HINTS & SOLUTIONS

MATHEMATICS

1. The equation ....

Sol. Given curve is $x + y = x^y$

Put y = 0, we get x = 1.

Now, differentiate $x + y = x^y$, take log on both sides, we get

$\ell n(x + y) = y\,\ell n\,x$

$$\Rightarrow \frac{1}{x+y}\left(1+\frac{dy}{dx}\right) = y,\left(\frac{1}{x}\right) + (\ell n\,x)\frac{dy}{dx}$$

put x = 1, y = 0, we get

$$\left.\frac{dy}{dx}\right]_{(1,0)} = -1 = \text{Slope of tangent}$$

$\Rightarrow$ Equation of normal, is

$$\left(\frac{y-0}{x-1}\right) = 1 \Rightarrow y = x-1$$

2. $\int \frac{\cos x - \sin x}{7 - 9\sin 2x}dx$ ....

Sol. $I = \int \frac{\cos x - \sin x}{7 - 9\sin 2x}dx$

or $I = \int \frac{dt}{7 - 9(t^2 - 1)}$

Let $\sin x + \cos x = t \Rightarrow (\cos x - \sin x)dx = dt$

$= \int \frac{dt}{4^2 - (3t)^2}$

$\therefore \sin^2 x + \cos^2 x + 2\sin x \cos x = t^2$

or $\sin^2 x + \cos^2 x + 2\sin x \cos x = t^2$

$= \int \frac{dt}{4^2 - (3t)^2}$ or $1 + \sin 2x = t^2$

or $\sin 2x = t^2 - 1$

$= \frac{1}{2.4}\cdot\frac{1}{3}\ell n\left|\frac{4+3t}{4-3t}\right| + C$

or $I = \frac{1}{24}\ell n\left|\frac{4+3(\sin x+\cos x)}{4-3(\sin x+\cos x)}\right| + C$

3. $I_1 = \int_0^{\pi}\frac{x\sin x}{1+\cos^2 x}dx$ ....

Sol. $I_1 = \int_0^{\pi}\frac{x\sin x}{1+\cos^2 x}dx = \int_0^{\pi}\frac{(\pi-x)\sin x}{1+\cos^2 x}dx$

$2I_1 = \pi\int_0^{\pi}\frac{x\sin x}{1+\cos^2 x}dx$

$= I_1 = \pi\int_0^{\pi}\frac{\sin x}{1+\cos^2 x}dx = \frac{\pi^2}{4}$

$I_2 = \int_0^{\pi}\frac{x^3\sin x}{(\pi^2 - 3\pi x + 3x^2)(1+\cos^2 x)}dx$

$= \int_0^{\pi}\frac{(\pi-x)^3\sin x dx}{\{\pi^2 - 3\pi(\pi-x) + 3(\pi-x)^2(1+\cos^2 x)}$

$I_2 = \int_0^{\pi}\frac{(\pi-x)^3\sin x}{\{\pi^2 - 3\pi x + 3x^2\}(1+\cos^2 x)}dx$

$= \int_0^{\pi}\frac{\pi(\pi^2 - 3\pi x + 3x^2)\sin x}{(\pi^2 - 3\pi x + 3x^2\}(1+\cos^2 x)}dx$

$\Rightarrow 2I_2 = \int_0^{\pi}\frac{\sin x}{1+\cos^2 x}dx \qquad \Rightarrow I_1 = I_2$

4. If $\vec{a}$ and $\vec{b}$ are ....

Sol : $\vec{a}\times\vec{b} = |\vec{a}||\vec{b}|\sin\theta\hat{n}$

$$\Rightarrow |\vec{a}\times\vec{b}| = |\vec{a}|\,|\vec{b}|\sin\theta \Rightarrow \sin\theta\frac{|\vec{a}\times\vec{b}|}{|\vec{a}|\,|\vec{b}|} \quad ...(1)$$

$$\vec{a}.\vec{b} = |\vec{a}|\,|\vec{b}|\cos\theta \Rightarrow \cos\theta = \frac{\vec{a}.\vec{b}}{|\vec{a}||\vec{b}|} \quad ...(2)$$

From (1) and (2),

$$\sin^2\theta + \cos^2\theta = 1,\ \Rightarrow\ |\vec{a}\times\vec{b}| + (\vec{a}.\vec{b})^2 = |\vec{a}|^2\,|\vec{b}|.$$

If $\theta = \frac{\pi}{4}$, then $\sin\theta = \cos\theta = \frac{1}{\sqrt{2}}$

$\therefore |\vec{a}\times\vec{b}| = \frac{|\vec{a}||\vec{b}|}{\sqrt{2}}$ and $\vec{a}\,.\,\vec{b} = \frac{|\vec{a}|\,|\vec{b}|}{\sqrt{2}}$, $\therefore |\vec{a}\times\vec{b}| = \vec{a}.\vec{b}$

$\therefore \vec{a}\times\vec{b} = |a|\,|\vec{b}|\sin\theta\hat{n} = \frac{|\vec{a}|\,|\vec{b}|}{\sqrt{2}}\hat{n}$ or $\vec{a}\times\vec{b} = (\vec{a}\,.\,\vec{b})\hat{n}$

5. Solution of the ....

Sol. The given differential equation can be written as

$$\frac{xdx + ydy}{ydx - xdy} = \frac{x\sin^2(x^2+y^2)}{y^3}$$

$$\Rightarrow \frac{2xdx + 2ydy}{ydx - xdy} = \frac{2x\sin^2(x^2+y^2)}{y^3}$$

$$\Rightarrow \frac{d(x^2+y^2)}{\sin^2(x^2+y^2)} = \frac{2x}{y^3}(ydx - xdy)$$

$$\Rightarrow \operatorname{cosec}^2(x^2+y^2)d(x^2+y^2) = 2\left(\frac{x}{y}\right)d\left(\frac{x}{y}\right)$$

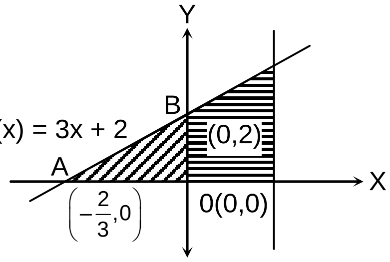
On integrating, we get

$$\int \operatorname{cosec}^2(x^2+y^2)d(x^2+y^2) = 2\int\left(\frac{x}{y}\right)d\left(\frac{x}{y}\right)$$

$$\Rightarrow -\cot(x^2+y^2) = \left(\frac{x}{y}\right)^2 + C,$$

which is the required solution.

6. Let f(x) be ....



Sol. f(x) = 3x + 2

We have $\lim\limits_{a\to x} \frac{af(x)-xf(a)}{a-x}\left(\frac{0}{0}\right) = 2$

$\Rightarrow \lim\limits_{a\to x} \frac{f(x)-xf'(a)}{1-0} = 2 \Rightarrow f(x) - xf'(x) = 2$

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

$\therefore$ On integrating both sides w.r.t. X,

we get $\int \frac{f'(x)}{f(x)-2}dx = \int \frac{1}{x}dx$

$\Rightarrow \ell n(f(x)-2) = \ell nx + \ell nc \Rightarrow f(x) = cx + 2$

As f(1) = 5, so

$5 = c + 2 \Rightarrow c = 3$

Hence f(x) = 3x + 2

Clearly area (ΔOAB) = $\frac{1}{2}\left(\frac{2}{3}\right)(2)$; = $\frac{2}{3}$ (square units)

Also $\int_0^2 (3x+2)\,dx = \left(\frac{3x^2}{2}+2x\right)_0^2 = 6 + 4 = 10$

7. If $\int \frac{(x-1)\,dx}{x^2\sqrt{2x^2-2x+1}}$ ....

Sol. $I = \int \frac{(x-1)\,dx}{x^2\sqrt{2x^2-2x+1}} = \int \frac{(x-1)\,dx}{x^3\sqrt{2-\frac{2}{x}+\frac{1}{x^2}}}$

Put $2 - \frac{2}{x} + \frac{1}{x^2} = t^2$, then $\left(\frac{x-1}{x^3}\right)dx = t\,dt$

$\Rightarrow I = \int \frac{t\,dt}{t} = t + C = \sqrt{2-\frac{2}{x}+\frac{1}{x^2}} + C$

$= \frac{\sqrt{2x^2-2x+1}}{x} + C$

So $f(x) = \sqrt{2x^2-2x+1}$ and g(x) = x

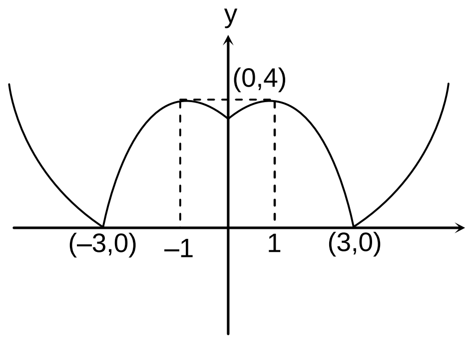
8. Let f(x) ....

Sol. f (x) satisfies Rolle's theorem on $\left[\frac{1}{k+1},\frac{1}{k}\right], K \in N$

$\therefore$ f '(x) = 0 on each interval $\left[\frac{1}{k+1},\frac{1}{k}\right], K \in N$

9. For the function ....

Sol. Graph of $y = ||x|^2 - 2|x| - 3|$



10. Let $I = \int \frac{e^x}{e^{4x}+1}dx$ ....

Sol. Given $I = \int \frac{e^x}{1+e^{4x}}dx$ and $j = \int \frac{e^{-x}}{1+e^{-4x}}dx$

$J = \int \frac{e^{2x}.e^x}{1+e^{4x}}dx$

$\therefore I + J = \int \frac{e^x(1+e^{2x})}{1+e^{4x}}dx$

put $e^x = t \Rightarrow e^x\,dx = dt$

$\therefore I + J = \int \frac{1+t^2}{1+t^4}dt = \int \frac{1+\frac{1}{t^2}}{t^2+\frac{1}{t^2}}dt$

$= \int \frac{1+\frac{1}{t^2}}{\left(t-\frac{1}{t}\right)^2+2}dt$

put $t - \frac{1}{t} = y \Rightarrow y = \left(1+\frac{1}{t^2}\right)dt = dy$

$= \int \frac{dy}{y^2+2} = \frac{1}{\sqrt{2}}\tan^{-1}\frac{y}{\sqrt{2}} = \frac{1}{\sqrt{2}}\tan^{-1}\frac{t^2-1}{\sqrt{2}t}$

$J + I = \frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{e^{2x}-1}{\sqrt{2}e^x}\right) + c$ .... (1)

|||y $J - I = \int \frac{e^x(-1+e^{2x})}{1+e^{4x}}dx = \int \frac{-1+t^2}{1+t^4}dt$

$= \int \frac{1-\frac{1}{t^2}}{t^2+\frac{1}{t^2}}dt = \int \frac{1-\frac{1}{t^2}}{\left(t+\frac{1}{t}\right)^2-2}dt \quad \left(t+\frac{1}{t}=y\right)$

$\therefore J - I = +\int \frac{dy}{y^2-2} = -\frac{1}{2\sqrt{2}}\ell n\left|\frac{y-\sqrt{2}}{y+\sqrt{2}}\right|$

$$J - I = \frac{1}{2\sqrt{2}} \ln \left| \frac{t + \frac{1}{t} - \sqrt{2}}{t + \frac{1}{t} + \sqrt{2}} \right|$$

$$= \frac{1}{2\sqrt{2}} . \ell n \left| \frac{t^2 - \sqrt{2}t + 1}{t^2 + \sqrt{2}t + 1} \right|$$

$$= \frac{1}{2\sqrt{2}} . \ell n \left| \frac{e^{2x} - \sqrt{2}e^x + 1}{e^{2x} + \sqrt{2}e^x + 1} \right| \quad \text{....... (2)}$$

11. The value of ....

$$\int \frac{\cos^3 x}{\sin^2 x + \sin x} \quad \text{.....................}$$

Sol. $I = \int \frac{\cos^3 x}{\sin^2 x + \sin x} dx$

$$= \int \frac{\cos x \ . \ (1 - \sin^2 x)}{\sin x (1 + \sin x)} dx$$

Put sin x = t , then cosx dx = dt

$$\Rightarrow \quad I = \int \frac{(1-t)(1+t) \quad dt}{t \quad (1+t)}$$

$= \ell n \ | \ t \ | - t + C = \ell n \ |\sin x| - \sin x + C$

12. Let F(x) = f(x) ....

Sol. $F(x) = f(x) - f\left(\frac{1}{x}\right)$

$$f(x) = \int_1^x \frac{\ln t}{1 + t + t^2} dt$$

$$f\left(\frac{1}{x}\right) = \int_1^{\frac{1}{x}} \frac{\ln t}{1 + t + t^2} dt$$

$$t = \frac{1}{p}$$

$$dt = \frac{-1}{p^2} dp$$

$$f\left(\frac{1}{x}\right) = \int_1^x \frac{\cancel{-} \ln p}{\frac{(1 + p + p^2)}{\cancel{p^2}}} \times \frac{\cancel{-}1}{\cancel{p^2}} dp$$

$$= \int_1^x \frac{\ln p \, dp}{1 + p + p^2} = f(x)$$

$$f(x) = f\left(\frac{1}{x}\right)$$

$$f(x) - f\left(\frac{1}{x}\right) = 0$$

F(e) = 0

13. $$\int_{-1/\sqrt{3}}^{1/\sqrt{3}} \frac{\cos^{-1}\left(\frac{2x}{x^2+1}\right) + \tan^{-1}\left(\frac{2x}{1-x^2}\right)}{e^x + 1} dx \ \text{.........}$$

Sol. put x = tanθ dx = $\sec^2\theta d\theta$

y $$I = \int_{-\pi/6}^{\pi/6} \left(\frac{\cos^{-1}(\sin 2\theta) + \tan^{-1}(\tan 2\theta)}{e^{\tan\theta} + 1} \right) \sec^2\theta d\theta$$

$$I = \int_{-\pi/6}^{\pi/6} \left(\frac{\left(\frac{\pi}{2} - 2\theta\right) + 2\theta}{e^{\tan\theta} + 1} \right) \sec^2\theta d\theta$$

$$= \frac{\pi}{2} \int_{-\pi/6}^{\pi/6} \left(\frac{\sec^2\theta \ d\theta}{e^{\tan\theta} + 1} \right)$$

$$I = \frac{\pi}{2} \int_{-\pi/6}^{\pi/6} \left(\frac{\sec^2\theta \ d\theta}{e^{-\tan\theta} + 1} \right)$$

$$\therefore \ 2I = \frac{\pi}{2} \int_{-\pi/6}^{\pi/6} \frac{\sec^2\theta (e^{\tan\theta} + 1) \ d\theta}{(e^{\tan\theta} + 1)}$$

$$= \frac{\pi}{2} . 2 \int_0^{\pi/6} \sec^2\theta \ d\theta$$

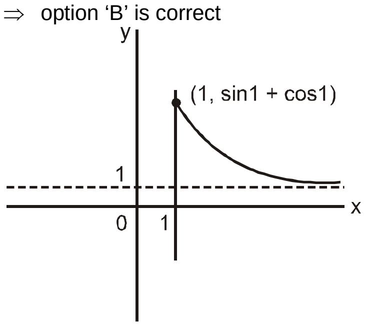
14. For the function ....

Sol. $f(x) = x \cos\frac{1}{x}$, $x \geq 1 \Rightarrow f'(x) = \frac{1}{x} \ \sin\frac{1}{x} + \cos\frac{1}{x}$

$\Rightarrow f''(x) = -\frac{1}{x^3} \cos\left(\frac{1}{x}\right)$

Now $\lim\limits_{x\to\infty} f'(x) = 0 + 1 = 1$

$\Rightarrow$ option 'B' is correct



$x \in [1, \infty) \quad \Rightarrow \quad \frac{1}{x} \in (0, 1]$

$\Rightarrow f''(x) < 0 \quad \Rightarrow$ option 'D' is correct

As f′(1) = sin 1 + cos 1 > 1

f′(x) is strictly decreasing and $\lim\limits_{x\to\infty} f'(x) = 1$

so graph of f′(x) is as below

Now in [x, x + 2], $x \in [1, \infty)$, f(x) is continuous and differentiable

so by LMVT, $f'(x) = \frac{f(x+2) - f(x)}{2}$

as $f'(x) > 1$ for all $x \in [1, \infty)$

$\Rightarrow \frac{f(x+2) - f(x)}{2} > 1$

$\Rightarrow f(x + 2) - f(x) > 2$

for all $x \in [1, \infty)$

15. Identify the correct ....

16. $\int_0^1 f(x)\,dx$ ....

Sol. $f(x) = x + 2x\int_0^x f(t)\,dt$

$\frac{f(x)-x}{x} = 2\int_0^x f(t)\,dt$ *D. w. r. to x*

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

$f'(x) = \left(\frac{2x^2+1}{x}\right) f(x)$

$\int \frac{f'(x)}{f(x)} dx = \int \left(2x + \frac{1}{x}\right) dx$

$\ln f(x) = x^2 + \ln x + c$

$\frac{f(x)}{x} = ke^{x^2}$

$f(x) = kxe^{x^2} \qquad (\because\ f(1) = e \ \Rightarrow\ k = 1)$

$\therefore\quad f(x) = xe^{x^2}$ $\Rightarrow$ odd function & always increasing function

$\int_0^1 f(x)\,dx = \int_0^1 xe^{x^2}\,dx$

Let $x^2 = t$ $2xdx = dt$

$\int_0^1 \frac{e^t}{2} dt = \frac{1}{2}(e-1)$

17. Value of integral ....

Sol. Let $f(x) = \ell n\left(\sqrt{(x-2)^2+4} + (x-2)\right)$.

Then f(4 – x)

$= \ell n\left(\sqrt{(4-x-2)^2+4} + (4-x-2)\right)$

$= \ell n\left(\sqrt{(x-2)^2+4} - (x-2)\right)$

$= \ell n\left(\frac{4}{\sqrt{(x-2)^2+4} + (x-2)}\right) = \ell n\, 4 - f(x)$

$\therefore$ I = 2 ℓn 4 = 4 ℓn 2

18. Value of integral ....

Sol. Let $f(x) = \cos^{-1}(\cos 2x)$

Then $f\left(\frac{\pi}{2}+x\right) = \cos^{-1}\left(\cos 2\left(\frac{\pi}{2}+x\right)\right)$

$= \cos^{-1}(\cos(\pi + 2x))$

$= \cos^{-1}(-\cos 2x) = \pi - f(x)$

$\therefore I = \pi \cdot \frac{\pi}{2} = \frac{\pi^2}{2}$

19. f(x) is increasing ....

Sol. We have

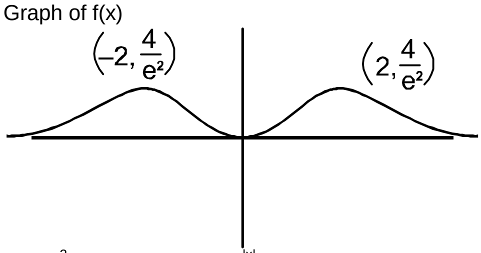
$f(x) = x^2 e^{-|x|} = \begin{cases} x^2e^{-x} & x \geq 0 \\ x^2e^{x} & x < 0 \end{cases}$

$f'(x) = \begin{cases} xe^{-x}(2-x) & x \geq 0 \\ xe^{x}(x+2) & x < 0 \end{cases}$

f(x) is increasing in $(-\infty, -2) \cup (0, 2)$

20. For which of ....

Sol. Graph of f(x)



$y = kx^2$ will intersect $y = e^{|x|}$
Then $kx^2 = e^{|x|}$

$x^2 e^{-|x|} = \frac{1}{k} \Rightarrow \frac{1}{k} = \frac{4}{e^2} \Rightarrow k = \frac{e^2}{4}$

21. (A) $2\left|\int_0^{\pi/2} \frac{\sin 8x . \ell n(\cot x)}{\cos 2x} dx\right|$ ....

Sol. (A) Let $I = \int_0^{\pi/2} \frac{\sin 8x\ .\ \ell n(\cot x)}{\cos 2x}\,dx$

$I = \int_0^{\frac{®}{2}} \frac{\sin 8\left(\frac{®}{2} - x\right) \ell n \left(\cot\left(\frac{®}{2} - x\right)\right)}{\cos 2\left(\frac{®}{2} - x\right)}$

$= \int_0^{\pi/2} \frac{-\sin 8x . \ell n(\tan x)}{-\cos 2x} dx$

$\Rightarrow I = -I \Rightarrow I = 0 \quad = -I$

(C) $\int_{-3}^{-1} f(x)\,dx + \int_{-1}^{1} f(x)\,dx + \int_{1}^{3} f(x)\,dx$

$= (-2)^2 + (0)^2 + (2)^2 = 8$

22. (A) If angle between ....

Sol. (A) $\vec{a} + \vec{b} + \sqrt{3}\,\vec{c} = \vec{0}$

$\Rightarrow \vec{a} + \vec{b} = -\sqrt{3}\,\vec{c}$

$\Rightarrow \left|\vec{a} + \vec{b}\right|^2 = \left|\sqrt{3}\ \vec{c}\right|^2$

$\Rightarrow a^2 + b^2 + 2\vec{a}\,.\,\vec{b} = 3c^2$

$\Rightarrow 2 + 2\cos\theta = 3$

$\Rightarrow \cos\theta = \frac{1}{2}$

(B) $\int_{-\pi/2}^{\pi/2} [\sin|x| - \cos|x|]\,dx$

$= \int_{-\pi/2}^{0} [\sin|x| - \cos|x|]\,dx + \int_{0}^{\pi/2} [\sin|x| - \cos|x|]\,dx$

$$= \int_{-\pi/2}^{0} [\sin(-x) - \cos(-x)]\, dx + \int_{0}^{\pi/2} [\sin x - \cos x\, dx$$

$$= \int_{-\pi/2}^{0} (-\sin x - \cos x\, dx$$

$$+ \int_{0}^{\pi/2} (\sin x - \cos x)\, dx$$

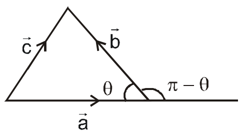
$$= [\cos x - \sin x]_{-\pi/2}^{0} + [-\cos x - \sin x]_{0}^{\pi/2}$$

$$= (\cos 0 - \sin 0) - \left[\cos\left(-\frac{\pi}{2}\right) - \sin\left(-\frac{\pi}{2}\right)\right]$$

$$+ \left(-\cos\frac{\pi}{2} - \sin\frac{\pi}{2}\right) - (-\cos 0 - \sin 0)$$

$$= (1 - 0) - (0 + 1) + (0 - 1) - (-1 - 0) = 0$$

(C) $\cos(\pi - \theta) = \dfrac{\vec{a}\ .\ \vec{b}}{|\vec{a}|\ |\vec{b}|} = \dfrac{-1+3}{\sqrt{1+3}\ \ \sqrt{1+3}} = \dfrac{2}{4}$



$$-\cos\theta = \frac{1}{2}$$

$$\theta = \frac{2\pi}{3}$$

(D) $y(x) = \displaystyle\int_{\pi^2/16}^{x^2} \frac{\cos x.\cos\sqrt{\theta}}{1+\sin^2\sqrt{\theta}}.d\theta$

$\Rightarrow y(x) = \cos x . \displaystyle\int_{\pi^2/16}^{x^2} \frac{\cos\sqrt{\theta}}{1+\sin^2\sqrt{\theta}}\, d\theta$

Applying Leibnitz theorem

$$= -\sin x \int_{\pi^2/16}^{x^2} \frac{\cos\sqrt{\theta}}{1+\sin^2\sqrt{\theta}}\, d\theta + \frac{2x\cos x\cdot\cos x}{1+\sin^2 x}$$

Hence at $x = \pi$,

$$\frac{dy}{dx} = 0 + \frac{2\pi(-1)(-1)}{1+0} = 2\pi$$

$$\therefore\ \frac{5f'(\pi)}{2\pi} = \frac{5(2\pi)}{2\pi} = 5$$

23. Let y(x) satisfies......................

Sol. $\dfrac{dy}{dx} - y\tan x = 2x\sec x$

$y(0) = 0$

I.F. $= e^{-\int \tan x\, dx} = e^{-\log\sec x}$

I.F. $= \cos x$

$\cos x\ .\ y = \displaystyle\int 2x\sec x.\cos x\, dx$

$\cos x.\ y = x^2 + c$

$c = 0$

$y = x^2 \sec x$

$$y\left(\frac{\pi}{4}\right) = \frac{\pi^2}{16}.\sqrt{2} = \frac{\pi^2}{8\sqrt{2}}$$

$$\frac{\pi^2}{8\sqrt{2}} = \frac{\pi^2}{\sqrt{k}}$$

$\sqrt{k} = 8\sqrt{2}$

$k = 64 \times 2$

$\therefore\ \dfrac{k}{24} = 2$

24. $\displaystyle\int_2^4 \left(\log_x 2 - \frac{(\log_x 2)^2}{\ell n 2}\right) dx$ ....

Sol. $I = \displaystyle\int_2^4 \left(\log_x 2 - \frac{(\log_x 2)^2}{\ell n 2}\right) dx$

$$= \int_2^4 \left(\frac{\ell n2}{\ell nx} - \frac{1}{\ell n 2}\frac{(\ell n2)^2}{(\ell nx)^2}\right) dx$$

put $\ell n\, x = t$

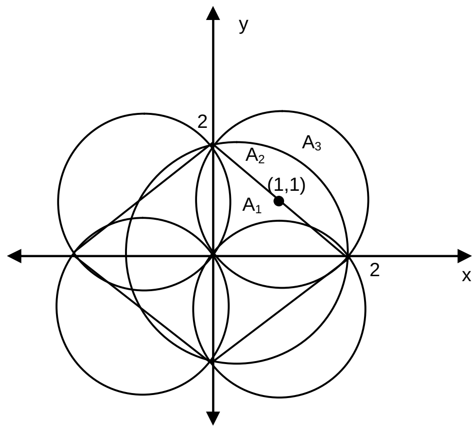
$\therefore\ x = e^t \quad \therefore\ dx = e^t\, dt$

$$= \ell n2 \int_{\ell n2}^{\ell n4} \left(\frac{1}{t} - \frac{1}{t^2}\right) e^t dt = \ell n2 \left\{\frac{e^t}{t}\right\}_{\ell n2}^{\ell n4}$$

$$= \ell n2 \left\{\frac{4}{\ell n4} - \frac{2}{\ell n2}\right\} = 0$$

25. Find the area ....

Sol.



$$A_1 + A_2 = \frac{1}{4}\pi \times 2^2 = \pi$$

$$A_1 = \frac{1}{2} \times 2 \times 2 = 2$$

$\therefore\ A_2 = \pi - 2$

$$A_2 + A_3 = \frac{1}{2}\pi \times \left(\sqrt{2}\right)^2 = \pi$$

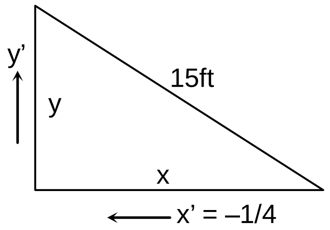
$\therefore\ A_3 = \pi - (\pi - 2) = 2$

$\therefore$ Required area $= 4(A_3)$

$= 4 \times 2 = 8$

26. A 15 foot ladder ....

Sol.



x' is negative because x is decreasing . Using Pythagorean Theorem and differentiating,

$x^2 + y^2 = 15^2$

$\Rightarrow 2xx' + 2yy' = 0$

After 12 sec we have $x = 10 - 12\left(\frac{1}{4}\right) = 7$ and so y =

$\sqrt{15^2 - 7^2} = \sqrt{176}$.

Put in and solve for y'

$7\left(-\frac{1}{4}\right) + \sqrt{176}\ y' = 0$

$\Rightarrow y' = \frac{7}{4\sqrt{176}}$ ft/sec $\Rightarrow$ n = 7

27. The degree and ....

Sol. General equation of parabola whose axis is x-axis is $y^2 = 4a(x + h)$

on differentiating w.r.t. x we get

$2y \cdot \frac{dy}{dx} = 4a \Rightarrow y \cdot \frac{dy}{dx} = 2a$

Again, differentiating, we get

$$\left(\frac{dy}{dx}\right)^2 + y \cdot \left(\frac{d^2y}{dx^2}\right) = 0$$

This is a differential equation whose degree and order are 1 and 2 respectively.

28. Let f(x) ....

Sol. $f(x) = \begin{cases} x^2 + 3x + a, & x \le 1 \\ bx + 2, & x > 1 \end{cases}$

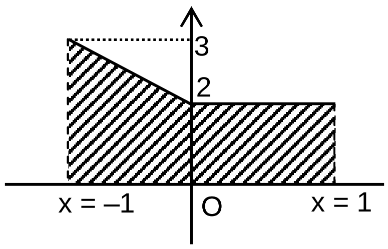
$2 + a = b$

and $5 = b$

$\Rightarrow \quad a^2 + b^2 = 34$

29. The area covered......................

Sol. y = max{2 – x, 2, 1 + x}



Area = $\left(\frac{1}{2}(2 + 3) \times 1\right) + 1 \times 2 = \frac{9}{2} = \frac{\alpha}{\beta}$

$\therefore \quad \alpha - \beta = 7$

30. The value of ....

Sol. $$I = \int_0^{\pi/2}\left(\frac{x\sin 2x \sin\left(\frac{\pi}{2}\cos x\right)}{2x-\pi} - \frac{(\pi - x)\sin x \sin\left(\frac{\pi}{2}\cos x\right)}{2x-\pi}\right)$$

$$= \int_0^{\pi/2} \sin 2x \,.\sin\left(\frac{\pi}{2}\cos x\right) dx$$

$\frac{\pi}{2}\cos x = t$

$\sin x\, dx = \frac{-2}{\pi}dt$

$$= \int_{\pi/2}^{0} 2 \times \left(-\frac{2}{\pi}\right) \times \frac{2t}{\pi}\sin t dt$$

$$= \frac{8}{\pi^2}\int_0^{\pi/2} t\sin t dt \quad \text{(integrating by parts) we get}$$

$\pi^2 I = 8$

31. If $f(x) = \int_2^x \frac{dt}{\sqrt{1+t^4}}$ ....

Sol. g(f(x)) = x

$\Rightarrow g'(f(x))\, f'(x) = 1$

$\Rightarrow g'(f(x)) = \frac{1}{f'(x)}$

$\Rightarrow g'(0) = \frac{1}{f'(2)} = \frac{1}{\frac{1}{\sqrt{17}}} = \sqrt{17}$

32. The general solution......................

Sol. put y = vx $\Rightarrow \frac{dy}{dx} = v + \frac{xdv}{dx}$

$\frac{2v\, dv}{1-v^2} = \frac{dx}{x}$

$\Rightarrow$ Integrating both sides $\int \frac{2v}{1-v^2} = \int \frac{dx}{x}$

$\ell n|v^2 - 1| + \ell n|x| + \ell nk = 0$

$\ell n|(v^2 - 1)xk| = 0$

$|(v^2 - 1)xk| = 1 \Rightarrow |y^2 - x^2| = |x|$

$\Rightarrow$ m = 2, b = 1 $\Rightarrow$ m + b = 3

33. If $\phi(x) = 3f\left(\frac{x^2}{3}\right)$ ....

Sol. $\phi'(x) = 3f'\left(\frac{x^2}{3}\right) \times \frac{2x}{3} + f'(3 - x^2)(-2x)$

$$= 2x\left(f'\left(\frac{x^2}{3}\right) - f'(3 - x^2)\right)$$

for $\uparrow$, $2x\left(f'\left(\frac{x^2}{3}\right) - f'(3 - x^2)\right) > 0$

case-I x > 0 and $f'\left(\frac{x^2}{3}\right) > f'(3-x^2)$

$\Rightarrow \frac{x^2}{3} > 3 - x^2$

$\frac{4}{3}x^2 > 3 \Rightarrow 4x^2 > 9$

$\therefore x \in (-\infty, -\frac{3}{2}) \cup \left(\frac{3}{2}, \infty\right)$

But x > 0 and $x \in (-3, 4)$

$\therefore x \in \left(\frac{3}{2}, 4\right)$

case-II x < 0 and $f'\left(\frac{x^2}{3}\right) < f'(3-x^2)$

$\Rightarrow \frac{x^2}{3} < 3 - x^2$

$\Rightarrow 4x^2 < 9$

$\therefore x \in (-\frac{3}{2}, \frac{3}{2})$

But x < 0 and $x \in (-3, 4)$

$\therefore x \in \left(-\frac{3}{2}, 0\right)$

$\therefore \uparrow$ in $x \in \left(-\frac{3}{2}, 0\right)$ or $\left(\frac{3}{2}, 4\right)$

Here $\alpha = 3$, $\beta = 2$ and $\gamma = 4$

$\therefore \alpha + \beta + \gamma = 9$

34. If $I_1 = \int_{-1}^{1}\left(\tan^{-1}x + \tan^{-1}\frac{1}{x}\right)$......................

Sol. $I_1 = \int_{-1}^{1}\left(\tan^{-1}x + \tan^{-1}\frac{1}{x}\right) dx = 0$

[Since $\tan^{-1}x$ is odd function]

$I_2 = \int_{-1}^{1}\left(\cot^{-1}x + \cot^{-1}\frac{1}{x}\right) dx$

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

$I_2 = 2\pi + I_1$

35. If f(x) is a polynomial......................

Sol. $f(x) = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4 + a_5x^5 + a_6x^6$

$\lim_{x\to 0}\left(1 + \frac{f(x)}{x^3}\right) = 1 \Rightarrow a_0 = a_1 = a_2 = a_3 = 0$

$\lim_{x\to 0}\left(1 + \frac{f(x)}{x^3}\right)^{1/x} = e^2$

$\lim_{x\to 0} e^{(a_4 + a_5x + a_6x^2)} = e^2 \qquad \Rightarrow a_4 = 2$

$f(x) = 2x^4 + a_5x^5 + a_6x^6$

$f'(x) = x^3 (8 + 5a_5x + 6a_6x^2)$

$f'(1) = 0, \ f'(2) = 0$

$a_5 = -\frac{12}{5}, \ a_6 = \frac{2}{3}$

$f(x) = 2x^4 - \frac{12}{5}x^5 + \frac{2}{3}x^6$

36. If $\int_0^{x^2} f(t)\,dt = 3x^2 + \int_{x^2}^{1} t\,f(t)\,dt$......................

Sol. diff. on both the sides

$f(x^2) \cdot 2x = 6x + [-x^2 \cdot f(x^2) \cdot 2x]$

$f(x^2)[2x + 2x^3] = 6x$

$f(x^2) = \frac{6x}{2x + 2x^3} = \frac{3}{1 + x^2}$

at $x = \sqrt{2}$, f(2) = 1

37. At present, a firm ....

Sol. $\int_{2000}^{P} dP = \int_0^{25}(100 - 12\sqrt{x})\,dx$

$(P - 2000) = 25 \times 100 - \frac{12 \times 2}{3}(25)^{3/2}$

P = 3500

38. For a certain curve ....

Sol. Integrating both sides w.r.t. x

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

at x = 1, $\frac{dy}{dx} = 0 \Rightarrow c = 1 \Rightarrow \frac{dy}{dx} = 3x^2 - 4x + 1$ ......(1)

Integrating both sides w.r.t. x

$y = x^3 - 2x^2 + x + c_1$

at x = 1, y = 5 $\Rightarrow c_1 = 5$

$\Rightarrow y = x^3 - 2x^2 + x + 5$

from equation (1) we get the critical points

$x = \frac{1}{3}, 1$

f(1) = 5 ; f(0) = 5, f(2) = 7, $f\left(\frac{1}{3}\right) = \frac{112}{27}$

Hence the global maximum value = 7

39. $\lim_{n\to\infty}$ 24......................

Sol. $A = \left[\lim_{n\to\infty}\left(\sin\frac{\pi}{2n}\sin\frac{2\pi}{2n}.......\sin\frac{2(n-1)}{2n}\right)\right]^{1/n}$

$\Rightarrow \ell nA = \frac{1}{n}\sum_{r=1}^{2(n-1)} \ell n \sin\frac{r}{2}\frac{\pi}{n} = \int_0^2 \ell n \sin\left(\frac{\pi x}{2}\right) dx$

put $\frac{\pi \ x}{2} = t$

$\Rightarrow \ell nA = \frac{2}{\pi}\int_0^{\pi} \ell n(\sin t)\,dt = \frac{4}{\pi}\int_0^{\pi/2} \ell n(\sin t)\,dt$

Ĝ= ℓn A = – 2 ℓn 2 $\Rightarrow A = \frac{1}{4}$

: y = 24A = $\frac{1}{4} \times 24 = 6$

40. The value of ....

Sol. Put x = tan θ, so $I = \int_{\pi/8}^{3\pi/8} \frac{\tan^2\theta - 1}{\sec^2\theta} d\theta$

$\therefore I = \int_{\pi/8}^{3\pi/8} (\sin^2\theta - \cos^2\theta)\, d\theta$ .... (1)

$I = \int_{\pi/8}^{3\pi/8} (\cos^2\theta - \sin^2\theta)\, d\theta$ .... (2)

(by property number 5)
Now, (1) + (2) given
$2I = 0 \Rightarrow I = 0$

PHYSICS

1. A non-relativistic ....

Sol. mvr = $n\hbar$

$\frac{mv^2}{r}$ = kr

solving above equation

$v^2 = \left(\frac{n\hbar}{m}\right)\left(\frac{k}{m}\right)^{1/2}$; $r^2 = \left(\frac{n\hbar}{k}\right)\left(\frac{k}{m}\right)^{1/2}$

2. An alternating ....

Sol. E = 6sin 20t + 8 cos 20t
= 10 sin (20t + ϕ_0)

$\phi_0 = \tan^{-1}\left(\frac{8}{6}\right) = 53°$

E_0 = 10 volt I_0 = 2A

$P = \frac{E_0 I_0}{2} = 10W$

$Q = \omega_0 \frac{L}{R} = 20\left(\frac{2}{10(5)}\right) = 0.8$

$\omega_0 L = \frac{1}{\omega_0 C}$

$\Rightarrow C = \frac{1}{\omega_0^2 L}$ = 12.5mF

3. A small ball ....

Sol. The force acting on a particle of charge Q that moves with a velocity of v in a magnetic field is given by the formula :

$\vec{F} = Q\vec{v} \times \vec{B}$ (1)

This force is perpendicular to both the velocity and the magnetic field, so as in the present case the magnetic field is uniform and horizontal, the ball will move along a curve in a vertical plane perpendicular to the field lines. Conservation of energy gives $v = \sqrt{2gh}$.

$Qv_y B = ma_x$.

$\Rightarrow QB \times \frac{dy}{dt} = m \times \frac{dv_x}{dt}$

QBh = mv = $m\sqrt{2gh}$

By substitution we can get rest of the answers

4. When an electron ....

Sol. Self explanatory

5. An air column ....

Sol. $(2n-1)\frac{v}{4\ell} = 264$

$\Rightarrow \ell = \frac{(2n-1)\times 330}{264 \times 4}$ m $\Rightarrow \ell$ = 31.25 cm if n = 1

ℓ = 93.75 cm if n = 2

ℓ = 156.25 cm if n = 3

6. The conductor ....

Sol. Retarding force F = $B_0 I\ell$

$= B_0 \left(\frac{B_0 v\ell}{R}\right)\ell = \frac{B_0^2 . v}{6}$

retardation = $\frac{B_0^2 v}{6 \times 1}$ (at any instant of time) ($\because$ m = 1)

$\frac{B_0^2 v}{6} = -\frac{dv}{dt} \Rightarrow \int_{v_0}^{v} \frac{-dv}{v} = \int_0^t \left(\frac{B_0^2}{6}\right) dt$

$\Rightarrow \ell n\left[\frac{v_0}{v}\right] = \frac{t}{600}$

$v = v_0 e^{-\frac{t}{600}}$

At t = 600 ℓn (2) $\Rightarrow$ $v = \frac{v_0}{2}$

t = 600 ℓn (2) $\Rightarrow$ $v = \frac{v_0}{2}$

$i = \frac{B_0 v\ell}{R} = \frac{B_0 v}{R} = \frac{B_0 v_0}{12} = \frac{v_0}{120}$

[$\because$ R = 6Ω , $|B_0|$ = 0.1 T]

$E = B_0 v\ell = \frac{v_0}{10} e^{-\frac{t}{600}}$

7. An air column ....

Sol. $f = 5.\frac{v}{4\ell}$ $\Rightarrow$ $\ell = \frac{5v}{4f} = \frac{15}{16}$ m

The open end is position of node of pressure. There is no pressure variation.

8. A proton and ....

Sol. $\lambda_d = \frac{h}{p}$ p is the same

p = mv $\frac{v_p}{v_e} = \frac{m_e}{m_p}$

$p = \sqrt{2mK}$ $mK = \frac{p^2}{2}$

Ans. **(b), (c), (d)**

9. A point charge ....

Sol. $\omega = 1 \Rightarrow \frac{qB}{m} = 1 \Rightarrow$ B = 10T

Speed = 5 m/s

10. In a photo ....

Sol. Energy of photon = $\dfrac{12400}{2000}$ eV = 6.2 eV

Maximum KE of electron at emitter = 6.2 – 4.5 = 1.7 eV
Minimum KE of electron at emitter = 0
Maximum KE of electron at collector = 1.7eV + 2eV = 3.7 eV
Minimum KE of electron at collector = 0 + 2 eV = 2 eV
If polarity is reversed, then Max KE of electron at emitter < 2 eV
So no electron will reach at the collector.

11. An infinitely ....

Sol. Force is exerted only by straight portions of loop

$F_{net} = \dfrac{\mu_0 I_1 I_2 L}{2\pi R} + \dfrac{\mu_0 I_1 I_2 L}{2\pi R} \Rightarrow$ option (B) & (D)

12. A source ....

Sol. $\lambda' = \dfrac{V - V_s}{f} = \dfrac{332 - 32}{1000}$ = 0.3 m

$f' = f\dfrac{(V + V_0)}{V - V_s} = 1000 \times \dfrac{332 + 64}{332 - 32}$ = 1320 Hz

$\lambda'' = \dfrac{V - V_0}{f'}$ = 0.2 m

13. From a cylinder ....

Sol. For cylinder

$B = \dfrac{\mu_0 ir}{2\pi R^2}$; $r < a$

$= \dfrac{\mu_0 i}{2\pi r}$; $r \geq a$

We can consider the given cylinder as a combination of two cylinders. One of radius 'R' carrying current I in one direction and other of radius $\dfrac{R}{2}$ carrying current $\dfrac{I}{3}$ in both directions.

At point A :

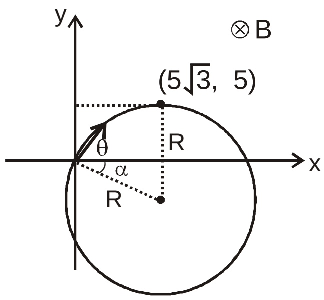
$B = \dfrac{\mu_0 (I/3)}{2\pi (R/2)} + 0 = \dfrac{\mu_0 I}{3\pi R}$

At point B :

$B = \dfrac{\mu_0}{2}\left(\dfrac{4I/3}{\pi R^2}\right)\left(\dfrac{R}{2}\right) + 0 = \dfrac{\mu_0 I}{3\pi R}$

14. A charged ....

Sol. $R^2 - (R - 5)^2 = (5\sqrt{3})^2$



$R^2 - R^2 (R - 5)^2 = (5\sqrt{3})^2$

$R^2 - R^2 - 25 + 10R = 75$

R = 10 m

$\sin\alpha = \dfrac{1}{2}$, a = 30° , θ = 90 – α = 60°

$\dfrac{mv}{qB} = R \Rightarrow v = \dfrac{RqB}{m} = \dfrac{10 \times 10^{-6} \times 10}{5 \times 10^{-5}}$ = 2 m/s

16. Choose the ....

Sol. $E = \dfrac{R}{2}\dfrac{dB}{dt} = \dfrac{nB_0 R}{2} t^{n-1}$

$\tau = qER = \dfrac{nB_0 qR^2}{2} t^{n-1} = mR^2 \dfrac{d\omega}{dt}$

$\dfrac{d\omega}{dt} = \dfrac{nB_0 q}{2m} t^{n-1}$

$\int_0^{\omega} d\omega = \dfrac{nB_0 q}{2m} \int_0^t t^{n-1} dt$

$\omega = \left(\dfrac{nB_0 q}{2m}\right)\dfrac{t^n}{n} = \dfrac{B_0 q}{2m} t^n$

$P = \tau\omega = \dfrac{nB_0^2 q^2 R^2}{4m} t^{2n-1}$

20. Choose the ....

Sol. $\omega = \dfrac{1}{\sqrt{LC}}$

$q_1 = q_0 \sin(\omega t + \pi/2) = q_0 \cos\omega t$

$q_2 = -q_0 \cos\omega t$

$q_2 = \dfrac{q_0}{2} = -q_0 \cos\omega t$

$\cos\omega t = -\dfrac{1}{2}$

$\omega t = \dfrac{2\pi}{3}$

$t = \dfrac{2\pi}{3\omega}$

When $U_L = U_C$

$|q| = \dfrac{q_0}{\sqrt{2}}$

$q = q_0 \cos\omega t$

$\omega t = \dfrac{\pi}{4},\ \pi - \dfrac{\pi}{4},\ \pi + \dfrac{\pi}{4}$ ....

21. In each of ....

Sol. (A) The fundamental frequency in the string,

$\dfrac{\sqrt{T/\mu}}{2\ell} = \sqrt{\dfrac{102.4}{1 \times 10^{-3}}} \times \dfrac{1}{2 \times 0.5}$

f_0 = Hz = 320 Hz.

Other possible resonance frequencies are f_A and f_0 = 320 Hz, 640 Hz, 960 Hz.

(B) The fundamental frequency in the string.

$f_0 = \dfrac{\sqrt{T/\mu}}{4\ell} = \dfrac{320}{4 \times 0.5}$ = 160 Hz.

Other possible resonance frequencies are

f_B = 160 Hz, 480 Hz, 800 Hz.

(C) The fundamental frequency in both ends open organ pipe is

f_0 = = 320 Hz.

Other possible resonance frequencies are
f_C = 320 Hz, 640 Hz, 960 Hz

(D) The fundamental frequency in one end open organ pipe is

$$f_0 = \frac{v}{4\ell} = \frac{320}{4\times 0.5} = 160 \text{ Hz.}$$

Other possible resonance frequencies are
f_D = 160 Hz, 480 Hz, 800 Hz.

22. A source of ....

Sol. $\Delta f_B = \frac{2v_0 f_0}{v - v_s} = \frac{2\times 10}{300} \times 6000 = 400$ Hz

$\Delta f_A = 0$

$\Delta f_C = \frac{2VV_s}{V^2 - V_S^2} = \frac{2\times 350\times 50\times 6000}{400\times 300} = 1750$ Hz

$\Delta f_D = \Delta f_E = \frac{4f}{3} - f = \frac{f}{3} = 2000$ Hz.

23. A photon strikes ....

Sol. Energy required to just remove the electron = 13.6 eV

$\therefore$ Energy required = 13.6 + 16.4 = 30 eV

If E be the photon energy 25%

E = 30 eV, E = 120eV = 24 × 5 eV.

X = 5 **Ans.**

24. A rectangular ....

Sol. Torque due to magnetic force should act opposite to that of gravity i.e. along the –ve y-axis. If $M\hat{k}$ is the magnetic moment

$\vec{\tau}_B = \vec{M}\times\vec{B} = M\hat{k}\times(3\hat{i}+4\hat{k})B_0 = 3MB_0\hat{j}$

$\Rightarrow$ M is –ve

$\therefore$ I should be clockwise i.e. from P to Q

$\vec{F} = I\left(\vec{L}\times\vec{B}\right) \Rightarrow$

$\vec{F}_{RS} = I[(-b\hat{j})\times(3\hat{i}+4\hat{k})B_0] = IB_0 b[3\hat{k} - 4\hat{i})$

$3(abI)B_0 = mg\, a/2$

$I = \frac{mg}{6B_0 b}$

25. The current in ....

Sol. Let the current be in the outer coil

The field at centre $B = \frac{\mu_0 I}{2b}$

The flux through the inner coil = $\frac{\mu_0 I \pi a^2}{2b}$

The induced emf produced in the inner coil

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

$\frac{\mu_0 \pi a^2}{2b}\frac{d}{dt}\left(2t^2\right) = \frac{2\mu_0\pi a^2 t}{b}$

Current induced in the inner coil = $\frac{\varepsilon}{R} = \frac{2\mu_0\pi a^2 t}{bR}$

Heat developed in the inner coil = $\int_0^t I^2 R dt$

$= \int_0^t \frac{4\mu_0^2\pi^2 a^4 t^2 R dt}{b^2 R^2} = \frac{4\mu_0^2\pi^2 a^4}{b^2 R}\frac{t^3}{3}$

26. Two sound ....

Sol. $f_1 = \frac{V}{\lambda}$

$f_1 = \frac{330}{5} = 66$

$f_2 = \frac{330}{5.5} = 60$

$\Delta f = f_1 - f_2 = 6$

27. A car while ....

Sol. Noise intensity due to one car is

$\beta = 10 \log I/I_0 = 94$ decibels

For 'n' cars

$\beta = 10 \log \frac{n^2 I}{I_0}$

$\beta = 10 [2 \log n + \log (I/I_0)]$

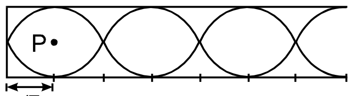
solving we get

n = 2 cars at a time.

28. A closed organ ....

Sol. The figure shows variation of displacement of particles in a closed organ pipe for 3rd overtone.

For third overtone $\ell = \frac{7\lambda}{4}$ or $\lambda\frac{4\ell}{7} = \frac{\lambda}{4}$ or $= \frac{\ell}{7}$



Hence the amplitude at P at a distance $\frac{\ell}{7}$ from closed end is 'a' because there is an antinode at that point

Alternate

Because there is node at x = 0 the displacement amplitude as function of x can be written as A = a sin kx = a sin $\frac{2\pi}{\lambda}$ x

For third overtone $\ell = \frac{7\lambda}{4}$ or $\lambda = \frac{4\ell}{7}$

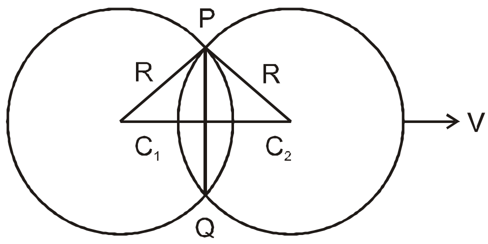
$\therefore$ A = a sin $\frac{7\pi}{2\ell}$ $\frac{\ell}{7}$ = a sin $\frac{\pi}{2}$ = a

at x = $\frac{\ell}{7}$

$\Rightarrow$ A = a

29. A uniform magnetic ....

Sol. $\varepsilon = |(\vec{v}\times\vec{B}).\vec{\ell}\,|$



ε = VB (PQ)

$= VB\ 2\sqrt{R^2 - \left(\frac{vt}{2}\right)^2} = VB\sqrt{4R^2 - V^2t^2}$

$= 4 \times 0.25\sqrt{4\times 25 - 16\times 4} = 6$ volt

30. Figure shows ....

Sol. $mg \sin\theta\, v = I^2 R$

$2 \times 10 \times \frac{1}{2} v = \frac{v^2(2^2)(1^2)}{2}$

v = 5 m/s

31. A rod of mass ....

Sol. Total heat produced= KE of the rod = $\frac{1}{2} \times 2 \times 3^2 = 9$ J

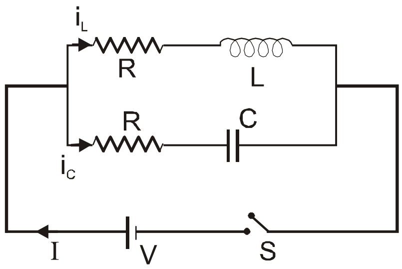
32. Find the current ....

Sol. Since the battery is across the two branches in parallel the current through the RL branch is unaffected by the current of the RC branch.

$\therefore\ i_L(t) = \left(\frac{V}{R}\right)\left(1 - e^{-\frac{R}{L}t}\right)$ and $i_C(t) = \frac{V}{R} e^{-\frac{t}{RC}}$

$\therefore\ I = i_L + i_C$

$I = \frac{V}{R}\left[1 - e^{-\frac{R}{L}t} + e^{-\frac{t}{RC}}\right]$



If $\tau_L = \tau_C = \tau$

$I = \frac{V}{R}\left[1 - e^{-\frac{t}{\tau}} + e^{-\frac{t}{\tau}}\right] = \frac{V}{R}$

i.e., $I = \frac{V}{R}$ for all t > 0

i.e. there will be no transient current through the battery in this case

$I = \frac{V}{R} = \frac{10}{2} = 5$A.

33. In figure below ....

Sol. If $X_L = X_C$ current will be same,

So, $V_L = V_C$;

$\therefore\ V_L' = 1 \times 2\pi \times 30 \times \frac{1}{\pi} = 60\,\text{Volt}$

$V_R = 80 \times 1 = 80\,\text{volt}$

$V = \sqrt{V_L'^2 + V_R^2} = \sqrt{(80)^2 + (60)^2} = 100\,\text{Volt}$

34. In the LCR ....

Sol. L removed L

$\cos 30^\circ = \frac{100}{\sqrt{100^2 + {X_C}^2}} = \frac{\sqrt{3}}{2}$

$X_C = \frac{100}{\sqrt{3}}\ \Omega$

C removed

$\cos 60^\circ = \frac{100}{\sqrt{100^2 \times {X_L}^2}} = \frac{1}{2}$

$X_L = 100\sqrt{3}\ \Omega$

$\frac{X_L}{X_C} = \frac{\omega L}{\frac{1}{\omega C}}$

$\omega^2 (LC) = 3$

$\omega_n = \frac{1}{\sqrt{LC}} = \frac{\omega}{\sqrt{3}} = \frac{300}{\sqrt{3}} = 100\sqrt{3}$

$\therefore$ frequency = $\frac{100\sqrt{3}}{2\pi}$ Hz

= resonant frequency

35. Moseley plot ....

Sol. $\sqrt{f} = a(Z - b)$

a = slope = $\frac{0.5 \times 10^9}{10}$ = $Hz^{1/2}$

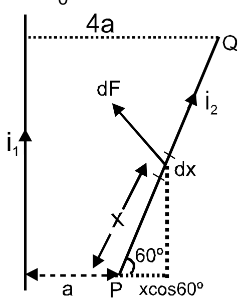
$0.95 \times 10^9 = 5 \times 10^7 (20 - b) \Rightarrow b = 1$

36. A long straight ....

Sol. $dF = B\, i_2\, dx$

$= \frac{\mu_0 i_1 i_2}{2\pi(a + x\cos 60^\circ)} dx$

$F = \int_0^{6a} dF = \frac{\mu_0 i_1 i_2}{\pi} \ln\left(\frac{4a}{a}\right) = \frac{2\mu_0 i_1 i_2}{\pi} \ell n\, 2$



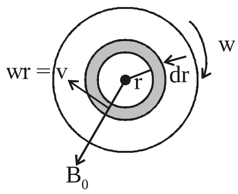
37. A rod of length ....

Sol.

$M = \int_0^{\ell/2} 2.\frac{q}{\ell} dx. \frac{\omega}{2\pi}.\pi x^2 = \frac{q\omega}{\ell}\frac{1}{3}\left(\frac{\ell}{2}\right)^3 = \frac{q\omega\ell^2}{24}$

38. A thin non ....

Sol. The force an any small part of the disc is in the vertically upward direction



$$dF = \left(\frac{Q}{® R^2} 2® r\, dr\right) \mu r\ B_0$$

$$dF = \frac{2Q\mu B_0}{R^2} r^2 dr$$

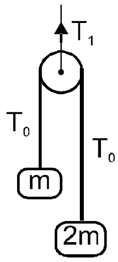
$$F = \frac{2}{3} Q\mu B_0 R = Mg$$

$$\Rightarrow \quad \mu = \frac{3Mg}{2QB_0R} = \frac{3\times 2\times 10}{2\times 2\times 10^{-2}\times 10\times \frac{1}{6}} = 9\times 10^2\, rad/s$$

39. AB wire is ....

Sol. $T_1 = 2T_0 = 2\left[\frac{2m(2m)}{m+2m}\right] g$

$T_1 = \frac{8m}{3} g = \frac{80m}{3}$ ....(i)



In resonance,

$f_{wire} = f_{tube}$

$$\frac{(1)V_1}{2\ell_1} = \frac{(1)V_2}{4\ell_2} \quad ; \quad \frac{\left(\sqrt{\frac{T_1}{\mu}}\right)}{2(x)} = \frac{(400)}{4\left(\frac{x}{2}\right)}$$

$\Rightarrow \ T_1 = \mu(16 \times 10^4)$

From (i),

$\frac{80}{3} m = 10^{-4} (16 \times 10^4)$

m = 0.6 kg.

40. In a car race ....

Sol. Let the velocities of car 1 and car 2 be V_1 m/s and V_2 m/s.

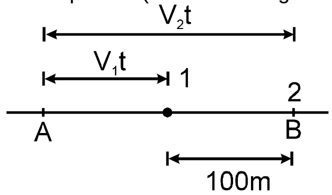
$\therefore$ Apparent frequencies of sound emitted by car 1 and car 2 as detected at end point are

$f_1 = f_0 \frac{V}{V-V_1}$, $\quad f_2 = f_0 \frac{V}{V-V_2}$

$\Rightarrow \ 330 = 300 \frac{330}{330-V_1}$, $\quad 360 = 300 \frac{330}{330-V_2}$

$\Rightarrow \ V_1 = 30$ m/s and $V_2 = 55$ m/s.

The distance between both the cars just when the 2nd car reach and point B (as shown in figure is)



$100m = V_2t - V_1t \ \Rightarrow \ t = 4$ sec.

CHEMISTRY

1. NaCl (aq.) solution is ....

Sol. Since freezing point of solution is lower than pure water so whole of the added ice will melt. Due to this solution will be diluted and vapour pressure will increase.

2. Colemanite $\xrightarrow{Na_2CO_3}$ ....

Sol. $Ca_2B_6O_{11} + Na_2CO_3 \longrightarrow \underset{(X)}{Na_2B_4O_7} \xrightarrow{HCl}$

$\underset{(Y)}{H_3BO_3} \xrightarrow{\Delta} \underset{(Z)}{B_2O_3} \xrightarrow{Mg} \underset{(W)}{B}$

Borax is $Na_2[B_4O_5(OH)_4].8H_2O$

3. A Daniel cell having originally ....

Sol. $Cu^{2+} + 4NH_3 \longrightarrow [Cu(NH_3)_4]^{2+}$

1	a	0
0	2	1

$K_f = \frac{[Cu(NH_3)_4]^{2+}}{[Cu^{2+}][NH_3]^4}$

or $\quad 1 \times 10^{12} = \frac{1}{[Cu^{2+}](2)^4}$ or $[Cu^{2+}] = 6.25\times 10^{-14}$ M

Now, $\quad E_{Cell} = E^0_{Cell} - \frac{0.06}{2} \log \frac{[Zn^{2+}]}{[Cu^{2+}]}$

$= 1.1 - \frac{0.06}{2} \log \frac{1}{6.25\times 10^{-14}} = 0.70$ V.

4. Which of the following ....

Sol. $Fe_2O_3 + 3CO \xrightarrow{\Delta} 2Fe + 3CO_2$ takes place in blast furnace.

5. If $\frac{1}{\lambda}$ is plotted against $C\lambda$ ....

Sol. $k = \frac{\alpha^2 c}{1-\alpha}$

using $\alpha = \frac{\lambda}{\lambda^\infty}$, we obtain

$k = \frac{c\lambda^2}{\lambda^\infty\ (\lambda^\infty - \lambda)}$; $\quad k\lambda^{\infty 2} - k\lambda\lambda^\infty = c\lambda^2$

on dividing by $k\lambda\lambda^{\infty 2}$

$$\frac{1}{\lambda} = \frac{1}{\lambda^\infty} + \frac{c\lambda}{k\ \lambda^{\infty 2}}$$

6. Which of the following ....

Sol. $t_{1/2} \propto (A)^{1-n}$; $[A]_t = [A]_0 - kt$ and $X = kt$

7. Which of the following ....

Sol. C_2H_5Br + C_2H_5I forms an ideal solution. Ideal solution cannot form any type of azeotrope.

8. 0.1 molar aqueous solution ....

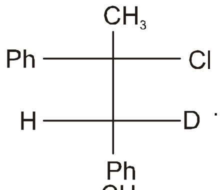
Sol. $\pi = iCRT$

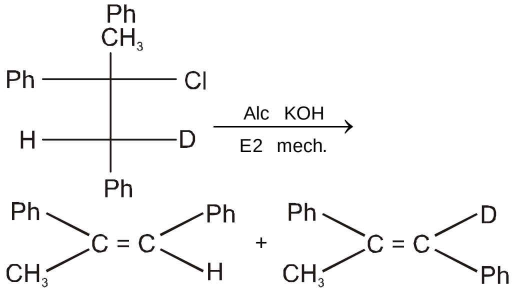
$= 2 \times 0.1 \times \frac{1}{12} \times 300$

= 5 atm

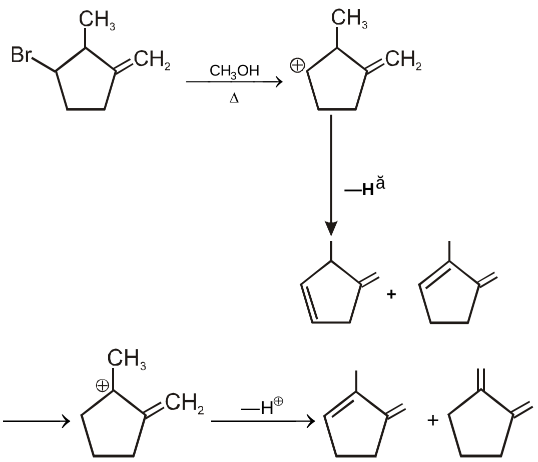
P_{ext} < O.P.

Hence net flow of solvent molecules will be from (solvent to solution)

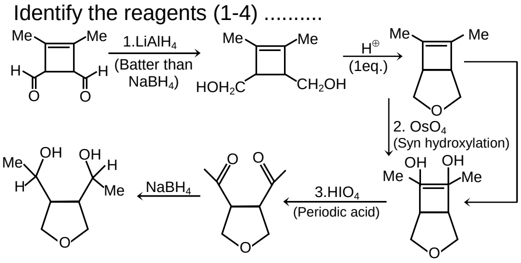
9.  ....

Sol. 

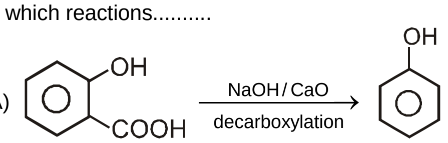
10. Which of the following..........

Sol. 

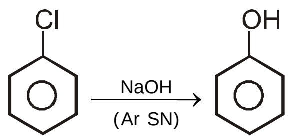
12. Identify the reagents (1-4) ....

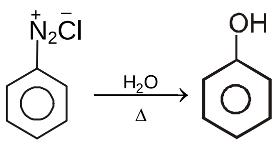
Sol: 

14. In which reactions..........

Sol. (A) 

(B) $C_6H_5 \xrightarrow{H_3O^+}$ MgBr $C_6H_6 + Mg\begin{smallmatrix}Br\\OH\end{smallmatrix}$

(C) 

(D) 

15. Select correct option(s) ....

Sol. $E^o_{cell} = 1.27\,V$

$\therefore\ \Delta G^\circ = -nFE^\circ J$

$= -2 \times 96500 \times 1.27 J = -245110\ \ J$

$\Delta G^\circ = \dfrac{-245110}{222} = -1104\ kJ/kg$

16. Select the incorrect ....

Sol. Cell reaction $Fe(s) + Ni_2O_3(s) \longrightarrow 2NiO(s) + FeO(s)$

17. Which of the following ....

Sol. Boiling point is not Colligative property.

$\Delta P = P^0 \times X_{solute}$. Hence it is a Colligative property.

π = CRT. It is a Colligative property.

18. The boiling point of a solution..........

Sol. (A) $\Delta T_b = iK_bm$

$\Delta T_f = iK_fm$

$\Rightarrow\ \dfrac{\Delta T_b}{\Delta T_f} = \dfrac{K_b}{K_f}$

(B) At boiling point (unless stated, P_{ex} = 760 torr)
Vapour pressure of solution is 760 torr

(C) Boiling point of water = 100ºC.
P^0_{water} = 760 torr.

$\Rightarrow\ \dfrac{760 - P_s}{760} = \dfrac{n}{n+N}$ (ΔT_b = (i.m.)K_b. = (i.m.) 0.5

$\Rightarrow$ i.m. = 2. (Hence 2 moles of solute in 1 Kg water)

$\Rightarrow\ \dfrac{760 - P_s}{760} = \dfrac{2}{\frac{1000}{18} + 2}$

$\Rightarrow\ \dfrac{760 - P_s}{P_s} = \dfrac{2}{\frac{500}{9}}$

$\Rightarrow\ \dfrac{760 - P_s}{P_s} = \dfrac{18}{500}$

$\Rightarrow$ 760 × 500 – 500 P_s = 18 P_s

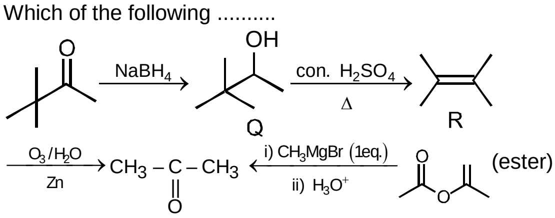
$\Rightarrow$ 760 × 500 = 518 P_s

$\Rightarrow$ P_s = 760 × $\dfrac{500}{518}$

= 734 torr

RLVP = $\dfrac{18}{518} = \dfrac{9}{259}$

20. Which of the following ....

Sol. 

21. Match column I with ....

Sol. For zero order $A_t = A_0 - kt$, slope = –k

Ist order $\log(a-x) = \dfrac{-k}{2.303}t + \log a$, slope = $\dfrac{-k}{2.303}$

IInd order $\dfrac{1}{(a-x)} = kt + \dfrac{1}{a}$, slope = k

IIIrd order $\dfrac{1}{(a-x)^2} = 2kt + \dfrac{1}{a^2}$, slope = 2k

23. A 1 : 3 molar mixture ....

Sol. $\dfrac{y_B}{y_T} = \dfrac{\frac{1}{4}}{\frac{3}{4}}\left(\dfrac{600}{200}\right)^3 = 3^2 : 1$; x = 2

24. The following data were ....

Sol.

$SO_2Cl_2(g) \longrightarrow$	$SO_2(g)$ +	$Cl_2(g)$
0.5	–	–
0.5-x	x	x

$P_T = 0.5 + x = 0.6$

x = 0.1

$$K = \frac{2.303}{100}\log\frac{0.5}{0.4} = \frac{2.303}{1000}$$

When $P_T = 0.65$

x = 0.15

$$\text{Rate} = K\,[P_{SO_2Cl_2}] = \frac{2.303}{1000} \times 0.35 = 8.06 \times 10^{-4}$$

25. To get the silicone ....

Sol. x = 5, y = 2

26. If certain decomposition ....

Sol. $C^{-2} = 4kt + 2$

$$-2C^{-3}\frac{dC}{dt} = 4k$$

$$-\frac{dC}{dt} = \frac{4k}{2C^{-3}} \;;\; -\frac{dC}{dt} = 2kC^3$$

Hence order is equal to 3.

27. How many of the ....

Sol. (iv) Bayer's method is used for red bauxite.

28. A sparingly soluble salt MX ....

Sol. $MX \rightleftharpoons M^+ + X^-$

x $x + 10^{-6}$

$[Na^+] = 10^{-6}$ M

$K_{Sol} = K_{M^+} + K_{X^-} + K_{Na^+}$

$29\times10^{-6} = 10^3\,[6\times10^{-3}x + (4\times10^{-3}(x + 10^{-6}) + (5\times10^{-3}\times10^{-6})]$

$x = 2 \times 10^{-6}$

$K_{sp} = 2 \times 10^{-6} \times 3 \times 10^{-6} = 6 \times 10^{-12}$

29. For a zero order reaction ....

Sol. For a zero order reaction rate remain a constant, hence time taken for 75% completion will 3 times of time taken for 25% completion.

30. Following graph shows ....

Ans. 6 (i, ii, v, vi, vii, viii)

Sol. $\dfrac{\pi}{RT} = i.C$ i = slope

$$M_{ABNORMAL} = \frac{M_{NORMAL}}{i}$$

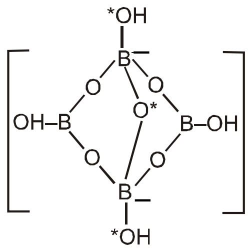
31. Dry air was passed through ....

Sol. $\dfrac{0.08}{3.2} = \dfrac{\frac{9}{M}}{6}$

M = 60

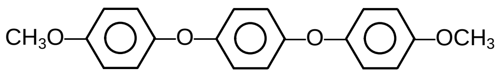
32. How many of the following ....

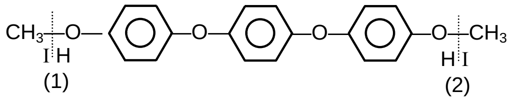
Sol. (A) Borax $Na_2[B_4O_5(OH)_4].8H_2O$



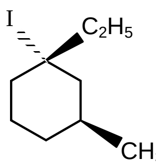
'*' Marked oxygen (3) do not take part in pπ–pπ Back bonding.

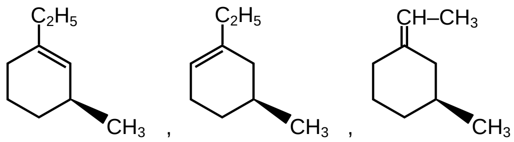
It has 30 π-bonds.

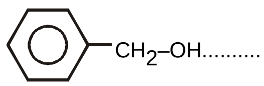
33.  ....

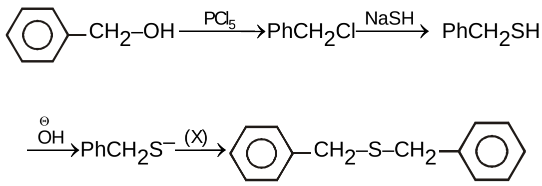
Sol. 

Benzene oxygen bond has partial double bond character.

34.  ....

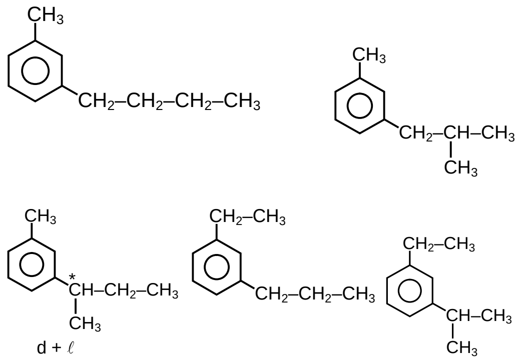
Sol. 

35. ..........

Sol. 

36. An aromatic hydrocarbon..........

Sol. Atleast one benzylic hydorgen must be present. Therefore possible isomers are :



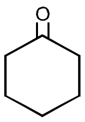
37. Observe the following ....

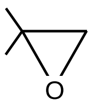
Sol. P, Q, S, T, U formed 1-Methylcyclohexanol.

38. $D_3C - C \equiv C - CH_3$ ....

Sol. Lindlar's catalyst form cis & birch reduction gives trans alkene. Which will then undergo syn addition.

39. How many of the following ....

Sol.  & $CH_3 - \underset{\underset{O}{\|}}{C} - OC_2H_5$,

 , $H-\underset{\underset{O}{\|}}{C}-O-CMe_3$ gives 3º alcohol.

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ADVANCED PATTERN PART TEST-4(APT-4)

TARGET : JEE (MAIN+ADVANCED) 2018

DATE : 14-01-2018

COURSE : VIJAY (01JR)

ANSWER KEY

CODE-0

MATHEMATICS

1. (C) **2.** (BC) **3.** (BC) **4.** (ABCD) **5.** (AB) **6.** (BCD) **7.** (AC)
8. (ABC) **9.** (ABD) **10.** (ABC) **11.** (BC) **12.** (BD) **13.** (CD) **14.** (BCD)
15. (BC) **16.** (AB) **17.** (C) **18.** (B) **19.** (CD) **20.** (AB)
21. (A) $\rightarrow$ P; (B) $\rightarrow$ R; (C) $\rightarrow$ Q; (D) $\rightarrow$ S **22.** (A) $\rightarrow$ R; (B) $\rightarrow$ S; (C) $\rightarrow$ Q; (D) $\rightarrow$ P **23.** (2)
24. (0) **25.** (8) **26.** (7) **27.** (7) **28.** (2) **29.** (7) **30.** (8)
31. (1) **32.** (3) **33.** (9) **34.** (2) **35.** (8) **36.** (1) **37.** (7)
38. (7) **39.** (6) **40.** (0)

PHYSICS

1. (AB) **2.** (ABCD) **3.** (ABC) **4.** (ABC) **5.** (AC) **6.** (ABCD) **7.** (ACD)
8. (ABCD) **9.** (AC) **10.** (B) **11.** (BD) **12.** (ABD) **13.** (CD) **14.** (ABCD)
15. (AD) **16.** (AC) **17.** (BD) **18.** (BC) **19.** (AC) **20.** (AD)
21. (A) – P, R ; (B) – Q, S ; (C) – P, R ; (D) – Q, S **22.** (A) – Q ; (B) – P ; (C) – R ; (D) – S
23. (5) **24.** (6) **25.** (3) **26.** (6) **27.** (2) ***28.*** *(2)* **29.** (6)
30. (5) **31.** (9) **32.** (5) **33.** (5) **34.** (3) **35.** (7) **36.** (2)
37. (2) **38.** (9) **39.** (6) **40.** (4)

CHEMISTRY

1. (AC) **2.** (CD) **3.** (BC) **4.** (ABC) **5.** (AC) **6.** (ABCD) **7.** (ABD)
8. (ACD **9.** (BC) **10.** (BCD) **11.** (ACD) **12.** (AD) **13.** (ABD) **14.** (ACD)
15. (AD) **16.** (ABC) **17.** (CD) **18.** (ABCD) **19.** (A) **20.** (ABC)
21. (A) – Q; (B) – R ; (C) – S ; R (D) – P ; R **22.** (A)-P; (B)-Q; (C)-P,S; (D)-R,S **23.** (2)
24. (8) **25.** (7) **26.** (3) **27.** (6) **28.** (6) **29.** (3) **30.** (6)
31. (6) **32.** (6) **33.** (2) **34.** (3) **35.** (3) **36.** (5) **37.** (5)
38. (4) **39.** (4) **40.** (5)

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ADVANCED PATTERN PART TEST-4(APT-4)

TARGET : JEE (MAIN+ADVANCED) 2018

DATE : 14-01-2018

COURSE : VIJAY (01JR)

ANSWER KEY

CODE-1

MATHEMATICS

1.	(D)	**2.**	(CD)	**3.**	(BD)	**4.**	(ABCD)	**5.**	(AD)	**6.**	(ACD)	**7.**	(AD)
8.	(ABD)	**9.**	(ACD)	**10.**	(ABC)	**11.**	(BD)	**12.**	(BC)	**13.**	(BC)	**14.**	(ACD)
15.	(AC)	**16.**	(AC)	**17.**	(D)	**18.**	(C)	**19.**	(BD)	**20.**	(AC)		

21. (A) $\rightarrow$ P; (B) $\rightarrow$ R; (C) $\rightarrow$ Q; (D) $\rightarrow$ S **22.** (A) $\rightarrow$ R; (B) $\rightarrow$ S; (C) $\rightarrow$ Q; (D) $\rightarrow$ P **23.** (2)

24.	(0)	**25.**	(8)	**26.**	(7)	**27.**	(7)	**28.**	(2)	**29.**	(7)	**30.**	(8)
31.	(1)	**32.**	(3)	**33.**	(9)	**34.**	(2)	**35.**	(8)	**36.**	(1)	**37.**	(7)
38.	(7)	**39.**	(6)	**40.**	(0)								

PHYSICS

1.	(CD)	**2.**	(ABCD)	**3.**	(ABC)	**4.**	(BCD)	**5.**	(AC)	**6.**	(ABCD)	**7.**	(BCD)
8.	(ABCD)	**9.**	(AC)	**10.**	(A)	**11.**	(AD)	**12.**	(BCD)	**13.**	(AB)	**14.**	(ABCD)
15.	(BC)	**16.**	(AC)	**17.**	(AD)	**18.**	(BD)	**19.**	(BC)	**20.**	(BC)		

21. (A) – P, R ; (B) – Q, S ; (C) – P, R ; (D) – Q, S

22. (A) – Q ; (B) – P ; (C) – R ; (D) – S

23.	(5)	**24.**	(6)	**25.**	(3)	**26.**	(6)	**27.**	(2)	***28.***	*(2)*	**29.**	(6)
30.	(5)	**31.**	(9)	**32.**	(5)	**33.**	(5)	**34.**	(3)	**35.**	(7)	**36.**	(2)
37.	(2)	**38.**	(9)	**39.**	(6)	**40.**	(4)						

CHEMISTRY

1.	(AB)	**2.**	(BD)	**3.**	(BD)	**4.**	(ABD)	**5.**	(AB)	**6.**	(ABCD)	**7.**	(ABC)
8.	(BCD)	**9.**	(AC)	**10.**	(ACD)	**11.**	(BCD)	**12.**	(AD)	**13.**	(ABC)	**14.**	(BCD)
15.	(AC)	**16.**	(ABD)	**17.**	(BD)	**18.**	(ABCD)	**19.**	(A)	**20.**	(ABD)		

21. (A) – Q; (B) – R ; (C) – S ; R (D) – P ; R **22.** (A)-P; (B)-Q; (C)-P,S; (D)-R,S **23.** (2)

24.	(8)	**25.**	(7)	**26.**	(3)	**27.**	(6)	**28.**	(6)	**29.**	(3)	**30.**	(6)
31.	(6)	**32.**	(6)	**33.**	(2)	**34.**	(3)	**35.**	(3)	**36.**	(5)	**37.**	(5)
38.	(4)	**39.**	(4)	**40.**	(5)								

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ADVANCED PATTERN PART TEST-4(APT-4)

TARGET : JEE (MAIN+ADVANCED) 2018

DATE : 14-01-2018 COURSE : VIJAY (01JR)

ANSWER KEY

CODE-2

MATHEMATICS

1.	(C)	**2.**	(BC)	**3.**	(BC)	**4.**	(ABCD)	**5.**	(AB)	**6.**	(BCD)	**7.**	(AC)
8.	(ABC)	**9.**	(ABD)	**10.**	(ABC)	**11.**	(BC)	**12.**	(BD)	**13.**	(CD)	**14.**	(BCD)
15.	(BC)	**16.**	(AB)	**17.**	(C)	**18.**	(B)	**19.**	(CD)	**20.**	(AB)		

21. (A) $\rightarrow$ P; (B) $\rightarrow$ R; (C) $\rightarrow$ Q; (D) $\rightarrow$ S **22.** (A) $\rightarrow$ R; (B) $\rightarrow$ S; (C) $\rightarrow$ Q; (D) $\rightarrow$ P **23.** (2)

24.	(0)	**25.**	(8)	**26.**	(7)	**27.**	(7)	**28.**	(2)	**29.**	(7)	**30.**	(8)
31.	(1)	**32.**	(3)	**33.**	(9)	**34.**	(2)	**35.**	(8)	**36.**	(1)	**37.**	(7)
38.	(7)	**39.**	(6)	**40.**	(0)								

PHYSICS

1.	(AB)	**2.**	(ABCD)	**3.**	(ABC)	**4.**	(ABC)	**5.**	(AC)	**6.**	(ABCD)	**7.**	(ACD)
8.	(ABCD)	**9.**	(AC)	**10.**	(B)	**11.**	(BD)	**12.**	(ABD)	**13.**	(CD)	**14.**	(ABCD)
15.	(AD)	**16.**	(AC)	**17.**	(BD)	**18.**	(BC)	**19.**	(AC)	**20.**	(AD)		

21. (A) – P, R ; (B) – Q, S ; (C) – P, R ; (D) – Q, S **22.** (A) – Q ; (B) – P ; (C) – R ; (D) – S

23.	(5)	**24.**	(6)	**25.**	(3)	**26.**	(6)	**27.**	(2)	***28.***	*(2)*	**29.**	(6)
30.	(5)	**31.**	(9)	**32.**	(5)	**33.**	(5)	**34.**	(3)	**35.**	(7)	**36.**	(2)
37.	(2)	**38.**	(9)	**39.**	(6)	**40.**	(4)						

CHEMISTRY

1.	(AC)	**2.**	(CD)	**3.**	(BC)	**4.**	(ABC)	**5.**	(AC)	**6.**	(ABCD)	**7.**	(ABD)
8.	(ACD)	**9.**	(BC)	**10.**	(BCD)	**11.**	(ACD)	**12.**	(AD)	**13.**	(ABD)	**14.**	(ACD)
15.	(AD)	**16.**	(ABC)	**17.**	(CD)	**18.**	(ABCD)	**19.**	(A)	**20.**	(ABC)		

21. (A) – Q; (B) – R ; (C) – S ; R (D) – P ; R **22.** (A)-P; (B)-Q; (C)-P,S; (D)-R,S **23.** (2)

24.	(8)	**25.**	(7)	**26.**	(3)	**27.**	(6)	**28.**	(6)	**29.**	(3)	**30.**	(6)
31.	(6)	**32.**	(6)	**33.**	(2)	**34.**	(3)	**35.**	(3)	**36.**	(5)	**37.**	(5)
38.	(4)	**39.**	(4)	**40.**	(5)								

Resonance®
Educating for better tomorrow

ADVANCED PATTERN PART TEST-4(APT-4)
TARGET : JEE (MAIN+ADVANCED) 2018

DATE : 14-01-2018 COURSE : VIJAY (01JR)

ANSWER KEY

CODE-3

MATHEMATICS

1. (D) **2.** (CD) **3.** (BD) **4.** (ABCD) **5.** (AD) **6.** (ACD) **7.** (AD)
8. (ABD) **9.** (ACD) **10.** (ABC) **11.** (BD) **12.** (BC) **13.** (BC) **14.** (ACD)
15. (AC) **16.** (AC) **17.** (D) **18.** (C) **19.** (BD) **20.** (AC)
21. (A) $\rightarrow$ P; (B) $\rightarrow$ R; (C) $\rightarrow$ Q; (D) $\rightarrow$ S **22.** (A) $\rightarrow$ R; (B) $\rightarrow$ S; (C) $\rightarrow$ Q; (D) $\rightarrow$ P **23.** (2)
24. (0) **25.** (8) **26.** (7) **27.** (7) **28.** (2) **29.** (7) **30.** (8)
31. (1) **32.** (3) **33.** (9) **34.** (2) **35.** (8) **36.** (1) **37.** (7)
38. (7) **39.** (6) **40.** (0)

PHYSICS

1. (CD) **2.** (ABCD) **3.** (ABC) **4.** (BCD) **5.** (AC) **6.** (ABCD) **7.** (BCD)
8. (ABCD) **9.** (AC) **10.** (A) **11.** (AD) **12.** (BCD) **13.** (AB) **14.** (ABCD)
15. (BC) **16.** (AC) **17.** (AD) **18.** (BD) **19.** (BC) **20.** (BC)
21. (A) – P, R ; (B) – Q, S ; (C) – P, R ; (D) – Q, S
22. (A) – Q ; (B) – P ; (C) – R ; (D) – S
23. (5) **24.** (6) **25.** (3) **26.** (6) **27.** (2) ***28.*** *(2)* **29.** (6)
30. (5) **31.** (9) **32.** (5) **33.** (5) **34.** (3) **35.** (7) **36.** (2)
37. (2) **38.** (9) **39.** (6) **40.** (4)

CHEMISTRY

1. (AB) **2.** (BD) **3.** (BD) **4.** (ABD) **5.** (AB) **6.** (ABCD) **7.** (ABC)
8. (BCD) **9.** (AC) **10.** (ACD) **11.** (BCD) **12.** (AD) **13.** (ABC) **14.** (BCD)
15. (AC) **16.** (ABD) **17.** (BD) **18.** (ABCD) **19.** (A) **20.** (ABD)
21. (A) – Q; (B) – R ; (C) – S ; R (D) – P ; R **22.** (A)-P; (B)-Q; (C)-P,S; (D)-R,S **23.** (2)
24. (8) **25.** (7) **26.** (3) **27.** (6) **28.** (6) **29.** (3) **30.** (6)
31. (6) **32.** (6) **33.** (2) **34.** (3) **35.** (3) **36.** (5) **37.** (5)
38. (4) **39.** (4) **40.** (5)