All India Test Series (JEE–2024)

AVJLM1/06 **Test- 06** **Lakshya JEE 2024**

DURATION : 180 Minutes **DATE : 16/01/2024** **M.MARKS : 300**

Topics Covered

Physics:	Latest Full Syllabus by NTA
Chemistry:	Latest Full Syllabus by NTA
Mathematics:	Latest Full Syllabus by NTA

General Instructions:
1. Immediately fill in the particulars on this page of the test booklet.
2. The test is of **3 hours** duration.
3. The test booklet consists of 90 questions. The maximum marks are **300**.
4. There are three sections in the question paper, Section I, II & III consisting of Section-I **(Physics),** Section-II **(Chemistry),** Section-III **(Mathematics)** and having **30 questions** in each part in which first **20** questions are compulsory and are of Objective Type and last **10** questions are integer type with answers ranging from '**0**' to '**999**' where answer needs to be rounded off to the nearest integer. Only 5 questions have to be attempted out of the last 10 questions of each section.
5. There is only one correct response for each objective type question.
6. Each correct answer will give **4** marks while **1** Mark will be deducted for a wrong response.
7. No student 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.
8. 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.
9. **Do not fold or make any stray mark on the Answer Sheet (OMR).**

OMR Instructions:
1. Use blue/black dark ballpoint pens.
2. Darken the bubbles completely. Don't put a tick mark or a cross mark where it is specified that you fill the bubbles completely. Half-filled or over-filled bubbles will not be read by the software.
3. Never use pencils to mark your answers.
4. Never use whiteners to rectify filling errors as they may disrupt the scanning and evaluation process.
5. Writing on the OMR Sheet is permitted on the specified area only and even small marks other than the specified area may create problems during the evaluation.
6. Multiple markings will be treated as invalid responses.
7. **Do not fold or make any stray mark on the Answer Sheet (OMR).**

Name of the Student (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

Candidate's Signature : _____ Invigilator's Signature _____

IMPORTANT CONSTANTS

Speed of light in free space,	:	3.00×10^8 ms^{-1}
Permeability of free space,	:	$4\pi \times 10^{-7}$ Hm^{-1}
Permittivity of free space,	:	8.85×10^{-12} Fm^{-1}
The Planck constant,	:	6.63×10^{-34} Js
Rest mass of electron,	:	9.1×10^{-31} kg
Rest mass of proton,	:	1.67×10^{-27} kg
Molar gas constant,	:	8.31 JK^{-1} mol^{-1}
The Avogadro constant,	:	6.02×10^{23} mol^{-1}
The Boltzmann constant,	:	1.38×10^{-23} JK^{-1}
Gravitational constant,	:	6.67×10^{-11} N m^{2}kg^{-2}
Acceleration of free fall	:	9.8 ms^{-2}
Rydberg Constant	:	1.097×10^7 m^{-1}
Atomic mass unit	:	1.67×10^{-27} kg
Charge on proton	:	1.6×10^{-19} C

IMPORTANT VALUES

$\sqrt{2}$ = 1.414	ln 10 = 2.303
$\sqrt{3}$ = 1.732	$\log_{10}2$ = 0.3010
$\sqrt{5}$ = 2.236	$\log_{10}3$= 0.4770
π = 3.142	$\log_{10}7$ = 0.845
e (Euler's constant) = 2.718	

* *Use above values unless otherwise specified in a question*.

❑ ❑ ❑

SECTION-I (PHYSICS)

Single Correct Type Questions

1. In a standard meter bridge experiment, to measure the specific resistance of a wire the following data are found:-

Length $(L) = (1 \pm 0.01)$m measured by a meter scale

Radius of wire $(r) = 1$mm ± 0.01mm. (measured by screw gauge).

Measured value of Resistance of wire $(R) = (5 \pm 0.01)$ Ω

The maximum possible error in the calculation of specific resistance using values of L, r and R is approximately

(1) 0.10 $\mu\Omega$m

(2) 0.20 $\mu\Omega$m

(3) 0.50 $\mu\Omega$m

(4) 0.60 $\mu\Omega$m

2. The current i in the circuit at any time t is
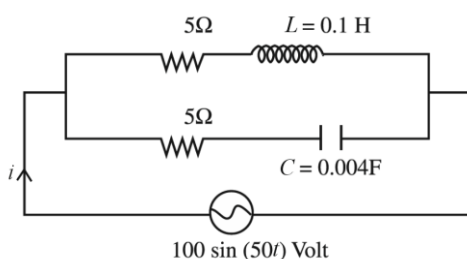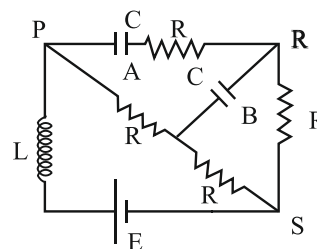

(1) 20 A

(2) $20\sin\left[50t + \dfrac{\pi}{4}\right]$ A

(3) $20\sin\left[50t - \dfrac{\pi}{4}\right]$ A

(4) 20sin (50t) A

3. All the surfaces & pulleys are frictionless in the shown arrangement. Pulleys P and Q are massless. The force applied by clamp on pulley P is
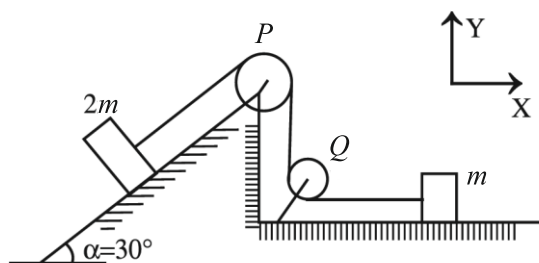

(1) $\dfrac{mg}{6}\left(\sqrt{3}\hat{i} - 3\hat{j}\right)$

(2) $\dfrac{mg}{6}\left(\sqrt{3}\hat{i} + 3\hat{j}\right)$

(3) $\dfrac{mg}{6}\sqrt{2}$

(4) $\dfrac{mg}{6}$

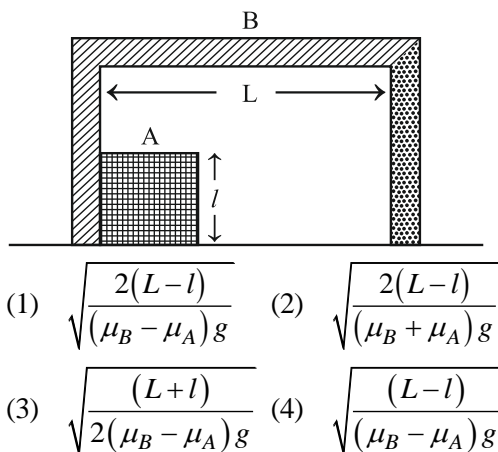**4.** The charge on the capacitors A and B in steady state is :-

(1) $\dfrac{CE}{2}, CE$

(2) $\dfrac{CE}{2}, \dfrac{CE}{2}$

(3) $CE, \dfrac{CE}{2}$

(4) CE, CE

5. In a region, uniform electric field exists as $\vec{E} = \left[10\hat{i} + 10\hat{j}\right]$ N/C. If the potential of origin is zero volts, the potential of point (10m, 10m, 10m,) is

(1) 20 Volts

(2) -200 Volts

(3) 10 Volts

(4) -10 Volts

6. A progressive mechanical longitudinal wave is represented by $y = A\sin(\omega t - kx + \pi)$. For $k = 100$ cm^{-1}, phase difference between two particles at $x_1 = 2$cm and $x_2 = 4$cm at $t = 0$ is

(1) 1 rad

(2) 4 rad

(3) 2 rad

(4) None of above

7. In the given arrangement, two capillaries of glass having radii r and $2r$ are dipped in pure water of density ρ, the surface tension of water is (contact angle is equal to zero)
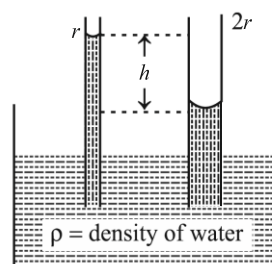

(1) $2\rho hgr$ (2) ρhgr

(3) $\dfrac{\rho hgr}{2}$ (4) $4\rho hgr$

8. A cubical block A of mass m and a box B of same mass are lying on a horizontal surface as shown in the figure. The coefficient of kinetic friction between the block and horizontal surface is μ_A, while that between the box and surface is μ_B. Given that $\mu_B > \mu_A$. At $t = 0$, the position is as shown in the figure and both are simultaneously given a velocity v_0 to the right. If the collision between the block and the box takes place, then the time after which block will collide with the right end of the box is

(1) $\sqrt{\dfrac{2(L-l)}{(\mu_B - \mu_A)g}}$ (2) $\sqrt{\dfrac{2(L-l)}{(\mu_B + \mu_A)g}}$

(3) $\sqrt{\dfrac{(L+l)}{2(\mu_B - \mu_A)g}}$ (4) $\sqrt{\dfrac{(L-l)}{(\mu_B - \mu_A)g}}$

9. The figure shows a hollow smooth circular tube fixed to a heavy horizontal table. It is the top view of the arrangement. A ball is shot into end A of the tube to leave the other end B at high speed. The balls diameter is slightly less than the internal diameter of the tube. Which of the paths below will the ball follow on the table after it leaves the tube?

(1)   (2)

(3)   (4) None of these
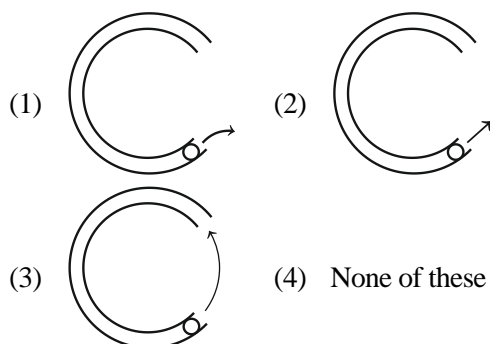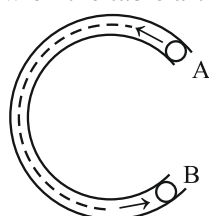
10. A conductor having uniform linear charge density λ is placed in circular form in 3 quadrants with different polarities as shown in the figure. Let $\vec{E}_0$ be the electric field at O. Then the angle made by $\vec{E}_0$ with the line along negative y-axis is
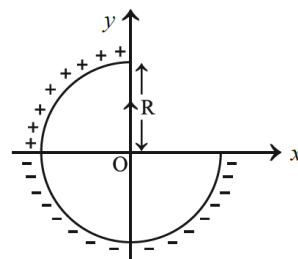
(1) $\tan^{-1}\left(\dfrac{1}{2}\right)$

(2) $\tan^{-1}(3)$

(3) $\tan^{-1}\left(\dfrac{1}{3}\right)$

(4) $\tan^{-1}(2)$

11. A point P lies on the axis of a fixed ring of mass M and radius R, at a distance of $2R$ from its centre O. A small particle starts from P and reaches O under gravitational attraction only. Its speed at O will be

(1) Zero

(2) $\sqrt{\dfrac{2GM}{R}}$

(3) $\sqrt{\dfrac{2GM}{R}\left(\sqrt{5}-1\right)}$

(4) $\sqrt{\dfrac{2GM}{R}\left(1-\dfrac{1}{\sqrt{5}}\right)}$

12. A neutral metallic finite block is placed at large but finite distance in front of a finite charged sheet. If the block experiences a force, then the block will be

(1) Attracted towards the sheet

(2) Repelled away from the sheet

(3) Attracted or repelled depending on nature of charge on the sheet

(4) None of these

13. The relation between R and r (internal resistance of the battery), for which the power consumed in the external part of the circuit is maximum, is
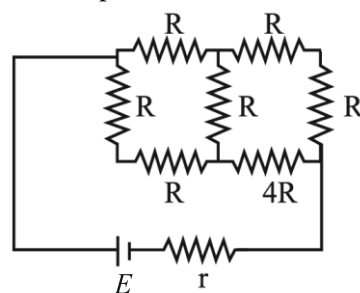

(1) $R = r$ (2) $R = \dfrac{r}{2}$

(3) $R = 2r$ (4) $R = 1.5r$

14. An equilateral triangular loop having a resistance R and length of each side $'l'$ is placed in a uniform magnetic field B which is varying with time t at $\dfrac{dB}{dt} = 1$ T/s . The induced current in the loop will be


(1) $\dfrac{\sqrt{3}}{4}\dfrac{l^2}{R}$ (2) $\dfrac{4}{\sqrt{3}}\dfrac{l^2}{R}$

(3) $\dfrac{\sqrt{3}}{4}\dfrac{R}{l^2}$ (4) $\dfrac{4}{\sqrt{3}}\dfrac{R}{l^2}$

15. An electron is released from rest at one point in a uniform electric field and travels a distance of 10 cm in 10^{-7} seconds. Potential difference across the points is approximately
(1) 11.4 volts   (2) 7.4 volts
(3) 5.4 volts   (4) 5.7 volts

16. A metal block of mass m is placed on a smooth metallic plane in support with inextensible light string as shown in diagram. If, after long time due to corrosion, the contact surface becomes rough with coefficient of friction μ, then friction force acting on the block will be
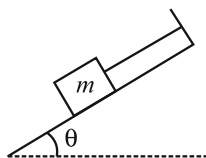
(1) $\mu mg \cos\theta$ (2) $mg \sin\theta$
(3) mg (4) None of these

17. A uniform rod of mass $2M$ and length $2L$ is bent at its mid point to form an L shape. Then, moment of inertia of the system about an axis along its angle bisector of L shaped rod is

(1) $\dfrac{7}{5}ML^2$ (2) $\dfrac{1}{3}ML^2$

(3) $\dfrac{7}{24}ML^2$ (4) $\dfrac{ML^2}{2}$

18. In an L-C-R series circuit, it is found that the power factor is maximum. Then the angular frequency of the emf source must be equal to

(1) $\dfrac{1}{\sqrt{LC}}$

(2) Near to zero
(3) A very large number
(4) None of these

19. In a process the density of a gas remains constant. If the absolute temperature of the gas is doubled, then change in the pressure will be
(1) 100% increase
(2) 200% increase
(3) 50% decrease
(4) 200% decrease

20. Two identical charges q are separated by distance $2d$ and fixed at this position. Third charge $–q$ is revolving in a circle of radius x in plane perpendicular to line joining charges whose centre coincides with mid point of line joining charges. The value of x for which speed of particle is maximum is [Consider gravity free space.]
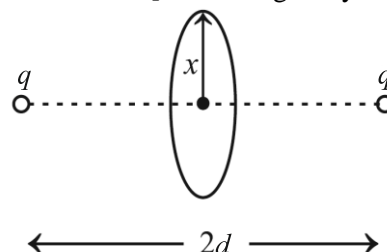

(1) $\dfrac{d}{\sqrt{2}}$ (2) $\sqrt{2}d$

(3) d (4) $2d$

Integer Type Questions

21. In the figure shown A is of mass 1 kg and B is a wedge of sufficient length of mass 2 kg. A moves with velocity 3 m/s and rises on B which is initially at rest. All the surfaces are smooth. By the time A reaches the highest point of its journey on B, find the work done by A on B (in joule).
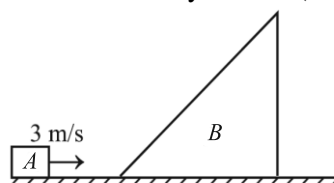
22. Consider a thin concavo-convex lens of glass ($\mu = 1.5$), convex surface of lens has a radius of curvature of 20 cm and concave surface has a radius curvature of 60 cm. The convex side of lens is silvered.
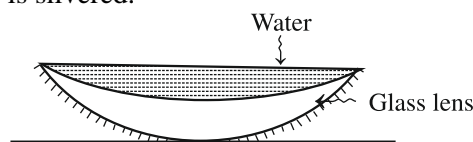

A pin is placed on optical axis of lens such that its image is formed at same place. If concave part of lens is now filled with water ($\mu = 4/3$), then the distance by which pin must be moved, so that its image again coincides with pin is $\dfrac{x}{13}$ cm. Value of x is _____.

23. A long straight wire carrying a current of 30A is placed in an external uniform magnetic field of induction 4×10^{-4} T (The direction of the current is parallel to magnetic field). The magnitude of the resultant magnetic induction at a point 2.0cm away from the wire is $n\times10^{-4}$ T. What is the value of n to the nearest integer?

24. A ball is projected from the ground at an angle of $45°$ with the horizontal surface. It reaches a maximum height of 120m and return to the ground. Upon hitting the ground for the first time it loses half of its kinetic energy. Immediately after the bounce, the velocity of the ball makes an angle $30°$ with the horizontal surface. The maximum height it reaches after the bounce (in meters) is

25. The figure shows a square loop PQRS with an edge length a .The resistance of the wire PQR is r and that of PSR is $2r$. The value of the magnetic field at the centre of the loop is found to be $\dfrac{\sqrt{2}\mu_0 i}{k\pi a}$, then what is the value of k?
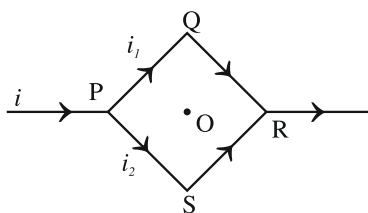

26. The time taken by a particle performing SHM on a straight line to pass from point A to B, where its velocities are same, is 2 seconds. After another 2 seconds it returns to B. The period of oscillation (in second) is

27. A young's double slit experiment is performed using monochromatic light of wavelength λ. The intensity of light at a point on the screen, where the path difference is λ is K units. The intensity of light at a point where the path difference $\dfrac{\lambda}{6}$ is given by $\dfrac{nK}{12}$, where n is an integer. The value of n is......

28. The potential energy of a particle is determined by the expression $U = \alpha (x^2 + y^2)$, where α is a positive constant. The particle begins to move from a point with the coordinates (3,3) only under the action of potential fields force. When it reaches the point (1, 1) its kinetic energy is $4K\alpha$. Find the value of K.

29. A mass m_1 lies on a fixed smooth cylinder. An ideal chord attached to m_1 passes over the cylinder and is connected to m_2. The system is released at $\theta = 30°$. The magnitude of acceleration of m_1 just after releasing the system is 5/n m/s², find the value of n. [g =10 m/s²]
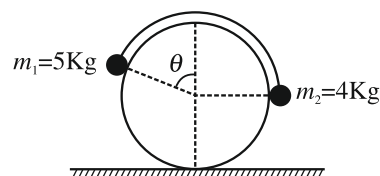
30. Consider the two loops with common center and on the same plane as shown in the figure. The large circular loop has radius R=10 cm and the small square loop has side a = 1 cm. There is a current circulating in the large loop given by $i(t)=i_0 t/\tau$ with $i_0 = \dfrac{2}{\pi}\times100A, \ \tau = 2\times10^{-2}$ sec. Emf (to the nearest integer in microvolt) induced in the small loop is
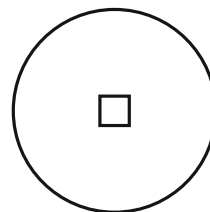
SECTION-II (CHEMISTRY)

Single Correct Type Questions

31. The standard molar heat of formation of ethane, CO_2 and water are respectively –21.l, –94.1 and –68.3 kcal/mol. The standard molar heat of combustion of ethane will be

(1) –372 kcal/mol   (2) 162 kcal/mol

(3) –240 kcal/mol   (4) 183.5 kcal/mol

32. The species in which the N-atom is in state of sp hybridization is

(1) NO_2

(2) NO_2^+

(3) NO_2^-

(4) NO_3^-

33. The option representing incorrect statement about elements of group 15 is:
    (1) The order of stability of oxidation state for +3 is $Bi^{3+} > Sb^{3+} > As^{3+}$ and for +5 is $Bi^{5+} < Sb^{5+} < As^{5+}$
    (2) In the case of nitrogen, all oxidation states from +1 to +5 tend to disproportionate in acid solution
    (3) There is considerable increase in covalent radius from N to P but from As to Bi only a small increase in covalent radius is observed
    (4) Nitrogen cannot form $d\pi$-$p\pi$ bond

34. For the photoelectric effect, the maximum kinetic energy (E_k) of the emitted photo electrons is plotted against the frequency (v) of the incident photons as shown in figure,
    The slope of the curve given below represents
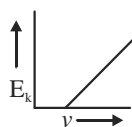
    (1) Charge of the electron
    (2) work function of the metal
    (3) Planck' s constant
    (4) Ratio of the planck's constant to electronic charge

35. Consider the following strong electrolytes
    NaOH,   KOH,   NaCl,   CH₃COONa,   BaCl₂
    A   B   C   D   E
    Which of the following option correctly represent the electrolytes whose molar conductivity at infinite dilution is needed for determination of molar conductivity at infinite dilution of $Ba(OH)_2$.
    (1) A, B and D   (2) A, C and D
    (3) A, C and E   (4) B, C and D

36. 2-Methyl but-1-ene reacts with mercuric acetate in presence of water to form a product, which on reduction with $NaBH_4$ yields
    (1) 2-Methyl butan-2-ol
    (2) 3-Methyl butan-2-ol
    (3) 2-Methyl butan-1-ol
    (4) None of the above

37. Which of the following is the strongest base:-
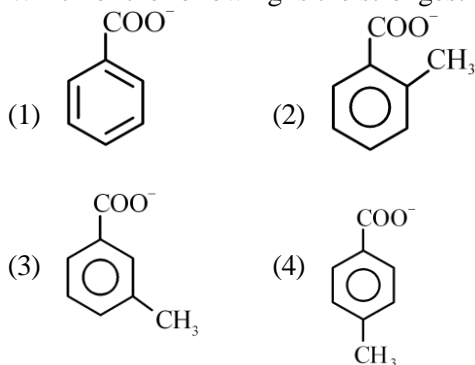
38. The degree of dissociation of $PCl_5(g)$ for the equilibrium $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ is approximately related to the pressure at equilibrium (P) by the relation [$\alpha \ll 1$]
    (1) $\alpha \propto P$ (2) $\alpha \propto \dfrac{1}{\sqrt{P}}$
    (3) $\alpha \propto \dfrac{1}{P^2}$ (4) $\alpha \propto \dfrac{1}{P^4}$

39. In the reaction $A \rightarrow B + C$, rate constant is $0.001\ Ms^{-1}$. If we start with 1 M of A then conc. of A and B after 10 minutes are respectively.
    (1) 0.5 M, 0.5M   (2) 0.6 M, 0.4 M
    (3) 0.4 M, 0.6 M   (4) None of these

40. On adding excess water, a compound produces white precipitate, which dissolves on adding dil HCl. The compound may be
    (1) $AsCl_3$ (2) $SbCl_3$
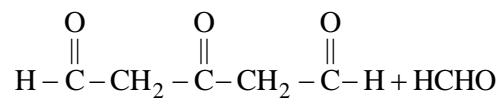   (3) $BiCl_3$ (4) Both $SbCl_3$ and $BiCl_3$

41. Compartments A and B have the following combinations of solution:

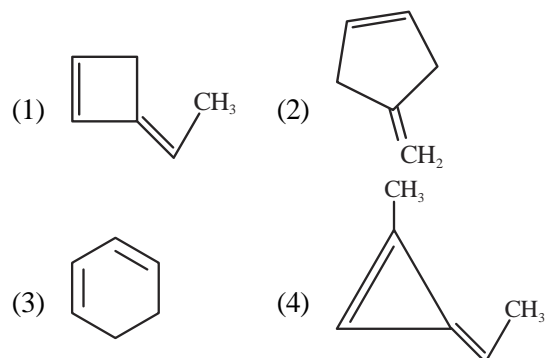 | | A | B |
    | --- | --- | --- |
    | i) | 0.1 M KCl | 0.2 M KCl |
    | ii) | 0.1 % (m/V) NaCl | 10% (m/V) NaCl |
    | iii) | 18 g L⁻¹ glucose | 34.2 g L⁻¹ sucrose |
    | iv) | 20% (mass-volume%) glucose | 10% (mass-volume %) glucose |

    Which of the following solutions are isotonic
    (1) i only   (2) iii only
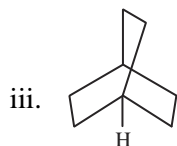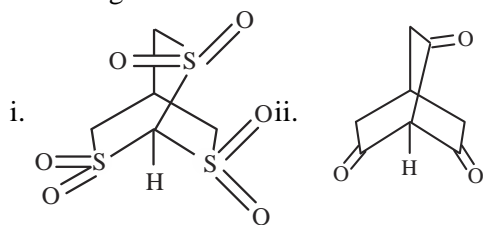   (3) iv only   (4) ii only

42. $X \xrightarrow{O_3/Zn,\ H_2O}$

    $$\underset{}{H-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-H} + HCHO$$

    The structure of X will be:

[7]

43. The acidity of the protons H in each of the following is

i.

ii.

iii.

   (1)   i > ii > iii   (2)   ii > iii > ii
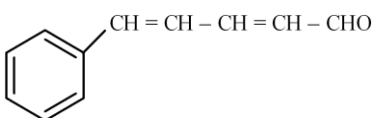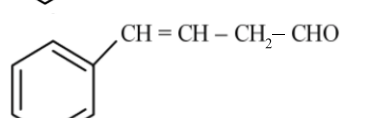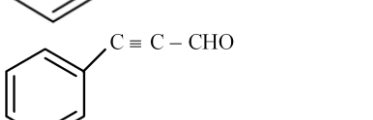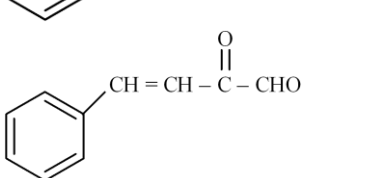   (3)   iii > i > ii   (4)   i = ii > iii

44. Which of the following hydrogen bond is strongest?

   (1)   H – F - - - - - - H – F

   (2)   H – O - - - - H – O
           | |
           H   H

   (3)   H – Cl - - - - - H – Cl

   (4) $F^{\ominus}$ - - - - H– F

45. The bond orders of NO^+, O_2^-, CN^- and CO_3^{2-} are respectively

   (1)   3.0, 1.5, 3.0, 2.0
   (2)   2.5, 2.0, 25, 1.5
   (3)   3.0, 1.5, 3.0, 1.33
   (4)   1.33, 1.5, 2.5, 2.33

46. An aldehyde, (P) which does not undergo self aldol condensation, gives benzaldehyde and two moles of (Q) on Ozonolysis. Compound (Q), on oxidation with silver ions gives oxalic acid. The structure of (P) is given as
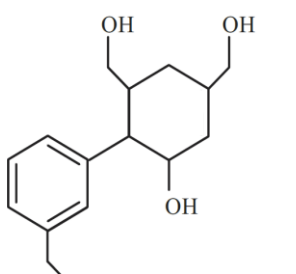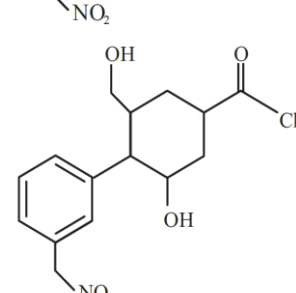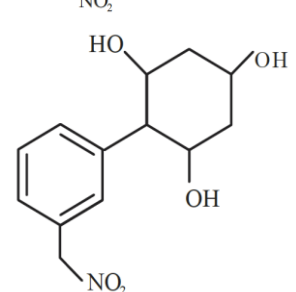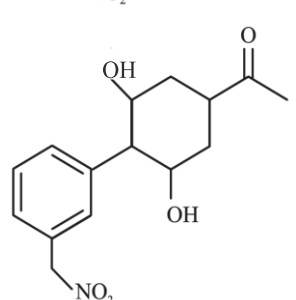
   (1)

   (2)

   (3)

   (4)

47. X and Y are neutral ligands. Both X and Y form octahedral complex with Ferrous ion viz. $[FeX_6]^{2+}$ and $[FeY_6]^{2+}$. Complex $[FeX_6]^{2+}$ is diamagnetic while $[FeY_6]^{2+}$ is paramagnetic. On the basis of this information, select the correct statement.

   (1) $[FeY_6]^{2+}$ is $d\,^2sp^3$ hybridised
   (2) $[FeX_6]^{2+}$ is $d\,^2sp^3$ hybridised
   (3)   Magnetic moment of $[FeY_6]^{2+}$ is 2.83 B.M
   (4)   Magnetic moment of $[FeY_6]^{2+}$ is 1.73 B.M

48. $\xrightarrow{\text{NaBH}_4}$ [X], [X] is
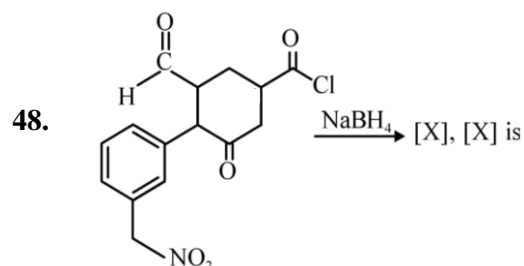
   (1)

   (2)

   (3)

   (4)

49. Which of the following compounds will not show mutarotation?

   (1)   Methyl -α- D glucopyranoside
   (2)   α–D(+) glucopyranose
   (3)   β–D(+) glucopyranose
   (4)   β–D(+) galactopyranose

**50.** The chloride of Vanadium has magnetic moment of 1.73BM. The vanadium chloride has the formula _____

(1) VCl_2 (2) VCl_3

(3) VCl_4 (4) VCl_5

Integer Type Questions

51. The conductivity (K) of a saturated solution of AgBr at 298K is 8.5×10^{-7} Scm^{-1}. If $\lambda^0_{Ag^\oplus}$ and $\lambda^0_{Br^\ominus}$ are 62 and 78 Scm^2 mol^{-1}, respectively, then value of K_{sp} of AgBr is $x \times 10^{-11}$moles^2/lit^2. Then value of 'x' is (nearest integer)

52. In a tripeptide Asp–Glu–Lys, the number of $\overset{\displaystyle}{\underset{\diagup}{C}} = O$ groups present is:

53. How many reactions will produce carboxylic acid, as their end product?

(1)

(2)

(3)

(4)

(5)

(6)
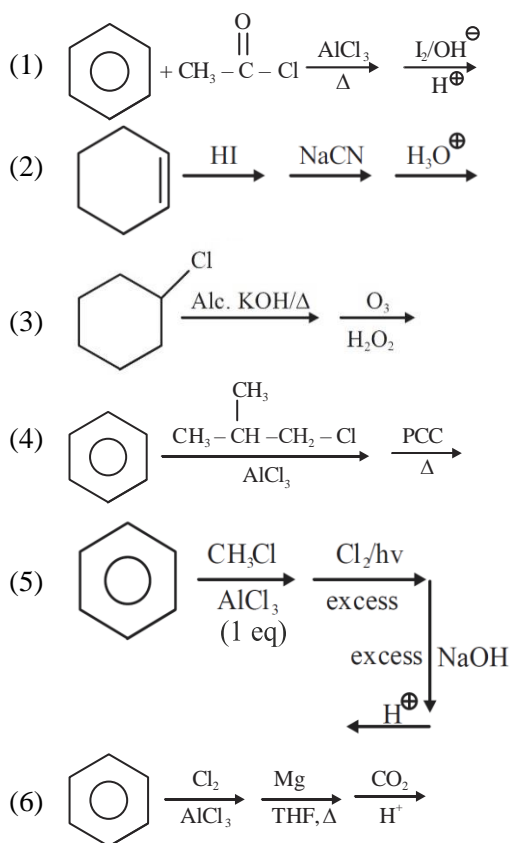
54. The Van't Hoff factor for 0.1M $Ba(NO_3)_2$ solution is 2.74. The % degree of dissociation is

55. The enthalpy of vaporization of liquid is 30 kJ mol^{-1} and entropy of vaporization is 75JK^{-1} mol^{-1}. The boiling point(K) of the liquid at 1 atm is

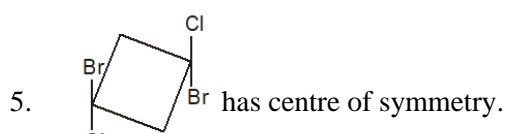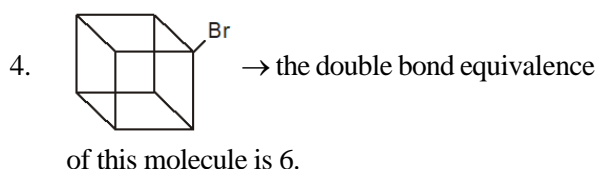**56.** How many substrates will give rearrangement (of carbocation) during S_N1 reaction?
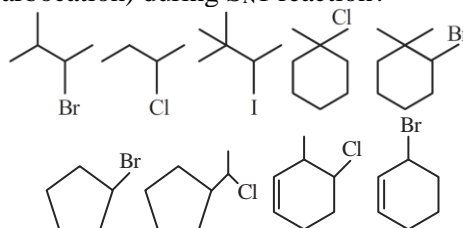
57. The enthalpy of hydration of Fe^{2+} is 11.4 kcal/mol higher than would be expected, if there were no crystal field stabilization energy. Assuming the aqua complex to be high-spin, estimate the magnitude of 10 Δ_0 for $[Fe(H_2O)_6]^{2+}$. Report answer in kcal/mol.

58. 5 mol of $Fe_2(C_2O_4)_3$ is oxidised by x mol of $K_2Cr_2O_7$ in acidic medium, calculate the value of x?

59. Consider the following statements:
1. Substitution reaction in alkyl halides is possible in both aqueous and polar aprotic medium.
2. The nucleophilic strength and basic strength for $\bar{C}H_3$, $\bar{N}H_2$, $\bar{O}H$ and F^- have same order.
3. SCN^- is an ambident nucleophile.
4. → the double bond equivalence of this molecule is 6.
5. has centre of symmetry.
6. Butan – 2 – ol is optically active.
How many of the above statements are correct?

60. The number of unpaired electrons in $[CoF_6]^{3-}$ is:

SECTION-III (MATHEMATICS)

Single Correct Type Questions

61. $\sum_{r=1}^{n} \cot^{-1}\left(\dfrac{2+2^{2r}}{2^r}\right)$ is equal to

(1) $\tan^{-1}(2^n)$ (2) $\tan^{-1}(2^n) - \dfrac{\pi}{4}$

(3) $\tan^{-1}(2^{n+1})$ (4) $\tan^{-1}(2^{n+1}) - \dfrac{\pi}{4}$

62. If a, b are natural numbers such that function f satisfies $f(a+b) = f(a)f(b)$ and $\sum_{r=1}^{\infty} f(r) = 31$, then $\dfrac{f(9)+f(10)}{f(9)-f(10)}$ is

(1) 61   (2) 60

(3) 63   (4) 62

63. The value of the definite integral $\int\limits_{-\infty}^{\ln 3} \{e^x\}\, dx$

equals (where $\{y\}$ denote fractional part of y)
(1) $3 + \ln 2 - 2 \ln 3$
(2) $3 - \ln 3$
(3) $2 \ln 3 + \ln 2$
(4) 1

64. If β is a root of the equation $4x^2 + 2x = 1$, then the other root must be
(1) $3\beta^3 - 4\beta$
(2) $4\beta^3 - 3\beta$
(3) $2\beta^2 - 1$
(4) $1 + \beta^2$

65. Area enclosed by the figure described by the equation $x^4 = 2x^2 + y^2 - 1$ is
(1) 3
(2) $\dfrac{8}{3}$
(3) $\dfrac{7}{3}$
(4) $\dfrac{10}{3}$

66. The sum of the first three numbers in an A.P. is 24 and their product is 384. Then which of the following hold(s) good?
(1) sum of n terms can be $2n(2n + 1)$
(2) sum to n terms can be $2n(n + 3)$
(3) sum of n terms can be $14n - 2n^2$, $2n(n + 1)$
(4) sum of the squares of the three numbers is 225

67. From an urn containing x white and $y - x$ black balls, n balls have been lost, then probability of drawing a white ball
(1) before the loss is $\dfrac{x}{2y}$
(2) after the loss is $\dfrac{x}{y}$ for $n = 1$
(3) after the loss is $\dfrac{x}{3y}$ for $n = 2$
(4) after the loss is $\dfrac{x}{4y}$ for $n = 3$

68. If one of the diameters of the circle $x^2 + y^2 - 2x - 6y + 6 = 0$ is a chord of another circle 'S', having center at $(2, 1)$, then radius of circle S is
(1) 3
(2) 5
(3) 7
(4) 1

69. If the latus rectum of the ellipse $x^2 + 4y^2 + 2x + 8y - P = 0$ is 4, and its major axis is L, then $P + L - 5$ is equal to
(1) 50
(2) 60
(3) 70
(4) 80

70. If $2\cos\alpha = \left(x + \dfrac{1}{x}\right)$ and $2\cos\beta = \left(y + \dfrac{1}{y}\right)$, $(xy > 0)$, $x, y, \alpha, \beta, \gamma \in R$ then
(1) $\sin(\alpha + \beta + \gamma) = 2\sin\gamma$
(2) $\cos\alpha \cos\beta = 2$
(3) $(\cos\alpha + \cos\beta)^2 = 4$
(4) $\sin(\alpha + \beta + \gamma) = \sin\alpha + \sin\beta + 2\sin\gamma$

71. Inradius of the triangle formed by the lines $7x + 5y + 3 = 0$, $16x + y = 14$, $13x = 2y + 17$ is
(1) $\dfrac{\sqrt{3}}{2}$
(2) $\dfrac{2}{\sqrt{3}}$
(3) $\sqrt{3}$
(4) 0

72. If $f(x, y) = 0$ is the solution of equation $(1 - y^2)dx = xy\, dy$, $f(4, 0) = 0$. Then the curve $f(x, y) = 0$ is
(1) symmetric about x-axis
(2) symmetric about line $y = -1$
(3) symmetric about line $y = 2$
(4) symmetric about $y = x$

73. If $f(1) = 2, f(4) = 7, f'(1) = 5, f'(4) = 4$ and $f''(x)$ is continuous, then the value of $\int\limits_{1}^{4} xf''(x)dx$
(1) has 2 prime factors
(2) is a prime number
(3) is 8
(4) is -5

74. If $\arg\left(\dfrac{z-2i}{z+2i}\right) = \dfrac{\pi}{6}$, then which of the following options gives the correct locus of z?

(1)

(2)

(3)

(4)
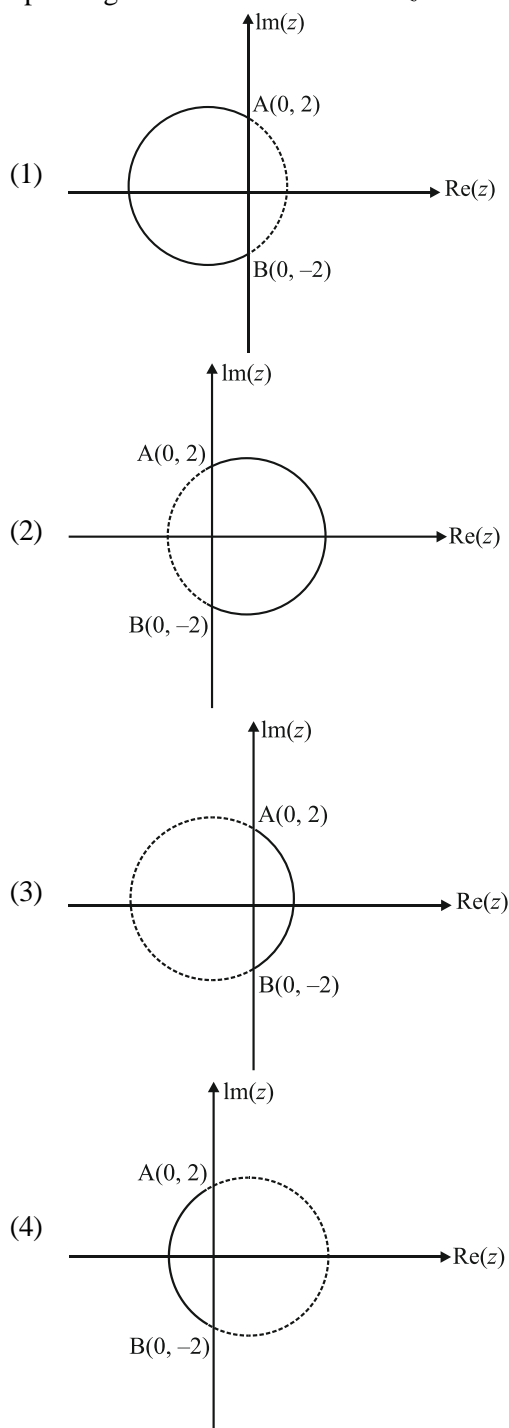
75. Let S be the set of all values of k, for which the shortest distance between the lines $\dfrac{x-k}{0} = \dfrac{y-3}{4} = \dfrac{z+6}{1}$ and $\dfrac{x+k}{3} = \dfrac{y}{-4} = \dfrac{z-6}{0}$ is 13. Then $4\left|\sum\limits_{k \in S} k\right|$ is equal to

(1) 152
(2) 154
(3) 153
(4) 151

76. Range of $f(x) = \dfrac{2\cos^2 x + 2\cos x + 3}{\cos^2 x + \cos x + 1}$ is $[l, m]$, then

(1) $l + m = 5$
(2) $l \cdot m = \dfrac{70}{9}$
(3) $l + m = \dfrac{20}{3}$
(4) $l \cdot m = 8$

77. If z is a complex number such that $\dfrac{z-1}{z+1} = a + ib$ (where $a, b \in R, z \neq -1$) and $|z| = 1$, then $(a + b)$ is (Im (z) = Imaginary part of z and Re(z) = Real part of z)

(1) $\dfrac{\text{Im}(z)}{1 + \text{Re}(z)}$
(2) $\dfrac{\text{Re}(z)}{1 + \text{Im}(z)}$
(3) $\dfrac{\text{Im}(z)}{1 - \text{Re}(z)}$
(4) $\dfrac{\text{Re}(z)}{1 - \text{Im}(z)}$

78. If a and b be the coefficients of x^4 and x^2 respectively in the expansion of $\left[x - \left(x^2 - 1\right)^{\frac{1}{2}}\right]^6 + \left[x + \left(x^2 - 1\right)^{\frac{1}{2}}\right]^6$, then

(1) $\dfrac{a-b}{a+b} = 60$
(2) $\dfrac{a+b}{a-b} = 60$
(3) $\dfrac{a-b}{a+b} = \dfrac{33}{15}$
(4) $\dfrac{a+b}{a-b} = \dfrac{33}{15}$

79. The complex number which satisfy the equation $2z = |z| + 2i$ can be

(1) $1 - \sqrt{3}\,i$
(2) $\dfrac{1}{\sqrt{3}} + i$
(3) $1 + \dfrac{1}{\sqrt{3}}i$
(4) $\sqrt{3} + i$

80. Let $T = \int\limits_0^{\ln 2} \dfrac{2e^{3x} + e^{2x} - 1}{e^{3x} + e^{2x} - e^x + 1}\,dx$, then e^T equals:

(1) $\dfrac{7}{4}$
(2) $\dfrac{7}{2}$
(3) $\dfrac{11}{2}$
(4) $\dfrac{11}{4}$

Integer Type Questions

81. A curve $y(x)$ satisfies the differential equation, $x\dfrac{dy}{dx} = y - x^2$ and passes through $(1, 0)$. If the area bounded by the curve and the x-axis is A, then $12A$ is

82. Let $f(x) = \begin{cases} \dfrac{B(e^x - e^{-x} - 2\sin x)}{x^3} & ; \quad x \neq 0 \\ A & ; \quad x = 0 \end{cases}$,

where A and B are chosen from the set of first ten natural numbers, with B > A. If the probability that $f(x)$ is continuous is $\dfrac{p}{q}$ (Where p and q are relatively prime), then $p + q$ is

83. Consider a square of side 2 cm. It is cut from one of its corner as shown in adjacent figure.
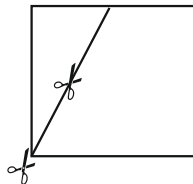
Maximum value of sum of the perimeters of two plane figures thus formed is $4\sqrt{k} + 8$, then k is

84. The coefficient of x^{210} in the expression $(x - 1)(x^2 - 2)(x^3 - 3) \dots (x^{20} - 20)$ is

85. The maximum value of p so that $(1 + 7^{2p})$ is a factor of $\displaystyle\sum_{r=0}^{125} (49)^r$, is equals to

86. The number of five-digit numbers that can be formed using its digits 1, 2, 3, 4, 5, 6, 7, 8, 9 in which one digit appears once and two digits appear twice (*e.g.*, 44533) is k then the value of $\dfrac{k}{1890}$ is equal to _____

87. Let O be the interior point of ΔABC such that $2\overrightarrow{OA} + 3\overrightarrow{OB} + 6\overrightarrow{OC} = \vec{0}$ where O is origin. If $\dfrac{\text{Area of } (\Delta ABC)}{\text{Area of } (\Delta AOB)} = \dfrac{m}{n}$, where m and n are relatively prime, then $(m - n)$ is equal to _____

88. If $\displaystyle\int \dfrac{\cos x - \sin x}{\sqrt{8 - \sin 2x}}\, dx = \alpha \sin^{-1}\left(\dfrac{\sin x + \cos x}{\beta}\right) + c$,

where c is a constant of integration, then the value of $(\alpha + \beta)$ is

89. Let B is adjoint of matrix A, having order 3 and $B^T B^{-1} = A$ (where B is non-singular), then $tr(A + B)$ is (where $tr(A)$ is sum of diagonal elements of matrix A)

90. Let $f : (0, \infty) \to (0, \infty)$ be a function differentiable at 3 and satisfying $f(3) = 3f'(3)$. If the value of

$$\lim_{x \to \infty} \left(\dfrac{f\left(3 + \dfrac{3}{x}\right)}{f(3)} \right)^x \text{ is } L, \text{ then } [L] \text{ is (where } [.] \text{ is}$$

greatest integer function)