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

PERIODIC ASSESSMENT TEST (PAT)

STUDENT SUPPORT BOOKLET (SSB)

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

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

Target Examination & Year:

JEE (MAIN+ADVANCED) 2025

TEST PATTERN	TEST TYPE	TEST CODE & SEQUENCE
JEE (ADVANCED)	CUMULATIVE TEST (CT)	ACT 03

DATE & DAY:
24th September 2023 | Sunday

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

Contents:

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

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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	D	C	A	12.00	00.00	08.00	02.00	00.71	00.60
	Q.No.	11	12	13	14	15	16	17	18	19	
	Ans.	AD	ABD	ABC	BC	AD	BC	5	7	1	
PART-II : PHYSICS	Q.No.	20	21	22	23	24	25	26	27	28	29
	Ans.	B	C	B	A	03.00	02.00	00.00	10.00	05.10	90.00
	Q.No.	30	31	32	33	34	35	36	37	38	
	Ans.	AB	AB	ACD	CD	AC	AD	3	5	3	
PART-III : CHEMISTRY	Q.No.	39	40	41	42	43	44	45	46	47	48
	Ans.	B	D	D	D	200	821	48	7	8	3
	Q.No.	49	50	51	52	53	54	55	56	57	
	Ans.	ABD	AD	ABD	AC	C	ABC	6	6	6	
PAPER-2											
PART-I : MATHEMATICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	B	CD	AD	B	AB	ABCD	32.00	02.00	00.00	20.00
	Q.No.	11	12	13	14	15	16	17	18	19	
	Ans.	02.00	07.00	B	C	D	B	8	1	9	
PART-II : PHYSICS	Q.No.	20	21	22	23	24	25	26	27	28	29
	Ans.	BC	ABD	AB	ACD	AC	ACD	27.00	08.00	10.00	20.00
	Q.No.	30	31	32	33	34	35	36	37	38	
	Ans.	03.00	09.00	B	A	B	A	2	1	5	
PART-III : CHEMISTRY	Q.No.	39	40	41	42	43	44	45	46	47	48
	Ans.	BD	ABC	ABC	AD	ABD	ABC	3	4	3	4
	Q.No.	49	50	51	52	53	54	55	56	57	
	Ans.	15	3	C	A	C	C	1	6	3	

TEXT SOLUTIONS (TS)

PAPER-1

PART-I: MATHEMATICS

1. Let माना $t_r = \dfrac{\sin\left(\left(r^2+1\right)r!\right)}{\sin(r.(r+1)!)\sin((r-1).r!)}$

r = 2, 3, 4, ..., 99

r. (r + 1) ! – (r – 1). r ! = r ! (r(r + 1)) – (r –1))

= r ! (r^2 + 1)

using sin (A – B) = sin A cos B – cosA sinB के प्रयोग से

t_r = cot ((r –1). r !) – cot (r. (r + 1) !)

sum योगफल = cot(2) – cot (99.100!)

2. $|\sin^2 x + 17 - x^2| = |16 - x^2| + |\sin^2 x + 1|$

$|x + y| = |x| + |y|$

$(16 - x^2)(\sin^2 x + 1) \geq 0$

$x \in [-4, 4]$

3. $(1+x) + x^2 (1+x) = x^4 (1+x)$

$(1+x)(1+ x^2 - x^4) = 0$

$1 + x = 0, \qquad 1 + x^2 - x^4 = 0$

$x = -1, \qquad x^4 - x^2 - 1 = 0$

$$x^2 = \frac{1\pm\sqrt{1+4}}{2} = \frac{1\pm\sqrt{5}}{2}$$

$$x^2 = \frac{\sqrt{5}+1}{2}, \; x = \pm\left(\frac{\sqrt{5}+1}{2}\right)$$

4. $2x = n\pi + (-1)^n x + (-1)^n \dfrac{\pi}{4}$

$(2 + (-1)^n) x = n\pi + (-1)^n \dfrac{\pi}{4}$

Sol. **(5 – 6)**

$x^4 - \lambda x^2 + 9 = 0 \Rightarrow \qquad x^2 = t \geq 0$

$\Rightarrow \qquad f(t) = t^2 - \lambda t + 9 = 0$

5. given equation has four real & distinct roots

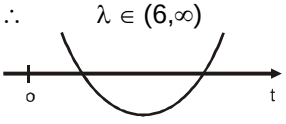
दी गयी समीकरण के चार वास्तविक एवं भिन्न–भिन्न मूल होने के लिये

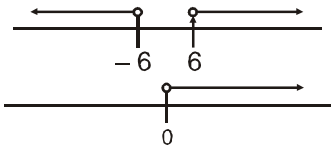
$D > 0 \Rightarrow \lambda^2 - 36 > 0$

$\dfrac{-b}{2a} > 0 \qquad \Rightarrow \qquad \dfrac{\lambda}{2} > 0 \Rightarrow \lambda > 0$

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

$\therefore \qquad \lambda \in (6,\infty)$





6. Equation has only two real roots

समीकरण के केवल दो मूल वास्तविक होने के लिये

case-I स्थिति-I $f(0) < 0 \qquad 9 < 0$

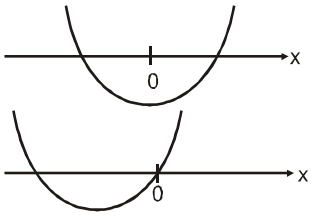
which is false जो असत्य है।

case-II स्थिति-II $f(0) = 0$

and और $\dfrac{-b}{2a} < 0$

$\therefore$ No solution अतः कोई हल विद्यमान नहीं है।

$\therefore$ Final answer is ϕ अतः हल रिक्त सम्मुचय होगा।



9. $F(a, b, \theta) =$

$$\frac{1}{3\sqrt{2} + a\sin\theta(1+2\cos 2\theta) + b\cos\theta(2\cos 2\theta - 1)}$$

$$= \frac{1}{3\sqrt{2} + a\sin 3\theta + b\cos 3\theta}$$

$$\text{Max. } F(a, b, \theta) = \frac{1}{3\sqrt{2} - \sqrt{a^2+b^2}} = \frac{1}{\sqrt{2}}$$

10. A.M $\geq$ H.M

$$\frac{1}{1+ab} + \frac{1}{1+2b} + \frac{1}{1+2b} \geq \frac{9}{1+ab+1+2a+1+2b}$$

$a^2 + b^2 + c^2 \geq ab + bc + ca$: Put c = 2,

$a^2 + b^2 = 8$

8 + 4 $\geq$ ab + 2b + 2a

15 $\geq$ 3 + ab + 2a + 2b

$$\Rightarrow \frac{1}{1+ab} + \frac{1}{1+2a} + \frac{1}{1+2b} \geq \frac{9}{15} = 0.60$$

11. Clearly common terms are in A.P., t_r = 15 r –8

स्पष्टतया उभयनिष्ठ पद समान्तर श्रेणी में होगे जहाँ

t_r = 15 r –8

$$\sum_{r=1}^{2n}(-1)^{(15r-8)}(5r+4)^2$$

$$= -(5.1+4)^2 + (5.2+4)^2 - (5.3+4)^2 + (5.4+4)^2$$

$$-(5.5+4)^2 + (5.6+4)^2 - (5.(2n-1)+4)^2 + (5.(2n)+4)^2$$

$$= (5)(5(1+2)+8) + (5)(5(3+4)+8) + (5)(5(5+6)+8)$$

$$+ \ldots\ldots + (5)(5(2n-1+2n)+8)$$

$$= 2.5.\frac{2n(2n+1)}{2} + 40n = 5n(10n+13)$$

12. $8\sin^3\theta - 3(2\sin\theta)^2 + 3.2\sin\theta - 1 = 2\lambda - 1$

$(2\sin\theta - 1)^3 = 2\lambda - 1$

$\sin\theta = \dfrac{1+\sqrt[3]{2\lambda-1}}{2}$

If यदि $\dfrac{1+\sqrt[3]{2\lambda-1}}{2} < -1 \Rightarrow \lambda < -13$.

If यदि $\dfrac{1+\sqrt[3]{2\lambda-1}}{2} > 1 \Rightarrow \lambda > 1$

If यदि $\lambda = -13$

$\sin\theta = -1 \Rightarrow \theta = 2n\pi - \dfrac{\pi}{2}, n \in I$

13. We will have to check
let α be the common root
माना α एक उभयनिष्ठ मूल है।
$\alpha^3 + 2\alpha^2 - \alpha + \lambda = 0 \Rightarrow \lambda = -\alpha^3 - 2\alpha^2 + \alpha$
$\alpha^2 + 5\alpha - 3\lambda = 0$
$\alpha^2 + 5\alpha - 3(-\alpha^3 - 2\alpha^2 + \alpha) = 0$
$\Rightarrow 3\alpha^3 + 7\alpha^2 + 2\alpha = 0$
$\Rightarrow \alpha(3\alpha^2 + 7\alpha + 2) = 0$
$\alpha(3\alpha^2 + 6\alpha + \alpha + 2) = 0$
$\alpha[3\alpha(\alpha + 2) + 1(\alpha + 2)] = 0$
$\alpha(3\alpha + 1)(\alpha + 2) = 0$
$\alpha = 0$ or $\alpha = -2$ or $\alpha = -1/3$
if यदि $\alpha = 0 \quad \Rightarrow \lambda = 0$
if यदि $\alpha = -2 \quad \Rightarrow 4 - 10 - 3\lambda = 0$
$\Rightarrow \lambda = -2$
if यदि $\alpha = -\dfrac{1}{3} \quad \Rightarrow \dfrac{1}{9} - \dfrac{5}{3} - 3\lambda = 0$

$\dfrac{1 - 15 - 27\lambda}{9} = 0, \qquad \lambda = -14/27$

14. $|x + 2| + |x - 2| = 4 - px$
(i) has one solution if $-p \geq 2$ i.e. $p \leq -2$ or $-p \leq -2$
$\Rightarrow$ $p \geq 2$
(ii) has two solution if $0 < -p < 2$
$\Rightarrow$ $-2 < p < 0$ or $-2 < -p < 0$
$\Rightarrow$ $0 < p < 2$
(iii) has more than two solutions if $-p = 0$ i.e. $p = 0$

हल. $|x + 2| + |x - 2| = 4 - px$
(i) का एक हल है यदि $-p \geq 2$ अर्थात् $p \leq -2$ या $-p \leq -2 \Rightarrow p \geq 2$
(ii) के दो हल है यदि $0 < -p < 2$
$\Rightarrow$ $-2 < p < 0$ या $-2 < -p < 0$
$\Rightarrow$ $0 < p < 2$
(iii) के दो से अधिक हल है यदि $-p = 0$ अर्थात् $p = 0$

15. 11! is divisible by 9 and 11 $\Rightarrow$ 3 + 9 + m + 1 + 6 + n + 0 + 0 = 9 λ, $\lambda \in$ N
3 + m + 6 + 0 = 9 + 1 + n + 0 $\Rightarrow$ m = 1 + n ,
$\Rightarrow$ 2n + 20 = 9λ
λ = even, $\lambda \neq 2 \Rightarrow \lambda = 4 \Rightarrow n = 8 \Rightarrow m = 9$
$a_9 = 9, a_8 = 17$. $\dfrac{1}{a_1}, \dfrac{1}{a_2}, \dfrac{1}{a_3}, ..., \dfrac{1}{a_8}, \dfrac{1}{a_9}, ...$
are in A.P.
C.D. = d = $\dfrac{1}{a_9} - \dfrac{1}{a_8} = \dfrac{8}{9\times17}; \dfrac{1}{a_1} + (8-1)\dfrac{8}{9\times17} = \dfrac{1}{17}$

$\Rightarrow a_1 = \dfrac{-9\times17}{47}$

$\dfrac{1}{a_k} > 0 \Rightarrow k > \dfrac{55}{8} \Rightarrow$ k = 7 is least integer

16. $2\cos 2\theta[\cos 4\theta + \cos 2\theta] = 1$
$2\cos 2\theta\cos 4\theta + 2\cos^2 2\theta = 1$
$2\cos 2\theta\cos 4\theta + \cos 4\theta = 0$
$\cos 4\theta(2\cos 2\theta + 1) = 0$
$\cos 4\theta = 0$

$4\theta = 2n\pi \pm \dfrac{\pi}{2}$

$\theta = \dfrac{n\pi}{2} \pm \dfrac{\pi}{8}$

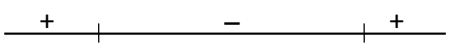
$\dfrac{\pi}{8}, \dfrac{3\pi}{8}, \dfrac{5\pi}{8}, \dfrac{7\pi}{8}$

a + d can be हो सकते है $\dfrac{3\pi}{8}$ or या $\dfrac{5\pi}{8}$

17. $\dfrac{3x^2 - 9x + 17}{x^2 + 3x + 10} - 1 \leq \dfrac{5x^2 - 7x + 19}{3x^2 + 5x + 12} - 1$

$\dfrac{(2x^2 - 12x + 7)(2x^2 + 2x + 2)}{(x^2 + 3x + 10)(3x^2 + 5x + 12)} \leq 0$

$\Rightarrow (x-3)^2 - \dfrac{11}{2} \leq 0$



x = 1, 2, 3, 4, 5

$3 - \dfrac{\sqrt{22}}{2}$

$3 + \dfrac{\sqrt{22}}{2} \approx 5.34$

0.65

18. $180^\circ = 3 \times 6^\circ \quad \sin 18^\circ = 3\sin 6^\circ - 4\sin^3 6^\circ = 3x - 4x^3$
$36^\circ = 3 \times 12^\circ \quad \cos 36^\circ = 4\cos^3 12^\circ - 3\cos 12^\circ = 4y^3 - 3y$

$\left(\dfrac{\sqrt{5}-1}{4}\right)\left(\dfrac{\sqrt{5}+1}{4}\right) = (3x - 4x^3)(4y^3 - 3x)$

$\dfrac{28}{4} = 28(12xy(x^2 + y^2) - xy(9 + 16x^2y^2))$

19. $\frac{x}{x+1} = 1 - \frac{1}{x+1}$

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

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

.
.
.

$\frac{x^{2^{n-1}}}{(x+1)(x^2+1).....(x^{2^{n-1}}+1)}$:

$= \frac{1}{(x+1)(x^2+1)....(x^{2^{n-2}}+1)} - \frac{1}{(x+1)(x^2+1).....(x^{2^{n-1}}+1)}$

$S_n = 1 - \frac{1}{(x+1)(x^2+1).....(x^{2^{n-1}}+1)}$

$S_\infty = 1$

PART-II: PHYSICS

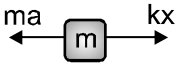
20. $P\bar{Q} = (2-3)\hat{i} + (-1-2)\hat{j}\ (4-(-1)\hat{k}$

$\bar{F}.\ P\bar{Q} = -4 + 9 + 10 = 15$ J

21. Acceleration of mass at distance x
x दूरी पर द्रव्यमान का त्वरण है
$a = g(\sin\theta - \mu_0 \text{ x } \cos\theta)$
speed is maximum, when a = 0
चाल अधिकतम होगी, जब a = 0
$g(\sin\theta - \mu_0 \text{ x } \cos\theta) = 0$

$x = \frac{\tan\theta}{\mu_0}$

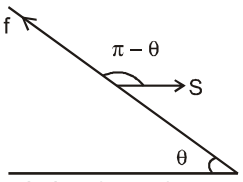
22. $mv\frac{dv}{dx} = ma - kx$



$\int_0^0 mvdv = \int_0^x (ma - kx)x$

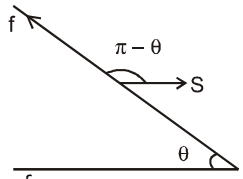
$x = \frac{2ma}{k}$.

23.



Friction force $f = mg\sin\theta$
Displacement s = Vt
Work done by the friction on the block is W
$= fs\cos(\pi - \theta)$
$= mg\sin\theta\ Vt\cos(\pi - \theta)$
$= -mgvt\ \sin\cos$

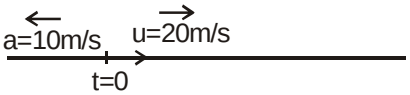
$= -\frac{mgvt}{2}\sin 2\theta = -\frac{mgvt}{2}$



घर्षण बल $f = mg\sin\theta$
विस्थापन s = Vt
ब्लॉक पर घर्षण बल द्वारा किया गया कार्य होगा
$W = fs\cos(\pi - \theta)$
$= mg\sin Vt\cos(\pi - \theta)$
$= -mgvt\sin\theta\cos\theta$

$= -\frac{mgvt}{2}\sin 2\theta = -\frac{mgvt}{2}$

24. The velocity of particle is zero when
$v = (20 - 10t) = 0$.
That is at t = 2 sec. v = 0.



From t = 0 to t = 2 distance traveled is

$S_1 = \frac{(20)^2}{2\times 10} = 20$ m.

Next 5 meter wil be covered in

$5 = \frac{1}{2} \times 10 \times t^2$ or $t = 1$ s.

∴ The particle covers 25 metres distance in 3 sec.

K.E. at t = 0 is $K_i = \frac{1}{2}mu^2 = \frac{1}{2}\ 2 \times (20)^2$

= 400 J

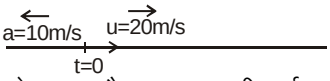
KE at t = 3 is

$K_f = \frac{1}{2}mv^2 = \frac{1}{2}2 \times (10)^2 = 100$ J

Therefore work done by block from t = 0 to t = 3s is

$\Delta W = K_f - K_i = 100 - 400 = -300$ J

कण का वेग शून्य होने के लिए
$v = (20 - 10t) = 0$.
अतः t = 2 sec. पर v = 0.



t = 0 से t = 2 सै. तक तय की गई दूरी

$S_1 = \frac{(20)^2}{2\times 10} = 20$ m.

अगले 5 मी. चलने में समय

$5 = \frac{1}{2} \times 10 \times t^2$ or $t = 1$ s.

∴ कण 25 मीटर दूरी 3 सै. में तय करेगा।

t = 0 पर गतिज ऊर्जा

$K_i = \frac{1}{2} mu^2 = \frac{1}{2} 2 \times (20)^2 = 400$ J

t = 3 सै. पर गतिज ऊर्जा

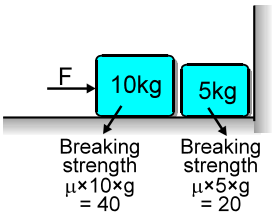
$K_f = \frac{1}{2} mv^2 = \frac{1}{2} 2 \times (10)^2 = 100$ J

अतः ब्लॉक द्वारा t = 0 से t = 3 सै. में किया गया कार्य

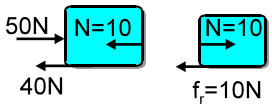
$\Delta W = K_f - K_i = 100 - 400 = -300$ J

25. At t = 3 sec. force on particle is
F = ma = 2 × 10 towards –ve x-direction
At t = 3 sec. the velocity of particles is
v = 10 m/s towards – ve x-direction
P = FV = 200 watts **Ans.**
t = 3 सै. पर कण पर बल
F = ma = 2 × 10 ऋणात्मक x-दिशा में
t = 3 सै. पर कण का वेग v = 10 m/s ऋणात्मक x-दिशा में
P = FV = 200 watts **Ans.**

26. If F = 20 N, 10 kg block will not move and it would not press 5 kg block So N = 0.
यदि F = 20 N, 10 kg के गुटका नहीं चलेगा तथा यह 5 kg गुटके को नहीं दबायेगी अतः N = 0.



27. If F = 50 N, force on 5 kg block = 10 N
यदि F = 50 N, तो 5 kg के ब्लॉक पर बल = 10 N लगेगा।



So friction force = 10 N
अतः घर्षण बल = 10 N

28. 05.10

29. $a_{0 \text{ to } 2} = -\frac{10}{2} = -5$

$a_{2 \text{ to } 3} = 0$

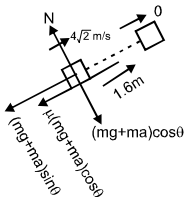
$a_{3 \text{ to } 5} = \frac{5}{1} = +5$

$a_{5 \text{ to } 5.5} = -\frac{5}{1/2} = -10$

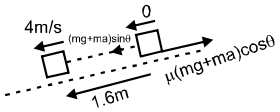
$T_{max} = m(g + a) = 60 (10 + 5) = 90$ kg

$T_{max} = 150 \times 15 = 2250$ N

30.



$0 = (4\sqrt{2})^2 - 2(g + a)(\sin\theta + \mu\cos\theta) \times 1.6$



$4^2 = 0^2 + 2(g + a)(\sin\theta - \mu\cos\theta) \times 1.6$

Solving,
हल करने पर $a = 2.5$ m/s^2
$\mu = 0.25$.

31. $x = (2t - 3)^2 \Rightarrow v = \frac{dx}{dt} = 4(2t - 3)$

For t < 1.5, v is negative and for t > 1.5 v is positive.

$a = \frac{dx}{dt} = 8 \Rightarrow$ a is positive t > 0.

Therefore from t = 0 to 1.5 sec., v is negative and a is positive hence the particle speeds down.
and for t > 1.5 sec., v is positive and a is positive hence the particle speeds up.
विकल्प :

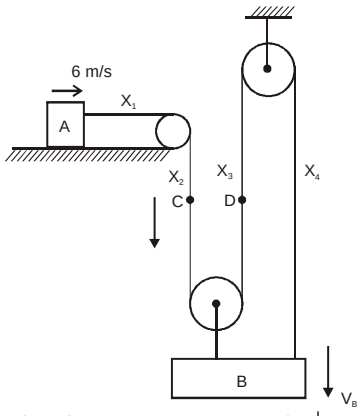
$x = (2t - 3)^2 \Rightarrow v = \frac{dx}{dt} = 4(2t - 3)$

t < 1.5 के लिये v ऋणात्मक है और t > 3 के लिए v धनात्मक है।

$a = \frac{dv}{dt} = 8 \Rightarrow$ a धनात्मक है t > 0.

t = 0 से 1.5 sec. तक v ऋणात्मक है और a धनात्मक है तथा कण की गति मन्दित होगी।
और t > 1.5 sec. के लिए v धनात्मक है और a धनात्मक है तथा कण की गति त्वरित होगी।

32.



Clearly स्पष्टतः, $V_C = 6$ m/s ↓
By string constraint,
डोरी बंधन से

$\dot{x}_1 + \dot{x}_2 + \dot{x}_3 + \dot{x}_4 = 0$

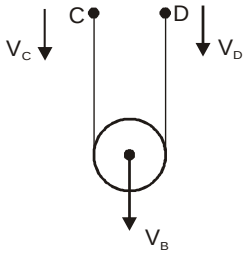
$-6 + V_B + V_B + V_B = 0$

$\Rightarrow \quad V_B = 2$ m/s $\downarrow$

Also, यह भी $\frac{V_C + V_D}{2} = V_B$

$\Rightarrow \qquad V_D = -2$ m/s

$\therefore \qquad V_D = 2$ m/s $\uparrow$



Thus अतः

$\left|\overrightarrow{V_C} - \overrightarrow{V_D}\right| = 6 + 2 = 8$ m/s

$\left|\overrightarrow{V_B} - \overrightarrow{V_C}\right| = 4$ m/s

$\left|\overrightarrow{V_B} - \overrightarrow{V_D}\right| = 4$ m/s

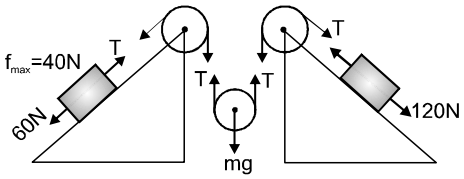
$\left|\overrightarrow{V_C}\right| - \left|\overrightarrow{V_D}\right| = 6 - 2 = 4$ m/s

33. $T = \frac{mg}{2}$

for minimum T, by F.B.D. of 20 kg block

$T = \frac{mg}{2}$

20 kg ब्लॉक के F.B.D. से F का न्यूनतम मान



$\Rightarrow$ T + 80 = 120 $\Rightarrow$ T = 40 N

$\Rightarrow$ m = 8 kg

For maximum T, by F.B.D. of 10 kg block

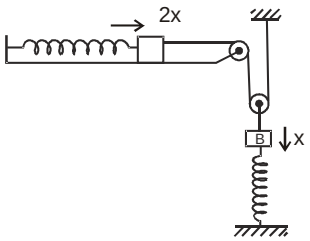
T = 40 + 60 $\Rightarrow$ T = 100 N

10 kg ब्लॉक के FBD से T के अधिकतम मान के लिए

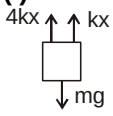
T = 40 + 60 $\Rightarrow$ T = 100 N

m = 20 kg.

34.



(i) F.B.D of B



$3kx = mg$

$\sqrt{x}10 \times x = 1 \times 10$

$x = \frac{1}{5} = 0.2$

(ii) (1) (g) (x)

$= \frac{1}{2}(1)(v)2 + \frac{1}{2}(1)(2v)^2 x + \frac{1}{2}(10)(0.2)^2 + \frac{1}{2}(10)(0.4)^2$

$2 = \frac{V^2}{2}(1 + 4 + 0.4 + 1.6)$

$V^2 = 4 \times 7$

$V = 2\sqrt{7}$

35. Only the following statements are true from definition of a conservative force.

"Its work is zero when the particle moves exactly once around any closed path".

"Its work depends on the end points of the motion, not on the path between".

निम्न कथन संरक्षी बल की परिभाषा से सत्य है । यह है।

"जब कण किसी बंद पथ के अनुदिश ठीक एक चक्कर पूरा करता है तो संरक्षी बल द्वारा किया गया कार्य शून्य होता है।"

" इसके लिए किया गया कार्य गति के अन्तिम बिन्दुओं पर निर्भर करता है पथ पर नहीं। "

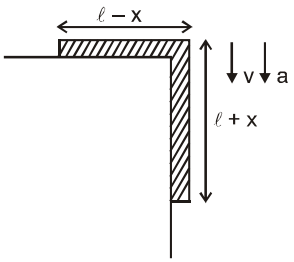
36. $S = \frac{1}{2}(g \sin\theta + \mu g \cos\theta) t_a^2 = \frac{1}{2}(g \sin\theta - \mu g \cos\theta) t_d^2$

$\Rightarrow \qquad \frac{t_d}{t_a} = \sqrt{\frac{\sin\theta + \mu\cos\theta}{\sin\theta - \mu\cos\theta}} = \sqrt{3} = \lambda$

$\Rightarrow \qquad \lambda^2 = 3 \quad (\because \theta = 60^\circ \ \& \ \mu = \frac{\sqrt{3}}{2})$

37. Consider at time t rope of length x has moved from horizontal portion.

माना कि t समय में रस्सी का क्षैतिज भाग x गति कर चुका है।



Assume mass per unit length λ

माना कि इकाई लम्बाई का द्रव्यमान λ है।

Apply NLM लगाने पर :

$\lambda(\ell + x)g - \mu(\ell - x)g\,\ell\lambda = 2\,\ell\,\lambda a$

$$\left(a = \frac{dv}{dt} = \frac{dv}{dx} \cdot \frac{dx}{dt} = v\frac{dv}{dx}\right)$$

$$\lambda g\,[(\ell + x) - \mu\,(\ell - x)] = 2\,\ell\,\lambda\,v\,\frac{dv}{dx}$$

$$\int_0^{\ell} g\;\;[(\ell + x) - \mu(\ell - x)]\;dx = \int_0^{v} 2\ell\;\;v\;\;dv$$

$$g\;\int_0^{\ell} \ell(1-\mu) + x(1+\mu)\;\;dx\;\; = \;\;\ell v^2$$

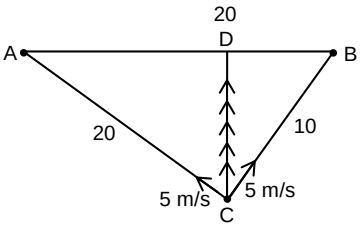
$$g\,[(1 - \mu)\,\ell]\,\ell + (1 + \mu)\,\frac{\ell^2}{2} = \ell v^2$$

$$g\left[(1-\mu)\;\;\ell + \frac{(1+\mu)\;\;\ell}{2}\right] = v^2$$

$$\Rightarrow\;\; V = \sqrt{\frac{g\ell}{2}[3 - \mu]}$$

Ans. 5 m/s

38.



$(20 - 5t) + (10 - 5t) = 20$
$30 - 10\,t = 20$
$t = 1$
$AD = 20 - 5t = 15$ m.

PART-III: CHEMISTRY

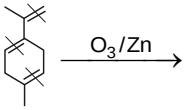
39. According to graph, total energy subjected = 12 eV
No. of photons = 2
$\therefore$ Energy of each photon = 6 eV
$(KE)_{max} = E - \phi$
$4 = 6 - \phi$
or, ϕ = 2 eV = Work function.

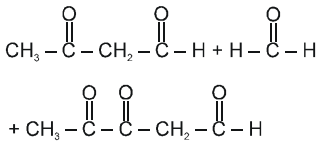
हल. ग्राफ के अनुसार, सम्बन्धित कुल ऊर्जा = 12 eV
फोटॉन की संख्या = 2
$\therefore$ प्रत्येक फोटॉन की ऊर्जा = 6 eV
$(KE)_{max} = E - \phi$
$4 = 6 - \phi$
या, ϕ = 2 eV = कार्य फलन

40. Change in potential energy (स्थितिज ऊर्जा में परिवर्तन) $= -2 \times \frac{y}{4} - (-2y)$ [$\because$ PE = – 2 KE]

$= -\frac{y}{2} + 2y = +\frac{3}{2}y$

41.





42. (D) Dumas & Kjeldahl`s method
(D) ड्यूमा विधि व जेल्डाल विधि

43. (200)

45. Total spin = 3 $\Rightarrow \frac{n}{2} = 3 \Rightarrow n = 6$
i.e. magnetic moment
$= \sqrt{n(n+2)} = \sqrt{6(6+2)} = \sqrt{48}$ B.M.

हल. कुल चक्रण = 3 $\Rightarrow \frac{n}{2} = 3 \qquad \Rightarrow n = 6$
चुम्बकीय आघूर्ण
$= \sqrt{n(n+2)} = \sqrt{6(6+2)} = \sqrt{48}$ B.M.

46. Orbital angular momentum of electron
$= \sqrt{\ell(\ell+1)}\;\;\frac{h}{2\pi}$

$\Rightarrow \sqrt{\ell(\ell+1)}\;\;\frac{h}{2\pi} = \sqrt{3}\frac{h}{\pi} \Rightarrow \ell = 3$

number of orientations
$= 2\,\ell + 1 = 2 \times 3 + 1 = 7$

हल. इलैक्ट्रॉन का कक्षीय कोणीय संवेग
$= \sqrt{\ell(\ell+1)}\;\;\frac{h}{2\pi}$

$\Rightarrow \sqrt{\ell(\ell+1)}\;\;\frac{h}{2\pi} = \sqrt{3}\frac{h}{\pi} \Rightarrow \ell = 3$

विन्यास की संख्या
$= 2\,\ell + 1 = 2 \times 3 + 1 = 7$

47. (8)

48. (3)

50. **For node** नोड के लिये $\psi = 0$
$\sigma - 1 = 0$
$\sigma = 1$
$\sigma = \frac{a_0}{2Z}$
or या $(\sigma^2 - 8\sigma + 12) = 0$
$\sigma = 6$ or $\sigma = 2$
$r = \frac{3a_0}{Z}$ $r = \frac{a_0}{Z}$

56. Orbital is 3s because no r^{ℓ} term
$\Rightarrow \ell = 0$ & polynomial is of order 2
$\Rightarrow n - \ell - 1 = 2$ or $n = 3$
(A = 3, B = 0, C = 0, D = 3, E = 0, F = 3)

हल. कक्षक 3s से है क्योंकि कोई r^{ℓ} पद नहीं है
$\Rightarrow \ell = 0$ व बहुपद 2 कोटि का है
$\Rightarrow n - \ell - 1 = 2$ or $n = 3$
(A = 3, B = 0, C = 0, D = 3, E = 0, F = 3)

57. S^{2-}, O^{2-}, F^{-}, Br^{-}, I^{-}, Ne
have greater radii then oxygen atom.
S^{2-}, O^{2-}, F^{-}, Br^{-}, I^{-}, Ne
की त्रिज्या ऑक्सीजन परमाणु से अधिक है।

PAPER-2

PART-I: MATHEMATICS

1. $3x^{\log_5 2} - \frac{1}{x^{\log_5 2}} = 4 \qquad (x > 0)$

$\Rightarrow \quad 3y - \frac{1}{y} = 4 \qquad \Rightarrow 3y^2 - 4y - 1 = 0$

$\Rightarrow \quad y = \frac{2 \pm \sqrt{7}}{3} \qquad \Rightarrow x^{\log_5 2} = \frac{2 \pm \sqrt{7}}{3}$

$\Rightarrow \quad 2^{\log_5 x} = \frac{2+\sqrt{7}}{3}$ which will give one value of x.

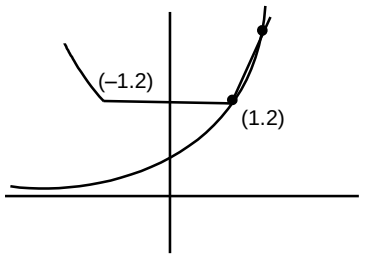
$2^{\log_5 x} = \frac{2+\sqrt{7}}{3}$ जो कि x का एक मान होगा।

2. Given abc < 0
product of roots of the given equation
$= \frac{a}{bc} \times \frac{bc}{bc}$
$= \frac{abc}{(bc)^2} < 0$
$\because$ 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
$= \frac{a}{bc} \times \frac{bc}{bc} = \frac{abc}{(bc)^2} < 0$
$\because$ मूलो का गुणनफल < 0
$\therefore$ एक मूल धनात्मक है तथा एक ऋणात्मक (वास्तविक मूल)

3. For graph



k = 2 $\quad a = 2^{1+\frac{3}{3}+\frac{5}{3^2}+\frac{7}{3^3}+\frac{9}{3^4}....+....} = 2^3 = 8$

$b = 2^{\frac{1}{2}}.2^{\frac{1}{2}\frac{1}{3}}.2^{\frac{1}{3.4}}.2^{\frac{1}{4.5}}.....2^{\frac{1}{n(n+1)}} = 2^{\left(\frac{n}{n+1}\right)}$

$\frac{b}{a} = \frac{2^{\frac{n}{n+1}}}{2^3} = \left(\frac{1}{2}\right)^{\frac{2n+3}{n+1}}$

4. Given दिया हुआ है $(a + b)\left\{\frac{\sin^4\alpha}{a} + \frac{\cos^4\alpha}{b}\right\} = 1$

$\Rightarrow \quad \sin^4\alpha + \cos^4\alpha + \frac{b}{a}\sin^4\alpha + \frac{a}{b}\cos^4\alpha = (\sin^2\alpha + \cos^2\alpha)^2$

$\Rightarrow \quad \left(\sqrt{\frac{b}{a}}\sin^2\alpha\right)^2 + \left(\sqrt{\frac{a}{b}}\cos^2\alpha\right)^2 - 2\sin^2\alpha\cos^2\alpha = 0$

$\Rightarrow \quad \left(\sqrt{\frac{b}{a}}\sin^2\alpha - \sqrt{\frac{a}{b}}\cos^2\alpha\right)^2 = 0$

$\Rightarrow \quad \sqrt{\frac{b}{a}}\sin^2\alpha = \sqrt{\frac{a}{b}}\cos^2\alpha$

$\Rightarrow \quad \frac{\sin^2\alpha}{a} = \frac{\cos^2\alpha}{b}$

$\Rightarrow \quad \frac{\sin^4\alpha}{a^2} = \frac{\cos^4\alpha}{b^2} = \lambda$ (saymaana)

Now from given condition अब दी गई शर्त के अनुसार

$a\left(\frac{\sin^4\alpha}{a^2}\right) + b\left(\frac{\cos^4\alpha}{b^2}\right) = \frac{1}{a+b}$

$\Rightarrow \quad a\lambda + b\lambda = \frac{1}{a+b}$

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

L.H.S. $= \frac{\sin^8\alpha}{a^3} + \frac{\cos^8\alpha}{b^3}$

$= a\left(\frac{\sin^4\alpha}{a^2}\right)^2 + b\left(\frac{\cos^4\alpha}{b^2}\right)^2$

$= (a + b)\,\lambda^2$

$= (a + b)\left(\frac{1}{(a+b)^2}\right)^2 = \frac{1}{(a+b)^3}$

= R.H.S.

5. $T_2 = {}^nC_1 (a^{1/13})^{n-1} (a^{3/2}) = 14a^{5/2} \quad \Rightarrow n = 14$

$\therefore \quad \frac{{}^nC_3}{{}^nC_2} = 4$

6. 1st term = $\log_{210} a$,

2nd term = $(\log_b 210)^{-1} = \log_{210} b$,

3rd term = $\frac{1}{\log_c 420 - \log_c 2} = \log_{210} c$, 4th term = $\frac{1}{\log_d 15 + \log_a 14} = \log_{210} d$

7. P(x) = (x–tan18º) (x–tan19º) …….
(x–tan26º) (x–tan27º)
P(–1) = ((1+tan18º) (1+tan27º)) …….
((1+ tan22º) (1+tan23º))
$= 2^5$
$\Rightarrow 1 - a_1 + a_2 - a_3 + \ldots\ldots - a_9 + a_{10} = 32$

8. P(x) =

$$\left(x - \cos\frac{\pi}{2}\right)\left(x - \cos\frac{\pi}{2^2}\right).....\left(x - \cos\frac{\pi}{2^{10}}\right)$$

P(–1) =

$$\left(1 + \cos\frac{\pi}{2}\right)\left(1 + \cos\frac{\pi}{2^2}\right).....\left(1 + \cos\frac{\pi}{2^{10}}\right)$$

$$= 2^{10}\left(\cos^2\frac{\pi}{2^2}\cos^2\frac{\pi}{2^3}.....\cos^2\frac{\pi}{2^{11}}\right)$$

$$= 2^{10}\left(\frac{\sin\frac{\pi}{2}}{2^{10}\sin\left(\frac{\pi}{2^{11}}\right)}\right)^2 = \frac{1}{2^{10}\sin^2\frac{\pi}{2^{11}}}$$

$a_{10} = 0$
$1 - a_1 + a_2 - a_3 + \ldots\ldots + a_8 - a_9$

$$= \frac{1}{2^{10}\sin^2\left(\frac{\pi}{2^{11}}\right)}$$

$2^{11}\sin^2$

$$\left(\frac{\pi}{2^{11}}\right)(1 - a_1 + a_2 - a_3 + \ldots\ldots + a_8 - a_9) + a_{10} = 2$$

Sol. **(9–10)**
$x = 1 \Rightarrow f(1) = 6, f(2) = 7$
$x = 2 \Rightarrow f(3) = 9, x = 3 \Rightarrow f(4) = 12, x = 4$
$\Rightarrow f(5) = 16$
differences 7 – 6, 9 – 7, 12 – 9, 16 – 12 ….. are in A.P.
अन्तर 7 – 6, 9 – 7, 12 – 9, 16 – 12 ….. समान्तर श्रेणी में है।

$\therefore f(x) = \ell x^2 + mx + k$

$$\ell = \frac{1}{2}, m = -\frac{1}{2}, k = 6 \qquad f(x) = \frac{x^2}{2} - \frac{x}{2} + 6$$

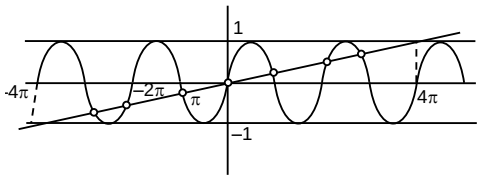
$$\sum_{r=1}^{n}\left(f(r) - \frac{r}{3}\right) = \sum_{r=1}^{n}\left(\frac{r^2}{2} - \frac{5r}{6} + 6\right) = \frac{1}{2}\frac{n(n+1)(2n+1)}{6} - \frac{5}{6}\frac{n(n+1)}{2} + 6n$$

$$= \frac{n}{6}\left(n^2 - n + 34\right)$$

c = 17, d = 3

11. Draw graph of $e^x = \tan x$.
$e^x = \tan x$ का आरेख खीचने पर

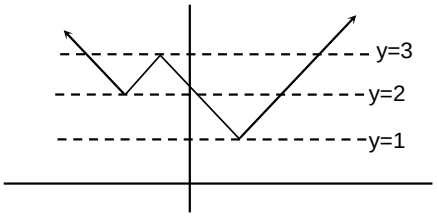
12.



number of inter section point of y = sinx and $y = \frac{x}{4\pi}$ is 7

y = sinx और $y = \frac{x}{4\pi}$ के प्रतिच्छेद बिन्दुओं की संख्या 7 होगी

13.



15. $\cos^n x - \sin^n x = 1$

n is even then $\sin^n x$ and $\cos^n x$ both are positive.

n सम है तब $\sin^n x$ और $\cos^n x$ दोनों धनात्मक है।

So इसलिए

$\sin^n x = 0$ and और $\cos^n x = 1$

$\cos x = \pm 1$

$x = 0, \pi$

16. x = 0 is always solution *n* being odd or even.

x = 0 सदैव हल है *n* विषम या सम होगा।

17. Let $\sqrt{2n^2 + 10 - 2\sqrt{n^4 + 6n^2 + 25}} = \sqrt{p} - \sqrt{q}$
$p + q = 2n^2 + 10$, $pq = n^4 + 6n^2 + 25$
$p^2 + q^2 + 2pq = 4^4 + 40n^2 + 100$
$4pq = 4n^4 + 24n^2 + 100 \Rightarrow (p - q)^2 = 16n^2$
$p = n^2 + 2n + 5$, $q = n^2 - 2n + 5$

$$\sum_{n=1}^{17}\sqrt{2n^2 + 10 - 2\sqrt{n^4 + 6n^2 + 25}} =$$

$$= \sum_{n=1}^{17}\left(\sqrt{(n+1)^2 + 4} - \sqrt{(n-1)^2 + 4}\right)$$

$$= \left(\sqrt{2^2+4} - \sqrt{4}\right) + \sqrt{3^2+4} - \sqrt{1^2+4} + \sqrt{\left(4^2+4\right)} - \sqrt{2^2+4} + \sqrt{5^2+4} - \sqrt{3^2+4}$$

$$+ \ldots\ldots + \left(\sqrt{16^2+4} - \sqrt{14^2+4}\right) + \left(\sqrt{17^2+4} - \sqrt{15^2+4}\right) + \left(\sqrt{\left(18^2+4\right)} - \sqrt{16^2+4}\right)$$

$= \sqrt{18^2+4} + \sqrt{17^2+4} - \sqrt{1^2+4} - \sqrt{4} = \sqrt{293} + 2\sqrt{2\times 41} - 2 - \sqrt{5}$

a = 293, b = 41, c = 5

a – 5b – 16c = 8

18. A + B + C = π

LHS = tanC (tanA + tanB) + tanA .

$$\tan B = \tan C \frac{\sin(A+B)}{\cos A\cos B} + \tan A\tan B$$

$$= \frac{\sin C\sin(\pi - C)}{\cos A\cos B\cos C} + \frac{\sin A\sin B}{\cos A\cos B}$$

$$= \frac{\sin^2 C + \sin A\sin B\cos C}{\cos A\cos B\cos C} = \frac{1-\cos^2 C + \sin A\sin B\cos C}{\cos A\cos B\cos C}$$

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

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

$$= \frac{1+\cos A\cos B\cos C}{\cos A\cos B\cos C} = 1 + \sec A\sec B\sec C$$

= RHS.

19. $(x^2+2x-15)(x^2+2x-63) = 385$,

$t = x^2+2x \quad \Rightarrow t^2 - 78t + 560 = 0$

$x^2+2x-70=0$, $x^2+2x-8=0$

$a = -1-\sqrt{71}$, b = –4, c = 2, d = $-1+\sqrt{71}$

L.H.S. =

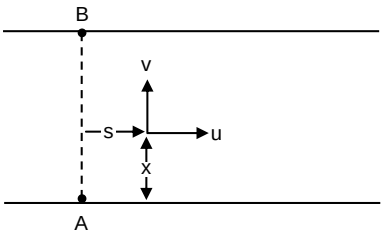
$$\frac{bc(a+d)+ad(c+b)-(a+d)-(b+c)}{2(1-ad)(1-bc)} = -\frac{(a+d)}{2(1-ad)} - \frac{(b+c)}{2(1-bc)}$$

$$= \frac{1}{3^2} + \frac{1}{71}$$

$$= \frac{q-p^2}{2} = 31$$

PART-II: PHYSICS

20.



$$\frac{ds}{dt} = u$$

$$\frac{dx}{dt} = v$$

$$\frac{ds}{dx} = \frac{u}{v}$$

$$\int_O^S ds = \frac{u}{v}\int_O^b dx \Rightarrow s = 700m$$

21. In xt graph velocity is represented by slope. In A and B options magnitude of slope is decreasing so speed is decreasing. In (D) option v is decreasing with time

xt-ग्राफ का ढाल वेग का प्रदर्शित करता है। A तथा B में ढाल का परिमाण घट रहा है, अतः चाल घटेगी।

(D) में समय के साथ v घट रहा है।

22. Kx sin 53° + T sin 53° = mg

Kx = T

$2Kx\ \frac{4}{5} = mg$

$Kx = \frac{5}{8}mg$

If string break $a_1 = \frac{5mg/8}{m}$

यदि डोरी टूटती है, तो $a_1 = \frac{5mg/8}{m} = 5\ g/8$

If spring break. $a_2 = g\cos 53° = 3\ g/5$

यदि स्प्रिंग टूटती है, तो $a_2 = g\cos 53° = 3\ g/5$

∴ **Ans.** (A, B)

23. U = 6x + 8y

$\vec{F} = -6\hat{i} - 8\hat{j}$

$\vec{a} = -6\hat{i} - 8\hat{j}$

$|\vec{a}| = 10\ m/s^2$

$S_x = u_x y + \frac{1}{2}a_x t^2$

$-9 = 0 - \frac{1}{2}(6)t^2$

$t = \sqrt{3}$ sec.

$\vec{v} = \vec{u} + \vec{a}t$

$\vec{v} = 0 + (-6\hat{i} - 8\hat{j})\sqrt{3}$

$|\vec{v}| = 10\sqrt{3}$ m/s.

24. P = F.V.

V will be maximum when F = mg sinθ

V अधिकतम होगी जब F = mg sinθ

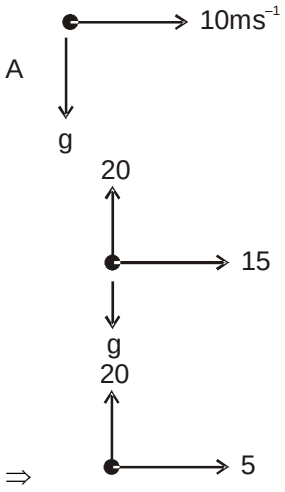
$\therefore \quad V_{max} = \frac{P}{mg\sin\theta}$

Hence, first increases then becomes

अतः पहले बढ़ेगी तत्पश्चात्

$V_{max} = \frac{P}{mg\sin\theta}$ = constant नियत

25.



$\Rightarrow$

$V_{3s} = 5\sqrt{17}$

= constant

26. $v = 3t^2$

$v = 3(3)^2 = 27$ m/s

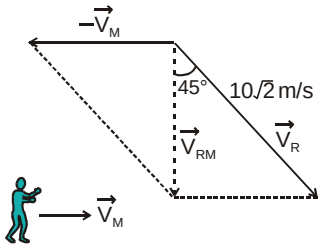
27. $\int_0^s dS = \int_0^2 3t^2 dt$

$S = \left[t^3\right]_0^2 = 8$

28. 10.00

29. **In the first case :**

From the figure it is clear that $\vec{V}_{RM}$ is 10 m/s downwards and $\vec{V}_M$ is 10 m/s towards right.



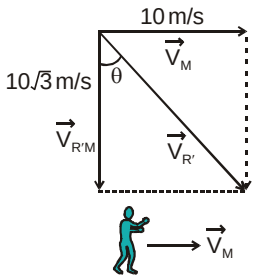
In the second case :

Velocity of rain as observed by man becomes $\sqrt{3}$ times in magnitude.

$\therefore$ New velocity of rain

$\vec{V}_{R'} = \vec{V}_{R'M} + \vec{V}_M$

$\therefore$ The angle rain makes with vertical is

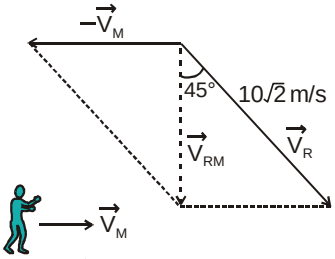


$$\tan\theta = \frac{10}{10\sqrt{3}} \quad \text{or } \theta = 30°$$

$\therefore$ Change in angle of rain = 45 – 30 = 15°.

पहले case में :

चित्र से यह स्पष्ट है कि $\vec{V}_{RM}$ 10 m/s ऊर्ध्वाधर है और $\vec{V}_M$ 10 m/s दांयी ओर है।



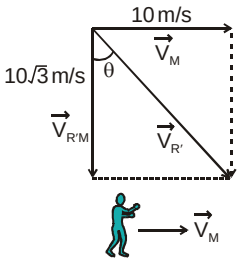
दूसरे case में :

दौड़ते हुए आदमी से देखने पर बारिश का वेग $\sqrt{3}$ गुना है।

$\therefore$ अतः बारिश का नया वेग

$\vec{V}_{R'} = \vec{V}_{R'M} + \vec{V}_M$

$\therefore$ वह कोण जो वर्षा ऊर्ध्वाधर से बनाती है।

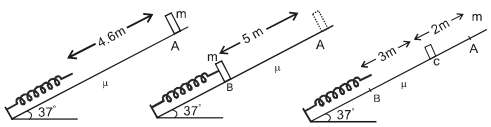


$$\tan\theta = \frac{10}{10\sqrt{3}} \qquad \text{या} \quad \theta = 30°$$

$\therefore$ कोण में परिवर्तन = 45 – 30 = 15°.

30. 03.00

31.



Work energy theorem (Between A & C)

कार्य उर्जा प्रमेय से (A और C के मध्य)

$$W_f + W_G + W_{sp} = \Delta K$$

$\Rightarrow$ $-\mu mg\cos\theta\,(5+3) + mg\,2\sin\theta = 0$

$\Rightarrow \quad \mu = \frac{2}{8}\tan 37° = \frac{3}{16}$

work energy theorem (bet. A & B)
कार्य उर्जा प्रमेय (A और B के मध्य)

$W_{sp} + W_G + W_f = \Delta K$

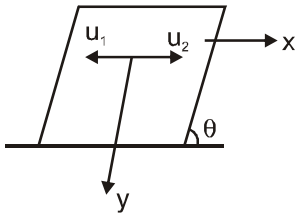
$\Rightarrow mg\ 5\sin 37° - \mu\, mg\ 5\cos\theta - \frac{1}{2}K(0.4)^2 = 0$

$(4 \times 10)\left[5\times\frac{3}{5} - \frac{3}{16}(5)\frac{4}{5}\right] = \frac{1}{2}\times\frac{16}{100}K$

K = 9000/ 8 N/m

so अतः x = 9

32. Velocities of the particles at any time t
किसी समय t पर कणों को वेग



$\vec{v}_1 = -u_1\hat{i} + g\sin\theta\, t\,\hat{j}$

$\vec{v}_2 = u_2\hat{i} + g\sin\theta\, t\,\hat{j}$

$\vec{v}_1 . \vec{v}_2 = 0 \Rightarrow u_1 u_2 = g^2\sin^2\theta\, t^2$

$\Rightarrow \quad t = \frac{\sqrt{u_1 u_2}}{g\sin\theta}$

33. $\vec{v}_2 - \vec{v}_1 = (u_2 + u_1)\,\hat{i}$ = constant नियतांक

34. $400 = \mu_s N = \mu_s(mg)$
$= \mu_s(100 \times 10)$
$\therefore \quad \mu_s = 0.4$

35. From the first trial, (पहली कोशिश में)

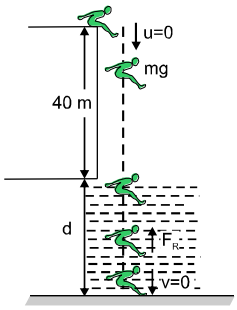
$s = \frac{1}{2}at^2$ or $a = \frac{2s}{t^2} = 3.0\ m/s^2$

Now, (अब) $a = \frac{F - \mu_k mg}{m} = \frac{F}{m} - \mu_k g$

$\therefore \quad 3 = \frac{500}{100} - 10\,\mu_k$

or या $\mu_k = 0.2$

36.



$mgh - F_R d = 0$

$d = \frac{mgh}{F_R} = 20\ m$

$\frac{d}{10} = 2\ m$ **Ans.**

37. $\varepsilon_i = \varepsilon_f$

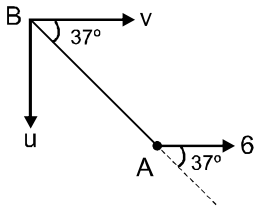
$mg\frac{L}{2}\sin\theta + 0 = m_1 g\frac{(L-x)}{2}\sin\theta - m_2 g\frac{x}{2} + \frac{1}{2}mv^2$

$mg\frac{L}{2}\sin\theta = \frac{g}{L}(L^2 + x^2 - 2Lx)\sin\theta - \frac{x^2}{L} + v^2$

$gL\sin\theta = \frac{g}{L}(L^2 + x^2 - 2Lx)\sin\theta - \frac{x^2}{L}g + v^2$

$v = \sqrt{\frac{5}{8}g\ell}$

38.



$v\cos 37° + u\cos 53° = 6\cos 37°$

$v\sin 37° = u\sin 53°$

$\Rightarrow \quad v = 3$

$u = 4$

$v_{rs} = \sqrt{3^2 + u^2} = 5.$

PART-III: CHEMISTRY

39. $\lambda_{Å} = \sqrt{\frac{150}{V}}$

$2 = \sqrt{\frac{150}{V}}$

V = 37.5 V

K.E. of photoelectron = 37.5 eV

Amount of energy required to liberated electron = 54.5 eV

Total energy of photon
= 54.4 + 37.5 = 91.9 eV

$91.9 = 13.6Z^2\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$

or Z = 3

हल. $\lambda_{Å} = \sqrt{\frac{150}{V}}$

$2 = \sqrt{\frac{150}{V}}$

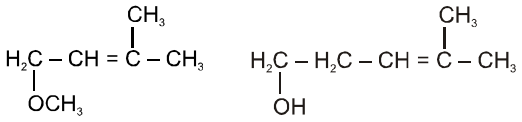
V = 37.5 V
प्रकाश इलेक्ट्रॉन की K.E. = 37.5 eV
इलेक्ट्रॉन निष्कासन के लिए आवश्यक
ऊर्जा की मात्रा = 54.5 eV
फोटॉन की कुल ऊर्जा
= 54.4 + 37.5 = 91.9 eV

$$91.9 = 13.6Z^2\left(\frac{1}{1^2}-\frac{1}{2^2}\right)$$

या Z = 3

41. Since B is in infrared region and A has more energy than B, hence it will have lesser wavelength i.e ultra violet, visible or infrared region.
चूंकि B अवरक्त क्षेत्र में है तथा A की ऊर्जा B से अधिक है, अतः इसकी न्यून तंरग दैर्ध्य होगी अर्थात् पराबैंगनी, दृश्य या अवरक्त क्षेत्र।

42.



CAN	– ve	+ ve
Alkaline $KMnO_4$	+ ve	+ ve
$[Ag(NH_3)_2]NO_3$	– ve	– ve
Na / Hexane हैक्सेन	– ve	+ ve

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

44. (A) Its DU = 4

(B) After hydrogenation its chlorination gives 11 monochloro products
(C) For hydrogenation it requires 2 mol of H_2
(A) इसका DU = 4 है।
(B) हाइड्रोजनीकरण के बाद इसके क्लोरीनीकरण से 11 मोनोक्लोरो उत्पाद मिलते है।
(C) हाइड्रोजनीकरण के लिए इसे 2 मोल H_2 की आवश्यकता होती है।

47. Total energy release for transition of n_2 to 1st excited state =10.20+17 = 27.2 eV
Total energy release for transition of n_2 to 2nd excited state=4.25+5.95 = 10.2 eV

$$\frac{27.2}{10.2} = \frac{13.6z^2\left[\frac{1}{4}-\frac{1}{n_2^2}\right]}{13.6z^2\left[\frac{1}{9}-\frac{1}{n_2^2}\right]}$$

$$\frac{27.2}{10.2} = \frac{9n_2^2-36}{4n_2^2-36}$$

$108.8n_2^2 - 979.2 = 91.8\ n^2 - 367.2$

$17n_2^2 = 612$
$n_2 = 6$

$$27.2 = 13.6 \times Z^2\left[\frac{1}{4}-\frac{1}{36}\right]$$

Z = 3
∴ Sample contains Li^{+2} species.

हल. n_2 से प्रथम उत्तेजित अवस्था में संक्रमण द्वारा मुक्त कुल ऊर्जा = 10.20 + 17 = 27.2 eV
n_2 से द्वितीय उत्तेजित अवस्था में संक्रमण द्वारा मुक्त कुल ऊर्जा = 4.25 + 5.95 = 10.2 eV

$$\frac{27.2}{10.2} = \frac{13.6z^2\left[\frac{1}{4}-\frac{1}{n_2^2}\right]}{13.6z^2\left[\frac{1}{9}-\frac{1}{n_2^2}\right]}$$

$$\frac{27.2}{10.2} = \frac{9n_2^2-36}{4n_2^2-36}$$

$108.8n_2^2 - 979.2 = 91.8\ n^2 - 367.2$

$17n_2^2 = 612$
$n_2 = 6$

$$27.2 = 13.6 \times Z^2\left[\frac{1}{4}-\frac{1}{36}\right]$$

Z = 3
∴ प्रादर्श में Li^{+2} आयन उपस्थित है।

48. According to paragraph If a electron jump from n = 6 to n' a photon of 4.25 eV energy releases.

$$4.25 = 13.6 \times (3)^2\left[\frac{1}{n'^2}-\frac{1}{36}\right] \quad n = 4$$

हल. जब इलेक्ट्रॉन n = 6 से किसी निम्न कक्षा n' में संक्रमण करता है, तो 4.25 eV ऊर्जा मुक्त होती है। अतः,

$$4.25 = 13.6 \times (3)^2\left[\frac{1}{n'^2}-\frac{1}{36}\right] \quad n = 4$$

49. E is phosphorous.
E, फास्फोरस है।

50. (3)

51. Let shell number for S_2 state be n.
माना कि S_2 अवस्था के लिए कोश संख्या n है।

$$(E_{S2})_{He^+} = -13.6\left(\frac{2^2}{n^2}\right) = -\frac{1}{4}\times 13.6$$

∴ n = 4
Also साथ ही, $n - \ell - 1 = 2$

$\therefore$ $4 - \ell - 1 = 2$ $\therefore$ $\ell = 1$

$\therefore$ S_2 = 4p orbital कक्षक

$\therefore$ Orbital angular momentum for electron in S_2 state

S_2 अवस्था में इलेक्ट्रॉन के लिए कक्षीय कोणीय संवेग

$$= \sqrt{\ell(\ell+1)}\,\frac{h}{2\pi} = \sqrt{1(1+1)}\,\frac{h}{2\pi} = \frac{\sqrt{2}\,h}{2\pi}$$

52. State S_1 is ns orbital

(∵ spherically symmetrical state)

Also, $n - \ell - 1 = 2$ $\therefore$ $n - 0 - 1 = 2$

$\therefore$ $n = 3$

$\therefore$ S_1 = 3s orbital.

$\therefore$ Energy absorbed for electronic transition from S_1 state to S_2 state

$= 0.66 \times 2^2 = 2.64$ eV.

हल. S_1 अवस्था, ns कक्षक हैं

(∵ गोलीय सममित अवस्था)

साथ ही, $n - \ell - 1 = 2$ $\therefore$ $n - 0 - 1 = 2$

$\therefore$ $n = 3$

$\therefore$ S_1 = 3s कक्षक

$\therefore$ इलेक्ट्रॉन के S_1 अवस्था से S_2 अवस्था में इलैक्ट्रॉनिक संक्रमण के लिए अवशोषित ऊर्जा

$= 0.66 \times 2^2 = 2.64$ eV.

55. $$\frac{V_9(Li^{2+})}{V_3(H)} = \frac{2.18\times10^6\times3\times3}{2.18\times10^6\times9\times1} = 1$$

56. N_2, CN^-, Si, CO, O_2^{2+}, C_2^{2-}

(all 6 contain 14 electrons)

N_2, CN^-, Si, CO, O_2^{2+}, C_2^{2-}

(सभी 6, 14 इलैक्ट्रॉन रखते हैं।)

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

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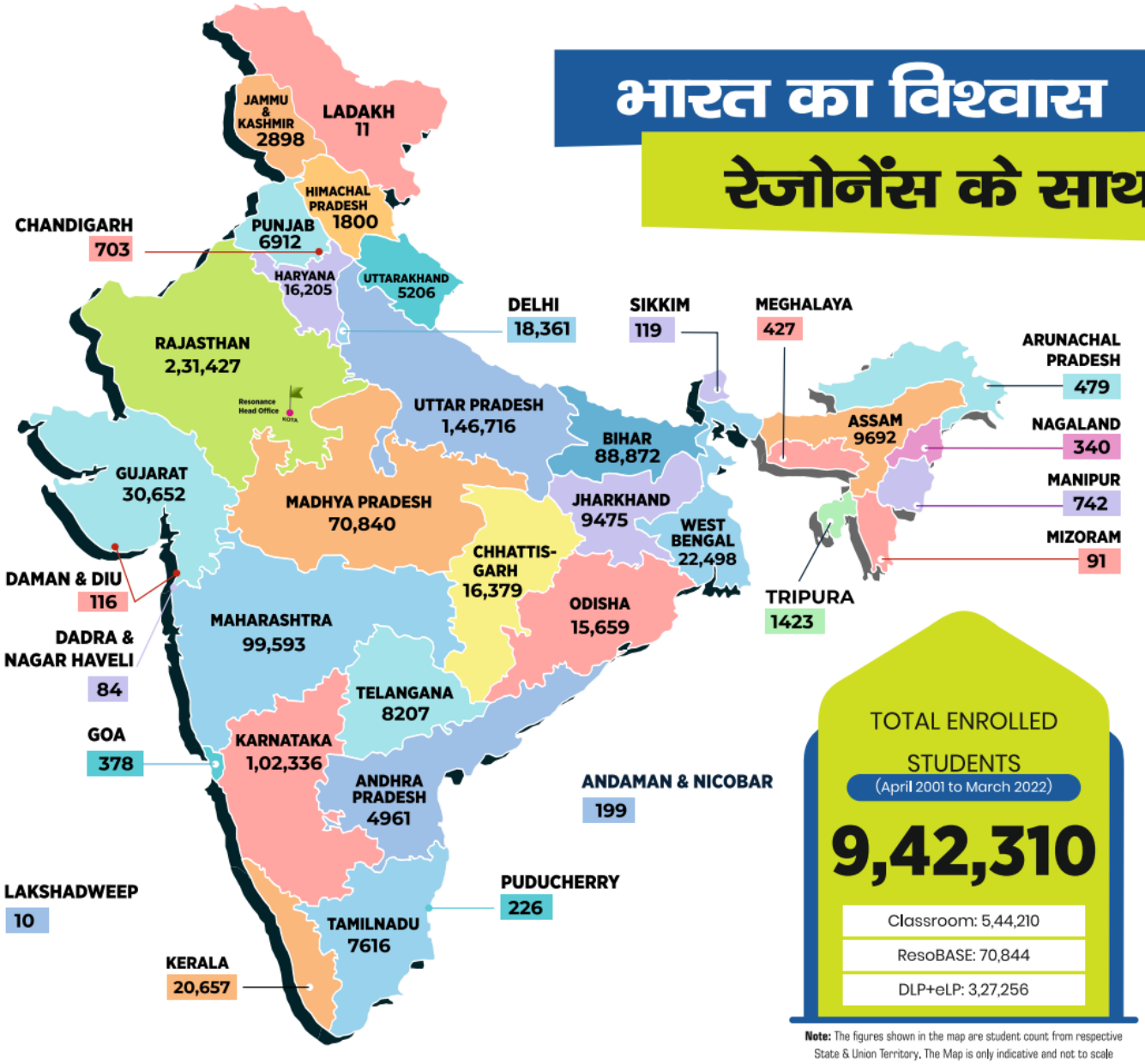

TOTAL ENROLLED STUDENTS
(April 2001 to March 2022)

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