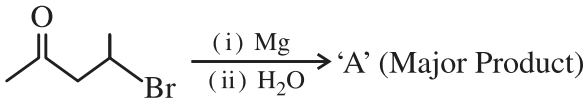
FINAL JEE–MAIN EXAMINATION – APRIL, 2023

(Held On Wednesday 12th April, 2023) **TIME : 9 : 00 AM to 12 : 00 NOON**

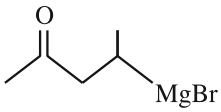
CHEMISTRY

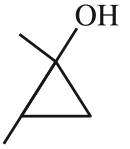
TEST PAPER WITH SOLUTION

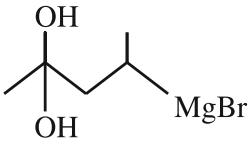
SECTION-A

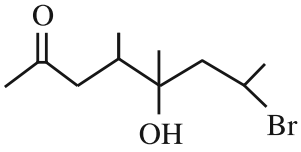
61. 

A is

(1) 

(2) 

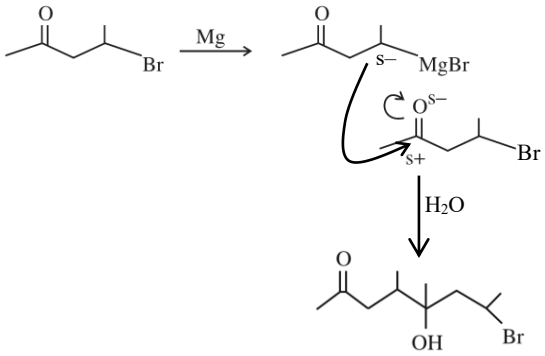
(3) 

(4) 

Official Ans. by NTA (4)

Allen Ans. (4)

Sol.



62. Four gases A, B, C and D have critical temperatures 5.3, 33.2, 126.0 and 154.3K respectively.

For their adsorption on fixed amount of charcoal, the correct order is :

(1) C > B > D > A

(2) C > D > B > A

(3) D > C > A > B

(4) D > C > B > A

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. Extent of adsorption α critical temp.

63. Given below are two statement: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: 5f electrons can participate in bonding to a far greater extent than 4f electrons

Reason R: 5f orbitals are not as buried as 4f orbitals

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

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

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

(3) **A** is false but **R** is true

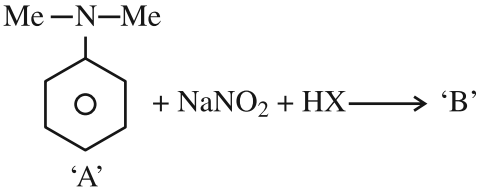
(4) **A** is true but **R** is false

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. 5f orbital not buried as 4f orbitals so e^- present in 5f orbital experience less nuclear attraction than e^- present in 4f orbital. Hence electrons of 5f orbital can take part in bonding to a far greater extent.

64. The <u>incorrect</u> statement regarding the reaction given below is



'A'

(1) The electrophile involved in the reaction is NO^+

(2) 'B' is N-nitroso ammonium compound

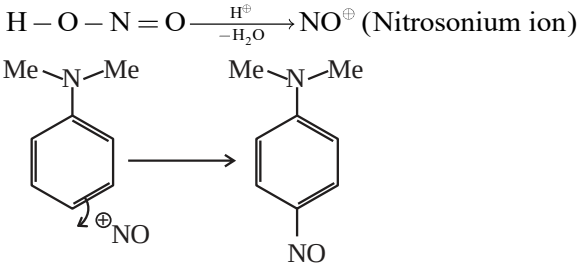
(3) The reaction occurs at low temperature

(4) The product 'B' formed in the above reaction is p-nitroso compound at low temperature

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. $NaNO_2 + HX \rightarrow HNO_2 + NaX$



P – Nitroso product

65. Match List I with List II

LIST I Complex		**LIST II CFSE (Δ_0)**	
A.	$[Cu(NH_3)_6]^{2+}$	I.	-0.6
B.	$[Ti(N_2O)_6]^{3+}$	II.	-2.0
C.	$[Fe(CN)_6]^{3-}$	III.	-1.2
D.	$[NiF_6]^{4-}$	IV.	-0.4

Choose the correct answer from the options given below :

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

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

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

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

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. CFSE = $(-0.4\ nt_{2g} + 0.6\ n_{eg})\ \Delta_0$

nt_{2g} = number of electrons in t_{2g} orbital

n_{eg} = number of electrons in eg orbital

Complex	No. of at electrons	CFSE(Δ_0)
$[Cu(NH_3)_6]^{+2}$	d^9 (S.L.) $t_{2g}^{2,2,2}eg^{2,1}$	-0.6
$[Ti(H_2O)_6]^{+3}$	d^1 (W.L.) $t_{2g}^{1,0,0}eg^{0,0}$	-0.4
$[Fe(CN)_6]^{3-}$	d^5 (S.L.) $t_{2g}^{2,2,1}eg^{0,0}$	-2.0
$[NiF_6]^{4-}$	d^8 (W.L.) $t_{2g}^{2,2,2}eg^{1,1}$	-1.2

66. Match List I with List II

	LIST I (Examples)		**LIST I (Examples)**
A.	2-Chloro-1, 3 - butadiene	I.	Biodegradable polymer
B.	Nylon 2-nylon 6	II.	Synthetic Rubber
C.	Polyacrylonitrile	III.	Polyester
D.	Dacron	IV.	Addition Polymer

Choose the correct answer from the options given below :

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

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

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

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

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. FACT

67. The density of alkali metals is in the order

(1) Na < K < Cs < Rb

(2) K < Na < Rb < Cs

(3) K < Cs < Na < Rb

(4) Na < Rb < K < Cs

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. In general moving down the group, mass increases more prominently as compared to volume (size) hence density increases for Group I metal. Due to empty 3d subshell in K increase in size is more prominent as compare to mass.

Li < K < Na < Rb < Cs

68. Given below are two statements :

Statements : $SbCl_5$ is more covalent than $SbCl_3$

Statements : The higher oxides of halogens also tend to be more stable than the lower ones.

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

(1) Both statement I and Statement II are correct

(2) Both statement I and Statement II are incorrect

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

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

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Statement I : Is correct according to Fajan's rule Sb^{+5} more polarising power than Sb^{+3}.

Statement II : Stability of higher oxides of halogen is primarily due to

a) Higher oxidation state

b) More EN halogen

c) Resonance stabilization

69. A metal chloride contains 55.0% of chlorine by weight. 100 mL vapours of the metal chloride at STP weigh 0.57 g. The molecular formula of the metal chloride is

(Given : Atomic mass of chlorine is 35.5u)

(1) MCl_2

(2) MCl_4

(3) MCl_3

(4) MCl

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Molecular. weight of metal chloride

$$= \frac{0.57}{100} \times 22700$$

$$= 129.39$$

$$\text{weight of Cl} = 129.39 \times 0.55$$

$$= 71.1645$$

$$\therefore \text{Mole of Cl} = \frac{71.1645}{35.5} \cong 2$$

Hence MCl_2

70. Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A : In the Ellingham diagram, a sharp change in slope of the line is observed for $Mg \rightarrow MgO$ at $\sim 1120\,^{\circ}C$

Reason R : There is a large change of entropy associated with the change of state

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

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

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

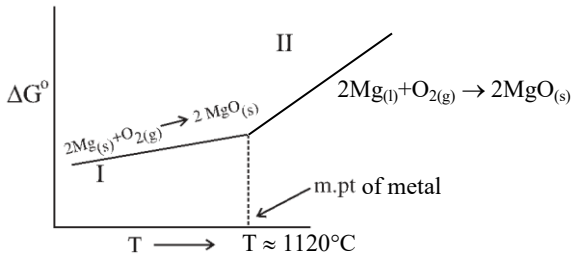
(3) A is false but R is true

(4) A is true but R is false

Official Ans. by NTA (2)

Allen Ans. (2)

Sol.



For line II, ΔS is more –ve than line I. hence higher slope.

For I $\Delta S_I = S_{solid} - S_{solid} + S_{gas}$

For II $\Delta S_{II} = S_{solid} - S_{liq} + S_{gas}$

Hence ΔS_{II} more –ve than ΔS_I

71. Match List I with List II

	LIST I		LIST II
A.	Nitrogen oxides in air	I.	Eutrophication
B.	Methane in air	II.	pH of rain water becomes 5.6.
C.	Carbon dioxide	III.	Global warming
D.	Phosphate fertilisers in water	IV.	Acid rain

Choose the correct answer from the options given below :

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

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

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

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

Official Ans. by NTA (1)

Allen Ans. (1)

Sol.:

i. $4NO_2\ g + O_2\ g + 2H_2O(\ell) \rightarrow 4HNO_3(aq)$

SO_2 & NO_2 have major contribution in acid rain

ii. CO_2, CH_4, O_3, CFC are responsible for global warming

iii. $H_2O(\ell) + CO_2(g) \rightleftharpoons H_2CO_3(aq.)$

$H_2CO_3(aq.) \rightleftharpoons H^+(aq.) + HCo_3^-(aq.)$

Rain water has pH of 5.6 due to the Presence of H^+ ions formed by the reaction of rain water with CO_2

iv. Phosphates present in fertilizers contribution for Eutrophication (Process in which nutrient enriched water bodies support a dense plant population, which kills animal life by depriving it of oxygen and results in subsequent loss of biodiversity is known as Eutrophication.)

72. For lead storage battery pick the correct statements

A. During charging of battery, $PbSO_4$ on anode is converted into PbO_2

B. During charging of battery, $PbSO_4$ on cathode is converted into PbO_2

C. Lead storage battery, consists of grid of lead packed with PbO_2 as anode

D. Lead storage battery has $\sim$ 38% solution of sulphuric acid as an electrolyte

Choose the correct answer from the options given below :

(1) B, D only

(2) B, C, D only

(3) A, B, D only

(4) B, C only

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Lead storage battery consists of lead anode and a grid of lead packed with lead oxide (PbO_2) as cathode, a 38% solution of H_2SO_4 is used as an electrolyte.

On charging the battery the reaction is reversed and $PbSO_4(s)$ on anode and cathode is converted into Pb and PbO_2 respectively.

73. $2-\text{hexene} \xrightarrow[(ii)H_2O]{(i)O_3} \text{Products}$

The two products formed in above reaction are -

(1) Butanoic acid and acetic acid

(2) Butanal and acetic acid

(3) Butanal and acetaldehyde

(4) Butanoic acid and acetaldehyde

Official Ans. by NTA (1)

Allen Ans. (1)

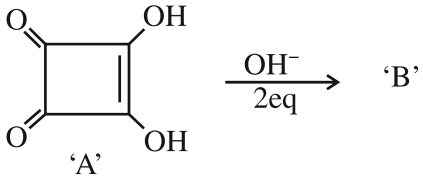
Sol. 

$\xrightarrow[ii)H_2O]{i)O_3} CH_3COOH + CH_3CH_2CH_2COOH$

Acetic acid Butanoic acid

it is oxidative ozonolysis.

74. Correct statements for the given reaction are :



'A' 'B'

A. Compound 'B' is aromatic

B. The completion of above reaction is very slow

C. 'A' shows tautomerism

D. The bond lengths C-C in compound B are found to be same

Choose the correct answer from the options given below :

(1) A, B and D only

(2) A, B and C only

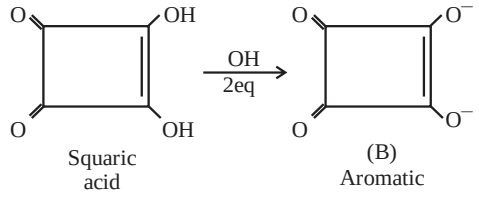
(3) B, C and D only

(4) A, C and D only

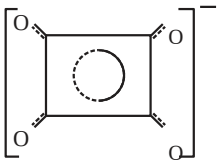
Official Ans. by NTA (4)

Allen Ans. (4)

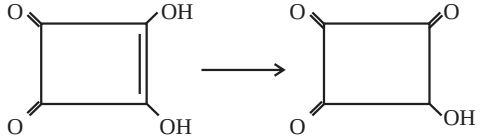
Sol.



Squaric acid (B) Aromatic



Resonance hybrid of B showing all C-C bond length same



Enol form it can show tautomer Keto form

75. The bond order and magnetic property of acetylide ion are same as that of

(1) NO^+

(2) O_2^+

(3) O_2^-

(4) N_2^+

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Acetylide ion $\rightarrow C_2^{2-}$ $\bar{C} \equiv \bar{C}$

Bond order = 3 & Diamagnetic

NO^+ $14e^-$ $\rightarrow$ Bond order = 3 & Diamagnetic

76. In the given reaction cycle

$CaCl_2 + Na_2CO_3 \longrightarrow \underline{X} + \underline{Y}$

Z

X, Y and Z respectively are

(1) X: CaO; Y: $NaCl + CO_2$; Z: KCl

(2) X: $CaCO_3$; Y: NaCl; Z: KCl

(3) X: $CaCO_3$; Y: NaCl; Z: HCl

(4) X: CaO; Y: $NaCl + CO_2$; Z: NaCl

Official Ans. by NTA (3)

Allen Ans. (3)

Sol.

$CaCl_2 + Na_2CO_3 \longrightarrow \underset{X}{CaCO_3} + \underset{Y}{NaCl}$

HCl

Z

77. Given below are two statements :

Statement I : Boron is extremely hard indicating its high lattice energy

Statement II : Boron has highest melting and boiling point compared to its other group members.

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

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

(2) Both Statement I and Statement II is correct

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

(4) Both Statement I and Statement II is incorrect

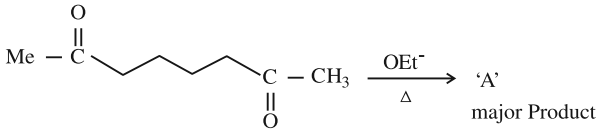
Official Ans. by NTA (2)

Allen Ans. (2)

Sol. Boron is non- metallic in nature. It is extremely hard and black coloured solid. It exists in many allotropic forms. Due to very strong crystalline lattice, boron has unusually high melting point and boiling point.

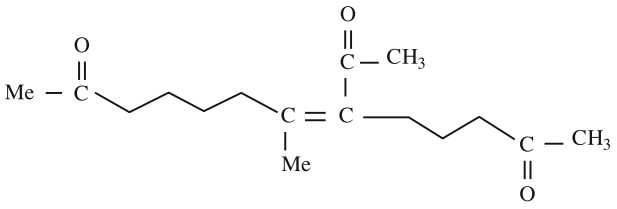
Element					
	B	Al	Ga	In	Tl
Melting point/K	2453	933	303	430	576
Boiling point/K	3923	2740	2676	2353	1730

78.



A in the above reaction is :

(1)



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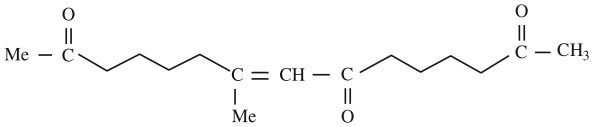

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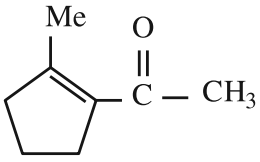

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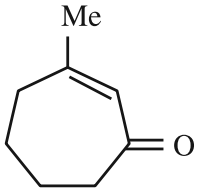
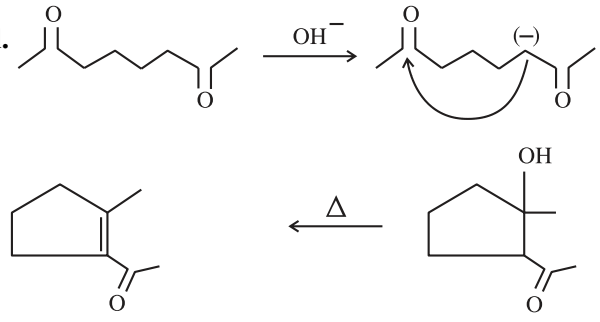


Official Ans. by NTA (3)

Allen Ans. (3)

Sol.



79. Match List I with List II

LIST I Type of Hydride		LIST II Example	
A.	Electron deficient hydride	I.	MgH_2
B.	Electron rich hydride	II.	HF
C.	Electron precise hydride	III.	B_2H_6
D.	Saline hydride	IV.	CH_4

Choose the correct answer from the options given below :

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

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

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

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

Official Ans. by NTA (1)

Allen Ans. (1)

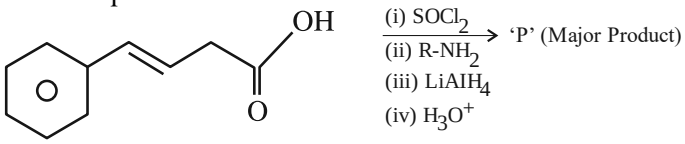
Sol. $B_2H_6 \Rightarrow e^-$ deficient hydride

$HF \Rightarrow e^-$ rich hydride

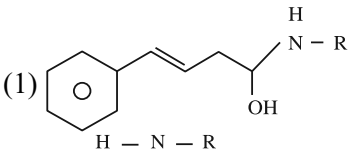
$CH_4 \Rightarrow e^-$ Precise hydride

$MgH_2 \Rightarrow$ Saline hydride

80. The major product 'P' formed in the following sequence of reactions is



(1)



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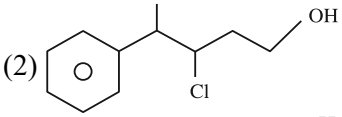

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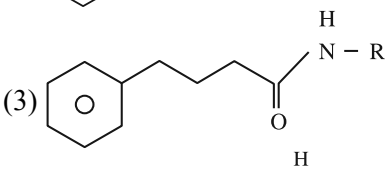

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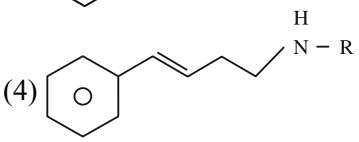
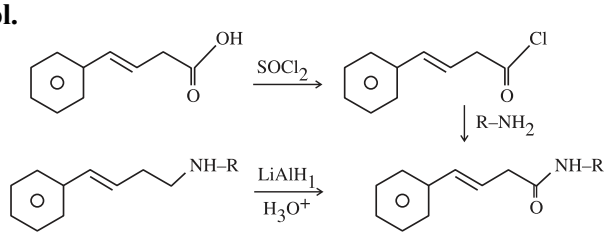


Official Ans. by NTA (4)

Allen Ans. (4)

Sol.



SECTION-B

81. One mole of an ideal gas at 350K is in a 2.0 L vessel of thermally conducting walls, which are in contact with the surroundings. It undergoes isothermal reversible expansion from 2.0L to 3.0L against a constant pressure of 4 atm. The change in entropy of the surroundings ΔS is _____ $J\ K^{-1}$ (Nearest integer)

Given : $R = 8.314\ J\ K^{-1}\ Mol^{-1}$.

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. $\Delta S_{System} = nR\ell n\left(\frac{V_2}{V_1}\right)$

$= 1 \times 8.314\ \ell n\left(\frac{3}{2}\right)$

$\Delta S_{System} = 3.37$

$\Delta S_{Surr.} = 3.37$

Correct Ans : 3

82. The mass of NH_3 produced when 131.8 kg of cyclohexanecarbaldehyde undergoes Tollen's test is _____ kg. (Nearest Integer)

Molar Mass of C = 12g/mol

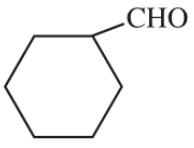
N = 14g/mol

O = 16g/mol

Official Ans. by NTA (60)

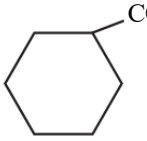
Allen Ans. (60)

Sol.



131.8 Kg

$+ \quad 2\ [Ag(NH_3)_2]\ OH$



$+ \quad 3NH_3 + 2Ag + H_2O$

$$W_{NH_3} = \frac{131.8 \times 1000}{112} \times 3 \times 17$$

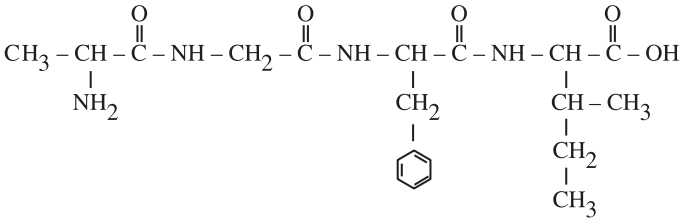
$= 60$ Kg

83. In an oligopeptide named Alanylglycylphenyl alanyl isoleucine, the number of sp^2 hybridised carbons is _____.

Official Ans. by NTA (10)

Allen Ans. (10)

Sol.



84. An analyst wants to convert. 1L HCl of pH = l to a solution of HCl of pH 2. The volume of water needed to do this dilution is _____ mL. (Nearest Integer)

Official Ans. by NTA (9000)

Allen Ans. (9000)

Sol.

$$\underset{10^{-1} \times 1}{(M_1 \times V_1)} = \underset{10^{-2} \times V_2}{(M_2 \times V_2)}$$

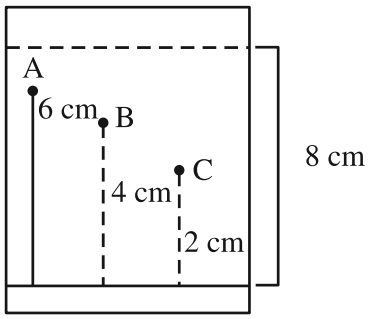
$V_2 = 10L$

Water added = 10 – 1

= 9 Litre

= 9000 mL

85. Three organic compounds A, B and C were allowed to run in thin layer chromatography using hexane and gave the following result (see figure). The R_f value of the most polar compound is _____ $\times 10^{-2}$



Official Ans. by NTA (25)

Allen Ans. (25)

Sol. More R_f, less its polarity

$$R_f = \frac{\text{Distance travelled by compound 'X'}}{\text{Distance travelled by solvent 'Y'}}$$

$$= \frac{2}{8} = 0.25 = 25 \times 10^{-2}$$

86. 80 mole percent of $MgCl_2$ is dissociated in aqueous solution. The vapour pressure of 1.0 molal aqueous solution of $MgCl_2$ at 38°C is _____ mm Hg. (Nearest integer)

Given : Vapour pressure of water at 38°C is 50 mm Hg

Official Ans. by NTA (48)

Allen Ans. (48)

Sol.

$$MgCl_2 \rightarrow Mg^{+2} + 2Cl^-$$
$$1-\alpha \qquad \alpha \qquad 2\alpha$$

$$i = 1 + 2\alpha \quad (\alpha = 0.8)$$

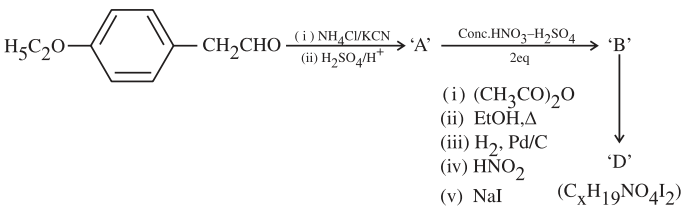
$$i = 2.6$$

$$\frac{\Delta p}{p^o} = \frac{i \times n_2}{n_1}$$

$$\Delta p = 2.34$$

$$p_s = 47.66$$
$$p_s \cong 48$$

87.

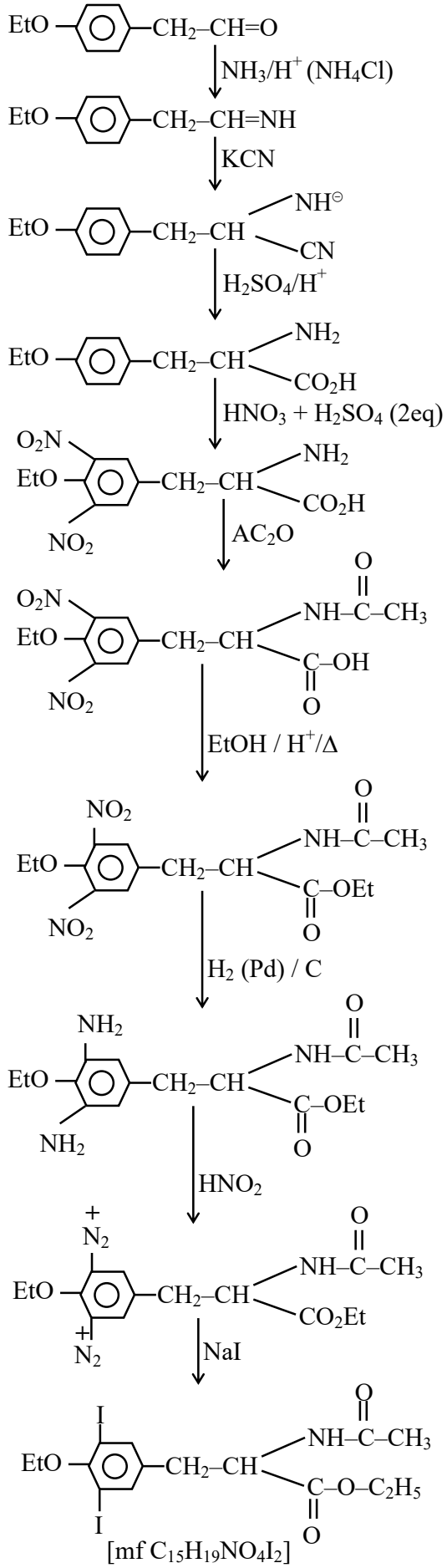


The value of x in compound 'D' is ____

Official Ans. by NTA (15)

Allen Ans. (15)

Sol.



[mf $C_{15}H_{19}NO_4I_2$]

88. At 600K, the root mean square (rms) speed of gas X (molar mass = 40) is equal to the most probable speed of gas Y at 90K. The molar mass of the gas Y is _____ g mol^{-1}. (Nearest integer)

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. $(U_{rms})_{X,600} = (U_{mp})_{Y,90}$

$$\sqrt{\frac{3\times R\times 600}{40}} = \sqrt{\frac{2\times R\times 90}{M}}$$

$M = 4$

89. The reaction $2NO + Br_2 \rightarrow 2NOBr$

takes places through the mechanism given below :

$NO + Br_2 \Leftrightarrow NOBr_2$ (fast)
$NOBr_2 + NO \rightarrow 2NOBr$ (slow)

The overall order of the reaction is _____.

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. RDS : $NOBr_2 + NO \rightarrow 2NOBr$

$r = K[NOBr_2][NO]$ ----(i)

$$Keq = \frac{[NOBr_2]}{[NO][Br_2]} \quad -----(ii)$$

From (i) & (ii)

$r = K.\ Keq.\ [NO]\ [Br_2]\ [NO]$

$r = K'[NO]^2[Br_2]$

Overall order = 3

Ans. 3

90. Values of work function (W_0) for a few metals are given below

Metal	Li	Na	K	Mg	Cu	Ag
W_o/eV	2.42	2.3	2.25	3.7	4.8	4.3

The number of metals which will show photoelectric effect when light of wavelength 400nm falls on it is _____

Given : $h = 6.6 \times 10^{-34}$ J s

$c = 3 \times 10^8$ m s^{-1}

$e = 1.6 \times 10^{-19}$ C

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. $E(ev) = \frac{1240}{400} = 3.1$ ev

Mg, Cu, Ag

Ans.3