FINAL JEE–MAIN EXAMINATION – JULY, 2022

(Held On Thursday 28th July, 2022) **TIME : 3 : 00 PM to 6 : 00 PM**

SECTION-A

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

Assertion A : Zero orbital overlap is an out of phase overlap.

Reason : It results due to different orientation/ direction of approach of orbitals.

In the light of the above statements. Choose the ***correct*** answer from the options given below

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

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

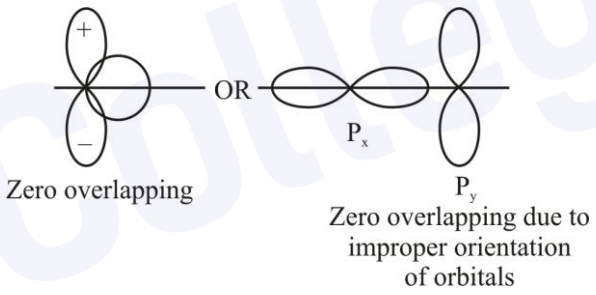
(C) A is true but R is false

(D) A is false but R is true

Official Ans. by NTA (A)

Ans. (A)

Sol.



2. The correct decreasing order for metallic character is

(A) Na > Mg > Be > Si > P

(B) P > Si > Be > Mg > Na

(C) Si > P > Be > Na > Mg

(D) Be > Na > Mg > Si > P

Official Ans. by NTA (A)

Ans. (A)

Sol. Across a period metallic character decreases

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

Assertion A : The reduction of a metal oxide is easier if the metal formed is in liquid state than solid state.

Reason R : The value of $\Delta G^{\ominus}$ becomes more on negative side as entropy is higher in liquid state than solid state.

In the light of the above statements. Choose the most appropriate answer from the options given below

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

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

(C) A is correct but R is not correct

(D) A is not correct but R is correct

Official Ans. by NTA (A)

Ans. (A)

Sol. $\Delta G = \Delta H - T\Delta S$

$\because$ Entropy of liquid is more than solid

$\therefore$ on melting the entropy increases and ΔG becomes more negative and hence it becomes easier to reduce metal

4. The products obtained during treatment of hard water using Clark's method are:

(A) $CaCO_3$ and $MgCO_3$

(B) $Ca(OH)_2$ and $Mg(OH)_2$

(C) $CaCO_3$ and $Mg(OH)_2$

(D) $Ca(OH)_2$ and $MgCO_3$

Official Ans. by NTA (C)

Ans. (C)

Sol. In Clark's method lime water is used

$$Ca(HCO_3)_2 + 2Ca(OH)_2 \rightarrow 2CaCO_3 + 2H_2O$$

$$Mg(HCO_3)_2 + 2Ca(OH)_2 \rightarrow 2CaCO_3 + Mg(OH)_2 + 2H_2O$$

5. **Statement I:** An alloy of lithium and magnesium is used to make aircraft plates.

Statement II : The magnesium ions are important for cell-membrane integrity.

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

(A) Both Statement I and Statement II are true

(B) Both Statement I and Statement II are false

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

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

Official Ans. by NTA (B)

Ans. (B)

Sol. Alloy of Li and Mg is used to make armour plates and not aircraft plates.

Calcium plays important roles in neuromuscular function, interneuronal transmission and cell membrane integrity

6. White phosphorus reacts with thionyl chloride to give

(A) PCl_5, SO_2 and S_2Cl_2 (B) PCl_3. SO_2 and S_2Cl_2

(C) PCl_3, SO_2 and Cl_2 (D) PCl_5, SO_2 and Cl_2

Official Ans. by NTA (B)

Ans. (B)

Sol. $P_4 + 8SOCl_2 \rightarrow 4PCl_3 + 4SO_2 + 2S_2Cl_2$

7. Concentrated HNO_3 reacts with Iodine to give

(A) HI, NO_2 and H_2O (B) HIO_2, N_2O and H_2O

(C) HIO_3, NO_2 and H_2O (D) HIO_4, N_2O and H_2O

Official Ans. by NTA (C)

Ans. (C)

Sol. $I_2 \qquad HIO_3 + 10NO_2 +$

8. Which of the following pair is not isoelectronic species?

(At. no. Sm, 62; Er, 68: Yb, 70: Lu, 71; Eu, 63: Tb, 65; Tm, 69)

(A) Sm^{2+} and Er^{3+} (B) Yb^{2+} and Lu^{3+}

(C) Eu^{2+} and Tb^{4+} (D) Tb^{2+} and Tm^{4+}

Official Ans. by NTA (A or D)

Ans. (A & D)

Sol. $Sm^{2+} \rightarrow$ electron = 60

$Er^{3+} \rightarrow$ electron = 65

$Tb^{2+} \rightarrow$ electron = 63

$Tm^{4+} \rightarrow$ electron = 65

(not isoelectronic)

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

Assertion A : Permanganate titrations are not performed in presence of hydrochloric acid.

Reason R : Chlorine is formed as a consequence of oxidation of hydrochloric acid.

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

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

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

(C) A is true but R is false

(D) A is false but R is true

Official Ans. by NTA (A)

Ans. (A)

Sol. $2KMnO_4 + 16HCl \rightarrow 2MnCl_2 + 2KCl + 8H_2O + Cl_2$

HCl gets oxidised by $KMnO_4$ into Cl_2

10. Match **List I** with **List II**

	List I (Complex)		**List II (Hybridization)**
A	$Ni(CO)_4$	I	sp^3
B	$[Ni(CN)_4]^{2-}$	II	sp^3d^2
C	$[Co(CN)_6]^{3-}$	III	d^2sp^3
D	$[CoF_6]^{3-}$	IV	dsp^2

Choose the correct answer from the options given below:

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

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

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

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

Official Ans. by NTA (B)

Ans. (B)

Sol. $Ni(CO)_4$ Hybridisation sp^3

$[Ni(CN)_4]^{2-}$ Hybridisation dsp^2

$[Co(CN)_6]^{3-}$ Hybridisation d^2sp^3

$[Co(F)_6]^{3-}$ Hybridisation sp^3d^2

11. Dinitrogen and dioxygen. the main constituents of air do not react with each other in atmosphere to form oxides of nitrogen because

(A) N_2 is unreactive in the condition of atmosphere.

(B) Oxides of nitrogen are unstable.

(C) Reaction between them can occur in the presence of a catalyst.

(D) The reaction is endothermic and require very high temperature.

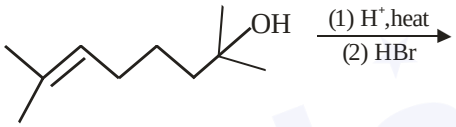
Official Ans. by NTA (D)

Ans. (D)

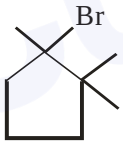
Sol. $N_2 + O_2 \underset{}{\overset{(1483-2000\ K)}{\rightleftharpoons}} 2NO$

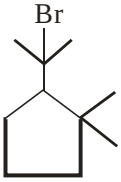
(Endothermic and feasible at high temperature)

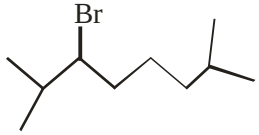
12. The major product in the given reaction is



(A) 

(B) 

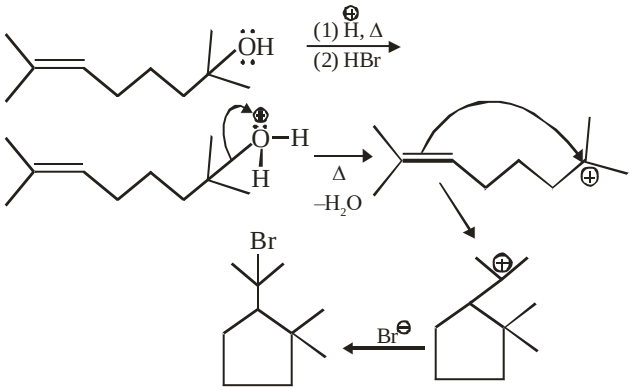
(C) 

(D) 

Official Ans. by NTA (C)

Ans. (C)

Sol.



13. Arrange the following in increasing order of reactivity towards nitration

A. p-xylene

B. bromobenzene

C. mesitylene

D, nitrobenzene

E. benzene

Choose the correct answer from the options given below

(A) C < D < E < A < B

(B) D < B < E < A < C

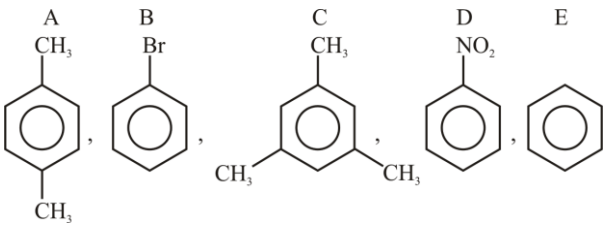
(C) D < C < E < A < B

(D) C < D < E < B < A

Official Ans. by NTA (B)

Ans. (B)

Sol.



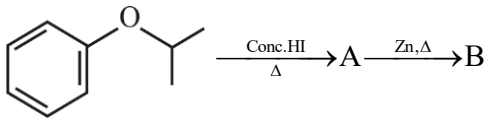
$-NO_2$ is strongly deactivating

–Br – deactivating

$-CH_3$–activating group

D < B < E < A < C

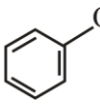
14. Compound I is heated with Conc. HI to give a hydroxy compound A which is further heated with Zn dust to give compound B. Identify A and B.



(A) A =  , B = 

(B) A =  , B = 

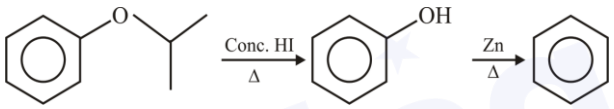
(C)

(D) A =  , B = 

Official Ans. by NTA (D)

Ans. (D)

Sol.



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

Assertion A : Aniline on nitration yields ortho, meta & para nitro derivatives of aniline.

Reason R: Nitrating mixture is a strong acidic mixture.

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

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

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

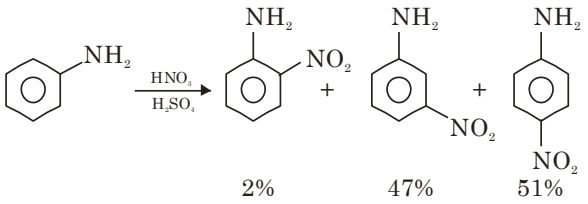
(C) A is true but R is false

(D) A is false but R is true

Official Ans. by NTA (A)

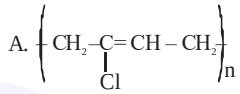
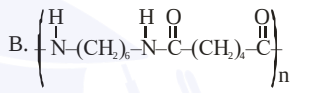
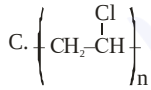
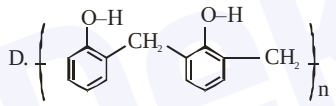
Ans. (A)

Sol.



Due to formation of anilinium ion in acidic medium meta product is also obtained in significant amount

16. Match **List I** with **List II**

List (Polymer)	List II(Nature)
A. 	I. Thermosetting polymer
B. 	II. Fibers
C. 	III. Elastomer
D. 	IV. Thermoplastic polymer

Choose the correct answer from the options given below:

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

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

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

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

Official Ans. by NTA (B)

Ans. (B)

Sol. Neoprene is elastomer

Nylon-6, 6 is fiber

PVC is thermoplastic

Novolac is thermosetting

17. Two statements in respect of drug-enzyme interaction are given below

Statement I : Action of an enzyme can be blocked only when an inhibitor blocks the active site of the enzyme.

Statement II : An inhibitor can form a strong covalent bond with the enzyme.

In the light of the above statements. Choose the ***correct*** answer from the options given below

(A) Both Statement I and Statement II are true

(B) Both Statement I and Statement II are false

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

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

Official Ans. by NTA (D)

Ans. (D)

Sol. Some drugs do not bind to active sites. These bind to different site of enzyme called allosteric sites.

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

Assertion A : Thin layer chromatography is an adsorption chromatography.

Reason : A thin layer of silica gel is spread over a glass plate of suitable size in thin layer chromatography which acts as an adsorbent.

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

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

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

(C) A is true but R is false

(D) A is false but R is true

Official Ans. by NTA (A)

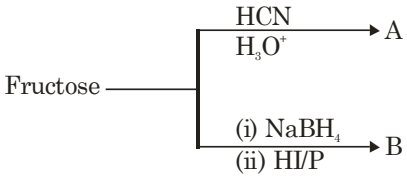
Ans. (A)

Sol. Theory based

Thin layer chromoatography (TLC) is another type of adsorption chromatography, which involve sepration of substance of a mixture ovel a thin layer of an adsorbent coated on glass plate.

A thin layer (about 0.2 mm thick) of an adsorbent (silica gel) or (Alumina) in spread overa glass plate of suitable size. Hence Assertion (A) is correct and Reason (R) is correct explanation of (A)

19. The formulas of A and B for the following reaction sequence are



(A) A = $C_7H_{14}O_8$, B = C_6H_{14}

(B) A = $C_7H_{13}O_7$, B = $C_7H_{14}O$

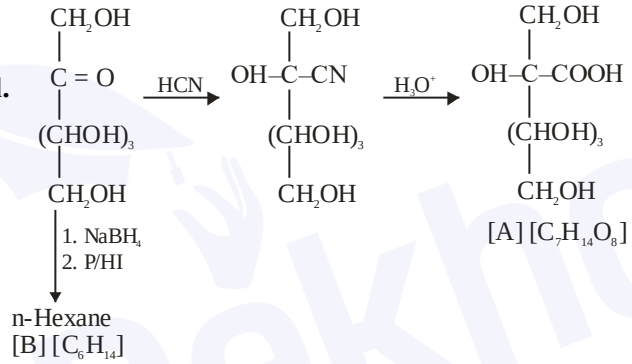
(C) A = $C_7H_{12}O_8$, B = C_6H_{14}

(D) A = $C_7H_{14}O_8$, B = $C_6H_{14}O_6$

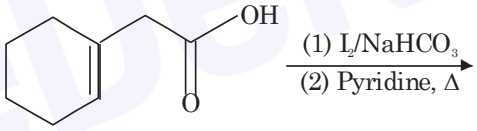
Official Ans. by NTA (A)

Ans. (A)

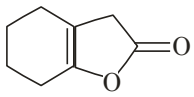
Sol.

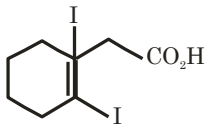


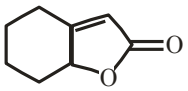
20.

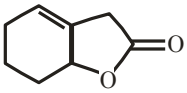


Find out the major product for the above reaction.

(A) 

(B) 

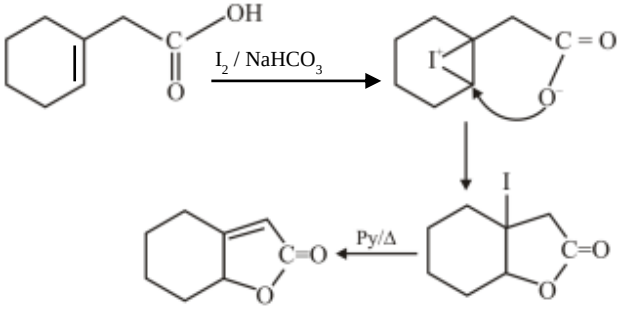
(C) 

(D) 

Official Ans. by NTA (C)

Ans. (C)

Sol.



SECTION-B

1. 2L of 0.2 M H_2SO_4 is reacted with 2L of 0.1 M NaOH solution, the molarity of the resulting product Na_2SO_4 in the solution is ____ millimolar. (Nearest integer).

Official Ans. by NTA (25)

Ans. (25)

Sol. $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

0.4 mol 0.2 mol -

0.3 mol - 0.1 mol

Molarity of Na_2SO_4 is $\frac{0.1}{4} = 0.025M$

= 25 mM.

2. Metal M crystallizes into a FCC lattice with the edge length of 4.0×10^{-8} cm. The atomic mass of the metal is _____ g/mol. (Nearest integer).

(Use : $N_A = 6.02\times10^{23}$ mol^{-1}, density of metal, M = 9.03 g cm^{-3})

Official Ans. by NTA (87)

Ans. (87)

Sol. $a = 4 \times 10^{-8}$ cm

d = 9.03g/ml

$$d = \frac{ZM}{N_A a^3}$$

$$M = \frac{9.03\times6.02\times10^{23}\times64\times10^{-24}}{4} = 86.97$$

3. If the wavelength for an electron emitted from H-atom is 3.3×10^{-10}m, then energy absorbed by the electron in its ground state compared to minimum energy required for its escape from the atom, is _____ times. (Nearest integer).

[Given : h = 6.626×10^{-34} Js,

Mass of electron = 9.1×10^{-31}]

Official Ans. by NTA (2)

Ans. (2)

Sol. $\lambda = \frac{h}{\sqrt{2mK}}$

$$K = \frac{h^2}{2m\lambda^2}$$

$$K = \frac{h^2}{2m\lambda^2} = \frac{43.9\times10^{-68}}{2\times9.1\times10^{-31}\times10.89\times10^{-20}}$$

$K = 2.215 \times 10^{-18}$

$E_{abs} = E_{req} + K$

$$\frac{E_{abs}}{E_{req}} = 1 + \frac{K}{E_{req}} = 1 + \frac{2.215\times10^{-18}}{13.6\times1.602\times10^{-19}} = 2.0166$$

4. A gaseous mixture of two substances A and B, under a total pressure of 0.8 atm is in equilibrium with an ideal liquid solution. The mole fraction of substance A is 0.5 in the vapour phase and 0.2 in the liquid phase. The vapour pressure of pure liquid A is _____ atm. (Nearest integer)

Official Ans. by NTA (2)

Ans. (2)

Sol. $\mathbf{Y_A = 0.5 \Rightarrow Y_B = 0.5}$

$\mathbf{P_A = P_B = 0.4}$ **atm**

$$P_A = P_A^0 X_A$$

$$P_A^0 = 2$$

5. At 600K, 2 mol of NO are mixed with 1 mol of O_2.

$$2NO_{(g)} + O_2(g) \rightleftharpoons 2NO_2(g)$$

The reaction occurring as above comes to equilibrium under a total pressure of 1 atom. Analysis of the system shows that 0.6 mol of oxygen are present at equilibrium. The equilibrium constant for the reaction is _____. (Nearest integer).

Official Ans. by NTA (2)

Ans. (2)

Sol. $2NO + O_2 \rightarrow 2NO$

2 1 -

2-2x 1-x 2x

1.2 0.6 0.8

$$K_p = \frac{\left(\frac{0.8}{2.6}\right)^2}{\left(\frac{1.2}{2.6}\right)^2\left(\frac{0.6}{2.6}\right)} = 1.925$$

6. A sample of 0.125 g of an organic compound when analysed by Duma's method yields 22.78 mL of nitrogen gas collected over KOH solution at 280K and 759 mm Hg. The percentage of nitrogen in the given organic compound is ____. (Nearest integer).

(a) The vapour pressure of water at 280 K is 14.2 mm Hg

(b) R = 0.082 L atm K^{-1} mol^{-1}

Official Ans. by NTA (22)

Ans. (22)

Sol. V = 22.78 ml, T = 280 K

P_{total} = 759 mmHg

$$P_{N_2} = 759 - 14.2 = 744.8 mmHg$$

$$n_{N_2} = \frac{744.8 \times 22.78}{760 \times 1000 \times 0.082 \times 280} = 0.00097$$

$$W_{Nitrogen} = 0.02716$$

$$\%N = \frac{0.02716}{0.125} \times 1000 = 21.728$$

7. On reaction with stronger oxidizing agent like KIO_4, hydrogen peroxide oxidizes with the evolution of O_2. The oxidation number of I in KIO_4 changes to _____.

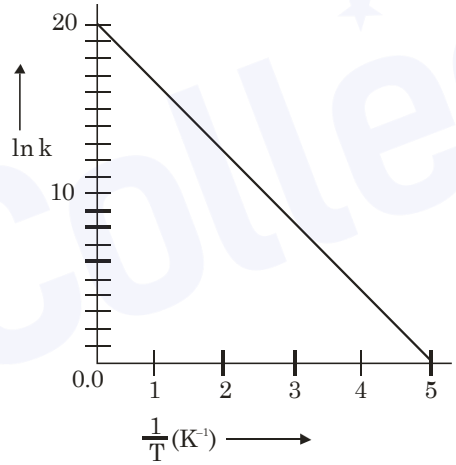
Official Ans. by NTA (5)

Ans. (5)

Sol. $IO_4^- + H_2O_2 \rightarrow IO_3^- + O_2$

8. For a reaction, given below is the graph of ln k vs $\frac{1}{T}$. The activation energy for the reaction is equal to _____ cal mol^{-1}. (Nearest integer).

(Given : R = 2 cal K^{-1} mol^{-1}**)**



Official Ans. by NTA (8)

Ans. (8)

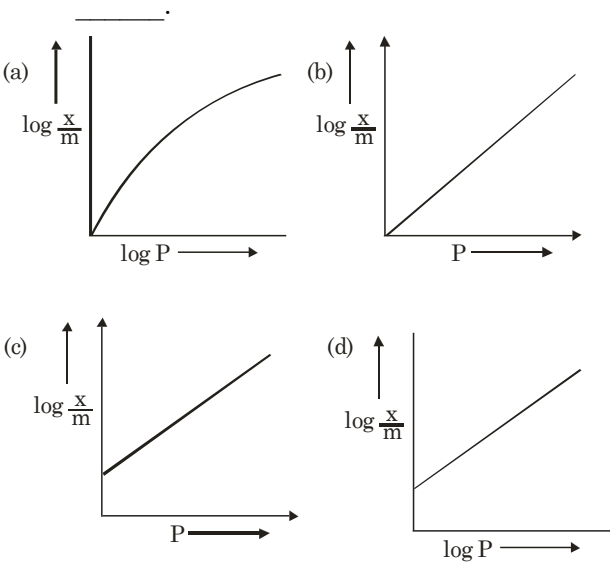
Sol. $K = Ae^{-Ea/RT}$

$$\ln k = \frac{-Ea}{RT} + \ln A$$

$$Slope = \frac{Ea}{R} = \frac{20}{5}$$

E_a = 4R = 8 Cal/mol

9. Among the following the number of curves not in accordance with Freundlich adsorption isotherm is _____.

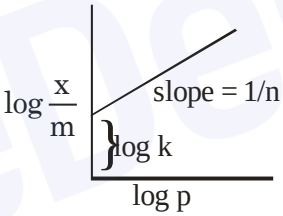


Official Ans. by NTA (3)

Ans. (3)

Sol. $$\frac{X}{m} = KP^{\frac{1}{n}}$$

$$\log \frac{x}{m} = \frac{1}{n} \log p + \log k$$



10. Among the following the number of state variable is _____.

Internal energy (U)

Volume (V)

Heat (q)

Enthalpy (H)

Official Ans. by NTA (3)

Ans. (3)

Sol. Internal energy, volume enthalpy are state variable