JEE Main 2023 (2nd Attempt)
(Shift - 02 Chemistry Paper) 13.04.2023

CHEMISTRY | **TEST PAPER WITH SOLUTION**

SECTION-A

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

(1) Ba(ox) : Barium oxalate

(2) $BaCO_3$

(3) $Ba(OAc)_2$

(4) $BaSO_4$

Official Ans. by NTA (2)

Allen Ans. (2)

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

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

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

(1) arginine

(2) lysine

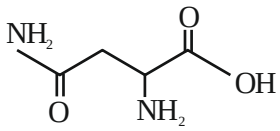
(3) asparagine

(4) histidine

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. Asparagine has only one basic functional group in its chemical structure.



Others are basic amino acid with more than one basic functional group.

63. Given below are two statements related to Ellingham diagram:

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

Statement-II : It consists of plots of Δ_fH^0 vs T for formation of oxides of elements.

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 incorrect but Statement II is. correct

(3) Both Statement I and Statement II are correct

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

Official Ans. by NTA (1)

Allen Ans. (4)

Sol. 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 Δ_fG^0 vs T for formation of oxides of elements.

64. 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 directions 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) A is true but R is false

(2) A is false but R is true

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

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

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. 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.

65. The total number of stereoisomers for the complex $[Cr(ox)_2\ ClBr]^{3-}$ (where ox = oxalate) is:

(1) 2

(2) 3

(3) 1

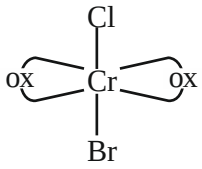
(4) 4

Official Ans. by NTA (2)

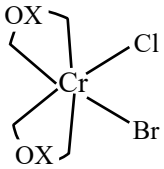
Allen Ans. (2)

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

- 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 l will be shown.

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

(1) $(NH_4)_2BeF_4 \xrightarrow{\Delta} BeF_2$

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

(3) $Be + F_2 \xrightarrow{\Delta} BeF_2$

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

Official Ans. by NTA (1)

Allen Ans. (1)

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

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

67. 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) Both A and R are correct but R is NOT the correct explanation of A

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

(3) A is not correct but R is correct

(4) A is correct but R is not correct

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. 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.

68. Given below are two statements:

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

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

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

(1) Both Statement I and Statement II are true

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

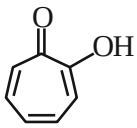
(3) Statement I is false but Statement II is true

(4) Both Statement I and Statement II are false

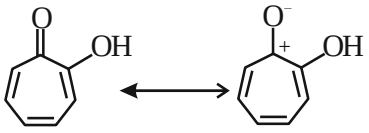
Official Ans. by NTA (2)

Allen Ans. (2)

Sol.

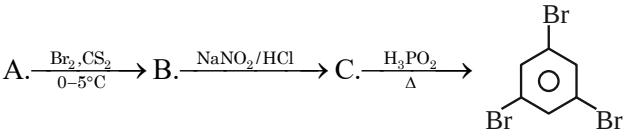


Tropolone is an aromatic compound and has 8π electrons ($6\pi e^-$ are endocyclic and $2\pi e^-$ are exocyclic) and π electrons of >C = O group in tropolone is not involved in aromaticity.



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

69. Compound A from the following reaction sequence is:



(1) Benzoic Acid

(2) Phenol

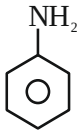
(3) Salicylic Acid

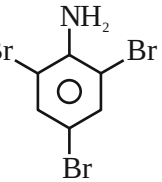
(4) Aniline

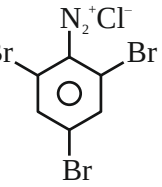
Official Ans. by NTA (4)

Allen Ans. (4)

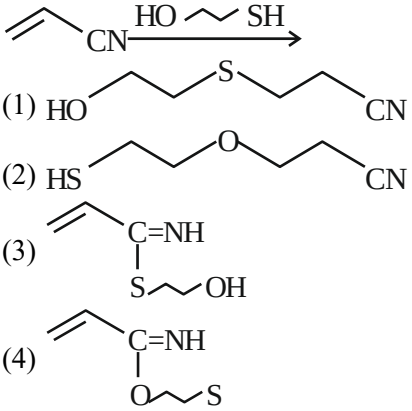
Sol.

A = 

B = 

C = 

70. The major product for the following reaction is:



(1)

(2)

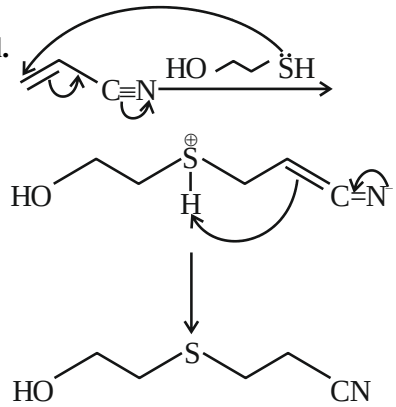
(3)

(4)

Official Ans. by NTA (1)

Allen Ans. (1)

Sol.



71. 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

(1) B and C only

(2) C and D only

(3) A and D only

(4) A and B only

Official Ans. by NTA (4)

Allen Ans. (4)

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

72. Match List I with List II

	LIST I		**LIST II**
A.	Weak intermolecular forces of attraction	I.	Hexamethylenediamine + adipic acid
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-II, B-IV, C-I, D-III

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

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

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

Official Ans. by NTA (2)

Allen Ans. (2)

Sol.

- 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

73. 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 is 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 Statement I and Statement II are correct

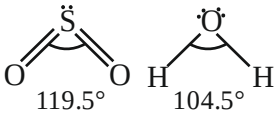
(2) Statement I is correct but Statement II is incorrect

(3) Both Statement I and Statement II are incorrect

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

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. 

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.

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

(1) Br^- only

(2) Cl^-, Br^- and I^- only

(3) Br^- and I^- only

(4) I^- only

Official Ans. by NTA (4)

Allen Ans. (4)

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

$4I^-(aq) + 4H^+(aq) + O_2(g) \rightarrow 2I_2(s) + 2H_2O(l)$

75. What happens when methane undergoes combustion in systems A and B respectively?

Adiabatic system	Diathermic container
System A	System B

(1)

System A	System B
Temperature rises	Temperature remains same

(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 remains same	Temperature rises

Official Ans. by NTA (1)

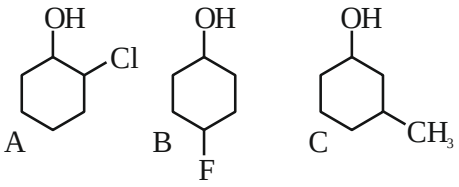
Allen Ans. (1)

Sol. 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.

76. 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) A is false but R is true

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

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

(4) A is true but R is false

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. Acidic strength α – I effect

$$\alpha \ \frac{1}{+I} \text{ effect}$$

F, Cl exerts –I 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.

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

(1) NaI < NaBr < NaCl < NaF

(2) NaF < NaCl < NaBr < NaI

(3) NaCl < NaF < NaBr < NaI

(4) NaI < NaBr < NaF < NaCl

Official Ans. by NTA (1)

Allen Ans. (1)

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

78. Match List I with List II

1 - 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

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

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

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

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

Official Ans. by NTA (2)

Allen Ans. (2)

Sol.

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

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

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

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

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

(1) 4 and 3

(2) 4 and 4

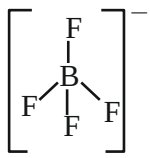
(3) 3 and 4

(4) 3 and 5

Official Ans. by NTA (1)

Allen Ans. (1)

Sol.



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

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

(1) $[Zn(H_2O)_6]^{2+}$

(2) $[Co(H_2O)_6]^{2+}$

(3) $[Co(en)_3]^{3+}$

(4) $[Ni(H_2O_6]^{2+}$

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. 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^-

SECTION-B

81. 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})

Official Ans. by NTA (40)

Allen Ans. (40)

Sol. mole of $AgBr = \frac{0.376}{188}$

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

mass of $Br^- = \frac{0.376}{188} \times 80$

% of $Br^- = \frac{0.376 \times 80}{188 \times 0.4} \times 100 = 40\%$

82. 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)

Official Ans. by NTA (100)

Allen Ans. (100)

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

From principle of atomic conservation of carbon atom,

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

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

$\therefore$ Molar mass of M_2CO_3 = 100 gm/mole

83. 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 _____.

Official Ans. by NTA (23)

Allen Ans. (23)

Sol.

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

x = 14

y = 2

z = 7

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

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

Official Ans. by NTA (17)

Allen Ans. (17)

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

85. At 298 K, the standard reduction potential for Cu^{2+} / Cu electrode is 0.34 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 _____.

Official Ans. by NTA (25)

Allen Ans. (25)

Sol. $Cu(OH)_2(s) \rightleftharpoons Cu^{2+}(aq) + 2OH^-(aq)$

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

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

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

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

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

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

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

86. 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

Official Ans. by NTA (448)

Allen Ans. (458)

Sol. $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

Initially	5mmol	2mmol	0	0
after Rxn	3mmol	0	2 mmole	2 mmole

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

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

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

87. $A(g) \rightarrow 2B(g) + C(g)$ is a 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)

Official Ans. by NTA (2200)

Allen Ans. (2200)

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

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

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

	$A(g) \rightarrow$	$2B(g)$ +	$C(g)$
at t = 0	800mm	0	0
at t = 30	100mm	1400mm	700mm

Total pressure after 30 minutes = 2200 mm Hg

88. The orbital angular momentum of an electron in 3s orbital is $\frac{xh}{2\pi}$. The value of .x is

Official Ans. by NTA (0)

Allen Ans. (0)

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

Value of l for s = 0

89. 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)

Official Ans. by NTA (17)

Allen Ans. (17)

Sol. $\sqrt{3}a = 4r$

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

r = 1.732Å

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

90. 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} respectively.

Official Ans. by NTA (116)

Allen Ans. (116)

Sol.

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

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

$\Delta Tb = 16.075$

$\Delta Tb = (T_b)_{solution} - (T_b)_{solvent}$

$(T_b)_{solution} = 100 + 16.07$

$= 116.07°C$