Sri Chaitanya IIT Academy.,India.

A.P T.S KARNATAKA TAMILNADU MAHARASTRA DELHI RANCHI

A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60_STERLING BT	**JEE-MAIN**	**Date: 27-08-2025**
Time: 09:00AM to 12:00PM	**RPTM-08**	**Max. Marks: 300**

IMPORTANT INSTRUCTION:

1. Immediately fill in the Admission number on this page of the Test Booklet with **Blue/Black** Ball Point **Pen** only.
2. The candidates should not write their Admission Number anywhere (except in the specified space) on the Test Booklet/ Answer Sheet.
3. The test is of **3 hours** duration.%
4. The Test Booklet consists of **75 Questions.** The maximum marks are **300.**
5. There are **three** parts in the question paper 1,2,3 consisting of **Mathematics, Physics** and **Chemistry** having **25 Questions** in each subject and subject having **two sections.**
   (I) Section –I contains **20 Multiple Choice Questions** with only one correct option.
   Marking scheme: +4 for correct answer, **0** if not attempt and **-1** in all other cases.
   (II) Section-II contains **05 Numerical Value Type Questions.**
   - The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11).**

   To cancel any attempted question bubble on the question number box.
   For example: To cancel attempted Question 21. Bubble on 21 as shown below

   Question Answered for Marking Question Cancelled for Marking
   Marking scheme: +4 for correct answer, **0** if **not attempt** and **-1** in all other cases.
6. Use **Blue / Black Point Pen only** for writing particulars / marking responses on the Answer Sheet. **Use of pencil is strictly prohibited.**
7. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electron device etc, except the Identity Card inside the examination hall.
8. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
9. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Hall. **However, the candidate are allowed to take away this Test Booklet with them.**
10. **Do not fold of make any stray marks on the Answer Sheet**

Name of the Candidate (in Capital): _____

Admission Number: | | | | | | | | | |

Candidate's Signature:_____ **Invigilator's Signature:** _____

27-09-25_Sr.Super60_STERLING BT_Jee-Main_RPTM-08_Test Syllabus

MATHEMATICS : Matrices and Determinants

PHYSICS : Magnetism: Biot–Savart's law and Ampere's law, Magnetic field near a current-carrying straight wire, along the axis of a circular coil and inside a long straight solenoid, Force on a moving charge and on a current-carrying wire in a uniform magnetic field, Magnetic moment of a current loop, Effect of a uniform magnetic field on a current loop, Moving coil galvanometer, Bar magnet as an equivalent solenoid, magnetic field lines, Para-, dia- and ferromagnetic substances. Magnetic susceptibility and permeability.
(In Phy & Che Each Out of 25Qs, 10 Qs From NCERT is Mandatory)

CHEMISTRY : Classification of Elements and Periodicity in Properties: Modern periodic law and the present form of periodic table, electronic configuration of elements, periodic trends in atomic radius, ionic radius, ionization enthalpy, electron gain enthalpy, valence, oxidation states, electronegativity and chemical reactivity.
Chemical bonding and Molecular Structure: Orbital overlap and covalent bond, Hybridisation involving s, p and d orbitals only(Excluding Hybridisation in complexes), Molecular orbital energy diagrams for homo nuclear diatomic species (upto Ne2), Hydrogen bond, Polarity in molecules, dipole moment, VSEPR model and shapes of molecules (linear, angular, triangular, square planar, pyramidal, square pyramidal, trigonal bipyramidal, tetrahedral and octahedral).
Hydrogen and its compounds: Position of hydrogen in periodic table, occurrence, isotopes, preparation, properties and uses of hydrogen, hydrides –ionic, covalent and interstitial, physical and chemical properties of water, heavy water, hydrogen peroxide-preparation, reactions, uses and structure, hydrogen as a fuel, hardness of water
NOTE: Hydrogen and its compounds deleted form Jee Mains syllabus
(In Phy & Che Each Out of 25Qs, 10 Qs From NCERT is Mandatory)

MATHEMATICS

Max Marks: 100

SECTION-I (SINGLE CORRECT ANSWER TYPE)

This section contains **20 Multiple Choice Questions.** Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

1. Statement-I : If $A=\begin{bmatrix}3 & -3 & 4\\ 2 & -3 & 4\\ 0 & -1 & 1\end{bmatrix}$, then $adj\left(adjA\right)=A$

Statement-II: $\left|\text{adj}(\text{adjA})\right|=\left|\text{A}\right|^{(\text{n-1})^2}$, A be $n\times n$ square non-singular matrix.

1) Statement-I is false, statement-II is false.
2) Statement-I is true, statement-II is true.
3) Statement-I is true, statement-II is false.
4) Statement-I is false, statement-II is true.

2. Match the following lists

COLUMN-I		COLUMN-II	
A	If $M_r=\begin{bmatrix}r-1 & \frac{1}{r}\\ 1 & \frac{1}{(r-1)^2}\end{bmatrix}$ and $\left\|M_r\right\|$ is the corresponding determinant, then $\lim\limits_{n\to\infty}\left(\left\|M_2\right\|+\left\|M_3\right\|+----+\left\|M_n\right\|\right)=$	P	0
B	If $(A+B)^2=A^2+B^2$ and $\left\|A\right\|=2$ then $\left\|B\right\|=$ _____ (where A and B are Square matrices of same odd order)	Q	1
C	If $A=\begin{bmatrix}3 & 1\\ -1 & 1\end{bmatrix}$ and a matrix C is defined as $C=\left(BAB^{-1}\right)\left(B^{-1}A^TB\right)$, (B is non singular 2×2 matrix) where $\left\|C\right\|=K^2\ \ (K\in N)$, then K= _____	R	2
D	If $A=\begin{bmatrix}1 & 1\\ -1 & 1\end{bmatrix}$ and $A^4=-\lambda I$ (I is unit matrix of order 2×2) then $\lambda-2$ is equal to	S	4

1) $A\to S,B\to R,C\to Q,D\to P$
2) $A\to Q,B\to P,C\to S,D\to R$
3) $A\to S,B\to P,C\to Q,D\to R$
4) $A\to S,B\to Q,C\to R,D\to P$

3. If A,B and $\left(adj\left(A^{-1}\right)+adj\left(B^{-1}\right)\right)$ are non-singular matrices of same order, then the Inverse of $A\left(adj\left(A^{-1}\right)+adj\left(B^{-1}\right)\right)^{-1}B$, is equal to _____

1) $AB^{-1}+A^{-1}B$ 2) $adj\left(B^{-1}\right)+adj\left(A^{-1}\right)$

3) $\frac{1}{|AB|}\left(adj(B)+adj(A)\right)$ 4) $\frac{AB^{-1}}{|A|}+\frac{BA^{-1}}{|B|}$

4. Let $P=\begin{bmatrix}1&0&0\\4&1&0\\16&4&1\end{bmatrix}$ and I be the Identity matrix of order3, If $Q=\left[q_{ij}\right]$ is a matrix such that $P^{50}-Q=I$ then $\frac{q_{31}+q_{32}}{q_{21}}$ is equal to _____

1) 52 2) 103 3) 201 4) 205

5. Let $a,b\in\mathbb{R}$, If $\Delta=\begin{vmatrix}1+a^2-b^2&2ab&-2b\\2ab&1-a^2+b^2&2a\\2b&-2a&1-a^2-b^2\end{vmatrix}$, then Δ is

1) $\le 27a^2b^2$ 2) $\ge 27a^2b^2$ 3) $\ge 9a^2b^2$ 4) $\le 35a^2b^2$

6. Let A be a 3×3 real matrix such that $A^2(A-2I)-4(A-I)=O$, where I and O are the identity and null matrices of 3×3 order respectively. If $A^5=\alpha A^2+\beta A+\gamma I$, where α,β,γ are real constants, then $\alpha+\beta+\gamma$ is equal to

1) 4 2) 76 3) 20 4) 12

7. Let $A=\begin{bmatrix}0&-2\\2&0\end{bmatrix}$ if M and N are two matrices given by $M=\sum_{k=1}^{10}A^{2k}$ and $N=\sum_{k=1}^{10}A^{2k-1}$ then MN^2 is _____

1) a Non-Identity symmetric matrix
2) a Skew-symmetric matrix
3) Neither Symmetric nor Skew-symmetric matrix
4) An identity matrix

8. If 'a', 'b' and 'c' are the roots of the equation $x^3+2x^2+1=0$, then the value of the determinant $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ is

1) 8 2) -8 3) 0 4) 2

9. If $A=\begin{bmatrix} 1 & 5 \\ \lambda & 10 \end{bmatrix}$, $A^{-1}=\alpha A+\beta I$ (I is the identity matrix of order 2) and $\alpha+\beta=-2$, then $4\alpha^2+\beta^2+\lambda^2$ is equal to

1) 12 2) 10 3) 14 4) 19

10. If ω is a non real complex cube root of unity, then value of

$\Delta=\begin{vmatrix} a_1+b_1\omega & a_1\omega^2+b_1 & c_1+b_1\overline{\omega} \\ a_2+b_2\omega & a_2\omega^2+b_2 & c_2+b_2\overline{\omega} \\ a_3+b_3\omega & a_3\omega^2+b_3 & c_3+b_3\overline{\omega} \end{vmatrix}$ is $(a_i,b_i,c_i\in\mathbb{R}(i=1,2,3)$ are distinct real numbers)

($\overline{z}$ denotes conjugate of complex number z)

1) 5 2) -1 3) 2 4) 0

11. For some $a,b\in R-\{0\}$, let $f(x)=\begin{vmatrix} a+\frac{\sin x}{x} & 1 & b \\ a & 1+\frac{\sin x}{x} & b \\ a & 1 & b+\frac{\sin x}{x} \end{vmatrix}$, $(x\neq 0)$,

$\lim\limits_{x\to 0} f(x)=\lambda+\mu a+\gamma b$, then $(\lambda+\mu+\gamma)^2$ is equal to

1) 25 2) 16 3) 9 4) 36

12. If $\Delta_r=\begin{vmatrix} 1 & n & n \\ 2r & n^2+n+1 & n^2+n \\ 2r-1 & n^2 & n^2+n+1 \end{vmatrix}$ and $\sum\limits_{r=1}^{n}\Delta_r=56$, then n is _____

1) 4 2) 6 3) 7 4) 8

13. If $A=\begin{bmatrix} 0 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 0 \end{bmatrix}$ and I is the identity matrix of order 2, then $(I-A)\cdot\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ is

1) $-I+A$ 2) $I+A$ 3) $-I-A$ 4) $-2A-I$

14. The number of 3×3 matrices 'M' with entries from $\{0,1,2\}$ are there , for which the sum of the principal diagonal entries of M^TM is '5' is

1) 198 2) 252 3) 135 4) 162

15. Let $A=[a_{ij}]=\begin{bmatrix} \log_5 128 & \log_4 5 \\ \log_5 8 & \log_4 25 \end{bmatrix}$ If A_{ij} is the co-factor of a_{ij},

$C_{ij}=\sum_{k=1}^{2} a_{ik}A_{jk}, 1\le i,j\le 2$, and $C=[C_{ij}]$, then $8\cdot|C|$ is equal to

1) 222 2) 242 3) 288 4) 262

16. Let 'K' be an integer such that triangle with vertices (K,-3K),(5,K) and (-K,2) has area 28 sq. units , then the ortho-center of this triangle is at the point

1) $\left(2,\frac{1}{2}\right)$ 2) $\left(2,\frac{-1}{2}\right)$ 3) $\left(1,\frac{3}{4}\right)$ 4) $\left(1,\frac{-3}{4}\right)$

17. Consider three matrices $A=\begin{bmatrix} 2 & 1 \\ 4 & 1 \end{bmatrix}, B=\begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}$ and $C=\begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix}$ then the value of the sum

$tr(A)+tr\left(\frac{A(BC)}{2}\right)+tr\left(\frac{A(BC)^2}{4}\right)+tr\left(\frac{A(BC)^3}{8}\right)+-----\infty\ terms$ is

1) 6 2) 9 3) 12 4)18

18. If $A=\begin{bmatrix} 1 & -2 \\ 4 & 5 \end{bmatrix}$ and $f(t)=t^2-3t+7$, then $f(A)+\begin{bmatrix} 3 & 6 \\ -12 & -9 \end{bmatrix}$ is equal to

1) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ 2) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ 3) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ 4) $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$

19. If a ,b, c are non-zero real numbers and if the system of equations $(a-1)x=y+z$, $(b-1)y=z+x$, $(c-1)z=x+y$ has a non-trivial solutions , then $ab+bc+ca$ equals

1)1 2) $a+b$ 3) $ab+b$ 4) abc

20. Let $f(x)=\begin{vmatrix} 2\cos^2 x & \sin 2x & -\sin x \\ \sin 2x & 2\sin^2 x & \cos x \\ \sin x & -\cos x & 0 \end{vmatrix}$ then the value of $\int_0^{\frac{\pi}{2}} \left(f(x)+f'(x)\right)dx$ is

1) π 2) $\frac{\pi}{2}$ 3) 2π 4) $\frac{3\pi}{2}$

SECTION-II (NUMERICAL VALUE TYPE)

This section contains **5 Numerical Value Type Questions.** The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11).**

Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.

21. Let $A=\begin{bmatrix} 0 & \alpha \\ 0 & 0 \end{bmatrix}$ and $(A+I)^{50}-50A=\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then the value of $a+b+c+d$ *is* ___

22. If $a_k=k\left(10C_k\right), b_k=(10-k)\left(10C_k\right)$, $A_k=\begin{bmatrix} a_k & 0 \\ 0 & b_k \end{bmatrix}$ and $A=\sum_{k=1}^{9} A_k=\begin{pmatrix} a & 0 \\ 0 & b \end{pmatrix}$, then the " sum of digits in $\frac{a\cdot b}{2^9-1}$ " is _____

23. Let A be a 3×3 matrix and det(A)=2. If $n=\det\underbrace{(adj(adj(.....(adjA))))}_{2024 times}$ then the remainder when 'n' is divided by '9' is equal to _____

24. If the system of equations $x-2y+3z=9, 2x+y+z=b, x-7y+az=24$ has infinitely many solutions ,then a-b is equals to _____

25. If A is a square matrix of order 3 such that $|A|=2$ then $\left|(adj(A^{-1}))^{-1}\right|=$

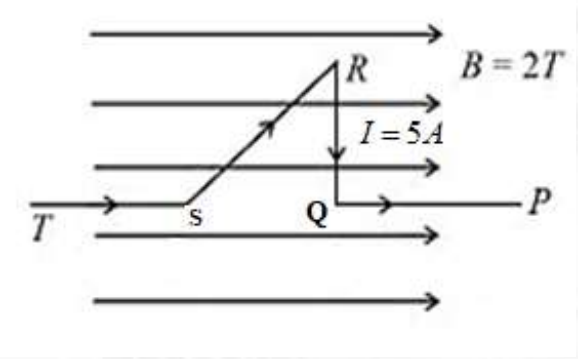
PHYSICS **Max Marks: 100**

SECTION-I (SINGLE CORRECT ANSWER TYPE)

This section contains **20 Multiple Choice Questions.** Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

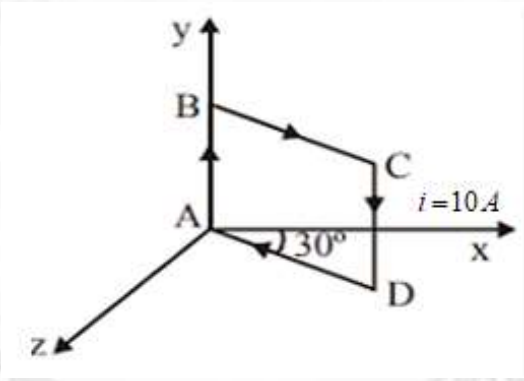
Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

26. A wire PQRST carrying current I=5A is placed in uniform magnetic field B=2T as shown in fig. If the length of part QR=4cm and SR=6cm then the magnetic force on SR edge of the wire is :



1) 0.4N 2) 0.6N 3) ZERO 4) 6N

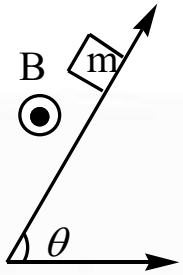
27. Figure shows a square current carrying loop ABCD of side 10cm and current i=10A. The magnetic moment $\vec{M}$ of the loop is



1) $(0.05)\left(\hat{i}-\sqrt{3}\hat{k}\right)A-m^2$ 2) $(0.05)\left(\hat{j}+\hat{k}\right)A-m^2$

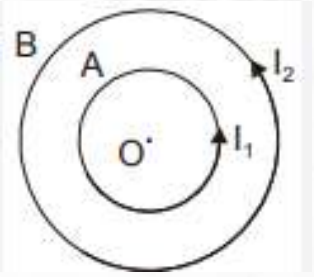
3) $(0.05)\left(3\hat{i}-\hat{k}\right)A-m^2$ 4) $\left(\hat{i}+\hat{k}\right)A-m^2$

28. A block of mass m & charge +q is released on a long smooth inclined plane magnetic field B is constant. uniform horizontal and parallel to surface as shown. Find the time from start when block loses contact with the surface



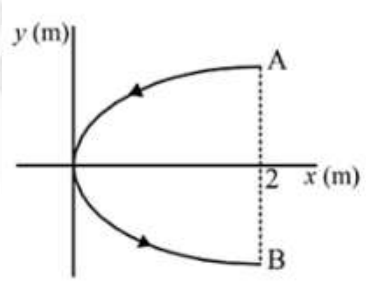
1) $\frac{m\cos\theta}{qB}$ 2) $\frac{m\,\mathrm{cosec}\,\theta}{qB}$ 3) $\frac{m\cot\theta}{qB}$ 4) $\frac{m\sin\theta}{2B}$

29. A and B are two concentric circular conductors of centre O and carrying current I_1 and I_2 as shown in the diagram. If ratio of their radii is 1:2 and ratio of the flux densities at O due to A and B is 1:3 then the value of $\frac{I_1}{I_2}$ will be:-



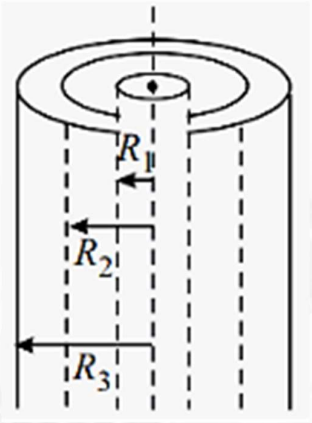
1) $\frac{1}{2}$ 2) $\frac{1}{3}$ 3) $\frac{1}{4}$ 4) $\frac{1}{6}$

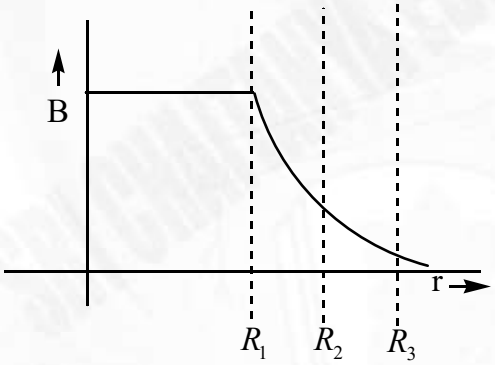
30. A conducting wire bent in the form of a parabola $y^2 = 2x$ carries a current i=2A as shown in figure. This wire is placed in a uniform magnetic field $\overline{B} = -4\hat{k}$ tesla. The magnetic force on the wire is (in newton)



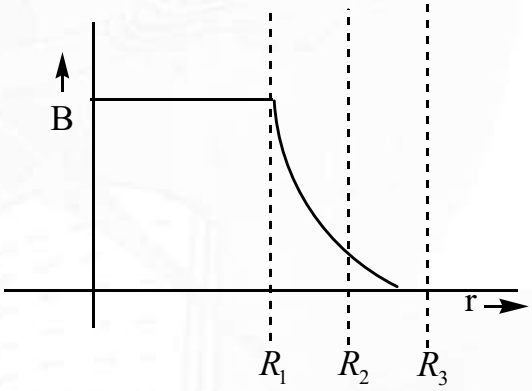
1) $-16\hat{i}$ 2) $32\hat{i}$ 3) $-32\hat{i}$ 4) $16\hat{i}$

31. A coaxial cable is made up of two conductors. The inner conductor is solid and is of radius R_1 and the outer conductor is hollow of inner radius R_2 and outer radius R_3. The space between the conductors is filled with air. The inner and outer conductors are carrying currents of equal magnitudes and in opposite directions. Then the variation of magnetic field with distance from the axis is best plotted as

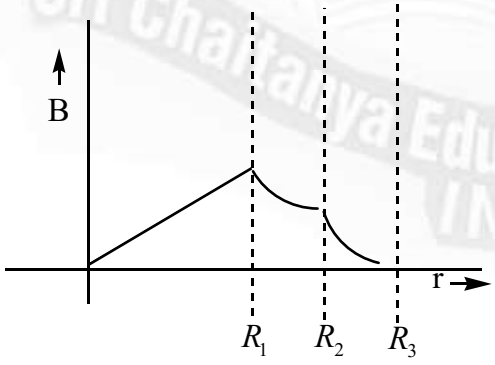




1)



2)



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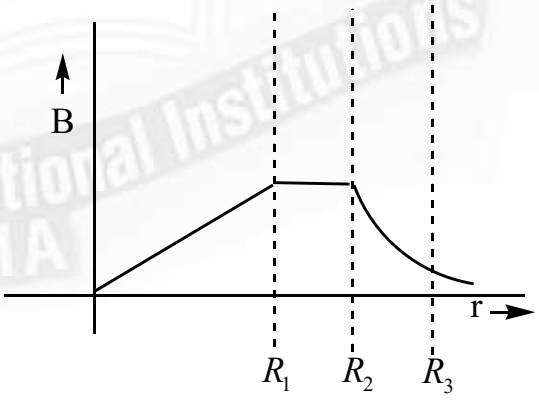


4)

32.

	Columns I (Magnetic moment of)		Column II
A	a uniformly charged ring rotating uniformly about its axis	p	$\frac{q\omega R^2}{5}$
B	a charged particle rotating uniformly about a point	q	$\frac{q\omega R^2}{4}$
C	a uniformly charged disk rotating uniformly about its axis	r	$\frac{q\omega R^2}{3}$
D	a uniformly charged spherical shell rotating uniformly about one of its diameter	s	$\frac{q\omega R^2}{2}$
E	a uniformly charged sphere rotating uniformly about one of its diameter	t	$q\omega R^2$

1) $A \to s, B \to q, C \to p, D \to t, E \to r$ 2) $A \to s, B \to s, C \to q, D \to r, E \to p$

3) $A \to s, B \to s, C \to p, D \to q, E \to r$ 4) $A \to s, B \to q, C \to s, D \to p, E \to r$

33. Assertion (A): A proton and an electron, with same momenta. Enter a magnetic field in a direction at right angles to the lines of the forces. The radius of the paths followed by them will be same

Reason(R): Electron has less mass than the protons

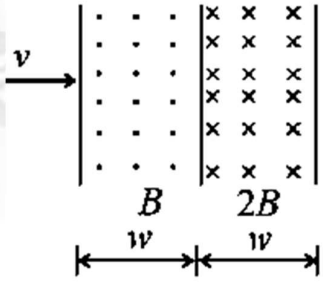
1) If both(A) and (R) are true and (R) is the correct explanation of(A)

2) If both(A) and (R) are true but (R) is not the correct explanation of(R)

3) If (A) is true but (R) is false

4) If both (A) and (R) are false

34. The figure shows two regions of uniform magnetic fields of strengths B and 2B. A charged particle of mass m and charge q enters the region of the magnetic field with a velocity $v = \frac{qBW}{m}$, where w is the width of each region of the magnetic field. The time taken by the particle to come out of the region of the magnetic field is

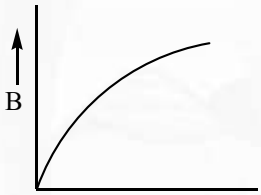


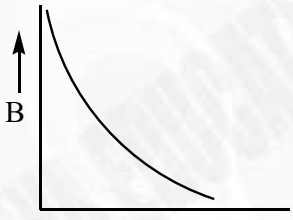
1) $\frac{4\pi m}{qB}$ 2) $\frac{2\pi m}{qB}$ 3) $\frac{\pi m}{2qB}$ 4) $\frac{\pi m}{qB}$

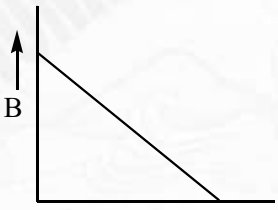
35. A thin circular disk of radius R is uniformly charged with density $\sigma > 0$ per unit area. The disk rotates about its axis with a uniform angular speed ω. The magnetic moment of the disk is :

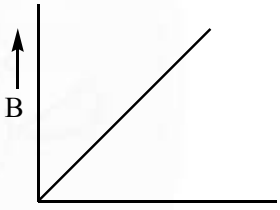
1) $2\pi R^4\sigma\omega$ 2) $\pi R^4\sigma\omega$ 3) $\frac{\pi R^4}{2}\sigma\omega$ 4) $\frac{\pi R^4}{4}\sigma\omega$

36. A charge Q is uniformly distributed over the surface of non-conducting disc of radius R. The disc rotates about an axis perpendicular to its plane and passing through its centre with an angular velocity ω. As a result of this rotation a magnetic field of induction B is obtained at the centre of the disc. If two keep both the amount of charge placed on the disc and its angular velocity to be constant and vary the radius of the disc then the variation of the magnetic induction at the centre of the disc will be represented by the figure :-

1) 

2) 

3) 

4) 

37. Two charged particles traverse identical helical paths in a completely opposite sense in a uniform magnetic field $\vec{B} = B_0\hat{k}$.

1) They have equal z-components of momenta.

2) They must have equal charges.

3) They necessarily represent a particle-antiparticle pair.

4) The charge to mass ratio satisfy $\left(\frac{e}{m}\right)_1 + \left(\frac{e}{m}\right)_2 = 0;$

38. The gyro-magnetic ratio (magnetic moment / angular momentum) of an electron in an H-atom, according to Bohr model, is

a) Independent of which orbit it is in b) negative

c) Positive d) increases with the quantum number n

1) a and c only correct 2) a, b and c are correct

3) b, d only correct 4) a, b only correct

39. Statement-1: For ampere's law $\oint \vec{B}.\vec{dl} = \mu_0 I, B$ also includes the contribution from current not enclosed by the loop. And
Statement-2: A moving charge produces magnetic field, but no electric field.
1) Statement-1 is true, Statement-2 is false
2) Statement-1 is false, Statement -2 is true.
3) Statement-1 is true; Statement-2 is true; Statement -2 is a correct explanation for Statement-1
4) Statement-1 is true; Statement-2 is true; Statement -2 is not a correct explanation for Statement-1

40. A long straight wire of radius "a" carries a steady current I distributed uniformly across its cross- section. What is the ratio of the magnetic field at $\frac{a}{2}$ that at 2a

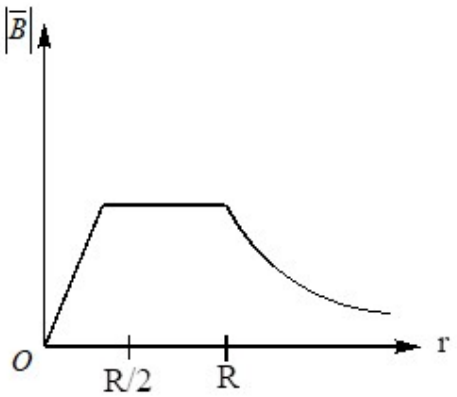
1) 4 2) $\frac{1}{2}$ 3)1 4) 2

41. A galvanometer having a coil of resistance 36Ω need 18 m A of current for full-scale deflection. If a maximum current of 3A is to be measure using this galvanometer, the resistance of the shunt to be added to the galvanometer should be $\frac{216}{x}\Omega$, where x is

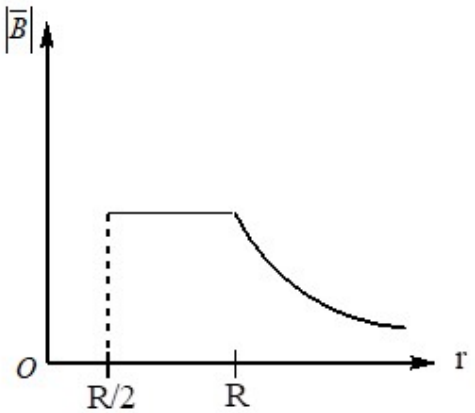
1) 447 2) 276 3) 994 4) 596

42. An infinitely long hollow conducting cylinder with inner radius R/2 and outer radius R carries a uniform current density along its length. The magnitude of the magnetic field, |B| as a function of the radial distance r from the axis, is best represented by

1)



2)



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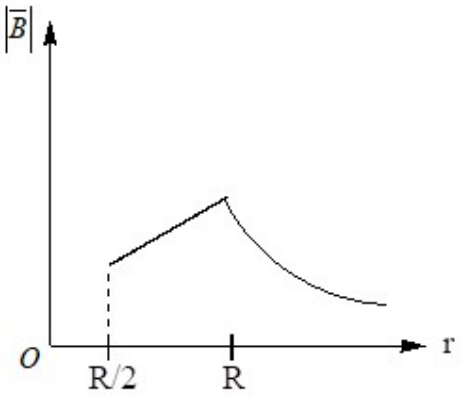
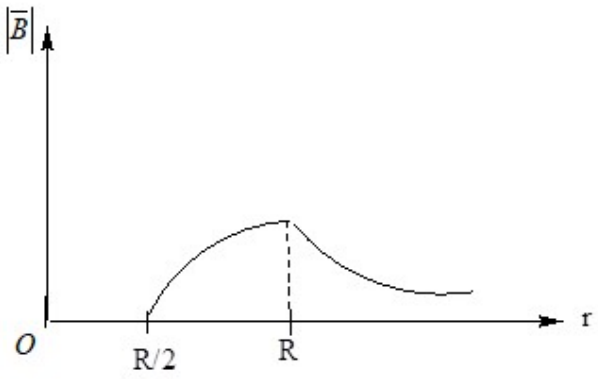


4)



43. ASSERTION: A solenoid tends to expand, when a current passes through it.

REASON: two straight parallel metallic wires carrying current in opposite direction attract each other.

1) Assertion is true; Reason is true; Assertion is correct explanation for Reason

2) Assertion is true; Reason is true; Assertion is not correct explanation for Reason

3) Assertion is true; Reason is false

4) Both Assertion and Reason are false .

44. STATEMENT-1: A charged particle undergoes uniform circular motion in a uniform magnetic field. The only force acting on the particle is that exerted by the uniform magnetic field. If now the speed of the same particle is somehow doubled keeping its charge and external magnetic field constant, then the centripetal force on the particle becomes four times.

STATEMENT-2: The magnitude of centripetal force on a particle of mass m moving in a circle of radius R with uniform speed v is $\frac{mv^2}{R}$

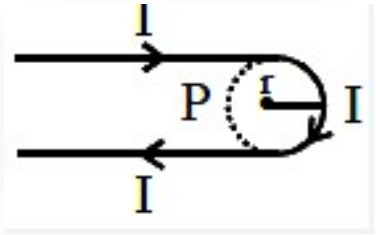
1)Statement-1 is true, Statement-2 is true; Statement-2 is not a correct explanation for Statement-1

2) Statement-1 is true, Statement-2 is false

3) Statement-1 is false, Statement-2 is true

4) Statement-1 is true; Statement-2 is true; Statement-2 is correct explanation for Statement-1

45. A hairpin like shape as shown in figure is made by bending a long current carrying wire. What is the magnitude of a magnetic field at point P which lies on the centre of the semicircle?



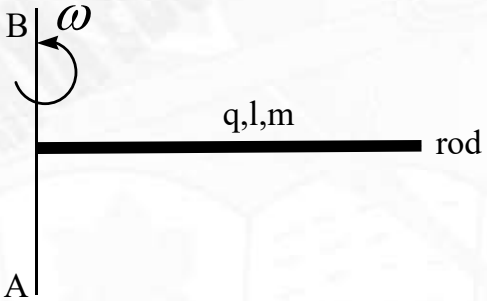
1) $\frac{\mu_0 I}{2\pi r}(2-\pi)$ 2) $\frac{\mu_0 I}{4\pi r}(2-\pi)$ 3) $\frac{\mu_0 I}{2\pi r}(2+\pi)$ 4) $\frac{\mu_0 I}{4\pi r}(2+\pi)$

SECTION-II (NUMERICAL VALUE TYPE)

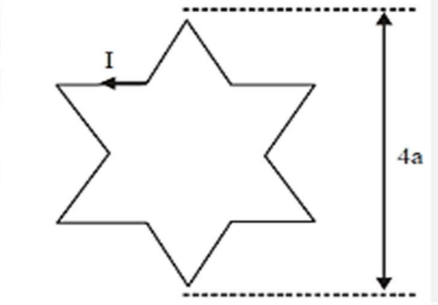
This section contains **5 Numerical Value Type Questions.** The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11**).

Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases

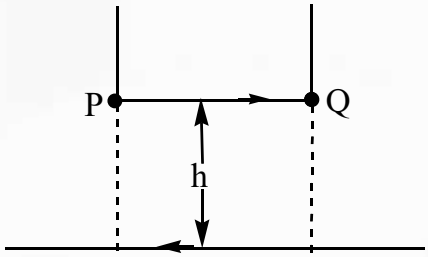
46. The magnetic moment of uniformly charged rod of length=50cm,charge 6mC rotating about axis AB with angular velocity ω=800rad/s is $\frac{x}{10}$ A-m^2 the value of 'x' is



47. A symmetric star shaped conducting wire loop is carrying a steady state current I as shown. The Distance between the diametrically opposite vertices of the star is 4 a. The magnitude of the magnetic field at the centre of the loop is $x\frac{\mu_0 i}{4\pi a}\left[\sqrt{3}-1\right]$ *then* $x=$

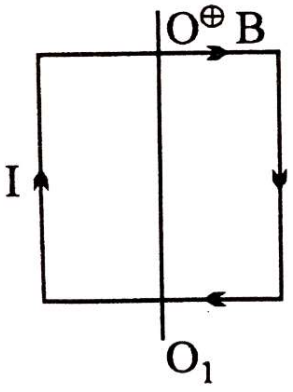


48. A long straight wire carrying current of 25A rests on a table as shown in figure. Another wire PQ of length 1m. mass 2.5g carries the same current but in the opposite direction. The wire PQ is free to slide up and down. To what height will PQ rise is x 10^{-4}m. $\left(\mu_0 = 4\pi \times 10^{-7}\, A/m\right)\, g = 10 m/s^2$.



49. A tightly wound long solenoid carries a current of 1A. An electron is executing uniform circular motion inside the solenoid with a time period T is x10^{-3}s (m_e=9x10^{-31} kg, q=1.6x10^{-19}c) $\mu_0 = 4\pi \times 10^{-7}\frac{H}{m}, B = 18\pi \times 10^{-12}$ Tesla

50. A square current carrying loop made of thin wire and having a mass m=10g can rotate without friction with respect to the vertical axis OO_1 , passing through the centre of the loop at the right angles to two opposite sides of the loop. The loop is placed in a homogeneous magnetic field with an induction $B = 10^{-1}T$ directed at right angles to the plane of the drawing. A current $I = 2A$ is flowing in the loop. The period of small oscillations that the loop performers about its position of stable equibrium is $\frac{x}{100}$s .The value of x is (rounding off to two signification figures)



CHEMISTRY

Max Marks: 100

SECTION-I (SINGLE CORRECT ANSWER TYPE)

This section contains **20 Multiple Choice Questions.** Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

51. Assertion (A): Generally , Ionisation enthalphy increases from left to right in a period.
Reason (R) : When successive electrons are added to the orbitals in the same principle quantum level , the shielding effect of inner core of electrons does not increase very much to compensate for the increased attraction of the electrons to the nucleus.
1) Assertion is correct and Reason is incorrect.
2) Assertion & Reason both are correct & Reason is correct explanation for Assertion
3) Assertion & Reason both are incorrect.
4) Assertion is incorrect & Reason is correct.

52. The first ionization enthalpies of $\mathrm{Na, Mg, } Al \textit{ and } \mathrm{Si}$ are in the order
1) $\mathrm{Na} < \mathrm{Mg} > Al < \mathrm{Si}$
2) $\mathrm{Na} > \mathrm{Mg} > Al > \mathrm{Si}$
3) $\mathrm{Na} < \mathrm{Mg} < Al < \mathrm{Si}$
4) $\mathrm{Na} > \mathrm{Mg} > Al < \mathrm{Si}$

53. Statement I: Cl^- and Ca^{+2} are isoelectronic species
Statement II: Isoelectronic species should have same charges
1) Statement-I is true, Statement-II is true; Statement-II is correct explanation for Statement –I
2) Statement-I is true, statement-II is true; Statement-II is not correct explanation for Statement-I
3) Statement-I is true, Statement-II is false
4) Statement-I is false, Statement-II is true

54.

Column-I		Column-II	
a)	He	p)	High electron gain enthalpy
b)	Cl	q)	Most electro positive element
c)	Cs	r)	Strongest reducing agent
d)	Li	s)	Highest ionization energy

1) a-s, b-p, c-q, d-r 2) a-q, b-s, c-p, d-r 3) a-s, b-q, c-p, d-r 4) a-s, b-q, c-r, d-p

55. In the modern periodic table, the period indicates the value of
1) atomic number
2) Atomic mass
3) Principal quantum number
4) Azimuthal quantum number

56. Considering the elements B, *Al*, Mg *and* *K* the correct order of their metallic character is
1) B > *Al* > Mg > *K* 2) *Al* > Mg > B > *K* 3) Mg > *Al* > *K* > B 4) *K* > Mg > *Al* > B

57. The IUPAC name of an element with atomic number 118 is
1) Ununoctium 2) Ununennium 3)Unnilennium 4) Unununium

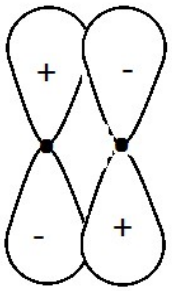
58. The correct sequence given below containing neutral, acidic, basic and amphoteric oxide each respectively are
1) NO, ZnO, CO_2, MgO 2) ZnO, NO, MgO, CO_2
3) NO, CO_2, ZnO, MgO 4) NO, CO_2, MgO, ZnO

59. Which of the following set of molecules will have zero dipole moment?
1) BF_3, HF, CS_2, 1,3 - dichloro benzene 2) NF_3, BeF_2, H_2O, 1,3 - dichloro benzene
3) BF_3, BeF_2, CS_2, 1,4 - dichloro benzene 4) NH_3, BeF_2, H_2O, 1,4 - dichloro benzene

60. XeF_2 is isostructural with
1) $SbCl_3$ 2) BCl_3 3) TeF_2 4) I_3^-

61. The types of hybrid orbitals of nitrogen in NO_2^+, NO_3^- and NH_4^+ respectively are expected to be
1) sp, sp^2, sp^3 2) sp, sp^3, sp^2 3) sp^2, sp, sp^3 4) sp^2, sp^3, sp

62. Which of the following best describes the diagram below of a molecular orbital?

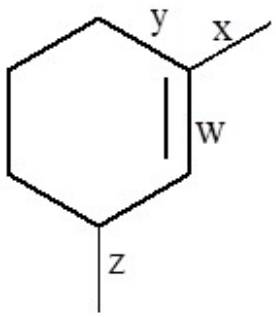


1) An anti-bonding π orbital 2) An anti bonding σ orbital
3) A non-bonding orbital 4) A bonding π orbital

63. Two nodal planes are present in
1) $\pi^* 2p_x$ 2) $\sigma 2p_z$ 3) $\pi 2p_x$ 4) $\pi 2p_y$

64. The bond length of HCl molecule is $1.275\,A^0$ and its dipole moment is $1.03\,D$. The ionic character of the molecule (in percentage) (charge of the electron $= 4.8 \times 10^{-10}$ esu) is
1)100 2)67.3 3)33.66 4)16.83

65. The C-C bond order in following compound is



1) x > y > z > w 2) z > y > x > w 3) y > z > x > w 4) z > x > y > w

66. Assertion (A): Through the central atom of both NH_3 and H_2O molecules are sp^3 hybridized. Yet H-N-H bond angle is greater than of H-O-H

Reason(R): This is because nitrogen atom has one lone pair and oxygen atom has two lone pairs

1) A and R both are correct and R is the correct explanation of A.
2) A and R both are correct, but R is not the correct explanation of A.
3) A is true, but R is false
4) A and R both are false

67. Statement I: SO_2 and H_2O both possess v-shaped structure

Statement II: The bond angle of SO_2 is less than that of H_2O

1) Both Statements are incorrect
2) Statement I is correct but Statement II is incorrect
3)Both statements are correct
4)Statement I is incorrect but statement II is correct

68.

List-I		List-II	
I)	Unnilquadium	A)	Dubnium
II)	Unnilhexium	B)	Copernicium
III)	Unnilpentium	C)	Ruther fordium
IV)	Ununbium	D)	Seaborgium
V)	Unununium	E)	Roentgenium

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

69. Which is not the correct order for the stated property

1) $Ba > Sr > Mg$ atomic radius 2) $F > O > N$ first ionization enthalpy

3) $Cl > F > I$ electron offinity 4) $O > Se > Te$ electronegatvity

70. Which of the following has a bond order of 1.75

1) ClO_3^- 2) ClO_4^- 3) NO_3^- 4) CO_3^{2-}

SECTION-II (NUMERICAL VALUE TYPE)

This section contains **5 Numerical Value Type Questions.** The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11**).

Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases

71. Calculate the percentage ionic character of molecule AB where the electronegative atom A is 3 and B is 2.1?_____

72. The IE_1, IE_2, IE_3, IE_4 and IE_5 of an element are $7.1, 14.3, 32.5, 46.8$ and $162.2\,ev$ respectively. The stable oxidation state of the element is_____

73. The ratio of lone pairs on the surrounding atoms to that of central atom of XeO_2F_2 is_____

74. How many maximum number of atoms are present in single plane of $Al(CH_3)_3$ molecule?

75. The number of 90^0 angles in SF_6 are _____

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