HINTS & SOLUTIONS

PAPER-1

PART : I MATHEMATICS

1. Number of real....................

Sol. Put y = $\sqrt{x} + \sqrt{x+2}$

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

hence $y + \left(\frac{y^2-2}{2}\right) = 3$

$2y + y^2 - 2 = 6$

$y^2 + 2y - 8 = 0$

$(y + 4)(y - 2) = 0$

as

$y > 0 \quad y = 2$

$\sqrt{x} + \sqrt{x+2} = 2$

$\sqrt{x+2} = 2 - \sqrt{x}$

$x + 2 = x + 4 - 4\sqrt{x}$

$2 = 4\sqrt{x}$

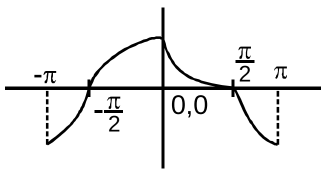
$x = \frac{1}{4}$

hence $x = \frac{1}{4}$ is only solution of equation

2. If $f(x) = \min\{1, \cos x, 1 - \sin x\}$....................

Sol. $f(x) = \begin{cases} \cos x & -\pi \le x \le 0 \\ 1 - \sin x & 0 < x \le \frac{\pi}{2} \\ \cos x & \frac{\pi}{2} < x \le \pi \end{cases}$

The graph of f(x) is



Hence all are correct.

3. Let y = f(x) be a ....

Sol. If f(x) is differentiable then

$$\lim_{t \to 0} \frac{f(2+t) - f(2-t)}{t}$$

$$= \lim_{t \to 0} \left\{ \frac{f(2+t) - f(2)}{t} + \frac{f(2-t) - f(2)}{-t} \right\}$$

$$= 2f'(2) = 4 \Rightarrow f'(2) = 2$$

Moreover if f(2) is not defined nothing can be said about continuity. Also given limit implies $\lim_{t \to 0}\left(f(2+t) - f(2-t)\right) = 0$, which may not necessarily mean that RHL = LHL at = 2

4. If the inequality $\sin^2 x$ ....

Sol. $a + a^2 \ge 2$ when x = 0

$a \le -2$

$a^2 + a\cos x \ge a^2 + a \ge 2 \ge \cos^2 x + \cos x = 1 + \cos x - \sin^2 x$

$\sin^2 x + a\cos x + a^2 \ge 1 + \cos x$

so, range of negative values of a is $a \le -2$

Alter:

$\cos^2 x + (1 - a)\cos x - a^2 \le 0$

$\cos x = t \in [-1, 1]$

$t^2 + (1 - a)t - a^2 \le 0$

5. Let $f(x) = \begin{cases} -4 & , -4 \le x < 0 \\ x^2 - 4 & , 0 \le x \le 4 \end{cases}$ ....

Sol. $-4 \le x \le 4 \Rightarrow 0 \le |x| \le 4$

$\Rightarrow |f(x)| = \begin{cases} |-4| & , -4 \le x < 0 \\ |x^2 - 4| & , 0 \le x \le 4 \end{cases}$

i.e. $|f(x)| = \begin{cases} 4 & , -4 \le x < 0 \\ 4 - x^2 & , 0 \le x < 2 \\ x^2 - 4 & , 2 \le x \le 4 \end{cases}$

and $f(|x|) = x^2 - 4, \ -4 \le x \le 4$

$\Rightarrow g(x) = \begin{cases} x^2 & , -4 \le x < 0 \\ 0 & , 0 \le x < 2 \\ 2x^2 - 8 & , 2 \le x \le 4 \end{cases}$

At x = 0, g(x) is continuous as well as differentiable.

At x = 2, g(x) is continuous but not differentiable.

6. If $\sin^{-1}\left(\frac{\sqrt{x}}{2}\right)+\sin^{-1}$....................

Sol. Here , $x \in [0,4]$

$$\sin^{-1}\left(\frac{\sqrt{x}}{2}\right) + \cos^{-1}\left(\frac{\sqrt{x}}{2}\right) + \tan^{-1}y = \frac{2\pi}{3} \Rightarrow y = \frac{1}{\sqrt{3}}$$

$\therefore$ maximum value of $(x^2 + y^2) = 16 + \frac{1}{3} = \frac{49}{3}$

And minimum value of $(x^2 + y^2) = (0)^2 + \frac{1}{3} = \frac{1}{3}$

7. Let f(x) = ...

Sol. $\because$ f(0) = 0

$\therefore$ f(1) must also be equal to 0 $\qquad \therefore \alpha > 0$

(2) $\because$ f(x) is continuous at x = 0 as $f(0) = f(0^+) = 0$

but for continuity at x = 1

$f(1) = f(1^-)$

$\Rightarrow 0 = \lim_{h\to 0^+} h^\alpha . (1-h)^\beta (1 - \cos(2\pi - 2\pi h))$

$\Rightarrow 0 = \lim_{h\to 0^+} h^\alpha (1-h)^\beta .(2\sin^2 h\pi)$

$\Rightarrow \lim_{h\to 0^+} h^\alpha (1-h)^\beta . 2\frac{\sin^2 \pi h}{(\pi h)^2} . (\pi h)^2 = 0$

$\Rightarrow 2\pi^2 \lim_{h\to 0^+} h^{\alpha+2} = 0$

$\Rightarrow \alpha + 2 > 0 \Rightarrow \alpha > -2$

(3) f(x) is derivable in (0, 1)

$\therefore$ Rolle's theorem is applicable if $\alpha > 0$

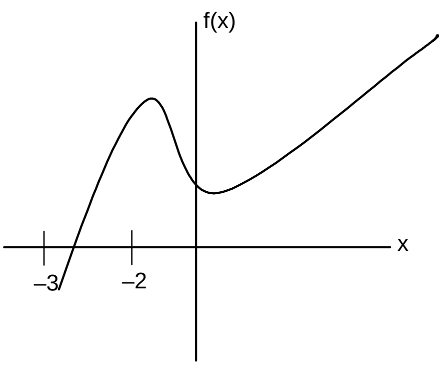
8. The value of ....

Sol. $S = \sum\sum 2\tan^{-1}\left(\frac{p}{q}\right) = \sum\sum 2\tan^{-1}\left(\frac{p}{q}\right)$

$S = \sum\sum \frac{\pi}{2} \Rightarrow \frac{\pi}{2}\sum_{r=1}^{20} 20 = \frac{400\pi}{2} = 200\pi$

9. Let $f(x) = x^3 + 2x^2 - x + 1$ ....

Sol.



From the figure it is clearly visible that roots of equation lies between (– 3 , –2)

$\therefore [\alpha] = -3$

10. The acute angle ....

Sol. $\vec{n}_1 = \vec{a} \times \vec{b} = (2\hat{i} + 3\hat{j} - \hat{k}) \times (\hat{i} - \hat{j} + 2\hat{k})$

$= 5(\hat{i} - \hat{j} - \hat{k})$

$\hat{n}_1 = \frac{\hat{i} - \hat{j} - \hat{k}}{\sqrt{3}} \quad \vec{v} = 2\hat{i} - 2\hat{j} + \hat{k}$

$\Rightarrow \hat{v} = \frac{2\hat{i} - 2\hat{j} + \hat{k}}{3}$

$\cos\left(\frac{\pi}{2} - \theta\right) = \sin\theta = \hat{v} . \hat{n} = \frac{1}{\sqrt{3}}$

11. If m_1 and m_2 are ....

Sol. The vertices of the given triangle are (0,0), $\left(\frac{a}{m_1}, a\right)$ and $\left(\frac{a}{m_2}, a\right)$.

So the area of the triangle is equal to $\frac{a^2(m_2 - m_1)}{(2m_1m_2)}$.

Since m_1 and m_2 are the roots of $x^2 - ax - a - 1 = 0$,

we have $m_1 + m_2 = a; m_1m_2 = -(a+1)$

or $(m_1 - m_2)^2 = (m_1 + m_2)^2 - 4m_1m_2 = a^2 + 4(a+1)$

$= (a+2)^2$

or $m_1 - m_2 = \pm(a+2)$

So, the required area is $\pm\frac{a^2(a+2)}{-2(a+1)} = \pm\frac{a^2(a+2)}{2(a+1)}$

Since the area is a positive quantity, we have

Area $= \frac{a^2(a+2)}{2(a+1)}$ if $a > -1$ or $a < -2$

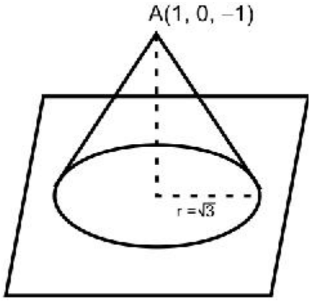
And Area $= -\frac{a^2(a+2)}{2(a+1)}$ if $-2 < a < -1$

12. If $x = \mathrm{cosec}(\tan^{-1}(\cos$....................

Sol. After solving for x and y we get $x = \sqrt{3 - a^2}$ and $y = \sqrt{3 - a^2}$

13. A rod of length 2 ....

Sol.



The rod sweeps out the figure which is a cone.

The distance of point $A(1,0,-1)$ from the plane is

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

The slant height l of the cone is 2 units.

Then the radius of the base of the cone is

$\sqrt{2^2-1} = \sqrt{4-1} = \sqrt{3}$

Hence, the volume of the cone is $\frac{\pi}{3}\left(\sqrt{3}\right)^2 \cdot 1 = \pi$ cubic units

Area of the circle on the plane which the rod traces is 3π.

Also, the centre of the circle is Q(x, y, z).

Then $\frac{x-1}{1} = \frac{y-0}{-2} = \frac{z+1}{2} = \frac{-(1-0-2+4)}{1^2+(-2)^2+2^2}$

or $Q(x,y,z) \equiv \left(\frac{2}{3},\frac{2}{3},\frac{-5}{3}\right)$.

14. Unit vectors $\vec{a}$ and ....

Sol. Since $\vec{a},\vec{b}$ and $\vec{c}$ are unit vectors inclined at angle θ, we have

$|\vec{a}| = |\vec{b}| = 1$ and $\cos\theta = \vec{a}\cdot\vec{c} = \vec{b}\cdot\vec{c}$

Now $\vec{c} = \alpha\vec{a} + \beta\vec{b} + \gamma\left(\vec{a}\times\vec{b}\right)$ ...(i)

$\Rightarrow \vec{a}\cdot\vec{c} = \alpha\left(\vec{a}\cdot\vec{a}\right) + \beta\left(\vec{a}\cdot\vec{b}\right) + \gamma\left\{\vec{a}\cdot\left(\vec{a}\times\vec{b}\right)\right\}$

$\Rightarrow \cos\theta = \alpha|\vec{a}|^2 \quad \left(\because \vec{a}\cdot\vec{b} = 0, \vec{a}\cdot\left(\vec{a}\times\vec{b}\right) = 0\right)$

$= \alpha$

Similarly, by taking dot product on both sides of (i) by $\vec{b}$, we get $\beta = \cos\theta$

$\therefore \alpha = \beta$

Again, $\vec{c} = \alpha\vec{a} + \beta\vec{b} + \gamma\left(\vec{a}\times\vec{b}\right)$

$\Rightarrow |\vec{c}|^2 = \left|\alpha\vec{a} + \beta\vec{b} + \gamma\left(\vec{a}\times\vec{b}\right)\right|^2$

$= \alpha^2|\vec{a}|^2 + \beta^2|\vec{b}|^2 + \gamma^2\left|\vec{a}\times\vec{b}\right|^2$

$+2\alpha\beta\left(\vec{a}\cdot\vec{b}\right) + 2\alpha\gamma\left\{\vec{a}\cdot\left(\vec{a}\times\vec{b}\right)\right\} + 2\beta\gamma\left(\vec{b}\cdot\left\{\vec{a}\times\vec{b}\right\}\right)$

$\Rightarrow 1 = \alpha^2 + \beta^2 + \gamma^2\left|\vec{a}\times\vec{b}\right|^2$

$= 2\alpha^2 + \gamma^2\left\{|\vec{a}|^2|\vec{b}|^2\sin^2\frac{\pi}{2}\right\}$

$= 2\alpha^2 + \gamma^2$ or $\alpha^2 = \frac{1-\gamma^2}{2}$

But $\alpha = \beta = \cos\theta$

$1 = 2\alpha^2 + \gamma^2$

$\Rightarrow \gamma^2 = 1 - 2\cos^2\theta = -\cos 2\theta$

$\therefore \beta^2 = \frac{1-\gamma^2}{2} = \frac{1+\cos 2\theta}{2}$

15. Let $\vec{a},\vec{b}$ and $\vec{c}$ be ....

Sol. $\vec{d}\cdot\vec{a} = \left[\vec{a}\vec{b}\vec{c}\right]\cos y = -\vec{d}\cdot\left(\vec{b}+\vec{c}\right)$ or $\cos y = -\frac{\vec{d}.\left(\vec{b}+\vec{c}\right)}{\left[\vec{a}\vec{b}\vec{c}\right]}$

Similarly $\sin x = -\frac{\vec{d}\cdot\left(\vec{a}+\vec{b}\right)}{\left[\vec{a}\vec{b}\vec{c}\right]}$ and $\frac{\vec{d}\cdot\left(\vec{a}+\vec{c}\right)}{\left[\vec{a}\vec{b}\vec{c}\right]} = -2$

$\left\{\because \frac{-\vec{d}\cdot\vec{b}}{[\vec{a}\vec{b}\vec{c}]} = -2\right\}$

$\therefore \sin x + \cos y + 2 = 0$

or $\sin x + \cos y = -2$

or $\sin x = -1, \cos y = -1$

Since we want the minimum value of x^2+y^2, $x = -\frac{\pi}{2}$, $y = \pi$

Therefore, the minimum value of x^2+y^2 is $\frac{5\pi^2}{4}$.

16. If f(x) = cot $\left(\frac{x}{2^n}\right)$ ....

Sol. We have $\sum_{r=1}^{n} \operatorname{cosec}\left(\frac{x}{2^{r-1}}\right) = \sum_{r=1}^{n} \frac{1}{\sin\left(\frac{x}{2^{r-1}}\right)}$

$$= \sum_{r=1}^{n} \frac{\sin\left(\frac{x}{2^{r-1}} - \frac{x}{2^r}\right)}{\sin\left(\frac{x}{2^r}\right)\sin\left(\frac{x}{2^{r-1}}\right)}$$

$$\sum_{r=1}^{n} \frac{\sin\left(\frac{x}{2^{r-1}}\right)\cos\left(\frac{x}{2^r}\right) - \cos\left(\frac{x}{2^{r-1}}\right)\sin\left(\frac{x}{2^r}\right)}{\sin\left(\frac{x}{2^r}\right)\sin\left(\frac{x}{2^{r-1}}\right)}$$

$$= \sum_{r=1}^{n} \left\{\cot\left(\frac{x}{2^r}\right) - \cot\left(\frac{x}{2^{r-1}}\right)\right\}$$

=

$$\left(\cot\left(\frac{x}{2}\right) - \cot x\right) + \left(\cot\frac{x}{2^2} - \cot\frac{x}{2}\right) + ... +$$

$$\left(\cot\frac{x}{2^n} - \frac{\cot x}{2^{n-1}}\right) = \cot\left(\frac{x}{2^n}\right) - \cot x$$

$\therefore$ f (x) - $\sum_{r=1}^{n} \operatorname{cosec}\left(\frac{x}{2^{r-1}}\right) = \cot x$

Hence cot x = 1

17. Let f(x) = [sin x] + ...

Sol. f(x) = $[\sin x] + [\sin 2x]$

Points of discontinuity exists at:

x = $\frac{\pi}{4}, \frac{\pi}{2}, \pi, \frac{5\pi}{4}, \frac{3\pi}{2}, 2\pi, \frac{9\pi}{4}, \frac{5\pi}{2}, 3\pi$

18. If the line passing ....

Sol. $\frac{dy}{dx} = \frac{-a^2}{(x-1)^2} = -2$ (Slope of line joining (-1,8) & (0,6))

$\Rightarrow$ x-1 = $\pm\frac{a}{\sqrt{2}}$

$\therefore$ The possible points are $\left(1 \pm \frac{a}{\sqrt{2}}, \pm a\sqrt{2}\right)$

Now equation of tangent is

y - $\left(\pm a\sqrt{2}\right) = -2\left(x - \left(1 \pm \frac{a}{\sqrt{2}}\right)\right)$

i.e., y - $\pm a\sqrt{2} = -2x + 2 \pm \sqrt{2}a$

As it passes through (0, 6), we get

$6 - (\pm a\sqrt{2}) = 2 \pm \sqrt{2}a$

i.e, 4 = $\pm 2\sqrt{2}a \Rightarrow a^2 = 2$

19. If 3f(x) + 2f ....

Sol. Putting x = 7 and then x = 11

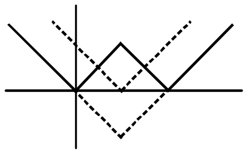
$\Rightarrow$ 3f(7) + 2f(11) = 100 …(i)

3f(11) + 2f(7) = 140 …(ii)

From (i) and (ii), f(7) = 4

20. If f(x) = $\big|\,\big|\,\big|\,\big|\,|x-1|-1\big|-1\big|-1\big|-1\big|$ ....

Sol.



|x – 1| is non-differentiable at one point.

similarly. By the graph, $\big|\,|x-1|-1\big|$ is non-differentiable at 3 points

similarly , we can show that

$\big|\,\big|\,|x-1|-1\big|-1\big|$ is non-differentiable at 5 points and so on.

f(x) is non-differentiable at 9 points.

PART : II PHYSICS

21. For a prism ....

Sol. In the case of minimum deviation,

$$\gamma = 2i_1 - \frac{\pi}{2} \text{ and } \sin i_1 = \mu \sin\frac{\pi}{4}$$

So, $\sin\gamma = -\cos 2i_1 = 2\sin^2 i_1 - 1 = \mu^2 - 1$

....(1)

In the case of grazing incidence,

$$\sin e = \mu \sin\left(\frac{\pi}{2} - r_1\right) = \mu\sqrt{1 - \sin^2 r_1} = \sqrt{\mu^2 - 1}$$

and $\beta = \frac{\pi}{2} + e - \frac{\pi}{2} \Rightarrow \sin\beta = \sqrt{\mu^2 - 1}$

....(2)

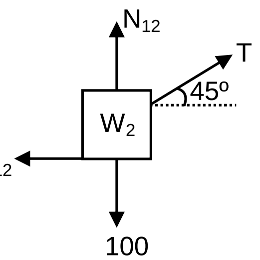
22. Read and examine ....

Sol. For one dimensional motion acceleration and velocity must always be parallel.

For motion in one plane acceleration and velocity must always be coplanar.

23. In the arrangement ....

Sol.



(1) $f_{12} = \mu N_{12}$

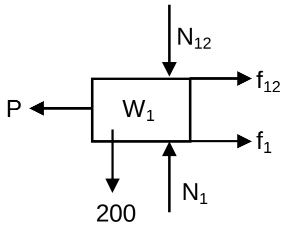
$\Rightarrow f_{12} = (0.25)\left(100 - \frac{T}{\sqrt{2}}\right)$

(2) $f_{12} = T \cos 45^o$

$\Rightarrow f_{12} = \frac{T}{\sqrt{2}}$

from (1) and (2)

$\frac{5}{4} f_{12} = 25 \Rightarrow f_{12} = 20$ and $T = 20\sqrt{2}$



For W_1, $P = f_1 + f_{12}$

$\Rightarrow P = \mu N_1 + 20$

$\Rightarrow P = (0.25)(280) + (20) = 90$

24. A steady state ....

Sol. $R = \frac{V}{i} = \frac{12}{4} = 3\Omega$

In AC circuit

$i = \frac{V}{z} \Rightarrow 2.4 = \frac{12}{\sqrt{3^2 + X_L^2}}$

$\Rightarrow x_L = 4\ \Omega \Rightarrow L = \frac{4}{\omega} = 0.08$ H

After connecting the capacitor :

$X_C = \frac{1}{50 \times 2500 \times 10^{-6}} = 8\Omega$

$\Rightarrow z = \sqrt{R^2 + (X_L - X_C)^2} = 5\Omega$

and $\tan\phi = \frac{X_L - X_C}{R} = \frac{-4}{3}$

so, power = $V_{rms} \times i_{rms} \times \cos\phi$

$= 12 \times 2.4 \times \frac{3}{5}$

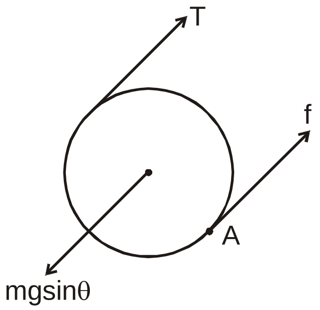
= 17.28 W

25. The density ....

Sol. Using $I = I_C + Md^2$, we can find the desired result.

26. A cylinder and ....

Sol.



The F.B.D. of cylinder is as shown. In equilibrium

$\Rightarrow T = Mg$ = tension in string

In equilibrium, net force on cylinder is zero $\therefore$ Torque is same about any axis.

$\Rightarrow$ Torque on cylinder about any point is zero.

$\tau_A = Mg\ 2R - mg \sin\theta\ R = 0$

$\therefore M = \frac{m \sin\theta}{2}$ Hence for only one value of M cylinder can remain in equilibrium. $\Rightarrow$ A is true, B is false

When the cylinder rolls up the incline, sense of rotation of cylinder about center of mass is clockwise. Hence T > f. $\Rightarrow$ C is false.

When the cylinder rolls down the incline, sense of rotation of cylinder about center of mass is anticlockwise. Hence T < f. $\Rightarrow$ D is True.

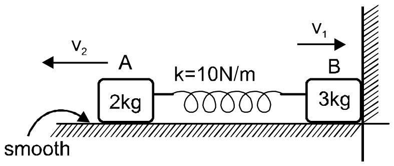
27. Initially distance ....

Sol. $x_1 + x_2 = 1$

$3x_1 = 2x_2$

........(i)

$x_1 = \frac{2}{5}$ m, $x_2 = \frac{3}{5}$ m



By momentum conservation and energy conservation,

$\frac{1}{2} \times 10 \times (1)^2 = \frac{1}{2} \times 3 \times v_1^2 + \frac{1}{2} \times 2 \times v_2^2$ ....(ii)

$v_1 = \frac{2}{\sqrt{3}}$ m/sec. , $v_2 = \sqrt{3}$ m/sec.

By elastic collision,

Impulse = $2m_B v_1 = 4\sqrt{3}$ N.sec.

Now, on maximum extension both block move with same velocity,

Let at that time velocity is v.

By energy conservation,

$$\frac{1}{2} \times 2 \times 3 + \frac{1}{2} \times 3 \times \frac{4}{3} = \frac{1}{2} \times 10 \times x^2_{max} + \frac{1}{2} \times 5 \times v^2$$

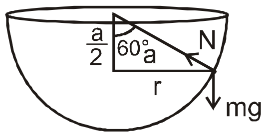
By momentum conservation,

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

$$v = \frac{4\sqrt{3}}{5} \text{ m/sec. } ; \qquad x = \frac{1}{5} \text{ m} = 20 \text{ cm.}$$

28. A particle moving ....

Sol. $r = a \sin 60° = \frac{a\sqrt{3}}{2}$



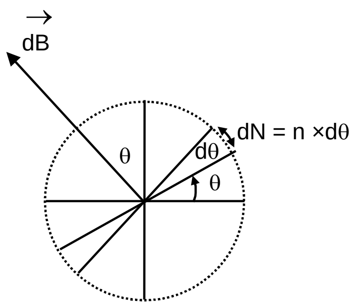
$$N \sin 60° = \frac{mu^2}{r}$$

$N \cos 60° = mg$

From the above two equations we get $u = \sqrt{\frac{3ag}{2}}$

29. The current in ....

Sol.



$$dB = \frac{\mu_0 (dN) \times I}{2R}$$

$dB_y = dB\cos\theta$

$$\int dB_y = \frac{\mu_0 nI}{2R} \int_0^{\pi/2} \cos\theta \, d\theta \;\Rightarrow\; B_y = \frac{\mu_0 nI}{2R} = B_x$$

$$B_{centre} = \frac{\mu_0 nI}{\sqrt{2}R}$$

magnetic moment

$$\int d\mu_y = \int I(\pi R^2)(n\cos\theta d\theta) = I\pi R^2 \times n = \mu_x$$

$$\mu_{net} = \sqrt{2} n I \pi R^2$$

30. Figure shows ....

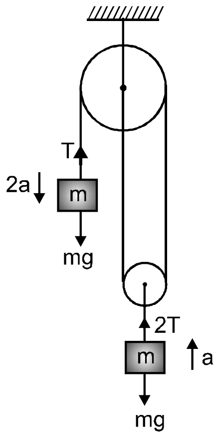
Sol. $\omega = \frac{1}{\sqrt{L_{eq} C_{eq}}} \Rightarrow C_{eq} = \frac{1}{\omega^2 L_{eq}} = \frac{1}{4 \times 5}$

$$\Rightarrow 20 = \frac{1}{0.2} + \frac{1}{C_2} \Rightarrow C_2 = \frac{1}{15} \text{ F}$$

$$\Rightarrow C_2 = \frac{200}{3} \text{ mF}$$

31. Both the blocks ....

Sol.



$mg - T = 2ma$ ....(i)

$2T - mg = ma$ ....(ii)

Solving,

$mg = 5\, ma$

$$a = \frac{g}{5}$$

$T = mg - 2ma$

$$= mg - 2m \frac{g}{5} = \frac{3mg}{5}$$

32. Two concentric ....

Sol. The potential of the two surface will be equal when the whole charge Q flows from inner to other shell.

$$U_i = \frac{KQ^2}{2R}$$

$$U_f = \frac{KQ^2}{4R}$$

Heat = $-\Delta U$

33. A charge 'q' is ....

Sol. (a) We can easily see that charge q is placed symetrically to surface ABCD, ABSR and ADQR.

Charge q is also placed symetrically to rest of the surfaces.

If the flux through the surface ABCD is x and through RSPQ is y then the total flux will be 3x + 3y

Now by Gauss law

$$\frac{q_{in}}{\varepsilon_0} = \phi$$

$$\Rightarrow\ 3x + 3y = \frac{q}{\varepsilon_0}$$

$$\Rightarrow\ x + y = \frac{q}{3\varepsilon_0}$$

(d) Flux through two surfaces are not same flux via ABCD is larger.

Ans. (a) $\frac{q}{3\varepsilon_0}$ (b) Flux through two surfaces are not same flux via ABCD is larger.

35. A satellite(S) is ....

Sol. For $v_0 = \sqrt{\frac{GM}{x}}$

Let satellite moves in elliptical path of semi major axis = a and eccentricity e

(A) $-\frac{GMm}{x} + \frac{1}{2}m\left(\sqrt{\frac{GM}{x}}\right)^2 = \frac{-GMm}{a(1-e)} + \frac{1}{2}mv_{max}^2 = \frac{-GMm}{2a}$

$\Rightarrow$ a = x and $v_{max} = \sqrt{\frac{GM}{a}\left(\frac{1+e}{1-e}\right)}$

(B) Now, by angular momentum conservation

$m(v_0 \cos\theta)x = mv_{max}\, r_{min}$

$\Rightarrow mv_0 x \cos\theta = m\sqrt{\frac{GM}{x}\left(\frac{1+e}{1-e}\right)} \times x(1-e)$

$\Rightarrow \cos\theta = \sqrt{1-e^2}$

$\Rightarrow$ e = $\sin\theta$

(C) For $v_0 > \sqrt{\frac{2GM}{x}}$ and $\theta = 0°$, satellite will escape earth's gravitational field in hyperbolic path.

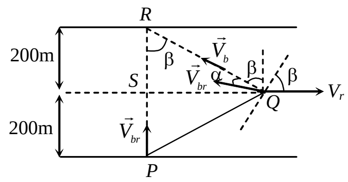
36. A man in a boat ....

Sol. To reach point R from Q, the boat should be aimed at point R as seen from ground

$$\vec{V}_r \cos\beta = \vec{V}_{br} \sin\alpha$$

$$2 \times \frac{2}{\sqrt{5}} = 4\sin\alpha \qquad \text{or}$$

$$\sin\alpha = \frac{1}{\sqrt{5}}$$



$$\Rightarrow\ \tan\alpha = \frac{1}{2}$$

Also $\qquad \tan\beta = \frac{1}{2}$

$$\theta = \alpha + \beta$$

$$\Rightarrow\ \tan\theta = \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta} = \frac{4}{3}$$

$\therefore$ n = 3

37. The current in ....

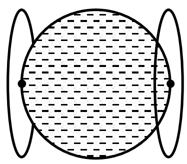
Sol. In the inner coil

$$i = \frac{EMf_{induced}}{R} = \frac{1}{R}\frac{d}{dt}\left(\frac{\mu_0.2t^2}{2b} \times \pi a^2\right) = \frac{2\mu_0 t\pi a^2}{Rb}$$

$$\therefore \text{Heat} = \int_0^t i^2 R dt = \frac{4\mu_0^2\pi^2 a^4}{Rb^2} \times \frac{t^3}{3}$$

38. Two uniformly ....

Sol. Charge on ring 2 will also be Q so that E is zero at centre of sphere.



Ring (1) Ring (2)

If charge on sphere is Q' then,

$$2 \times \frac{KQ}{\sqrt{2}R} + \frac{3KQ'}{2R} \Rightarrow Q' = -\frac{2\sqrt{2}}{3}Q$$

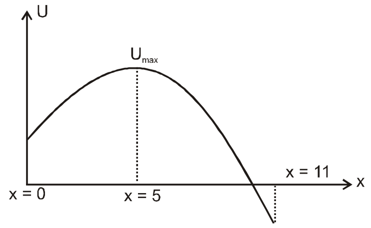
Potential at the centre of ring 2

$$= \frac{KQ}{R} + \frac{KQ}{\sqrt{5}R} + \frac{K\left(-\frac{2\sqrt{2}}{3}\right)Q}{R}$$

$$= \frac{KQ}{R}\left(1 + \frac{1}{\sqrt{5}} - \frac{2\sqrt{2}}{3}\right)$$

39. In a region, potential ....

Sol. Draw U v/s x graph. There is a maxima of potential energy between x = 11 to x = 0. So to bring the particle from x = 11 to x = 0, the particle has to cross the maxima (x = 5) and to just cross the point x = 5, velocity at x = 5 should be 0^+.



⇒ Applying energy conservation between x = 11 to x = 5.

$k_i + U_i = k_f + U_f$

$\frac{1}{2}(0.5)u^2 + (30 - (11-5)^2) = 0^+ + (30 - (5-5)^2)$

$u = 12$ m/sec $\Rightarrow \frac{u}{2} = 6$ m/sec

40. A block of mass ....

Sol Mg is balanced by upward impulsive force.

Fdt = dp

Fdt = mu (1+e)

Mg = mu (1+e)n

n = no. of bullets per second

$n = \frac{Mg}{mu(1+e)}$

PART : III CHEMISTRY

41. 34.3 g Pb_3O_4 is dissolved ....

Sol. $Pb_3O_4 + 4HNO_3 \longrightarrow 2Pb(NO_3)_2 + PbO_2 + 2H_2O$

0.05 mol	2 mol	0	0	0
0	1.8 mol	0.05 mol		

$HNO_3 + NaOH \longrightarrow NaNO_3 + H_2O$

1.8 mol

So moles of NaOH required is = 1.8 mol

42. The resistance of a conductivity ....

Sol. Conductance due to 0.1M NaCl

$G(NaCl) = \frac{1}{100} - \frac{1}{500} = \frac{4}{500}\Omega^{-1}$

conductivity of 0.1M NaCl solution

$K = \frac{\lambda_M \times M}{1000} = \frac{160 \times 0.1}{1000}$

$= 16 \times 10^{-3}$ mho cm^{-1}

so cell constant = $\frac{K}{G} = \frac{16 \times 10^{-3}}{8 \times 10^{-3}} = 2cm^{-1}$

λ_M of acetic acid solution

$\lambda_M = \frac{2}{500} \times \frac{1000}{0.1}$ = 40 mho cm^2/mol

and λ^∞ of acetic acid

= 420 + 140 – 160

= 400 Ω^{-1} cm^2 mol^{-1}

so degree of dissociation of acetic acid is

$\alpha - \frac{\lambda_M}{\lambda^\infty} = \frac{40}{400} = 0.1$

and $[H^+] = C\alpha$

= 1 × 0.1 = 0.01 M

pH = 2

43. Which of the following ....

Sol. (A) at anode oxidation occurs.

45. The correct order is/are ....

Sol. Bond order $\propto$ bond strength

Bond order $\propto \frac{1}{\text{Bond Length}}$

46. Select correct statement(s) ....

Sol. This complex contain ambidentate ligand.

47. In normal spinel having ....

Sol. Initially formula was $MgAl_2O_4$ and now formula is $MgAl_2X_3$ so anionic vacancy is 1.

48. Which statement(s) is/are ....

Sol. (C) π bonding M.O. is ungerade.

(D) C_2 is diamagnetic.

49. A 0.1M sodium acetate ....

Sol. $K_h = Ch^2$

$h = \sqrt{\frac{10^{-9}}{.1}}$

$h = 10^{-4}$

so $[OH^-] = 10^{-5}$ M

it basic solution.

50. Select the correct ....

Sol. (A) Packing fraction = $\frac{4 \times \frac{4}{3}\pi(R_+^3 + R_-^3)}{[2(R_+ + R_-)]^3} \times 100$ = 69.77%

(C) In CsCl, chloride ion forms crystal and Cs^+ ion occupy cubical void.

51. Select the correct ....

Sol. (C) for monoclinic system $a \neq b \neq c$ &

$\alpha = \gamma = 90°,\ \beta \neq 120°$

(D) packing fraction of B.C.C. is 68%

52. The correct statement(s) ....

Sol. MnO_4^- ü ì purple

$Cr_2O_7^{2-} \longrightarrow$ Orange

$2KMnO_4 \xrightarrow{\Delta} K_2MnO_4 + MnO_2 + O_2$

$2K_2Cr_2O_7 \xrightarrow{\Delta} 2K_2CrO_4 + Cr_2O_3 + \frac{3}{2}O_2$

53. Alkali metals dissolve ....

Sol. On increasing the conc. of alkali metal the no. of electrons increases in the solution so pairing of electrons will take place thus paramagnetic character decreases and conductivity increases.

54. Gas (A) + Cl_2 ....

Sol. $SO_2 + Cl_2 \xrightarrow{\text{Charcoal}} SO_2Cl_2 \xrightarrow[\text{phosphorus}]{+\text{ White}} PCl_5 + SO_2$

55. In which of the following ....

Sol. $H_3PO_3 \xrightarrow{\Delta} H_3PO_4 + PH_3$

$2I^- + H_2O + O_3 \rightarrow 2OH^- + I_2(s) + O_2(g)$

$2KClO_3 + 3H_2SO_4 \longrightarrow 2KHSO_4 + HClO_4 + \underset{(\text{yellow})}{2ClO_2(g)} + H_2O$

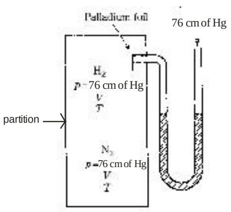
$HBr + H_2SO_4 \longrightarrow \underset{(\text{Redish Brown})}{Br_2(g)} + SO_2 + H_2O$

56. What is the valancy ....

Sol. out of 14 moles of Cl^- only 6 moles of Cl^- are changing it's oxidation state from –1 to 0 in the product Cl_2 and the oxidation state of remaining $8Cl^-$ ions. remain same in KCl and $CrCl_3$. So total no. of moles of electrons lost by 14 moles of HCl is 6 so each mole HCl takes up 3/7.

57. How many of the following ....

Sol. H_2(g), H^+ (aq), S(Rhombic), Zn(s), C(graphite), Al(s), Hg(ℓ)

58. 

....

Sol. The lower compartment contains N_2 (which cannot pass the Pd foil) under 76 cm of Hg pressure. After removing partitation, the hydrogen behave exactly as if the N_2 were not present since the volume available to the H_2 has doubled, the pressure in the container has fallen to one half it original value.

59. A solution is 0.01M ....

Sol. % of remaining $[Cu^{+2}]$ = 0.1%

so $[Cu^{+2}] = \dfrac{0.01 \times 0.1}{100}$ = 10^{-5} M

$[S^{2-}] = \dfrac{8.7 \times 10^{-36}}{10^{-5}}$

$[S^{2-}] = 8.7 \times 10^{-31}$ M

Ionic product of (CdS) = 0.01 × 8.7 × 10^{-31}

IP < K_{sp}

so no ppt

60. How many of the ....

Sol. Ammonium salts containing oxidising anions on heating liberates N_2 or N_2O.

$(NH_4)_2SO_4$, NH_4HCO_3, NH_4Cl, NH_4COONH_2)

PAPER-2

PART : I MATHEMATICS

1. If $x^4 f(x) - \sqrt{1-\sin(2\pi x)}$ ....

Sol. We shall consider two cases

Case-I : When f(x) $\geq$ 0, so

$x^4 f(x) - \sqrt{1-\sin 2\pi x}$ = f(x) -2f(x)

$\Rightarrow f(x) = \dfrac{\sqrt{1-\sin 2\pi x}}{(1+x^4)}$

Hence f(-2) = $\dfrac{1}{17}$

Case-II : When f(x) < 0, so

$x^4 (x) - \sqrt{1-\sin^2 \pi x} = -f(x) - 2f(x)$

$\Rightarrow f(x) = \dfrac{\sqrt{1-\sin 2\pi x}}{x^4+3} \geq 0$ (Not possible)

Hence f(–2) = $\dfrac{1}{17}$

2. If function f : R $\rightarrow$ R ....

Sol. $\dfrac{\cos x.\sin y}{\sin x.\cos y} = \dfrac{\sin(x+y)-\sin(x-y)}{\sin(x+y)+\sin(x-y)}$

$\Rightarrow$ f(2(x + y)) = sin (x + y) $\left(\because f'(0) = \dfrac{1}{2}\right)$

$\Rightarrow$ f(x) = $\sin\left(\dfrac{x}{2}\right)$

Now, $f''(x) = -\dfrac{1}{4}\sin\left(\dfrac{x}{2}\right)$

$\Rightarrow 4f''(x) + f(x) = 0$

3. $\lim\limits_{n\to\infty} \dfrac{n}{3}\left\{\left(\dfrac{3}{n}+\dfrac{9}{n^2}\right)^2 + ...\right\}$

Sol. Taking $\dfrac{3}{n}$ common from inner squared brackets

L = $\lim\limits_{n\to\infty} \dfrac{3}{n}\left\{\left(1+\dfrac{3}{n}\right)^2 + \left(1+\dfrac{6}{n}\right)^2 + \left(1+\dfrac{9}{n}\right)^2 + \ldots\left(1+\dfrac{3n}{n}\right)^2\right\}$

$\Rightarrow L = 3\lim\limits_{n\to\infty} \dfrac{1}{n}\sum\limits_{r=1}^{n}\left(1+\dfrac{3r}{n}\right)^2$

L = $\dfrac{3}{n}\sum\limits_{r=1}^{n}\left(1+\dfrac{6r}{n}+\dfrac{9r^2}{n^2}\right)$ = 21

4. $\lim_{n\to\infty}\sum_{r=1}^{n}\frac{r}{1\times3\times5\times7\times9\times.......\times(2r+1)}$ ....

Sol. $T(r)=\frac{r}{1\times3\times5\times.....\times(2r+1)}$

$=\frac{2r+1-1}{2(1\times3\times5\times....(2r+1))}$

$=\frac{1}{2}\left(\frac{1}{1\times3\times5....(2r-1)}-\frac{1}{1\times3\times5....(2r+1)}\right)$

$=-\frac{1}{2}[V(r)-V(r-1)]$

$\Rightarrow\sum_{r=1}^{n}T(r)=-\frac{1}{2}(V(n)-V(0))$

$=\frac{1}{2}\left(1-\frac{1}{1\times3\times5\times....\times(2n+1)}\right)$

$\Rightarrow\ \lim_{n\to\infty}\sum_{r=1}^{n}\frac{r}{1\times3\times5\times7\times9\times.......\times(2r+1)}$

$=\lim_{n\to\infty}\frac{1}{2}\left(1-\frac{1}{1\times3\times5\times....\times(2n+1)}\right)=\frac{1}{2}$

5. If f(x) is differentiable ....

Sol. $2f(x+y)+f(x-y)+3y^2=3f(x)-2xy$

Differentiate partially w.r.t. y

$\Rightarrow\ 2f'(x+y)-f'(x-y)+6y=0-2x$

Putting y = 0 $\Rightarrow 2f'(x)-f'(x)=-2x$

$\Rightarrow\ f'(x)=-2x$

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

$\because\ f(1)=-1$

$\Rightarrow\ c=0$

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

$\lim_{x\to1}\frac{f(x)+1}{x-1}=f'(1)=-2$

6. For all real value ....

Sol. Line $(2a+b)x+(a+3b)y+(b-3a)=0$

or $a(2x+y-3)+b(x+3y+1)=0$ are concurrent at point of intersection of line $2x+y=3$ and

$x+3y+1=0$

which is (2, –1)

now line $mx+2y+6=0$ must passes through this point

$\Rightarrow\ 2m-2+6=0\ \Rightarrow\ m=-2$

so $|m|=2$

7. The value of ....

$\lim_{x\to0^+}\left(\ell n\sin^3x-\ell n(x^4+ex^3)\right)$.........

Sol. $\lim_{x\to0^+}\ln\left(\frac{(\sin^3x)}{x^4+ex^3}\right)$

$=\lim_{x\to0^+}\ln\left(\frac{\sin^3x}{x^3}\cdot\frac{1}{x+e}\right)$

$=\lim_{x\to0^+}3\ln\left(\frac{\sin x}{x}\right)-\ln(x+e)$

$=-1$

8. If $\frac{\text{Area of }\Delta ABC}{\text{Area of rectangle OPQR}}$ ....

Sol. $\frac{\frac{1}{2}(\beta-\alpha)c}{\left(\frac{b^2-4c}{4}\right)\left(-\frac{b}{2}\right)}=\frac{8}{3}$ squaring and using

$(\beta-\alpha)^2=b^2-4c$

$9c^2=4b^4-16b^2c$

$4b^4-16b^2c-9c^2=0$

$4b^4-18b^2c+2b^2c-9c^2=0$

$2b^2[2b^2-9c]+c(2b^2-9c)=0$

$(2b^2+c)(2b^2-9c)=0\ \Rightarrow c>0\ \therefore\ 2b^2+c\neq0$

$\frac{b^2}{c}=\frac{9}{2}\Rightarrow\frac{b^2}{c}=4.5$

9. If two circles passing ....

Sol. $OA\,.\,OB=OC^2$

$\alpha\,.\,\beta=c^2$ & $\left(\frac{b^2-4c}{4}\right)^2=\alpha\beta$

$(b^2-4)^2=16$

$c=c^2$ $\quad b^2-4=4$

$c=1$ $\quad b^2=8$

Hence (A) and (C) are correct

10. Number of solutions ....

Sol. $5([x]+\{x\})+20\{x\}-3[x]=7$

$25\{x\}=7-2[x]$

$\{x\}=\frac{7-2[x]}{25}$

$[x]=0,1,2,3,-1,-2,-3,-4,-5,-6,-7,-8$

11. If S_1 is solution of ....

Sol. $[x]^2 + [x] - 6 = 0$

$\Rightarrow ([x] + 3)([x] - 2) = 0$

$\Rightarrow [x] = 2, -3$

$\Rightarrow x \in [2, 3) \cup [-3, -2)$ ......(1)

$[3x] + [x] < 2 + 3x$

$\Rightarrow [3x] + [x] < 2 + [3x] + \{3x\}$

$\Rightarrow [x] < 2 + \{3x\}$

Case -1

$x \in [2, 3)$

then $2 < 2 + \{3x\}$

$0 < \{3x\}$

$\Rightarrow x \in (2, 3) - \left\{\frac{7}{3}, \frac{8}{3}\right\}$

Case -2

$x \in [-3, -2)$

$-3 < 2 + \{3x\}$

$-5 < \{3x\}$

$x \in R$

$\Rightarrow x \in [-3, -2)$

Case -1 $\cup$ Case -2

$x \in [-3, -2) \cup (2, 3)$ ...(2)

(1) $\cap$ (2) $x \in [-3, -2) \cup (2, 3)$

12. The value of the ....

Sol. We have $f(x) = \frac{3x+a}{x^2+3}$

Now $\frac{3}{2} = \frac{3x+a}{x^2+3} \Rightarrow 3x^2 + 9 = 6x + 2a$

$\Rightarrow 3x^2-6x+9-2a=0$

13. The minimum value ....

Sol. $Y = f(x) = \frac{3x+3}{x^2+3} \Rightarrow x^2y + 3y = 3x + 3$

$\Rightarrow x^2y - 3x + 3y - 3 = 0$

when $x \in R$ and $y \neq 0$ so $D \geq 0$ [y = 0 when x = –1]

$\Rightarrow 9-4y(3y-3) \geq 0$

$\Rightarrow (2y - 3)(2y + 1) \leq 0$

Hence $y \in \left[\frac{-1}{2}, \frac{3}{2}\right]$

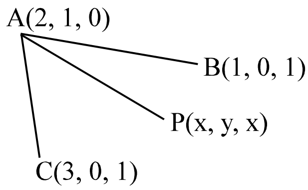
Hence minimum value of f(x) is $\frac{-1}{2} = \sin\left(\frac{-\pi}{6}\right)$ Ans.

14. Equation of the ....

15. Equation of the ....

Sol. Equation of the plane ABC, is

$$\begin{vmatrix} x-2 & y-1 & z \\ -1 & -1 & 1 \\ 1 & -1 & 1 \end{vmatrix} = 0$$



$(x - 2)[(-1) - (-1)] - (y - 1)[(-1) - 1] + z[1 + 1] = 0$

$2(y - 1) + 2z = 0 \Rightarrow y + z - 1 = 0$

vector normal to the plane is $\vec{r} = 0\hat{i} + \hat{j} + \hat{k}$

equation of the line through (0, 0, 2) and parallel to

16. (A) If $f(x) = \sqrt[4]{4^x + 8^{\frac{2}{3}(x-1)} - 72 - 4^{x-\frac{3}{2}}}$ ....

Sol. (A) $4^x + 8^{\frac{2}{3}(x-1)} - 72 - 4^{x-\frac{3}{2}} \geq 0$

$2^{2x} + 2^{2x-2} - 2^{2x-3} - 72 \geq 0$

let $2^{2x} = t$

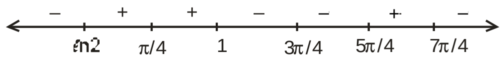
$t + \frac{t}{4} - \frac{t}{8} - 72 \geq 0$

$t \geq 64$

$\Rightarrow x \geq 3$

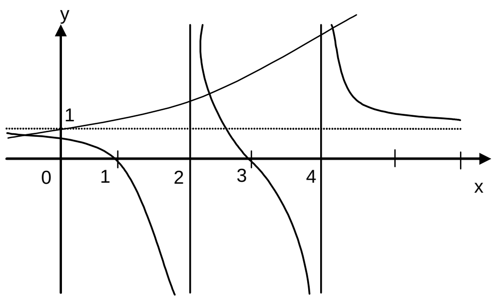
(B) $(e^x - 2)(\sin(x + \pi/4))(x - \log_2 2)(\sin x - \cos x) < 0$

$= \frac{1}{\sqrt{2}}(x - \ell n2)(\sin^2 x - \cos^2 x)(x - 1) < 0$



Least positive integral value is 3.

(C) $f : R \to R f(x) = \frac{x^3}{3} + (m - 1)x^2 + (m + 5)x + n$



$f'(x) = x^2 + 2(m - 1)x + (m + 5) \geq 0$

$\Delta \leq 0$

$4(m - 1)^2 - 4(m + 5) \leq 0$

$m^2 - 3m - 4 \leq 0$

$(m - 4)(m + 1) \leq 0$

$-1 \le m \le 4$

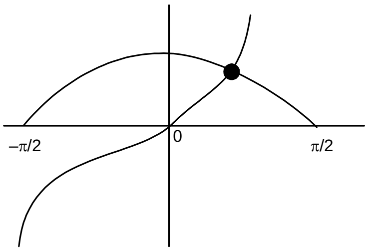
(C) f(x) = $\dfrac{(x-1)(x-3)}{(x-2)(x-4)} - e^x$

f(x) = 0 has three solutions

f(–x) = $\dfrac{(x+1)(x+3)}{(x+2)(x-4)} - e^x$ = 0 has three solution

$x^3 = \cos x$

one solution



there are total 7 solutions.

17. (A) In a ΔABC the ....

Sol. (A) r = R cos C

$4 \sin\dfrac{A}{2} \sin\dfrac{B}{2} \sin\dfrac{C}{2} = \cos C$

$2 \sin\dfrac{C}{2}\left[\cos\left(\dfrac{A-B}{2}\right) - \cos\dfrac{A+B}{2}\right] = \cos C$

$2 \cos\left(\dfrac{A+B}{2}\right) \cos\left(\dfrac{A-B}{2}\right) - 2\sin^2\dfrac{C}{2} = 1 - 2\sin^2\dfrac{C}{2}$

cos A + cos B = 1

$2\cos^2\dfrac{A}{2} + 2\cos^2\dfrac{B}{2} = 3$

(B) 2R cos A cos C = R cos B

$\dfrac{\cos B}{\cos A \cos C} = 2$

cos B = cos(A + C) + cos(A – C)

2 cos B = cos A cos C + sin A sin C

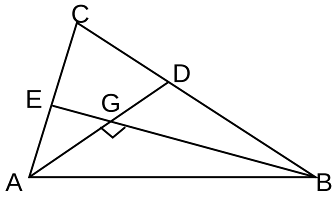
$\dfrac{2\cos B}{\cos A \cos C} = 1 + \tan A \tan C$

$\tan A \tan C = 3 \Rightarrow \dfrac{2}{3} \tan A \tan C = 2$

(C) $GA^2 + BG^2 = AB^2$

$\dfrac{1}{4}\dfrac{4}{9}(2a^2 + 2c^2 - b^2) + \dfrac{1}{4}\dfrac{4}{9}(2b^2 + 2c^2 - a^2) = c^2$

$\Rightarrow \dfrac{a^2 + b^2 + c^2}{6c^2} = 1$



(D) $\dfrac{8r}{R} = 8 \times 4 \sin\dfrac{A}{2} \sin\dfrac{B}{2} \sin\dfrac{C}{2}$

for maximum rule

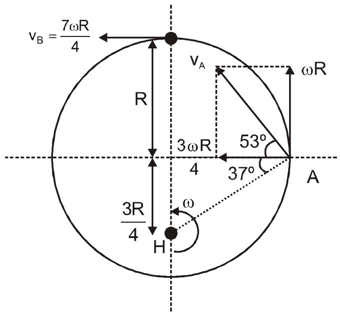
$A = B = C = \dfrac{\pi}{3} = 32 \times \dfrac{1}{2} \times \dfrac{1}{2} \times \dfrac{1}{2} = 4$

PART : II PHYSICS

18. A uniform disc ....

Sol. $v_A = \dfrac{\omega R}{4}\sqrt{9+16} = \dfrac{5\omega R}{4}$ = μr Ĝ $r = \dfrac{5R}{4}$

$\vec{v}_B = -\dfrac{7\omega R}{4}\hat{i}$



$I_H = \dfrac{mR^2}{2} + \dfrac{9mR^2}{16} = \dfrac{17mR^2}{16}$

$K = \dfrac{17mR^2\omega^2}{32}$

19. A ball of mass ....

Sol. No external torque is acting on the ball. So applying angular momentum conservation about point O.

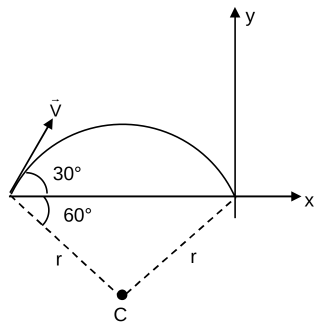
$m(\omega r)(r) = \text{constant} \Rightarrow \omega \propto \dfrac{1}{r^2}$

So $\omega \propto \dfrac{1}{(1/4)^2}$ = 16 times

$T = m\omega^2 r = (16)^2 \times \dfrac{1}{4}$ = 64 times

20. There exist a ....

Sol.



As $\vec{V} \perp \vec{B}$ particle will follow circular path of radius $r = \frac{m|\vec{v}|}{q|\vec{B}|} = \frac{V}{5}$

Let co-ordinate of centre of circle be $(x_0, y_0, 0)$

so $\sqrt{\left((x_0-(-5))^2+(y_0-0)^2\right)} = \sqrt{x_0^2+y_0^2}$

$\Rightarrow x_0 + 5 = -x_0 \Rightarrow x_0 = \frac{-5}{2}$

and $y_0 = \frac{-5}{2}\tan 60° = \frac{-5\sqrt{3}}{2}$

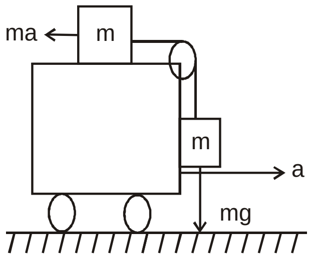
so, $\frac{V}{5} = \sqrt{\left(\frac{5}{2}\right)^2+\left(\frac{5\sqrt{3}}{2}\right)^2} = 5$

$\Rightarrow v = 25$ m/s

21. On a cart of mass ....

Sol. For no friction

on block A,



ma = mg

a = g

$\Rightarrow$ F = (5m) (a) = (5m) (g)

22. A graph between ....

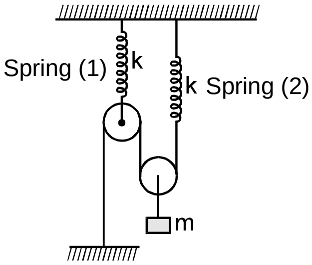
Sol. from graph

$V^2 = \left(-\frac{2700}{0.6}\right)S + 3600$

$2v\frac{dv}{ds} = \left(-\frac{2700}{0.6}\right), v\frac{dv}{ds} = -2250$

23. Mass m shown ....

Sol.



Initially the block is at rest under action of force 2T upward and mg downwards. When the block is pulled downwards by x, the spring (1) extends by x_1 and spring (2) extends by x_2.

$Kx_1 = 2kx_2$

$\Rightarrow x_1 = 2x_2$ ....(1)

$x = x_1 + \frac{x_2}{2}$ ....(2)

$\Rightarrow x_2 = \frac{2x}{5}$

$\therefore$ acceleration of the block is = $\frac{4kx}{5m}$

24. A thin converging ....

Sol. for 2^{nd} lens $\frac{1}{v} - \frac{1}{2\ell} = \frac{1}{-\ell}$ or $v = -2\ell$

$m_1 = -1$

for 3^{rd} lens $\frac{1}{v} - \frac{1}{-3\ell} = \frac{1}{2\ell}$ or $v = 6\ell$

$m_2 = -2$

$h_i = (m_1 \times m_2)\, h_0 = 2h$

25. For $\theta = \frac{\pi}{2}$ ....

Sol. CM is at rest, so particle A will move in a circle of radius $\frac{2\ell}{3}$

Initial angular acceleration is

$$\alpha = \frac{\tau}{I} = \frac{pE\sin 90°}{(m)\left(\frac{2\ell}{3}\right)^2 + (2m)\left(\frac{\ell}{3}\right)^2} = \frac{3qE}{2m\ell}$$

Applying energy conservation from initial position to equilibrium position :-

$K_i + U_i = K_f + U_f \Rightarrow 0 + 0 = \frac{1}{2}\left(\frac{2m\ell^2}{3}\right)^2 \omega^2_{max} - q\ell\, E\cos 0°$

$$\Rightarrow \omega_{max} = \sqrt{\frac{3qE}{m\ell}}$$

26. For $\theta = \theta_0$ ....

Sol $\tau = pE\theta = I\frac{d^2\theta}{dt^2}$

Angular frequency = $\sqrt{\frac{pE}{I}}$

$(V_A)_{max} = \frac{2\ell}{3}\omega_{max}$

$= \frac{2\ell}{3}\theta_0\sqrt{\frac{pE}{I}}$

$= \frac{2\ell}{3}\theta_0\sqrt{\frac{(q\ell)(E)}{m\left(\frac{2\ell}{3}\right)^2 + 2m\left(\frac{\ell}{3}\right)^2}} = \theta_0\sqrt{\frac{2qE\ell}{3m}}$.

28. If a friction force ....

Sol. No friction between M and m_0

$\therefore$ Acceleration of m_0 is zero

$\mu(M + m_0)\, g = mg$

$\Rightarrow \mu = \frac{m}{M+m_0}$

a = $\frac{mg - «(M+m_0)g}{M+m}$

$= \left[\frac{m - «(M+m_0)}{M+m}\right] g$

31. Which of the ....

Sol. Applying energy conservation before collision

$$\frac{MgL}{2} = \frac{1}{2}Mv_{CM}{}^2 + \frac{1}{2}\left(\frac{ML^2}{12}\right)\left(\frac{2v_{CM}}{L}\right)^2 \Rightarrow v_{CM} = \sqrt{\frac{3gL}{4}}\ \&\ \omega = 2\sqrt{\frac{3g}{4L}} = \sqrt{\frac{3g}{L}}$$

Angular Impulse of Normal reaction = Total Angular Impulse about COM = $L_f - L_i$

$$= \left(\frac{ML^2}{12}\right)\sqrt{\frac{3g}{L}} = \frac{ML\sqrt{3gL}}{12}$$

32. Which of the ....

Sol. During collision, for all points on the rod, $v_{seperation} = e\, v_{approach}$

Just after first collision

$V'_{cm} = e\sqrt{\frac{3gL}{4}}$ and $\omega' = e\sqrt{\frac{3g}{L}}$

so K.E'

$= \frac{1}{2}M\left(V'_{cm}\right)^2 + \frac{1}{2}\left(\frac{ML^2}{12}\right)(\omega')^2 = \frac{e^2MgL}{2}$

$\Rightarrow$ COM will rise upto $\frac{e^2L}{2}$ before coming to rest

when rod comes to instantaneous to rest, s

$\sin\theta_1 = \frac{\left(e^2L/2\right)}{(L/2)} = e^2$

similarly, after n - collision , $\sin\theta_n = e^{2n}$

33. A charged particle ....

Sol. **(A)** $i = \frac{q}{\left(\frac{2\pi r}{v}\right)} = \frac{qv}{2\pi r} = \frac{qv}{2\pi\left(\frac{mv}{qB}\right)} = \frac{q^2B}{2\pi m}$

(B) $\mu = i.\ \pi r^2 \propto v^2$

(C) $B_{centre} = \frac{\mu_0 i}{2\pi r} \propto v^{-1}$

(D) $r \propto v$

34. A projectile is ....

Sol. $V_1 = V_2 = u\cos\theta$

$T_1 = \frac{2u\sin\theta}{g}, T_2 = \frac{2eu\sin\theta}{g}$

$H_1 = \frac{u^2\sin^2\theta}{2g}, H_2 = \frac{e^2u^2\sin^2\theta}{2g}$

$R_1 = \frac{2u^2\sin\theta\cos\theta}{g}, R_2 = \frac{2eu^2\sin\theta\cos\theta}{g}$

PART : III CHEMISTRY

35. Which of the following ………

Sol. $P_4O_{10} \xrightarrow{H_2O} H_4P_4O_{12}$
cyclic tetrameta phosphoric acid

$\xrightarrow{H_2O} 2H_4P_2O_7 \xrightarrow{H_2O} H_3PO_4$
pyro phosphoric acid — phosphoric acid

36. Consider the cell ………

Sol. If the cell is taken to be conc cell, $E^0_{cell} = 0$

Anode: $Ag \longrightarrow Ag^+{}_a + e^-$

Cathode: $Ag^+{}_c + e^- \longrightarrow Ag$

$Ag_c^+ \rightleftharpoons Ag_a^+$

From Nearest eq,

$$E_{cell} = E^0_{cell} - \frac{0.059}{1}\log\frac{[Ag^+]a}{[Ag^+]c}$$

$\Rightarrow$ $$0 = 0 - \frac{0.059}{1}\log\frac{[Ag^+]_a}{[Ag^+]_c}$$

$\therefore$ $[Ag^+]_a = [Ag^+]_c \Rightarrow \frac{K_{sp}\text{ of AgBr}}{[Br^-]} = \frac{K_{sp}\text{ of AgCl}}{[Cl^-]}$

or, $$\frac{8\times10^{-13}}{10^{-10}} = \frac{[Br^-]}{[Cl^-]}$$

38. $Na_3[CrF_6]$ Paramagnetic ....

Sol. $_{24}Cr^{+3} = t_{2g}^{1,1,1},\ e_g^{0,0}$

39. Which of the following ....

Sol. B.E. $Cl_2 > Br_2 > F_2 > I_2$

40. Element X crystallizes ....

Sol. $d_{FCC} = \frac{4\times M}{N_A\times a^3}$ $\qquad d_{BCC} = \frac{2M}{N_A\times a^3}$

for F.C.C. lattice $a = \frac{4r}{\sqrt{2}}$

for b.c.c. lattice $a = \frac{4r}{\sqrt{3}}$

Ratio of density = $\frac{d_{FCC}}{d_{BCC}}$

$$= 2\times(\sqrt{2})^3 : (\sqrt{3})^3$$

41. An H_2O_2 solution ....

Sol. 11.2 'V' = 1M

5.6 V = $\frac{1}{2}$ M

42. What will be the colour ....

Sol. The pH at I equivalent point will be $\frac{pK_1 + pK_2}{2} = 5$

so at this pH colour of indicator is red.

43. Calculate the pH ....

Sol. $H_3PO_4 + NaOH \rightleftharpoons NaH_2PO_4 + H_2O$

H_3PO_4	NaOH	NaH_2PO_4
5	12.5	
0	7.5	5

$NaH_2PO_4 + NaOH \rightleftharpoons Na_2HPO_4 + H_2O$

NaH_2PO_4	NaOH	Na_2HPO_4
5	7.5	
0	2.5	5

$Na_2HPO_4 + NaOH \rightleftharpoons Na_3PO_4 + H_2O$

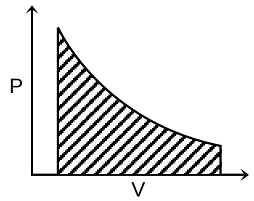
Na_2HPO_4	NaOH	Na_3PO_4
5	2.5	
2.5	0	2.5

So $pH = pK_3 + \log\frac{[Salt]}{[Acid]}$

pH = 11

44. Consider a PV ....

Sol.



(B) $|W| = \int PdV$

(C) $\Delta U = 0$ (isothermal)

So $|q| = |W|$

(D) $\int dq = \int TdS \Rightarrow q = T\Delta S$

(A) $dG = VdP - SdT$ (at constant temperature, SdT = 0)

$$\int dG = \int VdP$$

But $\Delta H = 0$ and

$dH = dU + PdV + VdP$

$\Rightarrow$ $0 = 0 + PdV + VdP$

$\Rightarrow$ $VdP = -PdV$

$\Rightarrow$ $|\Delta G|$ = area projected on volume axis.

45. The III law of thermodynamics ....

Sol. (A) Fact

(B) $S_m^o(H^+, aq) = 0$ (at any T) (Convention)

But $S_m^o(Al^{3+}, aq) < 0$, because a solution of Al^{3+} (aq) brings more ordered arrangement of water molecules than that of H^+ (aq).

(C) Same as B

(D) $\Delta H < 0$ (as the transition is taking place on cooling)

For equilibrium, $\Delta G = 0$

$\Delta H = T\Delta S$

$\Rightarrow$ $\Delta S < 0$ $\qquad \Rightarrow$ $\qquad S_m^o(\beta) < S_m^o(\alpha)$

46. (X) + KOH + Air ....

Sol. $2MnO_2 + 4KOH + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$

(X) (air) (Y) Green

$2K_2MnO_4 + Cl_2 \longrightarrow 2KMnO_4 + 2KCl$

(Y) (Z) Purple

47. When CO_2 is passed ....

Sol. (A) $Na_2CrO_4 \xrightarrow{CO_2} Na_2Cr_2O_7$ (orange color)

(B) $MnO_4^{2-} \xrightarrow{CO_2} MnO_4^- + MnO_2$

(C) False-In acidic medium no color change.

48. Which of the following ....

Sol. (A) $P_4 + 3NaOH + 3H_2O \xrightarrow{\Delta} PH_3 + 3NaH_2PO_2$

(B) $4S + 6NaOH \xrightarrow{\Delta} Na_2S_2O_3 + 2Na_2S + 3H_2O$

(C) $2F_2 + 4NaOH \xrightarrow{\Delta} O_2 + 4NaF + 2H_2O$

(D) $NaOH + NO_2 \xrightarrow{\Delta} NaNO_2 + NaNO_3 + H_2O$

49. Select the correct ....

Sol. (A) $Cl_2 \xrightarrow{\text{In basic medium}} Cl^- + OCl^-$

$Cl_2 \xrightarrow[\text{Neutral medium}]{H_2O} HCl + HClO$

(B) $K_2MnO_4 \xrightarrow[\text{neutral medium}]{\text{Acidic or}} KMnO_4 + MnO_2$

(C) $I_2 \xrightarrow{OH^-} HI + HOI$

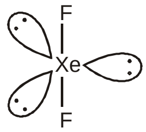
(D) $NaNO_2 \xrightarrow[\text{Acidic medium}]{H^+} NaNO_3 + NO$

50. Match the compounds ....

Sol. (A) $XeF_2 + 2H_2O \xrightarrow{\text{Hydrolysis}} 2Xe + 4HF + O_2$

$XeF_2 + 2HCl \longrightarrow Xe + 2HF + Cl_2$

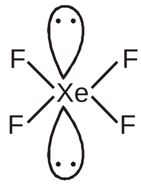
as oxidising agent



(B) $6XeF_4 + 12H_2O \xrightarrow[\text{Disproportionation}]{\text{Hydrolysis}} 4Xe + 2XeO_3 + 24HF + 3O_2$

$XeF_4 + 2Hg \longrightarrow Xe + 2HgF_2$

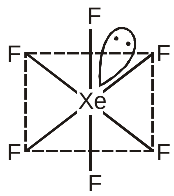
as oxidising agent.



(C) $XeF_6 + 3H_2O \xrightarrow{\text{Hydrolysis}} XeO_3 + 2HF$

$XeF_6 + 3H_2 \longrightarrow 6HF + Xe$

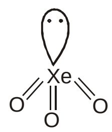
as oxidising agent



(D) $XeO_3 + OH^- \rightleftharpoons HXeO_4^-$

$2HXeO_4^- + 2OH^- \longrightarrow XeO_6^{4-} + Xe + O_2 + 2H_2O$

acts as oxidising agent.



ANSWER KEY

CODE-0

PAPER-1

PART : I MATHEMATICS

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

PART : II PHYSICS

21.	(AB)	**22.**	(CD)	**23.**	(BD)	**24.**	(AD)	**25.**	(AC)	**26.**	(AD)	**27.**	(ACD)
28.	(AB)	**29.**	(AD)	**30.**	(AC)	**31.**	(ACD)	**32.**	(AD)	**33.**	(AD)	**34.**	(ACD)
35.	(ABC)	**36.**	(3)	**37.**	(4)	**38.**	(8)	**39.**	(6)	**40.**	(5)		

PART : III CHEMISTRY

41.	(BC)	**42.**	(AB)	**43.**	(BCD)	**44.**	(ABC)	**45.**	(BCD)	**46.**	(CD)	**47.**	(B)
48.	(CD)	**49.**	(ABD)	**50.**	(BCD)	**51.**	(AB)	**52.**	(CD)	**53.**	(CD)	**54.**	(ABCD)
55.	(CD)	**56.**	(3)	**57.**	(7)	**58.**	(2)	**59.**	(1)	**60.**	(4)		

PAPER-2

PART : I MATHEMATICS

1.	(A)	**2.**	(C)	**3.**	(D)	**4.**	(C)	**5.**	(C)	**6.**	(C)	**7.**	(C)
8.	(BD)	**9.**	(AC)	**10.**	(A)	**11.**	(C)	**12.**	(C)	**13.**	(B)	**14.**	(B)

15. (C) **16.** (A) $\rightarrow$ (Q,R, S) ; (B) $\rightarrow$ (Q) ; (C) $\rightarrow$ (R) ; (D) $\rightarrow$ (S)

17. (A) $\rightarrow$ (S) ; (B) $\rightarrow$ (Q) ; (C) $\rightarrow$ (P) ; (D) $\rightarrow$ (R)

PART : II PHYSICS

18.	(C)	**19.**	(D)	**20.**	(D)	**21.**	(A)	**22.**	(C)	**23.**	(A)	**24.**	(D)
25.	(ACD)	**26.**	(BCD)	**27.**	(ABC)	**28.**	(B)	**29.**	(ABD)	**30.**	(AC)	**31.**	(ABCD)

32. (ABD) **33.** (A) – R ; (B) – Q ; (C) – S ; (D) – P **34.** (A) – Q ; (B) – P ; (C) – Q ; D – S

PART : III CHEMISTRY

35.	(D)	**36.**	(B)	**37.**	(A)	**38.**	(A)	**39.**	(A)	**40.**	(D)	**41.**	(A)
42.	(B)	**43.**	(B)	**44.**	(ABCD)	**45.**	(AD)	**46.**	(BD)	**47.**	(AB)	**48.**	(ABD)

49. (ABD) **50.** (A – P, Q, R) ; (B – P, Q, R, S); (C – P, Q, R) ; (D – Q, R, S)

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

ADVANCED PATTERN
CUMULATIVE TEST-1(ACT-1)
TARGET : JEE (MAIN+ADVANCED) 2017

DATE : 30-04-2017 REVSION PLAN 2 COURSE : VIJETA (ADP), VIJAY (ADR)

ANSWER KEY

CODE-1

PAPER-1

PART : I MATHEMATICS

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

PART : II PHYSICS

21.	(CD)	**22.**	(AB)	**23.**	(AD)	**24.**	(BD)	**25.**	(BC)	**26.**	(CD)	**27.**	(BCD)
28.	(CD)	**29.**	(BD)	**30.**	(AB)	**31.**	(BCD)	**32.**	(CD)	**33.**	(BD)	**34.**	(BCD)
35.	(ACD)	**36.**	(3)	**37.**	(4)	**38.**	(8)	**39.**	(6)	**40.**	(5)		

PART : III CHEMISTRY

41.	(AC)	**42.**	(AB)	**43.**	(ABC)	**44.**	(ABD)	**45.**	(ACD)	**46.**	(BD)	**47.**	(C)
48.	(BD)	**49.**	(ABC)	**50.**	(ACD)	**51.**	(AC)	**52.**	(BD)	**53.**	(BD)	**54.**	(ABCD)
55.	(CD)	**56.**	(3)	**57.**	(7)	**58.**	(2)	**59.**	(1)	**60.**	(4)		

PAPER-2

PART : I MATHEMATICS

1.	(B)	**2.**	(D)	**3.**	(C)	**4.**	(B)	**5.**	(D)	**6.**	(D)	**7.**	(B)
8.	(CD)	**9.**	(AD)	**10.**	(B)	**11.**	(D)	**12.**	(D)	**13.**	(C)	**14.**	(C)

15. (B) **16.** (A) $\rightarrow$ (Q,R, S) ; (B) $\rightarrow$ (Q) ; (C) $\rightarrow$ (R) ; (D) $\rightarrow$ (S)

17. (A) $\rightarrow$ (S) ; (B) $\rightarrow$ (Q) ; (C) $\rightarrow$ (P) ; (D) $\rightarrow$ (R)

PART : II PHYSICS

18.	(A)	**19.**	(B)	**20.**	(B)	**21.**	(C)	**22.**	(A)	**23.**	(B)	**24.**	(A)
25.	(BCD)	**26.**	(ABD)	**27.**	(BCD)	**28.**	(A)	**29.**	(BCD)	**30.**	(BC)	**31.**	(ABCD)

32. (ACD) **33.** (A) – R ; (B) – Q ; (C) – S ; (D) – P **34.** (A) – Q ; (B) – P ; (C) – Q ; D – S

PART : III CHEMISTRY

35.	(C)	**36.**	(A)	**37.**	(B)	**38.**	(A)	**39.**	(B)	**40.**	(C)	**41.**	(A)
42.	(C)	**43.**	(A)	**44.**	(ABCD)	**45.**	(AD)	**46.**	(AD)	**47.**	(AC)	**48.**	(ABC)

49. (ABC) **50.** (A – P, Q, R) ; (B – P, Q, R, S) ; (C – P, Q, R) ; (D – Q, R, S)

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

ADVANCED PATTERN
CUMULATIVE TEST-1(ACT-1)
TARGET : JEE (MAIN+ADVANCED) 2017

DATE : 30-04-2017 REVSION PLAN 2 COURSE : VIJETA (ADP), VIJAY (ADR)

ANSWER KEY

CODE-2

PAPER-1

PART : I MATHEMATICS

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

PART : II PHYSICS

21.	(AB)	**22.**	(CD)	**23.**	(BD)	**24.**	(AD)	**25.**	(AC)	**26.**	(AD)	**27.**	(ACD)
28.	(AB)	**29.**	(AD)	**30.**	(AC)	**31.**	(ACD)	**32.**	(AD)	**33.**	(AD)	**34.**	(ACD)
35.	(ABC)	**36.**	(3)	**37.**	(4)	**38.**	(8)	**39.**	(6)	**40.**	(5)		

PART : III CHEMISTRY

41.	(BC)	**42.**	(AB)	**43.**	(BCD)	**44.**	(ABC)	**45.**	(BCD)	**46.**	(CD)	**47.**	(B)
48.	(CD)	**49.**	(ABD)	**50.**	(BCD)	**51.**	(AB)	**52.**	(CD)	**53.**	(CD)	**54.**	(ABCD)
55.	(CD)	**56.**	(3)	**57.**	(7)	**58.**	(2)	**59.**	(1)	**60.**	(4)		

PAPER-2

PART : I MATHEMATICS

1.	(A)	**2.**	(C)	**3.**	(D)	**4.**	(C)	**5.**	(C)	**6.**	(C)	**7.**	(C)
8.	(BD)	**9.**	(AC)	**10.**	(A)	**11.**	(C)	**12.**	(C)	**13.**	(B)	**14.**	(B)

15. (C) **16.** (A) → (Q,R, S) ; (B) → (Q) ; (C) → (R) ; (D) → (S)

17. (A) → (S) ; (B) → (Q) ; (C) → (P) ; (D) → (R)

PART : II PHYSICS

18.	(C)	**19.**	(D)	**20.**	(D)	**21.**	(A)	**22.**	(C)	**23.**	(A)	**24.**	(D)
25.	(ACD)	**26.**	(BCD)	**27.**	(ABC)	**28.**	(B)	**29.**	(ABD)	**30.**	(AC)	**31.**	(ABCD)

32. (ABD) **33.** (A) – R ; (B) – Q ; (C) – S ; (D) – P **34.** (A) – Q ; (B) – P ; (C) – Q ; D – S

PART : III CHEMISTRY

35.	(D)	**36.**	(B)	**37.**	(A)	**38.**	(A)	**39.**	(A)	**40.**	(D)	**41.**	(A)
42.	(B)	**43.**	(B)	**44.**	(ABCD)	**45.**	(AD)	**46.**	(BD)	**47.**	(AB)	**48.**	(ABD)

49. (ABD) **50.** (A – P, Q, R) ; (B – P, Q, R, S); (C – P, Q, R) ; (D – Q, R, S)

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

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ADVANCED PATTERN
CUMULATIVE TEST-1(ACT-1)
TARGET : JEE (MAIN+ADVANCED) 2017

DATE : 30-04-2017 REVSION PLAN 2 COURSE : VIJETA (ADP), VIJAY (ADR)

ANSWER KEY

CODE-3

PAPER-1

PART : I MATHEMATICS

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

PART : II PHYSICS

21.	(CD)	**22.**	(AB)	**23.**	(AD)	**24.**	(BD)	**25.**	(BC)	**26.**	(CD)	**27.**	(BCD)
28.	(CD)	**29.**	(BD)	**30.**	(AB)	**31.**	(BCD)	**32.**	(CD)	**33.**	(BD)	**34.**	(BCD)
35.	(ACD)	**36.**	(3)	**37.**	(4)	**38.**	(8)	**39.**	(6)	**40.**	(5)		

PART : III CHEMISTRY

41.	(AC)	**42.**	(AB)	**43.**	(ABC)	**44.**	(ABD)	**45.**	(ACD)	**46.**	(BD)	**47.**	(C)
48.	(BD)	**49.**	(ABC)	**50.**	(ACD)	**51.**	(AC)	**52.**	(BD)	**53.**	(BD)	**54.**	(ABCD)
55.	(CD)	**56.**	(3)	**57.**	(7)	**58.**	(2)	**59.**	(1)	**60.**	(4)		

PAPER-2

PART : I MATHEMATICS

1.	(B)	**2.**	(D)	**3.**	(C)	**4.**	(B)	**5.**	(D)	**6.**	(D)	**7.**	(B)
8.	(CD)	**9.**	(AD)	**10.**	(B)	**11.**	(D)	**12.**	(D)	**13.**	(C)	**14.**	(C)

15. (B) **16.** (A) $\rightarrow$ (Q,R, S) ; (B) $\rightarrow$ (Q) ; (C) $\rightarrow$ (R) ; (D) $\rightarrow$ (S)

17. (A) $\rightarrow$ (S) ; (B) $\rightarrow$ (Q) ; (C) $\rightarrow$ (P) ; (D) $\rightarrow$ (R)

PART : II PHYSICS

18.	(A)	**19.**	(B)	**20.**	(B)	**21.**	(C)	**22.**	(A)	**23.**	(B)	**24.**	(A)
25.	(BCD)	**26.**	(ABD)	**27.**	(BCD)	**28.**	(A)	**29.**	(BCD)	**30.**	(BC)	**31.**	(ABCD)

32. (ACD) **33.** (A) – R ; (B) – Q ; (C) – S ; (D) – P **34.** (A) – Q ; (B) – P ; (C) – Q ; D – S

PART : III CHEMISTRY

35.	(C)	**36.**	(A)	**37.**	(B)	**38.**	(A)	**39.**	(B)	**40.**	(C)	**41.**	(A)
42.	(C)	**43.**	(A)	**44.**	(ABCD)	**45.**	(AD)	**46.**	(AD)	**47.**	(AC)	**48.**	(ABC)

49. (ABC) **50.** (A – P, Q, R) ; (B – P, Q, R, S) ; (C – P, Q, R) ; (D – Q, R, S)

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