Q1. A physical quantity Q is found to depend on quantities $a,\ b,\ c$ by the relation $Q = \frac{a^4 b^3}{c^2}$. The percentage error in $a,\ b$ and c are $3\%,\ 4\%$ and 5% respectively. Then, the percentage error in Q is:

(1) 66% (2) 43%

(3) 34% (4) 14%

Q2. A particle is moving in a straight line. The variation of position x as a function of time t is given as $x = \left(t^3 - 6t^2 + 20t + 15\right)$ m. The velocity of the body when its acceleration becomes zero is:

(1) $4\ \text{m s}^{-1}$ (2) $8\ \text{m s}^{-1}$

(3) $10\ \text{m s}^{-1}$ (4) $6\ \text{m s}^{-1}$

Q3. A stone of mass 900 g is tied to a string and moved in a vertical circle of radius 1 m making 10 rpm. The tension in the string, when the stone is at the lowest point is (if $\pi^2 = 9.8$ and $g = 9.8\ \text{m s}^{-2}$)

(1) 97 N (2) 9.8 N

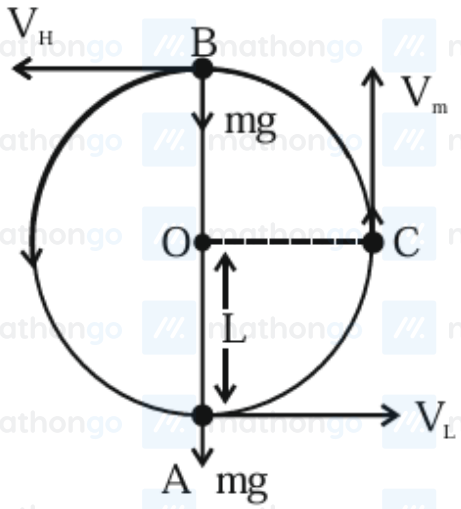
(3) 8.82 N (4) 17.8 N

Q4. The bob of a pendulum was released from a horizontal position. The length of the pendulum is 10 m. If it dissipates 10% of its initial energy against air resistance, the speed with which the bob arrives at the lowest point is: [Use, $g = 10\ \text{m s}^{-2}$]

(1) $6\sqrt{5}\ \text{m s}^{-1}$ (2) $5\sqrt{6}\ \text{m s}^{-1}$

(3) $5\sqrt{5}\ \text{m s}^{-1}$ (4) $2\sqrt{5}\ \text{m s}^{-1}$

Q5. A bob of mass m is suspended by a light string of length L. It is imparted a minimum horizontal velocity at the lowest point A such that it just completes half circle reaching the top most position B. The ratio of kinetic energies $\frac{(K.E.)_A}{(K.E.)_B}$ is :



(1) 3 : 2 (2) 5 : 1

(3) 2 : 5 (4) 1 : 5

Q6. A planet takes 200 days to complete one revolution around the Sun. If the distance of the planet from Sun is reduced to one fourth of the original distance, how many days will it take to complete one revolution?

(1) 25 (2) 50

(3) 100 (4) 20

Q7. A wire of length L and radius r is clamped at one end. If its other end is pulled by a force F, its length increases by l. If the radius of the wire and the applied force both are reduced to half of their original values keeping original length constant, the increase in length will become:

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

Q8. A small liquid drop of radius R is divided into 27 identical liquid drops. If the surface tension is T, then the work done in the process will be :

(1) $8\pi R^2T$
(2) $3\pi R^2T$
(3) $\frac{1}{8}\pi R^2T$
(4) $4\pi R^2T$

Q9. The temperature of a gas having 2.0×10^{25} molecules per cubic meter at 1.38 atm (Given, $k = 1.38 \times 10^{-23}\text{J K}^{-1}$) is :

(1) 500 K
(2) 200 K
(3) 100 K
(4) 300 K

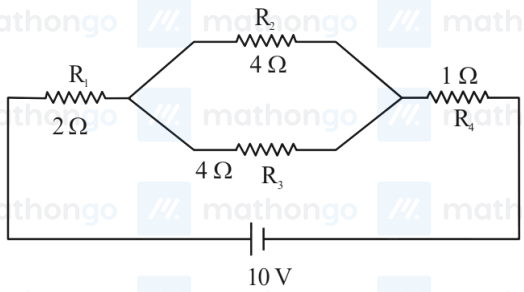
Q10. N moles of a polyatomic gas$(f = 6)$ must be mixed with two moles of a monoatomic gas so that the mixture behaves as a diatomic gas. The value of N is:

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

Q11. An electric field is given by $\left(6\hat{i} + 5\hat{j} + 3\hat{k}\right)$ N C^{-1}. The electric flux through a surface area $30\hat{i}$ m^2 lying in YZ-plane(in SI unit) is:

(1) 90
(2) 150
(3) 180
(4) 60

Q12. In the given circuit, the current in resistance R_3 is:



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

Q13. Two particles X and Y having equal charges are being accelerated through the same potential difference. Thereafter, they enter normally in a region of uniform magnetic field and describes circular paths of radii R_1 and R_2 respectively. The mass ratio of X and Y is :

(1) $\left(\frac{R_2}{R_1}\right)^2$
(2) $\left(\frac{R_1}{R_2}\right)^2$
(3) $\left(\frac{R_1}{R_2}\right)$
(4) $\left(\frac{R_2}{R_1}\right)$

Q14. In an a.c. circuit, voltage and current are given by: $V = 100\sin(100t)$ V and $I = 100\sin\left(100t + \frac{\pi}{3}\right)$ mA respectively. The average power dissipated in one cycle is :

(1) 5 W (2) 10 W

(3) 2.5 W (4) 25 W

Q15. A plane electromagnetic wave of frequency 35 MHz travels in free space along the X-direction. At a particular point (in space and time) $\vec{E} = 9.6\hat{j}$ V m^{-1}. The value of magnetic field at this point is:

(1) $3.2 \times 10^{-8}\hat{k}$ T (2) $3.2 \times 10^{-8}\hat{i}$

(3) $9.6\hat{j}$ T (4) $9.6 \times 10^{-8}\hat{k}$ T

Q16. If the distance between object and its two times magnified virtual image produced by a curved mirror is 15 cm , the focal length of the mirror must be :

(1) 15 cm (2) -12 cm

(3) -10 cm (4) $\frac{10}{3}$ cm

Q17. In Young's double slit experiment, light from two identical sources are superimposing on a screen. The path difference between the two lights reaching at a point on the screen is $\frac{7\lambda}{4}$. The ratio of intensity of fringe at this point with respect to the maximum intensity of the fringe is:

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

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

Q18. Two sources of light emit with a power of 200 W. The ratio of number of photons of visible light emitted by each source having wavelengths 300 nm and 500 nm respectively, will be :

(1) 1 : 5 (2) 1 : 3

(3) 5 : 3 (4) 3 : 5

Q19. Given below are two statements:

Statement I: Most of the mass of the atom and all its positive charge are concentrated in a tiny nucleus and the electrons revolve around it, is Rutherford's model.

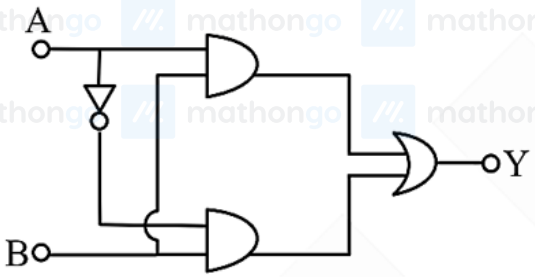
Statement II: An atom is a spherical cloud of positive charges with electrons embedded in it, is a special case of Rutherford's model.

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

(1) Both statement I and statement II are false (2) Statement I is false but statement II is true

(3) Statement I is true but statement II is false (4) Both statement I and statement II are true

Q20. The truth table for this given circuit is:



(1)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(2)

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

(3)

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(4)

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

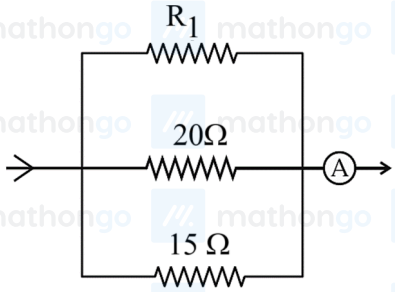
Q21. A particle is moving in a circle of radius $50\ \text{cm}$ in such a way that at any instant the normal and tangential components of its acceleration are equal. If its speed at $\text{t} = 0$ is $4\ \text{m s}^{-1}$, the time taken to complete the first revolution will be $\frac{1}{\alpha}\left[1 - \text{e}^{-2\pi}\right]$ s, where $\alpha =$_____.

Q22. A body of mass $5\ \text{kg}$ moving with a uniform speed $3\sqrt{2}\ \text{m s}^{-1}$ in $X - Y$ plane along the line $y = x + 4$. The angular momentum of the particle about the origin will be _____$\text{kg m}^2\ \text{s}^{-1}$.

Q23. Two metallic wires P and Q have same volume and are made up of same material. If their area of cross sections are in the ratio $4:1$ and force F_1 is applied to P, an extension of Δl is produced. The force which is required to produce same extension in Q is F_2. The value of $\frac{F_1}{F_2}$ is _____.

Q24. A simple harmonic oscillator has an amplitude A and time period 6π second. Assuming the oscillation starts from its mean position, the time required by it to travel from $x = A$ to $x = \frac{\sqrt{3}}{2}A$ will be $\frac{\pi}{x}$ s, where $x =$ _____.

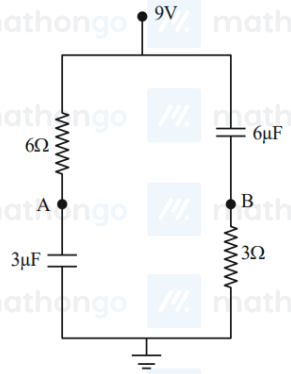
Q25. In the given circuit, the current flowing through the resistance $20\ \Omega$ is $0.3\ \text{A}$, while the ammeter reads $0.9\ \text{A}$. The value of R_1 is _____Ω.



Q26. A charge of $4.0\ \mu\text{C}$ is moving with a velocity of $4.0 \times 10^6\ \text{m s}^{-1}$ along the positive y-axis under a magnetic field B of strength $\left(2\hat{\text{k}}\right)$ T. The force acting on the charge is $x\hat{\text{i}}$ N. The value of x is _____.

Q27. A horizontal straight wire $5\ \text{m}$ long extending from east to west falling freely at right angle to horizontal component of earth's magnetic field $0.60 \times 10^{-4}\ \text{Wb m}^{-2}$. The instantaneous value of emf induced in the wire when its velocity is $10\ \text{m s}^{-1}$ is _____$\times 10^{-3}$ V.

Q28. In the given figure, the charge stored in $6\mu F$ capacitor, when points A and B are joined by a connecting wire is _____μC.



Q29. In a single slit diffraction pattern, a light of wavelength 6000 $\mathring{A}$ is used. The distance between the first and third minima in the diffraction pattern is found to be 3 mm when the screen is placed 50 cm away from slits. The width of the slit is ____$\times 10^{-4}$ m.

Q30. Hydrogen atom is bombarded with electrons accelerated through a potential different of V, which causes excitation of hydrogen atoms. If the experiment is being formed at $T = 0$ K. The minimum potential difference needed to observe any Balmer series lines in the emission spectra will be $\frac{\alpha}{10}$ V, where $\alpha =$ _____.(Write the value to the nearest integer)

Q31. Match List I with List II

List I (Spectral Series for Hydrogen)		**List II (Spectral Region/Higher Energy State)**	
A.	Lyman	I.	Infrared region
B.	Balmer	II.	UV region
C.	Paschen	III.	Infrared region
D.	Pfund	IV.	Visible region

Choose the correct answer from the options given below :-

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

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

Q32. The element having the highest first ionization enthalpy is

(1) Si (2) Al

(3) N (4) C

Q33. Given below are two statements:

Statement I: Fluorine has most negative electron gain enthalpy in its group.

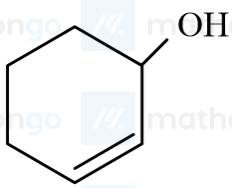
Statement II: Oxygen has least negative electron gain enthalpy in its group.

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

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

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

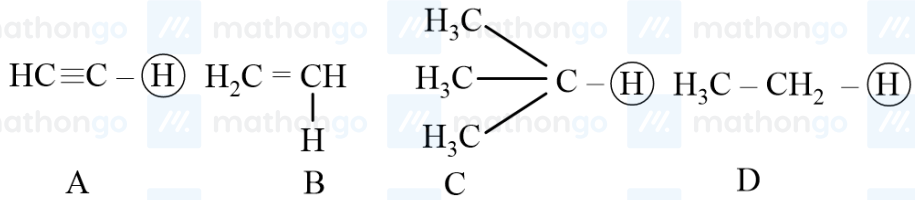
Q34.



According to IUPAC system, the compound is named as:

(1) Cyclohex – 1 – en – 2 – ol
(2) 1 – Hydroxyhex – 2 – ene
(3) Cyclohex – 1 – en – 3 – ol
(4) Cyclohex – 2 – en – 1 – ol

Q35. The ascending acidity order of the following H atoms is



A B C D

(1) C < D < B < A
(2) A < B < C < D
(3) A < B < D < C
(4) D < C < B < A

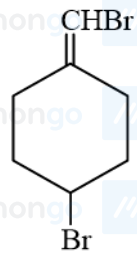
Q36. Match List I with List II

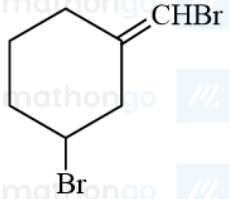
List I (Compound)		**List II (pK_a value)**	
A.	Ethanol	I.	10.0
B.	Phenol	II.	15.9
C.	m-Nitrophenol	III.	7.1
D.	p-Nitrophenol	IV.	8.3

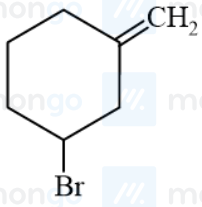
Choose the correct answer from the options given below:

(1) A-I, B-II, C-III, D-IV
(2) A-IV, B-I, C-II, D-III
(3) A-III, B-IV, C-I, D-II
(4) A-II, B-I, C-IV, D-III

Q37. Which one of the following will show geometrical isomerism?

(1) 

(2) 

(3) 

(4) 

Q38. Chromatographic technique/s based on the principle of differential adsorption is/are

A. Column chromatography B. Thin layer chromatography C. Paper chromatography

Choose the most appropriate answer from the options given below:

(1) B only (2) A only

(3) A & B only (4) C only

Q39. Anomalous behaviour of oxygen is due to its

(1) Large size and high electronegativity (2) Small size and low electronegativity

(3) Small size and high electronegativity (4) Large size and low electronegativity

Q40. Which of the following acts as a strong reducing agent? (Atomic number : $\mathrm{Ce} = 58, \mathrm{Eu} = 63, \mathrm{Gd} = 64, \mathrm{Lu} = 71$)

(1) Lu^{3+} (2) Gd^{3+}

(3) Eu^{2+} (4) Ce^{4+}

Q41. Which of the following statements are correct about Zn, Cd and Hg ?

A. They exhibit high enthalpy of atomization as the d-subshell is full.

B. Zn and Cd do not show variable oxidation state while Hg shows $+\mathrm{I}$ and $+\mathrm{II}$.

C. Compounds of Zn, Cd and Hg are paramagnetic in nature.

D. Zn, Cd and Hg are called soft metals.

Choose the most appropriate from the options given below:

(1) B, D only (2) B, C only

(3) A, D only (4) C, D only

Q42. The correct IUPAC name of $\mathrm{K_2MnO_4}$ is:

(1) Potassium tetraoxopermanganate (VI) (2) Potassium tetraoxidomanganate (VI)

(3) Dipotassium tetraoxidomanganate (VII) (4) Potassium tetraoxidomanganese (VI)

Q43. Alkyl halide is converted into alkyl isocyanide by reaction with

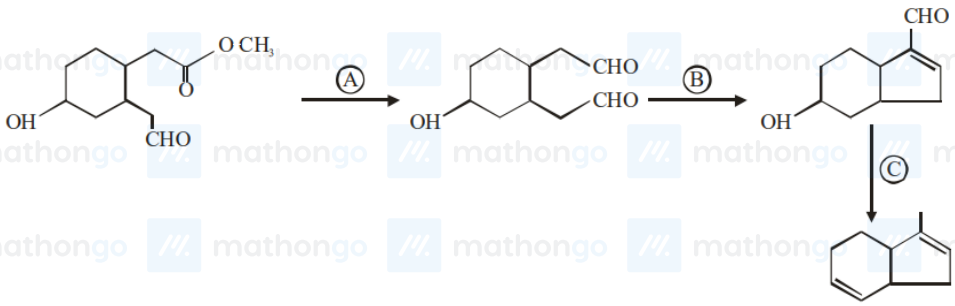
(1) NaCN (2) $\mathrm{NH_4CN}$

(3) KCN (4) AgCN

Q44. Phenol treated with chloroform in presence of sodium hydroxide, which further hydrolysed in presence of an acid results

(1) Salicyclic acid
(2) Benzene-1,2-diol
(3) Benzene-1, 3-diol
(4) 2-Hydroxybenzaldehyde

Q45. Identify the reagents used for the following conversion

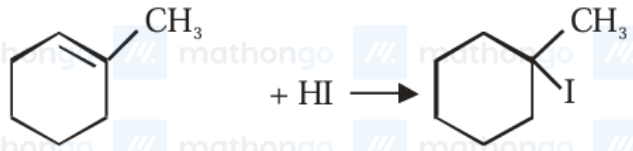


(1) $A = LiAlH_4,\ B = NaOH_{(aq)}, C = NH_2 - NH_2 / KOH$ ethylene glycol
(2) $A = LiAlH_4,\ B = NaOH_{(alc)}, C = Zn / HCl$
(3) $A = DIBAL - H, B = NaOH_{(aq)}\ C = NH_2 - NH_2 / KOH$ ethylene glycol
(4) $A = DIBAL - H, B = NaOH_{(alc)}, C = Zn / HCl$

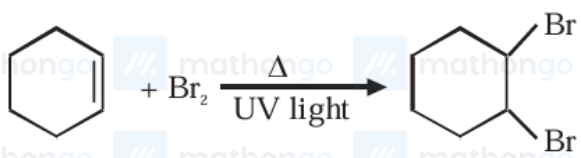
Q46. Which of the following reaction is correct?

(1) $CH_3CH_2CH_2NH_2 \xrightarrow[H_2O]{HNO_2, 0^\circ C} CH_3CH_2OH + N_2 + HCl$

(2)

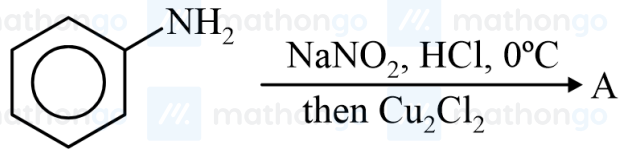


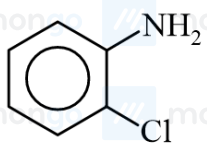
(3)

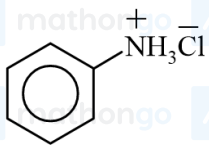


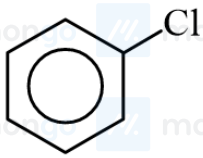
(4) $C_2H_5\,CONH_2 + Br_2 + NaOH \rightarrow C_2H_5\,CH_2\,NH_2 + Na_2\,CO_3 + NaBr + H_2O$

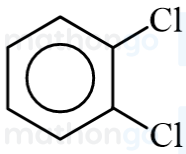
Q47. The product A formed in the following reaction is:



(1) 

(2) 

(3) 

(4) 

Q48. On passing a gas, 'X', through Nessler's reagent, a brown precipitate is obtained. The gas 'X ' is

(1) H_2S (2) CO_2

(3) NH_3 (4) Cl_2

Q49. A reagent which gives brilliant red precipitate with Nickel ions in basic medium is

(1) sodium nitroprusside (2) neutral $FeCl_3$

(3) meta-dinitrobenzene (4) dimethyl glyoxime

Q50. Match List I with List II

List I (Bio Polymer)		List II (Monomer)	
A.	Starch	I.	nucleotide
B.	Cellulose	II.	α-glucose
C.	Nucleic acid	III.	β-glucose
D.	Protein	IV.	α-amino acid

Choose the correct answer from the options given below :-

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

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

Q51. The total number of molccules with zero dipole moment among $CH_4, BF_3, H_2O, HF, NH_3, CO_2$ and SO_2 is _____.

Q52. The total number of 'Sigma' and Pi bonds in 2-formylhex-4-enoic acid is

Q53. The total number of anti bonding molecular orbitals, formed from $2s$ and $2p$ atomic orbitals in a diatomic molecule is _____.

Q54. Standard enthalpy of vapourisation for CCl_4 is $30.5\ \text{kJ mol}^{-1}$. Heat required for vapourisation of 284 g of CCl_4 at constant temperature is _____ kJ. (Given molar mass in gmol^{-1}; $C = 12, Cl = 35.5$)
Round off your answer to the nearest integer.

Q55. The following concentrations were observed at 500 K for the formation of NH_3 from N_2 and H_2. At equilibrium : $[N_2] = 2 \times 10^{-2}\text{M}$, $[H_2] = 3 \times 10^{-2}\text{M}$ and $[NH_3] = 1.5 \times 10^{-2}\text{M}$. Equilibrium constant for the reaction is _____.

Q56. If $50\ \text{mL}$ of 0.5M oxalic acid is required to neutralise $25\ \text{mL}$ of NaOH solution, the amount of NaOH in $50\ \text{mL}$ of given NaOH solution is_____g.

Q57. Molality of $0.8\mathrm{M}$ $\mathrm{H_2SO_4}$ solution (density $1.06\ \mathrm{g\ cm^{-3}}$) is $\_\_\_\_\_ \times 10^{-3}$ m.
Round off your answer to the nearest integer.

Q58. A constant current was passed through a solution of $\mathrm{AuCl_4^-}$ ion between gold electrodes. After a period of 10.0 minutes, the increase in mass of cathode was 1.314 g. The total charge passed through the solution is $\_\_\_ \times 10^{-2}$ F. (Given atomic mass of $\mathrm{Au} = 197$)

Q59. The half-life of radioisotopic bromine - 82 is 36 hours. The fraction which remains after one day is $\_\_\_\_\_ \times 10^{-2}$.
(Given antilog $0.2006 = 1.587$)
Round off to the nearest integer

Q60. Oxidation state of Fe(Iron) in complex formed in Brown ring test.

Q61. Let r and θ respectively be the modulus and amplitude of the complex number $z = 2 - i\left(2\tan\frac{5\pi}{8}\right)$, then (r, θ) is equal to
(1) $\left(2\sec\frac{3\pi}{8}, \frac{3\pi}{8}\right)$
(2) $\left(2\sec\frac{3\pi}{8}, \frac{5\pi}{8}\right)$
(3) $\left(2\sec\frac{5\pi}{8}, \frac{3\pi}{8}\right)$
(4) $\left(2\sec\frac{11\pi}{8}, \frac{11\pi}{8}\right)$

Q62. Number of ways of arranging 8 identical books into 4 identical shelves where any number of shelves may remain empty is equal to
(1) 18
(2) 16
(3) 12
(4) 15

Q63. If $\log_e a, \log_e b, \log_e c$ are in an $A.P.$ and $\log_e a - \log_e 2b, \log_e 2b - \log_e 3c, \log_e 3c - \log_e a$ are also in an $A.P.$, then $a : b : c$ is equal to
(1) $9:6:4$
(2) $16:4:1$
(3) $25:10:4$
(4) $6:3:2$

Q64. If each term of a geometric progression $\mathrm{a_1, a_2, a_3, \ldots}$ with $\mathrm{a_1} = \frac{1}{8}$ and $\mathrm{a_2} \neq \mathrm{a_1}$, is the arithmetic mean of the next two terms and $\mathrm{S_n} = \mathrm{a_1} + \mathrm{a_2} + \ldots + \mathrm{a_n}$, then $\mathrm{S_{20}} - \mathrm{S_{18}}$ is equal to
(1) 2^{15}
(2) -2^{18}
(3) 2^{18}
(4) -2^{15}

Q65. The sum of the solutions $x \in R$ of the equation $\frac{3\cos 2x + \cos^3 2x}{\cos^6 x - \sin^6 x} = x^3 - x^2 + 6$ is
(1) 0
(2) 1
(3) -1
(4) 3

Q66. Let A be the point of intersection of the lines $3x + 2y = 14, 5x - y = 6$ and B be the point of intersection of the lines $4x + 3y = 8,\ 6x + y = 5$. The distance of the point $P(5, -2)$ from the line AB is
(1) $\frac{13}{2}$
(2) 8
(3) $\frac{5}{2}$
(4) 6

Q67. The distance of the point $(2, 3)$ from the line $2x - 3y + 28 = 0$, measured parallel to the line $\sqrt{3}x - y + 1 = 0$, is equal to

(1) $4\sqrt{2}$ (2) $6\sqrt{3}$
(3) $3+4\sqrt{2}$ (4) $4+6\sqrt{3}$

Q68. If the mean and variance of five observations are $\frac{24}{5}$ and $\frac{194}{25}$ respectively and the mean of first four observations is $\frac{7}{2}$, then the variance of the first four observations in equal to
(1) $\frac{4}{5}$ (2) $\frac{77}{12}$
(3) $\frac{5}{4}$ (4) $\frac{105}{4}$

Q69. If R is the smallest equivalence relation on the set $\{1,2,3,4\}$ such that $\{(1,2),(1,3)\} \subset R$, then the number of elements in R is _____.
(1) 10 (2) 12
(3) 8 (4) 15

Q70. Let $\mathrm{A}=\begin{bmatrix}2 & 1 & 2\\ 6 & 2 & 11\\ 3 & 3 & 2\end{bmatrix}$ and $\mathrm{P}=\begin{bmatrix}1 & 2 & 0\\ 5 & 0 & 2\\ 7 & 1 & 5\end{bmatrix}$. The sum of the prime factors of $\left|\mathrm{P}^{-1}\mathrm{AP}-2\mathrm{I}\right|$ is equal to
(1) 26 (2) 27
(3) 66 (4) 23

Q71. Let $x=\frac{m}{n}(m,n$ are co-prime natural numbers) be a solution of the equation $\cos\left(2\sin^{-1}x\right)=\frac{1}{9}$ and let $\alpha,\beta(\alpha>\beta)$ be the roots of the equation $mx^2-nx-m+n=0$. Then the point (α,β) lies on the line
(1) $3x+2y=2$ (2) $5x-8y=-9$
(3) $3x-2y=-2$ (4) $5x+8y=9$

Q72. Let $y=\log_e\left(\frac{1-x^2}{1+x^2}\right), -1<x<1$. Then at $x=\frac{1}{2}$, the value of $225(y'-y'')$ is equal to
(1) 732 (2) 746
(3) 742 (4) 736

Q73. The function $f(x)=2x+3x^{\frac{2}{3}},\ x\in R$, has
(1) exactly one point of local minima and no point of local maxima
(2) exactly one point of local maxima and no point of local minima
(3) exactly one point of local maxima and exactly one point of local minima
(4) exactly two points of local maxima and exactly one point of local minima

Q74. The function $f(x)=\frac{x}{x^2-6x-16}, x\in\mathbb{R}-\{-2,8\}$
(1) decreases in $(-2,8)$ and increases in $(-\infty,-2)\cup(8,\infty)$
(2) decreases in $(-\infty,-2)\cup(-2,8)\cup(8,\infty)$
(3) decreases in $(-\infty,-2)$ and increases in $(8,\infty)$
(4) increases in $(-\infty,-2)\cup(-2,8)\cup(8,\infty)$

Q75. If $\int\frac{\sin^{\frac{3}{2}}x+\cos^{\frac{3}{2}}x}{\sqrt{\sin^3 x\cos^3 x\sin(x-\theta)}}dx=A\sqrt{\cos\theta\tan x-\sin\theta}+B\sqrt{\cos\theta-\sin\theta\cot x}+C$, where C is the integration constant, then AB is equal to
(1) $4\ \mathrm{cosec}\ (2\theta)$ (2) $4\sec\theta$
(3) $2\sec\theta$ (4) $8\ \mathrm{cosec}\ (2\theta)$

Q76. If $\sin\left(\frac{y}{x}\right)=\log_e|x|+\frac{\alpha}{2}$ is the solution of the differential equation $x\cos\left(\frac{y}{x}\right)\frac{dy}{dx}=y\cos\left(\frac{y}{x}\right)+x$ and $y(1)=\frac{\pi}{3}$, then α^2 is equal to

(1) 3 (2) 12

(3) 4 (4) 9

Q77. Let $\overrightarrow{OA}=\vec{a}, \overrightarrow{OB}=12\vec{a}+4\vec{b}$ and $\overrightarrow{OC}=\vec{b}$, where O is the origin. If S is the parallelogram with adjacent sides OA and OC, then $\frac{\text{area of the quadrilateral OABC}}{\text{area of S}}$ is equal to _____

(1) 6 (2) 10

(3) 7 (4) 8

Q78. Let a unit vector $\hat{u}=x\hat{i}+y\hat{j}+z\hat{k}$ make angles $\frac{\pi}{2}$, $\frac{\pi}{3}$ and $\frac{2\pi}{3}$ with the vectors $\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{k}$, $\frac{1}{\sqrt{2}}\hat{j}+\frac{1}{\sqrt{2}}\hat{k}$ and $\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}$ respectively. If $\vec{v}=\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}+\frac{1}{\sqrt{2}}\hat{k}$, then $|\hat{u}-\vec{v}|^2$ is equal to

(1) $\frac{11}{2}$ (2) $\frac{5}{2}$

(3) 9 (4) 7

Q79. Let $P(3,2,3), Q(4,6,2)$ and $R(7,3,2)$ be the vertices of ΔPQR. Then, the angle $\angle QPR$ is

(1) $\frac{\pi}{6}$ (2) $\cos^{-1}\left(\frac{7}{18}\right)$

(3) $\cos^{-1}\left(\frac{1}{18}\right)$ (4) $\frac{\pi}{3}$

Q80. An integer is chosen at random from the integers $1, 2, 3, \ldots\ldots, 50$. The probability that the chosen integer is a multiple of atleast one of $4, 6$ and 7 is

(1) $\frac{8}{25}$ (2) $\frac{21}{50}$

(3) $\frac{9}{50}$ (4) $\frac{14}{25}$

Q81. Let the set $C=\{(x,y)\mid x^2-2^y=2023, x,y\in\mathbb{N}\}$. Then $\sum_{(x,y)\in C}\left(x+y\right)$ is equal to _____.

Q82. Let α,β be the roots of the equation $x^2-\sqrt{6}x+3=0$ such that Im $(\alpha)>$Im (β). Let $a,\ b$ be integers not divisible by 3 and n be a natural number such that $\frac{\alpha^{99}}{\beta}+\alpha^{98}=3^n\left(a+ib\right),\ i=\sqrt{-1}$. Then $n+a+b$ is equal to _____.

Q83. Remainder when $64^{32^{32}}$ is divided by 9 is equal to _____.

Q84. Let $P(\alpha,\beta)$ be a point on the parabola $y^2=4x$. If P also lies on the chord of the parabola $x^2=8y$ whose mid point is $\left(1,\frac{5}{4}\right)$, then $(\alpha-28)(\beta-8)$ is equal to _____.

Q85. Let the slope of the line $45x+5y+3=0$ be $27r_1+\frac{9r_2}{2}$ for some $r_1,\ r_2\in R$. Then $\lim\limits_{x\to3}\left(\int_3^x\frac{8t^2}{\frac{3r_2x}{2}-r_2x^2-r_1x^3-3x}dt\right)$ is equal to _____.

Q86. Let for any three distinct consecutive terms $a,\ b,\ c$ of an A.P, the lines $ax+by+c=0$ be concurrent at the point P and $Q(\alpha,\beta)$ be a point such that the system of equations $x+y+z=6,\ 2x+5y+\alpha z=\beta$ and $x+2\,y+3\,z=4$, has infinitely many solutions. Then $(PQ)^2$ is equal to _____.

Q87. Let $f(x)=\sqrt{\lim\limits_{r\to x}\left\{\frac{2r^2[(f(r))^2-f(x)f(r)]}{r^2-x^2}-r^3e^{\frac{f(r)}{r}}\right\}}$ be differentiable in $(-\infty,0)\cup(0,\infty)$ and $f(1)=1$. Then the value of ae, such that $f(a)=0$, is equal to _____.

Q88. If $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}}\sqrt{1-\sin 2x}dx=\alpha+\beta\sqrt{2}+\gamma\sqrt{3}$, where α,β and γ are rational numbers, then $3\alpha+4\beta-\gamma$ is equal to _____.

Q89. Let the area of the region $\{(x,y):0\le x\le 3,0\le y\le \min\{x^2+2,2x+2\}\}$ be A. Then $12A$ is equal to _____.

Q90. Let O be the origin, and M and N be the points on the lines $\frac{x-5}{4}=\frac{y-4}{1}=\frac{z-5}{3}$ and $\frac{x+8}{12}=\frac{y+2}{5}=\frac{z+11}{9}$ respectively such that MN is the shortest distance between the given lines. Then $\overrightarrow{OM}\cdot\overrightarrow{ON}$ is equal to _____.

ANSWER KEYS

1. (3)	**2.** (2)	**3.** (2)	**4.** (1)	**5.** (2)	**6.** (1)	**7.** (4)	**8.** (1)
9. (1)	**10.** (3)	**11.** (3)	**12.** (1)	**13.** (2)	**14.** (3)	**15.** (1)	**16.** (3)
17. (1)	**18.** (4)	**19.** (3)	**20.** (2)	**21.** (8)	**22.** (60)	**23.** (16)	**24.** (2)
25. (30)	**26.** (32)	**27.** (3)	**28.** (36)	**29.** (2)	**30.** (121)	**31.** (3)	**32.** (3)
33. (4)	**34.** (4)	**35.** (1)	**36.** (4)	**37.** (2)	**38.** (3)	**39.** (3)	**40.** (3)
41. (1)	**42.** (2)	**43.** (4)	**44.** (4)	**45.** (4)	**46.** (2)	**47.** (3)	**48.** (3)
49. (4)	**50.** (4)	**51.** (3)	**52.** (22)	**53.** (4)	**54.** (56)	**55.** (417)	**56.** (4)
57. (815)	**58.** (2)	**59.** (63)	**60.** (1)	**61.** (1)	**62.** (4)	**63.** (1)	**64.** (4)
65. (3)	**66.** (4)	**67.** (4)	**68.** (3)	**69.** (1)	**70.** (1)	**71.** (4)	**72.** (4)
73. (3)	**74.** (2)	**75.** (4)	**76.** (1)	**77.** (4)	**78.** (2)	**79.** (4)	**80.** (2)
81. (46)	**82.** (49)	**83.** (1)	**84.** (192)	**85.** (12)	**86.** (113)	**87.** (2)	**88.** (6)
89. (164)	**90.** (9)						