Q1. For the four sets of three measured physical quantities as given below. Which of the following options is correct?

$(i)\ A_1 = 24.36, B_1 = 0.0724, C_1 = 256.2$
$(ii)\ A_2 = 24.44, B_2 = 16.082, C_2 = 240.2$
$(iii)\ A_3 = 25.2, B_3 = 19.2812, C_3 = 236.183$
$(iv)\ A_4 = 25, B_4 = 236.191, C_4 = 19.5$

(1) $A_4 + B_4 + C_4 < A_1 + B_1 + C_1 < A_3 + B_3 + C_3 < A_2 + B_2 + C_2$
(2) $A_1 + B_1 + C_1 = A_2 + B_2 + C_2 = A_3 + B_3 + C_3 = A_4 + B_4 + C_4$
(3) $A_1 + B_1 + C_1 < A_2 + B_2 + C_2 = A_3 + B_3 + C_3 < A_4 + B_4 + C_4$
(4) $A_1 + B_1 + C_1 < A_3 + B_3 + C_3 < A_2 + B_2 + C_2 < A_4 + B_4 + C_4$

Q2. A spring mass system (mass m, spring constant k and natural length l) rests in equilibrium on a horizontal disc. The free end of the spring is fixed at the centre of the disc. If the disc together with spring mass system rotates about it's axis with an angular velocity ω, $\left(k >> m\omega^2\right)$ the relative change in the length of the spring is best given by the option:

(1) $\sqrt{\frac{2}{3}}\left(\frac{m\omega^2}{k}\right)$
(2) $\frac{2m\omega^2}{k}$
(3) $\frac{m\omega^2}{k}$
(4) $\frac{m\omega^2}{3k}$

Q3. A particle starts from the origin at $t = 0$ with an initial velocity of $3.0\hat{i}\mathrm{m/s}$ and moves in the $x - y$ plane with a constant acceleration $\left(6.0\hat{i} + 4.0\hat{j}\right)\mathrm{m/s^2}$. The $x-$ coordinate of the particle at the instant when its $y-$ coordinate is $32m$ is D meters. The value of D is:

(1) 32
(2) 50
(3) 60
(4) 40

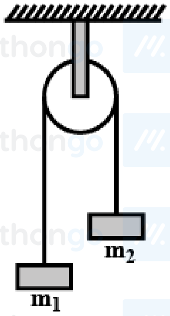
Q4. A rod of length l has non-uniform linear mass density given by $\rho(x) = a + b\left(\frac{x}{l}\right)^2$, where a and b are constants and $0 \leq x \leq l$ The value of x for the centre of mass of the rod is at:

(1) $\frac{3}{2}\left(\frac{a+b}{2a+b}\right)L$
(2) $\frac{3}{4}\left(\frac{2a+b}{3a+b}\right)L$
(3) $\frac{4}{3}\left(\frac{a+b}{2a+3b}\right)L$
(4) $\frac{3}{2}\left(\frac{2a+b}{3a+b}\right)L$

Q5. A particle of mass m is projected with a speed u from the ground at an angle $\theta = \frac{\pi}{3}$ w.r.t. horizontal (x-axis). When it has reached its maximum height, it collides completely inelastically with another particle of the same mass and velocity $u\hat{i}$. The horizontal distance covered by the combined mass before reaching the ground is:

(1) $\frac{3\sqrt{3}}{8}\frac{u^2}{g}$
(2) $\frac{3\sqrt{2}}{4}\frac{u^2}{g}$
(3) $\frac{5}{8}\frac{u^2}{g}$
(4) $2\sqrt{2}\frac{u^2}{g}$

Q6. A uniformly thick wheel with moment of inertia I and radius R is free to rotate about its centre of mass (see fig). A massless string is wrapped over its rim and two blocks of masses m_1 and $m_2 (m_1 > m_2)$ are attached to the ends of the string. The system Is released from rest. The angular speed of the wheel when m_1 descends by a distance h is:



(1) $\left[\frac{2(m_1-m_2)gh}{(m_1+m_2)R^2+I}\right]^{\frac{1}{2}}$
(2) $\left[\frac{2(m_1+m_2)gh}{(m_1+m_2)R^2+I}\right]^{\frac{1}{2}}$
(3) $\left[\frac{(m_1-m_2)}{(m_1+m_2)R^2+1}\right]^{\frac{1}{2}} gh$
(4) $\left[\frac{m_1+m_2}{(m_1+m_2)R^2+I}\right]^{\frac{1}{2}} gh$

Q7. Planet A has mass M and radius R. Planet B has half the mass and half the radius of Planet A. If the escape velocities from the Planets A and B are v_A and v_B, respectively, then $\frac{v_A}{v_B} = \frac{n}{4}$. The value of n is:
(1) 4
(2) 1
(3) 2
(4) 3

Q8. Two steel wires having same length are suspended from a ceiling under the same load. If the ratio of their energy stored per unit volume is 1 : 4, the ratio of their diameters is:
(1) $\sqrt{2} : 1$
(2) 1 : 2
(3) 2 : 1
(4) $1 : \sqrt{2}$

Q9. A small spherical droplet of density d is floating exactly half immersed in a liquid of density ρ and surface tension T. The radius of the droplet is (take note that the surface tension applies an upward force on the droplet):
(1) $r = \sqrt{\frac{2T}{3(d+\rho)g}}$
(2) $r = \sqrt{\frac{T}{(d-\rho)g}}$
(3) $r = \sqrt{\frac{T}{(d+\rho)g}}$
(4) $r = \sqrt{\frac{3T}{(2d-\rho)g}}$

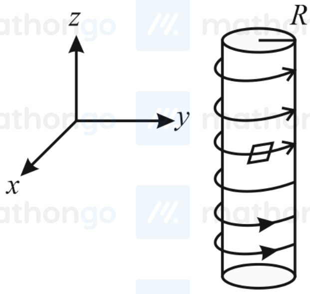
Q10. Two gases - argon (atomic radius 0.07nm, atomic weight 40) and xenon (atomic radius 0.1nm, atomic weight 140) have the same number density and are at the same temperature. The ratio of their respective mean free times is closest to:
(1) 3.67
(2) 1.83
(3) 2.3
(4) 4.67

Q11. A wire of length L and mass per unit length 6.0×10^{-3} kg m^{-1} is put under tension of 540 N. Two consecutive frequencies that it resonates at are: 420 Hz and 490 Hz. Then L in meters is :
(1) 2.1m
(2) 1.1m
(3) 8.1m
(4) 5.1m

Q12. A small circular loop of conducting wire has radius a and carries current I. It is placed in a uniform magnetic field B perpendicular to its plane such that when rotated slightly about its diameter and released, it starts performing simple harmonic motion of time period T. The mass of the loop is m then:

(1) $T=\sqrt{\frac{2m}{iB}}$
(2) $T=\sqrt{\frac{\pi m}{2iB}}$
(3) $T=\sqrt{\frac{2\pi m}{iB}}$
(4) $T=\sqrt{\frac{\pi m}{iB}}$

Q13. An electron gun is placed inside a long solenoid of radius R on its axis. The solenoid has n turns/length and carries a current I. The electron gun shoots an electron along the radius of the solenoid with speed v. If the electron does not hit the surface of the solenoid, maximum possible value of v is (all symbols have their standard meaning):

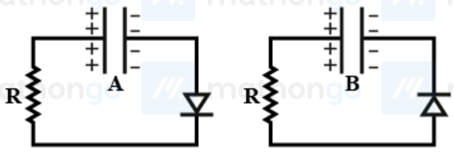


(1) $\frac{e\mu_0 nIR}{m}$
(2) $\frac{e\mu_0 nIR}{2m}$
(3) $\frac{e\mu_0 nIR}{4m}$
(4) $\frac{2e\mu_0 nIR}{m}$

Q14. In LC circuit the inductance $L=40$ mH and capacitance $C=100$ μF. If a voltage $V(t)=10\sin(314t)$ is applied to the circuit, the current in the circuit is given as:

(1) $0.52\cos(314t)$
(2) $10\cos(314t)$
(3) $5.2\cos(314t)$
(4) $0.52\sin(314t)$

Q15. Two identical capacitors A and B, charged to the same potential $5V$ are connected in two different circuits as shown below at time $t=0$. If the charge on capacitors A and B at time $t=CR$ is Q_A and Q_B respectively, then (Here e is the base of natural logarithm)



(1) $Q_A=\frac{VC}{e}, Q_B=\frac{CV}{2}$
(2) $Q_A=VC, Q_B=CV$
(3) $Q_A=VC, Q_B=\frac{VC}{e}$
(4) $Q_A=\frac{CV}{2}, Q_B=\frac{VC}{e}$

Q16. A plane electromagnetic wave is propagating along the direction $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$, with its polarization along the direction $\hat{k}$. The correct form of the magnetic field of the wave would be (here B_0 is an appropriate constant):

(1) $B_0\frac{\hat{i}-\hat{j}}{\sqrt{2}}\cos\left(\omega t-k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$
(2) $B_0\frac{\hat{j}-\hat{i}}{\sqrt{2}}\cos\left(\omega t+k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$
(3) $B_0\hat{k}\cos\left(\omega t-k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$
(4) $B_0\frac{\hat{i}+\hat{j}}{\sqrt{2}}\cos\left(\omega t-k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$

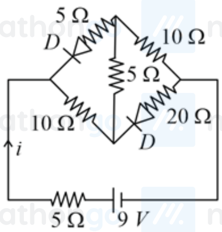
Q17. There is a small source of light at some depth below the surface of water (refractive index $=\frac{4}{3}$) in a tank of large cross sectional surface area. Neglecting any reflection from the bottom and absorption by water,

percentage of light that emerges out of surface is (nearly):
[Use the fact that surface area of a spherical cap of height h and radius of curvature r is $2\pi rh$]
(1) 21%
(2) 34%
(3) 17%
(4) 50%

Q18. An electron of mass m and magnitude of charge e at rest, gets accelerated by a constant electric field E. The rate of change of de-Broglie wavelength of this electron at a time t is (ignore relativistic effects)
(1) $\frac{d\lambda}{dt}=-\frac{h}{eEt}$
(2) $\frac{d\lambda}{dt}=-\frac{2h}{eEt}$
(3) $\frac{d\lambda}{dt}=-\frac{2h}{eEt^2}$
(4) $\frac{d\lambda}{dt}=-\frac{h}{eEt^2}$

Q19. The energy required to ionise a hydrogen like ion in its ground state is 9 Rydbergs. What is the wavelength of the radiation emitted when the electron in this ion jumps from the second excited stale to the ground state?
(1) 24. 2nm
(2) 11.4nm
(3) 35.8nm
(4) 8.6nm

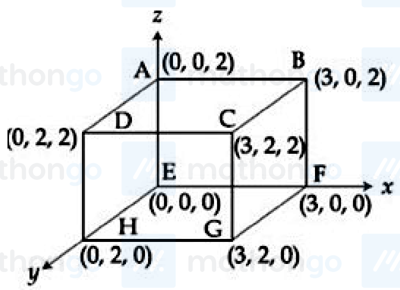
Q20. The current i in the network is



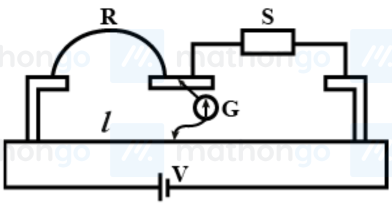
(1) 0.2 A
(2) 0.6 A
(3) 0.3 A
(4) 0 A

Q21. Starting at temperature $300K$, one mole of an ideal diatomic gas $(\gamma=1.4)$ is first compressed adiabatically from volume V_1 to $V_2=\frac{V_1}{16}$. It is then allowed to expand isobarically to volume $2V_2$. If all the processes are the quasi-static then the final temperature of the gas (in ^oK) is (to the nearest integer) ____________.

Q22. An electric field $\overrightarrow{E}=4x\hat{i}-\left(y^2+1\right)\hat{j}N/C$ passes through the box shown in figure. The flux of the electric field through surfaces $ABCD$ and $BCGF$ are marked as ϕ_{I} and ϕ_{II} respectively. The difference between $(\phi_I-\phi_{II})$ is (in Nm^2/C) ____________.

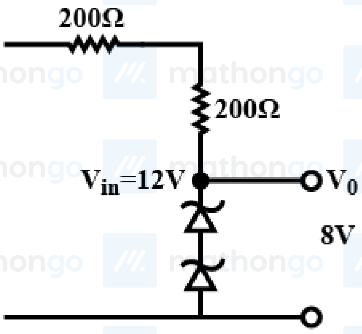


Q23. In a meter bridge experiment S is a standard resistance. R is a resistance wire. It is found that balancing length is $l=25$cm. If R is replaced by a wire of hall length and half diameter that of R of same material, then the balancing distance l' (in cm) will now be ______________.



Q24. In a Young's double slit experiment 15 fringes are observed on a small portion of the screen when light of wavelength 500 nm is used. Ten fringes are observed on the same section of the screen when another light source of wavelength λ is used. Then the value of λ is (in nm) __________.

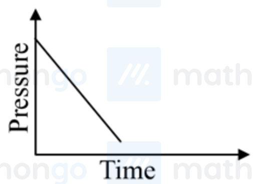
Q25. In the circuit shown below, is working as a 8 V dc regulated voltage source. When 12 V is used as an input, the power dissipated (in mW) in each diode is (Considering both zener diodes are identical)

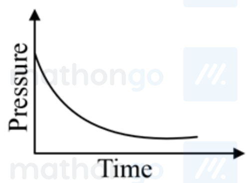


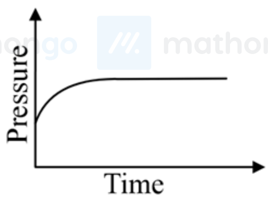
Q26. The first and second ionisation enthalpies of a metal are 496 and 4560 kJ mol^{-1}, respectively. How many moles of HCl and H_2SO_4, respectively, will be needed to react completely with 1 mole of the metal hydroxide?

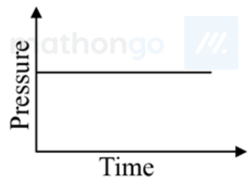
(1) 1 and 1
(2) 2 and 0.5
(3) 1 and 2
(4) 1 and 0.5

Q27. A mixture of gases O_2, H_2 and CO are taken in a closed vessel containing charcoal The graph that represents the correct behaviour of pressure with time is:

(1)


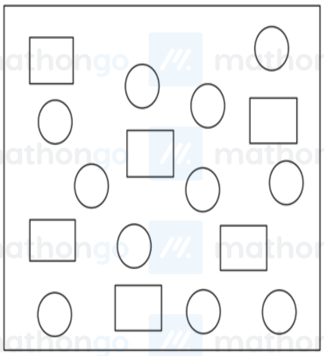
(2)


(3)


(4)


Q28. The true statement amongst the following is:
(1) Both ΔS and S are functions of temperature.
(2) Both S and ΔS are not functions of temperature
(3) S is not a function of temperature but ΔS is a function of temperature
(4) S is a function of temperature but ΔS is not a function of temperature

Q29. In the figure shown below reactant A (represented by square) is in equilibrium with product B (represented by circle). The equilibrium constant is (approx):



(1) 4
(2) 8
(3) 1
(4) 2

Q30. The solubility product of $Cr(OH)_3$ at 298K is 6.0×10^{-31}. The concentration of hydroxide ions in a saturated solution of $Cr(OH)_3$ will be
(1) $(2.22 \times 10^{-31})^{\frac{1}{4}}$
(2) $(18 \times 10^{-31})^{\frac{1}{4}}$
(3) $(18 \times 10^{-31})^{\frac{1}{2}}$
(4) $(4.86 \times 10^{-29})^{\frac{1}{4}}$

Q31. 5g of zinc is treated separately with an excess of
(a) dilute hydrochloric acid and
(b) aqueous sodium hydroxide.
The ratio of the volumes of H_2 evolved in these two reactions is:
(1) 1 : 2
(2) 1 : 1
(3) 1 : 4
(4) 2 : 1

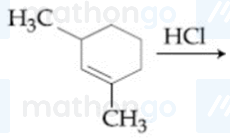
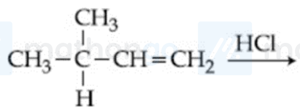
Q32. Among the statements (a) – (d), the correct ones are:
(a) Lithium has the highest hydration enthalpy among the alkali metals.
(b) Lithium chloride is insoluble in pyridine.
(c) Lithium cannot form ethynide upon its reaction with ethyne.
(d) Both lithium and magnesium react slowly with H_2O .
(1) (a), (b) and (d) only
(2) (a), (c) and (d) only
(3) (b) and (c) only
(4) (a) and (d) only

Q33. The reaction of $H_3N_3B_3Cl_3(A)$ with $LiBH_4$ in tetrahydrofuran gives inorganic benzene (B) . Further, the reaction of (A) with (C) leads to $H_3N_3B_3(Me)_3$. Compounds (B) and (C) respectively, are:
(1) Bogging god MeBr
(2) Diborane and MeMgBr
(3) Boron nitride and MeBr
(4) Borazine and MeMgBr

Q34. Which of the following has the shortest $C-Cl$ bond?

(1) $Cl-CH=CH_2$
(2) $Cl-CH=CH-NO_2$
(3) $Cl-CH=CH-CH_3$
(4) $Cl-CH=CH-OCH_3$

Q35. Which of the following reactions will not produce a racemic product ?

(1) 
(2) 
(3) $CH_3CH_2CH=CH_2 \xrightarrow{HBr}$
(4) 

Q36. The number of sp^2 hybrid orbitals in a molecule of benzene is:

(1) 24
(2) 6
(3) 18
(4) 12

Q37. Biochemical Oxygen Demand (BOD) is the amount of oxygen required (in ppm):

(1) for sustaining life in a water body.
(2) by bacteria to break-down organic waste in a certain volume of a water sample.
(3) for the photochemical breakdown of waste present in $1m^3$ volume of a water body
(4) by anaerobic bacteria to breakdown. inorganic waste present in a water body.

Q38. Amongst the following, the form of water with the lowest ionic conductance at 298K is:

(1) distilled water
(2) saline water used for intravenous injection
(3) water from a well
(4) sea water

Q39. The correct order of the spin-only magnetic moments of the following complexes is:

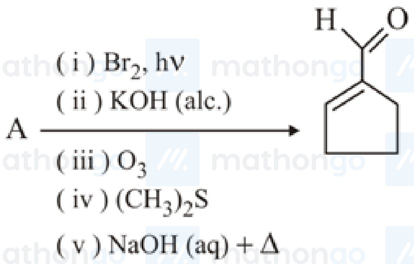
(I) $[Cr(H_2O)_6]Br_2$
(II) $Na_4[Fe(CN)_6]$
(III) $Na_3[Fe(C_2O_4)_3](\Delta_0 > P)$
(IV) $(Et_4N)_2[CoCl_4]$

(1) (III) > (I) > (IV) > (II)
(2) (III) > (I) > (II) > (IV)
(3) (I) > (IV) > (III) > (II)
(4) (II) ≈ (I) > (IV) > (III)

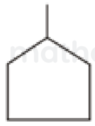
Q40. The isomer(s) of $[Co(NH_3)_4Cl_2]$ that has/ have a $Cl-Co-Cl$ angle of 90°, is/are:

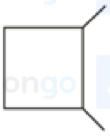
(1) meridional and trans
(2) cis and trans
(3) trans only
(4) cis only

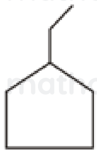
Q41. In the following reaction A is



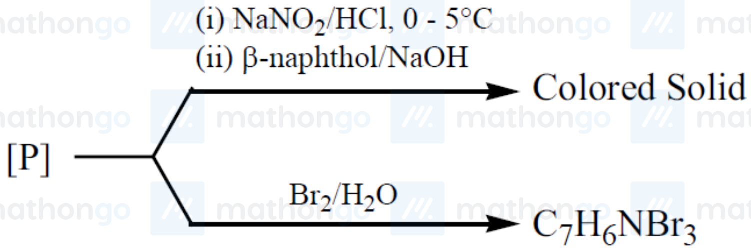
(1)


(2)


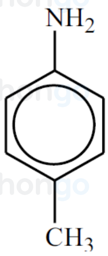
(3)


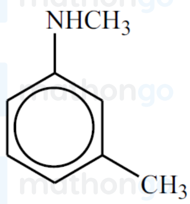
(4)


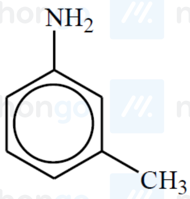
Q42. Consider the following reactions,

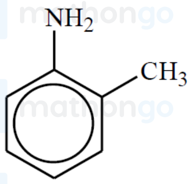


The compound [P] is:

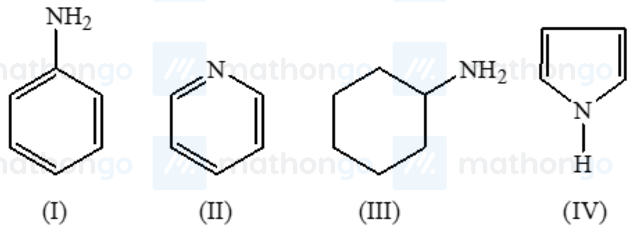
(1)


(2)


(3)


(4)


Q43. The decreasing order of basicity of the following amines is:



(1) (I) > (III) > (IV) > (II)
(2) (III) > (I) > (II) > (IV)
(3) (II) > (III) > (IV) > (I)
(4) (III) > (II) > (I) > (IV)

Q44. Which polymer has 'chiral' monomer(s)?

(1) Neoprene
(2) Buna −N
(3) Nylon 6,6
(4) PHBV

Q45. A, B and C are three biomolecules. The results of the tests performed on them are given below:

	Molisch's test	Barfoed Test	Biuret Test
A	Positive	Negative	Negative
B	Positive	Positive	Negative
C	Negative	Negative	Positive

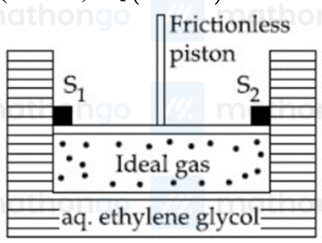
A, B and C are respectively:

(1) A = Glucose, B = Fructose C = Albumin
(2) A = Lactose, B = Glucose, C = Albumin
(3) A = Lactose, B = Glucose, C = Alanine
(4) A = Lactose, B = Fructose, C = Alanine

Q46. 10.30mg of O_2 is dissolved into a liter of sea water of density $1.03 g/mL$. The concentration of O_2 in ppm is ______________.

Q47. A cylinder containing an ideal gas ($0.1 mol$ of $1.0 dm^3$) is in thermal equilibrium with a large volume of 0.5 molal aqueous solution of ethylene glycol at its freezing point. If the stoppers S_1 and S_2 (as shown in the figure) are suddenly withdrawn, the volume of the gas in litres after equilibrium is achieved will be ______________.

(Given, $K_f(\text{water}) = 2.0 K kg mol^{-1}$, $R = 0.08 dm^3 atm K^{-1} mol^{-1}$)



Q48. A sample of milk splits after 60min . at 300K and after 40min . at 400K when the population of Iactobacillus acidophilus in it doubles. The activation energy (in kJ / mol) for this process is closest to ______________.
(Given, $R = 8.3 J mol^{-1} K^{-1}, \ln\left(\frac{2}{3}\right) = 0.4, e^{-3} = 4.0$)

Q49. The sum of the total number of bonds between chromium and oxygen atoms in chromate and dichromate ions is ______________.

Q50. Consider the following reactions $\mathrm{A} \xrightarrow[\text{(ii)}\mathrm{H_3O^+}]{\text{(i)}\mathrm{CH_3MBr}} \mathrm{B} \xrightarrow[573\mathrm{K}]{\mathrm{Cu}} 2-\text{methyl}-2-\text{butene}$. The mass percentage of carbon in A is _____________.

Q51. If $A=\{x\in R:|x|<2\}$ and $B=\{x\in R:|x-2|\geq 3\}$; then

(1) $A\cap B=(-2,-1)$
(2) $B-A=R-(-2,5)$
(3) $A\cup B=R-(2,5)$
(4) $A-B=[-1,2)$

Q52. Let $a,b\in R, a\neq 0$ be such that the equation, $ax^2-2bx+5=0$ has a repeated root α, which is also a root of the equation, $x^2-2bx-10=0$. If β is the other root of this equation, then $\alpha^2+\beta^2$ is equal to:

(1) 25
(2) 26
(3) 28
(4) 24

Q53. If z is a complex number satisfying $|Re(z)|+|Im(z)|=4$, then $|z|$ cannot be

(1) $\sqrt{\frac{17}{2}}$
(2) $\sqrt{10}$
(3) $\sqrt{7}$
(4) $\sqrt{8}$

Q54. Let a_n be the n^{th} term of a G.P. of positive terms. If $\sum_{n=1}^{100} a_{2n+1}=200$ and $\sum_{n=1}^{100} a_{2n}=100$, then $\sum_{n=1}^{200} a_n$ is equal to:

(1) 300
(2) 225
(3) 175
(4) 150

Q55. If $x=\sum_{n=0}^{\infty}(-1)^n\tan^2\theta$ and $y=\sum_{n=0}^{\infty}\cos^{2n}\theta$, for $0<\theta<\frac{\pi}{4}$, then:

(1) $x(1+y)=1$
(2) $y(1-x)=1$
(3) $y(1+x)=1$
(4) $x(1-y)=1$

Q56. In the expansion of $\left(\frac{x}{\cos\theta}+\frac{1}{x\sin\theta}\right)^{16}$, if l_1 is the least value of the term independent of x when $\frac{\pi}{8}\leq\theta\leq\frac{\pi}{4}$ and l_2 is the least value of the term independent of x when $\frac{\pi}{16}\leq\theta\leq\frac{\pi}{8}$, then the ratio $l_2:l_1$ is equal to:

(1) 1 : 8
(2) 16 : 1
(3) 8 : 1
(4) 1 : 16

Q57. If one end of a focal chord AB of the parabola $y^2=8x$ is at $A\left(\frac{1}{2},-2\right)$, then the equation of the tangent to it at B is:

(1) $2x+y-24=0$
(2) $x-2y+8=0$
(3) $x+2y+8=0$
(4) $2x-y-24=0$

Q58. The length of the minor axis (along y-axis) of an ellipse in the standard form is $\frac{4}{\sqrt{3}}$. If this ellipse touches the line $x+6y=8$ then its eccentricity is:

(1) $\frac{1}{2}\sqrt{\frac{11}{3}}$
(2) $\sqrt{\frac{5}{6}}$
(3) $\frac{1}{2}\sqrt{\frac{5}{3}}$
(4) $\frac{1}{3}\sqrt{\frac{11}{3}}$

Q59. If $p\rightarrow(p\wedge{\sim}q)$ is false, then the truth values of p and q are respectively

(1) F,F
(2) T,F
(3) T,T
(4) F,T

Q60. The following system of linear equations

$7x+6y-2z=0$

$3x+4y+2z=0$

$x-2y-6z=0$, has

(1) infinitely many solutions, (x,y,z) satisfying $y=2z$
(2) no solution
(3) infinitely many solutions, (x,y,z) satisfying $x=2z$
(4) only the trivial solution

Q61. Let $a-2b+c=1$.

If $f(x)=\begin{vmatrix} x+a & x+2 & x+1 \\ x+b & x+3 & x+2 \\ x+c & x+4 & x+3 \end{vmatrix}$, then:

(1) $f(-50)=501$
(2) $f(-50)=-1$
(3) $f(50)=-501$
(4) $f(50)=1$

Q62. Let $[t]$ denote the greatest integer $\leq t$ and $\lim\limits_{x\to 0} x\left[\frac{4}{x}\right]=A$. Then the function, $f(x)=\left[x^2\right]\sin(\pi x)$ is discontinuous, when x is equal to:

(1) $\sqrt{A+1}$
(2) $\sqrt{A+5}$
(3) $\sqrt{A+21}$
(4) $\sqrt{A}$

Q63. If $x=2\sin\theta-\sin 2\theta$ and $y=2\cos\theta-\cos 2\theta$, $\theta\in[0,2\pi]$, then $\frac{d^2y}{dx^2}$ at $\theta=\pi$ is:

(1) $\frac{3}{4}$
(2) $-\frac{3}{8}$
(3) $\frac{3}{2}$
(4) $-\frac{3}{4}$

Q64. Let f and g be differentiable functions on R such that fog is the identity function. If for some $a,b\in R, g^{'}(a)=5$ and $g(a)=b$, then $f^{'}(b)$ is equal to:

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

Q65. Let a function $f:[0,5]\to R$ be continuous, $f(1)=3$ and F be defined as:

$F(x)=\int_1^x t^2 g(t)dt$, where $g(t)=\int_1^t f(u)du$.

Then for the function $F(x)$, the point $x=1$ is:

(1) a point of local minima
(2) not a critical point
(3) a point of local maxima
(4) a point of inflection

Q66. If $\int\frac{d\theta}{\cos^2\theta(\tan 2\theta+\sec 2\theta)}=\lambda\tan\theta+2\log_e|f(\theta)|+C$ where C is a constant of integration, then the ordered pair $(\lambda, f(\theta))$ is equal to:

(1) $(1,1-\tan\theta)$
(2) $(-1,1-\tan\theta)$
(3) $(-1,1+\tan\theta)$
(4) $(1,1+\tan\theta)$

Q67. Given: $f(x)=\begin{cases} x, 0\le x<\frac{1}{2} \\ \frac{1}{2}, x=\frac{1}{2} \\ 1-x, \frac{1}{2}<x\le 1 \end{cases}$

and $g(x)=\left(x-\frac{1}{2}\right)^2, x\in R$. Then, the area (in sq. units) of the region bounded by the curves, $y=f(x)$ and $y=g(x)$ between the lines $2x=1$ and $2x=\sqrt{3}$, is:

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

Q68. If $\frac{dy}{dx}=\frac{xy}{x^2+y^2}$; $y(1)=1$; then a value of x satisfying $y(x)=e$ is:

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

Q69. If 10 different balls are to be placed in 4 distinct boxes at random, then the probability that two of these boxes contain exactly 2 and 3 balls is:

(1) $\frac{965}{2^{11}}$
(2) $\frac{965}{2^{10}}$
(3) $\frac{945}{2^{10}}$
(4) $\frac{945}{2^{11}}$

Q70. A random variable X has the following probability distribution:

$X:\ 1\quad 2\quad 3\quad 4\quad 5$

$P(X):\ k^2\quad 2k\quad k\quad 2k\quad 5k^2$

Then, $P(X>2)$ is equal to:

(1) $\frac{7}{12}$
(2) $\frac{1}{36}$
(3) $\frac{1}{6}$
(4) $\frac{23}{36}$

Q71. The number of terms common to the two A.P.'s $3, 7, 11, \ldots, 407$ and $2, 9, 16, \ldots, 709$ is ____________.

Q72. If $C_r\equiv {}^{25}C_r$ and $C_0+5\bullet C_1+9\bullet C_2+\ldots+(101)\bullet C_{25}=2^{25}\bullet k$, then k is equal to ____________.

Q73. If the curves, $x^2-6x+y^2+8=0$ and $x^2-8y+y^2+16-k=0, (k>0)$ touch each other at a point, then the largest value of k is ____________.

Q74. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors such that $\left|\vec{a}\right|=\sqrt{3}, \left|\vec{b}\right|=5, \vec{b}\bullet\vec{c}=10$ and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$. If $\vec{a}$ is perpendicular to the vector $\vec{b}\times\vec{c}$, then $\left|\vec{a}\times\left(\vec{b}\times\vec{c}\right)\right|$ is equal to ____________.

Q75. If the distance between the plane, $23x-10y-2z+48=0$ and the plane containing the lines $\frac{x+1}{2}=\frac{y-3}{4}=\frac{z+1}{3}$ and $\frac{x+3}{2}=\frac{y+2}{6}=\frac{z-1}{\lambda}(\lambda\in R)$ is equal to $\frac{k}{\sqrt{633}}$, then k is equal to ____________.

ANSWER KEYS

1. (3)	**2.** (3)	**3.** (3)	**4.** (2)	**5.** (1)	**6.** (1)	**7.** (1)	**8.** (1)
9. (4)	**10.** (2)	**11.** (1)	**12.** (3)	**13.** (1)	**14.** (1)	**15.** (3)	**16.** (1)
17. (3)	**18.** (4)	**19.** (2)	**20.** (3)	**21.** (1819)	**22.** (48)	**23.** (40)	**24.** (750)
25. (40)	**26.** (4)	**27.** (2)	**28.** (1)	**29.** (4)	**30.** (2)	**31.** (2)	**32.** (2)
33. (4)	**34.** (2)	**35.** (4)	**36.** (3)	**37.** (2)	**38.** (1)	**39.** (3)	**40.** (4)
41. (1)	**42.** (3)	**43.** (4)	**44.** (4)	**45.** (2)	**46.** (10)	**47.** (2.18)	**48.** (3.98)
49. (12)	**50.** (66.67)	**51.** (2)	**52.** (1)	**53.** (3)	**54.** (4)	**55.** (2)	**56.** (2)
57. (2)	**58.** (1)	**59.** (3)	**60.** (3)	**61.** (4)	**62.** (1)	**63.** (2)	**64.** (1)
65. (1)	**66.** (3)	**67.** (2)	**68.** (4)	**69.** (3)	**70.** (4)	**71.** (14)	**72.** (51)
73. (36)	**74.** (30)	**75.** (3)					