

JEE Main – 2025

28th JANUARY 2025 (Morning Shift)

General Instructions

- 1. The test is of **3 hours** duration and the maximum marks is **300**.
- The question paper consists of 3 Subjects (Subject I: Mathematics, Subject II: Physics, Subject III: Chemistry).
 Each Part has two sections (Section 1 & Section 2).
- **3.** Section 1 contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.
- **4. Section 2** contains **5 Numerical Value Type Questions**. The answer to each question is an **integer** ranging from 0 to 999.
- 5. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.
- 6. On completion of the test, the candidate must hand over the Answer Sheet to the **Invigilator** on duty in the Room/Hall. **However, the candidates are allowed to take away this Test Booklet with them**.

Marking Scheme

- **1. Section 1:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.
- 2. Section 2: +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.

SUBJECT I: MATHEMATICS

MARKS: 100

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SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

1.
$$\cos\left(\sin^{-1}\frac{3}{5} + \sin^{-1}\frac{5}{13} + \sin^{-1}\frac{33}{65}\right)$$
 is equal to:
(1) 1 (2) $\frac{32}{65}$ (3) $\frac{33}{65}$ (4) 0
2. Let $f: R \to R$ be a function defined by $f(x) = (2 + 3a)x^2 + \left(\frac{a+2}{a-1}\right)x + b, a \neq 1$.
If $f(x + y) = f(x) + f(y) + 1 - \frac{2}{7}xy$, then the value of $28\sum_{i=1}^{5}|f(i)|$ is:
(1) 715 (2) 675 (3) 735 (4) 545
3. Let for some function $y = f(x), \int_{0}^{x} (f(t)dt = x^2f(x), x > 0 \text{ and } f(2) = 3$. Then $f(6)$ is equal to:
(1) 2 (2) 3 (3) 1 (4) 6
4. The sum, of the squares of all the roots of the equation $x^2 + |2x - 3| - 4 = 0$, is:
(1) $6(3 - \sqrt{2})$ (2) $3(2 - \sqrt{2})$ (3) $6(2 - \sqrt{2})$ (4) $3(3 - \sqrt{2})$
5. The number of different 5-digit numbers greater than 50000 that can be formed using the digits 0, 1, 2, 3, 4, 5, 6, 7, such that the sum of their first and last digit should not be more than 8, is:
(1) 5719 (2) 4608 (3) 5720 (4) 4607
6. Let the equation of the circle, which touches x-axis at the point (a, 0), $a > 0$ and cuts off an intercept of length b on y-axis be $x^2 + y^2 - ax + \beta y + \gamma = 0$. If the circle les below x-axis, the ordered pair $(2a, b^2)$ is equal to:
(1) $(a, \beta^2 + 4\gamma)$ (2) $(r, \beta^2 - 4a)$ (3) $(r, \beta^2 + 4a)$ (4) $(a, \beta^2 - 4\gamma)$
7. Let $< a_n >$ be a sequence such that $a_0 = 0, a_1 = \frac{1}{2}$ and $2a_{n+2} = 5a_{n+1} - 3a_n, n = 0, 1, 2, 3,$
Then $\sum_{k=1}^{10} a_k$ is equal to:
(1) $3a_{100} - 100$ (2) $3a_{90} - 100$ (3) $3a_{100} + 100$ (4) $3a_{90} + 100$
8. The number k_1 and k_2 are randomly chosen from the set of natural numbers. Then, the probability that the value of $t^{k_1} + t^{k_1}$, $(i = \sqrt{-1})$ is non-zero, equals:
(1) $\frac{1}{2}$ (2) $\frac{3}{4}$ (3) $\frac{1}{4}$ (4) $\frac{2}{3}$

9. The relation $R = \{(x, y) : x, y \in z \text{ and } x + y \text{ is even}\}$ is: symmetric and transitive but not reflexive (1)(2) an equivalence relation (3) reflexive and transitive but not symmetric (4) reflexive and symmetric but not transitive 10. Let A(x, y, z) be a point in xy-plane, which is equidistant from three points (0, 3, 2), (2, 0, 3) and (0, 0, 1). Let B = (1, 4, -1) and C = (2, 0, -2). Then among the statements: (S1): $\triangle ABC$ is an isosceles right angled triangle, and (S2): the area of $\triangle ABC$ is $\frac{9\sqrt{2}}{2}$, (1) only (S2) is true (2) both are true (3) only (S1) is true (4) both are false 11. Let ${}^{n}C_{r-1} = 28$, ${}^{n}C_{r} = 56$ and ${}^{n}C_{r+1} = 70$. Let $A(4\cos t, 4\sin t)$, $B(2\sin t, -2\cos t)$ and $C(3r - n, r^2 - n - 1)$ be the vertices of a triangle ABC, where *t* is a parameter. If $(3x-1)^2 + (3y)^2 = \alpha$, is the locus of the centroid of triangle *ABC*, then α equals: (3) (1) (2) 20 8 (4) Let O be the origin, the point A be $z_1 = \sqrt{3} + 2\sqrt{2i}$, the point $B(z_2)$ be such that $\sqrt{3} |z_2| = |z_1|$ and 12. $\arg(z_2) = \arg(z_1) + \frac{\pi}{6}$. Then: (1) ABO is a scalene triangle ABO is an obtuse angled isosceles triangle (2) (4) area of triangle ABO is $\frac{11}{\sqrt{3}}$ area of triangle ABO is $\frac{11}{4}$ (3) Let T_r be the r^{th} term A.P. If for some, $m, T_m = \frac{1}{25}, T_{25} = \frac{1}{20}$ and $20\sum_{r=1}^{25} T_r = 13$, then $5m\sum_{r=m}^{2m} T_r$ is 13. equal to: (1) 98 (2) 126 (3) 112 (4) 142 14. Three defective oranges are accidently mixed with seven good ones and on looking at them, it is not possible to differentiate between them. Two oranges are drawn at random from the lot. If x denote the number of defective oranges, then the variance of *x* is: 2614 $\frac{18}{25}$ (2) (3) (4) (1) 25 75 Let ABCD be a trapezium whose vertices lie on the parabola $y^2 = 4x$. Let the sides AD and BC of the 15. trapezium be parallel to y-axis. If the diagonal AC is of length $\frac{25}{4}$ and it passes through the point (1, 0), then the area of ABCD is: (2) $\frac{125}{8}$ (3) $\frac{75}{8}$ (4) (1) If $f(x) = \frac{2^x}{2^x + \sqrt{2}}$, $x \in R$, then $\sum_{k=1}^{81} f\left(\frac{k}{82}\right)$ is equal to: 16. 81 $81\sqrt{2}$ (3) (1) 41 (2) 82 (4)

17.	If the ir	nage of the poin	t (4, 4, 3) in the line $\frac{x-1}{2}$	$\frac{1}{1} = \frac{y-2}{1}$	$-=rac{z-1}{3}$ is (α , β ,	γ), then	$\alpha + \beta + \gamma$ is equal to:
	(1)	9	(2)	7	(3)	8	(4)	12
18.	The are	ea (in sq. units) o	of the reg	gion $\{(x, y) : 0 \le y\}$	$y \leq 2 \mid x \mid$	+1, $0 \le y \le x^2 + 1$	$I, x \leq 3$	3} is:
	(1)	$\frac{17}{3}$	(2)	$\frac{80}{3}$	(3)	$\frac{32}{3}$	(4)	$\frac{64}{3}$
19.	The sur	m of all local mir	nimum v	alues of the fund	ction f(x	$x) = \begin{cases} 1 - 2x \\ \frac{1}{3}(7 + 2 \mid x) \\ \frac{11}{18}(x - 4)(x) \end{cases}$, :) , - - 5) ,	x < -1 -1 \le x \le 2 is: x > 2
	(1)	$\frac{167}{72}$	(2)	$\frac{131}{72}$	(3)	$\frac{157}{72}$	(4)	$\frac{171}{72}$
20.	If $\int_{-\pi/2}^{\pi/2} \frac{q}{r}$	$\frac{96x^2\cos^2 x}{(1+e^x)}dx =$	$\pi(\alpha\pi^2 +$	β), α , $\beta \in \mathbb{Z}$, then	$(\alpha + \beta)^2$	equals:		
	(1)	64	(2)	144	(3)	196	(4)	100

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SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

21. $f(x) = \begin{cases} 3x & , x < 0\\ \min\{1 + x + [x], x + 2[x]\} & , 0 \le x \le 2 \text{ where [.] denotes greatest integer function. If } \alpha \text{ and } \beta \text{ are } 5 & , x > 2 \end{cases}$

the number of points, where *f* is not continuous and is not differentiable, respectively, then $\alpha + \beta$ equals_____.

- 22. If $\alpha = 1 + \sum_{r=1}^{6} (-3)^{r-1} {}^{12}C_{2r-1}$, then the distance of the point $(12, \sqrt{3})$ from the line $\alpha x \sqrt{3}y + 1 = 0$ is_____.
- **23.** Let *M* denotes the set of all real matrices of order 3×3 and let $S = \{-3, -2, -1, 1, 2\}$. Let $S_1 = \{A = [a_{ij}] \in M : A = A^T \text{ and } a_{ij} \in S, \forall i, j\}, S_2 = \{A = [a_{ij}] \in M : A - A^T \text{ and } a_{ij} \in S, \forall i, j\}, S_3 = \{A = [a_{ij}] \in M : a_{11} + a_{22} + a_{33} = 0 \text{ and } a_{ij} \in S, \forall i, j\}.$ If $n(S_1 \cup S_2 \cup S_3) = 125\alpha$, then α equals _____.
- **24.** Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{d} = \vec{a} \times \vec{b}$. If \vec{c} is a vector such that $\vec{a} \cdot \vec{c} = |\vec{c}|$, $|\vec{c} 2\vec{a}|^2 = 8$ and the angle between \vec{d} and \vec{c} is $\frac{\pi}{4}$, then $|10 3\vec{b} \cdot \vec{c}| + |\vec{d} \times \vec{c}|^2$ is equal to _____.
- **25.** Let $E_1: \frac{x^2}{9} + \frac{y^2}{4} = 1$ be an ellipse. Ellipses E_i 's are constructed such that their centres and eccentricities are same as that of E_1 , and the length of minor axis of E_i is the length of major axis of

$$E_{i+1}$$
 $(i \ge 1)$. If A_i is the area of the ellipse E_i , then $\frac{5}{\pi} \left(\sum_{i=1}^{\infty} A_i \right)$, is equal to _____

SUBJECT II: PHYSICS

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

26. Which of the following circuits has the same outpur as that of the given circuit?



27. A hemispherical vessel is completely filled with a liquid of refractive index μ . A small coin is kept at the lowest point (O) of the vessel as shown in figure. The minimum value of the refractive index of the liquid so that a person can see the coin from point *E* (at the level of the vessel) is _____.



28. Consider a long thin conducting wire carrying a uniform current *I*. A particle having mass "*M*" and charge "*q*" is released at a distance "*a*" from the wire with a speed v_0 along the direction of current in the wire. The particle gets attracted to the wire due to magnetic force. The particle turns round when it is at distance *x* from the wire. The value of *x* is: [μ_0 is vacuum permeability]

(1)
$$\frac{a}{2}$$
 (2) $a\left[1-\frac{mv_0}{a\mu_0 I}\right]$ (3) $ae^{-\frac{4\pi mv_0}{q\mu_0 I}}$ (4) $a\left[1-\frac{mv_0}{2q\mu_0 I}\right]$

29. Three infinitely long wires with linear charge density λ are placed along the *x*-axis, *y*-axis and *z*-axis respectively. Which of the following denotes an equipotential surface?

(1)
$$xyz = \text{constant}$$
 (2) $(x^2 + y^2)(y^2 + z^2)(z^2 + x^2) = \text{constant}$

(3)
$$xy + yz + zx = \text{constant}$$
 (4) $(x + y)(y + z)(z - x) = \text{constant}$





31. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A : In a central force field, the work done is independent of the path chosen.
Reason R : Every force encountered in mechanics does not have an associated potential energy.
In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both **A** and **R** are true and **R** is the correct explanation of **A**
- (2) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**
- (3) **A** is true but **R** is false
- (4) **A** is false but **R** is true
- **32.** A wire of resistance *R* is bent into an equilateral triangle and an identical wire is bent into *a* square. The ratio of resistance between the two end points of an edge of the triangle to that of the square is:

	27	8	9	32
(1)	32	(2) <u>-</u>	(3) —	(4) ${27}$
	02	0	0	21

- **33.** In the experiment for measurement of viscosity ' η ' of given liquid with a ball having radius *R*, consider following statements.
 - **A.** Graph between terminal velocity *V* and *R* will be a parabola.
 - **B.** The terminal velocities of different diameter balls are constant for a given liquid.
 - **C.** Measurement of terminal velocity is dependent on the temperature.
 - **D.** This experiment can be utilized to assess the density of a given liquid.
 - $\textbf{E.} \qquad \ \ If balls are dropped with some initial speed, the value of η will change.$

Choose the correct answer from the options given below:

- (1) A, B and E Only (2) A, C and D Only
- (3) B, D and E Only (4) C, D and E Only

34. A bead of mass '*m*' slides without friction on the wall of a vertical circular hoop of radius '*R*' as shown in figure. The bead moves under the combined action of gravity and a massless spring (*k*) attached to the bottom of the hoop. The equilibrium length of the spring is '*R*'. If the bead is released from top of the hoop with (negligible) zero initial speed, velocity of bead, when the length of spring becomes '*R*', would be (spring constant is '*k*', *g* is acceleration due to gravity)



- **35.** A Carnot engine (*E*) is working between two temperatures 473 *K* and 273 *K*. In a new system two engines engine E_1 works between 473 *K* to 373 *K* and engine E_2 works between 373 *K* to 273 *K*. If η_{12} , η_1 and η_2 are the efficiencies of the engines *E*, E_1 and E_2 , respectively, then:
 - $(1) \qquad \eta_{12} \geq \eta_1 + \eta_2 \qquad (2) \qquad \eta_{12} < \eta_1 + \eta_2 \qquad (3) \qquad \eta_{12} = \eta_1 \eta_2 \qquad (4) \qquad \eta_{12} = \eta_1 + \eta_2$
- **36.** A particle of mass '*m*' and charge '*q*' is fastened to one end '*A*' of a massless string having equilibrium length l, whose other end is fixed at point '*O*'. The whole system is placed on a frictionless horizontal plane and is initially at rest. If uniform electric field is switched on along the direction as shown in figure, then the speed of the particle when it crosses the *x*-axis is:



- **37.** Consider following statements:
 - **A.** Surface tension arises due to extra energy of the molecules at the interior as compared to the molecules at the surface, of a liquid.
 - **B.** As the temperature of liquid rises, the coefficient of viscosity increases.
 - **C.** As the temperature of gas increases, the coefficient of viscosity increases.
 - **D.** The onset of turbulence is determined by Reynold's number.
 - **E.** In a steady flow two stream lines never intersect.
 - (1) A, D, E Only (2) A, B, C Only (3) B, C, D Only (4) C, D, E Only

38. Find the equivalent resistance between two ends of the following circuit:



39. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.Assertion A : A sound wave has higher speed in solids than gases.

Reason R : Gases have higher value of Bulk modulus than solids.

In the light of the above statements, choose the ${\bf correct}$ answer from the options given below:

- (1) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**
- (2) **A** is true but **R** is false
- (3) Both **A** and **R** are true and **R** is the correct explanation of **A**
- (4) **A** is false but **R** is true
- **40.** Due to presence of an em-wave whose electric component is given by $E = 100 \sin(\omega t kx)NC^{-1}$, a cylinder of length 200 *cm* holds certain amount of em-energy inside it. If another cylinder of same length but half diameter than previous one holds same amount of em-energy, the magnitude of the electric field of the corresponding em-wave should be modified as:

(1)
$$400\sin(\omega t - kx)NC^{-1}$$
 (2) $200\sin(\omega t - kx)NC^{-1}$

(3)
$$50\sin(\omega t - kx)NC^{-1}$$
 (4) $25\sin(\omega t - kx)NC^{-1}$

41. A thin prism P_1 with angle 4° made of glass having refractive index 1.54, is combined with another thin prism P_2 made of glass having refractive index 1.72 to get dispersion without deviation. The angle of the prism P_2 in degrees is:

(1)
$$\frac{16}{3}$$
 (2) 3 (3) 4 (4) 1.5

42. The center of mass of a thin rectangular plate (fig - *x*) with sides of length *a* and *b*, whose mass per unit area (σ) varies as $\sigma = \frac{\sigma_0 x}{ab}$ (where σ_0 is a constant), would be _____.



43. A proton of mass m_p' has same energy as that of a photon of wavelength ' λ '. If the proton is moving at non-relativistic speed, then ratio of its de Broglie wavelength to the wavelength of photon is:

(1)
$$\frac{1}{c}\sqrt{\frac{2E}{m_p}}$$
 (2) $\frac{1}{c}\sqrt{\frac{E}{m_p}}$ (3) $\frac{1}{c}\sqrt{\frac{E}{2m_p}}$ (4) $\frac{1}{2c}\sqrt{\frac{E}{m_p}}$

44. Choose the correct nuclear process from the below options:

[*p* : proton, *n* : neutron, e^- : electron, e^+ : positron, *v* : neutrino, \overline{v} : antineutrino]

- (1) $n \to p + e^+ + v$ (2) $n \to p + e^- + v$ (3) $n \to p + e^- + \overline{v}$ (4) $n \to p + e^+ + \overline{v}$
- **45.** Two capacitors C_1 and C_2 are connected in parallel to a battery. Charge-time graph is shown below for the two capacitors. The energy stored with them are U_1 and U_2 , respectively. Which of the given statements is true?



SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

- **46.** A tiny metallic rectangular sheet has length and breadth of 5 *mm* and 2.5 *mm*, respectively. Using a specially designed screw gauge which has pitch of 0.75 *mm* and 15 divisions in the circular scale, you are asked to find the area of the sheet. In this measurement, the maximum fractional error will be $\frac{x}{100}$ where *x* is _____.
- **47.** In a measurement, it is asked to find modulus of elasticity per unit torque applied on the system. The measured quantity has dimension of $[M^a L^b T^c]$. If b = 3, the value of *c* is _____.
- **48.** A double slit interference experiment performed with a light of wavelength 600 *nm* forms an interference fringe pattern on a screen with 10th bright fringe having its centre at a distance of 10 *mm* from the central maximum. Distance of the centre of the same 10th bright fringe from the central maximum when the source of light is replaced by another source of wavelength 660 *nm* would _____ be *mm*.
- **49.** Two iron solid discs of negligible thickness have radii R_1 and R_2 and moment of intertia I_1 and I_2 ,

respectively. For $R_2 = 2R_1$, the ratio of I_1 and I_2 would be $\frac{1}{x}$, where x =_____.

50. The moment of inertia of a solid disc rotating along its diameter is 2.5 times higher than the moment of inertia of a ring rotating in similar way. The moment of inertia of a solid sphere which has same radius as the disc and rotating in similar way, is *n* times higher than the moment of inertia of the given ring. Here, n =____.

Consider all the bodies have equal masses.

SUBJECT III: CHEMISTRY

52.

MARKS: 100

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

51. The metal ion whose electronic configuration is not affected by the nature of the ligand and which gives a violet colour in non-luminous flame under hot condition in borax bead test is:



Choose the **correct** answer from the options given below:

(1)	C and D Only	(2)	A, B and D Only
(3)	A and C Only	(4)	A and B Only

53. Consider 'n' is the number of lone pair of electrons present in the equatorial position of the most stable structure of ClF_3 . The ions from the following with 'n' number of unpaired electrons are:

А.	V^{3+}	В.	Ti ³⁺	С.	Cu^{2+}
D.	Ni^{2+}	E.	Ti^{2+}		

Choose the **correct** answers from the options given below:

- (1) A and C Only
 (2) B and D Only
 (3) A, D and E Only
 (4) B and C Only
- **54.** Given below are two statements:

Statement I: In the oxalic acid vs KMnO_4 (in the presence of dil. H_2SO_4) titration the solution needs to be heated initially to 60°C, but no heating is required in Ferrous ammonium sulphate (FAS) vs KMnO_4 titration (in the presence of dil. H_2SO_4).

Statement II: In oxalic acid vs KMnO_4 titration, the initial formation of MnSO_4 takes place at high temperature, which then acts as catalyst for further reaction. In the case of FAS vs KMnO_4 , heating oxidizes Fe^{2+} into Fe^{3+} by oxygen of air and error may be introduced in the experiment.

In the light of the above statements, choose the **correct** answer from the options given below:

- (1) Both Statement I and Statement II are false
- (2) Statement I is false but Statement II is true
- (3) Statement I is true but Statement II is false
- (4) Both Statement I and Statement II are true

55. The compounds that produce CO_2 with aqueous NaHCO₃ solution are:



Choose the **correct** answer from the options given below:

(1)	A, C and D Only	(2)	A and C Only
(3)	A and B Only	(4)	A, B and E Only

56. Given below are two statements:

Statement-I : Et > N - Ct, will undergo alkaline hydrolysis at a faster rate than Et - CH - Ct.

Statement-II : N_{Cl} , intramolecular substitution takes place first by involving lone pair of Et

electrons on nitrogen.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Statement I and Statement II are incorrect
- (2) Both Statement I and Statement II are correct
- (3) Statement I is incorrect but Statement II is correct
- (4) Statement I is correct but Statement II is incorrect
- **57.** A molecule ("P") on treatment with acid undergoes rearrangement and gives ("Q"). ("Q") on ozonolysis followed by reflux under alkaline condition gives ("R"). The structure of ("R") is given below:



58.	Given	below are two st	atement	s:					
	Stater	Statement-I: D-glucose pentaacetate reacts with 2, 4-dinitrophenylhydrazine.							
	Statement II : Starch, on heating with concentrated sulfuric acid at 100°C and 2-3 atmosphere							ere	
	pressu	ire produces glue	cose.						
	In the	light of the abov	e statem	ents, choose the	e correct	answer from the	options	s given below:	
	(1)	Both Statemer	nt I and S	Statement II are	false				
	(2)	Statement I is	true but	Statement II is	false				
	(3)	Statement I is	false bu	t Statement II is	true				
	(4)	Both Statemer	nt I and S	Statement II are	true				
59.	In a m	ultielectron ator	n, which	of the followin	g orbitals	described by th	ree qua	ntum numbers will ha	ave
	same e	energy in absenc	e of elec	tric and magnet	ic fields?				
	А.	$n = 1, \ \ell = 0, \ m_1 = 0$			В.	$n = 2, \ \ell = 0, \ m$	1 = 0		
	С.	$n = 2, \ \ell = 1, \ m$	1 = 1		D.	$n = 3, \ell = 2, m$	1 = 1		
	E. $n = 3, \ell = 2, m_1 = 0$								
	Choos	e the correct ans	swer fron	n the options giv	ven below	:			
	(1)	A and B Only	(2)	C and D Only	(3)	B and C Only	(4)	D and E Only	
60.	A weal	k acid HA has de	gree of c	lissociation x. W	hich opt	ion gives the corr	rect exp	ression of $(pH - pK_a)$	>
	(1)	$log\left(\frac{x}{1-x}\right)$	(2)	$\log(1+2x)$	(3)	$log\left(\frac{1-x}{x}\right)$	(4)	0	
61.	The in	correct decreasi	ng order	of atomic radii i	s:				
	1.	Si > P > Cl > F			2.	Be > Mg > Al >	Si		
	3.	Mg > Al > C > c	0		4.	Al > B > N > F			
62.	The pr	oducts A and B	in the fo	llowing reaction	s, respec	tively are:			
	$A \leftarrow A$	<u>ag-NO₂</u> CH ₂ -	$CH_0 - C$	H ₂ – Br <u>AgCN</u>	$\rightarrow B$				
	(1)	CH ₂ – CH ₂ – C	$H_0 - ON$	2 2	- CH ₂ – N	С			
	(2)	$CH_2 - CH_2 - CH_2$	$H_0 - NO$	$_{0}$, CH_{2} – CH_{3} –	$-CH_2 - N$	С			
	(3)	3) $CH_2 = CH_2 = CH_2 = CH_2 = CH_2 = CH_2 = CH_2$							
	(4)	$CH_2 - CH_2 - CH_2$	$H_0 - NO$	D_{0} , $CH_{0} - CH_{0} - CH_{0}$	- CH ₀ - C	N			
		3 2	2		2				
63.	The co	orrect order of sta	ability of	following carbo	cations is	S:			
	1	Ph F	°h	<u>~</u> п	- CU -	⊕ CU			
	Ph – C	C⊕ Ph-C	C⊕		-CH ₂ -	I			
	Ī	Ph I	H	\leq		CH ₃			
	A	А В	;	С	D				
	(1)	B > C > A > D	(2)	A > B > C > D	(3)	C > B > A > D	(4)	C > A > B > D	
64.	Both a	cetaldehyde and	l acetone	e (individually) u	indergo w	which of the follow	ving rea	actions?	
	А.	Iodoform Reac	tion	B. Cann	izaro Rea	ction C.	Aldol	Condensation	
	D.	Tollen's Test		E. Clem	nensen F	Reduction			
	Choos	e the correct an	swer from	m the options gi	ven belov	w:			
	(1)	A, B and D On	ıly		(2)	B, C and D On	ly		
	(3)	A, C and E On	ly		(4)	C and E Only			

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65. The molecules having square pyramidal geometry are:

(1)	$BrF_5 \& PCl_5$	(2)	SbF_2 & XeOF_4
(3)	BrF ₅ & XeOF ₄	(4)	SbF ₅ & PCl ₅

66. Match the List-I with List-II.

List-I (Redox Reaction)			List-II (Type of Redox Reaction)		
(A)	$\operatorname{CH}_4(g) + 2\operatorname{O}_2(g) \xrightarrow{\Delta} \operatorname{CO}_2(g) + 2\operatorname{H}_2\operatorname{O}(\ell)$	I.	Disproportionation reaction		
(B)	$2NaH(s) \xrightarrow{\Delta} 2Na(g) + H_2(g)$	п.	Combination reaction		
(C)	$V_2O_5(s) + 5Ca(s) \longrightarrow 2V(s) + 5CaO(s)$	III.	Decomposition reaction		
(D)	$2H_2O_2(aq) \xrightarrow{\Delta} 2H_2O(\ell) + O_2(g)$	IV.	Displacement reaction		

Choose the **correct** answer from the options given below:

(1)	A-II, B-III, C-I, D-IV	(2)	A-III, B-IV, C-I, D-II
(3)	A-II, B-III, C-IV, D-I	(4)	A-IV, B-I, C-II, D-III

- **67.** Ice and water are placed in a closed container at a pressure of 1 atm and temperature 273.15 K. If pressure of the system is increased 2 times, keeping temperature constant, then identify correct observation from following:
 - (1) Liquid phase disappears completely
 - (2) Volume of system increases
 - (3) The solid phase (ice) disappears completely
 - (4) The amount of ice decreases

68. What is the freezing point depression constant of a solvent, 50 g of which contain 1 g non-volatile solute (molar mass 256 g mol^{-1}) and the decrease in freezing point is 0.40 K?

- (1) $3.72 \text{ K kg mol}^{-1}$ (2) $4.43 \text{ K kg mol}^{-1}$
- (3) $1.86 \text{ K kg mol}^{-1}$ (4) $5.12 \text{ K kg mol}^{-1}$
- **69.** Which of the following oxidation reactions are carried out by both $K_2Cr_2O_7$ and $KMnO_4$ in acidic medium?

А.	$\mathrm{I}^- \to \mathrm{I}_2$	В.	$\mathrm{S}^{2-} \to \mathrm{S}$	С.	$\mathrm{Fe}^{2+} \rightarrow \mathrm{Fe}^{3+}$
D.	$\mathrm{I}^- \to \mathrm{IO}_3^-$	E.	$S_2O_3^{2-} \rightarrow SO_3^{2-}$	D_4^{2-}	

Choose the **correct** answer from the options given below:

(1)	B, C and D Only	(2)	A, D and E Only
(3)	C, D and E Only	(4)	A, B and C Only

70. Consider the following elements In, Tl, Al, Pb, Sn and Ge.The most stable oxidation states of elements with highest and lowest first ionisation enthalpies, respectively, are:

1. +2 and +3 **2.** +4 and +3 **3.** +1 and +4 **4.** +4 and +1

SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

71. Given below is the plot of the molar conductivity vs $\sqrt{\text{concentration}}$ for KCl in aqueous solution.



If, for the higher concentration of KCl solution, the resistance of the conductivity cell is 100Ω , then the resistance of the same cell with the dilute solution is 'x' Ω . The value of x is _____. (Nearest integer)

72. The molarity of a 70% (mass/mass) aqueous solution of a monobasic acid (X) is $___ \times 10^{-1}$ M. (Nearest integer)

[Given : Density of aqueous solution of (X) is 1.25 g mL^{-1} . Molar mass of the acid is 70 g mol⁻¹]

73. Quantitative analysis of an organic compound (X) shows following % composition.

C: 14.5% Cl: 64.46% H: 1.8%

(Empirical formula mass of the compound (X) is $___ \times 10^{-1}$)

[Given molar mass in g mol⁻¹ of C : 12, H : 1, O : 16, Cl : 35.5]

74. Consider the following sequence of reactions:



Chlorobenzene

11.25 mg of chlorobenzene will produce $___ \times 10^{-1}$ mg of product B. (Consider the reactions result in complete conversion) [Given molar mass of C, H, O, N and Cl as 12, 1, 16, 14 and 35.5 g mol⁻¹ respectively]

75. The formation enthalpies, ΔH_f^{Θ} for H(g) and O(g) are 220.0 and 250.0 kJ mol⁻¹, respectively, at 298.15 K, and ΔH_f^{Θ} for H₂O(g) is -242.0 kJ mol⁻¹ at the same temperature. The average bond enthalpy of the O – H bond in water at 298.15 K is _____ kJ mol⁻¹. (Nearest integer)