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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)	CUMULATIVE TEST (CT)	ACT 02

DATE & DAY:
14th January 2024 | Sunday

Duration & Time:
Paper-1 : 3 Hrs | 11:00 AM to 02:00 PM
Paper-2 : 3 Hrs | 2:30 PM to 5:30 PM

Contents:

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

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Kota Study Centre & Registered Corporate Office:
CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
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ANSWER KEY (AK)

PAPER-1											
PART-I : MATHEMATICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	C	C	D	A	C	A	AD	AC	ABC	AC
	Q.No.	11	12	13	14	15	16	17	18		
	Ans.	ABD	AC	01.00	02.00	01.00	08.00	06.00	12.50		
PART-II : PHYSICS	Q.No.	19	20	21	22	23	24	25	26	27	28
	Ans.	B	A	D	A	D	D	ABC	ABCD	AD	BD
	Q.No.	29	30	31	32	33	34	35	36		
	Ans.	BC	BC	04.00	01.20	01.11	01.33	10.36	06.50		
PART-III : CHEMISTRY	Q.No.	37	38	39	40	41	42	43	44	45	46
	Ans.	B	D	C	D	C	A	ABD	ABCD	AD	ABCD
	Q.No.	47	48	49	50	51	52	53	54		
	Ans.	ACD	BCD	04.00	20.00	75.00	08.00	16.00	04.00		
PAPER-2											
PART-I : MATHEMATICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	7	3	7	2	8	6	ABD	AD	ABD	ACD
	Q.No.	11	12	13	14	15	16	17	18		
	Ans.	CD	BD	14.00	04.25	05.00	14.00	80.00	24.00		
PART-II : PHYSICS	Q.No.	19	20	21	22	23	24	25	26	27	28
	Ans.	8	4	2	5	6	5	B	AB	AC	ABCD
	Q.No.	29	30	31	32	33	34	35	36		
	Ans.	BC	CD	15.00	64.00	16.00	01.00	10.00	02.00		
PART-III : CHEMISTRY	Q.No.	37	38	39	40	41	42	43	44	45	46
	Ans.	2	8	6	9	4	7	BC	BCD	AD	BC
	Q.No.	47	48	49	50	51	52	53	54		
	Ans.	AC	ABD	20.00	50.00	96.00	47.00	10.00	13.00		

STUDENT'S SPACE

TEXT SOLUTIONS (TS)

PAPER-1

PART-I: MATHEMATICS

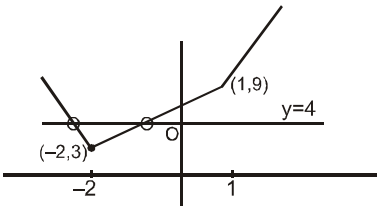
1. $n + m = 120$ …….. (1)

$56 = \frac{50n + 60m}{120}$ …….. (2)

(1) & (2) $\rightarrow$ n = 48 & m = 72

$\therefore \frac{9n}{m} = 6$.

2.



3. Refer to answer key

4. Converse of $p \rightarrow q$ is $q \rightarrow p$

$p \rightarrow q$ का प्रतिलोम $q \rightarrow p$ है।

$(q \rightarrow r) \rightarrow p$

$= (\sim q \vee r) \rightarrow p$

$= (q \wedge \sim r) \vee p$

5. $x^2 - 10x + 16 \le 0 \Rightarrow x \in [2, 8]$

if यदि x > 2 then तब

$-x^2 + 10x - 16 < x^2 - 4x + 4$

$2x^2 - 14x + 20 > 0 \Rightarrow (x - 2)(x - 5) > 0$

$x \in (5, 8]$

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

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

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

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

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

7. Let roots are $\frac{a}{r^2}, \frac{a}{r}, a, ar, ar^2$

माना मूल $\frac{a}{r^2}, \frac{a}{r}, a, ar, ar^2$

Now अब, $a\left(\frac{1}{r^2} + \frac{1}{r} + 1 + r + r^2\right) = 40$

$\frac{1}{a}\left(r^2 + r + 1 + \frac{1}{r} + \frac{1}{r^2}\right) = 10$

Dividing both दोनों को विभाजित करने पर

$\Rightarrow a^2 = 4 \Rightarrow a = \pm 2$

As product of roots चूंकि मूलों का गुणनफल

$= a^5 = -\delta$

$\Rightarrow \delta = 32$ or या -32

8. $x^2 - 8x + 12 + 4k - k^2 = 0, \ k \in R$

when both roots positive जब दोनो मूल धनात्मक है।

$$\left.\begin{array}{l}\text{(i) } D \ge 0 \quad \Rightarrow \quad (k-2)^2 \ge 0 \Rightarrow k \in R \\ \text{(ii) } f(0) > 0 \ \Rightarrow \ 12 + 4k - k^2 > 0 \Rightarrow k \in (-2, 6)\end{array}\right\}$$

(i) $\cap$ (ii) $\Rightarrow$ $k \in (-2, 6)$

$f(4) = (k^2 - 4k + 4) = (k - 2)^2$

$f(4)_{max} = 0$, at $k = 2$ पर

9. Equation can be written as

$\cos 2x(\cos 4x + \cos 2x) = 0$

समीकरण $\cos 2x(\cos 4x + \cos 2x) = 0$ को लिखा जा सकता है।

$\Rightarrow 2 \cos x \cos 2x \cos 3x = 0$

10. $x^2 - bx + c = 0$ $\begin{matrix}\nearrow \alpha \\ \searrow \beta\end{matrix}$

$\alpha + \beta = b$

$\therefore$ b is an odd positive integer and α, β are prime one of then must be 2

$\alpha\beta = c$

Let $\beta = 2$

$\Rightarrow \alpha + 2 = b$ and $2(\alpha) = c \ \Rightarrow \ 4 - 2b + c = 0$ .....(i)

$\Rightarrow b + c = 35$ .....(ii)

from (i) and (ii) $\Rightarrow$ c = 22, b = 13

$\Rightarrow f(x) = x^2 - 13x + 22$

$\Rightarrow f(1) = 10$

$\Rightarrow f(-1) = 36$

$\Rightarrow f_{min}\left(\frac{13}{2}\right) = \left(-\frac{81}{4}\right)$

11. $\frac{a}{1-r} = 162$ ….. (1)

$\frac{a(1-r^n)}{1-r} = 160$ ….. (2)

$1 - r^n = \frac{80}{81}$

$r^n = \frac{1}{81}$

$\left(\frac{1}{r}\right)^n = 81$

Case स्थिति – 1 n = 1, $r = \frac{1}{81}$ a = 160

Case स्थिति – 2 n = 2, $r = \pm\frac{1}{9}$ a = 180 or 144

Case स्थिति – 3 n = 4, $r = \pm\frac{1}{3}$ a = 108 or 216

12. $4x^2 + 2x - 1 = 0$ roots α, β

$\Rightarrow \quad 4\alpha^2 + 2\alpha - 1 = 0 \quad ....(1)$

Let $\beta = 4\alpha^3 - 3\alpha$

with the help of equation (1)

$\beta = \alpha\ [4\alpha^2 - 3] = \alpha[1 - 2\alpha - 3] = -2\alpha^2 - 2\alpha$

$= -2\ \frac{(1-2\alpha)}{4} - 2\alpha$ [using (1)]

$\beta = -\alpha - 1/2$

$\alpha + \beta = -1/2$ which is given. hence second root is $4\alpha^3 - 3\alpha$.

हल. $4x^2 + 2x - 1 = 0$ roots α, β

$\Rightarrow \quad 4\alpha^2 + 2\alpha - 1 = 0 \quad ....(1)$

माना $\beta = 4\alpha^3 - 3\alpha$

समीकरण (1) से

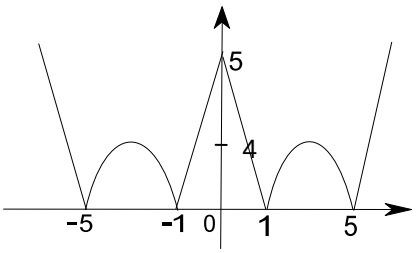
$\beta = \alpha\ [4\alpha^2 - 3] = \alpha[1 - 2\alpha - 3] = -2\alpha^2 - 2\alpha$

$= -2\ \frac{(1-2\alpha)}{4} - 2\alpha$ [using (1)]

$\beta = -\alpha - 1/2$

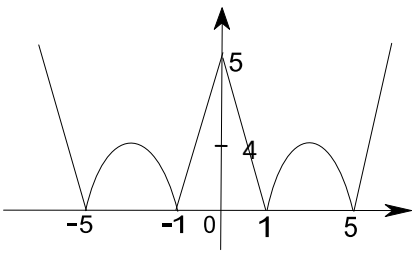
$\alpha + \beta = -1/2$ जो दी गयी समीकरण के अनुसार सही है। अतः दूसरा मूल $4\alpha^3 - 3\alpha$ ही होगा।

13. Graph of $y = |x^2 - 6|x| + 5|$



integral value of m for four solns. $\Rightarrow m = 0$

हल. $y = |x^2 - 6|x| + 5|$ का आरेख है



चार हलों के लिए m के पूर्णांक मान $\Rightarrow m = 0$

14. $417 = 17 + (n - 1)4$

$\Rightarrow 400 = 4(n - 1)$

$\Rightarrow n = 101$ …(i)

Similarly इसी प्रकार $466 = 16 + (m - 1)5$

$\Rightarrow 450 = 5(m - 1)$

$\Rightarrow m = 91$

Let T_n is common to both for some n for which m is an integer

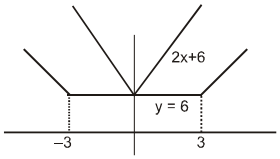
माना T_n किसी n के लिए दोनों उभयनिष्ठ है जबकि m एक पूर्णांक है।

$171(n - 1)4 = 16 + (m - 1)5$

$5m = 4n + 2$

Hence अतः $n = 2, 7, 12, ...97 \rightarrow 20$

15. one solution एक हल



16. $-\sqrt{a^2+b^2} \le a\cos\theta + b\sin\theta \le \sqrt{a^2+b^2}$

$\Rightarrow -\sqrt{74} \le 2k + 1 \le \sqrt{74}$

$-8 \le 2k + 1 \le 8$

$-4.5 \le k \le 3.5$

so, k can take eight integral values.

इसलिए k के 8 पूर्णांक मान है।

17. New mean $= \bar{X} + \frac{11(11+1)}{2.11} = \bar{X} + 6$

18. $\because \frac{1}{1-\sin x} = 2 \Rightarrow \sin x = \frac{1}{2} \Rightarrow x = \frac{\pi}{6}$

PART-II: PHYSICS

19. Friction force between wedge and block is internal i.e. will not change motion of COM. Friction force on the wedge by ground is external and causes COM to move towards right. Gravitational force (mg) on block brings it downward hence COM comes down.

20. $\bar{x} = \frac{m_1\ x_1\ +\ (-m_2)\ x_2}{m_1\ +\ (-m_2)}$

$= \frac{A_1\ x_1\ +\ (-A_2)\ x_2}{A_1\ +\ (-A_2)}$

$A_1 = \pi\ (3R)^2$, $A_2 = \pi R^2$

$x_1 = O$, $x_2 = 2R$

$\therefore\ = -R/4$

21. Momentum given to the wall during one collision = 2 mV cos 60º

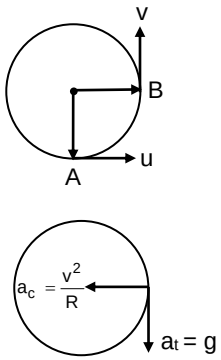
Momentum given to the wall during one collision = (2 mV cos 60º)n

$$F = \frac{dp}{dt} = 2mV\left(\frac{dn}{dt}\right)\cos 60^o$$

$$\text{Pressure} = \frac{F}{A} = \frac{2mv\cos 60^o \times \left(\frac{dn}{dt}\right)}{A}$$

$= 2\times10^3\ N/m^2$

22.



$u = \sqrt{5gR}$,

$v_B = \sqrt{u^2 - 2gh}$

$\Rightarrow v_B = \sqrt{\left(\sqrt{5gR}\right)^2 - 2gR} \Rightarrow v_B = \sqrt{3gR}$

$a_c = \frac{v^2}{R} = \frac{3gR}{R} = 3g$ and $a_t = \frac{mg}{m} = g$

$\therefore a_{net} = \sqrt{a_c^2 + a_t^2} = \sqrt{(3g)^2 + g^2} = \sqrt{10}\,g$

23. $10\times10\hat{i} + 10\times20\hat{j} + 40\times10\hat{k} = 20(3\hat{i} + 4\hat{j}) + 40v$

$40\hat{i} + 120\hat{j} + 400\hat{k} = 40v$

$\hat{i} + 3\hat{j} + 10\hat{k} = v$

24. P = FV = constant

maV = P

$aV = \frac{P}{m}$

$V.\ \frac{dv}{dt} = \frac{P}{m}$

$\int_0^V V.\,dv = \frac{P}{m}.\int_0^t dt$

$\frac{V^2}{2} = \frac{P}{m}t$

$V^2 = \frac{2P}{m}t$

$V = \sqrt{\frac{2P}{m}}.t^{1/2}$

$\frac{ds}{dt} = \sqrt{\frac{2P}{m}}.t^{1/2}$

$\int_0^s ds = \sqrt{\frac{2P}{m}}\int_0^t t^{1/2}\,dt$

$S = \sqrt{\frac{2P}{m}}.\frac{t^{3/2}}{3/2}$

$S = \frac{2}{3}\sqrt{\frac{2P}{m}}.\ t^{3/2}$

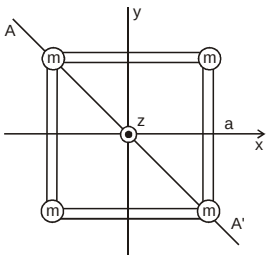
$= \left[\frac{4}{9}.\frac{2P}{m}.t^3\right]^{1/2} = \left[\frac{8Pt^3}{9m}\right]^{1/2}$

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

$= ma^2$

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

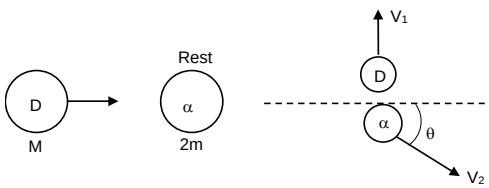
$= ma^2$



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

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

26.



$MV = 2MV_2\cos\theta$ ...(1)

$0 = MV_1 - 2MV_2\sin\theta$ ...(2)

$\frac{1}{2}MV^2 = \frac{1}{2}MV_1^2 + \frac{1}{2}2MV_2^2$ ...(3)

$V^2 = V_1^2 + 2V_2^2$

$= (2V_2\sin\theta)^2 + 2V_2^2$

$$V^2 = 4V_2 \sin^2\theta) + 2V_2^2$$

$$V^2 = V_2^2\left[4\sin^2\theta + 2\right]$$

$$V^2 = \frac{V^2}{4\cos^2\theta}(4\sin^2\theta + 2)$$

$4\cos^2\theta = 4\sin^2\theta + 2$

$4 - 4\sin^2\theta = 4\sin^2\theta + 2$

$8\sin^2\theta = 2$

$$\sin^2\theta = \frac{1}{4}$$

$$\sin\theta = \frac{1}{2}$$

$\theta = 30°$

$$\therefore V_2 = \frac{V}{2\cos 30°} = \frac{V}{\sqrt{3}}$$

$$V_1 = 2V_2 \sin\theta$$

$$= \frac{2V}{\sqrt{3}}\frac{1}{2} = \frac{V}{\sqrt{3}}$$

$$KE_\alpha = \frac{1}{2}(2m)V_2^2 = mV_2^2 = \frac{mV^2}{3}$$

$$\frac{KE_\alpha}{K_{D\ before}} = \frac{\frac{mV^2}{3}}{\frac{1}{2}mV^2} = \frac{2}{3}$$

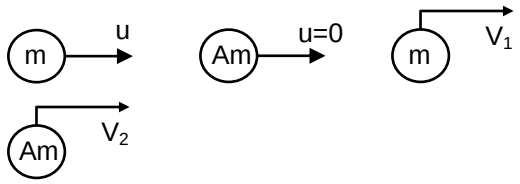
27. (A) just before reaching the point P is 3mg

बिन्दु P पर पहुँचने के ठीक पहले 3mg है।

(D) just after reaching the point P is zero

बिन्दु P पर पहुँचने के ठीक बाद शून्य है।

28.



From momentum conservation :

संवेग संरक्षण से :

$mu + 0 = mv_1 + (Am)\, v_2$

$\Rightarrow v_1 + Av_2 = u$ ..... (1)

$e = \frac{v_2 - v_1}{u}$, for elastic collision e = 1

$e = \frac{v_2 - v_1}{u}$ प्रत्यास्थ टक्कर के लिए e = 1

अतः so $v_2 - v_1 = u$ ..... (2)

Solving equ. (1) and (2),

$$v_1 = \left(\frac{1-A}{1+A}\right)u$$

समीकरण (1) व (2) को हल करने पर

$$v_1 = \left(\frac{1-A}{1+A}\right)u$$

fraction of KE retained by neutron

$$= \frac{\frac{1}{2}mV_1^2}{\frac{1}{2}mu^2} = \left(\frac{1-A}{1+A}\right)^2$$

न्यूट्रॉन द्वारा रोकी गई गतिज ऊर्जा का भाग

$$= \frac{\frac{1}{2}mV_1^2}{\frac{1}{2}mu^2} = \left(\frac{1-A}{1+A}\right)^2$$

fraction of KE lost by neutron = $1 - \left(\frac{1-A}{1+A}\right)^2$

$$= \frac{4A}{(A+1)^2}$$

न्यूट्रॉन द्वारा खोई हुई गतिज ऊर्जा का भाग

$$= 1 - \left(\frac{1-A}{1+A}\right)^2 = \frac{4A}{(A+1)^2}$$

(A,B) If D is used as a moderator

(A,B) यदि D मंदक के रूप में काम में लेते है तो

$$f = \frac{4x2}{(2+1)^2} = \frac{8}{9}$$

(C) If a nucleus of mass number 207 is used $f = \frac{4\times 207}{(207+1)^2} \approx \frac{1}{50}$

यदि 207 द्रव्यमान संख्या का नाभिक काम में ले तो

$$f = \frac{4\times 207}{(207+1)^2} \approx \frac{1}{50}$$

(D) If D is used as a moderator, the neutron will lose more fraction of its kinetic energy, as compared to heavy nuclei like Pb

यदि D मंदक के रूप में काम में लें तो न्यूट्रॉन इसकी गतिज ऊर्जा का ज्यादा भाग खोएगा भारी नाभिक जैसे Pb की तुलना में

29. Velocity of the block just after the impulse is given by :

$P_f - P_i = Jext = mV - 0$

$$= \frac{1}{2}\times(1\times10^{-3})\times(4\times10^4)$$

V = 5 m/sec.

For maximum compression V_f = 0 for an instant

$W_{nc} = KE\uparrow + PE\uparrow$

$-(\mu_K mg)\, x_{max} = (0 - \frac{1}{2} m(5)^2) + \frac{1}{2} Kx^2_{max}$

Solving we get

$x_{max} = 1$ m

At maximum compression, applied force on the block is kx = (40)(1) = 40 N

And the shear strength

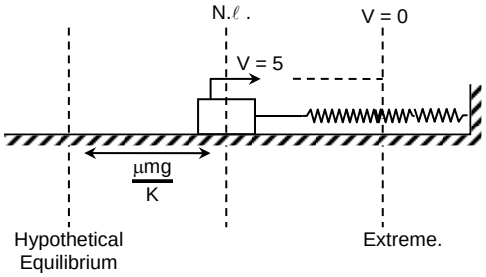
$= \mu_s N = \left(\frac{3}{4}\right)(40) = 30N$

So the block will turn back.

We can also estimate the time taken by the block to reach the maximum displaced position

The hypothetical equilibrium position will be behind the natural position by distance of $\frac{\mu mg}{K}$

(from Kx = μmg)



∴ Time taken by the block to go from hypothetical equilibrium to the extreme position = $\frac{T}{4} = \frac{\pi}{2}\sqrt{\frac{m}{K}}$

⇒ Time taken by the block from initial position (Natural length) to the extreme position will be less than $\frac{T}{4}$

$t < \frac{\pi}{2}\sqrt{\frac{m}{K}}$

हल : आवेग देने के ठीक बाद ब्लॉक का वेग:

$P_f - P_i = Jext = mV - 0$

$= \frac{1}{2} \times (1 \times 10^{-3}) \times (4 \times 10^4)$

V = 5 m/sec.

अधिकतम सम्पीडन के लिए, $V_f = 0$ किसी क्षण पर

$W_{nc} = KE\uparrow + PE\uparrow$

$-(\mu_K mg)\, x_{max} = (0 - \frac{1}{2} m(5)^2) + \frac{1}{2} Kx^2_{max}$

हल करने पर

$x_{max} = 1$ m

अधिकतम सम्पिडन पर, ब्लॉक पर कार्यरत बल kx = (40)(1) = 40 N

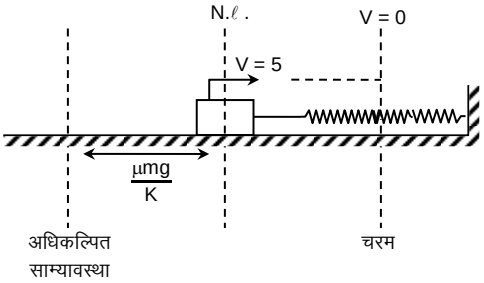
अपरूपण बल = $\mu_s N = \left(\frac{3}{4}\right)(40) = 30N$

अतः ब्लॉक आपस आयेगा।

हम ब्लॉक द्वारा अधिकतम विस्थापन तक पहुँचने के समय की गणना भी कर सकते है।

अधिकल्पित साम्यावस्था की स्थिति प्राकृतिक स्थिति से $\frac{\mu mg}{K}$ दूरी पर होगी।

(Kx = μmg से)



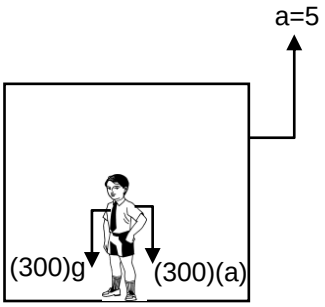
∴ ब्लॉक के अधिकल्पित साम्यावस्था की स्थिति से चरम स्थिति तक जाने में लिया गया समय

$= \frac{T}{4} = \frac{\pi}{2}\sqrt{\frac{m}{K}}$

⇒ ब्लॉक के प्रारम्भिक स्थिति (प्राकृतिक लम्बाई) से चरम स्थिति तक जाने में समय $\frac{T}{4}$ से कम होगा।

$t < \frac{\pi}{2}\sqrt{\frac{m}{K}}$

30.

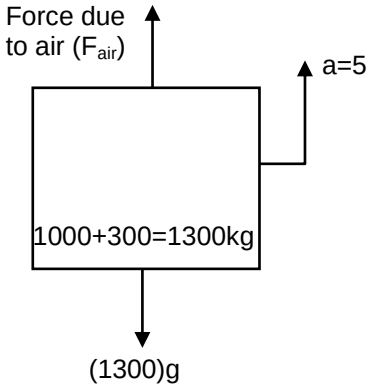


If we see with respect to the helicopter

N = (300)g + (300) (1)

N = (300) (g + a) = (300) (10 + 5)

N = 4500 N

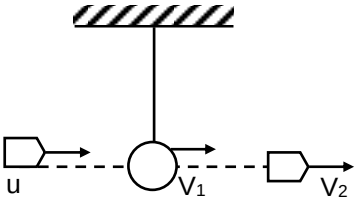


If we draw the free body diagram of (helicopter + passenger) system

$F_{air} - (1300)\, g = (1300)\, (5)$

$F_{air} - (1300)\, (g + 5) = 19500N$

31.



During the collision, we will apply momentum conservation टक्कर के दौरान, हम संवेग संरक्षण लगायेगे

$(0.1)\, (400) = (3)V_1 + (0.1)(40)$

$\Rightarrow V_1 = 12$m/sec, but $\sqrt{5g\ell}$

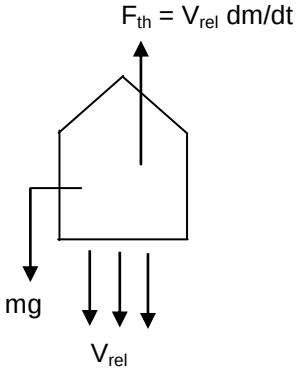
$= \sqrt{5\times10\times2} = 10$ m/sec

Since $V_1 > \sqrt{5g\ell}$ so the pendulum will able to complete the vertical circle,

so $h_{max} = 2\ell = 2 \times 2 = 4$ m

चूँकी $V_1 > \sqrt{5g\ell}$ तो लोलक ऊर्ध्वाधर वृत्तीय गति पूर्ण करेगा। इसलिए $h_{max} = 2\ell = 2 \times 2 = 4$ m

32.



$$a = \frac{V_{rel}\frac{dm}{dt} - mg}{m}$$

$$2 = \frac{V_{rel}(20) - (2000)g}{2000}$$

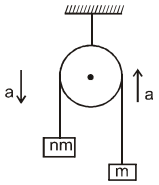
$V_{rel} = 1200$ m/sec

33. $a = \dfrac{(nm-m)}{nm+m}\, g$

$= \dfrac{(n-1)}{(n+1)}\, g$

$a_1 = a_2 = a$

$a_{cm} = \dfrac{nma_1 - ma_2}{(nm+m)} = \dfrac{(n-1)}{(n+1)} \times a$



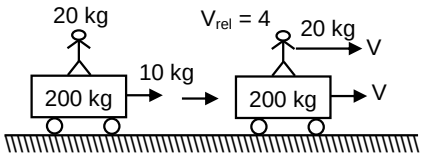
$$a_{cm} = \frac{(n-1)^2}{(n+1)^2} g = g/9 = 01.11$$

34. $\Sigma m\Delta r_{cm} = m_1\Delta r_1 + m_2\Delta r_2$

$= (m + 2m)\, (0) = m(x - 4) + 2m(x)$

$\Rightarrow x = \dfrac{4}{3}$ cm.

35.



Since there is no external force is acting on the man + cart system, so its total momentum will remain conserved

$P_f = P_i \Rightarrow$ $(200 + 20)\, (10) = (200)\, (V) + (20)\, (+V - 4)$

$$V = \frac{114}{11} = 10.36 m/sec$$

36. $F \propto x^n$

$mv\dfrac{dv}{dx} \propto x^n$

$Vdv\ \mu\ x^n\, dx$

$V^2 \propto x^{n+1}$

$V \propto x^{\frac{n+1}{2}}$

$P = F\, v \propto x^n \times x^{\frac{n+1}{2}}$

$P \propto x^{\frac{3n+1}{2}}$

PART-III: CHEMISTRY

37. For 1 mole of gas,
1 मोल गैस के लिए,

$$\left(P+\frac{a}{V^2}\right)(V-b)=RT$$

On substituting value, we get,
मान रखने पर, हमे प्राप्त होता है,

$$\left(P+\frac{3.64}{(0.15)^2}\right)(0.15-0.04)$$

$$=0.083\times 300$$

$$\left(P+\frac{3.64}{0.0225}\right)(0.11)=24.9$$

$$\left(P+\frac{3.64}{0.0225}\right)=\frac{24.9}{0.11}=226.36$$

$$P+161.78=226.36$$

$$P=64.58 \text{ bar}$$

38. Molarity of $Na_2CO_3xH_2O = \frac{11.44}{106+18x}$ M

$Na_2CO_3xH_2O$ की मोलरता $= \frac{11.44}{106+18x}$ M

$\therefore$ Moles of $Na_2CO_3.xH_2O$
= Moles of H_2SO_4
$\therefore$ $Na_2CO_3.xH_2O$ के मोल = H_2SO_4 के मोल

$$\left(\frac{11.44}{106+18x}\right)\left(\frac{25}{1000}\right)=\left(\frac{10}{1000}\right)(0.1)$$

$$x=10$$

39. Orbital angular momentum of electron

$$=\sqrt{l(l+1)}.\frac{h}{2\pi}=\sqrt{3}.\frac{h}{\pi} \qquad l=3$$

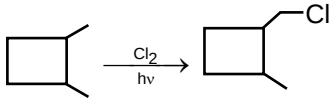
$\therefore$ number of orientation
$= 2l + 1 = 2 \times 3 + 1 = 7$

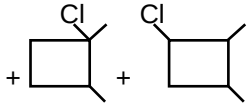
हल. इलेक्ट्रॉन का कक्षक कोणीय संवेग

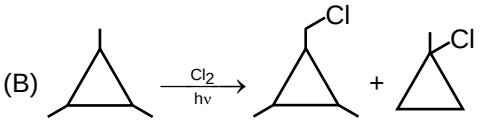
$$=\sqrt{l(l+1)}.\frac{h}{2\pi}=\sqrt{3}.\frac{h}{\pi}$$

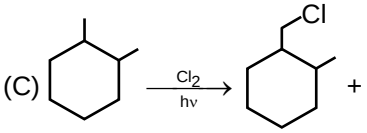
$l = 3$

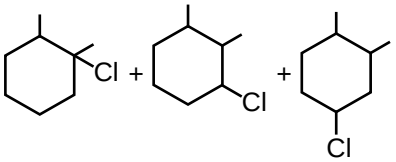
$\therefore$ विन्यास की संख्या
$= 2l + 1 = 2 \times 3 + 1 = 7$

40. (A) 



(B) 

(C) 



(D)  Gives one monochloro product (एक मोनोक्लोरो उत्पाद देता है।)

41. 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

42. XeO_4 will have normal bond angle of sp^3 hybridization.
XeO_4 sp^3 संकरण का सामान्य बंध कोण रखेगा।

43. (C) Rate of effusion of 2 : 1 molar ratio of H_2 and O_2 is 8 : 1 at constant temperature.
नियत तापमान पर H_2 व O_2 के 2 : 1 मोलर अनुपात की निसरण की दर 8 : 1 होती है।

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

$\therefore$ Attractive forces are dominant.

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

बिन्दु A तथा C पर $z < 1$

$\therefore$ आकर्षण बल प्रमुख है।

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

45. $N_2 + 3H_2 \rightarrow 2NH_3$

Initially

प्रारम्भ में a atm b atm 0

Finally अन्त में a – x b – 3x 2x

$\therefore$ a + b = 1 and तथा a + b – 2x = 0.75

$\therefore$ P_{NH_3} = 2x = 0.25 atm

46. (A) Tollen's reagent

(B) Fehling solution

(C) 2,4-D.N.P

(D) Iodoform test

(A) टॉलेन अभिकर्मक

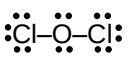
(B) फेहलिंग विलयन

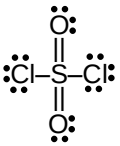
(C) 2,4-D.N.P

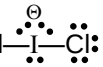
(D) आयोडोफॉर्म परीक्षण

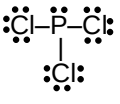
47. sp3d hybridisation in XeF_2 does not involve $d_{x^2-y^2}$ orbital.

XeF_2 में sp^3d संकरण में $d_{x^2-y^2}$ कक्षक सम्मिलित नहीं है।

48. (A) 

(B) 

(C) 

(D) 

49. (i) $Z = \frac{PM}{dRT} = \frac{10 \times 32}{20 \times \frac{1}{12} \times 300} = \frac{16}{25}$

$\therefore$ O_2 shows negative deviation

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

$\therefore$ N_2 shows negative deviation

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

(iv) $Z > 1$

(v) $Z > 1$

(vi) $Z < 1$

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

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

हल. (i) $Z = \frac{PM}{dRT} = \frac{10 \times 32}{20 \times \frac{1}{12} \times 300} = \frac{16}{25}$

$\therefore$ O_2 ऋणात्मक विचलन दर्शाती है।

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

$\therefore$ N_2 ऋणात्मक विचलन दर्शाती है।

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

(iv) $Z > 1$

(v) $Z > 1$

(vi) $Z < 1$

(vii) P = न्यून, $T = T_B$

$\therefore$ $Z = 1$ या $PV = nRT$

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

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

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

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

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

51. Mole of $HNO_3 = \frac{63}{63} = 1$;

Volume of HNO_3 solution = 125 mL

Molarity of HNO_3 = 8 M ;

Let's assume that volume of HNO_3 solution required for NaOH = V L

Mole of HNO_3 required for NaOH = 8 V.

Mole of NaOH = $\frac{24}{40} = \frac{6}{10}$

$8V = \frac{6}{10}$

V = 0.075 L = 75 mL.

हल. HNO_3 के लिए मोल = $\frac{63}{63} = 1$;

HNO_3 विलयन का आयतन = 125 mL

HNO_3 की मोलरता = 8 M ;

माना कि NaOH के लिए आवश्यक HNO_3 विलयन का आयतन = V L

NaOH के लिए आवश्यक HNO_3 के मोल = 8 V.

NaOH के मोल = $\frac{24}{40} = \frac{6}{10}$

$8\,V = \frac{6}{10}$

V = 0.075 L = 75 mL.

52. Expanded octet: PCl_5, SF_4
Incomplete octet: BF_3, BCl_3
Odd electron molecules: NO_2, NO, ClO_2

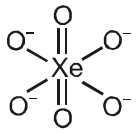
हल. प्रसारित अष्टक : PCl_5, SF_4

अपूर्ण अष्टक : BF_3, BCl_3

विषम इलेक्ट्रॉन अणु : NO_2, NO, ClO_2

53. 16 lone pairs, hence 32 unshared electrons.

16 एकाकी युग्म, इसलिए 32 असाँझित इलेक्ट्रॉन



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

PAPER-2

PART-I: MATHEMATICS

1. Let other two observations are x & y

माना कि दो प्रेक्षण x और y हैं

$\frac{3+4+4+x+y}{5} = 4$

$\Rightarrow x + y = 9$ ..... (1)

$\frac{3^2+4^2+4^2+x^2+y^2}{5} - (4)^2 = 5.20$

$\Rightarrow x^2 + y^2 = 65$ ..... (2)

From (1) & और (2) से

x = 1 x = 8

y = 8 y = 1

$|x - y| = 7$

2. $|x^2 - 3x + 2| + |x + 1| = |x^2 - 4x + 1|$

$\Rightarrow (x^2 - 3x + 2)(x + 1) \le 0$

$\Rightarrow (x - 1)(x - 2)(x + 1) \le 0$

$\Rightarrow x \in (-\infty, -1] \cup [1, 2]$

$\Rightarrow$ sum of natural solutions = 3

$\Rightarrow$ प्राकृत हलों का योगफल = 3

3. Given series दी गई श्रेढी

$27 + 9 + 5\frac{2}{5} + 3\frac{6}{7} + ...$

$= 27 + \frac{27}{3} + \frac{27}{5} + \frac{27}{7} + ... \frac{27}{2n-1} + ...$

Hence, n^{th} term of given series $T_n = \frac{27}{2n-1}$.

So, $T_9 = \frac{27}{2\times 9 - 1} = \frac{27}{17} = 1\frac{10}{17}$

अतः दी गई श्रेढी का nवां पद $T_n = \frac{27}{2n-1}$ है

इसलिए $T_9 = \frac{27}{2\times 9 - 1} = \frac{27}{17} = 1\frac{10}{17}$

4. $y = \frac{1}{2}[6 + 4\cos 2x + 3\sin 2x] \Rightarrow \frac{1}{2} \le y \le \frac{11}{2}$

5. $\frac{4\sin 9^\circ \sin 21^\circ \sin 39^\circ \sin 51^\circ \sin 69^\circ \sin 81^\circ}{\sin 54^\circ}$

$= \frac{4\sin 9^o \cos 9^o . \sin 39^o \cos 39^o \sin 21^o \cos 21^o}{\sin 54^o}$

$= \frac{\sin 18^o . \sin 78^o \sin 42^o}{2\sin 54^o}$

$= \frac{\sin 18^o}{4} \frac{(\cos 36^\circ - \cos 120^\circ)}{\sin 54^o} = \frac{1}{8}$

6. $\left|\left|\left|x-1\right|-1\right|-1\right| = \frac{1}{2}$

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

$\left|x-1\right| = \frac{1}{2}, \frac{3}{2}, \frac{5}{2}$

$x = \frac{1}{2}, \frac{3}{2}, -\frac{1}{2}, \frac{5}{2}, -\frac{3}{2}, \frac{7}{2}$

$\therefore$ Number of solution is 6.

$\therefore$ हलों की संख्या 6 है।

7. As $2\alpha^2, \alpha^4, 24$ are in A.P.

चूंकि $2\alpha^2, \alpha^4, 24$ समान्तर श्रेढी में है।

So इसलिए, $2\alpha^4 = 2\alpha^2 + 24$

$\Rightarrow \quad \alpha^4 - \alpha^2 - 12 = 0$

$\Rightarrow \quad (\alpha^2 - 4)(\alpha^2 + 3) = 0$

$\therefore \ \alpha = \pm 2$ (As $\alpha^2 + 3 \neq 0$ for any real α)

$\therefore \quad \alpha = \pm 2$ (चूंकि $\alpha^2 + 3 \neq 0$, α के किसी वास्तविक मान के लिए)

Also, $1, \beta^2, 6 - \beta^2$ are in G.P.

तथा $1, \beta^2, 6 - \beta^2$ गुणोत्तर श्रेढी में है।

So, इसलिए $\beta^4 = 1(6 - \beta^2)$

$\Rightarrow \quad \beta^4 + \beta^2 - 6 = 0$

$\Rightarrow \quad (\beta^2 + 3)(\beta^2 - 2) = 0$

$\Rightarrow \beta = \pm\sqrt{2}$ (As $\beta^2 + 3 \neq 0$ for any real β)

$\Rightarrow \quad (\beta^2 + 3)(\beta^2 - 2) = 0$

$\Rightarrow \quad \beta = \pm\sqrt{2}$ (चूंकि $\beta^2 + 3 \neq 0$, β के किसी वास्तविक मान के लिए)

Hence अतः , $\alpha_1^2 + \alpha_2^2 + \beta_1^2 + \beta_2^2 = 12$

8. Suppose a and b are the rest of the observations

माना कि a और b और शेष प्रेक्षणों का माध्य

$\sum x_i = n\bar{x}$

$\therefore$ 1 + 2 + 6 + a + b = 5(4, 4)

$\therefore$ a + b + 9 = 22

$\therefore$ a + b = 13 .....(1)

$\sum x_i^2 = 1^2 + 2^2 + 6^2 + a^2 + b^2 = 41 + a^2 + b^2$

$x^2 = \dfrac{\sum x_i^2}{n} - \bar{x}^2$

$8.24 + 19.36 = \dfrac{a^2 + b^2 + 41}{5}$

$5 \times 27.6 = a^2 + b^2 + 41$

$138 = a^2 + b^2 + 41$

$\therefore \ a^2 + b^2 = 97$ .....(2)

$a^2 + (13 - a)^2 = 97$ (from 1 से)

$a^2 + a^2 - 26a^2 + 169 = 97$

$a^2 - 13a + 36 = 0$

$\therefore$ a = 9 or या a = 4 i.e. अर्थात् b = 4 or या b = 9

9. p : mathematics is tough

q : physics is easy

r : chemistry is huge

Given statement p $\rightarrow$ (q v r) is logically equivalent to ~ (q v r) $\rightarrow$ ~p

10. $$\frac{\dfrac{-2\sin(40^o)\cos(40^o)}{\cos(80^o)} + \dfrac{\sin(20^o)}{\cos(20^o)}}{\dfrac{\cot(20^o) + \tan(80^o)}{\cot(20^o)}}$$

$= \dfrac{\tan(20^o) - \tan(80^o)}{1 + \tan 20^o \tan 80^o} = \tan(20^o - 80^o)$

$= -\sqrt{3}$

11. Given abc < 0

product of roots of the given equation

$= \dfrac{a}{bc} \times \dfrac{bc}{bc}$ $= \dfrac{abc}{(bc)^2} < 0$

$\because$ product of roots is < 0

$\therefore$ one roots is positive and one is negative real roots

हल. दिया गया है abc < 0

दी गई समीकरण के मूलों का गुणनफल

$= \dfrac{a}{bc} \times \dfrac{bc}{bc}$ $= \dfrac{abc}{(bc)^2} < 0$

$\because$ मूलो का गुणनफल < 0

$\therefore$ एक मूल धनात्मक है तथा एक ऋणात्मक (वास्तविक मूल)

12. $\sqrt{7 - \log_2 x} = 5 - \log_2 x$

Let माना $A = \log_2 x$ then तब

$\sqrt{7 - A} = 5 - A \Rightarrow 7 - A = 25 + A^2 - 10A$

$\Rightarrow A^2 - 9A + 18 = 0$

$\Rightarrow (A - 6)(A - 3) = 0$

$\Rightarrow A = 3, 6$

. $\log_2 x = 3, 6 \Rightarrow x = 2^3, 2^6 = 8, 64$

But ifपरन्तु यदि $x = 2^6$ then तब $5 - \log_2 x = 5 - 6 = -1$

i.e. $\sqrt{7 - \log_2 x} = \sqrt{-1}$ which is impossible जो कि असंभव है।

x = 8 only केवल

13. $\alpha + \beta + \gamma = 0$; $\sum\alpha\beta = 3$ $\alpha\beta\gamma = 1$

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

$\sum\alpha^2 = 0 - 2\sum\alpha\beta = -6$

$\alpha^2\beta^2\gamma^2 = (1)^2 = 1$

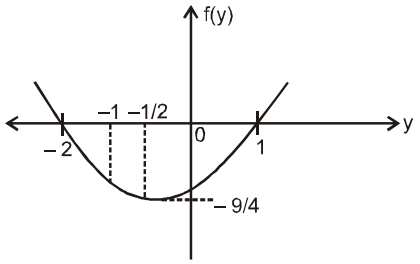
$\alpha^2\beta^2 + \beta^2\gamma^2 + \gamma^2\alpha^2 = (\alpha\beta + \beta\gamma + \gamma\alpha)^2 - 2\alpha\beta\gamma(\alpha + \beta + \gamma)$

$= 3^2 - 2.(1)(0) = 9$

Now equation नयी समीकरण $x^3 - (-6)x^2 + 9x - 1 = 0$

$\Rightarrow x^3 + 6x^2 + 9x - 1 = 0$

14.



$y = \dfrac{2x}{1+x^2} \Rightarrow x^2y - 2x + y = 0 \quad \forall\ x \in R$

$D \geq 0$

$4 - 4y^2 \geq 0 \qquad \Rightarrow y \in [-1, 1]$

Now अब $f(y) = 4y^2 + 13$

Maximum value of $\dfrac{f(y)}{4}$ is 4.25

$\dfrac{f(y)}{4}$ का अधिकतम मान 4.25 है।

15. Let $I \in R$ and Let the equation E be $|x|^2 - 2|x| + |\lambda - 3| = 0$. Then the largest element in the set

S = {x + λ : x is an integer of solution E} is.

$|x| = \dfrac{2 \pm \sqrt{4 - 4|\lambda - 3|}}{2 \times 1}$

$|x| = 1 \pm \sqrt{1 - |\lambda - 3|}$

$1 - |\lambda - 3| \geq 0$

$|\lambda - 3| \leq 1$

$-1 \leq \lambda - 3 \leq 1$

$+2 \leq I \leq 4$

here 'x' is an integer so , possible value of $\lambda = 2, 3, 4$

for $\lambda = 3 \Rightarrow |x| = 2, 0 \Rightarrow x = \pm 2, 0$

$\lambda = 2 \Rightarrow |x| = 1, \Rightarrow x = \pm 1$

$\lambda = 4 \Rightarrow |x| = 1, \Rightarrow x = \pm 1$

So, S = {5,1,3}

hence largest elements of S is 5

16. $3\sin x + 4\cos x = 5$

$\Rightarrow \dfrac{3}{5}\sin x + \dfrac{4}{5}\cos x = 1$

$\Rightarrow \sin(x + \alpha) = 1$; where जहाँ $\tan\alpha = \dfrac{4}{3}$

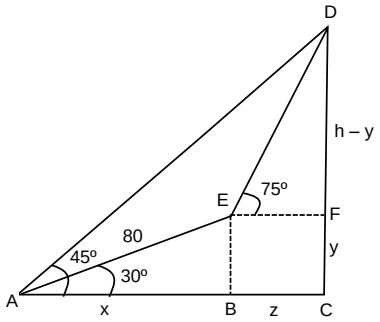
$\Rightarrow x + \alpha = \dfrac{\pi}{2} \qquad \Rightarrow x = \dfrac{\pi}{2} - \alpha$

Now अब $2\sin x + \cos x + 16\tan x$

$= 2\cos\alpha + \sin\alpha + 16\cot\alpha$

$= \dfrac{2\times3}{5} + \dfrac{4}{5} + \dfrac{16\times3}{4} = 14$

17.



$x = 80\cos30^\circ = 40\sqrt{3}$

$y = 80\sin30^\circ = 40$

$\tan45^\circ = 1$

$\Rightarrow x + z = h$

$\Rightarrow 40\sqrt{3} + z = h$ .....(i)

$\tan75^\circ = \dfrac{h - y}{z}$

$\Rightarrow 2 + \sqrt{3} = \dfrac{h - 40}{z}$

$\Rightarrow z = \dfrac{h - 40}{2 + \sqrt{3}}$

$\Rightarrow h - 40\sqrt{3} = \dfrac{h - 40}{2 + \sqrt{3}}$

$(1 + \sqrt{3})h = 80(1 + \sqrt{3})$

$h = 80.$

18. $a_7 = 3 = a + 6d$

$\Rightarrow a = 3 - 6d$

$a_1a_4 = a(a + 3d)$

$= (3 - 6d)(3 - 3d)$

$= 18d^2 - 27d + 9$

$d = \dfrac{27}{2\times18} = \dfrac{3}{4}$

$a = 3 - \dfrac{9}{2} = \dfrac{-3}{2}$

$S_n = \frac{n}{2}[2a + (n-1)d] = 0$

$-3 + (n-1)\frac{3}{4} = 0$

$\Rightarrow n = 5$

Now $n! - 4a_{n(n+2)} = 5! - 4a_{35}$

$= 120 - 4(a+34d)$

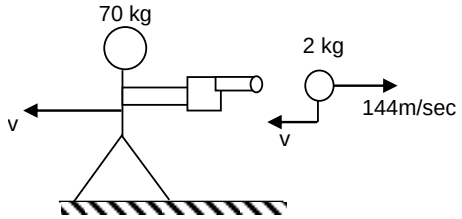
$= 120 - 4(\frac{-3}{2} + 34\times\frac{3}{4})$

$= 120 + 6 - 102 = 24$

PART-II: PHYSICS

19. 8

20. On the man + shell system, there is no external force, so the momentum of the system will remain conserved.



$p_i = p_f \Rightarrow 0 + 0 = (70)(v) + 2(+v - 144)$

so $v = 4$ m/sec.

21. Applying Newton's second law to a particle of mass m moving in a circular orbit of radius r with speed v, we get

$$\frac{mv^2}{r} = \frac{k}{r^3}$$

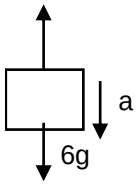
$$v = \sqrt{\frac{k}{m}} \times \frac{1}{r} \Rightarrow V \propto \frac{1}{r}$$

Time period, $T = \frac{2\pi r}{v} = \frac{2\pi r}{\frac{1}{r}\sqrt{\frac{k}{m}}} = 2\pi\sqrt{\frac{m}{k}}\, r^2$

$T \propto r^2$

22. 5

23. $a = \frac{6g - 2g}{8} = \frac{4g}{8} = g/2$

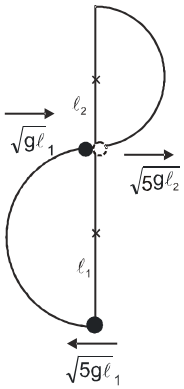


$6g - T = 6(g/2)$

$T = 3g$

$\Rightarrow$ reading of spring balance $= 2T = 6$ kg f

24.

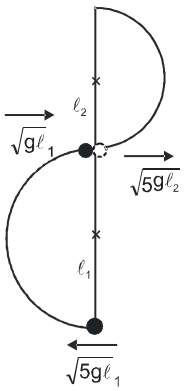


To complete the vertical circle

$\sqrt{g\ell_1} = \sqrt{5g\ell_2}$

$\frac{\ell_1}{\ell_2} = 5$

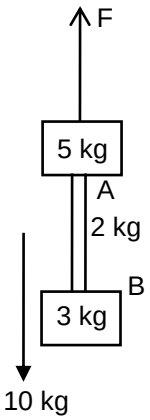
हल.



ऊर्ध्वाधर वृत्त पूर्ण करने के लिए $\sqrt{g\ell_1} = \sqrt{5g\ell_2}$

$\frac{\ell_1}{\ell_2} = 5$

25.



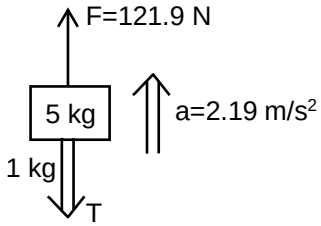
By $\Sigma F. = ma$

$F - 10g = 10$ [2.19]

$F - 100 = 2.19$

$F = 121.9$ Newton

Tension at mid point of rope



By $\Sigma F = ma$

$121.9 - 6g - T = 6$[2.19]

$T = 48.76$ N

$\approx$ 48 N

26. (A) $\frac{kqQ}{r^2}$

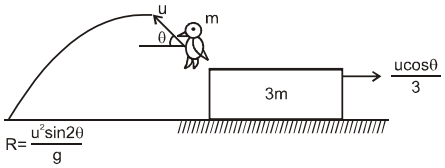
(B) $\frac{mv^2}{r}$

27. (A) $S_m = \frac{m_1S_1 + m_2S_2}{m_1 + m_2}$

$0 = \frac{(3m)\quad(-x) + (m)\quad(\ell - n)}{3m + m}$

$x = \frac{\ell}{4}$

(C)



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

Displacement of sled in this time = $\left(\frac{u\cos\theta}{3}\right)\left(\frac{2u\sin\theta}{g}\right) = \frac{1}{3}\left(\frac{u^2\sin2\theta}{g}\right)$

इस समय में सिल्ली का विस्थापन

$= \left(\frac{u\cos\theta}{3}\right)\left(\frac{2u\sin\theta}{g}\right) = \frac{1}{3}\left(\frac{u^2\sin2\theta}{g}\right)$

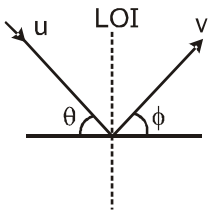
Total distance कुल दूरी $= \frac{4}{3}\left(\frac{u^2\sin2\theta}{g}\right)$

28. $v\cos\phi = u\cos\theta$

$v\sin\phi = eu\sin\theta$

$v^2 = u\sqrt{\cos^2\theta + e^2\sin^2\theta}$

$v = u\sqrt{(1-\sin^2\theta) + e^2\sin^2\theta}$



$\therefore v = u\sqrt{1-(1-e^2)\sin^2\theta}$

$\tan\phi = e\tan\theta$.

$I = m(v_{LOI} - u_{LOI})$

$= m(eu\sin\theta + u\sin\theta)$

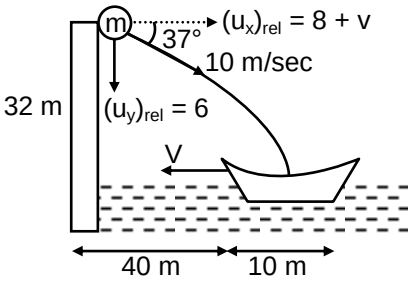
$= mu(1 + e)\sin\theta$.

$k_i = \frac{1}{2}mu^2 \qquad k_f = \frac{1}{2}mv^2$

$\frac{k_f}{k_i} = \frac{1/2\ \ mv^2}{1/2\ \ mu^2} = \cos^2\theta + e^2\sin^2\theta$

29. Lets see the motion of the ball relative to the boat.

नाव के सापेक्ष वस्तु की गति को देखिऐं।



$S_y = u_yt + 1/2\ a_yt^2$

$32 = 6t + 1/2(10)t^2$

get $t = 2$

$(S_x)_{rel} = (u_x)_{rel}\ t$

for minimum v

v न्यूनतम के लिए

$40 = (8 + v)(2) \Rightarrow v_{min.} = 12$ m/s

for maximum v

v अधिकतम के लिए

$50 = (8 + v)(2) \Rightarrow v_{max.} = 17$ m/s

30. **(1)** From graph

$F = 4 \quad 0 < x < 2$

(2) $F = -4x + c$

for $2 \le x \le 4$

for $x = 3 \qquad F = 0$

$0 = -4(3) + c$

$c = 12$

$\therefore$ for $4 \le x \le 6$

$F = 2x + c$

$x = 6 \quad F = 0$

$0 = 12 + c$

$c = -12$

$F = 2x - 12$ for $4 \le x \le 6$

(1) $U = -\int_0^x 4dx$

$U = -4x + c$

$x = 0 \quad U = 0 \qquad \therefore c = 0$

$U = -4x$ for $0 < x \le 2$

$U_{(2,0)} = -8$

(2) $\int_{U(2,0)=-8}^{U_x} du = -\int_2^x (-4x+12)dx$

$U_x + 8 = 2(x^2)_2^x - 12(x-2)$

$U_x + 8 = 2x^2 - 8 - 12x + 24$

$U_x = 2x^2 - 12x + 8$

$x = 4 \quad U_x = 32 - 48 + 8 = -8$

$x = 3 \quad U_x = 18 - 36 + 8 = -10J$

(3) $\int_{U_{(4,0)}=8}^{U} du = \int_4^x (2x-12)dx$

$U + 8 = (-x^2 + 12x)_4^x$

$= -x^2 + 12x + 16 - 48$

$U = -x^2 + 12x - 40$

Option (c) and (d) are correct

31. (a) $P_1 = 2.4 \times 10^{-26}$ kg–m/sec.

$P_2 = 7.0 \times 10^{-27}$ kg–m/sec

(b) $P_e = 2.4 \times 10^{-26}\,\hat{i}$, $\vec{P}_{an} = 7.0 \times 10^{-27}\,\hat{j}$

From momentum conservation,

$\vec{P}_{electron} + \vec{P}_{anti\text{-}neutrino} + \vec{P}_{proton} = 0$;

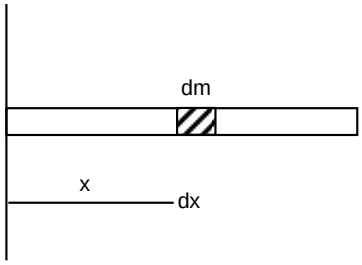
so $\vec{P}_{proton} = -(\vec{P}_e + \vec{P}_{an})$

$= -(24 \times 10^{-27}\,\hat{i} + 7.0 \times 10^{-27}\,\hat{j})$

$\left|\vec{P}_P\right| = \sqrt{(24)^2 + (7.0)^2} \times 10^{-27}$

$V_p = \dfrac{|\vec{P}_p|}{m_p} = 15.0$ m/sec.

32. $dI = (dm)x^2$



$I_{net} = \int (dm)x^2$

$I_{net} = \int_{x=0}^{x=2} (10x^2 dx)x^2$

$I_{net} = 64$ unit

33. If m is mass of one plate, then

यदि m एक प्लेट का द्रव्यमान है तो -

$Z_{cm} = \dfrac{m.20 + m.20 + m.20 + m.20 + m.0}{5m}$

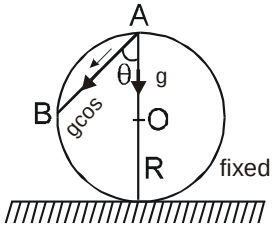
= 16 cm **Ans.**

34. AB = 2 R cosθ

acceleration along AB

$a = g \cos\theta$

u = 0 from A to B



$S = ut + at^2$

$2R\cos\theta = 0 + \dfrac{1}{2}(g\cos\theta)\,t^2$

$t = 2\sqrt{\dfrac{R}{g}}$

since the time taken doesn't depend on θ so the time taken will be same for AB and AC.

35. $t = \frac{u\sin\theta}{g} + \sqrt{\frac{2\left(200 + \frac{u^2\sin^2 30}{2g}\right)}{g}}$

$= \frac{60}{2\times 10} + \sqrt{\frac{2(200+45)}{10}}$

$= 3 + \sqrt{\frac{2\times 245}{10}} = 10\,\text{sec}$

36. When balloon of mass M is descending

$Mg - T = Ma$

$Mg - T = Mg/3$

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

When balloon of mass M' is ascending.

$T - M'g = \frac{M'g}{3}$

$T = \frac{4M'g}{3}$

$\frac{2Mg}{3} = \frac{4M'g}{3}$

$M' = \frac{M}{2}$

PART-III: CHEMISTRY

37. $Z = 1 - \frac{a}{RTV_m}$

Slope (ढाल) = $\frac{a}{R}$

$\Rightarrow \quad a = \frac{0.4}{1.64}\times 0.082$

$= 0.02 = 2 \times 10^{-2}$

38. $2\,NO_2 \longrightarrow N_2O_4$

$100 - x \qquad x/2$ mol

mole fraction of N_2O_4

$= \frac{\frac{x}{2}}{(100-x)+\frac{x}{2}} = \frac{2}{3}$

$200 - 2x + x = \frac{3x}{2}$

$200 = 1.5\,x + x$

$x = \frac{200}{2.5} = 80 = 8$ **Ans.**

39. $PV = \frac{1}{3}\,m\,N \times v_{rms}^{\ 2}$

$P \times 10 \times 10^{-3}$

$= \frac{1}{3} \times 3 \times 10^{-25} \times 6 \times 10^{24} \times (10^2)^2$

$P = \frac{6\times 10^{-1}\times 10^4}{10^{-2}} = 6 \times 10^5 Pa = 6$ bar

40. (9)

41. 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।

42. Planar species-

XeF_2, ClF_3, H_2O, XeF_5^-, I_3^-, BCl_3, XeF_4.

हल. समतलीय स्पीशीज–

XeF_2, ClF_3, H_2O, XeF_5^-, I_3^-, BCl_3, XeF_4.

43. For 1 mole of gas,

$\left(P + \frac{a}{V^2}\right)(V - b) = RT$

On substituting value, we get,

$\left(P + \frac{3.64}{(0.15)^2}\right)(0.15 - 0.04) = 0.083 \times 300$

$\left(P + \frac{3.64}{0.0225}\right)(0.11) = 24.9$

$\left(P + \frac{3.64}{0.0225}\right) = \frac{24.9}{0.11} = 226.36$

$P + 161.78 = 226.36$

$P = 64.58$ bar

हल. 1 मोल गैस के लिए,

$\left(P + \frac{a}{V^2}\right)(V - b) = RT$

मान रखने पर, हमे प्राप्त होता है,

$\left(P + \frac{3.64}{(0.15)^2}\right)(0.15 - 0.04) = 0.083 \times 300$

$$\left(P+\frac{3.64}{0.0225}\right)(0.11) = 24.9$$

$$\left(P+\frac{3.64}{0.0225}\right) = \frac{24.9}{0.11} = 226.36$$

P + 161.78 = 226.36

P = 64.58 bar

44. Theory based.

45. $d = \frac{PM}{ZRT}$ or $Z = \frac{PM}{dRT}$

$$\Rightarrow \quad Z_{O_2} = \frac{1\times 32}{0.8\times\frac{1}{12}\times 400} = 1.2$$

(positive deviation, so less compressible than ideal gas).

$$Z_{SO_2} = \frac{1\times 64}{\frac{32}{15}\times\frac{1}{12}\times 400} = 0.9$$

(negative deviation)

$$Z_{H_2} = \frac{1\times 2}{\frac{1}{25}\times\frac{1}{12}\times 400} = 1.5$$

(positive deviation from ideal gas).

1 atm is a low pressure, and at 400K, Z_{O_2} is greater than 1. Hence Z_{O_2} will be equal to 1 at temperature lower than 400K. Hence Boyle's temperature of O_2 will be less than 400K.

हल. $d = \frac{PM}{ZRT}$ या $Z = \frac{PM}{dRT}$

$$\Rightarrow \quad Z_{O_2} = \frac{1\times 32}{0.8\times\frac{1}{12}\times 400} = 1.2$$

(धनात्मक विचलन, अतः आदर्श गैस से कम सम्पीडित होती है।).

$$Z_{SO_2} = \frac{1\times 64}{\frac{32}{15}\times\frac{1}{12}\times 400} = 0.9$$

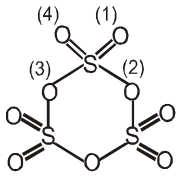
(ऋणात्मक विचलन)

$$Z_{H_2} = \frac{1\times 2}{\frac{1}{25}\times\frac{1}{12}\times 400} = 1.5$$

(आदर्श गैस से धनात्मक विचलन)

1 atm निम्न दाब है तथा 400K, पर Z_{O_2} 1 से अधिक होता है अतः 400K से कम ताप पर Z_{O_2} 1 के बराबर होगा। अतः O_2 का बॉयल ताप 400K से कम होगा।

46.



47. B and N can not expend their octet due to absence of d-orbital.

B व N में d-कक्षक की अनुपस्थिति के कारण अपना अष्ठक प्रसारित नही कर सकता है।

48. (A) $PbCl_2$ (B) AlO_2^- (D) PbO_2

49. $KClO_3(s) \xrightarrow{\Delta} KCl(s) + 3/2\ O_2(g)$

Thus, loss in mass is due to O_2 escaped and so mass of O_2 formed is 0.384 g.

or Moles of $O_2 = \frac{0.384}{32}$

$= 1.2 \times 10^{-2}$ mole

$\therefore$ Moles of $KClO_3 = \frac{2}{3} \times$ Moles of O_2

$\therefore$ Moles of $KClO_3 = \frac{1.2\times10^{-2}}{1.5}$

$= 8 \times 10^{-3}$ Mole

and mass of $KClO_3$ decomposed

$= 8 \times 10^{-3} \times 122.5$

$= 0.980$ g

$\therefore$ % of decomposition

$= \frac{0.980}{4.9} \times 100 = 20\%$

हल. $KClO_3(s) \xrightarrow{\Delta} KCl(s) + 3/2\ O_2(g)$

अतः द्रव्यमान मे हानि मुक्त हुई O_2 के कारण होती है। अतः बनने वाली O_2 का द्रव्यमान 0.384 g है।

या O_2 के मोल्स $= \frac{0.384}{32}$

$= 1.2 \times 10^{-2}$ मोल

$\therefore$ $KClO_3$ के मोल्स $= \frac{2}{3} \times O_2$ के मोल्स

$\therefore$ $KClO_3$ के मोल्स $= \frac{1.2\times10^{-2}}{1.5}$

$= 8 \times 10^{-3}$ मोल

अतः विघटित $KClO_3$ का द्रव्यमान

$= 8 \times 10^{-3} \times 122.5$

$= 0.980$ g

$\therefore$ विघटन का प्रतिशत

$= \frac{0.980}{4.9} \times 100 = 20\%$

50. $1 \text{ X } 50 = \frac{40}{M_X} \text{X} \frac{1}{12} \text{X } 600$

$M_X = 40$

$2 \text{ X } 50 = \frac{20}{M_y} \text{X} \frac{1}{12} \text{X } 600$

$M_y = 10$

$m + n = 40 + 10 = 50$

51. $\frac{r_{O_2}}{r_{H_2}} = \sqrt{\frac{M_{H_2}}{M_{O_2}}}; \quad \frac{r_{O_2}}{r_{H_2}} = \sqrt{\frac{2}{32}}$

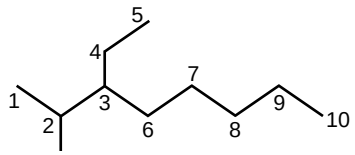
$\frac{r_{O_2}}{r_{H2}} = \frac{1}{4} \qquad r_{O_2} : r_{H_2} = 1:4$

$\frac{\frac{1}{t}}{\frac{1}{24}} = \frac{1}{4}$ or t = 96 S

52. 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 हैं।

53.



54. a = 5

b = 4

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

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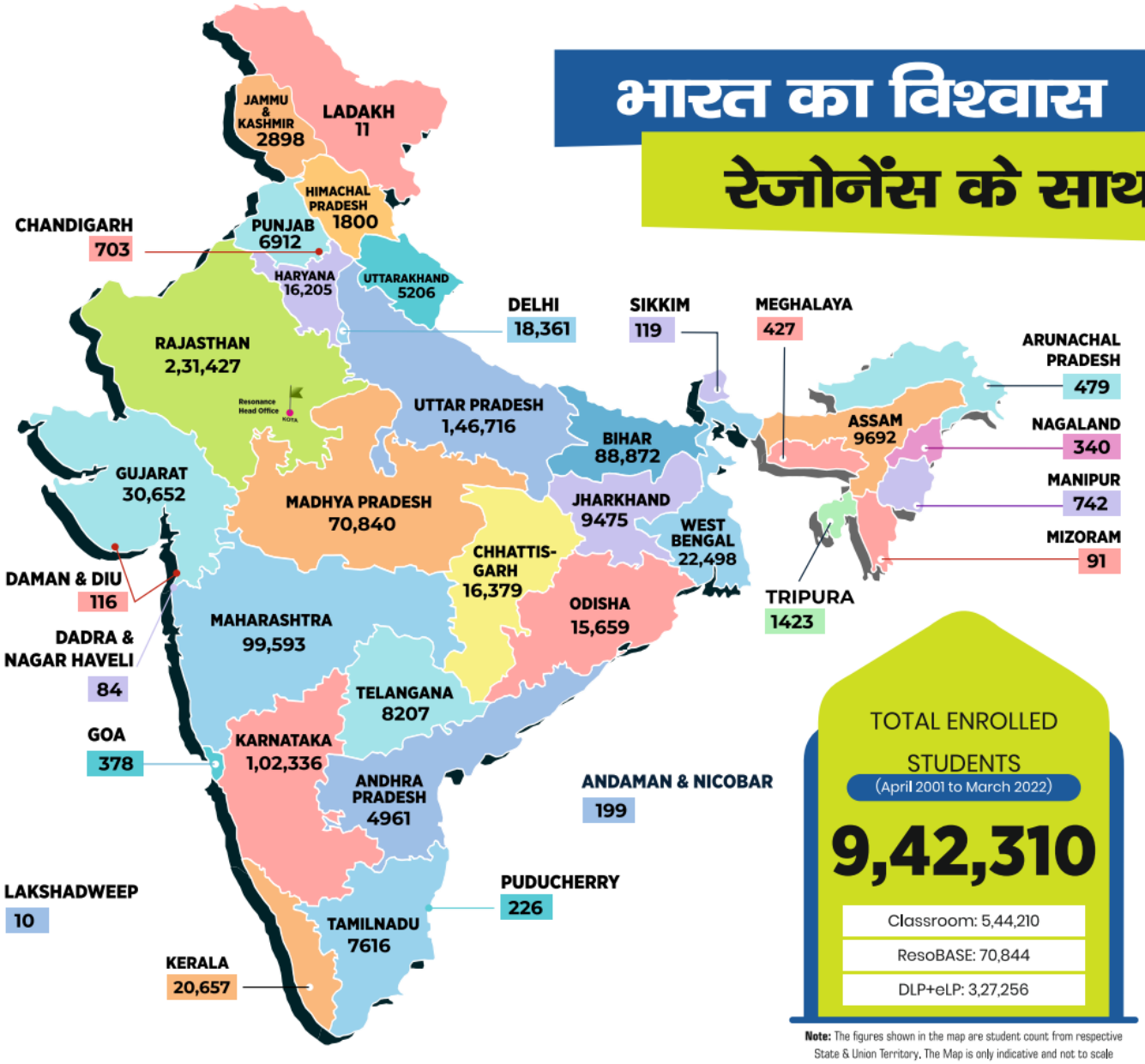

TOTAL ENROLLED STUDENTS
(April 2001 to March 2022)

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