FINAL JEE–MAIN EXAMINATION – APRIL, 2024

(Held On Thursday 04th April, 2024) **TIME : 3 : 00 PM to 6 : 00 PM**

CHEMISTRY

TEST PAPER WITH SOLUTION

SECTION-A

61. The equilibrium constant for the reaction

$$SO_3(g) \rightleftharpoons SO_2(g) + \frac{1}{2}O_2(g)$$

is $K_C = 4.9 \times 10^{-2}$. The value of K_C for the reaction given below is

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$ is

(1) 4.9 (2) 41.6

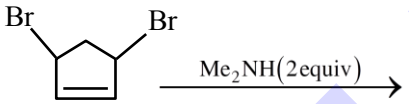
(3) 49 (4) 416

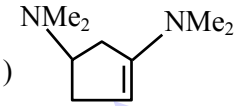
Ans. **(4)**

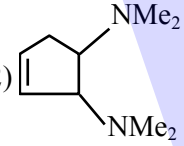
Sol. $$K'_C = \left(\frac{1}{K_C}\right)^2 = \left(\frac{1}{4.9\times10^{-2}}\right)^2$$

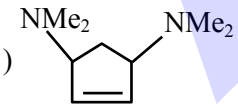
$K'_C = 416.49$

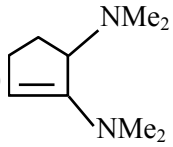
62. Find out the major product formed from the following reaction. [Me: $-CH_3$]



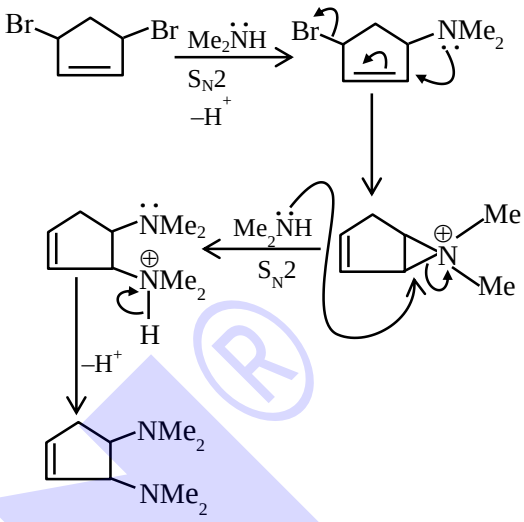
(1) 

(2) 

(3) 

(4) 

Ans. **(2)**

Sol. 

The above mechanism valid for both cis and trans isomers. So the products are same for both cis and trans isomers.

63. When MnO_2 and H_2SO_4 is added to a salt (A), the greenish yellow gas liberated as salt (A) is :

(1) NaBr (2) CaI_2

(3) KNO_3 (4) NH_4Cl

Ans. **(4)**

Sol. $$2NH_4Cl + MnO_2 + 2H_2SO_4 \xrightarrow{\Delta} MnSO_4 + (NH_4)_2SO_4 + 2H_2O + \underset{\text{greenish yellow solution}}{Cl_2}\uparrow$$

64. The correct statement/s about Hydrogen bonding is/are :

A. Hydrogen bonding exists when H is covalently bonded to the highly electro negative atom.

B. Intermolecular H bonding is present in o-nitro phenol

C. Intramolecular H bonding is present in HF.

D. The magnitude of H bonding depends on the physical state of the compound.

E. H-bonding has powerful effect on the structure and properties of compounds.

Choose the **correct** answer from the options given below :

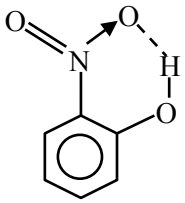
(1) A only (2) A, D, E only

(3) A, B, D only (4) A, B, C only

Ans. **(2)**

Sol. (A) Generally hydrogen bonding exists when H is covalently bonded to the highly electronegative atom like F, O, N.

(B) Intramolecular H bonding is present in

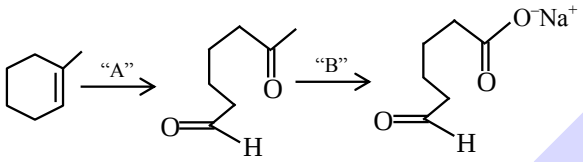


(C) Intermolecular Hydrogen bonding is present in HF

(D) The magnitude has Hydrogen bonding in solid state is greater than liquid state.

(E) Hydrogen bonding has powerfull effect on the structure & properties of compound like melting point, boiling point, density etc.

65.



In the above chemical reaction sequence "A'' and "B" respectively are :

(1) O_3, Zn/H_2O and $NaOH_{(alc.)}$ / I_2

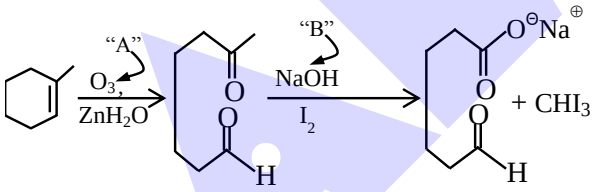
(2) H_2O, H^+ and $NaOH_{(alc.)}$ / I_2

(3) H_2O, H^+ and $KMnO_4$

(4) O_3, Zn/H_2O and $KMnO_4$

Ans. (1)

Sol.



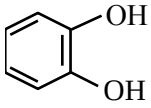
66. Common name of Benzene-1, 2-diol is

(1) quinol (2) resorcinol

(3) catechol (4) o-cresol

Ans. (3)

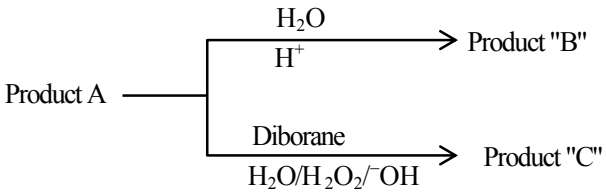
Sol.



IUPAC name : Benzene-1,2-diol

Common name : catechol

67. $CH_3-CH_2-CH_2-Br + NaOH \xrightarrow{C_2H_5OH}$ Product 'A'



Consider the above reactions, identify product B and product C.

(1) B = C = 2-Propanol

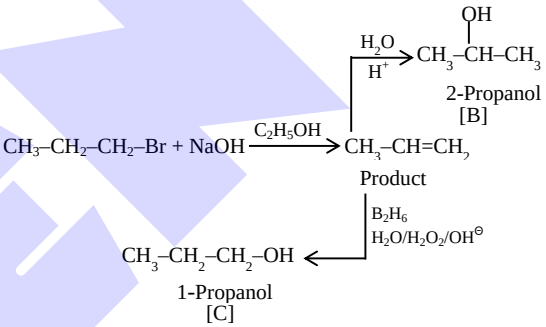
(2) B = 2-Propanol C = 1-Propanol

(3) B = 1-Propanol C = 2-Propanol

(4) B = C = 1-Propanol

Ans. (2)

Sol.



68. The adsorbent used in adsorption chromatography is/are

A. silica gel B. alumina

C. quick lime D. magnesia

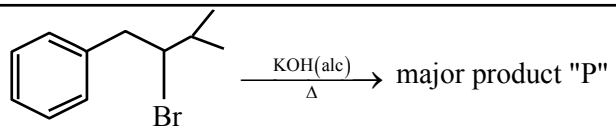
Choose the **most appropriate** answer from the options given below :

(1) B only (2) C and D only

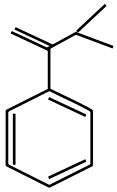
(3) A and B only (4) A only

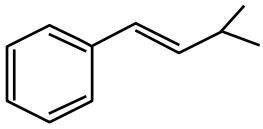
Ans. (3)

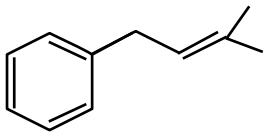
Sol. The most common polar and acidic support used is adsorption chromatography is silica. The surface silanol groups on their supported to adsorb polar compound and work particularly well for basic substances. Alumina is the example of polar and basic adsorbent that is used in adsorption chromatography.

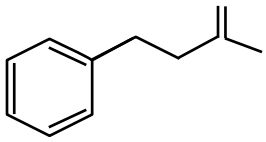
69. 

Product P is

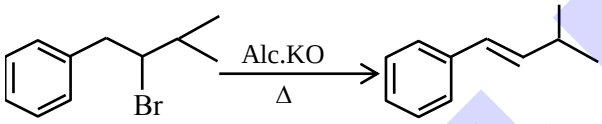
(1) 

(2) 

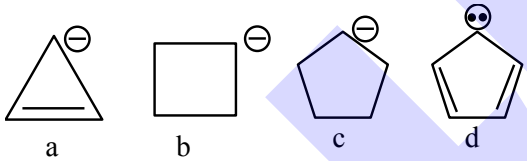
(3) 

(4) 

Ans. (2)

Sol. 

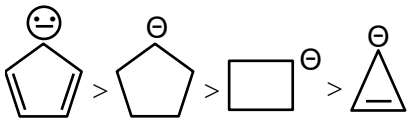
70. Correct order of stability of carbanion is



(1) c > b > d > a (2) a > b > c > d
(3) d > a > c > b (4) d > c > b > a

Ans. (4)

Sol. As we know compound (d) is aromatic and the compound (a) is anti-aromatic. Hence compound (d) is most stable and compound (a) is least stable among these in compound (b) and (c) carbon atom of that positive charge is sp^3 hybridised they on the basis of angle strain theory compound (c) is more stable than compound (b).



71. The correct order of the first ionization enthalpy is

(1) Al > Ga > Tl (2) Ga > Al > B
(3) B > Al > Ga (4) Tl > Ga > Al

Ans. (4)

Sol. (i) due to lanthanide contraction Tℓ has more I.E. as compared to Ga and Aℓ

(ii) due to scandide contraction Ga has more I.E. as compared to Aℓ

72. If an iron (III) complex with the formula $\left[Fe(NH_3)_x(CN)_y\right]^-$ has no electron in its e_g orbital, then the value of x + y is

(1) 5 (2) 6
(3) 3 (4) 4

Ans. (2)

Sol. Complex is $[\overset{III}{Fe}(NH_3)_2(CN)_4]^{\ominus}$

x = 2

y = 4

so x + y = 6

73. Fuel cell, using hydrogen and oxygen as fuels,

A. has been used in spaceship

B. has as efficiency of 40% to produce electricity

C. uses aluminium as catalysts

D. is eco-friendly

E. is actually a type of Galvanic cell only

(1) A,B,C only (2) A,B,D only
(3) A,B,D,E only (4) A,D,E only

Ans. (4)

Sol. Fuel cell is used in spaceship and it is type of galvanic cell.

74. Choose the **Incorrect** Statement about Dalton's Atomic Theory

(1) Compounds are formed when atoms of different elements combine in any ratio

(2) All the atoms of a given element have identical properties including identical mass

(3) Matter consists of indivisible atoms

(4) Chemical reactions involve recorganization of atoms

Ans. (1)

Sol. In compound atoms of different elements combine in fixed ratio by mass.

75. Match List I with List II

	LIST I		LIST II
A.	α- Glucose and α-Galactose	I.	Functional isomers
B.	α- Glucose and β-Glucose	II.	Homologous
C.	α- Glucose and α-Fructose	III.	Anomers
D.	α- Glucose and α-Ribose	IV.	Epimers

Choose the **correct** answer from the options given below:

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

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

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

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

Ans. **(3)**

Sol. Based on biomolecules theory and structure of these named compounds –

(A) α-Glucose and α-Galactose (IV) Epimers.

(B) α-Glucose and β-Glucose (III) Anomers

(C) α-Glucose and α-Fructose (I) Functional isomers

(D) α-Glucose and α-Ribose (II) Homologous

76. Given below are two statements:

Statement I : The correct order of first ionization enthalpy values of Li, Na, F and Cl is Na < Li < Cl < F.

Statement II : The correct order of negative electron gain enthalpy values of Li, Na, F and Cl is Na < Li < F < Cl

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) Both Statement I and Statement II are false

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

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

Ans. **(1)**

Sol.. (i)

	Na	<	Li	<	Cl	<	F
	↓		↓		↓		↓
$I.E._1$ in kJ/mol	496		520		1256		1681

(ii)

	Na	<	Li	<	F	<	Cl
	↓		↓		↓		↓
$\Delta_{eg}H$ in kJ/mol	–53		–60		–328		–349

77. For a strong electrolyte, a plot of molar conductivity against $(\text{concentration})^{1/2}$ is a straight line, with a negative slope, the correct unit for the slope is

(1) S cm^2 $mol^{-3/2}$ $L^{1/2}$ (2) S cm^2 mol^{-1} $L^{1/2}$

(3) S cm^2 $mol^{-3/2}$ L (4) S cm^2 $mol^{-3/2}$ $L^{-1/2}$

Ans. **(1)**

Sol. $\Lambda_m = \Lambda_m^o - A\sqrt{C}$

Units of $A\sqrt{C}$ = S cm^2 $mole^{-1}$

Uits of A = S cm^2 $mole^{-3/2}$ $L^{1/2}$

78. A first row transition metal in its +2 oxidation state has a spin-only magnetic moment value of 3.86 BM. The atomic number of the metal is

(1) 25 (2) 26

(3) 22 (4) 23

Ans. **(4)**

Sol. $_{22}Ti^{+2} \Rightarrow [Ar]3d^2$

$_{23}V^{+2} \Rightarrow [Ar]3d^3$

$_{25}Mn^{+2} \Rightarrow [Ar]3d^5$

$_{26}Fe^{+2} \Rightarrow [Ar]3d^6$

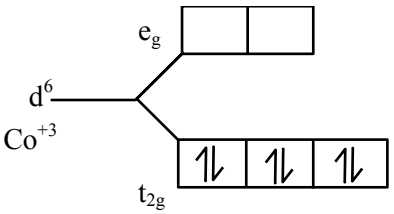
79. The number of unpaired d-electrons in $[Co(H_2O)_6]^{3+}$ is_____

(1) 4 (2) 2

(3) 0 (4) 1

Ans. **(3)**

Sol. $\Rightarrow [Co(H_2O)_6]^{+3}$



No unpaired electrons

80. The number of species from the following that have pyramidal geometry around the central atom is_____

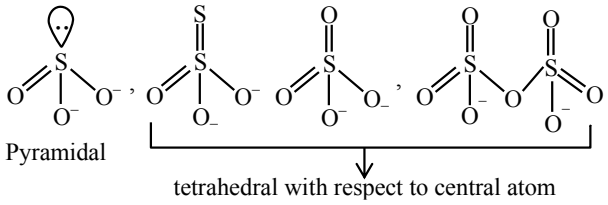
$S_2O_3^{2-}, SO_4^{2-}, SO_3^{2-}, S_2O_7^{2-}$

(1) 4 (2) 3

(3) 1 (4) 2

Ans. **(3)**

Sol.

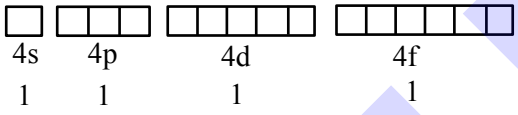


SECTION-B

81. The maximum number of orbitals which can be identified with n = 4 and $m_l = 0$ is_____

Ans. **(4)**

Sol.



So answer is 4.

82. Number of compounds/species from the following with non-zero dipole moment is_____

$BeCl_2$, BCl_3, NF_3, XeF_4, CCl_4, H_2O H_2S, HBr, CO_2, H_2, HCl

Ans. **(5)**

Sol. Polar molecule ($\mu \neq 0$): $NF_3, H_2O, H_2S, HBr, HCl$

Non Polar molecule ($\mu = 0$): $BeCl_2, BCl_3, XeF_4, CCl_4, CO_2, H_2$

So answer is 5.

83. Three moles of an ideal gas are compressed isothermally from 60 L to 20 L using constant pressure of 5 atm. Heat exchange Q for the compression is – ____ Lit. atm.

Ans. **(200)**

Sol. As isothermal $\Delta U = 0$

and process is irreversible

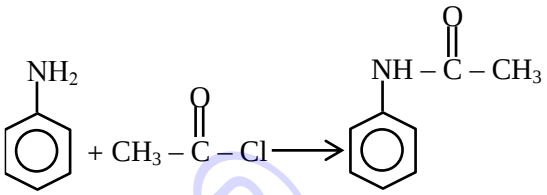
$Q = -W = -[-P_{ext}(V_2 - V_1)]$

$Q = 5(20 - 60) = -200$ atm-L

84. From 6.55 g of aniline, the maximum amount of acetanilide that can be prepared will be___$\times 10^{-1}$ g.

Ans. **(95)**

Sol.



93 g aniline form 135 gm acetanlide

so 6.55 g anilne form $\frac{135}{93} \times 6.55 = 9.5$

95×10^{-1}

85. Consider the following reaction, the rate expression of which is given below

$A + B \rightarrow C$

rate = $k[A]^{1/2}[B]^{1/2}$

The reaction is initiated by taking 1M concentration A and B each. If the rate constant (k) is 4.6×10^{-2} s^{-1}, then the time taken for A to become 0.1 M is_____sec. (nearest integer)

Ans. **(50)**

Sol. $K = \frac{2.303}{t}\log\frac{1}{0.1}$

$4.6 \times 10^{-2} = \frac{2.303}{t}$

t = 50 sec.

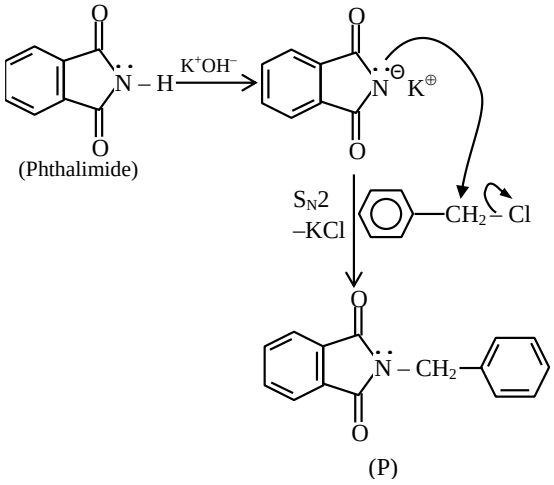
86. Phthalimide is made to undergo following sequence of reactions.

Phthalimide $\xrightarrow[\text{(ii)Benzylchloride}]{\text{(i)KOH}}$ 'P'

Total number of π bonds present in product 'P' is/are

Ans. **(8)**

Sol.

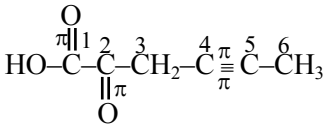


Total number of π-bonds present in product P is 8

87. The total number of 'sigma' and 'Pi' bonds in 2-oxohex-4-ynoic acid is____.

Ans. (18)

Sol.



2-Oxohex-4-ynoic acid

Number of σ-bonds = 14

Number of π-bonds = 4

= 18

88. A first row transition metal with highest enthalpy of atomisation, upon reaction with oxygen at high temperature forms oxides of formula M_2O_n (where n = 3,4,5). The 'spin-only' magnetic moment value of the amphoteric oxide from the above oxides is___ BM (near integer)

(Given atomic number : Sc : 21, Ti : 22, V : 23, Cr : 24, Mn : 25, Fe : 26, Co : 27, Ni : 28 ,Cu : 29, Zn : 30)

Ans. (0)

Sol. 'V' has highest enthalpy of atomisation (515 kJ/mol) among first row transition elements.

V_2O_5

Here 'V' is in +5 oxidation state

$V^{+5} \Rightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ (no unpaired electrons)

89. 2.7 Kg of each of water and acetic acid are mixed, The freezing point of the solution will be –x °C. Consider the acetic acid does not dimerise in water, nor dissociates in water x = _____(nearest integer)

[Given : Molar mass of water = 18 g mol^{-1}, acetic acid = 60 g mol^{-1}]

^{K_f} H_2O : 1.86 K kg mol^{-1}

^{K_f} acetic acid : 3.90 K kg mol^{-1}

freezing point : H_2O = 273 K, acetic acid = 290 K]

Ans. (31)

Sol. As moles of water > moles of CH_3COOH

water is solvent.

$T°_F - (T_F)_S = K_F \times M$

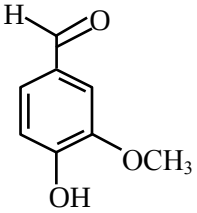
$$0 - (T_F)_S = 1.86 \times \frac{2700/60}{2700/1000}$$

$(T_F)_S = -31°C$.

90. Vanillin compound obtained from vanilla beans, has total sum of oxygen atoms and π electrons is__

Ans. (11)

Sol. Vanillin compound is an organic compound molecular formula $C_8H_8O_3$. It is a phenolic aldehyde. Its functional compounds include aldehyde, hydroxyl and ether. It is the primary component of the extract of the vanilla beans.



Total sum of oxygen atoms and π-electrons is 3 + 8 = 11

Total number of oxygen atoms = 3

Total number of π-bonds = 4

∴ Total number of π-electrons = 8

Are you targeting **JEE 2025 ?**

Ace it with **ALLEN**'s

Leader Course

Online Program 18 APRIL '24

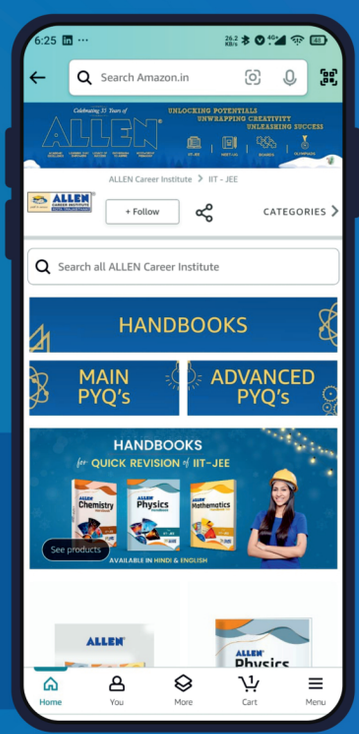
Offline Program 24 APRIL '24

ALLEN

Get The Latest

IIT-JEE Special Books

at Your Door Steps...!!



JOIN THE JOURNEY OF LEARNING

with

SCORE TEST PAPERS | HANDBOOKS

JEE-MAIN PYQ's | JEE-Adv. PYQ's

SHOP NOW

Available in
HINDI & ENGLISH