FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2024
FULL TEST – IV
PAPER –1
TEST DATE: 08-02-2024

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 –03, 18 – 20, 35 – 37):* 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 *(04 – 07, 21 – 24, 38 – 41)*: This section contains **TWELVE (12)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.

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 (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 – 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 – 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.

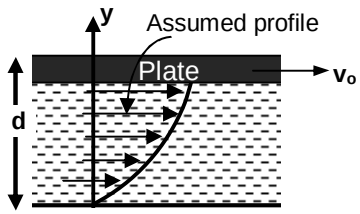
Physics

PART – I

SECTION – A
(One 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).*

1. A large plate moves with speed v_o over a stationary surface with layer of oil of viscosity η as shown in figure. If the velocity profile is that of parabola, with the oil at the plate having same velocity as plate. Choose the correct option(s)



(A) Equation of velocity profile is $v = \frac{v_o}{d^2}y^2$

(B) Equation of velocity profile is $y = \frac{dv^2}{v_o^2}$

(C) The shear stress on moving plate from oil is $\frac{\eta v_o}{2d}$

(D) For linear velocity profile, shear stress on moving plate from oil is $\frac{2\eta v_o}{d}$

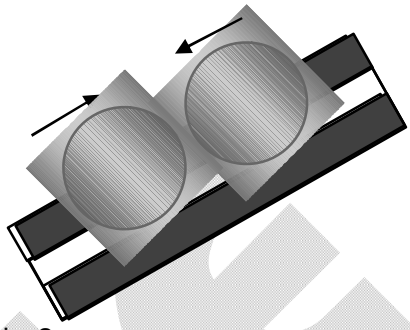
2. A solid metal cylinder is rotating with angular velocity ω about its axis. The cylinder is in uniform magnetic field B parallel to axis. For this situation mark the correct statement(s). (e = magnitude of charge on electron and m = mass of electron)
(A) The nature of net charge inside cylinder does not depend on angular velocity
(B) Electric field inside cylinder is proportional. to square of radial distance from axis of rotation
(C) The charge density inside cylinder is independent of radial distance r.
(D) For value of angular velocity $\omega = \frac{eB}{m}$, electric field inside cylinder is zero.

3. A charge particle of unit specific charge moves with velocity $\vec{v} = \left(6\hat{i} - 8\hat{k}\right)m/s$ in uniform m magnetic field $\vec{B} = 2\hat{j}T$. Choose the correct option(s)
(A) The path of particle may be $x^2 + z^2 - 2z = 24$
(B) The path of particle may be $x^2 + y^2 = 25$
(C) The path of particle may be $x^2 + z^2 = 25$
(D) The time period of particle will be 3.14 sec.

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.*

4. Two identical billiard balls moving with a speed of 3 ms^{-1}, roll, without slipping. towards each other on a horizontal rectangular U-shaped trough that is sufficiently deep that the balls are clear of its base (see figure). The resulting instantaneous collision is perfectly elastic, and during it, each ball reverses its linear velocity, though their angular velocity are not affected. R is radius of ball. Assume length of U-shape is sufficiently large.



How wide does the trough need to be for the balls to collide twice?

(A) Width $> \sqrt{\frac{3}{5}}R$ (B) Width $> 2\sqrt{\frac{3}{5}}R$

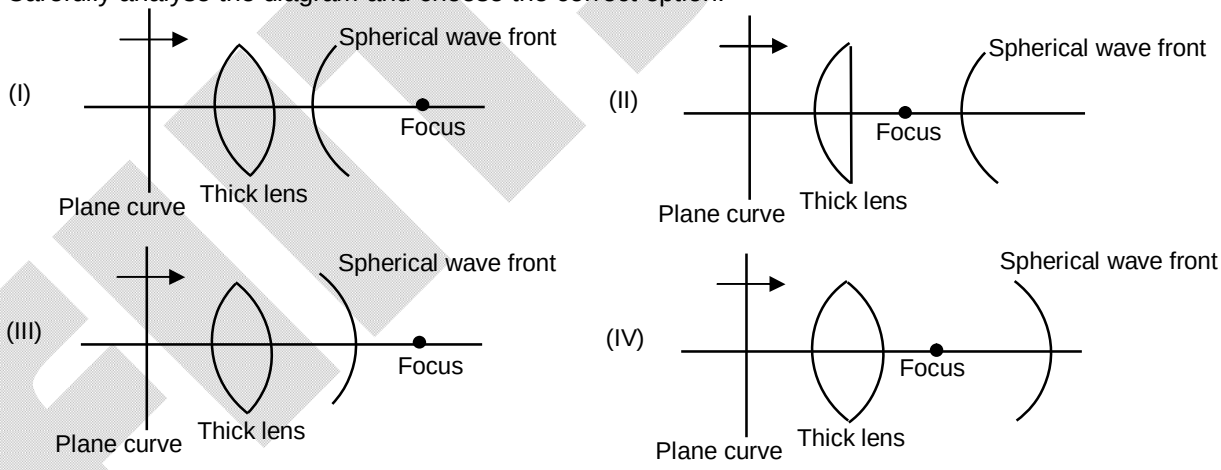
(C) Width $> \sqrt{\frac{2}{5}}R$ (D) Width $> 2\sqrt{\frac{2}{5}}R$

5. The amount of heat generated by 1.00 mg of a P_0^{210} preparation during the mean lifetime period of these nuclei if the kinetic energy of emitted alpha particle is 5.3 MeV and practically all daughter nuclei are formed directly in the ground state.

(A) 3.08×10^{10} J (B) 1.54×10^{6} J

(C) 3.08×10^{-6} J (D) 1.54×10^{10} J

6. Carefully analyse the diagram and choose the correct option:



(A) I and II are true (B) I and III are true

(C) I and IV are true (D) II and IV are true

7. ISRO desired to put as many satellites as possible in the circular orbits around the earth in equatorial plane of earth without interaction between any two satellites. The interaction between satellites can be neglected if separation between two successive orbits $\Delta r = r_n - r_{n-1} \geq 5R$ and maximum number of satellites in a particular orbit of radius r = NR can be 2N without any interaction.

The range of time periods (T) of satellites should be $512\pi \times 10^2 \text{ sec} \leq T \leq 4096\pi \times 10^2 \text{ sec}$. R = 6400 km (the radius of earth) and GM = 4×10^{14} SI units where M is mass of earth and G is universal gravitational constant. The maximum number of satellites that can be put in all possible orbits without interaction between any two satellites is.

(A) 350 (B) 80
(C) 180 (D) 250

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. Consider two radioactive nuclei A and B. Both convert into a stable nucleus C. Nucleus A converts into C after emitting two α particles and three β- particles. Nucleus B converts into C after emitting one α particle and five β- particles. At time t = 0, number of nuclei of A are $4N_o$ and that of B are N_o. In the conversion of A into C half life of A is 1 minute and that of B in conversion of B into C is 2 minute. Initially number of nuclei of C are zero, then match the following lists.

List - I		List - II	
(P)	The difference between atomic number of A and that of B is	(1)	6
(Q)	The difference between mass number of A and that of B is	(2)	4
(R)	If at an instant number of nuclei of A are equal to number of nuclei of B then at this instant the ratio between number of nuclei of C and number of nuclei of B is	(3)	18
(S)	The time t at which rate of disintegrations of A are equal to that of B in minutes is	(4)	2
		(5)	0.25

Codes:

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

9. The more general form of Bernoulli's equation for a compressible flow like that of a gas is given by $\frac{dp}{\rho} + vdv + gdh = 0,$ where the symbols have their usual meaning. A gas is flowing through a horizontal pipe at a temp of 27°C. The cross-sectional area of pipe at section-I is 0.2 m^2 and at section-II it is 0.05 m^2. The gauge pressures at section-I and II are 3×10^5 pa and 1×10^5 pa respectively. The gas constant $R_o\left(=\frac{R}{M}\right)$ = 290J/kg—° K and atmospheric pressure $P_o = 10^5$ pa. Take ln $2 = 0.7$ and $\sqrt{\frac{5800}{3}} = 44$. During the flow the gas undergoes isothermal process.

Match quantities of List-I with corresponding value (in SI unites) in List-II.

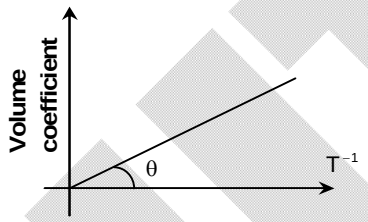
List - I		List - II	
(P)	The speed of gas at section-I in multiples of 11 (nearly)	(1)	2
(Q)	The speed of gas at section-II in multiples of 70 (nearly)	(2)	4
(R)	The ratio of densities of gas at section-I to section-II is	(3)	5
(S)	The mass flow rate of gas in the pipe in multiple of 40 (nearly)	(4)	10
		(5)	1

Codes:

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

10. A monatomic ideal gas of 2 moles was found to be undergoing a thermodynamic poly-tropic process whose volume coefficient is varying with temperature as shown. $\left(\text{take } R = \frac{25}{3} \text{ J/mol/K}\right)$

Match List I with List II:



List - I		List - II	
(P)	Work done by gas in joules for every 1 K rise in temperature if $\tan\theta = 3$	(1)	$\frac{175}{6}$
(Q)	Internal energy rise of the gas is joules for every 1 K rise in temperature if $\tan\theta = 2$	(2)	25
(R)	Heat absorbed by the gas in joules for every 1 K rise in temperature if $\tan\theta = 1$	(3)	$\frac{125}{3}$
(S)	Molar Heat capacity of gas if $\tan\theta = 2$	(4)	50
		(5)	$\frac{175}{3}$

Codes:

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

11. A small metal sphere of radius r and density ρ falls freely under gravity through a h before entering a tank of viscous liquid of density σ and coefficient of viscosity η. After entering in liquid, the velocity of ball does not change. List-I indicate values of different physical quantities with n and List-II have values of n.

List - I		List - II	
(P)	The terminal velocity is proportional to r^n.	(1)	$\frac{3}{2}$
(Q)	The destine h is proportional to r^n.	(2)	3
(R)	The rate of production of heat inside liquid is proportional to r^n.	(3)	5
(S)	The ratio of weight of ball to viscous force may be n.	(4)	4
		(5)	2

Codes:

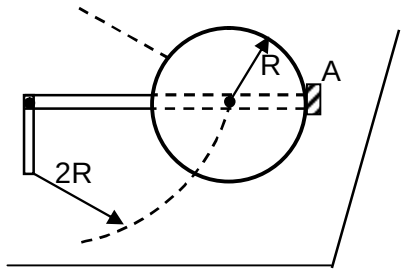
	P	Q	R	S
(A)	3	2	4	1
(B)	2	3	1	5
(C)	5	4	3	2
(D)	5	3	2	2

SECTION – B

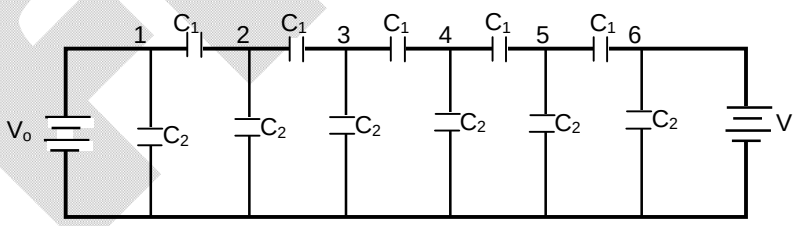
(Numerical Answer Type)

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

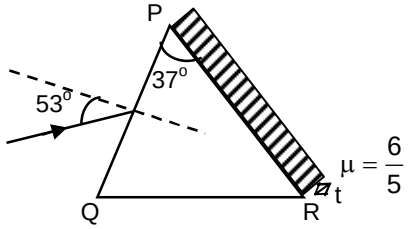
12. A uniform solid sphere of mass m and radius R rolls without sliding over a horizontal plane, rotating about horizontal axle OA as shown in figure. In the process, the centre of sphere moves with velocity v along a circle of radius '2R'. If kinetic energy of sphere is $\frac{n}{4}mv^2$. Find value of n.



13. In the circuit shown, ratio of capacitors is $C_2 / C_1 = 4/3$ and terminal voltage of the battery connected at the left end is V_o. If the terminal voltage of the battery connected at the right most end is in such a way that the potentials of nodes 1, 2, 3, 4, 5 and 6 are in a geometric progression, of forms $V_o x^y$, then the value of |x| + |y| is:
(Note: x & y are integers)



14. A light of wavelength $\lambda = 4800\,\text{Å}$ is incident on face PQ of prism of prism angle 37^o at an angle of incidence 53^o. On face PR of prism a coating of transparent material of $\mu = \frac{6}{5}$ is done. Refractive index of material of prism is 4/3. The minimum thickness of the film coating for which emerging light will have minimum intensity is $\frac{n}{5}\,\mu m$. The value of n is

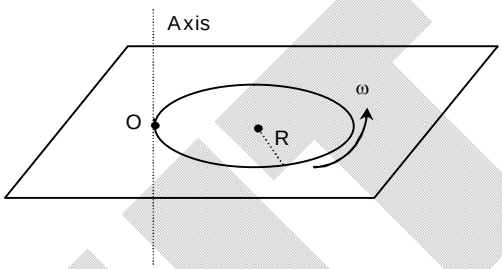


15. The binding energies per nucleon for a deuteron and an a-particle are 1.1 MeV and 7.1 MeV respectively. The energy released in the reaction $_1H^2 + {}_1H^2 \rightarrow {}_2He^4$ is Q. Then find value of $\frac{Q}{3}$ in MeV.

16. A long solenoid of n number of turns per unit length is in the form of a spring of fix cross-sectional area A and spring constant K. When a current of I amperes is passed through this solenoid (of zero resistance) then change in length of this spring is equal to $\frac{\mu_o n^2 l^2 A}{pK}$. Find value of p?

(Assuming change in length of solenoid is much smaller than original length of solenoid)

17. Suppose a uniform steel ring (mass M and radius R) is kept on a smooth horizontal surface with its plane horizontal. It is hinged about a point O on the perimeter and is made to rotate in a horizontal plane as shown:



The angular speed ω is kept constant. As a result of rotation, the whole ring comes under tensile stress. Assuming the cross-sectional area of steel used to be a_o, the difference in tensile stress (absolute value) at location O and at the location farthest from O is $\frac{nMR\omega^2}{22a_0}$. Find n $\left(\text{use } \pi = \frac{22}{7}\right)$.

Chemistry

PART – II

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).*

18. Which of the following radical(s) decolourise $KMnO_4$ without evolving any gas?
(A) SO_4^{2-} (B) Sn^{2+}
(C) SO_3^{2-} (D) Ag^{+}

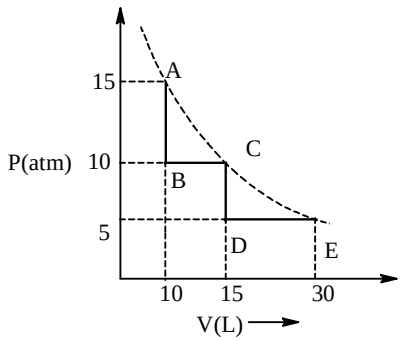
19. In ethane, the staggered conformation is more stable than eclipsed conformation. This is mainly due to:
(A) Steric hindrance between two H-atoms in eclipsed conformation
(B) The electrons in C–H bonds repels each other and this repulsion is maximum in eclipsed conformation
(C) Stabilizing interaction between C–H σ bonding orbital on one carbon atom and the C–H σ^* anti bonding orbital on the other carbon atom is maximum in staggered conformation
(D) All the three

20. An alkene on reductive ozonolysis yields only ethanal. The other isomer(s) of this alkene which on reductive ozonolysis may give
(A) propanal (B) methanal
(C) propanone (D) isopropanal

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.*

21. An ideal gas has been expanded irreversibly from state A to state E by the path $A \rightarrow B \rightarrow C \rightarrow D \rightarrow E$ (curve ACE is an isotherm). Which of the following is incorrect statement for the above process?
(A) work done = –125 ltr-atm
(B) heat absorbed = 125 ltr-atm
(C) $\Delta U = 0$
(D) $\Delta U < 0$



22. Specific conductance of saturated solution of AgCl is $2.68\times10^{-4}\,Sm^{-1}$ and that of water is $0.86\times10^{-4}\ Sm^{-1}$ at 298 K. Calculate the solubility product in mol/dm^3 unit if λ_m^o for HNO_3, $AgNO_3$ and HCl are $421\times10^{-4}Sm^2mol^{-1}, 133\times10^{-4}Sm^2mol^{-1}, 426\times10^{-4}Sm^2mol^{-1}$ respectively.
(A) 1.74×10^{-10} (B) 1.32×10^{-5}
(C) 1.32×10^{-2} (D) 1.74×10^{-4}

23. A monohydric alcohol (A) with M.W. 116 g, gives yellow ppt. with $NaOH/I_2$. On treatment with alc. KOH it gives an alkene (B) as a major product. Alkene (B) on reductive ozonolysis produces two compounds (C) and (D). The (D) with higher number of carbon atoms can undergo disproportionation reaction with conc. caustic potash. Which of the following statement is correct about above reaction sequence?
(A) Alcohol (A) can not have a quaternary carbon atom in it.
(B) Compound (D) will certainly contain five carbon atoms in it.
(C) Alcohol (A) may be secondary or tertiary.
(D) If alkene (B) undergoes HBr addition either in presence or absence of peroxide, results in same product.

24. The IUPAC name of the co-ordination compound

$[Fe(en)_2(H_2O)_2]\ [Fe(Ox)_2(CN)_2]$ where Ox = $\begin{matrix} COO^- \\ | \\ COO^- \end{matrix}$

is
(A) Diaquabis-(ethane-1,2-diammine)-iron(0)dicyanidobis-(oxalato)ferrate(III)
(B) Bis-(ethane-1,2-diammine)-diaquairon(III)dicyanidodioxalatoiron(III)
(C) Diaquabis-(ethane-1,2-diammine)-iron(III)dicyanidodioxalatoferrate(III)
(D) None of these

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.*

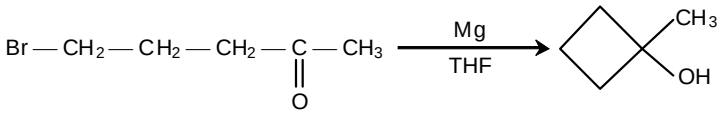
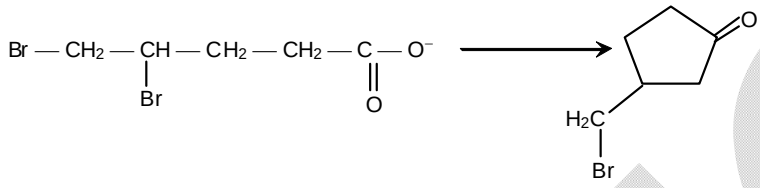
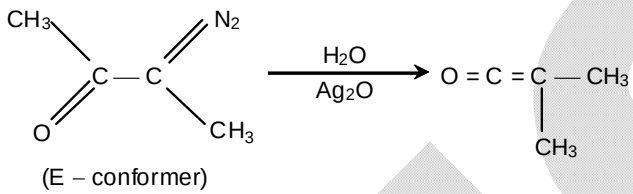
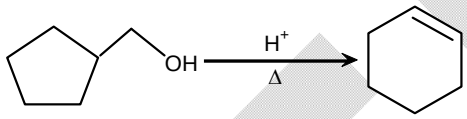
25. Match List – I with List – II:

List - I		List - II	
(P)	Borax	(1)	gives yellow precipitate with cobaltinitrite solution
(Q)	Potash Alum	(2)	sp^2 hybridized boron atom
(R)	Borazon	(3)	Structure Similar to graphite
(S)	Borazole	(4)	sp^3 hybridized boron atom
		(5)	Compound of a nonmetal

Codes:

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

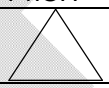
26. Match List – I with List – II:

List - I		List - II	
(P)		(1)	ΔS is controlling factor ΔH
(Q)		(2)	ΔH is controlling factor
(R)	 (E – conformer)	(3)	Kinetically controlled
(S)		(4)	Product is cyclic
		(5)	Randomness decreases Impossible reaction

Codes:

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

27. Match List – I with List – II:

List - I		List - II	
(P)	$CF_2 = CF_2 + HF \rightarrow$	(1)	Free radical addition
(Q)	$PhCH = CH_2 + Br_2 \rightarrow$	(2)	No reaction
(R)	 $+HBr \longrightarrow$	(3)	Nucleophilic addition
(S)	$(NC)_2C = CHCN + NH_3 \rightarrow$	(4)	Electrophilic addition
		(5)	Nucleophilic substitution

Codes:

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

28. Match List – I with List – II:

List - I		List - II	
(P)	$Bi^{3+} \rightarrow (BiO)^{+}$	(1)	Heat
(Q)	$[AlO_2]^{-} \rightarrow Al(OH)_3$	(2)	Hydrolysis
(R)	$SiO_4^{4-} \longrightarrow Si_2O_7^{6-}$	(3)	Acidification
(S)	$\left(B_4O_7^{2-}\right) \rightarrow \left[B(OH)_3\right]$	(4)	Dilution by water
		(5)	Decomposition

Codes:

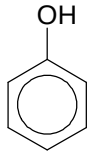
	P	Q	R	S
(A)	2, 4	2	3	2, 3
(B)	2, 1	3	2	1, 3
(C)	1, 4	5	3	1, 2
(D)	4	1, 2	5	5, 3

SECTION – B

(Numerical Answer Type)

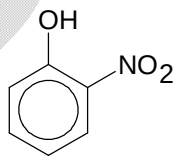
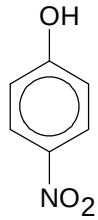
*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

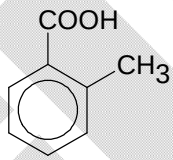
29. Among the various acid pairs, in how many pairs former acid is having more stable conjugate base than later one?

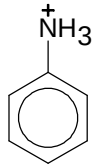
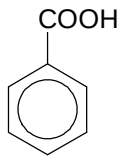
(i)  and CH_3COOH

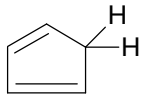
(ii) CF_3COOH and CH_3COOH

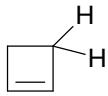
(iii) $CH_2 = CH - COOH$ and $CH \equiv C - COOH$

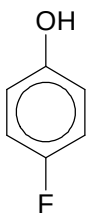
(iv)  and 

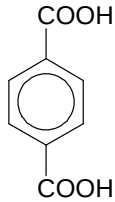
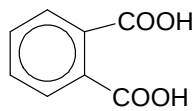
(v)  and

(vi)  and 

(vii) and 

(viii) and 

(ix) and 

(x)  and 

30. A mono alkene C_6H_{12} (A) undergo oxidative ozonolysis gives two acids (B) and (C). Neither (B) nor (C) contains more than four carbons. How many possible pairs can be there for (B) and (C).

31. A 19.6 g of a given gaseous sample contains 2.8 g of molecules, whose density is 0.75 g/litre, 11.2 gm of molecules, whose density is 3g/litre and 5.6 gm of molecules, whose density is 1.5 g/litre. All the density measurements are made at N.T.P. Calculate the total number of molecules (N) present in the given sample. Report your answer in "10^{-23} N".
Assume Avogadro's number as 6×10^{23}.

32. How many of the following terms are directly associated with Pb(lead)?
Pattinson's process, Sindoor, Calcium plumbate, Cinnabar, Solder, Bronze, Wolframite, Liquation, Self reduction.

33. How many of the following cations belongs to group IIA, III, IV and V only?
Hg_2^{2+}, Pb^{2+}, Sb^{3+}, Mg^{2+}, As^{3+}, Cu^{2+}, Cr^{3+}, Zn^{2+}, Sn^{2+}

34. Find the number of moles of phenyl hydrazine requires to convert one mole of glucose into osazone.

Mathematics

PART – III

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).*

35. Suppose $I_1 = \int_0^{\pi/2} \cos\left(\pi \sin^2 x\right)dx, I_2 = \int_0^{\pi/2} \cos\left(2\pi \sin^2 x\right)dx, I_3 = \int_0^{\pi/2} \cos\left(\pi \sin x\right)dx$, then

(A) $I_1 = 0$ (B) $I_1 + I_3 = 0$

(C) $I_1 + I_2 + I_3 = 0$ (D) $I_2 = I_3$

36. The equations of line(s) through (2, 3) from which the circle $x^2 + y^2 = 25$ intercept a chord of length 8 unit is/are?

(A) x = 2 (B) y = 3

(C) 9x + 11y – 51 = 0 (D) 12x + 5y – 39 = 0

37. If $y = \log_7\left(\log_7 x\right)$, then $\frac{dy}{dx}$ equal

(A) $\frac{\log_7 e}{x \log_e x}$ (B) $\frac{1}{x \log_e x \log_e 7}$

(C) $\frac{1}{\log_e (7x)^x}$ (D) $\frac{\log_7 e \cdot \log_x e}{x}$

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.*

38. The length of focal chord AB of ellipse $\frac{x^2}{4} + \frac{y^2}{3} = 1$ is $\left(\text{Given } A = \left(\frac{8}{5}, \frac{3\sqrt{3}}{5}\right)\right)$

(A) $\frac{4}{5}$ (B) $\frac{16}{5}$

(C) $\frac{32}{5}$ (D) $\frac{64}{5}$

39. If $2x - y + 1 = 0$ is a tangent on the parabola which intersect its directrix at (1, 3) and focus is (2, 1), then equation of axis of parabola is

(A) 11x – 2y = 24 (B) 11x + 2y + 24 = 0

(C) 2x – 11y – 24 = 0 (D) 2y + 11x = 24

40. If vectors $\vec{a}, \vec{b}, \vec{c}$ are in space such that $\vec{a}.\vec{b} = \vec{b}.\vec{c} = \vec{c}.\vec{a} = \frac{1}{2}$, then $\left(\vec{a} \times \vec{b}\right) \cdot \left(\vec{a} \times \left(\vec{b} \times \vec{c}\right)\right)$ is equal to

(A) $\frac{1}{\sqrt{2}}$ (B) $-\frac{1}{\sqrt{2}}$

(C) $\frac{1}{2\sqrt{2}}$ (D) $-\frac{1}{2\sqrt{2}}$

41. How many matrices X (3 × 3) with entries (0, 1, 2) are there for which sum of diagonal entries of XX' is 7?

(A) 560 (B) 562
(C) 504 (D) 540

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. Let N be the number of words which can be formed using all the letters of the word 'DARJEELING' so that there are atleast two consonants between any two vowels.

List - I		List - II	
(P)	If N is divisible by $2^n (n \in N)$, then n can be	(1)	1
(Q)	If N is divisible by $6^p (p \in N)$, then p must be less than	(2)	2
(R)	Number of odd divisors of N is greater than	(3)	3
(S)	Number of zeroes at the end of N is less than	(4)	4
		(5)	5

Codes:

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

43. Consider a system of linear equation $3x + y - z = 0$, $x - \frac{py}{4} + z = 2$ and $2x - y + 2z = q$ where $p, q \in I$ and $p, q \in [1, 10]$, then identify the correct statement(s).

List - I		List - II	
(P)	Number of ordered pairs (p, q) for which system of equation has unique solution	(1)	1
(Q)	Number of ordered pairs (p, q) for which system of equation has no solution is	(2)	9
(R)	Number of ordered pairs (p, q) for which system of equation has infinite solutions is	(3)	10
(S)	Number of ordered pairs (p, q) for which system of equation has atleast one solution	(4)	90
		(5)	91

Codes:

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

44. Match List – I with List – II:

List - I		List - II	
(P)	If $g:[1, 3]\to[1, 3]$ is a continuous decreasing function, then $\int_1^3\left(g(x)-g^{-1}(x)\right)dx$ is equal to	(1)	0
(Q)	If $f(x)=\frac{5-\cos 3x}{3+\cos 5x}$, then maximum value of $f(x)$ is	(2)	1
(R)	Let $f:R\to R$ be a function defined by $f(x)=x^3+px^2+qx-3$. If f is monotonic decreasing in the interval (1, 3) only, then $(p+q)$ is equal to	(3)	2
(S)	If $\lim\limits_{n\to\infty}\sum\limits_{r=1}^{n}\frac{n}{(n+r)(2n+r)}=\ln\left(\frac{a}{b}\right)$, where a and b are co-prime, then $\lvert a-b\rvert$ is equal to	(4)	3
		(5)	8

Codes:

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

45. Consider the hyperbola $\frac{x^2}{9}-\frac{y^2}{25}=1$ to match the List I with the List II.

List - I		List - II	
(P)	Line $y=2x+\sqrt{11}$ is	(1)	Focal chord of hyperbola
(Q)	Line $5x-3y=0$ is	(2)	Tangent to hyperbola
(R)	Line $2y=x-\frac{68}{\sqrt{11}}$ is	(3)	Asymptote to hyperbola
(S)	Line $y=x-\sqrt{34}$ is	(4)	Normal to hyperbola
		(5)	None of the above

Codes:

	P	Q	R	S
(A)	4	3	1	2
(B)	4	5	3	2
(C)	1	3	4	5
(D)	3	2	1	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**.*

46. If $f(x)=\left\{b^2+(a-1)b+2\right\}x-\int\left(\sin^2 x+\cos^4 x\right)dx$ be an increasing function of $x\in R$ and $b\in R$, then sum of all possible integral values of a is

47. If $I=\int_1^2 \frac{x^3-3x^2}{\ln(x-1)}dx$ and $J=\int_2^3 \frac{(3x-5)}{\ln(x-2)}dx$, then e^{I+J} equals_____.

48. Position vector of a point A is $\left(a\hat{i}+b\hat{j}+c\hat{k}\right)$ and $a^2+b^2+c^2=4$; and position vector of another point B is $\left(p\hat{i}+q\hat{j}+r\hat{k}\right)$ and $p^2+q^2+r^2=9$. Given $\angle AOB=2\cos^{-1}\frac{1}{5}$, where O is origin. If AQ is perpendicular to angle bisector of $\angle AOB$ i.e. line OQD where D lies on AB, then value of $25|QD|=?$

49. If $\frac{3x^2+1}{\sqrt{x^4+x^2}}\geq f(x)$, where f(x) is a constant function in $0<x\leq\sqrt{2}$, then minimum value of $\int_0^{\sqrt{2}} \frac{(3x^2+1)dx}{\sqrt{x^4+x^2}}$ is_____.

50. If $|adj(adj(adja))|=|adj(A)|^4$, then number of entries in diagonal of A is_____.

51. If AB = BA = I such that $a=\left[a_{ij}\right]_{2\times2}, B=\left[b_{ij}\right]_{2\times2}$, $a_{ij}=b_{ij}, a_{12}=-b_{12}, a_{21}=-b_{21}$ and a_{ij} are co-prime natural numbers, then $|a_{21}-a_{12}|$ = _____.