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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)	02JA	TOTAL PAGES	1	BATCH CODE(S)	02JA

Target Examination & Year:

JEE (MAIN+ADVANCED) 2025

TEST PATTERN	TEST TYPE	TEST CODE & SEQUENCE
JEE (ADVANCED)	PART TEST (PT)	APT 02

DATE & DAY:
24th December 2023 | Sunday

Duration & Time:
Paper-1 : 3 Hrs | 11:30 AM to 02:30 PM
Paper-2 : 3 Hrs | 03:00 PM to 06:00 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)

Scan QR Code for Video Solutions → Coming Soon

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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)
		MCQ		NVQ		CBQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Maths	**12**		**6**		**4**		**22**	**70**	**100.00%**
1	Sequence and Series	3	1,2,10	1	13	_	_	4	12	17.14%
2	Trigonometry	5	3,4,9,11,12	2	16,18	2	21,22	9	29	41.43%
3	Quadratic Equation	2	5,6,7,8	3	14,15,17	2	19,20	7	23	32.86%
	Total	**12**		**6**		**4**		**22**	**70**	**100%**

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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)
		MCQ		NVQ		CBQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Physics PHYSICS	**12**		**6**		**4**		**22**	**70**	**100.00%**
1	Mathematical Tools	2	23,34	–	–	–	–	2	6	8.57%
2	Rectilinear Motion	1	24	2	36,38	–	–	3	9	12.86%
3	Projectile Motion	2	25,26	2	35,37	–	–	4	12	17.14%
4	Friction	1	27	1	39	–	–	2	6	8.57%
5	Relative Motion	6	28,29,30,31, 32,33	–	–	–	–	6	18	25.71%
6	Newton's laws of Motion	–	–	1	40	4	41,42,43,44	5	19	27.14%
	Total	**12**		**6**		**4**		**22**	**70**	**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)
		MCQ		NVQ		CBQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
Physical Chemistry										
	Physical Chemistry CHEMISTRY	**6**		**3**		**2**		**11**	**35**	**50.00%**
1	Atomic Structure	3	45,46,47	1	57	2	63,64	6	20	28.57%
2	Mole concept	3	48,49,50	2	58,59	_	_	5	15	21.43%
Inorganic Chemistry										
	Inorganic Chemistry CHEMISTRY	**6**		**3**		**2**		**11**	**35**	**50.00%**
3	Chemical Bonding	3	51,53,56	2	61,62	_	_	5	15	21.43%
4	Periodic Table Periodicity	3	52,54,55	1	60	2	65,66	6	20	28.57%
	Total	**12**		**6**		**4**		**22**	**70**	**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)
		MSQ		NVQ		CMQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	**1**		**14**		**3**		**18**	**64**	**100.00%**
1	Sequence and Series	1	1	3	2,3,18	_	_	4	15	23.44%
2	Trigonometry	_	_	6	4,5,11,12, 16,17	3	8,9,10	9	32	50.00%
3	Quadratic Equation	_	_	5	6,7,13, 14,15	_	_	5	17	26.56%
	Total	**1**		**14**		**3**		**18**	**64**	**100%**

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PAPER2-PHYSICS										
S.No.	Topic Name	Question Type & Sequencing						Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		MSQ		NVQ		CMQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	**1**		**14**		**3**		**18**	**64**	**100.00%**
1	Rectilinear Motion	1	19	–	–	–	–	1	4	6.25%
2	Newton's laws of Motion	–	–	9	20,29,30,31, 32,33,34,35,36	–	–	9	28	43.75%
3	Friction	–	–	2	21,22	3	26,27,28	5	20	31.25%
4	Work, Power & Energy	–	–	1	23	–	–	1	4	6.25%
5	Mathematical Tools	–	–	2	24,25	–	–	2	8	12.50%
	Total	**1**		**14**		**3**		**18**	**64**	**100%**

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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)
		MSQ		NVQ		CMQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
Physical Chemistry										
	Class-11	**1**		**7**		**3**		**11**	**40**	**62.50%**
1	Introduction to chemistry	1	37	2	38,39	_	_	3	12	18.75%
2	Mole concept	_	_	5	40,47,48,49,50	_	_	5	16	25.00%
3	Atomic Structure	_	_	_	_	3	44,45,46	3	12	18.75%
Inorganic Chemistry										
	Class-11			**6**				**6**	**21**	**32.81%**
4	Periodic Table Periodicity	_	_	3	41,43,51	_	_	3	11	17.19%
5	Chemical Bonding	_	_	3	42,53,54	_	_	3	10	15.62%
Organic Chemistry										
	Class-11			**1**				**1**	**3**	**4.69%**
6	Structural Identification	_	_	1	52	_	_	1	3	4.69%
	Total	**1**		**14**		**3**		**18**	**64**	**100%**

ANSWER KEY (AK)

PAPER-1											
PART-I : MATHEMATICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	D	C	B	A	D	B	B	A	C	A
	Q.No.	11	12	13	14	15	16	17	18	19	20
	Ans.	C	C	02.00	03.00	51.00	02.00	09.00	150.00	D	A
	Q.No.	21	22								
	Ans.	D	D								
PART-II : PHYSICS	Q.No.	23	24	25	26	27	28	29	30	31	32
	Ans.	D	D	A	B	C	B	C	C	A	D
	Q.No.	33	34	35	36	37	38	39	40	41	42
	Ans.	A	B	05.00	09.00	04.00	01.00	10.00	04.00	AC	AC
	Q.No.	43	44								
	Ans.	BD	C								
PART-III : CHEMISTRY	Q.No.	45	46	47	48	49	50	51	52	53	54
	Ans.	A	C	C	B	B	A	A	B	D	C
	Q.No.	55	56	57	58	59	60	61	62	63	64
	Ans.	C	D	02.00	05.00	35.00	05.00	14.00	08.00	B	D
	Q.No.	65	66								
	Ans.	A	ABD								

PAPER-2											
PART-I : MATHEMATICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	ABCD	ABC	BD	CD	AB	BCD	ABC	C	B	A
	Q.No.	11	12	13	14	15	16	17	18		
	Ans.	00.00	01.00	02.00	2.5	02.00	10.00	14.64	50.00		
PART-II : PHYSICS	Q.No.	19	20	21	22	23	24	25	26	27	28
	Ans.	ACD	BD	AC	BC	AB	BCD	BCD	C	A	B
	Q.No.	29	30	31	32	33	34	35	36		
	Ans.	03.00	20.00	15.00	60.00	09.00	01.00	06.00	06.00		
PART-III : CHEMISTRY	Q.No.	37	38	39	40	41	42	43	44	45	46
	Ans.	BC	AC	AC	BC	AC	ABCD	CD	D	A	A
	Q.No.	47	48	49	50	51	52	53	54		
	Ans.	04.00	06.00	50.00	04.00	06.00	92.00	08.00	04.00		

PAPER-1

PART-I: MATHEMATICS

1. Given दिया है $b - a = c - b$

Now अब $\frac{3^{bx+1}}{3^{ax+1}} = 3^{(b-a)x}$

$\frac{3^{cx+1}}{3^{bx+1}} = 3^{(c-b)x}$

These two are equal for all x. प्रत्येक x के लिए ये दोनों समान है।

2. Harmoric mean between a & b is = $\frac{2ab}{a+b}$

a व b के मध्य हरात्मक माध्य है = $\frac{2ab}{a+b}$

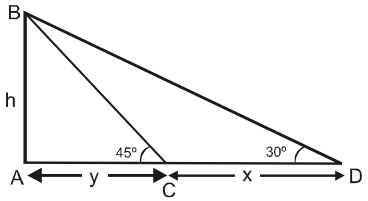
So H.M. between 1 and $\frac{1}{16}$ is

$= \frac{2.1.\frac{1}{16}}{1+\frac{1}{16}} = \frac{2}{17}$

अतः 1 एवं $\frac{1}{16}$ के मध्य हरात्मक माध्य

$= \frac{2.1.\frac{1}{16}}{1+\frac{1}{16}} = \frac{2}{17}$

3.



$\tan 45^\circ = \frac{h}{y}$, $\tan 30^\circ = \frac{h}{y+x}$

$\Rightarrow \sqrt{3} = \frac{y+x}{y} \Rightarrow \frac{x}{y} = \sqrt{3} - 1$

speed चाल = $\frac{x}{12}$ m/min मी/मिनट

$y = \left(\frac{\sqrt{3}+1}{2}\right)$ x. Now taken to cover distance

CA = $\frac{y}{\left(\frac{x}{12}\right)} = 12\,\frac{y}{x} = 6\,(\sqrt{3}+1)$ min.

$y = \left(\frac{\sqrt{3}+1}{2}\right)$ x. CA दूरी तय करने में लगा

समय = $\frac{y}{\left(\frac{x}{12}\right)} = 12\,\frac{y}{x} = 6\,(\sqrt{3}+1)$ min. मिनट

Total time taken by car to reach to tower = 6 (1.732 + 1) = 6 5 2.732 = 16.392 min.
= 16 min + 0.392 × 60 second = 16 min 23.520 second = 16 min 23 second
स्तम्भ तक पहुंचने में कार को कुल लगा समय = 6 (1.732 + 1) = 6 5 2.732 = 16.392 min. मिनट = 16 मिनट + 0.392 × 60 सेकण्ड = 16 मिनट 23.520 सेकण्ड = 16 मिनट 23 सेकण्ड

4. $\tan^2 3x < 1$

$-1 < \tan 3x < 1$

$n\pi - \frac{\pi}{4} < 3x < \frac{\pi}{4} + n\pi$

$x \in \left(\frac{n\pi}{3} - \frac{\pi}{12}, \frac{n\pi}{3} + \frac{\pi}{12}\right)$

5. $(n-2)x^2 + 8x + n + 4 > 0, \forall\, x \in R$

$\Rightarrow 64 - 4(n-2)(n+4) < 0$

and और $n - 2 > 0$

$\Rightarrow n^2 + 2n - 24 > 0$ and और $n > 2$

$\Rightarrow (n+6)(n-4) > 0$ and और $n > 2$

$\Rightarrow n > 4$ as $n \in N$ and और $n > 2$

$n \geq 5$

6. Let माना $2^x = t$

$t^2 + 2at + a + 1 = 0$

1 must lie between roots

1, मूलों के मध्य स्थित है।

$f(1) < 0 \rightarrow a < -\frac{2}{3}$

$f(0) > 0 \rightarrow a > -1$

$a \in \left(-1, -\frac{2}{3}\right)$

9. The given equation is

$(\cos x - 1)(12\cos^2 x + 5\cos x + 9) = 0$

$\Rightarrow \cos x = 1$

$x = 2n\pi,\ n \in Z$

Hence It has infinite solution as $n \in Z$

हल. दिया गया समीकरण है

$(\cos x - 1)(12\cos^2 x + 5\cos x + 9) = 0$

$\Rightarrow \cos x = 1$

$x = 2nn,\ n \in Z$

अतः अनन्त हल $n \in Z$

10. $\cos^2\theta = \frac{1}{6}\sin\theta.\tan\theta$

$6\cos^3\theta = 1 - \cos^2\theta$

$6\cos^3\theta + \cos^2\theta - 1 = 0$

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

$\cos\theta = \frac{1}{2} \Rightarrow \theta = 2n\pi \pm \frac{\pi}{3}, n \in Z$

11. b sinx = c – a cos x. square

$b^2 - b^2\cos^2 x = c^2 + a^2\cos^2 x - 2ac\cos x$

or $(a^2 + b^2)\cos^2 x - 2ac\cos x + c^2 - b^2$

$\therefore$ Its roots are cos α and cos β

$\therefore \cos\alpha.\cos\beta = \frac{c^2 - b^2}{a^2 + b^2}$

Similarly arranging as a quadratic in sin x

$\sin\alpha \sin\beta = \frac{c^2 - a^2}{a^2 + b^2}$

$\therefore \cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$

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

हल. b sinx = c – a cos x वर्ग करने पर

$b^2 - b^2\cos^2 x = c^2 + a^2\cos^2 x - 2ac\cos x$

या $(a^2 + b^2)\cos^2 x - 2ac\cos x + c^2 - b^2$

$\therefore$ इसके मूल cos α और cos β है।

$\therefore \cos\alpha.\cos\beta = \frac{c^2 - b^2}{a^2 + b^2}$

इसी प्रकार sin x के द्विघात समीकरण

$\sin\alpha \sin\beta = \frac{c^2 - a^2}{a^2 + b^2}$

$\therefore \cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$

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

12. $(s - 2)(3s - 1) = 0$

$\Rightarrow s = 1/3 = \sin\alpha$, say

$x = n\pi + (-1)^n\alpha$, n=0, 1, 2, 3, 4, 5 in $(0, 5\pi)$ में

13. $y^2 = 60$ ...(1)

nowअब 3 + y, 2y, 20 + y are in H.P. हरात्मक श्रेढी में है।

$\therefore \frac{1}{3+y}, \frac{1}{2y}, \frac{1}{20+y}$ are in A.P.

समान्तर श्रेढी में है।

$\therefore \quad \frac{1}{y} = \frac{1}{3+y} + \frac{1}{20+y}$

$\frac{1}{y} = \frac{23+2y}{(3+y)(20+y)}$

$\frac{1}{y} = \frac{23+2y}{60+23y+y^2}$

$\frac{1}{y} = \frac{23+2y}{2y^2+23y}$

$\frac{1}{y} = \frac{1}{y}$

Hence infinite values for y.

अतः y के मानों की संख्या अनन्त होगी।

14. $\alpha^2 - 7\alpha + 1 = 0$

$\Rightarrow \alpha(\alpha - 7) = -1$

$\Rightarrow \alpha - 7 = -\frac{1}{\alpha}$

$\therefore \frac{1}{(\alpha-7)^2} + \frac{1}{(\beta-7)^2} = \alpha^2 + \beta^2$

$= (\alpha+\beta)^2 - 2\alpha\beta = 47$

15. Clearly, $P(x) - x^3 = 0$ has roots 1, 2, 3, 4

$\therefore P(x) - x^3 = (x-1)(x-2)(x-3)(x-4)$

$\Rightarrow P(x) = (x-1)(x-2)(x-3)(x-4) + x^3$

Hence, $P(5) = 1\times2\times3\times4 + 125 = 149$

हल. स्पष्टतया, $P(x) - x^3 = 0$ के मूल 1, 2, 3, 4

$\therefore P(x) - x^3 = (x-1)(x-2)(x-3)(x-4)$

$\Rightarrow P(x) = (x-1)(x-2)(x-3)(x-4) + x^3$

अतः, $P(5) = 1\times2\times3\times4 + 125 = 149$

16. $\frac{\sin 8^0.\sin(60^0 - 8^0).\sin(60^0 + 8^0)}{\sin 24^0} =$

$\frac{\sin(8\times3^0)}{4\sin 24^0} = \frac{1}{4}.$

17. $2x^2 + 3x + 4 = 0$ has imaginary roots. Thus the given equations have identical roots.

$\therefore \frac{a}{2} = \frac{b}{3} = \frac{c}{4} = k$(say)

$\Rightarrow a + b + c = 9k$. for least value take $k = 1$

हल. $2x^2 + 3x + 4 = 0$ के काल्पनिक मूल है अतः दी गई समीकरण के सर्वसम मूल है।

$\therefore \frac{a}{2} = \frac{b}{3} = \frac{c}{4} = k$(say) $\Rightarrow a + b + c = 9k$.

$k = 1$ के लिए न्यूनतम मान

18. $\tan x + \tan y = 25$

$\cot x + \cot y = 30$

i.e. $\frac{25}{\tan x.\tan y} = 30$

$\tan x.\tan y = \frac{25}{30} = \frac{5}{6}$

$\tan(x + y) = \frac{\tan x + \tan y}{1 - \tan x.\tan y} = \frac{25}{1 - \frac{5}{6}} = 150$

Sol. (19to20)

$\frac{-b}{2a} = 3 \Rightarrow b = -6a$ ....(1)

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

$\Rightarrow b^2 - 4a(10) = 8a$

$b^2 = 48a$

$\Rightarrow (-6a)^2 = 48a \Rightarrow 36a^2 - 48a = 0$

$a = \frac{48}{36} = \frac{4}{3} \qquad \therefore b = -6a$

$b = -8$

$\therefore y = \frac{4}{3}x^2 - 8x + 10$

$y = \frac{4x^2 - 24x + 30}{3}$

$y \geq \frac{-2}{3} \Rightarrow \frac{4x^2 - 24x + 30}{3} \geq -\frac{2}{3}$

$4x^2 - 24x + 32 \geq 0 \Rightarrow x^2 - 6x + 8 \geq 0$

$(x-4)(x-2) \geq 0$

$x \in (-\infty, 2] \cup [4, \infty)$

21. $G.E = 4\sin 3x - 6\cos 3x + 5$

22. $G.E = \frac{3}{2} + \frac{1}{2}\cos x + \frac{1}{2}\sin x.$

PART-II: PHYSICS

23. P = Q

24. $a = t = \frac{dv}{dt}$

$\int_0^v dv = \int_0^t dt$

$v - 0 = \left[\frac{t^2}{2}\right]_0^6$

$v = 18\,\text{m/s}$.

$S = \int_0^8 V dt$

$= \int_0^6 \frac{t^2}{2} dt$

$= \left[\frac{t^3}{6}\right]_0^6 = 36m$ Total time

$= 6 + \frac{36}{18} = 8\,\text{sec.}$

25. $H = \frac{U^2 \sin^2\theta}{2g}$

$\theta = \text{const.}$ नियत

U^2 increasing by 5%

U^2 5% से बढ़ा दी जाती है।

So range increases by 5%.

इस प्रकार परास 5% से बढ़ जाती है।

26. Parallel to the plane

तल के समान्तर

$0 = u_{parallel} - g\cos 60^0 t$

Perpendicular to plane

तल के लम्बवत

$v = u_{\perp} - g\sin 60^0 t$

27. The normal reaction on the block is
ब्लॉक पर अभिलम्ब प्रतिक्रिया है

$N = mg - F\sin\theta$

$\therefore$ Net force on block is
ब्लॉक पर नेट बल है

$F\cos\theta - \mu N = F(\cos\theta + \mu \sin\theta) - \mu mg$

or acceleration of the block is
ब्लॉक का त्वरण है

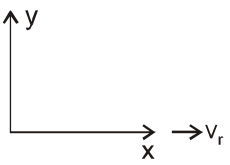
$$a = \frac{F(\cos\theta + \mu\sin\theta) - \mu mg}{m}$$

$$= \frac{F}{m}(\cos\theta + \mu\sin\theta) - \mu g$$

28. Time taken by man to cross the river

$$= \frac{\text{width of river}}{v_y}$$

$$12 = \frac{60}{v_y}$$



$v_y = 5$ m/sec.

Let the x component of velocity of man w.r. to river is v_x

Since velocity of man w.r. to ground makes an angle of 45° with river flow

x component of velocity of man w.r. to ground

= y component of velocity of man w.r. to ground

$v_r + v_x = v_y$

$5 + v_x = 5$

$v_x = 0$

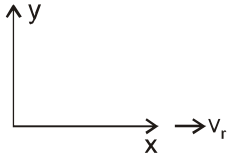
So velocity of man w.r. to water

$= v_y = 5$ m/sec.

नदी को पार करने में आदमी को लगा समय

$$= \frac{\text{नदी की चौडाई}}{v_y}$$

$$12 = \frac{60}{v_y}$$



$v_y = 5$ m/sec.

माना आदमी के वेग (नदी के सापेक्ष) का x घटक v_x है

चूंकि आदमी का वेग जमीन के सापेक्ष नदी प्रवाह के साथ 45° का कोण बनाती है।

आदमी के वेग (जमीन के सापेक्ष) का x घटक

= आदमी के वेग (जमीन के सापेक्ष) का y घटक

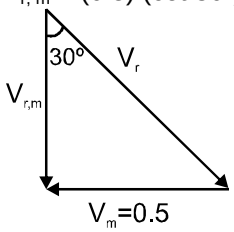
$v_r + v_x = v_y$

$5 + v_x = 5$

$v_x = 0$

आदमी का पानी के सापेक्ष वेग = $v_y = 5$ m/sec.

29. $V_{r,\,m} = (0.5)(\cot 30^\circ)$



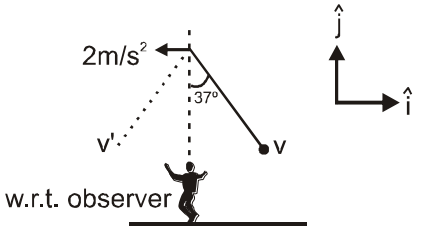
$= 0.5\sqrt{3}$ m/s

30. – The boatman cannot reach the other bank directly by steering with the boat.
– Hence, Boatman should maintain velocity 'v' at angle $[\sin^{-1}\frac{v}{u} + \frac{\pi}{2}]$ with river flow, so that his distance travelled in river as well as drift is minimized & then he should walk to destination.
– नाविक नाव के द्वारा नदी पार कर सीधे सम्मुख बिन्दु पर नहीं पहुँच सकता है।
– अतः नाविक को नाव का वेग 'v' नदी के प्रवाह के साथ कोण $[\sin^{-1}\frac{v}{u} + \frac{\pi}{2}]$ बनाये रखना पडेगा, ताकि नदी में तथा दूसरे किनारे पर पैदल चल कर तय की गई दूरी न्यूनतम हो सके।

31. w.r.t observer
प्रेक्षक के सापेक्ष
let final velocity of rain be v'
माना, वर्षा की बूँदों का अन्तिम वेग v' है।

initial velocity of rain = $\frac{3v}{5}\hat{i} - \frac{4v}{5}\hat{j}$

बारिश का प्रारम्भिक वेग = $\frac{3v}{5}\hat{i} - \frac{4v}{5}\hat{j}$



Acceleration of rain = $-2\hat{j}$ m/s^2

बारिश की बूँदों का त्वरण = $-2\hat{j}$ m/s^2

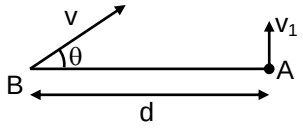
Final velocity of rain = $-\frac{3v'}{5}\hat{i} - \frac{4v'}{5}\hat{j}$

बारिश का अन्तिम वेग = $-\frac{3v'}{5}\hat{i} - \frac{4v'}{5}\hat{j}$

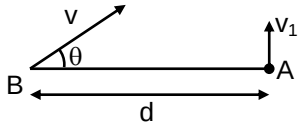
in y-direction
y-अक्ष की दिशा में

$v_{y\ final} = v_{y\ initial}$
$v' = v$
in x-direction
x-अक्ष की दिशा में
$v_{x\ final} = v_{x\ initial} + at$
$-\frac{3v'}{5} = \frac{3v}{5} - 2*6$
$-\frac{3v}{5} = \frac{3v}{5} - 12$
$v = 10$ m/s

32. $v \sin\theta = v_1$ .....(1)
and $t = \frac{d}{v\cos\theta}$ .....(2)



Solve (1) and (2)
Correct options is (D)
$v \sin\theta = v_1$ .....(1)
तथा $t = \frac{d}{v\cos\theta}$ .....(2)

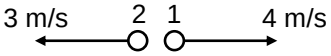


समीकरण (1) तथा (2) से
विकल्प (D) सही है

33. Velocity of approach will be $v\cos60 - v\cos60^0 = 0$
पहुँचने का वेग $v\cos60 - v\cos60^0 = 0$

34. $y = x^2 \sin x^3$
$\int x^2 \sin x^3 dx$ let माना $u = x^3 \Rightarrow du = 3x^2 dx$
$\int \frac{\sin x dx}{3} = \frac{1}{3}(-\cos x) + C = -\frac{1}{3}\cos x^3 + C$

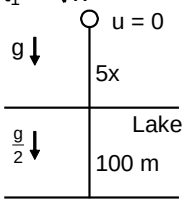
35. For particle 1
कण 1 के लिए



$\vec{V}_1 = 4\hat{i} - 10t\hat{j}$
For particle 2 कण 2 के लिए
$\vec{V}_2 = -3\hat{i} - 10t\hat{j}$
$\vec{V}_1 \cdot \vec{V}_2 = -12 + 100t^2 = 0$
$t = \frac{\sqrt{3}}{5}$, P = 5 **[Ans.: 5]**

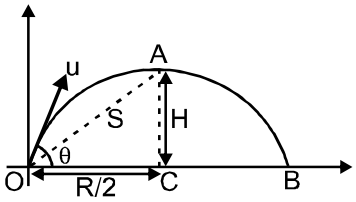
36. In air time taken is t_1
हवा में लिया गया समय t_1 है

$5x = \frac{1}{2} g t_1^2$
$t_1 = \sqrt{x}$



In water time taken is t_2
पानी में लिया गया समय t_2 है
$V = u + gt_1 = 10t_1$
on entering water velocity becomes half
पानी में प्रवेश करने पर वेग आधा हो जाता है
$100 = \frac{V}{2} t_2 + \frac{1}{2}\frac{g}{2} t_2^2$
$100 = 5t_1t_2 + \frac{5}{2} t_2^2$
$40 = 2t_1t_2 + t_2^2$
$40 = t_2[t_1+7]$
$40 = (7 - t_1)(7 + t_1)$
$40 = (7^2 - t_1^2)$
$t_1 = 3$ sec
$x = 9$

37. (1) $v_{av} = \frac{S}{T/2}$



$= \frac{\sqrt{\left(\frac{R}{2}\right)^2 + H^2}}{\frac{T}{2}}$

(2) Putting R रखने पर $= \frac{u^2 \sin 2\theta}{g}$

$H = \frac{u^2 \sin^2\theta}{2g}$

$T = \frac{2u\sin\theta}{g}$

$v_{av} = \frac{u}{2}\sqrt{1+3\cos^2\theta} = 4$ m/sec

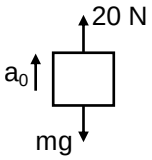
38. (1)
$x = \frac{t^2}{2}$
$V_x = \frac{dx}{dt} = t \quad \Rightarrow \quad a_x = 1$
$y^2 = 2x \quad \Rightarrow \quad y^2 = t^2 \Rightarrow y = t \Rightarrow V_y = 1 \Rightarrow a_y = 0$
$a = a_x = 1\ m/s^2$

39. The block begins to slide if
ब्लॉक चलना प्रारम्भ कर देगा यदि
$F\cos 37° = \mu (mg - F\sin 37°)$
$5t[\cos 37° + \mu \sin 37°] = \mu mg$
$5t\left[\frac{4}{5} + \frac{3}{5}\right] = 70$
or $t = 10$ second

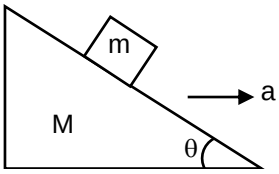
40. $T = T_1 + T_2 = m_1(g + a) + m_2 g$
$= 10 (10 + 2) + 8(10) = 120 + 80 = 200$ N.

41. Weight of block ब्लॉक का भार $= m(g - a)$
$= 1 (10 - 5) = 5$N

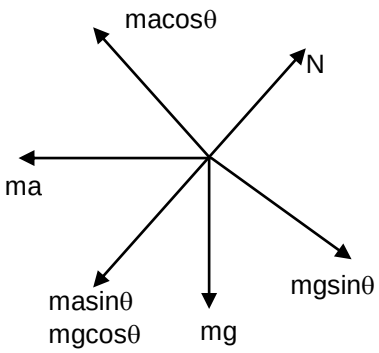
42. $ma_0 = 20 - m(g)$
$a_0 = 20 - 10$
$= 10$ m/s^2



43.



fBD of Block



along the inclined plane net force = 0
$mg \sin\theta = ma \cos\theta$
$a = g \tan\theta$

44. g cot θ , toward left बायीं ओर

PART-III: CHEMISTRY

45. Energy absorbed = Energy emitted
अवशोषित ऊर्जा = उत्सर्जित ऊर्जा

$\Rightarrow \frac{hc}{\lambda} = \frac{hc}{2\lambda_0} + \frac{hc}{4\lambda_0} + \frac{hc}{8\lambda_0} + \ldots\ldots$

$\Rightarrow \frac{1}{\lambda} = \frac{1}{2\lambda_0}\left(1 + \frac{1}{2} + \frac{1}{4} + \ldots..\right)$

$= \frac{1}{2\lambda_0}\left(\frac{1}{1 - \frac{1}{2}}\right) = \frac{2}{2\lambda_0} = \frac{1}{\lambda_0}$

$\Rightarrow \lambda = \lambda_0$
$\Rightarrow x = 1$ **Ans. 1**

46. $T \propto \frac{n^3}{Z^2}$

$\Rightarrow \frac{T}{x} = \frac{2^3}{3^3} \times \frac{3^2}{2^2} = \frac{2}{3}$

47. $E_1 = \frac{12400}{\lambda_1}$ $\therefore \frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1} = \frac{1}{2}$

$\Rightarrow \boxed{\lambda_1 = 2\lambda_2}$ $E_2 = \frac{12400}{\lambda_2}$

$E = \frac{12400}{3100} = 2\left(\frac{12400}{\lambda_1}\right) + \frac{12400}{\lambda_2}$

$\therefore \frac{12400}{3100} = 2\left(\frac{12400}{\lambda_1}\right) + \left(\frac{12400}{\lambda_{1/2}}\right)$

$\frac{12400}{3100} = 4\left(\frac{12400}{\lambda_1}\right)$

$\lambda_1 = 4 \times 3100$ Å
$= 12400$Å $= 1240$ nm

48. Mol. wt. of gas is $= \frac{16 \times 22.4}{5.6} = 64$ g
$32 + 16x = 64$ $x = 2$

हल. गैस का अणुभार $= \frac{16 \times 22.4}{5.6} = 64$ g
$32 + 16x = 64$ $x = 2$

49. (B) 3, 4, 1, 4

50. For maximum amount of product, the reactants should be present in their stoichiometric ratio.

$$2SO_2(g) + O_2(g) \longrightarrow 2SO_3(g)$$

mass	x	5 – x
mole	$\frac{x}{64}$	$\frac{5-x}{32}$

So, $\frac{\left(\frac{x}{64}\right)}{\left(\frac{5-x}{32}\right)} = 2 : 1$

Therefore, $x = 4$
$m_{SO_2} : m_{O_2} = 4 : 1$.

51. (A) NaCl

52. Rb is most electropositive
Rb सबसे अधिक वैद्युतधनात्मक है

53. $:\ddot{O}=C=\ddot{O}:$

54. Due to stable configuration the ΔH_{eg} for Ne is +ve.
स्थायी विन्यास के कारण Ne का ΔH_{eg} धनात्मक होता है।

55. After removal of one electron :
$C^+ : 1s^2\ 2s^2\ 2p^1$; $N^+ : 1s^2\ 2s^2\ 2p^2$
$O^+ : 1s^2\ 2s^2\ 2p^3$; $F^+ : 1s^2\ 2s^2\ 2p^4$
Removal of second electron will require maximum energy in case of O because of its half filled electronic configuration after removal of one electron.
$\therefore$ increasing order of 2nd ionisation enthalpy : C < N < F < O

हल. एक इलेक्ट्रॉन हटाने के पश्चात्
$C^+ : 1s^2\ 2s^2\ 2p^1$; $N^+ : 1s^2\ 2s^2\ 2p^2$
$O^+ : 1s^2\ 2s^2\ 2p^3$; $F^+ : 1s^2\ 2s^2\ 2p^4$
स्पष्ट है, कि O में से दूसरा इलेक्ट्रॉन हटाने के लिए अधिकतम ऊर्जा की आवश्यकता होगी, क्योंकि एक इलेक्ट्रॉन के निकल जाने के बाद यह अर्द्ध पूरित विन्यास धारण कर लेता है।
$\therefore$ द्वितीय आयनन एन्थैल्पी का बढ़ता हुआ क्रम :
C < N < F < O

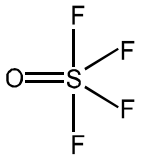
56. O=C=C=C=O (4σ and 4π bonds)
Sum = 4 + 4 = 8
O=C=C=C=O (4σ व 4π बन्ध)
योग = 4 + 4 = 8.

57. $$\frac{H[r_4 - r_3]}{He^+[r_4 - r_3]} = \frac{Z_{He^+}}{Z_H} = \frac{2}{1}$$

58. $M_xCl_y = MCl_y$ (valency of Cl = 1)
Molar mass of $M_xCl_y = 85.5 \times 2 = 171$ g/mol
$$\frac{\text{Mass of chlorine}}{\text{Mass of metalic chlorine}} = \frac{0.835}{1} = \frac{35.5\ y}{171}$$
On solving y = 4
$M_xCl_y = MCl_y$ (Cl की संयोजकता = 1)
M_xCl_y का मोलर द्रव्यमान = 85.5 × 2 = 171 g/mol
$$\frac{\text{क्लोरीन का द्रव्यमान}}{\text{धात्विक क्लोरीन का द्रव्यमान}} = \frac{0.835}{1} = \frac{35.5\ y}{171}$$
हल करने पर y = 4

59. Mg + Cl_2 $\longrightarrow$ $MgCl_2$
24 g 142 g
1 moles 2 mole 1 mole (Theoretically produced.)
सैद्धान्तिक रूप से उत्पादित
(L.R.) % Yield लब्धि = $\frac{0.35}{1}$ × 100 = 35%.

60. Fe, Zn, Be, Pb, Co are most stable in their +2 states.
Fe, Zn, Be, Pb, Co इनकी +2 ऑक्सीकरण अवस्था सबसे अधिक स्थायी हैं।

61. 

62. 1, 2, 3, 4, 5, 6, 8, 9

63. $\bar{\nu} = 2R$

(A) $2R = R \times 1^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

$\Rightarrow \quad 2 = \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

as n_1 and n_2 are integers, no value of n can satisfy this equation. Hence the H-atom sample do not get excited. For ionization $\bar{\nu}$ is R but the photon incident is of 2R. Hence H-atom sample will get ionized.
चूंकि n_1 तथा n_2 पूर्णांक है, अतः n का कोई मान इस समीकरण को संतुष्ट नहीं कर सकता है। अतः H-परमाणु प्रादर्श उत्तेजित नहीं होता है। आयनन के लिए $\bar{\nu}$, R है, लेकिन आपतित फोटोन 2R है। अतः H-परमाणु प्रादर्श आयनीकृत होगा।

(B) $2R = R \times (C)^2 \left(\frac{1}{4} - \frac{1}{x^2}\right)$

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

$\Rightarrow \quad \frac{1}{x^2} = \frac{1}{4} - \frac{-2}{9} = \frac{1}{36}$

$\Rightarrow \quad x = 6$

(C) To get ionized, this Li^{2+} require photon of $\bar{\nu} = 9R$, from ground state.
(C) आयनीकृत होने के लिए, आद्य अवस्था से Li^{2+} के लिए $\bar{\nu} = 9R$ का फोटोन आवश्यक है।

64. B.E.1 $n = 4 \longrightarrow n = \infty$
4th state

$\Rightarrow \bar{\nu} = R\left(\frac{1}{16} - \frac{1}{\infty}\right)$

$\Rightarrow \lambda = \frac{16}{R}$.

Second excitation : $1 \longrightarrow 3$

$\Rightarrow \bar{\nu} = R \times \left(\frac{1}{1} - \frac{1}{9}\right) = \frac{8R}{9}$

$\Rightarrow \nu = \bar{\nu}c = \frac{8Rc}{9}$

To ionize the H-atom, $n = 1 \longrightarrow n = \infty$
$\Rightarrow \bar{\nu} = R$

$\Rightarrow \nu = Rc$ if $\nu \geq Rc$, H-atom will get ionized.

Shortest line : $n = \infty \longrightarrow n = 1$

$\Rightarrow \bar{\nu} = R \qquad \Rightarrow \lambda = \frac{1}{R}$.

हल. B.E.1 $n = 4 \longrightarrow n = \infty$

4th अवस्था

$\Rightarrow \bar{\nu} = R\left(\frac{1}{16} - \frac{1}{\infty}\right)$

$\Rightarrow \lambda = \frac{16}{R}$.

द्वितीय उत्तेजनीकरण : $1 \longrightarrow 3$

$\Rightarrow \bar{\nu} = R \times \left(\frac{1}{1} - \frac{1}{9}\right) = \frac{8R}{9}$

$\Rightarrow \nu = \bar{\nu}c = \frac{8Rc}{9}$

H-परमाणु को आयनित करने के लिए, $n = 1 \longrightarrow n = \infty$

$\Rightarrow \bar{\nu} = R$

$\Rightarrow \nu = Rc$

यदि $\nu \geq Rc$, H-परमाणु आयनीकृत होगा।

सबसे छोटी रेखा : $n = \infty \longrightarrow n = 1$

$\Rightarrow \bar{\nu} = R \qquad \Rightarrow \lambda = \frac{1}{R}$.

65. After removal of $2e^-$ from s-subshell, the element attains the noble gas configuration.

हल. s-उपकोश से $2e^-$ हटाने पर तत्व अक्रिय गैस विन्यास प्राप्त कर लेता है।

66. (A) Ca < K < Ne < P < F
(B) F < Ca < Ne < P < K
(D) Ne < F < P < Ca < K

PAPER-2

PART-I: MATHEMATICS

1. Let 1, 2, 8 are p^{th} , q^{th} & r^{th} term of an A.P. with common difference d, then

माना 1, 2, 8 समान्तर श्रेढी के pवें, qवें तथा rवें पद है जिनका सार्वअन्तर d है, तब

$2 - 1 = (q - p)\,d$

$8 - 1 = (r - p)\,d$

$\Rightarrow \frac{q-p}{1} = \frac{r-p}{7} = d \qquad \Rightarrow \qquad q = p + d$

infinite possibility अनन्त सम्भावना

$r = p + 7d$

2. We have $a_9 = 5$

$\Rightarrow \quad a_1 + 8d = 5$

$\Rightarrow \quad 3 + 8d = 5$

$\therefore \quad d = \frac{1}{4}$ = common difference of A.P.

गु.श्रे. का सार्वअनुपात

Also पुनः, $g_9 = 5$

$\Rightarrow \quad g_1 r^8 = 5 \Rightarrow 2r^8 = 5$

$\therefore r = \left(\frac{5}{2}\right)^{\frac{1}{8}}$ = common ratio of G.P.

Now

(A) $a_5 g_{17} = \left(3 + 4 \times \frac{1}{4}\right)\left(2 \times \left(\frac{5}{2}\right)^{\frac{16}{8}}\right)$

$= (4)\left(2 \times \frac{25}{4}\right) = 50$

(B) $a_{21} g_{25} = \left(3 + 20 \times \frac{1}{4}\right)\left(2 \times \left(\frac{5}{2}\right)^{\frac{24}{8}}\right)$

$= (8)\left(2 \times \frac{125}{8}\right) = 250$

(C) $a_{37} g_{17} = \left(3 + 36 \times \frac{1}{4}\right)\left(2 \times \left(\frac{5}{2}\right)^{\frac{16}{8}}\right)$

$= (12)\left(2 \times \frac{25}{4}\right) = 150$]

(D) $a_{29} g_9 = \left(3 + 28 \times \frac{1}{4}\right)\left(2 \times \left(\frac{5}{2}\right)^{\frac{8}{8}}\right)$

$= (10)\left(2 \times \frac{5}{2}\right) = 50 = a_5 g_{17}$

3. $a_1 + 4a_2 + 6a_3 - 4a_4 + a_5 = 0$

$\Rightarrow a - 4(a + d) + 6(a + 2d) -$
$4(a + 3d) + (a + 4d) = 0 - 0 = 0$

Like wise we can check other options

हल. $a_1 + 4a_2 + 6a_3 - 4a_4 + a_5 = 0$

$\Rightarrow a - 4(a + d) + 6(a + 2d) -$
$4(a + 3d) + (a + 4d) = 0 - 0 = 0$

इसी तरह हम दूसरे विकल्पों की जाँच कर सकते है।

4. $2\sin^2\theta - 5\sin\theta + 2 = 0 \Rightarrow \sin\theta = \frac{1}{2}, 2$

$\sqrt{3}\tan\theta(\tan\theta - 1) + 1(\tan\theta - 1) = 0$

$\Rightarrow \tan\theta = 1, -\frac{1}{\sqrt{3}}$

'θ' lies in II quadrant

'θ' द्वितीय चतुर्थांश में है। $\Rightarrow \theta = 2n\pi + \frac{5\pi}{6}$

$n \in I$

5. tan A + tan B + tan C = tan A tan B tan C = 3 tan B = 6 tan A

$\therefore$ 3 tan A + tan C = 6 tan A

tan C = 3 tan A

$\therefore$ tan A + 2 tan A + 3 tan A = tan A . 2 tan A . 3 tan Ai.e. अर्थात् tan A = $\tan^3$A

i.e. अर्थात् $\tan^2 A = 1$ i.e. अर्थात्

tan A = 1

$\therefore A = \frac{\pi}{4}$

$\therefore$ tan A tan B = 2 $\tan^2$A = 2

6. Given equation is

$x^2 + 2(a + 1)x + 9a – 5 = 0$

$D = 4(a + 1)^2 – 4(9a – 5) = 4(a – 1)(a – 6)$

$\therefore D \geq 0 \Rightarrow a \leq 1$ or $a \geq 6 \Rightarrow$ roots are real

If a < 0, then 9a – 5 < 0. Hence, the products of roots is less than 0. So, the roots are of opposite sign. If a > 7, then sum of roots is –2(a + 1) < 0. Product of roots is greater than 0.

हल. दिया गया समीकरण

$x^2 + 2(a + 1)x + 9a – 5 = 0$

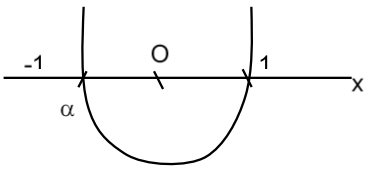
$D = 4(a + 1)^2 – 4(9a – 5) = 4(a – 1)(a – 6)$

$\therefore D \geq 0 \Rightarrow a \leq 1$ या $a \geq 6 \Rightarrow$ दोनों मूल वास्तविक है।

यदि a < 0 तब 9a – 5 < 0 अतः मूलो का गुणनफल शून्य से कम है

इसलिए मूल विपरीत चिन्ह के है। यदि a > 7 तब मूलों का योगफल –2(a + 1) < 0 मूलों का गुणन शून्य से बडा है।

7. f(1) = 0 one root is x = 1



$f(0) < 0 \Rightarrow r + p – 2q < 0$

$\Rightarrow \frac{r+p}{q} < 2$..... (A)]

Product of roots $= \frac{r+p-2q}{p+q-2r} = \alpha.1$

$\Rightarrow \alpha$ = rational (B)

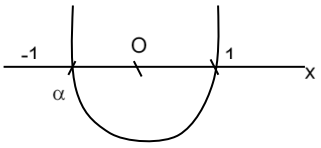
Also $(r + p) < 2q \Rightarrow (r + p)^2 < 4q^2$

$\Rightarrow 4q^2 – 4pr > (p – r)^2$

$\Rightarrow$ Roots of

$px^2 + 2qx + r = 0$ are real and distinct

हल. f(1) = 0 केवल एक मूल x = 1 है।



$f(0) < 0 \Rightarrow r + p – 2q < 0$

$\Rightarrow \frac{r+p}{q} < 2$..... (A)]

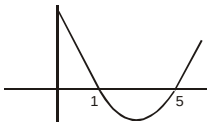
मूलों का गुणनफल $= \frac{r+p-2q}{p+q-2r} = \alpha.1$

$\Rightarrow \alpha$ = परिमेय (B)

तथा $(r + p) < 2q \Rightarrow (r + p)^2 < 4q^2$

$\Rightarrow 4q^2 – 4pr > (p – r)^2 \Rightarrow px^2 + 2qx + r = 0$ के मूल वास्तविक तथा भिन्न भिन्न है।

11. $y = \cos^4 x – 6\cos^2 x + 5\cos^2 x = t$



$y = t^2 – 6t + 5$ $0 \leq t \leq 1$

for $t \in [0, 1]$ min occurs at t = 1 (t = 1 पर न्यूनतम मान है)

$y_{min} = 0$

12. 16cos A . cos 2A . $\cos 2^2$ A . $\cos 2^3$ A

$= 16\left(\frac{\sin 2^4 A}{2^4 \sin A}\right) = \frac{\sin 2^4\left(\frac{2\pi}{15}\right)}{\sin\frac{2\pi}{15}}$

$= \frac{\sin\frac{32\pi}{15}}{\sin\frac{2\pi}{15}} = 1$

13. Let माना $y = (\alpha + \beta) – \sqrt{\alpha^2 + \beta^2}$

$y = -\sqrt{2} – \sqrt{4}$

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

$y^2 + 2\sqrt{2}y – 2 = 0$

14. $\alpha + \beta = – p$, $\alpha\beta = q$

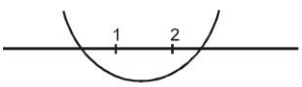
$\gamma + \delta = – q$, $\gamma\delta = p$

$\alpha + \beta + \gamma + \delta = 0 \Rightarrow p = – q$

$\frac{1}{\alpha}+\frac{1}{\beta}+\frac{1}{\gamma}+\frac{1}{\delta} = \frac{\alpha+\beta}{\alpha\beta} + \frac{\gamma+\delta}{\gamma\delta} = \frac{-p}{q} – \frac{q}{p}$

$= \frac{q}{q} – \frac{q}{-q} = 2$

15.



f(1) < 0

(2 – 2k + k – 4) < 0

k > – 2 ..... (i)

f(2) < 0

(8 – 4k + k – 4) < 0

$k > \frac{4}{3}$ ..... (ii)

from (i), (ii) से $k > \frac{4}{3}$

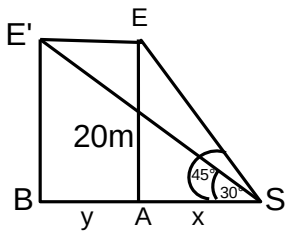
16. $-101 \le 20p + 35 \le 101$

$-6.8 \le p \le 3.3$

$\therefore$ Number of integral values of p is 10

$\therefore$ p के पूर्णांक मानों की संख्या 10 है।

17.



In Δ AES

$\tan 45° = \frac{20}{x}$

$x = 20$

In Δ BE' S

$\tan 30° = \frac{20}{20+y}$

$20\sqrt{3} = 20 + y$

$y = 20\left(\sqrt{3}-1\right) = 14.64$ m/s

18. Let the successive terms of the A.P. be a_1, a_2 ...., a_9 a_{10}.

माना समान्तर श्रेढ़ी के पद a_1, a_2 ...., a_9 a_{10}.

By hypothesis प्रश्नानुसार $a_2 + a_4 + a_6 + a_8 + a_{10} = 15$

i.e., अर्थात्

$(a + d) + (a + 3d) + ... + (a + 9d) = 15$

i.e. अर्थात्, $5a + 25d = 15$ .... (i)

and और $a_1 + a_3 + a_5 + a_7 + a_9 = 12\frac{1}{2}$

$5a + 20d = 12\frac{1}{2}$

From (i) and (ii)., we get $5d = 2\frac{1}{2}$

or

$d = \frac{1}{2}$ and $a = \frac{1}{2}$

(i) व (ii)., से $5d = 2\frac{1}{2}$ या $d = \frac{1}{2}$ और $a = \frac{1}{2}$

Hence the A.P. is अतः समान्तर श्रेणी है $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2, ...

PART-II: PHYSICS

19. At E, the acceleration $a < 0$

E पर, त्वरण $a < 0$

At C, the slope of x-t curve almost zero i.e., velocity at C is also zero.

C पर, वक्र का ढाल शून्य है। अर्थात् C पर वेग शून्य है,

At point B velocity = 0, before B velocity is positive so speed of particle is decreasing i.e., if $v > 0$ then

$a < 0$ (acceleration is negative hence at B. $a < 0$).

B पर वेग = 0, B से पहले वेग धनात्मक है इसलिए कण की चाल घट रही है अर्थात् यदि $v > 0$ है तो $a < 0$ (त्वरण ऋणात्मक है इसलिए B पर $a < 0$).

$<\vec{v}>$ between A and D is negative because initial position is greater than final position.

A तथा B के मध्य $<\vec{v}>$ ऋणात्मक है क्योंकि प्रारम्भिक स्थिति अन्तिम स्थिति से ज्यादा है।

From graph it is clear that

आरेख से यह स्पष्ट है कि

|slope at D | > | Slope at E |

| D पर ढाल | > | E पर ढाल |

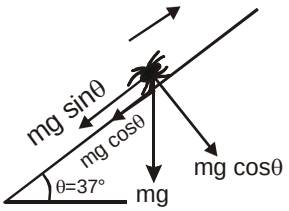
20. Since the apparent weight is increasing, hence acceleration of the lift should be upwards. This is possible in case of (b) and (d).

चूंकि आभासीय भार बढ़ता है इसलिए लिफ्ट का त्वरण ऊपर की तरफ होना चाहिए। जोकि विकल्प (b) तथा (d) में सम्भव है।

21. $mg\sin\theta + mg\cos\theta = ma$

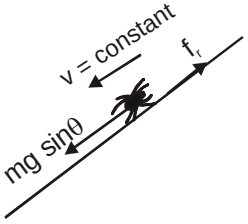
$a = g\sin\theta + g\cos\theta$

$= 10\left[\frac{3}{5}+\frac{4}{5}\right] = 14$ m/sec^2.



If $f_r = mg\sin\theta$

$= mg \times \frac{3}{5} = \frac{3mg}{5} < f_{r\,max}$



$f_r < f_{r\,max}$

$\frac{3mg}{5} < \frac{4mg}{5}$ hence insect can move with constant velocity.

22. Friction opposes relative motion.
No work is done by action reaction pair of friction. So, it can not be positive.
घर्षण सापेक्षिक गति का विरोध करता है। घर्षण के लिए किया प्रतिक्रिया युग्म द्वारा कोई कार्य नहीं किया जाता है। अतः यह धनात्मक नहीं हो सकता है।

23. T = m(g + a) But a = 0
$\Rightarrow$ T = mg and KE = 1/2 mv^2 i.e., constant.

24. All statements except (a) are correct.
विकल्प (a) के अलावा सभी कथन सही है।

25. $|\vec{A}|\cos\theta$ is magnitude along $\vec{B}$ of $\vec{A}$ component of $\vec{A}$ along $\vec{B}$ is

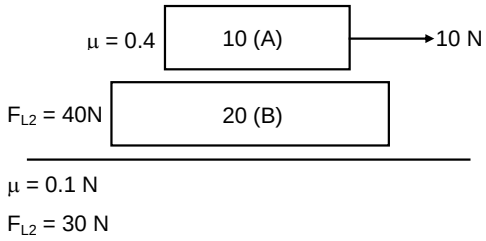
$$= |\vec{A}|\cos\theta\left(\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$$

$|\vec{A}|\sin\theta$ is magnitude of $\vec{A}$ perpendicular $\vec{B}$
$|\vec{A}|\cos\theta$, $\vec{B}$ के अनुदिश $\vec{A}$ परिमाण है। अतः $\vec{A}$ का $\vec{B}$ के अनुदिश घटक

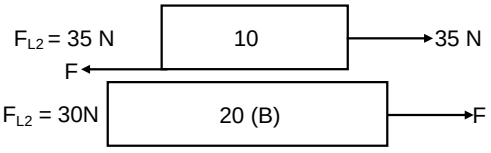
$$= |\vec{A}|\cos\theta\left(\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$$

$|\vec{A}|\sin\theta$, $\vec{B}$ के लम्बवत् $\vec{A}$ का परिमाण है।

26. If = 10N, Min F req to move is 30N hence blocks will not move
जब F = 10N है, गति कराने के लिए न्यूनतम् बल 30N चाहिए। अतः ब्लॉक गति नही करेगें।



27. If यदि F = 35 N



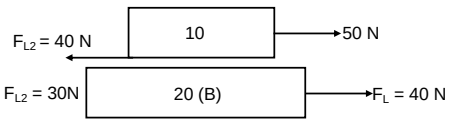
$F_{L_2} = 40N$ $\quad Q = \frac{35-30}{30} = \frac{1}{6} m/s^2$

$F_{L_2} = 30N$ $\quad 35 - F = 10 \times \frac{1}{6}$

$\Rightarrow F = 33.33N < F_{L_1}$

$\Rightarrow$ Hence, system move together with common acceleration
अतः निकाय उभयनिष्ठ त्वरण से एक साथ गति करेगें।

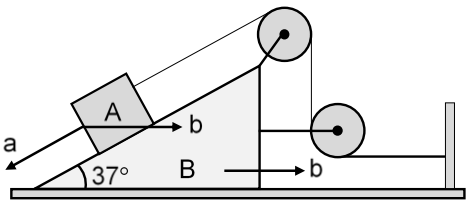
28. If यदि F = 50 N



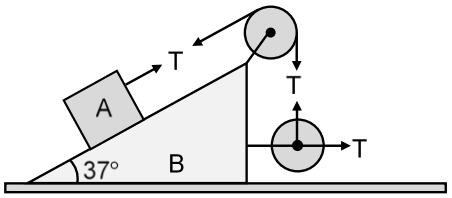
$$Q_A = \frac{50-40}{10} = 1 m/s^2$$

$$Q_B = \frac{40-30}{20} = \frac{1}{2} m/s^2$$

29. Let a = acceleration of A w.r.t. B
a = A का B के सापेक्ष त्वरण
b = acceleration of wedge B
b = B वेज का त्वरण
By string constraint, a = b
डोरी में बंधित गति से, a = b



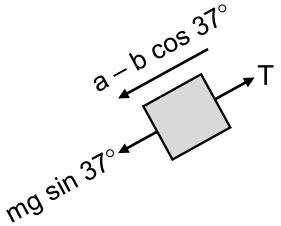
For system A + B
निकाय A + B के लिए
T = 8b + 5(b – a cos 37°)



$$T = 8b + 5\left(b - \frac{4b}{5}\right)$$

$= 8b + b = 9b$ …(i)

For A के लिए

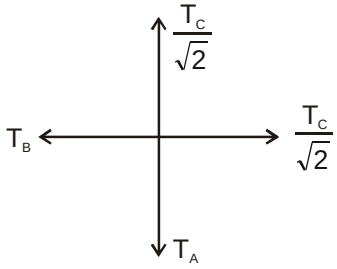


30 – T = 5 × (a – b cos 37°)

30 – T = 5 × $\frac{b}{5}$ = b …(ii)

Add (i) and (ii)
(i) तथा (ii) को जोड़ने पर
30 = 10b $\Rightarrow$ b = 3 m/s^2

30. $\frac{T_C}{\sqrt{2}} = T_A = T_B$.



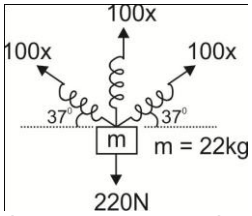
31. $T_1 - 60 = 6 \times 2$

$T_2 - 40 = 4 \times 2$

$\frac{T_1}{T_2} = \frac{3}{2}$

32. Just before cutting the spring

स्प्रिंग काटने के ठीक पहले

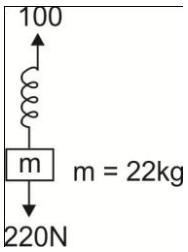


(100x + 60x + 60x) = 220

x = 1m

Just after cutting the spring

स्प्रिंग काटने के ठीक बाद



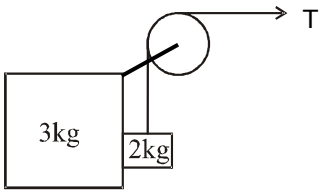
$a = \frac{(220-100)}{22} = \frac{60}{11}$

$\therefore$ n = 6

33. T = 5a ....(i)

2g - T – 0.1 N = 2a ....(ii)

N = 2a ...(iii)

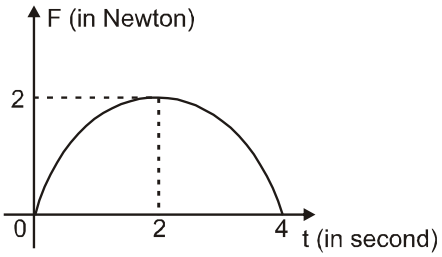


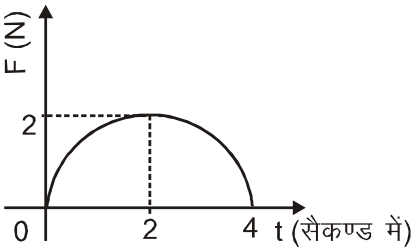
$\Rightarrow$ 2g = 7.2a

$\Rightarrow a = \frac{100}{36} = \frac{25}{9} m/s^2$

$a = \frac{\sqrt{2} \text{ x } 25}{9} m/s^2$

34.





$\Delta v = \int a \ dt = \int \frac{F}{m} \ dt$

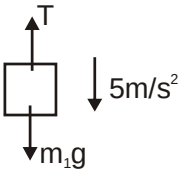
$\Delta v = \frac{1}{2\times10^{-3}} \int F \ dt$

$= \frac{1}{2\times10^{-3}} \times \frac{\pi(2)(2)}{2}$

$= \pi \times 10^3$ m/s $= \pi$ km/s

$v_0 = 1$ **Ans.**

35. FBD of m_1 m_1 का FBD



$m_1g - T = m_1.5$

$\Rightarrow$ $T = 5m_1$ .....(i)

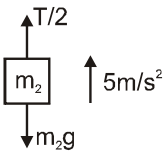
By symmetry acceleration of block C and B will be same.

सम्मिति से ब्लॉक C तथा B का त्वरण समान होगा।

By constraint acceleration of B will be 5 m/sec² upwards.

बन्धित गति से B का त्वरण ऊपर की तरफ 5 m/sec² होगा।

Now, FBD of B B का FBD



$\frac{T}{2} - m_2g = 5m_2$

$\Rightarrow$ $\frac{T}{2} = 15 \ m_2$

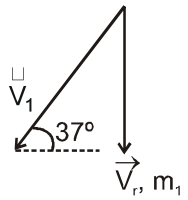
$\Rightarrow$ $T = 30 \ m_2$ .....(ii)

by (1) and (2) (1) तथा (2) से

$5m_1 = 30m_2 = \frac{m_1}{m_2} = 6$ **Ans.**

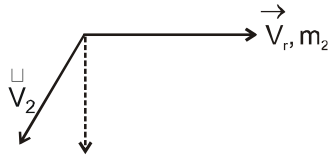
36. $V_{r_x} = V_1 \cos 37^\circ = (g \sin 37^\circ t_1) \cos 37^\circ$

$V_{r_y} = V_2 \sin 37^\circ = g \sin^2 37^\circ t_2$



$V_r = \sqrt{V_{r_x}^2 + V_{r_y}^2}$

$= \frac{10 \times 3}{25} \sqrt{16t_1^2 + 9t_2^2}$



$= \frac{6}{5} \sqrt{4 + 21} = 6 m/s$

PART-III: CHEMISTRY

37. Mass of N_A molecules (Molar mass)
N_A अणुओ का द्रव्यमान (मोलर द्रव्यमान)

$= \frac{3.4 \times 10^{-3}}{3 \times 10^{19}} \times 6 \times 10^{23}$

= 68 g/mol

This is satisfied only for x = 3 and y = 2.
यह केवल x = 3 तथा y = 2 के लिए सन्तुष्ट होता है।

38. Half mole of diatomic element X_2 contains 17 and 20 moles of electrons and neutrons so one mole atoms of X contains 17 and 20 moles of electrons and neutrons hence
Z = 17
N = 20
A = 37

हल. द्विपामाण्विक तत्व X_2 के आधे मोल में 17 तथा 20 मोल इलेक्ट्रॉन तथा न्यूट्रॉन है अतः X का एक मोल परमाणु 17 तथा 20 मोल इलेक्ट्रॉन तथा न्यूट्रॉन रखता है अत :
Z = 17
N = 20
A = 37

39. Mole (मोल) $= \frac{m(g)}{M} = \frac{V_L(NTP)}{22.4}$

$V = \left(\frac{22.4}{M}\right) \times m$

$\Rightarrow \left(\frac{22.4}{M}\right)$ = 11.2 or (या) M = 2

40. $4Al + 3O_2 \longrightarrow 2Al_2O_3$

Mole $\frac{5.4}{27} = 0.2$ $\frac{9.6}{32} = 0.3$ $\frac{0.2 \times 2}{4} = 0.1$
(LR)

$\therefore$ m = 0.1 × 102 = 10.2 g.

Moles of O_2 reacted = $\frac{0.2 \times 3}{4} = 0.15$

$\therefore$ Moles of O_2 (ER) left = 0.3 – 0.15 = 0.15.
To completely consume the extra amount of excess reagent,

Extra moles of Al required = $\frac{0.15 \times 4}{3} = 0.2$ moles (According to stoichiometry).

हल. $4Al + 3O_2 \longrightarrow 2Al_2O_3$

मोल $\frac{5.4}{27} = 0.2$ $\frac{9.6}{32} = 0.3$ $\frac{0.2 \times 2}{4} = 0.1$
(LR)

$\therefore$ m = 0.1 × 102 = 10.2 g.

अभिकृत O_2 के मोल = $\frac{0.2 \times 3}{4} = 0.15$

$\therefore$ शेष बचे O_2 (ER) के मोल = 0.3 – 0.15 = 0.15.
आधिक्य में लिये गये अभिकर्मक की अतिरिक्त मात्रा को पूर्णरूप से काम में लेने के लिए,

Al के आवश्यक अतिरिक्त मोल = $\frac{0.15 \times 4}{3}$

= 0.2 मोल (रससमीकरणमिती के अनुसार).

41. Isoelectronic species have same number of electrons, but different nuclear charge.

Ionic radius $\propto \frac{1}{\text{Nuclear charge}}$

हल. समइलेक्ट्रॉनिक प्रजाति में इलेक्ट्रॉन की संख्या समान होती हैं लेकिन नाभिकीय आवेश भिन्न होता है।

आयनिक त्रिज्या $\propto \frac{1}{\text{नाभिकीय आवेश}}$

42. All have 16 pair of electrons.
सभी 16 इलेक्ट्रॉन युग्म रखती है।

43. (C) Fe^{3+}
(D) Cu^2

44. (D) (III) (i) (S)

45. (A) (I) (iii) (R)

46.

(I) First line of Balmer series

$n_1 = 2 \qquad n_2 = 3$

$\Delta P.E. = 27.2 \times Z^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$= 27.2 \times (A)^2\left[\frac{1}{4} - \frac{1}{9}\right] = 27.2 \times \frac{5}{36}$

$= 3.78$ eV

$\Delta E = 13.6 \times (A)^2\left[\frac{1}{4} - \frac{1}{9}\right] = 1.88$ eV

$\bar{\nu} = R \times (A)^2\left[\frac{1}{4} - \frac{1}{9}\right] = \frac{5R}{36}$

$\lambda = \frac{36}{5R}$

Angular momentum $= \frac{3h}{2\pi} - \frac{2h}{2\pi} = \frac{h}{2\pi}$

(II) Third line of Paschen series of He^+ ion

$n_1 = 3 \qquad n_2 = 6$

$\Delta P.E. = 27.2 \times (B)^2\left[\frac{1}{9} - \frac{1}{36}\right] = 9.06$ eV

$\Delta E = 13.6 \times (B)^2\left[\frac{1}{9} - \frac{1}{36}\right] = 4.54$ eV

$\bar{\nu} = R \times (B)^2\left[\frac{1}{9} - \frac{1}{36}\right] = \frac{R}{3}$

$\lambda = \frac{3}{R}$

Angular momentum $= \frac{6h}{2\pi} - \frac{3h}{2\pi} = \frac{3h}{2\pi}$

(III) Lyman series limit for Li^{2+} ion

$n_1 = 1 \qquad n_2 = \infty$

$\Delta P.E. = 27.2 \times (C)^2\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right] = 27.2 \times 9 =$ 244.8 eV

$\Delta E = 13.6 \times 9\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right] = 122.4$ eV

$\bar{\nu} = R \times (C)^2\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right] = 9R$

(IV) 2^{nd} line of Lyman series of He^+ ion

$n_1 = 1 \qquad n_2 = 3$

$\Delta P.E. = 27.2 \times (B)^2\left[\frac{1}{1} - \frac{1}{9}\right] = 96.71$ eV

$\Delta E = 13.6 \times (B)^2\left[\frac{1}{1} - \frac{1}{9}\right] = 48.4$ eV

$\bar{\nu} = R \times (B)^2\left[\frac{1}{1} - \frac{1}{9}\right] = \frac{32R}{9}$

$\lambda = \frac{9}{32R}$

Angular momentum $= \frac{3h}{2\pi} - \frac{h}{2\pi} = \frac{2h}{2\pi}$

$= \frac{h}{\pi}$

हल.

(I) बामर श्रेणी की प्रथम रेखा

$n_1 = 2 \qquad n_2 = 3$

$\Delta P.E. = 27.2 \times Z^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$= 27.2 \times (A)^2\left[\frac{1}{4} - \frac{1}{9}\right] = 27.2 \times \frac{5}{36}$

$= 3.78$ eV

$\Delta E = 13.6 \times (A)^2\left[\frac{1}{4} - \frac{1}{9}\right] = 1.88$ eV

$\bar{\nu} = R \times (A)^2\left[\frac{1}{4} - \frac{1}{9}\right] = \frac{5R}{36}$

$\lambda = \frac{36}{5R}$

Δ कोणीय संवेग $= \frac{3h}{2\pi} - \frac{2h}{2\pi} = \frac{h}{2\pi}$

(II) He^+ आयन के लिए पाश्चन श्रेणी की तीसरी रेखा

$n_1 = 3 \qquad n_2 = 6$

$\Delta P.E. = 27.2 \times (B)^2\left[\frac{1}{9} - \frac{1}{36}\right] = 9.06$ eV

$\Delta E = 13.6 \times (B)^2\left[\frac{1}{9} - \frac{1}{36}\right] = 4.53$ eV

$\bar{\nu} = R \times (B)^2\left[\frac{1}{9} - \frac{1}{36}\right] = \frac{R}{3}$

$\lambda = \frac{3}{R}$

Δ कोणीय संवेग $= \frac{6h}{2\pi} - \frac{3h}{2\pi} = \frac{3h}{2\pi}$

(III) Li^{2+} आयन के लिए लाइमन श्रेणी सीमा (series limit)

$n_1 = 1 \qquad n_2 = \infty$

$\Delta P.E. = 27.2 \times (C)^2\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right] = 27.2 \times 9 =$ 244.8 eV

$\Delta E = 13.6 \times 9\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right] = 122.4$ eV

$\bar{\nu} = R \times (C)^2\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right] = 9R$

47. Moles of $Fe_2(SO_4)_3$ required = 6

$\therefore$ Mass of pure $Fe_2(SO_4)_3$ required = $6 \times 400 = 2400$ g

$\therefore$ Mass of 60 % pure $Fe_2(SO_4)_3$ required = $2400 \times \frac{100}{60} = 4000$ g = 4 Kg.

हल. $Fe_2(SO_4)_3$ के आवश्यक मोल = 6

$\therefore$ शुद्ध $Fe_2(SO_4)_3$ का आवश्यक भार = 6 × 400 = 2400 g

$\therefore$ 60 % शुद्ध $Fe_2(SO_4)_3$ का आवश्यक भार

$= 2400 \times \frac{100}{60} = 4000 \text{ g} = 4 \text{ Kg.}$

48. Oxidation number of P in $Ca_3(PO_4)_2$ =+5 = x

Oxidation number of Si in $CaSiO_3$ = +4 = y

2x – y = 6.

हल. $Ca_3(PO_4)_2$ में P की ऑक्सीकरण संख्या = +5 = x

$CaSiO_3$ में Si की ऑक्सीकरण संख्या = +4 = y

2x – y = 6.

49. $Ca(ClO_3)_2 \xrightarrow{\Delta} CaCl_2(s) + 3O_2$

x mole 3x mole

$3x = \frac{3.36}{22.4}$

$x = 0.05$

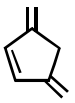
Wt. of $Ca(ClO_3)_2$ in the sample (प्रादर्श में $Ca(ClO_3)_2$ का भार) = 0.05 × 207 = 10.35 g

% purity (% शुद्धता) = $\frac{10.35}{20.7} \times 100 = 50\%$

50. X = 1; Y = 3

51. S^{2-}, O^{2-}, F^-, Br^-, I^-, Ne have greater radii then oxygen atom.

S^{2-}, O^{2-}, F^-, Br^-, I^-, Ne की त्रिज्या ऑक्सीजन परमाणु से अधिक है।

52. X = 

M.F. = C_7H_8

M.W. = 84 + 8 = 92

53. Expanded octet: PCl_5, SF_4

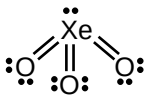
Incomplete octet: BF_3, BCl_3

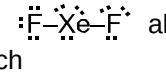
Odd electron molecules: NO_2, NO, ClO_2

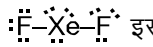
हल. प्रसारित अष्टक : PCl_5, SF_4

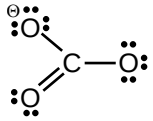
अपूर्ण अष्टक : BF_3, BCl_3

विषम इलेक्ट्रॉन अणु : NO_2, NO, ClO_2

54. (A) 

(B)  all three atoms carry 3 lp each

(B)  इसमें प्रत्येक परमाणु पर 3 एकाकी युग्म है

(C) 

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

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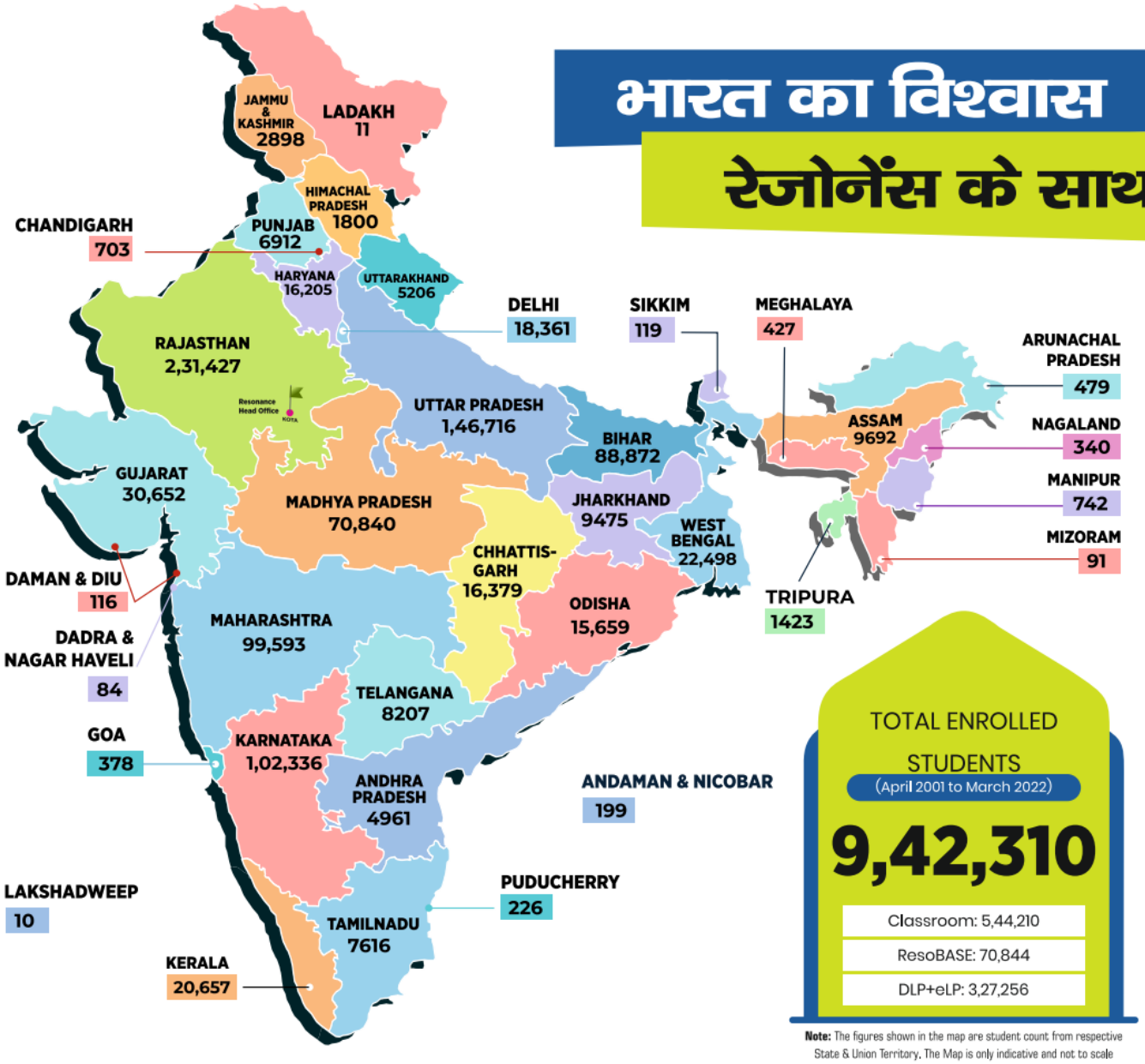

TOTAL ENROLLED STUDENTS
(April 2001 to March 2022)

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