JEE–MAIN EXAMINATION – JANUARY 2026

(HELD ON THURSDAY 22ND JANUARY 2026) **TIME : 9:00 AM TO 12:00 NOON**

CHEMISTRY TEST PAPER WITH SOLUTION

SECTION-A

51. Consider the transition metal ions Mn^{3+}, Cr^{3+}, Fe^{3+} and Co^{3+} and all form low spin octahedral complexes. The correct decreasing order of unpaired electrons in their respective d-orbitals of the complexes is

(1) $Cr^{3+} > Fe^{3+} > Co^{3+} > Mn^{3+}$

(2) $Mn^{3+} > Fe^{3+} > Co^{3+} > Cr^{3+}$

(3) $Fe^{3+} > Co^{3+} > Mn^{3+} > Cr^{3+}$

(4) $Cr^{3+} > Mn^{3+} > Fe^{3+} > Co^{3+}$

Ans. **(4)**

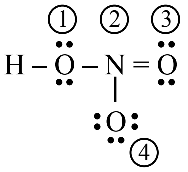
Sol. $Co^{3+} \rightarrow 3d^6 \Rightarrow t_{2g}^{2,2,2}\ e_g^{0,0}$,unpaired electron = 0

$Fe^{3+} \rightarrow 3d^5 \Rightarrow t_{2g}^{2,2,1}\ e_g^{0,0}$ unpaired electron = 1

$Cr^{3+} \rightarrow 3d^3 \Rightarrow t_{2g}^{1,1,1}\ e_g^{0,0}$ unpaired electron = 3

$Mn^{3+} \rightarrow 3d^4 \Rightarrow t_{2g}^{2,1,1}\ e_g^{0,0}$ unpaired electron = 2

52. The formal changes on the atoms marked as (1) to (4) in the Lewis representation of HnO_3 molecule respectively are



(1) +1, 0, 0, –1

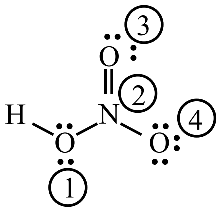
(2) 0, –1, 0, +1

(3) 0, +1, 0, –1

(4) 0, 0, –1, +1

Ans. **(3)**

Sol. Consider the structure of HNO_3



1 :- 0

2 :- (+1)

3 :- 0

4 :- (–1)

Formal charge = valence e's – non bonding e's

$$-\left(\frac{\text{bonding electrons}}{2}\right)$$

53. Given below are two statements :

Statement I : Phenol on treatment with $CHCl_3$/aq. KOH under refluxing condition, followed by acidification produces *p*-hydroxy benzladehyde as the major product and *o*-hydroxy benzaldehyde as the minor product.

Statement II : The mixture of *p*-hydroxybenzaldehyde and *o*-hydroxybenzaldehyde can be easily separated through steam distillation.

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

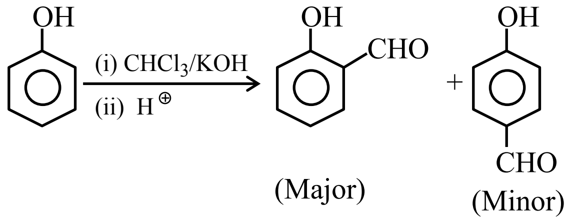
(2) Statement I is true but Statement II is false

(3) Both Statement I and Statement II are true

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

Ans. **(4)**

Sol.



(can be separated by steam distillation)

54. The energy required by electrons, present in the first Bohr orbit of hydrogen atom to be excited to second Bohr orbit is ________ J mol^{-1}.

Given : $R_H = 2.18 \times 10^{-11}$ ergs.

(1) 1.635×10^{-18}

(2) 9.835×10^{5}

(3) 9.835×10^{12}

(4) 1.635×10^{-11}

Ans. (2)

Sol. $E_n = -R_H \times \frac{Z^2}{n^2}$

$$\Delta E = 2.18 \times 10^{-11} \times 10^{-7} \times 1^2 \left[\frac{1}{1^2} - \frac{1}{2^2}\right]$$

$= 1.635 \times 10^{-18}$ Joule/atom

$= 1.635 \times 10^{-18} \times 6.02 \times 10^{23}$ Joule/mole

$= 9.835 \times 10^{5}$ Joule/mole

55. A ‘p’-block element (E) and hydrogen form a binary cation $(EH_x)^+$, while EH_3 on treatment with K_2HgI_4 in alkaline medium gives a precipitate of basic mercury(II)amido-iodine. Given below are first ionisation enthalpy values (kJ mol^{-1}) for first element each from group 13, 14, 15 and 16. Identify the correct first ionisation enthalpy value for element E.

(1) 1312

(2) 1086

(3) 1402

(4) 801

Ans. (3)

Sol. Element E is N, the species is NH_4^+, among B, C, N and O, N has highest first ionization energy.

56. In the reaction,

$2Al(s) + 6HCl(aq) \rightarrow 2Al^{3+}(aq) + 6Cl^-(aq) + 3H_2(g)$

(1) 11.2 L $H_2(g)$ at STP is produced for every mole of HCl consumed.

(2) 67.2 L $H_2(g)$ at STP is produced for every mole of Al that reacts.

(3) 12 L HCl(aq) is consumed for every 6L $H_2(g)$ produced.

(4) 33.6 L $H_2(g)$ is produced regardless of temperature and pressure for every mole of Al that reacts.

Ans. (1)

Sol. $2Al\ (s) + 6HCl\ (aq) \rightarrow 2Al^{3+}\ (aq) + 6Cl^-\ (aq) + 3H_2(g)$

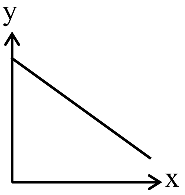
Mole of H_2 produced

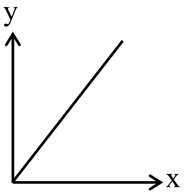
$= 2 \times$ mole of HCl used

$= \frac{2}{3} \times$ mole of Al used

57. Consider a solution of $CO_2(g)$ dissolved in water in a closed container.

Which one of the following plots correctly represents variation of log (partial pressure of CO_2 in vapour phase above water) [y-axis] with log (mole fraction of CO_2 in water) [x-axis] at 25°C ?

(1)


(2)


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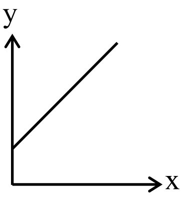
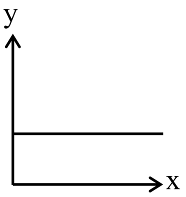


(4)


Ans. (3)

Sol. From Henry's law :

$P(g) = K_H.X(g)$

$\log P(g) = \log K_H + \log X(g)$

58. A first row transition metla (M) does not liberate H_2 gas from dilute HCl. 1 mol of aqueous solution of MSO_4 is treated with excess of aqueous KCN and then $H_2S(g)$ is passed through the solution. The amount of MS (metal sulphide) formed from the above reaction is _______ mol.

(1) 2

(2) 1

(3) 3

(4) 0

Ans. **(4)**

Sol. $Cu \xrightarrow{\text{dil.HCl}} \text{no reaction}$

$$CuSO_4 \xrightarrow{KCN} \underset{\text{perfect complex}}{[Cu(CN)_4]^{3-}} \xrightarrow{H_2S} \text{no sulphide ppt}$$

59. The correct order of reactivity of CH_3Br in methanol with the following nucleophiles is

F^-, I^-, $C_2H_5O^-$ and $C_6H_5O^-$

(1) $I^- > C_6H_5O^- > F^- > C_2H_5O^-$

(2) $I^- > C_2H_5O^- > C_6H_5O^- > F^-$

(3) $I^- > C_2H_5O^- > F^- > C_6H_5O^-$

(4) $I^- > F^- > C_6H_5O^- > C_2H_5O^-$

Ans. **(2)**

Sol. Order of nucleophilicity :

$I^{\ominus} > C_2H_5O^{\ominus} > PhO^{\ominus} > F^{\ominus}$

60. Match the **LIST-I** with **LIST-II**

List-I **Thermodynamic Process**		**List-II** **Magnitude in kJ**	
A.	Work done in reversible, isothermal expansion of 2 mol of ideal gas from 2 dm^3 to 20 dm^3 at 300 K.	I.	4
B.	Work done in irreversible isothermal expansion of 1 mol ideal gas from 1 m^3 to 3 m^3 at 300 K against A constant pressure of 3kPa.	II.	11.5
C.	Change in internal energy for adiabatic expansion of a 1 mol ideal gas with change of temperature = 320 K and $\bar{C}_V = \frac{3}{2}R$.	III.	6
D.	Change in enthalpy at constant pressure of 1 mole ideal gas with change of temperature = 337 K and $\bar{C}_P = \frac{5}{2}R$.	IV.	7

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

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

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

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

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

Ans. **(2)**

Option (A)

$$W = -nRT\ln\frac{V_2}{V_1}$$

$$= \frac{-2\times 8.314\times 300}{1000}\times \ln\left(\frac{20}{2}\right)\text{kJ}$$

$$= -11.5\ \text{kJ}$$

Option (B)

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

$$= -3[3-1]$$

$$= -6\ \text{kJ}$$

Option (C)

$$\Delta U = nC_V\Delta T$$

$$= 1\times\frac{3}{2}\times\frac{8.314\times 320}{1000}100\,\text{kJ}$$

$$= 3.99$$

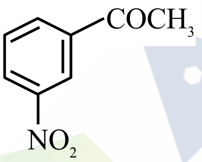
Option (D)

$$\Delta H = nC_P\Delta T$$

$$= 1\times\frac{5}{2}\times\frac{8.314\times 337}{1000}\text{kJ}$$

$$= 7\ \text{kJ}$$

61. Given below are two statements :

Statement I : Benzene is nitrated to give nitrobenzene, which on further treatment with CH_3COCl / $AlCl_3$ will give 

Statement II : NO_2 group is a *m*-directing, and deactivating group.

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

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

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

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

(4) Both Statement I and Statement II is are incorrect.

Ans. (3)

Sol. Nitrobenzene does not give Fridel-Craft acylation since it is highly deactivated ring.

62. A → products (First order reaction).

Three sets of experiment were performed for a reaction under similar experimental conditions.

Run 1 ⇒ 100 mL of 10 M solution of reactant A

Run 2 ⇒ 200 mL of 10 M solution of reactant A

Run 3 ⇒ 100 mL of 10 M solution of reactant A+ 100 mL of H_2O added.

The correct variation of rate of reaction is

(1) Run 1 = Run 2 = Run 3

(2) Run 3 < Run 1 = Run 2

(3) Run 3 < Run 1 < Run 2

(4) Run 1 < Run 2 < Run 3

Ans. **(2)**

Sol. For Ist order reaction

Rate = k[A]

with decrease in concentration of A, rate of reaction decreases.

63. Match the LIST-I with LIST-II

List-I **Reagents**		**List-II** **Name of Reaction involving carbonyl compound**	
A.	NH_2-NH_2, KOH	I.	Tollen's Test
B.	$Ag(NH_3)_2OH$	II.	Clemmensen Reduction
C.	Aq. $CuSO_4$, Sodium Potassium tartarate, KOH	III.	Wolff-Kishner Reduction
D.	Zn – Hg, HCl	IV.	Fehling's Test

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

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

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

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

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

Ans. **(1)**

Sol. Theoretical (NCERT Based)

64. Given below are two statements :

Statement I : The halogen that makes longest bond with hydrogen in HX, has the smallest covalent radius in its group.

Statement II : A group 15 element's hydride EH_3 has the lowest boiling point among corresponding hydrides of other group 15 elements. The maximum covalency of that element E is 4.

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) Statement I is false but Statement II is true.

(3) Both Statement I and Statement II are false.

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

Ans. (3)

Sol. HF < HCl < HBr < HI (bond length order)

F < Cl < Br < I (radius order)

$PH_3 < AsH_3 < NH_3 < SbH_3 < BiH_3$ (Boiling point order)

Maximum possible covalency of phosphorous is 6

65. Given below are two statements:

Statement I : Sucrose is dextrorotatory. However sucrose upon hydrolysis gives a solution having mixture of products. This solution shows laevorotation.

Statement II : Hydrolysis of sucrose gives glucose and fructose. Since the laevorotation of glucose is more than the dextrorotation of fructose the resulting solution becomes laevorotatory.

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

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

(2) Both Statement I and Statement II are false.

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

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

Ans. (4)

Sol. $C_{12}H_{22}O_{11} + H_2O \xrightarrow{HCl} C_6H_{12}O_6 + C_6H_{12}O_6$

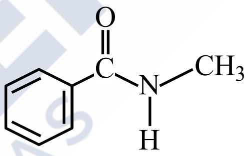
D– Glucose + D fructose

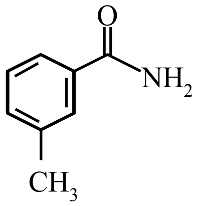
$[\alpha]_{\text{D-sucrose}} = +66.5°$, $[\alpha]_{\text{D-Glucose}} = +52.5°$,

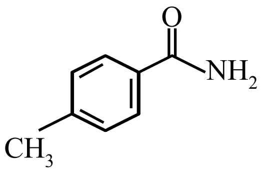
$[\alpha]_{\text{D-Fructose}} = -92.4°$

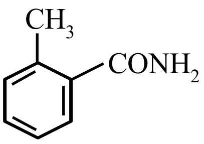
⇒ Sucrose is dextrorotatory and hydrolysed product is laevorotatory.

66. 'A' is a neutral organic compound (M. F : C_8H_9ON). On treatment with aqueous $Br_2/HO^{(-)}$, 'A' forms a compound 'B' which is soluble in dilute acid. 'B' on treatment with aqueous $NaNO_2/HCl(0–5°C)$ produces a compound 'C' which on treatment with CuCN/NaCN produces 'D' Hydrolysis of 'D' produces 'E' which is also obtainable from the hydrolysis of 'A'. 'E' on treatment with acidified $KMnO_4$ produces 'F'. 'F' contains two different types of hydrogen atoms. The structure of 'A' is

(1) 

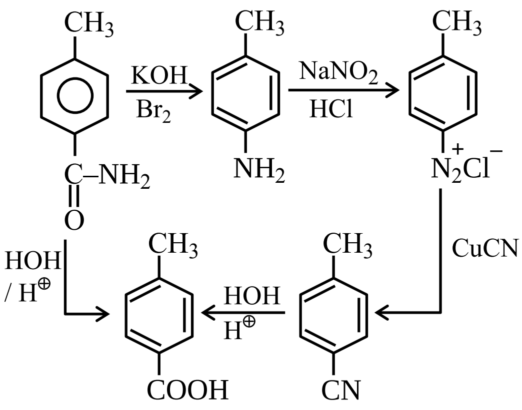
(2) 

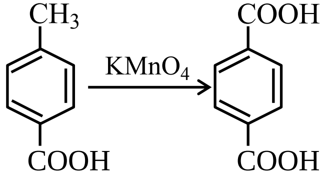
(3) 

(4) 

Ans. (3)

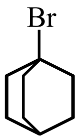
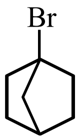
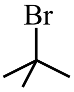
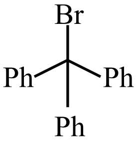
Sol.





67. The correct order of the rate of reaction of the following reactants with nucleophile by S_N1 mechanism is :

(Given : Structure I and II are rigid)

(I) (II) (III) (IV)

(1) IV < III < II < I (2) III < I < II < IV

(3) II < I< III < IV (4) I < II < III < IV

Ans. **(3)**

Rate of $S_N1 \propto$ Stability of $C^{\oplus}$ formed

(I) and (II) are unstable due to Bredt's rule, (I) has more +I effect.

(II) < (I) < (III) < (IV)

68. Two p-block elements X and Y form fluroides of the type EF_3. The fluoride compound XF_3 is a Lewis acid and YF_3 is a Lewis base. The hybridization of the central atoms of XF_3 and YF_3 respectively are

(1) Both sp^3 (2) sp^2 and sp^3

(3) sp^3 and sp^2 (4) Both sp^2

Ans. **(2)**

Sol. $XF_3 = BF_3$; sp^2

$YF_3 = NF_3$; sp^3

69. As compared with chlorocyclohexane, which of the following statements correctly apply to chlorobenzene ?

A. The magnitude of negative charge is more on chlorine atoms

B. The C – Cl bond has partial double bond character

C. C – Cl bond is less polar

D. C – Cl bond is longer due to repulsion between delocalised electrons of the aromatic ring and lone pairs of electrons of chlorine.

E. The C–Cl bond is formed using sp^2 hybridised orbital of carbon.

Choose the correct answer from the options given below :

(1) A, C and E only (2) B, C and D only

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

Ans. **(4)**

Sol. Chlorocylohexane is more polar due to –I effect of –Cl,

Whereas chlorobenzene has –I > +M, so it is less polar & also has partial double bond character.

70. Given below are two statements:

Statement I : The Henry's law constant K_H is constant with respect to variations in solution's concentration over the range for which the solutions is ideally dilute.

Statement II : K_H does not differ for the same solute in different solvents.

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

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

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

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

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

Ans. **(2)**

Sol. K_H depends on the nature of gas and solvent.

SECTION-B

71. The cycloalkane (X) on bromination consumes one mole of bromine per mole of (X) and gives the product (Y) in which C:Br ratio is 3 : 1. The percentage of bromine in the product (Y) is _______ %. (Nearest integer)

(Given : Molar mass in g mol^{-1} H : 1, C : 12, O : 16, Br : 80)

Ans. **(66)**

Sol. $C_6H_{10} \xrightarrow{Br_2} C_6H_{10}Br_2$

Molecular mass of $C_6H_{10}Br_2$ is :

$12 \times 6 + 10 + 160$

$72 + 10 + 160 = 242$

$$\% \text{ of Br} = \frac{160}{242} \times 100$$

% of Br = 66.11 % ≈ 66%

72. Consider the following electrochemical cell at 298K

$$\mathrm{Pt}\,|\,\mathrm{HSnO_2^-(aq)}\,|\,\mathrm{Sn(OH)_6^{2-}(aq)}\,|\,\mathrm{Bi_2O_3(s)}\,|\,\mathrm{Bi(s)}.$$

If the reaction quotient at a given time is 10^6, then the cell EMF (E_{cell}) is _______× 10^{-1}V (Nearest integer).

Given the standard half-cell reduction potential as

$$E^0_{\mathrm{Bi_2O_3/Bi,OH^-}} = -0.44\mathrm{V} \text{ and}$$

$$E^0_{\mathrm{Sn(OH)_6^{2-}/HSnO_2^-,OH}} = -0.90\mathrm{V}$$

Ans. **(4)**

Sol. $E^\circ_{cell} = -0.44-(-0.90)$

$= +\,0.46$ V

Applying Nernst equation :-

$$E_{cell} = E^\circ_{cell} - \frac{0.06}{n}\log Q$$

$$E_{cell} = 0.46 - \frac{0.06}{6}\log 10^6$$

$$E_{cell} = 4 \times 10^{-1}$$

x = 4

73. The temperature at which the rate constants of the given below two gaseous reactions become equal is ___________ K. (Nearest integer).

$$X \longrightarrow Y \qquad k_1 = 10^6 e^{\frac{-30000}{T}}$$

$$P \longrightarrow Q \qquad k_2 = 10^4 e^{\frac{-24000}{T}}$$

Given : ln 10 = 2.303

Ans. **(1303)**

Sol. $10^4 e^{\frac{-24000}{T}} = 10^6 e^{\frac{-30000}{T}}$

$$e^{\frac{6000}{T}} = 100$$

$$\frac{6000}{T} = 2\ln 10$$

$$T = \frac{6000}{2 \times 2.303}$$

T = 1302.64 K

T ≈ 1303 K

74. Sodium fusion extract of an organic compound (Y) with $CHCl_3$ and chlorine water gives violet color to the $CHCl_3$ layer. 0.15g of (Y) gave 0.12 g of the silver halide precipitate in Carius method. Percentage of halogen in the compound (Y) is ___________ . (Nearest integer).

(Given : molar mass g mol^{-1} C : 12, H : 1, Cl : 35.5, Br : 80, I : 127)

Ans. **(43)**

Sol. Iodine gives violet colour

$$\%\text{ of I} = \frac{\text{Atomic weight of I}}{\text{Molecular weight of AgI}} \times \frac{m}{W} \times 100$$

$$= \frac{127}{235} \times \frac{0.12}{0.15} \times 100$$

% of I = 43.23 % ≈ 43%

75. Dissociation of a gas A_2 takes place according to the following chemical reactions. At equilibrium, the total pressure is 1 bar at 300K.

$$A_2(g) \rightleftharpoons 2A(g)$$

The standard Gibbs energy of formation of the involved substances has been provided below:

Substance	ΔG°_f / kJ mol^{-1}
A_2	–100.00
A	–50.832

The degree of dissociation of A_2(g) is given by $(x \times 10^{-2})^{1/2}$ where x = _________.

(Nearest integer).

[Given : R = 8 J mol^{-1} K^{-1}, log 2 = 0.3010,
log 3 = 0.48]

Ans. **(33)**

Sol. $-1.664 \times 10^3 = -8.3 \times 300 \ln K_P$

$\ln K_P = 0.693$

$K_P = 2$

$$2 = \frac{4\alpha^2 P_0}{1-\alpha^2}$$

$$\alpha = \frac{1}{\sqrt{3}}$$

$$\alpha = \left(\frac{100}{3} \times 10^{-2}\right)^{1/2}$$

$= (33.33 \times 10^{-2})^{1/2}$