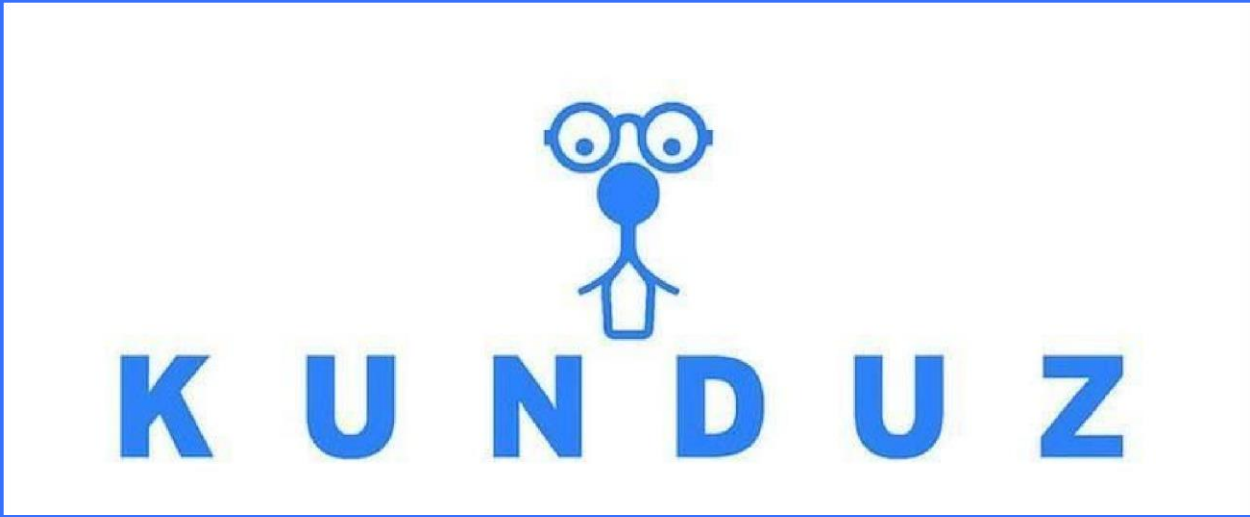


JEE Mains 4th September 2020 shift 1 Chemistry solutions prepared by KUNDUZ tutors

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Question number

Question and Answers

1

1) Elements with atomic number 101 and 104 belongs respectively to

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

(3) group 11 and group 6 (4) group (7) and group (8)

Soln: option (1)

Actinoids contains 14 elements from Ac^{89} to Lr^{103}.

So 101 element belongs to actinoid series of group 3.

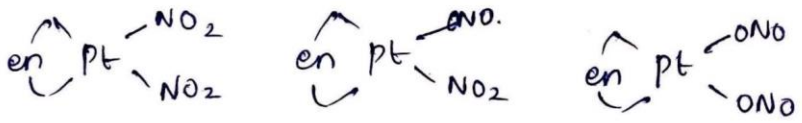
and 104 element belongs to group 4.

2

2) Find total possible number of isomers for the complex $[Pt(en)(NO_2)_2]$

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

Soln: option (2)



3

3) Match List - I with List - II and select the correct using the code given below the list.

	List I	List II
a)	Foam	i) Smoke
b)	Gel	(ii) Gem stone
c)	Aerosol	(iii) Froath
d)	Emulsions	(iv) Jelly
		(v) Rubber
		(vi) Milk

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

(2) a-iii , b-iv , c-(v) , d-vi

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

4) a-iii b-ii c-i d-vi

Soln: option (1)

Foam - dispersed phase (Gas) dispersed medium (Liquid) eg: Froath, whipped Cream etc.

Gel - Liquid in Solid sol eg: Cheese, Jelly, Butter

Aerosol - Solid in Gas sol eg: Smoke, dust.

Emulsions - Liquid in Liquid sol eg: Milk, hair cream.

4

4. Correct Order of ionic radii in O^{2-}, F^-, Mg^{2+}, Na^+.

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

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

Soln: option (3)

All the given species are Isoelectronic to each other. Isoelectronic species have same number of electrons. O^{2-}, F^-, Mg^{2+} and Na^+ have 10 electrons.

Greater the Z_{eff}, smaller is the radius

Order: $O^{2-} > F^- > Na^+ > Mg^{2+}$

5

5) which oxides are formed on heating Li, Na, K in excess of O_2

(1) Li_2O, Na_2O_2, KO_2 (2) Li_2O, Na_2O_2, K_2O

(3) Li_2O, Na_2O, K_2O (4) Li_2O_2, Na_2O_2, K_2O_2.

Soln: option (1)

On heating in excess air, Li form oxide sodium form peroxide while K, Rb, Cs form superoxide

$$4Li + O_2 \xrightarrow{\text{(excess)}} 2Li_2O$$

$$2Na + O_2 \xrightarrow[\text{(excess)}]{} Na_2O_2$$

$$K + O_2 \xrightarrow[\text{(excess)}]{} KO_2$$

(superoxide)

6

b) which of the following have same magnetic moment (spin only)

1) $[Cr(H_2O)_6]^{2+}$, $[Fe(H_2O)_6]^{2+}$ ② $[Cr(H_2O)_6]^{2+}$ $[CoCl_4]^{2-}$

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

Soln: option (1)

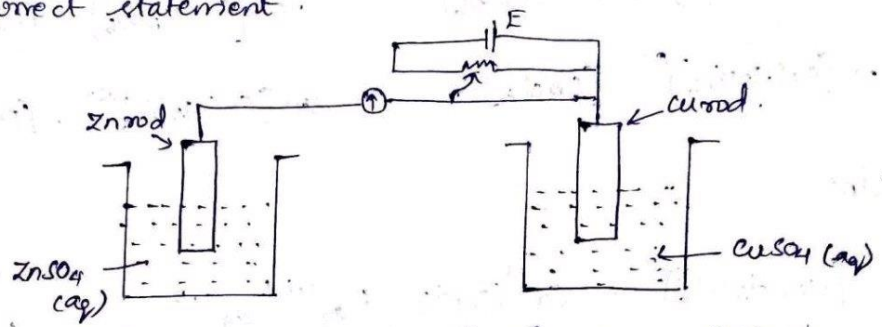
	no. of unpaired e⊖
$[Cr(H_2O)_6]^{2+} - Cr^{2+}(3d^4) = t_{2g}^{1,1,1}\, eg^{1,0}$	4
$[Fe(H_2O)_6]^{2+} - Fe^{2+}(3d^6) = t_{2g}^{2,1,1}\, eg^{1,1}$	4
$[CoCl_6]^{2-} = Co^{4+}(3d5) = t_{2g}^{1,1,1}\, eg^{1,1}$	5
$[Co(H_2O)_6]^{2+} - Co^{2+}(3d^7) = t_{2g}^{2,2,1}\, eg^{1,1}$	3
$[CoCl_4]^{2-} - Co^{2+}(3d^7) = t_{2g}^{2,2,1}\, eg^{1,1}$	3.

So $[Cr(H_2O)_6]^{2+}$ and $[Fe(H_2O)_6]^{2+}$ have same magnetic moment ($\because$ no. of unpaired e⊖ are same) and.

$[CoCl_4]^{2-}$ and $[Co(H_2O)_6]^{2+}$ have same magnetic moment.

7

7) For the given cell arrangement identify incorrect statement.



Given $(E^\circ_{Cu^{2+}/Cu}) = 0.34V$ & $E^\circ_{Zn^{2+}/Zn} = -0.76V$.

(1) At $E = 1.1\,V$ no electron will flow

(2) At $E > 1.1\,V$ electron will flow from Cu to Zn

(3) At $E < 1.1\,V$ Zn will dissolve and Cu will deposit

4) At $E < 1.1\,V$ Zn will deposit and Cu will dissolve

Soln: option (4)

$$E^\circ_{cell} = E^\circ_{Cu^{2+}/Cu} - E^\circ_{Zn^{2+}/Zn}$$

$$= 1.1\,V$$

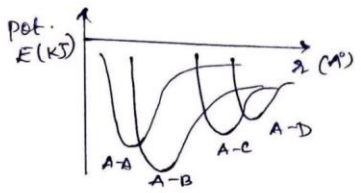
So if $E = 1.1\,V$ no electron will flow.

At $E > 1.1\,V$ Cell → electrolytic cell, $e^\ominus$ flow from Cu to Zn

$E < 1.1\,V$ Cell → electrochemical cell & Cu deposited, Zn will dissolve

8

8) Using following potential energy graph identify correct option.



(1) D has highest electronegativity

(2) A-B has most stiff bond.

(3) A-D has minimum bond length

(4) Bond length of A-B bond is greater than A-C Bond.

Soln: option (2)

Bond enthalpy of A-B bond is highest. So A-B bond is more strong and B is highest electronegative atom.

order of Bond length: A-D > A-C > A-B > A-A.

9

9) When Lead (II) nitrate is heated a brown gas 'B' is evolved. this gas 'B' on cooling give a colourless solid 'C'. Gas 'B' on reaction with NO forms a blue solid 'D'. Find oxidation state of 'N' in D.

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

Soln: option (2)

$Pb^{2+}(NO_3)_2 \xrightarrow{\Delta} PbO + 2NO_2\uparrow$ (brown)

Lead Nitrate — Lead oxide (B)

$2NO_2 \xrightarrow{\text{cooling}} N_2O_4$ (Dinitrogen tetroxide)

(C) colourless

$NO_2 + NO \longrightarrow N_2O_3$ (Dinitrogen trioxide)

(D) Blue

$N_2O_3 \Rightarrow 2x + 3(-2) = 0$

$2x = 6$

$x = 6/2 = 3$ Oxidation state = +3

10

10) Select the correct set of following statements.

(a) In metallurgy of iron, lime stone is converted to CaO

(b) Silver is extracted as anionic complex.

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

(d) Zr and Ti are purified by Van Arkel process.

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

Soln: Option (4) All statements are correct.

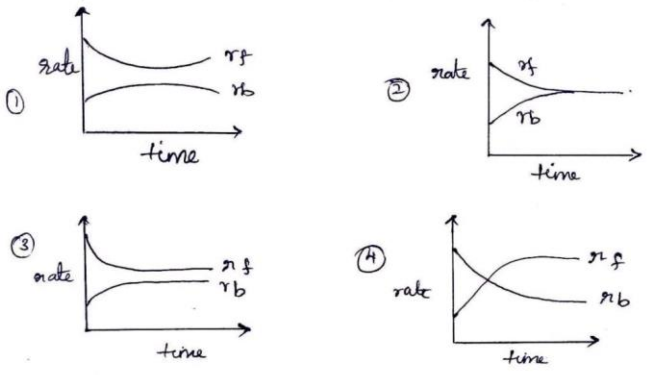
$$\underset{\text{(limestone)}}{CaCO_3} \longrightarrow CaO + CO_2.$$

$$\underset{\text{(ore)}}{Ag_2S} + 4NaCN \rightleftharpoons \underset{\text{(anionic complex)}}{2Na[Ag(CN)_2]} + Na_2S$$

11

11) At equilibrium for a reaction $A \rightleftharpoons B$.

Correct representation is (r_f - Rate of forward reaction, r_b = rate of backward reaction)



Soln: option (2)

At equilibrium rate of forward reaction = rate of backward reaction

$r_f = r_b$.

12

12. In which region lines of Balmer series lie

(1) Visible (2) Infrared (3) Ultraviolet (4) Radio wave.

Soln: option (1)

In Hydrogen spectrum, lines of Balmer series lie in the visible region.

Note:

Lyman series lie in ultraviolet region.

Paschen - near infrared

Brackett series - Far infrared region

Pfund series - far infrared region

13

13. For 1 mole of ideal gas which of the following statements must be true.

a) U and H depends only on temperature

b) Compressibility factor (z) cannot be 1

c) $C_p - C_v = R$

d) $\Delta U = C_v dT$ for all processes.

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

Soln: option (1)

For an ideal gas, ΔH and U depends on temperature.

$C_p - C_v = R$ - where R is gas constant.

$\Delta U = C_v dT$

$\Delta H = C_p dT$.

Note: Compressibility factor (z) for an ideal gas = 1.

14

4) 20 mL of 0.2 g H_2O_2 (impure) reacts with (completely) 0.316 g $KMnO_4$. find percentage purity of H_2O_2

[Given Mol. Mass H_2O_2 = 34 & $KMnO_4$ = 158]

Soln:

$$\underset{(+7)}{MnO_4^-} + \underset{(-1)}{H_2O_2} \longrightarrow \underset{(+2)}{Mn^{2+}} + \underset{(0)}{O_2}$$

Let mass of pure H_2O_2 be x g.

Equivalent of H_2O_2 = Eq. of MnO_4^-

n factor = no. of electrons involved or change in oxidation state.

For MnO_4^- (n) = 5

(H_2O_2) n = 2.

$$\frac{x}{34} \times 2 = \frac{0.316}{158} \times 5 \Rightarrow x = 0.17\ g$$

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

15

15) A reaction 75% complete in 90 min. find the time (in min) taken to complete 60% of the reaction.
[given $\log 2 = 0.3$, $\log 2.5 = 0.4$]

Soln:

$$k = \frac{2.303}{t} \log\left(\frac{100}{100-x}\right)$$

$$t_{75\%} = \frac{2.303}{k} \log\left(\frac{100}{100-75}\right)$$

$$t_{75\%} = 90 = \frac{2.303}{k} \log\left(\frac{100}{25}\right) = \frac{2.303}{k} \log 4 \quad \text{—(1)}$$

$$t_{60\%} = \frac{2.303}{k} \log\left(\frac{100}{100-60}\right) = \frac{2.303}{k} \log\left(\frac{100}{40}\right)$$

$$\frac{t_{75\%}}{t_{60\%}} = \frac{90}{t_{60\%}} = \frac{\log 4}{\log 2.5}$$

$$\frac{90}{t_{60\%}} = \frac{\log (2)^2}{\log 2.5} = \frac{2\log 2}{\log 2.5}$$

$$\frac{90}{t_{60\%}} = \frac{2 \times 0.3}{0.4}$$

$$\boxed{t_{60\%} = 60 \text{ min.}}$$

16

16) In the preparation of ammonia, mass of N_2 taken is 2.5kg and mass of H_2 taken is 1kg. Find mass of ammonia formed (in gram).

Soln:

$$N_2 + 3H_2 \longrightarrow 2NH_3$$

No. of moles = $\frac{\text{Mass}}{\text{Mol. wt}}$

Mole of $N_2 = \frac{2500g}{28} = \frac{625}{7} = 89.28$

Mole of $H_2 = \frac{1000g}{2} = 500$

$$N_2 + 3H_2 \longrightarrow 2NH_3$$

(Limiting reagent = N_2)

	N_2	$3H_2$	$2NH_3$
Initially	89.28 mol	500 mol	0
Final mole	0	(500 − 3(89.28))	(2 × 89.28)

Mass of NH_3 formed = No. of moles × Mol. wt

$= 2 \times 89.28 \times 17$

Ans = 3035.52 g.

17

17) Vapour pressure of solution obtained by mixing 1 mole of n hexane and 3 mole of n-heptane is 550 mm of Hg. On mixing 1 mole n-heptane, vapour pressure of solution increases by 10 mm Hg. Find the vapour pressure of pure n-heptane (in mm of Hg).

Soln:

$$P_{total} = P^{\circ}_{hex} X_{hex} + P^{\circ}_{hep} X_{hep}$$

where X = mole fraction = $\frac{\text{no. of moles}}{\text{Total no. of moles}}$

Total no. of moles: 1+3=4

$X_{hex} = \frac{1}{4}$

$x_{hep} = \frac{3}{4}$

$$550\ (P_{total}) = (P^{\circ}_{hex})\frac{1}{4} + P^{\circ}_{hept} \times \frac{3}{4} \quad \text{—(1)}$$

After adding 1 mole of n-heptane.

Total no. of moles = 4+1 = 5.

$X_{hex} = \frac{1}{5}$; $X_{hep} = \frac{4}{5}$.

$$560\ (P_{total}) = (P^{\circ}_{hex})\frac{1}{5} + P^{\circ}_{hept} \times \frac{4}{5} \quad \text{—(2)}.$$

(1) − (2), we get

$$550-560 = \left(\frac{P^{\circ}_{hex}}{4} + \frac{3P^{\circ}_{hep}}{4}\right) - \left(\frac{P^{\circ}_{hex}}{5} + \frac{4P^{\circ}_{hep}}{5}\right)$$

On solving:

$P^{\circ}_{hex} = P^{\circ}_{hept} - 200$ —(3) sub (3) in (1).

$$550 = \frac{P^{\circ}_{hept} - 200}{4} + \frac{3P^{\circ}_{hep}}{4}$$

On solving,

$P^{\circ}_{heptane}$ = 600 mm of Hg

18

18) Neopentyl alcohol on reaction with conc. H_2SO_4 forms two alkenes A & B in the ratio (85 : 15). Then Alkenes A & B respectively are

(1) $CH_3-\underset{\underset{CH_2}{\|}}{C}-CH_2CH_3$, $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!C=CH-CH_3$

(2) $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!C=CH-CH_3$, $CH_3-\underset{\underset{CH_2}{\|}}{C}CH_2CH_3$

(3) $CH_3-\underset{CH_3}{\underset{|}{CH}}-CH=CH_2$, $CH_3-\underset{CH_3}{\underset{|}{C}}=CH-CH_3$

(4) $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!C=CH-CH_3$, $CH_3-\underset{CH_3}{\underset{|}{CH}}-CH=CH_2$

Soln: option (2)

$$CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-CH_2-OH \xrightarrow[H^{\oplus}]{\text{conc. } H_2SO_4} CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-CH_2-\overset{\oplus}{O}H_2$$

neopentyl alcohol

$$\downarrow$$

$$H_3C-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-\overset{\oplus}{C}H_2 + H_2O$$

(1°)

$$\updownarrow \text{ rearrangement}$$

$$CH_2=\underset{(B)}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-CH_2CH_3 + CH_3-\underset{(A)}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}=CH-CH_3 \xleftarrow{-H^{\oplus}} CH_3-\underset{\oplus}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-CH_2-CH_3$$

(3°)

(minor) (major)

(More substituted alkene)

19

(19) Aqueous $AgNO_3$ is reacted with the following compounds. Find the order of reactivity.

(A) 

(B) 

(C) $CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3$

(D) $CH_3\underset{\underset{Cl}{|}}{CH}CH_2NO_2$

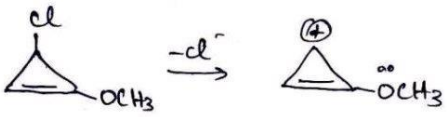
(1) A > B > C > D (2) B > A > C > D (3) B > A > D > C (4) A > B > C > D

Soln: Option (2)

Reaction of aq. $AgNO_3$ with alkyl halides follows S_N1 mechanism. In S_N1 reactions, Rate of reaction $\propto$ Stability of carbocation.

(A) 

(aromatic)

(B) 

(aromatic & +M effect).

(C) $CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3 \xrightarrow{-Cl^-} CH_3\overset{+}{C}H-CH_3$ (2°)

(D) $CH_3\underset{\underset{Cl}{|}}{CH}CH_2NO_2 \xrightarrow{-Cl^-} CH_3\overset{+}{C}H-CH_2NO_2$

(2°) (-I effect)

-I effect destabilizes the carbocation.

Stability order: B > A > C > D.

Reactivity order: B > A > C > D.

20

20) Which of the following is the correct statement for maltose?

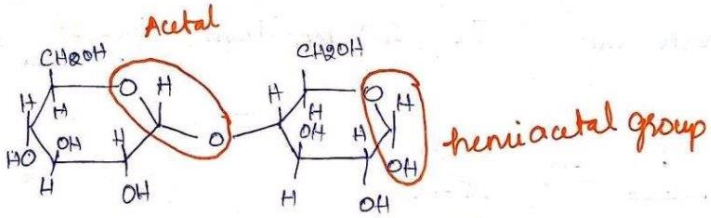
(1) It has one ketal and heniketal group.

(2) It has one acetal and one hemiacetal group.

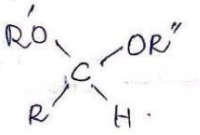
(3) It has two acetal group.

(4) It has one ketal and one heniketal group.

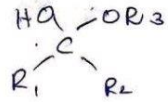
Soln: Option (2)



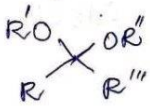
Acetal group –



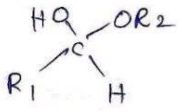
heniketal group –



ketal group –

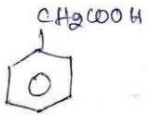


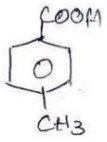
hemiacetal group –

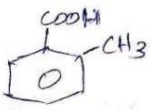


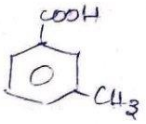
21

21) A compound (x) on reaction with $Br_2/FeBr_3$ in CCl_4 gives only a single isomer $(C_8H_7O_2Br)$. (X) on heating with soda lime gives Toluene. Find the structure of X.

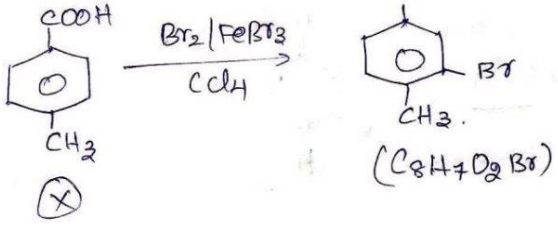
(1) 

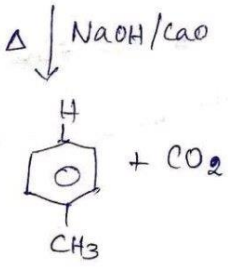
(2) 

(3) 

(4) 

Soln: Option (2)





If X gives Toluene on heating with sodalime, then X should be methyl substituted benzoic acid. Because sodalime is a decarboxylating agent

22

22) Which of the following reacts with alc. KOH & $CHCl_3$.

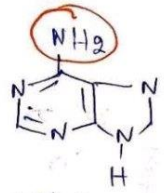
(1) Adenine & proline (2) Adenine & Thiamine

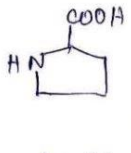
(3) Adenine & Lysine (4) Cytosine & proline.

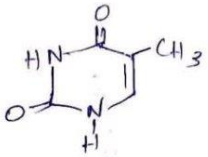
Soln: Option (3)

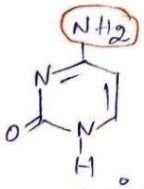
Reaction with $CHCl_3$ & alc. KOH (carbylamine reaction) is the identification test for presence of 1° amines.

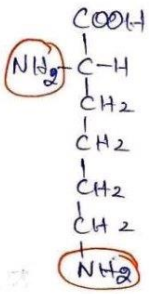
Structures:


Adenine


proline


Thymine

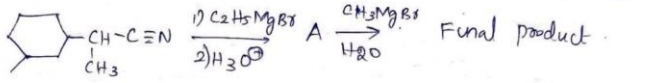

cytosine


(lysine)

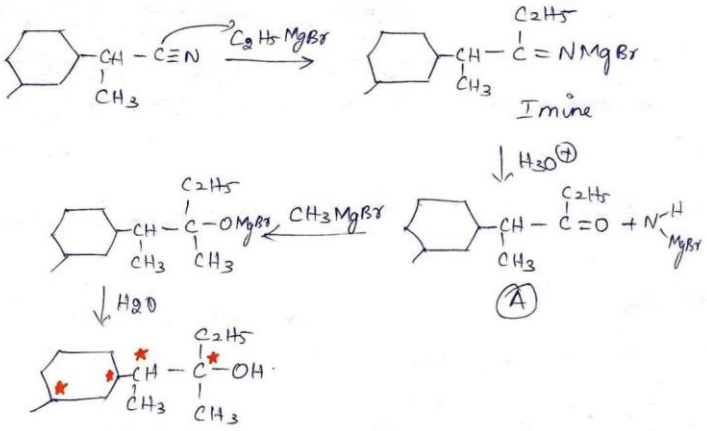
So Adenine, cytosine and lysine answers carbylamine reaction

23

23) Find the number of chiral centres in the final product



Soln: ~~Option~~ (4)

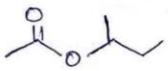
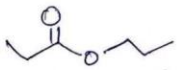
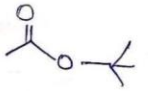
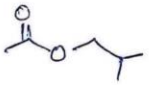


Ans: 4 chiral centres.

24

24) $P(C_6H_{12}O_2)$ undergoes acidic hydrolysis to give Q (an acid) and R (an alcohol). R gives Lucas test immediately.

Then P can be.

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

Soln: Option (3)

3° alcohols gives Lucas Test immediately. So R should be 3° alcohol.

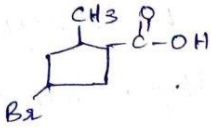


This part will be obtained as alcohol.

3° alcohol. (gives immediate turbidity in Lucas Test).

25

25) The IUPAC name of the following compound is.



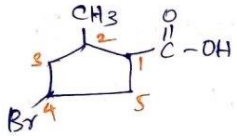
(1) 3-Bromo 5-methyl cyclopentane

(2) 3- Bromo - 5-methyl cyclopentanoic acid.

(3) 5-Bromo-5-methyl cyclopentanoic

(4) 4-Bromo - 2-methyl cyclopentane carboxylic acid.

Soln: Option (4)



Functional group = $-\overset{O}{\overset{\|}{C}}-OH$ carboxylic acid (parent name)

Substituents = Br, CH_3.

Carbon chain = cyclopentane

IUPAC: 4-Bromo - 2 - methyl cyclopentane carboxylic acid

Note: If two substituents are present, then it should be written in alphabetical order.

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