FIITJEE

ALL INDIA TEST SERIES

JEE (Advanced)-2025

CONCEPT RECAPITULATION TEST – I

PAPER –1

TEST DATE: 24-04-2025

Time Allotted: 3 Hours **Maximum Marks: 180**

General Instructions:

- The test consists of total 51 questions.
- Each subject (PCM) has 17 questions.
- This question paper contains **Three Parts.**
- **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
- Each **Part** is further divided into **Two Sections**: **Section-A & Section-B**.

Section – A (01 – 04, 18 – 21, 35 – 38): *This section contains **TWELVE (12)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.*

Section – A (05 –07, 22 – 24, 39 – 41): *This section contains **NINE (9)** questions. Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).*

Section – A (08 – 11, 25 – 28, 42 – 45): *This section contains **TWELVE (12)** Matching List Type Questions. Each question has **FOUR** statements in **List-I** entries (P), (Q), (R) and (S) and **FIVE** statements in **List-II** entries (1), (2), (3), (4) and (5). The codes for lists have choices (A), (B), (C), (D) out of which, **ONLY ONE** of these four options is correct answer.*

Section – B (12 – 17, 29 – 34, 46 – 51): *This section contains **EIGHTEEN (18)** numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

MARKING SCHEME

Section – A (Single Correct): Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3	If ONLY the correct option is chosen.
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	–1	In all other cases.

Section – A (One or More than One Correct): Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+4	If only (all) the correct option(s) is (are) chosen;
Partial Marks	:	+3	If all the four options are correct but ONLY three options are chosen;
Partial marks	:	+2	If three or more options are correct but ONLY two options are chosen and both of which are correct;
Partial Marks	:	+1	If two or more options are correct but ONLY one option is chosen and it is a correct option;
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	–2	In all other cases.

Section – B: Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+4	If ONLY the correct numerical value is entered at the designated place;
Zero Marks	:	0	In all other cases.

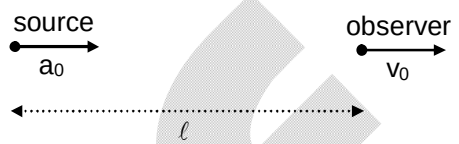
Physics

PART – I

SECTION – A
(One Options Correct Type)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

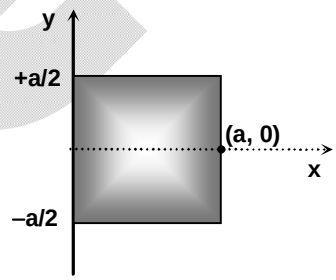
1. At t = 0, source starts accelerating with an acceleration a and observer starts moving with constant velocity v_0 as shown in the figure simultaneously. Source emits a frequency f and velocity of sound in the air is v. The frequency detected by the observer initially is:



(A) $\frac{(v-v_o)f^2}{(2vf-a)}$ (B) $\frac{2(v-v_o)f^2}{(2vf-a)}$

(C) $\frac{(v-v_o)f^2}{2(2vf-a)}$ (D) $\frac{2(v-v_o)f^2}{(vf-a)}$

2. A square laminar sheet with side a and mass M, has mass per unit area given by $\sigma(x)=\sigma_0\left[1-\frac{x}{a}\right]$. Moment of inertia of the sheet about y axis is



(A) $\frac{Ma^2}{2}$ (B) $\frac{Ma^2}{4}$

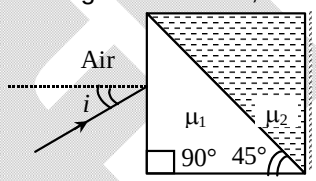
(C) $\frac{Ma^2}{6}$ (D) $\frac{Ma^2}{12}$

3. A dust particle oscillates in air with a time period which depends on atmospheric pressure *P*, density of air *d* and energy of the particle *E*, then time period is proportional to

(A) $P^{-\frac{5}{6}}d^{\frac{1}{2}}E^{\frac{1}{3}}$ (B) $P^{\frac{1}{2}}d^{3}E^{-2}$

(C) $P^{-\frac{1}{3}}d^{\frac{1}{2}}E^{2}$ (D) $P^{-2}d^{-\frac{1}{2}}E^{-3}$

4. In the given situation, for what value of *i,* the incidence ray will retrace its initial path



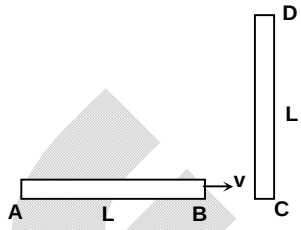
(A) $\cos^{-1}\left[\mu_1\sin\left(\frac{\pi}{4}-\sin^{-1}\frac{\mu_2}{\sqrt{2}\mu_1}\right)\right]$ (B) $\sin^{-1}\left[\mu_1\sin\left(\frac{\pi}{4}-\sin^{-1}\frac{\mu_2}{\sqrt{2}\mu_1}\right)\right]$

(C) $\sin^{-1}\left[\mu_2\sin\left(\frac{\pi}{4}-\sin^{-1}\frac{\mu_1}{\sqrt{2}\mu_2}\right)\right]$ (D) $\cos^{-1}\left[\mu_2\sin\left(\frac{\pi}{4}-\sin^{-1}\frac{\mu_1}{\sqrt{2}\mu_2}\right)\right]$

SECTION – A
(One or More than one correct type)

*This section contains **THREE (03)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

5. A rod CD of length L and mass M is placed horizontally on a frictionless horizontal surface as shown. A second identical rod AB which is also placed horizontally (perpendicular to CD) on the same horizontal surface is moving along the surface with a velocity v in a direction perpendicular to rod CD and its end B strikes the rod CD at end C and sticks to it rigidly. Then,



(A) velocity of centre of mass of the system just after impact is $\frac{v}{4}$.

(B) the ω(angular speed) of system just after collision is $\frac{3v}{5L}$.

(C) velocity of centre of mass of the system just after impact is $\frac{v}{2}$.

(D) the ω(angular speed) of system just after collision is $\frac{5v}{3L}$.

6. A large wooden plate of area 10 m^2 floating on the surface of a river is made to move horizontally with a speed of 2 m/s by applying a tangential force. River is 1 m deep and the water in contact with the bed is stationary. Then choose correct statements.
(Coefficient of viscosity of water = 10^{-3} N-s/m^2)
(A) velocity gradient is $2s^{-1}$.
(B) velocity gradient is $1s^{-1}$
(C) force required to keep the plate moving with constant speed is 0.02 N
(D) force required to keep the plate moving with constant speed is 0.01 N

7. A particle of mass *m* is given a velocity v_0 on a rough horizontal surface. The coefficient of friction between the particle and surface is μ. There is also a variable external force acts on the particle given as $|\vec{F}| = k|v|$ where *k* is a positive constant and *v* is instantaneous velocity. The directions of force at any instant is perpendicular to velocity. The particle moves in an instantaneously circular path of variable radius then
(A) the time taken by the particle to stop is $v_0/\mu g$.
(B) the time taken to reduce the angle between the acceleration and the velocity from 60° to 30° is $\frac{2m}{\sqrt{3}k}$.

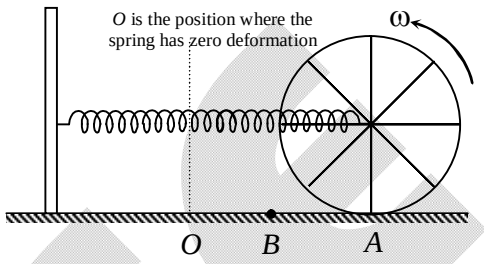
(C) the total distance covered by the particle is $\frac{v_0^2}{2\mu g}$.

(D) the radius of curvature of the path at any time *t* is $\frac{m}{k}\left(v_0 - \frac{\mu g t}{2}\right)$.

SECTION – A
(Matching List Type)

*This section contains **FOUR (04)** Matching List Type Questions. Each question has FOUR statements in **List-I** entries (P), (Q), (R) and (S) and FIVE statements in **List-II** entries (1), (2), (3), (4) and (5). The codes for lists have choices (A), (B), (C), (D) out of which **ONLY ONE** of these four options is correct answer.*

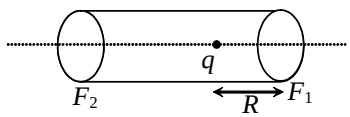
8. A uniform ring of mass M =1kg has massless spokes. A spring of stiffness constant K =1 N/m is attached to the centre of the ring at one end and the other end is fixed to the wall as shown in the figure. The ring is given an angular velocity ω and released from point A. As it reaches point B its velocity of centre of mass becomes V = 1m/s, where $V = R\omega$. The surface to the left of point B is perfectly rough, so that no slipping takes place. There is a point O on the rough part which corresponds to zero deformation of spring.



List-I		List-II
(P)	The time taken by the ring to go from A to B is (in sec)	1. $\sqrt{2}\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$
(Q)	The time taken by the ring to go from B to O is (in sec)	2. $\frac{\pi}{4}$
(R)	Velocity of centre of mass at O is (m/s)	3. $\sqrt{3}$
(S)	The maximum compression of the spring (in m)	4. $\sqrt{\frac{3}{2}}$ 5. $\sqrt{\frac{1}{2}}$

(A) (P) – 2, (Q) – 1, (R) – 4, (S) – 3
(B) (P) – 2, (Q) – 1, (R) – 3, (S) – 4
(C) (P) – 1, (Q) – 2, (R) – 4, (S) – 3
(D) (P) – 1, (Q) – 2, (R) – 3, (S) – 4

9. Consider an imaginary cylindrical surface of length $3R$ and radius R. A point charge q is placed at the axis of cylinder at a distance of $2R$ from plane circular face F_2 and at R from plane circular face F_1.

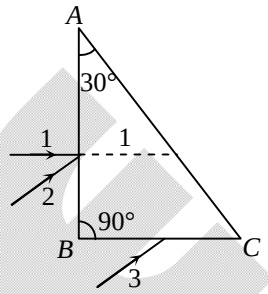


List–I		List–II
(P)	Electric flux through face F_1 is	1. $\frac{q}{\varepsilon_0}\left[\frac{1}{2\sqrt{2}}+\frac{1}{\sqrt{5}}\right]$
(Q)	Electric flux through face F_2 is	2. $\frac{q}{\varepsilon_0}$
(R)	Electric flux through curved surface of cylinder is	3. $\frac{q}{2\varepsilon_0}\left[1-\frac{1}{\sqrt{2}}\right]$
(S)	Total flux through the cylinder is	4. $\frac{q}{2\varepsilon_0}\left[1-\frac{2}{\sqrt{5}}\right]$

	5. $\frac{q}{2\varepsilon_0}\left[1+\frac{2}{\sqrt{5}}\right]$

(A) (P) – 3, (Q) – 4, (R) – 2, (S) – 1
(B) (P) – 4, (Q) – 3, (R) –1, (S) – 2
(C) (P) – 1, (Q) – 2, (R) – 3, (S) – 4
(D) (P) – 3, (Q) – 4, (R) –1, (S) – 2

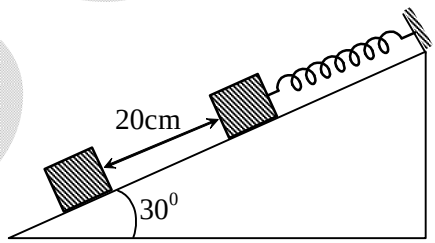
10. *ABC* is a right-angled prism kept in air. A ray (1) is incident on the face *AB* along the normal. Refractive index of the material of prism is the minimum value that will be required so that ray (1) undergoes total internal reflection at the face *AC*. Another ray (2) is incident on the face *AB* such that it emerges from face *AC* along the normal to *AC*. A third ray (3) falls on the face *BC* and emerges from face *AC* such that its angle of emergence is the same as that of incidence. Assuming light (1), (2) and (3) have the same wavelength, then match the following.



List–I	List-II
(P) Refractive index of the material of prism is	1. 120
(Q) Angle of incidence in degree of ray (2) is	2. 90
(R) Deviation in degree suffered by ray (2) is	3. 2
(S) Deviation in degree suffered by ray (3) is	4. 60

(A) (P) – 1; (Q) – 2; (R) – 3; (S) – 4
(B) (P) – 3; (QI) – 2; (R) – 4; (S) – 1
(C) (P) – 2; (Q) – 3; (R) – 4; (S) – 1
(D) (P) – 3; (Q) – 2; (R) – 1; (S) – 4

11. A block of mass 2 kg is released from rest on a smooth inclined plane of inclination 30^0 and connected by a massless spring of force constant 1000 N/m as shown in figure. Initially the spring is in its natural length. An external variable force also acts on the block down the inclined plane. Block comes to rest for a moment after travelling a distance of 20 cm along the inclined plane. From initial to this moment, column I gives work done by various forces and column II gives their values.



List–I	List-II
(P) Work done by gravity	1. zero
(Q) Work done by spring	2. 18 J
(R) Work done by external force	3. –20 J
(S) Work done by normal force	4. 2 J
	5. 20 J

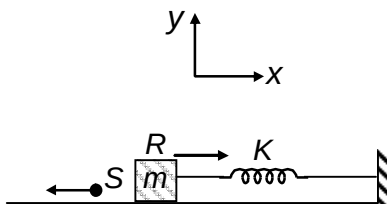
(A) (P) – 3, (Q) – 4, (R) – 2, (S) – 1
(B) (P) – 4, (Q) – 3, (R) – 1, (S) – 2
(C) (P) – 1, (Q) – 2, (R) – 3, (S) – 4
(D) (P) – 4, (Q) – 3, (R) – 2, (S) – 1

SECTION – B
(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

12. A man starts running a race with a velocity 2.5 π m/s. When he starts running he finds the wind is blowing at an angle of 45^0 with the track. As he progresses on the straight horizontal track he finds wind is rotating with uniform angular velocity and by the time he completes the race wind rotates through an angle 45^0. If the wind always blows perpendicular to the track and time of race is $\frac{10}{\ln\left(\sqrt{2}\right)}$ s, find the length of the race.

13. A sound source *S* emitting a sound of frequency 500 Hz and receiver *R* of mass *m* are at the same point. *R* is performing SHM with the help of a spring of force constant *k*. At a time $t = 0$, *R* is at mean position and moving toward right as shown in figure. At the same time, source starts moving away from the *R* with an acceleration 18.75 m/s^2. Find the frequency (in Hz) registered by receiver at a time *t* = 10s. Given that $\frac{m}{k} = \frac{100}{\pi^2}$ and amplitude of oscillation of *R* = $\frac{150}{\pi}$m , *v* sound = 300 m/s.



14. The average power transmitted across a cross-section by two sound waves moving in the same direction are equal. The wavelengths of two sound waves are in the ratio of 1 : 2, then find the ratio of their pressure amplitudes.

15. The bulk modulus of rubber is 9.8×10^8 N/m^2. To what depth (in mere) a rubber ball be taken in a lake so that its volume is decreased by 0.1%?

16. A bus is moving towards a huge wall with a velocity of 5 m/s. the driver sounds a horn of frequency 200 Hz. What is the frequency of beats heards by a passenger of the bus, if the speed of sound in air is 330 m/s.

17. A point source of power 4W is placed 1m below the free surface of liquid whose refractive index is '$\frac{2}{\sqrt{3}}$'. Find the rate of transfer of energy (in watt) from the liquid surface to air. Ignore any absorption or scattering of light energy.

Chemistry

PART – II

SECTION – A
(One Options Correct Type)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

18. A volume of 10 ml of 0.1 M tribasic acid, H_3A is titrated with 0.1 M – NaOH solution. What is the ratio (approximate value) of $\frac{[H_3A]}{[A^{3-}]}$ at the second equivalent point? Given:

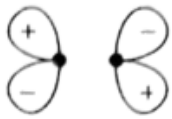
$K_1 = 7.5\times10^{-4}; K_2 = 10^{-8}; K_3 = 10^{-12}$

(A) 1.3×10^{-4} (B) 1.3×10^{-3}
(C) 1.3×10^{-7} (D) 1.3×10^{-6}

19. A mixture contains 1 mole of volatile liquid $A(P_A^o = 100\,mm\,Hg)$ and 3 moles of volatile liquid $B(P_B^o = 80\,mm\,Hg)$. If the solution behaves ideally, the total vapour pressure of the distillate is

(A) 85 mm Hg (B) 85.88 mm Hg
(C) 90 mm Hg (D) 92 mm Hg

20. Choose the correct statement for O_2 molecule from given statements (T= True and F= False)
As Per Molecular orbital theory, Both unpaired electrons of O_2 molecule are
(i) in degenerated molecular orbitals

(ii) in molecular orbital which has given shape: 

(iii) in molecular orbitals which are perpendicular to each other
(iv) in molecular orbitals which have No s-p mixing for O_2 molecule due to large difference in 2s and 2p atomic orbital of O atom.

(A) TTFF (B) FTFF
(C) TFTF (D) TTTT

21. Cyanogen (C_2N_2) gas is produced when excess of KCN reacts with aq. Solution of

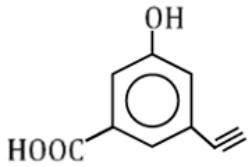
(A) $CdSO_4$ (B) $CuSO_4$
(C) $AgNO_3$ (D) $Fe_2(SO_4)_3$

SECTION – A
(One or More than one correct type)

*This section contains **THREE (03)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

22. A volume V of a ideal gas at a temperature T_1 and a pressure p is enclosed in a sphere. It is connected to another sphere of volume V/2 by a tube and stopcock. The second sphere is initially evacuated and the stopcock is closed. If the stopcock is opened the temperature of the gas in the second sphere becomes T_2. The first sphere is maintained at a temperature T_1. What is the final pressure p_1 within the apparatus?

(A) $\frac{2pT_2}{2T_2+T_1}$ (B) $\frac{2pT_2}{T_2+2T_1}$
(C) $\frac{pT_2}{2T_2+T_1}$ (D) $\frac{2pT_2}{T_1+T_2}$

23. Correct statement(s) about  is/are:

(A) Liberates H_2 on treatment with Na.
(B) give positive test with $FeCl_3$
(C) gives positive test with $NaHCO_3$
(D) gives positive test with Tollen's reagent

24. Choose the correct option?
(A) Electrochemical reactions reverse the action of electrolysis. Whereas electrolysis converts electrical energy to chemical energy, electrochemical reactions convert chemical energy directly to electrical energy.
(B) There is a convenient difference between electrochemical reactions and chemical reactions: the Gibbs energy change for an electrochemical reaction is equivalent to the maximum electrical work done by system on surrounding.
(C) The purpose of the salt bridge is to complete the electrical circuit between the two solutions and to facilitate the movement of ions from one compartment to the other.
(D) An equation relating the emf of a cell to variables such as temperature and the concentrations of reacting species is known as Nernst equation.

SECTION – A
(Matching List Type)

*This section contains **FOUR (04)** Matching List Type Questions. Each question has FOUR statements in **List-I** entries (P), (Q), (R) and (S) and FIVE statements in **List-II** entries (1), (2), (3), (4) and (5). The codes for lists have choices (A), (B), (C), (D) out of which **ONLY ONE** of these four options is correct answer.*

25. Match the List-I & List-II

List-I			List-II
(P)	$\left[Cr(H_2O)_4Br_2\right]^+$	(1)	Paramagnetic in nature
(Q)	$\left[Cu(NH_2CH_2CH_2NH_2)(CN)_2Cl_2\right]^{2-}$	(2)	Geometrical isomerism is exhibited.
(R)	$[Pt(ox)_2]^{2-}$	(3)	Central atom in d^2sp^3 hybridisation
(S)	$[Fe(OH)_4]^{4-}$	(4)	Linkage isomerism is exhibited.
		(5)	Complex having symmetrical bidentate ligand.

(A) P-1,2,3; Q-1,2,4,5 R-5, S-1
(B) P-1,2,3,4; Q-1,2 R-1,2,3; S-3,4
(C) P-2,3,4,5; Q-1,5, R-1,2,3, S-3,4
(D) P-3, Q-3,5, R-3, S-1,2,4

26. Match the list

	List–I (Pairs of ions)		List–II (Characteristics)
(P)	HCO_3^-, CO_3^{2-}	(1)	Both can decolourize MnO_4^- / H^+ solution
(Q)	S^{2-}, SO_3^{2-}	(2)	Both can produce white ppt. With $BaCl_2$(aq.) solution
(R)	SO_3^{2-}, CO_3^{2-}	(3)	Both can form soluble complex with small amount of $AgNO_3$ solution
(S)	$S_2O_3^{2-}, SO_3^{2-}$	(4)	Both can produce MO_2 type gas with dil. H_2SO_4
		(5)	None can react with $K_2Cr_2O_7$ solution (acidic)

(A) P-4, 5; Q-1; R-2, 4; S–1,2,3,4
(B) P-1,2,3,4; Q-1; R-2, 4; S–4,5
(C) P-2, 4; Q-1; R-4, 5; S–1,2,3,4
(D) P-2, 4; Q-1; R-1,2,3,4; S–4,5

27. Match the List-I & List-II

List-I			List-II
(P)	Cr_2O_3	(1)	Neutral oxide
(Q)	CrO_3	(2)	Amphoteric oxide
(R)	Fe_3O_4	(3)	Mix oxide
(S)	N_2O	(4)	Acidic oxide

(A) P-2, Q-4, R-3, S-1
(B) P-4, Q-2, R-3, S-1
(C) P-3, Q-4, R-2, S-1
(D) P-1, Q-2, R-3, S-4

28. Match the List-I & List-II

List-I			List-II
(P)	Ni^{2+}	(1)	Produce blue aq. solution
(Q)	Cr^{2+}	(2)	Half-filled t_{2g} orbitals in octahedral complex
(R)	V^{2+}	(3)	Diamagnetic ion
(S)	Ti^{4+}	(4)	Calculate $\mu = 2.84$ B.M. (spin only)

(A) P-2, Q-4, R-3, S-1
(B) P-4, Q-2, R-3, S-1
(C) P-4, Q-1, R-2, S-3
(D) P-1, Q-2, R-3, S-4

SECTION – B
(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

29. Sum of Pia (π) bond from given C_2, O_2, N_2

30. Find the number of reagent(s) which did not oxidize HCO_3^- ion solution
$MnO_2^- / H^+, Cr_2O_7^{2-} / H^+, Cl_2$ water, Br_2 water, I_2 water

31. How many statement are correct For the reaction A $\rightarrow$ Products (order = n), the theoretical time of completion of reaction is
(i) Infinite for all the value of n
(ii) Infinite for $n \geq 1$
(iii) $\frac{[A_0]^{1-n}}{K(1-n)}$ for $n \neq 1$
(iv) $\frac{[A_0]^{1-n}}{K(1-n)}$ for $n < 1$

32. For the reaction: A(g) $\rightarrow$ nB(g), rate constant is 6.93×10^{-4} s^{-1}. The reaction is performed at constant volume and temperature, starting with pure A(g). If after 1000 s from the start of reaction, the pressure of system becomes 3 times the initial pressure, the value of n is

33. An amount of 19 g of molten $SnCl_2$ is electrolysed for some time. Inert electrodes are used. 1.19 g of tin is deposited at the cathode. No substance is lost during electrolysis. If the ratio of the masses of $SnCl_2$ and $SnCl_4$ after electrolysis is x:261, the value of x is (Sn = 119)

34. The conductivity of saturated solution of sparingly soluble salt, $Ba_3(PO_4)_2$, is 1.2×10^{-5} $ohm^{-1}cm^{-1}$. The limiting equivalent conductances of $BaCl_2$, K_3PO_4 and KCl are 160, 140 and 100 $ohm^{-1}cm^2$ eq^{-1}, respectively. The k_{sp} of $Ba_3(PO_4)_2$ (in the order of 10^{-25}) is

Mathematics

PART – III

SECTION – A
(One Options Correct Type)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

35. The equation of locus of foot of perpendicular drawn from (1, 2) on the family of lines $(x-2)+\lambda(y-3)=$ (where $\lambda \in R$) is

(A) $(x-1)(y-3)+(y-2)=0$ (B) $(x-1)(y-2)+(y-2)(y-3)=0$

(C) $(x+1)(y+2)+3=0$ (D) $(x-1)+(y-3)(x-2)=0$

36. The lengths of two opposite edges of a tetrahedron are 12 and 15 units, their shortest distance is 10 units. If the volume of the tetrahedron is 200 cubic then the angle between the two edge is

(A) $\frac{\pi}{3}$ (B) $\sin^{-1}\left(\frac{1}{3}\right)$

(C) $\sin^{-1}\left(\frac{2}{3}\right)$ (D) $\sin^{-1}\left(\frac{3}{5}\right)$

37. The range of function $f(x) = \cos^2(\sin x) + \sin^2(\cos x)$ is

(A) $[1+\sin^2 1, 2+\cos^2 1]$ (B) $[\sin^2 1, 1+\cos^2 1]$

(C) $(1+\sin^2 1, 2-\cos^2 1)$ (D) $[\cos^2 1, 1+\sin^2 1]$

38. Least positive angle x satisfying the equation $\sin^3 x+\sin^3 2x+\sin^3 3x=(\sin x+\sin 2x+\sin 3x)^3$ is given by

(A) $\frac{\pi}{5}$ (B) $\frac{\pi}{8}$

(C) $\frac{\pi}{4}$ (D) $\frac{2\pi}{5}$

SECTION – A
(One or More than one correct type)

*This section contains **THREE (03)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

39. Let there be two circles with one touching x-axis at A(2, 0) and has radius 1 unit and other touching x-axis at B(6, 0). Let C and D be the centres of first and second circles respectively; Again let P(6, 2) be a point on a line perpendicular to CD and bisecting AB. If PA and PB intersect circles at E and F respectively, then

(A) $\frac{PE}{PF}=\frac{1}{\sqrt{5}}$ (B) $\frac{PE}{PF}=\sqrt{5}$

(C) $PE=\frac{8}{\sqrt{5}}$ (D) PF = 8

40. Given $ax^2 + bx + c \geq 0$, $bx^2 + cx + a \geq 0$ and $cx^2 + ax + b \geq 0$, where $a \neq b \neq c$ and $a, b, c \in R$.

Now $\frac{a^2+b^2+c^2}{ab+bc+ca}$ cannot take values

(A) $\frac{2}{3}$ (B) $\frac{1}{2}$

(C) $\frac{3}{2}$ (D) $\frac{9}{2}$

41. From a bag containing 5 pairs of socks, each pair a different color, a random sample of 4 single socks is drawn. Any complete pairs in the draw are discarded and replaced by the same number of socks drawn again from the bag. The process continues until the bag is empty or there are 4 socks of different colors held in the hand. The probability of latter alternative is

(A) greater than $\frac{1}{2}$ (B) greater than $\frac{1}{4}$

(C) greater than $\frac{3}{4}$ (D) greater than $\frac{9}{16}$

SECTION – A
(Matching List Type)

*This section contains **FOUR (04)** Matching List Type Questions. Each question has FOUR statements in **List-I** entries (P), (Q), (R) and (S) and FIVE statements in **List-II** entries (1), (2), (3), (4) and (5). The codes for lists have choices (A), (B), (C), (D) out of which **ONLY ONE** of these four options is correct answer.*

42. Match the following

List- I		List- II	
(P)	The value of $\frac{1}{\cos 60^o}+\frac{1}{\sin 24^o}+\frac{1}{\sin 48^o}-\frac{1}{\sin 12^o}$ is	(1)	$-\frac{1}{2}$
(Q)	The value of $\cos\frac{2\pi}{7}+\cos\frac{4\pi}{7}+\cos\frac{6\pi}{7}$ is	(2)	0
(R)	The value of $\sin\frac{\pi}{10}\sin\frac{2\pi}{10}\sin\frac{3\pi}{10}\sin\frac{4\pi}{10}$ is	(3)	$\frac{13}{24}$
(S)	The solution of equation $\sin x+\sin 2x+\sin 3x+\cos x+\cos 2x+\cos 3x$ is $x = 2k\pi \pm p\pi$ and $x = \frac{k\pi}{3}+q\pi$. Then p – q is	(4)	$\frac{\sqrt{5}}{16}$

(A) P → 2; Q → 3; R → 4; S → 1
(B) P → 3; Q → 1; R → 4; S → 2
(C) P → 2; Q → 4; R → 1; S → 3
(D) P → 2; Q → 1; R → 4; S → 3

43. Match List – I with List - II

	List – I		List - II
(P)	No. of possible 4 digit no. of the form $a_1a_2a_3a_4$ such that $a_1 > a_2 \geq a_3 > a_4$	(1)	62
(Q)	No. of divisor of $n = 2^3 \times 7^8 \times 5^6$ of the form $4\lambda+2$, $\lambda \geq 1$	(2)	$5^{10} - {}^5C_1 5^9 + {}^5C_2 5^8 - {}^5C_3 5^7 + {}^5C_4 5^6 - {}^5C_5 5^5$
(R)	If $f : \{x_1, x_2, x_3, x_4 ..... x_{10}\} \to \{y_1, y_2, y_3, y_4, y_5\}$ then no. of possible function in which $f(x_i) \neq y_i$	(3)	330

(S)	Number of triangles can be formed by joining the 3 vertices of a convex polygon of 35 diagonals	(4)	120

Codes :

	P	Q	R	S
(A)	2	4	3	1
(B)	3	2	1	4
(C)	1	4	3	2
(D)	3	1	2	4

44. Let $\alpha = \omega + \omega^2 + \omega^4, \beta = \omega^3 + \omega^5 + \omega^6,$ then match the following List – I with List – II.

List I		List II	
(P)	The value of $\alpha + \beta$ is	(1)	27
(Q)	Value of $(\alpha\beta)^3$ is	(2)	7
(R)	If $\alpha = \frac{a+\sqrt{b}i}{2}$ then $\frac{a+b}{2}+1$ is	(3)	0
(S)	$\sum_{k=0}^{6}\omega^{k^2}$ is $k_1 \pm \sqrt{k_2}i$, then the value of $k_2 - k_1$ is	(4)	1

Codes :

	P	Q	R	S
(A)	3	1	2	4
(B)	1	2	3	4
(C)	4	3	2	1
(D)	3	1	4	2

45. Match List – I with List - II

List – I		List - II	
(P)	Let normal to a parabola $y^2 = 4x$ at P meets the curve again in Q and if PQ and normal at Q makes angle α and β respectively with the x-axis, then $\lvert\tan\alpha(\tan\alpha+\tan\beta)\rvert$ is equal to	(1)	1
(Q)	If length of shortest normal chord of parabola $(x + y + 1)^2 = y - x$ is $\frac{p\sqrt{a}}{q\sqrt{b}}$ (p and q are prime), then (p-q) is	(2)	5
(R)	Area of quadrilateral formed by foci of hyperbola $\frac{x^2}{2} - 2y^2 = 1$	(3)	4
(S)	If $y^2 = 4x$ touches $x = ay^2 + 2y + 1$, $a \neq 0$, then [a+3] is ([.] is the greatest integer function)	(4)	2

Codes :

	P	Q	R	S
(A)	2	1	3	4
(B)	4	1	2	3
(C)	4	2	1	3
(D)	1	4	2	3

SECTION – B
(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

46. If a hyperbola is confocal and coaxial with ellipse $\frac{x^2}{4}+\frac{y^2}{1}=1$ and intersect it at $\left(\sqrt{3}, \frac{1}{2}\right)$. Length of transverse axis of hyperbola is _____

47. If the direction ratios of the normal of the plane which contains two parallel lines $\frac{x+1}{3}, \frac{y-2}{2}=\frac{z}{1}$ and $\frac{x-3}{3}=\frac{y+4}{2}=\frac{z-1}{1}$ are (8, 1, – 13k), then values of (k) is _____

48. Number of straight lines which satisfy the differential equation $\frac{dy}{dx}+x\left(\frac{dy}{dx}\right)^2-y=0$ is.....

49. $\alpha^3-3\alpha^2+5\alpha=1$ and $\beta^3-3\beta^2+5\beta=5$ then $(\alpha+\beta)$ is equal to _____

50. If f(x) = sin x + $\int_{-\pi/2}^{\pi/2}(\sin x+t\cos x)f(t)dt$, then f(x) may be equal $\left(-\frac{1}{k}\sin x-\frac{2}{k}\cos x\right)$, where k is a numerical quantity which equals _____

51. Let $f:[1,\infty)$ be a differentiable function such that f(e) = 1.
If $4\int_1^x f(t)dt=2xf(x)-x^2\forall x\geq 1$ then the value of [f(3)] is (where [.] denotes the greatest integer function) (Given $\ell n3=1.098$) _____