

**IIT-JEE****Batch – Growth (June) | Major Test - 4 (Paper-II)****Time: 3 Hours Test****Date: 2nd March 2025****Maximum Marks: 180**

Name of the Candidate: _____ Roll No. _____

Centre of Examination (in Capitals): _____

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

READ THE INSTRUCTIONS CAREFULLY

1. The candidates should not write their Roll Number anywhere else (except in the specified space) on the Test Booklet/Answer Sheet.
2. This Test Booklet consists of 54 questions.
3. This question paper is divided into three parts **PART A - MATHEMATICS, PART B - PHYSICS** and **PART C - CHEMISTRY** having 18 questions each and every **PART** has four sections.
 - (i) **Section-I** contains **6** Question Single Digit Integer (0-9 both inclusive)
Marking scheme: +3 for correct answer, 0 if not attempted and -1 in all other cases.
 - (ii) **Section-II** contains **6** Multiple Choice Option with more than one correct answer.
Marking scheme: +4 for correct answer, 0 if not attempted and +1 partial marking -2 in all other cases.
 - (iii) **Section-III** contains **6** Non-Negative Integer Value questions.
Marking scheme: +4 for correct answer, 0 if not attempted and 0 in all other cases.
4. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electronic device etc., except the Identity Card inside the examination hall/room.
5. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
6. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Room/Hall. However, the candidate is allowed to take away this Test Booklet with them.
7. For integer-based questions, the answer should be in decimals only not in fraction.
 8. If learners fill the OMR with incorrect syntax (say 24.5. instead of 24.5), their answer will be marked wrong.

TEST SYLLABUS**Batch – Growth (June) | Major Test-04 (Paper II)****2nd March 2025****Mathematics:**

FOM-1 (Real Numbers, Complex Numbers, Even Numbers, Odd Numbers Prime Numbers, Composite Numbers, Co-Prime Numbers/ Relatively Prime Numbers, Twin Prime Numbers, LCM and HCF, Indices, Polynomial in One Variable, Degree of Polynomials, Some Special Types of Polynomials, Value and Zeros of a Polynomial, Roots of a Polynomial Equation, Remainder Theorem, Factor Theorem, Factorization, Sets, Types of Sets, Laws of Algebra of Sets (Properties of Sets), INTERVALS AS A SUBSET OF \mathbb{R} Venn Diagram), FOM-2 (LINEAR INEQUALITIES WAVY CURVE METHOD, Rational Inequalities, Irrational Inequalities, Modulus Inequalities, Logarithmic & Exponential Inequality), Logarithm & (Function - NCERT), Sequence & Series, Compound Angle & Trigonometric Eq, Quadratic Eq St. Line, Circle, Binomial Theorem, Permutation & Combination, (Probability-NCERT), Parabola, Ellipse & Hyperbola, Statistics & Complex Number & (Limits - NCERT Level)

Physics:

Basic Mathematics (Except Vector), Basic Mathematics (Vector) ,Units & Dimension ,Kinematics -1D, Kinematics-2D,NLM & Friction, WEP, Circular Motion, Centre of Mass, Momentum & Collision, Rotational Motion, Gravitation, Elasticity, Thermal Expansion, Calorimetry and Heat Transfer, KTG & Thermodynamics, Fluid Mechanics, SHM & Waves

Chemistry:

Mole Concept & Concentration terms - 1 (Importance of chemistry, Nature of matter ,Sig. figure, Laws of chemical combination, Avogadro law, Dalton's atomic theory, Atomic and molecular masses, Till Average/ Mean Atomic Mass), Mole Concept & Concentration terms -2(Percentage composition, Stoichiometric, calculations, Limiting reagent & Concentration, terms Equivalent Concept) Atomic Structure, Periodic Table & Periodic Properties, Chemical Bonding, Thermodynamics-1, Thermochemistry & Thermodynamics-2, Chemical Eq, Ionic Eq, Redox Reaction, Nomenclature, GOC, Isomerism & Hydrocarbon, Hydrogen & its compound & S-block & Environmental Chemistry

Useful Data Chemistry:

Gas Constant	R	$= 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ $= 0.0821 \text{ Lit atm K}^{-1} \text{ mol}^{-1}$ $= 1.987 \approx 2 \text{ Cal K}^{-1} \text{ mol}^{-1}$
Avogadro's Number	N_a	$= 6.023 \times 10^{23}$
Planck's Constant	h	$= 6.626 \times 10^{-34} \text{ Js}$ $= 6.25 \times 10^{-27} \text{ erg.s}$
1 Faraday		$= 96500 \text{ Coulomb}$
1 calorie		$= 4.2 \text{ Joule}$
1 amu		$= 1.66 \times 10^{-27} \text{ kg}$
1 eV		$= 1.6 \times 10^{-19} \text{ J}$

Atomic No:

H = 1, D = 1, Li = 3, Na = 11, K = 19, Rb = 37, Cs = 55, F = 9, Ca = 20, He = 2, O = 8, Au = 79.

Atomic Masses:

He = 4, Mg = 24, C = 12, O = 16, N = 14, P = 31, Br = 80, Cu = 63.5, Fe = 56, Mn = 55, Pb = 207, Au = 197, Ag = 108, F = 19, H = 2, Cl = 35.5, Sn = 118.6

Useful Data Physics:

Acceleration due to gravity $g = 10 \text{ m / s}^2$

PART – A : MATHEMATICS

Single Digit Integer (0-9 both inclusive)

- The number of solutions of $\log_4 (x - 1) = \log_2 (x - 3)$ is
- For all complex numbers z_1, z_2 satisfying $|z_1| = 12$ and $|z_2 - 3 - 4i| = 5$, the minimum value of $|z_1 - z_2|$ is
- Let T_n denote the number of triangles which can be formed using the vertices of a regular polygon of n sides. If $T_{n+1} - T_n = 21$, then n equals,
- The value of the expression $\sqrt{3}\operatorname{cosec} 20^\circ - \sec 20^\circ$ is equal to
- Let $p, q \in \{1, 2, 3, 4\}$. The number of equations of the form $px^2 + qx + 1 = 0$ having real roots is
- For how many values of p , the circle $x^2 + y^2 + 2x + 4y - p = 0$ and the coordinate axes have exactly three common points?

One or More than One Correct

- A circle S passes through the point $(0, 1)$ and is orthogonal to the circles $(x - 1)^2 + y^2 = 16$ and $x^2 + y^2 = 1$. Then
 (A) radius of S is 8 (B) radius of S is 7
 (C) centre of S is $(-7, 1)$ (D) centre of S is $(-8, 1)$
- Let S_1, S_2, \dots be squares such that for each $n \geq 1$, the length of a side of S_n , equals the length of a diagonal of S_{n+1} . If the length of a side of S_1 is 10 cm, then for which of the following values of n is the area of S_n less than 1 sq. cm.
 (A) 7 (B) 8 (C) 9 (D) 10
- Let L be a normal to the parabola $y^2 = 4x$. If L passes through the point $(9, 6)$, then L is given by
 (A) $y - x + 3 = 0$ (B) $y + 3x - 33 = 0$ (C) $y + x - 15 = 0$ (D) $y - 2x + 12 = 0$
- Let a hyperbola pass through the focus of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$. The transverse and conjugate axes of this hyperbola coincide with the major and minor axes of the given ellipse, also the product of eccentricities of given ellipse and hyperbola is 1, then
 (A) the equation of hyperbola is $\frac{x^2}{9} - \frac{y^2}{16} = 1$ (B) the equation of hyperbola is $\frac{x^2}{9} - \frac{y^2}{25} = 1$
 (C) focus of hyperbola is $(5, 0)$ (D) vertex of hyperbola is $(5\sqrt{3}, 0)$
- Let a_1, a_2, a_3, \dots be an arithmetic progression with $a_1 = 7$ and common difference 8. Let T_1, T_2, T_3, \dots be such that $T_1 = 3$ and $T_{n+1} - T_n = a_n$ for $n \geq 1$. Then, which of the following is/are true?
 (A) $T_{20} = 1604$ (B) $\sum_{k=1}^{20} T_k = 10510$ (C) $T_{30} = 3454$ (D) $\sum_{k=1}^{30} T_k = 35610$
- Let S be the set of all non-zero real numbers α such that the quadratic equation $\alpha x^2 - x + \alpha = 0$ has two distinct real roots x_1 and x_2 satisfying the inequality $|x_1 - x_2| < 1$. Which of the following intervals is(are) a subset(s) of S ?
 (A) $\left(-\frac{1}{2}, -\frac{1}{\sqrt{5}}\right)$
 (B) $\left(-\frac{1}{\sqrt{5}}, 0\right)$
 (C) $\left(0, \frac{1}{\sqrt{5}}\right)$
 (D) $\left(\frac{1}{\sqrt{5}}, \frac{1}{2}\right)$

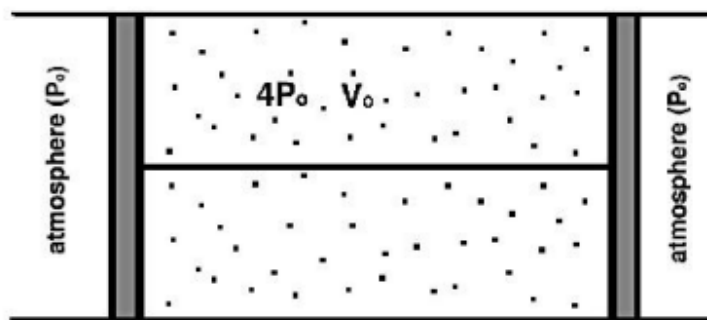
Numerical Value (If more than two decimal, truncate/roundoff the value two decimal places).

13. Suppose a, b denote the distinct real roots of the quadratic polynomial $x^2 + 20x - 2020$ and suppose c, d denote the distinct complex roots of the quadratic polynomial $x^2 - 20x + 2020$. Then the value of $ac(a - c) + ad(a - d) + bc(b - c) + bd(b - d)$ is _____.
14. Let \bar{z} denote the complex conjugate of a complex number z and let $i = \sqrt{-1}$. In the set of complex numbers, the number of distinct roots of the equation $\bar{z} - z^2 = i(\bar{z} + z^2)$ is _____.
15. Let m be the minimum possible value of $\log_3 (3^{y_1} + 3^{y_2} + 3^{y_3})$, where y_1, y_2, y_3 are real numbers for which $y_1 + y_2 + y_3 = 9$. Let M be the maximum possible value of $(\log_3 x_1 + \log_3 x_2 + \log_3 x_3)$, where x_1, x_2, x_3 are positive real numbers for which $x_1 + x_2 + x_3 = 9$. Then the value of $\log_2 (m^3) + \log_3 (M^2)$ is _____.
16. Let a and b be two nonzero real numbers. If the coefficient of x^5 in the expansion of $\left(ax^2 + \frac{70}{27bx}\right)^4$ is equal to the coefficient of x^{-5} in the expansion of $\left(ax - \frac{1}{bx^2}\right)^7$, then the value of $2b$ is _____.
17. A group of 9 students, s_1, s_2, \dots, s_9 , is to be divided to form three teams X, Y , and Z of sizes 2, 3, and 4, respectively. Suppose that s_1 cannot be selected for the team X , and s_2 cannot be selected for the team Y . Then the number of ways to form such teams, is _____.
18. A number is chosen at random from the set $\{1, 2, 3, \dots, 2000\}$. Let p be the probability that the chosen number is a multiple of 3 or a multiple of 7. Then the value of $500p$ is _____.

PART – B : PHYSICS

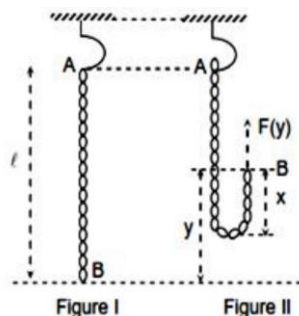
Single Digit Integer (0-9 both inclusive)

19. A monoatomic gas at pressure $4P_0$ and volume V_0 is contained between a conducting cylinder and two circular smooth adiabatic pistons. Both the pistons are tied to each other with the help of an ideal string. Now the gas is slowly heated by pouring hot water over the curved surface of the cylinder until tension in the string is doubled. Then, the heat supplied to the gas is $\frac{\eta}{2} P_0 V_0$. The value of η is _____.

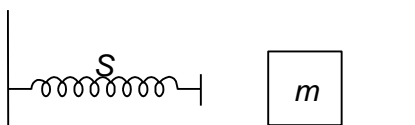


20. The equation of traveling wave in a uniform string of mass per unit length μ is given as $y = A \sin(\omega t - kx)$. The total energy transferred through the origin in time interval from $t = 0$ to $t = \pi/12\omega$ is $\frac{(\pi + 3)\mu\omega^2 A^2}{3nk}$. The value of n is _____.

21. A uniform chain of mass m and length l hangs from a hook in ceiling as shown in figure I. The bottom of link is now raised vertically with the help of upward external force $F(y) = \frac{mgy}{nl}$ very slowly as shown in figure II. The value of n is



22. On a cricket field, the batsman is at the origin of coordinates and a fielder stands in position given as $(46\hat{i} + 28\hat{j})$ m. The batsman hits the ball so that it rolls along the ground with constant velocity given by $(7.5\hat{i} + 10\hat{j})$ m/s. The fielder can run with a speed of 5 m/s. If he starts to run immediately when the ball is hit, what is the shortest time (in seconds) in which he could intercept the ball
23. A light spring S is attached to a wall as shown. The spring constant k is 300 N/m. The mass $m = 120$ g shown in the figure initially moves to the left at a speed of 8.0 m/s. It strikes the spring and becomes attached to it. Maximum compression in the spring will be $2x$ cm. Find the value of x .



24. The motion of an insect on table is given as $x = 4t - 2\sin t$ and $y = 4 - 2\cos t$, where x and y are in metres and t is in seconds. Find the value of maximum velocity magnitude minus minimum velocity magnitude attained by the insect.

One or More than One Correct

25. For a particle along any arbitrary path \vec{r}, \vec{v} and \vec{a} are position, velocity and acceleration vector respectively. Choose correct statement-

(A) $\left| \frac{d\vec{r}}{dt} \right|$ gives speed of particle

(B) $\frac{d|\vec{r}|}{dt}$ gives speed of particle

(C) $|\vec{a}| = \frac{d|\vec{v}|}{dt}$

(D) $\frac{d\vec{v}}{dt} = 0 \Rightarrow \frac{d|\vec{v}|}{dt} = 0$

26. Two particles A and B separated by a distance $2R$ are moving clockwise along the same circular path of radius R each with a uniform speed ' V '. At time $t = 0$, A is given a constant tangential acceleration of magnitude $a = \frac{32V^2}{25\pi R}$ in the same direction of initial velocity. Then

(A) The time elapse for the two bodies to collide is $\frac{5\pi R}{4V}$

(B) Angle covered by 'B' in this time is $\frac{5\pi}{4}$

(C) Angular acceleration of 'A' is $\frac{32V^2}{25\pi R^2}$

(D) Tangential acceleration of 'B' is zero

27. Choose the correct statement(s) regarding center of mass frame:

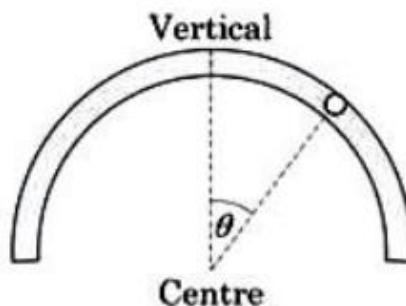
(A) If $\sum \vec{F}_{ext} = \vec{0}$ on a system, then center of mass frame is an inertial frame

(B) Centre of mass frame is a zero-momentum frame

(C) Kinetic energy of a system is minimum in centre of mass frame

(D) None of these

28. A semicircular glass tube filled with water containing an air bubble is sealed at its ends. If the tube is held with its plane vertical and made to move in its plane with a constant acceleration, the bubble stays aside of the highest point as shown in the figure. What can you conclude about acceleration vector of the tube?



(A) It points towards left.

(B) It points towards right.

(C) Its magnitude is $g \tan \theta$.

(D) Its magnitude is $g \cot \theta$.

29. A satellite of mass $5M$ orbits the earth in a circular orbit. At one point in its orbit, the satellite explodes into two pieces, one of mass M and the other of mass $4M$. After the explosion the mass M ends up travelling in the same circular orbit, but in opposite direction. After the explosion, motion of the mass $4M$.

(A) will be in a bound orbit

(B) will be in an unbound orbit

(C) will be in a hyperbolic orbit

(D) will be in elliptical orbit

30. A long cylinder of radius R_1 length " l " is displaced along its axis with constant velocity v_0 inside a stationary coaxial cylinder of radius R_2 . The space between the cylinders is filled with viscous liquid of coefficient of viscosity η . The flow is laminar. Choose correct options from following

(A) The velocity of liquid as a function of the distance " r " from axis of cylinders is $v = v_0 \left\{ \frac{\ln(r/R_2)}{\ln(R_1/R_2)} \right\}$

(B) The velocity of liquid as a function of the distance " r " from axis of cylinders is $v = v_0 \left\{ \frac{\ln(r/R_1)}{\ln(R_2/R_1)} \right\}$

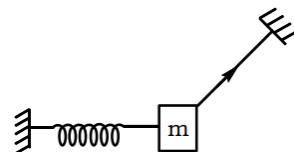
(C) The magnitude of force required to move the cylinder with constant velocity is $F = \frac{2\pi\eta v_0}{\ln(R_2/R_1)}$

(D) The magnitude of force required to move the cylinder with constant velocity is $F = \frac{4\pi\eta v_0}{\ln(R_2/R_1)}$

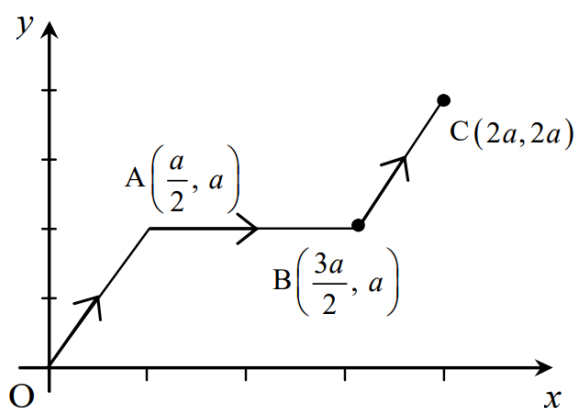
Numerical Value (If more than two decimal, truncate/roundoff the value two decimal places).

31. A capillary tube made of glass and internal radius ' r ' kept vertically such that its lower end is dipped in a liquid. The angle of contact is found to be 53° and surface tension of liquid is T_1 . Now the tube is replaced by a polymer tube with the same inner radius. Now, the contact angle changes to 37° and surface tension of the liquid is T_2 . Find $\frac{T_1}{T_2}$. (Temperature of the liquid is assumed to be constant).

32. In the fig shown a block of mass 2 kg is suspended in air by an ideal spring and an ideal string as shown. The spring is horizontal and tension in the string is 40 N. The acceleration of block just after the string is cut is _____ m/s^2 ($g = 10\text{m/s}^2$)

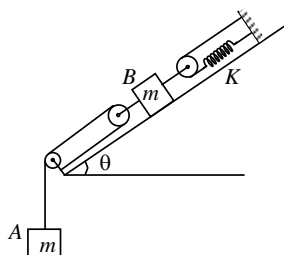


33. A force $\vec{F} = 2xy^3\hat{i} + 3x^2y^2\hat{j}$ on a body which travels from point 'O' (origin) to point C ($2a, 2a$) along the path OABC, as shown in the figure. If the work done by this force is xa^5 , find the value of x .



34. A particle undergoes SHM with a time period of 3 seconds. Minimum time taken by it, to travel from its mean position to a displacement equal to half of its amplitude is _____ seconds.

35. Two blocks A and B , each of mass m are connected by means of a pulley-spring system on a smooth inclined plane of inclination θ as shown in the figure. All the pulleys and spring are ideal. Now, B is slightly displaced from its equilibrium position. It starts to oscillate. Time period of oscillation of B will be _____ seconds (Take $m = 4 \text{ kg}$, $K = 5 \text{ N/m}$, $\pi = 3.14$)

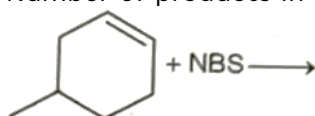


36. A vessel of large area of cross-section opened at the top has a small hole at its bottom and is completely filled with water. When the hole at the bottom is opened $\frac{3}{4}$ of volume of water comes out in time t_1 . The time (t_2) taken for the remaining $\frac{1}{4}$ of the water to come out is equal to xt_1 . The value of x is

PART-C: CHEMISTRY

Single Digit Integer (0-9 both inclusive)

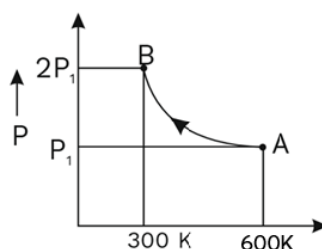
37. Find the quantum numbers of excited state of electrons in He^+ ion which on transition to ground state and first excited state emit two photons of wavelengths, **30.4 mm** and **108.5 nm** respectively. ($R_h = 1.09678 \times 10^7 \text{ m}^{-1}$)
38. The formula weight of an acid is **82.0**. 100 cm^3 of a solution of this acid containing **39.0 g** of the acid per litre were completely neutralized by 95.0 cm^3 of aqueous NaOH containing **40.0 g** of NaOH per litre. What is the basicity of the acid?
39. A certain buffer solution contains equal concentration of X^- and HX (K_b for X^- is 10^{-10}) what is pH of buffer?
40. The total number of cyclic structural as well as stereo isomers possible for a compound with the molecular formula C_5H_{10} is
41. Number of products in the following reaction:



42. A river contains **5 mg** of lead in **1,000L** of water. What is the concentration of lead in ppm?

One or More than One Correct

43. 2 moles of an ideal monoatomic gas is taken from a state A to state B through a process AB in which $PT = \text{constant}$. The process can be represented on a P - T graph as follows :



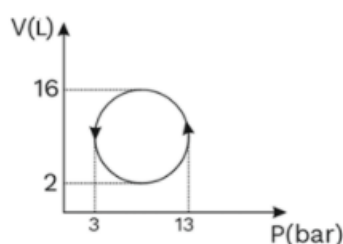
Select the correct option(s):

- (A) Heat evolved by the gas during process $AB = 2100R$
 (B) Heat absorbed by the gas during process $AB = 2100R$
 (C) $\Delta U = -900R$
 (D) $W = 2000R$

44. Which of the following is/are correct?
 (A) For $A(g) + e^- \rightarrow A^-(g)$ ΔH may be negative
 (B) For $A^-(g) + e^- \rightarrow A^{2-}(g)$ ΔH may be negative
 (C) For $A^-(g) + e^- \rightarrow A^{2-}(g)$ ΔH must be positive
 (D) For $A^{+3}(g) + e^- \rightarrow A^{+2}(g)$ ΔH must be negative
45. Choose the correct relations on the basis of Bohr's theory
 (A) Velocity of electron $\propto \frac{1}{n}$
 (B) Frequency of revolution $\propto \frac{1}{n^3}$
 (C) Radius of orbit $\propto n^2 Z$
 (D) Force of electron $\propto \frac{1}{n^4}$
46. In the reaction,
 $3Br_2 + 6CO_3^{2-} + 3H_2O \rightarrow 5Br^- + BrO_3^- + 6HCO_3^-$
 (A) bromine is oxidized and carbonate is reduced
 (B) bromine is oxidized
 (C) bromine is reduced
 (D) it is disproportionation reaction or autoredox change
47. What in general may be the general criteria of choosing a suitable indicator for a given titration?
 (A) The indicator should have a broad pH range
 (B) pH at the end point of titration should be close to neutral point of indicator
 (C) Indicator should have neutral at pH = 7
 (D) The indicator must show a sharp change in colour near the equivalence point of titration point
48. A hydrazine molecule is split in NH_2^+ and NH_2^- ions. Which of the following statements is/are correct?
 (A) NH_2^+ shows sp^2 - hybridisation whereas NH_2^- shows sp^3 - hybridization
 (B) $Al(OH)_4^-$ has a regular tetrahedral geometry
 (C) sp^2 - hybridized orbitals have equal s - and p - character
 (D) Hybridized orbitals always form σ - bonds

Numerical Value (If more than two decimal, truncate/roundoff the value two decimal places).

49. The pK_a of a weak acid (HA) is 4.5. The pOH of an aqueous buffered solution of HA in which 50% of the acid is ionized is $y \times 10^{-1}$. Find Y
50. Calculate the bond length of C – X bond, if C – C bond length is 1.54 \AA , X – X bond length is 1.00 \AA and electronegativity values of C and X are 2.0 and 3.0 respectively
51. The number of benzylic hydrogen atoms in ethylbenzene is
52. The number of isomers of dibromoderivative of an alkene (molar mass 186 g mol^{-1}) is
53. The number of cis-trans isomer possible for the following compound
54. Work done (in kJ) by the gas in the following cyclic process is
 (Given $1 \text{ litre bar} = 100 \text{ K}$ $\pi = 3.14$)



TEST CODE : 113108



Unacademy Centres across India

