

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 (MAIN)	PART TEST (PT)	MPT 02



DATE & DAY:

19th November 2023 | Sunday



Duration & Time:

3 Hrs | 10:00 AM to 1:00 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)

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PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

	P-1	Total		P-1	Total
Total Qs	90	90	Subject wise Qs.	30	30
Max. Marks	300	300	Subject wise Marks	100	100

Physics								
S.No.	Topic Name	Question Type & Sequencing				Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		MCQ		NVQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	20		10		30	120	100.00%
1	Projectile Motion	7	1,5,13,14,16,17,18	4	23,24,25,29	11	44	36.67%
2	Rectilinear Motion	10	2,3,4,6,8,9,10,11,15,19	2	22,28	12	48	40.00%
3	Mathematical Tools	1	7	1	27	2	8	6.67%
4	Relative Motion	2	12,20	3	21,26,30	5	20	16.67%
	Total	20		10		30	120	100%

PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

Chemistry								
S.No.	Topic Name	Question Type & Sequencing				Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		MCQ		NVQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
Physical Chemistry								
	Class-11	10		5		15	60	50.00%
1	Atomic Structure	7	31,32,35,36,38,39,40	5	51,52,53,54,55	12	48	40.00%
2	Introduction to chemistry	3	33,34,37	–	–	3	12	10.00%
Organic Chemistry								
	Class-11	7		2		9	36	30.00%
3	IUPAC & Structural Isomerism	4	41,42,43,46	2	59,60	6	24	20.00%
4	Structural Identification	3	47,49,50	–	–	3	12	10.00%
Inorganic Chemistry								
	Class-11	3		3		6	24	20.00%
5	Periodic Table Periodicity	3	44,45,48	3	56,57,58	6	24	20.00%
	Total	20		10		30	120	100%

PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

Maths								
S.No.	Topic Name	Question Type & Sequencing				Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		MCQ		NVQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	20		10		30	120	100.00%
1	Sets	1	61	1	81	2	8	6.67%
2	Quadratic Equation	8	62,65,67,69,72,73,75,78	4	82,85,87,90	12	48	40.00%
3	Trigonometry	7	63,66,68,70,71,76,79	3	84,88,89	10	40	33.33%
4	Basics	1	64	2	83,86	3	12	10.00%
5	Mathematical Reasoning	3	74,77,80	–	–	3	12	10.00%
	Total	20		10		30	120	100%

ANSWER KEY (AK)

PAPER											
PART-A: PHYSICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	4	3	3	2	1	4	2	1	2	4
	Q.No.	11	12	13	14	15	16	17	18	19	20
	Ans.	4	2	3	3	4	2	1	3	3	4
	Q.No.	21	22	23	24	25	26	27	28	29	30
	Ans.	0060	0002	0015	0020	0020	0050	0004	0003	0004	0002
PART-B: CHEMISTRY	Q.No.	31	32	33	34	35	36	37	38	39	40
	Ans.	2	4	3	2	3	2	2	4	3	1
	Q.No.	41	42	43	44	45	46	47	48	49	50
	Ans.	2	3	2	3	4	3	4	2	4	1
	Q.No.	51	52	53	54	55	56	57	58	59	60
	Ans.	0015	0036	0010	0008	0006	0047	0004	0005	0004	0006
PART-C: MATHS	Q.No.	61	62	63	64	65	66	67	68	69	70
	Ans.	3	2	2	3	1	4	4	3	2	2
	Q.No.	71	72	73	74	75	76	77	78	79	80
	Ans.	1	4	1	1	4	2	3	2	1	3
	Q.No.	81	82	83	84	85	86	87	88	89	90
	Ans.	0010	0022	0002	0010	0004	0002	0001	0008	0004	0004

STUDENT'S SPACE

TEXT SOLUTIONS (TS)

PAPER

PART-A: PHYSICS

1. $R = \frac{15}{2} T^2$

$$\frac{2u^2 \sin\theta \cos\theta}{g} = \frac{15}{4} \frac{4u^2 \sin^2\theta}{g^2}$$

$$\frac{2g}{15} = \tan\theta$$

$$\tan\theta = \frac{4}{3}$$

$$\theta = 53^\circ$$

हल. $\frac{u^2 \times 2 \sin\theta \cos\theta}{g} = \frac{15}{2 \times 2} \times \frac{4u^2 \sin^2\theta}{g}$

$$\cos\theta = \frac{15}{10 \times 2} \sin\theta$$

$$\tan\theta = \frac{4}{3} \text{ Ans.}$$

2. Average velocity औसत वेग = $\frac{s}{\Delta t} = v_{avg}$

$$S = \int_0^5 v dt = \int_0^5 (4t - t^2) dt = \frac{25}{3} \text{ m}$$

$$v_{avg} = \frac{25/3 \text{ m}}{5 \text{ sec.}} = \frac{5}{3} \text{ m/sec}$$

Average speed = $\frac{\text{distance covered}}{\text{time taken}} = \frac{\text{distance}}{\Delta t}$

औसत चाल = $\frac{\text{तय की गई दूरी}}{\text{लिया गया समय}} = \frac{\text{दूरी}}{\Delta t}$

$$\text{Distance दूरी} = \int_0^4 v dt + \int_4^5 (-v) dt$$

$$= \frac{32}{3} + \frac{7}{3} = \frac{39}{3} \text{ m} = 13 \text{ m}$$

Average speed औसत चाल = $\frac{13 \text{ m}}{5 \text{ sec}}$

Average acceleration औसत त्वरण (a_{avg}) = $\frac{v_f - v_i}{\Delta t}$

$$v_f = 4 \times 5 - 5^2 = 20 - 25 = -5$$

$$v_i = 0$$

$$a_{avg} = \frac{-5 - 0}{5} = -1 \text{ m/s}^2$$

3. $S_1 = \frac{1}{2} a (10)^2$

$$S_1 + S_2 = \frac{1}{2} a (20)^2 \Rightarrow S_2 = 3 \times \frac{1}{2} a (10)^2$$

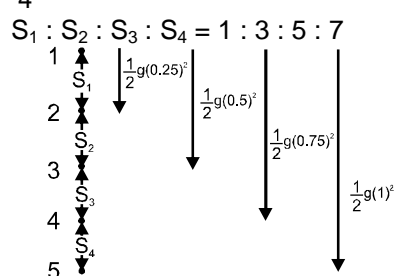
$$\therefore \frac{S_2}{S_1} = 3$$

4. By the time 5th drop starts falling, the first drop reaches to the ground
जब 5 वीं बून्द गिरना प्रारम्भ करती है, प्रथम बून्द सतह पर पहुँचती है

$$t = \sqrt{\frac{2 \times 5}{10}} = 1 \text{ sec.}$$

Hence the interval of falling of each drop = $\frac{1}{4} \text{ sec.} = 0.25 \text{ sec.}$

अतः प्रत्येक बून्द के गिरने का समयान्तराल = $\frac{1}{4} \text{ sec.} = 0.25 \text{ sec.}$



5. The person will catch the ball if his speed and horizontal speed of the ball are same i.e.

व्यक्ति गेंद को पकड़ेगा यदि उसकी चाल तथा गेंद की क्षैतिज चाल समान है अर्थात्

$$V_0 \cos\theta = \frac{V_0}{2} \Rightarrow \cos\theta = \frac{1}{2} = \cos 60^\circ$$

$$\theta = 60^\circ$$

6. $S_n - S_{n-2} = 80$

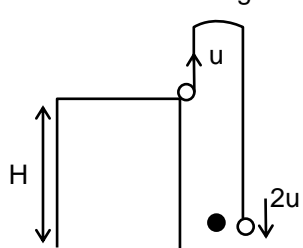
$$\left[0 \times n + \frac{1}{2} \times 10 \times n^2 \right] - \left[0 \times (n-2) + \frac{1}{2} \times 10 \times (n-2)^2 \right] = 80$$

$n = 5$ so height of tower अतः टॉवर की ऊँचाई = S_5

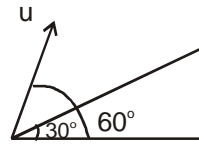
$$= 0 \times 5 + \frac{1}{2} \times 10 \times 5^2 = 125 \text{ m}$$

7. $\frac{dy}{dx} = \cos x + \frac{1}{x^2} (2x) + e^{2x} \cdot 2$

$$= \cos x + \frac{2}{x} + 2e^{2x}$$

8. Average speed औसत चाल = $\frac{\text{Total distance कुल दूरी}}{\text{time समय}} = \frac{15}{4} \text{ m/s}$
9. Velocity of stone is 10 m/s in the upward direction initially $-120 = 10t - \frac{1}{2} \times (10)^2 t^2$
प्रारंभ में पत्थर का वेग ऊपर की ओर दिशा में है -
 $120 = 10t - \frac{1}{2} \times (10)^2 t^2$
 $t = 6 \text{ sec}$
10. Slope ढाल > 0
So velocity will increase अतः वेग बढ़ेगा
but लेकिन
for $0 < t < t_1$ $\frac{dv}{dt} \Rightarrow$ increasing
 $0 < t < t_1$ के लिए $\frac{dv}{dt} \Rightarrow$ बढ़ रहा है।
for $t_1 < t < t_2$ $\frac{dv}{dt} \Rightarrow$ decreasing
 $t_1 < t < t_2$ के लिए $\frac{dv}{dt} \Rightarrow$ घट रहा है।
11. (Easy) From $t = 0 \text{ sec.}$ to $t = t_0 \text{ second,}$ the speed decreases and after $t = t_0 \text{ second}$ the speed increases.
 $t = 0$ सेकण्ड से $t = t_0$ सेकण्ड तक, चाल घटती है और $t = t_0$ के बाद चाल बढ़ती है।
Hence particle first decelerates and then accelerates
अतः कण पहले मंदित होता है फिर त्वरित होता है।
12. $V_s + V_r = 16$ $V_s - V_r = 8$
 $\Rightarrow V_s = 12 \text{ km/hr} \Rightarrow V_r = 4 \text{ km/hr}$
13. $t = \frac{2V}{g+a} = \frac{2 \times 20}{10+2} = \frac{40}{12} = \frac{10}{3} = 3.33 \text{ s}$
14. $H = \frac{v^2 - u^2}{2a} = \frac{(2u)^2 - u^2}{2g} = \frac{3u^2}{2g}$
- 
15. Avg. speed औसत चाल = $\frac{d}{\frac{d}{3(20)} + \frac{2d}{3(60)}} = 36 \text{ km/hr.}$

16. $u = 10 \text{ m/s}$
Time of flight on the incline plane नत तल पर उड़डयन काल



$$T = \frac{2u \sin \alpha}{g \cos \beta}$$

given दिया है $\alpha = 30^\circ$ & $\beta = 30^\circ$ & $u = 10\sqrt{3} \text{ m/s}$

$$T = \frac{2 \times 10\sqrt{3} \sin 30^\circ}{10 \cos 30^\circ}$$

so अतः $T = 2 \text{ sec.}$

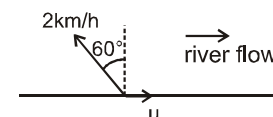
17. $T = \frac{v \operatorname{cosec} \theta}{g} = \frac{10\sqrt{3} \times \sqrt{2}}{2 \times 10 \times \sqrt{3}} = 2 \text{ sec}$

18. $\frac{1}{2} mv^2 = K, \frac{1}{2} m(v \cos 37^\circ)^2 = \frac{1}{2} m \left(\frac{4v}{5}\right)^2 = \frac{16}{25} K$

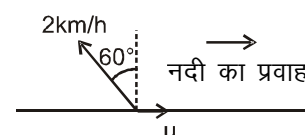
19. $y = u_y t + \frac{1}{2} a_y t^2$
 $\Rightarrow 0 = u_y \times 4 - \frac{1}{2} \times 10 \times 4^2$
or $4 = \frac{2u_y}{g} \Rightarrow u_y = 20 \text{ m/s} \Rightarrow u_y = 20 \text{ m/s}$
 $y = 20 \times 1 - \frac{1}{2} \times 10 \times 1^2 = 15 \text{ m}$

20. (Easy) Let speed of current be u .
For net velocity of man to be normal to river flow.
 $2 \sin 60^\circ = u$

or $u = \sqrt{3} \text{ km/hr.}$



- हलः (Easy) माना धारा की चाल u है।
व्यक्ति का नेट वेग नदी के प्रवाह से लम्बवत् होने के लिए
 $2 \sin 60^\circ = u$



21. 0060

22. Method - 1

$$S_A = 10(1) - \frac{1}{2} \times (10)^2 = 5 \text{ m}$$

$$S_B = -10(1) - \frac{1}{2} \times 10 \times 1^2 = -15 \text{ m}$$

$$S_A - S_B = 20 \text{ m}$$

Method - 2

$$S_{AB} = U_{AB} + a_{AB} t \quad (a_{AB} = 0)$$

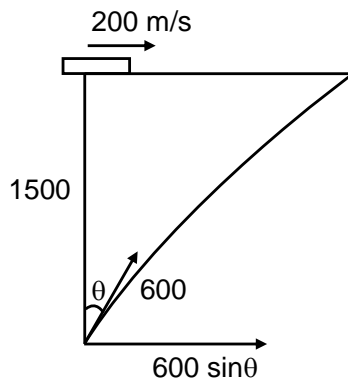
$$= 20(1) = 20 \text{ m}$$

Ans. : 2 m

23. $600 \sin \theta = 200$

$$\theta = \sin^{-1} \left(\frac{1}{3} \right)$$

$$n = 3$$



24. At maximum height $v = u \cos \theta$
अधिकतम ऊँचाई पर $v = u \cos \theta$

$$\frac{u}{3} = u \cos \theta \Rightarrow \cos \theta = \frac{1}{3}$$

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

$$= \frac{2u^2}{g} \times \frac{2\sqrt{2}}{3} \times \frac{1}{3} = \frac{4\sqrt{2} u^2}{9g}$$

25. $y = 80x - 4x^2, R = \frac{80}{4} = 20$

26. 0050

27. $A_x = 2$

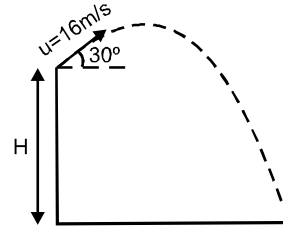
$$A_y = 2\sqrt{3}$$

$$A = \sqrt{A_x^2 + A_y^2} = \sqrt{4 + 12} = 4$$

28. $98t - \frac{1}{2}gt^2 = 98(t-4) - \frac{1}{2}g(t-4)^2$

Gives $t = 12$ sec. प्राप्त होता है।

29.



$$-H = 16 \sin 30^\circ \times 4 - \frac{1}{2} (10)^2$$

$$\Rightarrow H = 48 \text{ meter.}$$

30. Choose the floor of the elevator as reference. The observer is inside the elevator take the downward direction as positive.

लिफ्ट के फर्श को निर्देश स्थिति के रूप में लेते हैं। प्रेक्षक लिफ्ट के अन्दर है एवं नीचे की ओर दिशा को धनात्मक लेते हैं।

Acceleration of bolt relative to elevators is लिफ्ट के सापेक्ष बोल्ट का त्वरण

$$a' = g - (-a) = g + a$$

$$h = \frac{1}{2} a' t^2 = \frac{1}{2} (g+a) t^2$$

$$t = \sqrt{\frac{2h}{g+a}}$$

PART-B: CHEMISTRY

31. $l = 1$ for p and $l = 2$ for d.
Now ${}_{24}\text{Cr}$ has configuration

$$1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$$

Hence there are 12, p-electrons and 5, d-electrons.

हल. p के लिये $l = 1$ तथा d के लिये $l = 2$

अब ${}_{24}\text{Cr}$ का विन्यास

$$1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$$

इसलिये इसमें 12, p-इलेक्ट्रॉन और 5, d-इलेक्ट्रॉन होते हैं।

32. Isoelectronic species have same number of electrons.

समइलेक्ट्रॉनिक स्पीशीज इलेक्ट्रॉनों की समान संख्या रखती हैं।

33. 760 mm of Hg = 1 atm

34. Moles of oxygen atom = $\frac{192}{16} = 12 \text{ mol}$

Then moles of compound

$$\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O} = \frac{12}{6} = 2 \text{ mol}$$

हल. ऑक्सीजन परमाणु के मोल = $\frac{192}{16} = 12 \text{ मोल}$

तब यौगिक $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ के मोल

$$= \frac{12}{6} = 2 \text{ मोल}$$

35. Since photon emitted by Li^{2+} sample is unable to ionise H-atom,

Its energy is less than 13.6 eV

E (I line of Lyman series) = 91.8 eV

E (II line of Balmer series) = 22.95 eV

E (Last line of Brackett series)

= 7.65 eV (less)

E (Last line of Paschen's series)

= 13.6 eV

हल. चूँकि Li^{2+} प्रादर्श से उत्सर्जित फोटोन, जो H-परमाणु को आयनित नहीं कर पाता, अतः उसकी ऊर्जा 13.6 eV से कम होगी।

E (लाइमन श्रेणी की प्रथम रेखा) = 91.8 eV

E (बामर श्रेणी की द्वितीय रेखा) = 22.95 eV

E (ब्रेकेट श्रेणी की अन्तिम रेखा) = 7.65 eV (कम)

E (पाश्चन श्रेणी की अन्तिम रेखा) = 13.6 eV

36. $R = \frac{4KZe^2}{mv^2}$. So (इसलिए), $R \propto Z$.

37. Under similar condition of temperature and pressure, equal volume of all gases contains equal mole (or number of molecules)

ताप तथा दाब की समान परिस्थिति में, सभी गैसों के समान आयतन में मोल की संख्या (या अणुओं की संख्या) समान होती है।

38. $V = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^3, 4s^2$
 $\mu = 1.73 \text{ BM}$
 \Rightarrow Number of unpaired electron = 1
 So, Charge on vanadium ion = 4 + . So, x = 4

हल. $V = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^3, 4s^2$
 $\mu = 1.73 \text{ BM}$
 \Rightarrow अयुग्मित इलेक्ट्रॉन की संख्या = 1
 इसलिए, वैनेडियम आयन पर आवेश = 4 + . अतः, x = 4

39. Radial node occurs where probability of finding e^- is zero.
 रेडियल नोड प्राप्त होता है जहाँ इलेक्ट्रॉन के पाये जाने की प्रायिकता शून्य होती है।

$$\therefore \psi^2 = 0 \text{ or (या) } \psi = 0$$

$$\therefore 6 - 6\sigma + 6\sigma^2 = 0; \quad \sigma = 3 \pm 1\sqrt{3}$$

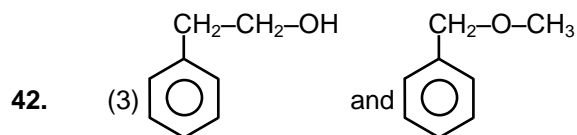
For max. distance r

$$(\text{अधिकतम दूरी } r \text{ के लिए}) = \frac{3}{2} \frac{3(3 + \sqrt{3})a_0}{Z}$$

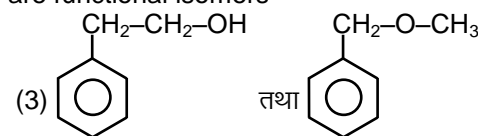
40. The given graph is for 2s orbital since it shows one radial node and $\Psi(r) \neq 0$ at $r = 0$.

दिया गया आरेख 2s कक्षक के लिये है, क्योंकि यह एक त्रिज्य नोड दर्शाता है तथा $r = 0$ पर $\Psi(r) \neq 0$ हैं।

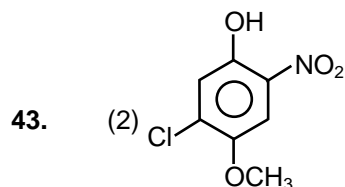
41. neopentyl is absent.
 नियोपेन्टिल अनुपस्थित है।



are functional isomers



क्रियात्मक समावयवी हैं।



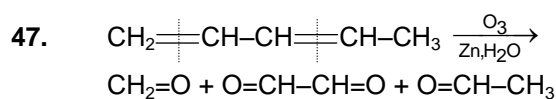
44. Refer periodic table.
 आवर्त सारणी देखें।

45. The block of an element corresponds to the type of subshell which receives the last electron : ${}_{28}\text{Ni} - [\text{Ar}] 3d^8 4s^2$.

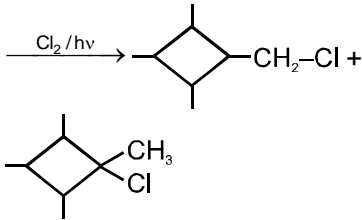
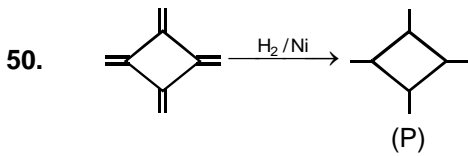
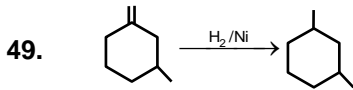
Group number = 8 + 2 = 10

हल. एक तत्व का ब्लॉक उस उपकोश के प्रकार पर निर्भर करता है जिसमें अन्तिम इलेक्ट्रॉन भरा जाता है ${}_{28}\text{Ni} - [\text{Ar}] 3d^8 4s^2$
 वर्ग संख्या = 8 + 2 = 10

46. Metamers मध्यावयवी



48. Theory based.
 सैद्धान्तिक



51. Volume fraction = $\frac{\text{Volume of nucleus}}{\text{Total vol. of atom}}$
 $= \frac{(4/3)\pi (10^{-13})^3}{(4/3)\pi (10^{-8})^3} = 10^{-15}$

हल. आयतन प्रभाज्य = $\frac{\text{नाभिक का आयतन}}{\text{परमाणु का कुल आयतन}}$
 $= \frac{(4/3)\pi (10^{-13})^3}{(4/3)\pi (10^{-8})^3} = 10^{-15}$

52. Energy of 1 mol of photon
 (1 मोल फोटोन की ऊर्जा) = $\frac{N_A hc}{\lambda}$
 $= \frac{6.023 \times 10^{23} \times 6.62 \times 10^{-34} \times 3 \times 10^8}{560 \times 10^{-9}}$
 $= 213.69 \times 10^3 \text{ J}$
 Time taken for this energy
 (इस ऊर्जा के लिए लगने वाला समय)
 $= \frac{213.6 \times 10^3 \text{ J}}{100 \text{ Js}^{-1}} = 2136 \text{ s} \approx 36 \text{ min.}$

53. $E = 13.6 \left(\frac{2^2}{n_1^2} \right) + KE_1$
 and $E = 13.6 \left(\frac{3^2}{n_2^2} \right) + KE_2$
 Given : $KE_1 - KE_2$
 $= \pm 2.55 = \pm 13.6 \left(\frac{1}{2^2} - \frac{1}{4^2} \right)$

on solving 2 equations,
 $|n_2 - n_1| = 8 \text{ or } 2$

हल. $E = 13.6 \left(\frac{2^2}{n_1^2} \right) + KE_1$

तथा $E = 13.6 \left(\frac{3^2}{n_2^2} \right) + KE_2$

दिया है : $KE_1 - KE_2$

$$= \pm 2.55 = \pm 13.6 \left(\frac{1}{2^2} - \frac{1}{4^2} \right)$$

दोनों समीकरणों को हल करने पर,
 $|n_2 - n_1| = 8 \text{ या } 2$

54. Time = 1 second LED 1 ; $\frac{LED2}{5 \times 1}$
 Energy = $A \times 1 = AJ$; 5J
 $\lambda = 500 \text{ nm}$; $\lambda = 400 \text{ nm}$
 no. of photons = $2n$; no. of photon = n
 $\Rightarrow A = 2n \times \frac{hc}{500}$; $5 = n \times \frac{hc}{400}$
 $\Rightarrow A = \frac{2 \times 400 \times 5}{500} = 8.$

हल. समय = 1 सैकण्ड LED 1 ; $\frac{LED2}{5 \times 1}$
 ऊर्जा = $A \times 1 = AJ$; 5J
 $\lambda = 500 \text{ nm}$; $\lambda = 400 \text{ nm}$
 फोटोन की संख्या = $2n$; फोटोनों की संख्या = n
 $\Rightarrow A = 2n \times \frac{hc}{500}$; $5 = n \times \frac{hc}{400}$
 $\Rightarrow A = \frac{2 \times 400 \times 5}{500} = 8.$

55. Energy of emitted photon
 $= 1.82 + 0.73 = 2.55 \text{ eV.}$
 So, $\Delta E = 13.6 \times 1^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$

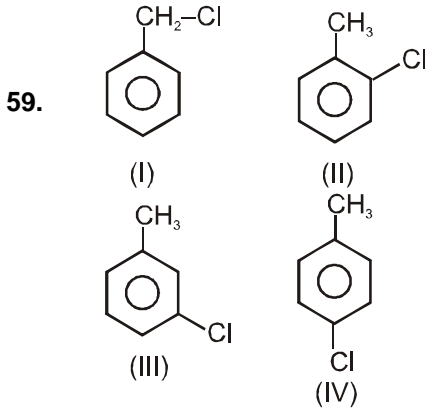
for $n_1 = 2$ & $n_2 = 4$
 उत्सर्जित फोटॉन की ऊर्जा
 $= 1.82 + 0.73 = 2.55 \text{ eV.}$
 अतः, $\Delta E = 13.6 \times 1^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$
 n_1 के लिए = 2 तथा n_2 के लिए = 4

56. Electronic configuration of an ion $[M^+]$ is $[Ar] 3d^{10}$, so electronic configuration of M is $[Ar] 3d^{10}, 4s^1$. Atomic number of M is 29 so atomic number of element which is just below M in the periodic table is 47.
 एक आयन $[M^+]$ का इलेक्ट्रॉनिक अभिविन्यास $[Ar] 3d^{10}$ है। अतः M का $[Ar]$ अभिविन्यास $3d^{10}, 4s^1$ है। M का परमाणु क्रमांक 29 है इसलिए M के नीचे वाले तत्व का परमाणु क्रमांक 47 है।

57. As there is sudden Jump between $I.E_4$ & $I.E_5$, so this element will have 4 electrons in outermost shell Hence, It has four valence electron.
 यह $I.E_4$ व $I.E_5$ के मध्य अचानक कूदता है इसलिए यह तत्व बाह्यतम कोश में 4 इलेक्ट्रॉन रखेगा। अतः यह चार संयोजी इलेक्ट्रॉन रखता है।

58. Expected electron configuration should be $[\text{Kr}] 4d^{10} 5s^0$. The principal quantum number (n) of valence shell is thus equal to 5. So the period of the element to which it belongs is 5.

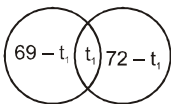
सम्भावित इलेक्ट्रॉनिक अभिविन्यास $[\text{Kr}] 4d^{10} 5s^0$ होना चाहिए। अतः संयोजी कोश की मुख्य क्वाण्टम संख्या (n) का मान 5 के बराबर है। इसलिए इस तत्व का आवर्त 5 होगा।



60. (i) $\text{CH}_3\text{-O-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$
(ii) $\text{CH}_3\text{-O-CH(CH}_3\text{)-CH}_2\text{-CH}_3$
(iii) $\text{CH}_3\text{-O-CH}_2\text{-CH(CH}_3\text{)-CH}_3$
(iv) $\text{CH}_3\text{-O-C(CH}_3\text{)}_2\text{-CH}_3$
(v) $\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH}_2\text{-CH}_3$
(vi) $\text{CH}_3\text{-CH}_2\text{-O-CH(CH}_3\text{)-CH}_3$

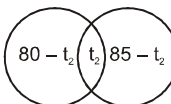
PART-C: MATHEMATICS

61.



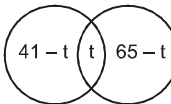
$$70 + 75 - t_1 = 100$$

$$t_1 = 45\% \Rightarrow \text{min. in } P \cap C = 45\%$$



$$t_2 = 83\% - 20\% = 63\%$$

$$\Rightarrow \text{min. } M \cap E = 63\%$$



$$t = 108 - 100 = 8\%$$

$$\text{min. in } ((P \cap C) \cap (M \cap E)) = 8\%$$

62. $x^3 + 7x^2 + px + q = 0$ $\begin{matrix} \alpha \\ \beta \\ x_1 \end{matrix}$
 $\Rightarrow \alpha + \beta + x_1 = -7, \alpha\beta + \beta x_1 + \alpha x_1 = p \dots(1)$

$$x^3 + 5x^2 + px + r = 0$$
 $\begin{matrix} \alpha \\ \beta \\ x_2 \end{matrix}$
 $\Rightarrow \alpha + \beta + x_2 = -5, \alpha\beta + \beta x_2 + \alpha x_2 = p \dots(2)$

Subtracting (2) from (1)

$$\alpha\beta + \beta x_1 + \alpha x_1 = p$$

$$\Rightarrow \frac{\alpha\beta + \beta x_2 + \alpha x_2 = p}{\alpha(x_1 - x_2) + \beta(x_1 - x_2) = 0}$$

$$\Rightarrow (x_1 - x_2)(\alpha - \beta) = 0 [x_1 \neq x_2]$$

$$\therefore \alpha + \beta = 0 \Rightarrow x_1 = -7$$

$$\Rightarrow x_2 = -5$$

63. $\therefore \tan A < 0$ and (और)

$$A + B + C = 180^\circ$$

$$\Rightarrow A > 90^\circ \Rightarrow B + C < 90^\circ$$

$$\Rightarrow \tan(B + C) > 0$$

$$\Rightarrow \frac{\tan B + \tan C}{1 - \tan B \tan C} > 0$$

$$\Rightarrow 1 - \tan B \tan C > 0$$

$$\Rightarrow \tan B \tan C < 1$$

64. $b = a^2, c = b^2, \frac{c}{a} = 3^3 \Rightarrow c = 27a$

$$\Rightarrow b^2 = 27a \Rightarrow a^4 = 27a$$

$$\Rightarrow a = 3, a > 0$$

$$c = 81, b = 9$$

$$\therefore a + b + c = 3 + 9 + 81 = 93$$

65. $x^2 + 3x + 1 = (x - \alpha)(x - \beta)$.

Put $x = 2$ रखने पर

$$\Rightarrow 11 = (2 - \alpha)(2 - \beta) \text{ option (B)}$$

$$\alpha^2 + 3\alpha + 1 = 0, \beta^2 + 3\beta + 1 = 0$$

$$\alpha^2 = -(3\alpha + 1), \beta^2 = -(3\beta + 1)$$

$$\frac{\alpha^2}{3\alpha + 1} = -1, \frac{\beta^2}{3\beta + 1} = -1$$

$$\Rightarrow \frac{\alpha^2}{3\alpha + 1} + \frac{\beta^2}{3\beta + 1} = -2 \text{ option (C)}$$

$$\left(\frac{\alpha}{1+\beta}\right)^2 + \left(\frac{\beta}{1+\alpha}\right)^2 = \frac{\alpha^2}{1+2\beta+\beta^2} +$$

$$\frac{\beta^2}{1+2\alpha+\alpha^2} = \frac{-(3\alpha+1)}{-\beta} + \frac{-(3\beta+1)}{-\alpha}$$

$$= \frac{\alpha(3\alpha+1) + \beta(3\beta+1)}{\beta\alpha}$$

$$= \frac{3(\alpha^2 + \beta^2) + (\alpha + \beta)}{1}$$

$$= \frac{3((\alpha + \beta)^2 - 2\alpha\beta) + (-3)}{1} = 3(7) - 3 = 18.$$

66. $A + B + C = \frac{3\pi}{2} \Rightarrow \cos 2A + \cos 2B + \cos 2C = 2 \cos(A + B) \cdot \cos(A - B) + 1 - 2 \sin^2 C$

$$= 2 \cos\left(\frac{3\pi}{2} - C\right) \cdot \cos(A - B) - 2 \sin^2 C + 1$$

($\because A + B + C = \frac{3\pi}{2}$)

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

$$= -2 \sin C \{\cos(A - B) + \sin\left(\frac{3\pi}{2} - (A + B)\right)\} + 1$$

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

$$= 1 - 4 \sin A \sin B \sin C.$$

67. $(\log_{10} 8)x^2 - (\log_{10} 5)x + x - 2 \log_{10} 2 = 0$

(1) sum of roots मूलों का योगफल

$$= \frac{-(-1 - \log_{10} 5)}{\log_{10} 8} = \frac{-\log_{10} \left(\frac{10}{5}\right)}{\log_{10} 8}$$

$$= \frac{-\log_{10} 2}{3 \log_{10} 2} = \frac{-1}{3} \text{ rational परिमेय}$$

(2) Product of roots मूलों का गुणन

$$= \frac{-2 \log_{10} 2}{\log_{10} 8} = \frac{-2}{3}$$

(3) sum of coefficient गुणांकों का योगफल

$$= \log_{10} 8 - \log_{10} 5 + 1 - \log_{10} 4 = \log_{10}$$

$$\left(\frac{8 \times 10}{5 \times 4}\right)$$

$$= \log_{10} 4 = \text{irrational परिमेय}$$

(4) Discriminant विवेचक $= (\log_{10} 2)^2 -$

$$4 \log_{10} 8 (-2 \log_{10} 2) = (\log_{10} 2)^2 + 24(\log_{10} 2)^2$$

$$= 25(\log_{10} 2)^2 = (5 \log_{10} 2)^2$$

irrational अपरिमेय.

68. $\tan x = \frac{b}{a}, \quad a \tan^3 x + b = \frac{\tan x}{\cos x}$

$$\Rightarrow \frac{a \frac{b^3}{a^3} + b}{\frac{1}{a \cos x}} = \frac{b}{a \cos x}$$

$$\frac{b^2 + a^2}{a} = \frac{1}{\cos x} \Rightarrow \cos x = \frac{a}{a^2 + b^2}$$

$$\Rightarrow \sin x = \frac{b}{a^2 + b^2}$$

$$\text{Eliminating 'x'} \left(\frac{b}{a^2 + b^2}\right)^2 + \left(\frac{a}{a^2 + b^2}\right)^2 = 1$$

$$\frac{b^2 + a^2}{(a^2 + b^2)^2} = 1 \Rightarrow a^2 + b^2 = 1$$

69. Equation has no real roots.

दी गयी समीकरण का कोई वास्तविक मूल नहीं होने के लिये

case-I स्थिति-I $D \geq 0 \Rightarrow \lambda^2 - 36 \geq 0$

$$\frac{-b}{2a} < 0 \Rightarrow \lambda < 0$$

$$f(0) > 0 \Rightarrow 9 > 0.$$

$$\therefore \lambda \in (-\infty, -6]$$

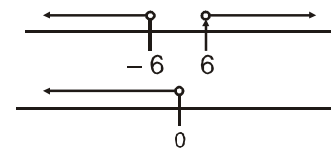
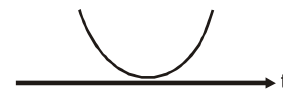
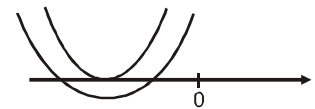
case-II स्थिति-II $D < 0$

$$\Rightarrow \lambda^2 - 36 < 0 \Rightarrow \lambda \in (-6, 6)$$

union of both cases gives

(स्थिति-I) \cup (स्थिति-II) से

$$\lambda \in (-\infty, 6)$$

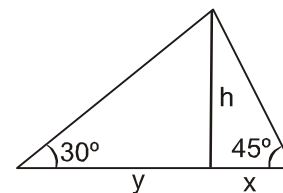


70. $y = \frac{\tan 3x}{\tan x} = \frac{3 - \tan^2 x}{1 - 3 \tan^2 x}$

$$\Rightarrow \tan^2 x = \frac{y - 3}{3y - 1} \geq 0$$

$$\Rightarrow y \in \left(-\infty, \frac{1}{3}\right) \cup [3, \infty)$$

71. $\frac{h}{x} = \tan 45^\circ \quad x = h \quad \dots\dots(1)$



$$\frac{h}{y} = \tan 30^\circ \quad y = \sqrt{3} h \quad \dots\dots(2)$$

$$(1) + (2) = (\sqrt{3} + 1)h \text{ meters मीटर}$$

72. $\therefore a \neq 0$ and तथा $a > -1$
 $\Rightarrow x^2 + \frac{2\ln(a+1)}{a} \cdot x + \frac{a^2 - 16}{a} = 0$
 Let माना $f(x) = x^2 + \frac{2\ln(a+1)}{a} \cdot x + \frac{a^2 - 16}{a}$
 $\therefore f(0) < 0$
 $\Rightarrow \frac{(a+4)(a-4)}{a} < 0$
 $\Rightarrow a \in (-\infty, -4) \cup (0, 4)$
 but परन्तु $a > -1$ so इसलिए $a \in (0, 4)$

73. $f(x) = 1 + \frac{1}{\left(x + \frac{1}{2}\right)^2 + \frac{3}{4}}$
 $f_{\max} = 1 + \frac{1}{0 + \frac{3}{4}} = \frac{7}{3}$ at $x = -\frac{1}{2}$

74. converse of $p \Rightarrow (q \wedge \sim r)$ is $(q \wedge \sim r) \Rightarrow p$
 $\equiv \sim(\sim q \vee r) \Rightarrow p$
 $\equiv \sim(r \vee \sim q) \Rightarrow p$

हल. $p \Rightarrow (q \wedge \sim r)$ का विलोम $(q \wedge \sim r) \Rightarrow p$ है।
 $\equiv \sim(\sim q \vee r) \Rightarrow p$
 $\equiv \sim(r \vee \sim q) \Rightarrow p$

75. $a > 0$, Let माना $f(x) = ax^2 + bx + c$
 $\left. \begin{aligned} f(1) &= a + b + c > 0 \\ f(0) &= c > 0 \end{aligned} \right\} \dots\dots\dots(1)$
 $a < 0$
 $\left. \begin{aligned} f(1) &= a + b + c < 0 \\ f(0) &= c < 0 \end{aligned} \right\} \dots\dots\dots(2)$
 $(1) \& (2) \Rightarrow c(a + b + c) > 0$

76. Here यहाँ, $\cos 2x + 2 \cos x = 1$
 $\Rightarrow 2\cos^2 x - 1 + 2 \cos x - 1 = 0$
 $\Rightarrow \cos^2 x + \cos x - 1 = 0$
 or या $\cos x = \frac{-1 + \sqrt{5}}{2}$, neglecting
 $\left(\frac{-1 - \sqrt{5}}{2}\right) \Rightarrow$ as $-1 \leq \cos x \leq 1$ and और
 $\left(\frac{-1 - \sqrt{5}}{2}\right) < -1$

$$\cos^2 x = \left(\frac{\sqrt{5}-1}{2}\right)^2 = \frac{6-2\sqrt{5}}{4} = \frac{3-\sqrt{5}}{2}$$

$$\sin^2 x (2 - \cos^2 x) = \left(1 - \frac{3-\sqrt{5}}{2}\right) \left(2 - \frac{3-\sqrt{5}}{2}\right)$$

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

77.

p	q	$\sim q$	$p \vee \sim q$	$\sim(p \vee \sim q)$	$p \vee q$	$\sim(p \vee q)$	$\sim(p \vee \sim q) \vee \sim(p \vee q)$
T	T	F	T	F	T	F	F
T	F	T	T	F	T	F	F
F	T	F	T	F	T	F	T
F	F	T	T	F	F	T	T

78. $\alpha + \beta + \gamma = 0$; $\sum \alpha\beta = 3$ $\alpha\beta\gamma = 1$
 $\alpha^2 + \beta^2 + \gamma^2 + 2\sum \alpha\beta = (\alpha + \beta + \gamma)^2$
 $\sum \alpha^2 = 0 - 2\sum \alpha\beta = -6$
 $\alpha^2 \beta^2 \gamma^2 = (1)^2 = 1$
 $\alpha^2 \beta^2 + \beta^2 \gamma^2 + \gamma^2 \alpha^2 = (\alpha\beta + \beta\gamma + \gamma\alpha)^2$
 $- 2\alpha\beta\gamma (\alpha + \beta + \gamma)$
 $= 3^2 - 2 \cdot (1)(0) = 9$
 Now equation तथा समीकरण $x^3 - (-6)x^2 + 9x - 1 = 0$
 $\Rightarrow x^3 + 6x^2 + 9x - 1 = 0$

79. $\frac{3 + \cot 76^\circ \cot 16^\circ}{\cot 76^\circ + \cot 16^\circ}$
 $= \frac{3 \sin 76^\circ \sin 16^\circ + \cos 76^\circ \cos 16^\circ}{\sin 16^\circ \cos 76^\circ + \sin 76^\circ \cos 16^\circ}$
 $= \frac{2 \sin 76^\circ \sin 16^\circ + \cos 6^\circ}{\sin 92^\circ}$
 $= \frac{\cos 6^\circ - \cos 92^\circ + \cos 6^\circ}{\sin 92^\circ}$
 $= \frac{1 - \cos 92^\circ}{\sin 92^\circ} = \tan 46^\circ = \cot 44^\circ$

80. $(p \wedge \sim q) \rightarrow (p \vee q)$
 $= \sim(p \wedge \sim q) \vee (p \vee q)$
 $= (\sim p \vee q) \vee (p \vee q)$
 $= (\sim p \vee p) \vee (q \vee q) = t \vee q$
 $= t$

81. $n(A - B) = 1681 - 1075 = 606$
 $= 576 + 2 \times 3 \times 5$

82. Let माना $f(x) = x^3 + bx^2 + cx + d$
 $b + c + d = 0$ (i)
 $4b + 2c + d = -4$ (ii)
 $9b + 3c + d = -18$ (iii)
 by (i), (ii) and तथा (iii)
 $b = -5, c = 11, d = -6$
 $\Rightarrow f(x) = x^3 - 5x^2 + 11x - 6$
Alter : $f(x) = (x - 1)(x - 2)(x - 3) + x^2 = x^3 - 5x^2 + 11x - 6 = x^3 - (x - 1)(5x - 6)$
 $\Rightarrow f(4) = (3)(2)(1) + 16 = 22$
 $f\left(\frac{6}{5}\right) = \left(\frac{6}{5}\right)^3$ Now अब $f(x) = x^3$
 $\Rightarrow x = 1$ or $\frac{6}{5}$
 $f(0) f(1) = (-6)(1) < 0$
 one root in $(0, 1)$ में एक मूल

83. $c(a - b) = a(b - c) \Rightarrow ac - bc = ab - ac$
 $\Rightarrow 2ac = ab + bc$
 $\Rightarrow \frac{2ac}{b} = a + c \Rightarrow \frac{2ac}{a + c} = b$
 Now अब $\frac{\log(a + c) + \log(a + c - 2b)}{\log(a - c)}$
 $= \frac{\log(a + c) + \log\left(a + c - \frac{4ac}{a + c}\right)}{\log(a - c)}$
 $= \frac{\log(a + c) + 2\log(a - c) - \log(a + c)}{\log(a - c)} = 2$

84. $(X \cos \theta + Y \sin \theta)^2 + 4(X \cos \theta + Y \sin \theta)(X \sin \theta - Y \cos \theta) + (X \sin \theta - Y \cos \theta)^2$
 $= aX^2 + bY^2$
 $\Rightarrow (1 + 2 \sin 2\theta) X^2 + (1 - 2 \sin 2\theta) Y^2 - (\cos 2\theta) XY = aX^2 + bY^2$
 $\Rightarrow \cos 2\theta = 0 \Rightarrow \theta = 45^\circ$
 $\Rightarrow a = 3, b = -1$

85. $x \rightarrow \frac{1}{x} \Rightarrow x^3 - 4x^2 + 4x + 8 = 0$
 sum योग $= -\left(-\frac{4}{1}\right) = 4$

86. $\log_{3/4} \log_8 (x^2 + 7) + \log_{1/2} \log_{1/4} (x^2 + 7)^{-1}$
 $= -2$
 $\Rightarrow \log_{3/4} \frac{1}{3} \log_2 (x^2 + 7) -$
 $\log_2 \frac{\log_2 (x^2 + 7)}{2} = -2$
 let (माना) $\log_2 (x^2 + 7) = t$

$\Rightarrow \log_{3/4} \frac{t}{3} - \log_2 \frac{t}{2} + 2 = 0$
 $\Rightarrow \log_{3/4} \frac{t}{3} + 1 - \left(\log_2 \frac{t}{2} - 1\right) = 0$
 $\Rightarrow \log_{3/4} \frac{t}{4} = \log_2 \frac{t}{4}$
 $\Rightarrow \frac{t}{4} = 1 \Rightarrow t = 4$
 $\therefore \log_2 (x^2 + 7) = 4$
 this gives अतः $x = \pm 3$

87. $(2 - x)(x + 1) = p$
 $\Rightarrow x^2 - x + (p - 2) = 0$... (1)
 (1) has both roots distinct & positive
 जैसा कि समीकरण (1) के मूल धनात्मक एवं भिन्न-भिन्न है,

\therefore (i) $D > 0$ (ii) $f(0) > 0$ (iii) $\frac{-b}{2a} > 0$

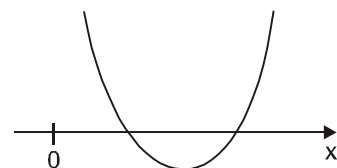
(i) $D > 0 \Rightarrow p < \frac{9}{4}$

(ii) $f(0) > 0 \Rightarrow p > 2$

(iii) $\frac{-b}{2a} = \frac{1}{2} > 0$ (always true)

(जो हमेशा सही होता है)

\therefore (i) \cap (ii) \cap (iii) $\Rightarrow p \in \left(2, \frac{9}{4}\right)$.



88. $2 \cos x + \sin x = 1$ (1)

$4 \cos^2 x = (1 - \sin x)^2$

$\Rightarrow 4 - 4 \sin^2 x = 1 + \sin^2 x - 2 \sin x$

$5 \sin^2 x - 2 \sin x - 3 = 0$

$\Rightarrow (\sin x - 1)(5 \sin x + 3) = 0$

$\Rightarrow \sin x = 1, \sin x = -\frac{3}{5}$

$\therefore \cos x = \frac{1 - \sin x}{2}$ (from equation (1))

\therefore when $\sin x = 1$

$7 \cos x + 6 \sin x = 7 \left(\frac{1 - \sin x}{2}\right) + 6 \sin x$

$= 7 \left(\frac{1 - 1}{2}\right) + 6 \times 1 = 6$ Ans.

and when $\sin x = \frac{-3}{5}$ then $7\cos x +$

$$6\sin x = 7 \left(\frac{1 + \frac{3}{5}}{2} \right) - \frac{6 \times 3}{5} = \frac{28 - 18}{5} = 2$$

हल. $2 \cos x + \sin x = 1$ (1)

$$4 \cos^2 x = (1 - \sin x)^2$$

$$\Rightarrow 4 - 4 \sin^2 x = 1 + \sin^2 x - 2 \sin x$$

$$5 \sin^2 x - 2 \sin x - 3 = 0$$

$$\Rightarrow (\sin x - 1)(5 \sin x + 3) = 0$$

$$\Rightarrow \sin x = 1, \sin x = -\frac{3}{5}$$

$\therefore \cos x = \frac{1 - \sin x}{2}$ समीकरण (1) से जब $\sin x = 1$

अतः $7\cos x + 6 \sin x = 7 \left(\frac{1 - \sin x}{2} \right) + 6$

$$\sin x = 7 \left(\frac{1 - 1}{2} \right) + 6 \times 1 = 6 \text{ Ans.}$$

और जब $\sin x = -\frac{3}{5}$ तब $7\cos x + 6 \sin x$

$$= 7 \left(\frac{1 + \frac{3}{5}}{2} \right) - \frac{6 \times 3}{5} = \frac{28 - 18}{5} = 2$$

89. $\tan 9^\circ - \tan 27^\circ - \tan 63^\circ + \tan 81^\circ$
 $= (\tan 9^\circ + \tan 81^\circ) - (\tan 27^\circ + \tan 63^\circ)$

$$= \frac{\sin 90^\circ}{\cos 9^\circ \cos 81^\circ} - \frac{\sin 90^\circ}{\cos 27^\circ \cos 63^\circ} = \frac{2}{2 \sin 9^\circ \cos 9^\circ} - \frac{2}{2 \sin 27^\circ \cos 27^\circ}$$

$$= \frac{2}{\sin 18^\circ} - \frac{2}{\sin 54^\circ} = \frac{2}{\frac{\sqrt{5}-1}{4}} - \frac{2}{\frac{\sqrt{5}+1}{4}}$$

$$= \frac{8(\sqrt{5}+1 - \sqrt{5}+1)}{4} = 4$$

90. $x^4 - Kx^3 + 2Kx^2 + Lx + M = 0$ $\begin{matrix} \alpha \\ \beta \\ \gamma \\ \delta \end{matrix}$

$$\Rightarrow \sum \alpha = K, \sum \alpha \beta = 2K, \sum \alpha \beta \gamma = -L$$

$$\alpha \beta \gamma \delta = M$$

$$\Rightarrow \alpha^2 + \beta^2 + \gamma^2 + \delta^2 = (\alpha + \beta + \gamma + \delta)^2 - 2 \sum \alpha \beta$$

$$K^2 - 4K = (K - 2)^2 - 4$$

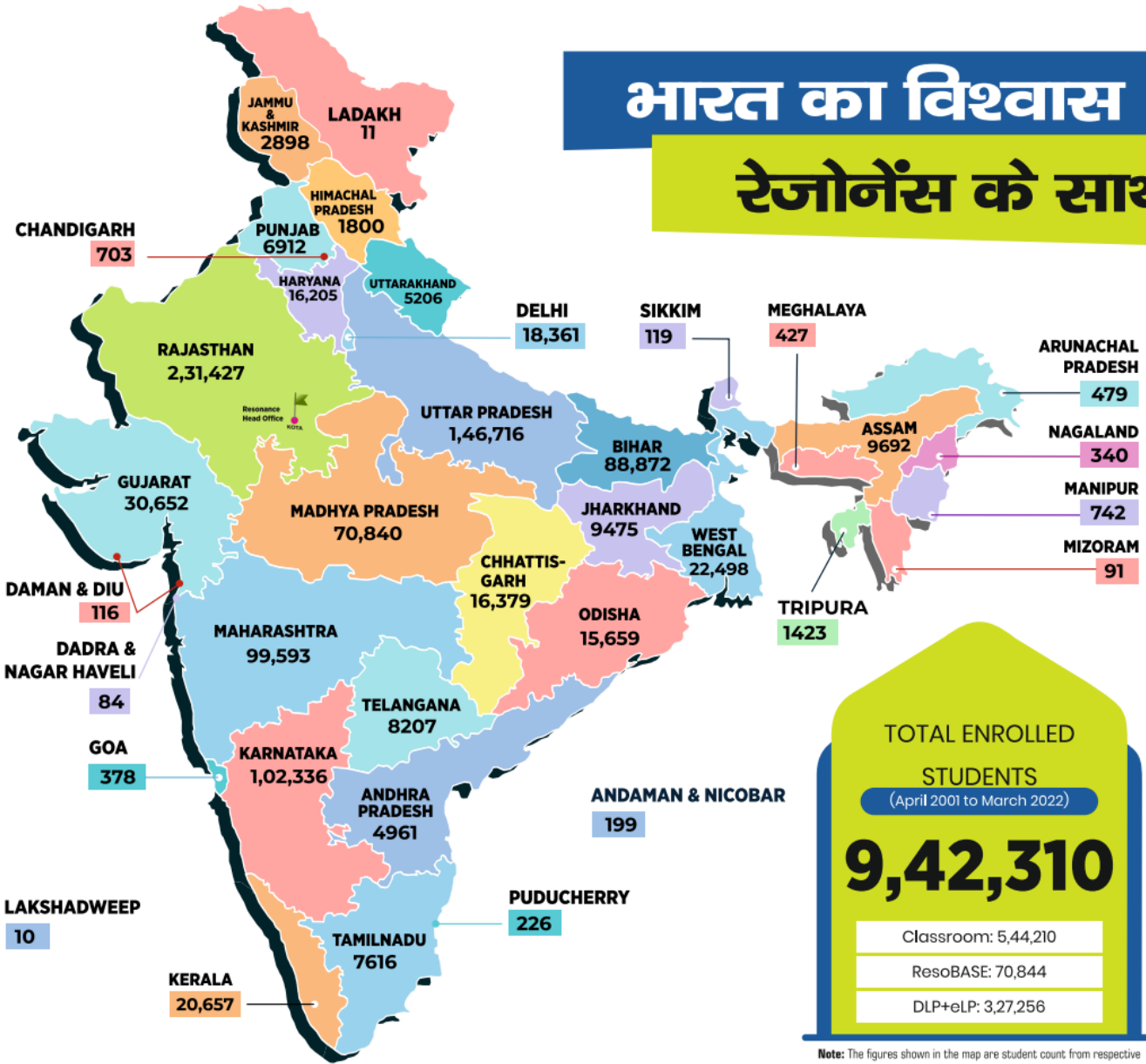
$$\Rightarrow (\alpha^2 + \beta^2 + \gamma^2 + \delta^2)_{\min} = -4$$

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



भारत का विश्वास

रेजोनेंस के साथ



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

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19 AIRs in TOP-100 (Classroom + DLP)

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