

JEE-MAIN EXAMINATION – JANUARY 2025

(HELD ON WEDNESDAY 22nd JANUARY 2025)

TIME : 9:00 AM TO 12:00 NOON

CHEMISTRY

SECTION-A

Ans. (3)

Sol. gm equivalent of Al deposited = $\frac{It}{06500}$

$$\frac{w}{27} \times 3 = \frac{2 \times 30 \times 60}{96500}$$

$$w = 0.336 \text{ g.}$$

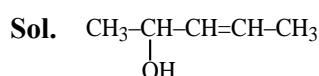
52. Which of the following statement is not true for radioactive decay ?

 - (1) Amount of radioactive substance remained after three half lives is $\frac{1}{8}$ th of original amount.
 - (2) Decay constant does not depend upon temperature.
 - (3) Decay constant increases with increase in temperature.
 - (4) Half life is $\ln 2$ times of $\frac{1}{\text{rate constant}}$.

Ans. (3)

Sol. Decay constant is independent of temperature.

Ans. (4)



It has 4 stereoisomers

- 54.** Which of the following electronegativity order is incorrect?

(1) Al < Mg < B < N (2) Al < Si < C < N
(3) Mg < Be < B < N (4) S < Cl < O < F

Ans. (1)

	Li	Be	B	C	N	O	F
(E.N.) =	1	1.5	2	2.5	3	3.5	4.0
On							
Pauling							
scale							

- 55.** Lanthanoid ions with $4f^7$ configuration are :
 (A) Eu^{2+} (B) Gd^{3+} (C) Eu^{3+} (D) Tb^{3+}
 (E) Sm^{2+}

Choose the correct answer from the options given below :

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

Ans. (1)

Sol. $^{63}\text{Eu}^{2+}$ – [Xe] 4f⁷6s⁰
 $^{64}\text{Gd}^{3+}$ – [Xe] 4f⁷5d⁰6s⁰
 $^{63}\text{Eu}^{3+}$ – [Xe] 4f⁶6s⁰
 $^{65}\text{Tb}^{3+}$ – [Xe] 4f⁸6s⁰
 $^{62}\text{Sm}^{2+}$ – [Xe] 4f⁶6s⁰
 Eu^{2+} & Gd^{3+}



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56. Match List-I with List-II

List-I		List-II	
(A)	$\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{F}^-$	(I)	Ionisation Enthalpy
(B)	$\text{B} < \text{C} < \text{O} < \text{N}$	(II)	Metallic character
(C)	$\text{B} < \text{Al} < \text{Mg} < \text{K}$	(III)	Electronegativity
(D)	$\text{Si} < \text{P} < \text{S} < \text{Cl}$	(IV)	Ionic radii

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

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

Ans. (3)

Sol. Ionic radii – $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{F}^-$

Ionisation energy – $\text{B} < \text{C} < \text{O} < \text{N}$

Metallic character – $\text{B} < \text{Al} < \text{Mg} < \text{K}$

Electron negativity – $\text{Si} < \text{P} < \text{S} < \text{Cl}$

57. Which of the following acids is a vitamin ?

- (1) Adipic acid (2) Aspartic acid
 (3) Ascorbic acid (4) Saccharic acid

Ans. (3)

Sol. Vitamin-C is Ascorbic acid.

58. A liquid when kept inside a thermally insulated closed vessel at 25°C was mechanically stirred from outside. What will be the correct option for the following thermodynamic parameters ?

(1) $\Delta U > 0, q = 0, w > 0$ (2) $\Delta U = 0, q = 0, w = 0$

(3) $\Delta U < 0, q = 0, w > 0$ (4) $\Delta U = 0, q < 0, w > 0$

Ans. (1)

Sol. Thermally insulated $\Rightarrow q = 0$

from Ist law

$$\Delta U = q + w$$

$$\Delta U = w$$

$$w > 0, \Delta U > 0$$

59. Radius of the first excited state of Helium ion is given as :

$a_0 \rightarrow$ radius of first stationary state of hydrogen atom.

$$(1) r = \frac{a_0}{2} \quad (2) r = \frac{a_0}{4} \quad (3) r = 4a_0 \quad (4) r = 2a_0$$

Ans. (4)

$$\text{Sol. } r = a_0 \cdot \frac{n^2}{Z} = a_0 \cdot \frac{(2)^2}{2} = 2a_0.$$

60. Given below are two statements :

Statement I : $\text{CH}_3 - \text{O} - \text{CH}_2 - \text{Cl}$ will undergo $\text{S}_{\text{N}}1$ reaction though it is a primary halide.

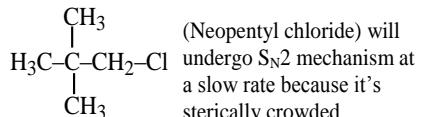
Statement II : $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3 - \text{C} - \text{CH}_2 - \text{Cl} \\ | \\ \text{CH}_3 \end{array}$ will not undergo $\text{S}_{\text{N}}2$ reaction very easily though it is a primary halide.

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

- (1) **Statement I** is incorrect but **Statement II** is correct.
 (2) Both **Statement I** and **Statement II** are incorrect
 (3) **Statement I** is correct but **Statement II** is incorrect
 (4) Both **Statement I** and **Statement II** are correct.

Ans. (4)

Sol. $\text{CH}_3 - \text{O} - \text{CH}_2 - \text{Cl}$ will undergo $\text{S}_{\text{N}}1$ mechanism because $\text{CH}_3 - \overset{+}{\text{O}} - \text{CH}_2$ is highly stable.



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61. Given below are two statements :

Statement I : One mole of propyne reacts with excess of sodium to liberate half a mole of H_2 gas.

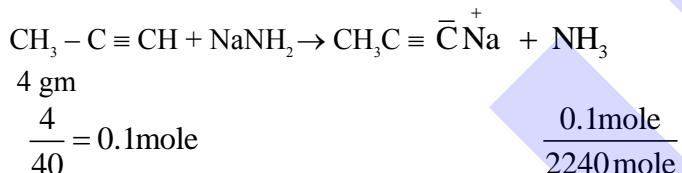
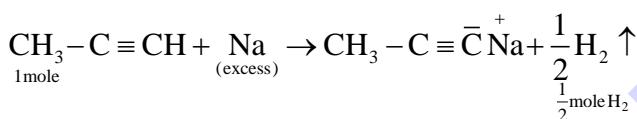
Statement II : Four g of propyne reacts with $NaNH_2$ to liberate NH_3 gas which occupies 224 mL at STP.

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 incorrect
- (3) **Statement I** is incorrect but **Statement II** is correct
- (4) Both **Statement I** and **Statement II** are correct.

Ans. (1)

Sol.



Statement I is correct but **Statement II** is incorrect

62. A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of CO_2 is converted into CO on addition of graphite. If total pressure at equilibrium is 0.8 atm, then K_p is :

- (1) 0.18 atm (2) 1.8 atm (3) 0.3 atm (4) 3 atm.

Ans. (2)



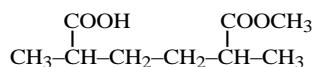
$$\begin{array}{ccc} 0.5 & - & \\ 0.5-x & & 2x \end{array}$$

$$P_{\text{total}} = 0.5 + x = 0.8$$

$$x = 0.3$$

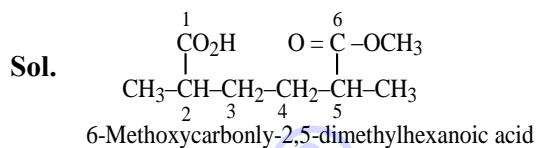
$$K_p = \frac{(0.6)^2}{0.2} = 1.8$$

63. The IUPAC name of the following compound is :



- (1) 2-Carboxy-5-methoxycarbonylhexane.
- (2) Methyl-6-carboxy-2,5-dimethylhexanoate.
- (3) Methyl-5-carboxy-2-methylhexanoate.
- (4) 6-Methoxycarbonyl-2,5-dimethylhexanoic acid.

Ans. (4)



64. Which of the following electrolyte can be sued to obtain $H_2S_2O_8$ by the process of electrolysis?

- (1) Dilute solution of sodium sulphate
- (2) Dilute solution of sulphuric acid
- (3) Concentrated solution of sulphuric acid
- (4) Acidified dilute solution of sodium sulphate.

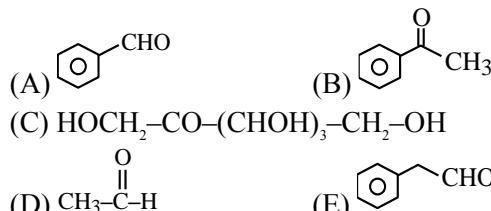
Ans. (3)

Sol. Theory based.

At anode :



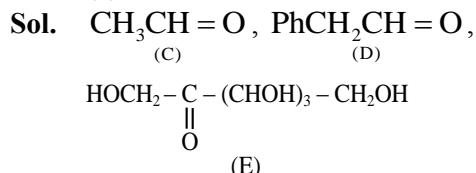
65. The compounds which give positive Fehling's test are :



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

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

Ans. (3)



All gives positive Fehling test



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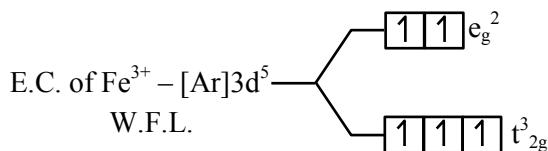
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66. In which of the following complexes the CFSE, Δ_0 will be equal to zero?

- (1) $[\text{Fe}(\text{NH}_3)_6]\text{Br}_2$ (2) $[\text{Fe}(\text{en})_3]\text{Cl}_3$
 (3) $\text{K}_4[\text{Fe}(\text{CN})_6]$ (4) $\text{K}_3[\text{Fe}(\text{SCN})_6]$

Ans. (4)

Sol. For complex $\text{K}_3[\text{Fe}(\text{SCN})_6]$



Calculation of CFSE

$$\begin{aligned} &= (-0.4 \times 3 + 0.6 \times 2) \Delta_0 \\ &= 0 \Delta_0 \end{aligned}$$

67. Arrange the following solutions in order of their increasing boiling points.

- (i) 10^{-4} M NaCl (ii) 10^{-4} M Urea
 (iii) 10^{-3} M NaCl (iv) 10^{-2} M NaCl
 (1) (ii) < (i) < (iii) < (iv) (2) (ii) < (i) \cong (iii) < (iv)
 (3) (i) < (ii) < (iii) < (iv) (4) (iv) < (iii) < (i) < (ii)

Ans. (1)

Sol. $\Delta T_b = i K_b \cdot m \propto i \cdot C$.

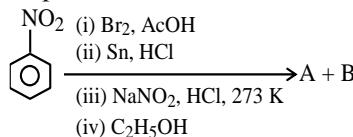
where C = concentration

Options	i.C.
(i)	2×10^{-4}
(ii)	1×10^{-4}
(iii)	2×10^{-3}
(iv)	2×10^{-2}

B.P. order :

(ii) < (i) < (iii) < (iv)

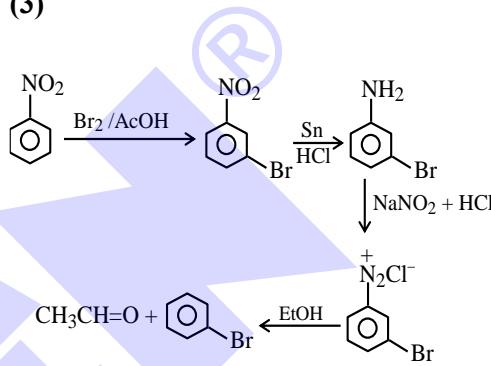
68. The products formed in the following reaction sequence are :



- (1) (2)
 (3) (4)

Ans. (3)

Sol.



69. From the magnetic behaviour of $[\text{NiCl}_4]^{2-}$ (paramagnetic) and $[\text{Ni}(\text{CO})_4]$ (diamagnetic), choose the correct geometry and oxidation state.

- (1) $[\text{NiCl}_4]^{2-}$: Ni^{II}, square planar
 $[\text{Ni}(\text{CO})_4]$: Ni(0), square planar
 (2) $[\text{NiCl}_4]^{2-}$: Ni^{II}, tetrahedral
 $[\text{Ni}(\text{CO})_4]$: Ni(0), tetrahedral
 (3) $[\text{NiCl}_4]^{2-}$: Ni^{II}, tetrahedral
 $[\text{Ni}(\text{CO})_4]$: Ni^{II}, square planar
 (4) $[\text{NiCl}_4]^{2-}$: Ni(0), tetrahedral
 $[\text{Ni}(\text{CO})_4]$: Ni(0), square planar

Ans. (2)

Sol. $[\text{NiCl}_4]^{2-}$

Ni^{+2} – [Ar] 3d⁸ 4s⁰ \rightarrow sp³, Tetrahedral

Number of unpaired electron = 2 paramagnetic

$[\text{Ni}(\text{CO})_4]$,

$\text{Ni}(0) \rightarrow$ [Ar] 3d¹⁰ 4s⁰ (After rearrangement)

No unpaired electron

sp³, Tetrahedral, Diamagnetic



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70. The **incorrect** statements regarding geometrical isomerism are :

- (A) Propene shows geometrical isomerism.
- (B) Trans isomer has identical atoms/groups on the opposite sides of the double bond.
- (C) Cis-but-2-ene has higher dipole moment than trans-but-2-ene.
- (D) 2-methylbut-2-ene shows two geometrical isomers.
- (E) Trans-isomer has lower melting point than cis isomer.

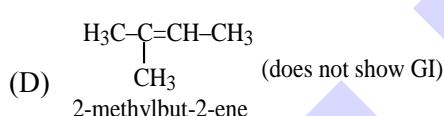
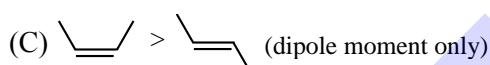
Choose the **CORRECT** answer from the options given below :

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

Ans. (1)

Sol. (A) $\text{CH}_3\text{-CH=CH}_2$. GI is not possible

(B) Trans isomer has identical atoms/groups on the opposite side of double bond.



SECTION-B

71. Some CO_2 gas was kept in a sealed container at a pressure of 1 atm and at 273 K. This entire amount of CO_2 gas was later passed through an aqueous solution of $\text{Ca}(\text{OH})_2$. The excess unreacted $\text{Ca}(\text{OH})_2$ was later neutralized with 0.1 M of 40 mL HCl. If the volume of the sealed container of CO_2 was x , then x is _____ cm^3 (nearest integer).

[Given : The entire amount of $\text{CO}_2(\text{g})$ reacted with exactly half the initial amount of $\text{Ca}(\text{OH})_2$ present in the aqueous solution.]

Ans. (45)

Sol. Let moles of $\text{CO}_2 = n$

moles of $\text{Ca}(\text{OH})_2$ total initially = $2n$

excess $\text{Ca}(\text{OH})_2 = n$

gm equivalent of $\text{Ca}(\text{OH})_2$ = gm equivalent of HCl

$$n \times 2 = 0.1 \times \frac{40}{1000} \times 1$$

$$n = 2 \times 10^{-3}$$

$$\text{Volume of } \text{CO}_2 = 2 \times 10^{-3} \times 22400 = 44.8 \text{ cm}^3$$

72. In Carius method for estimation of halogens, 180 mg of an organic compound produced 143.5 mg of AgCl . The percentage composition of chlorine in the compound is _____ %.

[Given : molar mass in g mol⁻¹ of Ag : 108, Cl = 35.5]

Ans. (20)

$$\text{Sol. } n_{\text{Cl}} = n_{\text{AgCl}} = \frac{143.5 \times 10^{-3}}{143.5} = 10^{-3}$$

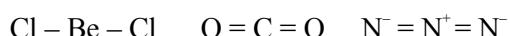
$$\% \text{ Cl} = \frac{10^{-3} \times 35.5}{180 \times 10^{-3}} \times 100 = 19.72$$

73. The number of molecules/ions that show linear geometry among the following is _____ .

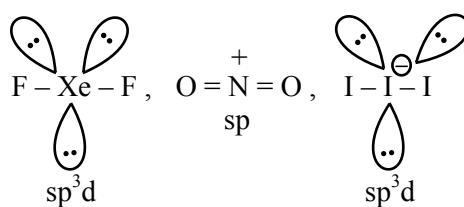


Ans. (6)

Sol. Linear species are



(sp) (sp) (sp)



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74. A → B

The molecule A changes into its isomeric form B by following a first order kinetics at a temperature of 1000 K. If the energy barrier with respect to reactant energy for such isomeric transformation is 191.48 kJ mol⁻¹ and the frequency factor is 10²⁰, the time required for 50%, molecules of A to become B is _____ picoseconds (nearest integer).

$$[R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}]$$

Ans. (69)

$$\text{Sol. } t_{1/2} = \frac{0.693}{K}$$

$$K = Ae^{-E_a/RT}$$

$$= 10^{20} \times e^{-\frac{191.48 \times 10^3}{8.314 \times 1000}}$$

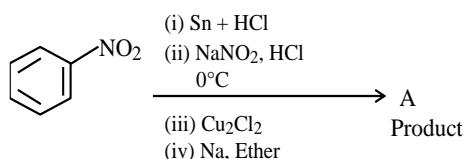
$$= 10^{20} \times e^{-23.031} = 10^{20} \times -e^{\ln 10 \times 10}$$

$$= \frac{10^{20}}{10^{10}} = 10^{10} \text{ sec.}$$

$$t_{1/2} = \frac{0.693}{10^{10}} = 6.93 \times 10^{-11}$$

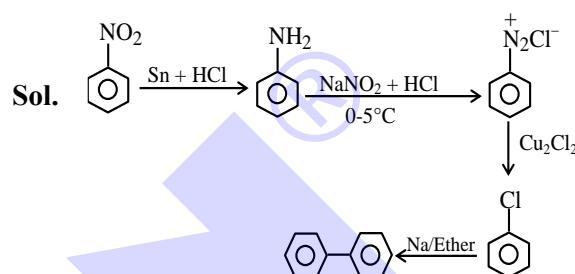
$$= 69.3 \times 10^{-12} \text{ sec.}$$

75. Consider the following sequence of reactions :



Molar mass of the product formed (A) is g mol^{-1} .

Ans. (154)



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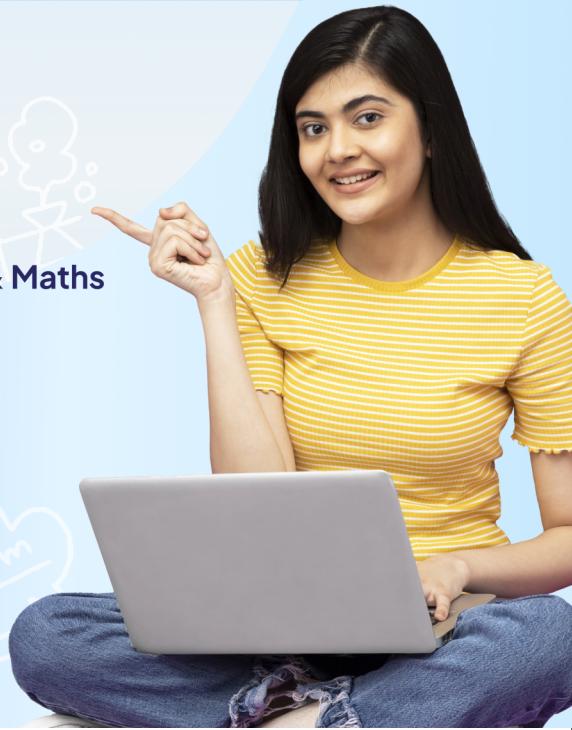


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