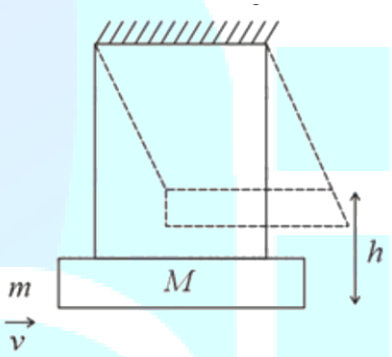
Q1. In order to determine the Young's Modulus of a wire of radius 0.2 cm (measured using a scale of least count $= 0.001$ cm) and length 1 m (measured using a scale of least count $= 1$ mm), a weight of mass 1 kg (measured using a scale of least count $= 1$ g) was hanged to get the elongation of 0.5 cm (measured using a scale of least count 0.001 cm). What will be the fractional error in the value of Young's Modulus determined by this experiment?
(1) 0.14%
(2) 0.9%
(3) 9%
(4) 1.4%

Q2. A mosquito is moving with a velocity $\vec{v} = 0.5t^2\hat{i} + 3t\hat{j} + 9\hat{k}\text{ms}^{-1}$ and accelerating in uniform conditions. What will be the direction of mosquitoes after 2 s ?
(1) $\tan^{-1}\left(\frac{2}{3}\right)$ from x-axis
(2) $\tan^{-1}\left(\frac{\sqrt{85}}{6}\right)$ from y-axis
(3) $\tan^{-1}\left(\frac{5}{2}\right)$ from y-axis
(4) $\tan^{-1}\left(\frac{5}{2}\right)$ from x-axis

Q3. Statement I: A cyclist is moving on an unbanked road with a speed of 7 km h^{-1} and takes a sharp circular turn along a path of the radius of 2 m without reducing the speed. The static friction coefficient is 0.2 . The cyclist will not slip and pass the curve ($g = 9.8$ m s^{-2})
Statement II : If the road is banked at an angle of 45°, cyclist can cross the curve of 2 m radius with the speed of 18.5 km h^{-1} without slipping.
In the light of the above statements, choose the correct answer from the options given below.
(1) Statement I is incorrect and statement II is correct
(2) Statement I is correct and statement II is incorrect
(3) Both statement I and statement II are false
(4) Both statement I and statement II are true

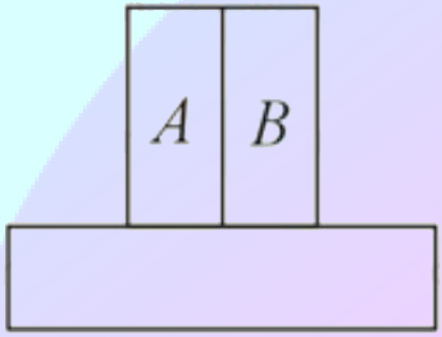
Q4. A large block of wood of mass $M = 5.99$ kg is hanging from two long massless cords. A bullet of mass $m = 10$ g is fired into the block and gets embedded in it. The (block + bullet) then swing upwards, their center of mass rising a vertical distance $h = 9.8$ cm before the (block + bullet) pendulum comes momentarily to rest at the end of its arc. The speed of the bullet just before the collision is: (Take $g = 9.8$ m s^{-2})



(1) 841.4 m s^{-1}
(2) 811.4 m s^{-1}
(3) 831.4 m s^{-1}
(4) 821.4 m s^{-1}

Q5. What will be the nature of flow of water from a circular tap, when its flow rate increased from 0.18 L($\text{min})^{-1}$ to 0.48 L($\text{min})^{-1}$? The radius of the tap and viscosity of water are 0.5 cm and 10^{-3} Pa s, respectively. (Density of water : 10^3 kg m^{-3})
(1) Unsteady to steady flow
(2) Remains steady flow
(3) Remains turbulent flow
(4) Steady flow to unsteady flow

Q6. A bimetallic strip consists of metals A and B. It is mounted rigidly as shown. The metal A has higher coefficient of expansion compared to that of metal B. When the bimetallic strip is placed in a cold both, it will :



(1) Bend towards the right
(2) Not bend but shrink
(3) Neither bend nor shrink
(4) Bend towards the left

Q7. Calculate the value of the mean free path (λ) for oxygen molecules at temperature 27°C and pressure 1.01×10^5 Pa. Assume the molecular diameter 0.3 nm and the gas is ideal. ($k = 1.38 \times 10^{-23}$ J K^{-1})
(1) 58 nm
(2) 32 nm
(3) 86 nm
(4) 102 nm

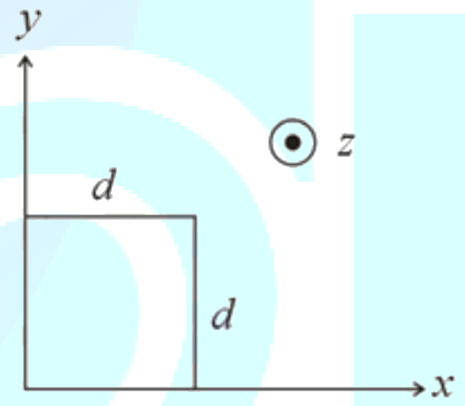
Q8. The amplitude of a mass-spring system, which is executing simple harmonic motion decreases with time. If mass = 500 g, Decay constant = 20 g s^{-1} then how much time is required for the amplitude of the system to drop to half of its initial value? ($\ln 2 = 0.693$)
(1) 34.65 s
(2) 17.32 s
(3) 0.034 s
(4) 15.1 s

Q9. Find out the surface charge density at the intersection of point $x = 3$ m plane and x-axis, in the region of uniform line charge of 8nCm^{-1} lying along the z-axis in free space.
(1) 0.424nCm^{-2}
(2) 47.88nCm^{-2}
(3) 0.07nCm^{-2}
(4) 4.0nCm^{-2}

Q10. A resistor develops 500 J of thermal energy in 20 s when a current of 1.5 A is passed through it. If the current is increased from 1.5 A to 3 A , what will be the energy developed in 20 s .
(1) 1500 J
(2) 1000 J
(3) 500 J
(4) 2000 J

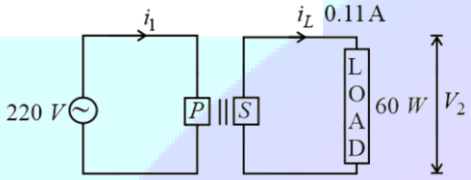
Q11. A charge Q is moving $\overrightarrow{dl}$ distance in the magnetic field $\vec{B}$. Find the value of work done by $\vec{B}$.
(1) 1
(2) Infinite
(3) Zero
(4) -1

Q12. The magnetic field in a region is given by $\vec{B} = B_0\left(\frac{x}{a}\right)\hat{k}$. A square loop of side d is placed with its edges along the x and y axes. The loop is moved with a constant velocity $\vec{v} = v_0\hat{i}$. The emf induced in the loop is :



(1) $\frac{B_0 v_0^2 d}{2a}$
(2) $\frac{B_0 v_0 d}{2a}$
(3) $\frac{B_0 v_0 d^2}{a}$
(4) $\frac{B_0 v_0 d^2}{2a}$

Q13. For the given circuit, comment on the type of transformer used :



(1) Auxilliary transformer
(2) Auto transformer
(3) Step-up transformer
(4) Step down transformer

Q14. Red light differs from blue light as they have :
(1) Different frequencies and different

wavelengths
(2) Different frequencies and same wavelengths
(3) Same frequencies and same wavelengths
(4) Same frequencies and different wavelengths

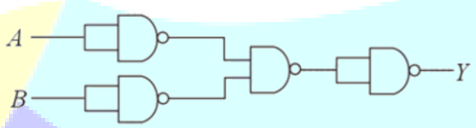
Q15. The refractive index of a converging lens is 1.4. What will be the focal length of this lens if it is placed in a medium of same refractive index ? (Assume the radii of curvature of the faces of lens are R_1 and R_2 respectively)
(1) 1
(2) Infinite
(3) $\frac{R_1R_2}{R_1-R_2}$
(4) Zero

Q16. The de-Broglie wavelength associated with an electron and a proton were calculated by accelerating them through same potential of 100 V . What should nearly be the ratio of their wavelengths ?
($m_p = 1.00727\text{u}, m_e = 0.00055\text{u}$)
(1) $1860:1$
(2) $(1860)^2:1$
(3) $41.4:1$
(4) $43:1$

Q17. The half-life of Au^{198} is 2.7 days. The activity of 1.50 mg of Au^{198}, if its atomic weight is 198 g mol^{-1} is, ($N_A = 6 \times 10^{23}$ mol^{-1})
(1) 240 Ci
(2) 357 Ci
(3) 535 Ci
(4) 252 Ci

Q18. Calculate the time interval between 33% decay and 67% decay if half-life of a substance is 20 min .
(1) 60 min
(2) 20 min
(3) 40 min
(4) 13 min

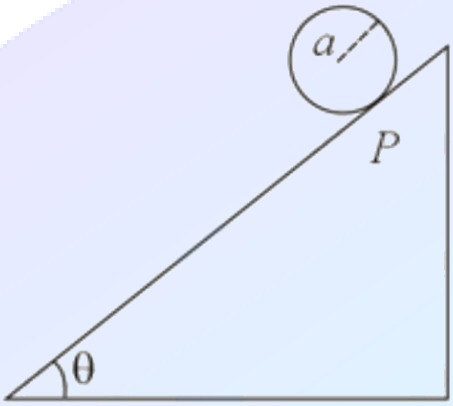
Q19. The following logic gate is equivalent to :



(1) NOR Gate
(2) OR Gate
(3) AND Gate
(4) NAND Gate

Q20. Two identical antennas mounted on identical towers are separated from each other by a distance of 45 km . What should nearly be the minimum height of receiving antenna to receive the signals in line of sight ?
(Assume radius of earth is 6400 km)
(1) 19.77 m
(2) 39.55 m
(3) 79.1 m
(4) 158.2 m

Q21. A body of mass 2 kg moves under a force of $(2\hat{\imath} + 3\hat{\jmath} + 5\hat{k})$N It starts from rest and was at the origin initially. After 4 s , its new coordinates are $(8, b, 20)$. The value of b is -
(Round off to the Nearest Integer)
Q22. A swimmer can swim with velocity of 12 km/h in still water. Water flowing in a river has velocity 6 km/h. The direction with respect to the direction of flow of river water he should swim in order to reach the point on the other bank just opposite to his starting point is ∴
(Round off to the Nearest Integer) (find the angle in degree)
Q23. A force $\vec{F} = 4\hat{\imath} + 3\hat{\jmath} + 4\hat{k}$ is applied on an intersection point of $x = 2$ plane and x-axis. The magnitude of torque of this force about a point (2,3,4) is .
(Round off to the Nearest Integer)
Q24. A solid disc of radius a and mass m rolls down without slipping on an inclined plane making an angle θ with the horizontal. The acceleration of the disc will be $\frac{2}{b}g\sin\theta$, where b is . (Round off to the Nearest Integer)
(g = acceleration due to gravity)
(θ = angle as shown in figure)

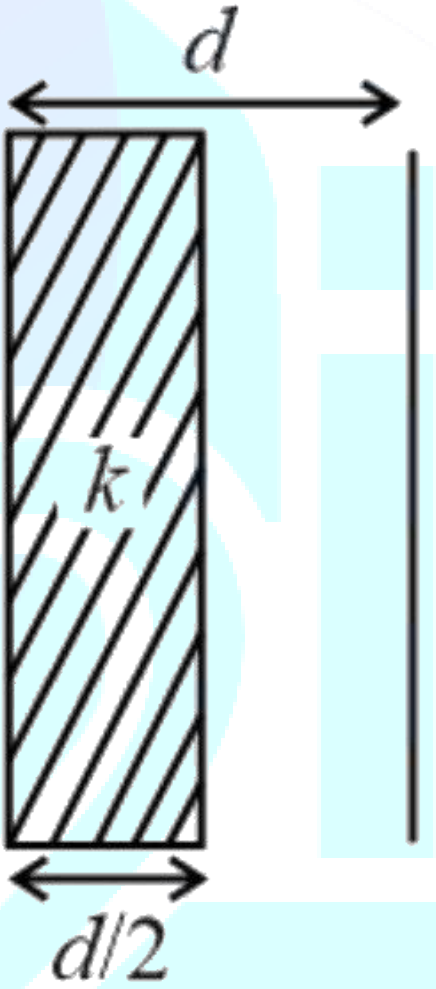


Q25. If one wants to remove all the mass of the earth to infinity in order to break it up completely. The amount of energy that needs to be supplied will be $\frac{x}{5}\frac{GM^2}{R}$ where x is -
(Round off to the Nearest Integer)
(M is the mass of earth, R is the radius of earth, G is the gravitational constant)

Q26. For an ideal heat engine, the temperature of the source is 127°C. In order to have 60% efficiency the temperature of the sink should be °C. (Round off to the nearest integer)

Q27. A closed organ pipe of length L and an open organ pipe contain gases of densities ρ_1 and ρ_2 respectively. The compressibility of gases are equal in both the pipes. Both the pipes are vibrating in their first overtone with same frequency. The length of the open pipe is $\frac{x}{3}L\sqrt{\frac{\rho_1}{\rho_2}}$, where x is -.
(Round off to the Nearest Integer)

Q28. In a parallel plate capacitor set up, the plate area of capacitor is 2 m^2 and the plates are separated by 1 m . If the space between the plates are filled with a dielectric material of thickness 0.5 m and are 2 m^2 (see figure) the capacitance of the set-up will be ε_0 .
(Dielectric constant of the material = 3.2)
(Round off to the Nearest Integer)



Q29. The energy dissipated by a resistor is 10 mJ in 1 s , when an electric current of 2 mA flows through it. The resistance is Ω. (Round off to the Nearest Integer)

Q30. A deviation of 2° is produced in the yellow ray when prism of crown and flint glass are achromatically combined. Taking dispersive powers of crown and flint glass are 0.02 and 0.03 respectively and refractive
index for yellow light for these glasses are 1.5 and 1.6 respectively. The refracting angles for crown glass prism will be ° (in degree)
(Round off to the Nearest Integer)

Q31. Identify the elements X and Y using the ionization energy values given below :

Ionization energy (kJ/mol)

	1st	2nd
X hong 495 mathor 4563		
Y	731	1450

(1) $X = Na; Y = Mg$
(2) $X = Mg; Y = F$
(3) $X = Mg; Y = Na$
(4) $X = F; Y = Mg$

Q32. The characteristics of elements X, Y and Z with atomic numbers, respectively, 33, 53 and 83 are:
(1) X and Y are metalloids and Z is a metal
(2) X is a metalloid, Y is a non-metal and Z is a metal.
(3) X, Y and Z are metals.
(4) X and Z are non-metals and Y is a metalloid

Q33. Statement I : Sodium hydride can be used as an oxidising agent.
Statement II : The lone pair of electrons on nitrogen in pyridine makes it basic.
Choose the CORRECT answer from the options given below :
(1) Both statement I and statement II are false
(2) Statement I is true but statement II is false
(3) Statement I is false but statement II is true
(4) Both statement I and statement II are true

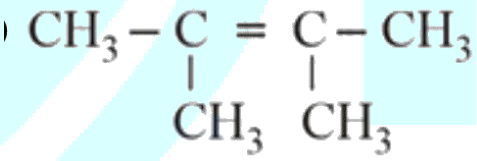
Q34. The exact volumes of 1 M NaOH solution required to neutralise 50 mL of $1MH_3PO_3$ solution and 100 mL of $2MH_3PO_2$ solution, respectively, are :
(1) 100 mLand 100 mL
(2) 100 mL and 50 mL
(3) 100 mL and 200 mL
(4) 50 mL and 50 mL

Q35. The correct statements about H_2O_2 are :
(A) used in the treatment of effluents.
(B) used as both oxidising and reducing agents.
(C) the two hydroxyl groups lie in the same plane.
(D) miscible with water.

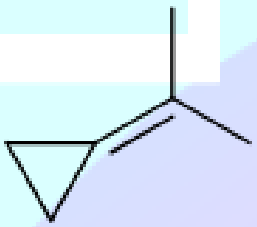
Choose the correct answer from the options given below :
(1) (A), (B), (C) and (D)
(2) (A), (B) and (D) only
(3) (B), (C) and (D) only
(4) (A), (C) and (D) only

Q36. The INCORRECT statement regarding the structure of C_{60} is :
(1) The six-membered rings are fused to both six and (2) Each carbon atom forms three sigma bonds. five-membered rings.
(3) The five-membered rings are fused only to sixmembered rings.
(4) It contains 12 six-membered rings and 24 fivemembered rings.

Q37. An unsaturated hydrocarbon X on ozonolysis gives A. Compound A when warmed with ammoniacal silver nitrate forms a bright silver mirror along the sides of the test tube. The unsaturated hydrocarbon X is :
(1)



(2)



(3) $HC \equiv C - CH_2 - CH_3$
(4) $CH_3 - C \equiv C - CH_3$

Q38. The green house gas/es is (are):
(A) Carbon dioxide
(B) Oxygen

(C) Water vapour
(D) Methane

Choose the most appropriate answer from the options given below:
(1) (A) and (C) only
(2) (A) only
(3) (A), (C) and (D) only
(4) (A) and (B) only

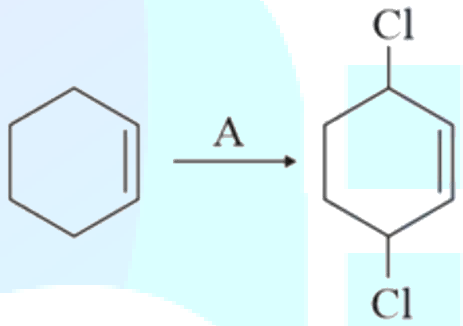
Q39. The INCORRECT statements below regarding colloidal solutions is :
(1) A colloidal solution shows colligative properties.
(2) An ordinary filter paper can stop the flow of colloidal particles.
(3) The flocculation power of Al^{3+} is more than that
of Na^{+}
(4) A colloidal solution shows Brownian motion of colloidal particles.

Q40. Which of the following reduction reaction CANNOT be carried out with coke?
(1) $Al_2O_3 \rightarrow Al$
(2) $ZnO \rightarrow Zn$
(3) $Fe_2O_3 \rightarrow Fe$
(4) $Cu_2O \rightarrow Cu$

Q41. Fex_2 and Fey_3 are known when x and y are :
(1) $x = F, Cl, Br, I$ and $y = F, Cl, Br$
(2) x = F, Cl, Br and y = F, Cl, Br, I
(3) x = Cl, Br, I and y = F, Cl, Br, I
(4) $x = F, Cl, Br, I$ and $y = F, Cl, Br, I$

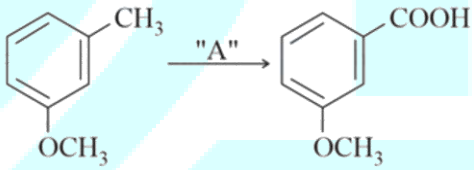
Q42. Arrange the following metal complex/ compounds in the increasing order of spin only magnetic moment. Presume all the three, high spin system.
(Atomic numbers Ce = 58, Gd = 64 and Eu = 63.)
(a) $(NH_4)_2[Ce(NO_3)_6]$
(b) $Gd(NO_3)_3$ and
(c) $Eu(NO_3)_3$
(1) (b) < (a) < (c)
(2) (c) < (a) < (b)
(3) (a) < (b) < (c)
(4) (a) < (c) < (b)

Q43.



Identify the reagent(s) ' A ' and condition(s) for the reaction :
(1) A = HCl; Anhydrous $AlCl_3$
(2) A = HCl, $ZnCl_2$
(3) A = Cl_2; UV light
(4) A = Cl_2; dark, Anhydrous $AlCl_3$

Q44.

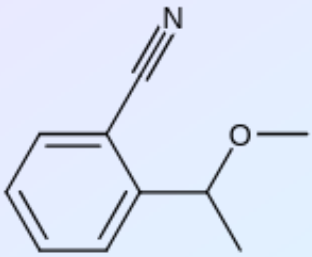


In the above reaction, the reagent " A " is :
(1) $NaBH_4, H_3O^{+}$
(2) $LiAlH_4$
(3) Alkaline $KMnO_4, H^{+}$
(4) HCl, Zn − Hg

Q45. Ammonolysis of Alkyl halides followed by the treatment with NaOH solution can be used to prepare primary, secondary and tertiary amines. The purpose of NaOH in the reaction is.
(1) to remove basic impurities
(2) to activate NH_3 used in the reaction
(3) to remove acidic impurities
(4) to increase the reactivity of alkyl halide.

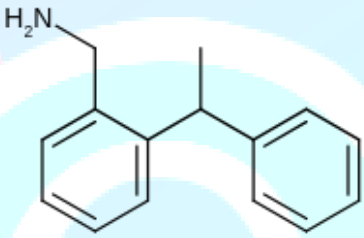
Q46. Which of the following is least basic?
(1) $(CH_3CO)\overset{N}{H}CHC_2H_5$
(2) $(C_2H_5)_3\ \ddot{N}$
(3) $(CH_3CO)_2\ \overset{N}{N}H$
(4) $(C_2H_5)_2\ \overset{N}{N}$

Q47.

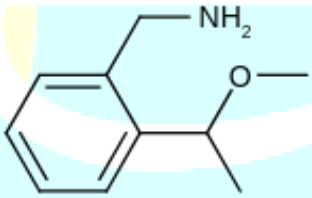


(i) C_6H_5MgBr Ether
(1.0 equivalent), dry X
(ii) H_3O^+Mathon Major Product

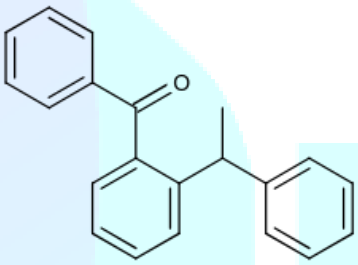
The structure of X is:
(1)



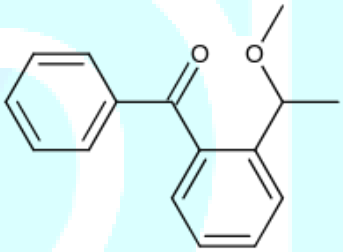
(2)



(3)



(4)



Q48. Which of the following polymer is used in the manufacture of wood laminates?
(1) cis-poly isoprene
(2) Melamine formaldehyde resin
(3) Urea formaldehyde resin
(4) Phenol and formaldehyde resin

Q49. Match List-I with List-II

List-I
Test/Reagents/Observation(s)
(a) Lassaigne's Test
(b) Cu(II) oxide
(c) Silver nitrate
(d)

The sodium fusion extract gives black precipitate with acetic acid and lead acetate

List-II

Species detected
(i) Carbon
(ii) Sulphur

(iii) N, S, P, and halogen
(iv) Halogen

Specifically

The correct match is :
(1) (a) - (iii), (b) - (i), (c) - (ii), (d) - (iv)
(2) (a) - (i), (b) - (iv), (c) - (iii), (d) - (ii)
(3) (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)
(4) (a) - (i), (b) - (ii), (c) - (iv), (d) - (iii)

Q50. The secondary structure of protein is stabilised by:
(1) Peptide bond
(2) glycosidic bond
(3) Hydrogen bonding
(4) van der Waals forces

Q51. When 35 mL of 0.15 M lead nitrate solution is mixed with 20 mL of 0.12 M chromic sulphate solution, $\times 10^{-5}$ moles of lead sulphate precipitate out. (Round off to the Nearest Integer).

Q52. The number of orbitals with $n = 5,\ m_1 = +2$ is . (Round off to the Nearest Integer).

Q53. At $25°C$, 50 g of iron reacts with HCl to form $FeCl_2$. The evolved hydrogen gas expands against a constant pressure of 1 bar. The work done by the gas during this expansion is - J. (Round off to the Nearest Integer)
[Given : $R = 8.314$ J mol^{-1} K^{-1}. Assume, hydrogen is an ideal gas]
[Atomic mass off Fe is 55.85 u]

Q54. Sulphurous acid (H_2SO_3) has $Ka_1 = 1.7 \times 10^{-2}$ and $Ka_2 = 6.4 \times 10^{-8}$. The pH of $0.588 M H_2SO_3$ is (Round off to the Nearest Integer).

Q55. In Duma's method of estimation of nitrogen, 0.1840 g of an organic compound gave 30 mL of nitrogen collected at 287 K and 758 mm of Hg pressure. The percentage composition of nitrogen in the compound is . (Round off to the Nearest Integer).
[Given : Aqueous tension at 287 K = 14 mm of Hg]

Q56. Ga (atomic mass 70 u) crystallizes in a hexagonal close packed structure. The total number of voids in 0.581 g of Ga is $\times 10^{21}$. (Round off to the Nearest Integer).

Q57. At 363 K , the vapour pressure of A is 21 kPa and that of B is 18 kPa . One mole of A and 2 moles of B are mixed. Assuming that this solution is ideal, the vapour pressure of the mixture is kPa . (Round of to the Nearest Integer).

Q58. A 5.0 m $moldm^{-3}$ aqueous solution of KCl has a conductance of 0.55 mS when measured in a cell constant 1.3 cm^{-1}. The molar conductivity of this solution is $mSm^2\ mol^{-1}$. (Round off to the Nearest Integer)

Q59. A and B decompose via first order kinetics with half-lives 54.0 min and 18.0 min respectively. Starting from an equimolar non-reactive mixture of A and B , the time taken for the concentration of A to become 16 times that of B is min. (Round off to the Nearest Integer).

Q60. $[Ti(H_2O)_6]^{3+}$ absorbs light of wavelength 498 nm during a $d - d$ transition. The octahedral splitting energy for the above complex is $\times 10^{-19}$ J. (Round off to the Nearest Integer). $h = 6.626 \times 10^{-34}$Js; $c = 3 \times 10^8$ ms^{-1}.

Q61. The least value of $|z|$ where z is complex number which satisfies the inequality $e^{\left(\frac{(|z|+3)(|z|-1)}{|z|+1}\log_e 2\right)} \geq \log_{\sqrt{2}}|5\sqrt{7} + 9i|, i = \sqrt{-1}$, is equal to :
(1) 3
(2) $\sqrt{5}$
(3) 2
(4) 8

Q62. Consider a rectangle $ABCD$ having 5,6,7,9 points in the interior of the line segments AB, BC, CD, DA respectively. Let α be the number of triangles having these points from different sides as vertices and β be the number of quadrilaterals having these points from different sides as vertices. Then $(\beta - \alpha)$ is equal to
(1) 795
(2) 1173
(3) 1890
(4) 717

Q63. Let $A(-1,1), B(3,4)$ and $C(2,0)$ be given three points. A line $y = mx, m > 0$, intersects lines AC and BC at point P and Q respectively. Let A_1 and A_2 be the areas of $\triangle ABC$ and $\triangle PQC$ respectively, such that $A_1 = 3A_2$, then the value of m is equal to :
(1) $\frac{4}{15}$
(2) 1
(3) 2
(4) 3

Q64. Let the lengths of intercepts on x-axis and y-axis made by the circle $x^2 + y^2 + ax + 2ay + c = 0, (a < 0)$ be $2\sqrt{2}$ and $2\sqrt{5}$, respectively. Then the shortest distance from origin to a tangent to this circle which is perpendicular to the line $x + 2y = 0$, is equal to :
(1) $\sqrt{11}$
(2) $\sqrt{7}$
(3) $\sqrt{6}$
(4) $\sqrt{10}$

Q65. Let C be the locus of the mirror image of a point on the parabola $y^2 = 4x$ with respect to the line $y = x$. Then the equation of tangent to C at $P(2,1)$ is :
(1) $x - y = 1$
(2) $2x + y = 5$
(3) $x + 3y = 5$
(4) $x + 2y = 4$

Q66. If the points of intersection of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the circle $x^2 + y^2 = 4b, b > 4$ lie on the curve $y^2 = 3x^2$, then b is equal to :
(1) 12
(2) 5
(3) 6
(4) 10

Q67. Let $A = \{2,3,4,5, \ldots, 30\}$ and $\simeq$ be an equivalence relation on $A \times A$, defined by $(a, b) \simeq (c, d)$, if and only if $ad = bc$. Then the number of ordered pairs which satisfy this equivalence relation with ordered pair $(4,3)$ is equal to :
(1) 5
(2) 6
(3) 8
(4) 7

Q68.
The maximum value of $f(x) = \begin{vmatrix} \sin^2 x & 1 + \cos^2 x & \cos 2x \\ 1 + \sin^2 x & \cos^2 x & \cos 2x \\ \sin^2 x & \cos^2 x & \sin 2x \end{vmatrix}, x \in R$ is
(1) $\sqrt{7}$
(2) $\frac{3}{4}$
(3) $\sqrt{5}$
(4) 5

Q69. Given that the inverse trigonometric functions take principal values only. Then, the number of real values of x which satisfy $\sin^{-1}\left(\frac{3x}{5}\right) + \sin^{-1}\left(\frac{4x}{5}\right) = \sin^{-1} x$ is equal to:
(1) 2
(2) 1
(3) 3
(4) 0

Q70.
Let $\alpha \in R$ be such that the function $f(x) = \begin{cases} \frac{\cos^{-1}(1-\{x\}^2)\sin^{-1}(1-\{x\})}{\{x\}-\{x\}^3}, & x \neq 0 \\ \alpha, & x = 0 \end{cases}$ is continuous at $x = 0$, where $\{x\} = x - [x]$, $[x]$ is the greatest integer less than or equal to x. Then :
(1) $\alpha = \frac{\pi}{\sqrt{2}}$
(2) $\alpha = 0$
(3) no such α exists
(4) $\alpha = \frac{\pi}{4}$

Q71. Let $f: S \to S$ where $S = (0, \infty)$ be a twice differentiable function such that $f(x + 1) = xf(x)$. If $g: S \to R$ be defined as $g(x) = \log_e f(x)$, then the value of $|g''(5) - g''(1)|$ is equal to :
(1) $\frac{205}{144}$
(2) $\frac{197}{144}$
(3) $\frac{187}{144}$
(4) 1

Q72. Let f be a real valued function, defined on $R - \{-1,1\}$ and given by $f(x) = 3\log_e\left|\frac{x-1}{x+1}\right| - \frac{2}{x-1}$. Then in which of the following intervals, function $f(x)$ is increasing?

(1) $(-\infty,-1)\cup\left(\left[\frac{1}{2},\infty\right)-\{1\}\right)$
(2) $(-\infty,\infty)-\{-1,1\}$
(3) $\left(-1,\frac{1}{2}\right]$
(4) $\left(-\infty,\frac{1}{2}\right]-\{-1\}$

Q73. Consider the integral $I=\int_0^{10}\frac{[x]e^{[x]}}{e^{x-1}}dx$ where $[x]$ denotes the greatest integer less than or equal to x. Then the value of I is equal to :
(1) $9(e-1)$
(2) $45(e+1)$
(3) $45(e-1)$
(4) $9(e+1)$

Q74. Let $P(x)=x^2+bx+c$ be a quadratic polynomial with real coefficients such that $\int_0^1 P(x)dx=1$ and $P(x)$ leaves remainder 5 when it is divided by $(x-2)$ Then the value of $9(b+c)$ is equal to:
(1) 9
(2) 15
(3) 7
(4) 11

Q75. If $y=y(x)$ is the solution of the differential equation $\frac{dy}{dx}+(\tan x)y=\sin x, 0\le x\le\frac{\pi}{3}$, with $y(0)=0$, then $y\left(\frac{\pi}{4}\right)$ is equal to
(1) $\frac{1}{4}\log_e 2$
(2) $\left(\frac{1}{2\sqrt{2}}\right)\log_e 2$
(3) $\log_e 2$
(4) $\frac{1}{2}\log_e 2$

Q76. Let C_1 be the curve obtained by the solution of differential equation $2xy\frac{dy}{dx}=y^2-x^2, x>0$. Let the curve C_2 be the solution of $\frac{2xy}{x^2-y^2}=\frac{dy}{dx}$. If both the curves pass through $(1,1)$, then the area (in sq. units) enclosed by the curves C_1 and C_2 is equal to :
(1) $\pi-1$
(2) $\frac{\pi}{2}-1$
(3) $\pi+1$
(4) $\frac{\pi}{4}+1$

Q77. Let $\vec{a}=\hat{\imath}+2\hat{\jmath}-3\hat{k}$ and $\vec{b}=2\hat{\imath}-3\hat{\jmath}+5\hat{k}$. If $\vec{r}\times\vec{a}=\vec{b}\times\overrightarrow{r,r}\cdot(\alpha\hat{\imath}+2\hat{\jmath}+\hat{k})=3$ and $\vec{r}\cdot(2\hat{\imath}+5\hat{\jmath}-\alpha\hat{k})=-1, \alpha\in R$, then the value of $\alpha+|\vec{r}|^2$ is equal to :
(1) 9
(2) 15
(3) 13
(4) 11

Q78. If (x,y,z) be an arbitrary point lying on a plane P which passes through the point $(42,0,0),(0,42,0)$ and $(0,0,42)$ then the value of expression $3+\frac{x-11}{(y-19)^2(z-12)^2}+\frac{y-19}{(x-11)^2(z-12)^2}+\frac{z-12}{(x-11)^2(y-19)^2}-\frac{x+y+z}{14(x-11)(y-19)(z-12)}$ is
(1) 0
(2) 3
(3) 39
(4) -45

Q79. If the foot of the perpendicular from point $(4,3,8)$ on the line $L_1:\frac{x-a}{l}=\frac{y-2}{3}=\frac{z-b}{4}, l\neq 0$ is $(3,5,7)$, then the shortest distance between the line L_1 and line $L_2:\frac{x-2}{3}=\frac{y-4}{4}=\frac{z-5}{5}$ is equal to
(1) $\frac{1}{2}$
(2) $\frac{1}{\sqrt{6}}$
(3) $\sqrt{\frac{2}{3}}$
(4) $\frac{1}{\sqrt{3}}$

Q80. Let A denote the event that a 6 -digit integer formed by $0,1,2,3,4,5,6$ without repetitions, be divisible by 3 . Then probability of event A is equal to :
(1) $\frac{9}{56}$
(2) $\frac{4}{9}$
(3) $\frac{3}{7}$
(4) $\frac{11}{27}$

Q81. Let $\frac{1}{16}, a$ and b be in G.P. and $\frac{1}{a},\frac{1}{b},6$ be in A.P., where $a,b>0$. Then $72(a+b)$ is equal to .

Q82. Let $S_n(x)=\log_{a^{1/2}}x+\log_{a^{1/3}}x+\log_{a^{1/6}}x+\log_{a^{1/11}}x+\log_{a^{1/18}}x+\log_{a^{1/27}}x+\cdots$ up to n-terms, where $a>1$. If $S_{24}(x)=1093$ and $S_{12}(2x)=265$, then value of a is equal to .

Q83. Let n be a positive integer. Let $A = \sum_{k=0}^{n}(-1)^k \times {}^nC_k\left[\left(\frac{1}{2}\right)^k + \left(\frac{3}{4}\right)^k + \left(\frac{7}{8}\right)^k + \left(\frac{15}{16}\right)^k + \left(\frac{31}{32}\right)^k\right]$. If $63A = 1 - \frac{1}{2^{30}}$, then n is equal to .

Q84. Consider the statistics of two sets of observations as follows:

	Size	Mean	Variance
Observation I	10	2	2
Observation II	n	3	1

If the variance of the combined set of these two observations is $\frac{17}{9}$, then the value of n is equal to .

Q85. In $\triangle$ ABC, the lengths of sides AC and AB are 12 cm and 5 cm , respectively. If the area of $\triangle$ ABC is 30 cm^2 and R and r are respectively the radii of circumcircle and incircle of ΔABC, then the value of $2R + r$(in cm) is equal to .

Q86. Let $A = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix}$ and $B = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$ be two 2×1 matrices with real entries such that $A = XB$, where $X = \frac{1}{\sqrt{3}}\begin{bmatrix} 1 & -1 \\ 1 & k \end{bmatrix}$, and $k \in R$. If $a_1^2 + a_2^2 = \frac{2}{3}(b_1^2 + b_2^2)$ and $(k^2+1)b_2^2 \neq -2b_1b_2$, then the value of k is .

Q87. Let $f: R \to R$ and $g: R \to R$ be defined as $f(x) = \begin{cases} x + a, & x < 0 \\ |x-1|, & x \geq 0 \end{cases}$ and $g(x) = \begin{cases} x+1, & x < 0 \\ (x-1)^2 + b, & x \geq 0 \end{cases}$, where a, b are non-negative real numbers. If $gof(x)$ is continuous for all $x \in R$, then $a + b$ is equal to .

Q88. For real numbers $\alpha, \beta, \gamma\ \delta,$ and if $\int \frac{(x^2-1)+\tan^{-1}\left(\frac{x^2+1}{x}\right)}{(x^4+3x^2+1)\tan^{-1}\left(\frac{x^2+1}{x}\right)}dx = \alpha\log_e\left(\tan^{-1}\left(\frac{x^2+1}{x}\right)\right) + \beta\tan^{-1}\left(\frac{\gamma(x^2-1)}{x}\right) + \delta\tan^{-1}\left(\frac{x^2+1}{x}\right) + C$ where C is an arbitrary constant, then the value of $10(\alpha + \beta\gamma + \delta)$ is equal to .

Q89. Let $\vec{c}$ be a vector perpendicular to the vectors $\vec{a} = \hat{\imath} + \hat{\jmath} - \hat{k}$ and $\vec{b} = \hat{\imath} + 2\hat{\jmath} + \hat{k}$. If $\vec{c} \cdot (\hat{\imath} + \hat{\jmath} + 3\hat{k}) = 8$, then the value of $\vec{c} \cdot (\vec{a} \times \vec{b})$ is equal to

Q90. If the distance of the point $(1, -2, 3)$ from the plane $x + 2y - 3z + 10 = 0$ measured parallel to the line, $\frac{x-1}{3} = \frac{2-y}{m} = \frac{z+3}{1}$ is $\sqrt{\frac{7}{2}}$, then the value of $|m|$ is equal to .

ANSWER KEYS

1. (4)	2. (2)	mac 3. (4)	4. (3)	5. (4) [a]	6. (4)	ma 7. (4)	8. (1)
9. (1)	10. (4)	11. (3)	12. (3)	13. (3)	14. (1)	15. (2)	16. (4)
17. (2)	18. (2)	mat 19. (1)	20. (2)	21. (12)	22. (120)	23. (20)	24. (3)
25. (3)	26. (-113)	) 27. (4)	28. (3)	29. (2500)	30. (12)	31. (1)	32. (2)
33. (3)	34. (3)	35. (2)	36. (4)	37. (3)	38. (3)	39. (2)	40. (1)
41. (1)	42. (4)	43. (3)	44. (3)	45. (3)	46. (3)	47. (4)	48. (3)
49. (3)	50. (3)	51. (525)	52. (3)	53. (2218)	54. (1)	55. (19)	56. (15)
57. (19)	58. (14)	59. (108)	60. (4)	61. (1)	62. (4)	mo63. (2)	64. (3)
65. (1)	66. (1)	67. (4)	68. (3)	69. (3)	70. (3)	71. (1)	72. (1)
73. (3)	74. (3)	75. (2)	76. (2)	77. (2)	78. (2)	79. (2)	80. (2)
81. (14)	82. (16)	83. (6)	84. (5)	85. (15)	86. (1)	87. (1)	88. (6)
89. (28)	90. (2)						