidal solution of liquid in gas

80. Which of the following statement about the composition of the vapour over an ideal a 1 : 1 molar mixture of benzene and toluene is **correct**? Assume that the temperature is constant at 25°C. (Given : Vapour Pressure Data at 25°C, benzene = 12.8 kPa, Toluene = 3.85 kPa)

(1) The vapour will contain a higher percentage of benzene

(2) The vapour will contain a higher percentage of toluene

(3) The vapour will contain equal amounts of benezene and toluene

(4) Not enough information is given to make a predication

Ans. (1)

Sol. A→ benzene, B→ toluene

1 : 1 molar mixture of A and B

$$\therefore\ x_A = \frac{1}{2} \text{ and } x_B = \frac{1}{2}$$

$$P_s = P_A^0 X_A + P_B^0 X_B$$

$$P_s = 12.8 \times \frac{1}{2} + 3.85 \times \frac{1}{2} = 8.325\text{kPa}$$

$$Y_A = \frac{P_A^0 X_A}{P_s} = \frac{12.8 \times \frac{1}{2}}{8.325} = 0.768$$

$$\therefore Y_B = 1 - Y_A = 1 - 0.768 = 0.232$$

so, the vapour will contain higher percentage of benzene.

81. The **correct** statement regarding the comparison of staggered and eclipsed conformation of ethane, is :-

(1) The staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has torsional strain

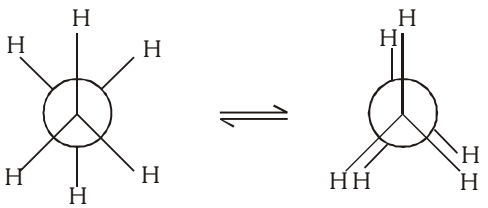
(2) The eclipsed conformation of ethane is more stable than staggered conformation, because eclipsed conformation has no torsional strain

(3) The eclipsed conformation of ethane is more stable than staggered conformation even through the eclipsed conformation has torsional strain

(4) The staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.

Ans. (4)

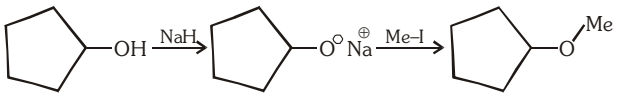
Sol.



Staggered form
* No torsional strain

Eclipsed form

82. The reaction



Can be classified as :-

(1) Williamson ether synthesis reaction

(2) Alcohol formation reaction

(3) Dehydration reaction

(4) Williamson alcohol synthesis reaction

Ans. (1)

Sol. This is an exmaple of Williamson ether syntehsis reaction in which sodium alkoxide reacts with alkyl halide and gives ether.

83. The product formed by the reaction of an aldehyde with a primary amine is :-

(1) Schiff base

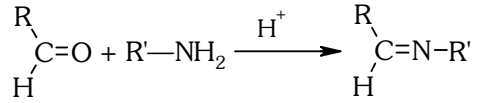
(2) Ketone

(3) Carboxylic acid

(4) Aromatic acid

Ans. (1)

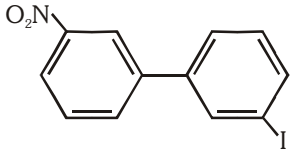
Sol.



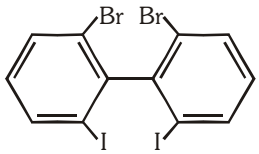
Aldehyde + primary amine Schiff base

84. Which of the following biphenyls is optically active?

(1)



(2)



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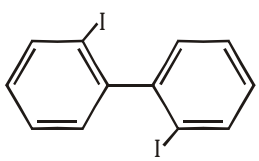
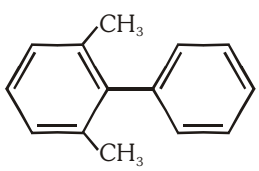
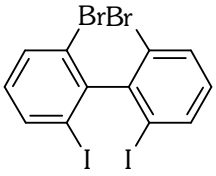


(4)



Ans. (2)

Sol.

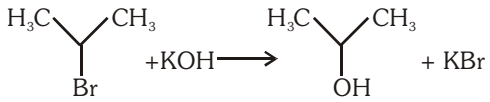


is optically active due to absence of plane of symmetry and center of symmetry

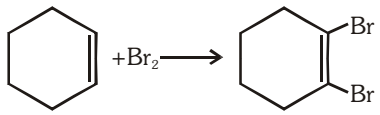
85. For the following reactions :-

(a) $CH_3CH_2CH_2Br + KOH \rightarrow CH_3CH{=}CH_2 + KBr + H_2O$

(b)



(c)



Which of the following statements is **correct** ?

(1) (a) and (b) are elimination reaction and (c) is addition reaction

(2) (a) is elimination, (b) is substitution and (c) is addition reaction

(3) (a) is elimination, (b) and (c) are substitution reactions

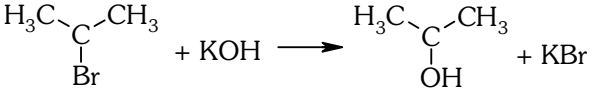
(4) (a) is substitution, (b) and (c) are addition reaction

Ans. (2)

Sol.

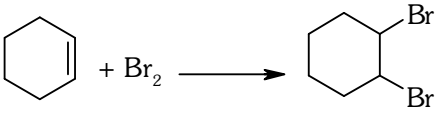
(a) $CH_3CH_2CH_2{-}Br + KOH \rightarrow CH_3CH{=}CH_2 + KBr + H_2O$ breaking of 2σ bonds and formation of 1π bond so it is an example of elimination reaction.

(b)



replacement of Br^- by OH^- is substitution reaction

(c)



breaking of 1π bond and formation of 2σ bonds is addition reaction

86. At 100°C the vapour pressure of a solution of 6.5g of a solute in 100 g water is 732 mm. If $K_b = 0.52$, the boiling point of this solution will be :-

(1) 101°C (2) 100°C

(3) 102°C (4) 103°C

Ans. (1)

Sol. $\left(\frac{P^0 - P_s}{P^0}\right) = \frac{n}{N} = \frac{w_{solute}}{M_{solute}} \times \frac{M_{solvent}}{W_{solvent}}$

at 100 °C, $P^0 = 760$ mm

$$\frac{760 - 732}{760} = \frac{6.5 \times 18}{M_{solute} \times 100}$$

$M_{solute} = 31.75 \text{ g mol}^{-1}$

$$\Delta T_b = m \times K_b = \frac{w_{solute} \times 1000}{M_{solute} \times w_{solvent}} \times K_b$$

$$\Delta T_b = \frac{0.52 \times 6.5 \times 1000}{31.75 \times 100} = 1.06°C$$

$\therefore$ boiling point of solution

$= 100°C + 1.06°C \simeq 101°C$

87. The **correct** statement regarding RNA and DNA, respectively is :

(1) The sugar component in RNA is arabinose and the sugar component in DNA is 2'-deoxyribose.

(2) The sugar component in RNA is ribose and the sugar component in DNA is 2'-deoxyribose.

(3) The sugar component in RNA is arabinose

(4) The sugar component in RNA is 2'-deoxyribose and the sugar component in DNA is arabinose.

Ans. (2)

Sol. RNA $\longrightarrow$ Ribose Nucleic Acid

DNA $\longrightarrow$ 2'-Deoxyribose Nucleic Acid

88. The **correct** statement regarding the basicity of arylamines is :-

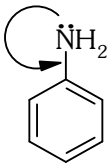
(1) Arylamines are generally less basic than alkylamines because the nitrogen lone-pair electrons are delocalized by interaction with the aromatic ring π electron system.

(2) Arylamines are generally more basic than alkylamines because the nitrogen lone-pair electrons are not delocalized by interaction with the aromatic ring π electron system.

(3) Arylamines are generally more basic than alkylamines because of aryl group.

(4) Arylamines are generally more basic than alkylamines, because the nitrongen atom in arylamines is sp-hybridized.

Ans. (1)

Sol. 

Aryl amine

$R-\ddot{N}H_2$

alkyl amine

* Delocalized lone pair of nitrogen

* less basic

89. Which one given below is a non-reducing sugar ?

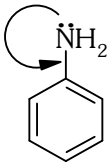
(1) Maltose

(2) Lactose

(3) Glucose

(4) Sucrose

Ans. (4)

Sol. 

Aryl amine

$R-\ddot{N}H_2$

alkyl amine

* Delocalized lone pair of nitrogen

* less basic

90. The pair of electron in the given carbanion, $CH_3C \equiv C^{\ominus}$, is present in which of the following orbitals ?

(1) 2p (2) sp^3

(3) sp^2 (4) sp

Ans. (4)

Sol. $CH_3-C \equiv C^{\ominus}$

No. of σ bp–1, ℓp–1] 2 & hybridisation is sp