JEE MAIN (Session 2) 2023
Paper Analysis

CHEMISTRY | 11th April 2023 _ Shift-2

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4818/6653 = **72.41%**
(2021)
2994/4087 = **73.25%**

SECTION - A

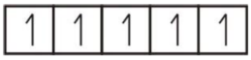
61. The magnetic moment is measured in Bohr Magneton (BM). Spin only magnetic moment of Fe in $[Fe(H_2O)_6]^{3+}$ and $[Fe(CN)_6]^{3-}$ complexes respectively is:

(1) 3.87 B. M. and 1.732 B.M.
(2) 6.92 B.M. in both
(3) 5.92 B.M. and 1.732 B.M.
(4) 4.89 B.M. and 6.92 B.M.

Sol. **3**

$[Fe(H_2O)_6]^{3+}$

$Fe^{3+} \Rightarrow [Ar]\ 3d^5\ 4s^0$

No pairing 

$\therefore$ Unpaired $e^- = 5$

$\mu = \sqrt{n(n+2)}$

$= \sqrt{5(5+2)}$

$\mu = \sqrt{35} = 5.92 B.M.$

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

$\therefore$ Unpaired $e^- = 1$

$\mu = \sqrt{n(n+2)}$

$= \sqrt{1(1+2)} = \sqrt{3} = 1.732 B.M.$

62. Which one of the following pairs is an example of polar molecular solids?

(1) $SO_2(s), CO_2(s)$ (2) $SO_2(s), NH_2(s)$ (3) $MgO(s), SO_2(s)$ (4) HCl (s), AlN(s)

Sol. **2**

SO_2 and NH_3 are polar molecules. They are constituent particles of polar molecular solids.

63. Match List I with List II

	List I Complex		**List II Colour**
A.	$Mg(NH_4)PO_4$	I.	Brown
B.	$K_3[Co(NO_2)_6]$	II.	White
C.	$MnO(OH)_2$	III.	Yellow
D.	$Fe_4[Fe(CN)_6]_3$	IV.	blue

Choose the correct answer from the options given below:

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

Sol. **4**

$Mg(NH_4)PO_4 \Rightarrow$ White

$K_3[Co(NO_2)_6] \Rightarrow$ Yellow

$MnO(OH)_2 \Rightarrow$ Brown

$Fe_4[Fe(CN)_6]_3 \Rightarrow$ Blue

64. A solution is prepared by adding 2 g of "X" to 1 mole of water. Mass percent of "X" in the solution is

(1) 5% (2) 20 % (3) 2 % (4) 10%

Sol. **4**

Solute (X) = 2 g

Solvent (H_2O) = 1 mole = 18 g

Total mass = 2 + 18 = 20 g

% mass of X = $\frac{2}{20} \times 100 = 10\%$

65. If Ni^{2+} is replaced by Pt^{2+} in the complex $[NiCl_2Br_2]2^-$, which of the following properties are expected to get changed?

A. Geometry

B. Geometrical isomerism

C. Optical isomerism

D. Magnetic properties

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

Sol. **4**

$[NiBr_2Cl_2]^{2-} \rightarrow$ This complex species is tetrahedral as $Br^{\ominus}$ & $Cl^{\ominus}$ are weak field ligands.

$[PtBr_2Cl_2]^{2-} \rightarrow$ As Pt belongs to 5d series. This complex species is square planar.

Both the complex species are optically inactive.

$[NiBr_2Cl_2]^{2-}$, being tetrahedral does not show Geometrical Isomerism.

$[PtBr_2Cl_2]^{2-}$ shows two Geometrical Isomers.

66. Given below are two statements :

Statement I : In the metallurgy process, sulphide ore is converted to oxide before reduction.

Statement II : Oxide ores in general are easier to reduce.

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) Statement I is incorrect but Statement II is correct

(4) Both Statement I and Statement II are incorrect

Sol. **1**

$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

Oxides on carbon reduction forms CO_2 while sulphide on carbon reduction gives CS_2.

CO_2 is more volatile compared to CS_2 therefore oxides are easy to reduce.

67. $H_3C-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow[(iii)D_2O]{\substack{(i)\ NaI,\ H_3PO_4\\(ii)\ Mg,\ Dry\ ether}} \underset{\text{Product}}{[X]}$

Product [X] formed in the above reaction is:

(1) $H_3C-CH_2-\underset{\underset{D}{|}}{CH}-CH_3$

(2) $H_3C-CH_2-CH=CH_2$

(3) $H_3C-CH=CH-CH_3$

(4) $H_3C-CH_2-\underset{\underset{OH}{|}}{\overset{\overset{H}{|}}{C}}-CH_3$

Sol. **1**

$$CH_3-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow{(i)\ NaI,\ H_3PO_4} CH_3-CH_2-\underset{\underset{I}{|}}{CH}-CH_3$$

$$\downarrow Mg$$

$$CH_3-CH_2-\underset{\underset{D}{|}}{CH}-CH_3 \xleftarrow{D_2O} CH_3-CH_2-\underset{\underset{MgI}{|}}{CH}-CH_3$$

68. Given below are two statements :

Statement I : Ethene at 333 to 343 K and 6-7 atm pressure in the presence of $AlEt_3$ and $TiCl_4$ undergoes addition polymerization to give LDP.

Statement II : Caprolactam at 533-543 K in H_2O through step growth polymerizes to give Nylon 6.

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

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

(2) Both Statement I and Statement II are true

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

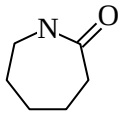
(4) Both Statement I and Statement II are false

Sol. **3**

(Fact-Based)

Statement-I : Ethane at 333 to 343 K and 6-7 atm pressure of $AlEt_3$ and $TiCl_4$ undergo addition polymerization to give HDPE not LDPE

Statement-II :



$\xrightarrow[H_2O]{533\text{-}543K}$ $\left[\overset{\overset{O}{\|}}{C}-(CH_2)_5-\overset{\overset{H}{|}}{N}\right]$

Caprolactam Nylon-6

69. For a chemical reaction A + B → Product, the order is 1 with respect to A and B.

Rate $mol\,L^{-1}\,S^{-1}$	[A] $mol\,L^{-1}$	[B] $mol\,L^{-1}$
0.10	20	0.5
0.40	x	0.5
0.80	40	Y

What is the value of x and y?

(1) 80 and 2 (2) 40 and 4 (3) 80 and 4 (4) 160 and 4

Sol. **1**

$r = K[A]^1[B]^1$

$0.1 = K(20)^1 (0.5)^1$ …(i)

$0.40 = K(x)^1 (0.5)^1$ …(ii)

$0.80 = K(40)^1 (y)^1$ …(iii)

From (i) and (ii)

x = 80

From (i) and (iii)

y = 2

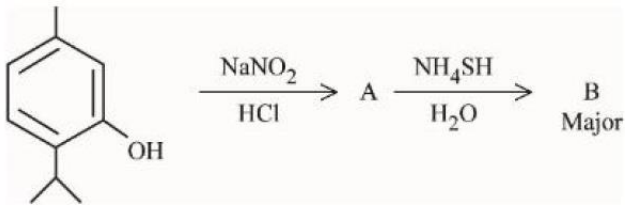
70. Which of the following compounds is an example of Freon?

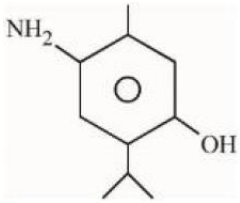
(1) C_2F_4 (2) C_2HF_3 (3) $C_2Cl_2F_2$ (4) $C_2H_2F_2$

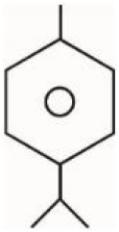
Sol. **3**

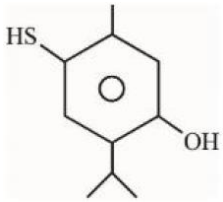
Freons are chlorofluoro carbon.

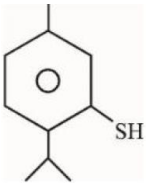
71. Compound 'B' is



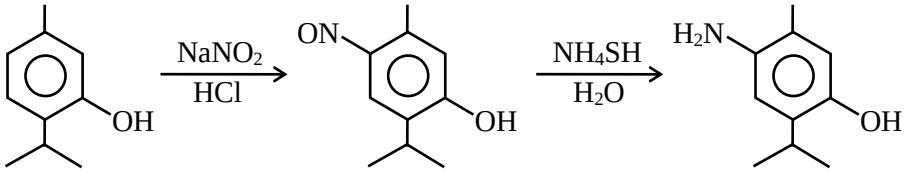
(1) 

(2) 

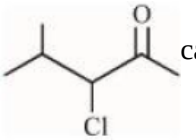
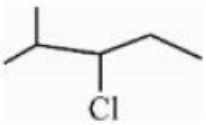
(3) 

(4) 

Sol. **1**



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

Assertion A:  can be subjected to Wolff-Kishner reduction to give 

Reason R:Wolff–Kishner reduction is used to convert  into 

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

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

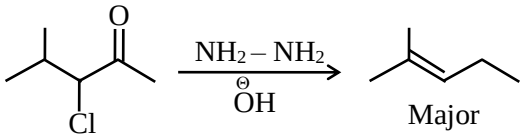
(2) A is true but R is false

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

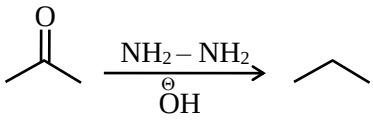
(4) A is false but R is true

Sol. **4**

Assertion (A)



Reason (R)



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

Assertion A : $[CoCl(NH_3)_5]^{2+}$ absorbs at lower wavelength of light with respect to $[CoCl(NH_3)_5(H_2O)]^{3+}$

Reason R : It is because the wavelength of the light absorbed depends on the oxidation state of the metal ion.

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

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

(2) A is true but R is false

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

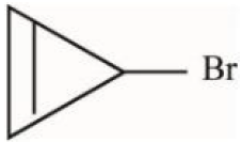
(4) A is false but R is true

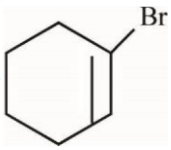
Sol. **4**

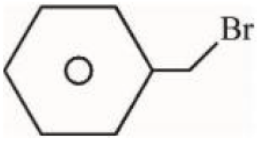
Since H_2O is strong field ligand compared to chloride and Co^{3+} ion is present.

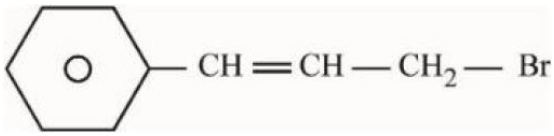
$\therefore$ CFSE is higher for $[Co(NH_3)5H_2O]^{+3}$, hence it will absorb at lower wavelength.

74. Compound from the following that will not produce precipitate on reaction with $AgNO_3$ is :

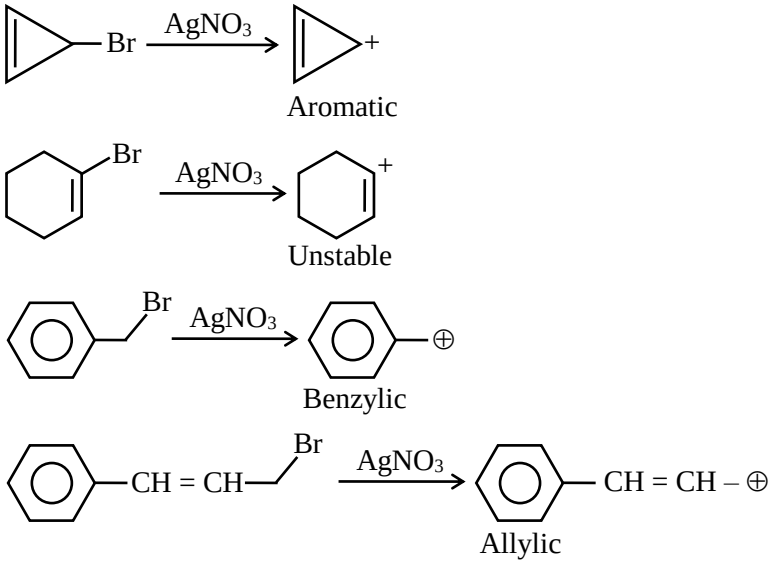
(1) 

(2) 

(3) 

(4) 

Sol. **2**



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

Assertion A : A solution of the product obtained by heating a mole of glycine with a mole of chlorine in presence of red phosphorous generates chiral carbon atom.

Reason R : A molecule with 2 chiral carbons is always optically active.

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 true but R is NOT the correct explanation of A

(3) A is true but R is false

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

Sol. **3**

$$H_2N - CH_2 - COOH \xrightarrow[\text{Red P}]{Cl_2} H_2N - \underset{\displaystyle Cl}{\overset{\displaystyle *}{CH}} - COOH$$

76. Alkali metal from the following with least melting point is:

(1) K (2) Cs (3) Rb (4) Na

Sol. **2**

On moving down the group in alkali metals melting point decreases.

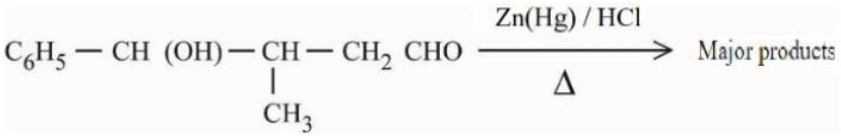
77. Which hydride among the following is less stable?

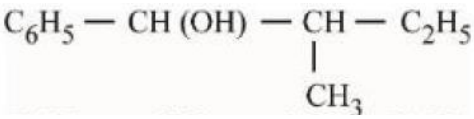
(1) HF (2) NH_3 (3) BeH_2 (4) LiH

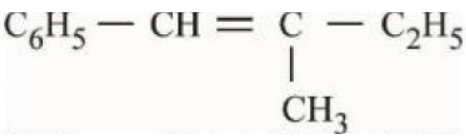
Sol. **3**

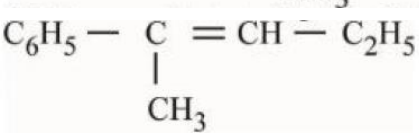
BeH_2 is hypovalent

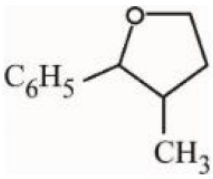
78. The major product formed in the following reaction is



A. 

B. 

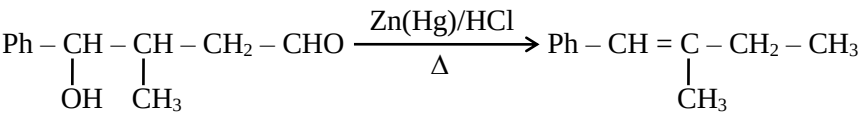
C. 

D. 

Choose the correct answer from the options given below:

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

Sol. **3**



79. One mole of P_4 reacts with 8 moles $SOCl_2$ to give 4 moles of A, x mole of SO_2 and 2 moles of B. A, B and x respectively are

(1) $POCl_3, S_2Cl_2$ and 4 (2) $POCl_3, S_2Cl_2$ and 2 (3) PCl_3, S_2Cl_2 and 4 (4) PCl_3, S_2Cl_2 and 2

Sol. **3**

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

80. What weight of glucose must be dissolved in 100 g of water to lower the vapour pressure by 0.20 mmHg? (Assume dilute solution is being formed)

Given : Vapour pressure of pure water is 54.2 mmHg at room temperature. Molar mass of glucose is $180\,g\,mol^{-1}$

(1) 2.59 g (2) 3.59 g (3) 3.69 g (4) 4.69 g

Sol. **3**

$$\frac{P^0 - P_s}{P^0} = \frac{n}{N} \text{ (for dilute solution)}$$

$$\frac{0.2}{54.2} = \frac{n \times 18}{100}$$

$$n = \frac{100}{271 \times 18}$$

$$w = \frac{100 \times 180}{271 \times 18}; \; w = 3.69 \text{ g}$$

SECTION - B

81. The total number of intensive properties from the following is_____ new line volume, Molar heat capacity, Molarity, E^{θ} cell, Gibbs free energy change, Molar mass, Mole

Sol. **4**

Extensive $\Rightarrow$ Mole, Volume, Gibbs free energy.

Intensive $\Rightarrow$ Molar mass, Molar heat capacity, Molarity, E^{θ} cell.

82. The volume of hydrogen liberated at STP by treating 2.4 g of magnesium with excess of hydrochloric acid is _____ $\times 10^{-2}$ L .

Given: Molar volume of gas is 22.4 L at STP. Molar mass of magnesium is 24 g mol^{-1}

Sol. **224**

$Mg + 2HCl \rightarrow MgCl_2 + H_2 \uparrow$

w = 2.4 g

$$N = \frac{2.4}{24} = 0.1 \text{mole}$$

1 mole of gas at STP $\Rightarrow$ 22.4 lit.

$\therefore$ 0.1 mole of gas = 0.1 × 22.4

= 2.24 lit. = 224 × 10^{-2} litre

83. The number of correct statements about modern adsorption theory of heterogeneous catalysis from the following is

A. The catalyst is diffused over the surface of reactants.

B. Reactants are adsorbed on the surface of the catalyst.

C. Occurrence of chemical reaction on the catalyst's surface through formation of an intermediate.

D. It is a combination of intermediate compound formation theory and the old adsorption theory.

E. It explains the action of the catalyst as well as those of catalytic promoters and poisons.

Sol. **3**

B, C and D are correct.

(NCERT – Surface Chemistry)

84. The number of correct statements from the following is

A. For 1 s orbital, the probability density is maximum at the nucleus

B. For 2 s orbital, the probability density first increases to maximum and then decreases sharply to zero.

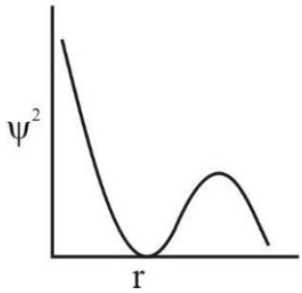
C. Boundary surface diagrams of the orbitals encloses a region of 100% probability of finding the electron.

D. p and d-orbitals have 1 and 2 angular nodes respectively

E. probability density of p-orbital is zero at the nucleus

Sol. **3**

A, D and E statements are correct.



For 2s orbital, the probability density first decreases and then increases.

At any distance from nucleus the probability density of finding electron is never zero and it always have some finite value.

85. The number of correct statements from the following is_____

A. E_{cell} is an intensive parameter

B. A negative $E^{\ominus}$ means that the redox couple is a stronger reducing agent than the H^+/H_2 couple.

C. The amount of electricity required for oxidation or reduction depends on the stoichiometry of the electrode reaction.

D. The amount of chemical reaction which occurs at any electrode during electrolysis by a current is proportional to the quantity of electricity passed through the electrolyte.

Sol. **4**

Given statements A, B, C and D are correct.

86. $Mg(NO_3)_2 XH_2O$ and $Ba(NO_3)_2 YH_2O$, represent formula of the crystalline forms of nitrate salts. Sum of X and Y is_____

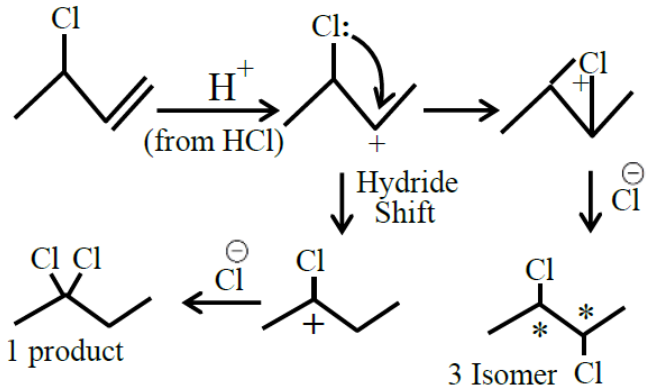
Sol. **6**

$Mg(NO_3)_2 \cdot 6H_2O$ is a hydrated salt whereas $Ba(NO_3)_2$ is a anhydrous salt.

$\therefore$ x + y = 6

87. The number of possible isomeric products formed when 3-chloro-1-butene reacts with HCl through carbocation formation is_____

Sol. **4**



Total Possible Isomeric product = 1 + 3 = 4

88. 4.5 moles each of hydrogen and iodine is heated in a sealed ten litre vessel. At equilibrium, 3 moles of HI were found. The equilibrium constant for $H_2(g)+I_2(g) \rightleftharpoons 2HI(g)$ is_____

Sol. **1**

	$H_{2(g)}$	$+ I_{2(g)}$	$\rightleftharpoons$	$2HI_{(g)}$
t = 0	4.5	4.5		–
t_{eq}	3	3		3

$$K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{(3)^2}{3\times 3} = \frac{9}{9} = 1$$

89. Number of compounds from the following which will not produce orange red precipitate with Benedict solution is _____

Glucose, maltose, sucrose, ribose, 2-deoxyribose, amylose, lactose

Sol. **2**

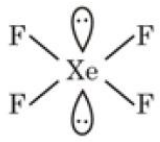
Benedict test :

Glucose	–	✓
maltose	–	✓
sucrose	–	×
ribose	–	✓
2-deoxyribose	–	✓
amylose	–	×
lactose	–	✓

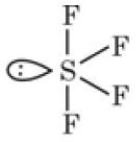
90. The maximum number of lone pairs of electrons on the central atom from the following species is_____

ClO_3^-, XeF_4, SF_4 and I_3^-

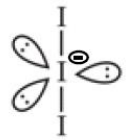
Sol. **3**



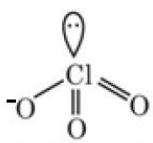
[2 lone pair]



[1 lone pair]



[3 lone pair]



[1 lone pair]

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