Resonance®
Educating for better tomorrow

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	XIII	COURSE NAME	VISHESH, VIJAY, ABHYAAAS, AJAY	COURSE CODE	JD, JR, ED, ER
PHASE CODE(S)	JD,JR,ED,ER	TOTAL PAGES	20	BATCH CODE(S)	JD,JR,ED,ER

Target Examination & Year:

JEE (MAIN+ADVANCED) 2024

TEST PATTERN	TEST TYPE	TEST CODE & SEQUENCE
JEE (MAIN)	ALL INDIA RESONANCE TEST (AIRT)	AIRT 01

DATE & DAY:
29st October 2023 | Sunday

Duration & Time:
3 Hrs | 09:30 AM to 12:30 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)

Scan QR Code for Video Solutions → Coming Soon

Resonance Eduventures Ltd.
Kota Study Centre & Registered Corporate Office:
CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
Tel. No.: 0744-2777777, 2777700 | www.resonance.ac.in | CIN: U80302RJ2007PLC024029

Resonance®
Educating for better tomorrow

Academic Session: 2023-24

PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

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

PHYSICS

S.No.	Topic Name	Question Type & Sequencing				Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		MCQ		NVQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	**11**		**7**		**18**	**72**	**60.00%**
1	Work, Power & Energy	4	1,2,16,19	4	23,24,25,26	8	32	26.67%
2	Rectilinear Motion	2	8,13	_	_	2	8	6.67%
3	Newton's laws of Motion	2	9,20	3	27,28,29	5	20	16.67%
4	Circular Motion	1	11	_	_	1	4	3.33%
5	Projectile Motion	1	12	_	_	1	4	3.33%
6	Friction	1	15	_	_	1	4	3.33%
	Class-12	**9**		**3**		**12**	**48**	**40.00%**
7	Gravitation	1	3	_	_	1	4	3.33%
8	Electrostatics	5	4,5,10,17,18	2	22,30	7	28	23.33%
9	Geometrical Optics	3	6,7,14	_	_	3	12	10.00%
10	Electro Magnetic Induction	_	_	1	21	1	4	3.33%
	Total	**20**		**10**		**30**	**120**	**100%**

Resonance® Educating for better tomorrow

Academic Session: 2023-24

PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

CHEMISTRY

S.No.	Topic Name	Question Type & Sequencing				Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		MCQ		NVQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
Physical Chemistry								
	Class-11	**7**		**5**		**12**	**48**	**40.00%**
1	Atomic Structure	2	31,32	_	_	2	8	6.67%
2	Mole concept	2	34,36	1	51	3	12	10.00%
3	Introduction to chemistry	1	35	_	_	1	4	3.33%
4	Chemical Equilibrium	2	40,42	2	54,56	4	16	13.33%
5	Gaseous State	_	_	2	52,57	2	8	6.67%
Inorganic Chemistry								
	Class-11	**5**		**2**		**7**	**28**	**23.33%**
6	Periodic Table Periodicity	2	33,41	1	53	3	12	10.00%
7	Chemical Bonding	3	37,38,39	1	55	4	16	13.33%
Organic Chemistry								
	Class-11	**3**		**1**		**4**	**16**	**13.33%**
8	IUPAC & Structural Isomerism	1	43	_	_	1	4	3.33%
9	GOC-I (Electronic Effect)	1	47	_	_	1	4	3.33%
10	GOC-II (Acid base, reaction intermediate & tautomerism)	1	48	1	59	2	8	6.67%
	Class-12	**5**		**2**		**7**	**28**	**23.33%**
11	Haloalkane & Haloarenes	3	44,45,46	2	58,60	5	20	16.67%
12	Streoisomerism	2	49,50	_	_	2	8	6.67%
	Total	**20**		**10**		**30**	**120**	**100%**

Resonance®
Educating for better tomorrow

Academic Session: 2023-24

PAT : TOPIC-WISE WEIGHTAGE SHEET (WS)

MATHEMATICS

S.No.	Topic Name	Question Type & Sequencing				Total Qs. (Topic-wise)	Total Marks (Topic-wise)	% Weightage (Topic-wise)
		MCQ		NVQ				
		No. of Qs.	Qs. Sequencing	No. of Qs.	Qs. Sequencing			
	Class-11	**11**		**6**		**17**	**68**	**56.67%**
1	Basics	1	61	2	81,84	3	12	10.00%
2	Quadratic Equation	4	62,63,64,65	1	89	5	20	16.67%
3	Sequence and Series	2	74,75	1	86	3	12	10.00%
4	Straight Line	4	77,78,79,80	1	90	5	20	16.67%
5	Trigonometry	_	_	1	87	1	4	3.33%
	Class-12	**9**		**4**		**13**	**52**	**43.33%**
6	Relation Function ITF	4	66,67,68,69	3	82,85,88	7	28	23.33%
7	Limit Continuity and Derivability	5	70,71,72,73,76	1	83	6	24	20.00%
	Total	**20**		**10**		**30**	**120**	**100%**

ANSWER KEY (AK)

PAPER											
PART-A: PHYSICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	1	2	1	1	2	1	1	1	2	4
	Q.No.	11	12	13	14	15	16	17	18	19	20
	Ans.	3	1	1	2	2	2	2	4	3	2
	Q.No.	21	22	23	24	25	26	27	28	29	30
	Ans.	0002	0011	0025	0090	0016	0050	0020	0005	0003	0001
PART-B: CHEMISTRY	Q.No.	31	32	33	34	35	36	37	38	39	40
	Ans.	4	3	3	4	2	2	4	3	1	1
	Q.No.	41	42	43	44	45	46	47	48	49	50
	Ans.	1	3	1	2	1	1	2	4	4	4
	Q.No.	51	52	53	54	55	56	57	58	59	60
	Ans.	0091	0003	0003	0012	0006	0002	0024	0004	0006	0005
PART-C: MATHS	Q.No.	61	62	63	64	65	66	67	68	69	70
	Ans.	3	2	3	2	2	3	1	2	3	1
	Q.No.	71	72	73	74	75	76	77	78	79	80
	Ans.	1	3	1	1	4	2	3	1	1	3
	Q.No.	81	82	83	84	85	86	87	88	89	90
	Ans.	0003	0007	0003	1775	0002	0028	0005	0002	0021	2560

STUDENT'S SPACE

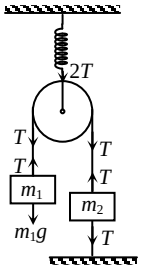
TEXT SOLUTIONS (TS)

PAPER

PART-A: PHYSICS

1. $T = m_1g$

$kx = 2T = 2m_1g$



$x = \frac{2m_1g}{k}$

Energy stored

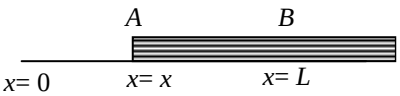
ऊर्जा संग्रहित

$= \frac{1}{2}kx^2 = \frac{1}{2}k\frac{4m_1^2g^2}{k^2} = \frac{2m_1^2g^2}{k}$

2. Total frictional force on AB

AB पर कुल घर्षण

$= \int_x^L \frac{Mg}{L} Kx\,dx$



∴ Heat generated

उत्पन्न ऊष्मा

$= \int_0^L \frac{MgK}{L}\left[\frac{L^2 - x^2}{2}\right]dx = \frac{KMgL^2}{3}$

3. $mR\omega^2 \propto \frac{1}{R^n} \Rightarrow m\left(\frac{4\pi^2}{T^2}\right)R \propto \frac{1}{R^n}$

$\Rightarrow T \propto R^{\left(\frac{n+1}{2}\right)}$

4. Assuming sphere is complete then charge on it = 2Q

So potential at point P due to this spherical charge = $\frac{1}{4\pi\varepsilon_0}\frac{2Q}{d}$

Hence potential due to hemisphere

$= \frac{1}{4\pi\varepsilon_0}\frac{Q}{d}$

माना गोला पूरा है तो इस पर आवेश = 2Q

अतः P बिन्दु पर इसके कारण विभव

$= \frac{1}{4\pi\varepsilon_0}\frac{2Q}{d}$

अतः अर्धगोले के कारण विभव = $\frac{1}{4\pi\varepsilon_0}\frac{Q}{d}$

5. The electric field due to the dipole on the circumference of the ring $E = \frac{p}{4\pi\varepsilon_0 R^3}$ and it is directed normal to the plane of charged ring.

द्विध्रुव के कारण वलय पर विद्युत क्षेत्र $E = \frac{p}{4\pi\varepsilon_0 R^3}$ है तथा दिशा वलय के तल के लम्बवत् है।

Hence force on the charged ring

अतः वलय पर बल

$F = qE = \frac{pq}{4\pi\varepsilon_0 R^3}$

6. Focal length of the convex lens

उतल लैंस की फोकस दूरी

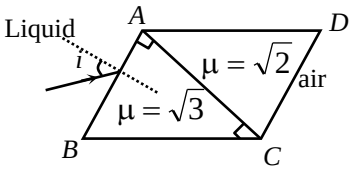
$\frac{1}{f} = \left(\frac{\mu_2 - \mu_1}{\mu_1}\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$\frac{1}{f} = \left(\frac{1.5-1}{1}\right)\left(\frac{1}{R} - \frac{1}{\infty}\right) = \frac{1}{2R} \Rightarrow f = 2R$

So the ray would become parallel to the principal axis after the refraction and fall $\perp^r$ to the mirror and hence would get reflected back along the same path.

अतः किरण अपवर्तन के पश्चात् मुख्य अक्ष के समान्तर हो जाएगी तथा दर्पण पर लम्बवत् आपतित होगी तथा पुनः अपने पथ के अनुदिश चली जाएगी।

7. $\sqrt{3}\sin(90 - i) = \sqrt{2}\sin r$



$1\sin i = \sqrt{2}\sin(90^0 - r)$

on solving we get हल करने पर $i = 45^0$

8. $f = a - bx$

For maximum velocity, acceleration should be zero.

i.e. $a - bx = 0 \Rightarrow x = \frac{a}{b}$

$\therefore$ At $x = \frac{a}{b}$, the particle has its maximum velocity.

$f = \frac{vdv}{dx} = a - bx \Rightarrow \frac{v^2}{2} = ax - \frac{bx^2}{2} + c$

At $x = 0$; $v = 0 \Rightarrow c = 0$

Substituting ; $x = \frac{a}{b}$; gives

$v_{max} = \frac{a}{\sqrt{b}}$

Also, the velocity of the car should become zero at station B.

i.e. $ax - \frac{bx^2}{2} = 0$

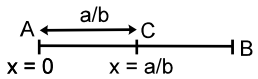
$\Rightarrow x = 0 ; x = \left(\frac{2a}{b}\right)$

$\therefore$ Distance between the cars is $\frac{2a}{b}$

Alternate : $f = a - bx$ means particle will do SHM.

At mean position ; $f = 0$

$\Rightarrow x = \frac{a}{b}$



In the figure shown, 'C' is the mean position and A & B are extreme positions

$\therefore x_{max} = \frac{2a}{b}$ &

$V_{max} = \omega A = \sqrt{b}.\frac{a}{b} = \frac{a}{\sqrt{b}}$

$f = a - bx$

अधिकतम वेग के लिए, त्वरण शून्य होना चाहिए।

अर्थात् $a - bx = 0 \Rightarrow x = \frac{a}{b}$

$\therefore x = \frac{a}{b}$ पर, कण का वेग अधिकतम है।

$f = \frac{vdv}{dx} = a - bx$

$\Rightarrow \frac{v^2}{2} = ax - \frac{bx^2}{2} + c$

$x = 0$ पर; $v = 0 \Rightarrow c = 0$

$x = \frac{a}{b}$ रखने पर

$v_{max} = \frac{a}{\sqrt{b}}$

स्टेशन B पर भी कार का वेग शून्य होना चाहिए।

i.e. $ax - \frac{bx^2}{2} = 0$

$\Rightarrow x = 0 ; x = \left(\frac{2a}{b}\right)$

$\therefore$ कारो के बीच की दूरी $\frac{2a}{b}$

9. Acceleration of boy,

लड़के का त्वरण

$a_b = \frac{50}{250} = \frac{1}{5} m/s^2$

$v_b = 0 + \frac{1}{5} \times 5 = 1 m/s$

Acceleration of box,

बक्से का त्वरण

$a_{box} = \frac{50}{500} = \frac{1}{10} m/s^2$

$v_{box} = 0 + \frac{1}{10} \times 5 = 0.5 m/s$

$v_b, box = 1 - (-0.5)$

= 1.5 m/s.

10. The net charge on middle plate is zero and is placed in uniform electric field. Hence net force on middle plate is zero.

मध्य पट्टिका पर कुल आवेश शून्य है तथा यह समान विद्युत क्षेत्र पर रखा गया है। अतः मध्य पट्टिका पर कुल बल शून्य होगा

11. $V = \sqrt{g\ R\ \tan\theta}$

$\Rightarrow (20)^2 = 10 \times 100 \times \tan\theta$

$\Rightarrow \tan\theta = \frac{4}{10} = \frac{2}{5} \Rightarrow \theta = \tan^{-1}(2/5)$

12. $y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$

$4 = 2\tan\theta - \frac{10 \times 4}{2(2)^2}$ $\quad \tan\theta = \frac{9}{2}$.

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

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

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

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

$= \frac{40-8}{4-2} = 16 \text{ m/s}^2.$

14. Image velocity (w.r.t. mirror) = – m × object velocity (w.r.t. mirror)
Here m = 1.
प्रतिबिम्ब का वेग = – m^2 × बिम्ब का वेग
यहाँ m = 1.

15. The magnitude of deceleration from graph is
मंदन का परिमाण (ग्राफ से)

$a = \frac{8-0}{4-0} = 2\text{m/s}^2$

The deceleration of block is
ब्लॉक का मंदन

$a = \mu g \qquad \therefore \ \mu = \frac{a}{g} = 0.2$

16. $U(x) = \frac{x^3}{3} - \frac{5x^2}{2} + 6x + 3$

$\frac{dU}{dx} = x^2 - 5x + 6 = 0$

$x = 2, 3$

$\frac{d^2U}{dx^2} = 2x - 5$

At x = 2m, $\frac{d^2U}{dx^2}$ = –1, which is a negative value thus U is maximum

x = 2m, $\frac{d^2U}{dx^2}$ = –1, जिसका मान ऋणात्मक है, इसलिए U अधिकतम् होगा।

At x = 3 m, $\frac{d^2U}{dx^2}$ = +1, which is a positive value thus U is minimum

x = 3 m, $\frac{d^2U}{dx^2}$ = +1, जिसका मान धनात्मक है, इसलिए U न्यूनतम् होगा।

$U_{min} = U(x = 3) = 7.5$ J
T.M.E = 15.5 J
$K_{max} + U_{min} = 15.5$ J
$K_{max} + U_{min} = 15.5$ J
$K_{max} = 15.5 - 7.5 = 8$

$\frac{1}{2}(4) V^2_{max} = 8$

$\Rightarrow V^2_{max} = 4$

$\Rightarrow V_{max} = 2$ m/s

17. $U_s = 2U_h$ + interection energy अन्तः ऊर्जा

18. $V_B - V_A = -\int E_x \, dx = -$ [Area under $E_x - x$ curve]

$V_B - V_A = -\int E_x \, dx = -[E_x - x$ वक्र से घिरा हुआ क्षेत्रफल]

$V_B - 10 = -\frac{1}{2}.2.(-20) = 20$

$V_B = 30$ V.

19. $\nabla \times \vec{F} = 0$ means $\vec{F}$ is conservative
$\nabla \times \vec{F} = 0$ अर्थात् $\vec{F}$ संरक्षी है।

$\nabla \times \vec{F} = \left(\hat{i}\frac{\partial}{\partial x} + \hat{j}\frac{\partial}{\partial y}\right) \times \left(F_x \ \hat{i} + F_y \ \hat{j}\right)$

$= \hat{k}\frac{\partial F_y}{\partial x} - \hat{k}\frac{\partial F_x}{\partial y} = 0$

$\frac{\partial F_y}{\partial x} = \frac{\partial F_x}{\partial y}$

(1) $\vec{F}_1 = x \ \hat{j}, \quad F_y = x, F_x = 0$

$\frac{\partial F_y}{\partial x} = 1, \ \frac{\partial F_x}{\partial y} = 0$

$\vec{F}_1$ is not conservative

$\vec{F}_1$ असंरक्षी है।

(2) $\vec{F}_2 = y\hat{i}$ is not conservative $\vec{F}_2 = y\hat{i}$ असंरक्षी है।

as $\frac{\partial F_x}{\partial y} = 1, \ \frac{\partial F_y}{\partial x} = 0$

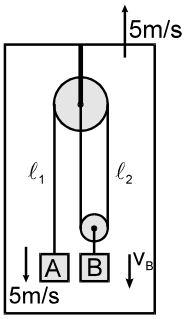
(3) $\vec{F}_3 = y \ \hat{i} + x \ \hat{j}$ is conservative as $\vec{F}_3 = y \ \hat{i} + x \ \hat{j}$ संरक्षी है।

$\frac{\partial F_x}{\partial y} = 1, \qquad \frac{\partial F_y}{\partial x} = 1$

(4) $\vec{F}_4 = y\hat{i} - x\hat{j}$ is not conservative

$\vec{F}_4 = y\hat{i} - x\hat{j}$ असंरक्षी हैं।

20.

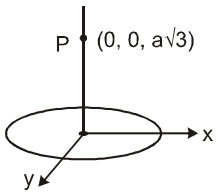


$\ell_1 + 2\,\ell_2 = \text{constant}$

$$\therefore \quad \frac{d\ell_1}{dt} + \frac{2\,d\ell_2}{dt} = 0$$

$(5 + 5) + 2\,(5 + v_B) = 0$ or $v_B = 10$ m/s

21.



By energy equation

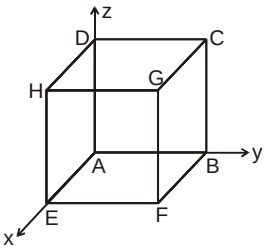
ऊर्जा समीकरण द्वारा

$$\frac{1}{4\pi\varepsilon_0}\frac{\lambda 2\pi a}{2a}q = \frac{1}{2}mv^2.$$

$$v = \frac{\lambda q}{2\varepsilon_0 m} \qquad \therefore \qquad x = 2$$

22. Flux through ABCD.

ABCD से होकर विद्युत फ्लक्स



$\phi_1 = \vec{E}\,\vec{A}$

$= (x^2\hat{i} + y\hat{j}).(-a^2\hat{i})$

$= 0$ as $x = 0$

Flux through EFGH

EFGH से होकर विद्युत फ्लक्स

$\phi_2 = (x^2\hat{i} + y\hat{j}).(+a^2\hat{i})$

$= x^2.a^2 = a^4 = 1.0 \times 10^{-4}$ Nm²/C

Flux through BCGF

BCGF से होकर विद्युत फ्लक्स

$\phi_3 = (x^2\hat{i} + y\hat{j}).(a^2\hat{j})$

$= a^3 = 1.0 \times 10^{-3}$ Nm²/C

Flux through EADH

EADH से होकर विद्युत फ्लक्स

$\phi_4 = (x^2\hat{i} + y\hat{j}).(-a^2\hat{j}) = 0$ as $y = 0$

Flux through ABFE

ABFE से होकर विद्युत फ्लक्स

$\phi_5 = (x^2\hat{i} + y\hat{j}).(-a^2\hat{k}) = 0$

Flux through CDHG

CDHG से होकर विद्युत फ्लक्स

$\phi_6 = 0$

Net flux (नेट फ्लक्स) $= (1.0 \times 10^{-4} + 1.0 \times 10^{-3})$ N-m²/C $= 11 \times 10^{-4}$ N-m²/C

23. $F\cos\theta = \mu N$

$N = mg - F\sin\theta$

$$F = \frac{\mu\, mg}{\cos\theta + \mu\sin\theta}$$

$$P = F\,v\cos\theta = \frac{\mu mg\, v\cos\theta}{\cos\theta + \mu\sin\theta}$$

$$= \frac{\mu mg\, v}{1 + \mu\tan\theta} = 25 \quad W$$

24. Change in velocity

$$= \frac{\text{area under } F - T \text{ graph}}{\text{mass}}$$

$$= \frac{40 + (-10)}{5} = 6 \text{ m/s}$$

$$W_F = \Delta K.E. = \frac{1}{2}(5)\,6^2 = 90 \text{ J}$$

25. $$W = \int_A^D (\vec{F}_1 + \vec{F}_2)\ .\ \vec{ds}$$

$= (4\hat{i} + \hat{j} + 4\hat{k})\ .\ (2\hat{i} + 2\hat{k}) = 8 + 8$

= **16 Joule** **...Ans.**

26. Displacement of the point of 'A' of the string

रस्सी के बिन्दु 'A' का विस्थापन

$= \sqrt{(3\sqrt{3})^2 + (3)^2} - \sqrt{4^2 + 3^2}$

$= 6 - 5 = 1$ m

Δk = Work done by tension

Δk = तनाव द्वारा किया गया कार्य

$= 50 \times 1 = 50$ Joule.

27. let m = 300 kg, x = 40 kg

$(m + x)\,g - B = (m + x)a$

$B - (m - x)\,g = (m - x)\,a$

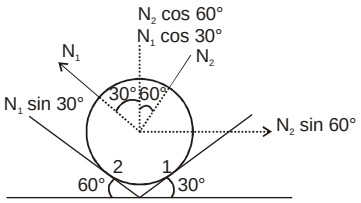
$mg + xg - mg + xg = 2ma$

$2xg = 2ma$

$$a = \frac{xg}{m} = \frac{40 \times 10}{300} = \frac{4}{3}\text{m/s}^2$$

15a = 20 **Ans.**

28.



$N_1 \sin 30° = N_2 \sin 60°$

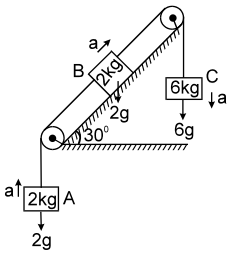
$N_1 \cos 30° + N_2 \cos 60° = mg$

Solving above equation

उपरोक्त समीकरण को हल करने पर

$$N_2 = \frac{mg}{2} = \frac{10 \times 10}{2} = 50$$

29.



All the blocks will be having the same acceleration along the length of the string.

So, Applying Newtons law along the string on A, B & C.

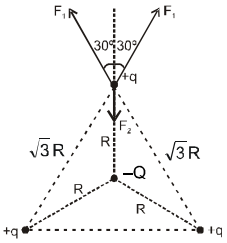
$\Rightarrow$ $6g - 2g \sin 30^0 - 2g = (6 + 2 + 2)a$

$\Rightarrow$ $3g = 10a$

$\Rightarrow$ $a = 3g/10$

or $a = 3\ m/s^2$

30.



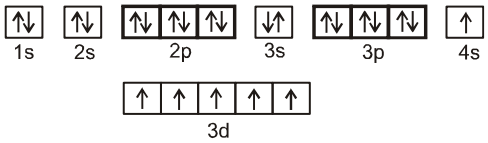
$F_2 - 2F_1 \cos 30^o = 0$

$$\Rightarrow \quad \frac{K(q)\ (Q)}{R^2} = \frac{2(Kq^2)}{(\sqrt{3}R)^2} \cos 30^o$$

$$\Rightarrow \quad Q = \frac{q}{\sqrt{3}} = \frac{\sqrt{3}}{\sqrt{3}}\ \mu C = 1\ \mu C.$$

PART-B: CHEMISTRY

31.



Out of 6 electrons in 2p and 3p must have on electron with m = +1 and $s = \frac{1}{2}$ but in 3d-subshell an orbital having m = +1 may have spin quantum no. $-\frac{1}{2}$ or $+\frac{1}{2}$.

Therefore, minimum and maximum possible values are 2 and 3 respectively.

2p तथा 3p मे 6 इलेक्ट्रॉन m = +1 तथा $s = \frac{1}{2}$ मान रखने चाहिए लेकिन 3d-उपकोश मे m = +1 रखने वाला एक कक्षक $-\frac{1}{2}$ या $+\frac{1}{2}$ चक्रण क्वाण्टम संख्या मान रख सकता है। इसलिए, न्यूनतम तथा अधिकतम सम्भव मान क्रमशः 2 तथा 3 है।

32. The wave function is independant of angle which implies it belongs to spherically symmetric s orbital. Further, it has only one radial node at r = Z/2 which indicates 2s orbital.

Sol. तरंग फलन कोण से स्वतंत्र है अर्थात् यह गोलीय रूप से सममित s कक्षक से सम्बंधित हैं। आगे यह r = Z/2 पर केवल एक त्रिज्यीय नोड़ रखता है। जो 2s कक्षक को इंगित करता है।

33. (3) I and II

(3) I व II

34. $3\ N_2H_5^+ + 2\ Cr_2O_7^{2-} + 13H^+ \longrightarrow$

$3N_2 + 4Cr^{3+} + 14H_2O$

35. (2) A $\rightarrow$ Q, B $\rightarrow$ S, C $\rightarrow$ R, D $\rightarrow$ P

36. Given : $M_1 = M_2$

$$\frac{10d_1\ x_1}{M_1} = \frac{10d_2\ x_2}{M_2}$$

$$\therefore \frac{d_1}{d_2} = \frac{x_2}{x_1} \times \frac{M_1}{M_2} = \frac{20}{40} \times \frac{180}{60} = \frac{3}{2}$$

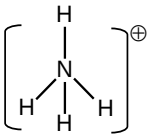
Thus, $d_1 > d_2$

हल दिया है, $M_1 = M_2$

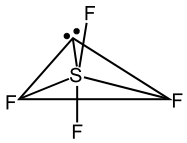
$$\frac{10d_1\ x_1}{M_1} = \frac{10d_2\ x_2}{M_2}$$

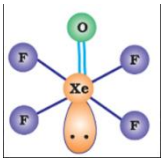
$$\therefore \frac{d_1}{d_2} = \frac{x_2}{x_1} \times \frac{M_1}{M_2} = \frac{20}{40} \times \frac{180}{60} = \frac{3}{2}$$

अतः, $d_1 > d_2$

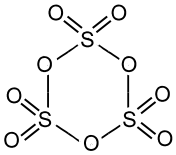
37. $NH_4^{\oplus}$  sp^3

$NO_2^{\oplus}$ $O = \overset{\oplus}{N} = O$ sp

SF_4  sp^3d

$XeOF_4 \Rightarrow$ 

sp^3d^2, square pyramidal

38. **(2)** 

(4)

Species स्पीशीज	**Number of π* electrons** **π*** इलेक्ट्रॉनों की संख्या
O_2	2
O_2^-	3
O_2^{2-}	4

Total (कुल) = 9 electrons (इलेक्ट्रॉन)

39.

	(A)	(B)	(C)	(D)
(1)	p	q	r	s

40.

	(A)	(B)	(C)	(D)
(1)	p	q	s	r

41. (A) Nitrogen has less favourable electron affinity because of stable half filled electron configuration, ns^2np^3.

Nitrogen has higher first ionisation energy because of stable half filled electron configuration, $ns^2\ np^3$.

Across the period, atomic size decreases; electrons are added in the same valence shell but for addition of each sucessive element , the nuclear charge increases by one unit positive charge (i.e. proton) So, C > N.

$IE_2(C) = 2.35$ MJ mol^{-1} ;

IE_2 (N) = 2.85 MJ mol^{-1}

(B) $\Delta_{eg}H$: O = –142 kJmol^{-1} ;

F = –333 kJ mol^{-1}

Δ_{IE1}; O = 1410 kJ mol^{-1} ;

F = 1681 kJ mol^{-1}

Across the period, atomic size decreases. So, O > F.

O will have greater IE_2 because it attains half filled configuration of N after losing 1 electron.

F has maximum EN in periodic table.

(C) $\Delta_{eg}H$; K = –48 kJ mol^{-1}; Mg 67 kJ mol^{-1} (stable configuration ns^2)

Δ_{IE1}; K = 419 kJ mol^{-1}; Mg = 737 kJ mol^{-1}

Metallic radius/pm K = 227; Mg = 160

IE_2(Mg) = 1.45 MJ mol^{-1} ; IE_2 (K) = 3.05 MJ mol^{-1}

(D) $\Delta_{eg}H$; F = –328 kJ mol^{-1} (more inter electronic repulsions on account of small size)

Cl = –349 kJ mol^{-1}

Δ_{IE1}; F = 1680 kJ mol^{-1}; Cl = 1256 kJ mol^{-1}

Covalent radius/pm; F = 64 ; Cl = 99

$IE_2(F) = 3.37$ MJ mol^{-1} ;

IE_2 (Cl) = 2.29 MJ mol^{-1}

हल. (A) नाइट्रोजन की इलेक्ट्रॉन बंधुता इसके स्थायी अर्द्ध पूरित इलेक्ट्रॉनिक विन्यास, ns^2np^3 के कारण कम होती है। अतः नाइट्रोजन की प्रथम आयनन ऊर्जा स्थायी अर्द्ध पूरित इलेक्ट्रॉनिक विन्यास $ns^2\ np^3$ के कारण उच्च होती है।

आवर्त के अनुदिश, परमाण्विक आकार में कमी होती है, क्योंकि इलेक्ट्रॉन समान संयोजी कोश में ही जुड़ते हैं किन्तु प्रत्येक उत्तरोत्तर तत्व के जुड़ने पर नाभिकीय आवेश में एक इकाई धनावेश (अर्थात् प्रोटॉन) की वृद्धि होती है। अतः, C > N.

$IE_2(C) = 2.35$ MJ mol^{-1} ;

IE_2 (N) = 2.85 MJ mol^{-1}

(B) $\Delta_{eg}H$: O = –142 kJmol^{-1} ;

F = –333 kJ mol^{-1}

Δ_{IE1}; O = 1410 kJ mol^{-1} ; F = 1681 kJ mol^{-1}

आवर्त की ओर, परमाण्वीय आकार में कमी होती है, इसलिए O > F.

O के लिए IE_2 का मान अधिक होगा, क्योंकि एक इलैक्ट्रॉन खोने के पश्चात् N के समान अर्द्धरूप से भरा हुआ विन्यास प्राप्त करता है।

आवर्त सारणी में F के लिए EN का मान अधिकतम होता है।

(C) $\Delta_{eg}H$; K = –48 kJ mol^{-1};

Mg67 kJ mol^{-1} (स्थायी विन्यास ns^2)

Δ_{IE1}; K = 419 kJ mol^{-1}; Mg = 737 kJ mol^{-1}

धात्विक त्रिज्या/pm K = 227; Mg = 160

IE_2(Mg) = 1.45 MJ mol^{-1} ;

IE_2 (K) = 3.05 MJ mol^{-1}

(D) $\Delta_{eg}H$; F = –328 kJ mol^{-1} (छोटा आकार का होने के कारण अधिक अन्तर इलेक्ट्रॉनिक प्रतिकर्षण)

Cl = –349 kJ mol^{-1}

Δ_{IE1}; F = 1680 kJ mol^{-1};

Cl = 1256 kJ mol^{-1}

सहसंयोजी त्रिज्या/pm; F = 64 ; Cl = 99

IE_2(F) = 3.37 MJ mol^{-1} ;

IE_2 (Cl) = 2.29 MJ mol^{-1}

42. Find equation required is given below,
आवश्यक समीकरणें नीचे दी गयी है –

$CO + H_2O \rightleftharpoons CO_2 + H_2$

$2CO + O_2 \rightleftharpoons 2CO_2$ .....(1)

$2H_2 + O_2 \rightleftharpoons 2H_2O$ .....(2)

(1) $\div 2$ $CO + \frac{1}{2}O_2 \rightleftharpoons$

$CO_2 \quad (k_1)^{1/2}$ .....(3)

Reverse (2) & $\div 2$

(2) को उल्टा करने पर तथा $\div 2$

$2H_2O \rightleftharpoons O_2 + 2H_2 \quad (k_2)^{1/2}$

$H_2O \rightleftharpoons \frac{1}{2}O_2 + H_2 \quad \left(\frac{1}{k_2}\right)^{\frac{1}{2}}$ ..... (4)

(3) + (4)

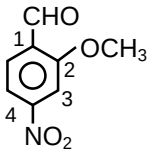
$CO + \frac{1}{2}O_2 \rightleftharpoons CO_2 \qquad (k_1)^{1/2}$

$H_2O \rightleftharpoons \frac{1}{2}O_2 + H_2 \qquad \left(\frac{1}{k_2}\right)^{\frac{1}{2}}$

$CO + H_2O \rightleftharpoons CO_2 + H_2$

$k = \sqrt{k_1} \times \sqrt{\frac{1}{k_2}} = \sqrt{\frac{k_1}{k_2}}$

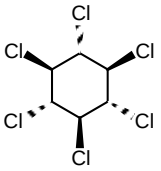
43.



44. Halides undergo S_N1 reaction in aqueous acetone forming a carbocation intermediate. The Substrate which forms most stable carbocation. Hence it is most reactive.

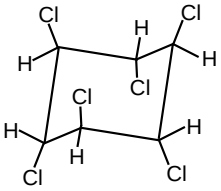
हैलाइड, जलीय ऐसीटोन में S_N1 अभिक्रिया देते है, जिसमें कार्बधनायन मध्यवर्ती बनता है। अभिकारक जो सबसे अधिक स्थायी कार्बधनायन बनाता है। इसलिए यह सबसे अधिक क्रियाशील होता है।

45.



All –Cl atoms are trans to each other and hence are axial

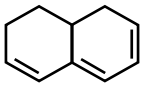
सभी –Cl परमाणु एक दूसरे के विपक्ष हैं तथा इसलिए अक्षीय हैं।



–Cl and –H are not suitably placed for an E2 reaction i.e. anti-elimination to take place.

–Cl तथा –H एक E2 अभिक्रिया के लिए उचित व्यवस्थित नहीं होते हैं अर्थात् प्रति–विलोपन होता है।

46. (1) $CH_3–O–\underset{\underset{Br}{|}}{CH}–CH_3 > CH_3–CH_2–\underset{\underset{Br}{|}}{CH}–CH_3$

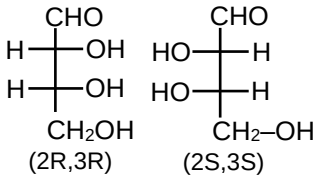
47.  is resonance stabilized. अनुनाद द्वारा स्थायी है

48. Carboxylic acids are stronger than H_2CO_3 and H_2CO_3 is more acidic than phenol and cresol.

कार्बोक्सिलिक अम्ल H_2CO_3 से प्रबल होते है एवं H_2CO_3 फिनॉल और क्रिसॉल से प्रबल होते है।

49. No group with restricted rotation about which GI is possible in option (4).
विकल्प (4) में प्रतिबंधित घूर्णन पर ज्यामितीय समावयवता दर्शाने वाले समूह उपस्थित नहीं है।

50. Enantiomers are non-superimposable mirror image of each other.
प्रतिबिम्ब रूप समावयवी एक–दूसरे पर अनाध्यारोपित दर्पण प्रतिबिम्ब होते है।



51. 70% W/W H_3PO_4
70g H_3PO_4 in 100g / cm^3
P = 1.5 g/ cm^3

$$M = \frac{70}{98} \times \frac{1000}{100} \times 1.54 = 11$$

$11 \times V = 1 \times 1000$
$V = 90.9 \approx 91$

हलः 70% W/W H_3PO_4
100g / cm^3 में 70g H_3PO_4
P = 1.5 g/ cm^3

$$M = \frac{70}{98} \times \frac{1000}{100} \times 1.54 = 11$$

$11 \times V = 1 \times 1000$
$V = 90.9 \approx 91$

52. The vander waals equation of state is :
(for 1 mole of gas)

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

When a is negligible, then

$$Z = \frac{pV_m}{RT} = 1 + \frac{b}{RT} P$$

that is Z increases with increaser in p.
when b is negligible, then

$$Z = \frac{pV_m}{RT} = 1 - \frac{a}{VRT}$$

increasing p implies decrease in V, which is turn, implies increase in the value of a/VRT and hence decrease in the value of Z.
The curve IV is applicable provided temperature of the gas is near but larger than it's critical temperature Hence, the choice (A), (B) and (C) are correct.

हल. वान्डर वॉल समीकरण, (1 मोल गैस के लिए)

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

जब 'a' नगण्य है, तब

$$Z = \frac{pV_m}{RT} = 1 + \frac{b}{RT} P$$

P बढ़ने के साथ Z भी बढ़ता है।
जब 'b' नगण्य है तब

$$Z = \frac{pV_m}{RT} = 1 - \frac{a}{VRT}$$

p बढाने पर V घटता है जो कि a/VRT को बढाता है जिससे Z के मान में कमी आती है।
वक्र IV लागू होगा यदि गैस का तापमान क्रांतिक ताप के समीप है परन्तु उससे अधिक है।
इसलिए (A), (B) व (C) सही है।

53. The correct definition also includes the terms neutral gaseous atom in ground state.
So, (ii), (iii), (iv).

हल. सही परिभाषा में भी आद्य अवस्था में उदासीन गैसीय परमाणु के पद निहित होते है। अतः (ii), (iii), (iv).

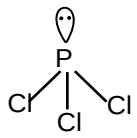
54.

	A	$\rightleftharpoons$	n B
t = 0	0.06		0
t = t	0.03		0.06

x = 0.03
nx = 0.06
n = 2

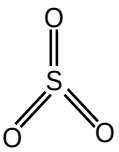
$$K_C = \frac{(0.06)^2}{0.03} = 0.12$$

55. (i) PCl_3



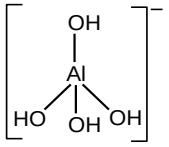
Pyramidal, non planar

(ii) SO_3



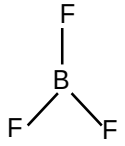
Trigonal, Planar

(iii) $[Al(OH)_4]^-$

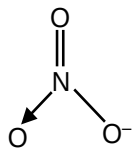


Tetrahedral, non planar

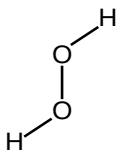
(iv) BF_3



Trigonal, planar

(v) NO_3^- 

Trigonal, planar

(vi) H_2O_2 

Open book, planar

56. $N_2O_3 \rightleftharpoons NO + NO_2$

In 1st vessel

at equilibrium 1 atm 1atm 1atm

hence $K_p = 1$ atm

In 2nd vessel

initially 3 atm 3atm 3atm

at equilibrium 3+x 3–x 3–x

$$K_p = \frac{(3-x)^2}{(3+x)} = 1$$

hence x = 1

$P_{NO_2} = 2\text{atm}$ Ans.

हल. $N_2O_3 \rightleftharpoons NO + NO_2$

साम्य पर

1st पात्र में 1 atm 1atm 1atm

अतः $K_p = 1$ atm

प्रारम्भ में 2nd पात्र में 3 atm 3atm 3atm

साम्य पर 3+x 3–x 3–x

$$K_p = \frac{(3-x)^2}{(3+x)} = 1$$

अतः x = 1

$P_{NO_2} = 2\text{atm}$ Ans.

57. According to Gay Lussac's law, at constant volume, pressure of a gas $\propto$ temperature

Or $\frac{P}{T}$ = constant

At two different temperature

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$

P_1 = 760 mm of Hg (At 273 K)

= 14.7 lb / sq. inch

T_1 = 273 K, T_2 = (160 + 273) K = 433 K

Now, $P_2 = P_1 \times \frac{T_2}{T_1} = \frac{147 \times 433}{273}$

= 23.3 lb / sq. inch

At 160°C, the pressure of air would be 23.3 lb / sq. inch.

Hence, valve should be set at 24 lb / sq. inch.

हल. नियत आयतन पर गेलूसेक नियम के अनुसार, गैस का दाब $\propto$ ताप

या $\frac{P}{T}$ = नियत

दो भिन्न ताप पर

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$

P_1 = 760 mm Hg (273 K पर)

= 14.7 lb / sq. inch

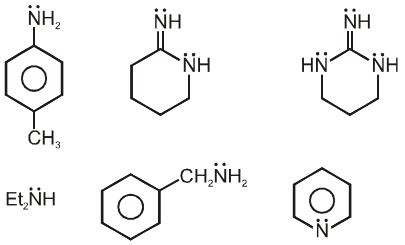
T_1 = 273 K, T_2 = (160 + 273) K = 433 K

अब, $P_2 = P_1 \times \frac{T_2}{T_1} = \frac{147 \times 433}{273}$

= 23.3 lb / sq. inch

160°C पर, वायु का दाब 23.3 lb / sq. inch. होगा। इसलिए, वॉल्व 24 lb / sq. inch. पर व्यवस्थित होना चाहिए।

58. (0004)

59. 

60. (i), (iii), (iv), (v), (viii)

PART-C: MATHEMATICS

61. $\alpha = \left(4-\sqrt{3}\right)+\left(2+\sqrt{3}\right)=6$

$\beta = \left(9-\sqrt{2}\right)-\left(2-\sqrt{2}\right)=7$

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

$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = 1$, $\alpha + \beta = \frac{-m(m-4)}{3m^2} = \frac{4-m}{3m}$

, $\alpha\beta = \frac{2}{3m^2}$

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

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

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

63. $x^2 + x + 1 = t \in \left[\frac{3}{4}, \infty\right)$

$f(t)=t^2 - (m-3)t+m=0 < \begin{matrix}\alpha \\ \beta\end{matrix}$

Case स्थिति-1 $f\left(\frac{3}{4}\right) < 0$

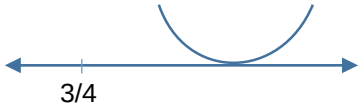
$$\frac{9}{16} - (m-3)\frac{3}{4} + m < 0$$

$$\frac{9}{16} + \frac{9}{4} + \frac{m}{4} < 0$$

$$\frac{m}{4} < \frac{-45}{16}$$

$$m < \frac{-45}{4}$$

Case स्थिति -II



(i) $D = 0 \Rightarrow (m-3)^2 = 4m$

$m^2 - 10m + 9 = 0$

$m = 1, 9$

(ii) $f(3/4) > 0 \Rightarrow m > -45/4$

(iii) $+\frac{m-3}{2} > \frac{3}{4}$

$4m - 12 > 6$

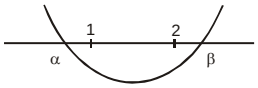
$m > \frac{9}{2}$

from (i) and (ii) and (iii) $\Rightarrow m = 9$

(i), (ii) और (iii) से $\Rightarrow m = 9$

64. $x^2 - 2px + (8p - 15) = 0$

$f(1) < 0$ and तथा $f(2) < 0$

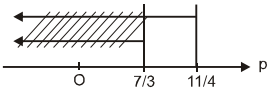


$\Rightarrow f(1) = 1 - 2p + 8p - 15 < 0$

$\Rightarrow p < 7/3$

and तथा $f(2) = 4 - 4p + 8p - 15 < 0$

$\Rightarrow 4p - 11 < 0 \Rightarrow p < \frac{11}{4}$



Hence अतः, $p \in (-\infty, 7/3)$ Ans.

65. Given equations are

$x^3 + ax + 1 = 0$

or $x^4 + ax^2 + x = 0$

and $x^4 + ax^2 + 1 = 0$

from (1) – (2), we get x = 1. Thus, x = 1 is common root

Hence, $1 + a + 1 = 0$

$a = -2$

हल. दी गई समीकरण

$x^3 + ax + 1 = 0$

या $x^4 + ax^2 + x = 0$

और $x^4 + ax^2 + 1 = 0$

(1) – (2) से x = 1 अतः x = 1 उभयनिष्ठ मूल

अतः, $1 + a + 1 = 0$

$a = -2$

66. $\sin(x - 3) > 0 = 2n\pi < x - 3 < (2n + 1)\pi$

$3 + 2n\pi < x < 3 + (2n + 1)\pi$

For n = –1 के लिए

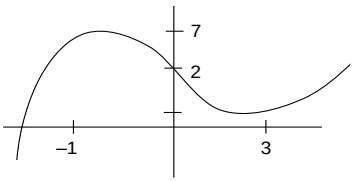
$3 - 2\pi < x < 3 - \pi$

Also तथा $16 - x \geq 0 \Rightarrow -4 \leq x \leq 4$

$\Rightarrow$ Domain प्रान्त : $x \in (3 - 2\pi, 3 - \pi) \cup (3, 4]$

67. Let $h(x) = x^3 - 3x^2 - 9x + 2, \quad x \in (-\infty, 3]$

$h'(x) = 3x^3 - 6x - 9 = 0 \Rightarrow x^2 - 2x - 3 = 0$



$-\infty < h(x) \leq 7$

$0 < e^{h(x)} \leq e^7$

so range = co-domain so onto

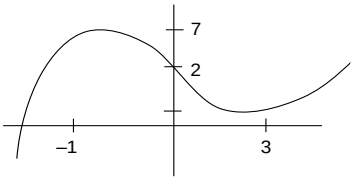
$f'(x) = e^{x^3 - 3x^2 - 9x + 2}(3x^2 - 6x - 9)$

$f'(x)$ can be positive and negative on $(-\infty, 3]$

so many-one

हल. माना $h(x) = x^3 - 3x^2 - 9x + 2, \quad x \in (-\infty, 3]$

$h'(x) = 3x^3 - 6x - 9 = 0 \Rightarrow x^2 - 2x - 3 = 0$



$-\infty < h(x) \leq 7$

$0 < e^{h(x)} \leq e^7$

इसलिए परिसर = सहप्रान्त इसलिए आच्छादक

$f'(x) = e^{x^3 - 3x^2 - 9x + 2}(3x^2 - 6x - 9)$

$f'(x)$ धनात्मक या ऋणात्मक हो सकता है $(-\infty, 3]$ पर

इसलिए बहुऐकी

68. $\because g'(y) = \frac{1}{f'(x)} \qquad \therefore f'(x) = 2e^{\frac{1-x}{2}} + x^2 + x + 1$

$$\therefore g'(y) = \frac{1}{2e^{\frac{1-x}{2}} + x^2 + x + 1} \quad .....(1)$$

$$\therefore y = f(x) = -4e^{\frac{1-x}{2}} + 1 + x + \frac{x^2}{2} + \frac{x^3}{3} = -\frac{7}{6}$$

$\Rightarrow x = 1$

$$\therefore g'\left(-\frac{7}{6}\right) = \frac{1}{2+1+1+1} = \frac{1}{5}$$

69. period of f(x) = $\frac{2\pi}{\sqrt{2[a]}\pi} = 1$

f(x) का आवर्त = $\frac{2\pi}{\sqrt{2[a]}\pi} = 1$

$\Rightarrow \sqrt{2[a]} = 2 \Rightarrow 2[a] = 4 \Rightarrow [a] = 2$

$\Rightarrow a \in [2, 3)$

70. $\lim\limits_{x\to0} \frac{\sin3x}{x^3} + \frac{a}{x^2} + b = \lim\limits_{x\to0} \frac{\sin3x + ax + bx^3}{x^3}$

$$= \lim_{x\to0} \frac{3\frac{\sin3x}{3x} + a + bx^2}{x^2}$$

For existence, if limit (3 + a) = 0

अस्तित्व के लिए यदि सीमा limit (3 + a) = 0

$\Rightarrow \quad a = -3$

$\therefore \quad 1 = \lim\limits_{x\to0} \frac{\sin3x - 3x + bx^3}{x^3}$

$$= 27\lim_{t\to0} \frac{\sin t - t}{t^3} + b = 0 (3x = t)$$

$$= -\frac{27}{6} + b = 0$$

$\Rightarrow \quad b = \frac{9}{2}$

71. For continuity, lim = value = 2(given)

$\lim\limits_{x\to2} f(x) = \frac{0}{0}$, Apply L'Hospital's rule

$\therefore$ lim = $\lim\limits_{x\to2} \{2x - (A + 2)\} = 2 - A$

$\therefore 2 - A = 2 \Rightarrow A = 0$

हल. सततता के लिए, lim = value = 2(दिया गया है)

$\lim\limits_{x\to2} f(x) = \frac{0}{0}$, L' हॉस्पीटल नियम से

$\therefore$ lim = $\lim\limits_{x\to2} \{2x - (A + 2)\} = 2 - A$

$\therefore 2 - A = 2 \Rightarrow A = 0$

72. f(x + y) = f(x).f(y)

$f'(0) = \frac{f(h) - f(0)}{h} = 11$

$f'(3) = \lim\limits_{x\to3^+} \frac{f(3+h) - f(3)}{h}$

$= \lim\limits_{h\to0} \frac{f(3).f(h) - f(3)f(0)}{h}$

$\lim\limits_{h\to0} = f(3)\left(\frac{f(h) - f(0)}{h}\right)$

$= f(3).f'(0)$

$= e^6 \times 2 = 2 \times e^6$

73. Put $x = \frac{1}{t}$ we get $t \to 0$

$$\lim_{t\to0}\left(t + \frac{1}{t}\right)e^t - \frac{1}{t}$$

$$= \lim_{t\to0}\frac{(t^2+1)e^t - 1}{t} = \lim_{t\to0}\frac{t^2e^t + e^t - 1}{t}$$

$$= \lim_{t\to0} te^t + \left(\frac{e^t - 1}{t}\right) = 0 + 1 = 1$$

74. A.M $\geq$ G.M.

$$\frac{\frac{a^4}{c^8} + \frac{b^2}{64} + \frac{c^2}{4a} + \frac{c^2}{4a} + \frac{c^2}{4a} + \frac{c^2}{4a} + \frac{1}{2b} + \frac{1}{2b}}{8}$$

$$\geq \left(\frac{a^4}{c^8} \times \frac{b^2}{64} \times \frac{c^8}{256a^4} \times \frac{1}{4b^2}\right)^{1/8} \geq \left(\frac{1}{4^8}\right)^{1/8}$$

$$\geq \frac{1}{4}$$

$$\therefore \frac{a^4}{c^8} + \frac{b^2}{64} + \frac{c^8}{a} + \frac{1}{b} \geq 8 \times \frac{1}{4} \geq 2$$

75. It is an A.P. , a = 20, d = $\frac{8}{3}$

यह एक समान्तर श्रेणी में है, a = 20, d = $\frac{8}{3}$

$S_n > 1568$

$\frac{n}{2}[40 + (n - 1)\frac{8}{3}] > 1568$

$\frac{n}{2} \times \frac{112 + 8n}{3} > 1568$

$n^2 + 14n > \frac{6}{8} \times 1568 = 1176$

$n^2 + 14n - 1176 > 0$

$(n + 42)(n - 28) > 0$

n is positive

n धनात्मक है।

$n > 28$

$n = 29$

76. $= \lim_{x\to 0} \frac{(2^x-1)(5^x-1)}{-\ln(1+\cos x-1)}$

$$= \frac{-\lim_{x\to 0} \frac{(2^x-1)(5^x-1)}{x \quad x}}{\frac{\ln(1+(\cos x-1))}{(\cos x-1)} \frac{(\cos x-1)}{x^2}}$$

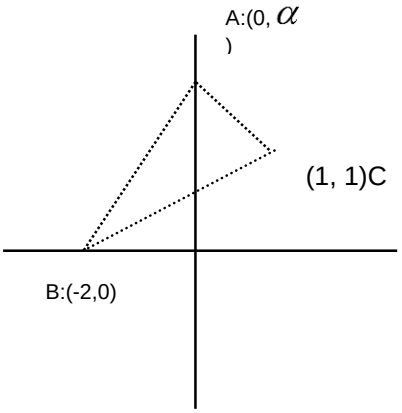
$= (\ln 4)\,(\ln 5)$

77. $\frac{\alpha}{2}\cdot\frac{\alpha-1}{-1} = -1$

$\alpha^2 - \alpha = 2$

$\alpha^2 - \alpha - 2 = 0$

$\alpha \in \{-1, 2\}$



Equation of BC

BC का समीकरण

$y - 1 = \frac{1}{3}(x-1) \Rightarrow \alpha - 1 = \frac{-1}{3}$

$\alpha = \frac{2}{3}$

78. Acute angle between the lines $x^2 + 4xy + y^2 = 0$ is

$\tan^{-1}\frac{2\sqrt{4-1}}{1+1} = \tan^{-1}\sqrt{3} = \pi/3$

Angle bisectors of $x^2 + 4xy + y^2 = 0$ are given by

$$\frac{x^2-y^2}{1-1} = \frac{xy}{2} \Rightarrow x^2 - y^2 = 0$$

$\Rightarrow \quad x = \pm y$

As x + y = 0 is perpendicular to x – y = 4, the given

Triangle is isosceles with vertical angle equal to $\pi/3$

And hence it is equilateral.

हल. रेखाओं के मध्य न्यूनकोण $x^2 + 4xy + y^2 = 0$ है

$\tan^{-1}\frac{2\sqrt{4-1}}{1+1} = \tan^{-1}\sqrt{3} = \pi/3$

$x^2 + 4xy + y^2 = 0$ के कोण अर्द्धक

$\frac{x^2-y^2}{1-1} = \frac{xy}{2} \Rightarrow x^2 - y^2 = 0$

$\Rightarrow\ x = \pm y$

चूकि x + y = 0, x – y = 4 के लम्बवत् है

त्रिभुज समद्विबाहु है जिसका शीर्ष कोण $\pi/3$ है।

अतः यह एक समबाहु है।

79. Vertex A is mirror image of ex – centre about x + y – 2 = 0

शीर्ष A, बहिष्केन्द्र का x + y – 2 = 0 के सापेक्ष दर्पण प्रतिबिम्ब है

So put इसलिए x = 2 $\Rightarrow$ y = 0

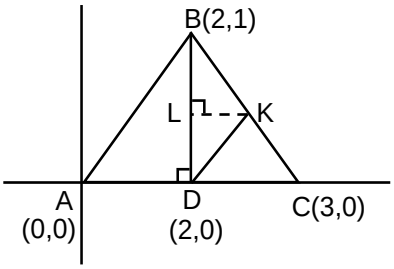
y = –4 $\Rightarrow$ x = 6

So इसलिए α = 6, β = 0

80. Δ_1 = ar(ΔABC)

$= \frac{1}{2} \times BD \times AC$

$= \frac{1}{2} \times 1 \times 3 = \frac{3}{2}$ sq. unit



Equation of DK : $y - 0 = \frac{1}{2}(x-2)$

x – 2y – 2 = 0

equation of BC : x + y = 3

solving then ; k = $\left(\frac{8}{3}, \frac{1}{3}\right)$

Δ_2 = ar(ΔBDK) = $\frac{1}{2} \times BD \times KL$

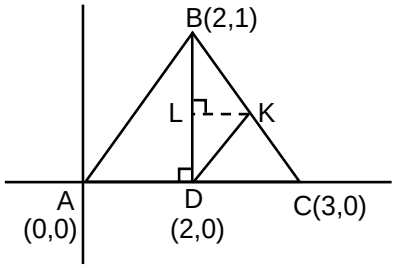
$= \frac{1}{2} \times 1 \times \left(\frac{8}{3} - 2\right) = \frac{1}{3}$ sq. units

ar(ΔABC). ar(ΔBDK) = $\frac{3}{2} \times \frac{1}{3} = \frac{1}{2}$

हल. Δ_1 = ar(ΔABC)

$= \frac{1}{2} \times BD \times AC$

$= \frac{1}{2} \times 1 \times 3 = \frac{3}{2}$ वर्ग इकाई



DK का समीकरण है : $y - 0 = \frac{1}{2}(x - 2)$

$x - 2y - 2 = 0$

BC का समीकरण : $x + y = 3$

हल करने पर; $k = \left(\frac{8}{3}, \frac{1}{3}\right)$

$\Delta_2 = ar(\Delta BDK) = \frac{1}{2} \times BD \times KL$

$= \frac{1}{2} \times 1 \times \left(\frac{8}{3} - 2\right) = \frac{1}{3}$ वर्ग इकाई

$ar(\Delta ABC).\ ar(\Delta BDK) = \frac{3}{2} \times \frac{1}{3} = \frac{1}{2}$

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

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

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

दी गई समीकरण $\left(2^{3/x}\right)^2 - 8 \cdot 2^{3/x} + 12 = 0$; put $2^{3/x} = y$ रखने पर तथा

82. Since f(x) is onto hence range of f(x) equals co-domain

Now range of $4x^2 + 3x$ in $\left[\frac{-1}{2}, 0\right]$ is

$\left[\frac{-9}{16}, 0\right]$

Hence range of $f(x) = \cos^{-1}(4x^2 + 3x)$ is

$\left[\frac{\pi}{2}, \pi - \cos^{-1}\frac{9}{16}\right]$

83. $f(x) = \frac{x}{x+1}$, f(x) is not differentiable at x = 0, $x = -1$

$g(x) = \frac{1}{1 + \frac{2}{f(x)}} = \frac{x}{3x+2}$

g(x) is not differentiable at x = 0,

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

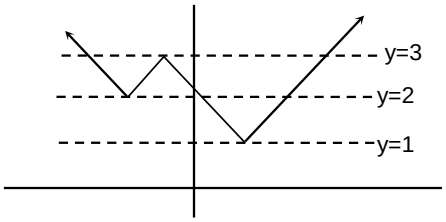
हल. $f(x) = \frac{x}{x+1}$, f(x) x = 0 और x = – 1 पर अवकलनीय नही है।

$g(x) = \frac{1}{1 + \frac{2}{f(x)}} = \frac{x}{3x+2}$

g(x), x = 0 पर अवकलनीय नही है।

$x = -1$ और $x = -\frac{2}{3}$

84.



85. Domain of $f(x) = \ell n \cos^{-1} x$

is $x \in [-1, 1)$

$\therefore \quad [\alpha] = -1$ or 0

हल. $f(x) = \ell n \cos^{-1} x$ का प्रान्त

$x \in [-1, 1)$ है।

$\therefore \quad [\alpha] = -1$ या 0

86. $\frac{2ab}{(a+b)\sqrt{ab}} = \frac{4}{5} \Rightarrow 5\sqrt{a}\ \sqrt{b} = 2(a + b)$

$\Rightarrow 2\left(\frac{\sqrt{a}}{\sqrt{b}}\right)^2 - 5\left(\frac{\sqrt{a}}{\sqrt{b}}\right) + 2 = 0$

$\Rightarrow \frac{\sqrt{a}}{\sqrt{b}} = 2$ or $\frac{1}{2}$

$\Rightarrow \frac{a}{b} = 4$ or $\frac{1}{4}$

87. $\log_{\sin x} x < 0$

$\Rightarrow x \in \left(1, \frac{\pi}{2}\right) \cup \left(\frac{\pi}{2}, \pi\right) \cup (2\pi, 3\pi) - \left\{\frac{5\pi}{2}\right\}$

88. by considering all four quadrants one by one, we get then Range of f(x) as {–2, 0, 4}

हल. सभी चार चतुर्थांशों में एक एक करके लेने पर f(x) का परिसर {–2, 0, 4} है।

89. Given a + b + c = 1

$ab+bc+ca=0$

abc = 2

Now $(a+b+c)^2=1$

$a^2+b^2+c^2+2\sum ab=1$

$\therefore \quad a^2+b^2+c^2=1$

Now, $a^3+b^3+c^3-3$ abc = 1 + 3 × 2 = 7

90. $L_1+\lambda L_2=0$

$(1+\lambda)x+(1-\lambda)y-1-2\lambda=0$

$$\begin{vmatrix} 1+\lambda & 1-\lambda & -1-2\lambda \\ 3 & -4 & 5 \\ 2 & -1 & 1 \end{vmatrix}=0$$

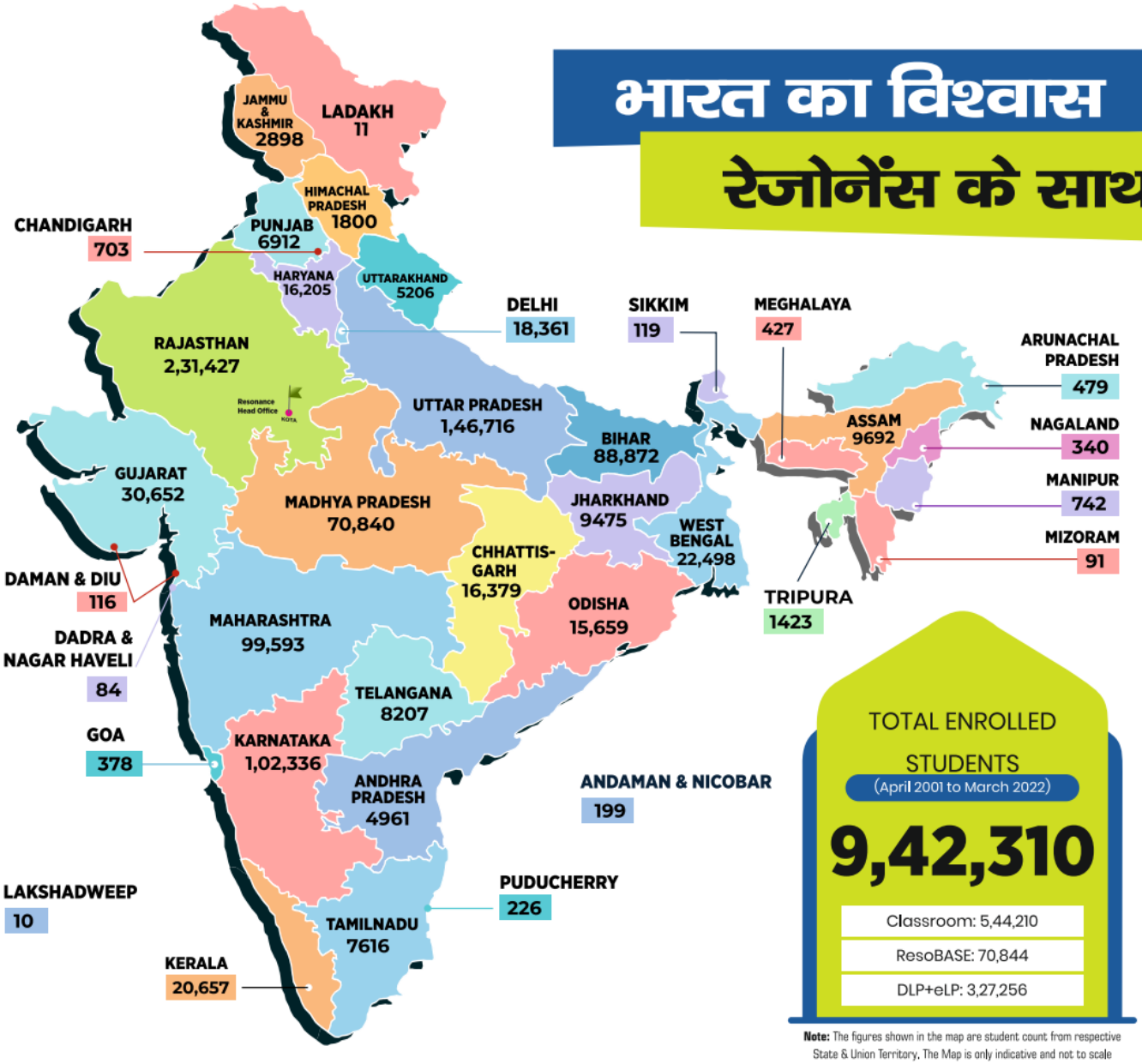
$\Rightarrow \quad \lambda=\frac{3}{16}$

$\therefore 19x+13y-22=0$

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

Resonance®
Educating for better tomorrow

भारत का विश्वास
रेजोनेंस के साथ



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