FINAL JEE–MAIN EXAMINATION – APRIL, 2023
Held On Thursday 13th April, 2023
TIME : 09:00 AM to 12:00 PM

SECTION - A

61. Given below are two statements :

Statement I: Permutit process is more efficient compared to the synthetic resin method for the softening of water.

Statement II: Synthetic resin method results in the formation of soluble sodium salts.

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

(1) Both the Statements I and II are correct

(2) Statement I is incorrect but Statement II is correct

(3) Statement I is correct but Statement II is incorrect

(4) Both the Statements I and II are incorrect

Sol. **4**

Nowadays hard water is softened by using synthetic ion exchangers. This method is more efficient than zeolite process/Permutit process

62. Which one of the following is most likely a mismatch?

(1) Zinc - Liquation

(2) Copper – Electrolysis

(3) Titanium - van Arkel Method

(4) Nickel - Mond process

Sol. **1**

Zinc is refined by distillation method, which is used for metals having low boiling point.

63. The energy of an electron in the first Bohr orbit of hydrogen atom is -2.18×10^{-18} J . Its energy in the third Bohr orbit is_____.

(1) $\frac{1}{27}$ of this value

(2) $\frac{1}{9}$ th of this value

(3) One third of this value

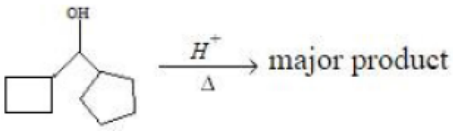
(4) Three times of this value

Sol. **2**

$E_{1,1} = -2.18 \times 10^{-18}$ J

$$E_{3,1} = E_{1,1} \times \frac{1^2}{3^2}$$

$$E_{3,1} = \frac{1}{9} \times E_{1,1}$$

64. 

In the above reaction, left hand side and right hand side rings are named as ' A ' and ' B ' respectively. They undergo ring expansion. The correct statement for this process is:

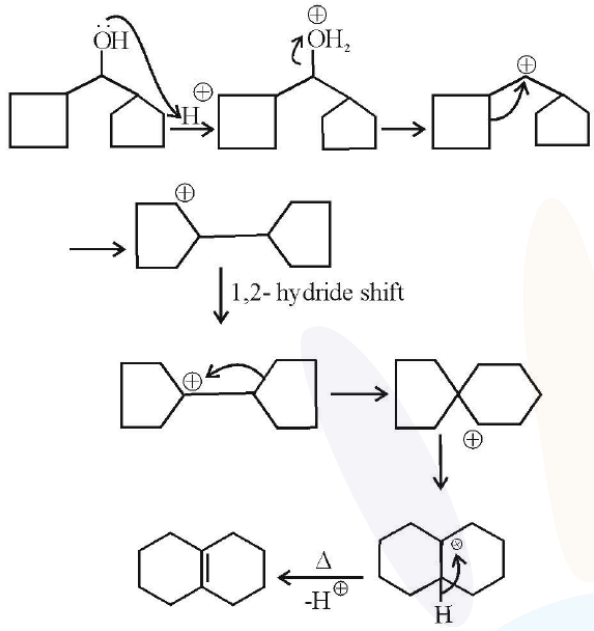
(1) Finally both rings will become six membered each.

(2) Ring expansion can go upto seven membered rings

(3) Finally both rings will become five membered each.

(4) Only A will become 6 membered.

Sol. **1**



65. Match The following

Column–A	Column–B
a) Nylon 6	I. Natural Rubber
b) Vulcanized Rubber	II. Cross Linked
c) cis–1, 4–polyisoprene	III. Caprolactam
d) Polychloroprene	IV. Neoprene

Choose the correct answer from options given below:

(1) a→II, a→III, c→IV, d→I

(2) a→IV, b→III, c→II, d→I

(3) a→III, b→II, c→I, d→IV

(4) a→III, b→IV, c→I, d→II

Sol. **3**

Nylon-6 - Caprolactum (Monomer)

Natural rubber- Isoprene (Monomer)

Vulcanized rubber - Sulphur containing rubber

Neoprene- Chloroprene (Monomer)

66. What happens when a lyophilic sol is added to a lyophobic sol?

(1) Film of lyophobic sol is formed over lyophilic sol.

(2) Lyophilic sol is dispersed in lyophobic sol.

(3) Lyophobic sol is coagulated

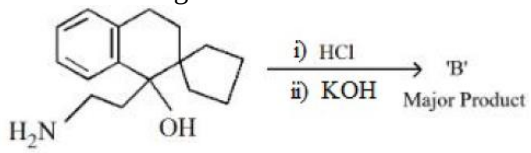
(4) Film of lyophilic sol is formed over lyophobic sol.

Sol. **4**

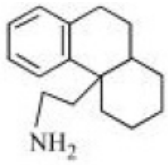
Protective film of lyophilic sol is formed over lyophobic sol.

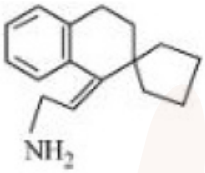
Which protects it from coagulation.

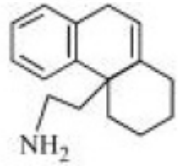
67. In the reaction given below

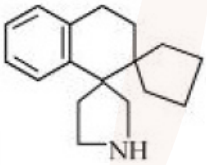


'B' is:

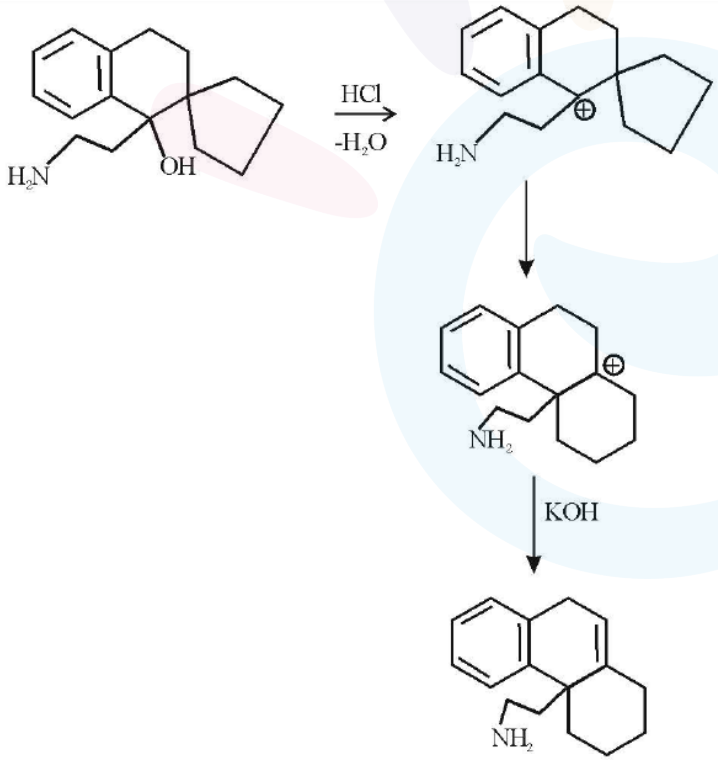
(1) 

(2) 

(3) 

(4) 

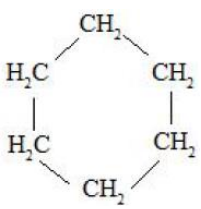
Sol. **3**



68. In the following reaction 'X' is

$$CH_3(CH_2)_4CH_3 \xrightarrow[\substack{HCl\\ \Delta}]{Anhy.AlCl_3} \underset{\text{major product}}{'X'}$$

(1) $CH_3(CH_2)_4CH_2Cl$

(2) 

(3) $Cl-CH_2-(CH_2)_4-CH_2-Cl$

(4) $CH_3CH-(CH_2)_2CH_3$

Sol. **4**

n-alkanes on heating in this presence of anhydrous $A1Cl_3$ and hydrogen chloride gas isomerise to branched chain alkanes. The major product has one methyl side chain.

$$CH_3-(CH_2)_4-CH_3 \xrightarrow[HCl,\Delta]{Anhy.AlCl_3} CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-(CH_2)_2-CH_3$$

2- methylpentane
(major)

69. 2-Methyl propyl bromide reacts with $C_2H_5O^-$ and gives 'A' whereas on reaction with C_2H_5OH it gives 'B'. The mechanism followed in these reactions and the products 'A' and 'B' respectively are :

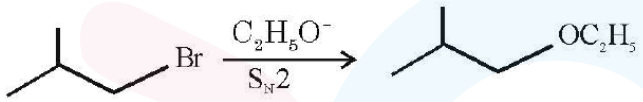
(1) S_N1, A= tert-butyl ethyl ether; S_N1, B= 2-butyl ethyl ether

(2) S_N2, A= 2-butyl ethyl ether; S_N2, B= iso-butyl ethyl ether

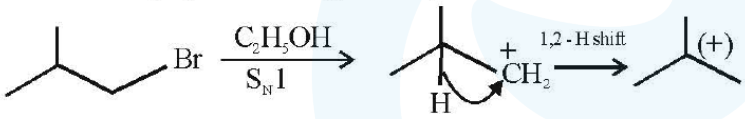
(3) S_N2, A= iso-butyl ethyl ether; S_N1, B= tert-butyl ethyl ether

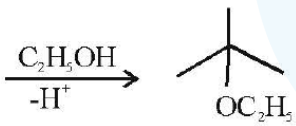
(4) S_N1, A= tert-butyl ethyl ether; S_N2, B= iso-butyl ethyl ether

Sol. **3**

(i) 

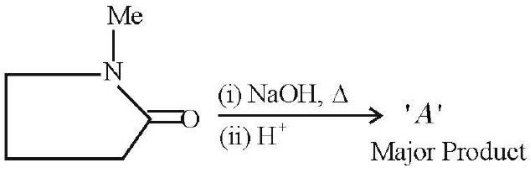
$C_2H_5O^-$ is strong nucleophile.

(ii) 

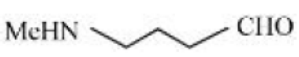


C_2H_5OH is weak nucleophile.

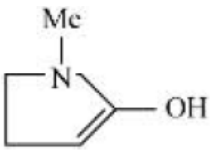
70. In the reaction given below

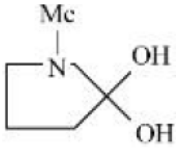


'A' is

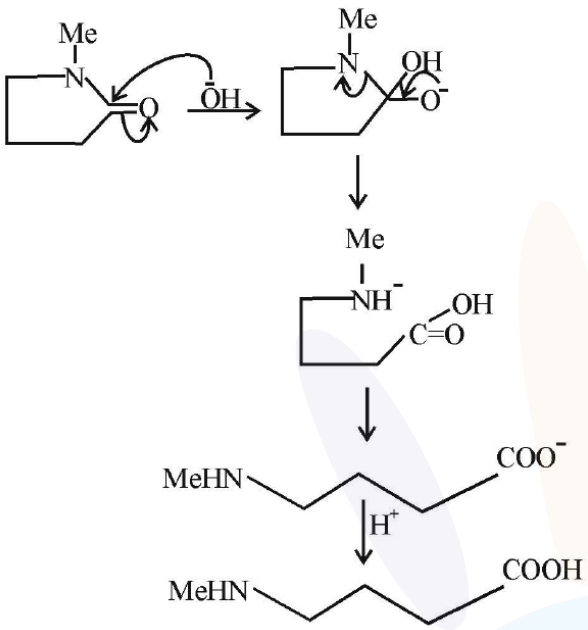
(1) 

(2) 

(3) 

(4) 

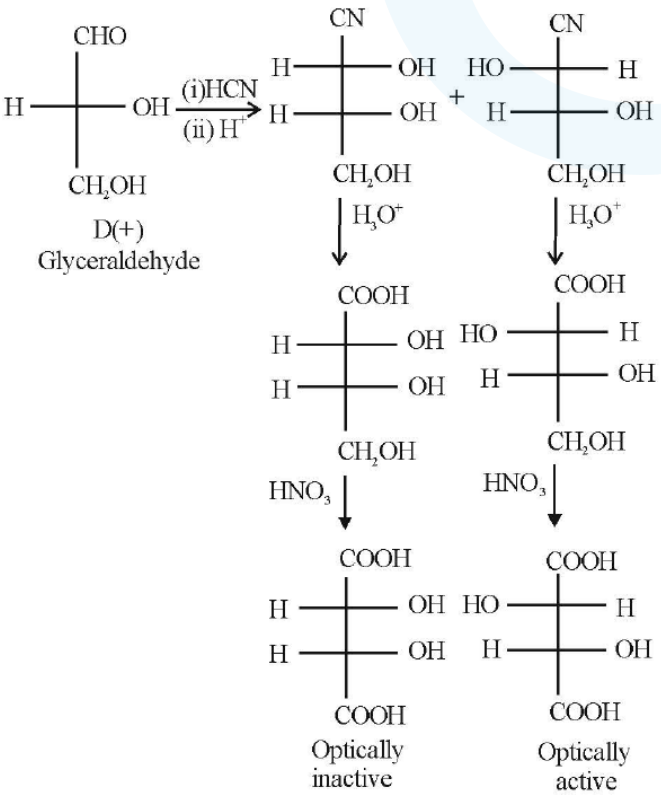
Sol. **2**



71. D–(+) Glyceraldehyde $\xrightarrow[\text{ii)}H_2O/H^+ \\ \text{iii)}HNO_3]{\text{i)}HCN}$

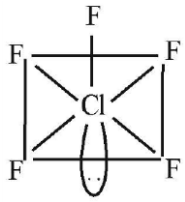
The products formed in the above reaction are
(1) Two optically active products
(2) One optically inactive and one meso product.
(3) One optically active and one meso product
(4) Two optically inactive products

Sol. **3**



72. ClF_5 at room temperature is a:
(1) Colourless liquid with square pyramidal geometry
(2) Colourless gas with trigonal bipyramidal geometry
(3) Colourless gas with square pyramidal geometry
(4) Colourless liquid with trigonal bipyramidal geometry

Sol. **1**



ClF_5 is colourless liquid.

73. The pair of lanthanides in which both elements have high third - ionization energy is:
(1) Dy, Gd (2) Eu,Gd (3) Lu,Yb (4) Eu,Yb

Sol. **4**

$Eu^{+2}:[Xe]4f^{7}$
$Yb^{+2}:[Xe]4f^{14}$
} High IE due to half filled & fully filled configurations

74. The mismatched combinations are
A. Chlorophyll - Co
B. Water hardness - EDTA
C. Photography -$[Ag(CN)_2]^-$
D. Wilkinson catalyst - $[(Ph_3P)_3\ RhCl]$
E. Chelating ligand - D-Penicillamine
Choose the correct answer from the options given below :
(1) A and C Only (2) D and E Only (3) A and E Only (4) A, C, and E Only

Sol. **1**

Mg is present in chlorophyll and in black and white photography the developed film is fixed by washing with hypo solution which dissolves the undecomposed AgBr to form a complex ion $[Ag(S_2O_3)_2]^{3-}$

75. Which of the following statements are not correct ?
A. The electron gain enthalpy of F is more negative than that of Cl.
B. Ionization enthalpy decreases in a group of periodic table.
C. The electronegativity of an atom depends upon the atoms bonded to it.
D. Al_2O_3 and NO are examples of amphoteric oxides.
Choose the most appropriate answer from the options given below :
(1) A, C and D Only (2) B and D Only (3) A, B and D Only (4) A, B, C and D

Sol. **1**

Electronegativity of an element depends on the atom with which it is attached.
NO = neutral oxide
Al_2O_3 = amphoteric oxide

76. The radical which mainly causes ozone depletion in the presence of UV radiations is :

(1) $NO^{\bullet}$ (2) $\dot{O}H$ (3) $CH_3^{\bullet}$ (4) $Cl^{\bullet}$

Sol. **4**

$$O_2(g) \xrightarrow{UV} O(g) + O(g)$$
$$O_2(g) + O(g) \longrightarrow O_3(g)$$
$$CF_2Cl_2(g) \xrightarrow{UV} \dot{C}l(g) + \dot{C}F_2Cl(g)$$
$$\dot{C}l(g) + O_3(g) \longrightarrow Cl\dot{O}(g) + O_2(g)$$
$$Cl\dot{O}(g) + O(g) \longrightarrow \dot{C}l(g) + O_2(g)$$

77. In which of the following processes, the bond order increases and paramagnetic character changes to diamagnetic one?

(1) $O_2 \rightarrow O_2^+$ (2) $O_2 \rightarrow O_2^{2-}$ (3) $NO \rightarrow NO^+$ (4) $N_2 \rightarrow N_2^+$

Sol. **3**

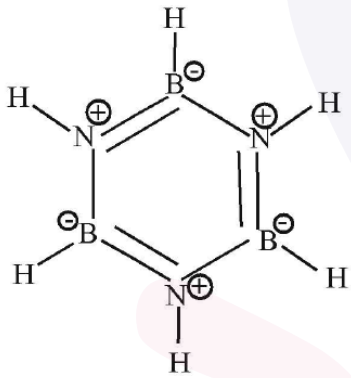
NO is paramagnetic with BO = 2.5, NO^+ is diamagnetic with BO = 3

78. The incorrect statement from the following for borazine is:

(1) It is a cyclic compound.
(2) It has electronic delocalization.
(3) It can react with water.
(4) It contains banana bonds.

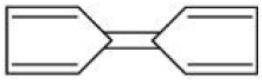
Sol. **4**

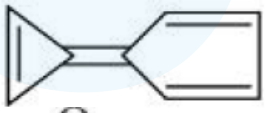
Borazine is $B_3N_3H_6$

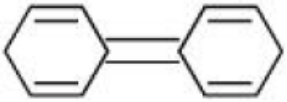


$B_3N_3H_6 + 9H_2O \rightarrow 3NH_3 + 3H_3BO_3 + 3H_2$

79. Among the following compounds, the one which shows highest dipole moment is

(1) 

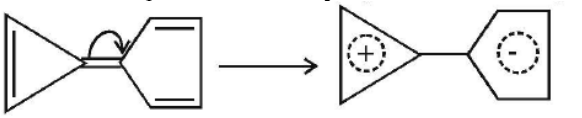
(2) 

(3) 

(4) 

Sol. **2**

Among the given compounds, the following compound has the highest dipole moment because both the +ve and -ve ends acquire aromaticity.



(Aromatic) (Aromatic)

80. $Be(OH)_2$ reacts with $Sr(OH)_2$ to yield an ionic salt. Choose the incorrect option related to this reaction from the following :

(1) Be is tetrahedrally coordinated in the ionic salt.
(2) The reaction is an example of acid - base neutralization reaction.
(3) The element Be is present in the cationic part of the ionic salt.
(4) Both Sr and Be elements are present in the ionic salt.

Sol. **3**

$Be(OH)_2$ is amphoteric in nature.
$Sr(OH)_2$ is basic in nature.
These two undergo acid – base reaction to form a salt.

$$Be(OH)_2 + Sr(OH)_2 \rightarrow \underset{\text{(salt)}}{Sr[Be(OH)_4]}$$

SECTION - B

81. Solution of 12 g of non-electrolyte (A) prepared by dissolving it in 1000 mL of water exerts the same osmotic pressure as that of 0.05M glucose solution at the same temperature. The empirical formula of A is CH_2O. The molecular mass of A is_____ g. (Nearest integer)

Sol. **240**

$\pi_A = \pi_{glucose}$

$C_ART = CRT$

$\frac{12 / M_A}{1} = 0.05$

M_A(Molar mass of A) = $\frac{12}{0.05} = \frac{1200}{5} = 240gm$

82. $KMnO_4$ is titrated with ferrous ammonium sulphate hexahydrate in presence of dilute H_2SO_4. Number of water molecules produced for 2 molecules of $KMnO_4$ is_____.

Sol. **68**

$2KMnO_4 + 8H_2SO_4 + 10FeSO_4 \cdot (NH_4)_2 SO_4 \cdot 6H_2O \rightarrow K_2SO_4 + 2MnSO_4 + 5\ Fe_2(SO_4)_3 + 10\ (NH_4)_2SO_4 + 68H_2O$

On the basis of above equation,

68 molecules of water will be produced from 2 molecules of $KMnO_4$.

83. 20 mL of calcium hydroxide was consumed when it was reacted with 10 mL of unknown solution of H_2SO_4. Also 20 mL standard solution of 0.5MHCl containing 2 drops of phenolphthalein was titrated with calcium hydroxide, the mixture showed pink colour when burette displayed the value of 35.5 mL whereas the burette showed 25.5 mL initially. The concentration of H_2SO_4 is_____ M.(Nearest integer)

Sol. **1**

miliequivalent of $Ca(OH)_2$ = miliequivalent of H_2SO_4

$M_1 \times 2 \times 20 = M_2 \times 2 \times 10$

$\boxed{2M_1 = M_2}$

miliequivalent of HCl = miliequivalent of $Ca(OH)_2$

$20 \times 0.5 = 10 \times M_1 \times 2$

$M_1 = 0.5$ M

Concentration of $H_2SO_4 = M_2 = 2M_1$

$= 2 \times 0.5$

$= 1$ M

84. $t_{87.5}$ is the time required for the reaction to undergo 87.5% completion and t_{50} is the time required for the reaction to undergo 50% completion. The relation between $t_{87.5}$ and t_{50} for a first order reaction is _____ $t_{87.5} = x \times t_{50}$. The value of x is_____ . (Nearest integer)

Sol. **3**

$A_0 \xrightarrow{t_{1/2}} A_0/2 \xrightarrow{t_{1/2}} A_0/4 \xrightarrow{t_{1/2}} A_0/8$

$t_{7/8} = t_{87.5\%} = 3t_{1/2}$

85. A certain quantity of real gas occupies a volume of 0.15 dm^3 at 100 atm and 500 K when its compressibility factor is 1.07 . Its volume at 300 atm and 300 K (When its compressibility factor is 1.4) is $\times 10^{-4}\ dm^3$. (Nearest integer)

Sol. **392**

$$Z = \frac{PV}{nRT}$$

$$\frac{Z_1}{Z_2} = \left(\frac{P_1V_1}{nRT_1}\right) \times \left(\frac{nRT_2}{P_2V_2}\right)$$

$$\frac{1.07}{1.4} = \left(\frac{100 \times 0.15}{500}\right)\left(\frac{300}{300 \times V_2}\right)$$

$$V_2 = \frac{0.03 \times 1.4}{1.07} = 0.03925$$

$$= 392 \times 10^{-4}\ dm^3$$

86. A metal surface of $100 cm^2$ area has to be coated with nickel layer of thickness 0.001 mm. A current of 2A was passed through a solution of $Ni(NO_3)_2$ for 'x' seconds to coat the desired layer. The value of x is_____. (Nearest integer)

(ρ_{Ni} (density of Nickel) is 10 g mL^{-1}, Molar mass of Nickel is 60 g mol^{-1} F = 96500 C mol^{-1})

Sol. **161**

Volume of nickel required = $100 \times 0.001 \times 10^{-3} \times 100$

$= 0.01\ cm^3$

Mass of Nickel required = 0.01×10

$= 0.1$ gm

Moles = $\frac{0.1}{60} = \frac{1}{600}$ mol

$Ni^{2+} + 2e^- \rightarrow Ni(s)$

for coating of 1 mol Ni, charge required = 2×96500 C

for coating of $\frac{1}{600}$ mol, charge required = $2 \times 96500 \times \frac{1}{600}$ C

$= \frac{965}{3}$ C

$$I = \frac{q}{t}$$

$$t = \frac{965/3}{2} = 160.83\ sec \approx 161$$

87. 25.0 mL of 0.050 M$Ba(NO_3)_2$ is mixed with 25.0 mL of 0.020 M NaF. K_{sp} of BaF_2 is 0.5×10^{-6} at 298 K. The ratio of $[Ba^{2+}][F^-]^2$ and K_{sp} is_____. (Nearest integer)

Sol. **5**

$$\left[Ba^{+2}\right] = \frac{25 \times 0.05}{50} = 0.025M$$

$$\left[F^-\right] = \frac{25 \times 0.02}{50} = 0.01M$$

$$\left[Ba^{+2}\right]\left[F^-\right]^2 = 25 \times 10^{-7}$$

$$K_{sp} = 5 \times 10^{-7}\ (given)$$

$$Ratio = \frac{\left[Ba^{+2}\right]\left[F^-\right]^2}{K_{sp}} = 5$$

88. $A_2 + B_2 \rightarrow 2AB$. $\Delta H_f^0 = -200\,kJ\,mol^{-1}$ new line AB, A_2 and B_2 are diatomic molecules. If the bond enthalpies of A_2, B_2 and AB are in the ratio 1 : 0.5:1, then the bond enthalpy of A_2 is _____kJ mol^{-1}. (Nearest integer)

Sol. **800**

$A_2 + B_2 \rightarrow 2AB \qquad \Delta H_f^\circ = -200 kJ / mol$

Bond enthalpy of A_2 = x

Bond enthalpy of B_2 = 0.5 x

Bond enthalpy of AB = x

ΔH_f° = x + 0.5 x – 2x = –2(200)

–0.5x = – 400

$x = \frac{400}{0.5} = 800 kJ / mol$

Bond enthalpy of A_2 = x = 800 kJ/mol

89. An organic compound gives 0.220 g of CO_2 and 0.126 g of H_2O on complete combustion. If the % of carbon is 24 then the % of hydrogen is _____$\times 10^{-1}$. (Nearest integer)

Sol. **56**

$$\% \text{ of carbon} = \frac{\frac{0.220}{44} \times 12}{x} \times 100$$

(x = mass of organic compound)

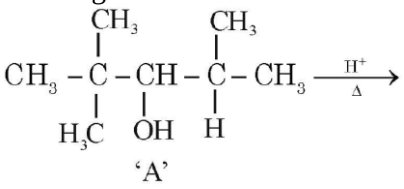
$24 = \frac{6}{x}$

x = 0.25 gm

$$\% \text{ of H} = \frac{\frac{0.126}{18} \times 2 \times 1}{0.25} \times 100$$

= 5.6 = 56 × 10^{-1}

90. For the given reaction



'A'

The total number of possible products formed by tertiary carbocation of A is_____.

Sol. **5**