FINAL JEE–MAIN EXAMINATION – JANUARY, 2023
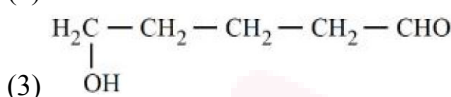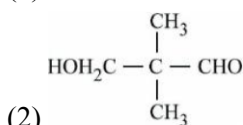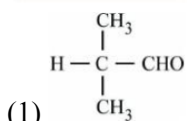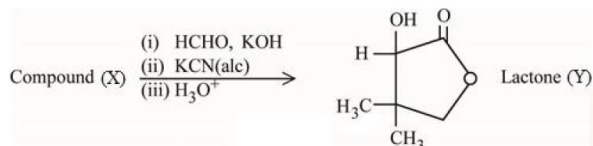### Held On Tuesday 24th January, 2023
TIME : 09:00 AM to 12:00 PM

SECTION-A

31. Compound (X) undergoes following sequence of reactions to give the Lactone (Y).

(1)

(2)

(3)

(4)

Official Ans. by NTA (1)

Ans. (1)

Sol.
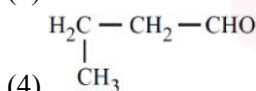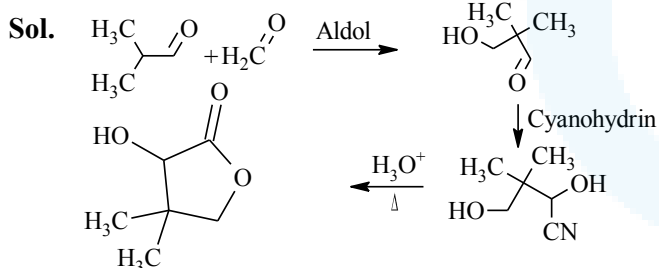
32. **Assertion A :** Hydrolysis of an alkyl chloride is a slow reaction but in the presence of NaI, the rate of the hydrolysis increases.

Reason R : I^- is a good nucleophile as well as a good leaving group.

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

(1) A is false but R is true

(2) A is true but R is false

(3) Both A and R are true and R is the correct explanation of A

(4) Both A and R are true but R is NOT the correct explanation of A

Official Ans. by NTA (3)

Ans. (3)

Sol. The rate of hydrolysis of alkyl chloride improves because of better Nucleophilicity of I^-.

33. Order of Covalent bond;

A. $KF > KI$; $LiF > KF$

B. $KF < KI$; $LiF > KF$

C. $SnCl_4 > SnCl_2$; $CuCl > NaCl$

D. $LiF > KF$; $CuCl < NaCl$

E. $KF < KI$; $CuCl > NaCl$

(1) C, E only   (2) B, C only

(3) B, C, E only   (4) A, B only

Official Ans. by NTA (3)

Ans. (3)

Sol. According to Fajan's Rule,

A. $KF > KI$ – False; $LiF > KF$ – True

B. $KF < KI$ – True; $LiF > KF$ – True

C. $SnCl_4 > SnCl_2$ – True; $CuCl > NaCl$ – True

D. $LiF > KF$ – True; $CuCl < NaCl$ – False

E. $KF < KI$ – True; $CuCl > NaCl$ – True

34. Increasing order of stability of the resonance structure is :

A.

B.

C.

D.
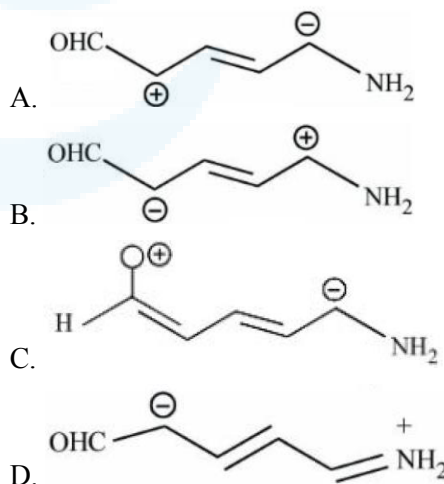
(1) C, D, B, A

(2) C, D, A, B

(3) D, C, A, B

(4) D, C, B, A

Official Ans. by NTA (2)

Ans. (BONUS)

Sol. No option is matching the correct answer.

Order should be : $C < A < B < D$

35. The magnetic moment of a transition metal compound has been calculated to be 3.87 B.M. The metal ion is

(1) Cr^{2+} (2) Mn^{2+}
(3) V^{2+} (4) Ti^{2+}

Official Ans. by NTA (3)

Ans. (3)

Sol. Cr^{+2} : [Ar], $3d^4$, $4s^0$ n = 4, $\mu = \sqrt{4(4+2)} = \sqrt{24}$
= 4.89 BM

Mn^{+2} : [Ar], $3d^5$, $4s^0$ n = 5, $\mu = \sqrt{5(5+2)} = \sqrt{35}$
= 5.91 BM

V^{+2} : [Ar], $3d^3$, $4s^0$ n = 3, $\mu = \sqrt{3(3+2)} = \sqrt{15}$
= 3.87 BM

Ti^{+2} : [Ar], $3d^2$, $4s^0$ n = 2, $\mu = \sqrt{2(2+2)} = \sqrt{8}$
= 2.82 BM

36. Match List I with List II.

	LIST I		LIST II
A.	Reverberatory furnace	I.	Pig Iron
B.	Electrolytic cell	II.	Aluminum
C.	Blast furnace	III.	Silicon
D.	Zone Refining furnace	IV.	Copper

(1) A – IV, B – II, C – I, D – III
(2) A – I, B – IV, C – II, D – III
(3) A – I, B – III, C – II, D – IV
(4) A – III, B – IV, C – I, D – II
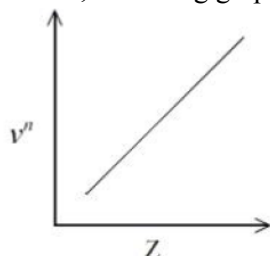
Official Ans. by NTA (1)

Ans. (1)

Sol. Reverberatory furnace: Used for roasting of Copper.
Electrolytic cell : For reactive metal : Al
Blast furnace : Hematite to Pig Iron
Zone Refining furnace: For semiconductors : Si

37. It is observed that characteristic X-ray spectra of elements show regularity. When frequency to the power 'n' i.e. v^n of X-rays emitted is plotted against atomic number 'Z', following graph is obtained.

The value of 'n' is

(1) 1 (2) 2
(3) $\dfrac{1}{2}$ (4) 3

Official Ans. by NTA (3)

Ans. (3)

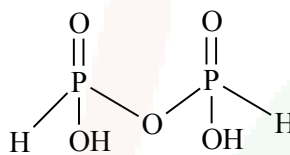**Sol.** According to Henry Moseley $\sqrt{v}$ α z – b

So n = $\dfrac{1}{2}$

38. Which of the Phosphorus oxoacid can create silver mirror from $AgNO_3$ solution ?

(1) $(HPO_3)_n$
(2) $H_4P_2O_5$
(3) $H_4P_2O_6$
(4) $H_4P_2O_7$

Official Ans. by NTA (2)

Ans. (2)

Sol.

Oxyacid having P–H bond can reduce $AgNO_3$ to Ag.

39. The primary and secondary valencies of cobalt respectively in $[Co(NH_3)_5Cl]Cl_2$ are :

(1) 3 and 5
(2) 2 and 6
(3) 2 and 8
(4) 3 and 6

Official Ans. by NTA (4)

Ans. (4)

Sol. $[Co(NH_3)_5Cl]Cl_2$

Oxidation number of Co is +3.

So primary valency is 3.

It is an octahedral complex so secondary valency 6 or Co-ordination number 6.

40. An ammoniacal metal salt solution gives a brilliant red precipitate on addition of dimethylglyoxime. The metal ion is :

(1) Cu^{2+}
(2) Co^{2+}
(3) Fe^{2+}
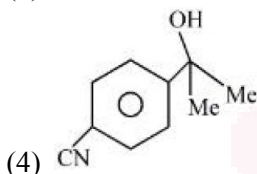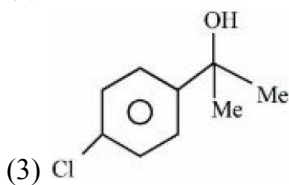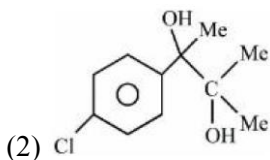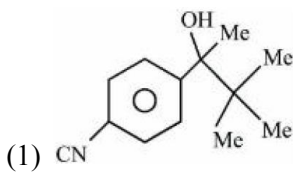(4) Ni^{2+}

Official Ans. by NTA (4)

Ans. (4)

Sol. $Ni^{+2} + 2DMG \xrightarrow{\quad NH_3(aq) \quad} [Ni(DMG)_2]$

Rosy Red complex

41. 'R' formed in the following sequence of reaction is:

(1)

(2)

(3)

(4)

Official Ans. by NTA (2)

Ans. (2)

Sol.
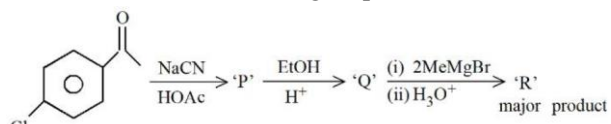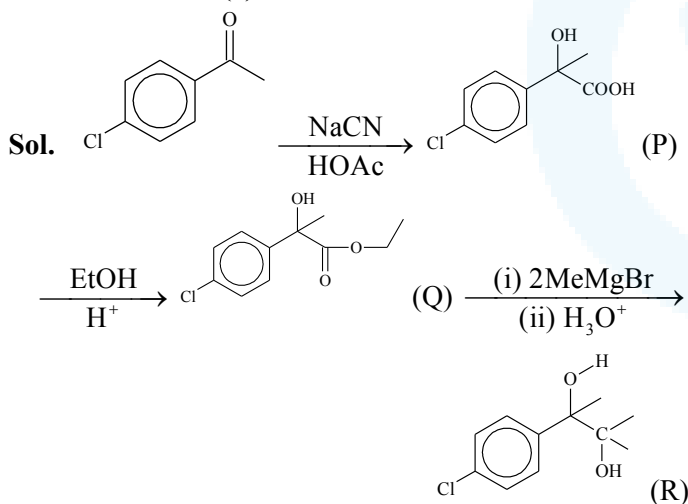
42. Match List I with List II.

	LIST I		LIST II
A.	Chlorophyll	I.	Na_2CO_3
B.	Soda ash	II.	$CaSO_4$
C.	Dentistry, Ornamental work	III.	Mg^{2+}
D.	Used in white washing	IV.	$Ca(OH)_2$

Choose the correct answer from the options given below :

(1) A – III, B – I, C – II, D – IV

(2) A – II, B – I, C – III, D – IV

(3) A – III, B – IV, C – I, D – II

(4) A – II, B – III, C – IV, D – I

Official Ans. by NTA (1)

Ans. (1)

Sol. Chlorophyll : Mg^{+2} complex

Soda ash : Na_2CO_3

Dentistry, Ornamental work : $CaSO_4$

Used in white washing : $Ca(OH)_2$

43. **Statement I :** For colloidal particles, the values of colligative properties are of small order as compared to values shown by true solutions at same concentration.

Statement II : For colloidal particles, the potential difference between the fixed layer and the diffused layer of same charges is called the electrokinetic potential or zeta potential.

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) Statement I is false but Statement II is true

(3) Both Statement I and Statement II are true

(4) Both Statement I and Statement II are false

Official Ans. by NTA (1)

Ans. (3)

Sol. **Statement I :** For colloidal particles, the values of colligative properties are of small order as compared to values shown by true solutions at same concentration. : True

Statement II : For colloidal particles, the potential difference between the fixed layer and the diffused layer of same charges is called the electrokinetic potential or zeta potential. : True
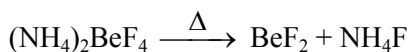
44. Reaction of BeO with ammonia and hydrogen fluoride gives 'A' which on thermal decomposition gives BeF_2 and NH_4F. What is 'A' ?

(1) $(NH_4)_2BeF_4$

(2) H_3NBeF_3

(3) $(NH_4)BeF_3$

(4) $(NH_4)Be_2F_5$

Official Ans. by NTA (1)

Ans. (1)

Sol. $BeO + 2NH_3 + 4HF \rightarrow (NH_4)_2BeF_4 + H_2O$

$(NH_4)_2BeF_4 \xrightarrow{\Delta} BeF_2 + NH_4F$

45. 'A' and 'B' formed in the following set of reactions are :

(1)

(2)

(3)

(4)
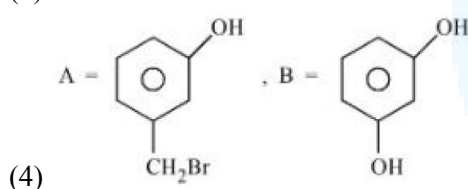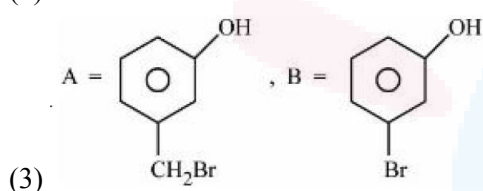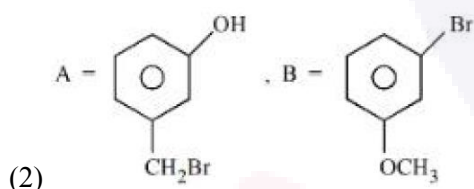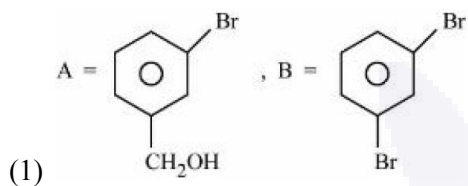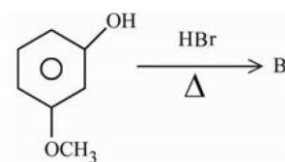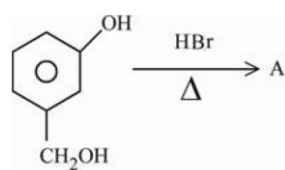
Official Ans. by NTA (4)

Allen Ans. (4)

Sol.
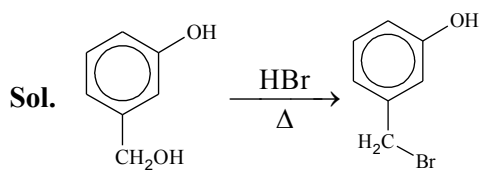
46. In the following given reaction 'A' is

(1)

(2)

(3)

(4)

Official Ans. by NTA (4)

Ans. (4)

Sol.
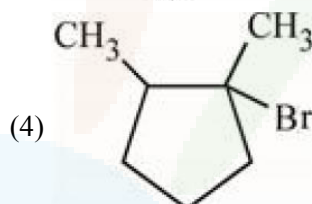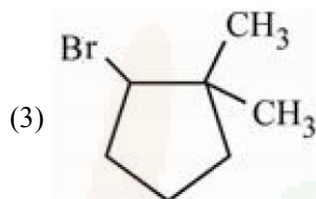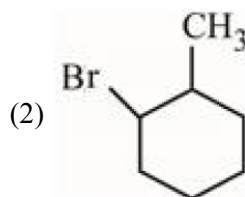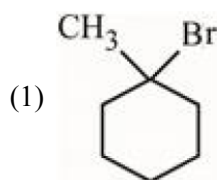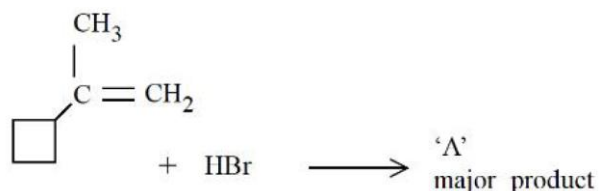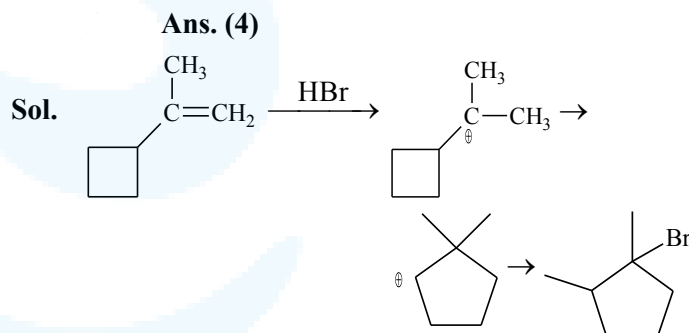
47. Decreasing order of the hydrogen bonding in following forms of water is correctly represented by

A. Liquid water

B. Ice

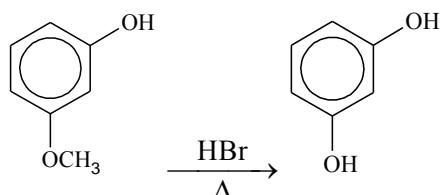C. Impure water

(1) A = B > C

(2) B > A > C

(3) C > B > A

(4) A > B > C

Official Ans. by NTA (2)

Ans. (2)

Sol. Ice > Liquid water > Impure water

Due to impurity extent of H-Bonding decreases.

48. Given below are two statements :

Statement I : Noradrenaline is a neurotransmitter.

Statement II : Low level of noradrenaline is not the cause of depression in human.

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

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

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

(3) Both Statement I and Statement II are correct

(4) Both Statement I and Statement II are incorrect

Official Ans. by NTA (1)

Ans. (1)

Sol. Fact

49. In the depression of freezing point experiment

A. Vapour pressure of the solution is less than that of pure solvent

B. Vapour pressure of the solution is more than that of pure solvent
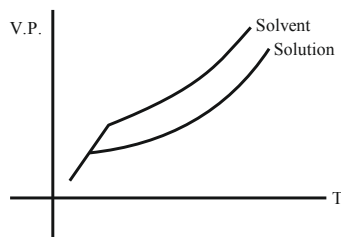
C. Only solute molecules solidify at the freezing point

D. Only solvent molecules solidify at the freezing point

(1) A and D only   (2) B and C only

(3) A and C only   (4) A only

Official Ans. by NTA (1)

Allen Ans. (1)

Sol.

Vapour pressure (V.P.) of solvent is greater than vapour pressure (V.P.) of solution.

Only solvent freezes.

50. Which of the following is true about freons ?

(1) These are chlorofluorocarbon compounds

(2) These are chemicals causing skin cancer

(3) These are radicals of chlorine and chlorine monoxide

(4) All radicals are called freons

Official Ans. by NTA (1)

Ans. (1)

Sol. Fact

SECTION-B

51. The dissociation constant of acetic is $x \times 10^{-5}$. When 25 mL of 0.2 M CH_3COONa solution is mixed with 25 mL of 0.02 M CH_3COOH solution, the pH of the resultant solution is found to be equal to 5. The value of x is _____.

Official Ans. by NTA (10)

Ans. (10)

Sol. Buffer of HOAc and NaOAc

$$pH = pKa + \log \frac{0.1}{0.01}$$

$$5 = pKa + 1$$

$$pKa = 4$$

$$Ka = 10^{-4}$$

$$x = 10$$

52. 5 g of NaOH was dissolved in deionized water to prepare a 450 mL stock solution. What volume (in mL) of this solution would be required to prepare 500 mL of 0.1 M solution ?

Given : Molar Mass of Na, O and H is 23, 16 and 1 g mol^{-1} respectively

Official Ans. by NTA (180)

Ans. (180)

Sol. $M = \dfrac{5}{40} \times \dfrac{1000}{450}$

$M_1V_1 = M_2V_2$

$\left(\dfrac{5}{40} \times \dfrac{1000}{450} \right) \times V_1 = 0.1 \times 500$

$V_1 = 180$

53. If wavelength of the first line of the Paschen series of hydrogen atom is 720 nm, then the wavelength of the second line of this series is _____ nm. (Nearest integer)

Official Ans. by NTA (492)

Ans. (492)

Sol. $\dfrac{1}{(\lambda_1)_P} = R_H Z^2 \left(\dfrac{1}{9} - \dfrac{1}{16} \right)$

$\dfrac{1}{(\lambda_2)_P} = R_H Z^2 \left(\dfrac{1}{9} - \dfrac{1}{25} \right)$

$\dfrac{(\lambda_2)_P}{(\lambda_1)_P} = \dfrac{\dfrac{7}{16 \times 9}}{\dfrac{16}{25 \times 9}} = \dfrac{25 \times 7}{16 \times 16}$

$(\lambda_2)_P = \dfrac{25 \times 7}{16 \times 16} \times 720$

$(\lambda_2)_P = 492$ nm

54. The number of correct statement/s from the following is _____.

A. Larger the activation energy, smaller is the value of the rate constant.

B. The higher is the activation energy, higher is the value of the temperature coefficient.

C. At lower temperatures, increase in temperature causes more change in the value of k than at higher temperature.

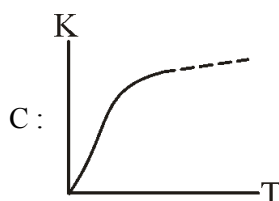**D.** A plot of ln k vs $\dfrac{1}{T}$ is a straight line with slope equal to $-\dfrac{Ea}{R}$

Official Ans. by NTA (3)

Ans. (3)

Sol. **A :** $k = Ae^{-\frac{Ea}{RT}}$

As Ea increases k decreases

B : Temperature coefficient = $\dfrac{k_{T+10}}{k_T}$

C :

Option (C) is wrong. Δk may be greater or lesser depending on temperature.

D : ln k = ln A $- \dfrac{Ea}{RT}$

55. At 298 K, a 1 litre solution containing 10 mmol of $Cr_2O_7^{2-}$ and 100 mmol of Cr^{3+} shows a pH of 3.0.

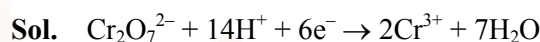Given : $Cr_2O_7^{2-} \to Cr^{3+}$; $E^0 = 1.330$ V and

$\dfrac{2.303\ RT}{F} = 0.059$ V

The potential for the half cell reaction is x × 10⁻³ V. The value of x is _____.

Official Ans. by NTA (917)

Ans. (917)

Sol. $Cr_2O_7^{2-} + 14H^+ + 6e^- \to 2Cr^{3+} + 7H_2O$

$E = 1.33 - \dfrac{0.059}{6} \log \dfrac{(0.1)^2}{(10^{-2})(10^{-3})^{14}}$

$E = 1.33 - \dfrac{0.059}{6} \times 42 = 0.917$

$E = 917 \times 10^{-3}$

$x = 917$

56. When $Fe_{0.93}O$ is heated in presence of oxygen, it converts to Fe_2O_3. The number of correct statement/s from the following is _____.

A. The equivalent weight of $Fe_{0.93}O$ is $\dfrac{\text{Molecular weight}}{0.79}$.

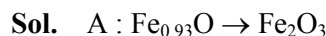B. The number of moles of Fe^{2+} and Fe^{3+} in 1 mole of $Fe_{0.93}O$ is 0.79 and 0.14 respectively.

C. $Fe_{0.93}O$ is metal deficient with lattice comprising of cubic closed packed arrangement of O^{2-} ions.

D. The % composition of Fe^{2+} and Fe^{3+} in $Fe_{0.93}O$ is 85% and 15% respectively.

Official Ans. by NTA (4)

Ans. (4)

Sol. A : $Fe_{0.93}O \to Fe_2O_3$

$nf = \left(3 - \dfrac{200}{93} \right) \times 0.93$

$nf = 0.79$

B : $2x + (0.93 - x) \times 3 = 2$

$x = 0.79$

$Fe^{2+} = 0.79$, $Fe^{3+} = 0.21$

C : Fact

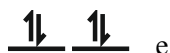D : %$Fe^{2+} = \dfrac{0.79}{0.93} \times 100 = 85\%$; $Fe^{3+} = 15\%$

57. The d-electronic configuration of $[CoCl_4]^{2-}$ in tetrahedral crystal field is $e^m t_2^n$. Sum of 'm' and 'number of unpaired electrons is _____.

Official Ans. by NTA (7)

Ans. (7)

Sol. $Co^{2+} : 3d^7 4s^0$, $Cl^- :$ WFL

Configuration $e^4 t_2^3$: m = 4

Number of unpaired electrons = 3

So, answer = 7

58. For independent process at 300 K.

Process	$\Delta H/kJ\ mol^{-1}$	$\Delta S/J\ K^{-1}$
A	−25	−80
B	−22	40
C	25	−50
D	22	20

The number of non-spontaneous process from the following is _____.

Official Ans. by NTA (2)

Ans. (2)

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

A : ΔG (J mol^{-1}) = $-25 \times 10^3 + 80 \times 300$: −ve
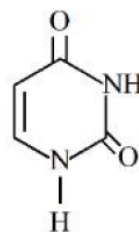
B : ΔG (J mol^{-1}) = $-22 \times 10^3 - 40 \times 300$: −ve

C : ΔG (J mol^{-1}) = $25 \times 10^3 + 300 \times 50$: +ve

D : ΔG (J mol^{-1}) = $22 \times 10^3 - 20 \times 300$: +ve

Processes C and D are non-spontaneous.

59. Uracil is base present in RNA with the following structure. % of N in uracil is _____.

Given :

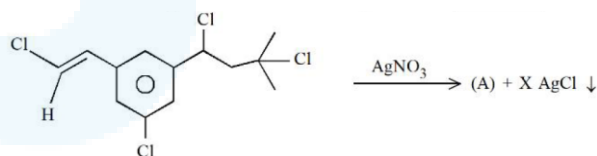Molar mass N = 14 g mol^{-1}; O = 16 g mol^{-1}; C = 12 g mol^{-1}; H = 1 g mol^{-1};

Official Ans. by NTA (25)

Ans. (25)

Sol. Mol. Wt of $C_4N_2H_4O_2$ = 112

$\%N = \dfrac{28}{112} \times 100 = 25\%$

60. Number of moles of AgCl formed in the following reaction is _____.

Official Ans. by NTA (2)

Ans. (2)

Sol. Benzylic and tertiary carbocations are stable.