JEE Main Solution Physics

Date - 01/02/2024, shift - II

Ans-31

Significant figures

(A) 1001 — 4

(B) 010.1 — 3

(C) 100.100 — 6

(D) 0.00100 10 — 5

Option (1) is correct

Ans-32

Case - 1 $\frac{2}{40} = \frac{x}{60}$

$x = 3\Omega$

Case - 2 x is shunted by 2Ω

$$\frac{2}{x} = \frac{\frac{6}{5}}{(100 - x)}$$

$$3x = 500 - 5x$$

$$x = \frac{500}{8} = 62.5 \text{ cm}$$

shifting of balance point

$= 62.5 - 40 = 22.5$ cm

option (3) is correct

Ans 33

For central maximum

$d \sin\theta = n\lambda$ $\quad n = 1$ First minima

$\sin\theta = \frac{2}{4} = \frac{1}{2}$

$\theta = 30^\circ$

angular spread on both sides

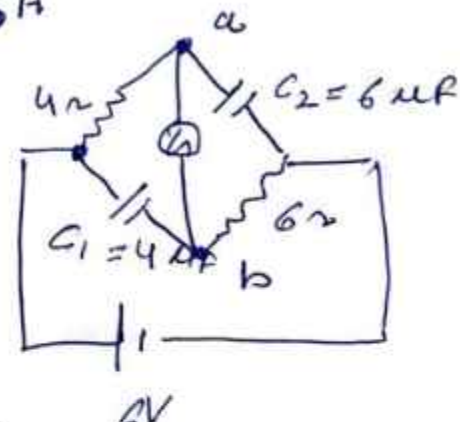
$= 2\theta = 60^\circ$

option (3) is correct

Ans -34

In steady state

$I = \frac{6}{12} = 0.5A$



$V_a = 6 - 2 = 4V$

$V_b = 4 - 1 = 3V$

$C_1 = 4\mu F$, $V_1 = 6 - 3 = 3$

$Q_1 = C_1 V_1 = 12\mu C$

$C_2 = 6\mu F$ $\quad V_2 = 4V$

$Q_2 = 24\mu C$

$\frac{Q_1}{Q_2} = \frac{12}{24} = \frac{1}{2}$

option (2) is correct

Ans-35

$$E = h\nu$$
$$= 6.63 \times 10^{-34} \times 6 \times 10^{14}$$
$$= 6.63 \times 6 \times 10^{-20} \text{ J}$$

$$P = 2 \times 10^{-3} \text{ W}$$

$$\text{No. of Photons emitted/sec} = \frac{P}{E}$$

$$= \frac{2 \times 10^{-3}}{6.63 \times 6 \times 10^{-20}}$$

$$= \frac{2 \times 10^{17}}{6.63 \times 6}$$
$$3$$

$$\simeq \frac{100 \times 10^{15}}{20}$$

$$\simeq 5 \times 10^{15}$$

Ans = 5×10^{15}

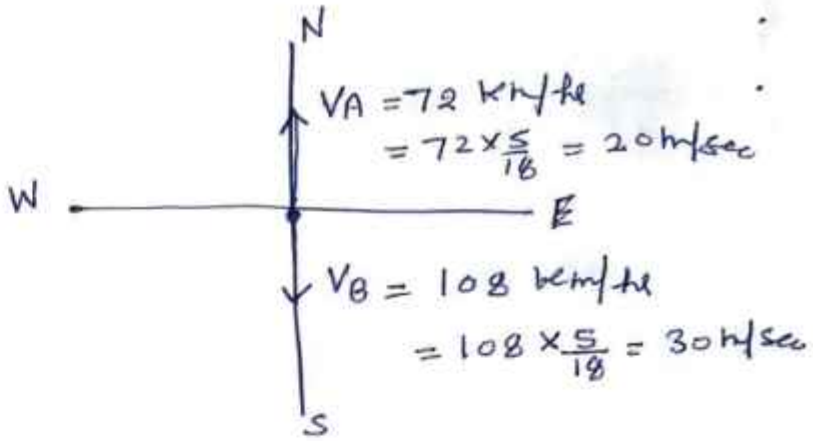
option (3) is Correct

Ans-36

Statement A, B, C, E are Correct

option 1 is Correct

Ans-37



$$\vec{V}_{BA} = \vec{V}_B - \vec{V}_A$$

$$= -30 - 20$$

$$= -50 \text{ m/sec}$$

$$\vec{V}_{GB} = \vec{V}_G - \vec{V}_B$$

$$= 0 - (-30) = 30 \text{ m/sec}$$

option (4) is correct

Ans-38

$$\frac{4}{3}\pi R^3 = 1000 \times \frac{4}{3}\pi r^3$$

$$R = 10r$$

surface energy before $= 1000 \times 4\pi r^2 \times S$

surface energy after $= 1 \times 4\pi (10r)^2 \times S$

it becomes $\frac{1}{10}$ th

option (2) is Correct

Ans- 39

$$\eta = \frac{\text{output}}{\text{Input}}$$

$$0.8 = \frac{24 \times I_0}{400}$$

$$I_0 = \frac{80}{6} = 13.33\,A$$

option (1) is correct

Ans-40

$$\text{Flux through } C_1 = \frac{2Q}{\varepsilon_0}$$

$$\text{Flux through } C_2 = \frac{2Q + 3Q}{\varepsilon_0}$$

$$= \frac{5Q}{\varepsilon_0}$$

$$\text{Ratio of fluxes} = \frac{\frac{2Q}{\varepsilon_0}}{\frac{5Q}{\varepsilon_0}}$$

$$= 2:5$$

option (1) is correct

Ans-41

K.E of disc

$$= \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

$$= \frac{1}{2}mv^2 + \frac{1}{2}\left[\frac{1}{2}mr^2 \frac{v^2}{r^2}\right]$$

$$= \frac{3}{4}mv^2$$

at height h K.E converts to PE

$$\frac{3}{4}mv^2 = mgh$$

$$\frac{3v^2}{4g} = h$$

option (1) is correct

Ans-42

$$f = 60\ MHz$$
$$= 60 \times 10^6 = 6 \times 10^7\ Hz$$

$$c = f\lambda$$
$$3 \times 10^8 = 6 \times 10^7 \times \lambda$$
$$\lambda = \frac{30}{6} = 5\ m$$

option (2) is correct

Ans-43

$$F \propto R^{-3/2}$$

$$F = KR^{-3/2}$$

$$\frac{mV^2}{R} = KR^{-3/2}$$

$$mV^2 = KR^{-1/2}$$

$$V \propto R^{-\frac{1}{4}}$$

$$T = \frac{2\pi R}{V}$$

$$T \propto \frac{R}{R^{-\frac{1}{4}}} \quad , \quad T \propto R^{\frac{5}{4}}$$

$$\boxed{T^2 \propto R^{\frac{5}{2}}}$$

Optim (4) is Correct

Ans-44

$$|F| = m\left(\frac{V-u}{t}\right)$$

$$= \frac{120}{1000}\left(\frac{0-25}{0+}\right)$$

$$= \frac{\overset{6}{\cancel{120}} \times \cancel{25}\ 5}{\cancel{100}\ 2}$$

$$= 30\ N$$

option (1) is Correct

Ans-45

$$W = 200\ J$$

$$nR(T_2 - T_1) = 200\ J$$

$$\Delta U = n C_V \Delta T$$

$$= n C_V \left[\frac{200}{nR}\right]$$

$$= \frac{C_V}{R} \times 200$$

$$= \frac{3R}{2R} \times 200$$

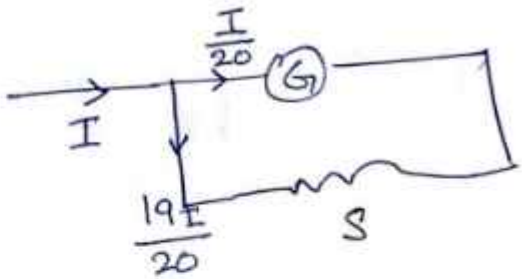
$$= 500\ J$$

$$\delta Q = \Delta U + \delta W$$

$$= 500 + 200 = 700\ J$$

Option (4) is correct

Ans-46



$$\frac{I}{20} \times G = \frac{19I}{20} \times S$$

$$S = \frac{G}{19}$$

$$\text{ammeter Resistance} = \frac{G \times \frac{G}{19}}{G + \frac{G}{19}}$$

$$\text{Ans} = \frac{G}{20}$$

Ans-47

Net Force $\vec{F} = \vec{F_1} + \vec{F_2}$

$= 8\hat{i} + 4\hat{j} + 4\hat{k}$

$$\vec{a} = \frac{\vec{F}}{m} = \frac{8\hat{i} + 4\hat{j} + 4\hat{k}}{4}$$

$$\boxed{\vec{a} = 2\hat{i} + \hat{j} + \hat{k}}$$

option (3) is correct

Ans-48

$$\text{energy} = h\nu = \frac{hc}{\lambda}$$

$$= \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{6.6 \times 10^{-7}}$$

$$= 3 \times 10^{-19}\ J$$

$$= \frac{3 \times 10^{-19}}{1.6 \times 10^{-19}}\ eV$$

$$= \frac{3}{1.6}\ eV = \left(\frac{30}{16}\right) eV$$

$$= \left(\frac{15}{8}\right) eV$$

$\boxed{x = 15}$

option (3) is correct

Ans-49

$$\sqrt{\frac{3RT}{M_{H_2}}} = 2$$

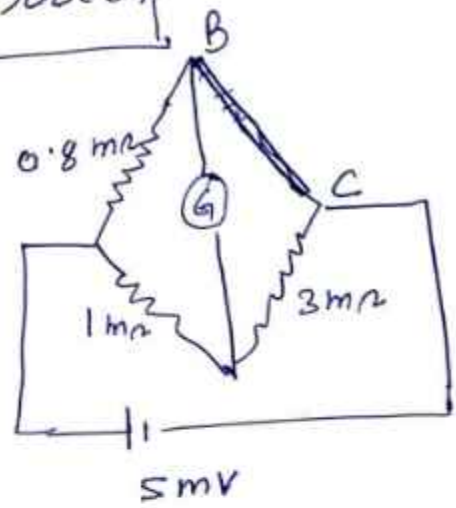
$$V_{rms_{O_2}} = \sqrt{\frac{3RT}{M_{O_2}}} = ?$$

$$= \sqrt{\frac{4 \times M_{H_2}}{M_{O_2}}}$$

$$= \sqrt{\frac{4 \times 2}{32}} = \sqrt{\frac{1}{4}} = \frac{1}{2} = 0.5 \text{ Km/sec}$$

Option (4) is Correct

Ans-50 Resistance of BC after 10 S



$$\frac{0.8}{1} = \frac{R_x}{3}$$

$$R_x = 2.4 \text{ m}\Omega$$

Change in resistance $= 2.4 \text{ m}\Omega - 3 \text{ m}\Omega$

$$= -0.6 \text{ m}\Omega$$

$$-0.6 = 3 \times \alpha \times \Delta T$$

$$\alpha = -\frac{0.6}{3 \times 20}$$

$$\alpha = -1 \times 10^{-2} \, {}^{o}C^{-1}$$

$\Delta T = 20^{\circ}C$ for 10 sec

Option (3) is Correct

Ans-51

$N = 200$

$A = 0.20\ m^2$

$B = 0.01\ T$

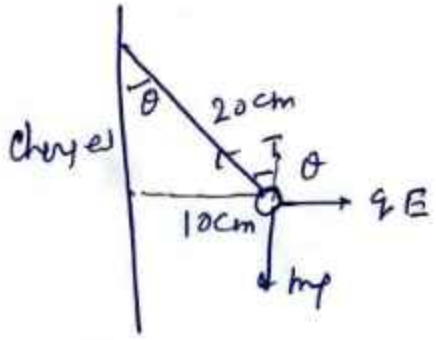
$W = \pi$ rad/sec

$e = NBAW = 200 \times 0.20 \times 0.01 \times \pi$

$= 0.4\pi = \frac{4\pi}{10} = \frac{2\pi}{5}$

$\boxed{\beta = 5}$

Ans-52



$\sin\theta = \frac{10}{20} = \frac{1}{2}$

$\theta = 30^\circ$

$T\cos\theta = mg$

$T\sin\theta = qE$

$\boxed{\alpha = 3}$

$\frac{qE}{mg} = \tan\theta$

$q = \frac{mg\tan\theta}{E} = \frac{2\times10^{-3}\times10\times1}{\sqrt{3}\times2\times10^{4}}$

$= \frac{10^{-6}}{\sqrt{3}}\ C = \frac{1}{\sqrt{3}}\ \mu C$

Ans-53

$$\lambda = 5000\ \text{Å} = 5\times10^{-7}\ m$$

$$d = 1\ mm = 1\times10^{-3}\ m$$

$$D = 1\ m$$

$$2I = I + I + 2I\cos\theta$$

$$\cos\theta = 0, \quad \theta = \frac{\pi}{2}$$

$$\Delta x = \frac{\lambda}{2\pi}\times\frac{\pi}{2} = \frac{\lambda}{4}$$

$$\frac{\lambda}{4} = \frac{dy}{D}$$

$$y = \frac{D\lambda}{4d} = \frac{1\times5\times10^{-7}}{4\times1\times10^{-3}} = 1.25\times10^{-4}\ m = 125\times10^{-6}\ m$$

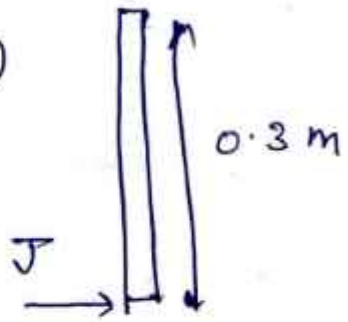
Ans = 125

Ans-54

Angular Impulse about (C.o.M)

$$= 0.2\times\frac{0.3}{2}$$

$$= 0.03$$



$$I_{COM} = \frac{ML^2}{12} = \frac{2\times(0.3)^2}{12} = \frac{0.09}{6}$$

Angular Impulse = change in angular Momenta

$$0.03 = \frac{0.09}{6}(\omega_f - 0)$$

$$\omega_f = 2\ \text{rad/sec} \qquad t = \frac{\pi}{2\times2} = \frac{\pi}{4}\ \text{sec}$$

x = 4

Ans-55 $V = 4\sqrt{x}$

$$\frac{dV}{dt} = 4\left[\frac{1}{2\sqrt{x}} \cdot \frac{dx}{dt}\right]$$

$$= 4\left[\frac{1}{2\sqrt{x}} \cdot V\right]$$

$$= 4\left[\frac{1}{2\sqrt{x}} \cdot 4\sqrt{x}\right]$$

$$\boxed{a = 8}$$

$$\boxed{\text{Ans} = 8 \text{ m/sec}^2}$$

Ans-56 $\frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$$f = RC\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

$$3\times10^{15} = RC\left[1 - \frac{1}{4}\right] = \frac{3RC}{4}$$

$$f' = RC\left[1 - \frac{1}{9}\right] = \frac{8RC}{9}$$

$$\frac{3\times10^{15}}{f'} = \frac{27}{32}$$

$$f' = \frac{32}{9}\times10^{15}\ \text{Hz} \qquad \boxed{x = 32}$$

Ans - 57

$$f = \sqrt{\frac{k}{m}}$$

$$\frac{f_1}{f_2} = \sqrt{\frac{m_2}{m_1}} = \sqrt{\frac{9m}{m}} = 3$$

Ans = 3

Ans - 58

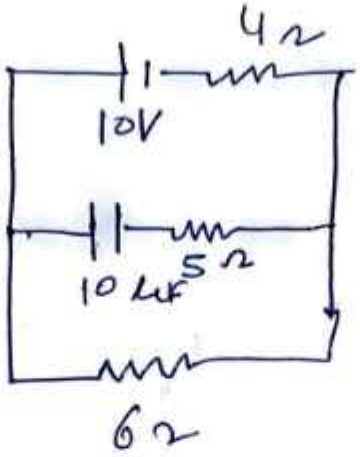
$$C\theta = NIAB$$

$$C = \frac{100 \times 10 \times 10^{-3} \times 2 \times 10^{-4} \times 10^{-2}}{0.05}$$

$$= 4 \times 10^{-5}$$

$$x = 4$$

Ans-59



In steady state

$$I = \frac{10}{6+4} = 1\ A$$

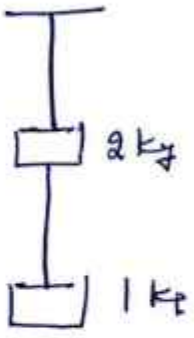
P.D across capacitor

$$= 6 \times 1 = 6\ V$$

$$Q = C \cdot V = 10 \times 6 = 60\ \mu C$$

Ans = 60

Ans-60



upper wire

$$\left(\frac{\Delta l}{l}\right)_U = \frac{F}{AY} = \frac{3g}{AY}$$

Lower wire

$$\left(\frac{\Delta l}{l}\right)_L = \frac{g}{AY}$$

Ratio = 3

NTA - JEE SOLUTION [SHIFT-2 . Ist Feb, 24]

A-61 Correct option in (3) Because
a) P-block contains both Metal and Non-metal but d-block Contains only metal
b) Non-Metals being smaller in size & high ENC have high IE and high EN

A-62 Correct option is (3) - BiH_3 because greater is the size of G-15 element weaker is the bond Strength b/w Bi-H and least stability.

A-63 Correct option is (3) because
radial node = n - l - 1
= 3 - 1 - 1 = 1

A-64 Correct option is - (3) -COOH group is EWG and withdrawn its electrons away from the chain or ring

A-65 Correct option is (4)

A-66 Correct option is (2) because $-NO_2$ has Polar oxygen and -OH group has Polar H atom. Both form H-bonding among itself.

A-67 Correct option is (2) ∵ SiO_2 - Acidic
GeO_2 and SnO - Amphoteric while PbO - basic

A-68 Correct option - (4) ∵ This test is used only for Carbon, Nitrogen and Sulphur

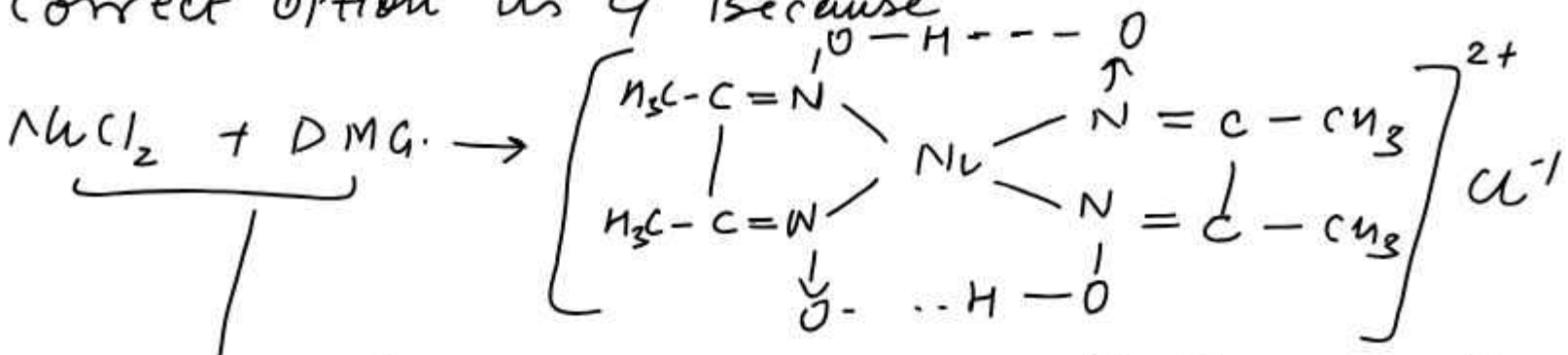
A-69 Correct option - (3) because no one has half-filled EC. and oxidizing nature ∝ ENC (effective nuclear charge) ie greater in Mn^{3+} than Cr^{2+} while both are iso-electronic.

A-70 Correct option is (2) because all are EWG (Electron withdrawing group) and shows

(Electron withdrawing group) and shows

M^-/R^- - effect

An-71 Correct option is 4 Because



5/6 - membered ring and Fe shows both +2 and +3 oxidation state in $Fe^{+3}[Fe^{+2}(CN^{-1})_6]$

A-72 Solubility of $Ca_3(PO_4)_2 = \frac{w \times 1000}{m \times 100}$

$= \left(\frac{w}{m} \times 10\right)$ mol/l

$Ca_3(PO_4)_2 \rightleftharpoons 3Ca^{2+} + 2PO_4^{2-}$

$\frac{w}{m} \times 10 \qquad \frac{w}{m} \times 10$

$K_{SP} = [Ca^{2+}]^3 \cdot [PO_4^{3-}]^2$

$= \left(\frac{w}{m} \times 10\right)^3 \times \left(\frac{w}{m} \times 10\right)^2$

$= 10^5 \times \left(\frac{w}{m}\right)^5$, Correct option is (2).

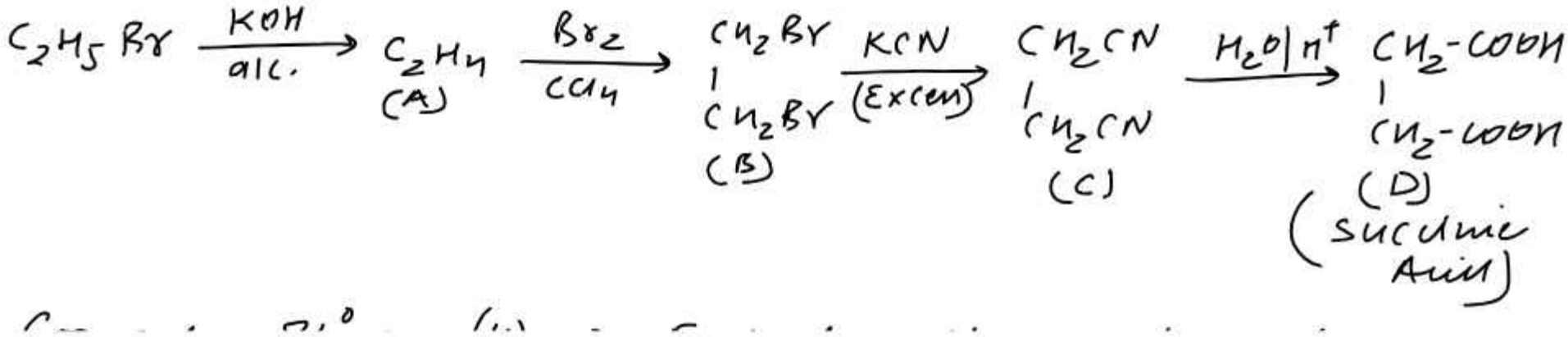
A-73 Correct option is (4)

A) Reduction of Phenol

B) & C) - Reimer-Tiemann Reaction

D) Nitration of Phenol

A-74 Correct option is (C) = Succinic Acid



A-75

A-75 Correct option – (4) ∵ First three shows colour due to charge transfer as they have no electrons in d-subshell

A-76 Correct option – (4)

A-77 correct option – (2)

A-78 Correct option is (1) Butenal ∵ it has complete shifting of π bond b/w >C=O

A-79 Correct option is (2)

A-80 Correct option is (1) Manganese After loosing 2 e⁻(s) from $4s^2$, it becomes $3d^5, 4s^0$ in half filled with extra stability having more ENC

A-81 Because,

10 ml. Hydrocarbon ⟶ 40 ml CO_2 ⟶ 50 ml water vapour

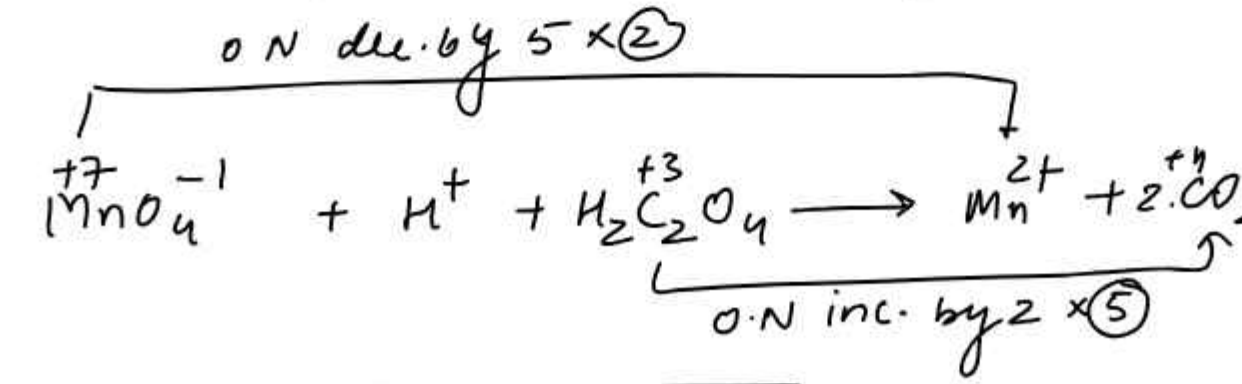
∴ $\frac{0.01}{22.4}$ mole of hydrocarbon → $\frac{0.04}{22.4}$ mole CO_2 ⟶ $\frac{0.05}{22.4}$ mole H_2O

So, 0.45 mole Hydrocarbon ⟶ 1.79 mole of CO_2 → 2.23 mole H_2O

then 1 mole Hydrocarbon → 4 mole CO_2 → 5 mole H_2O
= 4 mole [C] = 10 mole [H]

thus the answer will be 4 carbon atoms & 10 H-atoms.
and formula will be C_4H_{10}.

A-82



Net e^- - transfer = $\boxed{10 = n}$

$$E^0_{cell} = \frac{0.0591}{n}\log K_{eq} \quad \Big| \quad z = \frac{0.0591}{10} \times x \times \log_{10}{}_{10}$$

$$x = \frac{2 \times 10}{\quad} = 338.98$$

$$2 = \frac{0.0591}{10}\log 10^{x} \Big| \quad x = \frac{2\times10}{0.0591} = \underline{\underline{338.98}}$$

A-83

$$\overset{1\text{ gm}}{OC} \xrightarrow{\text{analysed}} NH_3 \equiv 10\text{ ml } 2M\ H_2SO_4$$

$$\equiv 10\text{ ml } 4N H_2SO_4$$

$$\%\ N = \frac{1.4\times N_1\times V_1}{\omega_{O.C}} = \frac{1.4\times 4\times 10}{1} = \underline{\underline{56}}$$

A-84 Acc, to equation

$$\begin{array}{lccc} t=0 & P_0, & 0 & 0 \\ & A & \longrightarrow & 2B + C \\ t=t & P_0-P & P\times2 & P \end{array}$$

Total Pressure, $P_t = P_0 - P + 2P + P$

$$P_t = P_0 + 2P$$

$$2P = P_t - P_0$$

$$P = \frac{P_t - P_0}{2}$$

Therefore, $P_0 - P = P_0 - \left(\frac{P_t - P_0}{2}\right) = \frac{3P_0 - P_t}{2}$

By 1st order

$$K = \frac{2.303}{t}\log\frac{P_0\times2}{3P_0 - P_t}$$

$$K = \frac{2.303}{115}\log\frac{0.1\times2}{0.1\times3 - 0.2}$$

$$K = \frac{2.303}{115}\log\frac{0.2}{0.1}$$

$$K = \frac{2.303}{115}$$

$$K = 0.02$$

$$K = \underline{2\times10^{-2}}$$

on comparing $K = 2\times10^{-2}$ with $\underline{x}\times10^{-2}\ s^{-1}$

then $\boxed{x = 2}$

A-85

$$\Delta G = -2.303RT\log K_{eq}$$

$$= -\frac{2.303\times8.314\times300\times\log 10}{1000}\ KJ\,mol^{-1}$$

$$= -2.303\times0.8314\ KJ/mol$$

$$= 5.744\ KJ/mol$$

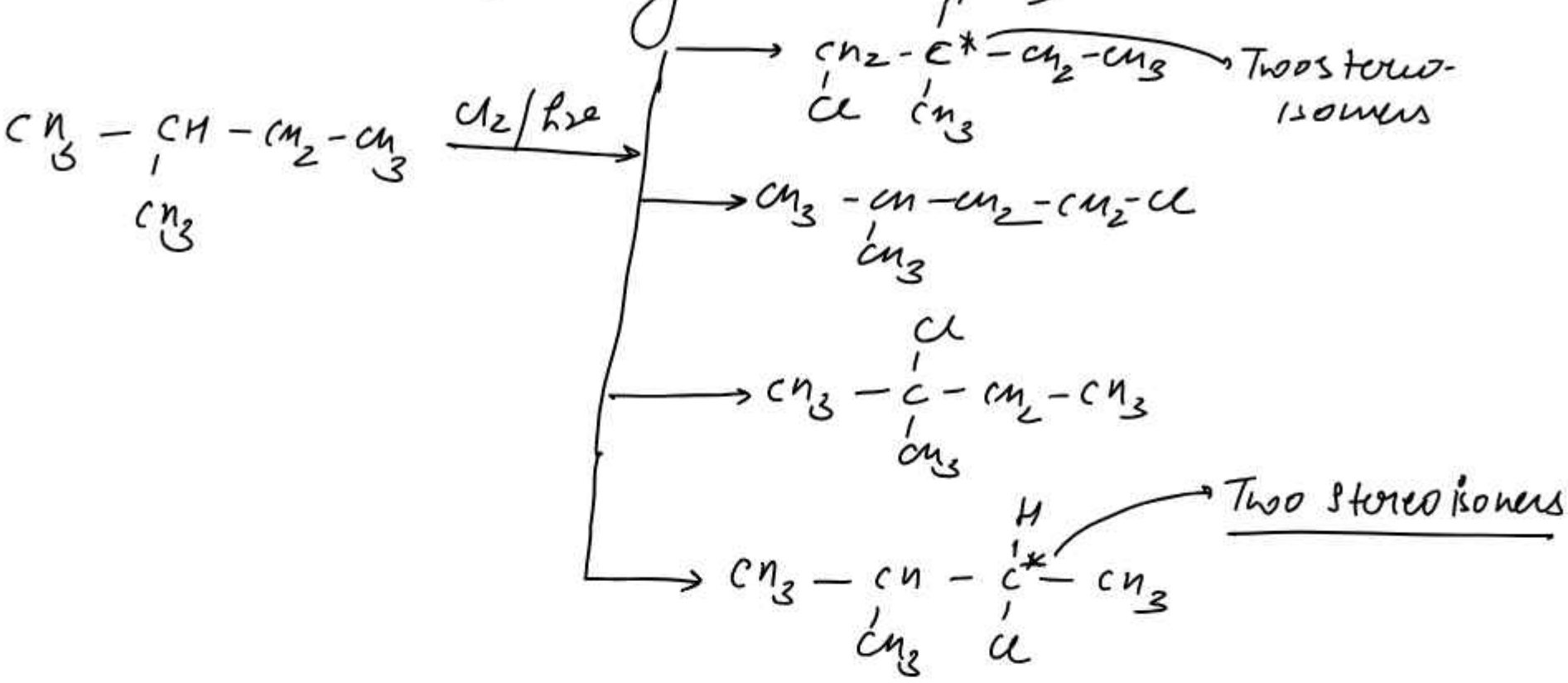
$$= 57.44\times10^{-10}\ KJ\ mol^{-1} \equiv -\underline{x}\times10^{-1}\ KJ\,mol^{-1}$$

then, $\boxed{x = 57.44}$

A-86 The number of tripeptides are 6 and it is simply done by formulation method $3! = 3\times2\times1 = 6$

done by formulation method $3! = 3 \times 2 \times 1 = 6$

A-87 Total Isomers (including stereoisomers) are six.



A-88 Total number of nitrogen compounds that gives test with Hinsberg Reagent are 7

A-89 Amount of electricity is required in coulomb

$$2H_2O \rightleftharpoons 4H^+ + 4e^{-1} + O_2$$

or

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

$\hookrightarrow 2F = 2 \times 96500\,C$

$= 193000\,C$

$= 1.93 \times 10^5\,C$

on comparing with $\frac{x}{10} \times 10^5\,C$

it will be $= 1.93$

A-90

$$\Delta T_f = \frac{K_f \times 1000 \times w_{solute}}{M_{solute} \times w_{solvent}}$$

$$2 = \frac{1.86 \times 1000 \times x}{620 \times 186 \times 1000}$$

$$x = 2 \times 620 = 1488\,gm \text{ or } 14.9\,gm$$