

JEE-MAIN EXAMINATION – APRIL 2025

(HELD ON THURSDAY 03rd APRIL 2025)

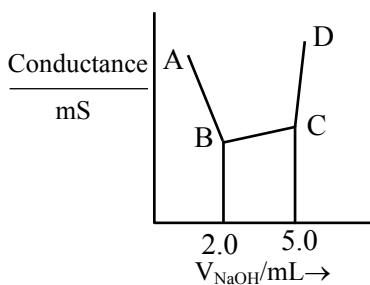
TIME : 3:00 PM TO 6:00 PM

CHEMISTRY

TEST PAPER WITH SOLUTION

SECTION-A

51. 40 mL of a mixture of CH_3COOH and HCl (aqueous solution) is titrated against 0.1 M NaOH solution conductometrically. Which of the following statement is **correct**?



- (1) The concentration of CH_3COOH in the original mixture is 0.005 M
- (2) The concentration of HCl in the original mixture is 0.005 M
- (3) CH_3COOH is neutralised first followed by neutralisation of HCl
- (4) Point 'C' indicates the complete neutralisation of HCl

Ans. (2)

Sol. From the given graph 2 ml NaOH solution is used for neutralisation of HCl and 3 ml NaOH solution is used for neutralisation of CH_3COOH .

$$\therefore \text{Mole of HCl} = \text{Mole of NaOH used}$$

$$M \times 40 = 0.1 \times 2$$

$$M = 0.005$$

$$\therefore \text{Mole of } \text{CH}_3\text{COOH} = \text{Mole of NaOH used}$$

$$M \times 40 = 0.1 \times 3$$

$$M = 0.0075$$

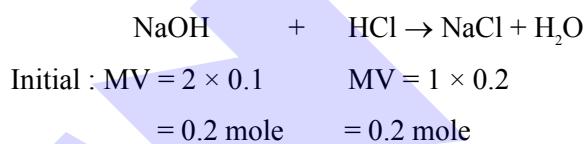
HCl is strong acid and will be neutralised first.

52. 10 mL of 2 M NaOH solution is added to 20 mL of 1 M HCl solution kept in a beaker. Now, 10 mL of this mixture is poured into a volumetric flask of 100 mL containing 2 moles of HCl and made the volume upto the mark with distilled water. The solution in this flask is :

- (1) 0.2 M NaCl solution
- (2) 20 M HCl solution
- (3) 10 M HCl solution
- (4) Neutral solution

Ans. (2)

Sol. When 10 ml, 2M NaOH solution is added to 20 ml of 1M HCl solution :



\therefore Resulting solution becomes neutral.

Now when 10 mol of above solution is poured into a flask containing 2 mole HCl and made solution 100 ml will distilled water.

$$\text{Molarity of HCl} = \frac{2}{100} \times 1000 = 20$$

53. Fat soluble vitamins are :

- A. Vitamin B₁
- B. Vitamin C
- C. Vitamin E
- D. Vitamin B₁₂
- E. Vitamin K

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

- (1) C & D Only
- (2) A & B Only
- (3) B & C Only
- (4) C & E Only

Ans. (4)

Sol. Vit D, E, K. A are fat soluble vitamins.



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54. Match the LIST-I with LIST-II.

LIST-I (Family)		LIST-II (Symbol of Element)	
A.	Pnicogen (group 15)	I.	Ts
B.	Chalcogen	II.	Og
C.	Halogen	III.	Lv
D.	Noble gas	IV.	Mc

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

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

Ans. (2)

- Sol.** (A) Pnictogen \Rightarrow Mc (Moscovium),
Atomic No. = 115
(B) Chalcogen \Rightarrow Lv (Livermorium),
Atomic No. = 116
(C) Halogen \Rightarrow Ts (Tennessine),
Atomic No. = 117
(D) Noble gas \Rightarrow Og (Oganesson),
Atomic No. = 118

55. For electron in '2s' and '2p' orbitals, the orbital angular momentum values, respectively are :

- (1) $\sqrt{2} \frac{\hbar}{2\pi}$ and 0
- (2) $\frac{\hbar}{2\pi}$ and $\sqrt{2} \frac{\hbar}{2\pi}$
- (3) 0 and $\sqrt{6} \frac{\hbar}{2\pi}$
- (4) 0 and $\sqrt{2} \frac{\hbar}{2\pi}$

Ans. (4)

Sol. Orbital angular momentum = $\sqrt{\ell(\ell+1)} \frac{\hbar}{2\pi}$

\therefore For 2s orbital : $\ell = 0$

Orbital angular momentum = 0

\therefore For 2p orbital : $\ell = 1$

$$\text{Orbital angular momentum} = \sqrt{1(1+2)} \frac{\hbar}{2\pi}$$

$$= \sqrt{2} \frac{\hbar}{2\pi}$$

56. Compounds that should not be used as primary standards in titrimetric analysis are :

- A. $\text{Na}_2\text{Cr}_2\text{O}_7$
- B. Oxalic acid
- C. NaOH
- D. $\text{FeSO}_4 \cdot 6\text{H}_2\text{O}$
- E. Sodium tetraborate

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

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

Ans. (4)

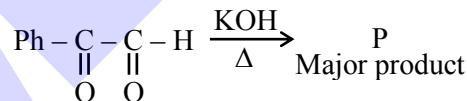
Sol. The primary standard is a highly pure stable compound with a known exact composition that can be accurately weighed and dissolved to create a solution of known concentration.

NaOH is hygroscopic and can't be used.

$\text{FeSO}_4 \cdot 6\text{H}_2\text{O}$ is unstable and can be easily oxidised.

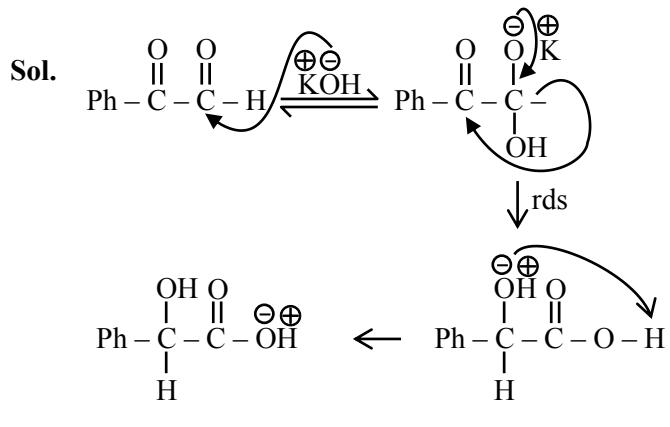
$\text{Na}_2\text{Cr}_2\text{O}_7$ is hygroscopic and can't be used.

57. The major product (P) in the following reaction is :



- (1) $\text{Ph} - \underset{\substack{\text{OH} \\ |}}{\text{CH}} - \text{CH}_2\text{OH}$
- (2) $\text{Ph} - \underset{\substack{\text{OH} \\ |}}{\text{CH}} - \text{COO}^-\text{K}^+$
- (3) $\text{Ph} - \underset{\substack{\text{O} \\ ||}}{\text{C}} - \text{COO}^-\text{K}^+$
- (4) $\text{Ph} - \underset{\substack{\text{O} \\ ||}}{\text{C}} - \text{CH}_2\text{OH}$

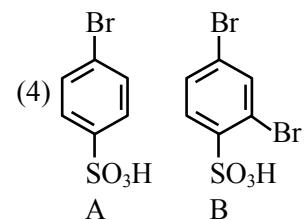
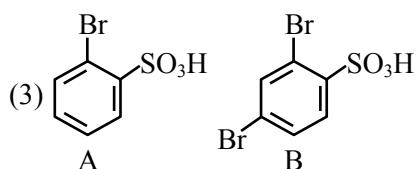
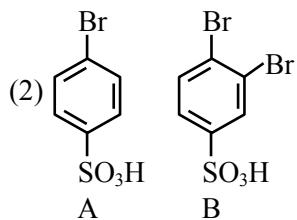
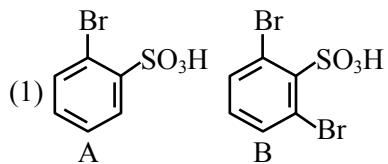
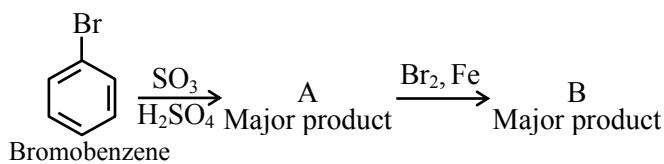
Ans. (2)



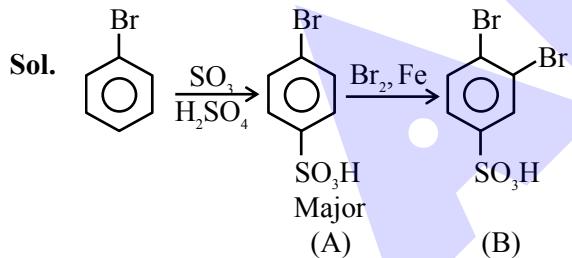
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58. In the following series of reactions identify the major products A & B respectively.



Ans. (2)



59. The standard cell potential (E_{cell}°) of a fuel cell based on the oxidation of methanol in air that has been used to power television relay station is measured as 1.21 V. The standard half cell reduction potential for O₂ ($E_{\text{O}_2/\text{H}_2\text{O}}^{\circ}$) is 1.229 V.

Choose the correct statement:

- (1) The standard half cell reduction potential for the reduction of CO₂ ($E_{\text{CO}_2/\text{CH}_3\text{OH}}^{\circ}$) is 19 mV
- (2) Oxygen is formed at the anode.
- (3) Reactants are fed at one go to each electrode.
- (4) Reduction of methanol takes place at the cathode.

Ans. (1)

Sol. $\because E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{Anode}}^{\circ}$

$$1.21 = 1.229 - E_{\text{Anode}}^{\circ}$$

\therefore Fuel cell involves oxidation of methanol which will occur at anode and reduction of O₂ will occur at cathode.

60. Identify the diamagnetic octahedral complex ions from below :

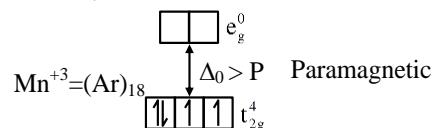
- A. [Mn(CN)₆]³⁻ B. [Co(NH₃)₆]³⁺
C. [Fe(CN)₆]⁴⁻ D. [Co(H₂O)₃F₃]⁻

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

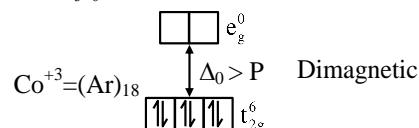
- (1) B and D Only (2) A and D Only
(3) A and C Only (4) B and C Only

Ans. (4)

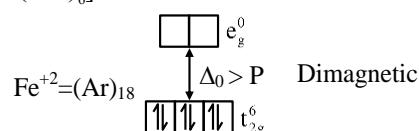
Sol. (A) [Mn(CN)₆]³⁻



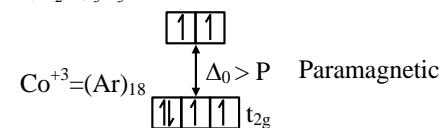
(B) [Co(NH₃)₆]³⁺



(C) [Fe(CN)₆]⁴⁻



(D) [Co(H₂O)₃F₃]⁻



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Ans. (1)

$$\begin{aligned}\textbf{Sol. } \text{Pressure of N}_2\text{ gas evolved} &= 715 - 15 \\ &= 700 \text{ mm Hg} \\ &= \frac{700}{760} \text{ atm.}\end{aligned}$$

$$\begin{aligned}
 \therefore \text{Mole of N}_2 \text{ evolved} &= \frac{PV}{RT} \\
 &= \frac{700 \times 60 \times 10^{-3}}{760 \times 0.0821 \times 300} \\
 &= 0.0022 \text{ mole} \\
 \therefore \text{wt. of N}_2 \text{ evolved} &= 0.0022 \times 28 = 0.063 \text{ gm} \\
 \therefore \text{wt. \% of nitrogen in compound} \\
 &= \frac{\text{wt. of nitrogen}}{\text{wt. of compound}} \times 100 \\
 &= \frac{0.063}{0.4} \times 100 \\
 &= 15.71\%
 \end{aligned}$$

- 62.** Mass of magnesium required to produce 220 mL of hydrogen gas at STP on reaction with excess of dil. HCl is

Given : Molar mass of Mg is 24 g mol^{-1} .

- (1) 235.7 g (2) 0.24 mg
(3) 236 mg (4) 2.444 g

Ans. (3)



Volume H₂ evolved = 220 ml

$$\text{Mole of H}_2 = \frac{220 \times 10^{-3}}{22.4} = \text{mole of Mg used}$$

$$\therefore \text{Mass of Mg used} = \frac{220 \times 10^{-3}}{22.4} \times 24 \\ = 235.7 \times 10^{-3} \text{ gm} \\ = 235.7 \text{ mg}$$

- 63.** Given below are two statements :

Statement I : Wet cotton clothes made of cellulose based carbohydrate takes comparatively longer time to get dried than wet nylon polymer based clothes.

Statement II : Intermolecular hydrogen bonding with water molecule is more in nylon-based clothes than in the case of cotton clothes.

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

(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. Cellulose derivative has more number of hydroxyl groups, so more H-bonding is present with water in cellulose derivatives cotton cloths.

- 64.** Given below are two statements :

Statement I : CrO_3 is a stronger oxidizing agent than MoO_3

Statement II : Cr(VI) is more stable than Mo(VI)

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) 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. Statement-I is true but statement II is false.

Cr(VI) is less stable than Mo(VI)

Hence, CrO_3 easily reduce into Cr^{+3} as compared to MoO_3 , and show stronger oxidizing nature.



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65. Given below are two statements :

Statement I : Hyperconjugation is not a permanent effect.

Statement II : In general, greater the number of alkyl groups attached to a positively charged C-atom, greater is the hyperconjugation interaction and stabilization of the cation.

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 false
- (3) Statement I is false but Statement II is true
- (4) Both Statement I and Statement II are true

Ans. (3)

Sol. Hyper conjugation is permanent effect because external reagent is not required, so Statement-I is false and Statement-II is true. because more alkyl group, more α -H, so more hyperconjugation which results more stability of carbocation.

66. Given below are two statements :

Statement I : When a system containing ice in equilibrium with water (liquid) is heated, heat is absorbed by the system and there is no change in the temperature of the system until whole ice gets melted.

Statement II : At melting point of ice, there is absorption of heat in order to overcome intermolecular forces of attraction within the molecules of water in ice and kinetic energy of molecules is not increased at melting point.

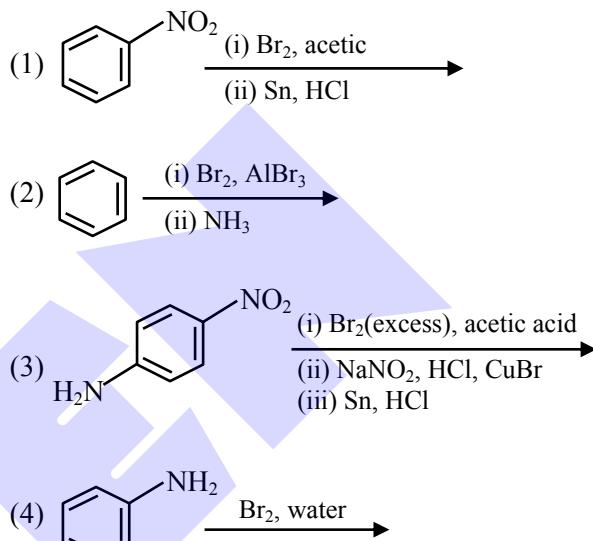
In the light of the above statements, choose the **correct** answer from the options given below:

- (1) Statement I is true but Statement II is false
- (2) Both Statement I and Statement II are false
- (3) Both Statement I and Statement II are true
- (4) Statement I is false but Statement II is true

Ans. (3)

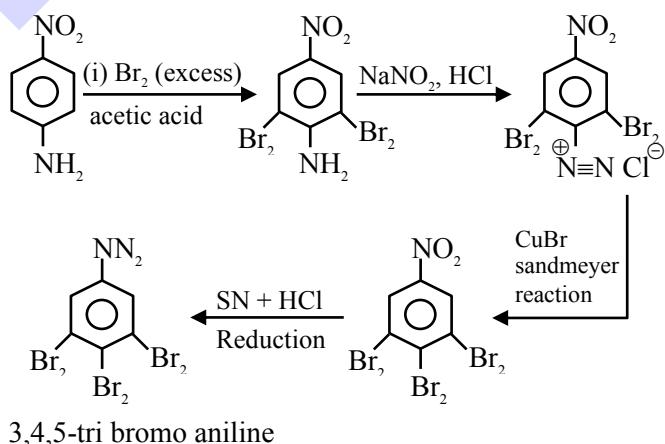
Sol. At melting point when ice melts, supplied heat is utilised to overcome intermolecular attraction within the molecules so temperature remain constant.

67. The sequence from the following that would result in giving predominantly 3, 4, 5 -Tribromooaniline is :



Ans. (3)

Sol.



3,4,5-tri bromo aniline



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68. The correct orders among the following are
 Atomic radius : B < Al < Ga < In < Tl
 Electronegativity : Al < Ga < In < Tl < B
 Density : Tl < In < Ga < Al < B
 1st Ionisation Energy : In < Al < Ga < Tl < B
 Choose the correct answer from the options given below :
- (1) B and D Only (2) A and C Only
 (3) C and D Only (4) A and B Only

Ans. (1)

Sol.

	B	Al	Ga	In	Tl
Atomic radius (pm)	88	143	135	167	170
Electronegativity	2	1.5	1.6	1.7	1.8
Density (g/cm ³)	2.35	2.7	5.9	7.31	11.85
Ionisation Energy (kJ/mol)	801	577	579	558	589

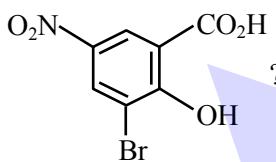
Radius Order Tl > In > Al > Ga > B

EN Order B > Tl > In > Ga > Al

Density Order Tl > In > Ga > Al > B

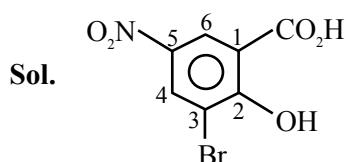
IE₁ Order B > Tl > Ga > Al > In

69. What is the correct IUPAC name of



- (1) 3-Bromo-2-hydroxy-5-nitrobenzoic acid
 (2) 3-Bromo-4-hydroxy-1-nitrobenzoic acid
 (3) 2-Hydroxy-3-bromo-5-nitrobenzoic acid
 (4) 5-Nitro-3-bromo-2-hydroxybenzoic acid

Ans. (1)



IUPAC 3-Bromo-2-hydroxy-5-nitro-Benzoic acid

70. Consider the following statements related to temperature dependence of rate constants.
 Identify the correct statements,

- A. The Arrhenius equation holds true only for an elementary homogenous reaction.
 B. The unit of A is same as that of k in Arrhenius equation.
 C. At a given temperature, a low activation energy means a fast reaction.
 D. A and Ea as used in Arrhenius equation depend on temperature.
 E. When Ea >> RT, A and Ea become interdependent.

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

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

Ans. (3)

Sol. Arrhenius equation hold true for elementary as well as complex reactions.

Unit of A is same as unit of k. Rate of reaction is high if activation energy is low,

A and Ea are temperature independent.

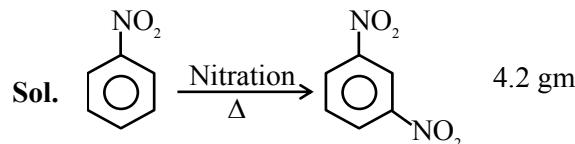
SECTION-B

71. X g of nitrobenzene on nitration gave 4.2 g of m-dinitrobenzene.

$$X = \text{_____ g. (nearest integer)}$$

[Given : molar mass (in g mol⁻¹) C : 12, H : 1, O : 16, N : 14]

Ans. (3)



$$\begin{array}{ll} \text{C}_6\text{H}_5\text{NO}_2 & \text{MF} = \text{C}_6\text{H}_4\text{N}_2\text{O}_4 \\ \text{MW} = 123 & \text{MW} = 168 \end{array}$$

$$\therefore \frac{4.2}{168} = 0.025 \text{ mol}$$

∴ required gm of nitro benzene

$$= 123 \times 0.025$$

$$= 3.075$$

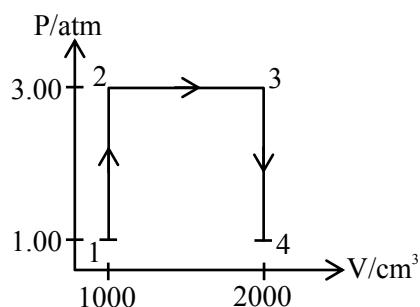
∴ Nearest integer is 3



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72.



A perfect gas (0.1 mol) having $\bar{C}_v = 1.50 \text{ R}$ (independent of temperature) undergoes the above transformation from point 1 to point 4. If each step is reversible, the total work done (w) while going from point 1 to point 4 is $(-)$ ____ J (nearest integer) [Given : $R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$]

Ans. (304)

$$\text{Sol. } W_{1 \rightarrow 2} = 0$$

$$W_{2 \rightarrow 3} = -P\Delta V$$

$$= -3 [2-1]$$

$$= -3 \text{ atm} - \ell$$

$$W_{3 \rightarrow 4} = 0$$

Total work done

$$= -3 \text{ atm} - \ell$$

$$= -3 \times 101.3 \text{ Joule}$$

$$= -304 \text{ Joule}$$

73. A sample of n-octane (1.14 g) was completely burnt in excess of oxygen in a bomb calorimeter, whose heat capacity is 5 kJ K^{-1} . As a result of combustion reaction, the temperature of the calorimeter is increased by 5 K. The magnitude of the heat of combustion of octane at constant volume is ____ kJ mol^{-1} (nearest integer).

Ans. (2500)

$$\text{Sol. Mole of octane} = \frac{1.14}{114} = 0.01 \text{ mole}$$

$$\text{Heat evolved} = C \times \Delta T$$

$$= 5 \times 5 \text{ kJ}$$

$$= 25 \text{ kJ}$$

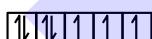
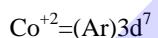
$$\therefore \text{Magnitude of Heat of combustion} = \frac{25}{0.01} = 2500 \text{ kJ/mol}$$

74. Among, Sc, Mn, Co and Cu, identify the element with highest enthalpy of atomisation. The spin only magnetic moment value of that element in its +2 oxidation state is ____ BM (in nearest integer).

Ans. (4)**Sol.**

	Sc	Mn	Co	Cu
Enthalpy of Atomisation (kJ/mole)	326	281	425	339

Highest Co



$$n = 3$$

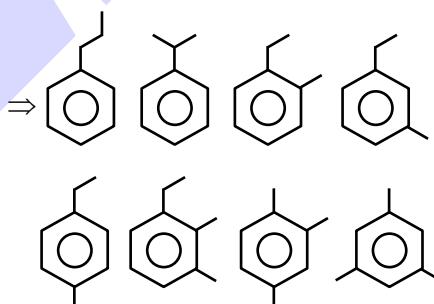
$$\mu = \sqrt{15} = 3.87$$

Nearest integer = 4

75. The total number of structural isomers possible for the substituted benzene derivatives with the molecular formula C_9H_{12} is ____.

Ans. (8)

$$\text{Sol. MF} = C_9H_{12}$$



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