JEE–MAIN EXAMINATION – JANUARY 2026

(HELD ON THURSDAY 22nd JANUARY 2026) **TIME : 3:00 PM TO 6:00 PM**

CHEMISTRY | TEST PAPER WITH SOLUTION

SECTION-A

51. At T(K), 100 g of 98% H_2SO_4 (w/w) aqueous solution is mixed with 100 g of 49% H_2SO_4 (w/w) aqueous solution. What is the mole fraction of H_2SO_4 in the resultant solution ?

(Given : Atomic mass H = 1 u ; S = 32 u; O = 16 u)

(Assume that temperature after mixing remains constant)

(1) 0.9 (2) 0.1

(3) 0.337 (4) 0.663

Ans. (4)

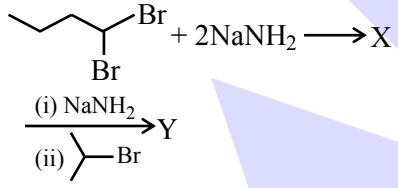
Sol. Total weight of H_2SO_4

$$= \left(100 \times \frac{98}{100}\right) + \left(100 \times \frac{49}{100}\right) = 147 \text{ gm}$$

Total weight of $H_2O = 200 - 147 = 53$ gm

$$\text{Mole fraction of } H_2SO_4 = \frac{\frac{147}{98}}{\left(\frac{147}{98} + \frac{53}{18}\right)} = 0.337$$

52. Consider the following reaction :



The product Y formed is :

(1) 2-methylhex-2-yne

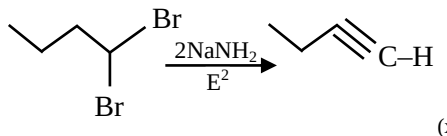
(2) 5-methylhex-2-yne

(3) 2-methylhex-3-yne

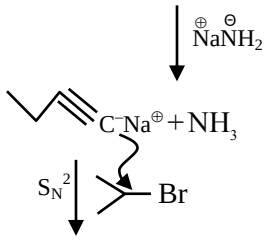
(4) Isopropylbut-1-yne

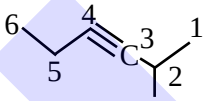
Ans. (3)

Sol.



(x)





2–methyl hex–3–yne

53. $A + 2B \longrightarrow AB_2$

36.0 g of 'A' (Molar mass : 60 g mol^{-1}) and 56.0 g of 'B' (Molar mass : 80 g mol^{-1}) are allowed to react. Which of the following statements are **correct** ?

(A) 'A' is the limting reagent

(B) 77.0 g of AB_2 is formed

(C) Molar mass of AB_2 is 140 g mol^{-1}

(D) 15.0 g of A is left unreacted after the completion of reaction.

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

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

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

Ans. (3)

Sol.

	A	+	2B	⟶	AB_2
Mole	$\frac{36}{60}$		$\frac{56}{80}$		
	0.6 mole		0.7 mole		
	0.25 mole		–		0.35 mole

(A) Molecular wt. of AB_2 is

$60 + 2 \times 80 = 220$ g/mol

(B) LR is AB.

(C) Wt. of A remaining = $0.25 \times 60 = 15$ g

(D) wt. of AB_2 formed = $0.35 \times 220 = 77$ gm.

54. Given below are two statements :

Statement-I L: The first ionization enthalpy of Cr is lower than that of Mn.

Statement-II : The second and third ionization enthalpies of Cr are higher than those of Mn.

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. (2)

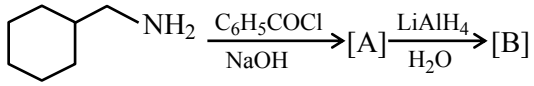
Sol. Cr = (Ar) $3d^5 4s^1$

Mn = (Ar)$3d^5 4s^2$

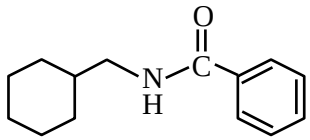
IE_1 (Cr) < IE_1 (Mn)

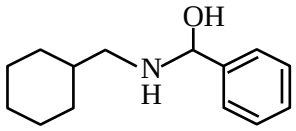
IE_2 (Cr) > IE_2 (Mn)

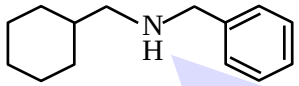
IE_3 (Cr) < IE_3 (Mn)

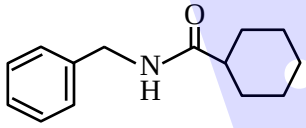
55. 

The final product [B] is :

(1) 

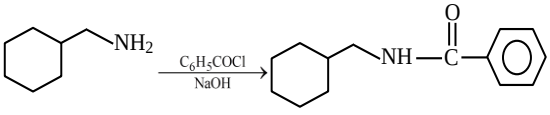
(2) 

(3) 

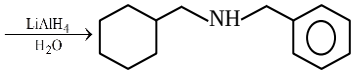
(4) 

Ans. (3)

Sol.



(A)



56. When 1 g of compound (X) is subjected to Kjeldahl's method for estimation of nitrogen, 15 mL, 1M H_2SO_4 was neutralized by ammonia evolved. The percentage of nitrogen in compound (X) is :

(1) 21

(2) 0.42

(3) 42

(4) 0.21

Ans. (3)

Sol. eq. of H_2SO_4 = eq. of Ammonia

$\Rightarrow \frac{15\times1\times2}{1000}$ = moles of ammonia × 1

$\Rightarrow$ Moles of ammonia = moles of 'N'

$\Rightarrow$ Weight of nitrogen = $\frac{15\times1\times2}{1000}\times14 = 0.42$

% weight of 'N' = $\frac{0.42}{1}\times100 = 42\%$

57. Correct statements regarding Arrhenius equation among the following are :

(A) Factor $e^{-Ea/RT}$ corresponds to fraction of molecules having kinetic energy less than Ea.

(B) At a given temperature, lower the Ea, faster is the reaction.

(C) Increase in temperature by about 10°C doubles the rate of reaction.

(D) Plot of log k vs $\frac{1}{T}$ gives a straight line with slope = $-\frac{Ea}{R}$.

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

(1) B and D only

(2) A and B only

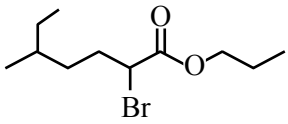
(3) A and C only

(4) B and C only

Ans. (4)

Sol. Fact based.

58. The IUPAC name of the following comopound is :



(1) n-propyl-2-bromo-5-methylheptanoate

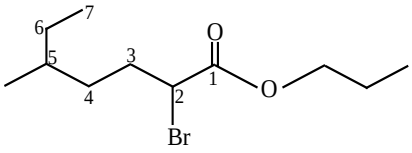
(2) 2-bromo-5-methylhexylpropanoate

(3) 2-bromo-5-methylpropanoate

(4) n-propyl-1-bromo-4-methylhexanoate

Ans. (1)

Sol.



Propyl-2-Bromo-5-Methylheptanoate

59. Given below are two statements :

Statement-I : Element 'X' and 'Y' are the most and least electronegative elements, respectively among N, As, Sb and P. The nature of the oxides X_2O_3 and Y_2O_3 is acidic and amphoteric, respectively.

Statement-II : BCl_3 is covalent in nature and gets hydrolysed in water. It produces $[B(OH)_4]^-$ and $[B(H_2O)_6]^{3+}$ in aqueous medium.

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 true but Statement-II is false.

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

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

Ans. (2)

Sol. Electronegativity order : N > P > As > Sb

Most electronegative — Least electronegative

X = N $X_2O_3 = N_2O_3$ (Acidic)

Y = Sb $Y_2O_3 = Sb_2O_3$ (Amphoteric)

Statement-I is true

$BCl_3 + 3H_2O \rightarrow B(OH)_3 + 3HCl$

Statement-II is false

60. Match List-I with List-II.

List-I Reaction of glucose with	**List-II Product formed**
A. Hydroxylamine	I. Glouconic acid
B. Br_2 water	II. Glucose pentacetate
C. Excess acetic anhydride	III. Saccharic acid
D. Concentrated HNO_3	IV. Glucoxime

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

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

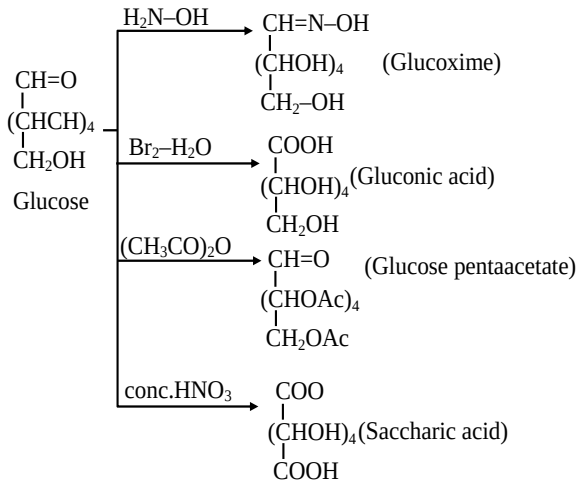
(2) A-IV, B-I, C-II, D-III

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

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

Ans. (2)

Sol.



61. Among H_2S, H_2O, NF_3, NH_3 and $CHCl_3$, identify the molecule (X) with lowest dipole moment value. The number of lone pairs of electrons present on the central atom of the molecule (X) is :

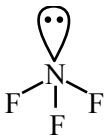
(1) 2 (2) 0

(3) 1 (4) 4

Ans. **(3)**

Sol.

Molecule	Dipole moment
H_2S	0.95
H_2O	1.85
NF_3	0.23 (minimum)
NH_3	1.47
$CHCl_3$	1.04



Number of lone pair on central atom = 1

62. Given below are two statements :

Statement-I : C < O < N < F is the correct order in terms of first ionization enthalpy values.

Statement-II : S > Se > Te > Po > O is the correct order in terms of the magnitude of electron gain enthalpy values.

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 true.

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

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

Ans. **(2)**

Sol. $C < O < N < F$

$2p^2\ 2p^4\ 2p^3\ 2p^5 \longrightarrow$

$Z_{eff} \uparrow$ I. E. $\uparrow$

Statement-I is correct

S > Se > Te > Po > O

$|\Delta_{eg}H|$ 200 195 190 174 141 (in kJ/mol)

Statement-II is correct.

63. Which of the following mixture gives a buffer solution with pH = 9.25 ?

Given : $pK_b\ (NH_4OH) = 4.75$

(1) 0.2M NH_4OH (0.4 L) + 0.1M HCl (1L)

(2) 0.2M NH_4OH (0.5 L) + 0.1M HCl (0.5 L)

(3) 0.5M NH_4OH (0.2 L) + 0.2M HCl (0.5 L)

(4) 0.4M NH_4OH (1 L) + 0.1M HCl (1L)

Ans. **(2)**

Sol. $pOH = pK_b + \log \frac{Salt}{Base}$

$4.75 = 4.75 + \log \frac{Salt}{Base}$

Milimoles of [Salt] = milimoles of [Base]

Option (D) :

$NH_4OH + HCl \rightarrow NH_4Cl + H_2O$

0.2M, 0.5L 0.1M, 0.5L

100 mmole 50 mmole

50 mmole – 50 mmole

Milimoles of NH_4OH = milimoles of NH_4Cl

64. The energy of first (lowest) Balmer line of H atom is x J. The energy (in J) of second Balmer line of H atom is :

(1) x^2 (2) $\frac{x}{1.35}$

(3) 2x (4) 1.35 x

Ans. **(4)**

Sol. Transition of first Balmer line

$n_1 = 2; n_2 = 3$

$\Delta E = x = 13.6\ (1)^2 \left[\frac{1}{2^2} - \frac{1}{3^2}\right]$ ..... (i)

Transition of 2nd Balmer line

$n_1 = 2; n_2 = 4$

$\Delta E = 13.6\ (1)^2 \left[\frac{1}{2^2} - \frac{1}{4^2}\right]$ ..... (ii)

Divide Eq. (ii) by eq. (i)

$$\frac{\Delta E}{x} = \frac{\frac{1}{4} - \frac{1}{16}}{\frac{1}{4} - \frac{1}{9}}$$

$$\frac{\Delta E}{x} = \frac{\frac{3}{16}}{\frac{5}{36}}$$

$$\frac{\Delta E}{x} = \frac{27}{20}$$

$\Delta E = 1.35x$.

65. Identify the **correct** statements :

A. Hydrated salts can be used as primary standard.

B. Primary standard should not undergo any reaction with air.

C. Reactions of primary standard with another substance should be instantaneous and stoichiometric.

D. Primary standard should not be soluble in water.

E. Primary standard should have low relative molar mass.

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

(1) A, B, C and E only

(2) A, B, and C only

(3) A, B and E only

(4) D and E only

Ans. (2)

Sol. Primary standard must be soluble for standard solution formation.

66. $[Ni(PPh_3)_2Cl_2]$ is a paramagnetic complex. Identify the **INCORRECT** statements about this complex.

A. The complex exhibits geometrical isomerism.

B. The complex is white in colour.

C. The calculated spin-only magnetic moment of the complex is 2.84 BM.

D. The calculated CFSE (Crystal Field Stabilization Energy) of Ni in this complex is $-0.8\Delta_0$.

E. The geometrical arrangement of ligands in this complex is similar to that in $Ni(CO)_4$.

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

(1) A and B only

(2) A, B and D only

(3) C and D only

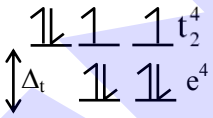
(4) C, D and E only

Ans. (2)

Sol. $[Ni(PPh_3)_2Cl_2]$

Given : Paramagnetic complex hence it must be tetrahedral so

Crystal field splitting :



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

(A) Tetrahedral complex not show geometrical isomerism.

(B) Complex is Blue colour

(C) Calculated spin only magnetic moment of the complex is 2.84 B.M.

(D) C.F.S.E $= -0.6\ \Delta_t\ (4) + 0.4\ \Delta_t\ (4)$

$= -0.8\ \Delta_t$ (not $-0.8\ \Delta_0$)

(E) $Ni(CO)_4$ also tetrahedral

Hence only A, B, D correct.

67. Consider the following reduction processes :

$Al^{3+} + 3e^- \rightarrow Al(s),\ E^o = -1.66$ V

$Fe^{3+} + e^- \rightarrow Fe^{2+},\ E^o = +0.77$ V

$Co^{3+} + e^- \rightarrow Co^{2+},\ E^o = +1.81$ V

$Cr^{3+} + 3e^- \rightarrow Cr(s),\ E^o = -0.74$ V

The tendency to act as reducing agent decreases in the order :

(1) $Al > Cr > Fe^{2+} > Co^{2+}$

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

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

(4) $Cr > Fe^{2+} > Al > Co^{2+}$

Ans. (1)

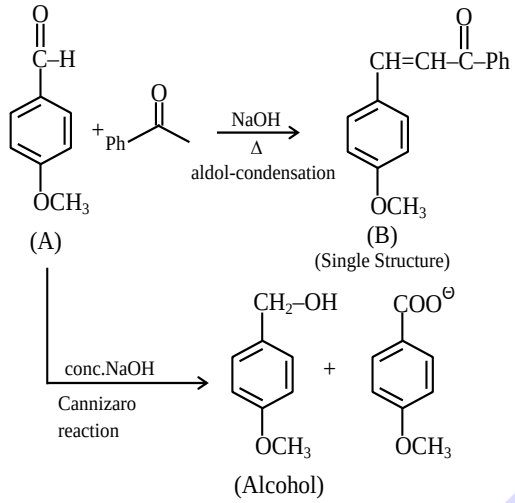
Sol. Reducing power $\propto \frac{1}{\text{Reduction potential}}$

68. The compound A, $C_8H_8O_2$ reacts with acetophenone to form a single product via cross-Aldol condensation. The compound A on reaction with conc. NaOH forms a substituted benzyl alcohol as

(1) 2-hydroxy acetophenone
(2) 4-methyoxy benzaldehyde
(3) 4-hydroxy benzylaldehyde
(4) 4-methyl benzoic acid

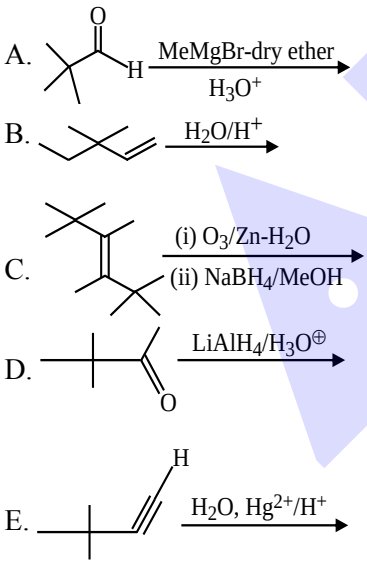
Ans. (2)

Sol.



(On cross aldol reaction, a single structure is obtained but it can show geometrical isomerism).

69. 3, 3-Dimenthyl-2-butanol **cannot** be prepared by :

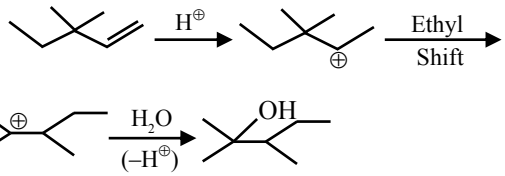


Choose the **correct** answer from the options given below :

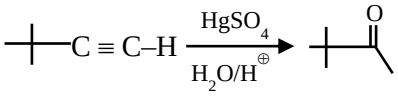
(1) B only (2) B and E only
(3) B and C only (4) B, C and E only

Ans. (2)

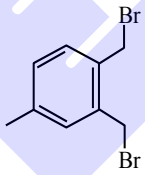
Sol. (B)

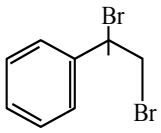


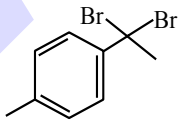
(E)

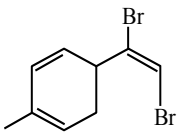


70. The dibromo compound [P] (molecular formula : $C_9H_{10}Br_2$) when heated with excess sodamide followed by treatment with dilute HCl gives [Q]. On warming [Q] with mercuric sulphate and dilute sulphuric acid yield [R] which gives positive Iodoform test but negative Tollen's test. The compound [P] is :

(1) 

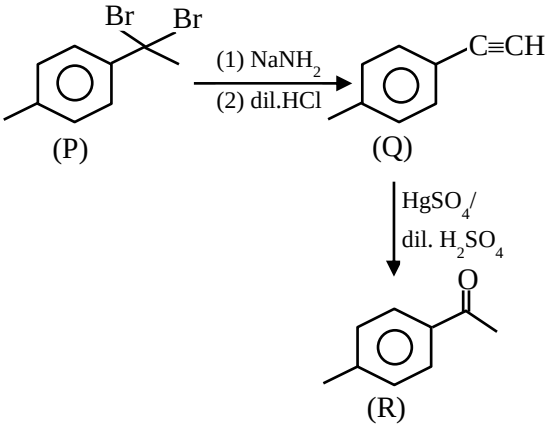
(2) 

(3) 

(4) 

Ans. (3)

Sol.



SECTION-B

71. Consider the following electrochemical cell :

$Pt \mid O_2(g)\ (1bar) \mid HCl\ (aq) \parallel M^{2+}(aq,\ 1.0\ M) \mid M(s)$

The pH above which, oxygen gas would start to evolve at anode is _____ (nearest integer).

$$\left[\text{Given : } \left.\begin{matrix} E^0_{M^{2+}/M} = 0.994V \\ E^0_{O_2/H_2O} = 1.23V \end{matrix}\right\} \text{standard reduction potential} \right.$$
$$\left. \text{and } \frac{RT}{F}(2.303) = 0.059\ V \text{ at the given condition} \right]$$

Ans. (4)

Sol. For spontaneity $E_{cell} > 0$

At limiting condition :

E_{Oxi} (anode) $= -E_{Red}$ (cathode)

$$H_2O \rightarrow 2H^+ + \frac{1}{2}O_2 + 2e^-$$

$$E = E^\circ - \frac{0.059}{2}\log\left[\frac{[H^+]^2 \times P_{O_2}^{1/2}}{1}\right]$$

$-0.997 = -1.23 + 0.059 \times pH$

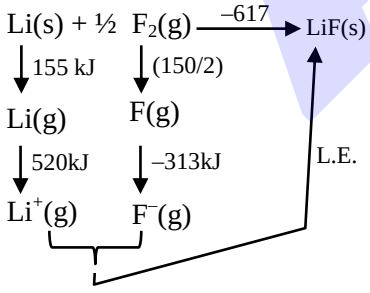
$pH = 3.94$

$pH \simeq 4$

72. If the enthalpy of sublimation of Li is 155 kJ mol^{-1}, enthalpy of dissociation of F_2 is 150 kJ mol^{-1}, ionization enthalpy of Li is 520 kJ mol^{-1}, electron gain enthalpy of F is –313 kJ mol^{-1}, standard enthalpy of formation of LiF is –594 kJ mol^{-1}. The magnitude of lattice enthalpy of LiF is _____ kJ mol^{-1} (Nearest integer).

Ans. (1031)

Sol.



$$-594 = 155 + 520 + \frac{150}{2} - 313 + (L.E.)$$

L.E. = – 1031 kJ/mol

73. Among the following oxides of 3d elements, the number of mixed oxides are_____.

Ti_2O_3, V_2O_4, Cr_2O_3, Mn_3O_4, Fe_3O_4, Fe_2O_3, Co_3O_4

Ans. (3)

Sol.

$Mn_3O_4 = MnO \cdot Mn_2O_3$

$Fe_3O_4 = FeO \cdot Fe_2O_3$ — Only three mixed oxides

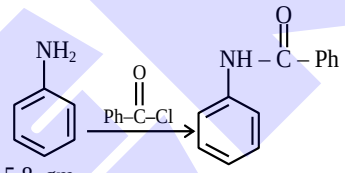
$Co_3O_4 = CoO \cdot Co_2O_3$

74. The mass of benzanilide obtained from the benzoylation reaction of 5.8 g of aniline, if yield of product is 82%, is_____g (nearest integer).

(Given molar mass in g mol^{-1} H:1, C:12, N:14, O:16)

Ans. (10)

Sol.



5.8 gm

$n = \frac{5.8}{93}$

$n = 0.0623$

$n = 0.0623 \times \frac{82}{100}$

mass = 0.051 × 197

mass = 10.047

75. Consider A $\xrightarrow{k_1}$ B and C $\xrightarrow{k_2}$ D are two reactions. If the rate constant (k_1) of the A → B reaction can be expressed by the following equation $\log_{10} k = 14.34 - \frac{1.5\times10^4}{T/K}$ and activation energy of C → D reaction (Ea_2) is $\frac{1}{5}$th of the A → B reaction (Ea_1), then the value of (Ea_2) is _____kJ mol^{-1}. (Nearest Integer)

Ans. (57)

Sol. $\frac{E_{a_1}}{2.303R} = 1.5 \times 10^4$

$E_{a_1} = 1.5 \times 10^4 \times 2.303 \times 8.314$

$E_{a_1} = 28.7207 \times 10^4$ J

$E_{a_1} = 287.207$ kJ

$E_{a_2} = \frac{E_{a_1}}{5} = \frac{287.207}{5} = 57.44$ kJ

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