Q1. A vector in $x-y$ plane makes an angle of 30° with y-axis. The magnitude of y-component of vector is $2\sqrt{3}$. The magnitude of x-component of the vector will be :

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

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

Q2. The speed of a wave produced in water is given by $\nu=\lambda^{a} g^{b} \rho^{c}$. Where $\lambda,\ g$ and ρ are wavelength of wave, acceleration due to gravity and density of water respectively. The values of $a,\ b$ and c respectively, are

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

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

Q3. The position of a particle related to time is given by $x=\left(5t^{2}-4t+5\right)$ m. The magnitude of velocity of the particle at $t=2$ s will be :

(1) 06 m s^{-1} (2) 14 m s^{-1}

(3) 10 m s^{-1} (4) 16 m s^{-1}

Q4. The position vector of a particle related to time t is given by $\overrightarrow{r}=\left(10t\hat{i}+15t^{2}\hat{j}+7\hat{k}\right)$m. The direction of net force experienced by the particle is :

(1) Positive x-axis (2) In $x-y$ plane

(3) Positive y-axis (4) Positive z-axis

Q5. A body is released from a height equal to the radius (R) of the earth. The velocity of the body when it strikes the surface of the earth will be: (Given $g=$ acceleration due to gravity on the earth.)

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

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

Q6. Two identical particles each of mass m go round a circle of radius a under the action of their mutual gravitational attraction. The angular speed of each particle will be :

(1) $\sqrt{\frac{Gm}{a^{3}}}$ (2) $\sqrt{\frac{Gm}{8a^{3}}}$

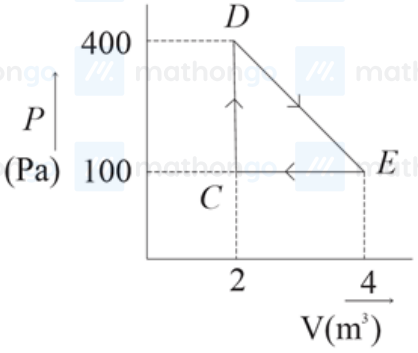
(3) $\sqrt{\frac{Gm}{4a^{3}}}$ (4) $\sqrt{\frac{Gm}{2a^{3}}}$

Q7. A wire of length L and radius r is clamped rigidly at one end. When the other end of the wire is pulled by a force f, its length increases by l. Another wire of same material of length $2L$ and radius $2r$ is pulled by a force $2f$. Then the increase in its length will be:

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

(3) $2l$ (4) l

Q8. A thermodynamic system is taken through cyclic process. The total work done in the process is :



(1) 200 J (2) 300 J
(3) 100 J (4) Zero

Q9. A flask contains Hydrogen and Argon in the ratio $2:1$ by mass. The temperature of the mixture is $30^{\circ}\mathrm{C}$. The ratio of average kinetic energy per molecule of the two gases $\left(\frac{K_{\text{argon}}}{K_{\text{hydrogen}}}\right)$ is: (Given : Atomic Weight of $Ar = 39.9$)

(1) 2 (2) 1
(3) 39.9 (4) $\frac{39.9}{2}$

Q10. In a linear Simple Harmonic Motion (SHM)

(A) Restoring force is directly proportional to the displacement.
(B) The acceleration and displacement are opposite in direction.
(C) The velocity is maximum at mean position.
(D) The acceleration is minimum at extreme points.

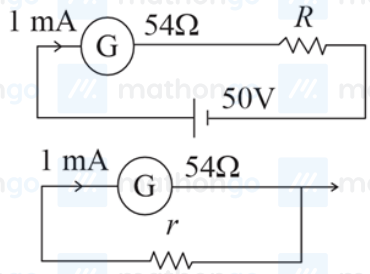
Choose the correct answer from the options given below:

(1) (C) and (D) only (2) (A), (C) and (D) only
(3) (A), (B) and (C) only (4) (A), (B) and (D) only

Q11. The electric field due to a short electric dipole at a large distance (r) from center of dipole on the equatorial plane varies with distance as :

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

Q12. For designing a voltmeter of range 50 V and an ammeter of range 10 mA using a galvanometer which has a coil of resistance 54 Ω showing a full scale deflection for 1 mA as in figure.



(A) for voltmeter $R \approx 50\ \text{k}\Omega$
(B) for ammeter $r \approx 0.2\ \Omega$
(C) for ammeter $r \approx 6\ \Omega$
(D) for voltmeter $R \approx 5\ \text{k}\Omega$
(E) for voltmeter $R \approx 500\ \Omega$

Choose the correct answer from the options given below:

(1) (A) and (C) (2) (C) and (E)
(3) (C) and (D) (4) (A) and (B)

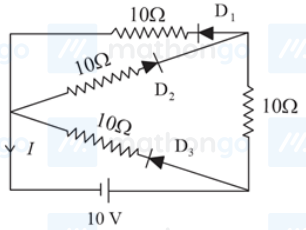
Q13. Given below are two statements:

Statement I : The equivalent resistance of resistors in a series combination is smaller than least resistance used in the combination.

Statement II : The resistivity of the material is independent of temperature. In the light of the above statements, choose the correct 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 true but Statement II is false (4) Statement I is false but Statement II is true

Q14. In the given circuit, the current I through the battery will be



(1) 2.5 A (2) 1 A
(3) 2 A (4) 1.5 A

Q15. A 12 V battery connected to a coil of resistance 6 Ω through a switch, drives a constant current in the circuit. The switch is opened in 1 ms. The emf induced across the coil is 20 V. The inductance of the coil is :
(1) 10 mH (2) 8 mH
(3) 5 mH (4) 12 mH

Q16. Match List-I with List II of Electromagnetic waves with corresponding wavelength range:

	List I		List II
(A)	Microwave	(I)	400 nm to 1 nm
(B)	Ultraviolet	(II)	1 nm to 10^{-3} nm
(C)	X-Ray	(III)	1 mm to 700 nm
(D)	Infra-red	(IV)	0.1 m to 1 mm

Choose the correct answer from the options given below:
(1) (A) – (IV), (B) – (I), (C) – (II), (D) – (III)
(2) (A) – (IV), (B) – (I), (C) – (III), (D) – (II)
(3) (A) – (IV), (B) – (II), (C) – (I), (D) – (III)
(4) (A) – (I), (B) – (IV), (C) – (II), (D) – (III)

Q17. A single slit of width a is illuminated by a monochromatic light of wavelength 600 nm. The value of a for which first minimum appears at $\theta = 30^{\circ}$ on the screen will be :
(1) 1.2 μm (2) 3 μm
(3) 1.8 μm (4) 0.6 μm

Q18. The de Broglie wavelength of an electron having kinetic energy E is λ. If the kinetic energy of electron becomes $\frac{E}{4}$, then its de-Broglie wavelength will be:
(1) $\sqrt{2}\lambda$ (2) $\frac{\lambda}{\sqrt{2}}$
(3) $\frac{\lambda}{2}$ (4) 2λ

Q19. The half-life of a radioactive nucleus is 5 years. The fraction of the original sample that would decay in 15 years is :
(1) $\frac{1}{8}$ (2) $\frac{1}{4}$
(3) $\frac{7}{8}$ (4) $\frac{3}{4}$

Q20. The height of transmitting antenna is 180 m and the height of the receiving antenna is 245 m. The maximum distance between them for satisfactory communication in line of sight will be: (given $R = 6400$ km)

(1) 96 km (2) 56 km
(3) 48 km (4) 104 km

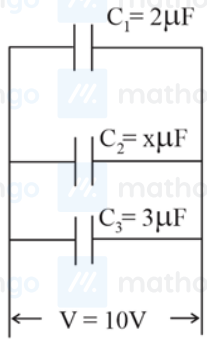
Q21. A block of mass 10 kg is moving along x-axis under the action of force $F = 5x$ N. The work done by the force in moving the block from $x = 2$ m to 4 m will be _____ J.

Q22. A solid sphere and a solid cylinder of same mass and radius are rolling on a horizontal surface without slipping. The ratio of their radius of gyrations respectively $(k_{sph} : k_{cyl})$ is $2 : \sqrt{x}$. The value of x is _____.

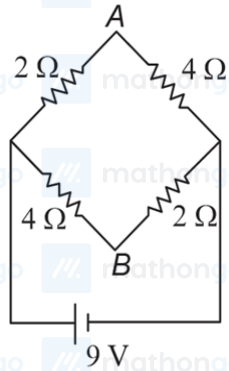
Q23. There is an air bubble of radius 1.0 mm in a liquid of surface tension 0.075 N m^{-1} and density 1000 kg m^{-3} at a depth of 10 cm below the free surface. The amount by which the pressure inside the bubble is greater than the atmospheric pressure is _____ $Pa(g = 10 \text{ m s}^{-2})$.

Q24. The fundamental frequency of vibration of a string between two rigid support is 50 Hz. The mass of the string is 18 g and its linear mass density is 20 g m^{-1}. The speed of the transverse waves so produced in the string is _____ m s^{-1}.

Q25. In the given figure the total charge stored in the combination of capacitors is 100 μC. The value of 'x' is _____.



Q26. A network of four resistances is connected to 9 V battery, as shown in figure. The magnitude of voltage difference between the points A and B is _____ V.



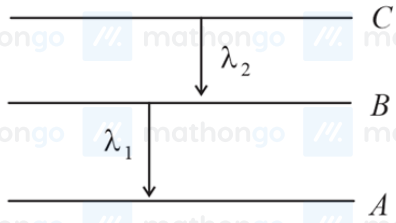
Q27. An electron in a hydrogen atom revolves around its nucleus with a speed of 6.76×10^6 m s^{-1} in an orbit of radius 0.52 Å. The magnetic field produced at the nucleus of the hydrogen atom is _____ T.

Q28. A 20 cm long metallic rod is rotated with 210 rpm about an axis normal to the rod passing through its one end. The other end of the rod is in contact with a circular metallic ring. A constant and uniform magnetic field 0.2 T parallel to the axis exists everywhere. The emf developed between the centre and the ring is _____ mV.

(Take $\pi = \frac{22}{7}$)

Q29. The refractive index of a transparent liquid filled in an equilateral hollow prism is $\sqrt{2}$. The angle of minimum deviation for the liquid will be _____ $^\circ$.

Q30. As per given figure A, B and C are the first, second and third excited energy levels of hydrogen atom respectively. If the ratio of the two wavelengths $\left(i.e.\ \frac{\lambda_1}{\lambda_2}\right)$ is $\frac{7}{4n}$, then the value of n will be



Q31. Given below are two statements

Statement I : According to Bohr's model of hydrogen atom, the angular momentum of an electron in a given stationary state is quantised.

Statement II : The concept of electron in Bohr's orbit, violates the Heisenberg uncertainty principle. In the light of the above statements, choose the most appropriate answer from the options given below

(1) Statement I is incorrect but Statement II is correct

(2) Both Statement I and Statement II are correct

(3) Both Statement I and Statement II are incorrect

(4) Statement I is correct but Statement II is incorrect

Q32. Consider the following statement

(A) NF_3 molecules has a trigonal planar structure.

(B) Bond Length of N_2 is shorter than O_2.

(C) Isoelectronic molecules or ions have identical bond order.

(D) Dipole moment of H_2S is higher than that of water molecule.

Choose the correct answer from the options given below:

(1) (A) and (B) are correct

(2) (A) and (D) are correct

(3) (C) and (D) are correct

(4) (B) and (C) are correct

Q33. Which of the following statement(s) is/are correct?

(A) The pH of 1×10^{-8} M HCl solution is 8.

(B) The conjugate base of H_2PO^{4-} is HPO_4^{2-}.

(C) K_w increases with increase in temperature.

(D) When a solution of a weak monoprotic acid is titrated against a strong base at half neutralisation point, $pH = \frac{1}{2}pK_a$. Choose the correct answer from the options given below:

(1) (B), (C)

(2) (A), (D)

(3) (A), (B), (C)

(4) (B), (C), (D)

Q34. During water-gas shift reaction

(1) Carbon monoxide is oxidized to carbon dioxide.

(2) Water is evaporated in presence of catalyst.

(3) Carbon is oxidized to carbon monoxide.

(4) Carbon dioxide is reduced to carbon monoxide.

Q35. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:

Assertion (A) : $BeCl_2$ and $MgCl_2$ produce characteristic flame

Reason (R) : The excitation energy is high in $BeCl_2$ and $MgCl_2$

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

(1) (A) is true but (R) is false

(2) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

(3) Both ((A) and (R) are true and (R) is the correct explanation of (A)

(4) (A) is false but (R) is true

Q36. For a good quality cement, the ratio of silica to alumina is found to be

(1) 1.5

(2) 4.5

(3) 2

(4) 3

Q37. Which of the following statement is correct for paper chromatography?

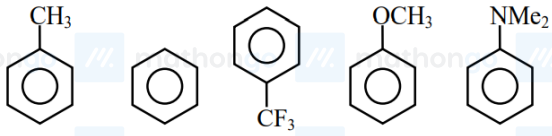
(1) Water present in the pores of the paper forms the stationary phase.

(2) Paper sheet forms the stationary phase.

(3) Water present in the mobile phase gets absorbed by the paper which then forms the stationary phase.

(4) Paper and water present in its pores together form the stationary phase.

Q38. Decreasing order of reactivity towards electrophilic substitution for the following compounds is:



(a) (b) (c) (d) (e)

(1) d > a > e > c > b

(2) e > d > a > b > c

(3) a > d > e > b > c

(4) c > b > a > d > e

Q39. The product formed in the following multistep reaction is:

$$CH_3-CH=CH_2 \xrightarrow[\text{ii) } H_2O_2,NaOH \\ \text{iii) PCC} \\ \text{iv) } CH_3MgBr]{\text{i) } B_2H_6}$$

(1) $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-OCH_3$

(2) $CH_3-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3$

(3) $CH_3-CH_2-\overset{\overset{OH}{|}}{CH}-CH_3$

(4) $CH_3-CH_2-CH_2-CH_2-OH$

Q40. The possibility of photochemical smog formation will be minimum at

(1) Srinagar, Jammu and Kashmir in January

(2) Kolkata in October

(3) Mumbai in May

(4) New-Delhi in August (Summer)

Q41. Which of the following expressions is correct in case of a CsCl unit cell (edge length 'a')?

(1) $r_{Cs^+} + r_{Cl^-} = \frac{a}{2}$ (2) $r_{Cs^+} + r_{Cl^-} = \frac{\sqrt{3}}{2}a$

(3) $r_{Cs^+} + r_{Cl^-} = \frac{a}{\sqrt{2}}$ (4) $r_{Cs^+} + r_{Cl^-} = a$

Q42. Which one of the following is not an example of calcination?

(1) $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$ (2) $Fe_2O_3.xH_2O \xrightarrow{\Delta} Fe_2O_3 + xH_2O$

(3) $2PbS + 3O_2 \xrightarrow{\Delta} 2PbO + 2SO_2$ (4) $CaCO_3.MgCO_3 \xrightarrow{\Delta} CaO + MgO + 2CO_2$

Q43. The number of $P-O-P$ bonds in $H_4P_2O_7$, $(HPO_3)_3$, and P_4O_{10} are respectively

(1) 0, 3, 6 (2) 0, 3, 4

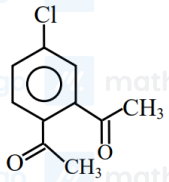
(3) 1, 2, 4 (4) 1, 3, 6

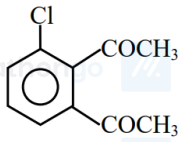
Q44. The complex with highest magnitude of crystal field splitting energy (Δ_0) is

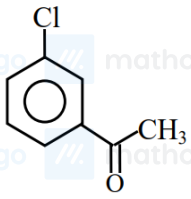
(1) $[Ti(OH_2)6]^{3+}$ (2) $[Cr(OH_2)_6]^{3+}$

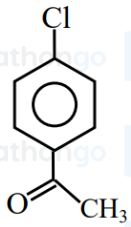
(3) $[Mn(OH_2)_6]^{3+}$ (4) $[Fe(OH_2)_6]^{3+}$

Q45. The major product formed in the Friedel-Craft acylation of chlorobenzene is

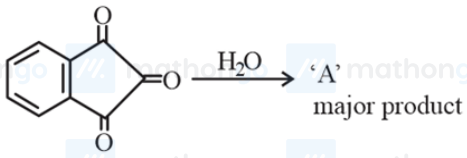
(1) 

(2) 

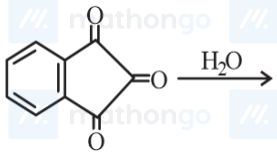
(3) 

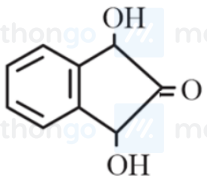
(4) 

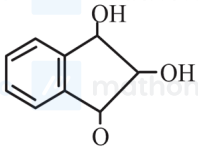
Q46.

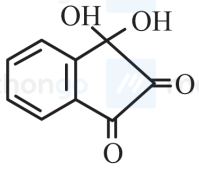


'A' formed in the above reaction is

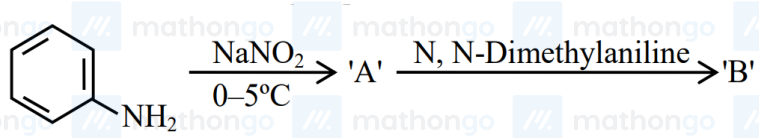
(1) 

(2) 

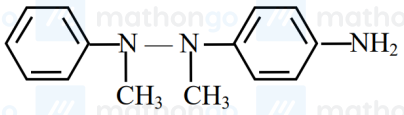
(3) 

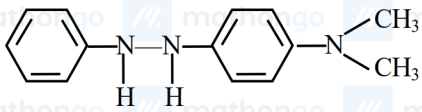
(4) 

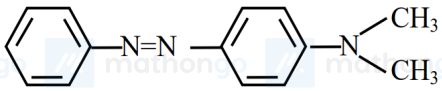
Q47. Consider the following sequence of reactions

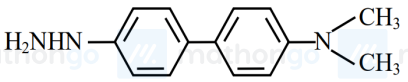


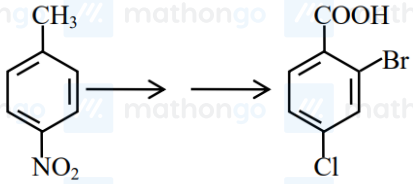
The product 'B' is

(1) 

(2) 

(3) 

(4) 

Q48. 

In the above conversion the correct sequence of reagents to be added is

(1) (i) $KMnO_4$, (ii) Br_2 / Fe, (iii) Fe /H^+, (iv) Cl_2

(2) (i) Br_2 / Fe, (ii) Fe /H^+, (iii) $KMnO_4$, (iv) Cl_2

(3) (i) Fe /H^+, (ii) HONO, (iii) CuCl, (iv) $KMnO_4$

(4) (i) Br_2 / Fe, (ii) Fe /H^+, (iii) HONO, (iv) CuCl (v) KM

Q49. Match List I with List II:

	List I (Monomer)		**List II (Polymer)**
(A)	Tetrafluoroethene	(I)	Orlon
(B)	Acrylonitrile	(II)	Natural rubber
(C)	Caprolactam	(III)	Teflon
(D)	Isoprene	(IV)	Nylon-6

Choose the correct answer from the options given below:

(1) (A) – (III), (B) – (I), (C) – (IV), (D) – (II)

(2) (A) – (IV), (B) – (I), (C) – (II), (D) – (III)

(3) (A) – (III), (B) – (IV), (C) – (II), (D) – (I)

(4) (A) – (II), (B) – (III), (C) – (IV), (D) – (I)

Q50. Which is not true for arginine?

(1) It has a fairly high melting point

(2) It is associated with more than one pK_a values.

(3) It has high solubility in benzene.

(4) It is a crystalline solid.

Q51. The total number of isoelectronic species from the given set is _____.

O^{2-}, F^-, Al, Mg^{2+}, Na^+, O^+, Mg, Al^{3+}, F

Q52. 30.4 kJ of heat is required to melt one mole of sodium chloride and the entropy change at the melting point is 28.4 J K^{-1} mol^{-1} at 1 atm. The melting point of sodium chloride is _____ K (Nearest Integer)

Q53. The total change in the oxidation state of manganese involved in the reaction of $KMnO_4$ and potassium iodide in the acidic medium is _____.

Q54. The vapour pressure of 30% (w/v), aqueous solution of glucose is _____ mm Hg at 25°C.

[Given: The density of 30% (w/v), aqueous solution of glucose is $1.2\ \text{g cm}^{-3}$ and vapour pressure of pure water is 24 mm Hg.]
(Molar mass of glucose is $180\ \text{g mol}^{-1}$)

Q55. The number of correct statements from the following is _____
(A) Conductivity always decreases with decrease in concentration for both strong and weak electrolytes.
(B) The number of ions per unit volume that carry current in a solution increases on dilution.
(C) Molar conductivity increases with decrease in concentration.
(D) The variation in molar conductivity is different for strong and weak electrolytes.
(E) For weak electrolytes, the change in molar conductivity with dilution is due to decrease in degree of dissociation.

Q56. For a reversible reaction $A \rightleftharpoons B$, the ΔH forward reaction $= 20\ \text{kJ mol}^{-1}$. The activation energy of the uncatalyzed forward reaction is $300\ \text{kJ mol}^{-1}$. When the reaction is catalysed keeping the reactant concentration same, the rate of the catalysed forward reaction at 27°C is found to be same as that of the uncatalyzed reaction at 327°C. The activation energy of the catalysed backward reaction is _____ kJ mol^{-1}.

Q57. $20\ \text{mL}$ of $0.5\ \text{M}$ NaCl is required to coagulate $200\ \text{mL}$ of As_2S_3 solution in 2 hours. The coagulating value of NaCl is _____.

Q58. In Chromyl chloride, the oxidation state of chromium is $(+)$ _____.

Q59. The volume (in mL) of $0.1\ \text{M}\ \text{AgNO}_3$ required for complete precipitation of chloride ions present in $20\ \text{mL}$ of $0.01\ \text{M}$ solution of $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2$ as silver chloride is_____

Q60. The homoleptic and octahedral complex of Co^{2+} and H_2O has _____ unpaired electron(s) in the t_{2g} set of orbitals.

Q61. The number of real roots of the equation $x|x| - 5|x+2| + 6 = 0$, is
(1) 5 (2) 4
(3) 6 (4) 3

Q62. If the set $\left\{Re\left(\frac{z-\bar{z}+z\bar{z}}{2-3z+5\bar{z}}\right) : z \in \mathbb{C},\ \ Re\ z = 3\right\}$ is equal to the interval $(\alpha,\ \beta]$, then $24(\beta - \alpha)$ is equal to
(1) 36 (2) 27
(3) 30 (4) 42

Q63. The total number of three-digit numbers, divisible by 3, which can be formed using the digits $1,\ 3,\ 5,\ 8$, if repetition of digits is allowed, is
(1) 21 (2) 20
(3) 22 (4) 18

Q64. Let A_1 and A_2 be two arithmetic means and $G_1,\ G_2$ and G_3 be three geometric means of two distinct positive numbers. Then $G_1^4 + G_2^4 + G_3^4 + G_1^2G_3^2$ is equal to
(1) $(A_1 + A_2)^2G_1G_3$ (2) $2(A_1 + A_2)G_1G_3$
(3) $(A_1 + A_2)G_1^2G_3^2$ (4) $2(A_1 + A_2)G_1^2G_3^2$

Q65. Let $\left(a + bx + cx^2\right)^{10} = \sum_{i=10}^{20} p_i x^i,\ a,\ b,\ c \in \mathbb{N}$. If $p_1 = 20$ and $p_2 = 210$, then $2(a + b + c)$ is equal to
(1) 6 (2) 15
(3) 12 (4) 8

Q66. If $(\alpha,\ \beta)$ is the orthocenter of the triangle ABC with vertices $A(3,\ -7),\ B(-1,\ 2)$ and $C(4,\ 5)$, then $9\alpha - 6\beta + 60$ is equal to

(1) 25 (2) 35
(3) 30 (4) 40

Q67. The number of common tangents, to the circles $x^2 + y^2 - 18x - 15y + 131 = 0$ and $x^2 + y^2 - 6x - 6y - 7 = 0$, is

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

Q68. Negation of $p \wedge (q \wedge \sim(p \wedge q))$ is

(1) $(\sim(p \wedge q)) \vee p$ (2) $p \vee q$
(3) $\sim(p \vee q)$ (4) $(\sim(p \wedge q)) \wedge q$

Q69. The mean and standard deviation of 10 observations are 20 and 8 respectively. Later on, it was observed that one observation was recorded as 50 instead of 40. Then the correct variance is

(1) 11 (2) 13
(3) 12 (4) 14

Q70. Let the determinant of a square matrix A of order m be $m - n$, where m and n satisfy $4m + n = 22$ and $17m + 4n = 93$. If $det(n\ adj(adj(mA))) = 3^a5^b6^c$, then $a + b + c$ is equal to

(1) 84 (2) 96
(3) 101 (4) 109

Q71. Let the system of linear equations

$-x + 2y - 9z = 7$
$-x + 3y + 7z = 9$
$-2x + y + 5z = 8$
$-3x + y + 13z = \lambda$

has a unique solution $x = \alpha,\ y = \beta,\ z = \gamma$. Then the distance of the point $(\alpha,\ \beta,\ \gamma)$ from the plane $2x - 2y + z = \lambda$ is

(1) 11 (2) 7
(3) 9 (4) 13

Q72. If the domain of the function $f(x) = \log_e\left(4x^2 + 11x + 6\right) + \sin^{-1}(4x + 3) + \cos^{-1}\left(\frac{10x+6}{3}\right)$ is $(\alpha,\ \beta]$, then $36|\alpha + \beta|$ is equal to

(1) 54 (2) 72
(3) 63 (4) 45

Q73. Let $[x]$ denote the greatest integer function and $f(x) = \max\{1 + x + [x],\ 2 + x,\ x + 2[x]\},\ 0 \le x \le 2$, where f is not continuous and n be the number of points in $(0,\ 2)$, where f is not differentiable. Then $(m + n)^2 + 2$ is equal to

(1) 2 (2) 11
(3) 6 (4) 3

Q74. If $\int_0^1 \frac{1}{(5+2x-2x^2)\left(1+e^{(2-4x)}\right)}dx = \frac{1}{\alpha}\log_e\left(\frac{\alpha+1}{\beta}\right),\ \alpha,\ \beta > 0$, then $\alpha^4 - \beta^4$ is equal to

(1) 19 (2) -21
(3) 0 (4) 21

Q75. Let $x = x(y)$ be the solution of the differential equation $2(y+2)\log_e(y+2)dx + (x+4-2\log_e(y+2))dy = 0$, $y > -1$ with $x\left(e^4-2\right) = 1$. Then $x\left(e^9-2\right)$ is equal to

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

(3) $\frac{32}{9}$ (4) $\frac{10}{3}$

Q76. Let S be the set of all $(\lambda,\ \mu)$ for which the vectors $\lambda\hat{i}-\hat{j}+\hat{k}$, $\hat{i}+2\hat{j}+\mu\hat{k}$ and $3\hat{i}-4\hat{j}+5\hat{k}$, where $\lambda-\mu=5$, are coplanar, then $\sum_{(\lambda,\,\mu)\in S} 80\left(\lambda^2+\mu^2\right)$ is equal to

(1) 2210 (2) 2130

(3) 2290 (4) 2370

Q77. Let $ABCD$ be a quadrilateral. If E and F are the mid points of the diagonals AC and BD respectively and $\left(\overrightarrow{AB}-\overrightarrow{BC}\right)+\left(\overrightarrow{AD}-\overrightarrow{DC}\right)=k\overrightarrow{FE}$, then k is equal to

(1) 4 (2) -2

(3) 2 (4) -4

Q78. Let the foot of perpendicular of the point $P(3,\ -2,\ -9)$ on the plane passing through the points $(-1,\ -2,\ -3)$, $(9,\ 3,\ 4)$, $(9,\ -2,\ 1)$ be $Q(\alpha,\ \beta,\ \gamma)$. Then the distance Q from the origin is

(1) $\sqrt{42}$ (2) $\sqrt{38}$

(3) $\sqrt{35}$ (4) $\sqrt{29}$

Q79. Let S be the set of all values of λ, for which the shortest distance between the lines $\frac{x-\lambda}{0}=\frac{y-3}{4}=\frac{z+6}{1}$ and $\frac{x+\lambda}{3}=\frac{y}{-4}=\frac{z-6}{0}$ is 13. Then $8\left|\sum_{\lambda\in S}\lambda\right|$ is equal to

(1) 306 (2) 304

(3) 308 (4) 302

Q80. A bag contains 6 white and 4 black balls. A die is rolled once and the number of balls equal to the number obtained on the die are drawn from the bag at random. The probability that all the balls drawn are white is

(1) $\frac{1}{4}$ (2) $\frac{11}{50}$

(3) $\frac{1}{5}$ (4) $\frac{9}{50}$

Q81. A person forgets his 4-digit ATM pin code. But he remembers that in the code all the digits are different, the greatest digit is 7 and the sum of the first two digits is equal to the sum of the last two digits. Then the maximum number of trials necessary to obtain the correct code is_____.

Q82. If the sum of the series $\left(\frac{1}{2}-\frac{1}{3}\right)+\left(\frac{1}{2^2}-\frac{1}{2\cdot3}+\frac{1}{3^2}\right)+\left(\frac{1}{2^3}-\frac{1}{2^2\cdot3}+\frac{1}{2\cdot3^2}-\frac{1}{3^3}\right)+\left(\frac{1}{2^4}-\frac{1}{2^3\cdot3}+\frac{1}{2^2\cdot3^2}-\frac{1}{2\cdot3^3}+\frac{1}{3^4}\right)+\ldots\ldots$ is $\frac{\alpha}{\beta}$, where α and β are co-prime, then $\alpha+3\beta$ is equal to _____.

Q83. Consider the triangles with vertices $A(2,\ 1)$, $B(0,\ 0)$ and $C(t,\ 4)$, $t=[0,\ 4]$. If the maximum and the minimum perimeters of such triangles are obtained at $t=\alpha$ and $t=\beta$ respectively, then $6\alpha+21\beta$ is equal to _____.

Q84. Let an ellipse with centre $(1,\ 0)$ and latus rectum of length $\frac{1}{2}$ have its major axis along x-axis. If its minor axis subtends an angle 60° at the foci, then the square of the sum of the lengths of its minor and major axes is equal to _____.

Q85. The number of elements in the set $\{n\in\mathbb{N}: 10\le n\le 100 \text{ and } 3^n-3 \text{ is a multiple of } 7\}$ is _____.

Q86. Let $A = \{1,\ 2,\ 3,\ 4\}$ and R be a relation on the set $A \times A$ defined by $R = \{((a,\ b),\ (c,\ d)) : 2a + 3b = 4c + 5d\}$. Then the number of elements in R is _____.

Q87. Let $f(x) = \int \frac{dx}{(3+4x^2)\sqrt{4-3x^2}},\ |x| < \frac{2}{\sqrt{3}}$. If $f(0) = 0$ and $f(1) = \frac{1}{\alpha\beta}\tan^{-1}\left(\frac{\alpha}{\beta}\right),\ \alpha,\ \beta > 0$, then $\alpha^2 + \beta^2$ is equal to _____.

Q88. If the area bounded by the curve $2y^2 = 3x$, lines $x + y = 3,\ y = 0$ and outside the circle $(x-3)^2 + y^2 = 2$ is A, then $4(\pi + 4A)$ is equal to _____.

Q89. If the line $x = y = z$ intersects the line $x\ \sin A + y\ \sin B + z\ \sin C - 18 = 0 = x\ \sin 2A + y\ \sin 2B + z \sin 2C - 9$, where $A,\ B,\ C$ are the angles of a triangle ABC, then $80\left(\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}\right)$ is equal to _____.

Q90. Let the plane P contain the line $2x + y - z - 3 = 0 = 5x - 3y + 4z + 9$ and be parallel to the line $\frac{x+2}{2} = \frac{3-y}{-4} = \frac{z-7}{5}$. Then the distance of the point $A(8,\ -1,\ -19)$ from the plane P measured parallel to the line $\frac{x}{-3} = \frac{y-5}{4} = \frac{2-z}{-12}$ is equal to _____.

ANSWER KEYS

1. (3)	**2.** (4)	**3.** (4)	**4.** (3)	**5.** (2)	**6.** (3)	**7.** (4)	**8.** (2)
9. (2)	**10.** (3)	**11.** (3)	**12.** (1)	**13.** (1)	**14.** (4)	**15.** (1)	**16.** (1)
17. (1)	**18.** (4)	**19.** (3)	**20.** (4)	**21.** (30)	**22.** (5)	**23.** (1150)	**24.** (90)
25. (5)	**26.** (3)	**27.** (40)	**28.** (88)	**29.** (30)	**30.** (5)	**31.** (2)	**32.** (4)
33. (1)	**34.** (1)	**35.** (4)	**36.** (4)	**37.** (1)	**38.** (2)	**39.** (3)	**40.** (1)
41. (2)	**42.** (3)	**43.** (4)	**44.** (2)	**45.** (4)	**46.** (1)	**47.** (3)	**48.** (4)
49. (1)	**50.** (3)	**51.** (5)	**52.** (1070)	**53.** (5)	**54.** (23)	**55.** (3)	**56.** (130)
57. (50)	**58.** (6)	**59.** (4)	**60.** (1)	**61.** (4)	**62.** (3)	**63.** (3)	**64.** (1)
65. (3)	**66.** (1)	**67.** (1)	**68.** (1)	**69.** (2)	**70.** (2)	**71.** (2)	**72.** (4)
73. (4)	**74.** (4)	**75.** (3)	**76.** (3)	**77.** (4)	**78.** (1)	**79.** (1)	**80.** (3)
81. (72)	**82.** (7)	**83.** (48)	**84.** (9)	**85.** (15)	**86.** (6)	**87.** (28)	**88.** (42)
89. (5)	**90.** (26)						