FINAL JEE–MAIN EXAMINATION – APRIL, 2023
Held On Thursday 13th April, 2023
TIME : 03:00 PM to 06:00 PM

SECTION - A

61. Which of the following are the Green house gases ?

(A) Water vapour (B) Ozone (C) I_2 (D) Molecular hydrogen

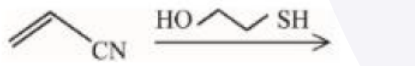
Choose the most appropriate answer from the options given below :

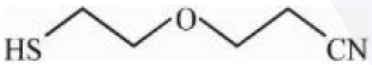
(1) C and D only (2) A and B only (3) B and C only (4) A and D only

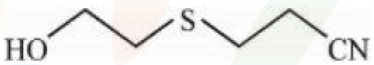
Sol. **2**

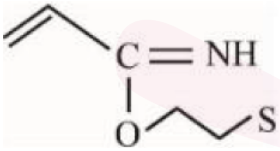
Green house gases are CO_2, CH_4, water vapour, nitrous oxide, CFC_s and ozone.

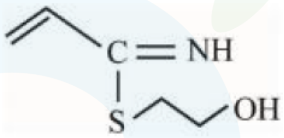
62. The major product for the following reaction is :



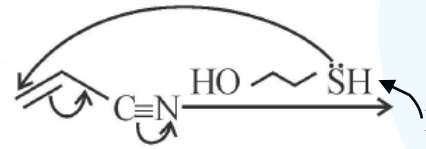
(1) 

(2) 

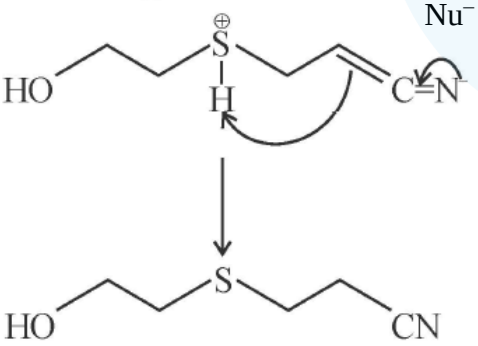
(3) 

(4) 

Sol. **2**



It a better Nu^- than OH and it soft
Nu^- soft will attack an soft electrophile size



63. In the wet tests for detection of various cations by precipitation, Ba^{2+} cations are detected by obtaining precipitate of :

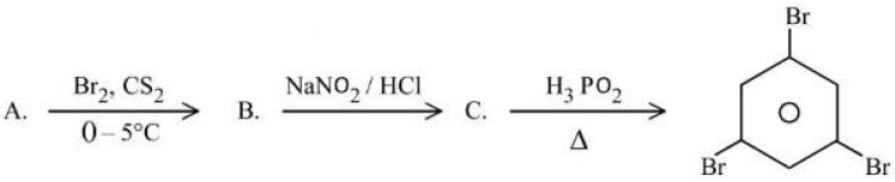
(1) $Ba(OAc)_2$ (2) $BaCO_3$ (3) $BaSO_4$ (4) Ba(ox) : Barium oxalate

Sol. **2**

In wet testing, $(NH_4)_2CO_3$ is used as group reagent for 5^{th} group cations (Ba^{2+}, Ca^{2+}, Sr^{2+})

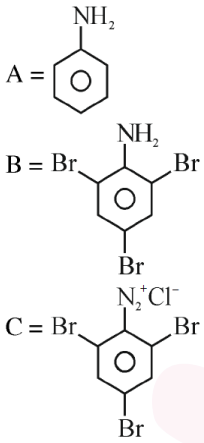
$$Ba^{+2} + (NH_4)_2CO_3 \rightarrow \underset{\text{(white precipitate)}}{BaCO_3\downarrow} + NH_4^{\oplus}$$

64. Compound A from the following reaction sequence is :



(1) Phenol (2) Benzoic Acid (3) Aniline (4) Salicylic Acid

Sol. **3**



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

Assertion A : Isotopes of hydrogen have almost same chemical properties, but difference in their rates of reaction.

Reason R : Isotopes of hydrogen have different enthalpy of bond dissociation.

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

(1) A is not correct but R is correct

(2) Both A and R correct but R is NOT the correct explanation of A

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

(4) A is correct but R is not correct

Sol. **3**

Source NCERT

Since the isotopes have the same electronic configuration, they have almost same chemical properties. The only difference is in their rates of reactions, mainly due to their different enthalpy of bond dissociation.

66. Given below are statements related to Ellingham diagram :

Statement I : Ellingham diagram can be constructed for oxides, sulfides and halides of metals.

Statement II : It consists of plosts of Δ_fH^0 vs for formation of oxides of Clements.

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

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

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

(3) Both Statement I and Statement II are incorrect

(4) Both Statement I and Statement II are correct

Sol. **1**

Statement I is correct, Ellingham diagram can be constructed for formation of oxides, sulphides and halides of metals. (Ref: NCERT)

Statement II is incorrect because Ellingham diagram consists of $\Delta_f G^0$ vs T for formation of oxides of elements.

67. Better method for preparation of BeF_2, among the following is

(1) $BeH_2 + F_2 \xrightarrow{\Delta} BeF_2$ (2) $Be + F_2 \xrightarrow{\Delta} BeF_2$

(3) $(NH_4)_2BeF_4 \xrightarrow{\Delta} BeF_2$ (4) $BeO + C + F_2 \xrightarrow{\Delta} BeF_2$

Sol. **3**

As per NCERT (s block), the better method of preparation of BeF_2 is heating $(NH_4)_2BeF_4$

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

68. Identify the correct order of standard enthalpy of formation of sodium halides.

(1) NaI < NaBr < NaF < NaCl (2) NaF < NaCl < NaBr < Nal

(3) NaCl < NaF < NaBr < Nal (4) Nal < NaBr < NaCl < NaF

Sol. **4**

For a given metal $\Delta_f H^0$ always becomes less negative from fluoride to iodide.

69. Which of the following complexes will exhibit maximum attraction to an applied magnetic field ?

(1) $[Zn(H_2O)_6]^{2+}$ (2) $[Ni(H_2O)_6]^{2+}$ (3) $[Co(en)_3]^{3+}$ (4) $[Co(H_2O)_6]^{2+}$

Sol. **4**

Complex with maximum number of unpaired electron will exhibit maximum attraction to an applied magnetic field

$[Zn(H_2O)_6]^{2+} \rightarrow d^{10}$ system $\rightarrow t_{2g}^6\ eg^4$, 0 unpaired e^-

$[Co(H_2O)_6]^{2+} \rightarrow d^7$ system $\rightarrow t_{2g}^5\ eg^2$, 3 unpaired e^-

$[Co(en)_3]^{3+} \rightarrow d^6$ system $\rightarrow t_{2g}^6\ eg^0$, 0 unpaired e^-

$[Ni(H_2O)_6]^{2+} \rightarrow d^8$ system $\rightarrow t_{2g}^6\ eg^2$, 2 unpaired e^-

70. The correct group of halide ions which can be oxidized by oxygen in acidic medium is

(1) Cl^-, Br^- and I^- only (2) Br^- only (3) Br^- and I^-only (4) I^-only

Sol. **4**

Only I^- among halides can be oxidised to Iodine by oxygen in acidic medium

$4I^-(aq) + 4H^+(aq) + O_2(g) \rightarrow 2I_2(s) + 2H2O(l)$

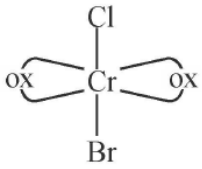
71. The total number of stereoisomers for the complex $[Cr(ox)_2ClBr]^{3-}$ (where ox = oxalate) is :

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

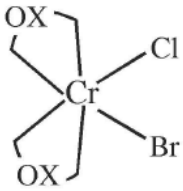
Sol. **1**

$[Cr(Ox)_2\ ClBr]^{-3}$

- No. of isomers-



- This structure has plane of symmetry, So no optical isomerism will be shown.



- This structure does not contain plane of symmetry, So two forms d as well as 1 will be shown.

72. Match List I with List II

I – Bromopropane is reacted with reagents in List I to give product in List II

LIST I-Reagent	**LIST II – Product**
A KOH (alc)	I. Nitrile
B. KCN (alc)	II. Ester
C. $AgNO_2$	III. Alkene
D. $H_3CCOOAg$	IV. Nitroalkane

Choose the correct answer from the options given below :

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

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

Sol. **4**

$CH_3 - CH_2 - CH_2 - Br + KOH(Alc) \rightarrow CH_3 - \underset{(Alkene)}{CH} = CH_2$

$CH_3 - CH_2 - CH_2 - Br + KCN(Alc) \rightarrow CH_3 - \underset{(Nitrile)}{CH_2 - CH_2} - CN$

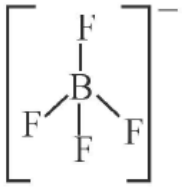
$CH_3 - CH_2 - CH_2 - Br + AgNO_2 + CH_3 - \underset{(Nitroalkane)}{CH_2 - CH_2} - NO_2 + AgBr \downarrow$

$CH_3 - CH_2 - CH_2 - Br + CH_3 - COOAg \rightarrow CH_3 - COO - \underset{(Ester)}{CH_2} - CH_2 - CH_3 + AgBr \downarrow$

73. The covalency and oxidation state respectively of boron in $[BF_4]^-$, are :

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

Sol. **2**



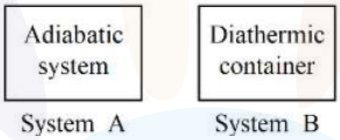
Number of covalent bond formed by Boron is 4

Oxidation number of fluorine is –1,

Oxidation number of B + 4 × (–1) = –1,

Thus, Oxidation number of B = + 3

74. What happens when methance undergoes combustion in systems A and B respectively ?



(1)

System A	System B
Temperature remains same	Temperature rises

(2)

System A	System B
Temperature falls	Temperature rises

(3)

System A	System B
Temperature falls	Temperature remains same

(4)

System A	System B
Temperature rises	Temperature remains same

Sol. **4**

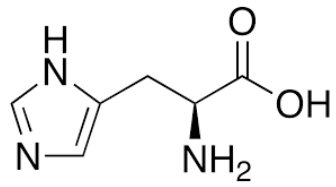
Adiabatic boundary does not allow heat exchange thus heat generated in container can't escape out thereby increasing the temperature. In case of Diathermic container, heat flow can occur to maintain the constant temperature.

75. The naturally occurring amino acid that contains only one basic functional group in its chemical structure is :

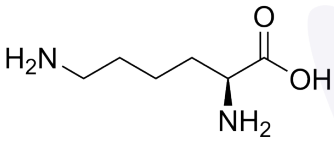
(1) histidine (2) lysine (3) asparagine (4) arginine

Sol. **3**

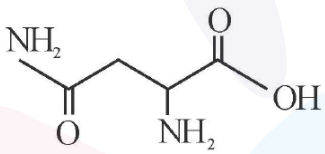
1. histidine



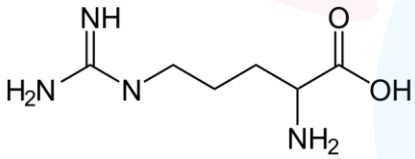
2. Lysine



3.



4. Arginine



76. Given below are two statements :

Statement I : SO_2 and H_2O both possess V-shaped structure.

Statement II : The bond angle of SO_2 less than that of H_2O

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

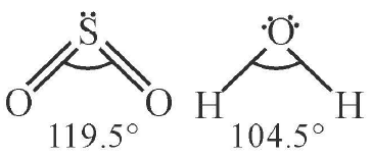
(1) Both Statements I and Statement II are incorrect

(2) Both Statement I and Statements II are correct

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

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

Sol. **3**



Both are bent in shape.

Bond angle of SO_2 (sp^2) is greater than that of H_2O (sp^3) due to higher repulsion of multiple bonds.

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

Assertion A : The diameter of colloidal particles in solution should not be much smaller than wavelength of light to show Tyndall effect.

Reason R: The light scatters in all direction when the size of particles is large enough.

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

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

(2) A is true but R is false

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

(4) A is false but R is true

Sol. **3**

Tyndall effect is observed only when the following two conditions are satisfied

(a) The diameter of the dispersed particle is not much smaller than the wave length of light used.

(b) Refractive indices of dispersed phase and dispersion medium differ greatly in magnitude.

78. Match List I with List II

LIST I	LIST II
A. Weak intermolecular farces of attraction	I. Hexamethylenendiamine + adipic
B. Hydrogen bonding	II. $AlEt_3 + TiCl_4$
C. Heavily branched polymer	III. 2–chloro –1, 3 – butadiene
D. High density polymer	IV. Phenol + formaldehyde

Choose the correct answer from the options given below :

(1) A–IV, B-I, C-III, D-II

(2) A–III, B-I, C-IV, D-II

(3) A–II, B-IV, C-I, D-III

(4) A–IV, B-II, C-III, D-I

Sol. **2**

- Hexamethylenediamine on reaction with adipic acid forms Nylon 6, 6 which shows H-bonding due to presence of amide group.
- $AlEt_3 + TiCl_4$ is Ziegler-Natta catalyst used to prepare high density polyethylene.
- 2-chloro-1, 3-butadiene (chloroprene) is monomer of neoprene which is a rubber (an elastomer)
- Phenol - formaldehyde forms Bakelite which is heavily branched (cross-linked) polymer

79. Given below are two statements :

Statement I : Tropolone is an aromatic compound and has 8 π electrons.

Statement II : π electrons of > C = O group in tropolone is incolved in aromaticity

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

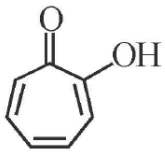
(1) Statement I is false but Statement II is true

(2) Statement I is true but Statement II is false

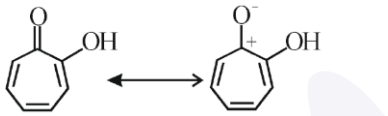
(3) Both Statement I and Statement II are true

(4) Both Statement I and Statement II are false

Sol. **2**

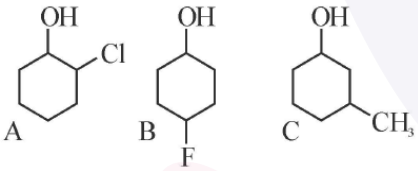


Tropolone is an aromatic compound and has 8π electrons ($6\pi e^-$ are endocyclic and $2\pi e^-$ are exocyclic) and π electrons of $>C=O$ group in tropolone is not involved in aromaticity.



aromatic compound ($6\pi e^-$)

80. Given below are two statements, one is labelled as **Assertion A** and the other is labelled as **Reason R**.
Assertion A : Order of acidic nature of the following compounds is A > B > C.



Reason R : Fluoro is a stronger electron withdrawing group than Chloro group.
In the light of the above statements, choose the correct answer from the options given below :
(1) Both A and R are correct and R is the correct explanation of A
(2) A is false but R is true
(3) Both A and R are correct but R is NOT the correct explanation of A
(4) A is true but R is false

Sol. **3**

Acidic strength α –I effect

$$\alpha \ \frac{I}{+I} \text{ effect}$$

F, Cl exerts -1 effect, Methyl exerts +I effect, C is least acidic.
Among A and B; since inductive effect is distance dependent, Extent of –I effect is higher in A followed by B even though F is stronger electron withdrawing group than Cl. Thus, A is more acidic than B.

SECTION - B

81. If the formula of Borax is $Na_2B_4O_x(OH)_y.zH_2O$, then x + y + z = _____.

Sol. **17**

Formula of borax is $Na_2B_4O_5(OH)_4 \cdot 8H_2O$

82. Sea water contains 29.25% NaCl and 19% $MgCl_2$ by weight of solution. The normal boiling point of the sea water is _____°C(Nearest integer)
Assume 100% ionization for both NaCl and $MgCl_2$
Given : $K_b(H_2O) = 0.52$ K kg mol^{-1}
Molar mass of NaCl and $MgCl_2$ is 58.5 and 95 g mol^{-1} respectivley.

Sol. **116**

Amount of solvent = 100 – (29.25 + 19) = 51.75g

$$\Delta T_b = \left[\frac{2\times 29.25\times 1000}{58.5\times 51.75} + \frac{3\times 19\times 1000}{95\times 51.75}\right]\times 0.52$$

$\Delta T_b = 16.075$
$\Delta T_b = (T_b)_{solution} - (T_b)_{solvent}$
$(T_b)_{solution} = 100 + 16.07$
$= 116.07°C$

83. 20 mL of 0.1 M NaOH is added to 50 mL of 0. 1 M acetic acid solution. The pH of the resulting solution is ____ $\times 10^{-2}$ (Nearest integer)

Given : pKa (CH_3 COOH) = 4.76

log 2 = 0.30

log 3 = 0.48

Sol. **458**

	CH_3COOH + NaOH $\rightarrow$	CH_3COONa +	H_2O
Initially	5mmol	2mmol	0	0
after Rxn	3mmol	0	2 mmole	2 mmole

$$pH = pKa + \log_{10} \frac{[salt]}{[acid]}$$

$$pH = 4.76 + \log_{10} \frac{2}{3}$$

$pH = 4.58 = 458 \times 10^{-2}$

84. At 298 K, the standard reduction potential for Cu^{2+}/Cu electrode is 0.034 V.

Given : K_{sp} $Cu(OH)_2 = 1 \times 10^{-20}$

$$\text{Take} \frac{2.303RT}{F} = 0.059V$$

The reduction potential at pH = 14 for the above couple is (–) x $\times 10^{-2}$ V.

The value of x is _____.

Sol. **25**

$Cu(OH)_2(s)$ $\square$ $Cu^{2+}(aq) + 2OH^-(aq)$

$Ksp = [Cu^{2+}] [OH^-]^2$

pH = 14; pOH = 0; $[OH^-] = 1M$

$$\therefore [Cu^{2+}] = \frac{Ksp}{[1]^2} = 10^{-20} M$$

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

$$E = E° - \frac{0.059}{2} \log_{10} \frac{1}{[Cu^{2+}]}$$

$$= 0.34 - \frac{0.059}{2} \log_{10} \frac{1}{10^{-20}}$$

$= –0.25 = –25 \times 10^{-2}$

85. Sodium metal crystallizes in a body centred cubic lattice with unit cell edge length of 4 Å. The radius of sodium atom is ____$\times 10^{-1}$ Å (Nearest integer)

Sol. **17**

$\sqrt{3}a = 4r$

$\sqrt{3} \times 4 = 4r$

r = 1.732Å

$= 17.32 \times 10^{-1}$

86. A (g) → 2B (g) + C (g) is first order reaction. The initial pressure of the system was found to be 800 mm Hg which increased to 1600 mm Hg after 10 min. The total pressure of the system after 30 min will be ____ mm Hg. (Nearest integer)

Sol. **2200**

$t_{\frac{1}{2}}$ = 10 minutes

$$(P_A)_{30\,min} = (P_A)_0\left(\frac{1}{2}\right)^{30/10}$$

$(P_A)_{30\ min}$ = 100 mm Hg

	A(g) ⟶	2B(g) +	C(g)
at t = 0	800 mm	0	0
at t = 30	l00 mm	1400 mm	700 mm

Total pressure after 30 minutes = 2200 mm Hg

87. 1g of a carbonate (M_2CO_3) on treatment with excess HCl produces 0.01 mol of CO_2. The molar mass of M_2CO_3 is ____ g mol^{-1}. (Nearest integer)

Sol. **100**

$$\underset{1gm}{M_2CO_3} + \underset{Excess}{2HCl} \rightarrow \underset{0.02mole}{2MCl} + H_2O + \underset{0.01mole}{CO_2}$$

From principle of atomic conservation of carbon atom,

Mole of $M_2CO_3 \times 1$ = Mole of $CO_2 \times 1$

$$\frac{1gm}{\text{molar mass of } M_2CO_3} = 0.01\times1$$

∴ Molar mass of M_2CO_3 = 100 gm/mole

88. 0.400 g of an organic compound (X) gave 0.376 g of AgBr in Carius method for estimation of bromine. % of bromine in the compound (X) is ____. (Given : Molar mass AgBr = 188 g mol^{-1}, Br = 80 g mol^{-1})

Sol. **40**

$$\text{mole of AgBr} = \frac{0.376}{188}$$

$$\text{mole of } Br^- = \text{mole of AgBr} = \frac{0.376}{188}$$

$$\text{mass of } Br^- = \frac{0.376}{188}\times80$$

$$\%\text{ of } Br^- = \frac{0.376\times80}{188\times0.4}\times100 = 40\%$$

89. The orbital angular momentum of an electron in 3s orbital is $\frac{xh}{2\pi}$. The value of x is ____ (nearest integer)

Sol. **0**

$$\text{Orbital angular momentum} = \sqrt{l(l+1)}\,\frac{h}{2\pi}$$

Value of l for s = 0

90. See the following chemical reaction :

$$Cr_2O_7^{2-} + XH^+ + 6Fe^{2+} \rightarrow YCr^{3+} + 6Fe^{3+} + ZH_2O$$

The sum of X, Y and Z is _____

Sol. **23**

$Cr_2O_7^{2-} + 14H^+ + 6Fe^{2+} \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

x = 14

y = 2

z = 7

Hence (x + y + z) = 14 + 2 + 7 = 23