Q1

maths 27-JAN-2shift

Solve:-

Sample space total Number of ball = 15 without replacement.

$$P(A) = \frac{{}^{6}C_4}{{}^{15}C_4} \times \frac{{}^{9}C_4}{{}^{11}C_4}$$

$$= \frac{6\times 5\times 4!}{4!\ 2\times 1} \times \frac{9\times 8\times 7\times 6\times 5!}{5!\ 4\times 3\times 2\times 1}$$

$$\frac{15\times 14\times 13\times 12\times 11!}{11!\ 4\times 3\times 2\times 1} \times \frac{11\times 10\times 9\times 8\times 7!}{4\times 3\times 2\times 1\times 7!}$$

$$= \frac{3}{5\times 13\times 11}$$

$$\boxed{= \frac{3}{715}}$$

Q-2

Solve $\frac{x^2}{16} - \frac{y^2}{9} = 1$

$b^2 = a^2(e^2-1)$

$9 = 16(e^2-1)$

$e^2-1 = \frac{9}{16}$

$e^2 = \frac{9}{16}+1$

$e = \sqrt{\frac{25}{16}}$

$e_1 = \frac{5}{4}$

$e_1 e_2 = 1$

$e_2 = \frac{1}{5}\times 4$

$e_2 = \frac{4}{5}$

$a = 5,\ b = 3$

equation of ellipse

$\frac{x^2}{25} + \frac{y^2}{9} = 1$

equation of chord

$T = S_1$

$\frac{x-0}{25} + \frac{2y}{9} \cancel{-1} = 0 + \frac{4}{9} \cancel{-1}$

$y = 2$

If $y = 2$

then

$\frac{x^2}{25} + \frac{4}{9} = 1$

$\frac{x^2}{25} = 1 - \frac{4}{9}$

$x^2 = \frac{125}{9}$

$x = \pm \frac{5\sqrt{5}}{3}$

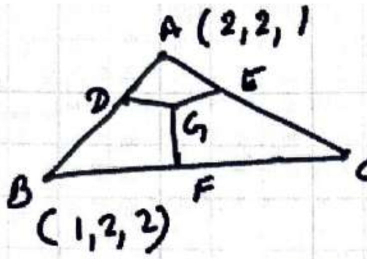
$P\left(\frac{5\sqrt{5}}{3}, 2\right),\ Q\left(-\frac{5\sqrt{5}}{3}, 2\right)$

length of chord

$PQ = \sqrt{\left(\frac{5\sqrt{5}}{3} + \frac{5\sqrt{5}}{3}\right)^2 + (2-2)^2}$

$\boxed{= \frac{10\sqrt{5}}{3}}$

(7)



$\triangle ABC$ is equilateral

Orthocentre and Centroid will be same

Co-ordinate of $G = \left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}, \frac{z_1+z_2+z_3}{3}\right)$

Co-ordinate $G = \left(\frac{5}{3}, \frac{5}{3}, \frac{5}{3}\right)$

Mid point of AB is $D\left(\frac{2+1}{2}, \frac{2+2}{2}, \frac{1+2}{2}\right)$

$D\left(\frac{3}{2}, 2, \frac{3}{2}\right)$

$GD = l_1 = l_2 = l_3 = \sqrt{\left(\frac{5}{3}-\frac{3}{2}\right)^2 + \left(\frac{5}{3}-2\right)^2 + \left(\frac{5}{3}-\frac{3}{2}\right)^2}$

$= \sqrt{\left(\frac{1}{6}\right)^2 + \left(\frac{-1}{3}\right)^2 + \left(\frac{1}{6}\right)^2}$

$= \sqrt{\frac{1}{36} + \frac{1}{9} + \frac{1}{36}}$

$= \sqrt{\frac{1+4+1}{36}}$

$= \sqrt{\frac{1}{6}}$

$\therefore l_1^2 + l_2^2 + l_3^2 = \sqrt{\frac{1}{6} + \frac{1}{6} + \frac{1}{6}}$

$= \sqrt{\frac{3}{6}}$

$= \sqrt{\frac{1}{2}}$

⑥

$$I = \int_0^{\pi} \frac{dx}{1-2a\cos x + a^2} \quad \text{---(i)}$$

$$I = \int_0^{\pi} \frac{dx}{1-2a\cos(\pi - x) + a^2}$$

$$I = \int_0^{\pi} \frac{dx}{1+2a\cos x + a^2} \quad \text{---(ii)}$$

Add (i) + (ii)

$$2I = \int_0^{\pi} \frac{dx}{1-2a\cos x + a^2} + \int_0^{\pi} \frac{dx}{1+2a\cos x + a^2}$$

$$2I = \int_0^{\pi} \frac{1+2a\cos x + a^2 + 1 - 2a\cos x + a^2}{(1+a^2)^2 - (2a\cos x)^2} dx$$

$$2I = \int_0^{\pi} \frac{2(1+a^2)}{(1+a^2)^2 - 4a^2\cos^2 x} dx$$

$$\cancel{2}I = \cancel{2}\int_0^{\pi/2} \frac{2(1+a^2)}{(1+a^2)^2 - 4a^2\cos^2 x} dx$$

$$I = \int_0^{\pi/2} \frac{2(1+a^2)\sec^2 x}{(1+a^2)^2\sec^2 x - 4a^2} dx$$

$$= \int_0^{\pi/2} \frac{\frac{2\sec^2 x\, dx}{1+a^2}}{\tan^2 x + \left(\frac{1-a^2}{1+a^2}\right)^2}$$

Let $\tan x = t$ $\quad x=0, t=0$

$\sec^2 x\, dx = dt$ $\quad x = \pi/2, t = \infty$

$$= \int_0^{\infty} \frac{\frac{2\,dt}{1+a^2}}{t^2 + k^2} \qquad \text{Let } k = \left(\frac{1-a^2}{1+a^2}\right)$$

$$= \frac{2}{1+a^2} \int_0^{\infty} \frac{dt}{t^2+k^2}$$

$$= \frac{2}{1+a^2} \cdot \frac{1}{k} \left[\tan^{-1}\left(\frac{t}{k}\right)\right]_0^{\infty}$$

$$= \frac{2}{1+a^2} \times \frac{1+a^2}{1-a^2} \left(\tan^{-1}\infty - \tan^{-1} 0\right)$$

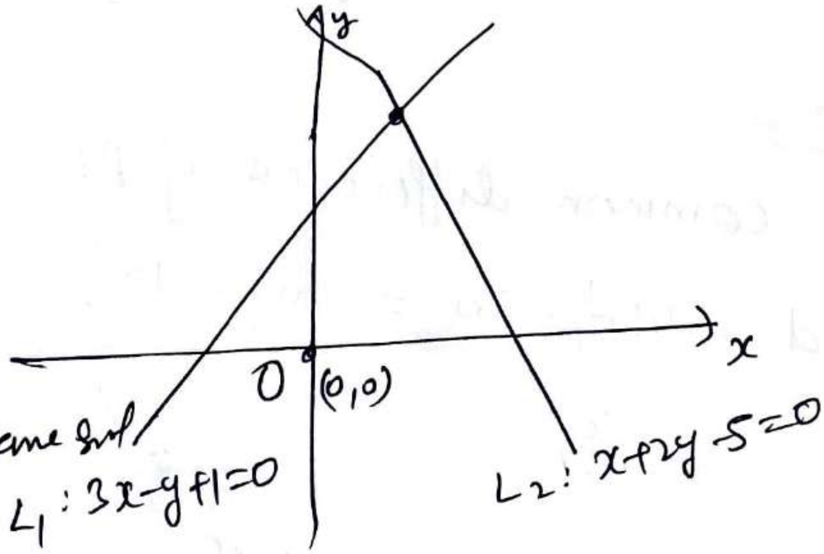
$$I = \frac{2}{1-a^2} \cdot \left(\frac{\pi}{2} - 0\right)$$

$$\boxed{I = \frac{\pi}{1-a^2}}$$

Solve:-

$P(a^2, a+1)$

$L_1 \Rightarrow 3x-y+1=0$



Origin and Point lies Same side

$L_1(O)\, L_1(P) > 0$

$3a^2 - a \cancel{-1} \cancel{+1} > 0$

$3a^2 - a > 0$

$a(3a-1) > 0$

$a \in (-\infty, 0) \cup (\frac{1}{3}, \infty)$ --- (1)

$L_2 \Rightarrow x+2y-5=0$

also also origin and point lies same side

$L_2(O) \cdot L_2(P) > 0$

$(-5)(a^2+2(a+1)-5) > 0$

$(a+3)(a-1) < 0$

$a \in (-3, 1)$ — (2)

Intersections (1) and (2)

$a \in (-3, 0) \cup (\frac{1}{3}, 1)$

Q-3

Solve :

common difference of AP.

$d = 19\frac{1}{4} - 20 = 18\frac{1}{2} - 19\frac{1}{4}$

$= -\frac{3}{4}$

$AP = -129\frac{1}{4}, \; \cdots\cdots 20$

$a = -129\frac{1}{4}$

$d = \frac{3}{4}$

∴ Required term $= -129\frac{1}{4} + (20-1)\frac{3}{4}$

$\boxed{= -115}$

(5)

Solve:-

$$f : R - \left\{-\frac{1}{2}\right\} \to R$$

$$g : R - \left\{-\frac{5}{2}\right\} \to R$$

$$f(g(x)) = \frac{2g(x)+3}{2g(x)+1}$$

$$x \neq -\frac{5}{2} \quad \& \quad g(x) \neq -1/2$$

$$\frac{|x|+1}{2x+5} \neq -1/2$$

$$x \in R - \left\{\frac{5}{2}\right\} \text{ and } x \in R$$

$$\boxed{\begin{array}{l}\text{Domain of fog} \\ \quad x \in R - \left\{\frac{5}{2}\right\}\end{array}}$$

⑧

Solve $\tan^{-1}x + \tan^{-1}(2x) = \tan^{-1}\left(\frac{x+2x}{1-x\cdot 2x}\right)$

$$\frac{\pi}{4} = \tan^{-1}\left(\frac{3x}{1-2x^2}\right)$$

$$\tan\left(\frac{\pi}{4}\right) = \frac{3x}{1-2x^2}$$

$$1-2x^2 = 3x$$

$$2x^2+3x-1 = 0$$

$$x = \frac{-3 \pm \sqrt{9+8}}{4}$$

$$= \frac{-3+\sqrt{17}}{4} \, ; \, \frac{-3-\sqrt{17}}{4}$$

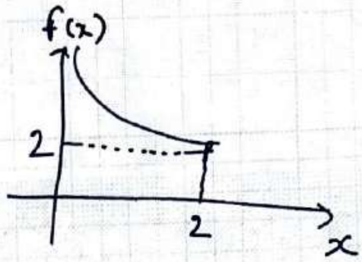
Only Possible Value $= \frac{-3+\sqrt{17}}{4}$

$\boxed{\text{Only 1 Value}}$

9

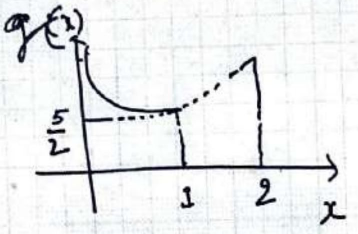
Consider the function $f:(0,2)\rightarrow R$; $f(x) = \frac{x}{2}+\frac{2}{x}$

$$f'(x) = \frac{1}{2} - \frac{2}{x^2}$$



$$g(x) = \begin{cases} \frac{x}{2}+\frac{2}{x} & 0<x\leq 1 \\ \frac{3}{2}+x & 1<x<2 \end{cases}$$

$\downarrow$



$g'(x) = \frac{1}{2} - \frac{2}{x^2}$ at $x=1$

LHD $= -\frac{3}{2}$

RHD $= 3/2$

$g'(1)$ is not differentiable at $x=1$

g is Continuous but not differentiable at $x=1$

10

$$\Rightarrow \lim_{x\to 0} \frac{3+\alpha\left(x-\frac{x^3}{3!}+\frac{x^5}{5!}-\cdots\right)+\beta\left(1-\frac{x^2}{2!}+\frac{x^4}{4!}+\cdots\right)+\left(-x-\frac{x^2}{2}-\frac{x^3}{3}\cdots\right)}{3\tan^2 x}=\frac{1}{3}$$

$$\Rightarrow \lim_{x\to 0} \frac{(3+\beta)+(\alpha-1)x+\left(-\frac{1}{2}-\frac{\beta}{2}\right)x^2+\cdots}{3x^2}\times\frac{x^2}{\tan^2 x}=\frac{1}{3}$$

$$\Rightarrow \quad \beta+3=0, \quad \alpha-1=0 \quad \text{and} \quad \frac{-\frac{1}{2}-\frac{\beta}{2}}{3}=\frac{1}{3}$$

$$\Rightarrow \quad \beta=-3, \ \alpha=1$$

$$\Rightarrow \boxed{2\alpha-\beta = 2+3=5}$$

Solve :-

$$\alpha = \frac{(4!)!}{(4!)^{3!}}$$

$$\beta = \frac{(5!)!}{(5!)^{4!}}$$

$$\alpha = \frac{(24)!}{(4!)^6}$$

$$\beta = \frac{(120)!}{(5!)^{24}}$$

Let 24 distinct objects are divided into 6 groups of 4 objects in each group.

No. of ways of formation of group $= \frac{24!}{(4!)^6 6!} \in N$

$\alpha \in N$

Similarly

Let 120 distinct objects are divided into 24 groups of 5 objects in each group.

No. of ways of formation of groups

$$= \frac{(120)!}{(5!)^{24}\, 24!} \in N$$

$\beta \in N$

#12

$x^2 - x - 1 = 0$

α, β are the root of eq^n

$S_{n-1} + S_{n-2} = 2023\alpha^{n-1} + 2024\beta^{n-1} + 2023\alpha^{n-2} + 2024\beta^{n-2}$

$= 2023\alpha^{n-2}(1+\alpha) + 2024\beta^{n-2}(1+\beta)$

$= 2023\alpha^{n-2}(\alpha^2) + 2024\beta^{n-2}(\beta^2)$

$= 2023\alpha^n + 2024\beta^n$

$S_{n-1} + S_{n-2} = S_n$

$n = 12$

$\boxed{S_{11} + S_{10} = S_{12}}$

$$2^m = 2^n + 56$$

$$2^m - 2^n = 2^3 \times 7$$

$$2^n\left(2^{m-n} - 1\right) = 2^3 \times 7$$

$$n = 3$$

$$2^{m-n} - 1 = 7$$

$$2^{m-n} = 2^3$$

$$m - n = 3$$

$$m = 6$$

$P(6,3)$ and $Q(-2,-3)$

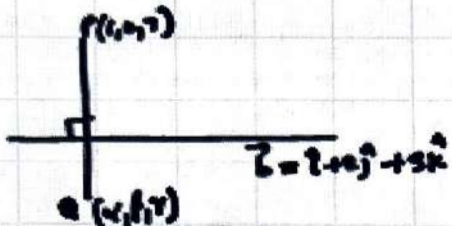
$$|PQ| = \sqrt{(6+2)^2 + (3+3)^2}$$

$$= \sqrt{64+36}$$

$$\boxed{|PQ| = 10}$$

12

$L_1 = \frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3} = \lambda$



$M(\lambda, 1+2\lambda, 2+3\lambda)$

$\vec{PM} = (\lambda-1)\hat{i} + (1+2\lambda)\hat{j} + (3\lambda-5)\hat{k}$

$\vec{PM}$ is $\perp$ to L_1

$\vec{PM} \cdot \vec{b} = 0$

$\lambda - 1 + 4\lambda + 2 + 9\lambda - 15 = 0$

$14\lambda = 14 \rightarrow \lambda = 1$

$\therefore M = (1, 3, 5)$

$\vec{Q} = 2\vec{M} - \vec{P}$

$\vec{Q} = 2\hat{i} + 6\hat{j} + 10\hat{k} - \hat{i} - 7\hat{k}$

$\vec{Q} = \hat{i} + 6\hat{j} + 3\hat{k}$

$\therefore (\alpha, \beta, \gamma) = (1, 6, 3)$

Required line having direction cosine (l, m, n)

$l^2 + m^2 + n^2 = 1$

$\Rightarrow l^2 + \left(-\frac{1}{2}\right)^2 + \left(-\frac{1}{\sqrt{2}}\right)^2 = 1$

$l^2 = \frac{1}{4}$

$l = \frac{1}{2}$

Equation of line passing through $(1, 6, 3)$ is

$\vec{r} = (\hat{i} + 6\hat{j} + 3\hat{k}) + k\left(\frac{1}{2}\hat{i} - \frac{1}{2}\hat{j} - \frac{1}{\sqrt{2}}\hat{k}\right)$

Satisfying $k = 4$

$\vec{r} = 3\hat{i} + 4\hat{j} + (3 - 2\sqrt{2})\hat{k}$

Point $= (3, 4, 3 - 2\sqrt{2})$

$$\begin{vmatrix} 1 & \frac{3}{2} & \frac{2\alpha+3}{2} \\ 1 & \frac{1}{3} & \frac{3\alpha+1}{3} \\ 2\alpha+3 & 3\alpha+1 & 0 \end{vmatrix} \Rightarrow \frac{1}{2}\times\frac{1}{3}\begin{vmatrix} 2 & 3 & 2\alpha+3 \\ 3 & 1 & 3\alpha+1 \\ 2\alpha+3 & 3\alpha+1 & 0 \end{vmatrix} = 0$$

$$(2\alpha+3)((3\alpha+1)3 - 2\alpha-3) - 3\alpha+1(2(3\alpha+1) - 3(2\alpha+3)) = 0$$

$$(2\alpha+3)(9\alpha+\cancel{3}-2\alpha-\cancel{3}) - (3\alpha+1)(\cancel{6\alpha}+2-\cancel{6\alpha}-9) = 0$$

$$(2\alpha+3)(7\alpha) + 7(3\alpha+1) = 0$$

$$14\alpha^2 + 21\alpha + 21\alpha + 7 = 0$$

$$2\alpha^2 + 6\alpha + 1 = 0$$

$$\alpha = \frac{-6 \pm \sqrt{36-8}}{4}$$

$$= \frac{-6 \pm \sqrt{28}}{4} = \frac{-3+\sqrt{7}}{2}, \frac{-3-\sqrt{7}}{2}$$

$$\alpha \in (-3, 0)$$

Q-16

Solve:- $g(x) = 3f\left(\frac{x}{3}\right) + f(x-3)$ and

$f''(x) > 0$

$\forall\ x \in (0,3)$

$\Rightarrow f''(x)$ is increasing function.

$g'(x) = 3 \cdot f'\left(\frac{x}{3}\right) \cdot \frac{1}{3} - f'(x-3)$

If g is decreasing in $(0, \alpha)$

$g'(x) < 0$

$f'\left(\frac{x}{3}\right) - f'(x-3) < 0$

$f'\left(\frac{x}{3}\right) < f'(x-3)$

$\frac{x}{3} < x-3$

$x < \frac{9}{4}$

$\exists\ \alpha = \frac{9}{4}$

$$\boxed{\text{Then } 8\alpha = 8 \times \frac{9}{4} = 18}$$

Q-17

Solve:-

$$2\tan^2\theta - 5\sec\theta = 1$$

$$2(\sec^2\theta - 1) - 5\sec\theta = 1$$

$$2\sec^2\theta - 2 - 5\sec\theta - 1 = 0$$

$$2\sec^2\theta - 5\sec\theta - 3 = 0$$

$$2\sec^2\theta - 0$$

$$(\sec\theta - 3)(2\sec\theta + 1) = 0$$

$$\sec\theta = 3 \quad \times$$

$$\sec\theta = -\tfrac{1}{2}$$

$n = 13$ for 7 solution.

$$S = \sum_{K=1}^{13} \frac{K}{2^K}$$

$$S = \frac{1}{2^1} + \frac{2}{2^2} + \frac{3}{2^3} + \cdots + \frac{12}{2^{12}} + \frac{13}{2^{13}}$$

$$\frac{1}{2}S = \frac{1}{2^2} + \frac{1}{2^3} + \cdots + \frac{12}{2^{13}} + \frac{13}{2^{14}}$$

$$\frac{S}{2} = \frac{1}{2} \cdot \frac{1 - \frac{1}{2^{13}}}{1 - \frac{1}{2}} - \frac{13}{2^{14}}$$

$$S = 2 \cdot \left(\frac{2^{13} - 1}{2^{13}}\right) - \frac{13}{2^{13}}$$

$$\boxed{\sum_{K=1}^{13} \frac{K}{2^K} = \frac{1}{2^{13}}\left(2^{14} - 15\right)}$$

Q-18

Solve:- $(x^2-4)\,dy - (y^2-3y)\,dx = 0$

$$\frac{dy}{y^2-3y} = \frac{dx}{x^2-4}$$

$$= \frac{1}{3}\int \frac{y-(y-3)}{y(y-3)}\,dy = \int \frac{1}{x^2-4}\,dx$$

$$= \frac{1}{3}\int \frac{1}{y-3}\,dy - \frac{1}{3}\int \frac{1}{y}\,dy = \log\left|\frac{x-2}{x+2}\right| + C$$

$$= \frac{1}{3}\ln\left|\frac{y-3}{y}\right| = \ln\left|\frac{x-2}{x+2}\right| + c$$

$y(4) = 3/2$

$x=4,\ y = 3/2$

$$= \frac{1}{3}\ln\left|\frac{\frac{3}{2}-3}{3/2}\right| = \ln\left|\frac{4-2}{4+2}\right| + c$$

$\therefore\ C = \frac{1}{4}\ln 3$

$\therefore\ \frac{1}{3}\ln\left|\frac{y-3}{y}\right| = \frac{1}{4}\ln\left|\frac{x-2}{x+2}\right| + \frac{1}{4}\ln(3)$

At $x=10$

$\frac{1}{3}\ln\left|\frac{y-3}{y}\right| = \frac{1}{4}\ln\left|\frac{2}{3}\right| + \frac{1}{4}\ln 3$

$\ln\left|\frac{y-3}{y}\right| = \ln 2^{3/4}$. $\forall x > 2$

then $\frac{dy}{dx} < 0$

as $y(4) = \frac{3}{2} \Rightarrow y \in (0,3)$

$-y+3 = 8^{1/4} \cdot y$

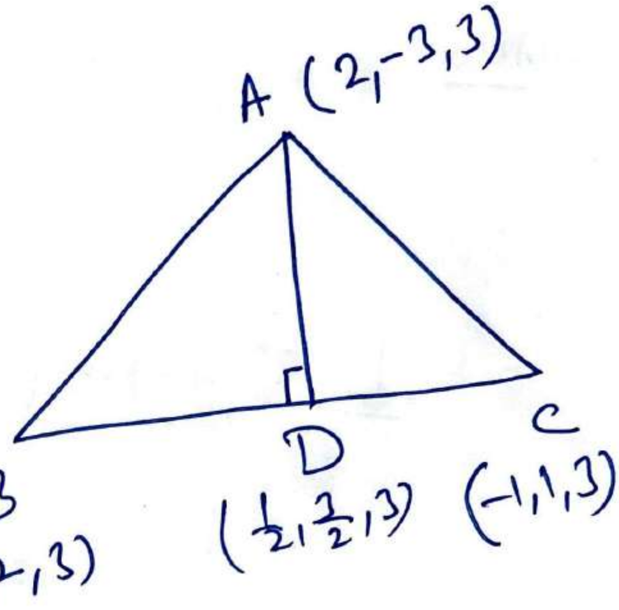
$$\boxed{y = \frac{3}{1+(8)^{1/4}}}$$

(14)

Solve :-

distance $AB = AC = 5$

D in the MidPoint of BC



Mid-Point D co-ordinate

$(\frac{1}{2}, \frac{3}{2}, 3)$

distance $AD = l = \sqrt{(2-\frac{1}{2})^2 + (-3-\frac{3}{2})^2 + (3-3)^2}$

$= \sqrt{\frac{9}{4} + \frac{81}{4} + 0}$

$l = \sqrt{\frac{45}{2}}$

$$\boxed{2l^2 = 45}$$

Q.20

Solve:- $$\int \frac{(x^8 - x^2)}{(x^{12}+3x^6+1)\tan^{-1}\left(x^3+\frac{1}{x^3}\right)}\,dx$$

Let $\tan^{-1}\left(x^3+\frac{1}{x^3}\right) = t$

$$\frac{1}{1+\left(x^3+\frac{1}{x^3}\right)^2}\left(3x^2 - \frac{3}{x^4}\right)dx = dt$$

$$\frac{1}{1+\left(x^6+\frac{1}{x^6}+2\right)} \cdot 3\left(\frac{x^6 - 3}{x^4}\right)dx = dt$$

$$\frac{x^8 - x^2}{(x^{12}+3x^6+1)}\,dx = \frac{dt}{3}$$

$$= \frac{1}{3}\int \frac{dt}{t}$$

$$= \frac{1}{3}\log_e |t| + c$$

$$\boxed{= \log_e\left(\left|\tan^{-1}\left(x^3+\frac{1}{x^3}\right)\right|\right)^{1/3} + c}$$

Q-21

Solve :-

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

$$x = X+h, \quad y = Y+K$$

$$\frac{dY}{dX} = \frac{X+Y}{X-Y}$$

$h+K-2=0$ — (i)
$h-K=0$ — (ii)
eqh (i) & (ii)
$h=K=1$

Let $Y = vX$

$$v + \frac{dv}{dx} = \frac{1+v}{1-v}$$

$$\frac{1-v}{1+v^2}\,dv = \frac{dX}{X}$$

$$\tan^{-1} v - \frac{1}{2}\ln(1+v^2) = \ln|X| + C$$

curve in passing (2,1)

$$\tan^{-1}\left(\frac{y-1}{x-1}\right) - \frac{1}{2}\ln\left(1+\left(\frac{y-1}{x-1}\right)^2\right) = \ln|x-1|$$

$\alpha = 1, \beta = 2$ $\quad \boxed{5\beta + \alpha = 11}$

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Answer :-

$$\frac{x-2}{1} = \frac{y}{-1} = \frac{z-7}{8} = \lambda$$

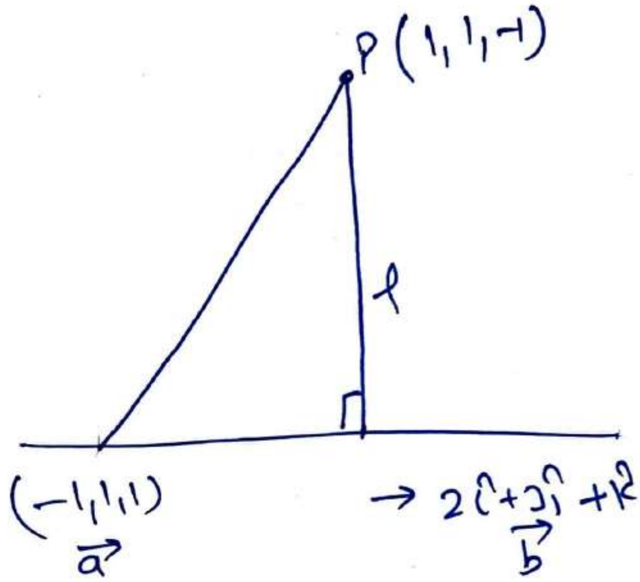
$$\frac{x+3}{4} = \frac{y+2}{3} = \frac{z+2}{1} = K$$

$\Rightarrow \lambda+2 = 4k-3$

$\Rightarrow 8\lambda+7 = k-2$

$\Rightarrow K=1, \lambda=-1$

$\therefore P(1,1,-1)$



Projection of $2\hat{i}-2\hat{k}$ on $2\hat{i}+3\hat{j}+\hat{k}$

$$= \frac{\vec{a}\cdot\vec{b}}{|\vec{b}|}$$

$$= \frac{4-2}{\sqrt{4+9+1}} = \frac{2}{\sqrt{14}}$$

$$\therefore l^2 = 8 - \frac{4}{14} = \frac{108}{14}$$

$$\boxed{14l^2 = 108}$$

(23)

Solve:-

$$2x-y+3=0$$
$$6x+3y+1=0$$
$$\alpha x+2y-2=0$$

will not form a Δ

So these lines are concurrent.

or Parallel to either them.

Case-1

Concurrent lines
$$\begin{vmatrix} 2 & -1 & 3 \\ 6 & 3 & 1 \\ \alpha & 2 & -2 \end{vmatrix}=0$$

$$\Rightarrow \alpha=\frac{4}{5}$$

Case-2 Parallel lines

$$-\frac{\alpha}{2}=-\frac{6}{3} \text{ or } \frac{\alpha}{-2}=2$$

$$\alpha=4, \text{ or } \alpha=-4$$

$$P=16+16+\frac{16}{25}$$

$$\boxed{[P]=\left[32+\frac{16}{25}\right]=32}$$

Q-24

$|z-z_0|^2 = 4$

α is complex number lies of circle

$|\alpha - z_0|^2 = 4$

$(\alpha - z_0)(\overline{\alpha - z_0}) = 4$

$(\alpha - z_0)(\bar{\alpha} - \bar{z_0}) = 4$

$\alpha\bar{\alpha} - \alpha\bar{z_0} - z_0\bar{\alpha} + |z_0|^2 = 4$

$|\alpha|^2 - \alpha\bar{z_0} - z_0\bar{\alpha} + 2 = 4$

$|\alpha|^2 - \alpha\bar{z_0} - z_0\bar{\alpha} = 2$ — (i)

from (i) & (ii)

$|\alpha|^2 + 14|\alpha|^2 = 3$

$15|\alpha|^2 = 3$

$5|\alpha|^2 = 1$

$\boxed{100|\alpha|^2 = 20}$

$|z - z_0|^2 = 16$

$\left(\frac{1}{\bar{\alpha}} - z_0\right)\left(\frac{1}{\alpha} - \bar{z_0}\right) = 16$

$\left(\frac{1}{\bar{\alpha}} - z_0\right)\left(\frac{1}{\alpha} - \bar{z_0}\right) = 16$

$\frac{(1 - \bar{\alpha} z_0)}{\bar{\alpha}}\frac{(1 - \alpha\bar{z_0})}{\alpha} = 16$

$1 - \bar{\alpha} z_0 - \alpha\bar{z_0} + \alpha\bar{\alpha} z_0\bar{z_0} = 16\alpha\bar{\alpha}$

$1 - \bar{\alpha} z_0 - \alpha\bar{z_0} + |\alpha|^2|z_0|^2 = 16|\alpha|^2$

$1 - \bar{\alpha} z_0 - \alpha\bar{z_0} + 2|\alpha|^2 = 16|\alpha|^2$

$1 - \bar{\alpha} z_0 - \alpha\bar{z_0} = 14|\alpha|^2$ — (ii)

Q-25

$|A-xI|=0$

Roots are -1 and 3

Sum of roots $= tr(A) = 2$

Product of roots $= |A| = -3$

Let $A = \begin{bmatrix} a_1 & a_2 \\ a_3 & a_4 \end{bmatrix}$

we have $a_1 + a_4 = 2$

$|A| = a_1a_4 - a_2a_3 = -3$

$$A^2 = \begin{bmatrix} a_1 & a_2 \\ a_3 & a_4 \end{bmatrix} \begin{bmatrix} a_1 & a_2 \\ a_3 & a_4 \end{bmatrix}$$

$$= \begin{bmatrix} a_1^2 + a_2a_3 & a_1a_2 + a_2a_4 \\ a_1a_3 + a_3a_4 & a_2a_3 + a_4^2 \end{bmatrix}$$

diagonal sum $= a_1^2 + a_2a_3 + a_2a_3 + a_4^2$

$= (a_1+a_4)^2 - 2a_1a_4 + 2a_2a_3$

$= 4 - 2(a_1a_4 - a_2a_3)$

$= 4 - 2(-3)$

$$\boxed{\text{Sum} = 10}$$

Q-26

Solve :-

Let the incorrect Mean μ' and S.D σ'

we

$$\mu' = \frac{\sum_{i=1} x_i'}{15} = 12$$

$$\sum x_i' = 180$$

correct information

$$\sum x_i = 180 - 10 + 12 = 182$$

$$\mu = \frac{182}{15}$$

Also

$$\sigma' = \sqrt{\frac{\sum x_i'^2}{15} - 144} = 3$$

$$\frac{\sum x_i'^2}{15} = 9 + 144$$

$$\sum x_i'^2 = 2295$$

Correct $\sum x_i^2 = 2295 - 100 + 144$

$$= 2339$$

$$\sigma = \sqrt{\frac{2339}{15} - \frac{182 \times 182}{225}}$$

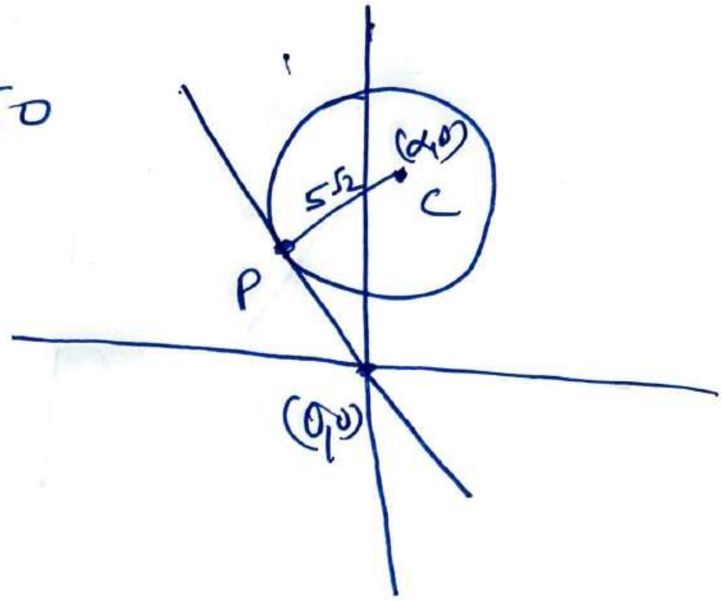
Required value $= 15(\mu + \mu^2 + \sigma^2) = 15\left(\frac{182}{15} + \frac{2339}{15}\right)$

$$\boxed{= 2521}$$

Q-27

Solve

$$(x-\alpha)^2+(y-\beta)^2=50$$



$$CP = 5\sqrt{2}$$

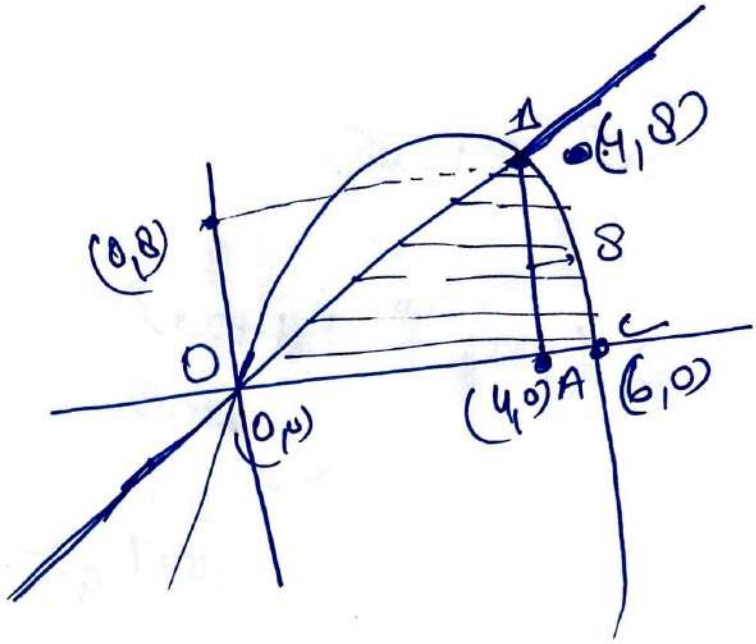
$$\left|\frac{\alpha+\beta}{\sqrt{2}}\right| = 5\sqrt{2}$$

$$\alpha+\beta = 10$$

$$\boxed{(\alpha+\beta)^2=100}$$

29

Solve :-



$0 \le y \le \min(2x, 6x - x^2)$

$y \le 2x \qquad y \le 6x - x^2$

area of $\triangle$ OAB

$= \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 4 \times 8$

total Area = area of $\triangle$OAB + area of arc ABCA

$A = 16 + \int_4^6 (6x - x^2)\, dx$

$A = \frac{76}{3}$

$12A = \frac{76}{3} \times \cancel{12}^{4}$

$\boxed{12A = 304}$

(201)

Solve:-

$(1-x)^{2008}(1+x+x^2)^{2007}$

$(1-x)(1-x)^{2007}(1+x+x^2)^{2007}$

$(1-x)(1-x^3)^{2007}$

$(1-x)\left({}^{2007}C_0 - {}^{2007}C_1 x^3 + \cdots\right)$

General term,

$(1-x)\left((-1)^r \, {}^{2007}C_r \, x^{3r}\right)$

$(-1)^r \, {}^{2007}C_r \, x^{3r} - (-1)^r \, {}^{2007}C_r \, x^{3r+1}$

$3r = 2012$

$r \neq \frac{2012}{3}$

$3r+1 = 2012$

$3r = 2011$

$r \neq \frac{2011}{3}$

Hence there is no term containing x^{2012}

$\boxed{\text{So coefficient of } x^{2012} = 0}$

$$I = \frac{\pi^2}{4} - 2\left(-x\cos x + \int \cos x\,dx\right)_0^{\pi/2}$$

$$= \frac{\pi^2}{4} - 2(0+1)$$

$$= \frac{\pi^2}{4} - 2$$

$$= \left(\frac{\pi}{2}\right)^2 - 2$$

$$\boxed{\alpha = 2}$$

30

Solve :-

$$f(x) = \int_0^x g(t) \ln\left(\frac{1-t}{1+t}\right) dt$$

$$f(-x) = \int_0^{-x} g(-k) \ln\left(\frac{1+k}{1-k}\right) dk$$

$$= -\int_0^x g(-k) \ln\left(\frac{1-k}{1+k}\right) \cdot dk \quad (g \text{ is odd})$$

$$f(-x) = -f(x) \Rightarrow f \text{ is also odd}$$

$$I = \int_{-\pi/2}^{\pi/2} \left(f(x) + \frac{x^2 \cos x}{1+e^x}\right) dx \quad \text{—(i)}$$

$$I = \int_{-\pi/2}^{\pi/2} \left(f(-x) + \frac{x^2 \cos(-x)}{1+e^{-x}}\right) dx$$

$$I = \int_{-\pi/2}^{\pi/2} \left(f(x) + \frac{x^2 \cos x \, e^x}{e^x+1}\right) dx \quad \text{—(ii)}$$

eqn (i) + (ii)

$$2I = 2\underbrace{\int_{-\pi/2}^{\pi/2} f(x) dx}_{\text{odd}} + \int_{-\pi/2}^{\pi/2} \underbrace{\frac{x^2 \cos x \, \cancel{(1+e^x)}}{\cancel{(1+e^x)}}}_{\text{even}} dx$$

$$2I = 0 + 2\int_0^{\pi/2} x^2 \cos x \, dx$$

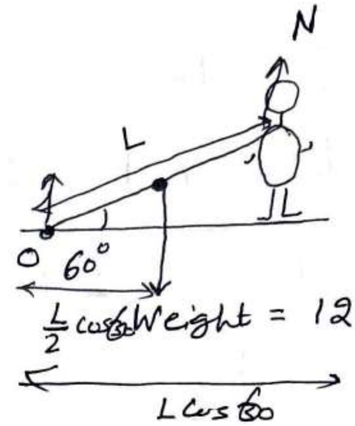
$$I = (x^2 \sin x)_0^{\pi/2} - \int_0^{\pi/2} 2x \sin x \, dx$$

JEE Main - 2024 Solution

Physics, 27 jan '24 shift - 2

Ans - 31

Let length of bar L and weight experienced by man N.



taking Moment about point O

$$12g \times \frac{L}{2}\cancel{\cos 60} - N \times \cancel{L \cos 60} = 0$$

$\boxed{N = 6g}$ Weight experienced by Person = 6 kg

Option (4) is correct

Ans - 32

$$V_P = 230V$$

$$\frac{N_P}{N_S} = \frac{10}{1}$$

$$\frac{N_P}{N_S} = \frac{V_P}{V_S}, \quad \frac{10}{1} = \frac{230}{V_S}$$

$$V_S = 23\,V \qquad R_S = 46\,\Omega$$

$$P_S = \frac{V_S^2}{R_S} = \frac{23 \times 23}{46} = 11.5W$$

$\boxed{P_S = 11.5W}$

Option (3) is Correct

$\boxed{\text{Ans - 33}}$

specific resistance or resistivity is the property of material and does not depend upon length or radius of wire. Hence specific resistance remains same S_1

$\boxed{\text{option 4 is correct}}$

$\boxed{\text{Ans - 34}}$

$$W_0 = 6.63 \text{ eV}$$

$$= 6.63 \times 1.6 \times 10^{-19} \text{ J}$$

$$W_0 = h \nu_0$$

$$\cancel{6.63} \times 1.6 \times 10^{-19} = \cancel{6.63} \times 10^{-34} \nu_0$$

$$\nu_0 = \frac{1.6 \times 10^{-19}}{10^{-34}} = 1.6 \times 10^{15}$$

$$\boxed{\nu_0 = 1.6 \times 10^{15} \text{ Hz}}$$

$\boxed{\text{option (2) is correct}}$

$\boxed{\text{Ans- 35}}$ $\quad {}_6C^{12} = 12.000000$ amu

${}_6C^{13} = 13.003354$ amu

${}_0n^1 = 1.008665$ amu

$$\text{Mass defect} = (12.000000 + 1.008665) - (13.003354)$$

$$= 0.005311 \text{ amu}$$

1 amu $= 931$ MeV

Energy required $= 931 \times 0.005311$

$$\boxed{E = 4.95 \text{ MeV}}$$

$\boxed{\text{option (2) is Correct}}$

$\boxed{\text{Ans. 36}}$ Limiting friction force depends on material and does not depend on the area of Contact

Hence statement I is false and statement II is correct

$\boxed{\text{option 1 is Correct}}$

$\boxed{\text{Ans-37.}}$

Radiation pressure $= \frac{I}{c}$

$$I = 6 \times 10^8 \ W/m^2$$

$$C = \frac{3 \times 108}{3} = 1 \times 10^8 \ m/sec$$

$$P = \frac{6 \times 108}{1 \times 108} = 6$$

$$\boxed{P = 6}$$

$\boxed{\text{option 1 is Correct}}$

$\boxed{\text{Ans-38}}$

$$P \propto T^3$$

$$P T^{-3} = C$$

For adiabatic process $PV^{\gamma} = C$

$$PV = nRT \ , \quad V = \frac{nRT}{P}$$

$$V \propto \frac{T}{P}$$

$$P \frac{T^{\gamma}}{P^{\gamma}} = C \ , \quad P T^{\frac{\gamma}{1-\gamma}} = C$$

on comparing $\frac{\gamma}{1-\gamma} = -3$

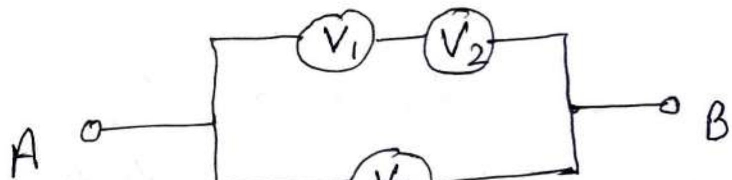
$2\cancel{\gamma} = 3$, $\boxed{\gamma = \frac{3}{2}}$

$\boxed{\text{option (4) is Correct}}$

Ans-39 Both electric field lines and equipotential surfaces are perpendicular to each other hence statement I is correct and statement II is correct explanation of statement I.

$\boxed{\text{option (3) is correct}}$

Ans-40



In parallel combination potential difference remains same in each branch.

hence $\boxed{V_1 + V_2 = V_3}$

$\boxed{\text{Option (3) is correct}}$

$\boxed{\text{Ans-41}}$ KE of 1 mole of O_2

$$= \frac{5}{2} RT$$

$$= \frac{5}{2} \times 8.31 \times 300$$

$$\boxed{KE = 6232.5\ J}$$

$\boxed{\text{option (2) is Correct}}$

$\boxed{\text{Ans-42}}$ $\left(P + \frac{a}{V^2}\right)(V - b) = RT$

dimension of $b = V = [L^3]$

dimension of $a = PV^2 = [ML^5T^{-2}]$

$$\frac{a}{b^2} = P = [ML^{-1}T^{-2}]$$

$\boxed{\text{option (3) is Correct}}$

Ans-43 Property by Virtue of which body regains its shape after removal of load is called elasticity and it depends inter-atomic forces between atoms and molecules of solid material.

option (2) is Correct

Ans-44 Let I_0 the intensity passing through first polaroid.

Then intensity passing through second polaroid $= I_0 \cos^2\theta$

Intensity after emerging from second polaroid

$$= I_0 \cos^2\theta \cos^2\left(\frac{\pi}{2}-\theta\right)$$

$$= I_0 \cos^2\theta \sin^2\theta$$

$$= \frac{I_0}{4} \sin^2 2\theta$$

Intensity will be maximum $\boxed{\theta = \frac{\pi}{4}}$

option (2) is Correct

Ans-45 angular speed = $\frac{\text{angular displacement}}{\text{Time}}$

Since angular displacement is same for earth and moon for one revolution and moon takes less time to complete revolution its angular speed will be more.

$\boxed{\text{option (3) is correct}}$

Ans-46 $60^\circ = \frac{\pi}{3}$

$200\ \mu A$ — $\frac{\pi}{3}$

For $\frac{\pi}{10}$ radian deflection

Current $= \frac{200}{\frac{\pi}{3}} \times \frac{\pi}{10}$

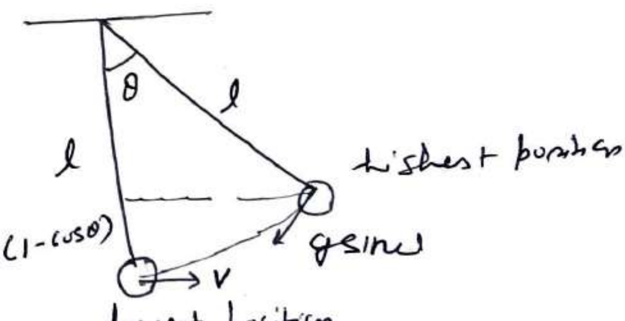
$\boxed{\text{Current} = 60\ \mu A}$

$\boxed{\text{option (2) is correct}}$

Ans-47 Position zero error is substracted from Vernier callipe to get actual reading, hence measured value should be more than actual value. Zero error comes due to manufacturing defect or due to poor handling

$\boxed{\text{option (3) is correct}}$

Ans-48



acc^n at highest position
$= g\sin\theta$

acc^n at lowest position
$= \dfrac{v^2}{l}$

$v^2 = 2gl(1-\cos\theta)$

both are equal $\quad \cancel{g}\sin\theta = \dfrac{2\cancel{g}\cancel{l}(1-\cos\theta)}{\cancel{l}}$

$\sin\theta = 2 - 2\cos\theta$

$\cancel{2}\sin\frac{\theta}{2}\cos\frac{\theta}{2} = 2(1-\cos\theta) = \cancel{2}2\sin^2\frac{\theta}{2}$

$\tan\frac{\theta}{2} = \frac{1}{2}, \quad \frac{\theta}{2} = \tan^{-1}\left(\frac{1}{2}\right)$

$\boxed{\theta = 2\tan^{-1}\left(\frac{1}{2}\right)}$

$\boxed{\text{option (2) is correct}}$

Ans - 49

When $s = 4\,cm$

$$V = \frac{2u}{3}$$

$$v^2 = u^2 + 2as$$

$$\frac{4u^2}{9} = u^2 + 2 \times a \times 4$$

$$-\frac{5u^2}{9} = 8a \qquad a = -\frac{5u^2}{9 \times 8}$$

Now Second Case

$$0 = \frac{4u^2}{9} - 2 \times \frac{5u^2}{9 \times 8} \times s$$

$$s = \frac{4 \times 4}{5} = \frac{16}{5} = 3.2\ cm$$

$$\boxed{s = 32 \times 10^{-3}\ m}$$

$$\boxed{D = 32}$$

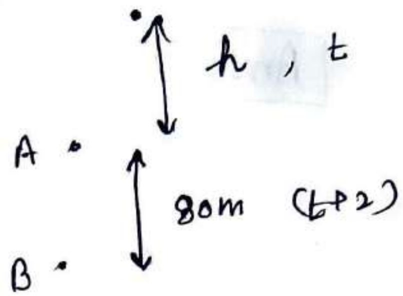
Ans - 50

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

option (2) is Correct

Ans-51

$$S_A = \frac{1}{2} g t^2 \quad , \quad h = \frac{1}{2} g t^2$$



$$(h + 80) = \frac{1}{2} g (t+2)^2$$

substracting

$$\frac{\cancel{80}\,16}{\cancel{g}} = \frac{1}{\cancel{2}} \times \cancel{g} \left[(t+2)^2 - t^2 \right]$$

$$(t+2-t)(t+t+2) = 16$$

$$2t + 2 = 8$$

$$t = 3 \text{ Sec}$$

$$h = \frac{1}{2} \times 10 \times 9 = 45 \text{ m}$$

$$\boxed{h = 45 \text{ m}}$$

Ans-52

$$a \sin\theta = n\lambda$$

$$a \sin\theta = \lambda \quad (\text{For Ist minima})$$

$$(0.001 \times 10^{-3}) \sin\theta = 5000 \times 10^{-10}$$

$$\sin\theta = 0.5$$

$$\boxed{\theta = 30^\circ}$$

$\boxed{\text{Ans-53}}$

$$P_1 = P_2 + \frac{1}{2}\rho V_2^2$$

$$\frac{1}{2}\rho V_2^2 = P_2 - P_1 = 4.5\times10^4 - 2\times10^4$$

$$\frac{1}{2}\times 1\cancel{000}\times V_2^2 = 2.5\times10^4$$

$$V_2^2 = 50$$

$$V_2 = \sqrt{50}$$

$$\boxed{V = 50 \text{ m/sec}}$$

$\boxed{\text{Ans-54}}$

$$V = \frac{KQ}{r}$$

$$Q = 50\times1.6\times10^{-19} = 8\times10^{-18}\,C$$

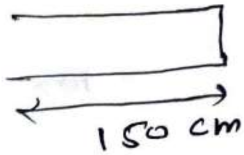
$$r = 9\times10^{-13}\text{ cm} = 9\times10^{-15}\text{ m}$$

$$V = \frac{\cancel{9}\times10^{9}\times8\times10^{-18}}{\cancel{9}\times10^{-15}}$$

$$\boxed{V = 8\times10^{6}\,V}$$

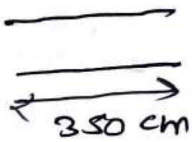
$\boxed{\text{Ans - 8}}$

Ans - 55



Fundamental frequency $f_1 = \frac{V}{4 \times 150}$

$= \frac{V}{600\,(cm)} = \frac{V}{6}\ Hz$



Fundamental frequency

$f_2 = \frac{V}{2 \times 350}$

$= \frac{V}{700\,(cm)} = \frac{V}{7}\ Hz$

$f_1 - f_2 = 7$

$\frac{V}{6} - \frac{V}{7} = 7 \quad , \quad \frac{V}{42} = 7$

$\boxed{V = 294\ m/sec}$

Ans - 56

since both sphere and ring rolls down without slipping starting from rest. Due to conservation of energy both have same kinetic energy. so $\frac{7}{\alpha} = 1$

$\boxed{\alpha = 7}$

$\boxed{\text{Ans-57}}$ For Paschen Series

$$\frac{1}{\lambda} = R\left[\frac{1}{3^2} - \frac{1}{n^2}\right]$$

For longest wavelength n should be maximum, $n = 4$

$$\frac{1}{\lambda} = R\left[\frac{1}{9} - \frac{1}{16}\right] = \frac{7R}{144}$$

$$\boxed{\lambda = \frac{144}{7R}} \qquad \boxed{\alpha = 144}$$

$\boxed{\text{Ans-58}}$ $\tau = \vec{P} \times \vec{E}$ $\quad \vec{E} = 0.2\hat{i}$ V/cm

$= 0.2 \times 10^2 \hat{i}$ V/m

$= 20\hat{i}$ V/m

$\vec{P} = q \times 2\vec{a}$ (-ve to +ve charge)

2a

$2\vec{a} = \vec{r} = (2-1)\hat{i} - \hat{j} + (5-4)\hat{k}$

$\vec{r} = \hat{i} - \hat{j} + \hat{k}$

$\vec{P} = 4(\hat{i} - \hat{j} + \hat{k}) \times 10^{-6}$

$\vec{\tau} = 4 \times 10^{-6} (\hat{i} - \hat{j} + \hat{k}) \times 20\hat{i}$

$\vec{\tau} = 4 \times 10^{-6} (20\hat{k} + 20\hat{j})$

$|\vec{\tau}| = 4 \times 10^{-6} \sqrt{(20)^2 + (20)^2} = 8 \times 10^{-5}\sqrt{2}$

$$\boxed{\alpha = 2}$$

Ans-59 Power factor $= \cos\phi = \frac{R}{Z}$

$$Z = \sqrt{(X_L - X_C)^2 + R^2}$$

$$X_L = \omega L = 2\pi f L = \cancel{2}\cancel{\pi} \times \cancel{50} \times \frac{100}{\pi} \times 10^{-3}\,\Omega$$

$$= 10\,\Omega$$

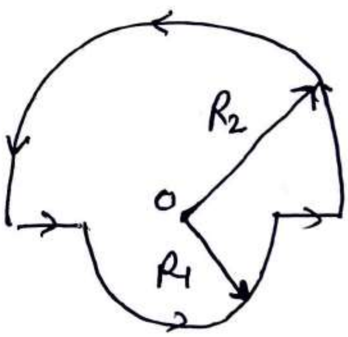
$$X_C = \frac{1}{2\pi f C} = \frac{1}{2\cancel{\pi} \times 50 \times \frac{10^{-3}}{\cancel{\pi}}} = \frac{1000}{10}$$

$$= 10\,\Omega$$

$$Z = \sqrt{0 + R^2} = R$$

$$\boxed{\cos\phi = \frac{R}{R} = 1}$$

Ans-60



$$B_0 = \frac{1}{2}\left[\frac{\mu_0 I}{2R_1} + \frac{\mu_0 I}{2R_2}\right]$$

$$= \frac{\mu_0 I}{2 \times 2}\left[\frac{1}{R_1} + \frac{1}{R_2}\right]$$

$$= \frac{\mu_0 I}{2 \times 2}\left[\frac{1}{2\pi} + \frac{1}{4\pi}\right]$$

$$= \frac{\mu_0 I\, 3}{4\pi \times 4} = \frac{10^{-7} \times 4 \times 3}{4}$$

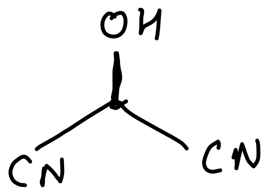
$$B_0 = 3 \times 10^{-7} \qquad \boxed{\alpha = 3}$$

NTA - JEE - SOLUTION [27^{th} - JAN, 24 SHIFT-2]

A-1 Correct option is (3) - Steam distillation
Steam distillation is used for those liquids which are insoluble in water, contains a non-volatile Impurities and are steam volatile

A-2 Correct option is (3) i.e; ______

A-3 Correct option is (2)



A-4 Correct option is (3) if the tin coating is Peeling off or become damaged then it exposes the iron in air is susceptible for rusting.

A-5 Correct option is (2) $CH_3-CH=CH-Cl$
Because vinyl halide and aryl halide do not undergo SN^1 reaction. Carbocation forms is unstable and does not exist

A-6 Correct option is (3) as N^{3-} has already reached max. electron. It has completed octet so no space to aquire further electron(s).

A-7 Correct option is (4) Pthalein test is only Performed from Phenolic group

A-8 Correct order is (3) i e; I > II > III
Structure -I has more covalent bond & no charge
structure -II has -ve charge on more Electronegative oxygen
Structure -III has +ve charge on oxygen is not Possible

A-9 Correct option is (1)

A - Kolbe schmidt

C - oxidation with acidified $Na_2Cr_2O_7$

A – Kolbe schmidt
B – Reimer Tiemann

C – oxidation with acidified $Na_2Cr_2O_7$
D – williamson's synthesis

A-10 Correct option is (3)

$$Ph-CH=CH_2 \xrightarrow[2)\ H_2O_2]{1)\ BH_3} Ph-CH_2-CH_2-OH \xrightarrow[-H_2O]{HBr} Ph-CH_2-CH_2-Br$$

$$\downarrow 1)\ HCHO \quad 2)\ H_2O/H^+$$

$$Ph-CH_2-CH_2-CH_2-OH$$

A-11 Correct option is (2). Wacker Process – $PdCl_2$ is used

A-12 Correct option is (2) i.e. Molarity as it depends upon the volume $\boxed{\propto T_{ab} \propto \frac{1}{P}}$ change

change.

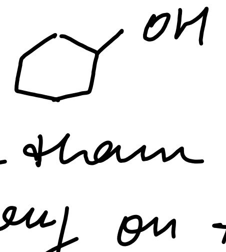
A-13 Correct option is 2 (~~4~~) because

A-14 Correct option is (4) i.e. $[Co(NH_3)_6]^{3+}$ as NH_3 is strong ligand with low spin complex hence inner d-subshell contributes in hybridization

In $SF_6 - sp^3d^2$, $BrF_5 = sp^3d^2$, and $[PtCl_4]^{2-} = dsp^2$

A-15 Correct option is (3) in which all elements must have $(n-1)d^{10}$ - electrons

A-16 Correct option is (4) and the final Product is

$(CH_3)_3C-I$ +  because secondary carbocation is less stable than tertiary carbocation so Nu-substitution is carry on tertiary carbocation

A-17 Correct option is 1.

A-18 Correct option is (4) that is acetic or ethanoic and whose molecular formula is $C_2H_4O_2$.

A-19 Correct option is (1) i.e; Primary structure remain intact.

A-20 Correct option is (3), statement is invalid ~~an~~ because staggered is more stable than an Eclipsed form.

A-21 Correct option is (2)

$Sr^{2+} = [Kr]$

$Cs^{+} = [Xe]$

have full filled Noble gas configuration

An 22

$$PbS + 4O_3 \longrightarrow PbSO_4 + 4O_2$$

1 mole of PbS reacts with 4 mole of O_3 and 4 mole of O_2

Total, $\boxed{X + Y = 4 + 4 = 8}$

A.23

$$2H^+ + 2e^{-1} \longrightarrow H_2 (1atm)$$

$$E_{cell} = -\frac{0.0591}{n=2} \log \frac{P_{H_2} = (1atm)}{[H^+]^2}$$

$$E_{cell} = -\frac{0.0591}{2} \log [H^+]^{-2}$$

$$= +\frac{0.0591}{\cancel{2}} \times \cancel{2} \times \log [H^+]$$

$$E_{cell} = -0.0591 \times \{-\log [H^+]\}$$

$E_{cell} = -0.0591 \times pH$

$= -0.0591 \times 3$

$E_{cell} = -0.1773$

$\boxed{E_{cell} = -17.73 \times 10^{-2}\ V}$

on comparing with

$E_{cell} = -x \times 10^{-2} V$

$\therefore \boxed{x = 17.73}$

A-24 Total no of compounds having chiral carbon is 5.

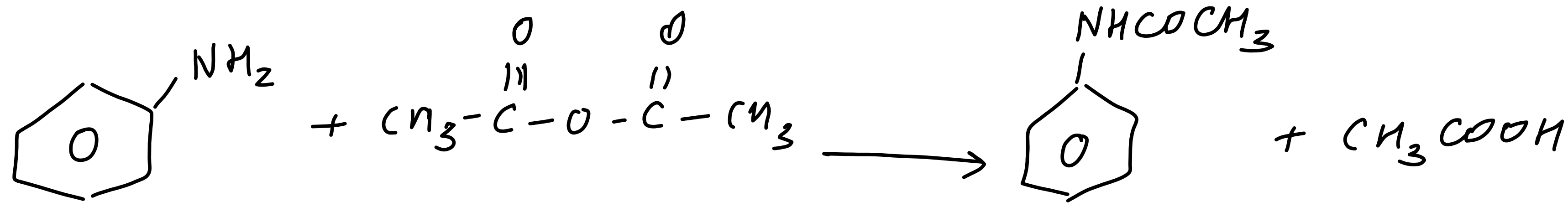
A-25 In Pt^{2+} ion, the electronic configuration is $4f^{14}, 5d^{8}, 6s^{0}$ being high effective nuclear charge, Pt^{2+} ion doesnot have pairing (d) electrons nuclear charge, Pt^{2+} ion undergoes hence unpairing of electrons.

Hence, net dipole moment is zero.

A-26 The number of Non-Polar molecule is four H_2, CH_4, CO_2 and BF_3 because in all of these the dipole or net dipole is zero.

A-27

A-28



M m = 72 + 7 + 14 = 93 u

m.m = 96 + 9 + 16 + 14 = 135 u

According to equation,

mole of aniline = mole of acetanilide

$$\frac{9.3}{93} = \frac{x}{135}$$

$$0.1 = \frac{x}{135} \Rightarrow \boxed{x = 13.5 \text{ gm}}$$

$$\Rightarrow x = 135 \times 10^{-1} \text{ gm}$$

A-29 Half-life for 1^{st}-order

$$K = \frac{0.693}{t_{1/2}} \quad —(1)$$

For 99.9% completion in 1^{st} order

$$K = \frac{2.303}{t} \log \frac{100}{0.1}$$

$$K = \frac{2.303}{t} \log 10^3 = \frac{2.303 \times 3}{t} \quad —(2)$$

By eq (1) & (2)

$$\frac{\cancel{2.303} \times 3}{t} = \frac{\cancel{2.303} \times 0.3010}{t_{1/2}}$$

$$t = \frac{3.0000}{0.3010} \times t_{1/2}$$

time as required, $\boxed{t = 9.97 \times t_{1/2}} = \underline{10} \times t_{1/2}$

A-30

$$1M = \frac{wt\,(gm)}{m \times V(dm^3)}$$

Vol of solution $= 70 \times 10^{-1}\ dm^3$

$$3 = \frac{84}{40 \times V(dm^3)}$$

on comparing with $= \underline{x}\ \times 10^{-1}\ dm^3$

then, $\boxed{x = 7}$

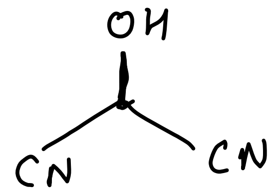
$$V(dm^3) = \frac{84}{40 \times 3} = 0.7$$

NTA - JEE - SOLUTION [27th - JAN, 24 SHIFT-2]

A-1 Correct option is (3) - Steam distillation
Steam distillation is used for those liquids which are insoluble in water, contains a non-volatile Impurities and are steam volatile

A-2 Correct option is (3) i.e; ______

A-3 Correct option is (2)



A-4 Correct option is (3) if the tin coating is Peeling off or become damaged then it exposes the iron in air is susceptible for rusting.

A-5 Correct option is (2) $CH_3-CH=CH-Cl$
Because vinyl halide and aryl halide do not undergo SN^1 reaction. Carbocation forms is unstable and does not exist

A-6 Correct option is (3) as N^{3-} has already reached max. electron. It has completed octet so no space to aquire further electron(s).

A-7 Correct option is (4) Pthalein test is only Performed from Phenolic group

A-8 Correct order is (3) i e; I > II > III
Structure -I has more covalent bond & no charge
structure -II has -ve charge on more Electronegative oxygen
Structure -III has +ve charge on oxygen is not Possible

A-9 Correct option is (1)

A - Kolbe schmidt

C - oxidation with acidified $Na_2Cr_2O_7$

A – Kolbe schmidt

B – Reimer Tiemann

C – oxidation with acidified $Na_2Cr_2O_7$

D – williamson's synthesis

A-10 Correct option is (3)

$$Ph-CH=CH_2 \xrightarrow[2)\ H_2O_2]{1)\ BH_3} Ph-CH_2-CH_2-OH \xrightarrow[-H_2O]{HBr} Ph-CH_2-CH_2-Br$$

$$\downarrow \begin{matrix} 1)\ HCHO \\ 2)\ H_2O/H^+ \end{matrix}$$

$$Ph-CH_2-CH_2-CH_2-OH$$

A-11 Correct option is (2). Wacker Process – $PdCl_2$ is used

A-12 Correct option is (2) i.e, Molarity as it depends upon the volume $\boxed{\text{volume} \propto T_{ab} \propto \frac{1}{P}}$ → change → change.

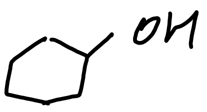
A-13 Correct option is ~~(4)~~ 2 because

A-14 Correct option is (4) i.e; $[Co(NH_3)_6]^{3+}$ as NH_3 is strong ligand with low spin complex hence inner d-subshell contributes in hybridization

In $SF_6 - sp^3d^2$, $BrF_5 = sp^3d^2$, and $[PtCl_4]^{2-} = dsp^2$

A-15 Correct option is (3) in which all elements must have $(n-1)d^{10}$ - electrons

A-16 Correct option is (4) and the final product is

$(CH_3)_3C-I$ +  because secondary carbocation is less stable than tertiary carbocation so Nu-substitution as carry on tertiary carbocation

A-17 Correct option is 1.

A-18 Correct option is (4) that is acetic or ethanoic and whose molecular formula is $C_2H_4O_2$.

A-19 Correct option is (1) i.e; Primary structure remain intact.

A-20 Correct option is (3), statement is invalid because staggered is more stable than an Eclipsed form.

A-21 Correct option is (2)

$Sr^{2+} = [Kr]$

$Cs^{+} = [Xe]$

have full filled Noble gas configuration

An 22

$$PbS + 4O_3 \longrightarrow PbSO_4 + 4O_2$$

1 mole of PbS reacts with 4 mole of O_3 and 4 mole of O_2

Total, $\boxed{x+y = 4+4 = 8}$

A.23

$$2H^+ + 2e^{-1} \longrightarrow H_2 (1atm)$$

$$E_{cell} = -\frac{0.0591}{n=2} \log \frac{P_{H_2} = (1atm)}{[H^+]^2}$$

$$E_{cell} = -\frac{0.0591}{2} \log [H^+]^{-2}$$

$$= +\frac{0.0591}{\cancel{2}} \times \cancel{2} \times \log [H^+]$$

$$E_{cell} = -0.0591 \times \{-\log [H^+]\}$$

$$E_{cell} = -0.0591 \times pH$$

$$= -0.0591 \times 3$$

$$E_{cell} = -0.1773$$

$$\boxed{E_{cell} = -17.73 \times 10^{-2} V}$$

on comparing with

$$E_{cell} = -x \times 10^{-2} V$$

$$\therefore \boxed{x = 17.73}$$

A-24 Total no of compounds having chiral carbon is 5.

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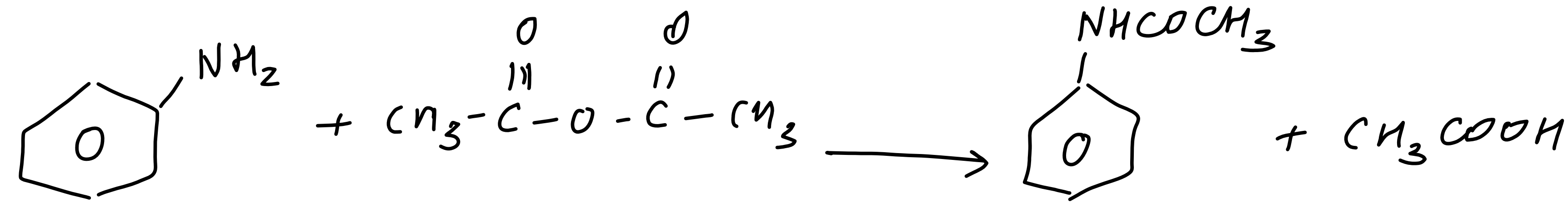

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$$3 = \frac{84}{40 \times V(dm^3)}$$

$$V(dm^3) = \frac{84}{40 \times 3} = 0.7$$

Vol of solution

$= 7.0 \times 10^{-1}\ dm^3$

on comparing with

$= \underline{x} \times 10^{-1}\ dm^3$

then, $\boxed{x = 7}$