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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	XII	COURSE NAME	VIJETA, ANOOP	COURSE CODE	JP, EP
PHASE CODE(S)	JP, EP	TOTAL PAGES	20	BATCH CODE(S)	JP, EP

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 | 02:30 PM to 05:30 PM

Contents:

Scan QR Code for Video Solutions → Coming Soon

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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-12	**11**		**4**		**15**	**60**	**50.00%**
1	Current Electricity	2	1,18	_	_	2	8	6.67%
2	Electrostatics	1	2	1	26	2	8	6.67%
3	Gravitation	1	3	1	30	2	8	6.67%
4	Electro Magnetic Induction	2	5,7	_	_	2	8	6.67%
5	Capacitor	1	6	_	_	1	4	3.33%
6	Electro Magnetic Field	3	8,11,19	1	24	4	16	13.33%
7	Geometrical Optics	1	16	1	27	2	8	6.67%
	Class-11	**9**		**6**		**15**	**60**	**50.00%**
8	Heat Transfer	1	4	_	_	1	4	3.33%
9	Unit and Dimension	1	9	_	_	1	4	3.33%
10	KTG And 1St Law Of Thermodynamics	2	10,20	_	_	2	8	6.67%
11	Work, Power & Energy	1	12	1	21	2	8	6.67%
12	Simple Harmonic Motion	2	13,17	_	_	2	8	6.67%
13	Rotation (Rigid Body Dynamics)	1	14	_	_	1	4	3.33%
14	Circular Motion	1	15	_	_	1	4	3.33%
15	System of Particles, Centre of Mass, Momentum and Collision	_	_	1	22	1	4	3.33%
16	Fluid	_	_	1	23	1	4	3.33%
17	Sound Waves	_	_	2	25,28	2	8	6.67%
18	Elasticity	_	_	1	29	1	4	3.33%
	Total	**20**		**10**		**30**	**120**	**100%**

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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	**4**		**3**		**7**	**28**	**23.33%**
1	Atomic Structure	1	31	_	_	1	4	3.33%
2	Mole concept	1	33	1	51	2	8	6.67%
3	Chemical Equilibrium	1	35	_	_	1	4	3.33%
4	Ionic Equilibrium	1	36	_	_	1	4	3.33%
5	Gaseous State	_	_	1	52	1	4	3.33%
6	Thermochemistry	_	_	1	53	1	4	3.33%
	Class-12			**4**		**4**	**16**	**13.33%**
7	Chemical Kinetics	_	_	1	54	1	4	3.33%
8	Electrochemistry	_	_	1	55	1	4	3.33%
9	Solid State	_	_	1	56	1	4	3.33%
10	Solution Colligative Properites	_	_	1	57	1	4	3.33%
Inorganic Chemistry								
	Class-11	**3**				**3**	**12**	**10.00%**
11	Chemical Bonding	1	32	_	_	1	4	3.33%
12	s-Block elements	1	37	_	_	1	4	3.33%
13	Periodic Table Periodicity	1	38	_	_	1	4	3.33%
	Class-12	**5**				**5**	**20**	**16.67%**
14	p-block Elements (15 & 16 group) (N & O Gases)	2	34,41	_	_	2	8	6.67%
15	Coordination Compound	1	39	_	_	1	4	3.33%
16	Metallurgy	1	40	_	_	1	4	3.33%
17	Qualitative Analysis	1	42	_	_	1	4	3.33%

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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			
Organic Chemistry								
	Class-11	**4**		**1**		**5**	**20**	**16.67%**
18	IUPAC & Structural Isomerism	2	43,50	_	_	2	8	6.67%
19	Structural Identification	2	45,48	1	60	3	12	10.00%
	Class-12	**4**		**2**		**6**	**24**	**20.00%**
20	Streoisomerism	2	44,47	1	59	3	12	10.00%
21	Haloalkane & Haloarenes	1	46	1	58	2	8	6.67%
22	Reduction, Oxidation & Hydrolysis of Organic Compounds	1	49	_	_	1	4	3.33%
	Total	**20**		**10**		**30**	**120**	**100%**

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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-12	**11**		**7**		**18**	**72**	**60.00%**
1	DETERMINANT	1	61	_	_	1	4	3.33%
2	Definite Integration	3	63,65,70	1	88	4	16	13.33%
3	Application of Derivatives	2	66,69	_	_	2	8	6.67%
4	Probability	1	67	1	85	2	8	6.67%
5	Indefinite Integration	1	75	_	_	1	4	3.33%
6	Limit Continuity and Derivability	1	76	1	89	2	8	6.67%
7	Method of Differentiation	1	77	_	_	1	4	3.33%
8	Relation Function ITF	1	79	1	81	2	8	6.67%
9	Differential Equation	_	_	2	86,87	2	8	6.67%
10	MATRICES	_	_	1	90	1	4	3.33%
	Class-11	**9**		**3**		**12**	**48**	**40.00%**
11	Straight Line	2	62,73	_	_	2	8	6.67%
12	Circle	1	64	_	_	1	4	3.33%
13	Permutation and Combination	2	68,72	_	_	2	8	6.67%
14	Conic Section	1	71	_	_	1	4	3.33%
15	Statistics	1	74	_	_	1	4	3.33%
16	Sequence and Series	1	78	1	82	2	8	6.67%
17	Mathematical Reasoning	1	80	_	_	1	4	3.33%
18	Quadratic Equation	_	_	1	83	1	4	3.33%
19	Binomial Theorem	_	_	1	84	1	4	3.33%
	Total	**20**		**10**		**30**	**120**	**100%**

ANSWER KEY (AK)

PAPER											
PART-A: PHYSICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	4	4	3	2	4	2	1	2	1	4
	Q.No.	11	12	13	14	15	16	17	18	19	20
	Ans.	2	1	2	2	1	2	1	4	1	1
	Q.No.	21	22	23	24	25	26	27	28	29	30
	Ans.	0001	0002	0005	0002	0002	0160	0003	0080	0500	0004
PART-B: CHEMISTRY	Q.No.	31	32	33	34	35	36	37	38	39	40
	Ans.	4	4	4	4	2	1	3	4	3	2
	Q.No.	41	42	43	44	45	46	47	48	49	50
	Ans.	3	2	1	4	4	2	4	4	4	2
	Q.No.	51	52	53	54	55	56	57	58	59	60
	Ans.	0091	0003	0150	0001	0001	0008	0003	0005	0002	0004
PART-C: MATHS	Q.No.	61	62	63	64	65	66	67	68	69	70
	Ans.	1	3	4	1	1	2	2	3	3	4
	Q.No.	71	72	73	74	75	76	77	78	79	80
	Ans.	1	1	1	2	4	2	3	3	1	4
	Q.No.	81	82	83	84	85	86	87	88	89	90
	Ans.	0007	0002	0025	0100	0018	0049	0008	0007	0006	0000

STUDENT'S SPACE

TEXT SOLUTIONS (TS)

PAPER

PART-A: PHYSICS

1. For damped osc.

$F_{net} = -kx - bV$

$\Rightarrow m = \frac{d^2x}{dt^2} + b\frac{dx}{dt} + kx = 0$

From kirchoff's loop equation for L–R–C circuit

$L\frac{di}{dt} + iR + \frac{q}{C} = 0 \Rightarrow L = \frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{1}{C}q = 0$

$m \to L,\ b \to R,\ k \to \frac{1}{C}$

2. $E \propto \frac{1}{r^4}, V \propto \frac{1}{r^3}$

3. $g = \frac{Gm}{R^2} = \frac{G(4/3\pi R^3\rho)}{R^2}$

$\Rightarrow \quad g \propto \rho R$

$\Rightarrow \quad g \to 18\times 2 = 36$ times

$T = 2\pi\sqrt{\frac{\ell}{g}}$

$\Rightarrow \quad T \propto \frac{1}{\sqrt{g}} = \frac{1}{\sqrt{36}} = \frac{1}{6}$ times

so $\quad T' = 2\times\frac{1}{6} = \frac{1}{3}$ second

4. ultra – voilet light

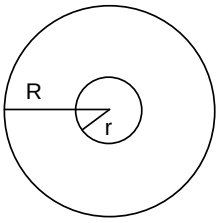
पराबैगनी प्रकाश

5. $R_1 = R_2, L_2 > L_1$

6. If L >> d, then the capacitors will act like dipoles. The interaction force between two dipole $F = \frac{6kp_1p_2}{r^4}$ where p_1 and p_2 = qd so

$F \propto \frac{d^2}{r^4}$

7. $\phi_{21} = \left(\frac{\mu_0 i}{2R}\right)\times\pi r^2$



$\phi_{21} = \left(\frac{\mu_0\pi r^2}{2r}\right)i$

8. $M = NIA = IA$

$\because \quad B = \frac{\mu_0}{2}\cdot\frac{NI}{R}$

$I = \left(\frac{2BR}{\mu_0}\right)$

$M = \left(\frac{2BR}{\mu_0}\right)\times\pi R^2$

$M = \frac{2\pi R^3 B}{\mu_0}$

9. Let radius of gyration $[k] \propto [h]^x [c]^y [G]^z$

By substituting the dimension of [k] = [L]

$[h] = [ML^2T^{-1}]$ $[c] = [LT^{-1}]$, $[G] = [M^{-1}L^3T^{-2}]$

and by comparing the power of both sides we can get $x = 1/2 = -3/2, z = 1/2$

So dimension of radius of gyration are $[h]^{1/2}[c]^{-3/2}[G]^{1/2}$

माना घूर्णन त्रिज्या, $[k] \propto [h]^x [c]^y [G]^z$

राशियों $[k] = [L]$ $[h] = [ML^2T^{-1}]$, $[c] = [LT^{-1}]$, $[G] = [M^{-1}L^3T^{-2}]$

की विमायें प्रतिस्थापित करने पर तथा दोनों ओर की घातों की तुलना करने पर हमें प्राप्त होगा,

$x = 1/2, y = -3/2, z = 1/2$

अतः घूर्णन त्रिज्या की विमा $[h]^{1/2}[c]^{-3/2}[G]^{1/2}$

10. $\frac{5}{4\ell n2}$

11. Both A and R are true but R is not correct explanation of A

A व R दोनों सत्य हैं किंतु R, A का सही स्पष्टीकरण नहीं हैं।

12. M = 1 kg

$a = \frac{F}{M} = \frac{2t}{(1)}\hat{i} + \frac{3t^2}{1}\hat{j}$

$V = \int a dt = \int 2t dt\ 1 + \int 3t^2 dt$

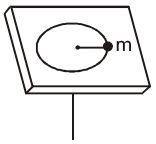
$V = t^2\ \hat{i} + t^3\ \hat{j}$

Power = F.V. = $(2ti + 3t^2\ \hat{j}).\ (t^2\ i + t^3\ \hat{j})$

power = $2t^3 + 3\ t^5$

13. Length of pendulum P and pendulum B is same.
Then frequency of the source is equal to the natural frequency of the system, so resonance will occur, therefore the amplitude of pendulum B will keep on increasing. So amplitude of pendulum B will be maximum.

14.



applying angular momentum conservation

$MV_0R_0 = (m)\ (v_1)\ \left(\frac{R_0}{2}\right)$

$V_1 = 2V_0$

New KE = $\frac{1}{2} m\ (2V_0)^2 = \ 2mv_0^2$

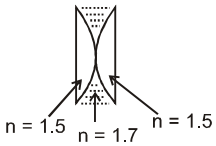
Ans. is (2)

15. $F = \frac{k}{R^n} = m\omega^2 R$

$\omega^2 \alpha \frac{1}{R^{n+1}} \Rightarrow \ \therefore \ \ T = \frac{2\pi}{\omega}$

So इसलिये $T \alpha R^{\frac{n+1}{2}}$

16.



$\frac{1}{f_1} = \left(\frac{1.5}{1} - 1\right)\left(\frac{1}{\infty} - \frac{1}{-20}\right) \Rightarrow f_1 = 40$ cm

$\frac{1}{f_2} = \left(\frac{1.7}{1} - 1\right)\left(\frac{1}{-20} - \frac{1}{+20}\right) \Rightarrow f_1 = -\frac{100}{7}$ cm

f_3 is also 40 cm

$\frac{1}{f_{eq}} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3} \Rightarrow$

$\frac{1}{f_{eq}} = \frac{1}{40} + \frac{1}{-100/7} + \frac{1}{40}$

$f_{eq} = -50$ cm

Ans is (2)

17. $V_1^2 = w^2(A^2 - x_1^2)$

$V_1^2 = w^2(A^2 - x_2^2)$

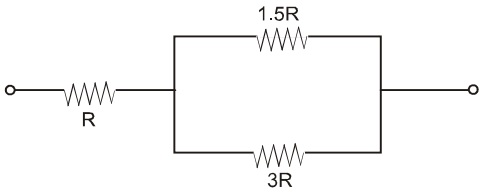
substructing $\frac{v_1^2}{w^2} + x_1^2 = \frac{v_2^2}{w^2} + x_2^2$

$\Rightarrow \frac{v_1^2 - v_2^2}{w^2} = \ x_2^2 - x_1^2$

$\Rightarrow \ w = \sqrt{\frac{v_1^2 - v_2^2}{x_2^2 - x_1^2}}$

$\Rightarrow \ T = 2\pi\sqrt{\frac{x_2^2 - x_1^2}{v_1^2 - v_2^2}}$

18.



$V_B = V_C = V_A$

19. $\cot^2\theta = \cot^2\theta_1 + \cot^2\theta_2$ (standard result)

20. $C = C_V + \frac{R}{1-n}$

$C - C_V = \frac{C_P - C_V}{1-n}$

$1 - n = \frac{C_P - C_v}{C - C_v}$

$n = 1 - \frac{C_P - C_v}{C - C_v} = \frac{C - C_P}{C - C_v}$

21. If the surface is rough we will apply modified work energy theorem.

$$W_{us} + W_{nc} = KE\uparrow + U\uparrow$$

$$0 + -(\mu_k mg)x = \left(\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2\right) + \left(\frac{1}{2}kx^2 = 0\right)$$

$$-(0.1)(50)(10)x = \left(0 - \frac{1}{2}(50)(2)^2\right) + \frac{1}{2}(100)x^2$$

$x^2 + x - 2 = 0 \quad \Rightarrow \quad x^2 + 2x - x - 2 = 0$

$(x - 1)(x + 2) = 0 \Rightarrow \quad x = 1$ m

22.

Initially Finally

Momentum Conservation

संवेग संरक्षण से

$$mv = mv_A + \frac{m}{2}v_B \qquad ...(i)$$

$$e = \frac{v_B - v_A}{v} = 1 \qquad ...(ii)$$

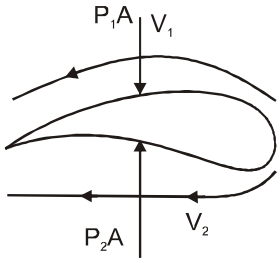
$2(v_B - v_A) = 2v_A + v_B$

$2v_B - v_B = 4v_A$

$v_B = 4v_A$

$$\frac{\lambda_A}{\lambda_B} = \frac{m_B v_B}{m_A v_A} = \frac{m/2}{m} \times 4 = 2$$

23.



Applying bernaullis' equation for air above and below the wing

पंखुड़ी के ऊपर तथा नीचे की वायु के लिए बरनॉली समीकरण लगाने पर

$$P_1 + \frac{1}{2}\rho V_1^2 = P_2 + \frac{1}{2}\rho V_2^2$$

$$(P_2 - P_1) = \frac{1}{2}\rho(V_1 + V_2)(V_1 - V_2)$$

Here यहाँ $V_1 = V + \Delta V$

$V_2 = V - \Delta V$

So अत, $(P_2 - P_1) = \frac{1}{2}\rho(2V)(2\Delta V) = 2\rho V \Delta V$

For level flight

समान स्तर पर उड़ने के लिए

$(P_2 - P_1) = mg$

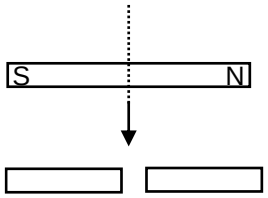
$(2\rho V \Delta V)A = mg$

Putting the values we will get

मान रखने पर प्राप्त होता है।

$\Delta V = 5$ m/sec.

24. If the magnet is cut into two pieces then



$$\ell \to \frac{1}{2} \quad \Rightarrow M \to \frac{1}{2}$$

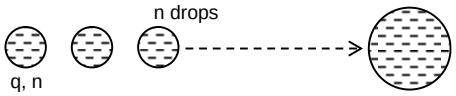
And $I = \frac{m\ell^2}{12}$, Since $m \to \frac{1}{2}$ and $\ell \to \frac{1}{2}$ so

I will be $\left(\frac{1}{2}\right) \times \left(\frac{1}{2}\right)^2 = \frac{1}{8}$ times, so

$T = 2\pi\sqrt{\frac{I}{MB}}$ will be $\sqrt{\frac{1/8}{1/2}} = \frac{1}{2}$ times

25. 0002

26.



Charge on the bigger drop = nq

Radius of the bigger drop = $n^{1/3}R$

$$V \propto \frac{q}{R} = \frac{n}{n^{1/3}} = n^{2/3} \text{ time} = (64)^{2/3} = 16$$

times

= 16 × 10 m volt = 160 m volt

27. $$v = v_{Fish} + \frac{(v_{Bird})\mu_{water}}{\mu_{air}}$$

$$12 = 8 + (v_{Bird})\frac{4}{3}$$

$$4 = (v_{Bird})\frac{4}{3}$$

$v_{Bird} = 3$ m/s

28. $f = \sqrt{\frac{T}{Ap}}\ \frac{1}{2\ell} = \sqrt{\frac{stress}{P}}\ \frac{1}{2\ell}$

$f = \frac{\sqrt{4\times strain}}{P}\ \frac{1}{2\ell} = \sqrt{\frac{y\times\Delta\ell}{\ell P}}\ \frac{1}{2\ell}$

$\sqrt{\frac{8\times10^{10}\times3.2\times10^{-4}}{0.5\times8\times10^{3}}}\ \frac{1}{2\times0.5} = 80$

29. $\frac{-dv}{v} = \frac{0.5}{100} = 0.005 = 0.005$

$B = \frac{\frac{-dP}{dv}}{v} = \frac{pgh}{\frac{-dv}{v}}$

$9.8\times10^{8} = \frac{10^{3}\times9.8\times d}{5\times10^{-3}} \Rightarrow d = 500\ m$

30. Let at a distance 'X' from planet 'A', the net gravitational field becomes zero

$\frac{GM}{X^2} = \frac{G\times9M}{(8R-X)^2}$

$(3X)^2 = (8R - X)^2$

$X = 2R$

Now, Particle should be projected such that it covers a minimum distance of '2R'.

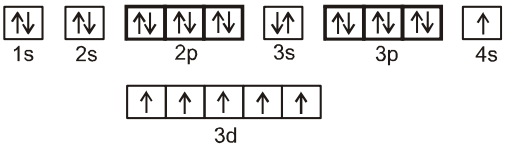
Thus

$\frac{1}{2}mv^2 - \frac{GMm}{R} - \frac{G(9M)m}{7R} = -\frac{GMm}{2R} - \frac{G(9M)m}{6R}$

$\frac{1}{2}v^2 = \frac{2}{7}\frac{GM}{R} \Rightarrow \quad v = \sqrt{\frac{4}{7}\frac{GM}{R}}$

PART-B: CHEMISTRY

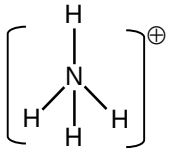
31.



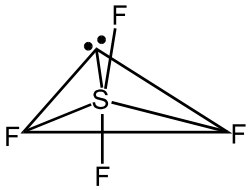
Out of 6 electrons in 2p and 3p must have on electron with m = +1 and s = $\frac{1}{2}$ but in 3d-subshell an orbital having m = +1 may have spin quantum no. $-\frac{1}{2}$ or $+\frac{1}{2}$.

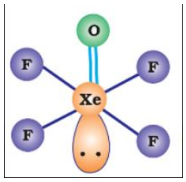
Therefore, minimum and maximum possible values are 2 and 3 respectively.

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

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

SF_4  sp^3d

$XeOF_4 \Rightarrow$  sp^3d^2,

square pyramidal

33. **(4)** Valency factor of $KMnO_4 = 5$
Valency factor of oxalate = 2
$5\ M_1\ V_1 = 2M_2\ V_2$

हल. **(4)** $KMnO_4$ का संयोजकता गुणांक = 5
ऑक्सेलेट का संयोजकता गुणांक = 2
$5\ M_1\ V_1 = 2M_2\ V_2$

34. $(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2\uparrow + 4H_2O\uparrow + Cr_2O_3\downarrow$

(1) $NH_4Cl \xrightarrow{\Delta} NH_3\uparrow + HCl\uparrow$

(2) $CuSO_4.5H_2O \longrightarrow CuSO_4 + 5H_2O\uparrow$

(3) $Ba(N_3)_2 \xrightarrow{\Delta} Ba + 3N_2\uparrow$

(4) $NaNO_3 + Zn + OH^- \longrightarrow Zn^{2+} + NH_3\uparrow$

35. (2) (i) – b (ii) – c (iii) – a

36. $Ni(OH)_2 \longrightarrow \underset{S_1}{Ni^{2+}} + \underset{2S_1}{2OH^-}$

$(S_1)(2S_1)^2 = 2 \times 10^{-15}$

$\therefore S_1 = 8 \times 10^{-6}$ M

$AgCN \longrightarrow \underset{S_2}{Ag^+} + \underset{S_2}{CN^-}$

$(S_2)(S_2) = 6 \times 10^{-17}$

$\therefore S_2 = 7.8 \times 10^{-9}$ M

37. LiCl is covalent compound. Due to the large size of the anion (Cl^-) its effective nuclear charge lessens and its valence shell is held less tightly towards its nucleus. Here, assertion is correct but reason is incorrect.

हल. LiCl सहसंयोजी यौगिक है। ऋणायन (Cl^-) के बड़े आकार के कारण इसका प्रभावी नाभिकीय आवेश कम होता है तथा इसका संयोजकता कोश नाभिक के प्रति कम आकर्षी होता है अतः कथन सही है लेकिन कारण गलत है।

38. Option (A) Element ΔH_{eg} (KJ/mole)

F –328

Cl –349

So option (A) is incorrect.

Option (D) Al_2O_3 is Amphoteric but NO is neutral oxide so option 'D' is incorrect.

हल. विकल्प (A) तत्व ΔH_{eg} (KJ/mole)

F –328

Cl –349

विकल्प (A) गलत है।

विकल्प (D) Al_2O_3 उभयधर्मी होता है। लेकिन NO उदासीन ऑक्साइड होता है। इसलिए विकल्प 'D' गलत है।

39. (A) $[NiBr_2Cl_2]^{2-}$ is tetrahedral and paramagnetic with 2 unpaired electrons.

(B) $V(CO)_6$ is octahedral and paramagnetic with 1 unpaired electron.

(C) $[Cr(CN)_6]^{3-}$ is octahedral and paramagnetic with 3 unpaired electrons.

(D) $Ni(CO)_4$ is tetrahedral and diamagnetic.

हल. (A) $[NiBr_2Cl_2]^{2-}$ चतुष्फलकीय तथा 2 अयुग्मित इलेक्ट्रॉनो के साथ अनुचुम्बकीय होता है।

(B) $V(CO)_6$ अष्टफलकीय तथा 1 अयुग्मित इलेक्ट्रॉन के साथ अनुचुम्बकीय होता है।

(C) $[Cr(CN)_6]^{3-}$ अष्टफलकीय तथा 3 अयुग्मित इलेक्ट्रॉनो के साथ अनुचुम्बकीय होता है।

(D) $Ni(CO)_4$ चतुष्फलकीय तथा प्रतिचुम्बकीय होता है।

40. **(2)** Cyanide process is for gold & silver (I– D) ; floatation process – pine oil (II–B) ; Electrolytic reduction – Al (III –C) ; Zone refining – Ge (IV – A).

(2) गोल्ड व सिल्वर के लिए सायनाइड प्रकम (I– D) ; प्लवन प्रकम–चीड का तेल (II–B) ; वैद्युतअपघटनीय अपचयन – Al (III –C) ; क्षेत्र परिशोधन– Ge (IV – A)

41. (1) Orthophosphorous acid

ऑर्थोफॉस्फोरस अम्ल: H_3PO_3 (O.S. = +3)

(2) Hypophosphorous acid

हाइपोफॉस्फोरस अम्ल : H_3PO_2 (O.S. = +1)

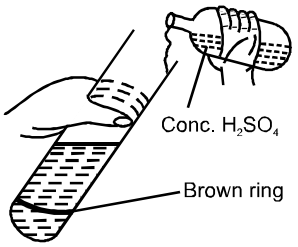
(3) Hypophosphoric acid

हाइपोफॉस्फोरिक अम्ल : $H_4P_2O_6$ (O.S. = +4)

(4) Orthophosphoric acid

ऑर्थोफॉस्फोरिक अम्ल : H3PO4 (O.S. = +5)

42. **Brown ring test :** When a freshly prepared saturated solution of iron (II) sulphate is added to nitrate solution and then concentrated H_2SO_4 is added slowly from the side of the test tube, a **brown ring** is obtained at the junction of two layers.

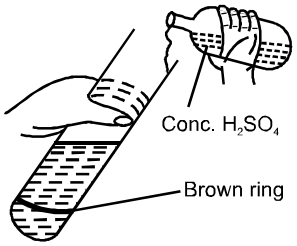


$NaNO_3 + H_2SO_4 \longrightarrow NaHSO_4 + HNO_3$

$6FeSO_4 + 2HNO_3 + 3H_2SO_4$
$\longrightarrow 3Fe_2(SO_4)_3 + 2NO + 4H_2O$

or $2NO_3^- + 4H_2SO_4 + 6Fe^{2+}$
$\longrightarrow 6Fe^{3+} + 2NO\uparrow + 4SO_4^{2-} + 4H_2O.$
$Fe^{2+} + NO\uparrow + 5H_2O \longrightarrow$
$[Fe^{I}(H_2O)_5\ NO^{+}]^{2+}$ (brown ring).

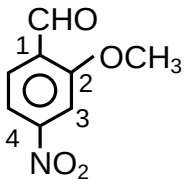
हल. **भूरी वलय परीक्षण:** जब आयरन (II) सल्फेट के ताजा निर्मित सन्तृप्त विलयन को नाइट्रेट विलयन में मिलाया जाता है तथा तब परखनली के एकसिरे से सान्द्रित H_2SO_4 को धीरे से मिलाया जाता है। दोनो परतों के संधि पर **भूरी वलय** प्राप्त होती है।



$NaNO_3 + H_2SO_4 \longrightarrow NaHSO_4 + HNO_3$
$6FeSO_4 + 2HNO_3 + 3H_2SO_4$
$\longrightarrow 3Fe_2(SO_4)_3 + 2NO + 4H_2O$

या $2NO_3^- + 4H_2SO_4 + 6Fe^{2+} \longrightarrow$
$6Fe^{3+} + 2NO\uparrow + 4SO_4^{2-} + 4H_2O.$
$Fe^{2+} + NO\uparrow + 5H_2O \longrightarrow$
$[Fe^{I}(H_2O)_5\ NO^{+}]^{2+}$ (भूरी वलय).

43.

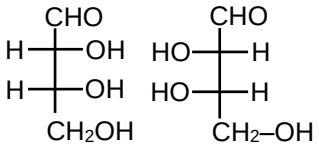


44. No group with restricted rotation about which GI is possible in option (4).
विकल्प (4) में प्रतिबंधित घूर्णन पर ज्यामितीय समावयवता दर्शाने वाले समूह उपस्थित नहीं है।

45. 1-Butyne is terminal alkyne and gives Tollen's and $Cu_2Cl_2 + NH_4OH$ test but 2-butyne is internal alkyne so it does not give the above tests.
1-Butyne is terminal alkyne and gives Tollen's and $Cu_2Cl_2 + NH_4OH$ test but 2-butyne is internal alkyne so it does not give the above tests.
1-ब्यूटाइन अन्तस्थ एल्काइन है एवं टॉलेन और $Cu_2Cl_2 + NH_4OH$ परीक्षण देता है लेकिन 2-ब्यूटाइन मध्यस्थ एल्काइन है इसलिये उपरोक्त परीक्षण नही देता है।

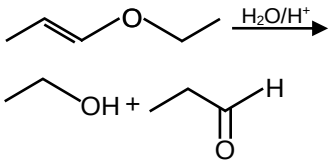
46. Fact

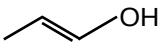
47. Enantiomers are non-superimposable mirror image of each other.
प्रतिबिम्ब रूप समावयवी एक–दूसरे पर अनाध्यारोपित दर्पण प्रतिबिम्ब होते है।



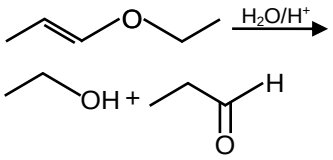
48. (4) a, c & d

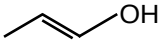
49.



(from 

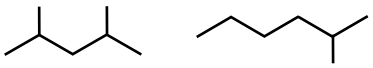
after tautomerism)



(

की चलावयवता के बाद)

50. 
Functional isomers. (क्रियात्मक समावयवी)


Chain isomers (श्रृंखला समावयवी)

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

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

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

हल: 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. $\Delta H^o_r = \{4E_{C-H} + 2E_{Cl-Cl}\} - \{2E_{C-H} + 2E_{C-Cl} + 2E_{H-Cl}\}$

54. For [A], as concentration is decreasing linearly with time, so it is zero order with respect to A.

So, x = 0 ; for B, as ln[B] vs time is linear, so it is First order wrt B.

Hence , y = 1. So , 2 x + y = 1

[A] के लिए, सान्द्रता समय के साथ रेखीय रूप से कमी होती है इसलिए यह A के सापेक्ष शुन्य कोटि का होता है।

अतः, x = 0 ; B के लिए ℓn[B] व समय के बीच आरेख रेखीय है अतः यह B के सापेक्ष प्रथम कोटि का होता है।

इसलिए, y = 1. अतः, 2 x + y = 1

55. $E_{cell} = E^0_{cell} - \frac{2.303 \times RT}{nF} \log \frac{(Zn^{+2})}{(Cu^{+2})}$

$= 0.76 + 0.34 - \frac{0.06}{2} \log \frac{2}{0.2} = 1.07$ volt.

56. Diameter of Cr (Cr का व्यास)

$= 2 \times 2.6 = 5.2$ Å $= 5.2 \times 10^{-8}$cm.

$\therefore$ Number of atoms in 2.50 cm row

(2.50 cm पंक्ति मे परमाणुओ की संख्या)

$= \frac{2.50}{5.2 \times 10^{-8}} = 0.48 \times 10^8$

$= 4.8 \times 10^7$ Cr atoms

$\therefore$ Moles of Cr atoms (Cr परमाणु के मोल)

$= \frac{4.8 \times 10^7}{6.022 \times 10^{23}} = 0.797 \times 10^{-16}$

$= 0.797 \times 10^{-17} \approx 8.0 \times 10^{-17}$

$\therefore$ x = 8.0

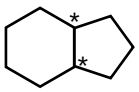
57. $\Delta T_f = k_f \times m$

$(\Delta T_f)_A = k_f \times \frac{5 \times 1000}{M_A \times 95}$;

$(\Delta T_f)_B = k_f \times \frac{5 \times 1000}{M_B \times 95}$;

$\frac{(\Delta T_f)_A}{(\Delta T_f)_B} = \left(\frac{M_B}{M_A}\right) = \frac{3}{1} = 3.$

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

59. 

60. $CH_2=CH-CH_2-CH_3 \xrightarrow[Zn,H_2O]{O_3}$

$CH_2=O + CH_3-CH_2-CH=O$

$CH_3-CH=CH-CH_3 \xrightarrow[Zn,H_2O]{O_3}$

$CH_3-CH=O + CH_3-CH=O$

$CH_2=C(CH_3)_2 \xrightarrow[Zn,H_2O]{O_3}$

$CH_2=O + (CH_3)_2C=O$

Total products = 4.

कुल उत्पाद = 4.

PART-C: MATHEMATICS

61.

$$f(\theta)=\frac{1}{2}\begin{vmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{vmatrix}+\begin{vmatrix} \sin\pi & \cos\left(\theta+\frac{\pi}{4}\right) & \tan\left(\theta-\frac{\pi}{4}\right) \\ \sin\left(\theta-\frac{\pi}{4}\right) & -\cos\left(\frac{\pi}{2}\right) & \log_e\frac{4}{\pi} \\ \cot\left(\theta+\frac{\pi}{4}\right) & \log_e\left(\frac{\pi}{4}\right) & \tan\pi \end{vmatrix}$$

Skew symmetric

$$f(\theta)=\frac{1}{2}\begin{vmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{vmatrix}+0$$

$$f(\theta)=\frac{1}{2}\left[2+2\sin^2\theta\right]=1+\sin^2\theta$$

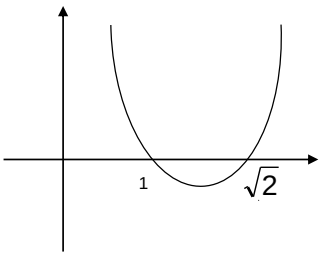
now $g(\theta)=\sqrt{f(\theta)-1}+\sqrt{f\left(\frac{\pi}{2}-\theta\right)-1}$

$g(\theta)=\sin\theta+\cos\theta$, $0\le\theta\le\frac{\pi}{2}$

$g(\theta)_{max}=\sqrt{2}$ & $g(\theta)_{min}=1$

Hence P(x) = $a(x-\sqrt{2})(x-1)$

$P(2)=2-\sqrt{2}\Rightarrow \quad a=1$.



Thus $P(x)=(x-\sqrt{2})(x-1)$

clearly A is correct options

62. $\alpha = -3, \beta = 5$

63. $|A| = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ 0 & a_{22} & a_{23} \\ 0 & 0 & a_{33} \end{vmatrix}$

$|A| = a_{11}.a_{22}.a_{33}$

$|A| = (I_{5,2}-I_{3,2}).(I_{6,2}-I_{4,2}).(I_{7,2}-I_{5,2})$

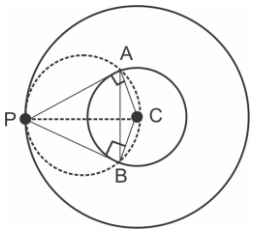
$= \frac{1}{4.5.6}=\frac{1}{120}$

$P = |adj(A^{-1})| = |A^{-1}|^2 = \frac{1}{|A|^2} = 4^2.5^2.6^2$

$P = 2^6.3^2.5^2$

Number of divisors = 7 × 3 × 3 = 63

64.



circumcentre will be midpoint of PC

PC के मध्य बिन्दुका बिन्दुपथ है

$h=\frac{\sqrt{2}\cos\theta+2}{2}$

$k=\frac{\sqrt{2}\sin\theta}{2}$

$\left(\frac{2h-2}{\sqrt{2}}\right)^2+\left(\frac{2k}{\sqrt{2}}\right)^2=1$

$2\left((h-1)^2+k^2\right)=1$

$2x^2-4x+2y^2+1=0$

65. $\int_0^{t^2} f^2(x)dx+\frac{1}{2}t^6\int_0^{\pi/2}\sin^3 x dx=\int_0^{t^2}2xf(x)dx$

$\int_0^{t^2} f^2(x)dx+\frac{t^6}{2}.\frac{2}{3}=\int_0^{t^2}2xf(x)dx$

$f^2\left(t^2\right).2t+2t^5=2t^2f\left(t^2\right)2t$

$f^2\left(t^2\right)+t^4-2t^2f\left(t^2\right)=0 \Rightarrow \left(f(t^2)-t^2\right)^2=0$

$\Rightarrow f(t^2)=t^2$

$\Rightarrow f(x)=x\ \forall x\ge 0$

From the graph, it is clear that x = 0 and x = 1 are only two solutions.

66. $y = ax^2 + bx$

thr' (1, 2), $a + b = 2$ ____(i)

$\frac{dy}{dx} = 2ax + b$

$\left.\frac{dy}{dx}\right|_{x=1} = 2a + b = 3$ _____ (ii)

$a = 1, b = 1$

Req. Equation of circle is

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

thr' (3, 1), $k = -1$

Req. Equation is, $x^2+y^2-4x-y+3=0$

67. $p = \frac{1}{{}^6C_1 \times {}^6C_1} = \frac{1}{36}, \quad q = 1 - p = \frac{35}{36}$

As given दिया गया है

Probability of getting at least one double six $> \frac{99}{100}$

कम से कम एक बार दोनों पर 6 आने की प्रायिकता $> \frac{99}{100}$

$\Rightarrow 1 - \left(\frac{35}{36}\right)^n > 0.99 \qquad \Rightarrow 0.01 > \left(\frac{35}{36}\right)^n$

$\Rightarrow 10^{-2} > \left(\frac{35}{36}\right)^n \Rightarrow -2 > n$ [– .01224]

$\Rightarrow n > \frac{2}{0.01224}$

$\Rightarrow n = 164$

(least value न्यूनतम मान)

68. 13 letters (4I, 2N, 7 diff) 9 type

All different ${}^9C_5 5! = 15120$

2 alike 3 different ${}^2C_1 . {}^8C_3 \frac{5!}{2!} = 6720$

3 alike 2 alike 1 different ${}^2C_2 . {}^7C_1 \frac{5!}{2!2!}$ = 210

3 alike 2 different ${}^1C_1 . {}^8C_2 \frac{5!}{3!} = 560$

3 alike 2 alike ${}^1C_1 . {}^1C_1 \frac{5!}{3!2!} = 10$

4 alike 1 different ${}^1C_1 . {}^8C_1 \frac{5!}{4!} = 40$

total = 22660

हल. 13 अक्षर (4I, 2N, 7 भिन्न) 9 type

सभी भिन्न ${}^9C_5 5! = 15120$

2 एक समान, 3 भिन्न ${}^2C_1 . {}^8C_3 \frac{5!}{2!} = 6720$

3 एक समान, 2 एक समान 1 भिन्न ${}^2C_2 . {}^7C_1 \frac{5!}{2!2!}$ = 210

3 एक समान, 2 भिन्न ${}^1C_1 . {}^8C_2 \frac{5!}{3!} = 560$

3 एक समान, 2 एक समान ${}^1C_1 . {}^1C_1 \frac{5!}{3!2!} = 10$

4 एक समान, 1 भिन्न ${}^1C_1 . {}^8C_1 \frac{5!}{4!} = 40$

कुल = 22660

69. $f(x) = x - 1, 1 \le x \le 2$

$g(x) = x - 1 + b \sin\frac{\pi}{2}x, 1 \le x \le 2$

$f(1) = 0; f(2) = 1 \Rightarrow$ Rolle's theorem is not applicable to 'f' but LMVT is applicable to f

($\therefore$ x – 1 is continuous and differentiable in [1, 2] and (1,2) respectively)

Now g(1) = b; g(2) = 1 and

Function x – 1, $\sin\frac{\pi x}{2}$ are both continuous in [1, 2] and (1, 2)

$\therefore$ For Rolle's theorem to be applicable to g, we must have b = 1

हल. $f(x) = x - 1, 1 \le x \le 2$

$g(x) = x - 1 + b \sin\frac{\pi}{2}x, 1 \le x \le 2$

$f(1) = 0; f(2) = 1 \Rightarrow$ रोल प्रमेय f के लिए लागू नहीं है परन्तु f लाग्रांज लागू होती है।

($\therefore$ x – 1, [1, 2] और (1,2) में सतत् और अवकलनीय है)

अब g(1) = b; g(2) = 1 और

फलन x – 1, $\sin\frac{\pi x}{2}$ दोनों [1, 2] और (1, 2) में सतत् है।

$\therefore$ b = 1 के लिए रोल प्रमेय लागू होती है।

70. $\lim_{n\to\infty} \frac{\sum_{r=1}^{2n}\left(\sqrt{r}\sum_{r=1}^{2n}\frac{1}{\sqrt{r}}\right)}{4\sum_{r=1}^{n} r} = \lim_{n\to\infty} \frac{\sum_{r=1}^{2n}\sqrt{r}\ \sum_{r=1}^{2n}\frac{1}{\sqrt{r}}}{2n(n+1)}$

$= \lim_{n\to\infty} \frac{\frac{1}{n}\sum_{r=1}^{2n}\sqrt{\frac{r}{n}}\ \ \frac{1}{n}\sum_{r=1}^{2n}\frac{1}{\sqrt{\frac{r}{n}}}}{2(1+\frac{1}{n})}$

$= \frac{\int_0^2 \sqrt{x}dx \int_0^2 \frac{1}{\sqrt{x}}dx}{2} = \frac{\frac{2.}{3}2^{\frac{3}{2}}.2.2^{\frac{1}{2}}}{2} = \frac{8}{3}$

71. Normal at P is x + y =3 is tangents to $\frac{x^2}{5} + \frac{y^2}{b^2} = 1$

So $5 + b^2 = 9 \quad \Rightarrow \quad b = 2$

Comparing with $\frac{xx_1}{5} + \frac{yy_1}{4} = 1$,

we get Q $\left(\frac{5}{3}, \frac{4}{3}\right)$

So $R\left(-\frac{5}{3}, \frac{-4}{3}\right)$

$\Rightarrow \quad QR = \frac{2}{3}\sqrt{41}$, $PQ = \frac{2\sqrt{2}}{3}$

Area of $\Delta PQR = \frac{1}{2}\begin{vmatrix} 1 & 2 & 1 \\ \frac{5}{3} & \frac{4}{3} & 1 \\ -\frac{5}{3} & -\frac{4}{3} & 1 \end{vmatrix}$

$= \frac{1}{2}\begin{vmatrix} 1 & 2 & 1 \\ \frac{5}{3} & \frac{4}{3} & 1 \\ 0 & 0 & 2 \end{vmatrix} = \frac{10-4}{3} = 2$

हल. $\frac{x^2}{5} + \frac{y^2}{b^2} = 1$ पर स्पर्श रेखाए जो P पर अभिलम्ब $x + y = 3$ है।

इसलिए $5 + b^2 = 9 \quad \Rightarrow \quad b = 2$

तुलना करने पर $\frac{xx_1}{5} + \frac{yy_1}{4} = 1$, $Q\left(\frac{5}{3}, \frac{4}{3}\right)$

इसलिए $R\left(-\frac{5}{3}, \frac{-4}{3}\right)$

$\Rightarrow$ $QR = \frac{2}{3}\sqrt{41}$, $PQ = \frac{2\sqrt{2}}{3}$

त्रिभुज PQR का क्षेत्रफल $= \frac{1}{2}\begin{vmatrix} 1 & 2 & 1 \\ \frac{5}{3} & \frac{4}{3} & 1 \\ -\frac{5}{3} & -\frac{4}{3} & 1 \end{vmatrix}$

$= \frac{1}{2}\begin{vmatrix} 1 & 2 & 1 \\ \frac{5}{3} & \frac{4}{3} & 1 \\ 0 & 0 & 2 \end{vmatrix} = \frac{10-4}{3} = 2$

72. No. of ways getting one correct
केवल एक सही आने के तरीके है।

$= {}^7C_1\, 6! \left(1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + ... + \frac{1}{6!}\right) = {}^7C_1.265$

No. of ways getting two correct $= {}^7C_2.5!$

$\left(1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + ... - \frac{1}{5!}\right) = {}^7C_2 . 44$

दो सही आने के तरीके $= {}^7C_2. 5!$

$\left(1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + ... - \frac{1}{5!}\right) = {}^7C_2 . 44$

No. of ways getting three correct $= {}^7C_3.4!$

$\left(1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!}\right) = {}^7C_3.9$

तीन सही आने के तरीके $= {}^7C_3.4!$

$\left(1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!}\right) = {}^7C_3.9$

Required no. of ways
अभीष्ट तरीके

$= {}^7C_3 . 9 + {}^7C_2 . 44 + {}^7C_1. 265$

73. $\frac{x+8}{1/\sqrt{5}} = \frac{y+8}{2/\sqrt{5}}$ = PA or या PB

Let r now it lies on $y = x^2 + x - 2$
माना r ,$y = x^2 + x - 2$ पर स्थित है।

$\left(\frac{2r}{\sqrt{5}} - 8\right) = \left(\frac{r}{\sqrt{5}} - 8\right)^2 + \left(\frac{r}{\sqrt{5}} - 8\right) - 2$

$\frac{r^2}{5} + r\left(\frac{-17}{\sqrt{5}}\right) + 62 = 0$

$PA + PB = 17\sqrt{5}$

$PA \cdot PB = 62 \times 5 = 310$

74. $\int_0^{\pi} |\sin kx|\, dx = 2 , K \in N$

Here age wise data in ascending order is given as 14,16,18,20,22,24
So, n=6, Hence median is the A.M. of 3rd & 4th observation

Median (M) $= \frac{18+20}{2} = 19$

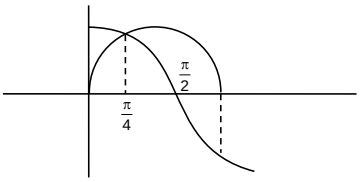
x_i	14	16	18	20	22	24	Total
$\lvert d_i \rvert = \lvert x_i - 19 \rvert$	5	3	1	1	3	5	$\sum \lvert d_i \rvert = 18$

$$M \cdot D \cdot = \frac{1}{n}\sum |d_i| = \frac{18}{6} = 3$$

75. diff. $\frac{x(\cos x - \sin x)}{e^x + 1} + \frac{g(x) \cdot (e^x + 1 - xe^x)}{(e^x + 1)^2}$

$= g(x) \cdot \frac{\{e^x + 1 - xe^x\}}{(e^x + 1)^2} + g'(x) \cdot \frac{x}{e^x + 1}$

$\Rightarrow$ g'(x) = cos x – sin x
g''(x) = –sin x – cos x



h(x) = g + g' $\Rightarrow$ h(x) = g'+g" –2sinx

76. f(0) = k

LHL $= \lim_{x \to 0^-} \frac{x \sin^{-1}(1 - x + [x])}{\text{sgn}(x) + \cos x}$

$= \lim_{x \to 0^-} \frac{x \sin^{-1}(-x)}{-(1 - \cos x)} = 2$

RHL = $\lim_{x\to0^+} \frac{\tan^{-1}(x-[x])}{-(e^{2x}-1)}.\lambda$

$= \lim_{x\to0^+} \frac{\tan^{-1}x}{-(e^{2x}-1)}.\lambda = -\frac{\lambda}{2}$

$\Rightarrow$ k = 2 and $\lambda = -4$

77. $h'(x) = 2f(x)f'(x) - 2g(x)g'(x)$

$= -2f(x)g(x) + 2g(x)f(x) = 0$

78. {x}, [x], x is in G.P.

$[x]^2 = x\{x\}$

Let $x = I + f$

$I^2 = (I + f)\, f$

$\Rightarrow \quad f^2 + fI - I^2 = 0$

$f = \frac{-I \pm \sqrt{I^2 4 + 4I^2}}{2}$

$f = I\left[\frac{-1\pm\sqrt{5}}{2}\right]$

So, common ratio is $\frac{-1+\sqrt{5}}{2}$ as fractional part should be positive.

79. $f(x) + f\left(\frac{1}{x}\right) = x^2 + \frac{1}{x}$

Replacing x by $\frac{1}{x}$, we get $f\left(\frac{1}{x}\right)$ + f(x)

$= \frac{1}{x^2} + x$

or $\frac{1}{x^2} + x = x^2 + \frac{1}{x}$

$x - \frac{1}{x} = x^2 - \frac{1}{x^2}$

$\left(x-\frac{1}{x}\right) = \left(x-\frac{1}{x}\right)\left(x+\frac{1}{x}\right)$

$\left(x-\frac{1}{x}\right)\left(x+\frac{1}{x}-1\right) = 0$

$x = \frac{1}{x}$, $x + \frac{1}{x} = 1$ (rejected)

$x = \pm 1$

so, p = 2

80.

p	q	~ p	~ q	p → q	~ q → p	(p → q) ∨ (~ q → p)	p ∧ ~ q	~ p ∨ q	(p ∧ ~ q) ∧ (~ p ∨ q)
T	T	F	F	T	T	T	F	T	F
T	F	F	T	F	T	T	T	F	F
F	T	T	F	T	T	T	F	T	F
F	F	T	T	T	F	T	F	T	F

From table

$(p \to q) \vee (\sim q \to p)$ is tautology

and $(p \wedge \sim q) \wedge (\sim p \vee q)$ is fallacy

81. $\frac{3}{2}\tan^{-1}\frac{\pi}{\sqrt{2}} + \frac{1}{4}\sin^{-1}\left(\frac{2\left(\frac{\pi}{\sqrt{2}}\right)}{1+\left(\frac{\pi}{\sqrt{2}}\right)^2}\right) + \cot^{-1}\left(\frac{\pi}{\sqrt{2}}\right)$

$\Rightarrow \frac{3}{2}\tan^{-1}\frac{\pi}{\sqrt{2}} + \frac{1}{4}\sin^{-1}\left(\frac{2\tan\theta}{1+\tan^2\theta}\right) + \frac{\pi}{2} - \tan^{-1}\frac{\pi}{\sqrt{2}}$

$\Rightarrow \frac{1}{2}\tan^{-1}\frac{\pi}{\sqrt{2}} + \frac{1}{4}\sin^{-1}(\sin 2\theta) + \frac{\pi}{2}$

$\Rightarrow \frac{1}{2}\tan^{-1}\frac{\pi}{\sqrt{2}} + \frac{1}{4}(\pi - 2\theta) + \frac{\pi}{2}$

$\Rightarrow \frac{1}{2}\tan^{-1}\frac{\pi}{\sqrt{2}} + \frac{\pi}{4} - \frac{\theta}{2} + \frac{\pi}{2}$

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

$= \frac{a}{b}\pi$

82. Let $\frac{1}{p}, \frac{1}{q}, \frac{1}{r}, \frac{1}{s}$

$\alpha, \alpha + d, \alpha + 2d, \alpha + 3d$

$\frac{1}{p}, \frac{1}{r}$ are roots of $2ax^2 - 8ax + 1 = 0$

$\frac{1}{q}, \frac{1}{s}$ are roots of $6bx^2 + 12bx + 1 = 0$

Now, $2\alpha + 2d = 4 \Rightarrow \alpha + d = 2$ -------(1)

$2\alpha + 4d = -2 \Rightarrow \alpha + 2d = -1$ -------(2)

(2) – (1) $\Rightarrow$ d = – 3 $\Rightarrow \alpha = +5$

Now $\alpha(\alpha + 2d) = \frac{1}{2a} \Rightarrow a^{-1} = 2\alpha(\alpha + 2d)$

= 10 (5 – 6) = –10

& $(\alpha + d)(\alpha + 3d) = \frac{1}{6b} \Rightarrow b^{-1} = 6(\alpha + d)(\alpha + 3d) = 6(2).(5 - 9) = -48$

so. $a^{-1} - b^{-1} = -10 + 48 = 38$

83. $f(x) = x^2 + bx + p$

$\because f(1) = \frac{1}{3} \Rightarrow 1 + b + p = \frac{1}{3} \Rightarrow b + p = -\frac{2}{3}$

Let α be the common root

$\Rightarrow f(\alpha) = 0$ and $f(f(f(f(\alpha)))) = 0$

$\Rightarrow f(f(f(0))) = 0$

$\Rightarrow f(f(p)) = 0$

$\Rightarrow f^2(p) + bf(p) + p = 0$

$\Rightarrow (p^2 + bp + p)(p^2 + bp + p + b) + p = 0$

$(p+b+1)(p^2+bp+p+b)+1=0$

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

$\left(\frac{-2-2p}{9}\right)+1=0$

$\Rightarrow \frac{2+2p}{9}=1$

$p=\frac{7}{2}$

$\Rightarrow f(-3)=9-3b+p=9+3p+2+p$

$= 11+4p=11+4\left(\frac{7}{2}\right)=25$

84. $\sum_{r=0}^{9} {}^{20}C_{2r}\cdot {}^{20}C_{2r+2}=\sum_{r=0}^{9} {}^{20}C_{2r}\cdot {}^{20}C_{18-2r}$

= Coefficient of x^{18} in $({}^{20}C_0 + {}^{20}C_2\, x^2 + \ldots.. + {}^{20}C_{20}\, x^{20}) \times ({}^{20}C_0 + {}^{20}C_2\, x^2 + \ldots.. + {}^{20}C_{20}\, x^{20})$

= Coefficient of x^{18} in $\left(\frac{(1+x)^{20}+(1-x)^{20}}{2}\right)^2$

= Coefficient of x^{18} in

$$\frac{1}{4}(1+x)^{40}+\frac{1}{4}(1-x)^{40}+\frac{1}{2}(1-x^2)^{20}$$

$= \frac{1}{4}{}^{40}C_{18}+\frac{1}{4}{}^{40}C_{18}-\frac{1}{2}{}^{20}C_9$

$= \frac{1}{2}\left[{}^{40}C_{22}-{}^{20}C_{11}\right]=\frac{1}{2}\left[\frac{40}{22}{}^{39}C_{21}-\frac{20}{11}{}^{19}C_{10}\right]$

$= \frac{10}{11}\left[{}^{39}C_{21}-{}^{19}C_{10}\right]$

$\therefore a = 10$

हल. $\sum_{r=0}^{9} {}^{20}C_{2r}\cdot {}^{20}C_{2r+2}=\sum_{r=0}^{9} {}^{20}C_{2r}\cdot {}^{20}C_{18-2r}$

$= ({}^{20}C_0 + {}^{20}C_2\, x^2 + \ldots.. + {}^{20}C_{20}\, x^{20}) \times ({}^{20}C_0 + {}^{20}C_2\, x^2 + \ldots.. + {}^{20}C_{20}\, x^{20})$ में x^{18} का गुणांक

$= \left(\frac{(1+x)^{20}+(1-x)^{20}}{2}\right)^2$ में x^{18} का गुणांक

$= \frac{1}{4}(1+x)^{40}+\frac{1}{4}(1-x)^{40}+\frac{1}{2}(1-x^2)^{20}$ में x^{18} का गुणांक

$= \frac{1}{4}{}^{40}C_{18}+\frac{1}{4}{}^{40}C_{18}-\frac{1}{2}{}^{20}C_9$

$= \frac{1}{2}\left[{}^{40}C_{22}-{}^{20}C_{11}\right]=\frac{1}{2}\left[\frac{40}{22}{}^{39}C_{21}-\frac{20}{11}{}^{19}C_{10}\right]$

$= \frac{10}{11}\left[{}^{39}C_{21}-{}^{19}C_{10}\right]$

$\therefore a = 10$

85. $\lim_{x\to 0}\left(\frac{a^x+b^x}{2}\right)^{\frac{2}{x}}=6$

$\Rightarrow \lim_{x\to 0}\left[1+\left(\frac{a^x+b^x}{2}-2\right)\right]^{\frac{2}{x}}=6$

$\Rightarrow e^{\lim_{x\to 0}\frac{(a^x-1)+(b^2-1)}{x}}=6 \Rightarrow ab=6$

a = 6, b = 1 ; a = 3, b = 2 ; a = 1, b = 6 ; a = 2, b = 3

$\therefore p=\frac{4}{36}=\frac{1}{9}$ $\Rightarrow \frac{2}{p}=\frac{2}{\left(\frac{1}{9}\right)}=18$

86. Equation of normal at any point (x, y) is

$\frac{dy}{dx}(Y-y)+(X-x)=0$

Passes through (3, 0)

$\Rightarrow (3-x)\frac{dx}{dy}-y=0 \Rightarrow ydy=(3-x)\,dx$

$\Rightarrow \frac{y^2}{2}=3x-\frac{x^2}{2}+C$ ..... (i)

The curve contains the point (3, 4) $\Rightarrow 8 = 9 - \frac{9}{2}+C \Rightarrow C = 7/2$

By equation (i)

$\frac{y^2}{2}=3x-\frac{x^2}{2}+\frac{7}{2}\Rightarrow x^2+y^2-6x-7=0$

a + b + c + d = 8

87. $x\,dy - (y^2 - 4y)\,dx = 0$

$$\Rightarrow \quad \int \frac{dy}{y^2 - 4y} = \int \frac{1}{x} dx$$

$$\Rightarrow \quad \frac{1}{4}\int \frac{y - (y-4)}{y(y-4)} dy = \int \frac{1}{x} dx$$

$$\Rightarrow \quad \frac{1}{4}\int \left(\frac{1}{y-4} - \frac{1}{y} \right) dy = \int \frac{1}{x} dx$$

$$\Rightarrow \quad \frac{1}{4}\left\{ \ln\left|\frac{y-4}{y}\right| \right\} = \ln x + \frac{1}{4}\ln C$$

$$\ln\left|\frac{y-4}{y}\right| = \ln C x^4 \Rightarrow \frac{y-4}{y} = \lambda x^4 \quad y(1) = 2$$

$\Rightarrow \quad -1 = \lambda \qquad$ So $\dfrac{y-4}{y} = -x^4$

since we have to find $10y\left(\sqrt{2}\right)$

so put $x = \sqrt{2}$

we get $\dfrac{y-4}{y} = -4$, $\qquad y - 4 = -4y$

$5y = 4$

So $10y\left(\sqrt{2}\right) = 10 \times \dfrac{4}{5} = 8$

88. Given curves are

$x^2 + y^2 = 4$ and $y = \sqrt{3\,|\,x\,|}$

$\Rightarrow |x|^2 + 3|x| - 4 = 0$

$\Rightarrow x = \pm 1$ and $y = \sqrt{3}$

Now, equations of tangents are

$x + \sqrt{3}\,y = 4$ and $-x + \sqrt{3y} = 4$;

The tangents intersects on y-axis at $\left(0, \dfrac{4}{\sqrt{3}}\right)$

Now,

$\Rightarrow \angle AOB = \dfrac{\pi}{3}$

89. Let $n = 2m$

$$\left[\lim_{n\to\infty} \left(2 \times 3^2 \times 2^3 \times 3^4 \ldots\ldots 2^{n-1} \times 3^n\right)^{\frac{1}{(n^2+1)}} \right]^4$$

$$= \left[\lim_{m\to\infty} \left(2^{1+3+5+\ldots\ldots+(2m-1)} . 3^{2+4+6+\ldots\ldots+2m}\right)^{\frac{1}{4m^2+1}} \right]^4$$

$$= \left[\lim_{m\to\infty} \left(2^{m^2} . 3^{m^2+m}\right)^{\frac{1}{4m^2+1}} \right]^4$$

$$= \left(\lim_{m\to\infty} 2^{\frac{m^2}{4m^2+1}} . 3^{\frac{m^2+m}{4m^2+1}} \right)^4 = 6$$

90. $\det\left(A^2 - I_3\right) = \det\left(A^2 - AA^T\right)$

$= \det\left(A\left(A - A^T\right)\right) = \det\left(A - A^T\right)\det(A)$

Further det $A = \pm 1$, and matrix $A - A^T$ is a skew symmetric matrix with odd order hence its determinant is 0.

पुनः det $A = \pm 1$ तथा आव्यूह $A - A^T$ विषम क्रम का विषम सममित आव्यूह है अतः इसके सारणिक का मान 0 है।

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

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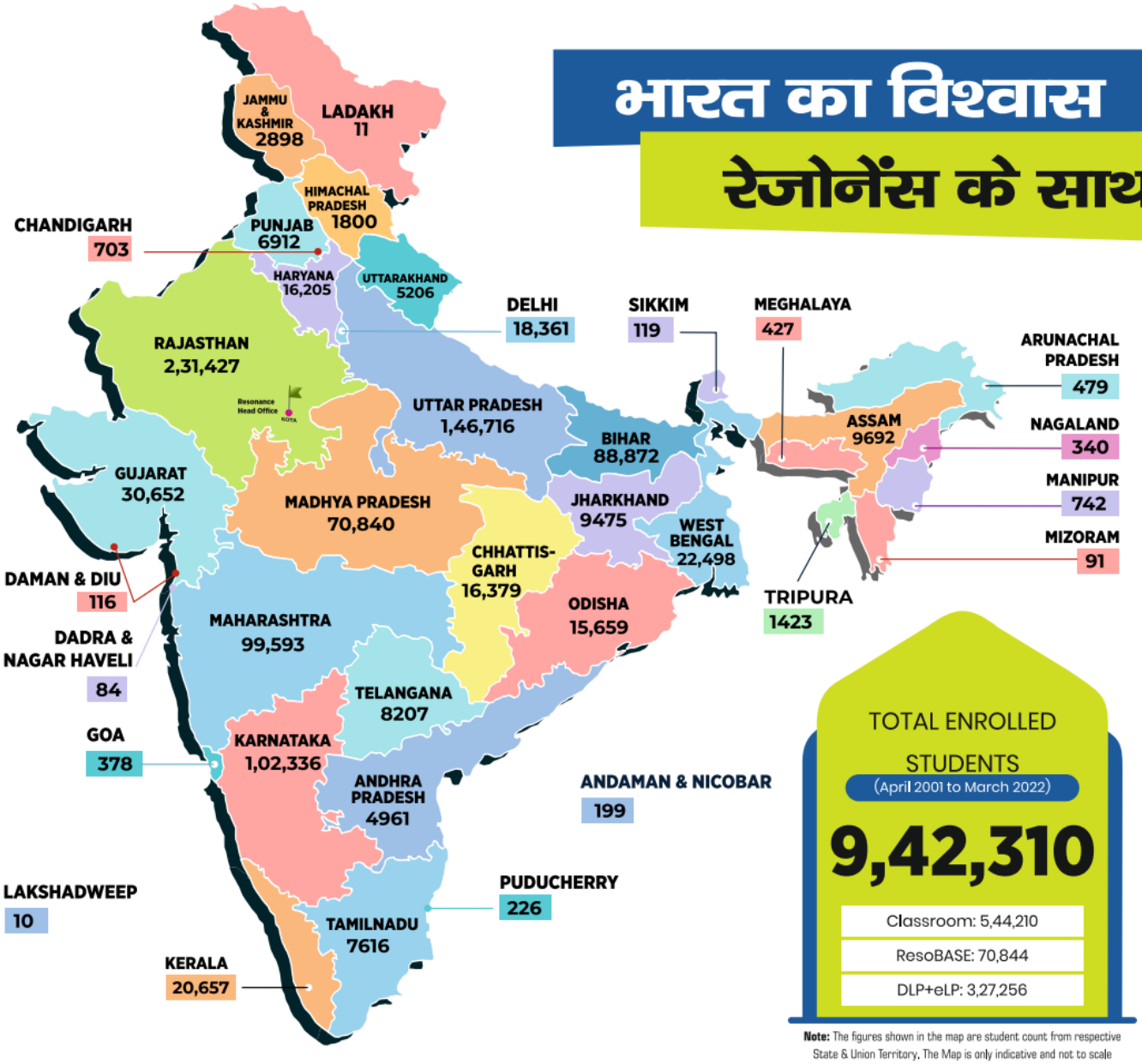
भारत का विश्वास
रेजोनेंस के साथ



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