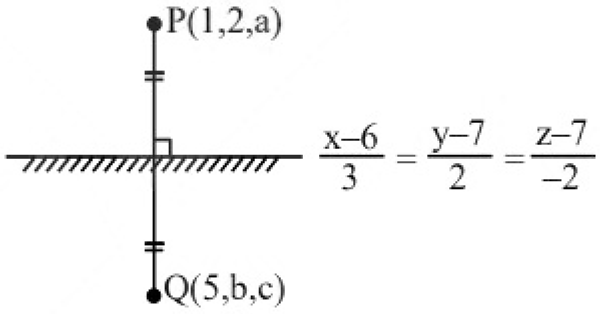
1 - JEE Main Maths 22-Jan 2026 Shift -1

Q1 Solution:
(1)



Point $M \equiv \left(3, \frac{b}{2} + 1, \frac{c+a}{2}\right)$ satisfies the line

$\frac{3-6}{3} = \frac{\frac{b}{2} + 1 - 7}{2} = \frac{\frac{c+a}{2} - 7}{-2}$

$-1 = \frac{b-12}{4} = \frac{c+a-14}{-4}$

$\Rightarrow b = 8 \quad ...(1)\ \&\ c + a = 18 \quad ...(2)$

Now $PQ \perp L$

$\Rightarrow (4\text{i} + (b-2)\text{j} + (c-a)\text{k}) \cdot (3\text{i} + 2\text{j} - 2\text{k}) = 0$

$\Rightarrow 12 + 2(b-2) - 2(c-a) = 0$

$\Rightarrow 6 + (b-2) - (c-a) = 0$

$\Rightarrow b - c + a + 4 = 0$

$\Rightarrow 8 - c + a + 4 = 0$

$\Rightarrow c + a = 12 \quad ...(3)$

From (2) & (3)

$c = 15, \ a = 3$

So $a^2 + b^2 + c^2 = 9 + 64 + 225 = 298$

Q2 Solution:
(2)

$6\int_1^x f(t)\,dt = 3xf(x) + x^3 - 4$

Differentiate both sides

$6f(x) = 3xf'(x) + 3f(x) + 3x^2$

$3f(x) = 3xf'(x) + 3x^2$

$x\frac{dy}{dx} - y = -x^2$

$\frac{x\frac{dy}{dx} - 9}{x^2} = -1$

$\Rightarrow \frac{d}{dx}\left(\frac{y}{x}\right) = -1$

$\frac{y}{x} = -x + C$

$\Rightarrow f(x) = -x^2 + Cx$

At $x = 1,\ y = 1 \Rightarrow C = 2$

$f(x) = -x^2 + 2x$

$f(2) - f(3) = 3$

Q3 Solution:
(3)

Let $1 + x = r$

$\therefore S = 1 \cdot r + 2 \cdot r^2 + 3 \cdot r^3 + \cdots + 100r^{100} \quad ...(1)$
(AGP)

$rS = 1 \cdot r^2 + 2 \cdot r^3 + \cdots + 99r^{100} + 100r^{101} \quad ...(2)$

$(1) - (2)$ gives

$S = -\frac{(1+x)^{101}}{x^2} + \frac{1}{x^2} + \frac{100(1+x)^{101}}{x}$

$\therefore$coefficient of x^{48} in S

$= -$ coefficient of x^{48} in $\frac{(1+x)^{101}}{x^2} + 100\,.$ Coefficient of x^{48} in $\frac{(1+x)^{101}}{x}$

$= 100\,.\,{}^{101}C_{49} - {}^{101}C_{50}$

Q4 Solution:
(2)

R = {(3, 3), (7, 8), (11, 13)}

to make it symmetric (8, 7), (13, 11) must be added.

Q5 Solution:
(1)

Case I $x < -4$

$x(-x+4) + 3(-x+2) + 10 = 0$

$x^2 + 7x - 4 = 0$

$\Rightarrow x = -\frac{7+\sqrt{65}}{2}$ or $-\frac{7-\sqrt{65}}{2}$

Reject Accept

Case II $-4 \le x < -2$

$x(x+4) + 3(-(x+2)) + 10 = 0$

$x^2 + x + 4 = 0$

$D < 0$ No solution

Case III $x \ge -1$

$x(x+4) + 3(x+2) + 10 = 0$

$x^2 + 7x + 16 = 0$

$D < 0$ No solution

$\Rightarrow$ No. of solutions $= 1$

Q6 Solution:
(4)

$-1 \leq \frac{5-x}{2x+3} \leq 1$ & $10 - x > 0$, $10 - x \neq 1$

$\left|\frac{5-x}{2x+3}\right| \geq 1$ & $x < 10$ & $x \neq 9$

$(5-x)^2 - (2x+3)^2 \leq 0$ & $x < 10$ & $4x \neq 9$

$(x+8)(3x-2) \geq 0$ & $x < 10$ & $x \neq 9$

$\Rightarrow \left(-\infty, -8\right] \cup \left[\frac{2}{3}, 10\right) - \left\{9\right\}$

$\Rightarrow \left(\alpha + \beta + \gamma + \delta\right) = 6\left(-8 + \frac{2}{3} + 10 + 9\right)$

$= 70$

Q7 Solution:
(1)

$I = \int_{-\pi/2}^{\pi/2} \frac{1}{[x]+4} dx$

$I = \int_{-\pi/2}^{-1} \frac{dx}{2} + \int_{-1}^{0} \frac{dx}{3} + \int_{0}^{1} \frac{dx}{4} + \int_{1}^{\pi/2} \frac{dx}{5}$

$= \frac{1}{2}\left(-1 + \frac{\pi}{2}\right) + \frac{1}{3}\left(1\right) + \frac{1}{4}\left(1\right) + \left(\frac{\pi}{2} - 1\right)\frac{1}{5}$

$= \frac{7\pi}{20} - \frac{7}{60} = \frac{7}{60}\left(3\pi - 1\right)$

Q8 Solution:
(4)

Sum of first 4 terms $S_4 = 6$

$\frac{4}{2}\left(2a + 3d\right) = 6 \Rightarrow 2a + 3d = 3 \quad ...\left(1\right)$

Sum of first 6 terms $S_6 = 4$

$\frac{6}{2}\left(2a + 5d\right) = 4 \Rightarrow 2a + 5d = \frac{4}{3} \quad ...\left(2\right)$

eq. (2) - eq. (1)

$\left(2a + 5d\right) - \left(2a + 3d\right) = \frac{4}{3} - 3$

$\Rightarrow d = -\frac{5}{6}$

$\therefore \; 2a + 3\left(-\frac{5}{6}\right) = 3 \Rightarrow a = \frac{11}{4}$

$S_{12} = \frac{12}{2}\left\{2\left(\frac{11}{4}\right) + \left(12 - 1\right)\left(-\frac{5}{6}\right)\right\}$

$S_{12} = 6\left(-\frac{22}{6}\right) = -22$

Q9 Solution:
(4)

$y = \frac{1 - \alpha x}{2}$

Put this in equation of hyperbola

$\therefore x^2 - 9\left(\frac{1-\alpha x}{2}\right)^2 = 9$

$\left(4 - 9\alpha^2\right)x^2 + 18\alpha x - 45 = 0$

$\because$ line does not intersect hyperbola

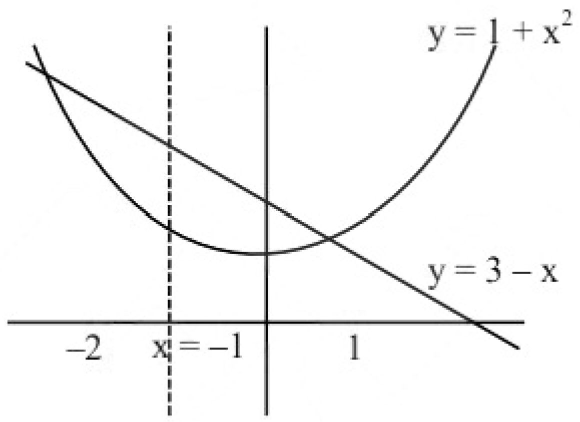
$\therefore D < 0$

$\Rightarrow \alpha^2 - \frac{5}{9} > 0$

$\Rightarrow \alpha \in \left(-\infty, -\frac{\sqrt{5}}{3}\right) \cup \left(\frac{\sqrt{5}}{3}, \infty\right)$

Here $\frac{\sqrt{5}}{3} \approx 0.74$

Q10 Solution:
(4)



$$\frac{m}{n} = \frac{\int_{-1}^{1}\left[\left(3-x\right)-\left(1+x^2\right)\right]dx}{\int_{-2}^{1}\left[\left(3-x\right)-\left(1+x^2\right)\right]dx} = \frac{20}{7}$$

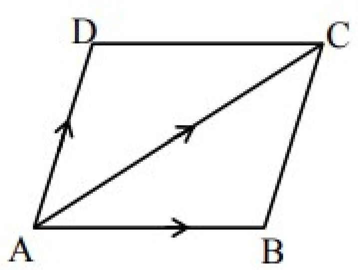
$\therefore \quad m + n = 20 + 7$

$= 27$

Q11 Solution:
(3)

$\overrightarrow{AC} = 3\hat{i} + 6\hat{j} + \left(\lambda - 5\right)\hat{k}$

$\vec{v} \cdot \overrightarrow{AC} = 1 \Rightarrow 3 + 6 + \lambda - 5 = \sqrt{9 + 36 + (\lambda - 5)^2}$



$\Rightarrow \lambda^2 + 8\lambda + 16 = \lambda^2 - 10\lambda + 70$

$\Rightarrow \lambda = \frac{54}{18} = 3$

$\therefore$Quadratic: $9x^2 - 18x + 5 = 0 \Rightarrow x = \frac{1}{3}, \frac{5}{3}$

$\therefore 2\alpha - \beta = \frac{10-1}{3} = 3$

Q12 Solution:
(2)

$f\left(x\right) = x^{2025} - x^{2000}$

$f'\left(x\right) = 0 \Rightarrow x = \left(\frac{2000}{2025}\right)^{1/25} = \alpha \left(\text{say}\right)$

$\therefore f(0) = 0,\ f(1) = 0,\ f\left(\alpha\right) = \left(\frac{80}{81}\right)^{80} \cdot \frac{-1}{81} = 80^{80} \cdot (-81)^{-81}$

Q13 Solution:
(1)

Required probability $= 1 - \left(\text{product not divisible by 3}\right)$

Multiple of $3 = 16$

Not multiple of $3 = 34$

$= 1 - \frac{^{34}C_2}{^{50}C_2}$

$= \frac{664}{1225}$

Q14 Solution:
(1)

$A = \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix} \Rightarrow A^2 = \begin{bmatrix} 13 & 21 \\ 21 & 34 \end{bmatrix}$

$\left|A^{2025} - 3A^{2024} + A^{2023}\right|$

$= \left|A^{2023}\left(A^2 - 3A + I\right)\right|$

$= |A|^{2023}\left|A^2 - 3A + I\right|$

$= 1 \cdot \begin{vmatrix} 8 & 12 \\ 12 & 20 \end{vmatrix} = 160 - 144 = 16$

Q15 Solution:
(4)

$\left(x_1 y_1\right) = \left(3t_1^2, 6t_1\right)$ and $\left(x_2 y_2\right) = \left(3t_2^2, 6t_2\right)$

$t_1 t_2 = -4$

$x_1 x_2 = 9\left(t_1 t_2\right)^2, \quad y_1 y_2 = 36\ \ t_1 t_2$

$x_1 x_2 - y_1 y_2 = 9\left(16\right) - 36\left(-4\right)$

$= 144 + 144$

$= 288$

Q16 Solution:
(3)

Let $P(2\lambda + 1, -3\lambda - 1, \lambda)$

Then $4\lambda^2 + 9\lambda^2 + \lambda^2 = 16 \cdot 14 \Rightarrow \lambda = \pm 4 \Rightarrow -4$ $\left(\text{nearer to origin}\right)$

$\therefore P(-7, 11, -4)$

$$\therefore \text{Shortest distance} = \frac{\begin{vmatrix} 2 & -1 & 7 \\ 1 & 2 & 3 \\ 2 & 1 & 1 \end{vmatrix}}{\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 3 \\ 2 & 1 & 1 \end{vmatrix}}$$

$$= \frac{28}{\sqrt{1+25+9}} = \frac{4\sqrt{7}}{\sqrt{5}}$$

Q17 Solution:
(2)

$$\tan^{-1}(4x) + \tan^{-1}(6x) = \frac{\pi}{6}$$

$$\Rightarrow \tan^{-1}\left(\frac{4x+6x}{1+24x^2}\right) = \frac{\pi}{6}$$

$$\Rightarrow \frac{10x}{1-24x^2} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow 24x^2 + 10\sqrt{3}\ \ x - 1 = 0$$

$$x = \frac{-10\sqrt{3} \pm \sqrt{300+96}}{48}$$

$$x = \frac{\sqrt{396} - 10\sqrt{3}}{48}$$

Only 1 solution in $\left(-\frac{1}{2\sqrt{6}}, \frac{1}{2\sqrt{6}}\right)$

Q18 Solution:
(4)

$$(x-2)^2 + (y-1)^2 = 3^2 \ \& \ (x+1)^2 + (y+4)^2 = r^2$$

$$|r_1 - r_2| < c_1c_2 < r_1 + r_2$$

$$|r-3| < \sqrt{(2+1)^2 + (1+4)^2} < r+3$$

$$|r-3| < \sqrt{34} \ \& \ r+3 > \sqrt{34}$$

$$-\sqrt{34} < r-3 < \sqrt{34} \ \& \ r > \sqrt{34} - 3$$

i.e. $r = (3-\sqrt{34}, 3+\sqrt{34}) \cap (\sqrt{34}-3, \infty)$

i.e. $r \in (\sqrt{34}-3, \sqrt{34}+3)$

$$\therefore \ \alpha\beta = (\sqrt{34}-3)(\sqrt{34}+3)$$

$$= 34 - 9$$

$$= 25$$

Q19 Solution:
(3)

$$\sum P(x_i) = 1$$

$$\Rightarrow 9k + 10k^2 = 1$$

$$\Rightarrow 10k^2 + 9k - 1 = 0 \ \Rightarrow \ k = \frac{1}{10}$$

$$P(3 < x \le 6) = 3k + 3k^2$$

$= \frac{3}{10} + \frac{3}{100} = 0.33$

$= 0.33$

Q20 Solution:
(4)

$$\frac{xdy - ydx}{x^2} = \frac{\sqrt{x^2 + y^2}}{x^2}dx$$

$$d\left(\frac{y}{x}\right) = \sqrt{1 + \frac{y^2}{x^2}} \cdot \frac{1}{x}dx$$

$$\int \frac{d\left(\frac{y}{x}\right)}{\sqrt{1 + \left(\frac{y}{x}\right)^2}} = \int \frac{1}{x}dx$$

$$= ln\left(\frac{y}{x} + \sqrt{1 + \frac{y^2}{x^2}}\right) = lnx + lnk = lnkx$$

$$\Rightarrow y + \sqrt{x^2 + y^2} = kx^2$$

$$0 + 1 = k$$

$$\Rightarrow y + \sqrt{x^2 + y^2} = x^2$$

$$y + \sqrt{9 + y^2} = 9$$

$$y = 4$$

Q21 Solution:
(18)

$$A + A^T = O$$

$$A\begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix} = \begin{bmatrix} 3 \\ 3 \\ 2 \end{bmatrix} \text{ and } A^2\begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix} = \begin{bmatrix} -3 \\ 19 \\ -24 \end{bmatrix}$$

$$A + A^T = O$$

A is skew symmetric matrix

$$A = \begin{bmatrix} 0 & a & b \\ -a & 0 & c \\ -b & -c & 0 \end{bmatrix}$$

Now ATQ

$$\begin{bmatrix} 0 & a & b \\ -a & 0 & c \\ -b & -c & 0 \end{bmatrix}\begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix} = \begin{bmatrix} 3 \\ 3 \\ 2 \end{bmatrix}$$

$a = -3$ and $c = b + 2$

$$A^2\begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix} = A\begin{bmatrix} 3 \\ 3 \\ 2 \end{bmatrix} = \begin{bmatrix} 0 & -3 & b \\ 3 & 0 & c \\ -b & -c & 0 \end{bmatrix}\begin{bmatrix} 3 \\ 3 \\ 2 \end{bmatrix}$$

$$= \begin{bmatrix} -9 + 2b \\ 9 + 2c \\ -3b - 3c \end{bmatrix} = \begin{bmatrix} -3 \\ 19 \\ -24 \end{bmatrix}$$

By comparing we get

$b = 3,\ c = 5$

Now $A = \begin{bmatrix} 0 & -3 & 3 \\ 3 & 0 & 5 \\ -3 & -5 & 0 \end{bmatrix}$

Let $B = A + I = \begin{bmatrix} 1 & -3 & 3 \\ 3 & 1 & 5 \\ -3 & -5 & 1 \end{bmatrix}$

$\det\left(B\right) = 44 = 2^2 \times 11$

we find $D = \det\left(\operatorname{adj}\left(2 \ \ \operatorname{adj}\left(B\right)\right)\right)$

$D = 2^{14} \cdot 11^4$

Compare with $2^{\alpha} 3^{\beta} 11^{\gamma}$

$\alpha = 14, \ \ \beta = 0, \ \ \gamma = 4$

$\alpha + \beta + \gamma = 18$

Q22 Solution:
(49)

$\left(9 + 7\omega - 7\omega^2\right) + \omega^{20}\left(9 + 7\omega - 7\omega^2\right)^{20} + \omega^{40}\left(9 + 7\omega - 7\omega^2\right)^{20} + \left(14 + 7\left(\omega + \omega^2\right)\right)^{20}$

$\left(9 + 7\omega - 7\omega^2\right)^{20}\left(1 + \omega + \omega^2\right) + \left(14 - 7\right)^{20}$

$= 7^{20}$

$= \left(49\right)^{10}$

Hence, $M = 49$

Q23 Solution:
(660)

Case 1:

2 from AB, 2 from BC, 1 from AC

$\binom{4}{2} \cdot \binom{5}{2} \cdot \binom{4}{1} = 6 \cdot 10 \cdot 4 = 240$

Case 2:

2 from AB, 1 from BC, 2 from AC

$\binom{4}{2} \cdot \binom{5}{1} \cdot \binom{4}{2} = 6 \cdot 5 \cdot 6 = 180$

Case 3:

1 from AB, 2 from BC, 2 from AC

$\binom{4}{1} \cdot \binom{5}{2} \cdot \binom{4}{2} = 4 \cdot 10 \cdot 6 = 240$

Q24 Solution:
(4)

Use $\sin\left(A + B\right)\sin\left(A - B\right) = \sin^2 A - \sin^2 B$

$\cos\left(A + B\right)\cos\left(A - B\right) = \cos^2 A - \sin^2 B$

$\frac{\cos 60°\cos 36°}{\sin 30°\sin 18°} = \frac{\sqrt{5}+1}{\sqrt{5}-1} \times \frac{\sqrt{5}+1}{\sqrt{5}+1} = \frac{(\sqrt{5}+1)^2}{4}$

$= \frac{3+\sqrt{5}}{2}$

$\alpha = 3, \ \beta = 1$

So, $(\alpha + \beta) = 4$

Q25 Solution:
(16)

$\int (\tan x)^{-11/2} . \sec^8 x dx$

$= \int (\tan x)^{-11/2} (1 + \tan^2 x)^3 \sec^2 x dx$

Put $\tan x = t$

$\Rightarrow \int t^{-11/2}(1+t^2)^3 dt = \int t^{-11/2}\left(1+3t^2+3t^4+t^6\right) \ dt$

$= \int \left(t^{-11/2} + 3t^{-7/2} + 3t^{-3/2} + t^{1/2}\right) dt$

$= -\frac{2}{9}(\cot x)^{9/2} - \frac{6}{5}(\cot x)^{5/2} - 6(\cot x)^{1/2} + \frac{2}{3}(\cot x)^{-3/2} + C$

$\Rightarrow p_1 = 2, \ p_2 = 6, \ p_3 = 6, \ p_4 = 2$

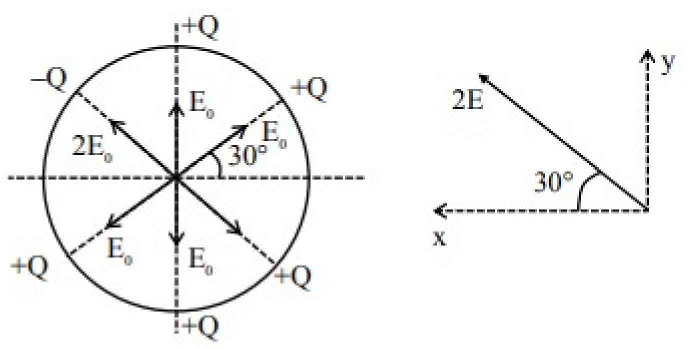
and $q_1 = 9, \ q_2 = 5, \ q_3 = 1, \ q_4 = 3$

$\frac{15 p_1 p_2 p_3 p_4}{q_1 q_2 q_3 q_4} = \frac{15 \cdot 2 \cdot 6 \cdot 6 \cdot 2}{9 \cdot 5 \cdot 1 \cdot 3} = 16$

2 - JEE Main Physics 22-Jan 2026 Shift -1

Q26 Solution:
(4)

Let $\frac{kQ}{r^2} = E_0$

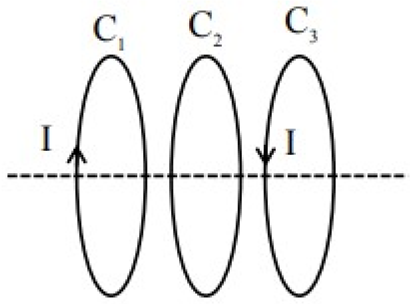


$\vec{E}_{\text{net}} = 2E_0\cos 30°(-\hat{i}) + 2E_0 \sin 30°(\hat{j})$

$= \frac{2kQ}{r^2}\left[\frac{\sqrt{3}}{2}(-\hat{i}) + \frac{1}{2}\hat{j}\right]$

$= \frac{-Q}{4\pi\varepsilon_0 r^2}\left(\sqrt{3} \ \hat{i} - \hat{j}\right)$

Q27 Solution:
(1)



Magnetic field through the coil is

$\vec{B} = \left(B_{c_2} - B_{c_1}\right)\hat{i}$

$\phi = \left(B_{c_2} - B_{c_1}\right)A$

$\varepsilon = \frac{-d\phi}{dt}$

Find the direction according to Lenz's law.

If the coil moves away, then the magnetic field decreases and vice versa.

Correct Ans. (1)

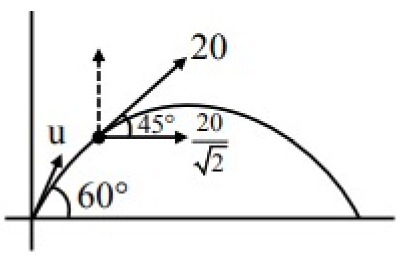
Q28 Solution:
(4)

According to Pascal's law, pressure at any point in a liquid at rest is the same in all directions.

It exists at every point in the liquid, not just at the boundaries. So statement (1) is false.

For an interior molecule, the net cohesive forces are zero. Hence statement (2) is correct.

Q29 Solution:
(3)



$u\cos60° = \frac{20}{\sqrt{2}}$

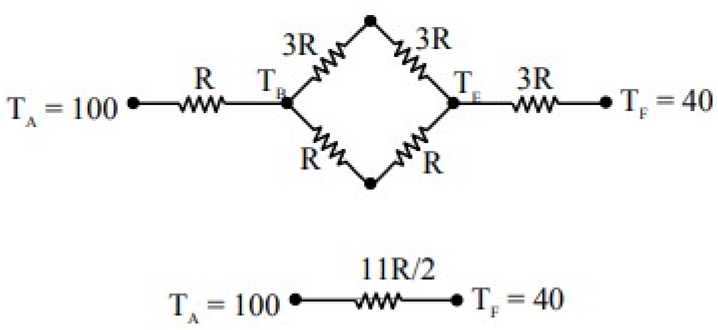
$\frac{u}{2} = \frac{20}{\sqrt{2}}$

$u = \frac{40}{\sqrt{2}}$

$u = 20\sqrt{2}\ \text{m/s}$

Q30 Solution:
(1)

Let $\left[R = \frac{\ell}{3KA}\right]$



$H = \left[\frac{100 - 40}{\frac{11R}{2}}\right] \quad ...\left(1\right)$

$H = \frac{100 - T_B}{R} \quad ...\left(2\right)$

$H = \frac{T_E - 40}{3R} \quad ...\left(3\right)$

Using (1) and (2)

$120 = 1100 - 11T_A$

$T_B = 89°C$

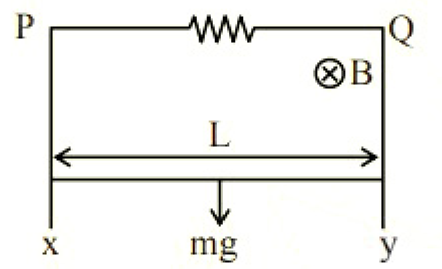
Using (1) and (3)

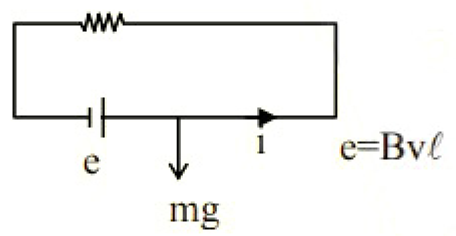
$T_E = 73°C$

Q31 Solution:
(4)

(Dropped)

Q32 Solution:
(2)





At equilibrium (or for terminal velocity)

$mg = IB\ell \Rightarrow mg = \left(\frac{Bv\ell}{R}\right)B\ell$

$V = \frac{mgR}{B^2\ell^2}$

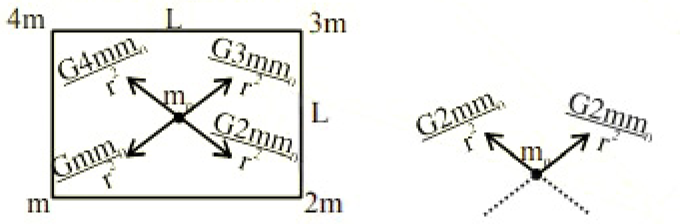
Q33 Solution:
(1)

$h\nu = \left(4 \times 4.002 - 15.348\right) \times 1.66 \times 10^{-27} \times \left(3 \times 10^8\right)^2$

$\nu = 14.94 \times 10^{19}$ kHz

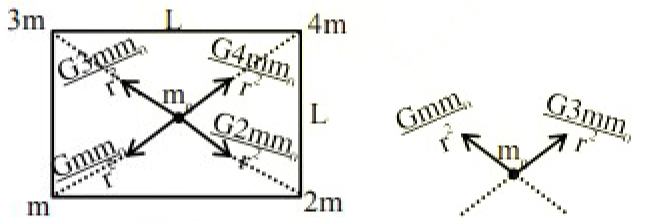
Q34 Solution:
(4)

Initial configuration



$$F = 2\sqrt{2}\frac{Gmm_0}{r^2}$$

New configuration



$$F' = \sqrt{10}\frac{Gmm_0}{r^2} \Rightarrow \frac{F}{F'} = 2\sqrt{2}.\frac{1}{\sqrt{10}} = \frac{2}{\sqrt{5}}$$

$\therefore \alpha = 2$

Q35 Solution:
(2)

$I = \frac{7}{5}\left[m_1R_1^2 + m_2R_2^2\right]$

$= \frac{7}{5}\left[5(10)^2 + 10(20)^2\right] \times 10^{-4}$

$I = 63 \times 10^{-2}\ \text{kg m}^2$

$I = 0.63\ \text{kg m}^2$

Q36 Solution:
(4)

$\vec{E} = 10x\hat{i} + 5y\hat{j}$

$V_{\text{at}(10,20)} = 500\ \text{V}$

$\Delta V = -\int \vec{E} \cdot d\vec{r}$

$500 - V_0 = -\int_{(0,0)}^{(10,20)} \left(10x\hat{i} + 5y\hat{j}\right) \cdot \left(dx\hat{i} + dy\hat{j}\right)$

$500 - V_0 = -\left[5x^2 + \frac{5y^2}{2}\right]_{(0,0)}^{(10,20)}$

$V_0 - 500 = \left(500 + 5 \times \frac{400}{2}\right) - \left(0 - 0\right)$

$V_0 - 500 = 500 + 1000$

$V_0 = 2000\ \text{V}$

Q37 Solution:
(1)

(A) $F = Kx$

$\left[MLT^{-2}\right] = \left[K\right]\left[L\right]$

$\left[K\right] = ML^0T^{-2}$

(B) Thermal conductivity

$\frac{dQ}{dt} = \frac{kA}{\ell}\Delta T$

$ML^2T^{-3} = \frac{[k]L^2K}{L}$

$[k] = MLT^{-3}K^{-1}$

(C) Boltzmann constant

$[K] = ML^2T^{-2}K^{-1}$

(D) Inductive reactance

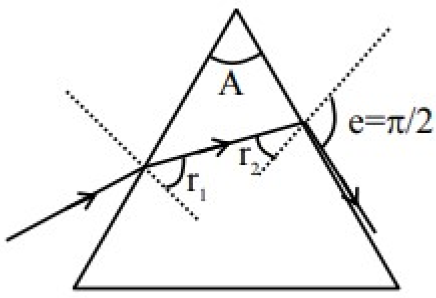
$\frac{[V]}{[I]} = \frac{ML^2T^{-3}A^{-1}}{A}$

$= ML^2T^{-3}A^{-2}$

Q38 Solution:
(1)

Equilateral prism

$A = 60°$



$\mu \sin r_2 = 1 \cdot \sin e = 1$

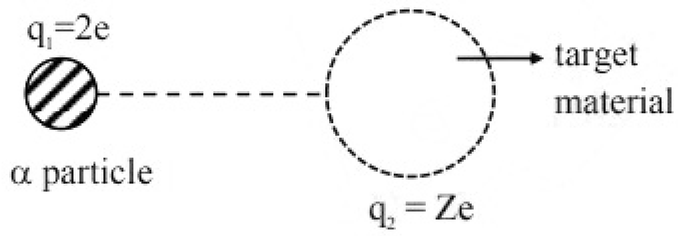
$\sin r_2 = \frac{1}{\mu} = \frac{1}{\sqrt{2}}$

$r_2 = 45°$

$\therefore \quad r_1 = A - r_2 = 15°$

Q39 Solution:
(4)

By mechanical energy conservation



$(\text{ME})_i = (\text{ME})_f$

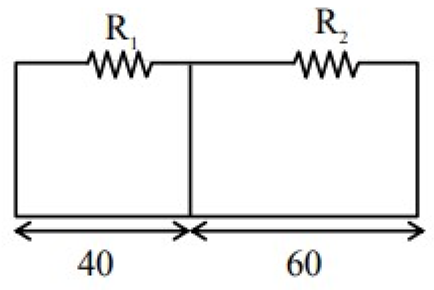
$PE_i + KE_i = PE_f + KE_f$

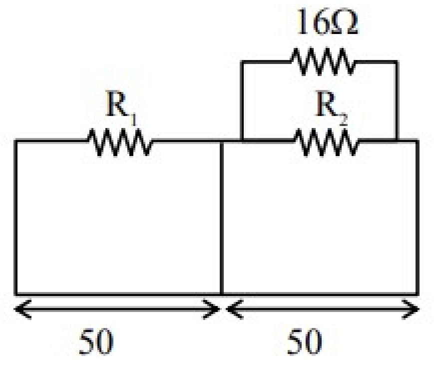
$0 + 7.9 \times 10^6 \times 1.6 \times 10^{-19} = \frac{k(2e)(Ze)}{r} + 0$

$r = \frac{9 \times 10^9 \times 2 \times (1.6 \times 10^{-19})^2 \times 79}{7.9 \times 10^6 \times 1.6 \times 10^{-19}} = 2.88 \times 10^{-14}$ m

For diameter $\Rightarrow D = 2r = 5.76 \times 10^{-14}$ m

Q40 Solution:
(4)





$\frac{R_1}{R_2} = \frac{40}{60} = \frac{2}{3} \quad ...(1)$

$\frac{R_1}{\left(\frac{R_2 \times 16}{R_2 + 16}\right)} = \frac{50}{50} \Rightarrow R_1 = \frac{16R_2}{16 + R_2} \quad ...(2)$

$\frac{2}{3}R_2 = \frac{16R_2}{16 + R_2}$

$\frac{32}{3} + \frac{2R_2}{3} = 16$

$\frac{2R_2}{3} = 16 - \frac{32}{3} = \frac{16}{3}$

$R_2 = 8\Omega$

By equation (1)

$R_1 = \frac{2}{3}R_2 = \frac{16}{3}\Omega$

Q41 Solution:
(3)

$V_e = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G \times \rho \times \frac{4\pi R^3}{3}}{R}} \Rightarrow V_e \propto \sqrt{\rho} \times R$

$\frac{(V_e)_B}{(V_e)_A} = \sqrt{\frac{\rho_B}{\rho_A}} \times \frac{R_B}{R_A} = \sqrt{\frac{0.1\rho_A}{\rho_A}} \times \left(\frac{0.1R_A}{R_A}\right)$

$\frac{(V_e)_B}{(V_e)_A} = \frac{1}{10} \times \frac{1}{\sqrt{10}}$

$(V_e)_B = \frac{10 \times 1000}{10\sqrt{10}} = 100\sqrt{10}$ m/sec

Q42 Solution:
(4)

$PV^\gamma =$ constant

$TV^{\gamma - 1} =$ constant

$TV^{\gamma - 1} = \left(\frac{T}{4}\right)(8V)^{(\gamma - 1)}$

$4 = 8^{(\gamma - 1)}$

$2^2 = 2^{3\gamma - 3}$

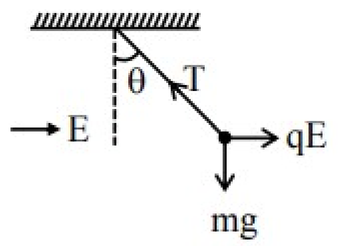
$2 = 3(\gamma - 1)$

$\gamma = \frac{5}{3}$

Gas is a monoatomic gas.

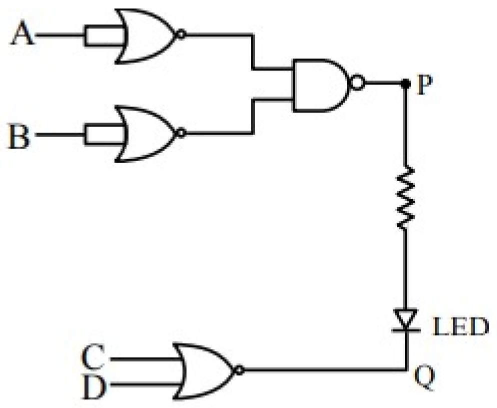
Answer is He.

Q43 Solution:
(4)



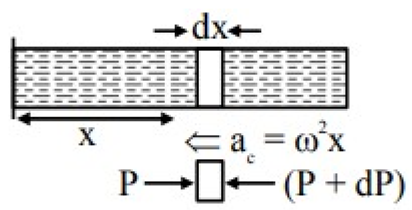
$T = \sqrt{(qE)^2 + (mg)^2}$

Q44 Solution:
(4)



LED will glow in forward biasing:
P higher potential – 1
Q lower potential – 0

Q45 Solution:
(1)



$A[(P + dP) - P] = (dm)(\omega^2 x)$

$dP = \frac{(dm)}{A}\omega^2 x$

$dP = \frac{(\rho)(A)(dx)\omega^2 x}{A}$

also $[PM = \rho RT]$

$\rho = \frac{PM}{RT}$

$dP = \left(\frac{PM}{RT}\right)\omega^2 x dx$

$\int_{P_A}^{P_B} \frac{dP}{P} = \frac{\omega^2 M}{RT}\int_0^{\ell} x dx$

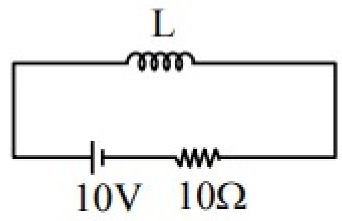
$$\ell n\left(\frac{P_B}{P_A}\right) = \frac{\omega^2\ell^2 M}{2RT}$$

$$P_B = P_A \;\; e^{\frac{M\omega^2\ell^2}{2RT}}$$

Q46 Solution:
(20)

$L = 10 \times 10^{-3}$ H

$N = 10^4$



$I_0 = \frac{10}{10} = 1\text{A} \quad \left(\text{max current}\right)$

$I = \frac{1}{e}$

$E_d = \frac{B^2}{2\mu_0}$

$B = \mu_0 n I$

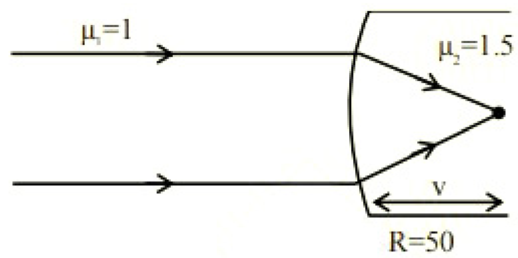
$L = \mu_0 n^2 \pi R^2 \ell$

$E_d = \frac{\mu_0 n^2 I^2}{2}$

$= \frac{4\pi \times 10^{-7} \times 10^8 \times \frac{1}{e^2}}{2}$

$= \frac{20\pi}{e^2}$

Q47 Solution:
(100)



$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R} \Rightarrow \frac{1.5}{v} - \frac{1}{\infty} = \frac{1.5 - 1}{50}$

$V = 150$ cm

$x \rightarrow$ measure from center

$x = V - R$

$= 150 - 50 = 100$ cm

Q48 Solution:
(4)

$n = \frac{C}{V}$

$V = \frac{\omega}{k} = \frac{4.5 \times 10^{14}}{3 \times 10^6} = \frac{3}{2} \times 10^8$

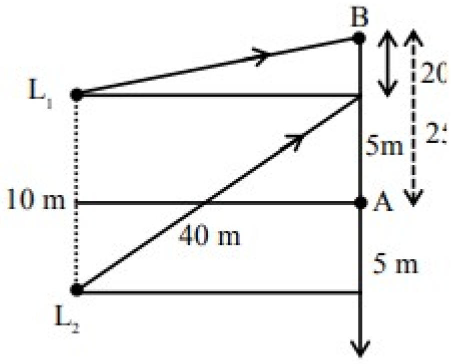
$n = 2$

$n = \sqrt{\mu_r \varepsilon_r} \quad \left(\mu_r = 1\right)$

$2 = \sqrt{\varepsilon_r}$

$\varepsilon_r = 4$

Q49 Solution:
(600)



Point B will be 10^{th} maxima

$\Delta x = L_2B - L_1B$

$L_1B = \sqrt{20^2 + 40^2} = 20\sqrt{5}\,\text{m} = 44.6\text{m}$

$L_2B = \sqrt{40^2 + 30^2} = 50\text{m}$

$\Delta x = 50 - 44.6 = 5.4\text{m}$

$\Delta x = n\lambda$

$5.4 = 10 \times \lambda$

$\lambda = 0.54\text{m}$

$V = f\lambda$

$f = \frac{324}{0.54} = 600\text{Hz}$

Q50 Solution:
(16)

$m_1 = \pi R_1^2 T_1 \rho \quad m_2 = \pi R_2^2 T_2 \rho$

$I_1 = \frac{m_1 R_1^2}{2} \quad I_2 = \frac{m_2 R_2^2}{2}$

$I_1 = I_2$

$\frac{\pi R_1^2 T_1 \rho R_1^2}{2} = \frac{\pi R_2^2 T_2 \rho R_2^2}{2} \Rightarrow \frac{T_1}{T_2} = \frac{1}{16}$

3 - JEE Main Chemistry 22-Jan 2026 Shift -1

Q51 Solution:
(2)

Rate of $S_N1 \propto$ Stability of $C^{\oplus}$ formed

(I) and (II) are unstable due to Bredt's rule, (I) has more +I effect.

$(II) < (I) < (III) < (IV)$

Q52 Solution:
(3)

Order of nucleophilicity:

$I^- > C_2H_5O^- > PhO^- > F^-$

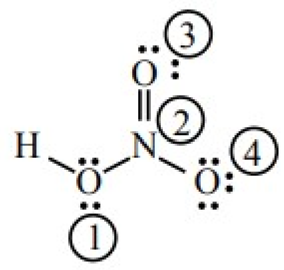
Q53 Solution:
(3)

$XF_3 = BF_3\ ;\ sp^2$

$YF_3 = NF_3\ ;\ sp^3$

Q54 Solution:
(3)

Consider the structure of HNO_3



1 : 0
2 : (+1)
3 : 0
4 : (-1)

Formal charge = valence e's - non bonding e's-$\left(\frac{\text{bonding electrons}}{2}\right)$

Q55 Solution:
(2)

$E_n = -R_H \times \frac{Z^2}{n^2}$

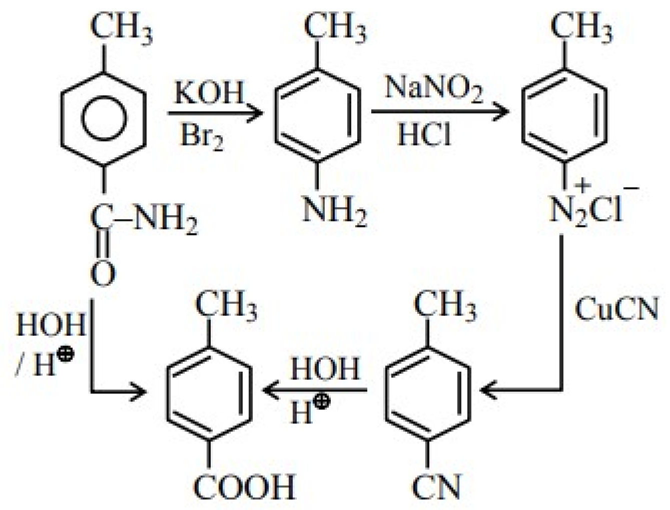
$\Delta E = 2.18 \times 10^{-11} \times 10^{-7} \times 1^2\left[\frac{1}{1^2} - \frac{1}{2^2}\right]$

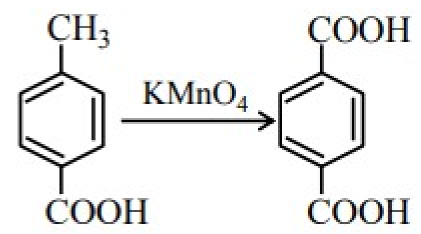
$= 1.635 \times 10^{-18}$ Joule/atom

$= 1.635 \times 10^{-18} \times 6.02 \times 10^{23}$ Joule/mole

$= 9.835 \times 10^5$ Joule/mole

Q56 Solution:
(3)





Q57 Solution:
(1)

$Cu \xrightarrow{\text{dil. HCl}} \text{no reaction}$

$CuSO_4 \xrightarrow{KCN} \underset{\text{perfect complex}}{\left[Cu(CN)_4\right]^{3-}} \xrightarrow{H_2S} \text{no sulphide ppt}$

Q58 Solution:
(4)

$C_{12}H_{22}O_{11} + H_2O \xrightarrow{HCl} C_6H_{12}O_6 + C_6H_{12}O_6$

D-Glucose + D-Fructose

$[\alpha]_{\text{D-sucrose}} = +66.5°,\ [\alpha]_{\text{D-glucose}} = +52.5°,\ [\alpha]_{\text{D-fructose}} = -92.4°$

$\Rightarrow$ Sucrose is dextrorotatory and the hydrolysed product is laevorotatory.

Q59 Solution:
(3)

$HF < HCl < HBr < HI$ (bond length order)

F<Cl<Br<I (radius order)

$PH_3 < AsH_3 < NH_3 < SbH_3 < BiH_3$ (Boiling point order)

Maximum possible covalency of phosphorus is 6

Q60 Solution:
(1)

$Co^{3+} \rightarrow 3d^6 \Rightarrow t_{2g}^{2,2,2}\ e_g^{0,0}$, unpaired electron = 0

$Fe^{3+} \rightarrow 3d^5 \Rightarrow t_{2g}^{2,2,1}\ e_g^{0,0}$, unpaired electron = 1

$Cr^{3+} \rightarrow 3d^3 \Rightarrow t_{2g}^{1,1,1}\ e_g^{0,0}$, unpaired electron = 3

$Mn^{3+} \rightarrow 3d^4 \Rightarrow t_{2g}^{2,1,1}\ e_g^{0,0}$, unpaired electron = 2

Q61 Solution:
(2)

K_H depends on the nature of gas and solvent.

Q62 Solution:
(4)

$2Al\ (s) + 6HCl\ (aq) \rightarrow 2Al^{3+}\ (aq) + 6Cl^{-}(aq) + 3H_2(g)$

Mole of H_2 produced

$= 2 \times$ mole of HCl used

$= \frac{2}{3} \times$ mole of Al used

Q63 Solution:
(4)

From Henry's law:

$P(g) = K_H . X(g)$

$\log P(g) = \log K_H + \log X(g)$

Q64 Solution:
(3)

Theoretical (NCERT Based)

Q65 Solution:
(3)

Chlorocyclohexane is more polar due to $-I$ effect of $-Cl$,

Whereas chlorobenzene has $-I > +M$, so it is less polar & also has partial double bond character.

Q66 Solution:
(1)

Element E is N, the species is NH_4^+, among B, C, N and O, N has highest first ionization energy.

Q67 Solution:
(4)

Nitrobenzene does not give Friedel–Craft acylation since it is highly deactivated ring.

Q68 Solution:
(2)

For 1st order reaction

Rate = k[A]

with decrease in concentration of A, rate of reaction decreases.

Q69 Solution:
(1)

Option (A)

$W = -nRT\ln\frac{V_2}{V_1}$

$= \frac{-2\times 8.314\times 300}{1000}\times \ln\left(\frac{20}{2}\right)\text{kJ}$

$= -11.5\text{kJ}$

Option (B)

$W = -P_{\text{ext}}[V_2 - V_1]$

$= -3[3-1]$

$= -6\text{kJ}$

Option (C)

$\Delta U = nC_v\Delta T$

$= 1\times\frac{3}{2}\times\frac{8.314\times 320}{1000}\text{kJ}$

$= 3.99\text{kJ}$

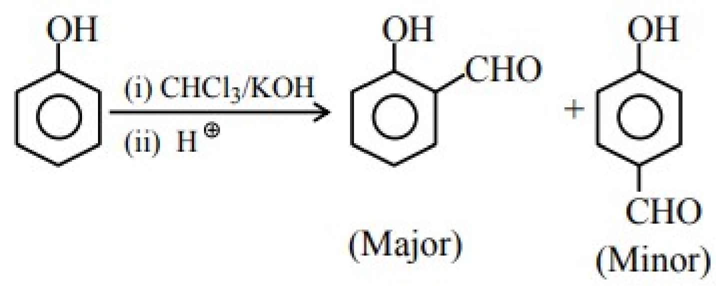
Option (D)

$\Delta H = nC_p\Delta T$

$= 1\times\frac{5}{2}\times\frac{8.314\times 337}{1000}\text{kJ}$

$= 7\text{kJ}$

Q70 Solution:
(1)



(can be separated by steam distillation)

Q71 Solution:
(1303)

$10^4 e^{-\frac{24000}{T}} = 10^6 e^{-\frac{30000}{T}}$

$e^{\frac{6000}{T}} = 100$

$\frac{6000}{T} = 2\ln 10$

$T = \frac{6000}{2\times 2.303}$

$T = 1302.64\text{ K}$

$T \approx 1303\text{ K}$

Q72 Solution:
(43)

Iodine gives violet colour

$$\% \text{ of I } = \frac{\text{Atomic weight of I}}{\text{Molecular weight of AgI}} \times \frac{m}{W} \times 100$$

$$= \frac{127}{235} \times \frac{0.12}{0.15} \times 100$$

$$\% \text{ of I } = 43.23\% \approx 43\%$$

Q73 Solution:
(33)

$$-1.664 \times 10^3 = -8.3 \times 300 \ln K_p$$

$$\ln K_p = 0.693$$

$$K_p = 2$$

$$2 = \frac{4\alpha^2 P_0}{1-\alpha^2}$$

$$\alpha = \frac{1}{\sqrt{3}}$$

$$\alpha = \left(\frac{100}{3} \times 10^{-2}\right)^{1/2}$$

$$= \left(33.33 \times 10^{-2}\right)^{1/2}$$

Q74 Solution:
(4)

$$E^\circ_{\text{cell}} = -0.44 - (-0.90)$$

$$= +0.46 \text{ V}$$

Applying Nernst equation:

$$E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.06}{n} \log Q$$

$$E_{\text{cell}} = 0.46 - \frac{0.06}{6} \log 10^6$$

$$E_{\text{cell}} = 4 \times 10^{-1}$$

$$x = 4$$

Q75 Solution:
(66)

$$C_6H_{10} \xrightarrow{Br_2} C_6H_{10}Br_2$$

Molecular mass of $C_6H_{10}Br_2$ is:

$$12 \times 6 + 10 + 160$$

$$72 + 10 + 160 = 242$$

$$\% \text{ of Br} = \frac{160}{242} \times 100$$

$$\% \text{ of Br} = 66.11\% \approx 66\%$$