JEE–MAIN EXAMINATION – JANUARY 2026

(HELD ON WEDNESDAY 21st JANUARY 2026) **TIME : 3:00 PM TO 6 :00 PM**

CHEMISTRY — TEST PAPER WITH SOLUTION

SECTION-A

51. Consider the following spectral lines for atomic hydrogen:

A. First line of Paschen series

B. Second line of Balmer series

C. Third line of Paschen series

D. Fourth line of Bracket sereis

The correct arrangement of the above lines in ascending order of energy is:

(1) D < C < A < B

(2) A < B < C < D

(3) C < D < B < A

(4) D < A < C < B

Ans. (4)

Sol. $\Delta E = 13.6\, Z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

Series	n_1	n_2
(A) Paschen (1st line)	3	4
(B) Balmer (2nd line)	2	4
(C) Paschen (3rd line)	3	6
(D) Bracket (4th line)	4	8

So correct ascending order of energy of above lines is :

D < A < C < B

52. Match **List-I** with **List-II**.

List-I Pair of Compounds		**List-II Type of Isomers**	
A.	2-Methylpropene and but-1-ene	I.	Stereoisomers
B.	Cis-but-2-ene and trans-but-2-ene	II.	Position isomers
C.	2-Butanol and diethyl ether	III.	Chain isomers
D.	But-1-ene and but-2-ene	IV.	Functional group isomers

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

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

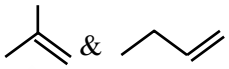
(2) A-III, B-I, C-II, D-IV

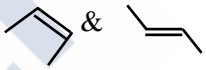
(3) A-I, B-IV, C-III, D-II

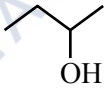
(4) A-II, B-I, C-IV, D-III

Ans. (2)

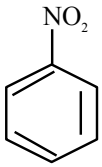
Sol.

(A)  (III) Chain isomer

(B)  (I) Streoisomers

(C)  & $CH_3–CH_2–O–CH_2–CH_3$ (IV) Functional isomers

(D)  (IV) Positional isomers

53. 

(1) $Br_2/FeBr_3/\Delta$
(2) $Sn/HCl/\Delta$
(3) pH neutralisation
(4) Br_2/H_2O
(5) $NaNO_2/HBr$, 0–5°C
(6) CuBr/NaBr

→ Major Product (P)

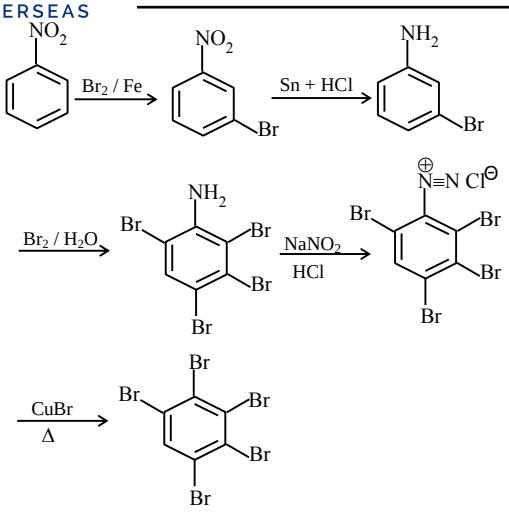
Consider the above sequence of reactions. The number of bromine atom(s) in the final product (P) will be:

(1) 1 (2) 6

(3) 5 (4) 4

Ans. (3)

Sol.



Number of Br atom in major product (P) = 5

54. Aqueous HCl reacts with $MnO_2(s)$ to form $MnCl_2(aq)$, $Cl_2(g)$ and $H_2O(l)$. What is the weight (in g) of Cl_2 liberated when 8.7 g of $MnO_2(s)$ is reacted with excess aqueous HCl solution ? (Given Molar mass in g mol^{-1} Mn = 55, Cl = 35.5, O = 16, H = 1)

(1) 7.1 (2) 71

(3) 21.3 (4) 14.2

Ans. (1)

Sol. $MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$

$\frac{8.7}{87}$ Excess

= 0.1 mole 0.1 mole

Wt. of Cl_2 obtained = 0.1 × 71 = 7.1 g

55. By usual analysis, 1.00g of compound (X) gave 1.79g of magnesium pyrophosphate. The percentage of phosphorus in compound (X) is: (nearest integer)

(Given, molar mass in g mol^{-1}: O = 16, Mg = 24, P = 31)

(1) 50 (2) 30

(3) 20 (4) 40

Ans. (1)

Sol. $$\% \text{ of P} = \frac{n_{Mg_2P_2O_7} \times 2 \times 31}{w_{(\text{unknown compound})}} \times 100$$

$$= \frac{\left(\frac{1.79}{222} \times 2 \times 31\right)}{1} \times 100$$

$$= 49.99\% \approx 50\%.$$

56. Consider the following data:

$\Delta_f H^{\ominus}$(methane, g) = –X kJ mol^{-1}

Enthalpy of sublimation of graphite = Y kJ mol^{-1}

Dissociation enthalpy of H_2 = Z kJ mol^{-1}

The bond enthalpy of C – H bond is given by:

(1) $\frac{X + Y + 2Z}{4}$

(2) $\frac{X + Y + 4Z}{2}$

(3) X + Y + Z

(4) $\frac{-X + Y + Z}{4}$

Ans. (1)

Sol. $C(s) + 2H_2(g) \rightarrow CH_4(g)$

$-x = (\Delta H_{sub} \text{ of carbon}) + 2 \times (\text{B.E. of H – H})$

$-4 \times (\text{B.E. of C – H})$

$-x = y + 2z - 4\,(\text{B.E. of C – H})$

$\text{B.E. of C – H} = \frac{y + 2z + x}{4}$.

57. Match **List-I** with **List-II**.

	List-I Reagents		**List-II Reaction Name (Involving aldehydes)**
A.	H_2, Pd-$BaSO_4$	I.	Etard Reaction
B.	$SnCl_2$, HCl	II.	Rosenmund Reduction
C.	CrO_2Cl_2, CS_2	III.	Gatterman–Koch Reaction
D.	CO,HCl, Anhyd. $AlCl_3$	IV.	Stephen Reaction

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

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

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

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

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

Ans. (4)

Sol. NCERT Name reaction theory based

58. Decomposition of A is a first order reaction at T(K) and is given by A(g) → B(g) + C(g). In a closed 1 L vessel, 1 bar A(g) is allowed to decompose at T(K). After 100 minutes, the total pressure was 1.5 bar. What is the rate constant (in min^{-1}) of the reaction ? (log 2 = 0.3)

(1) 6.9×10^{-1}

(2) 6.9×10^{-3}

(3) 6.9×10^{-2}

(4) 6.9×10^{-4}

Ans. **(2)**

Sol. $A_g \rightarrow B_g + C_g$

1 – –

1–P P P

$P_{total} = 1 + P$

$1.5 = 1 + P$

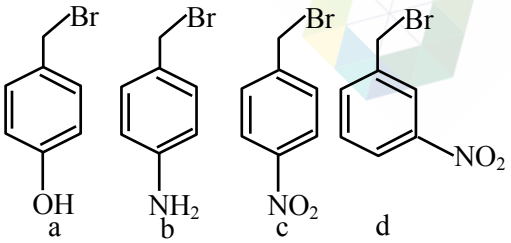
$P = 0.5$

$K = \frac{1}{100} \ln \frac{1}{0.5}$

$= \frac{0.693}{100}$

$= 6.9 \times 10^{-3}\ min^{-1}$

59. The correct order of reactivity of the following benzyl halides towards reaction with KCN is:



(1) a > b > c > d

(2) b > a > d > c

(3) b > a > c > d

(4) a > b > d > d

Ans. **(2)**

Sol. This is S_N1 reaction.

Rate of S_N1 reaction ∝ stability of carbocation

60. Given below are two statements:

Statement-I: The correct order in terms of atomic/ionic radii is Al > Mg > Mg^{2+} > Al^{3+}.

Statement-II: The correct order in terms of the magnitude of electron gain enthalpy is Cl > Br > S > O.

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

(1) Both **Statement I** and **Statement II** are false

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

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

(4) Both **Statement I** and **Statement II** are true

Ans. **(2)**

Sol. Correct order of size is Mg > Al > Mg^{2+} > Al^{3+}

Atomic size depends mainly upon $Z_{effective}$ and shell number.

Generally on moving down the group electron affinity decreases and on moving across the period electron affinity increase.

In the periodic table Cl has maximum electron affinity. Halogen has higher electron affinity than Chalcogen.

Cl > Br > S > O

61. The **correct** statements are:

A. Activation energy for enzyme catalysed hydrolysis of sucrose is lower than that of acid catalysed hydrolysis.

B. During denaturation, secondary and tertiary structures of a protein are destroyed but primary structure remains intact.

C. Nucleotides are joined together by glycosidic linkage between C_1 and C_4 carbons of the pentose sugar

D. Quaternary structure of proteins represents overall folding of the polypeptide chain.

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

(1) A, C and D Only

(2) A, B and D Only

(3) A and B Only

(4) B and C Only

Ans. **(3)**

Sol. Activation energy for enzyme catalysed hydrolysis of sucrose is lower than that of acid catalysed hydrolysis.

During denaturation secondary and tertiary structures of a protein are destroyed but primary structure remains intact.

62. The correct order of the rate of the reaction for the following reaction with respect to nucleophiles is:

$CH_3Br + Nu^{\ominus} \longrightarrow CH_3Nu + Br^{\ominus}$

(1) $PhO^- > {}^-OH > CH_3COO^- > ClO_4^-$

(2) $ClO_4^- > CH_3COO^- > {}^-OH > PhO^-$

(3) $CH_3COO^- > PhO^- > {}^-OH > ClO_4^-$

(4) $^-OH > PhO^- > CH_3COO^- > ClO_4^-$

Ans. **(4)**

Sol. Stability order of anion

$ClO_4^- > CH_3-\overset{\overset{O}{\|}}{C}-O^- > Ph\text{–}O^- > OH^-$ and nucleophlicity order reverse of stability of anion

$OH^- > Ph\text{–}O^- > CH_3-\overset{\overset{O}{\|}}{C}-O^- > ClO_4^-$

63. Given below are two statements:

Statement I: Crystal Field Stabilization Energy (CFSE) of $[Cr(H_2O)_6]^{2+}$ is greater than that of $[Mn(H_2O)_6]^{2+}$.

Statement II: Potassium ferricyanide has a greater spin-only magnetic moment than sodium Ferrocyanide.

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 true but **Statement II** is false

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

Ans. **(1)**

Sol. $[Mn(H_2O)_6]^{2+} \Rightarrow$ CFSE value is zero because of d^5 configuraiton with WFL in coordination number 6 $[Cr(H_2O)_6]^{2+}$.

$[Cr(H_2O)_6]^{2+} \Rightarrow$ CFSE value is $-0.6\Delta_0$ because of d^4 configuraiton with WFL in coordination number 6.

For : $K_3[Fe(CN)_6]$, $\mu = \sqrt{1(1+2)} = \sqrt{3}$ B.M.

For : $Na_4[Fe(CN)_6]$, $\mu = \sqrt{0}$ B.M.

64. The correct increasing order of C – H(A),

C – O(B), C = O(C) and C ≡ N(D) bonds in terms of covalent bond length is:

(1) A < B < C < D

(2) A < D < C < B

(3) D < C < B < A

(4) D < C < A < B

Ans. **(2)**

Sol. C–H (A) 107 pm

C≡N (D) 116 pm

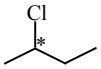
C–O (B) 143 pm

C=O (C) 121 pm

65. Given below are four compounds:
(a) n-propyl choride
(b) iso-propyl chloride
(c) sec-butyl chloride
(d) neo-pentyl chloride
Percentage of carbon in the one which exhibits optical isomerism is:

(1) 52 (2) 56 (3) 46 (4) 40

Ans. **(1)**

Sol. 

2-Chlorobutane is optically active and chiral molecule

Molecular formula $\Rightarrow C_4H_9Cl$

Molar mass = 48 + 9 + 35.5 = 92.5

$\%OC = \frac{48}{92.5} \times 100 = 51.89\%$

66. Given below are some of the statements about Mn and Mn_2O_7. Identify the correct statements

A. Mn forms the oxide Mn_2O_7 in which Mn is in its highest oxidation state.

B. Oxygen stabilizes the Mn in higher oxidation states by forming multiple bonds with Mn

C. Mn_2O_7 is an ionic oxide.

D. The structure of Mn_2O_7 consists of one bridged oxygen.

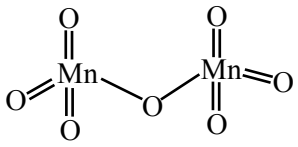
Choose the **correct** answer from the options given below:

(1) A, B, C and D (2) A, B and D Only

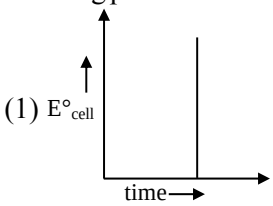
(3) A, C and D Only (4) A, B and C Only

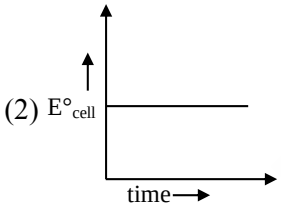
Ans. **(2)**

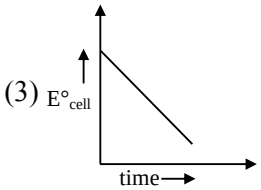
Sol. Mn_2O_7 : Mn in +7 oxidation state.

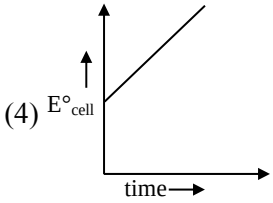


67. For a closed circuit Daniell cell, which of the following plots is the accurate one at a given temperature ?

(1) 

(2) 

(3) 

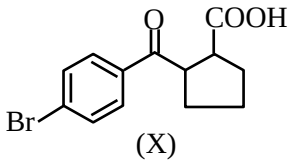
(4) 

Ans. **(2)**

Sol. E^0_{cell} remain constant with time.

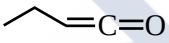
68. Given below are two statements :

Statement – I : Compound (X), shown below , dissolves in $NaHCO_3$ solution and has two chiral carbon atoms



(X)

Statement – II : Compound (Y), shown below, has two carbons with sp^3 hybridization, one carbon with sp^2 and one carbon with sp hybridization



(Y)

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

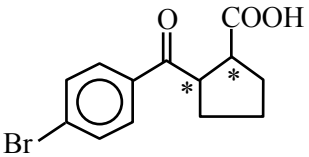
(2) **Statement I** is false but **Statement II** is true

(3) Both **Statement I** and **Statement II** are true

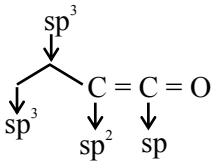
(4) Both **Statement I** and **Statement II** are false

Ans. **(3)**

Sol.



Two chiral centre and due to presence of –COOH compound dissolves in $NaHCO_3$.



69. Given below are two statements :

Statement I : The correct order in terms of bond dissociation enthalpy is $Cl_2 > Br_2 > F_2 > I_2$

Statement II : The correct trend in the covalent character of the metal halides is $[SnCl_4 > SnCl_2]$, $[PbCl_4 > PbCl_2]$ and $[UF_4 > UF_6]$

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

Ans. **(1)**

Sol. Statement-I :

Bond energy order is $Cl_2 > Br_2 > F_2 > I_2$

Bond energy increases with increase in bond order.

Statement-II

Correct order of covalent character

According to the Fajan's rule, higher the charge on cation , greater is the covalent character.

$PbCl_2 < PbCl_4$,

$UF_6 > UF_4$,

$SnCl_4 > SnCl_2$

70. On heating a mixture of common salt and $K_2Cr_2O_7$ in equal amount along with concentrated H_2SO_4 in a test tube, a gas is evolved. Formula of the gas evolved and oxidation state of the central metal atom in the gas respectively are :

(1) CrO_2Cl_2 and +5 (2) CrO_2Cl_2 and +6

(3) $Cr_2O_2Cl_2$ and +6 (4) $Cr_2O_2Cl_2$ and +3

Ans. **(2)**

Sol. $4NaCl + K_2Cr_2O_7 + 6H_2SO_4$

$\longrightarrow 2KHSO_4 + 2CrO_2Cl_2 + 4NaHSO_4 + 3H_2O$

(Chromyl chloride)

In Chromyl chloride Cr is in +6 oxidation state.

SECTION-B

71. The first and second ionization constants of H_2X are 2.5×10^{-8} and 1.0×10^{-13} respectively. The concentration of X^{2-} in 0.1 M H_2X solution is _____ $\times 10^{-15}$ M. (Nearest Integer)

Ans. **(100)**

Sol. $H_2X \rightleftharpoons H^+ + HX^-$,

$0.1-x \quad x+y \quad x-y$

$$2.5 \times 10^{-8} = \frac{(x+y)(x-y)}{0.1-x}$$

$HX^- \rightleftharpoons H^+ + X^{2-}$,

$x-y \quad x+y \quad y$

$$1 \times 10^{-13} = \frac{(x+y)(y)}{x-y}$$

Approximate : $K_{a_1} >> K_{a_2} \Rightarrow$ So $x >> y$.

$x + y \approx x$, $x - y \approx x$

$$10^{-13} = \frac{x.y}{x}$$

$y = 10^{-13}$

$[X^{2-}] = 10^{-13}$

$[X^{2-}] = 100 \times 10^{-15}$

72. The osmotic pressure of a living cell in 12 atm at 300 K. The strength of sodium chloride solution that is isotonic with the living cell at this temperature is _____ g L^{-1}. (Nearest integer)

Given : R = 0.08 L atm K^{-1} mol^{-1}

Assume complete dissociation of NaCl

(Given : Molar mass of Na and Cl are 23 and 35.5 g mol^{-1} respectively.)

Ans. **(15)**

Sol. $\pi = iCRT$

$12 = 2 \times C \times 0.08 \times 300$

$12 = 2 \times C \times 24$

$C = \frac{1}{4}$ mole/L

then strength of NaCl solution

$= \frac{1}{4} \times 58.5$ g/L

$= 14.625$ g/L

$= 15$ g/L

73. A substance 'X' (1.5 g) dissolved in 150 g of a solvent 'Y' (molar mass = 300 g mol^{-1}) led to an elevation of the boiling point by 0.5 K. The relative lowering in the vapour pressure of the solvent 'Y' is _____ $\times 10^{-2}$. (Nearest integer)

[Given : K_b of the solvent = 5.0 K kg mol^{-1}]

Assume the solution to be dilute and no association or dissociation of X takes place in solution.

Ans. (3)

Sol. $\Delta T_b = i \times K_b \times m$

$0.5 = i \times m \times 5$

$i \times m = \frac{0.5}{5} = 0.1$

$i \times a = \frac{15}{1000}$

(where a = moles of solute)

Now,

$$\frac{P_o - P_S}{P^o} = i\, X_{solute} = i \times \frac{a}{a + \frac{150}{300}}$$

$$= i \times \frac{a}{1/2} = \frac{15/1000}{1/2} = \frac{30}{1000} = 3 \times 10^{-2} = 3$$

74. Identify the metal ions among Co^{2+}, Ni^{2+}, Fe^{2+}, V^{3+} and Ti^{2+} having a spin-only magnetic moment value more than 3.0 BM. The sum of unpaired electrons present in the high spin octahedral complexes formed by those metal ions is _____.

Ans. (7)

Sol. $V^{3+} = (Ar)_{18}\, 3d^2$

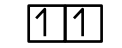
$Ti^{2+} = (Ar)_{18}\, 3d^2$

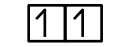
$Ni^{2+} = (Ar)_{18}\, 3d^8$

$Fe^{2+} = (Ar)_{18}\, 3d^6$

$Co^{2+} = (Ar)_{18}\, 3d^7$

Only for Fe^{2+} and Co^{2+} μ is more than 3.0 B.M.

Fe^{2+} $3d^6$  $n = 4, \mu > 3$

Co^{2+} $3d^7$  $n = 3, \mu > 3$

$\therefore$ Number of unpaired electrons = 4 + 3 = 7

75. MX is a sparingly soluble salt that follows the given solubility equilibrium at 298 K

$MX(s) \rightleftharpoons M^+(aq) + X^-(aq)$; $K_{sp} = 10^{-10}$

If the standard reduction potential for

$M^+(aq) \xrightarrow{+e^-} M(s)$ is $\left(E^{\ominus}_{M^+/M}\right) = 0.79V$, then the value of the standard reduction potential for the metal/metal insoluble salt electrode $E^{\ominus}_{X^-/MX(s)/M}$ is _____ mV. (nearest integer)

[Given: $\frac{2.303RT}{F} = 0.059V$]

Ans. (200)

Sol. $E^o_{X^-/MX(s)/M} = E^o_{M^+/M} + \frac{0.0591}{n} \log K_{sp}$

$= 0.79 + \frac{0.059}{1} \log 10^{-10}$

$= 0.79 - 0.59$

$= 0.20$ V $= 200$ mV