Q1. If two vectors $\vec{A}$ and $\vec{B}$ having equal magnitude R are inclined at an angle θ, then

(1) $\vec{A}-\vec{B}=\sqrt{2}R\sin\frac{\theta}{2}$ (2) $\vec{A}+\vec{B}=2R\sin\frac{\theta}{2}$

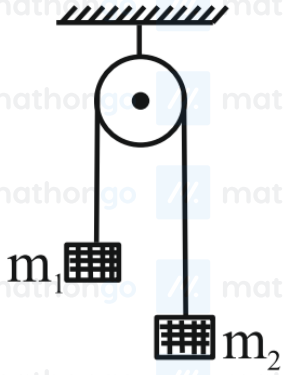
(3) $\vec{A}+\vec{B}=2R\cos\frac{\theta}{2}$ (4) $\vec{A}-\vec{B}=2R\cos\frac{\theta}{2}$

Q2. Consider two physical quantities A and B related to each other as $E=\frac{B-x^2}{At}$ where E, x and t have dimensions of energy, length and time respectively. The dimension of AB is

(1) $L^{-2}M^{1}T^{0}$ (2) $L^{2}M^{-1}T^{1}$

(3) $L^{-2}M^{-1}T^{1}$ (4) $L^{0}M^{-1}T^{1}$

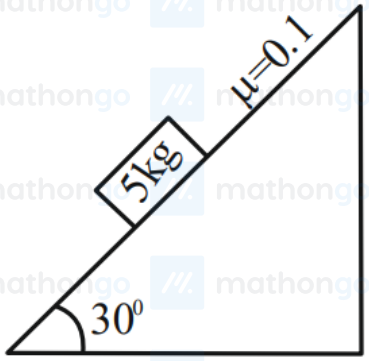
Q3. A light string passing over a smooth light fixed pulley connects two blocks of masses m_1 and m_2. If the acceleration of the system is $\frac{g}{8}$, then the ratio of masses is



(1) $\frac{9}{7}$ (2) $\frac{8}{1}$

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

Q4. A block of mass 5 kg is placed on a rough inclined surface as shown in the figure. If $\vec{F}_1$ is the force required to just move the block up the inclined plane and $\vec{F}_2$ is the force required to just prevent the block from sliding down, then the value of $\vec{F}_1-\vec{F}_2$ is: [Use $g=10$ m s^{-2}]



(1) $25\sqrt{3}$ N (2) $5\sqrt{3}$ N

(3) $\frac{5\sqrt{3}}{2}$ N (4) 10 N

Q5. A body of mass 2 kg begins to move under the action of a time dependent force given by $\vec{F}=6t\ \hat{i}+6t^2\ \hat{j}$ N. The power developed by the force at the time t is given by:

(1) $6t^4+9t^5$ W (2) $3t^3+6t^5$ W

(3) $9t^5+6t^3$ W (4) $9t^3+6t^5$ W

Q6. The mass of the moon is $\frac{1}{144}$ times the mass of a planet and its diameter $\frac{1}{16}$ times the diameter of a planet. If the escape velocity on the planet is v, the escape velocity on the moon will be:

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

(3) $\frac{v}{12}$ (4) $\frac{v}{6}$

Q7. A small spherical ball of radius r, falling through a viscous medium of negligible density has terminal velocity v. Another ball of the same mass but of radius $2r$, falling through the same viscous medium will have terminal velocity:

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

(3) $4v$ (4) $2v$

Q8. A gas mixture consists of 8 moles of argon and 6 moles of oxygen at temperature T. Neglecting all vibrational modes, the total internal energy of the system is

(1) 29 RT (2) 20 RT

(3) 27 RT (4) 21 RT

Q9. The speed of sound in oxygen at S.T.P. will be approximately:

(Given, $R = 8.3$ J K^{-1}, $\gamma = 1.4$)

(1) 310 m s^{-1} (2) 333 m s^{-1}

(3) 341 m s^{-1} (4) 325 m s^{-1}

Q10. Force between two point charges q_1 and q_2 placed in vacuum at r cm apart is F. Force between them when placed in a medium having dielectric $K = 5$ at $\frac{r}{5}$ cm apart will be:

(1) $\frac{F}{25}$ (2) $5F$

(3) $\frac{F}{5}$ (4) $25F$

Q11. By what percentage will the illumination of the lamp decrease if the current drops by 20%?

(1) 46% (2) 26%

(3) 36% (4) 56%

Q12. The resistance per centimeter of a meter bridge wire is r, with X Ω resistance in left gap. Balancing length from left end is at 40 cm with 25 Ω resistance in right gap. Now the wire is replaced by another wire of $2r$ resistance per centimeter. The new balancing length for same settings will be at

(1) 20 cm (2) 10 cm

(3) 80 cm (4) 40 cm

Q13. A uniform magnetic field of 2×10^{-3} T acts along positive Y-direction. A rectangular loop of sides 20 cm and 10 cm with current of 5 A is in Y-Z plane. The current is in anticlockwise sense with reference to negative X axis. Magnitude and direction of the torque is :

(1) 2×10^{-4} N m along positive Z –direction (2) 2×10^{-4} N m along negative Z-direction

(3) 2×10^{-4} N m along positive X-direction (4) 2×10^{-4} N m along positive Y-direction

Q14. An AC voltage $V = 20\sin 200\pi t$ is applied to a series LCR circuit which drives a current $I = 10\sin 200\pi t + \frac{\pi}{3}$. The average power dissipated is:

(1) 21.6 W (2) 200 W
(3) 173.2 W (4) 50 W

Q15. Given below are two statements:

Statement I: Electromagnetic waves carry energy as they travel through space and this energy is equally shared by the electric and magnetic fields.

Statement II: When electromagnetic waves strike a surface, a pressure is exerted on the surface.

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

Q16. When unpolarized light is incident at an angle of 60° on a transparent medium from air. The reflected ray is completely polarized. The angle of refraction in the medium is

(1) 30° (2) 60°
(3) 90° (4) 45°

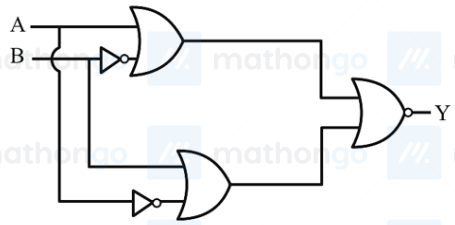
Q17. In a photoelectric effect experiment a light of frequency 1.5 times the threshold frequency is made to fall on the surface of photosensitive material. Now if the frequency is halved and intensity is doubled, the number of photo electrons emitted will be:

(1) Doubled (2) Quadrupled
(3) Zero (4) Halved

Q18. The mass number of nucleus having radius equal to half of the radius of nucleus with mass number 192 is:

(1) 24 (2) 32
(3) 40 (4) 20

Q19. The output of the given circuit diagram is



(1)

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

(2)

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

(3)

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

(4)

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

Q20. The measured value of the length of a simple pendulum is 20 cm with 2 mm accuracy. The time for 50 oscillations was measured to be 40 seconds with 1 second resolution. From these measurements, the accuracy in the measurement of acceleration due to gravity is $N\%$. The value of N is:

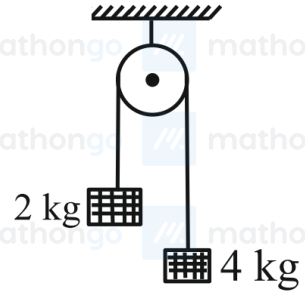
(1) 4 (2) 8

(3) 6 (4) 5

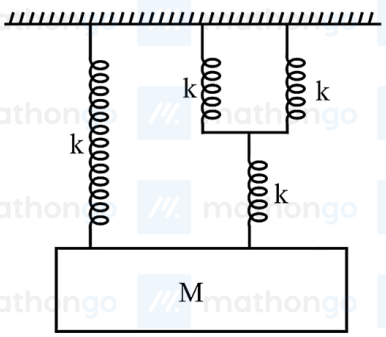
Q21. Two identical spheres each of mass 2 kg and radius 50 cm are fixed at the ends of a light rod so that the separation between the centers is 150 cm. Then, moment of inertia of the system about an axis perpendicular to the rod and passing through its middle point is $\frac{x}{20}$ kg m^2, where the value of x is

Q22. A body of mass m is projected with a speed u making an angle of 45^o with the ground. The angular momentum of the body about the point of projection, at the highest point is expressed as $\frac{\sqrt{2}mu^3}{Xg}$. The value of X is_____.

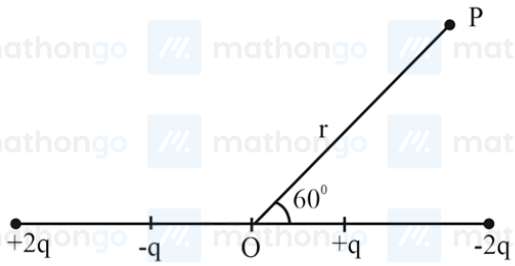
Q23. Two blocks of mass 2 kg and 4 kg are connected by a metal wire going over a smooth pulley as shown in figure. The radius of wire is 4.0×10^{-5} m and Young's modulus of the metal is 2.0×10^{11} N m^{-2}. The longitudinal strain developed in the wire is $\frac{1}{\alpha\pi}$. The value of α is _____. [Use $g = 10$ m s^{-2})



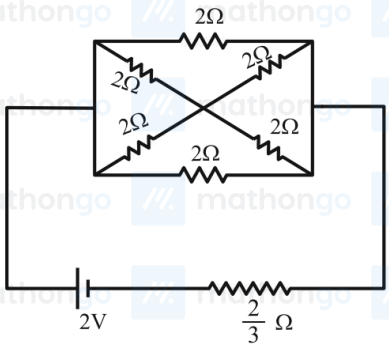
Q24. The time period of simple harmonic motion of mass M in the given figure is $\pi\sqrt{\frac{\alpha M}{5K}}$, where the value of α is _____.



Q25. The distance between charges $+q$ and $-q$ is $2l$ and between $+2q$ and $-2q$ is $4l$. The electrostatic potential at point P at a distance r from centre O is $-\alpha\frac{ql}{r^2}\times 10^9$ V, where the value of α is _____. (Use $\frac{1}{4\pi\varepsilon_0}=9\times 10^9$ N m^2 C^{-2})



Q26. In the following circuit, the battery has an emf of 2 V and an internal resistance of $\frac{2}{3}$ Ω. The power consumption in the entire circuit is _____ W.



Q27. Two circular coils P and Q of 100 turns each have same radius of π cm. The currents in P and R are 1 A and 2 A respectively. P and Q are placed with their planes mutually perpendicular with their centers coincide. The resultant magnetic field induction at the center of the coils is $\sqrt{x}$ mT, where $x=$ _____. [Use $\mu_0=4\pi\times 10^{-7}$ T m A^{-1}]

Q28. The magnetic flux ϕ (in weber) linked with a closed circuit of resistance 8 Ω varies with time (in seconds) as $\phi=5t^2-36t+1$. The induced current in the circuit at $t=2$ s is _____ A.

Q29. Light from a point source in air falls on a convex curved surface of radius 20 cm and refractive index 1.5. If the source is located at 100 cm from the convex surface, the image will be formed at _____ cm from the object.

Q30. A nucleus has mass number A_1 and volume V_1. Another nucleus has mass number A_2 and volume V_2. If relation between mass number is $A_2 = 4A_1$, then $\frac{V_2}{V_1} =$ _____.

Q31. A sample of $CaCO_3$ and $MgCO_3$ weighed 2 .21 g is ignited to constant weight of 1 .152 g. The composition of the mixture is:
(Given molar mass in g mol^{-1}, $CaCO_3$: 100, $MgCO_3$: 84)
(1) 1 .187 g $CaCO_3 + 1$ .023 g $MgCO_3$ (2) 1 .023 g $CaCO_3 + 1$ .023 g $MgCO_3$
(3) 1 .187 g $CaCO_3 + 1$ .187 g $MgCO_3$ (4) 1 .023 g $CaCO_3 + 1$ .187 g $MgCO_3$

Q32. The four quantum numbers for the electron in the outer most orbital of potassium (atomic no. 19) are
(1) $n = 4, l = 2, m = -1, s = +\frac{1}{2}$ (2) $n = 4, l = 0, m = 0, s = +\frac{1}{2}$
(3) $n = 3, l = 0, m = -1, s = +\frac{1}{2}$ (4) $n = 2, l = 0, m = 0, s = +\frac{1}{2}$

Q33. Consider the following elements.

Group ↓ A'B' → Period
C'D'

Which of the following is/are true about A', B', C' and D' ?
A. Order of atomic radii: $B' < A' < D' < C'$
B. Order of metallic character : $B' < A' < D' < C'$
C. Size of the element : $D' < C' < B' < A'$
D. Order of ionic radii : $B'^{+} < A'^{+} < D'^{+} < C'^{+}$
Choose the correct answer from the options given below:
(1) A only (2) A, B and D only
(3) A and B only (4) B, C and D only

Q34. Which of the following is least ionic?
(1) $BaCl_2$ (2) AgCl
(3) KCl (4) $CoCl_2$

Q35. $A_g \rightleftharpoons B_g + \frac{C}{2^g}$. The correct relationship between K_P, α and equilibrium pressure P is
(1) $K_P = \frac{\alpha^{\frac{1}{2}} P^{\frac{1}{2}}}{2 + \alpha^{\frac{1}{2}}}$ (2) $K_P = \frac{\alpha^{\frac{3}{2}} P^{\frac{1}{2}}}{2 + \alpha^{\frac{1}{2}} 1 - \alpha}$
(3) $K_P = \frac{\alpha^{\frac{1}{2}} P^{\frac{1}{2}}}{2 + \alpha^{\frac{3}{2}}}$ (4) $K_P = \frac{\alpha^{\frac{1}{2}} P^{\frac{1}{2}}}{2 + \alpha^{\frac{3}{2}}}$

Q36. Given below are two statements :
Statement I: S_8 solid undergoes disproportionation reaction under alkaline conditions to form S^{2-} and $S_2O_3^{2-}$
Statement II: ClO_4^- can undergo disproportionation reaction under acidic condition.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Statement I is correct but statement II is incorrect. (2) Statement I is incorrect but statement II is correct
(3) Both statement I and statement II are incorrect (4) Both statement I and statement II are correct

Q37. Given below are two statements :

Statement I: Group 13 trivalent halides get easily hydrolysed by water due to their covalent nature.

Statement II: $AlCl_3$ upon hydrolysis in acidified aqueous solution forms octahedral $AlH_2O_6^{3+}$ ion.

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

(1) Statement I is true but statement II is false

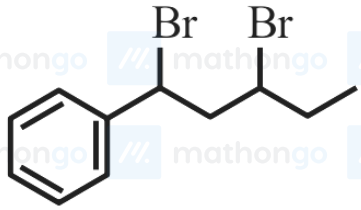
(2) Statement I is false but statement II is true

(3) Both statement I and statement II are false

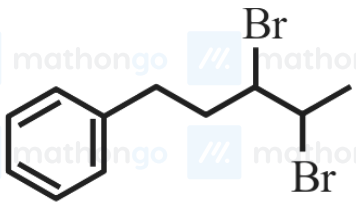
(4) Both statement I and statement II are true

Q38. Identify structure of 2, 3-dibromo-1-phenylpentane.

(1)



(2)



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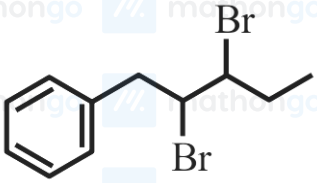

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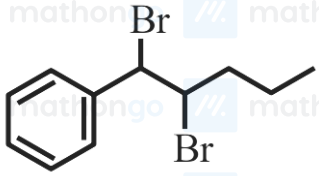


Q39. The fragrance of flowers is due to the presence of some steam volatile organic compounds called essential oils. These are generally insoluble in water at room temperature but are miscible with water vapour in the vapour phase. A suitable method for the extraction of these oils from the flowers is:

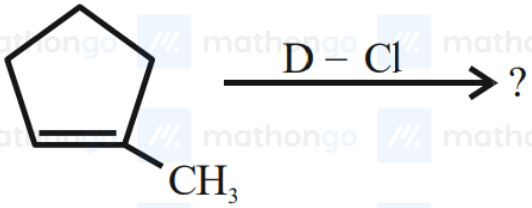
(1) crystallisation

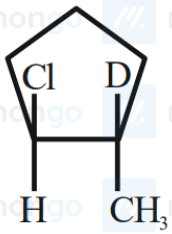
(2) distillation under reduced pressure

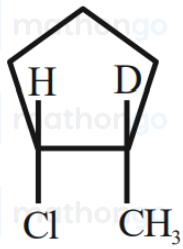
(3) distillation

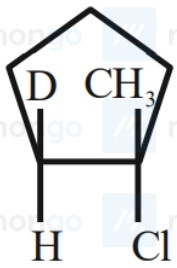
(4) steam distillation

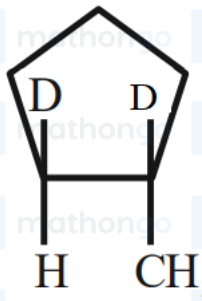
Q40. Major product of the following reaction is:



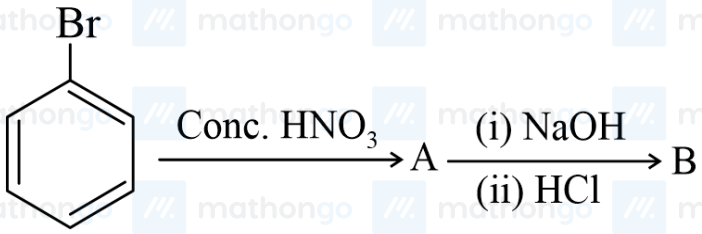
(1) 

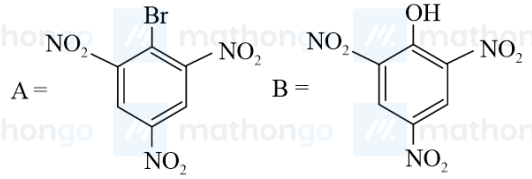
(2) 

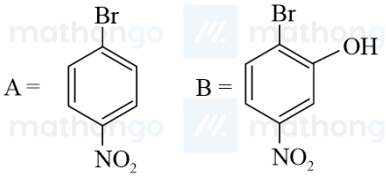
(3) 

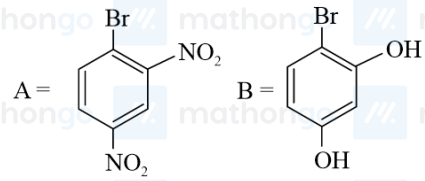
(4) 

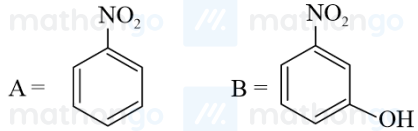
Q41. Identify *A* and *B* in the following reaction sequence.



(1) 

(2) 

(3) 

(4) 

Q42. Choose the correct statements from the following

A. All group 16 elements form oxides of general formula EO_2 and EO_3 where $E = S,\ \ Se,\ \ Te$ and Po. Both the types of oxides are acidic in nature.

B. TeO_2 is an oxidising agent while SO_2 is reducing in nature.

C. The reducing property decreases from H_2S to H_2Te down the group.

D. The ozone molecule contains five lone pairs of electrons.

Choose the correct answer from the options given below:

(1) A and D only

(2) B and C only

(3) C and D only

(4) A and B only

Q43. Choose the correct statements from the following

A. Mn_2O_7 is an oil at room temperature B. V_2O_4 reacts with acid to give VO_2^{2+}

C. CrO is a basic oxide D. V_2O_5 does not react with acid

Choose the correct answer from the options given below:

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

(3) A, B and C only (4) B and C only

Q44. Select the option with correct property:

(1) $NiCO_4$ and $NiCl_4^{2-}$ both diamagnetic (2) $NiCO_4$ and $NiCl_4^{2-}$ both paramagnetic

(3) $NiCl_4^{2-}$ diamagnetic, $NiCO_4$ paramagnetic (4) $NiCO_4$ diamagnetic, $NiCl_4^{2-}$ paramagnetic

Q45. Match List I with List II

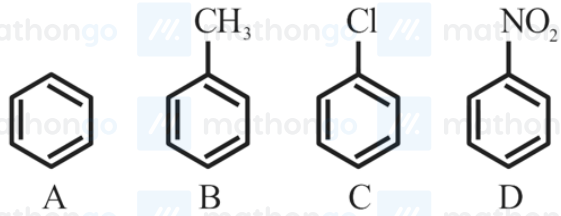
	LIST – I (Complex ion)		LIST – II (Electronic Configuration
A.	$CrH_2O_6^{3+}$	I.	$t_{2g}^2e_g^0$
B.	$FeH_2O_6^{3+}$	II.	$t_{2g}^3e_g^0$
C.	$NiH_2O_6^{2+}$	III.	$t_{2g}^3e_g^2$
D.	$VH_2O_6^{3+}$	IV.	$t_{2g}^6e_g^2$

Choose the correct answer from the options given below :

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

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

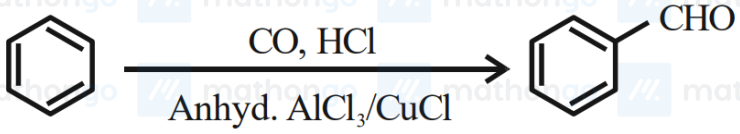
Q46. The correct order of reactivity in electrophilic substitution reaction of the following compounds is:



(1) B > C > A > D (2) D > C > B > A

(3) A > B > C > D (4) B > A > C > D

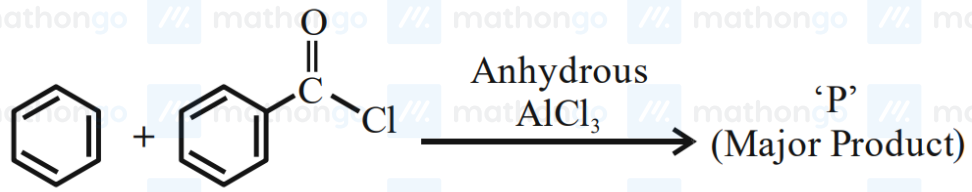
Q47. Identify the name reaction.

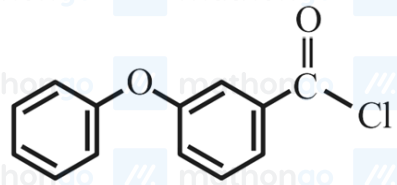


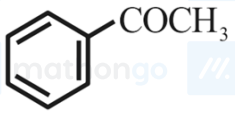
(1) Stephen reaction (2) Etard reaction

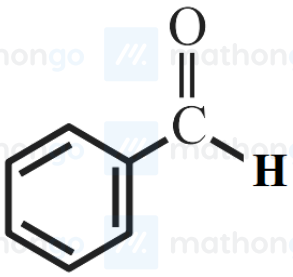
(3) Gatterman-koch reaction (4) Rosenmund reduction

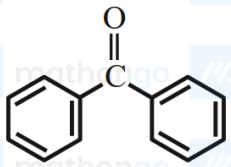
Q48. Identify major product '*P*' formed in the following reaction.



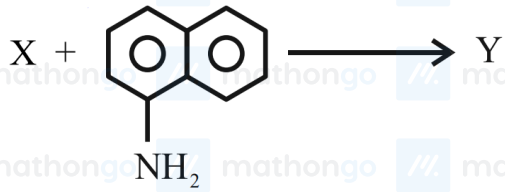
(1) 

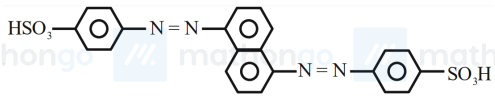
(2) 

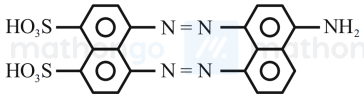
(3) 

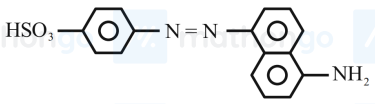
(4) 

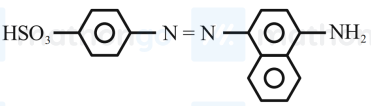
Q49. The azo-dye *Y* formed in the following reactions is Sulphanilic acid $+ \quad NaNO_2 + CH_3COOH \rightarrow X$



(1) 

(2) 

(3) 

(4) 

Q50. Given below are two statements :

Statement I: Aniline reacts with con. H_2SO_4 followed by heating at $453 - 473$ K gives p-aminobenzene sulphonic acid, which gives blood red colour in the 'Lassaigne's test'.

Statement II: In Friedel - Craft's alkylation and acylation reactions, aniline forms salt with the $AlCl_3$ catalyst. Due to this, nitrogen of aniline acquires a positive charge and acts as deactivating group.

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

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

Q51. The molarity of 1L orthophosphoric acid H_3PO_4 having 70% purity by weight (specific gravity 1 .54 g cm^{-3}) is _____ M. (Molar mass of $H_3PO_4 = 98$ g mol^{-1})

Q52. A diatomic molecule has a dipole moment of 1 .2 D. If the bond distance is $1\overset{o}{A}$, then fractional charge on each atom is _____ $\times 10^{-1}$ esu. (Given $1D = 10^{-18}$ esu cm)

Q53. If 5 moles of an ideal gas expands from 10L to a volume of 100L at 300K under isothermal and reversible condition then work, w, is $-x$ J. The value of x is - _____.
(Given R = 8 .314 J K^{-1} mol^{-1})

Q54. Number of isomeric products formed by monochlorination of 2-methylbutane in presence of sunlight is _____.

Q55. The values of conductivity of some materials at 298 .15 K in Sm^{-1} are
2.1×10^{3}, 1.0×10^{-16}, $1.2 \times 10, 3.91$, 1.5×10^{-2}, 1×10^{-7}, 1.0×10^{3}. The number of conductors among the materials is _____.

Q56. r = kA for a reaction, 50% of A is decomposed in 120 minutes. The time taken for 90% decomposition of A is _____ minutes.

Q57. Number of moles of H^{+} ions required by 1 mole of MnO_4^{-} to oxidise oxalate ion to CO_2 is _____.

Q58. In the reaction of potassium dichromate, potassium chloride and sulfuric acid (conc.), the oxidation state of the chromium in the product is + _____.

Q59. A compound x with molar mass $108g$ mol^{-1} undergoes acetylation to give product with molar mass $192g$ mol^{-1}. The number of amino groups in the compound x is _____.

Q60. From the vitamins $A, B_1, B_6, B_{12}, C, D, E$ and K, the number vitamins that can be stored in our body is _____.

Q61. The number of solutions, of the equation $e^{\sin x} - 2e^{-\sin x} = 2$ is
(1) 2 (2) more than 2
(3) 1 (4) 0

Q62. Let z_1 and z_2 be two complex number such that $z_1 + z_2 = 5$ and $z_1^3 + z_2^3 = 20 + 15i$. Then $z_1^4 + z_2^4$ equals-
(1) $30\sqrt{3}$ (2) 75
(3) $15\sqrt{15}$ (4) $25\sqrt{3}$

Q63. The number of ways in which 21 identical apples can be distributed among three children such that each child gets at least 2 apples, is
(1) 406 (2) 130
(3) 142 (4) 136

Q64. Let 2^{nd}, 8^{th} and 44^{th}, terms of a non-constant $A.P.$ be respectively the 1^{st}, 2^{nd} and 3^{rd} terms of $G.P.$ If the first term of A.P. is 1 then the sum of first 20 terms is equal to-
(1) 980 (2) 960
(3) 990 (4) 970

Q65. If for some m, n; ${}^{6}C_m + 2{}^{6}C_{m+1} + {}^{6}C_{m+2} > {}^{8}C_3$ and ${}^{n-1}P_3 : {}^{n}P_4 = 1:8$, then ${}^{n}P_{m+1} + {}^{n+1}C_m$ is equal to
(1) 380 (2) 376
(3) 384 (4) 372

Q66. Let $A(a, b)$, $B(3, 4)$ and $(-6, -8)$ respectively denote the centroid, circumcentre and orthocentre of a triangle. Then, the distance of the point $P(2a + 3, 7b + 5)$ from the line $2x + 3y - 4 = 0$ measured parallel to the line $x - 2y - 1 = 0$ is

(1) $\frac{15\sqrt{5}}{7}$ (2) $\frac{17\sqrt{5}}{6}$

(3) $\frac{17\sqrt{5}}{7}$ (4) $\frac{\sqrt{5}}{17}$

Q67. Let a variable line passing through the centre of the circle $x^2 + y^2 - 16x - 4y = 0$, meet the positive co-ordinate axes at the point A and B. Then the minimum value of $OA + OB$, where O is the origin, is equal to

(1) 12 (2) 18

(3) 20 (4) 24

Q68. Let P be a parabola with vertex $(2, 3)$ and directrix $2x + y = 6$. Let an ellipse $E: \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $(a > b)$ of eccentricity $\frac{1}{\sqrt{2}}$ pass through the focus of the parabola P. Then the square of the length of the latus rectum of E, is

(1) $\frac{385}{8}$ (2) $\frac{347}{8}$

(3) $\frac{512}{25}$ (4) $\frac{656}{25}$

Q69. Let $f: \rightarrow R \rightarrow (0, \infty)$ be strictly increasing function such that $\lim_{x \to \infty} \frac{f(7x)}{f(x)} = 1$. Then, the value of $\lim_{x \to \infty} \frac{f(5x)}{f(x)} - 1$ is equal to

(1) 4 (2) 0

(3) $\frac{7}{5}$ (4) 1

Q70. Let the mean and the variance of 6 observation a, b, 68, 44, 48, 60 be 55 and 194, respectively if $a > b$, then $a + 3b$ is

(1) 200 (2) 190

(3) 180 (4) 210

Q71. Let A be a 3×3 real matrix such that $A\begin{pmatrix}1\\0\\1\end{pmatrix} = 2\begin{pmatrix}1\\0\\1\end{pmatrix}$, $A\begin{pmatrix}-1\\0\\1\end{pmatrix} = 4\begin{pmatrix}-1\\0\\1\end{pmatrix}$, $A\begin{pmatrix}0\\1\\0\end{pmatrix} = 2\begin{pmatrix}0\\1\\0\end{pmatrix}$. Then, the system $(A - 3I)\begin{pmatrix}x\\y\\z\end{pmatrix} = \begin{pmatrix}1\\2\\3\end{pmatrix}$ has

(1) unique solution (2) exactly two solutions

(3) no solution (4) infinitely many solutions

Q72. If $a = \sin^{-1}(\sin 5)$ and $b = \cos^{-1}(\cos 5)$, then $a^2 + b^2$ is equal to

(1) $4\pi^2 + 25$ (2) $8\pi^2 - 40\pi + 50$

(3) $4\pi^2 - 20\pi + 50$ (4) 25

Q73. If the function $f: (-\infty, -1) \rightarrow (a, b)$ defined by $f(x) = e^{x^3 - 3x + 1}$ is one-one and onto, then the distance of the point $P(2b + 4, a + 2)$ from the line $x + e^{-3}y = 4$ is:

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

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

Q74. Consider the function $f: 0, \infty \to R$ defined by $fx = e^{-\log_e x}$. If m and n be respectively the number of points at which f is not continuous and f is not differentiable, then $m + n$ is

(1) 0 (2) 3
(3) 1 (4) 2

Q75. Let $f, g: 0, \quad \infty \to R$ be two functions defined by $fx = \int_{-x}^{x} t - t^2 e^{-t^2} dt$ and $gx = \int_0^{x^2} t^{\frac{1}{2}} e^{-t^2} dt$. Then the value of $9f\sqrt{\log_e 9} + g\sqrt{\log_e 9}$ is equal to

(1) 6 (2) 9
(3) 8 (4) 10

Q76. The area of the region enclosed by the parabola $y = 4x - x^2$ and $3y = x - 4^2$ is equal to

(1) $\frac{32}{9}$ (2) 4
(3) 6 (4) $\frac{14}{3}$

Q77. The temperature Tt of a body at time $t = 0$ is $160^\circ \quad F$ and it decreases continuously as per the differential equation $\frac{dT}{dt} = -KT - 80$, where K is positive constant. If $T15 = 120^\circ \quad F$, then $T45$ is equal to

(1) $85^\circ \quad F$ (2) $95^\circ \quad F$
(3) $90^\circ \quad F$ (4) $80^\circ \quad F$

Q78. Let α, β, γ be mirror image of the point $2, 3, 5$ in the line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$. Then $2\alpha + 3\beta + 4\gamma$ is equal to

(1) 32 (2) 33
(3) 31 (4) 34

Q79. The shortest distance between lines L_1 and L_2, where $L_1: \frac{x-1}{2} = \frac{y+1}{-3} = \frac{z+4}{2}$ and L_2 is the line passing through the points $A-4, 4, 3, \quad B-1, 6, 3$ and perpendicular to the line $\frac{x-3}{-2} = \frac{y}{3} = \frac{z-1}{1}$, is

(1) $\frac{121}{\sqrt{221}}$ (2) $\frac{24}{\sqrt{117}}$
(3) $\frac{141}{\sqrt{221}}$ (4) $\frac{42}{\sqrt{117}}$

Q80. A coin is biased so that a head is twice as likely to occur as a tail. If the coin is tossed 3 times, then the probability of getting two tails and one head is-

(1) $\frac{2}{9}$ (2) $\frac{1}{9}$
(3) $\frac{2}{27}$ (4) $\frac{1}{27}$

Q81. Let a, b, c be the length of three sides of a triangle satisfying the condition $a^2 + b^2x^2 - 2ba + c$ $x + b^2 + c^2 = 0$. If the set of all possible values of x is in the interval $\alpha, \beta,$ then $12\alpha^2 + \beta^2$ is equal to _____.

Q82. Let the coefficient of x^r in the expansion of $x + 3^{n-1} + x + 3^{n-2}x + 2 + x + 3^{n-3}x + 2^2 + \ldots + x + 2^{n-1}$ be α_r. If $\sum_{r=0}^{n} \alpha_r = \beta^n - \gamma^n, \beta, \gamma \in N$, then the value of $\beta^2 + \gamma^2$ equals _____.

Q83. Let $A-2, -1, \quad B1, 0, \quad C\alpha, \beta$ and $D\gamma, \delta$ be the vertices of a parallelogram $ABCD$. If the point C lies on $2x - y = 5$ and the point D lies on $3x - 2y = 6$, then the value of $\alpha + \beta + \gamma + \delta$ is equal to _____.

Q84. If $\lim_{x \to 0} \frac{ax^2e^x - b\log_e 1 + x + cxe^{-x}}{x^2 \sin x} = 1$, then $16a^2 + b^2 + c^2$ is equal to _____.

Q85. Let $A = 1, 2, 3, \ldots 100$. Let R be a relation on A defined by $x, \quad y \in R$ if and only if $2x = 3y$. Let R_1 be a symmetric relation on A such that $R \subset R_1$ and the number of elements in R_1 is n. Then the minimum value of n is _____.

Q86. Let A be a 3×3 matrix and $\det A = 2$. If $n = \det \underbrace{adj adj \ldots adj}_{2024 - \text{times}} A$, then the remainder when n is divided by 9 is equal to _____.

Q87. $\frac{120}{\pi^3} \int_0^{\pi} \frac{x^2 \sin x \cos x}{\sin^4 x + \cos^4 x} dx$ is equal to _____.

Q88. Let $y = yx$ be the solution of the differential equation $\sec^2 x dx + e^{2y} \tan^2 x + \tan x dy = 0, \ 0 < x < \frac{\pi}{2}, y\frac{\pi}{4} = 0$. If $y\frac{\pi}{6} = \alpha$, then $e^{8\alpha}$ is equal to _____.

Q89. Let $\vec{a} = 3\hat{i} + 2\hat{j} + \hat{k}, \vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{c}$ be a vector such that $\vec{a} + \vec{b} \times \vec{c} = 2\vec{a} \times \vec{b} + 24\hat{j} - 6\hat{k}$ and $\vec{a} - \vec{b} + \hat{i} \cdot \vec{c} = -3$. Then $\vec{c}^2$ is equal to _____.

Q90. A line passes through $A4, -6, -2$ and $B16, -2, 4$. The point Pa, b, c where a, b, c are non-negative integers, on the line AB lies at a distance of 21 units, from the point A. The distance between the points Pa, b, c and $Q4, -12, 3$ is equal to _____.

ANSWER KEYS

1. (3)	**2.** (2)	**3.** (1)	**4.** (2)	**5.** (4)	**6.** (1)	**7.** (1)	**8.** (3)
9. (1)	**10.** (2)	**11.** (3)	**12.** (4)	**13.** (2)	**14.** (4)	**15.** (2)	**16.** (1)
17. (3)	**18.** (1)	**19.** (3)	**20.** (3)	**21.** (53)	**22.** (8)	**23.** (12)	**24.** (12)
25. (27)	**26.** (3)	**27.** (20)	**28.** (2)	**29.** (200)	**30.** (4)	**31.** (1)	**32.** (2)
33. (2)	**34.** (2)	**35.** (2)	**36.** (1)	**37.** (4)	**38.** (3)	**39.** (4)	**40.** (3)
41. (1)	**42.** (4)	**43.** (2)	**44.** (4)	**45.** (4)	**46.** (4)	**47.** (3)	**48.** (4)
49. (4)	**50.** (4)	**51.** (11)	**52.** (0)	**53.** (-28721)	**54.** (6)	**55.** (4)	**56.** (399)
57. (8)	**58.** (6)	**59.** (2)	**60.** (5)	**61.** (4)	**62.** (2)	**63.** (4)	**64.** (4)
65. (4)	**66.** (3)	**67.** (2)	**68.** (4)	**69.** (2)	**70.** (3)	**71.** (1)	**72.** (2)
73. (1)	**74.** (3)	**75.** (3)	**76.** (3)	**77.** (3)	**78.** (2)	**79.** (3)	**80.** (1)
81. (36)	**82.** (25)	**83.** (32)	**84.** (81)	**85.** (66)	**86.** (7)	**87.** (15)	**88.** (9)
89. (38)	**90.** (22)						