All India Test Series (JEE–2024)

AVJLM1/05 | **Test- 05** | **Lakshya JEE 2024**

DURATION : 180 Minutes | **DATE : 12/01/2024** | **M.MARKS : 300**

Topics Covered

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

IMPORTANT VALUES

$\sqrt{2}$ = 1.414

$\sqrt{3}$ = 1.732

$\sqrt{5}$ = 2.236

π = 3.142

e (Euler's constant) = 2.718

ln 10 = 2.303

$\log_{10}2$ = 0.3010

$\log_{10}3$= 0.4770

$\log_{10}7$ = 0.845

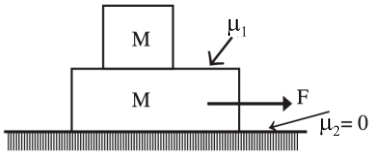
**** Use above values unless otherwise specified in a question.***

❑❑❑

SECTION-I (PHYSICS)

Single Correct Type Questions

1. For $\mu_1 = \frac{F}{Mg}$, the power supplied by constant force F to the shown system of two blocks as a function of time t is



(1) Zero (2) $\frac{F^2}{2M}t$

(3) $\frac{F^2}{M}t$ (4) $\frac{F^2}{4M}t$

2. Current I flowing along the path ABCD, along the four edges of the cube [Figure-(a)], creates a magnetic field B_0 at the centre of the cube. Find the magnetic field B created at the center of the cube by a current I flowing along the path of the six edges ABCGHEA [Figure-(b)].

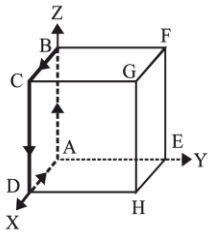


Figure-(a)

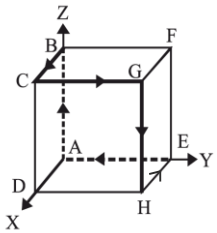


Figure-(b)

(1) $\sqrt{\frac{3}{2}}B_0$, Towards corner G

(2) $\sqrt{3}B_0$, Towards corner F

(3) $\sqrt{\frac{3}{2}}B_0$, Towards corner H

(4) $\sqrt{3}B_0$, Towards corner G

3. Maximum height reached by a rocket fired with a speed equal to 50% of the escape velocity from earth's surface (R = radius of earth) is :

(1) $R/2$ (2) $16R/9$

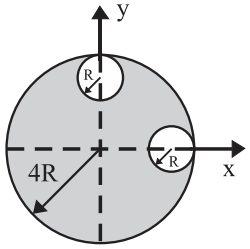
(3) $R/3$ (4) $R/8$

4. A ball suspended by a thread swings in a vertical plane so that its accelerations in the extreme position and lowest position are equal in magnitude. Angle θ of thread deflection with vertical downward direction in the extreme position will be:

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

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

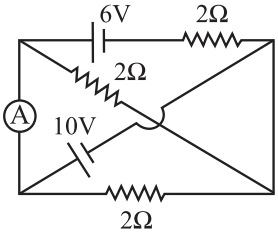
5. From a uniform circular disc of radius 4 R two small discs of radius R are cut off as shown. The centre of mass of the new structure will be as shown: (Centre of lower circular cavity lies on x-axis and centre of upper circular cavity lies on y-axis)



(1) $\hat{i}\frac{R}{5}+\hat{j}\frac{R}{5}$ (2) $-\hat{i}\frac{R}{5}+\hat{j}\frac{R}{5}$

(3) $-\hat{i}\frac{R}{14}-\hat{j}\frac{R}{14}$ (4) $-\hat{i}\frac{3R}{14}-\hat{j}\frac{3R}{14}$

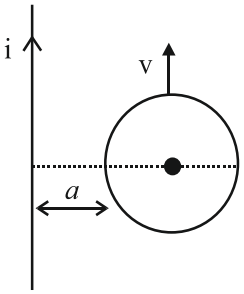
6. An ideal ammeter A is connected in a circuit as shown in circuit diagram. What will be the reading of ammeter (in S.I. units)?



(1) 3 (2) 5

(3) 7 (4) None of these

7. In plane of a straight long current carrying wire a circular loop of radius r is moved with a velocity v as shown in the diagram. The force needed to maintain its velocity constant is (i current flows in the straight wire):



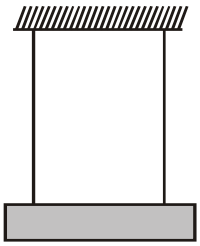
(1) $\frac{\mu_0 ivr}{2\pi a}$

(2) $\frac{\mu_0 ivr}{2\pi(a+r)}$

(3) $\frac{\mu_0 ivr}{2\pi}ln\left(\frac{2r+a}{a}\right)$

(4) Zero

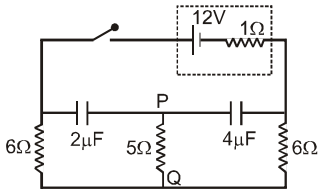
8. Two wires of equal length and cross-section area are suspended as shown in figure. Their Young's modulus are Y_1 and Y_2 respectively. The equivalent Young's modulus of this system of two wires for short extension will be



(1) $Y_1 + Y_2$ (2) $\frac{Y_1 + Y_2}{2}$

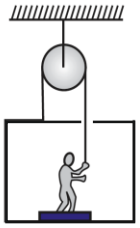
(3) $\frac{Y_1 Y_2}{Y_1 + Y_2}$ (4) $\sqrt{Y_1\ Y_2}$

9. In the circuit shown in figure, both of the capacitors are initially uncharged. The current through resistor *PQ* just after closing the switch is:



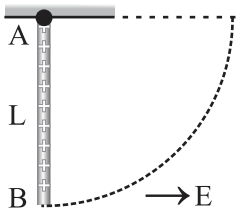
(1) 2A from P to Q
(2) 2A from Q to P
(3) 6A from P to Q
(4) None of these

10. Figure shows a man of mass 50 kg standing on a light weighing machine kept in a box of mass 30 kg. The box is hanging from a pulley fixed to the ceiling through a light rope, the other end of which is held by the man himself. If the man manages to keep the box at rest, the weight shown by the machine is ($g = 10\ m/s^2$)



(1) 100 N (2) 200 N
(3) 250 N (4) 400 N

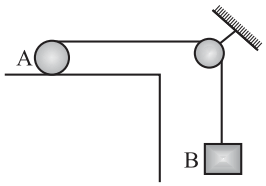
11. A uniform rod *AB* of length *L* and mass *M* is uniformly charged with a charge *Q* and it is freely suspended from end *A* in the vertical plane as shown in figure. An electric field *E* is suddenly switched on in the horizontal direction due to which rod get turned by a maximum angle 90°. The magnitude of *E* is



(1) $\frac{Mg}{Q}$ (2) $\frac{2Mg}{Q}$

(3) $\frac{4Mg}{Q}$ (4) $\frac{3Mg}{Q}$

12. Find the acceleration of uniform solid right circular roller *A*, weighing 12 kg when it is being pulled by an- other weight *B* (6 kg) along the horizontal plane as in figure (pulley is massless). The weight *B* is attached to the end of a string wound around the circumference of roller. Assume there is no slipping of the roller and the string is inextensible.



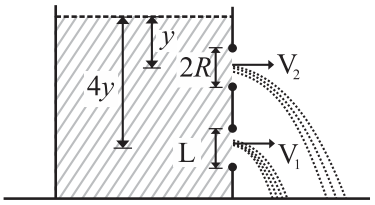
(1) 4 g/7 (2) 2 g/7
(3) g/7 (4) 3 g/7

13. Only two point masses of masses m_1 and m_2 come out of a blast of a particle kept at rest initially in free space. If momentum of first point mass is *p*, then which of the following expression gives the minimum energy of explosion?

(1) $\frac{p^2}{2(m_1 + m_2)}$ (2) $\frac{p^2}{2\sqrt{m_1 m_2}}$

(3) $\frac{p^2(m_1 + m_2)}{2m_1 m_2}$ (4) $\frac{p^2}{2(m_1 - m_2)}$

14. A large open tank has two small holes in its vertical wall as shown in figure. One is a square hole of side *'L'* at a depth '4*y*' from the top and the other is a circular hole of radius *'R'* at a depth *'y'* from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then, *'R*' is equal to:



(1) $\frac{L}{\sqrt{2\pi}}$ (2) $2\pi L$

(3) $\sqrt{\frac{2}{\pi}}L$ (4) $\frac{L}{2\pi}$

15. Diameter of a plano-convex lens is 6 cm and thickness at the centre is 3 mm. If the speed of light in the material of the lens is 2×10^8 m/sec, the focal length of the lens is (Assume paraxial approximation)

(1) 15.15 cm (2) 20.40 cm
(3) 30.30 cm (4) 10.15 cm

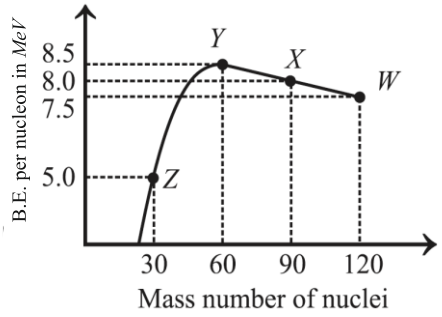
16. If the distance between the first maxima and fifth minima, on same side of central maxima of a double slit pattern, is 7 mm and the slits are separated by 0.15 mm with the screen 50 cm from the slits, then wavelength of the light used is

(1) 600 nm (2) 525 nm
(3) 467 nm (4) 420 nm

17. In which of the following process the number of protons in the nucleus increases?

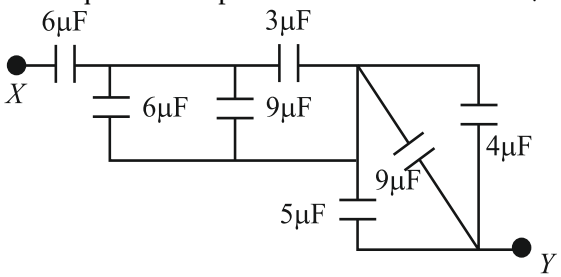
(1) α decay (2) β^- decay
(3) β^+ decay (4) K capture

18. Binding energy per nucleon verses mass number curve for nuclei is shown in the figure. *W, X, Y* and *Z* are four nuclei indicated on the curve. The process that would release energy is



(1) $Y\rightarrow 2Z$ (2) $W\rightarrow X+Z$
(3) $W\rightarrow 2Y$ (4) $X\rightarrow Y+Z$

19. Find equivalent capacitance between *X* and *Y*.



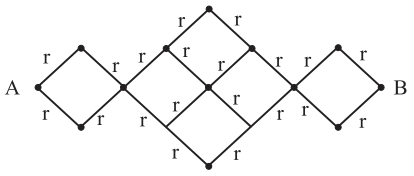
(1) 3.6 μF (2) 6 μF
(3) 1.5 μF (4) 9 μF

20. After falling through a vertical height *h* a particle strikes an incline plane of angle of inclination θ. If the plane is smooth and the particle after strike moves horizontally then, the coefficient of restitution between the particle and incline surface is equal to

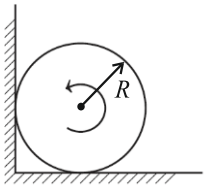
(1) $\tan^2\theta$ (2) $\cot^2\theta$
(3) $\tan\theta$ (4) $\cot\theta$

Integer Type Questions

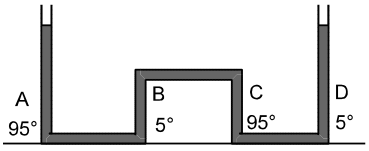
21. The resistance of each straight section is r = 2Ω. Find the equivalent resistance (in ohms) between *A* and *B*.



22. A uniform cylinder of the radius *R* (*R* = 3 m) is spun about its axis at an angular velocity $\omega_o\left(\omega_o = 40\sqrt{\pi}\,\text{rad}\,\text{s}^{-1}\right)$ and placed between two perpendicular walls as shown. The coefficient of friction between the walls and cylinder is μ (μ =2). Then, how many rotations will the cylinder make before it comes to rest? ($g = 10\ \text{m/s}^2$)



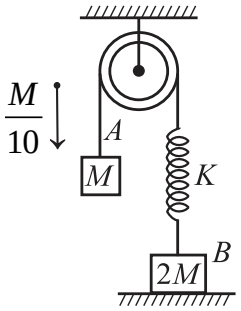
23. The apparatus shown in the figure consists of four glass columns connected by horizontal sections. The height of two central columns *B* & *C* are 49 cm each. The two outer columns *A* & *D* are open to the atmosphere. *A* & *C* are maintained at a temperature of 95° C while the columns *B* & *D* are maintained at 5° C. The height of the liquid in *A* & *D* measured from the base line are 52.8 cm & 51 cm respectively. The coefficient of thermal expansion of the liquid is $N \times 10^{-4}/°\text{C}$. Value of *N* is qual to _____. (Answer to the closest integer)



24. An object is placed in front of a convex spherical mirror at a distance of 50 cm. A plane mirror is introduced covering the lower half of the convex mirror. If the distance between the object and the plane mirror is 30 cm, it is found that the images formed by the two mirrors are at same location. What is the radius of curvature of the convex mirror _____cm. (Answer to the nearest integer)

25. One mole of an ideal diatomic gas undergoes a process such that pressure *P* varies with temperature *T* as $P \propto 1/T^2$. The molar specific heat for such a process is *xR*. Value of 2*x* is equal to_____. (*R* is universal gas constant)

26. In the shown figure, a particle of mass $M/10$ strikes the block of mass M with velocity V_o and gets attached to it. For what velocity V_o (in ms^{-1}), the block B is just able to leave the ground?
(Given, M = 100gm, K = 880 N/m, g =10m/s^2)



27. A galvanometer of resistance 30Ω is connected to an ideal battery of emf 2V with 1970Ω resistance in series. A full-scale deflection of 20 divisions is obtained in the galvanometer. To reduce the deflection to 10 divisions, the resistance value (in ohm) in series required is 10n. Then value of n is

28. The ionisation potential of H-atom is $13.6\,V$. When a hydrogen atom gas sample is excited from ground state by monochromatic radiations of $970.6\,Å$, then according to Bohr's theory, the number of possible subsequent different emission lines will be_____.

29. The length of a magnet is large compared to its width and breadth. The time period of its oscillation in a vibration magnetometer is 150 ms. The magnet is cut along its length into three equal parts and three parts are then placed on each other with their like poles together. The time period of this combination (in ms) will be

30. A satellite is launched into a circular orbit, $\frac{R}{4}$ above the surface of the earth. The time period of revolution is $T = 2\pi(n)^{3/2}\sqrt{\frac{R}{g}}$, where R is the radius of the earth and g is the acceleration due to gravity at earth's surface. Then what is value of 4n?

SECTION-II (CHEMISTRY)

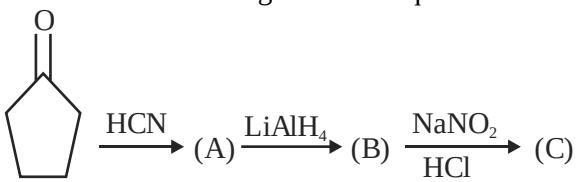
Single Correct Type Questions

31. A pure liquid A has a vapour pressure of 10 torr. At the same temperature, vapour pressure reduced by 5 torr when 9 g of solid B is dissolved in 20 g of A. Molecular mass of A is 200 amu. The molecular mass of B is:
[Consider B neither undergoes dissociation nor association]
(1) 100 amu
(2) 90 amu
(3) 75 amu
(4) 120 amu

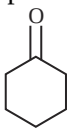
32. The correct option for free expansion of an ideal gas under adiabatic condition is
(1) system q < 0, ΔT = 0, w = 0 and $\Delta S_{system} = 0$
(2) system q = 0, ΔT = 0, w = 0 and $\Delta S_{system} = 0$
(3) system q = 0, ΔT = 0, w = 0 and $\Delta S_{system} \neq 0$
(4) system q = 0, ΔT < 0, w > 0 and $\Delta S_{system} \neq 0$

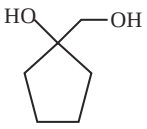
33. Consider two complexes $[Fe(H_2O_6)]^{+2}$ and $[Fe(CN)_6]^{-4}$. Identify the option representing the properties or characteristics in which they differ:
(1) geometry, magnetic moment
(2) geometry, hybridisation
(3) magnetic moment, colour
(4) hybridisation, number of d-electrons

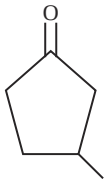
34. Consider the following reaction sequence.

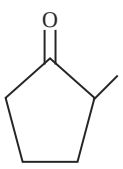


Find product C in the above reaction sequence is:

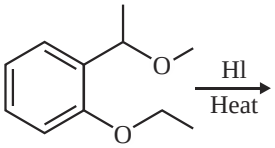
(1) 

(2) 

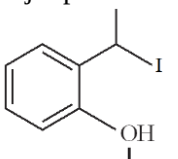
(3) 

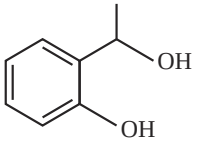
(4) 

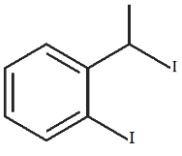
35. Consider the reaction

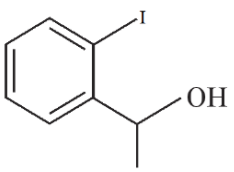


The major product formed in the above reaction is:

(1) 

(2) 

(3) 

(4) 

36. The percentage composition by weight of an aqueous solution of a non-electrolyte solute (Molar mass = 150) which boils at 373.52 K is: (Given K_b for H_2O = 0.52 K kg mol^{-1})

(1) 20% (2) 13%

(3) 7% (4) 25%

37. Among the orders of thermal stability of hydrides of group 15 given in the options, the correct order is represented by, which of the following option.

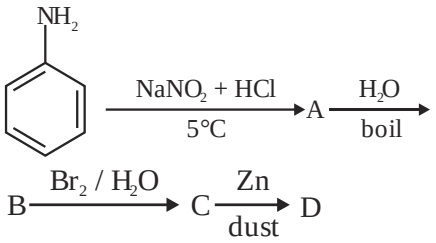
(1) $NH_3 > PH_3 > AsH_3 > BiH_3 > SbH_3$

(2) $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$

(3) $NH_3 < PH_3 < SbH_3 > AsH_3 > BiH_3$

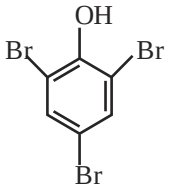
(4) $BiH_3 > SbH_3 > AsH_3 > PH_3 > NH_3$

38.

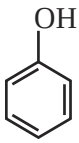


Compound 'D' is

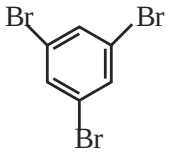
(1)



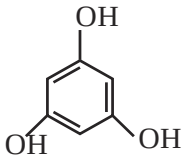
(2)



(3)



(4)



39. The option correctly representing ionic radius (in Å) of N^{-3}, O^{-2} and F^- respectively is:

(1) 1.71, 1.40 and 1.36

(2) 1.71, 1.36 and 1.40

(3) 1.36, 1.40 and 1.71

(4) 1.36, 1.71 and 1.40

40. **Statement-1:** Boric acid (H_3BO_3) and fluoroboric acid (HBF_4) both are mono basic acid in water

Statement-2: Both the acid are OH^- acceptors rather than proton donors

(1) Statement 1 is true, statement 2 is true, statement 2 is a correct explanation for statement 1

(2) Statement 1 is true, statement 2 is true, statement 2 is NOT a correct explanation for statement 1

(3) Statement 1 is true, statement 2 is false

(4) Statement 1 is false, statement 2 is true

41. Which of the following statements regarding sulphur is not correct?

(1) Both rhombic and monoclinic sulphur are soluble in CS_2

(2) Both rhombic and monoclinic sulphur have S_8 molecules

(3) The stable form at room temperature is rhombic sulphur

(4) Monoclinic sulphur transforms to rhombic form when heated above 369 K

42. In the detection of nitrogen of an organic compound by Lassaigne's test, Prussian blue colour is obtained. This is due to the formation of which of the following complexes?

(1) $Fe_2\left[Fe(CN)_6\right]$

(2) $Fe_4\left[Fe(CN)_6\right]_3$

(3) $Fe_3\left[Fe(CN)_6\right]_4$

(4) $Na_4\left[Fe(CN)_6\right]$

43. A 2.5 g sample of a Mohr's salt reacts completely with 50 mL of $\frac{N}{10}$ $KMnO_4$ solution. The option correctly representing % purity of the sample of Mohr's salt is (Molar mass of Mohr's salt is 392 g/mol.)

(1) 78.4

(2) 82.4

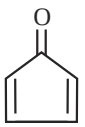
(3) 37

(4) 40

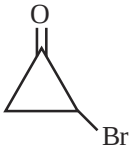
44. Among the carbonyl compound given in the options, the compound which has maximum dipole moment is:

(1)

(2)



(3)



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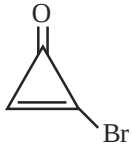


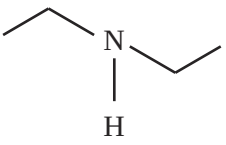
45. $CH_3CH_2Br \xrightarrow{AgCN} A \xrightarrow{H_3O^{\oplus}} B$; (B) is

(1) $CH_3CH_2NHCH_3$

(2) $CH_3 - CH_2 - CH_2 - NH_2$

(3) $CH_3 - CH_2 - NH_2$

(4)

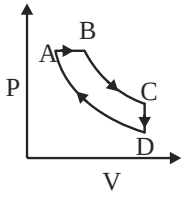


46. Which of the following options correctly represents potential energy of the electron present in He^+ ion:

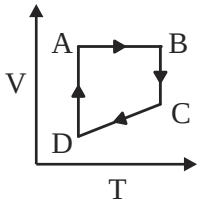
(1) $\frac{e^2}{2\pi\varepsilon_0 r}$ (2) $\frac{3e^2}{4\pi\varepsilon_0 r}$

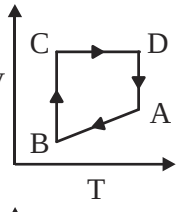
(3) $\frac{-2e^2}{4\pi\varepsilon_0 r}$ (4) $\frac{-e^2}{4\pi\varepsilon_0 r}$

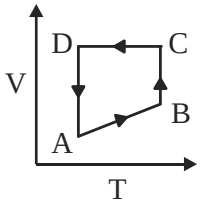
47. Consider P-V diagram of a cycle process ABCDA for an ideal gas.

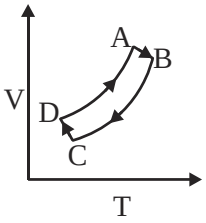


Identify the option representing the same process as represented in the P–V diagram above.

(1) 

(2) 

(3) 

(4) 

48. Which of the following order is INCORRECT for the indicated property?

(1) BeO < MgO (basic strength)

(2) BeF_2 < LiF (Lattice energy)

(3) $SO_2 > SeO_2 > TeO_2$ (acidic strength)

(4) NaCl > KCl > RbCl > CsCl (melting point)

49. The option containing the pair which does not exist or is highly unstable.

(1) $T\ell^{+1}I_3$ and CuF_2

(2) $T\ell^{+1}Br$ and $CuBr_2$

(3) $T\ell^{+3}I_3$ and CuI_2

(4) $T\ell^{+1}Cl$ and $CuCl_2$

50. Orange solid $(S_1) \xrightarrow{\Delta}$ diamagnetic gas + only green residue

Orange solid $(S_2) \xrightarrow{\Delta}$ paramagnetic gas + green solid + yellow solid

S_1 and S_2 are respectively:

(1) $(NH_4)_2Cr_2O_7$, KNO_3

(2) $Na_2Cr_2O_7$, $K_2Cr_2O_7$

(3) $K_2Cr_2O_7$, $(NH_4)_2Cr_2O_7$

(4) $(NH_4)_2Cr_2O_7$, $Na_2Cr_2O_7$

Integer Type Questions

51. Given below are amino acids.

Histidine, Glycine, Valine, Alanine, Aspartic acid, Lysine, Methionine.

The number of essential or semi essential amino acids is:

52. A radioactive isotope has a half-life of 3 hours. Mass of the isotope (in grams) remaining undecayed after 18 hours, if the initial mass of the isotope is 256 g is:

53. The number of compounds having molecular formula C_4H_8O, which react with CH_3MgBr to form 2° alcohol after acidification is:

54. Consider the reaction at equilibrium $N_2O_4(g) \rightleftharpoons 2NO_2(g)$. The degree of dissociation of N_2O_4 is 0.2 at 1 atm. The value of K_P for the reaction $2NO_2(g) \rightleftharpoons N_2O_4(g)$ at the same temperature is:

55. All the energy released from the reaction X → Y, $\Delta_rG° = 193kJ\ mol^{-1}$ is used for oxidizing M^+ as $M^+ \rightarrow M^{3+} + 2e^-$, E° = -0.25V. Under standard conditions, the number of moles of M^+ oxidized when one mole of X is converted to Y is

[$F = 96500C\ mol^{-1}$]

56. Calculate the number of acyclic isomeric compounds with molecular formula C_5H_{10} (including stereoisomers)

57. Total number of molecules in which all the possible bond angles are identical

PF_3, CF_4, XeF_4, PF_5,IF_7, BeF_2, SF_6

58. Propane reacts with chlorine in sunlight to give two products. 1-chloropropane is obtained in 44% yield and 2-chloropropane is obtained in 56% yield of the total product. 2-Methylpropane reacts with chlorine under same conditions to produce 1-chloro-2-methylpropane 66% and 2-chloro-2-methylpropane 34%. What will be the percent yield (X) of the major product obtained when 1, 3, 5-trimethylcyclohexane is treated with Cl_2 in similar conditions (nearest integer)?

59. 0.71g of a sample of bleaching powder ($CaOCl_2$) is dissolved in 100 mL of water. 50 mL of this solution is titrated with KI solution. The I_2 so liberated required 10 mL of 0.1N $Na_2S_2O_3$ (hypo) solution in acidic medium for complete neutralisation. Calculate the percentage of available Cl_2 from the sample of bleaching powder.

60. At 1 atm and 273 K, 16 g of SO_x gas occupies 5.6 L. What is the value of x?

SECTION-III (MATHEMATICS)

Single Correct Type Questions

61. If $f(x)=\frac{1}{4}\left[\sin x+\left[\sin x+\left[\sin x+[\sin x]\right]\right]\right]$, then number of solutions of equation $\frac{1}{2}\left[f(x)+[f(x)]\right]=\cos x$, is (where [·] denotes GIF)

(1) 1 (2) 2
(3) 3 (4) 0

62. Let $f(x)$ be a cubic polynomial with $f(1) = -10$, $f(-1) = 6$ and has a local minima at $x = 1$, and $f'(x)$ has a local minima at $x = -1$. Then $f(0)$ is equal to

(1) 0 (2) –5
(3) –8 (4) –6

63. Let $f(x)$ be a function satisfying $f'(x) = f(x)$ with $f(0) = 1$ and g be the function satisfying $f(x) + g(x) = x$, then the value of $\int_0^1 f(x)g(x)dx$

(1) $\frac{3-e^2}{2}$ (2) $\frac{e^2-3}{2}$
(3) $\frac{e^2}{2}$ (4) $\frac{e-2}{4}$

64. The total number of six digit numbers, formed using the digits 4, 5, 9 only and divisible by 6, is

(1) 80 (2) 81
(3) 82 (4) 84

65. If $I=\int\frac{\left(1+x^2\right)}{\left(1-x^2+x^4\right)\cot^{-1}\left(\frac{x^2-1}{x}\right)}dx = -\ln|f(x)| + c$ then $f(1)$ is equal to

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

66. If $n \in N$ and A is nilpotent matrix of index two, then which of the following is correct? (where I is an identity matrix)

(1) $A(I+A)^n = A^{-1}$ (2) $(I+A)^n A = A$
(3) $(I+A)^n A = A^n$ (4) $A(I+A)^n = I$

67. If $f(x)=\prod_{n=1}^{50}(x-n)^{n(51-n)}$, then $\frac{f'(51)}{f(51)}$

(1) 1200 (2) 1225
(3) 1250 (4) 1275

68. If the equation $(x-2)^2 + \cos^2\theta = 1$ is possible, then complete solution is ($\theta \in R$)

(1) $1 \le x \le 3$ (2) $0 \le x \le 1$
(3) $0 \le x \le 3$ (4) $x \in R$

69. Direction ratios of two lines L_1 and L_2 are (3, 2, 1) and (1, 2, 3) then sum of direction cosines of a line L which is perpendicular to L_1 and L_2, is

(1) 0 (2) 2
(3) –3 (4) –2

70. If the projection of the vector $\hat{i}+2\hat{j}+\hat{k}$ on the sum of the two vectors $2\hat{i}+4\hat{j}-5\hat{k}$ and $-\lambda\hat{i}+2\hat{j}+3\hat{k}$ is 1, then 20λ is equal to

(1) 200 (2) 20
(3) 100 (4) 50

71. The vertices of a hyperbola be at (–2, 0) and (2, 0) and one of its foci be at (–3, 0), if $\left(2k,\sqrt{5}\right)$ lies on hyperbola then k^2 is

(1) 3 (2) 1
(3) 2 (4) 4

72. If A is the area of region enclosed by the curves $f(x) = -x^2 + 2x$, $g(x) = 2^x$ and the lines $x = 0$, $x = 2$ then

(1) $A=\frac{3}{\ell n2}-\frac{4}{3}$ (2) $A=\frac{4}{\ell n2}-\frac{4}{3}$
(3) $A=3\ell n2-\frac{1}{3}$ (4) $A=3\ell n2+\frac{1}{3}$

73. Consider relation $R = \{(x, y); x^3 + y^3 = 1, x \in R, y \in R\}$ then R is
(1) Symmetric only
(2) Reflexive only
(3) Transitive only
(4) Symmetric and transitive only

74. Solution of differential equation
$$x-1=xy\frac{dy}{dx}+\frac{x^2y^2}{2!}\left(\frac{dy}{dx}\right)^2+\frac{x^3y^3}{3!}\left(\frac{dy}{dx}\right)^3+\ldots \text{ is}$$
(1) $y = \ln x + c$
(2) $y = (\ln x)^2 + c$
(3) $y=\pm\sqrt{(\ln x)^2+c}$
(4) $y=\pm\sqrt{\ln x+c}$

75. If the equation $x^3 - (p + 1)x^2 + (q - p)x - q = 0$ has roots $\tan(\theta_r)$ where $r = 1, 2, 3$ and $q - p \neq 1$ where $p, q \in R$, then
(1) $\sin(\theta_1+\theta_2+\theta_3)=\frac{1}{2}$
(2) $\cot(\theta_1+\theta_2+\theta_3)=1$
(3) $\theta_1+\theta_2+\theta_3=\frac{3\pi}{4}$
(4) $\theta_1 + \theta_2 + \theta_3 = \pi$

76. Match the following List-I with List-II

	List-I		List-II
P	If one end of a focal chord of the parabola $y^2 = 16x$ is at (1, 4) and the length of this focal chord is λ, then $\frac{\lambda}{25}$ is	1	$\frac{1}{3}$
Q	Sum of distinct values in the range of function $f(x) = [x^2] - [x]^2$; $x \in [0, 2)$ (where $[\cdot]$ is G.I.F), is	2	1
R	If x is real, then the greatest value of the expression $\frac{x+2}{2x^2+3x+6}$ is	3	2
S	If $y = e^{-x}\cos x$ and $y_4 + 2ky = 0$, where $y_4=\frac{d^4y}{dx^4}$, then k is equal to	4	3

Coded
(1) P → 4, Q → 1, R → 2, S → 3
(2) P → 3, Q → 1, R → 4, S → 2
(3) P → 2, Q → 4, R → 1, S → 3
(4) P → 2, Q → 4, R → 3, S → 1

77. If $f(x) = 2x^5 + x^3 + x$ and $g(x) = e^{x^2+x^4}$, then $\int f(x)\cdot g(x)\,dx$ is equal to
(1) $\frac{x}{2}g(x)+c$ (2) $x\,g(x) + c$
(3) $g(x) + c$ (4) $\frac{x^2}{2}g(x)+c$

78. $\lim\limits_{x\to0^+}\left(\ell n\left(\sin^4 x\right)-\ell n\left(e^2x^4+x^5\right)\right)$ is equal to
(1) e^2 (2) -1
(3) -2 (4) e^{-2}

79. A line passing through the point (2, 2) and encloses an area of magnitude A with the axes (not in I[st] quadrant). The intercept on axes made by line are the roots of equation
(1) $x^2 - Ax - 2A = 0$
(2) $x^2 + Ax - A = 0$
(3) $x^2 - Ax + A = 0$
(4) $x^2 + Ax - 2A = 0$

80. If $f(x)=\left[1+\left[\cos\left(\frac{\pi x}{2}\right)+1\right]x\right]$ where $[\cdot]$ is greatest integer function, then $\int_{-2}^{1} f(x)\,dx$ is
(1) $\frac{3}{2}$
(2) 1
(3) 2
(4) $\frac{1}{2}$

Integer Type Questions

81. If $a \le \tan^{-1}\left(\frac{1+x^4}{\sqrt{3}+x^4}\right) < b$ for $x \in R$, then $\frac{5\pi}{a+b}$ is

82. Equation $\lambda x^2 + y^2 - 12xy + x - 3y + c = 0$ represents two lines whose slopes are m and m^2 then product of possible values of λ is $-32k$, then k equal to

83. Let O be the centre of a circle of radius 1. P and Q are the points on the circle such that $\phi = \angle POQ$ is an acute angle and R is a point outside the circle such that $OPRQ$ is a parallelogram. If the area of the part of the parallelogram that is outside the circle is $f(\phi)$, then $\lim\limits_{\phi\to0}\frac{4f(\phi)}{\sin\phi}$ is equal to

84. If P is probability that the value of determinant of order two is made with elements of set {0, 1} is non negative, then $16P$ is equal to

85. Sum of 16 terms of an arithmetic progression whose first term is 16, is square of 16[th] term. The value of $25d^2$ is (where $d \neq 0$ is common difference of arithmetic progression)

86. If $\tan\left(\sin^{-1}\left(\cos\left(\tan^{-1}\frac{x}{2}\right)\right)\right)=\frac{\lambda}{|x|}$, then λ is equal to

87. If $\int_0^{1/2}\frac{\left(2-x^2\right)e^x}{\sqrt{(1+x)(1-x)^3}}dx=\sqrt{ke}-1$, then k is

88. Foci of an ellipse passing through the point (1, 3), are (1, 1) and (3, 1). If e is eccentricity, then $(e+1)^2$ is equal to

89. If complex numbers w and z satisfy the equations $|z|^2 = zw$ and $|w+\bar{w}|+|z-\bar{z}|=8$. If w varies, then the area enclosed by locus of z is

90. The value of $\sum_{r=1}^{5} {}^{20}C_{2r-1}$ is 2^{λ}, then λ is equal to