Resonance®
Educating for better tomorrow

JEE (Main)

PAPER-1 (B.E./B. TECH.)

2023

COMPUTER BASED TEST (CBT)

Questions & Solutions

Date: 12 April, 2023 (SHIFT-1) | TIME : (9.00 a.m. to 12.00 p.m)

Duration: 3 Hours | Max. Marks: 300

SUBJECT: CHEMISTRY

Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | **FAX No. :** +91-022-39167222

To Know more : sms **RESO** at **56677** | **Website :** www.resonance.ac.in | **E-mail :** contact@resonance.ac.in | **CIN :** U80302RJ2007PLC024029

Toll Free : 1800 258 5555 7340010333 facebook.com/ResonanceEdu twitter.com/ResonanceEdu www.youtube.com/resowatch blog.resonance.ac.in

PART : CHEMISTRY

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

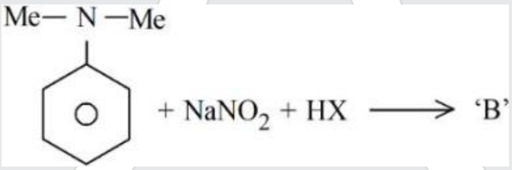
The two products formed in above reaction are -
(1) Butanoic acid and acetaldehyde
(2) Butanal and acetic acid
(3) Butanoic acid and acetic acid
(4) Butanal and acetaldehyde

Ans. NTA : (3)

Sol. This is oxidative Ozonolysis of alkene which will give carboxylic acid

$$CH_3–CH=CH–CH_2–CH_2–CH_3 \xrightarrow{O_3 / H_2O_2} CH_3–COOH + CH_3–CH_2–CH_2–COOH$$

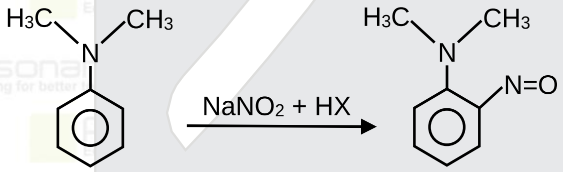
62. The incorrect statement regarding the reaction given below is



(1) 'B' is N-nitroso ammonium compound
(2) The product 'B' formed in the above reaction is p-nitroso compound at low temperature
(3) The electrophile involved in the reaction is NO^+
(4) The reaction occurs at low temperature

Ans. NTA : (1)

Sol.



63. Match list I with List II.

	List – I		List - II
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-II, B-III, C-IV, D-I
(2) A-III, B-II, C-I, D-IV
(3) A-II, B-III, C-I, D-III
(4) A-III, B-II, C-IV, D-I

Ans. NTA : (4)

Sol. Electron deficient hydride : Hydride which of not sufficient number of electron to form normal covalent bond. e.g. Hydride of group 13 (BH_3, (B_2H_6), AlH_3(Al_2H_6))
Electron precise hydride : hydride which contain sufficient valence electron to form covalent bond
e.g. Hydride of group 14 (CH_4 , SiH_4 , GeH_4 , SnH_4 , PbH_4)
Electron rich hydride which contains excess of valence electron to form covalent bond.
e.g. Hydride of group 15 (NH_3 , PH_3), and hydride of group 17 (HF, HCl, Br)
Saline hydride : hydrides of Alkaline and alkaline earth metal
e.g. (NaH, KH, MgH_2, CH_2)

64. Given below are two statements:
Statement I: SbCl, is more covalent than $SbCl_3$
Statement II: 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 incorrect
(2) Both statement I and Statement II are correct
(3) Statement I is incorrect but Statement II is correct
(4) Statement I is correct but Statement II is incorrect

Ans. NTA : (2)

Sol. The halides in higher oxidation state will be more covalent than the one in lower oxidation state.
Higher stability of higher oxides is due to greater polarisability and multiple bond for mation.

65. The density of alkali metals is in the order
(1) Na < Rb < K < Cs (2) K<Na < Rb < Cs
(3) K<Cs <Na < Rb (4) Na < K < Cs < Rb

Ans. NTA : (2)

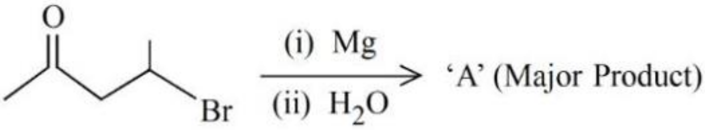
Sol. Density increase down the group but K is lighter than Na.
Order = Li < K < Na < Rb < Cs
Density / g cm^{-3} ; Li = 0.53 ; Na = 0.97 ; K = 0.86 ; Rb = 1.53 ; Cs = 1.90
Due to their large size the atoms of alkali metals are less closely pocked.
Consequently have low density
On going down the group, both the atomic size and atomic mass increase but the increase in atomic mass compensates the bigger atomic size.
As a result, the density of alkali metals increases from Li to Cs.
K is however, lighter then Na. It is probably due to an unusual increase in atomic size of potassium.

66. 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) A is true but R is false
(2) Both A and R are true but R is NOT the correct explanation of A
(3) Both A and R are true and R is the correct explanation of A
(4) A is false but R is true

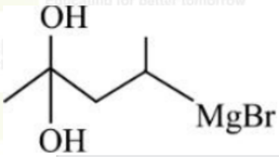
Ans. NTA : (3)

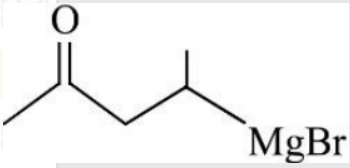
Sol. As number of valence shell is higher, electrons of it's orbitals can participate in bonding in greater extents.
4f electron is more shielded as compare to 5f electrons. 5f orbitals is not as buried as 4f orbitals.

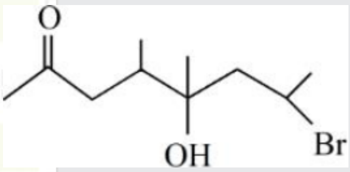
67. In the following reaction.



A is

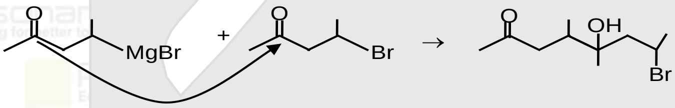
(1) 

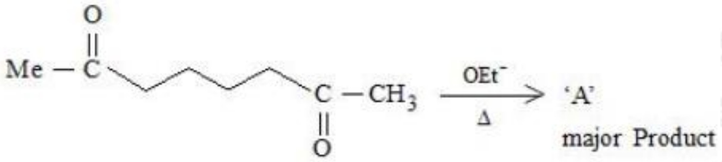
(2) 

(3) 

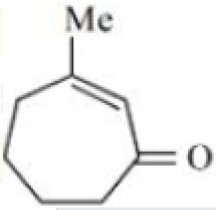
(4) 

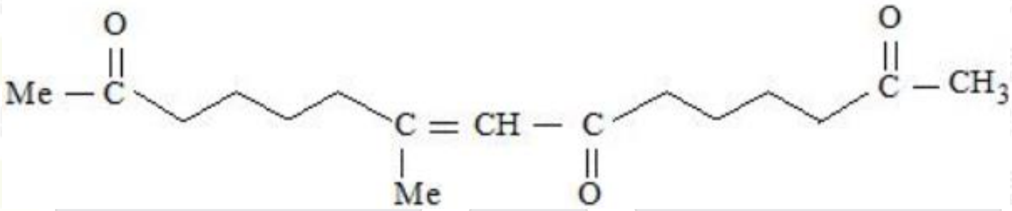
Ans. NTA : (3)

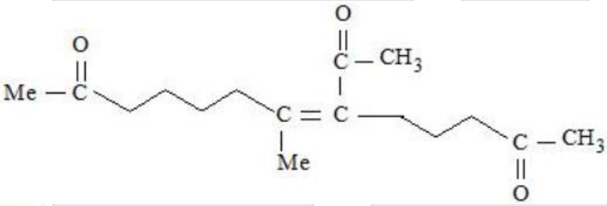
Sol. 

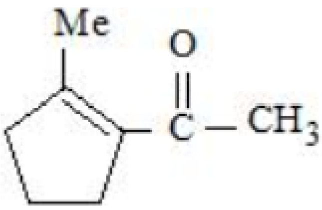
68. 

A in the above reaction is:

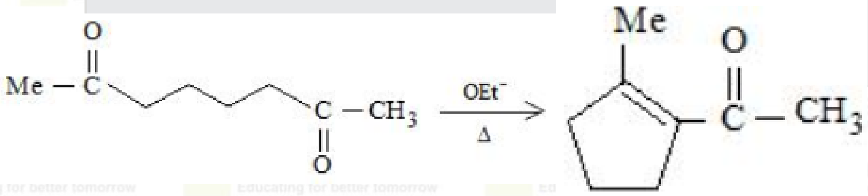
(1) 

(2) 

(3) 

(4) 

Ans. NTA : (4)

Sol. 

69. 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) Both Statement I and Statement II are incorrect

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

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

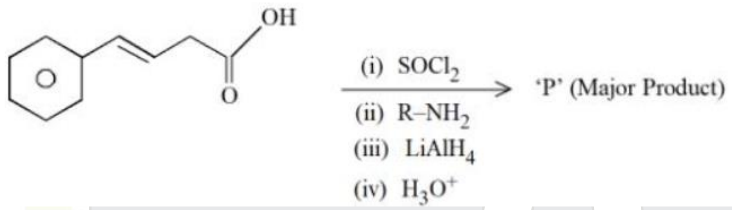
(4) Both statement I and Statement II are correct

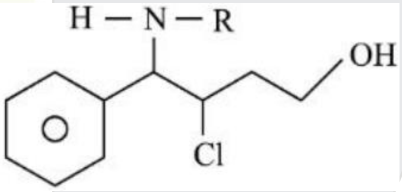
Ans. NTA : (4)

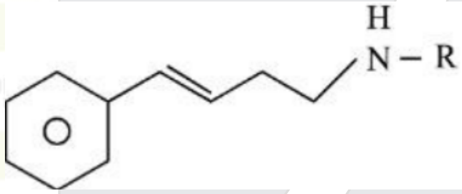
Sol. Boron is non-metallic in nature. It is extremely hard and black coloured solid. Due to very strong crystalline lattice, boron has unusually high melting point. Rest of the member are soft metals with low melting point and high electrical conductivity.

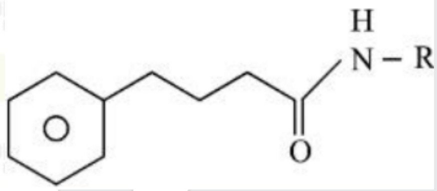
Melting point / K *(B > Al > Ga < In < Tl)*	2453	933	303	430	576
Boiling point / K *(B > Al > Ga > In > Tl)*	3923	2740	2676	2353	1730

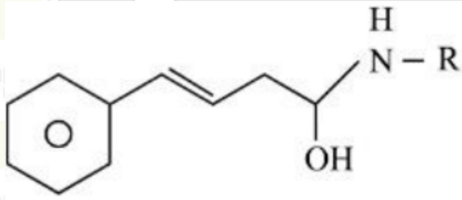
70. The major product 'P' formed in the following sequence of reactions is



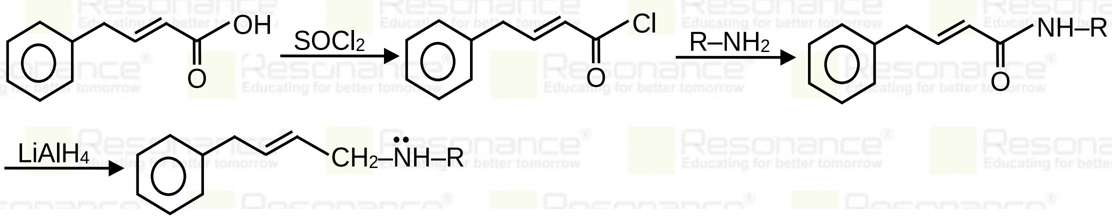
(1) 

(2) 

(3) 

(4) 

Ans. NTA : (2)

Sol. 

71. Match list I with List II.

	List – I		List - II
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-II, B-IV, C-I, D-III

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

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

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

Ans. NTA : (4)

Sol. Nylon-2-Nylon-6 is Biodegradable polymer.
Polyacrylonitrile (PAN) is synthetic rubber.
2-Chlorobuta-1,3-diene is a Addition polymer.
Dacron is polyester of Terphthalic acid and Glycol.

72. Four gases A, B, C and D have critical temperatures 5.3, 33.2, 126.0 and 154.3K respectively.
For their adsorption on a fixed amount of charcoal, the correct order is:

(1) C>D>B>A

(2) C>B>D>A

(3) D>C>B>A

(4) D>C>A> B

Ans. NTA : (3)

Sol. Gas which has higher value of critical temperature shows more adsorption or get easily liquefied.

73. Match list I with List II.

	List – I Complex		List – II CFSE (Δ_0)
A.	$[Cu(NH_3)_6]^{2+}$	I.	–0.6
B.	$[Ti(H_2O)_6]^{3-}$	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-III, B-IV, C-I, D-II

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

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

Ans. NTA : (1)

Sol. For octahedral complex : CFSE = [– 0.4 (n) t_{2g} + 0.6 (n′) e_g] Δ_0 + *nP.

Complex	**ion**	**configuration**	**ligand**	**SFL/WFL**	**t_{2g}, eg configuration**	**CFSE value**
$[Ti(H_2O)_6]^{+3}$	Ti^{+3}	d^1	H_2O	WFL	$t_{2g}^{1,0,0}\ eg^{0,0}$	$-0.4\ \Delta_0$
$[Cu(NH_3)_6]^{+2}$	Cu^{+2}	d^9	NH_3	SFL	$t_{2g}^{2,2,2}\ eg^{2,1}$	$-0.6\ \Delta_0$
$[Fe(Cl)_6]^{-3}$	Fe^{+3}	d^5	Cl	WFL	$t_{2g}^{1,1,1}\ eg^{1,1}$	$0\ \Delta_0$
$[NiF_6]^{-4}$	Ni^{+2}	d^8	F	WFL	$t_{2g}^{2,2,2}\ eg^{1,1}$	$-1.2\ \Delta_0$

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

(1) O_2^-

(2) O_2^+

(3) N_2^+

(4) NO^+

Ans. NTA : (4)

Sol.

Species	total number of electron	bond order	unpaired electron (n)	magnetic momentum $\sqrt{(n\times(n+2)}BM$
Acetylides ion (C_2^{-2})	14	3	0	0
O_2^-	17	1.5	1	√3
O_2^+	15	2.5	1	√3
N_2^-	15	2.5	1	√3
NO^+	14	3	0	0

75. In the given reaction cycle

$CaCl_2 + Na_2CO_3 \longrightarrow X + Y$

(Y → $CaCl_2$ via Z)

X, Y and Z respectively are

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

(2) CaO (X), $NaCl + CO_2$ (Y), NaCl (Z)

(3) $CaCO_3$ (X), NaCl (Y), HCl (Z)

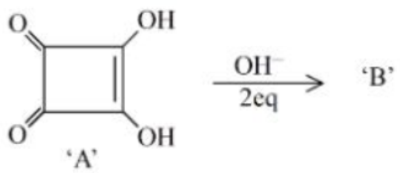
(4) $CaCO_3$, NaCl, KCl

Ans. NTA : (3)

Sol. $CaCl_2 + Na_2CO_3 \longrightarrow CaCO_3 + NaCl$

($CaCO_3$ → $CaCl_2$ via HCl)

76. Correct statements for the given reaction are:



A. Compound 'B' is aromatic

B. The completion of above reaction is very slow

C. 'A' shows tautomerism

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

Choose the correct answer from the options given below:

(1) A, B and C only

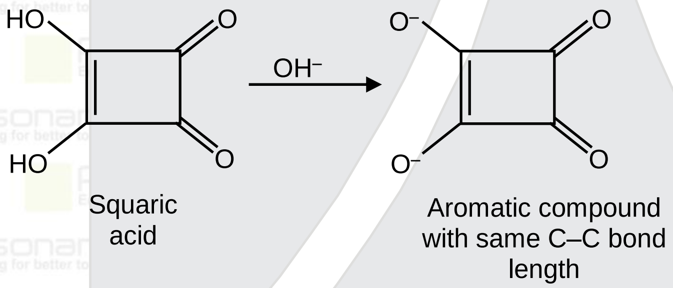
(2) A, C and D only

(3) B, C and D only

(4) A, B and D only

Ans. NTA : (2)

Sol.



77. 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 oxides	III.	Global warming
D.	Phosphate fertilisers in water	IV.	Acid rain

Choose the correct answer from the options given below.

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

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

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

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

Ans. NTA : (3)

Sol. NCERT

78. 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 MgO at 1120 °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 true but R is false

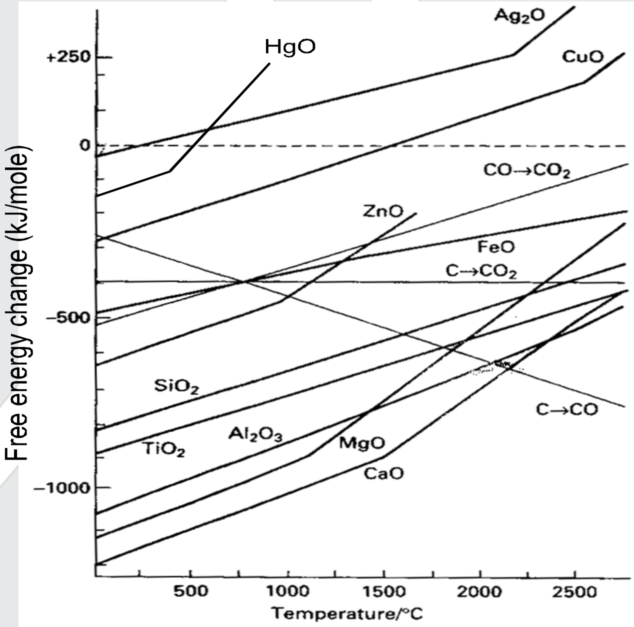
(4) A is false but R is true

Ans. NTA : (2)

Sol. The diagram predicts that MgO and ZnO ought to decompose if heated strongly enough, but it does not hold out much hope for obtaining say pure Mg by straight forward heating of the oxide to a high temperature where the boiling point of the metal is exceeded. However the slope increases since the reaction is now involving a larger entropy change as the randomness increases in reactants. For example,

$2\ Mg(g) + O_2(g) \longrightarrow 2\ MgO(s)$

Here, three moles of gas phases are converted into solid phase in the reaction. This takes place above 1120ºC, which is the boiling point of Mg.



79. 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) $MC1_3$

(2) $MC1_2$

(3) MCI

(4) $MC1_4$

Ans. **NTA : (2)**

Reso : (2)

Sol. number of mole of metal chloride = $\frac{100}{22400}$

100 ml of metal chloride gives = 0.57g of Cl_2 at STP

so 22400 ml = 1 mole of metal chloride gives = $\frac{0.57}{100}$x22400g of Cl_2 at STP = 127.68 gm

Mass of chlorine = 55 % by Mass of metal chloride = $\frac{55}{100}\times 127.68$ = 70.224

Number of moles of chlorine in metal chloride = $\frac{70.224}{35.5}$ = 1.978 ≈ 2

Formula of metal chloride : MCl_2

80. 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 38% solution of sulphuric acid as an electrolyte

Choose the correct answer from the options given below:

(1) B, C, D only

(2) A, B, D only

(3) B. C only

(4) B, D only

Ans. NTA : (4)

Sol. Lead storage batteries used is automobiles (Cars/bikes):

Anode : Pb(s) **Cathode :** PbO_2(s)

H_2SO_4(conc.) about 38% solution of H_2SO_4 is taken as an electrolyte.

Anode : $Pb(s) \longrightarrow Pb^{2+}(aq) + 2e^-$

$Pb^{2+}(aq) + SO_4^{2-}(aq) \longrightarrow PbSO_4(s)$

$Pb(s) + SO_4^{2-}(aq) \longrightarrow PbSO_4 + 2e^-$

Most of the $PbSO_4$(s) ppt sticks to the lead rod.

Cathode : $2e^- + 4H^+ + PbO_2(s) \longrightarrow Pb^{2+}(aq) + 2H_2O(\ell)$

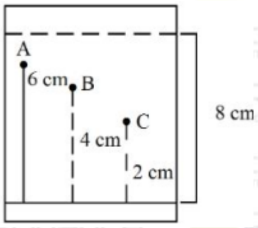
$Pb^{2+}(aq) + SO_4^{2-}(aq) + 4H^+ + 2e^- \longrightarrow PbSO_4(s) + 2H_2O(\ell)$

$PbSO_4$(s) sticks to cathode rod.

$Pb(s) + PbO_2 + 4H^+ + 2SO_4^{2-}(aq) \longrightarrow 2PbSO_4(s) + 2H_2O(\ell)$

E_{cell} = 2.05 V

81. 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________ $\times 10^{-2}$



Ans. NTA : 25

Sol. Organic compound C is more polar

$$\frac{\text{distance travelled by substance}}{\text{distance travelled by solvent}}$$

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

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

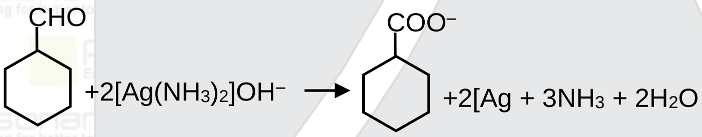
Molar Mass of C = 12g/mol

N = 14g/mol

O = 16g/mol

Ans. NTA : 60

Sol.



$$W_{NH_3} = \frac{131.8 \times 1000}{112} \times 3 \times 17 = 60 \text{ Kg}$$

83. 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_______JK^{-1} (Nearest integer)

Given: R= 8.314 J K^{-1} mol^{-1}. (Challengeble)

Ans. NTA : 3

Reso : –2

Sol. $$\Delta S_{Surr} = \frac{-P_{ext}(V_2 - V_1)}{T}$$

$$\Delta S_{Surr} = \frac{-4(3-2) \times 101.3}{350}$$

= –1.157J

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

takes place 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 ________.

Ans. **NTA : 3**

Sol. $2NO + Br_2 \longrightarrow 2NOBr$

(i) $NO + Br_2 \underset{k_2}{\overset{k_1}{\rightleftharpoons}} NOBr_2$ Fast

(ii) $NOBr_2 + NO \xrightarrow[K_3]{\text{Slow}} 2NOBr$ $\quad r = k_3 [NOBr_2][NO]$

$K_{eq} = \frac{k_1}{k_2} = \frac{[NOBr_2]}{[NO][Br_2]} \Rightarrow \quad [NOBr_2] = \frac{k_1 \times [NO][Br_2]}{k_2}$

$r = \frac{k_1 k_3}{k_2} [NO]^2 [Br_2] \qquad r = k [NO]^2 [Br_2]$

so net order of reaction = 2 + 1 = 3

85. 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

Ans. NTA : 48

Sol. $\frac{P^o - P_s}{P_s} = i \times \text{molality} \times \frac{M}{1000}$

$i = 1 + (n - 1)\alpha$

$i = 1 + (3 - 1) \times 0.8 = 2.6$

1 m = 1 mole of solute $MgCl_2$ dissolve in 1000 g of solvent water.

so $\frac{50 - P_s}{P_s} = \frac{2.6 \times 1}{1000/18}$

$= 50 - P_S = 0.0468 \times P_S$

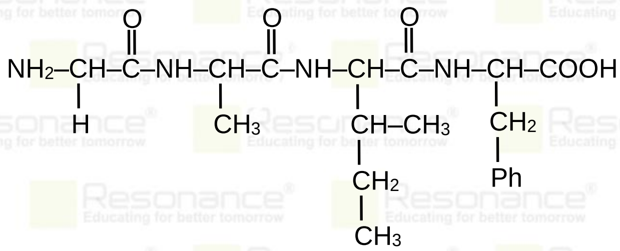
$1.0468\ P_S = 50$

so $P_S = \frac{50}{1.0468} = 47.764 \approx 48$mm of Hg

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

Ans. NTA : 10

Sol.



87. 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)

Ans. NTA : 4

Sol. $(U_{rms})_{Xgas} = (U_{mps})_{Ygas}$

$$\sqrt{\frac{3RT}{M_X}} = \sqrt{\frac{2RT}{M_Y}}$$

$$\sqrt{\frac{3R600}{40}} = \sqrt{\frac{2R90}{M_Y}}$$

$M_Y = 4$ g mol^{-1}

88. Value of work function (W0) for a few metals are given below

Metal	Li	Na	K	Mg	Cu	Ag
W_0/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: $h = 6.6 \times 10^{-34}$Js

$c=3\times10^{8}$m s^{-1}

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

Ans. NTA : 3

Sol. **The energy photon (E) =** $\frac{hc}{\lambda}$

$\lambda =$ **400 nm**

(E) $= \frac{6.6\times10^{-34}\times3\times10^{8}}{400\times10^{-9}}$

E (in eV) = $\frac{6.6\times10^{-34}\times3\times10^{8}}{400\times10^{-9}\times1.6\times10^{-19}}$ eV

The metals Li, Na, k have a work function less than the energy of a photon. So in presence of light with wavelength 400 nm, they exhibit photo electric effect.

89. An analyst wants to convert 1L HCl of pH=1 to a solution of HCl of pH 2. The volume of water needed to do this dilution is__________ mL. (Nearest integer)

Ans. NTA : 9000

Sol. At pH = 1

Concentration of $[H^+] = 10^{-1} = 0.1$ M

At pH = 2

Concentration of $[H^+] = 10^{-2} = 0.01$ M

Now for dilution

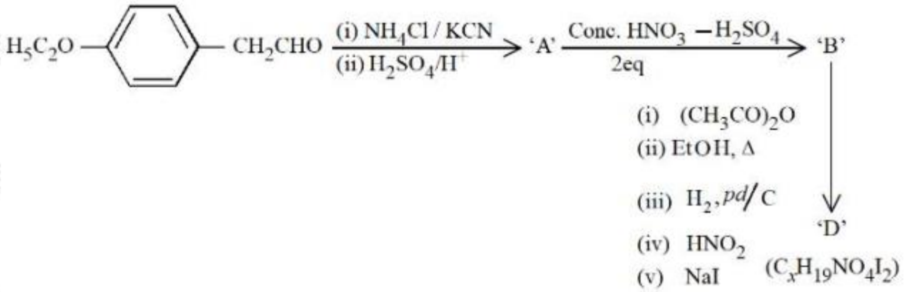
$M_1V_1 = M_2V_2$

$0.1 \times 1 = 0.01 \times V_2$

$V_2 = 10$ L

Final Volume is = 10 – 1 = 9 L = 9000 mL

90.



The value of x in compound 'D' is________.

Ans. NTA : 15