ADVANCED PATTERN CUMULATIVE TEST-2 (ACT-2)

TARGET : JEE (MAIN+ADVANCED) 2017

DATE : 07-05-2017 REVSION PLAN 2 COURSE : VIJETA (ADP), VIJAY (ADR)

HINTS & SOLUTIONS

PAPER-1

PART : I MATHEMATICS

1. Let $x, y, z \in I$ and satisfy ....

Sol. $\left.\begin{array}{l}3x - y - z = 0\\ -3x + z = 0\end{array}\right] \Rightarrow y = 0$

$\Rightarrow 3x - z = 0$ and $x^2 + z^2 \le 100$

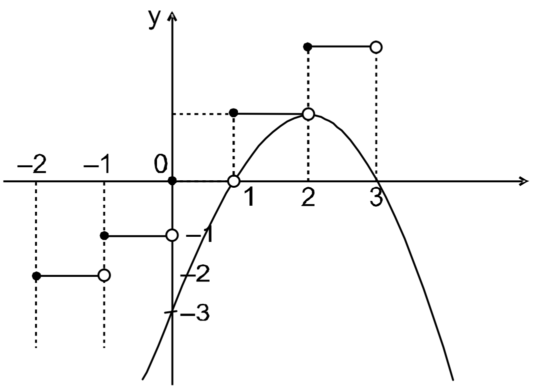
$\Rightarrow x^2 + 9x^2 \le 100 \Rightarrow x^2 \le 10$

$\Rightarrow x = -3, -2, -1, 0, 1, 2, 3$

$\Rightarrow$ Total 7 solutions

2. Number of roots of ....

Sol. $[x] = -(x^2 - 4x + 3) = -(x-1)(x-3)$



from graph no solution

3. Let P(x) is a polynomial ....

Sol. $P(x) + 1 \equiv (x-1)^3.Q_1(x) \Rightarrow P'(x)$ has twice repeated root '1'.

Also $P(x) - 1 \equiv (x+1)^3.Q_2(x) \Rightarrow P'(x)$ has twice repeated root '–1'.

$\Rightarrow P'(x) = k(x-1)^2.(x+1)^2$ (as degree of P(x) ≤ 5)

$= k(x^2-1)^2$

$= k(x^4 - 2x^2 + 1)$

$\Rightarrow P(x) = k\left(\frac{x^5}{5} - \frac{2x^3}{3} + x\right) + C$

Using P(1) = –1 and P(–1) = 1 we get $k = -\frac{15}{8}$ C = 0.

$\Rightarrow P(x) = -\frac{15}{8}x\left(\frac{x^4}{5} - \frac{2x^2}{3} + 1\right)$

$= -\frac{x}{8}(3x^4 - 10x^2 + 15)$

4. If the equation ....

Sol. We have $(x^2 + a|x| + a + 1)(x^2 + (a + 1)|x| + a) = 0$

Clearly for a > 0,

$x^2 + a|x| + a + 1 > 0 \ \forall \ x \in R$ and

$x^2 + (a + 1)|x| + a > 0 \ \forall \ x \in R$

Hence the given equation has no real root if $a \in (0, \infty)$

5. If the ordered pair ....

Sol. Expression = $x^2 + 2y^2 + 4x = 9 + y^2 + 4x$

$= 9 + 9 - x^2 + 4x = 18 - [x^2 - 4x]$

$= 18 - [(x-2)^2 - 4] = 22 - (x-2)^2$

$\therefore$ Maximum value = 22

Alternatively :

Expression = $x^2 + 2y^2 + 4x = 9 + y^2 + 4x$

$= 9 + 9\sin^2\theta + 4(3\cos\theta) = 9 + 9(1 - \cos^2\theta) + 12\cos\theta$

$= 18 - 3[3\cos^2\theta - 4\cos\theta] = 18 - 3 \times 3\left[\cos^2\theta - \frac{4}{3}\cos\theta\right]$

$= 18 - 9\left[\left(\cos\theta - \frac{2}{3}\right)^2 - \frac{4}{9}\right]$

$= 18 + 4 - 9\left(\cos - \frac{2}{3}\right)^2 = 22 - 9\left(\cos - \frac{2}{3}\right)^2$

Clearly maximum value = 22

6. For any $x, y \in R$, ...

Sol. As $x, y \in R$ and $xy > 0$, so x and y will be of same sign.

$\therefore$ All the quantities $\frac{2x}{y^3}, \frac{x^3y}{3}, \frac{4y^2}{9x^4}$ are positive.

$\therefore$ A.M. $\ge$ G.M.

$\Rightarrow \frac{2x}{y^3} + \frac{x^3y}{3} + \frac{4y^2}{9x^4} \ge 3\left(\left(\frac{2x}{y^3}\right)\left(\frac{x^3y}{3}\right)\left(\frac{4y^2}{9x^4}\right)\right)^{\frac{1}{3}} = 3 \times \frac{2}{3} = 2$

7. If p_1, p_2 are the roots ....

Sol. Given that $p_1, q_1, p_2 q_2$ are in A.P.

$\therefore (p_2 - p_1)^2 = (q_2 - q_1)^2$

$\Rightarrow (p_2 + p_1)^2 - 4p_1p_2 = (q_2 + q_1)^2 - 4q_1q_2$

$\Rightarrow \left(\frac{-b}{a}\right)^2 - 4\left(\frac{c}{a}\right) = \left(\frac{-b}{c}\right)^2 - 4\left(\frac{a}{c}\right)$

$\Rightarrow \frac{b^2 - 4ac}{a^2} = \frac{b^2 - 4ac}{c^2}$

Since $b^2 - 4ac$ is the discriminant of both the equations and roots are different

$\therefore b^2 \ne 4ac$

$\therefore a^2 = c^2$

$\Rightarrow$ a = c (Not possible because two quadratic equations become identical)

or a = – c

$\Rightarrow \frac{a}{c} = -1$ **Ans.**]

8. Let a_1, a_2, a_3, a_4 and ....

Sol. Given $b + (a_1 + a_2 + a_3 + a_4) = 8$

or $a_1 + a_2 + a_3 + a_4 = 8 - b$ ....(1)

Also $b^2 + a_1^2 + a_2^2 + a_3^2 + a_4^2 = 16$

or $a_1^2 + a_2^2 + a_3^2 + a_4^2 = 16 - b^2$ ....(2)

Using R.M.S. ≥ A.M. for a_1, a_2, a_3, a_4

R.M.S. ≥ A.M. a_1, a_2, a_3, a_4

or $\sqrt{\frac{a_1^2 + a_2^2 + a_3^2 + a_4^2}{4}} \geq \frac{a_1 + a_2 + a_3 + a_4}{4}$

or $\frac{a_1^2 + a_2^2 + a_3^2 + a_4^2}{4} \geq \frac{(a_1 + a_2 + a_3 + a_4)^2}{16}$

$\Rightarrow 16 - b^2 \geq \frac{(8-b)^2}{4}$

$\Rightarrow 64 - 4b^2 \geq 64 + b^2 - 16b \Rightarrow 5b^2 - 16b \leq 0$

$\Rightarrow b(5b - 16) \leq 0$ Thus $0 \leq b \leq \frac{16}{5}$

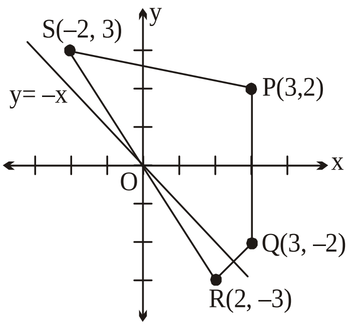
Hence $b_{max} = \frac{16}{5}$

9. Let P be the point ....

Sol. We have $\vec{d}_1 = \overrightarrow{RP} = \hat{i} + 5\hat{j}$

$\vec{d}_2 = \overrightarrow{SQ} = 5\hat{i} - 5\hat{j}$

Area = $\frac{1}{2}\left|\vec{d}_1 \times \vec{d}_2\right|$



$= \frac{1}{2}\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 5 & 0 \\ 5 & -5 & 0 \end{vmatrix} = \frac{1}{2}\left|(-5-25)\hat{k}\right| = 15$ (square units)

Alternatively: Area $A = \frac{1}{2}\begin{vmatrix} 3 & 2 & 1 \\ 3 & -2 & 1 \\ 2 & -3 & 1 \end{vmatrix} + \frac{1}{2}\begin{vmatrix} 3 & 2 & 1 \\ 2 & -3 & 1 \\ -2 & 3 & 1 \end{vmatrix}$

$= \frac{1}{2}\begin{vmatrix} 0 & 4 & 0 \\ 1 & 1 & 0 \\ 2 & -3 & 1 \end{vmatrix} + \frac{1}{2}\begin{vmatrix} 1 & 5 & 0 \\ 4 & -6 & 0 \\ -2 & 3 & 1 \end{vmatrix}$

$= \frac{1}{2}|4| + \frac{1}{2}|-6-20|$ = 2 + 13 = 15 (square units)

10. In Δ ABC, if $\angle$C = 3......................

Sol. Using Sine law,

$\frac{27}{\sin\theta} = \frac{48}{\sin 3\theta} \Rightarrow \frac{\sin 3\theta}{\sin\theta} = \frac{16}{9} \Rightarrow 3 - 4\sin^2\theta = \frac{16}{9}$

$\Rightarrow 4\sin^2\theta = 3 - \frac{16}{9} = \frac{11}{9} \Rightarrow \sin^2\theta = \frac{11}{36}$ ....(1)

Again $\frac{b}{\sin 4\theta} = \frac{27}{\sin\theta}$

$\Rightarrow \frac{b}{27} = \frac{\sin 4\theta}{\sin\theta} = \frac{2\sin 2\theta \cos 2\theta}{\sin\theta} = 4\cos\theta\cos 2\theta = 4\cos\theta(1 - 2\sin^2\theta)$

$\Rightarrow \frac{b}{27} = 4\sqrt{1-\sin^2\theta}\,(1 - 2\sin^2\theta) = 4\sqrt{1-\frac{11}{36}}\left(1-\frac{22}{36}\right)$

$\Rightarrow \frac{b}{27} = 4\left(\frac{5}{6}\right)\left(\frac{14}{36}\right)$ [using (1) and (2)] [(1) व (2) से]

Hence b = 35

Hence $\frac{b}{7}$ = 5 Ans.

11. If the sides a, b, c ....

Sol. Solving as a quadratic equation in c^2 we get, $c^2 = a^2 + b^2 \pm \sqrt{2}\,ab$

or $a^2 + b^2 - c^2 = \pm\sqrt{2}\,ab$

$= \frac{a^2 + b^2 - c^2}{2ab} = \pm\frac{1}{\sqrt{2}} \Rightarrow C = \frac{\pi}{4}$ or $\frac{3\pi}{4}$

12. Let p(x) be a ....

Sol. Let Q(x) = p(x) + x – 2016

y degree of Q(x) is 2017

$\because$ Q(0) = Q(1) = Q(2) = ……. = Q(2016) = 0

$\because$ Q(x) = x (x – 1) (x – 2) ……….(x – 2016)

$\Rightarrow$ Q(2017) = 2017 · 2016 · 2015 ……1 = (2017) !

$\Rightarrow$ p(2017) + 2017 – 2016 = 2017 ! $\Rightarrow$ p(2017) = 2017 ! – 1

13. Consider all functions......................

Sol. A $\rightarrow$ Number of function such that if f(k) is odd then f (k + 1) is even

B $\rightarrow$ Number of bijective functions.

$P(A|B) = \frac{P(A \cap B)}{P(B)}$

$P(B) = \frac{4!}{(4)^4}$

$P(A \cap B) \rightarrow$ Both A & B occur simultaneously. So,

Enumerate all the cases.

Case1. f(1)=1----favorable outcomes=4

Case2. f(1)=2----favorable outcomes =2

Case3. f(1)=3----favorable outcomes =4 (similar to case 1)

Case4. f(1)=4----favorable outcomes =2 (similar to case 2)

Hence,

$P(A \cap B) = \frac{12}{4^4}$

$P\left(\frac{A}{B}\right) = \frac{12}{24} = \frac{1}{2}$

14. Let a and b are ....

Sol. Total ways= $\frac{8!}{(2!)^4\, 4!} = 105$

Atleast one pair has gcd equal to 2 = Total ways – when no pair has gcd equal to 2
When No pair has gcd equal to 2
Case1.4 is paired with odd no. and All other even no. are paired with odd no.
'4' has four choices.
'2' has three choices.
'6' has two choices
'8' has one choices
No. of ways = 4 × 3 × 2 × 1 = 24
Case2.4 is paired with even no. 8.
'2' has four choices
'6' has three choices
No. of ways = 4 × 3 × 1 = 12
No of ways to split such that no pair has gcd equal to 2 = 24 + 12 = 36

15. A person is to walk......................

Sol. Let A is origin (0, 0), B(6, 6)
C(2, 2) D (4, 3)
way will be

(1) $\underset{A}{(0,0)} \rightarrow \underset{C}{(2,2)} \rightarrow \underset{B}{(6,6)}$ A → B $\frac{4!}{2!2!} \times \frac{8!}{4!4!}$

(2) $\underset{A}{(0,0)} \rightarrow \underset{D}{(4,3)} \rightarrow \underset{B}{(6,6)}$ A → B $\frac{7!}{4!3!} \times \frac{5!}{2!3!}$

A → C → B = 420
A → D → B = 350
Now ways when he is pass through both C & D are added two times so excluiding one time

$\underset{(0,0)}{A} \rightarrow \underset{(2,2)}{C} \rightarrow \underset{(4,3)}{D} \rightarrow \underset{(6,6)}{B} = \frac{4!}{2!2!} \times \frac{3!}{2!1!} \times \frac{5!}{3!2!}$

= 180
total number of ways are = 420 + 350 – 180 = 590

16. Let a three-dimensional......................

Sol. $2\vec{V} + \vec{V} \times (\hat{i} + 2\hat{j}) = (2\hat{i} + \hat{k})$ ....(i)

or $2\vec{V} \cdot (\hat{i} + 2\hat{j}) + 0 = (2\hat{i} + \hat{k}) \cdot (\hat{i} + 2\hat{j})$

or $2\vec{V} \cdot (\hat{i} + 2\hat{j}) = 2$

or $\left|\vec{V} \cdot (\hat{i} + 2\hat{j})\right|^2 = 1$

or $|\vec{V}|^2 \cdot |\hat{i} + 2\hat{j}|^2 \cos^2\theta = 1$ (θ is the angle between $\vec{V}$ and $\hat{i} + 2\hat{j}$)

or $|\vec{V}|^2\, 5(1 - \sin^2\theta) = 1$

or $|\vec{V}|^2\, 5\sin^2\theta = 5|\vec{V}|^2 - 1$ ....(ii)

From equation (i), we have

$\left|2\vec{V} + \vec{V} \times (\hat{i} + 2\hat{j})\right|^2 = |2\hat{i} + \hat{k}|^2$

or $4|\vec{V}|^2 + \left|\vec{V} \times (\hat{i} + 2\hat{j})\right|^2 = 5$

or $4|\vec{V}|^2 + |\vec{V}|^2 \cdot |\hat{i} + 2\hat{j}|^2 \sin^2\theta = 5$

or $4|\vec{V}|^2 + 5|\vec{V}|^2 \sin^2\theta = 5$

or $4|\vec{V}|^2 + 5|\vec{V}|^2 - 1 = 5$

or $9|\vec{V}|^2 = 6$

or $3|\vec{V}|^2 = \sqrt{6}$

$= \sqrt{6} = \sqrt{m}$

$\therefore$ $m = 6$

17. The plane denoted......................

Sol. $4x + 7y + 4z + 81 = 0$ ...(i)

$5x + 3y + 10z = 25$ ...(ii)

Equation of plane passing through their line of intersection is

$(4x + 7y + 4z + 81) + \lambda(5x + 3y + 10z - 25) = 0$

or $(4 + 5\lambda)x + (7 + 3\lambda)y + (4 + 10\lambda)z + 81 - 25\lambda = 0$ ....(iii)

Plane (iii) and (i)

$4(4 + 5\lambda) + 7(7 + 3\lambda) + 4(4 + 10\lambda) = 0$

$\therefore$ $\lambda = -1$

Form (iii), equation of plane is

$-x + 4y - 6z + 106 = 0$ ....(iv)

d = Distance of (iv) from (0,0,0) $= \frac{106}{\sqrt{1 + 16 + 36}} = \frac{106}{\sqrt{53}}$

d = (0,0,0) (iv) $= \frac{106}{\sqrt{1 + 16 + 36}} = \frac{106}{\sqrt{53}}$

18. If $\vec{a}$ and $\vec{b}$ are any......................

Sol. Let angle between $\vec{a}$ and $\vec{b}$ be θ.

We have $|\vec{a}| = |\vec{b}| = 1$

Now $|\vec{a} + \vec{b}| = 2\cos\frac{\theta}{2}$ and $|\vec{a} - \vec{b}| = 2\sin\frac{\theta}{2}$

Consider $F(\theta) = \frac{3}{2}\left(2\cos\frac{\theta}{2}\right) + 2\left(2\sin\frac{\theta}{2}\right)$

$\therefore$ $F(\theta) = 3\cos\frac{\theta}{2} + 4\sin\frac{\theta}{2}$, $\theta \in [0, \pi]$

19. If $\vec{x}, \vec{y}$ are two ....

Sol. Since $\vec{x}$ and $\vec{y}$ are non-collinear vectors, therefore $\vec{x}, \vec{y}$ and $\vec{x} \times \vec{y}$ are non-coplanar vectors.

$\left[(a-2)\alpha^2 + (b-3)\alpha + c\right]\vec{x}$

$+\left[(a-2)\beta^2 + (b-3)\beta\beta + c\right]\vec{y}$

$+\left[(a-2)\gamma^2 + (b-3)\gamma + c\right](\vec{x} \times \vec{y}) = 0$

Coefficient of each vector $\vec{x}$, $\vec{y}$ and $\vec{x} \times \vec{y}$ is zero.

$(a-2)\alpha^2 + (b-3)\alpha + c = 0$

$(a-2)\beta^2 + (b-3)\beta + c = 0$

$(a-2)\gamma^2 + (b-3)\beta + c = 0$

The above three equations will satisfy if the coefficients fo α, β and γ are zero because α, β and γ are three distinct real numbers.

$a-2=0$ or $a=2$

$b-3=0$ or $b=3$ and $c=0$

$\therefore\ a^2+b^2+c^2 = 2^2+3^2+0^2 = 4+9=13$

20. If α, β are roots......................

Sol. $x^2-2x+2=0 \Rightarrow \alpha = 1+i,\ \beta = 1-i$

Let $t+\alpha = t+1+i = r(\cos\phi + i\sin\phi)$

$\Rightarrow r = \sqrt{(t+1)^2+1},$

$\tan\phi = \frac{1}{t+1} \Rightarrow r = \sqrt{1+\cot^2\phi}$

$r = \operatorname{cosec}\phi$

Now $\frac{(t+\alpha)^{11}-(t+\beta)^{11}}{\alpha-\beta} = \frac{\sin 11\theta}{(\sin\theta)^{11}}$

$\Rightarrow \frac{r^{11}[\cos\phi + i\sin\phi]^{11} - r^{11}[\cos\phi - i\sin\phi]^{11}}{(1+i)-(1-i)}$

$\Rightarrow \frac{r^{11}\,2i\sin 11\phi}{2i} = \frac{\sin 11\theta}{(\sin\theta)^{11}} \Rightarrow \theta = \phi$

so $\tan\theta = \tan\phi = \frac{1}{t+1} \Rightarrow \cot\theta = t+1$

$\Rightarrow \cot\theta - t = 1$

21. The remainder ....

Sol. Let f(x) = $(x-1)^3\,Q(x)+8$

then $(x-1)^2$ is a factor of f'(x)

let f(x) = $(x+1)^3\ Q_2(x)-8$

then $(x+1)^2$ is a factor of f'(x)

let $f'(x) = a(x-1)^2(x+1)^2 = a(x^4-2x^2+1)$

$f(1) = 8 \ \Rightarrow\ 8a+15b = 120$

$f(-1) = -8 \ \Rightarrow\ -8a+15b = -120$

hence a = 15

$f'(x) = 15(x-1)^2\ (x+1)^2$

$f'(0) = 15$

22. ABCD and EFGC ....

Sol. Alter :- Let B(α^2, kα) and F(β^2, kβ)

ABCD is a square $\Rightarrow \alpha^2 = k\alpha$

$\Rightarrow k = \alpha$ ....(1)

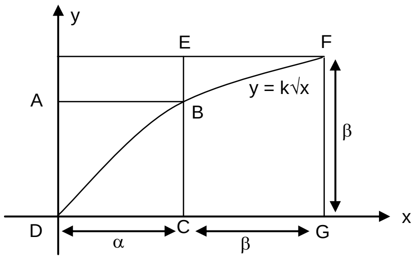
also EFGC is a square

$\Rightarrow \beta^2 - \alpha^2 = k\beta \Rightarrow \alpha^2 + k\beta - \beta^2 = 0$

$\Rightarrow \alpha^2 + \alpha\beta - \beta^2 = 0$ ($\because$ k = α)

$\Rightarrow \frac{\alpha}{\beta} = -\frac{1+\sqrt{5}}{2}\ \left(\frac{-1-\sqrt{5}}{2}\text{Rej}\right)$

$\Rightarrow \frac{\alpha}{\beta}(\sqrt{5}+1) = 2$



So co-ordinate of B are (α, α)

co-ordinate of F are ($\alpha+\beta$, β)

$\alpha = k\sqrt{\alpha} \ \Rightarrow \alpha^2 = k^2\alpha \Rightarrow \alpha = 0$

$\alpha = k^2$ ....(1)

co-ordinate of B are (k^2, k^2)

also B = $k\sqrt{\alpha+\beta}$

$\beta = k^2\left(\frac{1-\sqrt{5}}{2}\right)$ is not possible

$B^2 = k^2(\alpha+\beta)$

$B^2 = k^2[k^2+\beta]$

$\Rightarrow B^2 - k^2\beta - k^4 = 0$

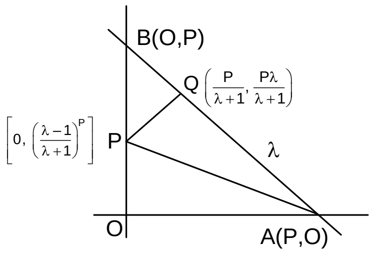
$\Rightarrow B = \frac{k^2 \pm \sqrt{5k^4}}{2}$

$\Rightarrow B = \left[\frac{1\pm\sqrt{5}}{2}\right]k^2$

$\frac{FG}{BC} = \frac{\beta}{\alpha} = \frac{\left(\frac{\sqrt{5}+1}{2}\right)k^2}{k^2} = \frac{\sqrt{5}+1}{2}$

23. The line x + y = p meet......................

Sol.



$f(x) = a\frac{x^5}{5} - \frac{2ax^3}{3} + ax + b$

$\frac{\Delta APQ}{\Delta OAB} = \frac{3}{8}$

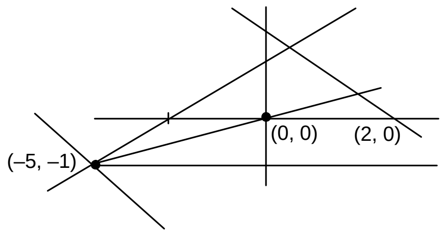
$\frac{\frac{P^2\lambda}{(\lambda+1)^2}}{\frac{1}{2}P^2} = \frac{3}{8} \quad \Rightarrow \lambda = 3$ or $\frac{1}{3}$

$\frac{AQ}{BQ} = 3$ or $\frac{1}{3}$

$\frac{1}{3}$ is rejected because it gives –ve co-ordinate of P which is not possible.

24. The sides of triangle......................

Sol. $x^2 - 3y^2 - 2xy + 8y - 4 \equiv (x - 3y + 2)(x + y - 2)$



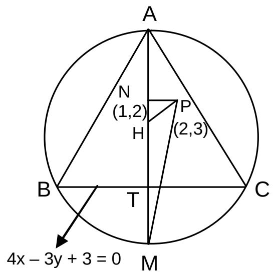
from diagram slope $\left(-1, \frac{1}{5}\right)$

$a = -1,\ b = \frac{1}{5}$

$a + \frac{1}{b} = 4$

25. In acute angle triangle......................

Sol.



Equation of line BC

$4x - 3y + 3 = 0$

$\because$ we known that image orthocentre about BC lies on circumcircle

So $HM = 2HT = 2 \times \left|\frac{4-6+3}{5}\right| = \frac{2}{5}$

Equation of line HA $= (y - 2) = -\frac{3}{4}(x - 1)$

$= 3x + 4y - 11 = 0$

$PN = \left|\frac{6+12-11}{5}\right| = \frac{7}{5}$

So HNP is right angles so

$HN = \sqrt{2 - \frac{49}{25}} = \frac{1}{5}$

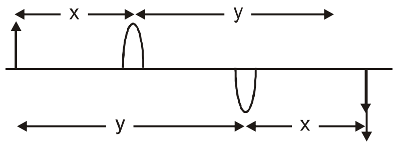
so radius

$r = PM = \sqrt{PN^2 + MN^2} = \sqrt{\frac{49+9}{25}} = \sqrt{\frac{58}{25}} = \frac{\sqrt{58}}{5}$

PART : II PHYSICS

26. A converging lens ....

Sol. $\dfrac{\frac{y}{x}h_0}{\frac{x}{y}h_0} = 9$



$y = 3x$ ....(i)

$y - x = 60$ ....(ii)

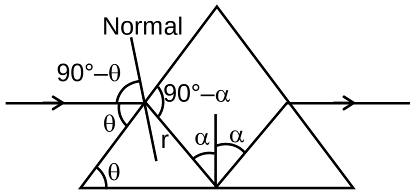
$f = \frac{xy}{x+y}$ ....(iii)

Solving (i), (ii) & (iii)

f = 22.5 cm.

27. An isosceles ....

Sol. $\sin\alpha > \frac{4\times2}{3\times3} = \frac{8}{9}$ ......(i)



At first surface :

$\frac{\sin(90-\theta)}{\sin r} = \frac{3}{2}$ ......(ii)

$r = \alpha - \theta$ .....(iii)

Now $\tan\theta > \frac{2}{\sqrt{17}}$

28. Twelve infinite ....

Sol. ϕ_{cub} = flux due to single wire from whole cube

$\phi_{cub} = \frac{\lambda\ell}{8\varepsilon_0}$ similarly four wires out of twelve will have same contribution and eight will have zero.

ϕ_{cub} , $= \frac{\lambda\ell}{8\varepsilon_0} \times 4 = \frac{\lambda\ell}{2\varepsilon_0}$

29. In the figure ....

Sol. The F.B.D. of wire PQ is

The force due to surface tension = $F_{ST} = 2T \times 2\ AD\ \tan\theta$

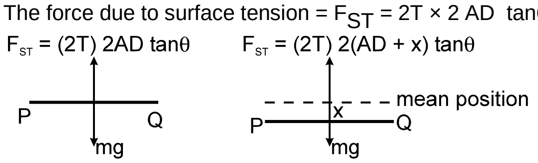


Figure (a) Figure (b)

For wire to be in equilibrium (Figure (a))

$4T\ AD\ \tan\theta = mg$ .... (1)

If the wire PQ is at a distance x below the mean position, the restoring force on the wire is (Figure (b))

$-ma = 4T\tan\theta\,(AD + x) - mg = 4T\tan\theta\, x$

Hence the wire PQ executes SHM

$a = -\frac{4T}{m}\tan\theta\ x$

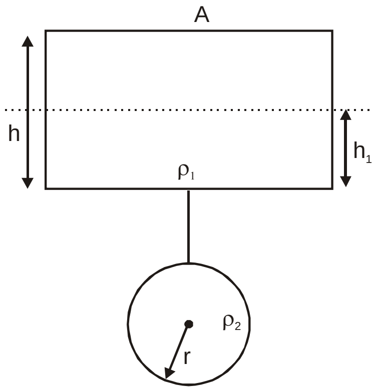
comparing with $a = -\omega^2 x$ we get

$$\omega^2 = \frac{4T}{m}\tan\theta$$

or $T = 2\pi\sqrt{\frac{m}{4T\tan\theta}} = 2\pi\sqrt{\frac{1\times10^{-3}}{4\times25\times10^{-3}}} = \frac{\pi}{5}$ s

30. Figure shows ....

Sol. Taking cylinder and the ball as system



$$\frac{4}{3}\pi R^3 \cdot \rho_2 \cdot g + Ah.\rho_1 g = \frac{4}{3}\pi R^3 \cdot \rho_W \cdot g + Ah_1.\rho_W g$$

$$\rightarrow R = \left[\frac{3A(h_1\rho_\omega - h\rho_1)}{4\pi(\rho_2 - \rho_w)}\right]^{1/3}$$

using values

$A = 11\ cm^2$; $h_1 = 4$ cm ; $\rho_W = 1\ gm/cm^3$;

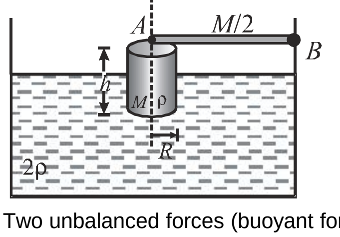
$\rho_1 = 0.5\ gm/cm^3$; $\rho_2 = 8 gm/cm^3$

$$R = \left[\frac{3\times11\,(4\times1 - 6\times0.5)}{4\times\left(\frac{22}{7}\right)\times(8-1)}\right]^{1/3} = \left(\frac{3}{8}\right)^{1/3} \text{cm}$$

$\Rightarrow R^3 = 3/8$

31. A cylindrical block ....

Sol. The acceleration of the cylinder is caused by the net unbalanced forces acting on it which may be considered to be sum of the excess buoyant force and the additional vertical force exerted by the hinged at A.



Two unbalanced forces (buoyant force, f_b and reaction force by the rod f_1) are there on cylinder so we may neglect gravitational force.

For vertical motion of the cylinder

$$ma = -f_b^{axcess} + f_1 \qquad \text{…(i)}$$

writing equation of motion for the rod

$$-f_1.\ell = I\alpha$$

$$-f_1 = I\frac{a}{\ell^2} \qquad \text{…(ii)}$$

from (i) and (ii)

$$\left(m + \frac{I}{\ell^2}\right)a = -f_b^{excess}$$

$$= -(\pi R^2 x)\rho_l g$$

$$\left(m + \frac{\left(\frac{m}{2}\right)\ell^2}{3\ell^2}\right)a = -(2\pi R^2\rho g)x$$

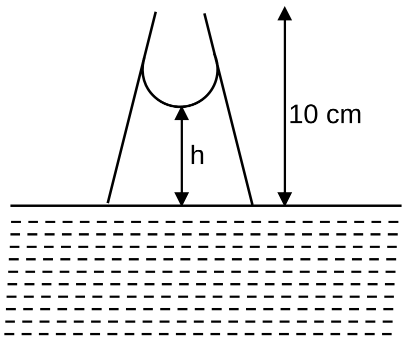
$$a = -\frac{2\pi R^2\rho g}{\left(m + \frac{m}{6}\right)} = -\left(\frac{12\pi R^2\rho g}{7m}\right)x$$

$$a = -\frac{2\pi R^2\rho g}{\left(m + \frac{m}{6}\right)} = -\left(\frac{12\pi R^2\rho g}{7m}\right)x$$

$$\omega = \sqrt{\frac{12g}{7h}}$$

32. Internal diameter ....

Sol.



Radius as function of height

$= 0.5\times10^{-3} - \frac{0.25\times10^{-3}h}{10}$

$= (5 - 0.25\ h)\times10^{-4}$ m (where h is in cm)

Pressure just below meniscus will be $= \frac{2T}{r} = \rho gh$

$$\frac{2\times8\times10^{-2}}{(5-0.25h)\times10^{-4}} = 10^4\times h\times10^{-2} \text{ (where h is in cm)}$$

$16 = 5h - 0.25\ h^2$

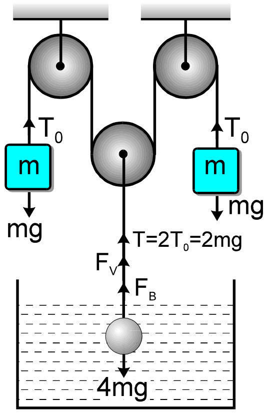
$h^2 - 20h = 64$

$(h - 10)^2 = 36$

$h - 10 = -6 \Rightarrow h = 4$cm **Ans**

33. A spherical ball ....

Sol. From the free body diagram of the sphere :



$F_V = 4\text{ mg} - 2\text{ mg} - F_B$

$\Rightarrow F_V = 2\text{ mg} - F_B$

$\Rightarrow 6\pi\eta r V = \frac{4}{3}\pi r^3\left(\frac{\sigma}{2} - \rho\right)g$

(since $4m = \frac{4}{3}\pi r^3 \times \sigma$)

$\Rightarrow V = \frac{1}{9}\frac{r^2(\sigma - 2\rho)g}{\eta}$

34. A man starts ....

Sol. Let total distance travelled is 4s.

$2s \to V_1 \to t_1 = \frac{2s}{V_1}$

$s \to V_2 \to t_2 = \frac{s}{V_2}$

$s\left[\begin{array}{l} V_1 \to t_0 \\ V_2 \to t_0 \end{array}\right.$

$(V_1 + V_2)\, t_0 = s \Rightarrow t_0 = \frac{s}{V_1 + V_2}$

$< V > = \frac{4s}{t_1 + t_2 + 2t_0} = \frac{4s}{\frac{2s}{V_1} + \frac{s}{V_2} + \frac{2s}{V_1 + V_2}}$

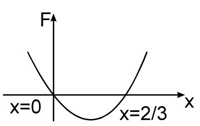
$= \frac{4V_1V_2(V_1+V_2)}{2V_2(V_1+V_2) + V_1(V_1+V_2) + 2V_1V_2}$

$= \frac{4V_1V_2(V_1+V_2)}{2V_1V_2 + 2V_2^2 + V_1^2 + V_1V_2 + 2V_1V_2}$

$= \frac{4V_1V_2(V_1+V_2)}{V_1^2 + 2V_2^2 + 5V_1V_2}$

35. A particle of ....

Sol. The particle is at equilibrium at x = 0 and $x = \frac{2}{3}$.



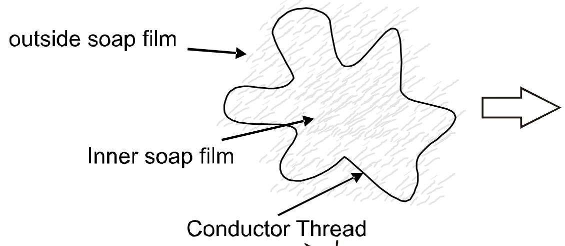
The minimum speed imparted to the particle should be such that it just reaches $x = \frac{2}{3}$ from there on it shall automatically reach x = 0

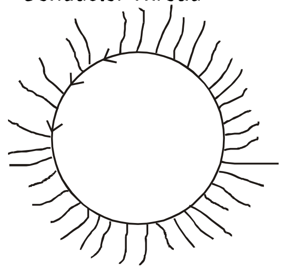
$$\frac{1}{2}mv^2 = -\int_4^{2/3} F\,dx = -\int_4^{2/3} x(3x-2)dx = \frac{1300}{27}$$

or $v = \sqrt{\frac{2600}{27}}$ m/s

36. A conducting loop ....

Sol. Due to the surface tension force by outside film, loop will expand. So current will induce in anticlockwise direction.

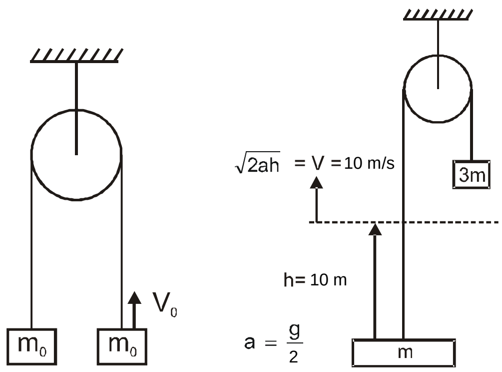




$$\text{Charge flown} = \frac{\phi_f - \phi_i}{R} = \frac{B\left[\pi\left(\frac{\ell}{2\pi}\right)^2 - \frac{\ell^2}{8\pi}\right]}{R} = \frac{B\ell^2}{8\pi R}$$

37. Given system ....

Sol.



$V_0 t - \frac{1}{2}gt^2 = \frac{1}{2}gt^2$

$gt^2 = V_0 t$

$t = \frac{V_0}{g} = 1$

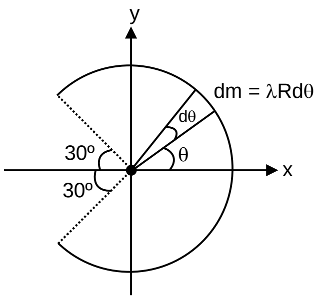
$V_0 = 10$ m/s

Since collision is elastic and velocity exchange take place so.

$m_0 = 4m$ $\qquad$ $m_0 = 8$ kg

38. Consider the ....

Sol.



$M = \left(2\pi - \frac{\pi}{3}\right)\lambda R = \frac{5\pi\lambda R}{3}$

$\int_{-\frac{5\pi}{6}}^{+5\pi/6} (R\cos\theta)\lambda R d\theta = \lambda R^2 \int_{-\frac{5\pi}{6}}^{5\pi/6} \cos\theta \, d\theta$

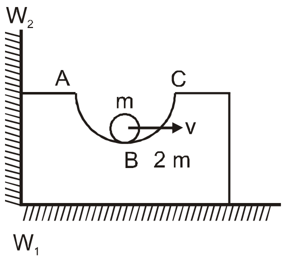
$= \lambda R^2 \left[\sin\frac{5\pi}{6} - \sin\left(-\frac{5\pi}{6}\right)\right]$

$= \lambda R^2$

$x_{cm} = \frac{1}{\frac{5\pi\lambda R}{3}} \lambda R^2 = \frac{3R}{5\pi}$

39. A uniform disc ....

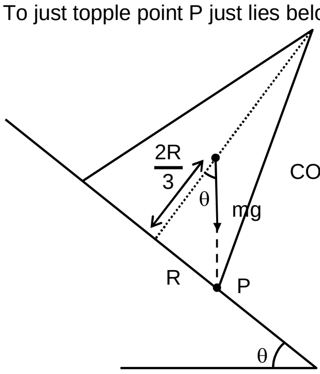
Sol. $mg(R - r) = \frac{3P^2}{4m}$



$P = m\sqrt{\frac{4g(R - r)}{3}}$ = Impulse on the system by wall

40. A hollow cone ....

Sol. To just topple point P just lies below COM



COM of cone is at height $\frac{2R}{3}$ from base

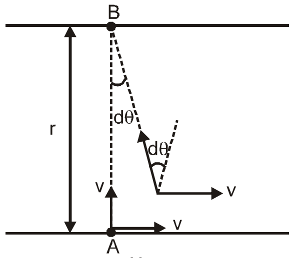
$\tan\theta = \frac{R}{\frac{2R}{3}} \Rightarrow \theta = \tan^{-1}\left(\frac{3}{2}\right)$

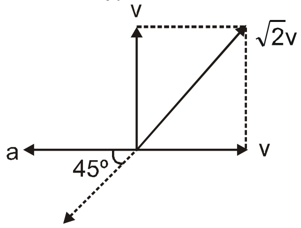
41. A man crosses ....

Sol. $\frac{dr}{dt} = -v$

$\frac{rd\theta}{dt} = v$

$dv = vd\theta \Rightarrow a = \frac{dv}{dt} = \frac{vd\theta}{dt} = v\omega = v\left(\frac{v}{d}\right) = \frac{v^2}{d}$





$a_r = a\sin 45 = \frac{a}{\sqrt{2}} = \frac{v^2}{\sqrt{2}d} = \frac{(\sqrt{2}v)^2}{\rho} \Rightarrow \rho = 2\sqrt{2}d$

42. Nuclei of radioactive ....

Sol. $\frac{dN}{dt} = t^2 - \lambda N$

for $\frac{dN}{dt}$ to be minimum ; $\frac{d^2N}{dt^2} = 0$

$\Rightarrow \frac{d^2N}{dt^2} = 2t - \lambda\frac{dN}{dt} = 2t - \lambda(t^2 - \lambda N) = 0$ or N

$= \frac{\lambda t_0^2 - 2t_0}{\lambda^2}$

43. Interference ....

Sol. (D)Shift of fringe pattern

$= (\mu - 1)\ \frac{t\ \ D}{d}$

$\therefore$ = (0.6) t

$30 \times 4800 \times 10^{-10} = 0.6$

$t = \frac{30D(4800 \times 10^{-10})}{d} = \frac{1.44 \times 10^{-5}}{0.6} = 24 \times 10^{-6}$

44. The ratio of ....

Sol. $a = \frac{V^2}{r}$

$a \propto \frac{Z^2}{1/Z}$ or $a \propto Z^3$

$\frac{a_1}{a_2} = \left(\frac{2}{1}\right)^3 = 8$

45. Two particles ....

Sol. upto the time $V_A > V_B$. Separation between A & B will increase

Separation will be max at t = $\frac{3}{2}$ sec

$x_A = (2)(1) + (1)\left(\frac{1}{2}\right) = \frac{5}{2}$

$x_B = \frac{1}{2}(2)(1) + \frac{1}{2}(1)\left(\frac{1}{2}\right) = \frac{5}{4}$

maximum separation $x = x_A - x_B = \frac{5}{4}$

46. A tunnel is dug ....

Sol. maximum velocity will be at its centre. From energy conservation

$$\frac{1}{2}m\left(\frac{2GM}{R}\right)+m\left(\frac{-GM}{R}\right)=\frac{1}{2}mv_1^2+m\left(\frac{-3}{2}\frac{GM}{R}\right)$$

$$\frac{1}{2}mv_1^2 = \frac{3}{2}\frac{GMm}{R}$$

$$V_1 = \sqrt{\frac{3GM}{R}}$$

47. A certain quantity ....

Sol. $\Delta Q_{AB} = nC_p\Delta T = \frac{\gamma}{\gamma-1}\, nR\Delta T = \frac{\gamma}{\gamma-1}[3P_0V_0 - P_0V_0] =$

$2PV_0 \times \frac{\gamma}{\gamma-1}$

$\Delta Q_{AC} = \Delta U + \Delta w$

$= \frac{nR}{\gamma-1}\Delta T + \frac{1}{2} \times 3V_0\,[P_0 + 4P_0]$

$= \frac{[16P_0V_0 - P_0V_0]}{\gamma-1} + \frac{15P_0V_0}{2}$

$56 = 2P_0V_0 \times \frac{\gamma}{\gamma-1}$

$360 = 15P_0V_0\left[\frac{\gamma+1}{2(\gamma-1)}\right]$

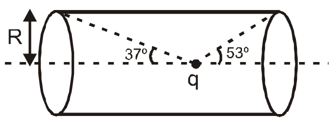
$\frac{360}{56} = \frac{15}{4}\,\frac{(\gamma+1)}{\gamma}$

$12\gamma = 7\gamma + 7$

$\gamma = \frac{7}{5} = 1 + \frac{2}{f} \Rightarrow f = 5$

48. A point charge ....

Sol.



$$\phi = \frac{q}{\epsilon_0}\left(\frac{2\pi(1-\cos 37^o)}{4\pi}\right)-\frac{q}{\epsilon_0}\left(\frac{2\pi(1-\cos 53^o)}{4\pi}\right)$$

$$\phi = \frac{q}{\epsilon_0}\left[1-\frac{1}{2}\left(1-\frac{4}{5}\right)-\frac{1}{2}\left(1-\frac{3}{5}\right)\right]$$

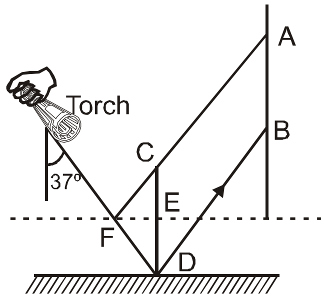
$$\frac{q}{\epsilon_0}\left[1-\frac{1}{10}-\frac{2}{10}\right] = \frac{7q}{10\,\epsilon_0}$$

49. Two sound sources ....

Sol. The minima will be heard at P when a crest from S_1 and a trough from S_2 reach there at the same time. This will happen if $L_1 - L_2$ is $\lambda/2$ or $\lambda + (\lambda/2)$ or $2\lambda + (\lambda/2)$ and so on. Hence, the increase in L_1 between consecutive minima is λ_1 and from the data we see that $\lambda = 0.40$ m. Then from $\lambda = v/f \Rightarrow f = 340/0.40 = 850$ Hz.

50. As shown in ....

Sol.



The mirror moves by DE=1 cm. From geometry DE=CE.Also BA=DC= 2cm.Now if the wall is moved by 1 cm, the spot will move further by 1cot37=4/3

PART : III CHEMISTRY

51. 40ml of 0.1M ....

Sol. $NaH_2PO_4 + Na_3PO_4 \longrightarrow 2Na_2HPO_4$

$pH = 11 - \log 2 + \log\frac{16}{8} = 11$

52. Number of diatomic ....

Sol. $2NH_4ClO_4 \xrightarrow{\Delta} N_2 + Cl_2 + 2O_2 + 4H_2O$

$Pb(NO_3)_2 \xrightarrow{\Delta} PbO + 2NO_2 + \frac{1}{2}O_2$

$KNO_3 \xrightarrow{\Delta} KNO_2 + \frac{1}{2}O_2$

53. How many of the ....

Sol. $B_2H_6 + H_2O \longrightarrow H_3BO_3 + H_2\uparrow$

$SiH_4 + H_2O \longrightarrow SiO_2 + H_2\uparrow$

54. How many of following ....

Sol. $NaCl \xrightarrow{\text{Electrolysis}} H_2\uparrow + Cl_2\uparrow$

$K_2SO_4 \longrightarrow H_2\uparrow + O_2\uparrow$

$Cu(NO_3)_2 \longrightarrow Cu_{(S)} + O_2\uparrow$

$AuCl_3 \longrightarrow Au_{(S)} + Cl_2\uparrow$

$H_2SO_4 \longrightarrow H_2\uparrow + O_2\uparrow$

$HCOOH \longrightarrow H_2\uparrow + CO_2\uparrow + O_2\uparrow$

$CH_3COOH \longrightarrow C_2H_6\uparrow + CO_2\uparrow + O_2\uparrow$

$Al_2(SO_4)_3 \longrightarrow H_2\uparrow + O_2\uparrow$

55. How many of the ....

Sol. $[Cu(NH_3)_4]^{2+}$, $AuCl_4^-$,

$AgF_4^-[Ni(CN)_4]^{2-} \longrightarrow dsp^2$ $I_2Cl_6 \rightarrow sp^3d^2$

56. The concentration ....

Sol. $CH_3COOAg(s) + H^+(aq) + Cl^-(aq) \longrightarrow$

$CH_3COOH(aq) + AgCl \downarrow,$

$K_{eq} = 10^{-8} \times 10^5 \times 10^{10} = 10^7$

$[CH_3COO^-] = \sqrt{10^{-5} \times 0.1} = 10^{-3} M$

57. A mixture of 32 gm ....

Sol. $\left(\frac{r_{D_2}}{r_{O_2}}\right) = \frac{n_{D_2}}{n_{O_2}}\sqrt{\frac{M_{O_2}}{M_{D_2}}}$; $n_{O_2} = 1$; $n_{D_2} = 4$

$\Rightarrow 4\sqrt{\frac{32}{4}} = 8\sqrt{2}$

58. If certain decomposition.........

Sol. $\frac{a - p^2}{p^2} = b\,kt$

$\frac{a}{p^2} - 1 = b\,kt$

on differentiate

$-\frac{2a}{p^3}\,dp = b\,k\,dt$

$-\frac{dp}{dt} = \frac{bk}{2a}\,p^3$

59. It is observed that ....

Sol. $C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(g)$

$\Delta G^o = \Delta H^o - T\Delta S^o$

(useful energy) = – 3000 – 300 × 0.18

= – 3054 KJ/mol

Energy required per hour = $\frac{128}{9} \times 60 \times 60$ J

$\therefore$ Glucose needed per hour =

$\frac{\frac{128}{9} \times 60 \times 60}{3054 \times 1000} mol = \frac{\frac{128}{9} \times 60 \times 60}{3054 \times 1000} \times 180\ g \approx 3\ g$

60. If Aufbau rule is not ....

Sol. $_{26}Fe$ (normal configuration) = $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^6$

↑↓	↑	↑	↑	↑

3d

(n + ℓ) for each unpaired electron = 5

Total (n + ℓ) for 4 unpaired electrons = 20.

$_{26}Fe$ (abnormal configuration) = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^8$

↑↓	↑↓	↑↓	↑	↑

3d

Total (n + ℓ) for 2 unpaired electrons = 10

% change = $\frac{20 - 10}{20}$ × 100 = 50 = 10 x

x = 5.

61. Consider the following ....

Sol. P : Total number of polar compounds

$\Rightarrow$ (i), (ii), (iii), (iv), (v), (vi), (vii)

S : Total number of non planar compounds

$\Rightarrow$ (iv), (vii), (viii)

62. EMF of the following ....

Sol. At cathode:

$\frac{1}{2}Hg_2^{2+} + e^- \rightarrow Hg(l)$

At anode:

$\frac{1}{2}H_2(g) \rightarrow H^+(aq) + e^-$

$\frac{1}{2}Hg_2^{2+} + \frac{1}{2}H_2(g) \rightarrow Hg(l) + H^+(aq)$

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

or 0.575 = (0.28 – 0) + 0.059 pH

or pH = $\frac{0.575 - 0.28}{0.059} = 5$

63. Out of the following ....

Sol. Naming of (1), (2), (4), (6) and (7) are wrong.

64. A 0.001 molal solution ....

Sol. $\Delta T_f = i \times m \times k_f$

$.0058 = i \times 10^{-3} \times 1.86$

i = 3

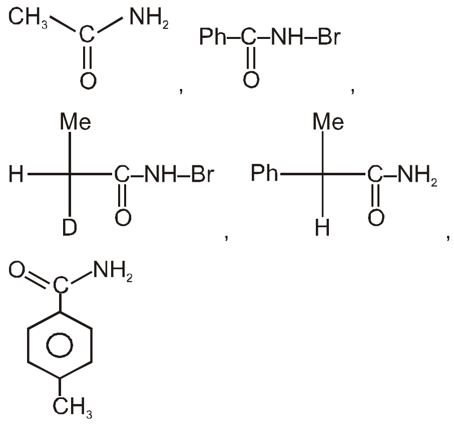
so $[M(NH_3)_4Cl_2]Cl_2$

65. What is the co-ordination ………

Sol. In (HCP) coordination number in same layer is 6.

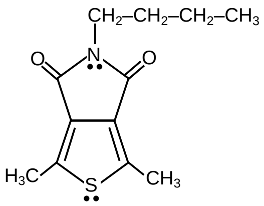
66. How many of the ………

Sol. Only 1° amide and N-Bromo amide gives hoffman's bromamide reaction.



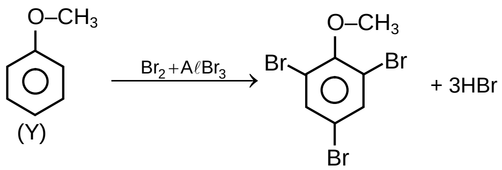
67. Calculate total number ………

Sol.



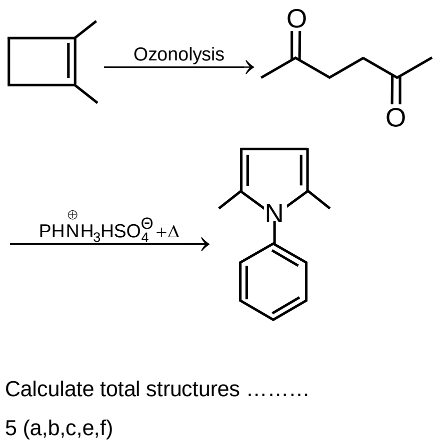
68. Aromatic compound Y………

Sol.



69. Calculate total number ………

Sol.



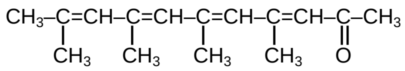
70. Calculate total structures ………

Sol. 5 (a,b,c,e,f)

$$pK_b \ \alpha \ \frac{1}{\text{Basicity}}$$

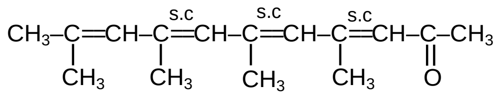
therefore molecule will be less basic than aniline.

71.



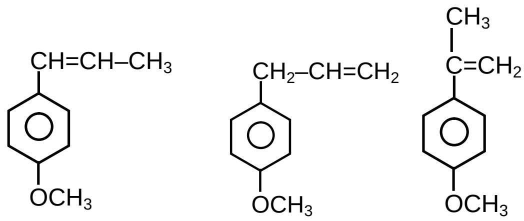
………

Sol. X = 8, Y= 5, Z = 4



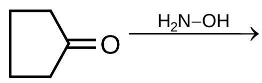
72. $C_{10}H_{12}O$ ………
(X)

Sol.



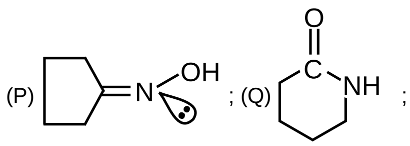
(cis & trans)

73.



………

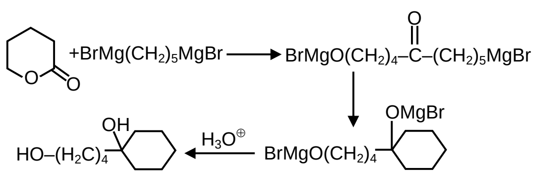
Sol.



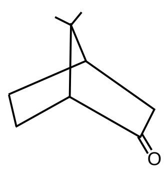
(R) $HO-\overset{O}{\overset{||}{C}}-(CH_2)_4-NH_2$; (S) Nylon 5

74. Total number of carbon ………

Sol.



75.



………

(Enantiomerically pure)

Sol. P will be 2 diastereomeric alcohols ∴ Q will also be 2.

PAPER-2

PART : I MATHEMATICS

1. Let x be a perfect ....

Sol. Given that x = 5q + r ……….. (i) (with r = 0, 1, 2, 3, 4)

and $\sqrt{x}+r=q$ ……….. (ii)

From (i) $x=5\sqrt{x}+5r+r$

$(x-6r)^2 = 25x$

(i) r = 0 $\Rightarrow$ x = 0, 25

but $x\neq 0$ so x = 25

(ii) r = 1 $\Rightarrow$ $x^2-12x+36=25x$

$x^2-37x+36=0$

x = 1, 36

but x = 1 not satisfy equation (i) & (ii)

so x = 36

(iii) r = 2 $\Rightarrow$ $x^2-24x+144=25x$

$x^2-49x+144=0$

no solution for natural no.

(iv) r = 3 $\Rightarrow$ $x^2-36x+324=25x$

$x^2-71x+324=0$

no solution for natural no.

(v) r = 4 $\Rightarrow$ $x^2-48x+576=25x$

x = 9, 64

x = 9 not satisfy equation (i) & (ii)

so x = 64

x = 25, 36, 64 Ans.

2. Let $S_n=1-\frac{1}{2}+\frac{1}{3}-$......................

Sol. $\frac{1}{n+1}+\frac{1}{n+2}+....+\frac{1}{2n}=\left(1+\frac{1}{2}+\frac{1}{3}+.....+\frac{1}{2n}\right)-\left(1+\frac{1}{2}+...+\frac{1}{n}\right)$

$=1-\frac{1}{2}+\frac{1}{3}............+\frac{1}{2n-1}-\frac{1}{2n}$

also $S_{2n}<\frac{1}{n}+\frac{1}{n}+.....+\frac{1}{n}=\frac{n}{n}=1$

$S_{2n}=\left(1-\frac{1}{2}\right)+\left(\frac{1}{3}-\frac{1}{4}\right)+.......(\ )\geq\frac{1}{2}+\text{positive value}$

3. If in triangle ABC, ...

Sol. $\overrightarrow{AB}+\overrightarrow{BC}=\overrightarrow{AC}$

$\overrightarrow{BC}=\frac{2\vec{u}}{|\vec{u}|}-\frac{\vec{u}}{|\vec{u}|}+\frac{\vec{v}}{|\vec{v}|}=\frac{\vec{u}}{|\vec{u}|}+\frac{\vec{v}}{|\vec{v}|}$

$\overrightarrow{AB}\cdot\overrightarrow{BC}=\left(\frac{\vec{u}}{|\vec{u}|}-\frac{\vec{v}}{|\vec{v}|}\right)\left(\frac{\vec{u}}{|\vec{u}|}+\frac{\vec{v}}{|\vec{v}|}\right)$

$=\left(\hat{u}-\hat{v}\right)\cdot\left(\hat{u}+\hat{v}\right)=1-1=0$

$\Rightarrow\ \angle B=90^\circ$

$\Rightarrow\ 1+\cos 2A+\cos 2B+\cos 2C=0$

4. If $\vec{a}\times\left(\vec{b}\times\vec{c}\right)$ is ....

Sol. $\vec{a}\times\left(\vec{b}\times\vec{c}\right)=\left(\vec{a}\cdot\vec{c}\right)\vec{b}-\left(\vec{a}\cdot\vec{b}\right)\vec{c}$ and

$\left(\vec{a}\times\vec{b}\right)\times\vec{c}=-\left(\vec{c}\cdot\vec{b}\right)\vec{a}+\left(\vec{a}\cdot\vec{c}\right)\vec{b}$

We have been given, $\left(\vec{a}\times\left(\vec{b}\times\vec{c}\right)\right)\cdot\left(\left(\vec{a}\times\vec{b}\right)\times\vec{c}\right)=0$

$\therefore\ \left(\left(\vec{a}\cdot\vec{c}\right)\vec{b}-\left(\vec{a}\cdot\vec{b}\right)\vec{c}\right)\cdot\left(\left(\vec{a}\cdot\vec{c}\right)\vec{b}-\left(\vec{c}\cdot\vec{b}\right)\vec{a}\right)=0$

or

$\left(\vec{a}\cdot\vec{c}\right)^2\left|\vec{b}\right|^2-\left(\vec{a}\cdot\vec{c}\right)\left(\vec{b}\cdot\vec{c}\right)\left(\vec{a}\cdot\vec{b}\right)$

$-\left(\vec{a}\cdot\vec{b}\right)\left(\vec{a}\cdot\vec{c}\right)\left(\vec{b}\cdot\vec{c}\right)+\left(\vec{a}\cdot\vec{b}\right)\left(\vec{b}\cdot\vec{c}\right)\left(\vec{c}\cdot\vec{a}\right)=0$

or $\left(\vec{a}\cdot\vec{c}\right)^2\left|\vec{b}\right|^2=\left(\vec{a}\cdot\vec{c}\right)\left(\vec{a}\cdot\vec{b}\right)\left(\vec{b}\cdot\vec{c}\right)$

or $\left(\vec{a}\cdot\vec{c}\right)\left(\left(\vec{a}\cdot\vec{c}\right)\left(\vec{b}\cdot\vec{b}\right)-\left(\vec{a}\cdot\vec{b}\right)\left(\vec{b}\cdot\vec{c}\right)\right)=0$

$\vec{a}\cdot\vec{c}=0$ or $\left(\vec{a}\cdot\vec{c}\right)\left|\vec{b}\right|^2=\left(\vec{a}\cdot\vec{b}\right)\left(\vec{b}\cdot\vec{c}\right)$

5. m and n are real ....

Sol. $9m^2 + m(2n-92) + n^2 - 20n + 244 = 0$

Consider Qudratic in 'm' for real 'm' discriminant ≥ 0

$\Rightarrow$ $4(n-46)^2 - 4\times 9\times(n^2-20n+244)\geq 0$

$\Rightarrow$ $n^2 - 11n + 10 \leq 0$

$\Rightarrow$ $n\in[1, 10]$

Similarly for quadratic in 'n' & for real 'n'

$m\in[3, 6]$

6. Let $\ell_1 = \lim\limits_{x\to\infty}\sqrt{\frac{x-\cos^2 x}{x+\sin x}}$ ....

Sol. $l_1 = \lim\limits_{x\to\infty}\sqrt{\frac{1-\frac{\cos^2 x}{x}}{1+\frac{\sin x}{x}}} = 1$

$l_2 = \lim\limits_{h\to 0^+} 2\int_0^1\frac{h\,dx}{h^2+x^2} = \lim\limits_{h\to 0^+}\left[2\frac{h}{h}\tan^{-1}\frac{x}{h}\right]_{0^+}^{1} = \pi$

Note:

$\frac{22}{7}>\pi\ \left[\frac{22}{7}=3.1428571 \text{ and } \pi\approx 3.1415929\right]$

7. Let f : R → R defined ....

Sol. We have $f(x) = \cos^{-1}(-\{-x\})$

$D_f = R$

As $0\leq\{-x\}<1\ \forall\ x\in R$

$\Rightarrow -1 < -\{-x\}\leq 0$

So $R_f = \left[\frac{\pi}{2},\pi\right)$

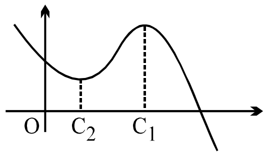
Clearly, f is neither even nor odd.

f (x + 1) = f (x) $\Rightarrow$ f is periodic with period 1

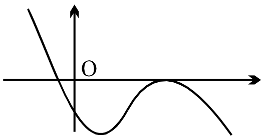
8. If f(x) is continuous ....

Sol. If f ' (x) = 0 has n real roots

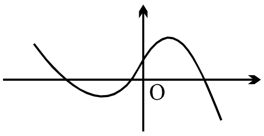
$\Rightarrow$ f (x) = 0 has atmost (n + 1) roots

(A) 

f (x) = 0 has 1 real root

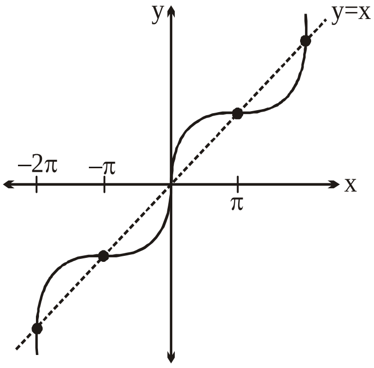
(B) 

f (x) = 0 has 2 real and distinct roots

(C) 

f (x) = 0 has 3 real roots

9. Consider the function......................

Sol. 

We have f ' (x) = 1 + cos x $\Rightarrow$ f is strictly increasing and has inflection point at x = nπ

Also there is no x for which f (x) is not increasing.

$\Rightarrow$ (A) is not correct

As f is continuous $\forall$ x $\in$ R hence bounded in every closed interval.

As f is odd hence symmetric w.r.t origin and its graphs lies in 1st and 3rd quadrant and y = x cut the graph at infinitely many points.

10. If f(x) = $\begin{cases} \sin x & x \text{ is rational} \\ \cos x & x \text{ is irrational} \end{cases}$ ....

Sol. f is continuous at all points where sin x = cos x

11. Let $(a-1)(x^2+\sqrt{3}x+1)^2$ ....

Sol. $(a-1)(x^2+\sqrt{3}x+1)^2 - (a+1)[(x^2+1)^2 - (x\sqrt{3})^2] \le 0$

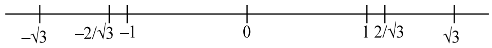
Or $(a-1)(x^2+\sqrt{3}x+1)^2 - (a+1)(x^2+x\sqrt{3}+1)(x^2-x\sqrt{3}+1) \le 0$

$(x^2+\sqrt{3}x+1)\ [(a-1)(x^2+\sqrt{3}x+1) - (a+1)(x^2-\sqrt{3}x+1)] \le 0 \quad \forall x \in R$

$\Rightarrow -2(x^2+1) + 2a\sqrt{3}x \le 0$

$\Rightarrow x^2 - a\sqrt{3}x + 1 \ge 0 \ \forall x \in R \quad \Rightarrow \quad 3a^2 - 4 \le 0 \quad (D \le 0)$

$\Rightarrow a \in \left[-\frac{2}{\sqrt{3}}, \frac{2}{\sqrt{3}}\right]$



$\Rightarrow$ number of possible integral value of 'a' is {–1, 0, 1}

$\Rightarrow$ 3 **Ans.** $\Rightarrow$ **(C)**

and sum of all integral values of 'a' is – 1 + 0 + 1 = 0

Ans. $\Rightarrow$ **(D)**]

12. Let a, b, c and ....

Sol. If all equations have imag. roots

$\Rightarrow D_1 < 0, D_2 < 0, D_3 < 0$

$\Rightarrow \left.\begin{array}{l} b^2 < 4acm \\ c^2 < 4abm \\ a^2 < 4bcm \end{array}\right\} \Rightarrow a^2b^2c^2 < 4^3a^2b^2c^2m^3 \Rightarrow m > \frac{1}{4}$

Alter:- If atleast one of the equations has real roots then

$D_1 + D_2 + D_3 \ge 0$

$(b^2 - 4acm) + (c^2 - 4bam) + a^2 - 4cbm \ge 0$

$a^2 + b^2 + c^2 \ge 4(ab + bc + ca)m$

$4m \le \frac{a^2+b^2+c^2}{ab+bc+ca}$ .... (1) $\quad \forall a,b,c \in R^+$

but $a^2 + b^2 \ge 2ab$, $b^2 + c^2 \ge 2bc$, $c^2 + a^2 \ge 2ac$

$\therefore \quad a^2 + b^2 + c^2 \ge ab + bc + ca$

$\frac{a^2+b^2+c^2}{ab+bc+ca} \ge 1$

$\therefore \quad \left.\frac{a^2+b^2+c^2}{ab+bc+ca}\right|_{min} = 1$; Hence 4m must be less than or equal to the minimum value.

$\therefore \quad 4m \le \frac{a^2+b^2+c^2}{ab+bc+ca}$

$\therefore \quad 4m \le 1 \Rightarrow m \le \frac{1}{4}$

$m \in \left(0, \frac{1}{4}\right]$

13. Let $(\log_2 x)^2 - 4\log_2 x$ ....

Sol. $(\log_2 x)^2 - 4\log_2 x - 12 = (m+1)^2$

$t^2 - 4t - \{12 + (m+1)^2\} = 0$

$t = \frac{4 \pm \sqrt{16 + 4(12 + (m+1)^2)}}{2}$

D > 0 $\Rightarrow$ **(A)** is correct

now D_{min} when m = – 1

D_{min} m = – 1

$\log_2 x = \frac{4 \pm 8}{2} = 6$ or – 2

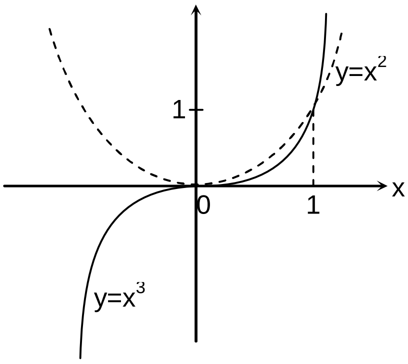
$x = 2^6$ or 2^{-2} $\Rightarrow$ **(C)** and **(D)** are correct

Also $\log_2 x_1 + \log_2 x_2 = 4$

$\log_2 x_1 x_2 = 4 \Rightarrow x_1 x_2 = 2^4 \Rightarrow$ **(B)** is correct

14. Let f (x) = min{x^3, x^2} ....

Sol. The graph of y = f(x) is

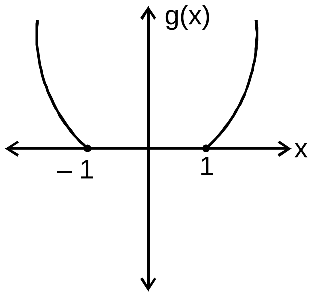


which is continuous for all x but not differentiable at x = 1
and y = g(x) = $[x]^2 + \{x\}$ is discont. at all $x \in I - \{1\}$

18. Let f(x) = x^2 – |x|, ...

Sol.

$$g(x) = \begin{cases} 0 & |x| \le 1 \\ 2(x^2 - |x|) & |x| \ge 1 \end{cases}$$



(A) incorrect
(B) g(x) is many one
(C) $\alpha, \beta \in [-1, 1]$ Ĝ $\alpha + \beta \in [-2, 2]$
(D) f(–x) = f(x) Hence incorrect

19. f(x) = | (x^2 – ax + 2) ....

Sol. f(x) = |(x^2 – ax + 2)(x^2 – px + 4)|
f(x) = | g(x) · h(x) |
Case (i). for 4 points of nonderivability discriminant of g(x) & h(x) both should be the
Ĝ $a^2 > 8$ & $p^2 > 16$
Case (ii). 3 points of non-derivability NOT possible
f(x) = 0 can not have 3 roots all of which are non repeated
Case (iii). if a = 3 & n = 2 Ĝ both equation must have a common root Ĝ p = 5.

20. If f(x) = $(\sin^2 x - 1)^n$ ....

Sol. If x = a is the point of local extremum of
y = f(x) then f(a – h).f(a + h) > 0
⇒ f(π/2 –h) f(π/2 + h) > 0
f(π/2 – h) = $(-ve)^n$ …………(1)
f(π/2 + h) = $(-ve)^n$ …………(2)
f(π/2) = 0 …………(3)
⇒ f(π/2 – h). f(π/2 + h) = $(-ve)^{2n} > 0$
⇒ n can be odd or even.
⇒ f(π/2 – h). f(π/2 + h) = $(-ve)^{2n} > 0$
So from (1), (2) and (3), if n is odd or even maxima or minima occurs accordingly.

PART : II PHYSICS

21. A fusion reaction ....

Sol. Mass defect $\Delta m = 4m_H - m_{He} - 2m_e$

$$Q = 0.027608 \text{ u} \times 932 \frac{\text{MeV}}{\text{u}} = 25.7 \text{ MeV}$$

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

22. Consider white ....

Sol. $K_{max} = \dfrac{hC}{\lambda_{min}} - \phi$

For A ⇒ K_{max} = 3.1 – 1.55 = 1.55eV
For B ⇒ K_{max} = 3.1 – 2.48 = 0.62eV
In experiment with metal A complete spectrum is able to eject photo electrons but for metal B spectrum from 400nm to 500nm, will be able to eject photo electrons. Number of photons in spectrum 400nm to 500nm will be less than 1/3 of total photons in white light.

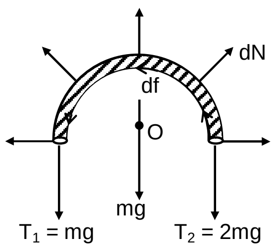
$$\int_{400}^{700} \frac{P}{\left(\frac{hc}{\lambda}\right)} d\lambda = K I_1$$

$$\int_{400}^{500} \frac{P}{\left(\frac{hc}{\lambda}\right)} d\lambda = K I_1$$

$$I_2 = \frac{18}{11} \text{ mA}$$

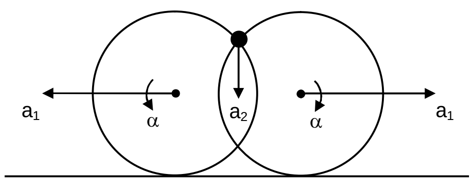
23. Consider a rope ....

Sol. FBD of rope in contact with pulley is shown here we can see torque of dN about O is zero
Torque of friction is balanced by torque T_1 and T_2.

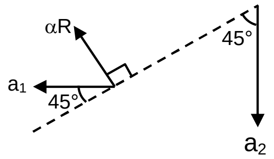


24. Two identical ....

Sol.

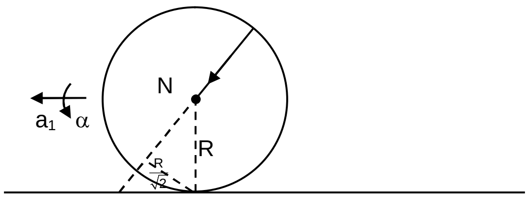


Constraint relation



$a_1\cos45° = a_2 \cos45°$

$\Rightarrow a_1 = a_2 = a$



$$\frac{NR}{\sqrt{2}} = 2mR^2\left(\frac{a}{R}\right)$$

$N = 2\sqrt{2}ma$ .... (1)

For bead

$mg - \sqrt{2}\,N = ma$ .... (2)

from (1) & (2)

we get $a = \dfrac{g}{5}$

25. A particle travels ....

Sol.

$$R = \frac{\left(1+\left(\frac{dy}{dx}\right)^2\right)^{3/2}}{\frac{d^2y}{dx^2}} = \frac{(1+b^2)^{3/2}}{2c}$$

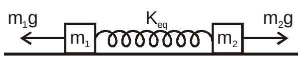
$\vec{a} = \vec{a}_r + \vec{a}_t$

$\vec{a}_t = 0$. (speed constant)

$$|\vec{a}| = |\vec{a}_r| = \frac{v_0^2}{R} = \frac{2cv_0^{\,2}}{\left(1+b^2\right)^{3/2}}$$

26. Consider the ....

Sol. Above situation can be represented as



Now at maximum elongation $v_{2/1} = 0$

Say at any moment elongation of spring is x

$$a_{2/1} = 2g - k_{eq}x\left(\frac{1}{m_1}+\frac{1}{m_2}\right)$$

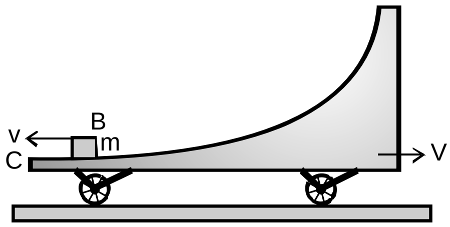
$$vdv = \left[2g - k_{eq}\times\left(\frac{m_1+m_2}{m_1m_2}\right)\right]dx$$

$$\Rightarrow x_{max} = \frac{4m_1m_1g}{K_{eq}(m_1+m_2)}$$

Ans. $k_1x_1 = k_2x_2 = k_{eq}x$

27. A toy cart of ....

Sol.



$mv = MV$ ...(i)

$$\frac{1}{2}mv^2 + \frac{1}{2}MV^2 = mgH \qquad ...(ii)$$

Solving

$$v = \sqrt{\frac{2gHM}{M+m}} \;\&\; V = \sqrt{\frac{2gH}{M+m}\cdot\frac{m^2}{M}}$$

Maximum relative velocity of cart w.r.t. block

$$= V + v = \sqrt{\frac{2gH(M+m)}{M}}$$

$\therefore$ time taken by block to travel from B to C

$$t = \frac{L}{V+v} = L\sqrt{\frac{M}{2gH(M+m)}}$$

28. Two uniform ....

Sol. $\tau = MB\sin\theta$

$\alpha \propto -\theta$

$$\Rightarrow f \propto \sqrt{\frac{i_1i_2}{r_2}}$$

29. A particle is ....

Sol. It is clear from the figure that acceleration does not change sign, i.e., does not change in direction. Only the magnitude of acceleration first increases and then decreases.

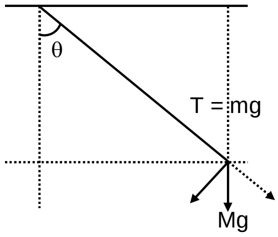
Velocity keeps on increasing.

Hence displacement also keeps on increasing.

30. A small ball ....

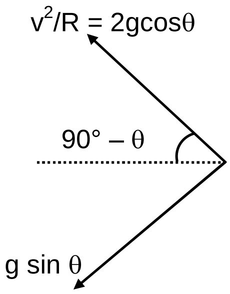
Sol. By work energy theorem

$$MgR\cos\theta = \frac{1}{2}Mv^2$$



$\Rightarrow$ v = $\sqrt{2gR\cos\theta}$

Radial force equation : T = Mg cos θ + $\dfrac{Mv^2}{R}$



$\Rightarrow$ T = Mg cos θ + $\dfrac{M}{R}\cdot 2gR\cos\theta$

Mg = 3Mg cos θ $\Rightarrow$ cos θ = $\left(\dfrac{1}{3}\right)$

For acceleration to be horizontal

$$\tan\theta = \frac{2g\cos\theta}{g\sin\theta} = 2\cot\theta$$

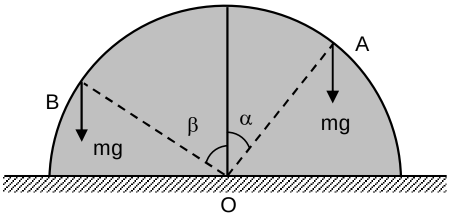
$$\theta = \tan^{-1}\sqrt{2}$$

31. A solid hemisphere ....

Sol. (A) Contact force on each block is vertically upward

(B) force of friction on hemisphere from ground is zero

(C) & (D)



Net torque about O = 0

mg R sinα + τ_N – mgR sinβ

τ_N = mgR (sinβ – sinα)

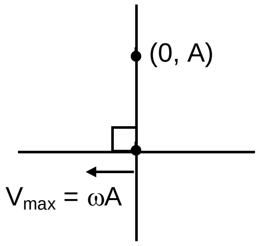
32. A charged ....

Sol. (a) For (2A, 0), θ = 0° or 180°

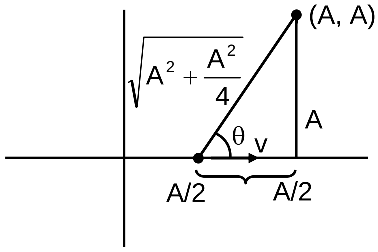
$\therefore$ B = 0 permanent zero

(b) Magnetic field will be max at (0, A) when the particle passes through (0, 0)

$$B_{max} = \frac{\mu_0}{4\pi}\times\frac{q(\omega A)\sin 90^\circ}{A^2} = \frac{\mu_0}{4\pi}\cdot\frac{q\omega}{A}$$



(c) $\sin\theta = \dfrac{A}{A\sqrt{5}/2} = \dfrac{2}{\sqrt{5}}$



$$r = \sqrt{A^2+\frac{A^2}{4}} = \frac{A\sqrt{5}}{2}$$

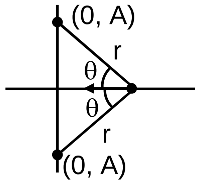
$$V = \omega\sqrt{A^2-x^2} = \omega\sqrt{A^2-\left(\frac{A}{2}\right)^2} = \frac{\omega A\sqrt{3}}{2}$$

$$B = \frac{\mu_0}{4\pi}\times\frac{qv\sin\theta}{r^2} = \frac{\mu_0}{4\pi}\times\frac{q\left(\omega A\dfrac{\sqrt{3}}{2}\right)\cdot\dfrac{2}{\sqrt{5}}}{\left(A\dfrac{\sqrt{5}}{2}\right)^2} = \frac{\mu_0}{4\pi}\cdot$$

$$\frac{q\omega}{A}\cdot\frac{\sqrt{3}}{2}\cdot\frac{2}{\sqrt{5}}\times\frac{4}{5} = \frac{\sqrt{3}\mu_0 q\omega}{5\sqrt{5}\pi A}$$

(d) same r, same θ

$\Rightarrow$ same B



33. Two parallel ....

Sol. $E_{ind} = L\dfrac{di}{dt} = Bv\ell \Rightarrow$ $di = \dfrac{B\ell}{L}\cdot(vdt) = \dfrac{B\ell}{L}\cdot dx$

$\therefore$ $i = \dfrac{B\ell}{L}\cdot x$

$F_{mag} = -Bi\ell = -\dfrac{B^2\ell^2}{L}\cdot x(\leftarrow)$ ($\therefore$ SHM of rod)

$\omega_{SHM} = \sqrt{\dfrac{B^2\ell^2}{Lm}}$

using SHM equation $v^2 = v_{max}^2 - \omega^2 x^2$

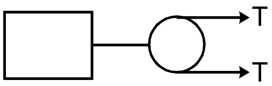
$\Rightarrow x^2 = \dfrac{3v_{max}^2}{4\omega^2}$

$x = \sqrt{\dfrac{3J^2L}{4mB^2\ell^2}}$

$\therefore \quad i = \dfrac{B\ell}{L} \cdot x = \sqrt{\dfrac{3J^2}{4mL}}$

34. In the given ....

Sol. F.B.D of the mass M :



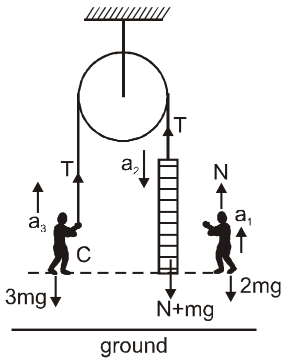
T = F

$ma = 2T = 2F \quad \Rightarrow \quad a = \dfrac{2F}{m}$.

so, acceleration of point P is $2a = \dfrac{4F}{m}$

35. Man A of mass ....

Sol.



$N - 2mg = 2ma_1$ ....(i)

$N + mg - T = ma_2$ ....(ii)

$T - 3mg = 3ma_3$ ....(iii)

$a_1 = 4$ and $a_2 = a_3 \Rightarrow \quad N = 2mg + 2m(4)$

$\Rightarrow a_2 = 2 \text{ m/s}^2$ (by equations)

$\Rightarrow a_{rel} = 2\text{m/s}^2 \Rightarrow S_{rel} = \dfrac{1}{2} a_{rel} t^2 = \dfrac{1}{2} \times 2 \times 1 = 1\text{m}.$

$a_3 = 4$; $a_2 = -a_1$

$\Rightarrow T = 3mg + 12m$

by (ii) $N + mg - 3mg - 12m = -ma_1$

$\Rightarrow N = 2mg + 12m - ma_1$

by (i) $2mg + 12m - ma_1 - 2mg = 2ma_1 \Rightarrow a_1 = 4$

$\Rightarrow a_{rel} = 0 \quad \Rightarrow \quad S_{rel} = 0$

$a_3 = 4$; $a_1 = 4 \Rightarrow T = 3mg + 12m$ and $N = 2mg + 8m$

by eq.(ii) $\quad 2mg + 8m + mg - 3mg - 12m = ma_2$

$\Rightarrow a_2 = -4\text{m/s}^2$

$\Rightarrow a_2 = 4 \text{ m/s}^2$ upward.

36. In a tall viscous ....

Sol. $\dfrac{dv}{dt} = -6\pi\eta r v = -kv$

$\Rightarrow v = v_0 e^{-kt}$

$\Rightarrow$ After half lives of velocity

$v = \dfrac{v_0}{2^n}$

$\Rightarrow \dfrac{v}{v_0} = \dfrac{1}{2^n}$

$\Rightarrow \dfrac{1}{16} = \dfrac{1}{2^n}$

$\Rightarrow n = 7 = 4s$

$\Rightarrow$ 1 half life = 1s

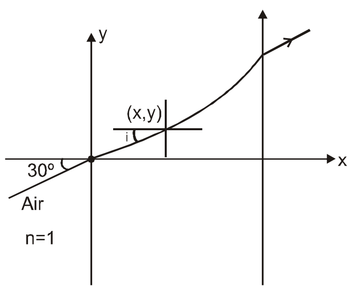
$\Rightarrow$ velocity varies as :

t	v
0	16
1	8
2	4
3	2
4	1

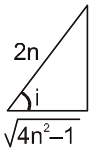
$\Rightarrow \dfrac{F_1}{F_2} = \dfrac{a_1}{a_2} = \dfrac{12}{3} = 4$

37. A light ray ....

Sol.



(a) $1 \times \sin 30^\circ = n \sin i$



$\sin i = \frac{1}{2n}$

$\tan i = \frac{1}{\sqrt{4n^2-1}}$

$$\frac{dy}{dx} = \frac{1}{\sqrt{x+3}}$$

$$\int_0^y dy = \int_0^x (x+3)^{-1/2} dx$$

$y = 2(\sqrt{x+3} - \sqrt{3})$

(b) when x = 1

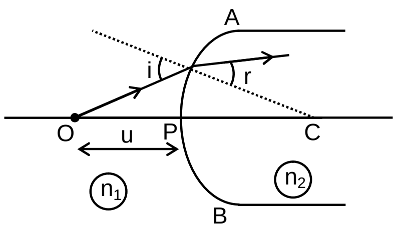
$y = 2(\sqrt{1+3} - \sqrt{3})$

$y = 2(2 - \sqrt{3})$

$\therefore$ Position at which ray comes out of the medium is $(1, 2(2-\sqrt{3}))$.

38. A point object ....

Sol. $\frac{n_2}{v} - \frac{n_1}{(-u)} = \frac{n_2 - n_1}{R}$



$$\frac{n_2}{v} = \frac{n_2 - n_1}{R} - \frac{n_1}{u}$$

(a) if $n_1 > n_2 \Rightarrow$ v is – ve ; $\Rightarrow$ (a)

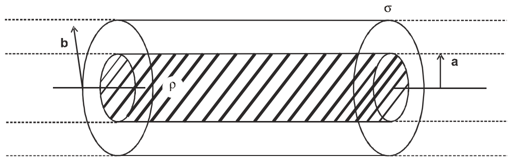
(b) $\frac{2n_1}{v} = \frac{n_1}{R} - \frac{n_1}{u}$

$$\frac{2}{v} = \frac{1}{R} - \frac{1}{u}$$

if $R > u \Rightarrow$ v is -ve

39. A long co-axial ....

Sol.



Relation between σ and s

cable is electrically neutral

$\sigma.2\pi b\ell + \rho.\pi a^2\ell = 0$

$2\sigma b + \rho a^2 = 0$

$\sigma + \frac{\rho a^2}{2b} = 0$

$\frac{\sigma}{a^2} + \frac{\rho}{2b} = 0$

Electric - field calculation

(1) r < a

$E.2\pi r\ell = \frac{\rho.\pi r^2\ell}{\varepsilon_0}$

$E = \frac{\rho r}{2\varepsilon_0}$

(2) a < r < b

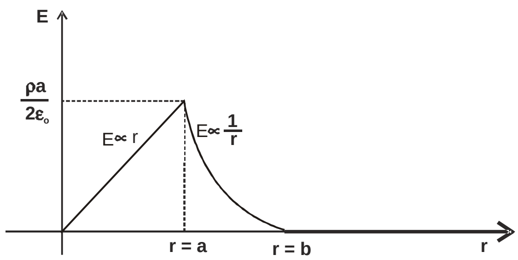
$E.2\pi r\ell = \frac{\rho.\pi a^2\ell}{\varepsilon_0}$

$E = \frac{\rho a^2}{2\varepsilon_0 r}$

(3) r > b

$E.2pr\ell = 0$

E = 0



40. Consider an ....

Sol. Consider the projected area of any face to calculate the flux

Electric flux with ABCD, ABEF, DCGH is zero

PART : III CHEMISTRY

43. Which of the following ....

Sol. $Cu_2S + 2Cu_2O \rightarrow 6Cu + SO_2$

$FeO + SiO_2 \rightarrow FeSiO_3$

44. An equimolar mixture ....

Sol. $$\frac{y_B}{y_T} = \frac{x_B \times}{x_T \times}\left(\frac{P_B^0}{P_T^0}\right)^n$$

n = no. of fractional distillation

$$\frac{y_B}{y_T} = \frac{\frac{1}{2}}{\frac{1}{2}}\left(\frac{600}{200}\right)^5$$

$= 3^5 : 1$

49. Which reaction will ....

Sol. H_2O_2 acts as oxidising agent with $SnCl_2$ & $K_4[Fe(CN)_6]$

50. Nitrogen dioxide gas ....

Sol. $HCl(g) + NO_2(g) \longrightarrow Cl_2 + NOCl + H_2O$

$HBr + NO_2 \longrightarrow Br_2 + NO + H_2O$

$CO + NO_2 \longrightarrow CO_2 + NO$

51. Select the correct ....

Sol. Coordination number of Be^{2+} does not exceed 4.

52. The equilibrium constant ....

Sol. Let initial mole of SO_2Cl_2 (g) is one

	$SO_2Cl_2(g)$ $\rightleftharpoons$	$SO_2(g)$ +	$Cl_2(g)$
Initial mole	1	0	0
At eq.	$1-\alpha$	α	α

$$K_p = \frac{\alpha^2}{1-\alpha^2} \times P$$

$\alpha = 0.6$.

Average molar mass of mixture

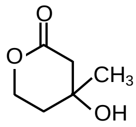
= (64 + 71) × 0.25 + 64 × 0.375 + 71 × 0.375

= 84.375.

53. (P) + (Q) $\xrightarrow[\Delta]{H^{\oplus}}$ ....

Sol. (P) $\Rightarrow$ CH_3–CH= O &

Q $\Rightarrow$ HO–CH_2–CH_2–C(CH_3)(OH)–CH_2–COOH

(R) will be formed by intramolecular esterification 

54. CH_3–CH_2–CH(CH_3)–OH ....

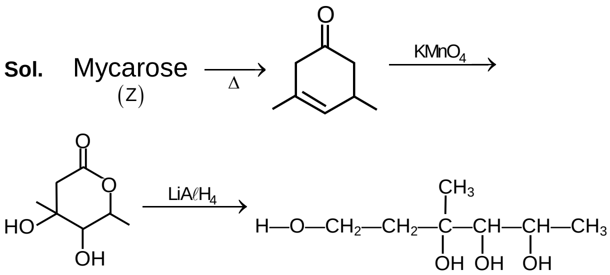
Sol. (P) CH_3–CH_2–CH(CH_3)–Br

(R) CH_3–CH_2–CH(CH_3)–CH(OH)–CH_3

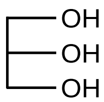
(Q) CH_3–CH_2–C(CH_3)=O

(S) CH_3–CH_2–C(CH_3)(OH)–CH_2–CH_3

55. Mycarose occurs ....

Sol. 

56. Observe the following ....

Sol. 

$\xrightarrow{H_2SO_4/\Delta}$ CH_2(OH)–CH_2–CH=O

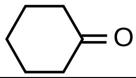
$\xrightarrow[E_1]{H_2SO_4/\Delta}$ CH_2=CH–CH=O
(M)

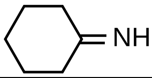
$\xrightarrow[\text{Tischenko reaction}]{(C_2H_5O)_3Al}$ CH_2=CH–C(=O)–O–CH_2–CH=CH_2
(N)

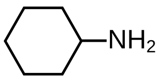
57. Find the reaction ....

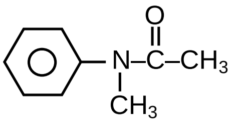
Sol. A & B will give primary amine which will react by Hinseberg's reagent. Product of primary amine will be soluble in base.

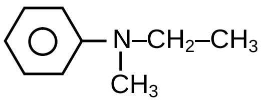
(A) (1) R–Cl (2) RCN (3) RCH_2–NH_2

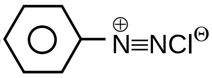
(B) (1) 

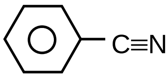
(2) 

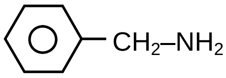
(3) 

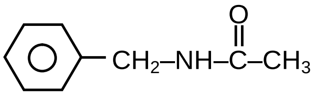
(C) (1) 

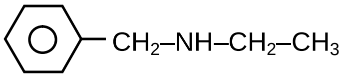
(2) 

(D) (1) 

(2) 

(3) 

(4) 

(5) 

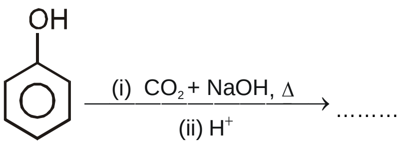
58. Which amongs ....

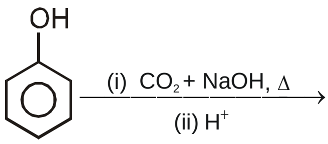
Sol. (A) It is perkin reaction

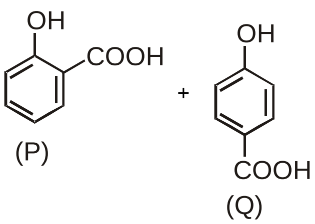
(B) It is knoevenagel reaction.

(C) It is based on reformatsky reaction

(D) $Ph-\overset{*}{C}H(OH)-COOH$ will be product.

59. 

Sol. 



60. Which amongs the ....

Sol. All are formed by conjugated addition / 1,4-addition.

ADVANCED PATTERN CUMULATIVE TEST-2(ACT-2)

TARGET : JEE (MAIN+ADVANCED) 2017

DATE : 07-05-2017 REVSION PLAN 2 COURSE : VIJETA (ADP), VIJAY (ADR)

ANSWER KEY

CODE-0

PAPER-1

PART : I MATHEMATICS

1.	(7)	**2.**	(0)	**3.**	(1)	**4.**	(4)	**5.**	(1)	**6.**	(2)	**7.**	(1)
8.	(4)	**9.**	(5)	**10.**	(5)	**11.**	(3)	**12.**	(1)	**13.**	(3)	**14.**	(3)
15.	(8)	**16.**	(6)	**17.**	(7)	**18.**	(5)	**19.**	(9)	**20.**	(1)	**21.**	(4)
22.	(2)	**23.**	(3)	**24.**	(4)	**25.**	(8)						

PART : II PHYSICS

26.	(2)	**27.**	(2)	**28.**	(2)	**29.**	(5)	**30.**	(8)	**31.**	(7)	**32.**	(4)
33.	(7)	**34.**	(3)	**35.**	(2)	**36.**	(8)	**37.**	(8)	**38.**	(8)	**39.**	(7)
40.	(3)	**41.**	(2)	**42.**	(2)	**43.**	(4)	**44.**	(8)	**45.**	(5)	**46.**	(3)
47.	(5)	**48.**	(7)	**49.**	(2)	**50.**	(3)						

PART : III CHEMISTRY

51.	(7)	**52.**	(5)	**53.**	(3)	**54.**	(6)	**55.**	(5)	**56.**	(3)	**57.**	(8)
58.	(3)	**59.**	(3)	**60.**	(5)	**61.**	(4)	**62.**	(5)	**63.**	(4)	**64.**	(4)
65.	(6)	**66.**	(5)	**67.**	(2)	**68.**	(1)	**69.**	(6)	**70.**	(5)	**71.**	(9)
72.	(4)	**73.**	(5)	**74.**	(4)	**75.**	(4)						

PAPER-2

PART : I MATHEMATICS

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

PART : II PHYSICS

21.	(ABCD)	**22.**	(BD)	**23.**	(BC)	**24.**	(BD)	**25.**	(AB)	**26.**	(AC)	**27.**	(AC)
28.	(AD)	**29.**	(CD)	**30.**	(ABC)	**31.**	(C)	**32.**	(BCD)	**33.**	(AB)	**34.**	(C)
35.	(AC)	**36.**	(ABC)	**37.**	(BC)	**38.**	(AB)	**39.**	(BD)	**40.**	(ABC)		

PART : III CHEMISTRY

41.	(ABCD)	**42.**	(C)	**43.**	(CD)	**44.**	(ABD)	**45.**	(ABCD)	**46.**	(C)	**47.**	(AC)
48.	(BCD)	**49.**	(AB)	**50.**	(ABC)	**51.**	(ACD)	**52.**	(BC)	**53.**	(BC)	**54.**	(AD)
55.	(BCD)	**56.**	(ABC)	**57.**	(AB)	**58.**	(ABC)	**59.**	(ABCD)	**60.**	(ABCD)		

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ANSWER KEY

CODE-1

PAPER-1

PART : I MATHEMATICS

1.	(7)	**2.**	(0)	**3.**	(1)	**4.**	(4)	**5.**	(1)	**6.**	(2)	**7.**	(1)
8.	(4)	**9.**	(5)	**10.**	(5)	**11.**	(3)	**12.**	(1)	**13.**	(3)	**14.**	(3)
15.	(8)	**16.**	(6)	**17.**	(7)	**18.**	(5)	**19.**	(9)	**20.**	(1)	**21.**	(4)
22.	(2)	**23.**	(3)	**24.**	(4)	**25.**	(8)						

PART : II PHYSICS

26.	(2)	**27.**	(2)	**28.**	(2)	**29.**	(5)	**30.**	(8)	**31.**	(7)	**32.**	(4)
33.	(7)	**34.**	(3)	**35.**	(2)	**36.**	(8)	**37.**	(8)	**38.**	(8)	**39.**	(7)
40.	(3)	**41.**	(2)	**42.**	(2)	**43.**	(4)	**44.**	(8)	**45.**	(5)	**46.**	(3)
47.	(5)	**48.**	(7)	**49.**	(2)	**50.**	(3)						

PART : III CHEMISTRY

51.	(7)	**52.**	(5)	**53.**	(3)	**54.**	(6)	**55.**	(5)	**56.**	(3)	**57.**	(8)
58.	(3)	**59.**	(3)	**60.**	(5)	**61.**	(4)	**62.**	(5)	**63.**	(4)	**64.**	(4)
65.	(6)	**66.**	(5)	**67.**	(2)	**68.**	(1)	**69.**	(6)	**70.**	(5)	**71.**	(9)
72.	(4)	**73.**	(5)	**74.**	(4)	**75.**	(4)						

PAPER-2

PART : I MATHEMATICS

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

PART : II PHYSICS

21.	(ABCD)	**22.**	(AD)	**23.**	(AD)	**24.**	(CD)	**25.**	(CD)	**26.**	(BC)	**27.**	(BC)
28.	(CD)	**29.**	(AB)	**30.**	(BCD)	**31.**	(B)	**32.**	(ABD)	**33.**	(AD)	**34.**	(D)
35.	(BC)	**36.**	(ACD)	**37.**	(AB)	**38.**	(BC)	**39.**	(BC)	**40.**	(ABC)		

PART : III CHEMISTRY

41.	(ABCD)	**42.**	(B)	**43.**	(AD)	**44.**	(ABC)	**45.**	(ABCD)	**46.**	(B)	**47.**	(BC)
48.	(ACD)	**49.**	(AD)	**50.**	(BCD)	**51.**	(ABD)	**52.**	(BC)	**53.**	(BD)	**54.**	(AC)
55.	(ACD)	**56.**	(ABD)	**57.**	(AC)	**58.**	(ABD)	**59.**	(ABCD)	**60.**	(ABCD)		

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ANSWER KEY

CODE-2

PAPER-1

PART : I MATHEMATICS

1.	(7)	**2.**	(0)	**3.**	(1)	**4.**	(4)	**5.**	(1)	**6.**	(2)	**7.**	(1)
8.	(4)	**9.**	(5)	**10.**	(5)	**11.**	(3)	**12.**	(1)	**13.**	(3)	**14.**	(3)
15.	(8)	**16.**	(6)	**17.**	(7)	**18.**	(5)	**19.**	(9)	**20.**	(1)	**21.**	(4)
22.	(2)	**23.**	(3)	**24.**	(4)	**25.**	(8)						

PART : II PHYSICS

26.	(2)	**27.**	(2)	**28.**	(2)	**29.**	(5)	**30.**	(8)	**31.**	(7)	**32.**	(4)
33.	(7)	**34.**	(3)	**35.**	(2)	**36.**	(8)	**37.**	(8)	**38.**	(8)	**39.**	(7)
40.	(3)	**41.**	(2)	**42.**	(2)	**43.**	(4)	**44.**	(8)	**45.**	(5)	**46.**	(3)
47.	(5)	**48.**	(7)	**49.**	(2)	**50.**	(3)						

PART : III CHEMISTRY

51.	(7)	**52.**	(5)	**53.**	(3)	**54.**	(6)	**55.**	(5)	**56.**	(3)	**57.**	(8)
58.	(3)	**59.**	(3)	**60.**	(5)	**61.**	(4)	**62.**	(5)	**63.**	(4)	**64.**	(4)
65.	(6)	**66.**	(5)	**67.**	(2)	**68.**	(1)	**69.**	(6)	**70.**	(5)	**71.**	(9)
72.	(4)	**73.**	(5)	**74.**	(4)	**75.**	(4)						

PAPER-2

PART : I MATHEMATICS

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

PART : II PHYSICS

21.	(ABCD)	**22.**	(BD)	**23.**	(BC)	**24.**	(BD)	**25.**	(AB)	**26.**	(AC)	**27.**	(AC)
28.	(AD)	**29.**	(CD)	**30.**	(ABC)	**31.**	(C)	**32.**	(BCD)	**33.**	(AB)	**34.**	(C)
35.	(AC)	**36.**	(ABC)	**37.**	(BC)	**38.**	(AB)	**39.**	(BD)	**40.**	(ABC)		

PART : III CHEMISTRY

41.	(ABCD)	**42.**	(C)	**43.**	(CD)	**44.**	(ABD)	**45.**	(ABCD)	**46.**	(C)	**47.**	(AC)
48.	(BCD)	**49.**	(AB)	**50.**	(ABC)	**51.**	(ACD)	**52.**	(BC)	**53.**	(BC)	**54.**	(AD)
55.	(BCD)	**56.**	(ABC)	**57.**	(AB)	**58.**	(ABC)	**59.**	(ABCD)	**60.**	(ABCD)		

ADVANCED PATTERN CUMULATIVE TEST-2(ACT-2)

TARGET : JEE (MAIN+ADVANCED) 2017

DATE : 07-05-2017 REVSION PLAN 2 COURSE : VIJETA (ADP), VIJAY (ADR)

ANSWER KEY

CODE-3

PAPER-1

PART : I MATHEMATICS

1.	(7)	**2.**	(0)	**3.**	(1)	**4.**	(4)	**5.**	(1)	**6.**	(2)	**7.**	(1)
8.	(4)	**9.**	(5)	**10.**	(5)	**11.**	(3)	**12.**	(1)	**13.**	(3)	**14.**	(3)
15.	(8)	**16.**	(6)	**17.**	(7)	**18.**	(5)	**19.**	(9)	**20.**	(1)	**21.**	(4)
22.	(2)	**23.**	(3)	**24.**	(4)	**25.**	(8)						

PART : II PHYSICS

26.	(2)	**27.**	(2)	**28.**	(2)	**29.**	(5)	**30.**	(8)	**31.**	(7)	**32.**	(4)
33.	(7)	**34.**	(3)	**35.**	(2)	**36.**	(8)	**37.**	(8)	**38.**	(8)	**39.**	(7)
40.	(3)	**41.**	(2)	**42.**	(2)	**43.**	(4)	**44.**	(8)	**45.**	(5)	**46.**	(3)
47.	(5)	**48.**	(7)	**49.**	(2)	**50.**	(3)						

PART : III CHEMISTRY

51.	(7)	**52.**	(5)	**53.**	(3)	**54.**	(6)	**55.**	(5)	**56.**	(3)	**57.**	(8)
58.	(3)	**59.**	(3)	**60.**	(5)	**61.**	(4)	**62.**	(5)	**63.**	(4)	**64.**	(4)
65.	(6)	**66.**	(5)	**67.**	(2)	**68.**	(1)	**69.**	(6)	**70.**	(5)	**71.**	(9)
72.	(4)	**73.**	(5)	**74.**	(4)	**75.**	(4)						

PAPER-2

PART : I MATHEMATICS

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

PART : II PHYSICS

21.	(ABCD)	**22.**	(AD)	**23.**	(AD)	**24.**	(CD)	**25.**	(CD)	**26.**	(BC)	**27.**	(BC)
28.	(CD)	**29.**	(AB)	**30.**	(BCD)	**31.**	(B)	**32.**	(ABD)	**33.**	(AD)	**34.**	(D)
35.	(BC)	**36.**	(ACD)	**37.**	(AB)	**38.**	(BC)	**39.**	(BC)	**40.**	(ABC)		

PART : III CHEMISTRY

41.	(ABCD)	**42.**	(B)	**43.**	(AD)	**44.**	(ABC)	**45.**	(ABCD)	**46.**	(B)	**47.**	(BC)
48.	(ACD)	**49.**	(AD)	**50.**	(BCD)	**51.**	(ABD)	**52.**	(BC)	**53.**	(BD)	**54.**	(AC)
55.	(ACD)	**56.**	(ABD)	**57.**	(AC)	**58.**	(ABD)	**59.**	(ABCD)	**60.**	(ABCD)		