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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	VIPUL	COURSE CODE	JB
PHASE CODE(S)	01JB,01JBH	TOTAL PAGES	1	BATCH CODE(S)	01JB,01JBH

Target Examination & Year:

JEE (MAIN + ADVANCED) 2025

TEST PATTERN	TEST TYPE	TEST CODE & SEQUENCE
JEE (MAIN)	CUMULATIVE TEST (CT)	MCT 01

DATE & DAY:
03rd September 2023 | Sunday

Duration & Time:
3 Hrs | 11:30 AM to 02:30 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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ANSWER KEY (AK)

PAPER											
PART-A: PHYSICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	2	2	1	3	2	4	1	3	2	1
	Q.No.	11	12	13	14	15	16	17	18	19	20
	Ans.	2	4	1	4	1	3	1	4	2	2
	Q.No.	21	22	23	24	25	26	27	28	29	30
	Ans.	0016	0018	0030	0064	0030	0010	0018	0004	0016	0025
PART-B: CHEMISTRY	Q.No.	31	32	33	34	35	36	37	38	39	40
	Ans.	2	1	1	3	2	3	4	1	4	3
	Q.No.	41	42	43	44	45	46	47	48	49	50
	Ans.	3	1	1	2	3	4	2	1	2	2
	Q.No.	51	52	53	54	55	56	57	58	59	60
	Ans.	0003	0017	0002	0071	0075	0007	0009	0004	0003	0006
PART-C: MATHS	Q.No.	61	62	63	64	65	66	67	68	69	70
	Ans.	3	3	1	4	4	4	2	1	2	1
	Q.No.	71	72	73	74	75	76	77	78	79	80
	Ans.	4	2	1	3	2	3	1	4	2	4
	Q.No.	81	82	83	84	85	86	87	88	89	90
	Ans.	0001	0002	0047	2025	0002	0001	0002	0021	0081	0016

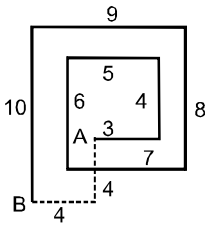
STUDENT'S SPACE

TEXT SOLUTIONS (TS)

PAPER

PART-A: PHYSICS

1.



$AB = \sqrt{4^2 + 4^2} = 4\sqrt{2}$.

2. $V = -\frac{3}{4}t + 2$

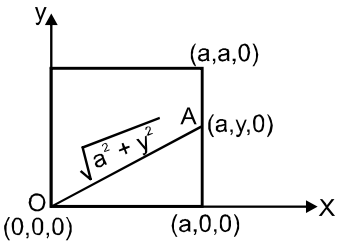
$y = m\,x + c$

$\Rightarrow C = +2$, m or slope या ढाल $= -\frac{3}{4}$.

3. Given figure represents a regular pentagan so magnitude of AE = 10 metre.

दिया गया चित्र समपंचभुज को दर्शाता है अतः AE का परिमाण 10 m है।

4.



Let B = (a, a, a)

Dist. = OA + AB

$T = \frac{\text{Dist}}{\text{Speed}} = \frac{OA + AB}{u}$

$T = \frac{1}{u}\left[\sqrt{a^2 + y^2} + \sqrt{(a-y)^2 + a^2}\right]$

$\frac{dT}{dy} = 0$

$\Rightarrow \quad \frac{2y}{2\sqrt{a^2 + y^2}} + \frac{2(a-y)(-1)}{2\sqrt{(a-y)^2 + a^2}} = 0$

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

$y^2(a-y)^2 + a^2 y^2 = a^2 (a^2 - y)^2 + y^2 (a-y)^2$

$\Rightarrow \quad y^2 = (a-y)^2$

$\Rightarrow \quad y = a - y \quad \Rightarrow \quad y = a/2$

$T_{min} = \frac{1}{u}\left[2\sqrt{a^2 + \frac{a^2}{4}}\right] = \frac{1}{u}\left[\sqrt{4a^2 + a^2}\right]$

$= \frac{\sqrt{5}a}{u}$.

5. $\vec{A}.\vec{A} + \vec{A}.\vec{B}$

$\vec{A}.\vec{B} = 0$

$\vec{A}.\vec{A} = A^2$

6. Slope of A is greater than slope of B.

A ढाल B से अधिक है।

$\therefore a_A > a_B$

$S = \frac{1}{2}at^2$ ($\because u = 0$)

$\therefore S_A > S_B$

7. $v = \frac{dx}{dt} = 3t^2 - 2t$

$v_4 = 3 \times 4^2 - 2 \times 4 = 40$

$v_2 = 3 \times 2^2 - 2 \times 2 = 8$

$<a> = \frac{v_4 - v_2}{4 - 2}$

8. $\vec{V} = \frac{d\vec{r}}{dt} = 2\hat{i} + 10t\,\hat{j}$

$\vec{a} = 10\,\hat{j}$

$\vec{V}(t=0) = 2\hat{i}$

$\vec{a}(t=0) = 10\,\hat{j} \quad \Rightarrow \quad \vec{V} \perp \vec{a} \ (\theta = 90^0)$

9. $\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 1 & 0 \\ 1 & -1 & 0 \end{vmatrix} = \hat{k}(-2-1)$

$= -3\hat{k}$

$\left|\vec{A}\times\vec{B}\right| = 3$

10. $\vec{a}.\vec{v} = \left(-\hat{i}+2\hat{j}-2\hat{k}\right).\left(2\hat{i}+\hat{j}-\hat{k}\right) \; -2+2+2$

$= 2 > 0 \;\; \vec{a}.\vec{v} > 0$

$\therefore$ speed will increase. चाल बढेगी।

11. $a = \dfrac{dv}{dt}$

$\int dv = \int a dt$

$\int dr = \int v dt$

12. $v = 3t^2 - 12t + 3$

$a = 6t - 12 = 0$

$\Rightarrow t = 2$ sec.

$v\,(t = 2 \text{ sec}) = -9$ m/s

13. $H = \dfrac{1}{2}gt^2$

$s = \dfrac{1}{2}g\left(\dfrac{t}{2}\right)^2 = \dfrac{1}{4}\left(\dfrac{1}{2}gt^2\right) = \dfrac{H}{4}$

$\Rightarrow \left(H - \dfrac{H}{4}\right) = \dfrac{3H}{4}$ (from ground जमीन से)

14. $\vec{P}.\vec{Q} = 0 \; = (a^2 - 2a - 3)$

$\Rightarrow a = 3$ & $a = -1$

15. $R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

$A = 5 = B$ and $\theta = 60^o$

$\Rightarrow R = 5\sqrt{3}\,N$

16. $AB\sin\theta = \sqrt{3}\,AB\cos\theta$

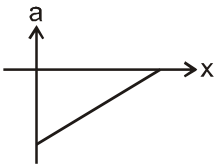
$\tan\theta = \sqrt{3}$

$\theta = \dfrac{\pi}{3}$

17. The linear relationship between V and x is $V = -mx + C$ where m and C are positive constants.

$\therefore$ Acceleration

$a = V\dfrac{dV}{dx} = -m(-mx + C)$



$\therefore a = m^2x - mC$

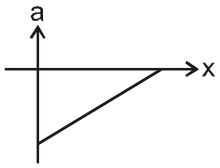
Hence the graph relating a to x is.

V तथा x के मध्य रेखीय सम्बन्ध से

$V = -mx+C$ जहाँ m तथा C धनात्मक नियतांक है।

$\therefore$ त्वरण

$a = V\dfrac{dV}{dx} = -m(-mx + C)$



$\therefore a = m^2x - mC$

अतः a व x वाला सम्बन्ध निम्न ग्राफ है।

18. for 0 to 1 seconds velocity increases linearly

0 से 1 सेकण्ड तक वेग समान रूप से बढ़ रहा है।

$a = \dfrac{4-2}{1-0} = 2 m/s^2$

$\Rightarrow$ a vs t graph is st. line parallel to x–axis (+ve acceleration)

a तथा t के मध्य का ग्राफ x–अक्ष के समानान्तर सरल रेखा है (धनात्मक त्वरण)

for 1 to 1.5 sec. के लिये

$v \rightarrow$ cost नियतांक $\Rightarrow a = 0$

for $t > 1.5$ sec. के लिये a is negative (a ऋणात्मक है)

19. Area क्षेत्रफल $= \int y\,dx = \int_0^2 x^2 dx = \frac{x^3}{3}\Big|_0^2 = \frac{8}{3}$

20. $Q = 4V^3 + 3V^2$

$dQ/dv = 12V^2 + 6V$

$V = 0, -1/2$

$\frac{d^2Q}{dV^2} = 24\,v + 6 \Rightarrow \left(\frac{d^2Q}{dV^2}\right)_{v=0} = 6$ (+ve)

$\left(\frac{d^2Q}{dv^2}\right)_{v=-1/2} = -12 + 6 = -6$ (-ve)

$V = -1/2$ for maximum Q

'Q' के अधिकतम के लिए

21. $v = \frac{dx}{dt} = u + 2a(t-2)$

$u + 2a(-2) = 0$

$\frac{u}{a} = 4.$

22. $f(x) = 6\sin^2 x$

$f'(x) = 6(2\sin x \cos x) = 6\sin(2x)$

$f'(\pi/12) = 6\sin\left(\frac{\pi}{6}\right) = 3.$

23. Speed of particle is कण की चाल है

$$|V| = \sqrt{(2)^2 + (1)^2 + (2)^2}$$

$|V| = 3$ m/sec

$$S\int_0^{10} |V|dt = \int_0^{10} 3\,dt = |3t|_0^{10}$$

$S = 30$ m **Ans. 30 m**

24. $x = 16t - 2t^2$

$\therefore$ $v = 16 - 4t = 0$ or $t = 4$ sec (break point घुमाव बिन्दु)

$\therefore$ Distance दूरी

$= \left[16t - 2t^2\right]_0^4 + \left|16t - 2t^2\right|_4^8 = [64 - 32] + \left|[(128-128)-(32)]\right|$

$= 32 + 32 = 64$ m

25. For f(f(f(x))) के लिए

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

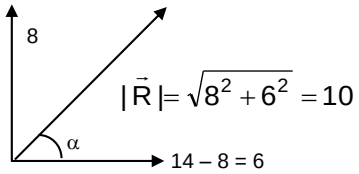
$f(f(f(x))) = \left(\left(x^2-1\right)^2 - 1\right) - 1$

$f(f(f(0))) = 0 - 1 = -1$

$\therefore\ a = -1$

$b = 4 \times \frac{4}{5} \times \frac{3}{4} \times \frac{5}{3} = 4$

26.



27. $v = \frac{dx}{dt} = 3t^2 - 2t$

$v_4 = 3 \times 4^2 - 2 \times 4 = 40$

$v_2 = 2 \times 2^2 - 2 \times 2 = 4$

$\langle a \rangle = \frac{v_4 - v_2}{4-2}$

$= \frac{40-4}{4-2} = 18$ m/s^2.

28. $g(2) = \frac{1}{2-1} = 1$

$f(g(2)) \Rightarrow f(1) = 2+1+1 = 4$

29. $x + y = 8$

$A = xy$

$A = x(8 - x)$

$A = 8x - x^2$

$dA/dx = 8 - 2x$

$x = 4$

$y = 4$

$A = xy = 16$

30. $f'(x) = 2x + 2$

$f'' (x) = 2$

$\therefore\ g(f''(x)) = g(2) = 2(2) + 1 = 5$

$\therefore\ \int_{-2}^{3} 5dx = 5[x]_{-2}^{3} = 5[3 - (-2)] = 5 \times 5$

$= 25.$

PART-B: CHEMISTRY

31. Since P, V and T are same for both gases, their number of moles (n) will also be same. So, number of gram-molecules (n) and number of molecules ($n \times N_A$) will also be same. However, the atomicity of gases is different. So, number of atoms will be different.

हल. चूंकि दोनों गैसों के लिए P, V तथा T समान हैं अतः इनके मोलों (n) की संख्या भी समान होगी। अतः, ग्राम अणुओं की संख्या (n) क्या अणुओं की संख्या ($n \times N_A$) भी समान होगी। यद्यपि गैस की परमाण्विकता भिन्न है, अतः परमाणुओं की संख्या भिन्न होगी।

32. (I) 0.5 mole O_3 = 24 gm O_3

0.5 मोल O_3 = 24 gm O_3

(II) 0.5 gm atom of oxygen = 8 gm

0.5 ग्राम परमाणु ऑक्सीजन = 8 gm

(III) $\frac{3.011\times10^{23}}{6.022\times10^{23}} \times 32 = 16$ gm O_2

(IV) $\frac{5.6}{22.4} \times 44$ gm $CO_2 = 11$ CO_2

33. Power of the bulb = 100 watt = 100 J s^{-1}

Energy of one photon $E = h\nu = \frac{hc}{\lambda}$

$= \frac{6.626\times10^{-34}\times3\times10^{8}}{400\times10^{-9}} = 4.969 \times 10^{-19}$ J

Number of photon emitted

$= \frac{100}{4.969\times10^{-19}} = 2.012 \times 10^{20}$

हल. एक बल्ब की शक्ति = 100 वॉट = 100 J s^{-1}

एक फोटॉन की ऊर्जा $E = h\nu = \frac{hc}{\lambda}$

$= \frac{6.626\times10^{-34}\times3\times10^{8}}{400\times10^{-9}} = 4.969 \times 10^{-19}$ J

उत्सर्जित फोटॉन की संख्या $= \frac{100}{4.969\times10^{-19}}$

$= 2.012 \times 10^{20}$

34. Moles of $O^{2-} = \frac{8}{16} = \frac{1}{2}$ mole

Number of O^{2-} ions = $\frac{1}{2} \times N_A$

Total Charge on O^{2-}

$= \frac{1}{2} \times N_A \times 2e = N_A e.$

हल. O^{2-} के मोल = $\frac{8}{16} = \frac{1}{2}$ मोल

O^{2-} आयनों की संख्या = $\frac{1}{2} \times N_A$

O^{2-} पर कुल आवेश

$= \frac{1}{2} \times N_A \times 2e = N_A e$

35. $PV = nRT$

$3.06 \times 1 = n \times 0.0821 \times 373$

$n = 0.1$, mass of $H_2O_{(vap)} = 1.8$ g

$\Rightarrow$ Volume of $H_2O_{(l)} = 1.8$ mL

हल. $PV = nRT$

$3.06 \times 1 = n \times 0.0821 \times 373$

$n = 0.1$, $H_2O_{(वाष्प)}$ का द्रव्यमान = 1.8 g

$\Rightarrow$ $H_2O_{(l)}$ का आयतन = 1.8 mL

36. $\left[V_n = 2.18 \times 10^6 \times \frac{Z}{n} \right]$ m/ sec.

So, $V_3 = V_0 \times \frac{1}{3} = V_0/3$

37. Refer ChemINFO-1.1 & 1.2 (DPP No.-3).

38. 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 = $\frac{\text{नाभिक का आयतन}}{\text{परमाणु का कुल आयतन}}$

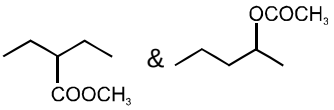
$= \frac{(4/3)\pi (10^{-13})^3}{(4/3)\pi (10^{-8})^3} = 10^{-15}$

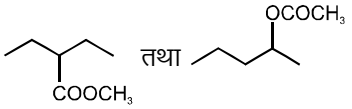
39. Bohr's theory is applicable only to atoms having one electron. Therefore, it is not applicable to H^+ as it has no electron.

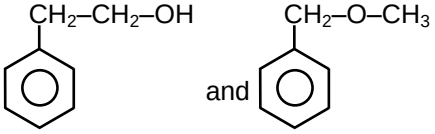
हल : केवल एक इलैक्ट्रॉन रखने वाले परमाणुओं के लिए बोर सिद्धान्त लागू होता है। अतः यह H^+ के लिए लागू नहीं होता है क्योंकि H^+ के पास कोई इलैक्ट्रॉन नहीं होता है।

41. Both are ethers only

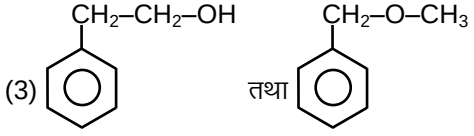
दोनों यौगिक ईथर है

43.  are metamers

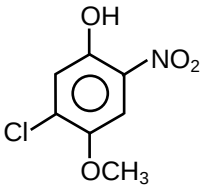
 मध्यावयवी है।

45. (3) 

are functional isomers

(3) 

क्रियात्मक समावयवी हैं।

47. (2) 

48. Check molecular formula. Isomers should have same molecular formula.

अणु सूत्र को देखिये। समावयवी समान अणुसूत्र रखने चाहिए।

49. Only this $(CH_3)_3COH$ compound has same molecular formula with diethylether.

$(CH_3)_3COH$ केवल इस यौगिक का अणुसूत्र डाईएथिलईथर के समान है।

51. Mass of 0.25 mole X_3 = 13.5 g.

Mass of 1 mole $X_3 = \frac{13.5}{0.25}$ = 54 g.

Mass of 1 molecule of X_3 = 54 amu.

Mass of 1 atom of $X_3 = \frac{54}{3}$ = 18 amu

$= 18 \times 1.66 \times 10^{-24}$ g $= 3 \times 10^{-23}$ g.

So p is 3.

हल. 0.25 मोल X_3 का द्रव्यमान = 13.5 g.

1 मोल X_3 का द्रव्यमान $= \frac{13.5}{0.25}$ = 54 g.

X_3 के एक अणु का द्रव्यमान = 54 amu.

X_3 के एक परमाणु का द्रव्यमान $= \frac{54}{3}$

$= 18$ amu $= 18 \times 1.66 \times 10^{-24}$ g

$= 3 \times 10^{-23}$ g

अतः p = 3.

52. $r = 0.529 \times \frac{n^2}{z}$ Å

$\frac{r_1}{r_2} = \frac{n_1^2 \times Z_2}{Z_1 \times n_2^2} = \frac{9 \times 6}{3 \times 16} = \frac{9}{8} = \frac{x}{y}$

x + y = 17

53. $\frac{(e/m)_p}{(e/m)_\alpha} = \frac{e/m}{2e/4m} = \frac{2}{1} = \frac{x}{y}$

So, ratio (अत:, अनुपात) = 2

54. No. of sodium in $Na_4Fe(CN)_6$

$= 2 \times 4\ N_A$

$= 8\ N_A$

$= 8 \times 6 \times 10^{23}$

$= 48 \times 10^{23}$

p + q = 71

हल. $Na_4Fe(CN)_6$ में सोडियम की संख्या

$= 2 \times 4\ N_A$

$= 8\ N_A$

$= 8 \times 6 \times 10^{23}$

$= 48 \times 10^{23}$

p + q = 71

55. $100 \times 48 = n \times 64 \Rightarrow n = 75$

59. $C=\underset{\underset{C}{|}}{C}-CHO$; $C-C=C-CHO$;

$C=C-C-CHO$

PART-C: MATHEMATICS

61. The above equation reduces to $(x-2^{2012})^2+(x-2^{2012})-2=0$

दी गई समीकरण

$(x-2^{2012})^2+(x-2^{2012})-2=0$

$\Rightarrow a,b = 2^{2012}-2, 2^{2012}+1$

$\Rightarrow (a-b)^{2018} = 3^{2018}$

62. $6(x^4+1)-25(x^3-x)+12x^2=0$

$6\left(x^2+\frac{1}{x^2}\right)-25\left(x-\frac{1}{x}\right)+12=0$

$\Rightarrow \quad 6\left(x-\frac{1}{x}\right)^2-25\left(x-\frac{1}{x}\right)+24=0$

Let माना $t = x-\frac{1}{x}$

$6t^2-25t+24=0$

$\Rightarrow \quad 6t^2-16t-9t+24=0$

$\Rightarrow \quad t=\frac{3}{2}$ or $\frac{8}{3}$

$\Rightarrow$ after solution हल करने पर

$x=2,\frac{-1}{2},3,\frac{-1}{3}$

63. $x^2-2x>0$ definitionपरिभाषित

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

$\Rightarrow \quad x^2-2x+10=10$

$x^2-2x=0$

$\Rightarrow$ x = 0, 2 but it's not solution.

परन्तु यह हल नहीं है।

64. $\log_{100}{}^{10}=\frac{1}{2}$

$\log_2\left(\log_4 2\right)=\log_2\left(\frac{1}{2}\right)=-1$

$\log_4\left(\log_2^2\left(256\right)^2\right)=4$

$\log_4{}^8=\frac{3}{2}$

$\log_8{}^4=\frac{2}{3}$

65. $\log_3 a-\frac{\log_3 a}{\log_3 x}=\frac{\log_3 a}{\log_3 x-1}$

$\Rightarrow\left(\log_3 x-1\right)^2=\log_3 x$

$\Rightarrow\left(\log_3 x\right)^2-3\left(\log_3 x\right)+1=0$

The roots of above equation are $\log_3 x_1$ and $\log_3 x_2$

दी गई समीकरण के मूल $\log_3 x_1$ तथा $\log_3 x_2$ है

$\log_3 x_1 + \log_3 x_2 = 3 \Rightarrow x_1x_2 = 27$

66. $p(\alpha) = \alpha$

$p(p(\alpha)) = p(\alpha) = \alpha$

$p(p(\alpha)) = p(\alpha) = \alpha$

67. $2x^2 + 3x + 4 = 0$ 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

68. Put $2^x = t$, then (1) can be written as

$2^x = t$ रखने पर (1) से

$$1+\log_2 t - 2\log_2(t+3) + \frac{2}{2}\log_2\left(10-\frac{1}{t}\right) = 0$$

$$\Rightarrow 1+\log_2 t - \log_2(t+3)^2 + \log_2(10t-1) - \log_2 t = 0$$

$$\Rightarrow \log_2(10t-1)/(t+3)^2 = -1$$

$$\Rightarrow 10t-1 = \frac{1}{2}(t+3)^2$$

$$\Rightarrow t^2 - 14t + 11 = 0$$

If $t_1 = 2^{x_1}, t_2 - 2^{x_2}$ are roots of (2),

यदि $t_1 = 2^{x_1}, t_2 - 2^{x_2}$ (2) के मूल है।

then तब , $t_1 t_2 = 2^{x_1} \cdot 2^{x_2} = 11$

$\Rightarrow x_1 + x_2 = \log_2 11$

69. $x^2 + px + q = 0 \begin{matrix}\nearrow \alpha \\ \searrow \beta\end{matrix} \Rightarrow p = -11,\ q = 24$

then correct equation will be $x^2 - 11x + 24 = 0$

अतः सही समीकरण होगी $x^2 - 11x + 24 = 0$

$\Rightarrow (x-8)(x-3) = 0 \qquad \Rightarrow x = 3, 8$

70. Put $x \to \frac{1}{x}$ in (1) and then compare with (2)

(1) में $x \to \frac{1}{x}$ रखने पर तब (2) से तुलना करने पर

$$4\beta + 8\delta = 5$$

71. **(4)** Since α, β are the roots of

$$(x-a)(x-b)+c = 0$$

i.e., of $x^2 - (a+b)x + ab + c = 0$

$\therefore \alpha + \beta = a + b, \alpha\beta = ab + c \Rightarrow a + b = \alpha + \beta$,

$ab = \alpha\beta - c$

$\therefore$ a, b are the roots of

$x^2 - (\alpha + \beta)x + \alpha\beta - c = 0$

$\therefore -\frac{1}{a}, \frac{1}{b}$ are the roots of

$(\alpha\beta - c)x^2 + (\alpha + \beta)x + 1 = 0 \therefore (d)$ holds.

हल. **(4)** चूकि α, β समीकरण

$(x-a)(x-b)+c = 0$

अर्थात्, of $x^2 - (a+b)x + ab + c = 0$

$\therefore \alpha + \beta = a + b, \alpha\beta = ab + c \Rightarrow a + b = \alpha + \beta$,

$ab = \alpha\beta - c$

$\therefore$ a, b समीकरण

$x^2 - (\alpha + \beta)x + \alpha\beta - c = 0$

$\therefore -\frac{1}{a}, \frac{1}{b}$ मूल है

$(\alpha\beta - c)x^2 + (\alpha + \beta)x + 1 = 0 \therefore (d)$

मूल है

72. $\lambda = \frac{\alpha}{\beta}$

$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = 1$, $\alpha + \beta$

$= \frac{-m(m-4)}{3m^2} = \frac{4-m}{3m}$, $\alpha\beta = \frac{2}{3m^2}$

Now अब $(\alpha + \beta)^2 = 3\alpha\beta$

$$\frac{(4-m)^2}{9m^2} = 3 \times \frac{2}{3m^2}$$

$(4 - m)^2 = 18 \Rightarrow m^2 - 8m - 2 = 0$

73. $x_i^5 - 3x_i^3 - 1 = 0$

$x_i^{100} - x_i^{95} = 3x_i^{98}$

$\sum x_i^{100} - \sum x_i^{95} = 3\sum x_i^{98}$

$$\frac{\sum x_i^{100} - \sum x_i^{95}}{\sum x_i^{98}} = 3$$

74. From the given relations it follows that

दिये गये सम्बन्धों के अनुसार

$y^{1-\log x} = 10$, $z^{1-\log y} = 10$

Taking logarithms of these equalities to the base 10,

लघुगणक का आधार 10 का लेने पर

we get

$(1-\log x)\log y = 1$, $(1-\log y)\log z = 1$.

$$\Rightarrow \quad \log x = 1 - \frac{1}{\log y}$$

$$= 1 - \frac{1}{1 - \frac{1}{\log z}} = \frac{1}{1 - \log z}$$

$$\Rightarrow \quad x = 10^{\frac{1}{1-\log z}}$$

75. $A \Delta B = (A \cup B) - (A \cap B)$

$\Rightarrow \quad (A \cup B) - (A \Delta B) = A \cap B$

$A \Delta C = (A \cup C) - (A \cap C)$

$\Rightarrow \quad (A \cup C) - (A \Delta C) = A \cap C$

76. Let माना $f(x) = 2x^4 + x^3 - ax^2 + bx + a + b - 1$

$\because x^2 + x - 6 = (x - 2)(x + 3)$ is a factor of f(x) का एक गुणनखण्ड है।

$\therefore f(2) = f(-3) = 0$

$\therefore 4a + b = 67$ and और $a - b = 13$, $a = 16$, $b = 3$

$\therefore g(1) = a + b - a + b = 2b = 6$

77. स्पष्टतया

78. $$\frac{(x-2)(x-4)(x-7)}{(x+2)(x+4)(x+7)} - 1 > 0$$

$$\Rightarrow \frac{(x^3 - 13x^2 + 50x - 56) - (x^3 + 13x^2 + 50x + 56)}{(x+2)(x+4)(x+7)} > 0$$

$$\Rightarrow \frac{-26x^2 - 112}{(x+2)(x+4)(x+7)} > 0$$

$$\Rightarrow \underset{-7}{-} \underset{-4}{+} \underset{-2}{-} +$$

Ans. $(-\infty, -7) \cup (-4, -2)$

79. $x^3 + bx + c = 0$ $\qquad \beta\gamma = 1 = -\alpha$

$\alpha + \beta + \gamma = 0$, $\alpha\beta + \beta\gamma + \gamma\alpha = -b$, $\alpha\beta\gamma = -c$

$\alpha = -c = -1$

$c = 1$

Now, $\alpha = -1 \Rightarrow \beta + \gamma = 1$

$-\beta - \gamma + \beta\gamma = -b$

$\beta\gamma = 1 - b = 1 \Rightarrow b = 0$

Now $x^3 + 0.x + 1 = 0 \Rightarrow x^3 + 1 = 0$

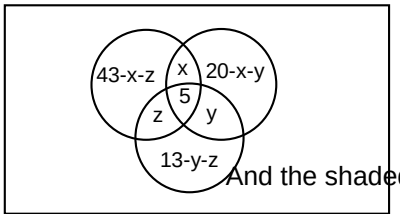
Hence $\alpha^3 = \beta^3 = \gamma^3 = -1$

$b = 0$, $c = 1$

$b^3 + 2c^3 - 3\alpha^3 - 6\beta^3 - 8\gamma^3$

$= 0 + 2 + 3 + 6 + 8 = 19$

80.



And the shaded region is तथा छाय

$(20 - x - y) + (43 - x - z) + (13 - y - z) + x + y + z + 5 = 60$

21= x + y + z

81. Here $x \in N$, therefore the 2nd value $x = \frac{3}{\log_2 6}$ has to be rejected

given equation reduced to $\left(2^{3/x}\right)^2 - 8\cdot 2^{3/x} + 12 = 0$; put $2^{3/x} = y$ and proceed.

हल. यहाँ $x \in N$ इसलिए दुसरा मान $x = \frac{3}{\log_2 6}$ अस्वीकार्य है।

82. squaring we get

वर्ग करने पर

$$\left(\log_3(3x)^{1/3} + \frac{\log_3(3x)^{1/3}}{\log_3 x}\right) 3\log_3 x = 4$$

माना $\log_3 x = t$

$$\Rightarrow \frac{1}{3}\ \frac{(t+1)(t+1)}{t}.3t = 4$$

$$\Rightarrow t + 1 = \pm 2$$

$$\Rightarrow x = 3 \text{ or } x = \frac{1}{27}$$

$\therefore$ product of roots मूलों का गुणन $= \frac{1}{9} = k$

$\therefore\ 18k = 2$

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

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

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

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

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

84. α, β are roots of the equation

$x^2 + px + q = 0$

$\Rightarrow \quad \alpha + \beta = -p \quad \ldots$ (i) and

$\alpha\beta = q \quad \ldots$ (ii)

α, β are also roots of the equation

$x^{2008} + p^{1004}x^{1004} + q^{1004} = 0$

$$\Rightarrow \quad \alpha^{2008} + (\alpha+\beta)^{1004}.\ \alpha^{1004} + (\alpha\cdot\beta)^{1004} = 0$$

$$\Rightarrow \alpha^{2008} + \left(\frac{\alpha}{\beta}+1\right)^{1004}\cdot\beta^{1004}$$

$$.\ \alpha^{1004} + (\alpha\cdot\beta)^{1004} = 0$$

Dividing by $(\alpha\beta)^{1004}$

$$\Rightarrow \quad \left(\frac{\alpha}{\beta}\right)^{1004} + \left(\frac{\alpha}{\beta}+1\right)^{1004} + 1 = 0$$

Given $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$ are the roots of

$x^n + 1 + (x+1)^n = 0$

$$\Rightarrow \quad \left(\frac{\alpha}{\beta}\right)^n + 1 + \left(\frac{\alpha}{\beta}+1\right)^n = 0$$

By comparing equation (iii) and (iv), we get

n = 1004

हल. α, β समीकरण $x^2 + px + q = 0$ के मूल है।

$\Rightarrow \quad \alpha + \beta = -p \quad \ldots$ (i) and

$\alpha\beta = q \quad \ldots$ (ii)

α, β समीकरण

$x^{2008} + p^{1004}x^{1004} + q^{1004} = 0$ के मूल है।

$$\Rightarrow \quad \alpha^{2008} + (\alpha+\beta)^{1004}.\ \alpha^{1004} + (\alpha\cdot\beta)^{1004} = 0$$

$$\Rightarrow \quad \alpha^{2008} + \left(\frac{\alpha}{\beta}+1\right)^{1004}\cdot\beta^{1004}$$

$$.\ \alpha^{1004} + (\alpha\cdot\beta)^{1004} = 0$$

$(\alpha\beta)^{1004}$ से विभाजित करने पर

$$\Rightarrow \quad \left(\frac{\alpha}{\beta}\right)^{1004} + \left(\frac{\alpha}{\beta}+1\right)^{1004} + 1 = 0$$

दिया गया है कि $\frac{\alpha}{\beta}$ और $\frac{\beta}{\alpha}$ समीकरण

$x^n + 1 + (x+1)^n = 0$ के मूल है।

$$\Rightarrow \quad \left(\frac{\alpha}{\beta}\right)^n + 1 + \left(\frac{\alpha}{\beta}+1\right)^n = 0$$

(iii) और (iv) से तुलना करने पर

n = 1004

85. $\alpha + \beta = -p,\ \alpha\beta = q$

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

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

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

$$= \frac{q}{q} - \frac{q}{-q} = 2$$

86. $$\frac{2^{2a+4+a+b}.3^{2b+4+a+b}.5^{a+2+b+2}}{30^4.2^{3a+b}.3^{3b+a}.5^{a+b}}$$

$$= \frac{2^4\cdot3^4\cdot5^4.2^{3a+b}\cdot3^{3b+a}\cdot5^{a+b}}{30^4\cdot2^{3a+b}\cdot3^{3b+a}\cdot5^{a+b}} = 1$$

87. Refer to answer key

88. AB and CB are two two-digit numbers with the same unit digit.

Therefore, R.H.S. should also be a multiplication of two two-digit numbers with the same unit digit.

R.H.S. = DDD = D x 111 = D x 3 x 37.

Now 37 is a two-digit number with 7 as the unit digit. Therefore , 3D should also be a two-digit number with 7 as the unit–digit

$\Rightarrow$ D = 9 and 3D = 27. Therefore, 27 x 37 = 999. Hence, A = 2, B = 7, C = 3 and D = 9 and

A + B + C + D = 2 + 7 + 3 + 9 = 21.

89. $\alpha + \beta = -\sqrt{6}$, $\alpha\beta = 3$

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 0$

$\alpha^{14} + \beta^{14} = (\alpha^2)^7 + (\beta^2)^7 = (\alpha^2 + \beta^2)\ (....) = 0$

$\alpha^{10} + \beta^{10} = (\alpha^2)^5 + (\beta^2)^5 = (\alpha^2 + \beta^2)\ (....) = 0$

Now

$$\frac{\alpha^{23}+\beta^{23}+\alpha^{14}+\beta^{14}}{\alpha^{15}+\beta^{15}+\alpha^{10}+\beta^{10}} = \frac{\alpha^{23}+\beta(-\alpha^2)^{11}+0}{\alpha^{15}+\beta(-\alpha^2)^7+0}$$

$$= \frac{\alpha^{22}(\alpha-\beta)}{\alpha^{14}(\alpha-\beta)} = \alpha^8 = (-9)^2 = 81$$

(since $\alpha^2 + 3 = -\sqrt{6}\alpha \Rightarrow \alpha^4 = -9$)

90. $\therefore\ \alpha + \beta = \sqrt{2}$ $\qquad\qquad \alpha\beta = 2$

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

$\alpha^4 + \beta^4 = (\alpha^2 + \beta^2)^2 - 2(\alpha\beta)^2 = 4 - 8 = -4$

$\alpha^6 + \beta^6 = (\alpha^2 + \beta^2)\ (\alpha^4 + \beta^4) - (\alpha\beta)^2\ (\alpha^2 + \beta^2)$

$= -2\ (-4 - 4) = 16$

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

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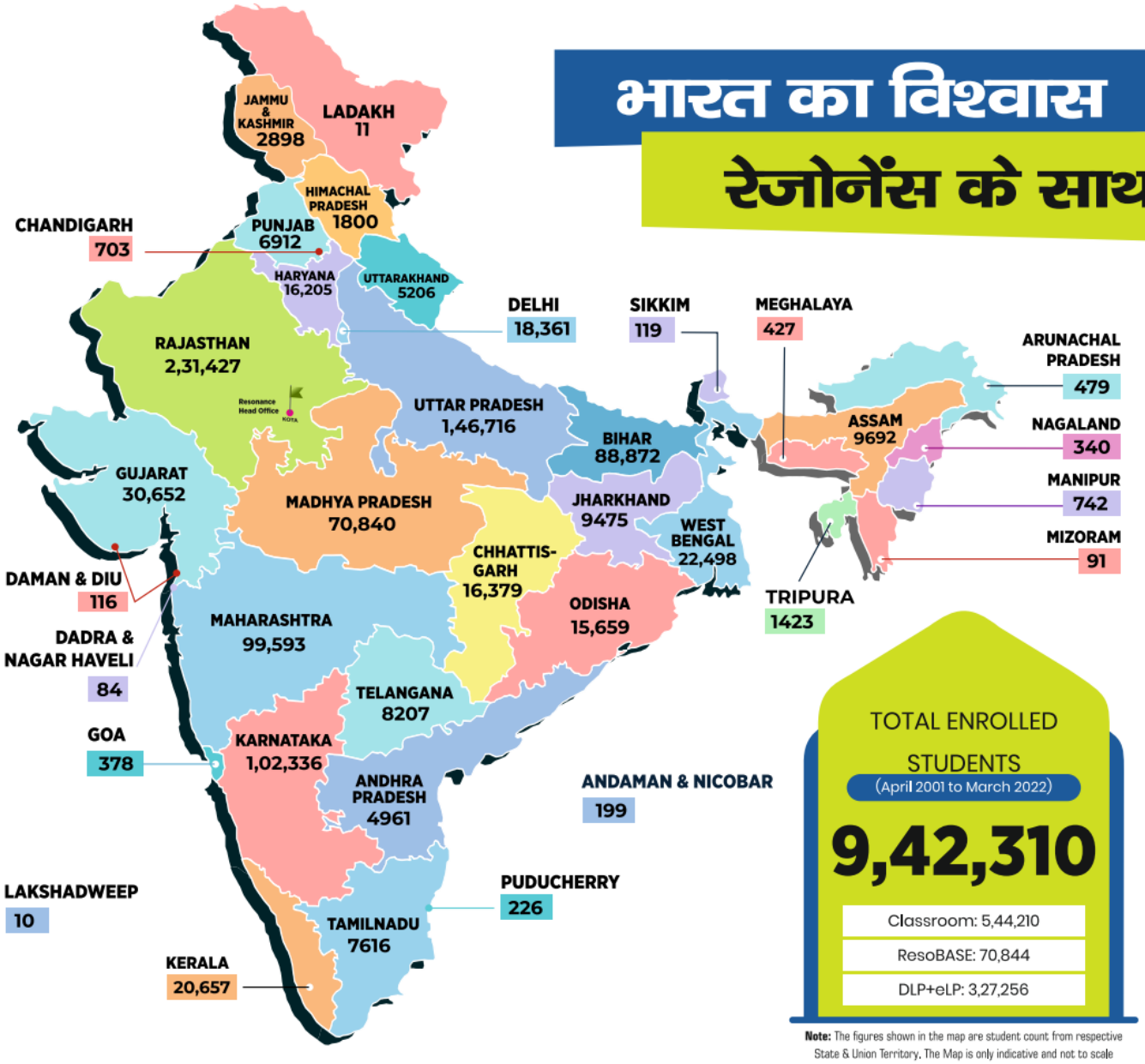

TOTAL ENROLLED STUDENTS
(April 2001 to March 2022)

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

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  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