Q1. A student determined Young's Modulus of elasticity using the formula $Y = \frac{MgL^3}{4bd^3\delta}$. The value of g is taken to be 9.8 m s^{-2} without any significant error, his observations are as following.

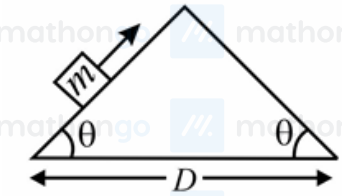
Physical Quantity	Least count of the Equipment used for measurement	Observed Value
Mass (M)	1 g	2 kg
Length of bar (L)	1 mm	1 m
Breadth of bar (b)	0.1 mm	4 cm
Thickness of bar (d)	0.01 mm	0.4 cm
Depression (δ)	0.01 mm	5 mm

Then the fractional error in the measurement of Y is :

(1) 0.155 (2) 0.0083

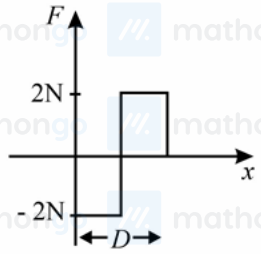
(3) 0.083 (4) 0.0155

Q2. An object of mass m is being moved with a constant velocity under the action of an applied force of 2 N along a frictionless surface with following surface profile.

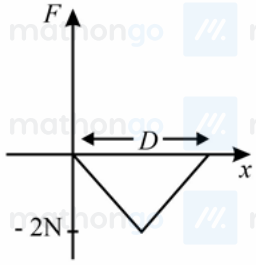


The correct applied force vs distance graph will be :

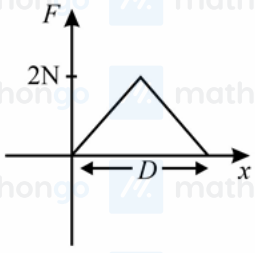
(1)



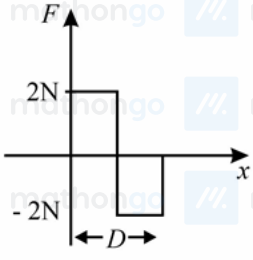
(2)



(3)



(4)



Q3. The ranges and heights for two projectiles projected with the same initial velocity at angles 42° and 48° with the horizontal are R_1, R_2 and H_1, H_2 respectively. Choose the correct option:

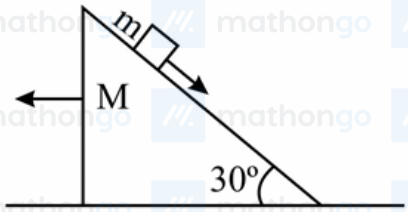
(1) $R_1 = R_2$ and $H_1 = H_2$ (2) $R_1 = R_2$ and $H_1 < H_2$

(3) $R_1 > R_2$ and $H_1 = H_2$ (4) $R_1 < R_2$ and $H_1 < H_2$

Q4. A block of mass m slides on the wooden wedge, which in turn slides backward on the horizontal surface. The acceleration of the block with respect to the wedge is:

Given $m = 8$ kg, $M = 16$ kg

Assume all the surfaces shown in the figure to be frictionless.



(1) $\frac{3}{5}$ g
(2) $\frac{4}{3}$ g
(3) $\frac{6}{5}$ g
(4) $\frac{2}{3}$g

Q5. A body of mass m dropped from a height h reaches the ground with a speed of $0.8\sqrt{gh}$. The value of work done by the air-friction is:

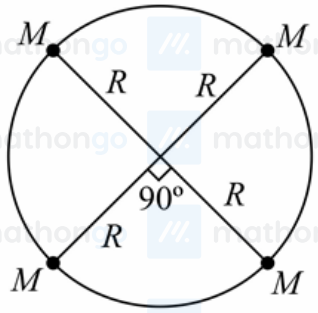
(1) $-0.68mgh$
(2) mgh
(3) $0.64mgh$
(4) $1.64mgh$

Q6. Electric field of a plane electromagnetic wave propagating through a non-magnetic medium is given by $E = 20\cos 2 \times 10^{10}t - 200x$ V m^{-1}. The dielectric constant of the medium is equal to:

(Take $\mu_r = 1$)

(1) 2
(2) $\frac{1}{3}$
(3) 9
(4) 3

Q7. Four particles each of mass M, move along a circle of radius R under the action of their mutual gravitational attraction as shown in figure. The speed of each particle is :



(1) $\frac{1}{2}\sqrt{\frac{GM}{R}2\sqrt{2}+1}$
(2) $\frac{1}{2}\sqrt{\frac{GM}{R(2\sqrt{2}+1)}}$
(3) $\frac{1}{2}\sqrt{\frac{GM}{R}2\sqrt{2}-1}$
(4) $\sqrt{\frac{GM}{R}}$

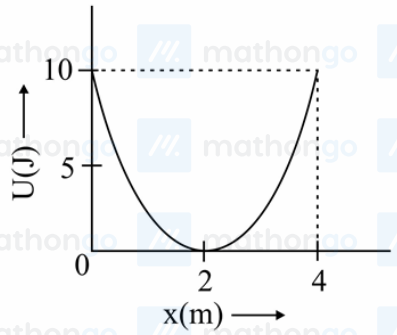
Q8. A glass tumbler having inner depth of 17.5 cm is kept on a table. A student starts pouring water $\mu = \frac{4}{3}$ into it while looking at the surface of water from the above. When he feels that the tumbler is half filled, he stops pouring water. Up to what height, the tumbler is actually filled ?

(1) 10 cm
(2) 11.7 cm
(3) 7.5 cm
(4) 8.75 cm

Q9. Due to cold weather, a 1 m water pipe of cross-sectional area 1 cm^2 is filled with ice at -10 °C. Resistive heating is used to melt the ice. Current of 0.5 A is passed through 4 kΩ resistance. Assuming that all the heat produced is used for melting, what is the minimum time required?
(Given latent heat of fusion for water/ice $= 3.33 \times 10^5$ J kg^{-1}, specific heat of ice $= 2 \times 10^3$ J kg^{-1} $°C^{-1}$ and density of ice $= 10^3$ kg m^{-3})

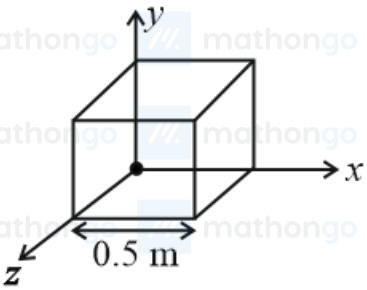
(1) 3.53 s
(2) 0.353 s
(3) 35.3 s
(4) 70.6 s

Q10. A mass of 5 kg is connected to a spring. The potential energy curve of the simple harmonic motion executed by the system is shown in the figure. A simple pendulum of length 4 m has the same period of oscillation as the spring system. What is the value of acceleration due to gravity on the planet where these experiments are performed ?



(1) 4 m s^{-2}
(2) 8 m s^{-2}
(3) 5 m s^{-2}
(4) 10 m s^{-2}

Q11. A cube is placed inside an electric field, $\vec{E} = 150y^2\hat{j}$ The side of the cube is 0.5 m and is placed in the field as shown in the given figure. The charge inside the cube is:



(1) 8.3×10^{-11}C
(2) 3.8×10^{-11}C
(3) 3.8×10^{-12}C
(4) 8.3×10^{-12}C

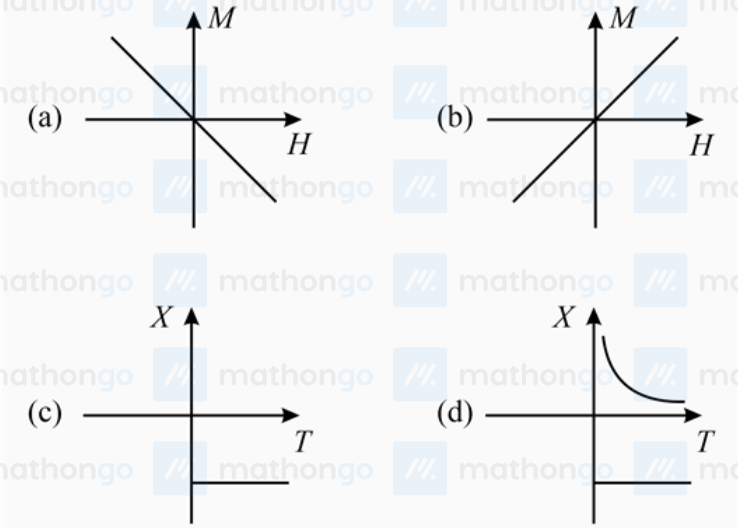
Q12. A capacitor is connected to a 20 V battery through a resistance of 10Ω. It is found that the potential difference across the capacitor rises to 2 V in 1 μs. The capacitance of the capacitor is _____μF.
Given In $\frac{10}{9} = 0.105$

(1) 0.95
(2) 9.52
(3) 1.85
(4) 0.105

Q13. Two resistors $R_1 = (4 \pm 0.8)$ Ω and $R_2 = (4 \pm 0.4)$ Ω are connected in parallel. The equivalent resistance of their parallel combination will be :

(1) (4 ± 0.4) Ω
(2) (2 ± 0.4) Ω
(3) (4 ± 0.3) Ω
(4) (2 ± 0.3) Ω

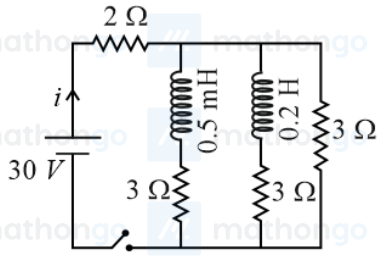
Q14. Following plots show Magnetization (M) vs Magnetising field (H) and Magnetic susceptibility (χ) vs Temperature (T) graph :



Which of the following combination will be represented by a diamagnetic material?

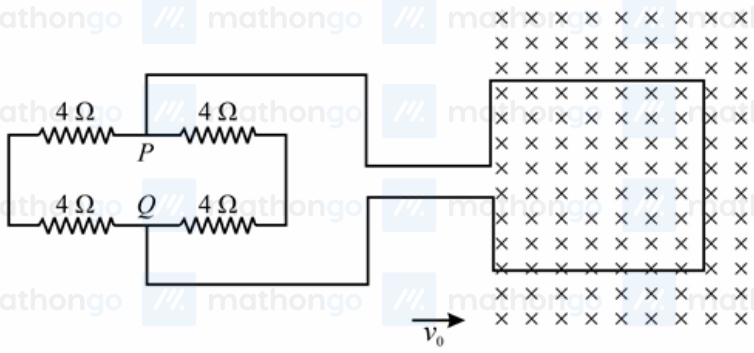
(1) (b), (c)
(2) (b), (d)
(3) (a), (d)
(4) (a), (c)

Q15. For the given circuit the current i through the battery when the key in closed and the steady state has been reached is



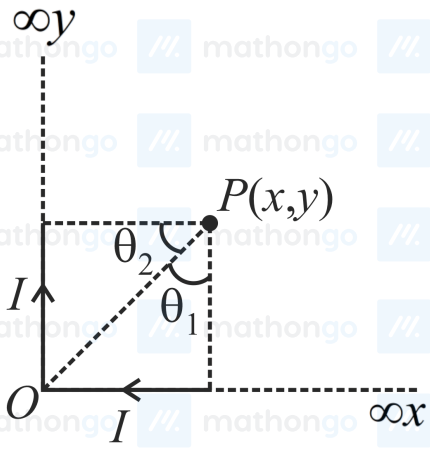
(1) 10 A
(2) 6 A
(3) 25 A
(4) 0 A

Q16. A square loop of side 20 cm and resistance 1 Ω is moved towards right with a constant speed v_0. The right arm of the loop is in a uniform magnetic field of 5 T. The field is perpendicular to the plane of the loop and is going into it. The loop is connected to a network of resistors each of value 4Ω. What should be the value of v_0 so that a steady current of 2 mA flows in the loop ?



(1) 10^{-2} cm s^{-1}
(2) 1 m s^{-1}
(3) 1 cm s^{-1}
(4) 10^{2} m s^{-1}

Q17. There are two infinitely long straight current-carrying conductors and they are held at right angles to each other so that their common ends meet at the origin as shown in the figure given below. The ratio of current in both conductors is 1: 1. The magnetic field at point P is_____.

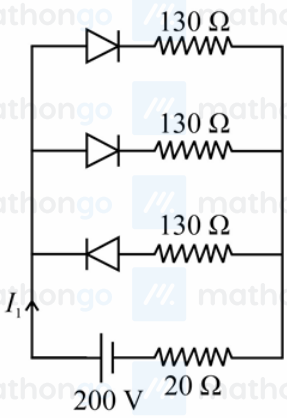


(1) $\frac{\mu_0 I}{4\pi xy}\sqrt{x^2+y^2}$ - $\left(x+y\right)$
(2) $\frac{\mu_0 I xy}{4\pi}\sqrt{x^2+y^2}$ - $\left(x+y\right)$
(3) $\frac{\mu_0 I}{4\pi xy}\sqrt{x^2+y^2}+\left(x+y\right)$
(4) $\frac{\mu_0 I xy}{4\pi}\sqrt{x^2+y^2}+\left(x+y\right)$

Q18. The temperature of an ideal gas in three dimensions is 300 K. The corresponding de-Broglie wavelength of the electron approximately at 300 K is:
m_e = mass of electron $= 9\times10^{-31}$ kg, h = Planck constant $= 6.6\times10^{-34}$ J s, k_B = Boltzmann constant $= 1.38\times10^{-23}$ J K^{-1}
(1) 2.26 nm
(2) 3.25 nm
(3) 8.46 nm
(4) 6.26 nm

Q19. The half life period of a radioactive element x is same as the mean life time of another radioactive element y. Initially they have the same number of atoms. Then:
(1) x and y decay at the same rate always.
(2) x-will decay faster than y.
(3) y-will decay faster than x.
(4) x and y have same decay rate initially and later on different decay rate.

Q20. In the given figure, each diode has a forward bias resistance of 30 Ω and infinite resistance in reverse bias. The current I_1 will be :



(1) 2.0 A
(2) 3.75 A
(3) 2.73 A
(4) 2.35 A

Q21. The average translational kinetic energy of N_2 gas molecules at _____°C becomes equal to the K.E. of an electron accelerated from rest through a potential difference of 0.1 volt.
(Given $k_B = 1.38 \times 10^{-23}$ J K^{-1} (Fill the nearest integer).

Q22. An engine is attached to a wagon through a shock absorber of length 1.5 m. The system with a total mass of 40,000 kg is moving with a speed of 72 km h^{-1} when the brakes are applied to bring it to rest. In the process of the system being brought to rest, the spring of the shock absorber gets compressed by 1.0 m. If 90% of energy of the wagon is lost due to friction, the spring constant is _____ $\times 10^5$ N m^{-1}.

Q23. When a body slides down from rest along a smooth inclined plane making an angle of 30° with the horizontal, it takes time T. When the same body slides down from the rest along a rough inclined plane making the same angle and through the same distance, it takes time αT, where α is a constant greater than 1. The co-efficient of friction between the body and the rough plane is $\frac{1}{\sqrt{x}}\frac{\alpha^2 - 1}{\alpha^2}$ where $x =$ _____.

Q24. A 2 kg steel rod of length 0.6 m is clamped on a table vertically at its lower end and is free to rotate in the vertical plane. The upper end is pushed so that the rod falls under gravity. Ignoring the friction due to clamping at its lower end, the speed of the free end of the rod when it passes through its lowest position is _____m s^{-1}.
(Take $g = 10$ m s^{-2})

Q25. The width of one of the two slits in a Young's double slit experiment is three times the other slit. If the amplitude of the light coming from a slit is proportional to the slit-width, the ratio of minimum to maximum intensity in the interference pattern is x: 4 where x is _____.

Q26. A uniform heating wire of resistance 36 Ω is connected across a potential difference of 240 V. The wire is then cut into half and a potential difference of 240 V is applied across each half separately. The ratio of power dissipation in first case to the total power dissipation in the second case would be 1: x, where x is

Q27. A steel rod with $y = 2.0 \times 10^{11}$ N m^{-2} and $\alpha = 10^{-5}$ $°C^{-1}$ of length 4 m and area of cross-section 10 cm^2 is heated from 0°C to 400°C without being allowed to extend. The tension produced in the rod is

$x \times 10^5$ N where the value of x is _____.

Q28. The temperature of 3.00 mol of an ideal diatomic gas is increased by $40.0°C$ without changing the pressure of the gas. The molecules in the gas rotate but do not oscillate. If the ratio of change in internal energy of the gas to the amount of workdone by the gas is $\frac{x}{10}$. Then the value of x (round off to the nearest integer) is _____.

(Given $R = 8.31$ J mol^{-1} K^{-1}

Q29. Two satellites revolve around a planet in coplanar circular orbits in anticlockwise direction. Their period of revolutions are 1 hour and 8 hours respectively. The radius of the orbit of nearer satellite is 2×10^3 km. The angular speed of the farther satellite as observed from the nearer satellite at the instant when both the satellites are closest is $\frac{\pi}{x}$ rad h^{-1}, where x is _____.

Q30. A carrier wave with amplitude of 250 V is amplitude modulated by a sinusoidal base band signal of amplitude 150 V. The ratio of minimum amplitude to maximum amplitude for the amplitude modulated wave is 50: x, then value of x, is _____.

Q31. Number of paramagnetic oxides among the following given oxides is _____.

Li_2O, CaO, Na_2O_2, KO_2, MgO and K_2O

(1) 1 (2) 3

(3) 0 (4) 2

Q32. Hydrogen peroxide reacts with iodine in basic medium to give :

(1) IO^- (2) IO_3^-

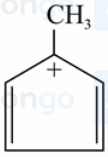
(3) I^- (4) IO_4^-

Q33. The potassium ferrocyanide solution gives a Prussian blue colour, when added to :

(1) $CoCl_3$ (2) $CoCl_2$

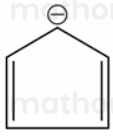
(3) $FeCl_2$ (4) $FeCl_3$

Q34. Which one of the following compounds is aromatic in nature?

(1) 

(2) 

(3) Both A and B

(4) 

Q35. The stereoisomers that are formed by electrophilic addition of bromine to trans - but - 2 - ene is/are :

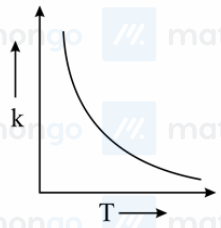
(1) 2 identical mesomers (2) 2 enantiomers

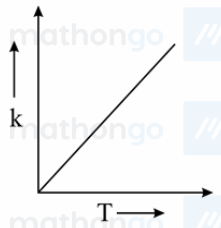
(3) 2 enantiomers and 2 mesomers (4) 1 racemic and 2 enantiomers

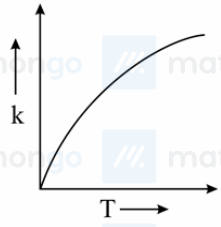
Q36. In the following sequence of reactions, $C_3H_6 \xrightarrow{H^+ / H_2O} A \xrightarrow[\text{dilKOH}]{\text{KIO}} B + C$. The compounds B and C respectively are :

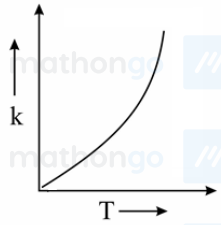
(1) CI_3COOK, CH_3I (2) CH_3I, $HCOOK$
(3) CI_3COOK, $HCOOH$ (4) CHI_3, CH_3COOK

Q37. Water sample is called cleanest on the basis of which one of the BOD values given below :
(1) 11 ppm (2) 15 ppm
(3) 3 ppm (4) 21 ppm

Q38. Which one of the following given graphs represents the variation of rate constant (k) with temperature (T) for an endothermic reaction?
(1)


(2)


(3)


(4)


Q39. Match List - I with List - II.

List-I (Colloid Preparation Method)	**List-II (Chemical Reaction)**
(a) Hydrolysis	(i) $2AuCl_3 + 3HCHO + 3H_2O \rightarrow 2Au(sol) + 3HCOOH + 6HCl$
(b) Reduction	(ii) $As_2O_3 + 3H_2S \rightarrow As_2S_3(sol) + 3H_2O$
(c) Oxidation	(iii) $SO_2 + 2H_2S \rightarrow 3S(sol) + 2H_2O$
(d) Double Decomposition	(iv) $FeCl_3 + 3H_2O \rightarrow Fe(OH)_3(sol) + 3HCl$

Choose the most appropriate answer from the options given below :
(1) (a) - (i), (b) - (iii), (c) - (ii), (d) - (iv)
(2) (a) - (iv), (b) - (i), (c) - (iii), (d) - (ii)
(3) (a) - (i), (b) - (ii), (c) - (iv), (d) - (iii)
(4) (a) - (iv), (b) - (ii), (c) - (iii), (d) - (i)

Q40. Calamine and Malachite, respectively, are the ores of :
(1) Copper and Iron (2) Zinc and Copper
(3) Aluminium and Zinc (4) Nickel and Aluminium

Q41. The oxide without nitrogen-nitrogen bond is :

(1) N_2O_4 (2) N_2O
(3) N_2O_5 (4) N_2O_3

Q42. In the given chemical reaction, colors of theFe^{2+} and Fe^{3+} ions, are respectively :

$5Fe^{2+} + MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$

(1) Yellow, Green (2) Yellow, Orange
(3) Green, Orange (4) Green, Yellow

Q43. Identify the element for which electronic configuration in $+3$ oxidation state is $[Ar]3\ d^5$:

(1) Ru (2) Mn
(3) Co (4) Fe

Q44. The Crystal Field Stabilization Energy (CFSE) and magnetic moment (spin-only) of an octahedral aqua complex of a metal ion M^{Z+} are $-0.8\Delta_0$ and 3.87 BM, respectively. Identify M^{Z+} :

(1) V^{3+} (2) Co^{2+}
(3) Cr^{3+} (4) Mn^{4+}

Q45. Experimentally reducing a functional group **cannot** be done by which one of the following reagents ?

(1) Zn / H_2O (2) $Pt - C / H_2$
(3) $Pd - C / H_2$ (4) Na / H_2

Q46. Given below are two statements :

Statement I : The nucleophilic addition of sodium hydrogen sulphite to an aldehyde or a ketone involves proton transfer to form a stable ion.

Statement II : The nucleophilic addition of hydrogen cyanide to an aldehyde or a ketone yields amine as final product.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both Statement I and Statement II are false. (2) Both Statement I and Statement II are true.
(3) Statement I is false but Statement II is true. (4) Statement I is true but Statement II is false.

Q47. In the following sequence of reactions a compound A, (molecular formula $C_6H_{12}O_2$) with a straight chain structure gives a C_4 carboxylic acid. A is :

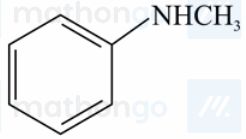
$A \xrightarrow[H_3O^+]{LiAlH_4} B \xrightarrow{\text{Oxidation}} C_4$ - carboxylic acid

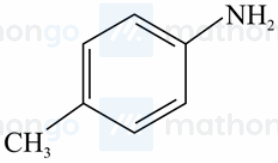
(1) $CH_3-CH_2-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-O-CH=CH_2$ (2) $CH_3-CH_2-CH_2-O-CH=CH-CH_2-OH$

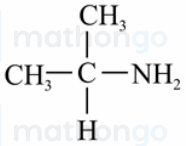
(3) $CH_3-CH_2-CH_2-COO-CH_2-CH_3$ (4) $CH_3-CH_2-COO-CH_2-CH_2-CH_3$

Q48. Which one of the following gives the most stable Diazonium salt ?

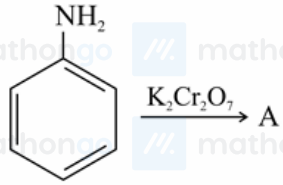
(1) $CH_3-CH_2-CH_2-NH_2$

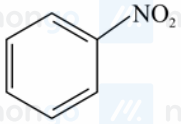
(2) 

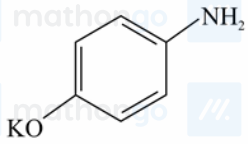
(3) 

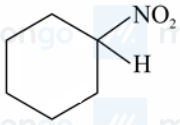
(4) 

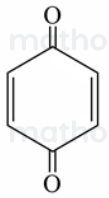
Q49. Identify A in the following reaction.



(1) 

(2) 

(3) 

(4) 

Q50. Monomer units of Dacron polymer are :

(1) glycerol and phthalic acid
(2) ethylene glycol and phthalic acid
(3) ethylene glycol and terephthalic acid
(4) glycerol and terephthalic acid

Q51. The number of atoms in 8 g of sodium is $x \times 10^{23}$. The value of x is _____. (Nearest integer)
Given : $N_A = 6.02 \times 10^{23}$ mol^{-1} Atomic mass of Na $= 23.0u$]

Q52. A 50 watt bulb emits monochromatic red light of wavelength of 795 nm. The number of photons emitted per second by the bulb is $x \times 10^{20}$. The value of x is _____.
(Nearest integer)
[Given : $h = 6.63 \times 10^{-34}$Js and $c = 3.0 \times 10^8$ ms^{-1}

Q53. The spin-only magnetic moment value of B_2^+ species is $\times 10^{-2}$BM (Nearest integer)
[Given : $\sqrt{3} = 1.73$]

Q54. An empty LPG cylinder weighs 14.8 kg. When full, it weighs 29.0 kg and shows a pressure of 3.47 atm. In the course of use at ambient temperature, the mass of the cylinder is reduced to 23.0 kg. The final pressure inside the cylinder is _____ atm. (Nearest integer)
(Assume LPG to be an ideal gas)

Q55. For the reaction $2NO_2(g) \rightleftharpoons N_2O_4(g)$, when $\Delta S = -176.0$ J K^{-1} and $\Delta H = -57.8$ kJ mol^{-1} the magnitude of ΔG at 298 K for the reaction is _____ $kJmol^{-1}$. (Nearest integer)

Q56. The molar solubility of $Zn(OH)_2$ in $0.1MNaOH$ solution is $x \times 10^{-18}M$. The value of x is _____ . (Nearest integer)
Given : The solubility product of $Zn(OH)_2$ is 2×10^{-20}

Q57. If 80 g of copper sulphate $CuSO_4 \cdot 5H_2O$ is dissolved in deionised water to make 5 L of solution. The concentration of the copper sulphate solution is $x \times 10^{-3}$ mol L^{-1}. The value of x is _____.
[Atomic masses Cu : 63.54u, S : 32u, O : 16u, H : 1u]

Q58. If the conductivity of mercury at 0°C is 1.07×10^6 S m^{-1} and the resistance of a cell containing mercury is 0.243Ω, then the cell constant of the cell is $x \times 10^4$ m^{-1}. The value of x is _____ . (Nearest integer)

Q59. The sum of oxidation states of two silver ions in $AgNH_{3_2}Ag(CN)_2$ complex is _____ .

Q60. A peptide synthesized by the reactions of one molecule each of Glycine, Leucine, Aspartic acid and Histidine will have _____ peptide linkages.

Q61. The number of pairs a, b of real numbers, such that whenever α is a root of the equation $x^2 + ax + b = 0$, $\alpha^2 - 2$ is also a root of this equation, is :
(1) 6 (2) 8
(3) 4 (4) 2

Q62. Let P_1, P_2 ... , P_{15} be 15 points on a circle. The number of distinct triangles formed by points P_i, P_j, P_k such that $i + j + k \neq 15$, is :
(1) 455 (2) 419
(3) 12 (4) 443

Q63. Let $S_n = 1 \cdot (n-1) + 2 \cdot (n-2) + 3 \cdot (n-3) + \ldots + (n-1) \cdot 1$, $n \geqslant 4$.
The sum $\sum_{n=4}^{\infty} \frac{2 S_n}{n!} - \frac{1}{(n-2)!}$ is equal to :
(1) $\frac{e-2}{6}$ (2) $\frac{e-1}{3}$
(3) $\frac{e}{6}$ (4) $\frac{e}{3}$

Q64. Let a_1, a_2, ... , a_{21} be an $A.P.$ such that $\sum_{n=1}^{20} \frac{1}{a_n a_{n+1}} = \frac{4}{9}$. If the sum of this $A.P.$ is 189, then $a_6 a_{16}$ is equal to :
(1) 57 (2) 48
(3) 36 (4) 72

Q65. If n is the number of solutions of the equation $2\cos x 4\sin\frac{\pi}{4} + x\sin\frac{\pi}{4} - x - 1 = 1$, $x \in 0, \pi$ and S is the sum of all these solutions, then the ordered pair n, S is :
(1) $2, \frac{8\pi}{9}$ (2) $3, \frac{13\pi}{9}$
(3) $2, \frac{2\pi}{3}$ (4) $3, \frac{5\pi}{3}$

Q66. Consider the parabola with vertex $\frac{1}{2}, \frac{3}{4}$ and the directrix $y = \frac{1}{2}$. Let P be the point where the parabola meets the line $x = -\frac{1}{2}$. If the normal to the parabola at P intersects the parabola again at the point Q. then $(PQ)^2$ is equal to :

(1) $\frac{25}{2}$ (2) $\frac{75}{8}$

(3) $\frac{125}{16}$ (4) $\frac{15}{2}$

Q67. Let θ be the acute angle between the tangents to the ellipse $\frac{x^2}{9} + \frac{y^2}{1} = 1$ and the circle $x^2 + y^2 = 3$ at their point of intersection in the first quadrant. Then $\tan\theta$ is equal to :

(1) $\frac{5}{2\sqrt{3}}$ (2) $\frac{4}{\sqrt{3}}$

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

Q68. Which of the following is equivalent to the Boolean expression $p \wedge \sim q$?

(1) $\sim p \rightarrow \sim q$ (2) $\sim(q \rightarrow p)$

(3) $\sim(p \rightarrow q)$ (4) $\sim(p \rightarrow \sim q)$

Q69. Consider the system of linear equations

$-x + y + 2z = 0$

$3x - ay + 5z = 1$

$2x - 2y - az = 7$

Let S_1 be the set of all $a \in R$ for which the system is inconsistent and S_2 be the set of all $a \in R$ for which the system has infinitely many solutions. If nS_1 and nS_2 denote the number of elements in S_1 and S_2 respectively, then

(1) $nS_1 = 2, \quad nS_2 = 0$ (2) $nS_1 = 2, nS_2 = 2$

(3) $nS_1 = 0, \quad nS_2 = 2$ (4) $nS_1 = 1, nS_2 = 0$

Q70. $\cos^{-1}(\cos(-5)) + \sin^{-1}(\sin(6)) - \tan^{-1}(\tan(12))$ is equal to :

(The inverse trigonometric functions take the principal values)

(1) $3\pi + 1$ (2) $3\pi - 11$

(3) $4\pi - 11$ (4) $4\pi - 9$

Q71. The range of the function $f(x) = \log_{\sqrt{5}} 3 + \cos\frac{3\pi}{4} + x + \cos\frac{\pi}{4} + x + \cos\frac{\pi}{4} - x - \cos\frac{3\pi}{4} - x$ is :

(1) $\frac{1}{\sqrt{5}}, \sqrt{5}$ (2) $[0, 2]$

(3) $(0, \sqrt{5})$ (4) $[-2, 2]$

Q72. The function $fx = x^3 - 6x^2 + ax + b$ is such that $f2 = f4 = 0$.

Consider two statements:

S_1 there exists $x_1, x_2 \in 2, 4, \quad x_1 < x_2,$ such that $f'x_1 = -1$ and $f'x_2 = 0$.

S_2 there exists $x_3, x_4 \in 2, 4, \quad x_3 < x_4,$ such that f is decreasing in $2, x_4,$ increasing in $x_4, 4$ and $2f'x_3 = \sqrt{3}fx_4$ then

(1) S_1 is true and S_2 is false (2) both S_1 and S_2 are false

(3) both S_1 and S_2 are true (4) S_1 is false and S_2 is true

Q73. Let f : R → R be a continuous function. Then $\lim_{x \to \pi/4} \frac{\frac{\pi}{4}\int_2^{\sec^2 x} f(x)\,dx}{x^2 - \frac{\pi^2}{16}}$ is equal to:

(1) $f(2)$ (2) $2f(\sqrt{2})$

(3) $2f(2)$ (4) $4f(2)$

Q74. Let $J_{n,m} = \int_0^{1/2} \frac{x^n}{x^m - 1} dx, \forall n > m$ and $n, \quad m \in N$. Consider a matrix $A = a_{ij}{}_{3\times 3}$ where $a_{ij} = \begin{cases} J_{6+i,3} - J_{i+3,3}, & i \le j \\ 0, & i > j \end{cases}$. Then adj A^{-1} is :

(1) $(15)^2 \times 2^{34}$ (2) $(15)^2 \times 2^{42}$

(3) $(105)^2 \times 2^{36}$ (4) $(105)^2 \times 2^{38}$

Q75. The function $f(x)$, that satisfies the condition $f(x) = x + \int_0^{\pi/2} \sin x \cos y f(y)\,dy$, is :

(1) $x + \frac{\pi}{2}\sin x$ (2) $x + (\pi + 2)\sin x$

(3) $x + \frac{2}{3}(\pi - 2)\sin x$ (4) $x + (\pi - 2)\sin x$

Q76. The area, enclosed by the curves $y = \sin x + \cos x$ and $y = |\cos x - \sin x|$ and the lines $x = 0, \quad x = \frac{\pi}{2}$, is :

(1) $2\sqrt{2}(\sqrt{2} + 1)$ (2) $2\sqrt{2}(\sqrt{2} - 1)$

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

Q77. If $y = y(x)$ is the solution curve of the differential equation $x^2 \quad dy + y - \frac{1}{x}dx = 0; \quad x > 0$ and $y(1) = 1$, then $y\frac{1}{2}$ is equal to :

(1) $3 + e$ (2) $3 - e$

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

Q78. The distance of line $3y - 2z - 1 = 0 = 3x - z + 4$ from the point $(2, -1, 6)$ is :

(1) $2\sqrt{5}$ (2) $2\sqrt{6}$

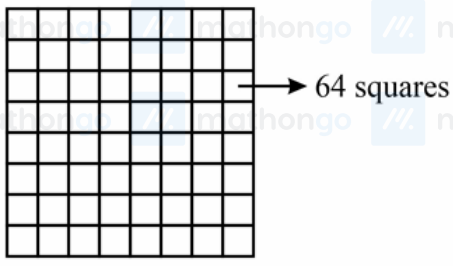
(3) $\sqrt{26}$ (4) $4\sqrt{2}$

Q79. Let the acute angle bisector of the two planes $x - 2y - 2z + 1 = 0$ and $2x - 3y - 6z + 1 = 0$ be the plane P. Then which of the following points lies on P ?

(1) $(0, \quad 2, \quad -4)$ (2) $-2, \quad 0, \quad -\frac{1}{2}$

(3) $(4, \quad 0, \quad -2)$ (4) $3, \quad 1, \quad -\frac{1}{2}$

Q80. Two squares are chosen at random on a chessboard (see figure). The probability that they have a side in common is :



(1) $\frac{1}{9}$ (2) $\frac{1}{7}$
(3) $\frac{2}{7}$ (4) $\frac{1}{18}$

Q81. If for the complex numbers z satisfying $|z - 2 - 2i| \leq 1$, the maximum value of $|3iz + 6|$ is attained at $a + ib$, then $a + b$ is equal to _____ .

Q82. All the arrangements, with or without meaning, of the word FARMER are written excluding any word that has two R appearing together. The arrangements are listed serially in the alphabetic order as in the English dictionary. Then the serial number of the word FARMER in this list is _____ .

Q83. If the sum of the coefficients in the expansion of $(x + y)^n$ is 4096, then the greatest coefficient in the expansion is _____.

Q84. Let the points of intersections of the lines $x - y + 1 = 0$, $x - 2y + 3 = 0$ and $2x - 5y + 11 = 0$ are the mid points of the sides of a triangle ABC. Then the area of the triangle ABC is

Q85. A man starts walking from the point $P(-3, 4)$, touches the x-axis at R, and then turns to reach at the point $Q(0, 2)$, The man is walking at a constant speed. If the man reaches the point Q in the minimum time, then $50(PR)^2 + (RQ)^2$ is equal to _____ .

Q86. Let $f(x) = x^6 + 2x^4 + x^3 + 2x + 3$, $x \in$ R. Then the natural number n for which $\lim\limits_{x \to 1} \frac{x^n f(1) - f(x)}{x - 1} = 44$ is _____ .

Q87. Let $f(x)$ be a polynomial of degree 3 such that $fk = -\frac{2}{k}$ for $k = 2, 3, 4, 5$. Then the value of $52 - 10 f(10)$ is equal to _____ .

Q88. Let [t] denote the greatest integer $\leq$ t. The number of points where the function $f(x) = [x]x^2 - 1 + \sin\frac{\pi}{[x] + 3} - [x + 1]$, $x \in (-2, 2)$ is not continuous is _____ .

Q89. Let $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - \hat{k}$. Let a vector $\vec{v}$ be in the plane containing $\vec{a}$ and $\vec{b}$. If $\vec{v}$ is perpendicular to the vector $3\hat{i} + 2\hat{j} - \hat{k}$ and its projection on $\vec{a}$ is 19 units, then $|2\vec{v}|^2$ is equal to _____.

Q90. Let X be a random variable with distribution.

x	-2	-1	3	4	6
$P(X = x)$	$\frac{1}{5}$	a	$\frac{1}{3}$	$\frac{1}{5}$	b

If the mean of X is 2.3 and variance of X is σ^2, then $100\sigma^2$ is equal to :

ANSWER KEYS

1. (4)	**2.** (4)	**3.** (2)	**4.** (4)	**5.** (1)	**6.** (3)	**7.** (1)	**8.** (1)
9. (3)	**10.** (1)	**11.** (1)	**12.** (1)	**13.** (4)	**14.** (4)	**15.** (1)	**16.** (3)
17. (3)	**18.** (4)	**19.** (3)	**20.** (1)	**21.** (500)	**22.** (16)	**23.** (3)	**24.** (6)
25. (1)	**26.** (4)	**27.** (8)	**28.** (25)	**29.** (3)	**30.** (200)	**31.** (1)	**32.** (3)
33. (4)	**34.** (4)	**35.** (1)	**36.** (4)	**37.** (3)	**38.** (4)	**39.** (2)	**40.** (2)
41. (3)	**42.** (4)	**43.** (4)	**44.** (2)	**45.** (4)	**46.** (4)	**47.** (3)	**48.** (3)
49. (4)	**50.** (3)	**51.** (2)	**52.** (2)	**53.** (173)	**54.** (2)	**55.** (5)	**56.** (2)
57. (64)	**58.** (26)	**59.** (2)	**60.** (3)	**61.** (1)	**62.** (4)	**63.** (2)	**64.** (4)
65. (2)	**66.** (3)	**67.** (3)	**68.** (3)	**69.** (1)	**70.** (3)	**71.** (2)	**72.** (3)
73. (3)	**74.** (4)	**75.** (4)	**76.** (2)	**77.** (2)	**78.** (2)	**79.** (2)	**80.** (4)
81. (5)	**82.** (77)	**83.** (924)	**84.** (6)	**85.** (1250)	**86.** (7)	**87.** (26)	**88.** (2)
89. (1494)	**90.** (781)						