FINAL JEE–MAIN EXAMINATION – JULY, 2022

(Held On Monday 25th July, 2022) **TIME : 9 : 00 AM to 12 : 00 NOON**

CHEMISTRY — TEST PAPER WITH SOLUTION

SECTION-A

1. SO_2Cl_2 on reaction with excess of water results into acidic mixture

$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$

16 moles of NaOH is required for the complete neutralisation of the resultant acidic mixture. The number of moles of SO_2Cl_2 used is :

(A) 16 (B) 8

(C) 4 (D) 2

Official Ans. by NTA (C)

Allen Ans. (C)

Sol. Let $n(SO_2Cl_2) = x$ moles

$\therefore n(H_2SO_4) = x, n(HCl) = 2x$

$\Rightarrow n(H^+) = 4x$

For Neutralisation

$\Rightarrow n(H^+) = n(OH^-)$

$\Rightarrow 4x = 16$

$\Rightarrow \mathbf{x = 4}$

2. Which of the following sets of quantum numbers is not allowed ?

(A) $n = 3, l = 2, m_l = 0, s = +\frac{1}{2}$

(B) $n = 3, l = 2, m_l = -2, s = +\frac{1}{2}$

(C) $n = 3, l = 3, m_l = -3, s = -\frac{1}{2}$

(D) $n = 3, l = 0, m_l = 0, s = -\frac{1}{2}$

Official Ans. by NTA (C)

Allen Ans. (C)

Sol. $l = 0, 1, 2 \ldots\ldots (n-1)$

$\therefore$ for $n = 3$

$l = 0, 1, 2$

$\Rightarrow l = 3,$

not possible for $n = 3$

3. The depression in freezing point observed for a formic acid solution of concentration 0.5 mL L^{-1} is 0.0405°C. Density of formic acid is 1.05 g mL^{-1}. The Van't Hoff factor of the formic acid solution is nearly : (Given for water $k_f = 1.86$ K kg mol^{-1})

(A) 0.8 (B) 1.1

(C) 1.9 (D) 2.4

Official Ans. by NTA (C)

Allen Ans. (C)

Sol. $[HCOOH] = 0.5$ ml l^{-1}

$\Rightarrow$ (0.5 ml × 1.05 g ml^{-1}) HCOOH in 1L

$\Rightarrow$ 0.525 g HCOOH in 1L

$$m = \frac{(0.525/46)}{1kg} \text{ mol [Assuming dilute solution]}$$

$$\therefore \Delta T_f = iK_f m \Rightarrow i = \frac{\Delta T_f}{k_f m} = \frac{0.0405 \times 46}{1.86 \times 0.525} = 1.9$$

4. 20 mL of 0.1 M NH_4OH is mixed with 40 mL of 0.05 M HCl. The pH of the mixture is nearest to:

(Given: $K_b(NH_4OH) = 1 \times 10^{-5}$, log 2 = 0.30, log 3 = 0.48, log 5 = 0.69, log 7 = 0.84, log 11 =1.04)

(A) 3.2 (B) 4.2

(C) 5.2 (D) 6.2

Official Ans. by NTA (C)

Allen Ans. (C)

Sol. $NH_4OH + HCl \rightarrow NH_4Cl + H_2O$

mmole 2 2

\- - 2 mmole

$$\left[NH_4^+\right] = \frac{2\text{mmole}}{60\,\text{ml}} = \frac{1}{30}\,\text{M}$$

$$pH = \frac{pK_w - pK_b - \log C}{2} = \frac{14 - 5 + 1.48}{2} = 5.24$$

5.

Match **List - I** with **List - II**

	List - I		List - II
(A)	$N_2(g)+3H_2(g) \rightarrow 2NH_3(g)$	(I)	Cu
(B)	$CO(g)+3H_2(g) \rightarrow CH_4(g)+H_2O(g)$	(II)	$Cu/ZnO-Cr_2O_3$
(C)	$CO(g)+H_2(g) \rightarrow HCHO(g)$	(III)	$Fe_xO_y+K_2O+Al_2O_3$
(D)	$CO(g)+2H_2(g) \rightarrow CH_3OH(g)$	(IV)	Ni

Choose the correct answer from the options given below :

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

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

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

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

Official Ans. by NTA (C)

Allen Ans. (C)

Sol. **Factual**

6. The IUPAC nomenclature of an element with electronic configuration $[Rn]5f^{14}6d^{1}7s^{2}$ is :

(A) Unnilbium (B) Unnilunium

(C) Unnilquadium (D) Unniltrium

Official Ans. by NTA (D)

Allen Ans. (D)

Sol. Atomic Number 103

7. The compound(s) that is(are) removed as slag during the extraction of copper is :

(1) CaO (2) FeO

(3) Al_2O_3 (4) ZnO

(5) NiO

Choose the correct answer from the options given below :

(A) (3) (4) Only (B) (1), (2), (5) Only

(C) (1), (2) Only (D) (2) Only

Official Ans. by NTA (D)

Allen Ans. (D)

Sol. $FeO + SiO_2 \rightarrow FeSiO_3$

8. The reaction of H_2O_2 with potassium permanganate in acidic medium leads to the formation of mainly:

(A) Mn^{2+} (B) Mn^{4+}

(C) Mn^{3+} (D) Mn^{6+}

Official Ans. by NTA (A)

Allen Ans. (A)

Sol. $H_2O_2 + MnO_4^- \rightarrow Mn^{2+} + O_2$ (unbalanced)

9. Choose the correct order of density of the alkali metals :

(A) Li < K < Na < Rb < Cs

(B) Li < Na < K < Rb < Cs

(C) Cs < Rb < K < Na < Li

(D) Li < Na < K < Cs < Rb

Official Ans. by NTA (A)

Allen Ans. (A)

Sol. **Factual**

10. The geometry around boron in the product 'B' formed from the following reaction is

$$BF_3 + NaH \xrightarrow{450K} A + NaF$$

$$A + NMe_3 \rightarrow B$$

(A) trigonal planar (B) tetrahedral

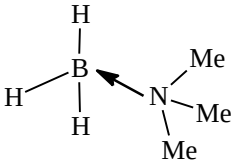
(C) pyramidal (D) square planar

Official Ans. by NTA (B)

Allen Ans. (B)

Sol. $BF_3 + NaH \xrightarrow{450K} \underset{\text{(diborane)}}{B_2H_6} + NaF$

$$B_2H_6 + NMe_3 \longrightarrow \underset{\text{symmetrical cleavage}}{2[BH_3 \leftarrow NMe_3]}$$



11. The interhalogen compound formed from the reaction of bromine with excess of fluorine is a :

(A) hypohalite (B) halate

(C) perhalate (D) halite

Official Ans. by NTA (B)

Allen Ans. (B)

Sol. $Br_2 + 5\underset{\text{(excess)}}{F_2} \longrightarrow 2\overset{+5}{Br}F_5 \xrightarrow{H_2O} HBrO_3$ (Forms bromate)

12. The photochemical smog does not generally contain :

(A) NO (B) NO_2

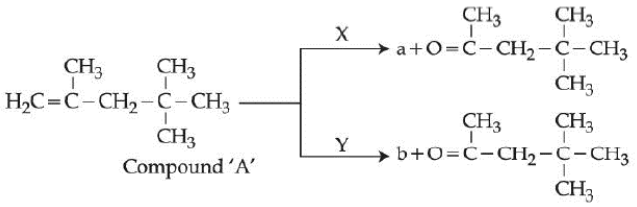
(C) SO_2 (D) HCHO

Official Ans. by NTA (C)

Allen Ans. (C)

Sol. **Factual**

13. A compound 'A' on reaction with 'X' and 'Y produces the same major product but different by product 'a' and 'b'. Oxidation of 'a' gives a substance produced by ants.



'X' and 'Y' respectively are :

(A) $KMnO_4/H^+$ and dil. $KMnO_4$, 273 K

(B) $KMnO_4$,(dilute), 273 K and $KMnO_4/H^+$

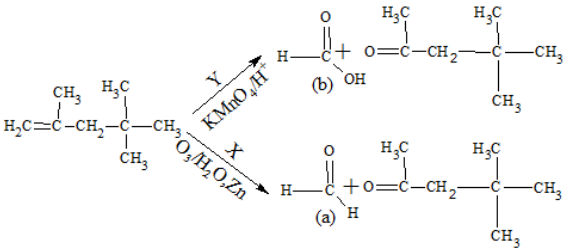
(C) $KMnO_4/H^+$ and O_3, H_2O/Zn

(D) O_3, H_2O/Zn and $KMnO_4/H^+$

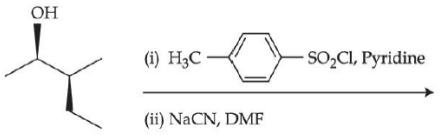
Official Ans. by NTA (D)

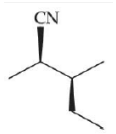
Allen Ans. (D)

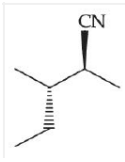
Sol.

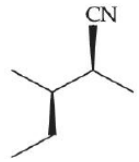


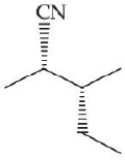
14. Most stable product of the following reaction is:



(A) 

(B) 

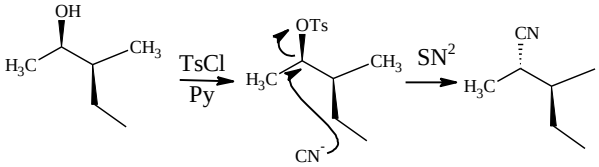
(C) 

(D) 

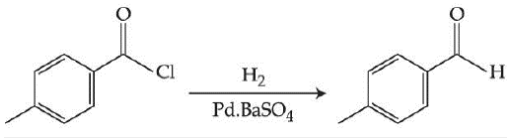
Official Ans. by NTA (B)

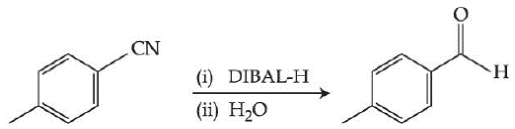
Allen Ans. (B)

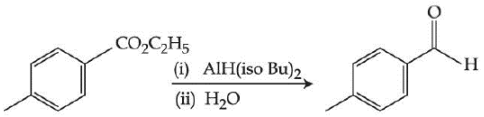
Sol.

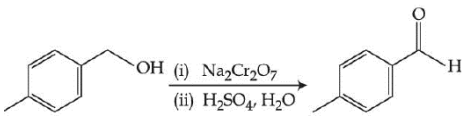


15. Which one of the following reactions does not represent correct combination of substrate and product under the given conditions ?

(A) 

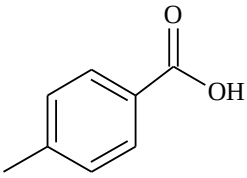
(B) 

(C) 

(D) 

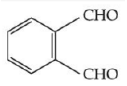
Official Ans. by NTA (D)

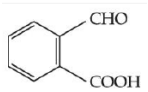
Allen Ans. (D)

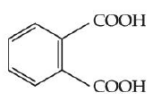
Sol. 

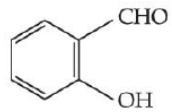
is formed

16. An organic compound 'A' on reaction with NH_3 followed by heating gives compound B. Which on further strong heating gives compound C ($C_8H_5NO_2$). Compound C on sequential reaction with ethanolic KOH, alkyl chloride and hydrolysis with alkali gives a primary amine. The compound A is :

(A) 

(B) 

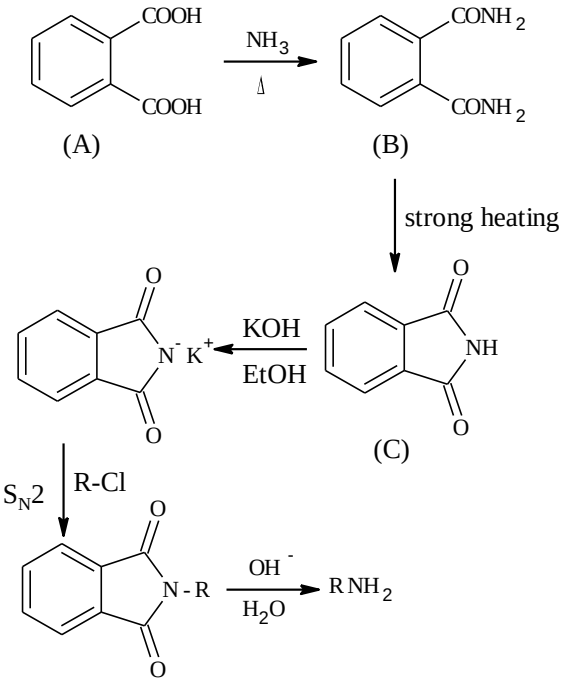
(C) 

(D) 

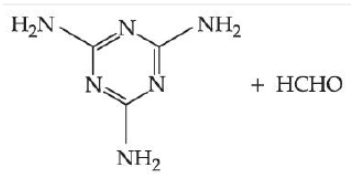
Official Ans. by NTA (C)

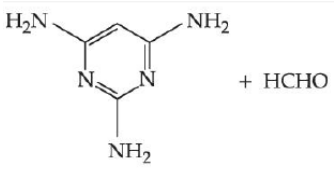
Allen Ans. (C)

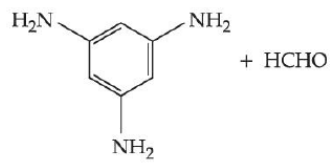
Sol. Gabriel Pthalimide reaction

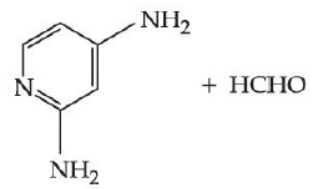


17. Melamine polymer is formed by the condensation of :

(A) 

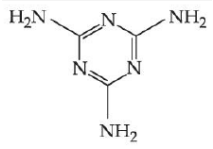
(B) 

(C) 

(D) 

Official Ans. by NTA (A)

Allen Ans. (A)

Sol. Melamine : 

Formaldehyde HCHO

Melamine formaldehyde Resin is melamine polymer

18. During the denaturation of proteins, which of these structures will remain intact ?

(A) Primary

(B) Secondary

(C) Tertiary

(D) Quaternary

Official Ans. by NTA (A)

Allen Ans. (A)

Sol. Primary structure remains intact during denaturation of proteins

19. Drugs used to bind to receptors, inhibiting its natural function and blocking a message are called :

(A) Agonists

(B) Antagonists

(C) Allosterists

(D) Anti histaminists

Official Ans. by NTA (B)

Allen Ans. (B)

Sol. Factual

20. Given below are two statements :

Statement I : On heating with $KHSO_4$, glycerol is dehydrated and acrolein is formed.

Statement II : Acrolein has fruity odour and can be used to test glycerol's presence.

Choose the correct option.

(A) Both Statement I and Statement II are correct.

(B) Both Statement I and Statement II are incorrect

(C) Statement I is correct but Statement II is incorrect.

(D) Statement I is incorrect but Statement II is correct.

Official Ans. by NTA (C)

Allen Ans. (C)

Sol. Acrolein has a pungent, suffocating odour.

Acrolein is used to detect presence of glycerol

SECTION-B

1. Among the following species

$N_2, N_2^+, N_2^-, N_2^{2-}, O_2, O_2^+, O_2^-, O_2^{2-}$

the number of species showing diamagnetism is

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. Diamagnetic species are: N_2, O_2^{2-}

2. The enthalpy of combustion of propane, graphite and dihydrogen at 298 K are: –2220.0 kJ mol^{-1}, –393.5 kJ mol^{-1} and –285.8 kJ mol^{-1} respectively. The magnitude enthalpy of formation of propane (C_3H_8) is……kJ mol^{-1}. (Nearest integer)

Official Ans. by NTA (104)

Allen Ans. (104)

Sol. $3C_{(gr)} + 4H_{2(g)} \rightarrow C_3H_{8(g)}$

$= -103.7$ kJ mol^{-1}

3. The pressure of a moist gas at 27°C is 4 atm. The volume of the container is doubled at the same temperature. The new pressure of the moist gas is …. $\times 10^{-1}$ atm. (Nearest integer)

(Given : The vapour pressure of water at 27°C is 0.4 atm)

Official Ans. by NTA (22)

Allen Ans. (22)

Sol. $\left[P_{gas}\right]_0 + V.P. = 4$

$\left[P_{gas}\right]_0 = 4 - 0.4 = 3.6$

As volume is doubled, $\left[P_{gas}\right]_{new} = 1.8$ atm

New Total Pressure = 1.8 + 0.4 = 2.2 atm

4. The cell potential for $Zn|Zn^{2+}(aq)||Sn^{x+}|Sn$ is 0.801 V at 298 K. The reaction quotient for the above reaction is 10^{-2}. The number of electrons involved in the given electrochemical cell reaction is. . . . .

(Given $E^0_{Zn^{2+}|Zn} = -0.763V$, $E^0_{Sn^{x+}|Sn} = +0.008V$ and $\frac{2.303RT}{F} = 0.06V$ **)**

Official Ans. by NTA (4)

Allen Ans. (2)

Sol. $E = E^0 - \frac{2.303\,RT}{nF}\log Q$

Here, $E = +0.801V$, $E^0 = 0.008 - (-0.763)$

$= +0.771$ V

$\therefore 0.801 = +0.771 - \frac{0.06}{n}\log 10^{-2}$

$\Rightarrow n = 4$

5. The half life for the decomposition of gaseous compound A is 240 s when the gaseous pressure was 500 Torr initially. When the pressure was 250 Torr, the half life was found to be 4.0 min. The order of the reaction is……. (Nearest integer)

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. $(t_{1/2})_{500\ torr} = 240$ sec $= 4$ min.

$(t_{1/2})_{250\ torr} = 4$ min.

$t_{1/2} \propto a^{1-n}$

As $t_{1/2}$ is independent of initial pressure. Hence, order is 1st order.

6. Consider the following metal complexes :

$[Co(NH_3)]^{3+}$

$[CoCl(NH_3)_5]^{2+}$

$[Co(CN)_6]^{3-}$

$[Co(NH_3)_5(H_2O)]^{3+}$

The spin-only magnetic moment value of the complex that absorbs light with shortest wavelength is B.M. (Nearest integer)

Official Ans. by NTA (0)

Allen Ans. (0)

Sol. $\Delta_0 \propto \frac{1}{\lambda}$

Here, CN^- being SFL will have maximum CFSE

So, $[Co(CN)_6]^{3-}$ will be d^2sp^3, $\mu = 0$

7. Among Co^{3+}, Ti^{2+}, V^{2+} and Cr^{2+} ions, one if used as a reagent cannot liberate H_2 from dilute mineral acid solution, its spin-only magnetic moment in gaseous state is ……B.M. (Nearest integer)

Official Ans. by NTA (5)

Allen Ans. (5)

Sol. Co^{3+} can't liberate H_2.

It has d^6 configuration,

Number of unpaired electrons = 4

$\mu = \sqrt{4 \times 6} = 4.92$ B.M.

8. While estimating the nitrogen present in an organic compound by Kjeldahl's method, the ammonia evolved from 0.25 g of the compound neutralized 2.5 mL of 2 M H_2SO_4. The percentage of nitrogen present in organic compound is ..... .

Official Ans. by NTA (56)

Allen Ans. (56)

Sol. $$\%N = \frac{1.4(N_1V_1)}{\text{mass of organic compound}}$$

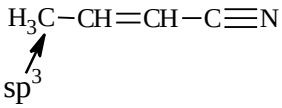
$$\%N = \frac{1.4(2.5\times2\times2)}{0.25} = 56$$

9. The number of sp^3 hybridised carbons in an acyclic neutral compound with molecular formula C_4H_5N is :

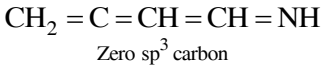
Official Ans. by NTA (0 Or 1)

Allen Ans. (0 or 1)

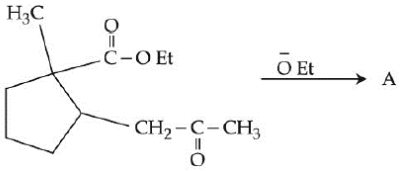
Sol. $$DU = 4+1-\left(\frac{5-1}{2}\right) = 3$$



or



10. In the given reaction



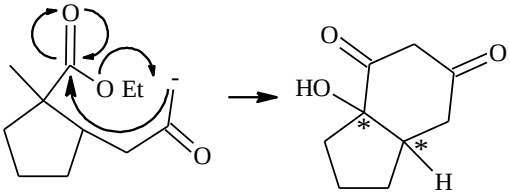
(Where Et is $-C_2H_5$)

The number of chiral carbon/s in product A is

Official Ans. by NTA (2)

Allen Ans. (2)

Sol.



2 chiral carbons