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DIVISION: JEE (MAIN+ADVANCED)
ACADEMIC SESSION: 2023-24

PERIODIC ASSESSMENT TEST (PAT)

STUDENT SUPPORT BOOKLET (SSB)

Answer Key (AK) | Standard Hints (SH) | Text Solutions (TS) | Weightage Sheet (WS)

CLASS	XI	COURSE NAME	VIKAAS	COURSE CODE	JA
PHASE CODE(S)	01JA,01JAZA, 02JA,IA,03JA	TOTAL PAGES	1	BATCH CODE(S)	01JA,01JAZA, 02JA,IA,03JA

Target Examination & Year:

JEE (MAIN+ADVANCED) 2025

TEST PATTERN	TEST TYPE	TEST CODE & SEQUENCE
JEE (ADVANCED)	PART TEST (PT)	APT 04

DATE & DAY:
04th February 2024 | Sunday

Duration & Time:
Paper-1 : 3 Hrs | 11:00 AM to 2:00 PM
Paper-2 : 3 Hrs | 2:30 PM to 5:30 PM

Contents:

- Weightage Sheet (WS) ✓
- Answer Key (AK) ✓
- Standard Hints (SH) ☐
- Text Solutions (TS) ✓
- Resonance Student's Critical Analysis of Learning for Excellence (ResoSCALE) ☐
- Student Self Assessment Sheet (SAS) ☐
- Video Solutions (VS) ☐

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Academic Session: 2023-24

PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

	P-1	P-2	Total		P-1	P-2	Total
Total Qs	54	54	108	Subject wise Qs.	18	18	36
Max. Marks	186	186	372	Subject wise Marks	62	62	124

PAPER1-MATHEMATICS										
S.No.	Topic Name	Question Type & Sequencing						Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		MSQ		MCQ		CBQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	**6**		**8**		**4**		**18**	**60**	**100.00%**
1	Straight Line	2	1,5	2	7,8	2	17,18	6	20	33.33%
2	Permutation and Combination	2	2,3	2	9,10	2	15,16	6	20	33.33%
3	Solution of Triangle	1	4	2	11,12	_	_	3	10	16.67%
4	Binomial Theorem	1	6	2	13,14	_	_	3	10	16.67%
	Total	**6**		**8**		**4**		**18**	**60**	**100%**

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Academic Session: 2023-24

PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

PAPER1-PHYSICS										
S.No.	Topic Name	Question Type & Sequencing						Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		MSQ		MCQ		CBQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	**6**		**8**		**4**		**18**	**60**	**100.00%**
1	Circular Motion	3	19,21,23	_	_	2	33,34	5	18	30.00%
2	System of Particles, Centre of Mass, Momentum and Collision	1	20	2	27,32	2	35,36	5	16	26.67%
3	Rotation (Rigid Body Dynamics)	2	22,24	5	25,28,29,30,31	_	_	7	23	38.33%
4	Work, Power & Energy	_	_	1	26	_	_	1	3	5.00%
	Total	**6**		**8**		**4**		**18**	**60**	**100%**

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PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

PAPER1-CHEMISTRY										
S.No.	Topic Name	Question Type & Sequencing						Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		MSQ		MCQ		CBQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	**6**		**8**		**4**		**18**	**60**	**100.00%**
1	Gaseous State	1	37	1	43	_	_	2	7	11.67%
2	Thermodynamics	1	38	1	46	2	51,52	4	13	21.67%
3	Chemical Equilibrium	1	39	2	44,45	_	_	3	10	16.67%
4	Chemical Bonding	2	40,41	2	47,48	2	53,54	6	20	33.33%
5	GOC-I (Electronic Effect)	1	42	1	50	_	_	2	7	11.67%
6	Periodic Table Periodicity	_	_	1	49	_	_	1	3	5.00%
	Total	**6**		**8**		**4**		**18**	**60**	**100%**

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PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

PAPER2-MATHEMATICS								
S.No.	Topic Name	Question Type & Sequencing				Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		NVQ		MSQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	**12**		**6**		**18**	**60**	**100.00%**
1	Straight Line	6	1,2,3,4,5,6	1	18	7	22	36.67%
2	Permutation and Combination	2	7,8	1	13	3	10	16.67%
3	Binomial Theorem	2	9,10	2	15,16	4	14	23.33%
4	Solution of Triangle	2	11,12	2	14,17	4	14	23.33%
	Total	**12**		**6**		**18**	**60**	**100%**

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Academic Session: 2023-24

PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

PAPER2-PHYSICS								
S.No.	Topic Name	Question Type & Sequencing				Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		NVQ		MSQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	**12**		**6**		**18**	**60**	**100.00%**
1	Work, Power & Energy	1	19	1	34	2	7	11.67%
2	Rotation (Rigid Body Dynamics)	6	20,22,23,24,27,29	2	35,36	8	26	43.33%
3	Circular Motion	4	21,26,28,30	_	_	4	12	20.00%
4	System of Particles, Centre of Mass, Momentum and Collision	1	25	2	32,33	3	11	18.33%
5	Simple Harmonic Motion	_	_	1	31	1	4	6.67%
	Total	**12**		**6**		**18**	**60**	**100%**

PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

PAPER2-CHEMISTRY								
S.No.	Topic Name	Question Type & Sequencing				Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		NVQ		MSQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	**12**		**6**		**18**	**60**	**100.00%**
1	Gaseous State	2	37,38	1	49	3	10	16.67%
2	Thermodynamics	2	39,40	1	51	3	10	16.67%
3	Chemical Equilibrium	2	41,42	1	50	3	10	16.67%
4	Chemical Bonding	5	43,44,45,46,47	3	52,53,54	8	27	45.00%
5	GOC-I (Electronic Effect)	1	48	_	_	1	3	5.00%
	Total	**12**		**6**		**18**	**60**	**100%**

ANSWER KEY (AK)

PAPER-1											
PART-I : MATHEMATICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	AD	ABCD	ABC	AD	ABD	ACD	A	C	A	A
	Q.No.	11	12	13	14	15	16	17	18		
	Ans.	E	E	D	A	A	B	D	C		
PART-II : PHYSICS	Q.No.	19	20	21	22	23	24	25	26	27	28
	Ans.	ABC	ABCD	AD	ACD	AC	ACD	A	B	A	B
	Q.No.	29	30	31	32	33	34	35	36		
	Ans.	A	C	C	B	B	A	B	A		
PART-III : CHEMISTRY	Q.No.	37	38	39	40	41	42	43	44	45	46
	Ans.	A	BC	ABD	AC	ABD	ACD	D	A	B	B
	Q.No.	47	48	49	50	51	52	53	54		
	Ans.	D	C	B	B	B	C	A	C		

PAPER-2											
PART-I : MATHEMATICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	04.00	80.00	02.75	27.00	04.00	09.00	80.00	06.00	11.50	08.00
	Q.No.	11	12	13	14	15	16	17	18		
	Ans.	20.25	02.00	ABCD	AC	AD	AC	AC	CD		
PART-II : PHYSICS	Q.No.	19	20	21	22	23	24	25	26	27	28
	Ans.	30.00	12.00	10.00	02.00	11.00	25.00	36.00	16.00	10.00	75.00
	Q.No.	29	30	31	32	33	34	35	36		
	Ans.	64.00	40.00	BC	CD	BC	AD	ABC	ABC		
PART-III : CHEMISTRY	Q.No.	37	38	39	40	41	42	43	44	45	46
	Ans.	10.00	03.00	16.00	00.66 to 00.67	02.00	20.00	12.00	06.00	09.00	05.00
	Q.No.	47	48	49	50	51	52	53	54		
	Ans.	03.00	06.00	B	CD	ABD	CD	ABC	ABD		

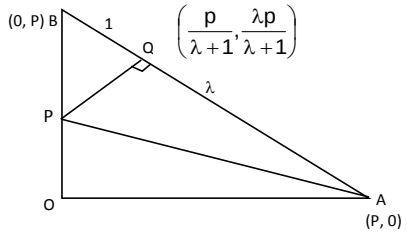
STUDENT'S SPACE

TEXT SOLUTIONS (TS)

PAPER-1

PART-I: MATHEMATICS

1.



Let coordinates of Q $\equiv \left(\frac{p}{\lambda+1},\frac{\lambda p}{\lambda+1}\right)$

Eq of PQ

$\Rightarrow y-\frac{\lambda p}{\lambda+1}=1\left(x-\frac{p}{\lambda+1}\right)$

coordinates of P $\equiv \left(0, p\ \frac{\lambda-1}{\lambda+1}\right)$

$$\frac{\Delta APQ}{\Delta OAB}=\frac{\frac{1}{2}PQ.AQ}{\frac{1}{2}OA.OB}=\frac{3}{8}$$

$$\frac{\sqrt{2}P}{\lambda+1}.\frac{\sqrt{2}P\lambda}{\lambda+1}=\frac{3}{8}P^2 \qquad \Rightarrow \frac{2\lambda}{(\lambda+1)^2}=\frac{3}{8}$$

$3\lambda^2 - 10\lambda + 3 = 0 \Rightarrow \lambda = 3, 1/3$

2. (A) ${}^6C_3 . {}^4C_2 . 5!5! = (5!)^3$
(B) ${}^6C_1 . 9!$
(C) (6+1)! 4! = 7! 4!
(D) ${}^{10}p_4$

3. Consider $2^k \in N$
If k is odd $2^k + 1$ is divisible by 3 and
If k is even $2^k + 2$ is divisible by 3.
Hence if 2^k is divided by 3 the remainder is 1 if k is even and 2 if k is odd.
so for the expression $2^m + 2^n + 2^p$ to be divisible by 3 either all m, n & p should be odd or all m, n and p should be even.
Hence possible number of ordered triplet is
= 50 × 25 × 13 + 50 × 25 × 12 = 31250

हल. माना $2^k \in N$
यदि k विषम है तब $2^k + 1$, 3 से भाज्य होगा।
तथा
यदि k सम है तब $2^k + 2$, 3 से भाज्य होगा।
अतः यदि 2^k में 3 का भाग देने पर शेषफल 1 होगा, यदि k सम है तथा शेषफल 2 होगा यदि k विषम है।
इसलिए व्यंजक $2^m + 2^n + 2^p$, 3 से भाज्य होगा, यदि सभी m, n तथा p सम हो अथवा सभी m, n तथा p विषम हो।
अतः अधिकतम संभावित त्रिकों की संख्या
= 50 × 25 × 13 + 50 × 25 × 12 = 31250 है।

4. From the given relation we have

$$\frac{c^2+b^2-a^2}{2bc}=\frac{b}{2c}$$

$\Rightarrow \quad a^2 - c^2 = 0 \Rightarrow a = c.$

So (a) is correct and a = c $\Rightarrow$ A = C and the given relation
Gives sin B = sin 2C.

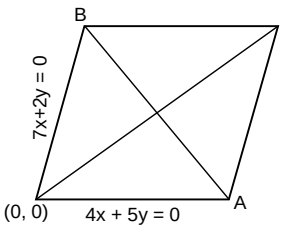
हल. दिया गया सम्बन्ध है -

$$\frac{c^2+b^2-a^2}{2bc}=\frac{b}{2c}$$

$\Rightarrow \quad a^2 - c^2 = 0 \Rightarrow a = c.$

इसलिए (a) सही है तथा a = c $\Rightarrow$ A = C तथा दिया गया सम्बन्ध sin B = sin 2C.

5.



Consider line $11x + 7y = k$
रेखा $11x + 7y = k$ है।
Intersection of $4x + 5y = 0$ is

$$\left(\frac{5k}{27},\frac{-4k}{27}\right)=A$$

$4x + 5y = 0$ के प्रतिच्छेदन $\left(\frac{5k}{27},\frac{-4k}{27}\right)=A$ है।

Similarly intersection with line $7x + 2y = 0$

is $\left(\frac{-2k}{27},\frac{7k}{27}\right)=B$

रेखा $7x + 2y = 0$ के साथ प्रतिच्छेदन

$\left(\frac{-2k}{27},\frac{7k}{27}\right)=B$ है।

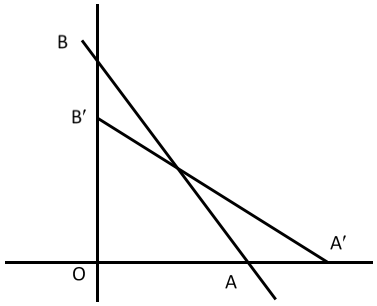
Mid point in $\left(\frac{k}{18},\frac{k}{18}\right)$ मध्य बिन्दु $\left(\frac{k}{18},\frac{k}{18}\right)$ है।

Line joining (0, 0) and $\left(\frac{k}{18},\frac{k}{18}\right)$ is y = x

(0, 0) और $\left(\frac{k}{18},\frac{k}{18}\right)$ से गुजरने वाली रेखाy = x

6. (A) For constant term put x = 0 and get constant term = 4
अचर पद के लिए x = 0 रखने पर अचर पद = 4
(C) Required अभीष्ट = 1.25 + 2.24 + 3.23 + ... + 25.1 = 2925
(D) Coefficient of x^{24} = 1.25 + 2.24 + 3.23 + ... + 25.1 = 2925
x^{24} का गुणांक 1.25 + 2.24 + 3.23 + ... + 25.1 = 2925

7.



A (2,0) , B (0,3)
OA = 2 , OB = 3

Let variable line be $\frac{x}{a}+\frac{y}{b}=1$

OA′ = a , OB′ = b
A′ (a,o) , B′ = (o, b) $\Rightarrow$ a + b = 5

AB′ $\Rightarrow \frac{x}{2}+\frac{y}{b}=1$ A'B $\Rightarrow \frac{x}{a}+\frac{y}{3}=1$

Let P (x,y) be P of intersection of AB′ & A′ B

$\frac{x}{2}+\frac{y}{5-a}=1$ $\frac{x}{a}+\frac{y}{3}=1$

$\frac{x}{2}+\frac{y}{5-\frac{3x}{3-y}}=1$ 3x + ay = 3a

$\Rightarrow a=\frac{3x}{3-y}$ $\Rightarrow \frac{x}{2}+\frac{y(3-y)}{15-5y-3x}=1$

$15x - 5xy - 3x^2 + 6y - 2y^2 = 30 - 10y - 6x$
$3x^2 + 2y^2 + 5xy - 21x - 16y + 30 = 0$
$(x + y - 5)(3x + 2y - 6) = 0$
Hence point of intersection is (–4, 9)

8. $m_{PQ} = m_{RS} = 5$
Let P (β, 2)

$\Rightarrow$ equation of PQ is $\frac{y-2}{x-\beta}=5$

$\Rightarrow Q \equiv (3, 17 - 5\beta)$

and equation of PS is $\frac{y-2}{x-\beta}=-\frac{1}{5}$

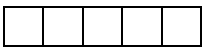
$\Rightarrow S\equiv (-3, \frac{13+\beta}{5})$

mid point of QS is also mid point of PR

$\Rightarrow$ coordinate of $R\equiv\left(-\beta, \frac{88-24\beta}{5}\right)$

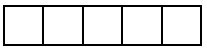
So locus of R is 24x – 5y + 88 = 0

9.



1st box can be filled in 9 ways
2nd box can be filled in 9 ways (repetition is allowed)
3rd box can be filled in 9 ways
4th box can be filled in 9 ways
Now, we have to fill the 5th box carefully such that the number is divisible by 3.
Add the 4 numbers in the first 4 box.
If their sum is in the form 3n. then fill the last box by 3,6 or 9
Similarly their sum is in the form of 3n + 1, then fill the last box in 3 ways by 2, 5 or 8
Similarly their sum is in the form of 3n + 2, then fill the last box in 3 ways by 1, 4 or 7
Therefore, in any case, the last box can be filled in 3 ways only
$\therefore$ Number of five-digit numbers
$= 9\times9\times9\times9\times3 = 3^9$

हल.



1st बॉक्स को भरने के तरीके 9
2nd बॉक्स को भरने के तरीके 9 (अंको की पुनरावृत्ति संभव है)
3rd बॉक्स को भरने के तरीके 9
4th बॉक्स को भरने के तरीके 9
अब, 5th बॉक्स को इस प्रकार भरना है कि संख्या 3 से भाज्य हो जाये इसके लिए प्रथम चार बॉक्स में भरी गई संख्याओं का योग करते है।
यदि योगफल 3n रूप में है तो 5th बॉक्स को 3 या 6 या 9 से भरा जायेगा।
इसी प्रकार योगफल 3n + 1 रूप में है तो 5th बॉक्स को 2 या 5 या 8 से भरा जायेगा।
इसी प्रकार योगफल 3n + 2 रूप में है तो 5th बॉक्स को 1 या 4 या 7 से भरा जायेगा।
इसलिए पांच अंको की कुल संख्याओं की संख्या
$= 9\times9\times9\times9\times3 = 3^9$

10. The possible arrangements of teachers and students can be as follows:
विद्यार्थियों तथा अध्यापको के बैठने के संभावित तरीके निम्न है
(i) TSSTSSTSS
(ii) STSSTSSTS
(iii) SSTSSTSST
Hence, total number of ways = 3.(3!)6!
= (18)6!
अतः कुल तरीके = 3.(3!)6! = (18)6!

11. $\frac{1}{2}$.c.BD.sinθ = $\frac{\sqrt{3}}{2}$.a.sin(45° –θ) BD

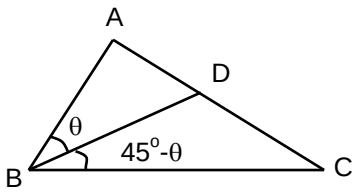
$\frac{c}{a}=\frac{\sqrt{3}\sin\left(45^o-\theta\right)}{\sin\theta}$

$\frac{\frac{\sqrt{3}}{2}}{\frac{\sqrt{3}+1}{2\sqrt{2}}}=\frac{\frac{\sqrt{3}}{\sqrt{2}}\left(\cos\theta-\sin\theta\right)}{\sin\theta}$

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

$$\frac{2\sqrt{3}}{\sqrt{3}+1} = \cot\theta - 1$$

$$\cot\theta = \sqrt{3}$$



12. $\dfrac{(2R)^3(\sin^3 A + \sin^3 B + \sin^3 C)}{\sin^3 A + \sin^3 B + \sin^3 C} = 8$

$\Rightarrow [R = 1]$

Greatest length of a side of a triangle inscribed in a circle can be equal to diameter of the circle.

वृत्त के अन्तर्गत त्रिभुज की एक भुजा की अधिकतम लम्बाई वृत्त के व्यास के बराबर हो सकते है।

Hence maximum value of a = 2

अतः a का अधिकतम मान 2 है।

13. $\because \dfrac{2}{1!9!} + \dfrac{2}{3!7!} + \dfrac{1}{5!5!} = \dfrac{2^m}{n!}$

$$\frac{1}{10!}\left\{\frac{2\times 10!}{1!9!} + \frac{2\times 10!}{3!7!} + \frac{10!}{5!5!}\right\} = \frac{2^m}{n!}$$

$$\Rightarrow \frac{1}{10!}\left\{2\,{}^{10}C_1 + 2\,{}^{10}C_3 + {}^{10}C_5\right\} = \frac{2^m}{n!}$$

$$\Rightarrow \frac{1}{10!}\left\{2\,{}^{10}C_1 + 2\,{}^{10}C_3 + {}^{10}C_5\right\} = \frac{2^m}{n!}$$

$$\Rightarrow \frac{1}{10!}(2)^{10-1} = \frac{2^m}{n!}$$

$\therefore$ m = 9 and n = 10

Here, x – y + 1 = 0 and x + y + 3 = 0 are perpendicular to each other, then orthocentre is the point of intersection which is (–2, –1)

$\therefore$ –2 = 2m – 2n

and –1 = m – n

$\therefore$ Point is (2m – 2n, m – n).

हल. $\because \dfrac{2}{1!9!} + \dfrac{2}{3!7!} + \dfrac{1}{5!5!} = \dfrac{2^m}{n!}$

$$\frac{1}{10!}\left\{\frac{2\times 10!}{1!9!} + \frac{2\times 10!}{3!7!} + \frac{10!}{5!5!}\right\} = \frac{2^m}{n!}$$

$$\Rightarrow \frac{1}{10!}\left\{2\,{}^{10}C_1 + 2\,{}^{10}C_3 + {}^{10}C_5\right\} = \frac{2^m}{n!}$$

$$\Rightarrow \frac{1}{10!}\left\{2\,{}^{10}C_1 + 2\,{}^{10}C_3 + {}^{10}C_5\right\} = \frac{2^m}{n!}$$

$$\Rightarrow \frac{1}{10!}(2)^{10-1} = \frac{2^m}{n!}$$

$\therefore$ m = 9 और n = 10

यहाँ, x – y + 1 = 0 और x + y + 3 = 0 एक दूसरे के लम्बवत् है अतः लम्बकेन्द्र प्रतिच्छेद बिन्दु है जो कि (–2, –1) है।

$\therefore$ –2 = 2m – 2n और –1 = m – n

$\therefore$ बिन्दु (2m – 2n, m – n) है.

14. $\because 3^{4n} = 81^n = (1 + 80)^n = 1 + 80\lambda,\ \lambda \in N$

$\therefore 3^{3^{4n}} = 3^{1+80\lambda} = 3.3^{80\lambda} = 3 \,.\, (9)^{40\lambda}$

$= 3(10 - 1)^{40\lambda}$

$= 3(1 + 10\mu) = 3 + 30\mu$

$\therefore$ Last digit of $3^{3^{4n}} + 1$ is 4.

हल. $\because 3^{4n} = 81^n = (1 + 80)^n = 1 + 80\lambda,\ \lambda \in N$

$\therefore 3^{3^{4n}} = 3^{1+80\lambda} = 3.3^{80\lambda} = 3 \,.\, (9)^{40\lambda}$

$= 3(10 - 1)^{40\lambda}$

$= 3(1 + 10\mu) = 3 + 30\mu$

$\therefore 3^{3^{4n}} + 1$ का अन्तिम अंक 4 है।

15. The no. of ways of arranging 2's is ${}^{15}C_4$.
Fill the first empty position left after arranging the 2's with a
0 (1 way) and pick the remaining five places from the position
of remaining five zeros ${}^{10}C_5$ ways.
$\therefore {}^{15}C_4 \times 1 \times {}^{10}C_5$

16. Put a '0' in the first position (1 way). Pick five other positions for the remaining 0's (${}^{14}C_5$ ways), put a '1' in the first of the remaining positions (1 way), then arrange the remaining four 1 's (${}^{8}C_4$ ways) ${}^{14}C_5 \times {}^{8}C_4$

17. Let the parametric equation of the line drawn be $x = r\cos\theta$, $y = r\sin\theta$
Putting it in L_1

$\therefore$ $r\sin\theta = r\cos\theta + 10$

$$\frac{1}{OA} = \frac{\sin\theta - \cos\theta}{10}$$

Putting it in L_2

$$\frac{1}{OB} = \frac{\sin\theta - \cos\theta}{20}$$

Let P = (h, k) and OP = r

$h = r\cos\theta$ $k = r\sin\theta$

$$\frac{2}{r} = \left(\frac{\sin\theta - \cos\theta}{10}\right) + \frac{\sin\theta - \cos\theta}{20}$$

3y – 3x = 40

हल. माना कि रेखा का प्राचलिक समीकरण $x = r\cos\theta$ और $y = r\sin\theta$ है।

इसे L_1 में रखने पर

$\therefore$ $r\sin\theta = r\cos\theta + 10$

$$\frac{1}{OA} = \frac{\sin\theta - \cos\theta}{10}$$

इसे L_2 में रखने पर

$$\frac{1}{OB} = \frac{\sin\theta - \cos\theta}{20}$$

माना P = (h, k) और OP = r

$h = r\cos\theta \qquad k = r\sin\theta$

$$\frac{2}{r} = \left(\frac{\sin\theta - \cos\theta}{10}\right) + \frac{\sin\theta - \cos\theta}{20}$$

$3y - 3x = 40$

18. $$r^2 = \frac{10 \text{ x } 20}{(\sin\theta - \cos\theta)^2} \Rightarrow (y - x)^2 = 200$$

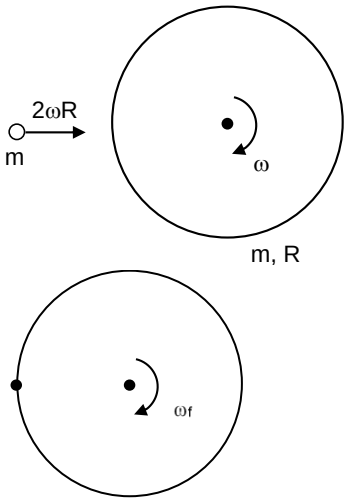
PART-II: PHYSICS

19. Sphere is rotating about a diameter
गोला, व्यास के सापेक्ष घूर्णन कर रहा हैं अतः
so अतः, $a = \alpha R$
but, R is zero for particles on the diameter.
लेकिन व्यास पर स्थित बिन्दुओ के लिये R शून्य होगा

20. (A) Their velocities are interchanged
इनके वेग परस्पर परिवर्तित हो जाते है।
(B) Their speeds are interchanged
इनकी चालें परस्पर परिवर्तित हो जाती है।
(C) Their momenta are interchanged
इनके संवेग परस्पर परिवर्तित हो जाते है।
(D) The faster body slows down and the slower body speeds up.
तीव्रगामी वस्तु धीमी हो जाती है तथा धीमी वस्तु तेज हो जाती है।

21. (A) During a period of 1 year displacement is equal to zero, so that average velocity is equal to zero.
(B) During a period of one year distance travel is not equal to zero. So that average speed is not equal to zero.
(C) During a period of first 6 month of the year change in velocity not equal to zero. So that average acceleration is not equal to zero.
(D) In uniform circular motion instantaneous acceleration is act towards centre of circular path.
(A) एक वर्ष के दौरान विस्थापन शून्य है, अतः औसत वेग शून्य होगा।
(B) एक वर्ष में तय दूरी शून्य नहीं होती, अतः औसत चाल शून्य नहीं होगी।
(C) एक वर्ष में प्रथम 6 माह के दौरान वेग परिवर्तन शून्य नहीं है, अतः औसत त्वरण शून्य नही होगा।
(D) नियत वृत्तीय गति में तात्क्षणिक त्वरण वृत्तीय पथ के केन्द्र की ओर क्रियाशील होता है।

22.



conserving angular momentum about centre of disc
चकती के केन्द्र के सापेक्ष कोणीय वेग संरक्षण करने पर

$$\frac{1}{2}mR^2\omega = \left(mR^2 + \frac{1}{2}mR^2\right)\omega_f$$

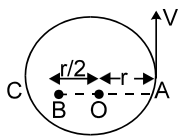
$$\Rightarrow \omega_f = \frac{\omega}{3}$$

Impulse on particle कण पर आवेग = $\Delta\vec{P}$

$$\vec{P}_i = 2m\omega R\,\hat{i} \; ; \; \vec{P}_f = m\omega_f R\hat{j} = \frac{m\omega R}{3}\hat{j}$$

$$\left|\Delta\vec{P}\right| = \sqrt{(2m\omega R)^2 + \left(\frac{m\omega R}{3}\right)^2} = \frac{\sqrt{37}}{3}m\omega R$$

23.

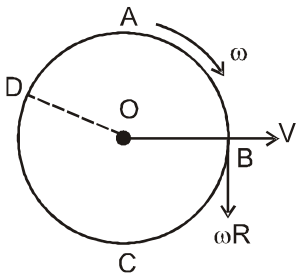


$$\frac{\omega_{Ao}}{\omega_{AB}} = \frac{v/r}{v/\frac{3r}{2}} = \frac{v/r}{2v/3r}$$

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

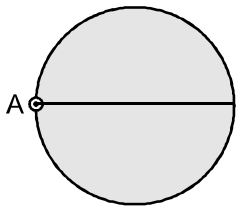
$$\omega_{AC} = \frac{v}{2r} = \frac{\omega}{2}$$

24.



for pure rolling
शुद्ध लौटनी गति के लिए
$V = \omega R$
$V_A = 2V$
$V_B = \sqrt{2}\,V$
$(V_C = 0)$

25.



Moment of inertia of a complete disc about point A is $\frac{MR^2}{2} + MR^2 = \frac{3}{2}MR^2$

सम्पूर्ण चकती का बिन्दु A के परितः जड़त्व आघूर्ण है $\frac{MR^2}{2} + MR^2 = \frac{3}{2}MR^2$

Moment of inertia of a semi–disc of same mass $= \frac{3}{2}\ MR^2$.

समान द्रव्यमान की अर्ध चकती का जड़त्व आघूर्ण होगा $= \frac{3}{2}MR^2$

26. KE at maximum height
अधिकतम् ऊँचाई पर गतिज ऊर्जा

$\frac{1}{2}mu^2\cos^2 60^0 = 10\ J$

$\frac{1}{2}mu^2 = 40\ J$

$Mg\ H_{max} = 30\ J$ .....(1)

when जब PE = KE

PE = 20 = KE

$\Rightarrow$ $mgh = 20$ .....(2)

from (1) and (2)
((1) तथा (2) से)

$\frac{h}{H_{max}} = \frac{2}{3}$

27. Using moment of conservation
संवेग संरक्षण के उपयोग से

$mv + 2m(0) = mv_1 + 2mv_2$

$v_1 + 2v_2 = v$ ...(i)

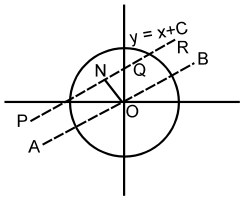
and तथा $e = 1 = \frac{v_2 - v_1}{v - 0}$

$v_2 - v_1 = v$ ...(ii)

from eq. (i) and (ii) समीकरण (i) तथा (ii) से

$v_1 = \frac{v}{3}$ $\qquad \frac{K_{ini}}{K_{final}} = \frac{\frac{1}{2}mv^2}{\frac{1}{2}m\left(\frac{v}{3}\right)^2} = \frac{9}{1}$

28.



$I_{PQR} = I_{AOB} + M.(ON)^2$

$I_{PQR} = \frac{1}{4}MR^2 + M\left(\frac{C}{\sqrt{2}}\right)^2$.

But $\qquad I_{PQR} = \frac{1}{2}MR^2$

$\therefore \qquad C = \pm\frac{R}{\sqrt{2}}$.

Hence (B) is correct.
अतः B सही हैं

29. $mgR\left(1-\frac{2}{\pi}\right) = I\alpha$

$I = mR^2 - m\left(\frac{2R}{\pi}\right)^2 + m\left(R - \frac{2R}{\pi}\right)^2$

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

$mgR\left(1-\frac{2}{\pi}\right) = 2mR^2\left(1-\frac{2}{\pi}\right)\alpha\ \left(\alpha = \frac{g}{2R}\right)$

$= 1\ rad/sec^2$

30. $T_1\frac{\ell}{4} = T_2\frac{\ell}{2}$ $\qquad \frac{T_1}{T_2} = 2$

31. $T = 2\pi\sqrt{\frac{I}{mg\ell}}$, $I = m\ell^2 + m(2\ell)^2 = 5m\ell^2$

$= 2\pi\sqrt{\frac{5m\ell^2}{2mg\frac{3\ell}{2}}} = 2\pi\sqrt{\frac{5\ell}{3g}}$

$\therefore \qquad L_{eq} = \frac{5\ell}{3}$

32. Particle is starting from rest, i.e. from one of its extreme position.

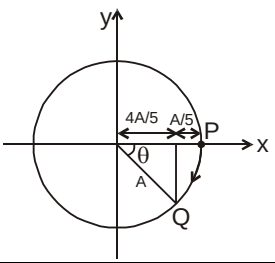
As particle moves a distance $\frac{A}{5}$, we can represent it on a circle as shown.
कण स्थिर अवस्था से चलना प्रारम्भ करता है अर्थात अपने किसी अन्त्य बिन्दु में चलना प्रारम्भ करता है।

जैसे कि कण, $\frac{A}{5}$ दूरी तय करता है, इसे एक वृत्त पर दर्शाया जा सकता है।

$\cos\theta = \frac{4A/5}{A} = \frac{4}{5}$ $\qquad \theta = \cos^{-1}\left(\frac{4}{5}\right)$

$\omega t = \cos^{-1}\left(\frac{4}{5}\right)$ $\qquad t = \frac{1}{\omega}\cos^{-1}\left(\frac{4}{5}\right)$

$= \frac{T}{2\pi}\cos^{-1}\left(\frac{4}{5}\right)$



Method : As starts from rest i.e. from extreme position $x = A \sin(\omega t + \phi)$
द्वितीय विधिः चुंकि कण स्थिरावस्था से गति करता है अर्थात अन्त्य बिन्दु से गति करता है।
$x = A \sin(\omega t + \phi)$

At t = 0 पर ; $x = A \Rightarrow \phi = \frac{\pi}{2}$

$\therefore A - \frac{A}{5} = A \cos \omega t$

$\frac{4}{5} = \cos \omega t \Rightarrow \omega t = \cos^{-1} \frac{4}{5}$

$t = \frac{T}{2\pi} \cos^{-1}\left(\frac{4}{5}\right)$

33. As speed of ball is variable, so motion is non uniform circular motion.
चूंकि गेंद की चाल परिवर्ती है अतः असमान वृत्तीय गति है।

34. At the highest position of ball, net tangential force is zero, hence tangential acceleration of ball is zero,
सबसे उच्चतम स्थिति पर गेंद का स्पर्श रेखीय त्वरण शून्य होगा,

35. 1

36. $m_A \times 0.8 = m_A \times 0.2 + m_B \times 1.0$
$m_A \times 0.6 = m_B \times 1.0$ $m_B = 0.6 m_A$

$e = \frac{1-0.2}{0.8} = 1$

$I_d = 6 \times 0.5 - 6 \times 0 = 3N - sec.$
$= 10 \times \{0.8 - 0.5\} = 10 \times 0.3 = 3$ NS

$\Delta U = \frac{1}{2} \times 10 \times (0.8)^2 - \frac{1}{2} \times 10 \times (0.5)^2$
$= 5 \times 0.64 \quad 8 \times 0.25$
$= 3.2 - 2.0 = 1.2$ J

PART-III: CHEMISTRY

38. $q = +950$ J
$\Delta v = (14 - 4) = 10$ lit
$W = -P \times \Delta v$
$= -10$ bar lit
$= -10 \times 100 = -1000$
$\Delta E = q + W$
$= 950 - 1000$
$= -50$ J

39. For reaction $\Delta n < 0$ so high pressure is favoured for forward reaction.
Reaction is endothermic so high temperature favours forward reaction.

हल. अभिक्रिया के लिए $\Delta n < 0$ अतः उच्च दाब अग्र अभिक्रिया के लिए अनुकूल होता है।
अभिक्रिया ऊष्माशोषी है अतः उच्च ताप अग्र अभिक्रिया के लिए अनुकूल होता है।

40. B and N can not expand their octet due to absence of d-orbital.
B व N में d-कक्षक की अनुपस्थिति के कारण अपना अष्ठक प्रसारित नही कर सकता है।

41. SO_3 ($2p\pi - d\pi$)
P_4O_{10} ($4p\pi - d\pi$)
H_2SO_4 ($2p\pi - d\pi$)

42. It is based on definition.
यह परिभाषा पर आधारित है।

44. $N_2O_4 \rightleftharpoons 2NO_2$
$1 - \alpha \quad 2\alpha$

$\frac{D}{d} = 1 + (n - 1)\alpha$

$\Rightarrow \frac{46}{69/2} = 1 + \alpha \Rightarrow \frac{4}{3} = 1 + \alpha$

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

$K_P = \frac{4\alpha^2}{1-\alpha^2} . P$

$\Rightarrow K_P = \frac{4 \times \frac{1}{9}}{1 - \frac{1}{9}} . 2$

45. $X(s) \rightleftharpoons A(g) + 2B(g)$
$a \quad (2a + 2b)$
$Y(s) \rightleftharpoons C(g) + 2B(g)$
$b \quad (2a + 2b)$

$\frac{K_{p_1}}{K_{p_2}} = \frac{a}{b} = 2 \Rightarrow a = 2b$

$K_{P_1} = a(2a + 2b)^2$

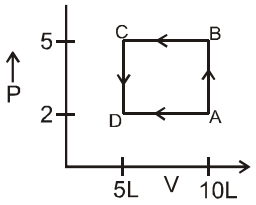
$\Rightarrow 9 \times 10^{-3} = 2b(6b)^2$
$\Rightarrow 9 \times 10^{-3} = 2b \times 36b^2$

$\frac{9 \times 10^{-3}}{72} = b^3 = \frac{1}{8} \times 10^{-3}$

$\Rightarrow \frac{1}{2} \times 10^{-1} = b \Rightarrow 0.05 = b$

$\Rightarrow a = 2 \times 0.05 = 0.10$ atm
Total pressure of gases
(गैसों का कुल दाब) $= P_A + P_B + P_C$
$= 3(a+b)$
$= 3(0.15) = 0.45$ atm

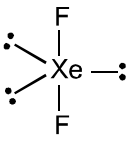
46.

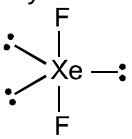


$W_{ABCD} = 3 \times 5 = 15$ atm
$q_{ABCD} = -W_{ABCD}$

47. (A) Due to the presence of formal charges
(B) According to MOT bond length of
$O_2^- > O_2^+$
(D) H_2O : 104.5º, OF_2 : 103° and OCl_2 : 111°.

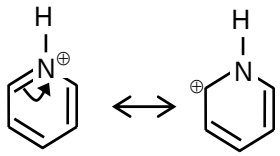
हल. (A) औपचारिक आवेशों की उपस्थिति के कारण
(B) MOT के अनुसार बंध लम्बाई का क्रम
$O_2^- > O_2^+$
(D) H_2O : 104.5º, OF_2 : 103° और OCl_2 : 111°.

48.  Steric number = 5 ;
Hybridisation = sp^3d.

हल.  त्रिविम संख्या = 5 ;
संकरण = sp^3d.

49. All are isoelectronic species having 10 electrons in each species but different nuclear charge and thus ionic radius $\propto \frac{1}{\text{Nuclear charge}}$.
So correct order is ${}_9F^- < {}_8O^{2-} < {}_7N^{3-}$.

हल. सभी समइलेक्ट्रॉनिक स्पीशीज हैं, क्योंकि सभी में इलेक्ट्रॉनों की संख्या समान (10) है परन्तु नाभिकीय आवेश अलग–अलग हैं तथा इस प्रकार
आयनिक त्रिज्या $\propto \frac{1}{\text{नाभिकीय आवेश}}$
इसलिए सही क्रम ${}_9F^- < {}_8O^{2-} < {}_7N^{3-}$ है।

50. 

51. P v/s $\frac{1}{V}$
Slope = nRT = 22.4 atm L

$$W = -nRT\ell n\left(\frac{V_2}{V_1}\right)$$

$$W = +22.4\ell n\left(\frac{11.2}{22.4}\right)$$

$$W = 22.4\ell n\ 2$$

$$W = 22.4 \times 0.7 = 15.68 \text{ atm L}$$

हल. P v/s $\frac{1}{V}$
ढ़ाल = nRT = 22.4 atm L

$$W = -nRT\ell n\left(\frac{V_2}{V_1}\right)$$

$$W = +22.4\ell n\left(\frac{11.2}{22.4}\right)$$

$$W = 22.4\ell n\ 2$$

$$W = 22.4 \times 0.7 = 15.68 \text{ atm L}$$

52. Work done in irreversible process $= -P_{ex}(\Delta V)$
At constant temperature $P_1V_1 = P_2V_2$
In (a),

$$2 \times 8 = 10 \times V_2$$

$V_2 = 1.6$ L
$\Delta V = 1.6 - 8 = -6.4$ L
W = – 10 (–6.4) = 64 L bar
In (b),

$$V_2 = \frac{2 \times 8}{20} = 0.8 \text{ L}$$

$\Delta V = 0.8 - 1.6 = -0.8$ L
$w = -P_{ext}(\Delta V) = -20(-0.8) = 16$ L bar
Total work $= w_a + w_b =$ 64 + 16 = 80 L bar

हल. अनुत्क्रमणीय प्रक्रम में किया गया कार्य = $-P_{ex}(\Delta V)$
नियत ताप पर $P_1V_1 = P_2V_2$
(a) में,

$$2 \times 8 = 10 \times V_2$$

$V_2 = 1.6$ L
$\Delta V = 1.6 - 8 = -6.4$ L
W = – 10 (–6.4) = 64 L bar
(b) में,

$$V_2 = \frac{2 \times 8}{20} = 0.8 \text{ L}$$

$\Delta V = 0.8 - 1.6 = -0.8$ L
$w = -P_{ext}(\Delta V) = -20(-0.8) = 16$ L bar
कुल कार्य $= w_a + w_b =$ 64 + 16 = 80 L bar

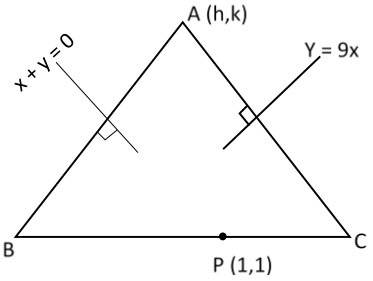
53. (A) A.B.M.O. are formed by the linear combination of two atomic orbitals when their wave functions are subtracted.
(B) the electron density increases between the nuclei of B.M.O.
(C) It is false.
(D) The energy of B.M.O. is always less than energies of the combining atomic orbitals
(A) A.B.M.O. का निर्माण दो परमाण्वीय कक्षकों के रेखीय संयोजन द्वारा होता है जब इनके तरंग फलन घटात्मक रूप से संयोजित होते है।
(B) B.M.O. के नाभिको के मध्य इलेक्ट्रॉन घनत्व में वृद्धि होती है।
(C) यह असत्य है।
(D) B.M.O. की ऊर्जा, संयोजित होने वाले परमाणु कक्षकों की ऊर्जाओं से सदैव कम होती है।

54. (A) Total energy of system decreases
(C) The bond order of a molecule is half of difference in number of bonding and antibonding electrons.
(A) निकाय की कुल ऊर्जा घटती है।
(C) अणु का बन्ध क्रम बन्धी व प्रतिबन्धी इलेक्ट्रॉनों की संख्या में अन्तर का आधा होता है।

PAPER-2

PART-I: MATHEMATICS

1.



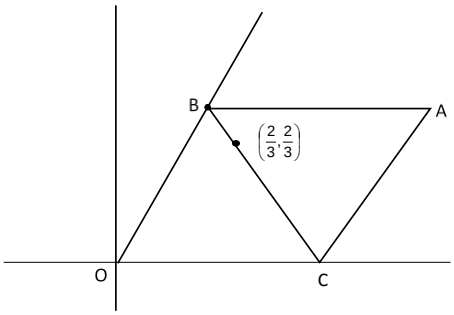
B is image of A about $y = -x$
$\Rightarrow$ B $(-k, -h)$
C is image of A about $y = 9x$
$\Rightarrow C\left(\frac{9k-40h}{41}, \frac{9h+40k}{41}\right)$
Slope of PB = slope of PC

$$\frac{1+h}{1+k} = \frac{1-\left(\frac{9h+40k}{41}\right)}{1-\left(\frac{9k-40h}{41}\right)}$$

$$\frac{1+h}{1+k} = \frac{41-9h-40k}{41+40h-9k}$$

$40(h^2 + k^2) + 90h - 10k = 0$
hence locus of (h, k) is $4(x^2 + y^2) + 9x - y = 0$

2.



Let $B = \left(\alpha, \frac{4\alpha}{3}\right)$ hence $OC = OB = \frac{5\alpha}{3}$

$\Rightarrow C\left(\frac{5\alpha}{3}, 0\right)$

$$\text{slope of BC} = \frac{\frac{4\alpha}{3}-0}{\alpha-\frac{5\alpha}{3}} = \frac{\frac{2}{3}-0}{\frac{2}{3}-\frac{5\alpha}{3}}$$

$$\Rightarrow -2 = \frac{\frac{2}{3}}{\frac{2}{3}-\frac{5\alpha}{3}} \Rightarrow \alpha = \frac{3}{5}$$

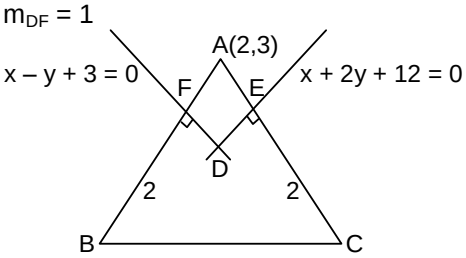
$$A \equiv \left(\alpha + \frac{5\alpha}{3}, \frac{4\alpha}{3}\right) \equiv \left(\frac{8\alpha}{3}, \frac{4\alpha}{3}\right) = \left(\frac{8}{5}, \frac{4}{5}\right)$$

3. $x^3 - 3x^2 + 6x + 1 = 0$ (p, q, r)
$p + q + r = 3$, $pq + qr + pr + rp = 6$, $pqr = -1$

$$\text{Centroid} \equiv \left(\frac{pq+qr+rp}{3}, \frac{\frac{1}{pq}+\frac{1}{qr}+\frac{1}{rp}}{3}\right)$$

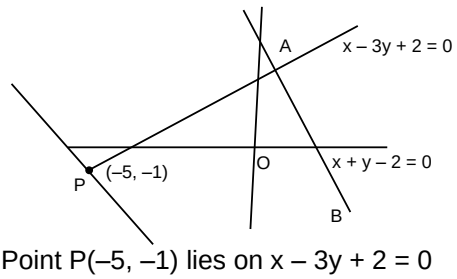
$$\equiv \left(\frac{6}{3}, \frac{p+q+r}{3pqr}\right) \equiv (2, -1)$$

4. $m_{DF} = 1$



$m_{AB} = -1$
$AB \equiv y - 3 = -1(x - 2) \Rightarrow x + y = 5$
$m_{DE} = -\frac{1}{2} \Rightarrow m_{AC} = 2$
$AC \equiv y - 3 = 2(x - 2) \Rightarrow 2x - y = 1$
$\Rightarrow$ E (–2, –5) and F(1, 4)
$\Rightarrow$ B(–1, 6) and C(–10, –21)
$\Delta DBC = \frac{1}{2}|-6(6 + 21) - (-21 + 3) - 10(-3 - 6)| = 27$

5. $x^2 - 3y^2 - 2xy + 8y - 4 = 0$
$\Rightarrow$ $x - 3y + 2 = 0$ and $x + y - 2 = 0$



Point P(–5, –1) lies on $x - 3y + 2 = 0$
If origin lies inside the triangle then maximum slope

$\Rightarrow$ $-1 < M_{PB} < \frac{1}{5}$

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

$\left|a+\frac{1}{b}\right| = 4$

6 Each family consist of parallel lines and in each family there are 3 pair of lines which has a distance of $\sqrt{2}$ unit between them. So square formed by these pair one from each family will have diagonal of 2 unit. Total no. of such squares = 3 × 3 = 9

हल. प्रत्येक निकाय समान्तर सरल रेखाओं को प्रदर्शित करता है। प्रत्येक निकाय मे समान्तर सरल रेखाओं के 3 युग्म इस प्रकार है कि उनके मध्य दूरी $\sqrt{2}$ इकाई है अतः इन युग्मों से बनने वाले वर्गो के विकर्णों की लम्बाई 2 इकाई है।

इसलिए बनने वाले वर्गो की संख्या = 3 × 3 = 9

7. Given $m \le 30,\ n \le 30$

$\Rightarrow$ Total cases = $30 \times 30 = 900$

Required condition: $2n \ge m$ and $2m \ge n$

Let us find ordered pairs (m, n) such that $2n < m$ and $2m < n$. By symmetry we will get same answer for both conditions. Hence,

let us evaluate only one $2m < n$

Value of n	Number of Points (m,n)
1,2	0
3,4	1
5,6	2
…	
29,30	14

$\therefore$ Required Number

$= 900 - 2 \times 2\sum_{r=0}^{14} r = 480$

8. Here the sum of the numbers on six cards vanishes.

Case I: If selected 3 cards each of number–1 or 1 i.e

Number of arrangements = $\frac{6!}{3!3!}$ = 20

Case II: If selected 2 cards each of no. –1,0 or 1 i.e

Number of arrangements = $\frac{6!}{2!2!2!}$ = 90

Case III: If selected one card each of number-1 and 1 and 4 cards of no. 0.

Number of arrangements = $\frac{6!}{1!1!4!}$ =30

Case IV: If all cards selected from the no. 0

No. of arrangements = $\frac{6!}{6!} = 1$

Hence total no. of arrangements are 20 + 90 + 30 + 1 = 141

9. $(1+2x)^{10} + (1+2x)^{11} + ... + (1+2x)^{20}$

$= (1+2x)^{10}\frac{\left[(1+2x)^{11}-1\right]}{(1+2x)-1}$

$= \frac{(1+2x)^{21}-(1+2x)^{10}}{2x}$

coeff. of x^{12} का गुणांक = $^{21}C_{13}\frac{2^{13}}{2}$

= $^{21}C_{13}2^{12}$

10. $\left(1-2x^3+3x^5\right)\left(\sum_{r=0}^{n} {}^nC_r\left(\frac{1}{x}\right)^r\right)$

coefficient of x = - 2 x $^nC_2$ + 3x $^nC_4$ = 154

$\Rightarrow -n(n-1)+\frac{3n(n-1)(n-2)(n-3)}{4\cdot3\cdot2\cdot1}=154$

$\Rightarrow$ $n^4 - 6n^3 + 3n^2 + 2n = 1232$

Possible value from options, n = 8

हल. $\left(1-2x^3+3x^5\right)\left(\sum_{r=0}^{n} {}^nC_r\left(\frac{1}{x}\right)^r\right)$

x का गुणांक = – 2 x $^nC_2$ + 3x $^nC_4$ = 154

$\Rightarrow -n(n-1)+\frac{3n(n-1)(n-2)(n-3)}{4\cdot3\cdot2\cdot1}=154$

$\Rightarrow$ $n^4 - 6n^3 + 3n^2 + 2n = 1232$

विकल्प से संभावित मान n = 8 है।

11. $\Delta = \frac{1}{2}ab\sin C$

$\Rightarrow 15\sqrt{3} = \frac{1}{2}x6x10x\sin C$

$\Rightarrow \sin C = \frac{\sqrt{3}}{2}$

$\angle ACB$ is obtuse अधिक कोण $\Rightarrow C = 120^0$

$c = \sqrt{a^2+b^2-2ab\cos C}$

c = 14 cm

$r = \frac{\Delta}{s}$

$\Rightarrow r = \sqrt{3}$

$r^8 = 81$

12. $\frac{1}{r_1}, \frac{1}{r_2}, \frac{1}{r_3}$ are in A.P.

$\frac{s-a}{\Delta}, \frac{s-b}{\Delta}, \frac{s-c}{\Delta}$ are in A.P.

a, b, c are in A.P.

$\boxed{2b = a + c}$

हल. $\frac{1}{r_1}, \frac{1}{r_2}, \frac{1}{r_3}$ समान्तर श्रेढी में है।

$\frac{s-a}{\Delta}, \frac{s-b}{\Delta}, \frac{s-c}{\Delta}$ समान्तर श्रेढी में है।

a, b, c समान्तर श्रेढी में है।

$\boxed{2b = a + c}$

13. The cases for a_1 {H, T} i.e.. $a_1 = 2$
The case for a_2 : (HT, TH. TT}. $a_2 = 3$
For $n \geq 3$. if the first outcome is H. then next just T and then $\mathbf{a_{n-2}}$
If the first outcome is T. then a_{n-1} should follow'.
So. $a_n = 1 \times 1 \times a_{n-2} + 1 \times a_{n-1} \Rightarrow a_n = a_{n-2} + a_{n-1}$
So. $a_3 = a_1 + a_2 = 5$, $a_4 = 3+5= 8$ and so on

14. Let the angle be A = x – d, B = x, C = x + d.
Then x – d + x + x + d = 180° $\Rightarrow$ x = 60°.
Therefore, two larger anglesw are B = 60° and C.
Here b = 9 and c = 10

Now, $\cos B = \dfrac{c^2 + a^2 - b^2}{2ac}$

$\Rightarrow \quad \dfrac{1}{2} = \dfrac{100 + a^2 - 81}{20a}$

$\Rightarrow \quad a^2 - 10a + 19 = 0$

$\Rightarrow \quad a = 5 \pm \sqrt{6}$

हल. माना कोण A = x – d, B = x, C = x + d.
तब x – d + x + x + d = 180° $\Rightarrow$ x = 60°
इसलिए दो बडे कोण B = 60° और C है।
अतः b = 9 और c = 10 है।

अब, $\cos B = \dfrac{c^2 + a^2 - b^2}{2ac}$

$\Rightarrow \quad \dfrac{1}{2} = \dfrac{100 + a^2 - 81}{20a}$

$\Rightarrow \quad a^2 - 10a + 19 = 0$

$\Rightarrow \quad a = 5 \pm \sqrt{6}$

15. $A = C_0C_2 + C_1C_3 + ... + C_{m-2}C_m - C_0C_2$
$\Rightarrow {}^{2m}C_{m-2} - {}^{m}C_2$
and और $C_0^{\,2} + C_1^{\,2} + ... + C_m^{\,2} = {}^{2m}C_m$

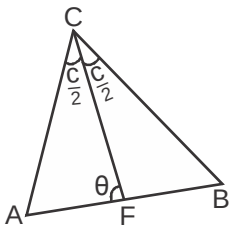
16. Coefficients of r^{th}, $(r + 1)^{th}$ and $(r +2)^{th}$ terms are ${}^{14}C_{r-1}$, ${}^{14}C_r$ and ${}^{14}C_{r+1}$
r oki in, (r + 1)वाँ और (r +2) वाँ पद के गुणांक ${}^{14}C_{r-1}$, ${}^{14}C_r$ तथा ${}^{14}C_{r+1}$
If these coefficients are in A.P., then $2({}^{14}C_r) = {}^{14}C_{r-1} + {}^{14}C_{r+1}$
यदि ये गुणांक समान्तर श्रेणी में है तब $2({}^{14}C_r) = {}^{14}C_{r-1} + {}^{14}C_{r+1}$

$\Rightarrow \dfrac{2(14)!}{r!(14-r)!} = \dfrac{(14)!}{(r-1)!(15-r)!} + \dfrac{(14)!}{(r+1)!(13-r)!}$

$\Rightarrow \dfrac{2(14)!}{r!(14-r)!} + \dfrac{(14)![(r+1)r + (15-r)(14-r)]}{(r+1)!(15-r)!}$

$\Rightarrow 2(15 - r)(r + 1) = 2r^2 - 28r + 210$
$\Rightarrow r^2 - 14r + 45 = 0$
$\Rightarrow (r - 5)(r - 9) = 0 \quad \Rightarrow r = 5$ or 9

17.



$\Delta = \Delta_1 + \Delta_2$

$\Rightarrow \dfrac{1}{2}ab\sin C = \dfrac{1}{2}(b)(CF)\sin\dfrac{C}{2} + \dfrac{1}{2}(a)(CF)\sin\left(\dfrac{C}{2}\right)$

$\Rightarrow ab\sin C = CF\sin\left(\dfrac{C}{2}\right)(a+b)$

$\Rightarrow CF = \dfrac{2ab\sin\left(\dfrac{C}{2}\right)\cos\left(\dfrac{C}{2}\right)}{(a+b)\sin\left(\dfrac{C}{2}\right)}$

$\Rightarrow CF = \dfrac{2ab\cos\left(\dfrac{C}{2}\right)}{a+b}$

Also in ΔCFB में $\dfrac{CF}{\sin B} = \dfrac{a}{\sin(\pi - \theta)}$

$\Rightarrow CF = \dfrac{a\sin B}{\sin(B + \dfrac{C}{2})} \left(\because \theta = B + \dfrac{C}{2}\right)$

$= \dfrac{b\sin A}{\sin(B + \dfrac{C}{2})} \quad \left(\because \dfrac{a}{\sin A} = \dfrac{b}{\sin B}\right)$

18. Equation of line
(A) $y - 2 = m(x - 8)$ and $m < 0$

$\Rightarrow \quad P\left(8 - \dfrac{2}{m}, 0\right)$ and Q(0, 2 – 8m)

OP + OQ = $\left|8 - \dfrac{2}{m}\right| + |2 - 8m|$

$= 10 + \dfrac{2}{(-m)} + 8(-m) \geq 10 + 2\sqrt{\dfrac{2}{(-m)} \times 8(-m)} \geq 18.$

Area of ΔOPQ is minimum when (8,2) is midpoint of line. So, P(16, 0), Q(0,4)
$\Delta OPQ = \dfrac{1}{2}(16)(4) = 32.$

हल. रेखा का समीकरण
(A) $y - 2 = m(x - 8)$ और $m < 0$

$\Rightarrow \quad P\left(8 - \dfrac{2}{m}, 0\right)$ और Q(0, 2 – 8m)

$$OP + OQ = \left|8 - \frac{2}{m}\right| + |2 - 8m| = 10$$

$$+ \frac{2}{(-m)} + 8(-m) \geq 10 + 2\sqrt{\frac{2}{(-m)} \times 8(-m)} \geq 18.$$

ΔOPQ का क्षेत्रफल न्यूनतम होगा जब रेखा का मध्य बिन्दु (8,2) है।

इसलिए P(16, 0), Q(0,4) $\Delta OPQ = \frac{1}{2}$ (16) (4) = 32 है।

PART-II: PHYSICS

19. For maximum speed,
अधिकतम् चाल के लिए

$$\frac{dv}{dt} = 0 \Rightarrow \quad a = 0$$

If at maximum speed, elongation is x, then
यदि अधिकतम् चाल पर विस्तार x है, तब

$$F = kx \Rightarrow \quad x = \frac{F}{k}$$

Now, by WET,
अब, कार्य ऊर्जा प्रमेय से

$$-\frac{1}{2}kx^2 + Fx = \frac{1}{2}mv^2$$

$$\therefore \quad V = \frac{F}{\sqrt{mk}} = 6\ m/s$$

20. Since it does not topple, for limiting condition. N should pass through A. The torque about A must be zero.
चुंकि यह पलटता नहीं है, सीमान्त स्थिति के लिए N, A से गुजरेगा। A परितः बलाघूर्ण शून्य होगा।

$$\therefore \quad \tan\theta = \frac{R}{h/2}$$

$$\Rightarrow \quad h = \frac{2R}{\tan\theta} = \frac{2 \times 2}{4/3}\ m$$

21. Maximum tension in string at lowest
डोरी में अधिकतम तनाव निम्नतम बिन्दु पर होगा

$$T_{max} = \frac{mv_{LP}^2}{L} + mg \qquad ...(1)$$

maximum tension in string at heighest point.
उच्चतम बिन्दु पर अधिकतम तनाव

$$T_{min} = \frac{mv_{HP}^2}{L} - mg \qquad ...(2)$$

from energy conservation उर्जा संरक्षण से

$$\frac{1}{2}mv_{LP}^2 = 2mgL + \frac{1}{2}mv_{HP}^2 \qquad ....(3)$$

from (1) & (3) (1) व (3) से

$$T_{max} = \frac{1}{L}mv_{HP}^2 + 5\ mg \qquad ...(4)$$

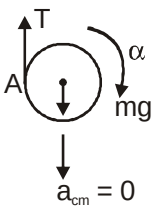
from (2) & (4) (2) व (4) से

$$4 = \frac{T_{max}}{T_{min}} = \frac{\frac{mv_{HP}^2}{L} + 5mg}{\frac{mv_{HP}^2}{L} - mg}$$

$$\Rightarrow \quad 3mv_{HP}^2 = 9\ mgL$$

$$\Rightarrow \quad V_{HP} = \sqrt{3gL} = 10\ m/s \quad \textbf{Ans.}$$

22.



$a_A = a = \alpha \cdot R$ ...(i)
$T - mg = 0$ ...(ii)
$T.R = \frac{mR^2}{2}.\alpha$ ....(iii)

$$\therefore \quad g = \frac{a}{2}$$

Ans. 2

23. For A : $5m(r\alpha) = 5\ mg\ \sin 37^\circ - T_1$
$5mr\alpha = 3mg - T_1$ .....(i)
For B : $m2r\alpha = T_2 - mg$ .....(ii)
For pulley,
$I\alpha = T_1 r - T_2 2r$
$I\alpha = (3mg - 5mr\alpha)r - (mg + mg\ 2r\alpha)2r$
$I\alpha = 3mgr - 5mr^2\alpha - 2mgr - 4mr^2\alpha$
$I\alpha = mgr - 9mr^2\alpha$
$(I + 9mr^2)\alpha = mgr$

$$\alpha = \frac{mgr}{I + 9mr^2} = \frac{mgr}{11mr^2}$$

$$\alpha = \frac{g}{11r}.$$

24. Time in which C.M. reaches its highest point = 1 sec. (from v = u + at, putting v = 0, u = +10, a = 10 m/sec^2) after projection angular velocity will not change as the torque of external forces is zero.
In 1 sec., the rod will rotate by an angle = ωt

$$= \frac{\pi}{2} \times 1\ rad.$$

The rod will be vertical with point A at the lowest point.

$$\therefore \quad a_A = g - \omega^2 L/2 = 10 - \frac{\pi^2 4}{4 \times 2}$$

$= 5\ m/sec^2$.
वह समय जब द्रव्यमान केन्द्र उच्चतम बिन्दु पर है = 1 sec. (v = u + at से v = 0, u = +10, a = 10 m/sec^2 रखने पर) फेंकने के पश्चात् कोणीय वेग

नहीं बदलता है, क्योंकि बाह्य बलों का बलाघूर्ण शून्य है।

1 सेकण्ड में छड़ द्वारा घुमा गया कोण = $\omega t = \frac{\pi}{2}$ × 1 rad.

छड़ ऊर्ध्वाधर होगी तथा बिन्दु A निम्नतम स्थिति में होगा।

$\therefore a_A = g - \omega^2 L/2 = 10 - \frac{\pi^2 4}{4\times 2} = 5 \text{ m/sec}^2$.

25. If J is the impulse imparted to the m_2 by spring after removal of F_0 (up to the time spring attains its natural length for the first time.)

यदि बल F_0 हटाने के पश्चात् स्प्रिंग द्वारा m_2 को दिया गया आवेग J हो तो (जब तक स्प्रिंग प्रथम बार सामान्य लम्बाई प्राप्त करती है।)

$$\frac{J^2}{2m_2} = \frac{1}{2}K\left(\frac{F_0}{K}\right)^2 = \frac{F_0^2}{2K} \quad J = F_0\sqrt{\frac{m_2}{K}}$$

Same impulse is imparted to m_1 by wall.

समान आवेग m_1 द्वारा दीवार पर आरोपित होता है।

Time required

आवश्यक समय

$$= \frac{T}{4} = \frac{1}{4}\,2\pi\sqrt{\frac{m_2}{K}} = \frac{\pi}{2}\sqrt{\frac{m_2}{k}}$$

$$<N> = \frac{J}{T/4} = \frac{4J}{T}$$

$$= F_0\sqrt{\frac{m_2}{K}} \Big/ \frac{\pi}{2}\sqrt{\frac{m_2}{k}} = \frac{2F_0}{\pi}$$ **Ans. 36**

26. $g_{eff} = \sqrt{g^2 + a^2} = \sqrt{g^2 + 3g^2} = 2g$

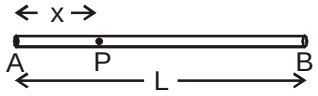
V_{min} at equilibrium position $= \sqrt{4g_{eff}\ell}$

V_{min} साम्य स्थिति पर $= \sqrt{4g_{eff}\ell}$

$= \sqrt{4(2g)\ell} \qquad = \sqrt{8g\ell}$

27. The KE of given section AP and PB will be equal if MI of each section AP and section PB about A is same.

दिये गये भाग AP तथा PB की गतिज ऊर्जा समान होगी यदि बिन्दु A के परितः AP तथा PB का जड़त्व आघूर्ण समान है।



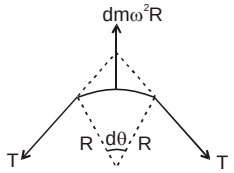
$$I_{AP} = (\lambda x)\,\frac{x^2}{3}$$

$$I_{PB} = I_{AB} - I_{AP} = (\lambda L)\,\frac{L^2}{3} - (\lambda x)\,\frac{x^2}{3}$$

$$\therefore \quad I_{AP} = I_{PB} \Rightarrow \frac{\lambda x^3}{3} = \frac{\lambda L^3}{3} - \frac{\lambda x^3}{3}$$

$$\text{or} \qquad x^3 = \frac{L^3}{2} \qquad \text{or} \qquad x = \frac{L}{2^{1/3}}$$

28.



$$dm\omega^2 R = 2T\sin\frac{d\theta}{2}$$

$$\Rightarrow \qquad \left(\frac{m}{\ell}Rd\theta\right)\,\omega^2 R = Td\theta$$

$$\therefore \qquad T = \frac{m}{\ell}\,\omega^2 R^2 \qquad \text{....(1)}$$

But परन्तु $\omega = 2\pi n$

$\ell = 2\pi R$

$$\therefore \qquad T = m\ell n^2$$

29. Mass of disc (X), $mx = \pi R^2 t\rho$

Where ρ = density of material of disc

$$\therefore \qquad I_X = \frac{1}{2}m_X R^2 = \frac{1}{2}R^2 t\rho R^2$$

$$I_X = \frac{1}{2}\pi R^4 \qquad \text{.....(i)}$$

Again mass of disc (Y)

$$m_y = \pi = (4R)^2\,\frac{t}{4}\rho = 4\pi R^2 t\rho$$

$$\text{and } I_Y = \frac{1}{2}m_Y(4R^2) = \frac{1}{2}4\pi R^2 t.16R^2$$

$$\Rightarrow \qquad I_Y = 32\pi t\rho R^4 \qquad \text{.....(ii)}$$

$$\therefore \qquad \frac{I_Y}{I_X} = \frac{32\pi t\rho R^4}{\frac{1}{2}\pi\rho t R^4}$$

$$\Rightarrow \qquad = 64$$

$$\therefore \qquad I_Y = 64\,I_x$$

डिस्क (X) का द्रव्यमान $mx = \pi R^2 t\rho$

जहाँ ρ = डिस्क के पदार्थ का घनत्व

$$\therefore \qquad I_X = \frac{1}{2}m_X R^2 = \frac{1}{2}R^2 t\rho R^2$$

$$I_X = \frac{1}{2}\pi\rho R^4 \qquad \text{.....(i)}$$

डिस्क (Y) का द्रव्यमान

$$m_y = \pi = (4R)^2\,\frac{t}{4}\rho = 4\pi R^2 t\rho$$

तथा $I_Y = \frac{1}{2}m_Y(4R^2) = \frac{1}{2}4\pi R^2 t\rho.16R^2$

$$\Rightarrow \qquad I_Y = 32\pi t\rho R^4 \qquad \text{.....(ii)}$$

$$\therefore \qquad \frac{I_Y}{I_X} = \frac{32\pi t\rho R^4}{\frac{1}{2}\pi\rho t R^4}$$

$$\Rightarrow \qquad = 64$$

$$\therefore \qquad I_Y = 64\,I_x$$

30. Let V be velocity of mass 2m just after bullet passes through it. From momentum conservation

यदि 2m द्रव्यमान का वेग गोली के निकलने के ठीक बाद V हो तो संवेग संरक्षण नियम से

$mu + 0 = m\left(\frac{u}{2}\right) + 2mV$

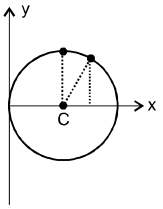
$V = \frac{u}{4}$

For completing circle
वृत्त पूर्ण करने के लिए

$V \geq \sqrt{5g\ell}$; $\frac{u}{4} \geq \sqrt{5g\ell}$;

$u \geq 4\sqrt{5g\ell} \geq 40$ m/s

31. $a_c = \omega^2 R \Rightarrow 18 = \omega^2 . 2 \Rightarrow \omega = 3$ rad/s from figure shown चित्रानुसार दर्शाया गया है।



$x = R + R \sin \omega t = 2 (1 + \sin 3t)$
$y = R \cos \omega t = 2 \cos 3t$

32. Before collision.
टक्कर के पहले

$v_B = v$ & $v_w = \left(\frac{m}{M}\right)V$

Impulse by wall दीवार के द्वारा आवेग = 2mv
velocity of com
द्रव्यमान केन्द्र का वेग

$= \left(\frac{2mv}{M+m}\right)$

when, block B reaches the highest point of 'w', momentum still remain the same
जब, गुटके B, w के अधिकतम बिन्दु पर संवेग अभी भी समान रहता है

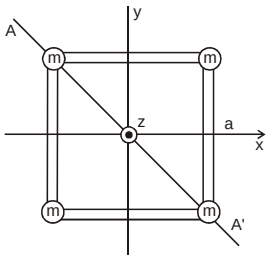
$(2mv) = (M + m)(v) \Rightarrow v = \frac{2mv}{M+m}$

33. The resultant force can be accelerating or decelerating, hence the momentum can increase or decrease. Hence (A) is wrong.
Since $F_{net} = M a_{cm}$
$\therefore \quad a_{cm} \neq 0$;
hence v_{cm} must change
Hence (B)
In case of a circular motion of centre of mass about a point the distance of centre of mass will remain constant. Hence (C)
Kinetic energy of some particles may increase and of some particles may decrease at the same time.
परिणामी बल त्वरित एवं अत्वरित कर सकता है, अतः संवेग बढ़ या घट सकता है, इसलिए (A) गलत है
चुंकि $F_{net} = M a_{cm}$
$\therefore \quad a_{cm} \neq 0$;
इसलिए v_{cm} अवश्य परिवर्तित होगा
इसलिए (B)
द्रव्यमान केन्द्र वृत्तिय गति की स्थिति में बिन्दु के सापेक्ष द्रव्यमान केन्द्र की दूरी समान ही रहेगी
एक ही समय में कुछ कणों की गतिज ऊर्जा बढ़ सकती है एवं कुछ कणों की गतिज ऊर्जा घट सकती है।

34. Maximum work done by the spring = maximum loss in P.E. of the spring $= \frac{1}{2}kx^2$
The block will have maximum KE when the spring is in its undeformed state i.e., P.E =0 state
When spring does negative work the kinetic energy of the block will decrease.
While moving away from the wall the P E of the spring first decreases and then increases and therefore the K.E of the block first increases and then decreases.
स्प्रिंग द्वारा किया गया अधिकतम कार्य = स्प्रिंग की स्थितिज ऊर्जा में अधिकतम हानि $= \frac{1}{2}kx^2$
जब स्प्रिंग अपनी अधिकृत अवस्था में हे तब ब्लॉक की गतिज ऊर्जा अधिकतम होगी P.E =0 अवस्था
जब स्प्रिंग धनात्मक कार्य करती है तो ब्लॉक की गतिज ऊर्जा घटेगी।
जबकि दीवार से दूर गति कर रही स्प्रिंग की स्थितिज ऊर्जा पहले घटती है तथा फिर बढ़ती है। अतः ब्लॉक की गतिज ऊर्जा पहले बढ़ती है तथा फिर घटती है।

35. $I_{xx} = m\left(\frac{a}{2}\right)^2 + m\left(\frac{a}{2}\right)^2 + m\left(\frac{a}{2}\right)^2 + m\left(\frac{a}{2}\right)^2 = ma^2$

$I_{yy} = m\left(\frac{a}{2}\right)^2 + m\left(\frac{a}{2}\right)^2 + m\left(\frac{a}{2}\right)^2 + m\left(\frac{a}{2}\right)^2 = ma^2$



$I_{AA'} = m\left(\frac{a}{2}\right)^2 + m\left(\frac{a}{2}\right)^2 + 0 + 0 = ma^2$

$I_{zz} = \left(m\left(\frac{a}{2}\right)^2\right) \times 4 = 2ma^2$

36. As,चूंकि $\vec{a}_{cm} = 0$ and तथा $\vec{\alpha} = 0$

$\Rightarrow \quad \Sigma\vec{F}_{ext.} = 0$

$\Rightarrow \quad \Sigma\tau_{ext}$ about any point will be same. Which is equal to zero.

$\Sigma\tau_{ext}$ किसी भी बिन्दु के सापेक्ष समान होगा जो शून्य के बराबर है।

PART-III: CHEMISTRY

37. (i) $Z = \frac{PM}{dRT} = \frac{10\times32}{20\times\frac{1}{12}\times300} = \frac{16}{25}$

$\therefore$ O_2 shows negative deviation

(ii) $Z = \frac{6}{11.2} \quad \Rightarrow Z < 1$

$\therefore$ N_2 shows negative deviation

(iii) A shows negative deviation at $T = T_C$ and $P < P_C$

(iv) $Z > 1$

(v) $Z > 1$

(vi) $Z < 1$

(vii) P = low, $T = T_B$

$\therefore$ $Z = 1$ or $PV = nRT$

हल. (i) $Z = \frac{PM}{dRT} = \frac{10\times32}{20\times\frac{1}{12}\times300} = \frac{16}{25}$

$\therefore$ O_2 ऋणात्मक विचलन दर्शाती है।

(ii) $Z = \frac{6}{11.2} \quad \Rightarrow Z < 1$

$\therefore$ N_2 ऋणात्मक विचलन दर्शाती है।

(iii) A, $T = T_C$ तथा $P < P_C$ पर ऋणात्मक विचलन दर्शाती है।

(iv) $Z > 1$

(v) $Z > 1$

(vi) $Z < 1$

(vii) P = न्यून, $T = T_B$

$\therefore$ $Z = 1$ या $PV = nRT$

38. $Z = 1 + \frac{Pb}{RT}$ (high pressure) उच्च दाब

$\frac{dZ}{dP} = \frac{b}{RT} = \frac{1}{2.8}$

$b = \frac{RT}{2.8} = \frac{22.4}{2.8} = 4(N_A \times \frac{4}{3}\pi r^3)$

$(N_A \times \frac{4}{3}\pi r^3)$ =Volume of 1 mol gas molecules (1 मोल गैस अणुओं का आयतन)

$= \frac{5.6}{2.8} = 2$

39. P v/s $\frac{1}{V}$

Slope = nRT = 22.4 atm L

$W = -nRT\ell n\left(\frac{V_2}{V_1}\right)$

$W = -22.4\ell n\left(\frac{11.2}{22.4}\right)$

$W = 22.4\ell n\ 2$

$W = 22.4\times0.7 = 15.68$ atm L

हल. P v/s $\frac{1}{V}$

ढ़ाल = nRT = 22.4 atm L

$W = -nRT\ell n\left(\frac{V_2}{V_1}\right)$

$W = -22.4\ell n\left(\frac{11.2}{22.4}\right)$

$W = 22.4\ell n\ 2$

$W = 22.4\times0.7 = 15.68$ atm L

40. For adiabatic process

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

In question

$TV^n =$ Constant

$n = \gamma - 1$

$\gamma = 1.67$

$n = 1.67 - 1 = 0.67$

हल. रूद्धोष्मीय प्रक्रम के लिए

$TV^{\gamma-1} =$ नियत

प्रश्न में

$TV^n =$ नियत

$n = \gamma - 1$

$\gamma = 1.67$

$n = 1.67 - 1 = 0.67$

41. $N_2O_3(g) \rightleftharpoons NO(g) + NO_2(g)$

$K_P = 1$

Intial

Pressure 3 3 3

at eq. 3 + P 3 – P 3 – P

$K_P = \frac{(3-P)^2}{(3+P)} = 1$

Solving this P = 1 atm

हल. $N_2O_3(g) \rightleftharpoons NO(g) + NO_2(g)$

$K_P = 1$

प्रारम्भिक

दाब 3 3 3

साम्य पर 3 + P 3 – P 3 – P

$K_P = \frac{(3-P)^2}{(3+P)} = 1$

हल करने पर P = 1 atm

42. x = -2, y = 1, z = -1, (y - x + z) = 2

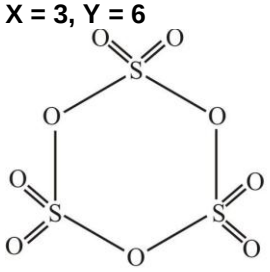
43. Bond orders $N_2 = 3$, $O_2^+ = 2.5$, $O_2 = 2$, $O_2^- = 1.5$, $C_2^{-2} = 3$

हल. बन्ध क्रम $N_2 = 3$, $O_2^+ = 2.5$, $O_2 = 2$, $O_2^- = 1.5$, $C_2^{-2} = 3$

44. Only NH_3, H_2O, HF, HCOOH, $B(OH)_3$, CH_3COOH

हल. केवल NH_3, H_2O, HF, HCOOH, $B(OH)_3$, CH_3COOH

45. **X = 3, Y = 6**



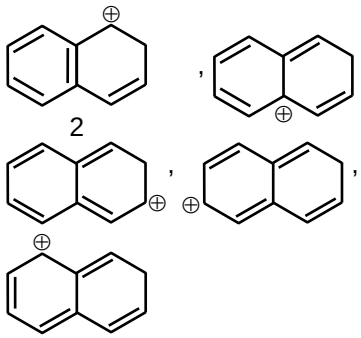
46. Mn_2O_7, SO_2, NO_2, CrO_3, SiO_2 = acidic

हल. Mn_2O_7, SO_2, NO_2, CrO_3, SiO_2 = अम्लीय

47. Trimethylamine is pyramidal at nitrogen. ClF_3, N_2O and H_2O are polar and planar molecules.

हल. ट्राइमेथिलएमिन नाइट्रोजन पर पिरामिडीय है। ClF_3, N_2O तथा H_2O ध्रुवीय तथा समतलीय अणु हैं।

48.



2

49. At points A & C $z < 1$

$\therefore$ Attractive forces are dominant.

$$Z = \left(\frac{PV_{Real}}{PV_{ideal}}\right)$$

बिन्दु A तथा C पर $z < 1$

$\therefore$ आकर्षण बल प्रमुख है।

$$Z = \left(\frac{PV_{\text{वास्तविक}}}{PV_{\text{आदर्श}}}\right)$$

50. $\Delta G° = -RT \ln K_{eq}$

or (या), $-1743 = -8.3 \times 300 \times \ln k_{eq}$

51. In process-1 heat supplied = area under AB curve + $n \times c_v \times 100$ .... (isobaric process)
In process-2 heat supplied = area under AC curve .... (isothermal process)
In process-3 heat supplied = 0 .... (adiabatic process)
In process-4 heat supplied = $n \times c_v$ (T– 600) = negative .... (isochoric process)

हल. प्रक्रम-1 में प्रवाहित ऊष्मा = AB वक्र के अन्तर्गत क्षैत्रफल + $n \times c_v \times 100$ .... (समदाबीय प्रक्रम)
प्रक्रम-2 में प्रवाहित ऊष्मा = AC वक्र के अन्तर्गत क्षैत्रफल .... (समतापीय प्रक्रम)
प्रक्रम-3 में प्रवाहित ऊष्मा = 0 ....(रूद्धोष्मीय प्रक्रम)
प्रक्रम-4 में प्रवाहित ऊष्मा = $n \times c_v$ (T– 600) = ऋणात्मक .... (समआयतनिक प्रक्रम)

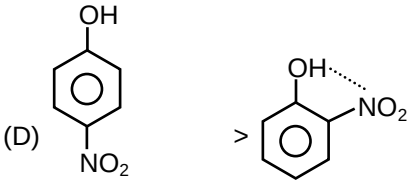
52. NO_3^- and CO_3^{2-} have bond order 1.33 or 4/3.

हल. NO_3^- तथा CO_3^{2-} बंध क्रम 1.33 या 4/3 रखते हैं।

53. (A) $H_2 < D_2 < T_2$
(Boiling Point $\propto$ Moleculer mass)
(B) neo pentane < n-pentane

$$\left[\text{Boiling point} \propto \frac{1}{\text{Branching}}\right]$$

(C) He < Xe < Ar
(Boiling Point $\propto$ Atomic mass)

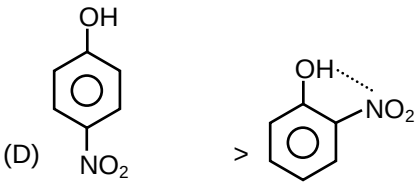
(D) 

Intermolecular H-bonding	Intramolecular H-bonding

हल. (A) $H_2 < D_2 < T_2$
(क्वथनांक बिन्दु $\propto$ अणुभार)
(B) नियोपेन्टेन < n-पेन्टेन

$$\left[\text{क्वथनांक बिन्दु} \propto \frac{1}{\text{शाखा}}\right]$$

(C) He < Xe < Ar
(क्वथनांक बिन्दु $\propto$ परमाणु भार)

(D) 

अन्तरअणुक H-बंध	अन्तराअणुक H-बंध

54. For AX_4 type molecule
If $\mu = 0$, it is non-polar. It must be tetrahedral (or) square planar.
Ex : CH_4, SiH_4 $\rightarrow$tetrahedral (Zero lone pairs)
XeF_4, ICl_4 $\rightarrow$ square planar (Two lone pairs)

हल. AX_4 प्रकार के अणु के लिए
यदि $\mu = 0$ यह अध्रवीय है। यह चतुष्फलकीय अथवा वर्ग समतलीय होना चाहिए।
उदाः : CH_4, SiH_4 $\rightarrow$ चतुष्फलकीय (शून्य एकाकी युग्म)
XeF_4, ICl_4 $\rightarrow$ वर्ग समतलीय (दो एकाकी युग्म)

---- TEXT SOLUTIONS (TS) END ----

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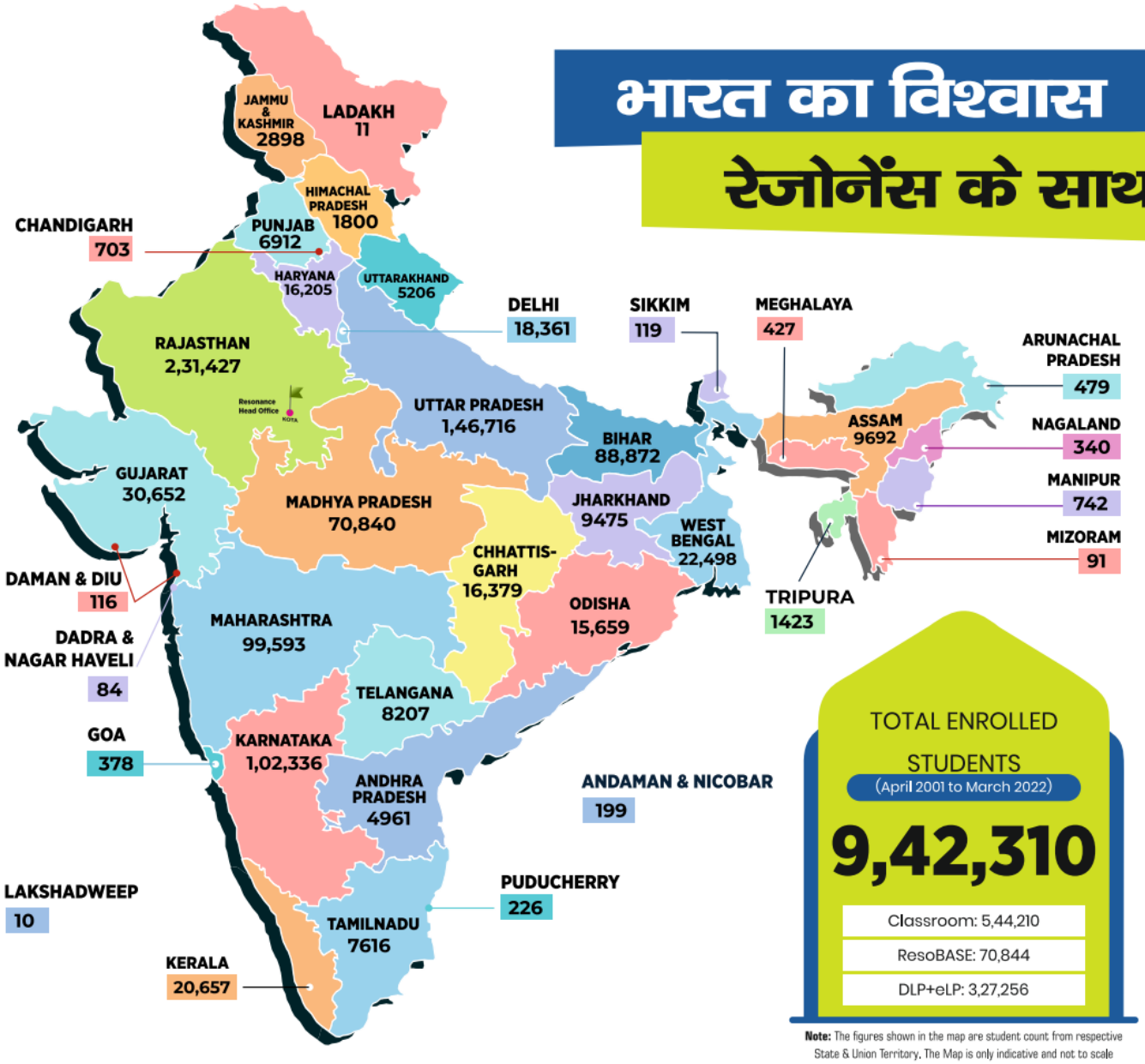

TOTAL ENROLLED STUDENTS
(April 2001 to March 2022)

9,42,310

- Classroom: 5,44,210
- ResoBASE: 70,844
- DLP+eLP: 3,27,256

Note: The figures shown in the map are student count from respective State & Union Territory. The Map is only indicative and not to scale

Resonance : The Legacy of 21 Years (2001-2022) of Academic Excellence

- **JEE (Adv.) / IIT-JEE** ▸ **50 हजार +** SELECTIONS SINCE 2002
  229 AIRs in TOP-100 (Classroom + DLP)
- **JEE (Main) / AIEEE** ▸ **2.40 लाख+** SELECTIONS SINCE 2009
  136 AIRs in TOP-100 (Classroom + DLP)
- **NEET (UG) / AIPMT** ▸ **19 हजार+** SELECTIONS SINCE 2012
  19 AIRs in TOP-100 (Classroom + DLP)

- **NTSE** SINCE 2006 ▸ **2440** Scholars
- **KVPY** SINCE 2006 ▸ **2859** Fellowship Winners
- **OLYMPIADS** SINCE 2006 ▸ **52** Medalists (Gold/Silver/ Bronze) in International Olympiads
- **CA & CS** SINCE 2013 ▸ **4179** Selections — 5 Times AIR-1 in CA & CS Exams
- **CLAT, SET & GPTU** SINCE 2014 ▸ **77** Selections — AIR-1 in GPTU