|JEE MAIN 2025 | DATE : 22 JAN 2025 (SHIFT-1) MORNING

CHEMISTRY

SECTION 1

[:Q.51] Match List – I with List – II.

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

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

[:A] (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

[:B] (A)-(IV), (B)-(I), (C)-(III), (D)-(II)

[:C] (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

[:D] (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

[:ANS] **C**

[:Q.52] From the magnetic behaviour of $[NiCl_4]^{2-}$ (paramagnetic) and $[Ni(CO)_4]$ (diamagnetic), choose the correct geometry and oxidation state.

[A] $[NiCl_4]^{2-}: Ni^{II}$, square planar
$[Ni(CO)_4]^{2-}: Ni(0)$, square planar

[B] $[NiCl_4]^{2-}: Ni^{II}$, tetrahedral
$[Ni(CO)_4]^{2-}: Ni(0)$, tetrahedral

[C] $[NiCl_4]^{2-}: Ni(0)$, tetrahedral
$[Ni(CO)_4]^{2-}: Ni(0)$, square planar

[D] $[NiCl_4]^{2-}: Ni^{II}$, tetrahedral
$[Ni(CO)_4]^{2-}: Ni^{II}$, square planar

[:ANS] **B**

[:SOLN]

$[NiCl_4]^{2-}$

$Ni^{-2} - [Ar]\ 3d^8\ 4s^0 \rightarrow sp^3$, Tetrahedral

Number of unpaired electron = 2 paramagentic

$[Ni(CO)_4]$,

$Ni(0) \rightarrow [Ar]\ 3d^{10}\ 4s^0$

No unpaired electron

sp^3, Tetrahedral, Diamagnetic

[:Q.53] Which of the following electrolyte can be used to obtain $H_2S_2O_8$ by the process of electrolysis?

[A] Dilute solution of sulphuric acid

[B] Concentrated solution of sulphuric acid

[C] Acidified dilute solution of sodium sulphate.

[D] Dilute solution of sodium sulphate.

[:Ans]

[:Q.54] 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 Kp is:

[A] 0.3 atm [B] 0.18 atm [C] 3 atm [D] 1.8 atm

[:Ans] **D**

[:SOLN] **The reaction is**

$$CO_{2(g)} + C_S \rightleftharpoons 2CO_{(g)}$$

$0.5 \quad - \quad 0$

$0.5 - x \quad - \quad 2x$

$p_{total} = p_{co_2} + p_{co}$

$= 0.5+x = 0.8$

$x=0.3$

$$k_p = \frac{2x^2}{0.5-x} = \frac{\left[2\times(0.3)\right]^2}{0.5-0.3} = 1.8$$

[:Q.55] Which of the following acids is a vitamin?

[A] Ascorbic acid [B] Adipic acid [C] Saccharic acid [D] Aspartic acid

[:Ans] **A**

[:SoLN] Ascorbic acid is vitamin C

[:Q.56] Which of the following statement is not true for radioactive decay?

[A] Decay constant does not depend upon temperature.

[B] Decay constant increases with increase in temperature.

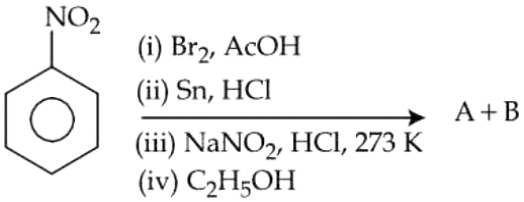
[C] Half life is In 2 times of $\frac{1}{\text{rate constant}}$.

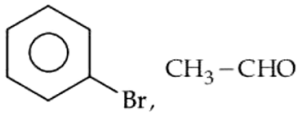
[D] Amount of radioactive substance remained after three half live is $\frac{1}{8}$th of original amount

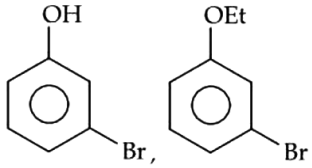
[:Ans] **B**

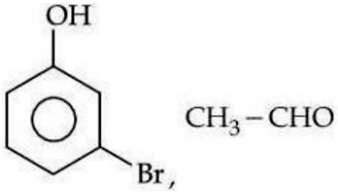
[SOLN] **Decay constant is independent of temperature.**

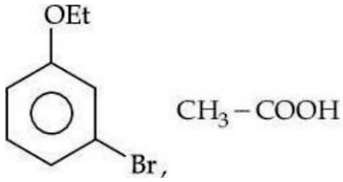
[:Q.57] The products formed in the following reaction sequence are



[A] 

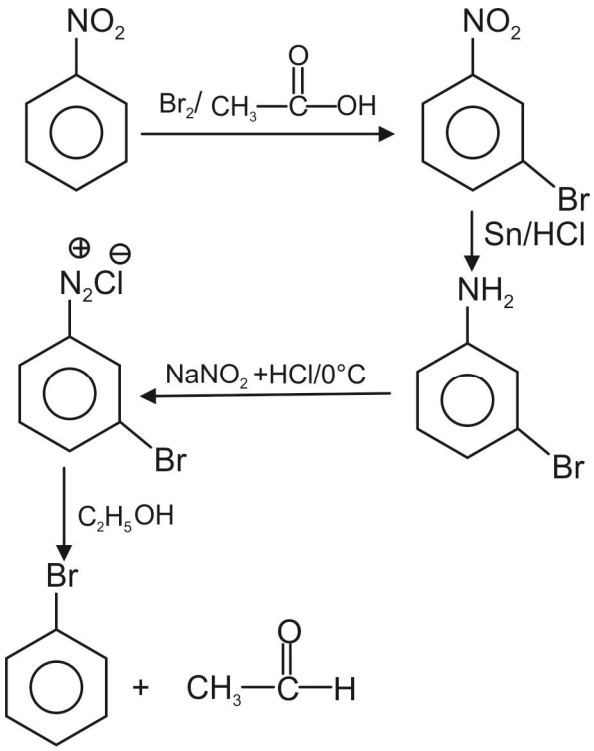
[B] 

[C] 

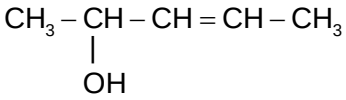
[D] 

[:Ans] **A**

[:SoLN]



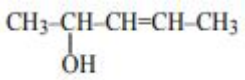
[:Q.58] How many different stereoisomers are possible for the given molecule?



[A] 2 [B] 4 [C] 4 [D] 3

[:ANS] **C**

[:SoLN]



Stereogeric unit 2

Unsymmetrical so, S.I. = 2^n

S. I. = $2^2 = 4$

[:Q.59] A liquid when kept inside a thermally insulated closed vessel at 25°C was mechanically stirred form outside. What will be the correct option for the following thermodynamic parameters?

[A] $\Delta U = 0, q = 0, w = 0$ [B] $\Delta U > 0, q = 0, w > 0$

[C] $\Delta U = 0, q < 0, w > 0$ [D] $\Delta U < 0, q = 0, w > 0$

[:Ans] **B**

[:SOLN] As the system is thermally insulated, no exchange of heat is allowed.

So, q = 0

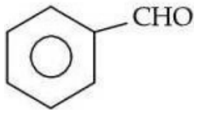
According to 1st law of thermodynamics

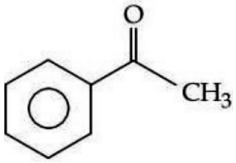
$\Delta U = q + w$

Work done from outside

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

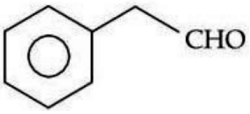
[:Q.60] The compounds which given positive Fehling's test are:

(A) 

(B) 

(C) $HOCH_2 - CO - (CHOH)_3 - CH_2 - OH$

(D) $CH_3 - \overset{\overset{O}{\|}}{C} - H$

(E) 

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

[A] (A), (C) and (D) only

[B] (C), (D) and (E) only

[C] (A), (B) and (C) only

[D] (A), (D) and (E) only

[:Ans] **B**

[:SoLN] **Aliphatic aldehyde**

α – hydroxy aldehyde and ketone qives +ve fehling test.

[:Q.61] 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:

[A] (A) and (D) only

[B] (A) and (B) only

[C] (B) and (C) only

[D] (B) and (E) only

[:Ans] **C**

[:SOLN]

$_{63}Eu^{2+}$ – [Xe] $4f^7 6s^0$

$_{64}Gd^{3+}$ – [Xe] $4f^7\ 5d^0 6s^0$

$_{63}Eu^{3+}$ – [Xe] $4f^6\ 6s^0$

$_{65}Tb^{3+}$ – [Xe] $4f^8\ 6s^0$

$_{62}Sm^{2+}$ – [Xe] $4f^6\ 6s^0$

Eu^{2+} & Gd^{3+}

[:Q.62] Which of the following electronegativity order is **incorrect**?

[A] Mg < Be < B < N

[B] Al < Si < C < N

[C] Al < Mg < B < N

[D] S < Cl < O < F

[:Ans] **C**

[:SOLN]

[:Q.63] 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 form the options given below:

[A] (A) and (E) only

[B] (C), (D) and (E) only

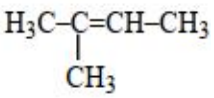
[C] (B) and (C) only

[D] (A), (D) and (E) only

[:Ans] **D**

[:SoLN] **(A)** $CH_3 - CH = CH_2$ G.I. not possible

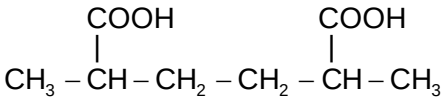
(D)



G.I not possible

(E) Trans is more symmetrically fit in crystal lattice so having high m.p.

[:Q.64] The IUPAC and of the following compound is:



[A] Methy1-5-carboxy-2-methylhexanoate.

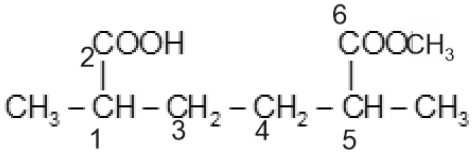
[B] 6-Methoxycarbony1-2-5-dimethylhexanoic acid.

[C] 2-Carboxy-5-methoxycarbony 1hexane.

[D] Methy1-6-carboxy-2,5-dimethylhexanoate.

[:Ans] **B**

[:SOLN]



6-Methoxycarbonyl-2,5-dimethyl hexanoic acid.

[:Q.65] 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

Options

[A] (ii) < (i) < (iii) < (iv) [B] (ii) < (i) ≡ (iii) < (iv)

[C] (i) < (ii) < (iii) < (iv) [D] (iv) < (iii) < (i) < (ii)

[:Ans] **A**

[:SOLN] $\Delta T_b = i.k_b.m$

$T_b^s - T_b^\circ = ik_b.m$

$T_b^s \propto i.m$

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

$(iv) > (iii) > (i) > (ii)$

[:Q.66] Radius of the first excited state of Helium ion is given as:

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

[A] $r = 4a_0$ [B] $r = 2a_0$ [C] $r = \frac{a_0}{4}$ [D] $r = \frac{a_0}{2}$

[:Ans] **D**

[:SOLN] As we know that $r = a_0 \times \frac{n^2}{z} = a_0 \frac{(2)^2}{2} = 2a_0$

As for first excited state

n = 2; He (z = 2)

[:Q.67] 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:

[A] Statement I is correct but Statement II is incorrect

[B] Both Statement I and Statement II are incorrect

[C] Both Statement I and Statement II are correct

[D] Statement I is incorrect but Statement II is correct

[:Ans] **A**

[:SoLN]

$$CH_3-C\equiv CH + Na \xrightarrow[(ex)]{} CH_3-C\equiv C^{\ominus}Na^{\oplus} + \frac{1}{2}H_2\uparrow$$

$$CH_3-C\equiv CH + NaNH_2 \longrightarrow CH_3-C\equiv C^{\ominus}Na^{\oplus} + \frac{1}{2}H_2\uparrow$$

4g/40= 0.1 mole $\frac{0.1 \text{ mole}}{2240 \text{ ml}}$ at STP liberate

[:Q.68] Given below are two statements:

Statement I : CH_3-O-CH_2-Cl will undergo S_N1 reaction though it is a primary halide.

Statement II : $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_2-Cl$ will not undergo S_N2 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:

[A] Both Statement I and Statement II are incorrect

[B] Statement I is correct but Statement II is incorrect

[C] Both Statement I and Statement II are correct

[D] Statement I is incorrect but Statement II is correct

[:Ans] **C**

[:SOLN] $S_N1(\text{Rate}) \propto$ stability of carbocation

$$S_N2(\text{Rate}) \propto \frac{1}{\text{steric factor}}$$

I.Having $CH_3-\ddot{O}-\overset{\oplus}{C}H_2$ highly stable C+. So S_N1 favour

II.having crowding factor so, S_N2 not easily possible.

[:Q.69] A solution of aluminium chloride is electrolysed for 30 minutes using a current of 2A. The amount of the aluminium deposite at the cathode is _____ .

[Given: molar mass of aluminium and chloring are $27\,g\,mol^{-1}$ and $35.5\,g\,mol^{-1}$ respectively. Faraday constant $= 96500\ C\ mol^{-1}$]

[A] 0.336 g [B] 0.441 g [C] 1.007 g [D] 1.660 g

[:Ans] **A**

[:SOLN] No. of gm-equivalent of 'Al' deposited

$$= \frac{It}{z}$$

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

On calculation

W = 0.336 gm

[:Q.70 In which of the following complexes the CFSE, Δ_o will be equal to zero?

[A] $\left[Fe(en)_3\right]Cl_3$ [B] $K_4\left[Fe(CN)_6\right]$

[C] $K_3\left[Fe(SCN)_6\right]$ [D] $\left[Fe(NH_3)_6\right]Br_2$

[:Ans] **C**

[:SOLN] $K_3\left[Fe(SCN)_6\right] - Fe^{3+}, 3d^5 \quad t_{2g}{}^3 - eg^2$

$$CFSE = 3(-0.4\Delta_0) + 2(0.6\Delta_0) = 0\Delta_0$$

SECTION2

[:Q.71] The number of molecules/ions that show linear geometry among the following is_____.

$SO_2, BeCl_2, CO_2, N_3^-, NO_2, F_2O, XeF_2, NO_2^+, I_3^-, O_3$

[:ANS] **6**

[:SOLN] $BeCl_2$, CO_2, N_3^-, XeF_2, NO_2^+, I_3^-

sp **sp** **sp** sp^3d sp sp^3d

[:Q.72] $A \rightarrow B$.

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 factors is 10^{20}, the time required for 50% molecules of A to become B is _____ picoseconds (nearest integer).

$\left[R = 8.314\,JK^{-}\,mol^{-1}\right]$

[:Ans] 69.3×10^{-12}

[:SOLN] For 1st order reaction :

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

A/c Arhenius equation:

$$k = A.e^{-Ea/RT}$$

$$= 10^{20} \times e^{-23.01} = 10^{10} \text{ sec}$$

$$k = 10^{20} \times e^{-\frac{191.48\times10^3}{8.314\times10^3}}$$

$$t_{1/2} = \frac{0.693}{10^{10}} = 69.3 \times 10^{-12} \text{ sec}$$

[:Q.73] 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 $gmol^{-1}$ of Ag : 108, Cl : 35.5)

[:Ans] **20**

[:SoLN] $$n_{Cl^-} = n_{AgCl} = \frac{143.5 \times 10^{-3}}{143.5} = 10^{-3}$$

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

[:Q.74] Some CO_2 gas was kept in a sealed container at a pressure of 1 atm and 273 K. This entire amount of CO_2 gas was later passed through an aqueous solution of $Ca(OH)_2$. The excess unreacted $Ca(OH)_2$ 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 $CO_2(g)$ reacted with exactly half the initial amount of $Ca(OH)_2$ present in the aqueous solution.]

[:Ans] **44.8 cc**

[:SOLN] Let mole of CO_2 taken = n

Mole of $Ca(OH_2)$ taken initially = 2n

Excess of $Ca(OH_2)$ = n

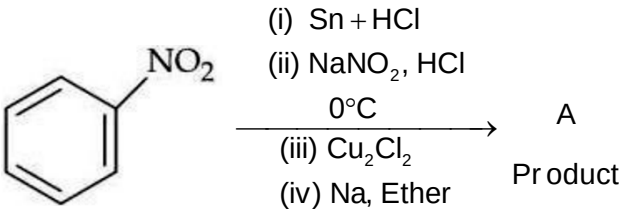
(gm -eq) of $Ca(OH_2)$ = gm-eq of HCl

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

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

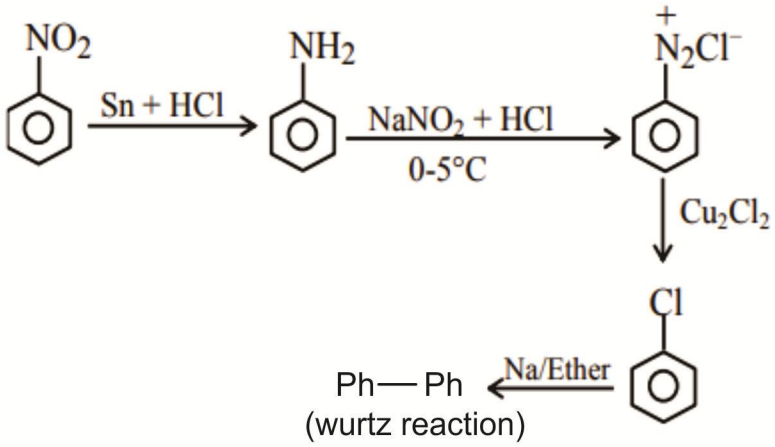
Volume of $CO_2 = 2 \times 10^{-3} \times 22400 = 44.8\,cc$

[:Q.75] Consider the following sequence of reactions:



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

[:Ans] **154**



Mol. Formula of (4) is $C_{12}H_{10}$

$C_{12\times2}+H_{10\times1}=144+10=154\,g/mol$