JEE Main September 2020

Question Paper With Text Solution

4 September| Shift-1

CHEMISTRY

MATRIX

JEE Main & Advanced | XI-XII Foundation| VI-X Pre-Foundation

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JEE MAIN SEP 2020 | 4 SEP SHIFT-1

1. The elements with atomic numbers 101 and 104 belong to, respectively, :

(1) Actinoids and Group 6 (2) Actinoids and Group 4

(3) Group 6 and Actinoids (4) Group 11 and Group 4

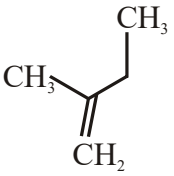
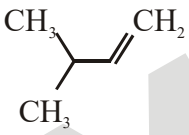
Ans. (2)

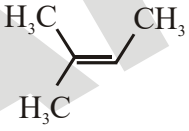
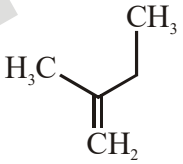
Sol. A (Z = 101) $\Rightarrow$ Actinoid

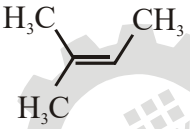
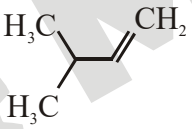
$\Rightarrow$ Actinoid having atomic no. 90 to 103

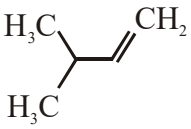
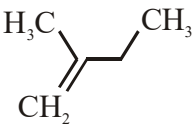
B (Z = 104) $\Rightarrow$ group 4^{th}.

2. When neopently alcohol is heated with an acid, it slowly converted into an 85 : 15 mixture of alkenes A and B, respectively.

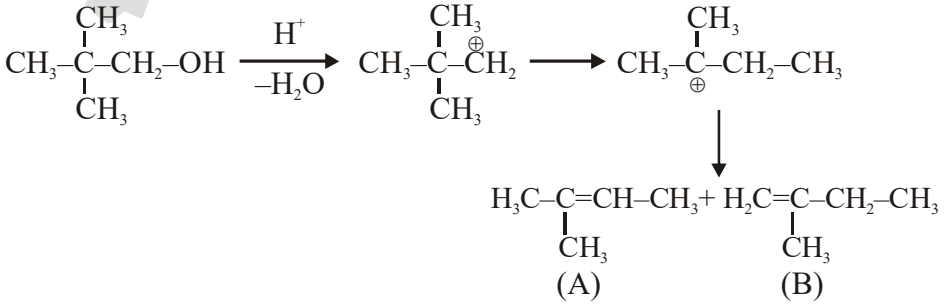
(1)  and 

(2)  and 

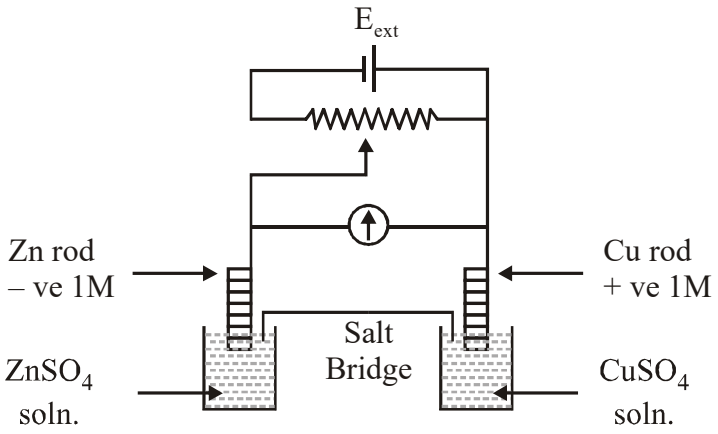
(3)  and 

(4)  and 

Ans. 2

Sol. 

3.



$E^{\circ}_{Cu^{2+}|Cu} = +0.34\,V$

$E^{\circ}_{Zn^{2+}|Zn} = -0.76\,V$

Identify the incorrect statement from the options below for the above cell :

(1) If $E_{ext} > 1.1$ V, Zn dissolves at Zn electrode and Cu deposits at Cu electrode

(2) If $E_{ext} > 1.1$ V, e^- flows from Cu to Zn

(3) If $E_{ext} = 1.1$ V, no flow of e^- or current occurs

(4) If $E_{ext} < 1.1$ V, Zn dissolves at anode and Cu deposits at cathode

Ans. 1

Sol. If EMF of external battery is more than 1.1 volt then current flows from Zn to Cu and electron flow direction is from Cu to Zn. Also Zn deposits at Zn electrode and Cu dissolves at Cu electrode

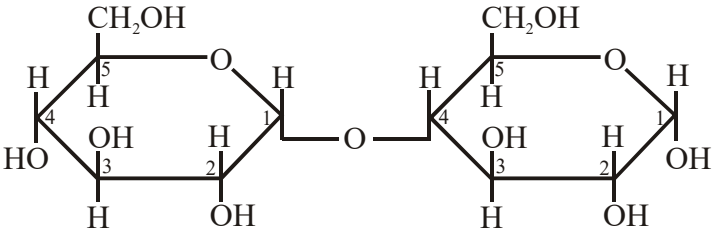
4. What are the functional groups present in the structure of maltose ?

(1) Two acetals (2) One acetal and one ketal

(3) One acetal and one hemiacetal (4) One ketal and one hemiketal

Ans. 3

Sol.



(I) α–D–Glucose (II) α–D–Glucose

Maltose

It contains one acetal and one hemiacetal group

5. The ionic radii of O^{2-}, F^-, Na^+ and Mg^{2+} are in the order :

(1) $F^- > O^{2-} > Na^+ > Mg^{2+}$ (2) $O^{2-} > F^- > Mg^{2+} > Na^+$

(3) $O^{2-} > F^- > Na^+ > Mg^{2+}$ (4) $Mg^{2+} > Na^+ > F^- > O^{2-}$

Ans. 3

Sol.

	O^{2-}	F^-	Na^+	Mg^{2+}
$\frac{Z}{e}$ =	$\frac{8}{10}$	$\frac{9}{10}$	$\frac{11}{10}$	$\frac{12}{10}$

Size of isoelectronic species $\propto \frac{1}{Z/e}$

$\frac{Z}{e} \uparrow$ size $\downarrow$

6. The pair in which both the species have the same magnetic moment (spin only) is :

(1) $[Co(OH)_4]^{2-}$ and $[Fe(NH_3)_6]^{2+}$ (2) $[Mn(H_2O)_6]^{2+}$ and $[Cr(H_2O)_6]^{2+}$

(3) $[Cr(H_2O)_6]^{2+}$ and $[CoCl_4]^{2-}$ (4) $[Cr(H_2O)_6]^{2+}$ and $[Fe(H_2O)_6]^{2+}$

Ans. 4

Sol. (1) $\left[Co(OH)_4\right]^{2-}, Co^{2+}(3d^7), e_g^{2,2}, t_{2g}^{1,1,1} n = 3$

$\left[Fe(NH_3)_6\right]^{2+}, Fe^{2+}(3d^6), t_{2g}^{2,1,1}\, e_g^{1,1}, n = 4$

(2) $\left[Mn(H_2O)_6\right]^{2+}, Mn^{2+}(3d^5), t_{2g}^{1.1,1} e_g^{1,1}, n = 5$

$\left[Cr(H_2O)_6\right]^{2+}, Cr^{2+}(3d^4), t_{2g}^{1.1,1} e_g^{1,0}, n = 4$

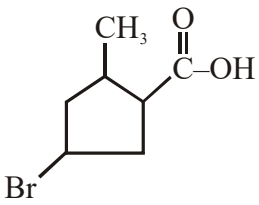
(3) $\left[Cr(H_2O)_6\right]^{2+}, Cr^{2+}(3d^4), t_{2g}^{1.1,1} e_g^{1,0}, n = 4$

$\left[COCl_4\right]^{2-}, CO^{2+}(3d^7), e_g^{2,2}, t_{2g}^{1,1,1}, n = 3$

(4) $\left[Cr(H_2O)_6\right]^{2+}, Cr^{2+}(3d^4), t_{2g}^{1.1,1} e_g^{1,0}, n = 4$

$\left[Fe(H_2O)_6\right]^{2+}, Fe^{2+}(3d^6), t_{2g}^{2,1,1}\, e_g^{1,1}, n = 4$

7. The IUPAC name of the following compound is :



(1) 3-Bromo-5-methylcyclopentane carboxylic acid

(2) 4-Bromo-2-methylcyclopentane carboxylic acid

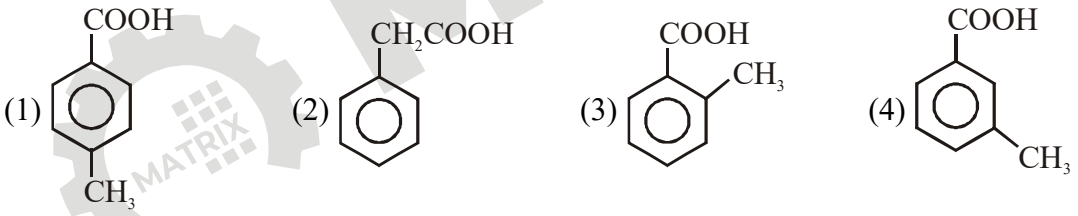
(3) 3-Bromo-5-methylcylopentanoic acid

(4) 5-Bromo-3-methylcyclopentanoic acid

Ans. 2

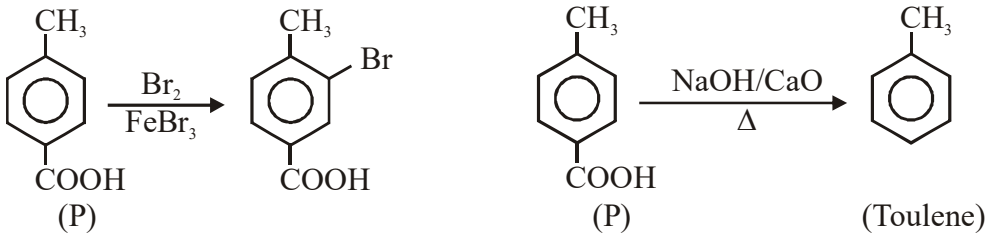
Sol. According to IUPAC Nomenclature rules carboxylic acid will get priority and bromo is written prior to methyl due to alphabetical order

8. [P] on treatment with $Br_2/FeBr_3$ in CCl_4 produced a single isomer $C_8H_7O_2Br$ while heating [P] with sodalime gave touene. The compound [P] is :

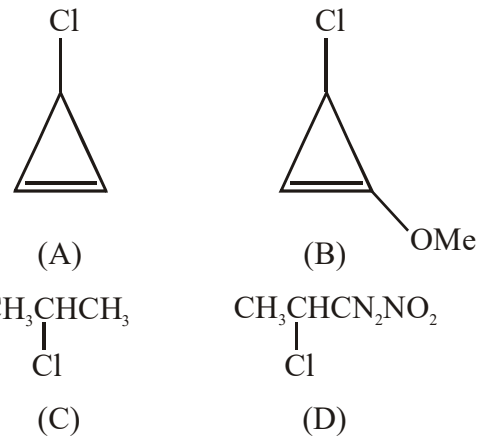


Ans. (1)

Sol.



9. The decreasing order of reactivity of the following organic molecules towards $AgNO_3$ solution is :



(1) (A) > (B) > (D) > (C)

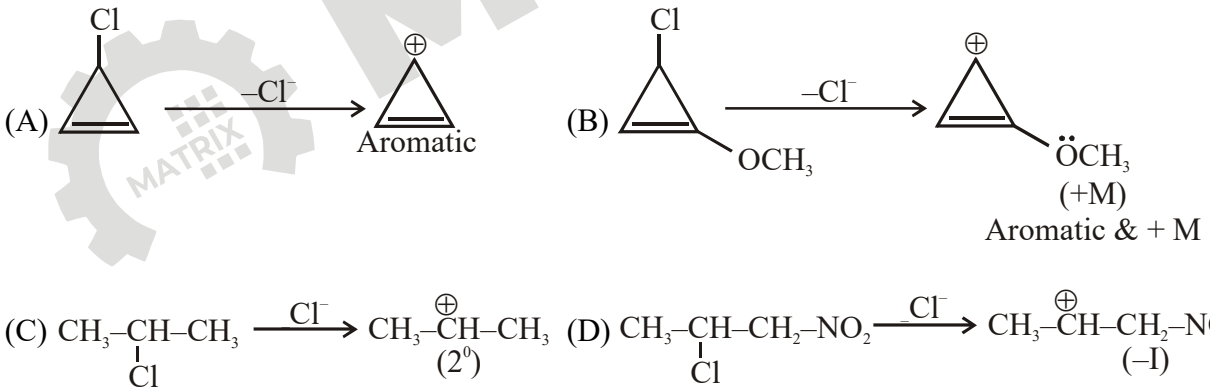
(2) (C) > (D) > (A) > (B)

(3) (B) > (A) > (C) > (D)

(4) (A) > (B) > (C) > (D)

Ans. (3)

sol. Reaction of Alkyl halide with $AgNO_3$ follow S_N1 reaction and rate of S_N1 reaction depend on stability of carbocation .



Reactivity order : B > A > C > D

10. Match the following :

(i) Foam	(a) smoke
(ii) Gel	(b) cell fluid
(iii) Aerosol	(c) jellies
(iv) Emulsion	(d) rubber
	(e) froth
	(f) milk

(1) (i)-(b), (ii)-(c), (iii)-(e), (iv)-(d) (2) (i)-(d), (ii)-(b), (iii)-(e), (iv)-(f)

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

Ans. (3)

Sol. Froth is foam, jellies are Gel, Smoke is Aerosol and Milk is Emulsion according colloidal solution

11. Among statements (a) - (d), the correct ones are :

(a) Lime stone is decomposed to CaO during the extraction of iron from its oxides.

(b) In the extraction of silver, silver is extracted as an anionic complex

(c) Nickel is purified by Mond's process.

(d) Zr and Ti are pruified by Van Arkel method

(1) (a), (c) and (d) only (2) (c) and (d) only

(3) (a), (b), (c) and (d) (4) (b), (c) and (d) only

Ans. (3)

Sol. * All are correct statements

(a) $(CaCO_3)$ limestone $\xrightarrow{1000^\circ C}$ CaO (Basic flux) + CO_2

(b) $Ag + 2NaCN \longrightarrow Na\left[Ag(CN)_2\right]$ Soluble complex.

(c) Ni impure $+ 4CO \xrightarrow[50°C]{\Delta} \left[Ni(CO)_4\right] \xrightarrow{250°}$ Ni + 4CO (Pure)

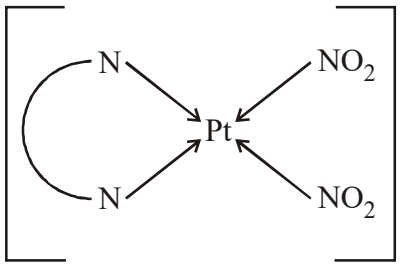
(d) $M + 2I_2 \longrightarrow MI_4 \xrightarrow{\Delta} M + 2I_2$ (M = Ti/Zr) (Pure)

12. The number of isomers possible for $[Pt(en)(NO_2)_2]$ is :

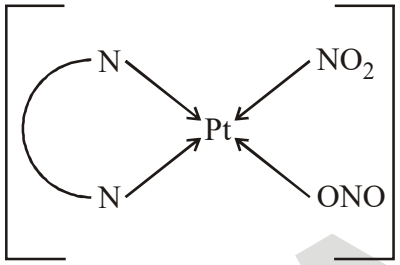
(1) 1 (2) 4 (3) 2 (4) 3

Ans. (4)

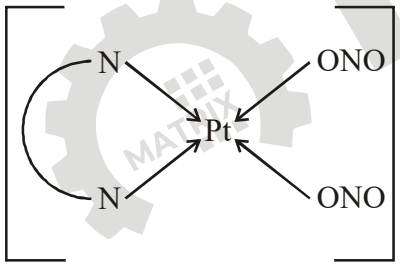
Sol. Donor atoms of NO_2 ligands



N, N



N, O



O, O

13. On heating, lead(II) nitrate gives a brown gas (A). The gas (A) on cooling changes to a colourless solid/liquid (B). (B) on heating with NO changes to a blue solid (C). The oxidation number of nitrogen in solid (C) is :

(1) + 5 (2) + 4 (3) + 3 (4) + 2

Ans. (3)

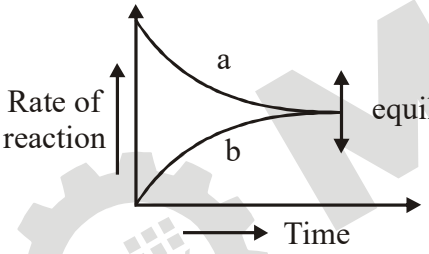
Sol. $Pb(NO_3)_2 \xrightarrow{\Delta} PbO(s) + \underset{\text{Brown gas (X)}}{2NO_2\uparrow} + \frac{1}{2}O_2\uparrow$

$2NO_2 \xrightarrow{\text{Cooling}} \underset{\text{(Y)}}{N_2O_4}$

$2NO + N_2O_4 \longrightarrow \overset{+3}{2N_2O_3}$ (blue solid/liquid)

(Z)

14. For the equilibrium A $\rightleftharpoons$ B, the variation of the rate of the forward (a) and reverse (b) reaction with time is given by :

(1)


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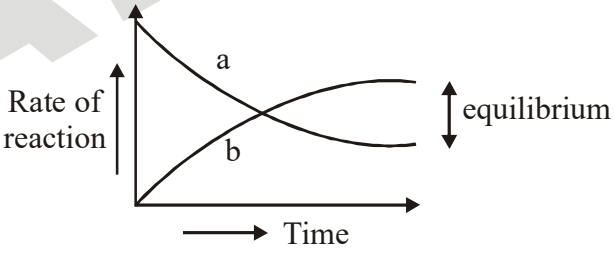

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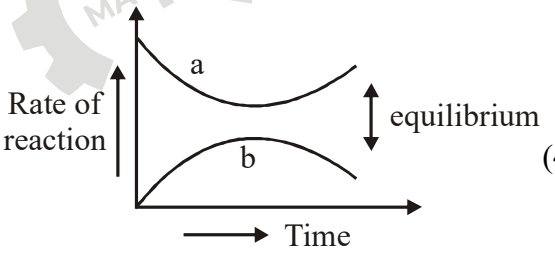
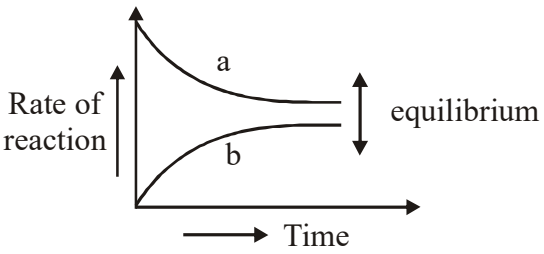


(4)


Ans. (1)

Sol. At equilibrium, rate of forward reaction = Rate of backward reaction.

15. Which of the following will react with $CHCl_3$ + alc. KOH ?

(1) Thymine and proline

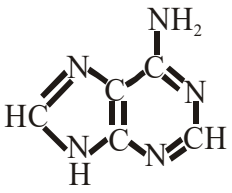
(2) Adenine and thymine

(3) Adenine and proline

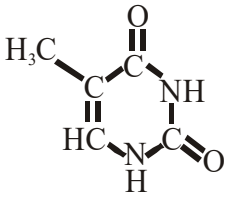
(4) Adenine and lysine

Ans. (4)

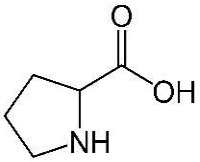
Sol.



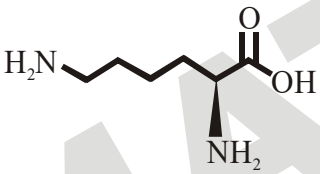
Adenine (A)



Thymine (T)



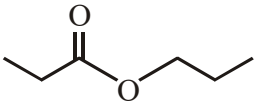
Proline

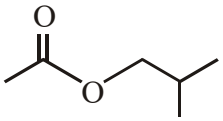


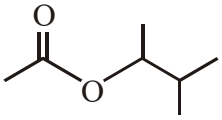
Lysine

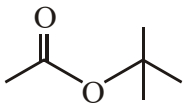
Adenine and lysine contain NH_2 group therefore they will give reaction with $CHCl_3$ + KOH

16. An organic compound (A) (molecular formula $C_6H_{12}O_2$) was hydrolysed with dil. H_2SO_4 to give a carboxylic acid (B) and and alcohol (C). 'C' gives white turbidity immediately when treated with anhydrous $ZnCl_2$ and conc. HCl. The organic compound (A) is :

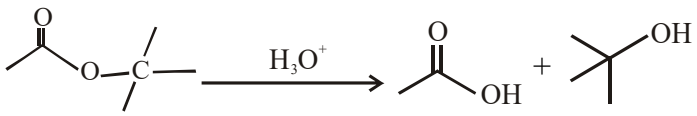
(1) 

(2) 

(3) 

(4) 

Ans. (4)

Sol. 

(A) (B) (C)

17. For one mole of an ideal gas, which of these statements must be true ?

(a) U and H each depends only on temperature

(b) Compressibility factor z is not equal to 1

(c) $C_{P,m} - C_{V,m} = R$

(d) $dU = C_V dT$ for any process

(1) (a), (c) and (d) (2) (a) and (c) (3) (c) and (d) (4) (b), (c) and (d)

Ans. (1)

Sol. For ideal gas U and H are function of Temprature $U = \frac{f}{2}nRT$ and $H = U + PV$

$C_P - C_V = R$

$\Delta U = nC_V dT$ for all processes $n = 1$

18. On combustion of Li, Na and K in excess of air, the major oxides formed, respectively, are :

(1) Li_2O, Na_2O and K_2O_2 (2) Li_2O, Na_2O_2 and KO_2

(3) Li_2O, Na_2O_2 and K_2O_2 (4) Li_2O, Na_2O_2 and K_2O

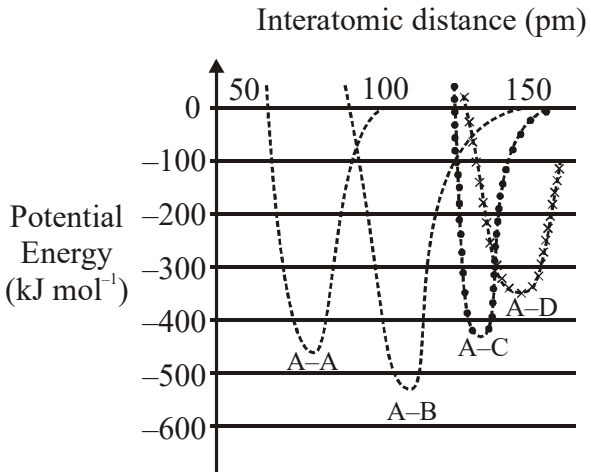
Ans. (2)

Sol. $Li(s) + \frac{1}{2} O_2(g) \xrightarrow{\Delta} Li_2O$
(Normal oxide)

$2Na(s) + O_2(g) \xrightarrow{\Delta} Na_2O_2$
(per oxide)

$K(s) + O_2(g) \xrightarrow{\Delta} KO_2$
(super oxide)

19. The intermolecular potential energy for the molecules A, B, C and D given below suggests that :



(1) A-B has the stiffest bond.

(2) D is more electronegative than other atoms.

(3) A-D has the shortest bond length.

(4) A-A has the largest bond enthalpy.

Ans. (1)

Sol. Bond enthalpy of AB bond is highest so A-B bond is more strong and B is highest electronegative atom.

Order of bond length $\Rightarrow$ A–A < A – B < A – C < A –D

20. The region in the electromagnetic spectrum where the Balmer series lines appear is :

(1) Ultraviolet (2) Visible (3) Microwave (4) Infrared

Ans. (2)

Sol. In hydrogen spectrum maximum lines of Balmer series lies in visible region.

21. A 20.0 mL solution containing 0.2 g impure H_2O_2 reacts completely with 0.316 g of $KMnO_4$ in acid solution. The purity of H_2O_2 (in %) is_____ (mol. wt. of $H_2O_2 = 34$; mol. wt. of $KMnO_4 = 158$)

Ans. 85

Sol. Let mass of pure H_2O_2 is x gram

+7	–1			0
MnO_4^- +	H_2O_2	$\rightarrow$	Mn^{2+} +	O_2
n-factor	5		2	

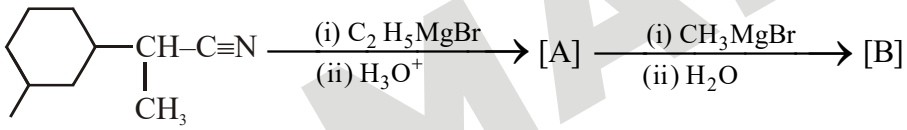
Eq. of H_2O_2 = Eq. of MnO_4^-

$$\left[\frac{x}{34}\right]2 = \left[\frac{0.316}{158}\right]5$$

$x = 0.17$

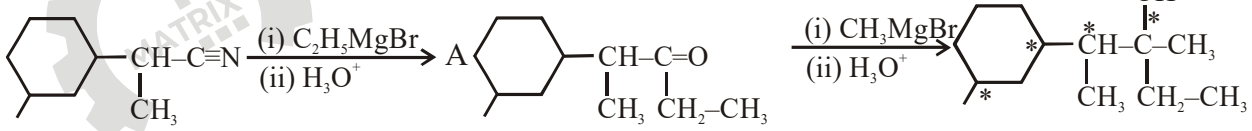
So, % purity of H_2O_2 solution $= \frac{0.17}{0.2} \times 100 = 85\%$

22. The number of chiral centres present in [B] is _____.



Ans. 4

Sol.



* represent chiral carbon which are 4

23. The mass of ammonia in grams produces when 2.8 kg of dinitrogen quantitatively reacts with 1 kg of dihydrogen is_____.

Ans. 3400

Sol.

	N_2	+ $3H_2$	$\rightarrow$	$2NH_3$
Number of mole initially	$\frac{2800}{28} = 100$	$\frac{1000}{2} = 500$		0
Number of mole finally	0	200		200

mass of NH_3 Produced = $200 \times 17 = 3400$ gram

24. At 300 K, the vapour pressure of a solution containing 1 mole n-hexane and 3 moles of n-heptane is 550 mm of Hg. At the same temperature, if one more mole of n-heptane is added to this solution, the vapour pressure of the solution increases by 10 mm of Hg. What is the vapour pressure in mm Hg of n-neptane in its pure state_____ ?

Ans. 600

Sol. $550 = P^0_{hep} \times \frac{3}{4} + P^0_{hex} \times \frac{1}{4}$ ----------(1)

$560 = P^0_{hep} \times \frac{4}{4} + P^0_{hex} \times \frac{1}{5}$ ---------(2)

solving equation 1 and 2

$P^0_{hep} = 600$ mm of Hg.

25. If 75% of a first order reaction was completed in 90 minutes, 60% of the same reaction would be completed in approximately (in minutes) _____.

(Take : log 2 = 0.30 ; log 2.5 = 0.40)

Ans. 60

Sol. $90 = \frac{2.303}{k}\log\frac{100}{25}$ -------- (1) $t = \frac{2.303}{k}\log\frac{100}{40}$ ----------(2)

Divide equation 1 by 2

$\frac{90}{t} = \frac{\log 4}{\log 2.5}$

t = 60 mins.