JEE MAIN 2024 SESSION-2

Paper with Solution

CHEMISTRY | 08th April 2024 _ Shift-2

SECTION – A

61. The Reaction :

$$\frac{1}{2}H_2(g) + AgCl(s) \rightarrow H^+_{(aq)} + Cl^-_{(aq)} + Ag_{(s)}$$

Occurs in which of the following galvanic cell :

(1) $Pt|H_{2(g)}|HCl_{(soln.)}|AgNO_{3(aq)}|Ag$ (2) $Pt|H_{2(g)}|KCl_{(soln.)}|AgCl_{(s)}|Ag$

(3) $Pt|H_{2(g)}|HCl_{(soln.)}|AgCl_{(s)}|Ag$ (4) $Ag|AgCl_{(s)}|KCl_{(soln.)}|AgNO_{3(aq)}|Ag$

Sol. **3**

Fact

62. The correct sequence of acidic strength of the following aliphatic acids in their decreasing order is:

CH_3CH_2COOH, CH_3COOH, $CH_3CH_2CH_2COOH$, HCOOH

(1) $HCOOH > CH_3CH_2CH_2COOH > CH_3CH_2COOH > CH_3COOH$

(2) $CH_3CH_2CH_2COOH > CH_3CH_2COOH > CH_3COOH > HCOOH$

(3) $HCOOH > CH_3COOH > CH_3CH_2COOH > CH_3CH_2CH_2COOH$

(4) $CH_3COOH > CH_3CH_2COOH > CH_3CH_2CH_2COOH > HCOOH$

Sol. **3**

Correct order of acidic strength.

$HCOOH > CH_3COOH > CH_3CH_2COOH > CH_3CH_2CH_2COOH$

acidic strength α stability of conjugate base formed after removal of H^+

$$H-\overset{\overset{O}{\|}}{C}-O^{\Theta} > CH_3-\overset{\overset{O}{\|}}{C}-O^{\Theta} > CH_3-CH_2-\overset{\overset{O}{\|}}{C}-O^{\Theta} > CH_3-CH_2-CH_2-\overset{\overset{O}{\|}}{C}-O^{\Theta}$$

acidic strength $\alpha \frac{1}{+I \text{ effect}}$

63. In qualitative test for identification of presence of phosphorous, the compound is heated with an oxidising agent. Which is further treated with nitric acid and ammonium molybdate respectively. The yellow coloured precipitate obtained is:

(1) $Na_3PO_4.12MoO_3$ (2) $(NH_4)_3PO_4.12MoO_3$

(3) $(NH_4)_3PO_4.12(NH_4)_2MoO_4$ (4) $MoPO_4.\ 21\ NH_4NO_3$

Sol. **2**

$$2P + 3Na_2O_2 + \underset{\text{air}}{O_2} \xrightarrow{\text{fusion}} 2Na_3PO_4$$

$$Na_3PO_4 + 12(NH_4)_3MoO_4 + 21HNO_3 \rightarrow \underset{\text{yellow}}{(NH_4)_3PO_4.12MoO_3} + 21NH_4NO_3 + 12H_2O$$

The organic compound is fused with sodium peroxide. The fused mass is then extracted with water. The aqueous solution so obtained is boild with concentrated nitric acid, and ammonium molybdate solution is added to it. A yellow solution or precipitate indicates the presence of phosphorus in the organic compound. The yellow precipitate is of ammonium phosphomolybdate

64. Which one the following compounds will readily react with dilute NaOH ?

(1) C_6H_5OH (2) C_2H_5OH (3) $(CH_3)_3COH$ (4) $C_6H_5CH_2OH$

Sol. **1**

$C_6H_5OH \rightarrow$ Phenol.

(Stronger acid in comparison to other given)

NaOH strong base so it will readily react with acid having more acidic strength.

65. Identify the correct statements about p-block elements and their compounds.

(A) Non metals have higher electronegativity than metals.

(B) Non metals have lower ionisation enthalpy than metals.

(C) Compounds formed between highly reactive non-metals and highly reactive metals are generally ionic.

(D) The non-metal oxides are generally basic in nature.

(E) The metal oxides are generally acidic or neutral in nature.

Choose the correct answer from the options given below :

(1) (A) and (C) only (2) (B) and (E) only (3) (D) and (E) only (4) (B) and (D) only

Sol. **1**

(1) Non metals have higher I.E. than metals,

(2) The nonmetal oxides are generally acidic in nature

(3) The metal oxides are generally basic in nature

66. Given below are two statements:

Statement (I): S_N2 reactions are 'stereospecific', indicating that they result in the formation of only one stereo-isomer as the product.

Statement (II): S_N1 reactions generally result in formation of product as racemic mixtures.

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

(1) Statement I is true but Statement II is false

(2) Both Statement I and Statement II are true

(3) Statement I is false but Statement II is true

(4) Both Statement I and Statement II are false

Sol. **2**

Both statement I and II are correct.

In $SN^2 \rightarrow$ backside attack takes place so Inversion product is formed (Stereospecific)

In $SN^1 \rightarrow$ both Inversion and Retension product & formed called racemic mixture.

67. The equilibrium $Cr_2O_7^{2-} \rightleftharpoons 2CrO_4^{2-}$ is shifted to the right in :

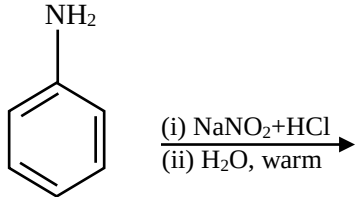
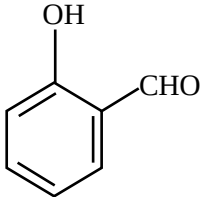
(1) a basic medium (2) a weakly acidic medium

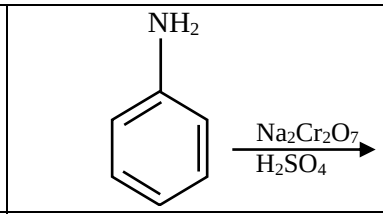
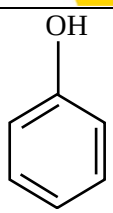
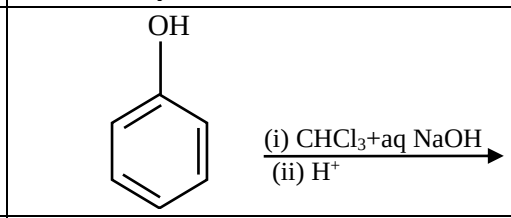
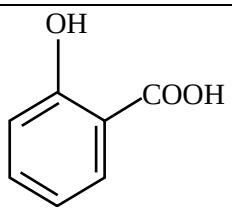
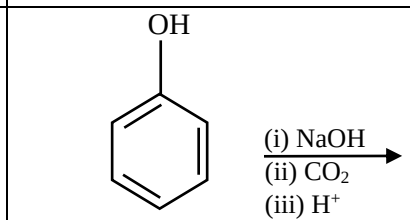
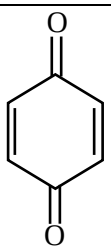
(3) a neutral medium (4) an acidic medium

Sol. **1**

Fact

68. Match List-I with List-II

	List-I (Reaction)		**List-I (Products)**
(A)		(i)	

(B)		(ii)	
(C)		(iii)	
(D)		(iv)	

Choose the correct answer from the options given below:

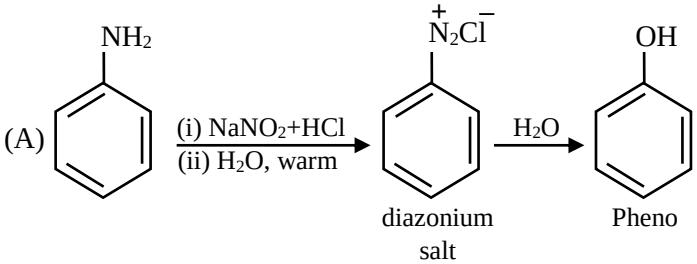
(1) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)

(2) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

(3) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)

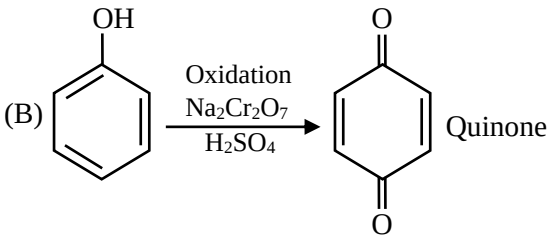
(4) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)

Sol. **4**

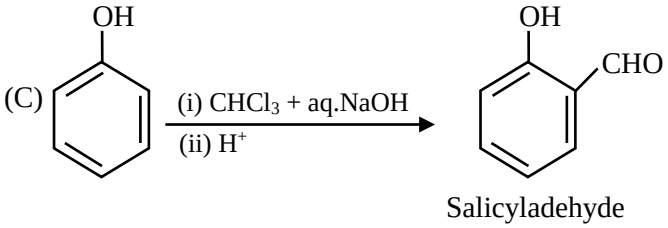


diazonium salt

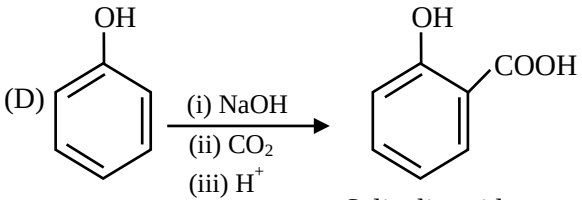
Pheno



Quinone



Salicyladehyde



Salicylic acid

69. For a reaction $A \xrightarrow{K_1} B \xrightarrow{K_2} C$
If the rate of formation of B is set to be zero then the concentration of B is given by :
(1) $K_1K_2[A]$ (2) $(K_1+K_2)[A]$ (3) $K_1-K_2)[A]$ (4) $K_1/K_2)[A]$

Sol. **4**

$\Rightarrow A \xrightarrow{K_1} B \xrightarrow{K_2} C$

Net rate of formation of $B \Rightarrow \frac{dB}{dt} = r_1 - r_2$

$$\frac{dB}{dt} = k_1[A] - k_2[B] = 0$$

$$\Rightarrow k_1[A] = k_2[B]$$

$$[B] = \frac{k_1[A]}{k_2}$$

70. Given below are two statements:
Statement (I): Kjeldahl method is applicable to estimate nitrogen in pyridine.
Statement (II): The nitrogen present in pyridine can easily be converted into ammonium sulphate in Kjeldahl method.
In the light of the above statements, choose the correct answer from the options given below :
(1) Statement I is false but Statement II is true
(2) Both Statement I and Statement II are true
(3) Statement I is true but Statement II is false
(4) Both Statement I and Statement II are false

Sol. **4**

Nitrogen present in pyridine can not be estimated by Kjeldahl method as the nitrogen present in pyridine can not be easily converted into ammonium sulphate.

71. When ψ_A and ψ_B are the wave functions of atomic orbitals, then σ^* is represented by :
(1) $\psi_A - \psi_B$ (2) $\psi_A + 2\psi_B$ (3) $\psi_A - 2\psi_B$ (4) $\psi_A + \psi_B$

Sol. **1**

Fact

72. Match List-I with List-II

	List-I (Complex ion)		**List-I (Spin only magnetic in B.M.)**
(A)	$[Cr(NH_3)_6]^{3+}$	(I)	4.90
(B)	$[NiCl_4]^{2-}$	(II)	3.87
(C)	$[CoF_6]^{3-}$	(III)	0.0
(D)	$[Ni(CN)_4]^{2-}$	(IV)	2.83

Choose the correct answer from the options given below:
(1) (A)-(II), (B)-(IV), (C)-(I), (D)-(III) (2) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)
(3) (A)-(IV), (B)-(III), (C)-(I), (D)-(II) (4) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

Sol. **1**

(A) $[Cr(NH_3)_6]^{3+} \rightarrow Cr^{3+}(3d^3) = t_{2g}^3 e_g^0,\ \mu = \sqrt{15} = 3.87$

(B) $(NiCl_4)^{2-} \rightarrow Ni^{2+}(3d^8) = e^4t_2^4\ \mu = \sqrt{8} = 2.83$

(C) $[CoF_6]^{3-} \rightarrow Co^{3+}(3d^6) = t_{2g}^4 e_g^2, \mu = 4.90$

(D) $[Ni(CN)_4]^{2-} \rightarrow Ni^{2+}(3d^8) \rightarrow \mu = 0$ (by VBT)

73. The emf of cell $TI|\underset{(0.001M)}{Tl^{+}}||\underset{(0.01M)}{Cu^{2+}}|Cu$ is 0.83 V at 298 K, If could be increased by :

(1) Increasing concentration of Cu^{2+} ions

(2) Increasing concentration of both Tl^{+} and Cu^{2+} ions

(3) Decreasing concentration of both Tl^{+} and Cu^{2+} ions

(4) Increasing concentration of Tl^{+} ions

Sol. **1**

$$\left(Ti \rightarrow Ti^{+} + e^{-}\right) \times 2$$

$$\underline{Ca^{2+} + 2e^{-} \rightarrow Cu}$$

$$2Ti + Ci^{2+} \rightarrow 2Ti^{+} + Cu$$

$$E_{cell} = E^{o}_{cell} - \frac{0.0591}{2}\log\frac{\left[Ti^{+}\right]^{2}}{\left[Cu^{2+}\right]}$$

74. Given below are two statements:

Statement (I): Fusion of MnO_2 with KOH and an oxidising agent gives dark green K_2MnO_4.

Statement (II): Manganate ion on electrolytic oxidation in alkaline medium gives permanganate ion.

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

(1) Statement I is false but Statement II is true (2) Both Statement I and Statement II are true

(3) Statement I is true but Statement II is false (4) Both Statement I and Statement II are false

Sol. **2**

Fact

75. Identify the incorrect statements about group 15 elements :

(A) Dinitrogen is a diatomic gas which acts like an inert gas at room temperature.

(B) The common oxidation states of these elements are 3, +3 and +5.

(C) Nitrogen has unique ability to form $p\pi$–$p\pi$ multiple bonds.

(D) The stability of +5 oxidation states increases down the group.

(E) Nitrogen shows a maximum covalency of 6.

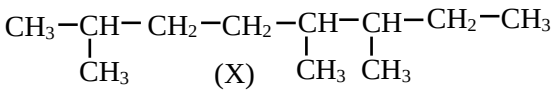
Choose the correct answer from the options given below :

(1) (A), (B), (D) only (2) (A), (C), (E) only (3) (D) and (E) only (4) (B), (D), (E) only

Sol. **3**

Fact

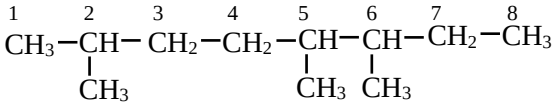
76. IUPAC name of following hydrocarbon (X) is :



(1) 3,4,7-Trimethyloctane (2) 2-Ethyl-2,6-diethylheptane

(3) 2,5,6-Trimethyloctane (4) 2-Ethyl-3,6-dimethylheptane

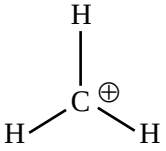
Sol. **3**



IUPAC Name → 2, 5, 6- Trimethyloctane.

77. The shape of carbocation is:
(1) diagonal pyramidal (2) diagonal (3) trigonal planar (4) tetrahedral

Sol. **3**



trigonal Plannar structure.

78. Match List-I with List-II

	List-I (Test)		**List-I (Identification)**
(A)	Bayer's test	(I)	Phenol
(B)	Ceric ammonium nitrate test	(II)	Aldehyde
(C)	Phthalein dye test	(III)	Alcoholic-OH group
(D)	Schiff's test	(IV)	Unsaturation

Choose the correct answer from the options given below:
(1) (A)-(III), (B)-(I), (C)-(IV), (D)-(II) (2) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)
(3) (A)-(II), (B)-(III), (C)-(IV), (D)-(I) (4) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

Sol. **2**

(A) Bayer's test $\rightarrow$ for unsaturation.
($KMnO_4$ reaction gives Purple / violet colour indication.)
(B) Ceric ammonium $\rightarrow$ for alcoholic (OH) group Nitrate test.
$\Rightarrow$ red colour appears.
(C) Phthalein dye test $\Rightarrow$ for phenol forms phenol phthalein (colourless) which on reaction with NaOH $\Rightarrow$ Pink colour.
(D) Schiff's test $\Rightarrow$ for Aldehyde detectation (– CHO)

79. Given below are two statements:
Statement (I): A Buffer solution is the mixture of a salt and an acid or a base mixed in any particular quantities.
Statement (II): Blood is naturally occurring buffer solution whose pH is maintained by $H_2CO_3 / HCO_3^{\ominus}$ concentrations.
In the light of the above statements, choose the correct answer from the options given below :
(1) Statement I is true but Statement II is false (2) Both Statement I and Statement II are false
(3) Both Statement I and Statement II are true (4) Statement I is false but Statement II is true

Sol. **4**

H_2CO_3 / HCO_3^- buffer system helps to maintain pH of blood between 7.26 to 7.42.

80. Given below are two statements:
Statement (I): All the following compounds react with p-toluenesulfonyl chloride.
$C_6H_5NH_2$ $(C_6H_5)_2NH$ $(C_6H_5)_3N$
Statement (II) : Their products in the above reaction are soluble is aqueous NaOH.
In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is true but Statement II is false
(2) Both Statement I and Statement II are true
(3) Statement I is false but Statement II is true
(4) Both Statement I and Statement II are false

Sol. **4**

P – tolenesulfonyl chloride is Heisenberg reagent.
$\Rightarrow$ gives reaction with Primary and secondary amines not with tertiary.
$\Rightarrow$ Product of 1° Amine $\Rightarrow$ Soluble in Base (NaOH)
Product of 2° Amine $\Rightarrow$ Soluble in acid (HCl)

SECTION – B

81. Molality of an aqueous solution of urea is 4.44 m. Mole fraction of urea in solution is $x\times10^{-3}$ Value of x is _____. (Integer answer)

Sol. **74**

$$\frac{X_B}{X_A}=\frac{m\times MA}{1000}$$

$$\frac{X_B}{1-X_B}=\frac{4.44\times18}{1000}$$

$$\frac{X_B}{1-X_B}=0.08$$

$$X_B=0.08-0.08X_B$$

$1.08\ X_B = 0.08$

$X_B = 0.0740$

$X_B = 74 \times 10^{-3}$

$\Rightarrow 74$

82. Number of molecules having bond order 2 from the following molecules is

C_2, O_2, Be_2, Li_2, Ne_2, N_2, He_2

Sol. **2**

C_2 and O_2

83. $\Delta vapH^{\ominus}$ for water is + 40.79 kJ mol-1 at 1 bar and 100 °C. Change in internal energy for this vapourisation under same condition is_____ kJ mol-1. (Integer answer)

(Given R = 8.3JK $^{-1}$ mol^{-1})

Sol. **38**

$\Delta H_V = 40.79$ KJ/mol

$H_2O(\ell) \longrightarrow H_2O(g)$

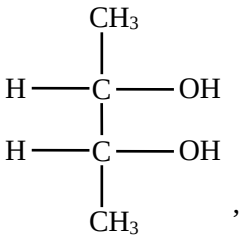
$\Delta H = \Delta U + \Delta n_g RT$

$$\Delta U = (40.79) - \frac{(1)(8.31)(373)}{1000}$$

$\Delta U = 37.69$

$\Delta U = 38$ KJ/mol

84. Total number of optically active compounds from the following is _____ .



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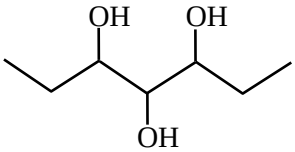


,

$CH_3–CH_2–CH_2–CH_2–OH$

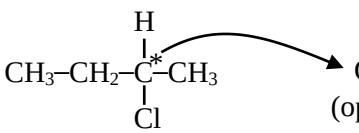
$CH_3–CH_2–CH(Cl)–CH_3$,

$CH_3–CH_2–CH_2–CH_2–Cl$

$(CH_3)_2CH–CH_2–CH_2–Cl$

Sol. **1**

Optical active means Chiral center (atleast one) and have non-superimposable mirror image.



85. Total number of unpaired electrons in the complex ions $[Co(NH_3)_6]^{3+}$ and $[NiCl_4]^{2-}$ is_____.

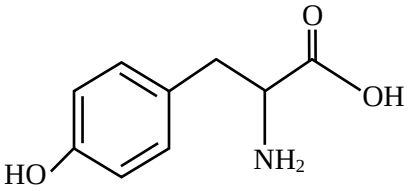
Sol. **2**

$[Co(NH_3)_6]^{3+} \rightarrow Co^{3+}(d^6) = t_{2g}^6 eg^0, n = 0$

$[NiCl_4]^{2-} \rightarrow Ni^{2+}(d^8) = e^4t_2^4$; n = 2

86. The total number of carbon atoms present in tyrosine, an amino acid, is _____.

Sol. **9**

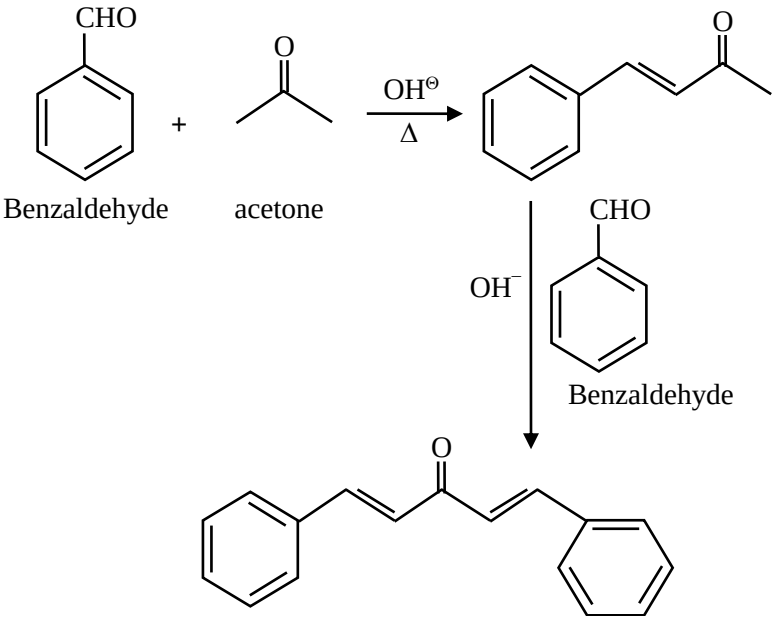


Tyrosine structure
(amino acid)

Here Total carbon atoms = 9

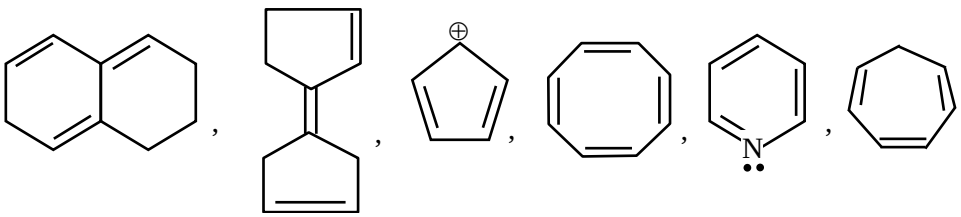
87. Two moles of benzaldehyde and one mole of acetone under alkaline conditions using aqueous NaOH after heating gives x as the major product. The number of π bonds in the product x is _____.

Sol. **9**

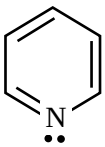


Hence Number of π-bond = 9

88. Total number of aromatic compounds among the following compounds is _____.



Sol. **1**



$6\pi e^{\Theta}$ in delocalsation follow Huckel rule.

89. Wavenumber for a radiation having 5800 Å wavelength is x × 10 cm^{-1}. The value of x is (Integer answer

Sol. **1724**

$$\bar{\nu} = \frac{1}{\lambda} \Rightarrow \frac{1}{5800 \times 10^{-8}} cm^{-1}$$

$$\Rightarrow \frac{10^8}{5800} \Rightarrow \frac{10^6}{58}$$

$$\Rightarrow \frac{100000}{58} \times 10$$

$$\Rightarrow 1724.13 \times 10$$

$$\Rightarrow 1724$$

90. A solution is prepared by adding 1 mole ethyl alcohol in 9 mole water. The mass percent of solute in the solution is (Integer answer) (Given: Molar mass in g mol^{-1} Ethyl alcohol: 46 water: 18)

Sol. **22**

Mass of ethyl alcohol = 1 mole × MM

$\Rightarrow$ 46 g

Mass of water $\Rightarrow$ 9 mole × MM

$\Rightarrow$ 162 g

$$\% \text{ by mass of ethyl alcohol} = \frac{46}{162 + 46} \times 100$$

$\Rightarrow$ 22 % (approx.)

Continuing to keep the pledge
of **imparting education** for the **last 17 Years**

65136+
SELECTIONS SINCE 2007

JEE (Advanced)	JEE (Main)	NEET/AIIMS	NTSE/OLYMPIADS
12142	32584	17875 (Under 50000 Rank)	2535 (6th to 10th class)

Most Promising RANKS
Produced by MOTION Faculties

NEET / AIIMS

- AIR-1 to 10 — 25 Times
- AIR-11 to 50 — 84 Times
- AIR-51 to 100 — 84 Times

JEE MAIN+ADVANCED

- AIR-1 to 10 — 8 Times
- AIR-11 to 50 — 37 Times
- AIR-51 to 100 — 41 Times

NITIN VIIJAY (NV Sir)
Founder & CEO

Nation's Best SELECTION
Percentage (%) Ratio

Student Qualified in NEET

(2023)
6492/7084 = **91.64%**
(2022)
4837/5356 = **90.31%**

Student Qualified in JEE ADVANCED

(2023)
2747/5182 = **53.01%**
(2022)
1756/4818 = **36.45%**

Student Qualified in JEE MAIN

(2024-First Attemp)
6495/10592 = **61.31%**
(2023)
5993/8497 = **70.53%**
(2022)
4818/6653 = **72.41%**

MOTION