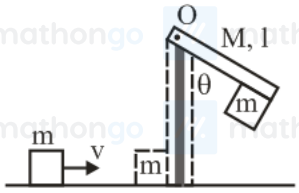
Q1. Moment of inertia of a cylinder of mass m, length L and radius R about an axis passing through its centre and perpendicular to the axis of the cylinder is $I = M\left(\frac{R^2}{4} + \frac{L^2}{12}\right)$. If such a cylinder is to be made for a given mass of a material, the ratio $\frac{L}{R}$ for it to have minimum possible I is:

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

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

Q2. A block of mass $m = 1$ kg slides with velocity $v = 6\ m\ s^{-1}$ on a frictionless horizontal surface and collides with a uniform vertical rod and sticks to it as shown. The rod is pivoted about O and swings as a result of the collision making angle θ before momentarily coming to rest. if the rod has mass $M = 2$ kg, and length $\ell = 1$ m, the value of θ is approximately $(\text{take } g = 10\ m\ s^{-2})$



(1) 63° (2) 55°

(3) 69° (4) 49°

Q3. A satellite is moving in a low nearly circular orbit around the earth. Its radius is roughly equal to that of the earth's radius R_e. By firing rockets attached to it, its speed is instantaneously increased in the direction of its motion so that it become $\sqrt{\frac{3}{2}}$ times larger. Due to this the farthest distance from the centre of the earth that the satellite reaches is R. Value of R is :

(1) $4R_e$ (2) $2.5R_e$

(3) $3R_e$ (4) $2R_e$

Q4. Pressure inside two soap bubbles are 1.01 and 1.02 atmosphere, respectively. The ratio of their volumes is :

(1) 4 : 1 (2) 0.8 : 1

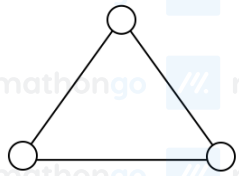
(3) 8 : 1 (4) 2 : 1

Q5. A balloon filled with helium ($32^\circ C$ and 1.7 atm) bursts. Immediately after wards the expansion of helium can be considered as :

(1) irreversible isothermal (2) irreversible adiabatic

(3) reversible adiabatic (4) reversible isothermal

Q6.



Consider a gas of triatomic molecules are assumed to be triangular and made of massless rigid rods whose vertices are occupied by atoms. The internal energy of a mole of the gas at temperature T is:

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

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

Q7. A uniform thin rope of length 12 m and mass 6 kg hangs vertically from a rigid support and a block of mass 2 kg is attached to its free end. A transverse short wave train of wavelength 6 cm is produced at the lower and the rope. What is the wavelength of the wave train (in cm) when it reaches the top of the rope?

(1) 3 (2) 6

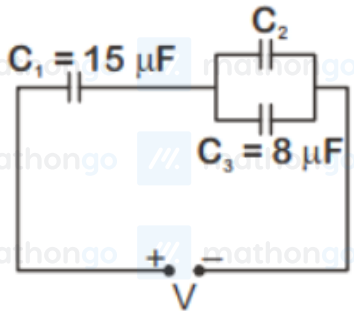
(3) 12 (4) 9

Q8. Two isolated conducting spheres S_1 and S_2 of radius $\frac{2}{3}R$ and $\frac{1}{3}R$ have 12 μC and -3 μC charges, respectively, and are at a large distance from each other, They are now connected by a conducting wire. A long time after this is done the charges on S_1 and S_2 are respectively:

(1) 4.5 μC of both (2) $+4.5$ μC and -4.5 μC

(3) 3 μC and 6 μC (4) 6 μC and 3 μC

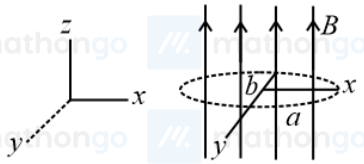
Q9. In the circuit shown in the figure, the total charge is 750 μC and the voltage across capacitor C_2 is 20 V. Then the charge on capacitor C_2 is :



(1) 450 μC (2) 590 μC

(3) 160 μC (4) 650 μC

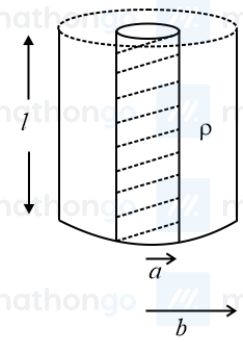
Q10. An elliptical loop having resistance R, of semi major axis a , and semi minor axis b is placed in a magnetic field as shown in the figure. If the loop is rotated about the x-axis with angular frequency ω, the average power loss in the loop due to Joule heating is :



(1) $\frac{\pi^2 a^2 b^2 B^2 \omega^2}{2R}$ (2) zero

(3) $\frac{\pi \mathrm{bB}\,\omega}{\mathrm{R}}$ (4) $\frac{\pi^2 a^2 b^2 B^2 \omega^2}{R}$

Q11. Model a torch battery of length l to be made up of a thin cylindrical bar of radius a and a concentric thin cylindrical shell of radius b filled in between with an electrolyte of resistivity ρ (see figure). If the battery is connected to a resistance of value R, the maximum Joule heating in R will take place for :



(1) $R = \frac{\rho}{2\pi\ell}\left(\frac{b}{a}\right)$ (2) $\mathrm{R} = \frac{\rho}{2\pi\ell}\ln\left(\frac{\mathrm{b}}{\mathrm{a}}\right)$
(3) $R = \frac{\rho}{\pi\ell} In\left(\frac{b}{a}\right)$ (4) $\mathrm{R} = \frac{2\rho}{\pi\ell}\ln\left(\frac{\mathrm{b}}{\mathrm{a}}\right)$

Q12. Magnitude of magnetic field (in SI units) at the centre of a hexagonal shape coil of side $10\ \mathrm{cm}$, 50 turns and carrying current$I$ (Ampere) in units of $\frac{\mu_0 I}{\pi}$ is :
(1) $250\sqrt{3}$ (2) $50\sqrt{3}$
(3) $500\sqrt{3}$ (4) $5\sqrt{3}$

Q13. A charged particle carrying charge $1\ \mu C$ is moving with velocity $\left(2\hat{i} + 3\hat{j} + 4\widehat{k}\right)\ \mathrm{m\ s^{-1}}$. If an external magnetic field of $\left(5\hat{i} + 3\hat{j} - 6\widehat{k}\right) \times 10^{-3} T$ exists in the region where the particle is moving then the force on the particle is $\overrightarrow{\mathrm{F}} \times 10^{-9}\ \mathrm{N}$. the vector $\overrightarrow{\mathrm{F}}$ is :
(1) $-0.30\hat{\mathrm{i}} + 0.32\hat{\mathrm{j}} - 0.09\widehat{\mathrm{k}}$ (2) $-30\hat{\mathrm{i}} + 32\hat{\mathrm{j}} - 9\widehat{\mathrm{k}}$
(3) $-300\hat{i} + 320\hat{j} - 90\widehat{k}$ (4) $-3.0\hat{i} + 32\hat{j} - 0.9\widehat{k}$

Q14. A $750\ \mathrm{Hz},\ 20\ \mathrm{V(rms)}$ source is connected to a resistance of $100\ \Omega$, an inductance of $0.1803\ \mathrm{H}$ and a capacitance of $10\ \mu\mathrm{F}$ all in series. The time in which the resistance (heat capacity $2\ \mathrm{J/^{\circ}C}$) will get heated by $10^{\circ}\mathrm{C}$. (assume no loss of heat to the surroundings) is close to :
(1) 418 s (2) 245 s
(3) 365 s (4) 348 s

Q15. The magnetic field of a plane electromagnetic wave is $\overrightarrow{B} = 3 \times 10^{-8} \sin[200\pi(y + ct)]\hat{i}\ \mathrm{T}$. Where, $c = 3 \times 10^{8}\ \mathrm{m\ s^{-1}}$ is the speed of light the corresponding electric filed is :
(1) $\overrightarrow{\mathrm{E}} = 9\sin\left[200\pi\left(\mathrm{y} + \mathrm{ct}\right)\widehat{\mathrm{k}}\ \mathrm{V/m}\right.$ (2) $\overrightarrow{\mathrm{E}} = -10^{-6}\sin\left[200\pi\left(\mathrm{y} + \mathrm{ct}\right)\widehat{\mathrm{k}}\ \mathrm{V/m}\right.$
(3) $\overrightarrow{\mathrm{E}} = 3 \times 10^{-8}\sin\left[200\pi\left(\mathrm{y} + \mathrm{ct}\right)\widehat{\mathrm{k}}\ \mathrm{V/m}\right.$ (4) $\overrightarrow{\mathrm{E}} = -9\sin\left[200\pi\left(\mathrm{y} + \mathrm{ct}\right)\widehat{\mathrm{k}}\ \mathrm{V/m}\right.$

Q16. In a Young's double slit experiment, light of $500\ \mathrm{nm}$ is used to produce and interference pattern. When the distance between the slits is $0.05\ \mathrm{mm}$, the angular width (in degree) of the fringes formed on the distance screen is close to :
(1) 0.17° (2) 0.57°
(3) 1.7° (4) 0.07°

Q17. When the wavelength of radiation falling on a metal is changed from $500\ \mathrm{nm}$ to $200\ \mathrm{nm}$, the maximum kinetic energy of the photoelectrons becomes three times larger. The work function of the metal is close to:

(1) $0.81\,\text{eV}$ (2) $1.02\,\text{eV}$
(3) $0.52\,\text{eV}$ (4) $0.61\,\text{eV}$

Q18. In a radioactive material, a fraction of active material remaining after the time $t\ is\ \frac{9}{16}$. The fraction that was remaining after the time $\frac{t}{2}$ is :
(1) $\frac{4}{5}$ (2) $\frac{3}{5}$
(3) $\frac{3}{4}$ (4) $\frac{7}{8}$

Q19. When a diode is forward biased, it has a voltage drop of $0.5\ \text{V}$. the safe limit of current through the diode is $10\ \text{mA}$. If a battery of emf $1.5\ \text{V}$ is used in the circuit, the value of minimum resistance to be connected in series with the diode so that the current does not exceed the safe limit is :
(1) $300\ \Omega$ (2) $50\ \Omega$
(3) $100\ \Omega$ (4) $200\ \Omega$

Q20. Using screw gauge of pitch $0.1\,\text{cm}$ and 50 divisions on its circular scale, the thickness of an object is measured. It should correctly be recorded as,
(1) $2.121\,\text{cm}$ (2) $2.124\,\text{cm}$
(3) $2.125\,\text{cm}$ (4) $2.123\,\text{cm}$

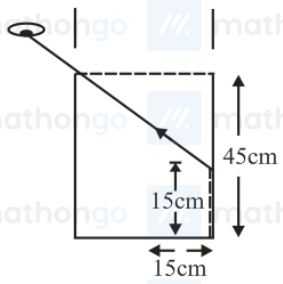
Q21. A cricket ball of mass $0.15\ \text{kg}$ is thrown vertically up by a bowling machine so that it rises to a maximum height of $20\ \text{m}$ after leaving the machine. If the part pushing the ball applies a constant force F on the ball applies a constant force F on the ball and moves horizontally a distance of $0.2\ \text{m}$ while launching the ball, the value of $F(\text{in}\ N)$ is $\left(g = 10\ \text{m}\,\text{s}^{-2}\right)$

Q22. A person of $80\ \text{kg}$ mass is standing on the rim of a circular platform of mass $200\ \text{kg}$ rotating about its axis at 5 revolutions per minute (rpm). The person now starts moving towards the centre of the platform. What will be the rotational speed (in rpm) of the platform when the person reaches its centre....

Q23. When a long glass capillary tube of radius $0.015\,\text{cm}$ is dipped in a liquid, the liquid rises to a height of $15\ \text{cm}$ within it. If the contact angle between the liquid and glass to close to 0°, the surface tension of the liquid, in milliNewton m^{-1}, is $\left[\rho_{(\text{liqued})} = 900\ \text{kg}\ \text{m}^{-3}, \text{g} = 10\ \text{m}\,\text{s}^{-2}\right]$ (Given answer in closed integer)

Q24. A bakelite beaker has volume capacity of $500\ \text{cc}$ at 30°C. When it is partially filled with V_{m} volume (at 30°C) of mercury, it is found that the unfilled volume of the beaker remains constant as temperature is varied. If $\gamma_{\text{bester}} = 6 \times 10^{-6} 0^{\circ}\text{C}^{-1}$, where γ is the coefficient of volume expansion, then V_{m} (in cc) is close to ...

Q25. An observer can see through a small hole on the side of a jar (radius $15\ \text{cm}$) at a point at height of $15\ \text{cm}$ from the bottom (see figure). The hole is at a height of $45\ \text{cm}$. When the jar is filled with a liquid up to a height of $30\ \text{cm}$ the same observer can see the edge at the bottom of the jar. If the refractive index of the liquid is $\frac{\text{N}}{100}$, where N is an integer, the value of N is



Q26. The atomic number of the element unnilennium is :

(1) 109 (2) 102
(3) 108 (4) 119

Q27. If the boiling point of H_2O is 373 K, and the boiling point of H_2S will be :

(1) less than 300 K (2) equal to 373 K
(3) more than 373 K (4) greater than 300 K but less than 373 K

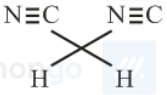
Q28. Of the species, NO, NO^+, NO^{2+} and NO^-, the one with minimum bond strength is :

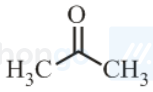
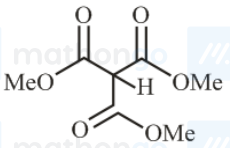
(1) NO^+ (2) NO
(3) NO^{2+} (4) NO^-

Q29. An acidic buffer is obtained on mixing:

(1) 100 mL of 0 .1 M CH_3COOH and 100 mL of 0 .1 M NaOH
(2) 100 mL of 0 .1 M HCl and 200 mL of 0 .1 M NaCl
(3) 100 mL *of* 0 .1 MCH_3COOH *and* 200 mL *of* 0 .1 $MNaOH$
(4) 100 mL of 0 .1 M HCl and 200 mL of 0 .1 M CH_3COONa

Q30. Which one of the following compounds possesses the most acidic hydrogen?

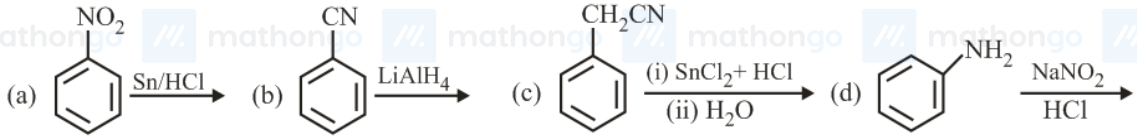
(1) 
(2) $H_3C - C \equiv C - H$

(3) 
(4) 

Q31. Glycerol is separated in soap industries by :

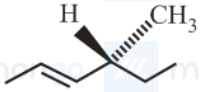
(1) Fractional distillation (2) Differential distillation
(3) Steam distillation (4) Distillation under reduced pressure

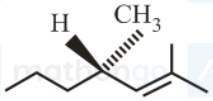
Q32. The Kjeldahl method of Nitrogen estimation fails for which of the following reaction products?

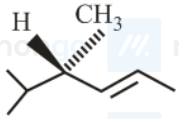


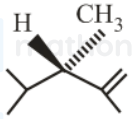
(1) (c) and (d) (2) (a) and (d)
(3) (a), (c) and (d) (4) (b) and (c)

Q33. Which of the following compounds produces an optically inactive compound on hydrogenation?

(1) 

(2) 

(3) 

(4) 

Q34. Thermal power plants can lead to :

(1) Acid rain
(2) Blue baby syndrome
(3) Ozone layer depletion
(4) Eutrophication

Q35. Henry's constant (in kbar) for four gases α, β, γ and δ in water at 298 K is given below :

	α	β	γ	δ
K_H	50	2	2×10^{-5}	0.5

(density of water $= 10^3$ k gm^{-3} at 298 K) This table implies that :

(1) α has the highest solubility in water at a given pressure
(2) solubility of γ at $308K$ is lower than at $298K$
(3) The pressure of a 55.5 molal solution of δ is 250 bar
(4) The pressure of 55.5 molal solution of γ is 1 bar.

Q36. Let C_{NaCl} and C_{BaSO_4}, be the conductances (in S) measured for saturated aqueous solutions of NaCl and $BaSO_4$ respectively, at a temperature T. Which of the following is false?

(1) Ionic mobilities of ions from both salts increase with T.
(2) $C_{BaSO_4}(T_2) > C_{BaSO_4}(T_1)$ for $T_2 > T_1$
(3) $C_{NaCl}(T_2) > C_{NaCl}(T_1)$ for $T_2 > T_1$
(4) $C_{NaCl} \gg C_{BaSO_4}$ at given T

Q37. It is true that:

(1) A second order reaction is always a multistep reaction
(2) A zero order reaction is a multi-step reaction
(3) A first order reaction is always a single step reaction
(4) A zero order reaction is a single step reaction

Q38. Tyndall effect is observed when :

(1) The diameter of dispersed particles is much larger than the wavelength of light used.
(2) The diameter of dispersed particles is much smaller than the wavelength of light used
(3) The refractive index od dispersed phase is greater than that of the dispersion medium.
(4) The diameter of dispersed particles is similar to the wavelength of light used.

Q39. Aqua regia is used for dissolving noble metals (Au, Pt, etc.). The gas evolved in this process is

(1) NO
(2) N_2O_5
(3) N_2
(4) N_2O_3

Q40. In a molecule of pyrophosphoric acid, the number of $P-OH$, $P=0$ and $P-O-P$ bonds/moiety(ies) respectively are :

(1) 2, 4 and 1 (2) 3, 3 and 3

(3) 4, 2 and 0 (4) 4, 2 and 1

Q41. The electronic spectrum of $[Ti(H_2O)_6]^{3+}$ shows a single broad peak with a maximum at $20,300\,cm^{-1}$. The crystal field stabilization energy (CFSE) of the complex ion, in $kJmol^{-1}$, is : $(1\,kJmol^{-1} = 83.7\,cm^{-1})$

(1) 145.5 (2) 242.5

(3) 83.7 (4) 97

Q42. The complex that can show optical activity is :

(1) trans $-[Cr(Cl_2)(Ox)_2]^{3-}$ (2) trans $-[Fe(NH_3)_2(CN)_4]^-$

(3) cis $-[Fe(NH_3)_2(CN)_4]^-$ (4) cis $-[CrCl_2(ox)_2]^{3-}$ (ox = oxalate)

Q43. The mechanism of Sn1 reaction is given as:

$$R-X \longrightarrow \underset{\text{Ion pair}}{R^{\oplus}X^{\ominus}} \longrightarrow \underset{\substack{\text{Speparated ion}\\ \text{pair}}}{R^{\oplus}} \xrightarrow[\text{Solvent}]{Y^{\ominus}} R-Y+X^{\ominus}$$

A student writes general characteristics based on the given mechanism as :

(a) The reaction is favoured by weak nucleophiles.

(b) $R^{\oplus}$ would be easily formed if the substituents are bulky y

(c) The reaction is accompanied by recemization

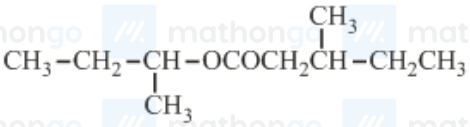
(d) The reaction is favoured by non-polar solvents.

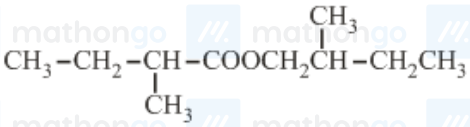
Which observations are correct?

(1) (a) and (b) (2) (a) and (c)

(3) (a), (b) and (c) (4) (b) and (d)

Q44. An organic compound [A], molecular formula $C_{10}H_{20}O_2$ was hydrolyzed with dilute sulphuric acid to given a carboxylic acid [B] and an alcohol [C]. Oxidation of [C] with $CrO_3 - H_2SO_4$ produced [B]. Which of the following structures are not possible for [A]

(1) 

(2) 

(3) $CH_3CH_2CH_2COOCH_2CH_2CH_2CH_3$ (4) $(CH_3)_3-C-COOCH_2C(CH_3)_3$

Q45. The antifertility drug "Novestrol" can react with :

(1) $ZnCl_2$ / HCl; $FeCl_3$; Alcoholic HCN (2) Br_2 / water, $ZnCl_2$ / HCl; $FeCl_3$

(3) Alcoholic HCN; NaOCl; $ZnCl_2$ / HCl (4) Br_2 / water, $ZnCl_2$ / HCl; NaOCl

Q46. The mole fraction of glucose $(C_6H_{12}O_6)$ in an aqueous binary solution is 0.1. The mass percentage of water in it, to the nearest integer, is .....

Q47. The volume strength of $8.9\ \mathrm{MH_2O_2}$ solution calculated at $273\ K$ and 1 atm is ..... $\left(\mathrm{R}=0.0821\ \mathrm{L\ atm\ K^{-1}\ mol^{-1}}\right)$ (rounded off to the nearest integer)

Q48. The total number of monohalogenated organic products in the following (including stereoisomers) reaction is

$$\underset{\text{(Simplest optically active alkene)}}{\mathrm{A}} \xrightarrow[\text{(ii) } \mathrm{X_2}/\Delta]{\text{(i) } \mathrm{H_2}/\mathrm{Ni}/\Delta}$$

Q49. An element with molar mass $2.7\times10^{-2}\ \mathrm{kg\ mol^{-1}}$ forms a cubic unit cell with edge length $405\ \mathrm{pm}$. If its density is $2.7\times10^{3}\ \mathrm{kg\ m^{-3}}$, the radius of the element is approximately ..... $\times10^{-12}\mathrm{m}$ (to the nearest integer)

Q50. The photoelectric current from Na (work function, $\mathrm{w_0}=2.3\,\mathrm{eV}$) is stopped by the output voltage of the cell

$$\mathrm{Pt(s)\|H_2(g,1\,bar)|\,HCl(aq\cdot,pH=1)|\,AgCl(s)\mid Ag(s)}$$

the pH of aq. HCl required to stop the photoelectric current from $\mathrm{K}(\mathrm{w_0}=2.25\,\mathrm{eV})$, all other conditions remaining the same, is ..... $\times10^{-2}$ (to the nearest integer).

Given $2.303\frac{\mathrm{RT}}{\mathrm{F}}=0.06\mathrm{V};\mathrm{E^0_{AgCl\,/\,Ag\,/Cl}}=0.22\mathrm{V}$

Q51. Consider the two sets:

$A=\{m\in R:$ both the roots of $x^2-(m+1)x+m+4=0$ are real $\}$ and $B=[-3,5)$

Which of the following is not true?

(1) $A-B=(-\infty,-3)\cup(5,\infty)$ (2) $A\cap B=\{-3\}$

(3) $B-A=(-3,5)$ (4) $A\cup B=R$

Q52. If α and β are the roots of the equation $x^2+px+2=0$ and $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ are the roots of the equation $2x^2+2qx+1=0$, then $\left(\alpha-\frac{1}{\alpha}\right)\left(\beta-\frac{1}{\beta}\right)\left(\alpha+\frac{1}{\beta}\right)\left(\beta+\frac{1}{\alpha}\right)$ is equal to :

(1) $\frac{9}{4}\left(9+q^2\right)$ (2) $\frac{9}{4}\left(9-q^2\right)$

(3) $\frac{9}{4}\left(9+p^2\right)$ (4) $\frac{9}{4}\left(9-p^2\right)$

Q53. If the first term of an $A.P.$ is 3 and the sum of its first 25 terms is equal to the sum of its next 15 terms, then the common difference of this $A.P.$is

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

(3) $\frac{1}{4}$ (4) $\frac{1}{7}$

Q54. The value of $(2\cdot{}^1P_0-3\cdot{}^2P_1+4\cdot{}^3P_2-\ldots\ldots$ up to 51^{th} term)+($1!-2!+3!-\ldots\ldots$ up to 51^{th} term) is equal to

(1) $1-51(51)!$ (2) $1+(51)!$

(3) $1+(52)!$ (4) 1

Q55. If the number of integral terms in the expansion of $\left(3^{\frac{1}{2}}+5^{\frac{1}{8}}\right)^n$ is exactly 33, then the least value of n is

(1) 264 (2) 128

(3) 256 (4) 248

Q56. Let P be a point on the parabola, $y^2=12x$ and N be the foot of the perpendicular drawn from P , on the axis of the parabola. A line is now drawn through the mid-point M of PN, parallel to its axis which meets the parabola at Q. If the $y-$intercept of the line NQ is $\frac{4}{3}$, then :

(1) $PN = 4$ (2) $MQ = \frac{1}{3}$
(3) $MQ = \frac{1}{4}$ (4) $PN = 3$

Q57. A hyperbola having the transverse axis of length, $\sqrt{2}$ has the same foci as that of the ellipse, $3x^2 + 4y^2 = 12$ then this hyperbola does not pass through which of the following points?
(1) $\left(\frac{1}{\sqrt{2}}, 0\right)$ (2) $\left(-\sqrt{\frac{3}{2}}, 1\right)$
(3) $\left(1, -\frac{1}{\sqrt{2}}\right)$ (4) $\left(\sqrt{\frac{3}{2}}, \frac{1}{\sqrt{2}}\right)$

Q58. Let $[t]$ denote the greatest integer $\leq t$. If $\lambda\, \varepsilon\, R - \{0,\ 1\}$, $\lim\limits_{x\to 0}\left|\frac{1-x+|x|}{\lambda - x + [x]}\right| = L$, then L is equal to
(1) 1 (2) 2
(3) $\frac{1}{2}$ (4) 0

Q59. The proposition $p \to {\sim}(p \wedge {\sim}q)$ is equivalent to :
(1) q (2) $({\sim}p) \vee q$
(3) $({\sim}p) \wedge q$ (4) $({\sim}p) \vee ({\sim}q)$

Q60. For the frequency distribution: Variate $(x) : x_1,\ x_2,\ x_3, \ldots, x_{15}$
Frequency $(f) : f_1,\ f_2,\ f_3, \ldots, f_{15}$
where $0 < x_1 < x_2 < x_3 < \ldots < x_{15} = 10$ and $\sum_{i=1}^{15} f_i > 0$, the standard deviation cannot be
(1) 4 (2) 1
(3) 6 (4) 2

Q61. If $\Delta = \begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ 2x-3 & 3x-4 & 4x-5 \\ 3x-5 & 5x-8 & 10x-17 \end{vmatrix} = Ax^3 + Bx^2 + Cx + D$, then $B + C$ is equal to :
(1) -1 (2) 1
(3) -3 (4) 9

Q62. $2\pi - \left(\sin^{-1}\frac{4}{5} + \sin^{-1}\frac{5}{13} + \sin^{-1}\frac{16}{65}\right)$ is equal to :
(1) $\frac{\pi}{2}$ (2) $\frac{5\pi}{4}$
(3) $\frac{3\pi}{2}$ (4) $\frac{7\pi}{4}$

Q63. If $y^2 + \log_e\left(\cos^2 x\right) = y,\ \ x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ then :
(1) $y''(0) = 0$ (2) $|y'(0)| + |y''(0)| = 1$
(3) $|y''(0)| = 2$ (4) $|y'(0)| + |y''(0)| = 3$

Q64. The function, $f(x) = (3x-7)x^{\frac{2}{3}},\ x \in \mathrm{R}$, is increasing for all x lying in
(1) $(-\infty, 0) \cup \left(\frac{14}{15}, \infty\right)$ (2) $(-\infty, 0) \cup \left(\frac{3}{7}, \infty\right)$
(3) $\left(-\infty, \frac{14}{15}\right)$ (4) $\left(-\infty, -\frac{14}{15}\right) \cup (0, \infty)$

Q65. $\int_{-\pi}^{\pi} |\pi - |\mathrm{x}||\mathrm{d}x$ is equal to
(1) $\sqrt{2}\pi^2$ (2) $2\pi^2$
(3) π^2 (4) $\frac{\pi^2}{2}$

Q66. The area (in sq. units) of the region $\{(x,\ y) : 0 \le y \le x^2 + 1,\ 0 \le y \le x + 1,\ \frac{1}{2} \le x \le 2\}$ is

(1) $\frac{23}{16}$ (2) $\frac{79}{24}$

(3) $\frac{79}{16}$ (4) $\frac{23}{6}$

Q67. The solution curve of the differential equation, $(1 + e^{-x})(1 + y^2)\frac{dy}{dx} = y^2$ which passes through the point $(0,\ 1)$, is

(1) $y^2 + 1 = y\left(\log_e\left(\frac{1+e^{-x}}{2}\right) + 2\right)$ (2) $y^2 + 1 = y\left(\log_e\left(\frac{1+e^{x}}{2}\right) + 2\right)$

(3) $y^2 = 1 + y\log_e\left(\frac{1+e^{x}}{2}\right)$ (4) $y^2 = 1 + y\log_e\left(\frac{1+e^{-x}}{2}\right)$

Q68. The foot of the perpendicular drawn from the point $(4,\ 2,\ 3)$ to the line joining the points $(1,\ -2,\ 3)$ and $(1,\ 1,\ 0)$ lies on the plane

(1) $2x + y - z = 1$ (2) $x - y - 2z = 1$

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

Q69. The lines $\vec{r} = \left(\hat{i} - \hat{j}\right) + l\left(2\hat{i} + \hat{k}\right)$ and $\vec{r} = \left(2\hat{i} - \hat{j}\right) + m\left(\hat{i} + \hat{j} - \hat{k}\right)$

(1) Do not intersect for any values of l and m (2) Intersect for all values of l and m

(3) Intersect when $l = 2$ and $m = \frac{1}{2}$ (4) Intersect when $l = 1$ and $m = 2$

Q70. A die is thrown two times and the sum of the scores appearing on the die is observed to be a multiple of 4. Then the conditional probability that the score 4 has appeared at least once is

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

(3) $\frac{1}{8}$ (4) $\frac{1}{9}$

Q71. If $\left(\frac{1+i}{1-i}\right)^{\frac{m}{2}} = \left(\frac{1+i}{i-1}\right)^{\frac{n}{3}} = 1,\ \ (m,\ n \in N)$ then the greatest common divisor of the least values of m and n is

Q72. The value of $0.16^{\log_{2.5}\left(\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \ldots\infty\right)}$ is _____

Q73. The diameter of the circle, whose Centre lies on the line $x + y = 2$ in the first quadrant and which touches both the lines $x = 3$ and $y = 2$ is

Q74. If $\lim\limits_{x \to 0}\left\{\frac{1}{x^8}\left(1 - \cos\frac{x^2}{2} - \cos\frac{x^2}{4} + \cos\frac{x^2}{2}\cos\frac{x^2}{4}\right)\right\} = 2^{-k}$ then the value of k is

Q75. Let $A = \begin{bmatrix} x & 1 \\ 1 & 0 \end{bmatrix}$, $x\ \varepsilon\ R$ and $A^4 = [a_{ij}]$. If $a_{11} = 109$, then a_{22} is equal to_____.

ANSWER KEYS

1. (3)	**2.** (1)	**3.** (3)	**4.** (3)	**5.** (2)	**6.** (4)	**7.** (3)	**8.** (4)
9. (2)	**10.** (1)	**11.** (2)	**12.** (3)	**13.** (2)	**14.** (4)	**15.** (1)	**16.** (2)
17. (4)	**18.** (3)	**19.** (3)	**20.** (2)	**21.** (150)	**22.** (9)	**23.** (101)	**24.** (20)
25. (158)	**26.** (1)	**27.** (1)	**28.** (4)	**29.** (4)	**30.** (4)	**31.** (4)	**32.** (1)
33. (4)	**34.** (1)	**35.** (3)	**36.** (1)	**37.** (2)	**38.** (4)	**39.** (1)	**40.** (4)
41. (4)	**42.** (4)	**43.** (3)	**44.** (2)	**45.** (2)	**46.** (47)	**47.** (100)	**48.** (8)
49. (143)	**50.** (142)	**51.** (1)	**52.** (4)	**53.** (1)	**54.** (3)	**55.** (3)	**56.** (3)
57. (4)	**58.** (2)	**59.** (2)	**60.** (3)	**61.** (3)	**62.** (3)	**63.** (3)	**64.** (1)
65. (3)	**66.** (2)	**67.** (3)	**68.** (1)	**69.** (1)	**70.** (4)	**71.** (4)	**72.** (4)
73. (3)	**74.** (8)	**75.** (10)					