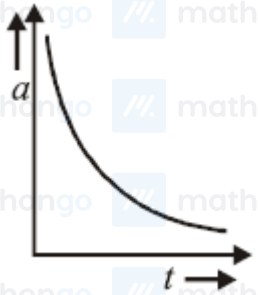
Q1. A student measured the diameter of a wire using a screw gauge with the least count 0.001 cm and listed the measurements. The measured value should be recorded as

(1) 5.3200 cm (2) 5.3 cm

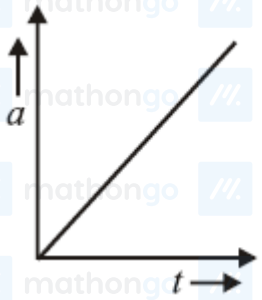
(3) 5.32 cm (4) 5.320 cm

Q2. The distance travelled by a body moving along a line in time t is proportional to t^3. The acceleration-time (a, t) graph for the motion of the body will be

(1)



(2)



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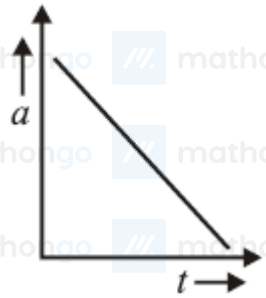

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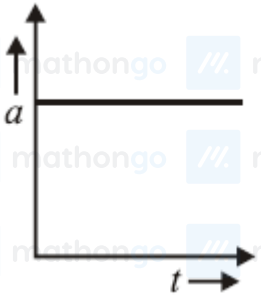
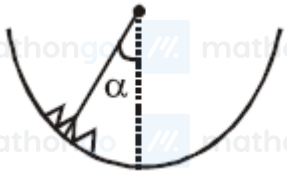


Q3. An insect crawls up a hemispherical surface very slowly. The coefficient of friction between the insect and the surface is $1/3$. If the line joining the centre of the hemispherical surface to the insect makes an angle α with the vertical, the maximum possible value of α so that the insect does not slip is given by



(1) $\cot\alpha = 3$ (2) $\sec\alpha = 3$

(3) $\operatorname{cosec}\alpha = 3$ (4) $\cos\alpha = 3$

Q4. A projectile moving vertically upwards with a velocity of 200 ms^{-1} breaks into two equal parts at a height of 490 m. One part starts moving vertically upwards with a velocity of 400 ms^{-1}. How much time it will take, after the break up with the other part to hit the ground?

(1) $2\sqrt{10}$ s (2) 5 s

(3) 10 s (4) $\sqrt{10}$ s

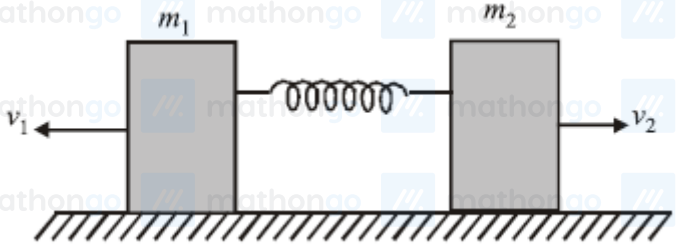
Q5. Two bodies A and B of mass m and $2m$ respectively are placed on a smooth floor. They are connected by a spring of negligible mass. A third body C of mass m is placed on the floor. The body C moves with a velocity v_0 along the line joining A and B and collides elastically with A. At a certain time after the collision it is found

that the instantaneous velocities of A and B are same and the compression of the spring is x_0. The spring constant k will be

(1) $m\frac{v_0^2}{x_0^2}$ (2) $m\frac{v_0}{2x_0}$

(3) $2m\frac{v_0}{x_0}$ (4) $\frac{2}{3}m\left(\frac{v_0}{x_0}\right)^2$

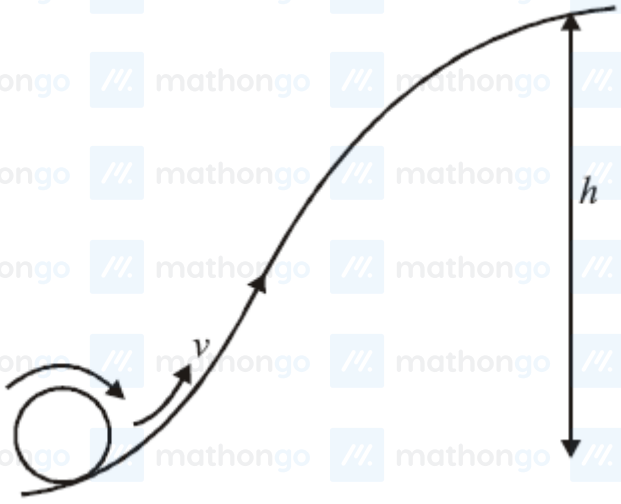
Q6. A spring is compressed between two blocks of masses m_1 and m_2 placed on a horizontal frictionless surface as shown in the figure. When the blocks are released, they have initial velocity of v_1 and v_2 as shown. The blocks travel distances x_1 and x_2 respectively before coming to rest. The ratio $\left(\frac{x_1}{x_2}\right)$ is



(1) $\frac{m_2}{m_1}$ (2) $\frac{m_1}{m_2}$

(3) $\sqrt{\frac{m_2}{m_1}}$ (4) $\sqrt{\frac{m_1}{m_2}}$

Q7. A solid sphere is rolling on a surface as shown in figure, with a translational velocity v m s^{-1}. If it is to climb the inclined surface continuing to roll without slipping, then minimum velocity for this to happen is



(1) $\sqrt{2gh}$ (2) $\sqrt{\frac{7}{5}gh}$

(3) $\sqrt{\frac{7}{2}gh}$ (4) $\sqrt{\frac{10}{7}gh}$

Q8. This question has Statement 1 and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements. Statement 1: When moment of inertia I of a body rotating about an axis with angular speed ω increases, its angular momentum L is unchanged but the kinetic energy K increases if there is no torque applied on it. Statement 2: $L = I\omega$, kinetic energy of rotation $= \frac{1}{2}I\omega^2$

(1) Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 1.
(2) Statement 1 is false, Statement 2 is true.
(3) Statement 1 is true, Statement 2 is true, Statement 2 is correct explanation of the Statement 1.
(4) Statement 1 is true, Statement 2 is false.

Q9. Assuming the earth to be a sphere of uniform density, the acceleration due to gravity inside the earth at a distance of r from the centre is proportional to

(1) r
(2) r^{-1}
(3) r^2
(4) r^{-2}

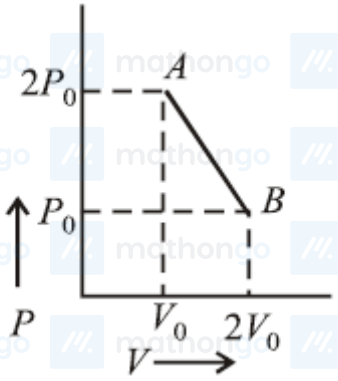
Q10. Water is flowing through a horizontal tube having cross-sectional areas of its two ends being A and A' such that the ratio A/A' is 5 . If the pressure difference of water between the two ends is 3×10^5 N m^{-2}, the velocity of water with which it enters the tube will be (neglect gravity effects)

(1) 5 m s^{-1}
(2) 10 m s^{-1}
(3) 25 m s^{-1}
(4) $50\sqrt{10}$ m s^{-1}

Q11. A given ideal gas with $\gamma = \frac{C_p}{C_v} = 1.5$ at a temperature T. If the gas is compressed adiabatically to one-fourth of its initial volume, the final temperature will be

(1) $2\sqrt{2}T$
(2) $4T$
(3) $2T$
(4) $8T$

Q12. n moles of an ideal gas undergo a process $A \rightarrow B$ as shown in the figure. Maximum temperature of the gas



during the process is

(1) $\frac{9P_0V_0}{nR}$
(2) $\frac{3P_0V_0}{2nR}$
(3) $\frac{9P_0V_0}{2nR}$
(4) $\frac{9P_0V_0}{4nR}$

Q13. This question has Statement 1 and Statement 2 . Of the four choices given after the Statements, choose the one that best describes the two Statements. Statement 1: Bats emitting ultrasonic waves can detect the location of a prey by hearing the waves reflected from it. Statement 2: When the source and the detector are moving, the frequency of reflected waves is changed.

(1) Statement 1 is false, Statement 2 is true.
(2) Statement 1 is true, Statement 2 is false.
(3) Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 1.
(4) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 1.

Q14. A wave represented by the equation $y_1 = a\cos(kx - \omega t)$ is superimposed with another wave to form a stationary wave such that the point $x - 0$ is node. The equation for the other wave is

(1) $a\cos(kx - \omega t + \pi)$ (2) $a\cos(kx + \omega t + \pi)$

(3) $a\cos\left(kx + \omega t + \frac{\pi}{2}\right)$ (4) $a\cos\left(kx - \omega t + \frac{\pi}{2}\right)$

Q15. A series combination of n_1 capacitors, each of capacity C_1 is charged by source of potential difference 4 V. When another parallel combination of n_2 capacitors each of capacity C_2 is charged by a source of potential difference V, it has the same total energy stored in it as the first combination has. The value of C_2 in terms of C_1 is then

(1) $16\frac{n_2}{n_1}C_1$ (2) $\frac{2C_1}{n_1 n_2}$

(3) $2\frac{n_2}{n_1}C_1$ (4) $\frac{16C_1}{n_1 n_2}$

Q16. Three resistors of 4Ω, 6Ω and 12Ω are connected in parallel and the combination is connected in series with a 1.5 V battery of 1Ω internal resistance. The rate of Joule heating in the 4Ω resistor is

(1) 0.55 W (2) 0.33 W

(3) 0.25 W (4) 0.86 W

Q17. It is preferable to measure the e.m.f. of a cell by potentiometer than by a voltmeter because of the following possible reasons. (i) In case of potentiometer, no current flows through the cell. (ii) The length of the potentiometer allows greater precision. (iii) Measurement by the potentiometer is quicker. (iv) The sensitivity of the galvanometer, when using a potentiometer is not relevant. Which of these reasons are correct?

(1) (i),(iii),(iv) (2) (i),(iii),(iv)

(3) (i),(ii) (4) (i),(ii),(iii),(iv)

Q18. In a sensitive meter bridge apparatus the bridge wire should possess

(1) high resistivity and low temperature coefficient. (2) low resistivity and high temperature coefficient.

(3) low resistivity and low temperature coefficient. (4) high resistivity and high temperature coefficient.

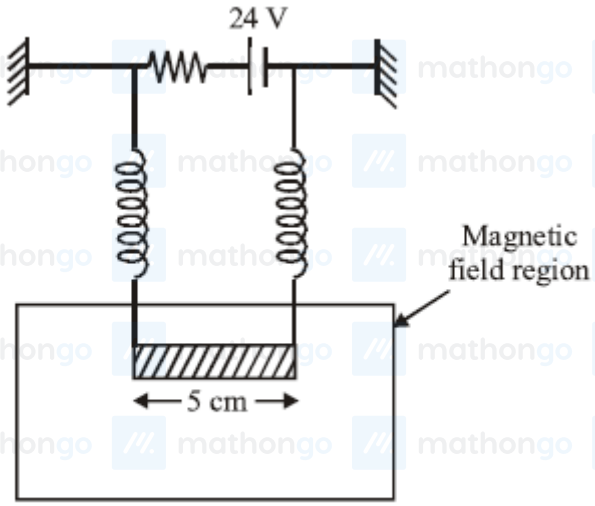
Q19. The magnetic force acting on charged particle of charge 2μC in magnetic field of $2T$ acting in $y-$ direction, when the particle velocity is $(2\hat{i} + 3\hat{j}) \times 10^6$ ms^{-1} is

(1) 8 N in z-direction (2) 8 N in y-direction

(3) 4 N in y-direction (4) 4 N in z-direction

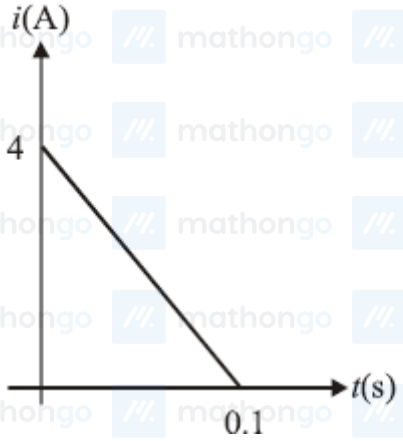
Q20. The circuit in figure consists of wires at the top and bottom and identical springs as the left and right sides. The wire at the bottom has a mass of 10 g and is 5 cm long. The wire is hanging as shown in the figure. The springs stretch 0.5 cm under the weight of the wire and the circuit has a total resistance of 12Ω. When the lower wire

is subjected to a static magnetic field, the springs, stretch an additional 0.3 cm. The magnetic field is



(1) 0.6 T and directed out of page
(2) 1.2 T and directed into the plane of page
(3) 0.6 T and directed into the plane of page
(4) 1.2 T and directed out of page

Q21. Magnetic flux through a coil of resistance 10Ω is changed by $\Delta\phi$ in 0.1 s. The resulting current in the coil varies with time as shown in the figure. Then $|\Delta\phi|$ is equal to (in weber)



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

Q22. A resistance R and a capacitance C are connected in series to a battery of negligible internal resistance through a key. The key is closed at $t = 0$. If after t sec the voltage across the capacitance was seven times the voltage across R, the value of t is

(1) $3RC\ell n2$
(2) $2RC\ell n2$
(3) $2RC\ln 7$
(4) $3RC\ell n7$

Q23. We wish to make a microscope with the help of two positive lenses both with a focal length of 20 mm each and the object is positioned 25 mm from the objective lens. How far apart the lenses should be so that the final image is formed at infinity?

(1) 20 mm (2) 100 mm
(3) 120 mm (4) 80 mm

Q24. The first diffraction minimum due to the single slit diffraction is seen at $\theta = 30^\circ$ for a light of wavelength $5000\mathring{A}$ falling perpendicularly on the slit. The width of the slit is
(1) 2.5×10^{-5} cm (2) 1.25×10^{-5} cm
(3) 10×10^{-5} cm (4) 5×10^{-5} cm

Q25. The maximum number of possible interference maxima for slit separation equal to 1.8λ, where λ is the wavelength of light used, in a Young's double slit experiment is
(1) zero (2) 3
(3) infinite (4) 5

Q26. A hypothetical atom has only three energy levels. The ground level has energy, $E_1 = -8$eV. The two excited states have energies, $E_2 = -6$eV and $E_3 = -2$eV. Then which of the following wavelengths will not be present in the emission spectrum of this atom?
(1) 207 nm (2) 465 nm
(3) 310 nm (4) 620 nm

Q27. A doubly ionised Li atom is excited from its ground state$(n = 1)$ to $n = 3$ state. The wavelengths of the spectral lines are given by $\lambda_{32}, \lambda_{31}$ and λ_{21}. The ratio $\lambda_{32}/\lambda_{31}$ and $\lambda_{21}/\lambda_{31}$ are, respectively
(1) $8.1, 0.67$ (2) $8.1, 1.2$
(3) $6.4, 1.2$ (4) $6.4, 0.67$

Q28. Which of the following Statements is correct?
(1) The rate of radioactive decay cannot be controlled but that of nuclear fission can be controlled.
(2) Nuclear forces are short range, attractive and charge dependent.
(3) Nuclei of atoms having same number of neutrons are known as isobars.
(4) Wavelength of matter waves is given by de Broglie formula but that of photons is not given by the same formula

Q29. This question has Statement 1 and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements. Statement 1: A pure semiconductor has negative temperature coefficient of resistance. Statement 2: On raising the temperature, more charge carriers are released into the conduction band.
(1) Statement 1 is false, Statement 2 is true.
(2) Statement 1 is true, Statement 2 is false.
(3) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.
(4) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 1.

Q30. A 10 kW transmitter emits radio waves of wavelength 500 m. The number of photons emitted per second by the transmitter is of the order of
(1) 10^{37} (2) 10^{31}
(3) 10^{25} (4) 10^{43}

Q31. An aqueous solution of oxalic acid dihydrate contains its 6.3 g in 250ml. The volume of 0.1 N NaOH required to completely neutralize 10ml of this solution

(1) 4ml (2) 20ml

(3) 2ml (4) 40ml

Q32. 5 g of benzene on nitration gave 6.6 g of nitrobenzene. The theoretical yield of the nitrobenzene will be

(1) 4.5 g (2) 5.6 g

(3) 8.09 g (4) 6.6 g

Q33. If the radius of first orbit of H atom is a_0, the deBroglie wavelength of an electron in the third orbit is

(1) $4\pi a_0$ (2) $8\pi a_0$

(3) $6\pi a_0$ (4) $2\pi a_0$

Q34. Which among the following elements has the highest first ionization enthalpy?

(1) Nitrogen (2) Boron

(3) Carbon (4) Oxygen

Q35. The formation of molecular complex $BF_3 - NH_3$ results in a change in hybridization of boron

(1) from sp^2 to dsp^2 (2) from sp^2 to sp^3

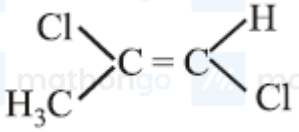
(3) from sp^3 to sp^2 (4) from sp^3 to sp^3d

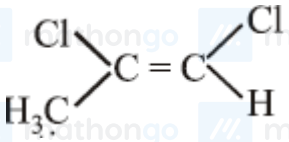
Q36. Although CN^- ion and N_2 molecule are isoelectronic, yet N_2 molecule is chemically inert because of

(1) presence of more number of electrons in bonding orbitals (2) lone bond energy

(3) absence of bond polarity (4) uneven electron distribution.

Q37. Among the following chloro-compound having the lowest dipole moment is

(1) CH_3Cl (2) 

(3) CH_2Cl_2 (4) 

Q38. α, v and u represent most probable velocity, average velocity and root mean square velocity respectively of a gas at a particular temperature. The correct order among the following is

(1) $u > v > \alpha$ (2) $v > u > \alpha$

(3) $\alpha > u > v$ (4) $u > \alpha > v$

Q39. The difference between the reaction enthalpy change $(\Delta_r H)$ and reaction internal energy change $(\Delta_r U)$ for the reaction:

$$2C_6H_6(l) + 15O_2(g) \longrightarrow$$

at 300 K is $\left(R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}\right)$

(1) 0 J mol^{-1} (2) 2490 J mol^{-1}
(3) -2490 J mol^{-1} (4) -7482 J mol^{-1}

Q40. 8 mol of AB_3(g) are introduced into a 1.0dm^3 vessel. If it dissociates as $2AB_3(g) \rightleftharpoons A_2(g) + 3B_2(g)$. At equilibrium, 2 mol of A_2 are found to be present. The equilibrium constant of this reaction is
(1) 2 (2) 3
(3) 27 (4) 36

Q41. Given (i) $HCN(aq) + H_2O(b) \rightleftharpoons H_3O^+(aq) + CN^-(aq)$ $K_a = 6.2 \times 10^{-10}$ (ii) $CN^-(aq) + H_2O(l) \rightleftharpoons HCN(aq) + OH^-(aq)$ $K_b = 1.6 \times 10^{-5}$. These equilibria show the following order of the relative base strength,
(1) $OH^- > H_2O > CN^-$ (2) $OH^- > CN^- > H_2O$
(3) $H_2O > CN^- > OH$ (4) $CN^- > H_2O > OH^-$

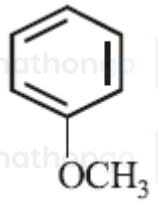
Q42.

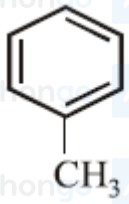
$$X\,MnO_4^- + Y\,C_2O_4^{2-} + Z\,H^+ \rightleftharpoons X\,Mn^{2+} + 2Y\,CO_2 + \frac{Z}{2}H_2O$$

In the following balanced reaction,
values of X, Y and Z respectively are
(1) 2,5,16 (2) $8, 2, 5$
(3) $5, 2, 16$ (4) $5, 8, 4$

Q43. A metal M on heating in nitrogen gas gives Y. Y on treatment with H_2O gives a colourless gas which when passed through $CuSO_4$ solution gives a blue colour. Y is
(1) NH_3 (2) $Mg(NO_3)_2$
(3) $Mg_3\,N_2$ (4) MgO

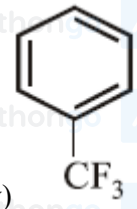
Q44. In the below mentioned compounds the decreasing order of reactivity towards electrophilic substitution is (i)





(ii)

(iii) 

(iv) 

(1) (iv) > (i) > (ii) > (iii)
(2) (ii) > (iii) > (i) > (iv)
(3) (iii) > (i) > (iv) > (ii)
(4) (i) > (ii) > (iii) > (iv)

Q45. The reaction, $CH_3CHO \xrightarrow[Zn(Hg)/\ Conc.\ HCl]{[H]} CH_3CH_3$

(1) Cannizaro's reaction
(2) Rosenmund reduction
(3) Wolf-Kishner reduction
(4) Clemmenson reduction

Q46. Water sample is reported to be highly polluted if BOD (Biological Oxygen Demand) value of sample becomes

(1) more than 17ppm
(2) equal to 10ppm
(3) equal to 5ppm
(4) less than 5ppm

Q47. The radius of a calcium ion is 94pm and of the oxide ion is 146pm. The possible crystal structure of calcium oxide will be

(1) tetrahedral
(2) trigonal
(3) octahedral
(4) pyramidal

Q48. A solution containing 0.85 g of $ZnCl_2$ in 125.0 g of water freezes at $-0.23^{\circ}C$. The apparent degree of dissociation of the salt is (K_f for water $= 1.86$ K kg mol^{-1}, atomic mass: Zn $= 65.3$ and Cl $= 35.5$)

(1) 1.36%
(2) 73.5%
(3) 7.35%
(4) 2.47%

Q49. The ppm level of F^- in a 500 g sample of a tooth paste containing 0.2 g F^- is

(1) 400
(2) 1000
(3) 250
(4) 200

Q50. In a chemical reaction A is converted into B. The rates of reaction, starting with initial concentrations of A as 2×10^{-3}M and 1×10^{-3} M, are equal to 2.40×10^{-4}Ms^{-1} and 0.60×10^{-4}Ms^{-1} respectively. The order of reaction with respect to reactant A will be

(1) 0
(2) 1.5
(3) 1
(4) 2

Q51. The correct statement for both the processes of physisorption and chemisorption is

(1) both are endothermic
(2) chemisorption is endothermic but physisorption is exothermic
(3) both are exothermic
(4) physisorption is endothermic but chemisorption is exothermic.

Q52. In the electrolysis of alumina to obtain aluminium metal, cryolite is added mainly to
(1) lower the melting point of alumina
(2) dissolve alumina in molten cryolite
(3) remove the impurities of alumina
(4) increase the electrical conductivity

Q53. Magnetic moment of Gd^{3+} ion $(Z = 64)$ is
(1) 3.62 BM
(2) 9.72BM
(3) 7.9 BM
(4) 10.60BM

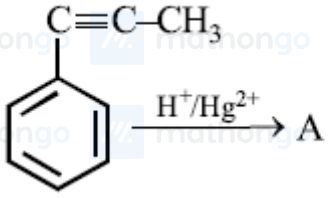
Q54. Which of the following complex ions will exhibit optical isomerism? (en = 1, 2-diamine ethane).
(1) $[Cr(NH_3)_2Cl_2]^+$
(2) $[Co(en)_2Cl_2]^+$
(3) $[Co(NH_3)_4Cl_2]^+$
(4) $[Zn(en)_2]^{2+}$

Q55. Which of the following statements is wrong?
(1) Ethyl chloride on reduction with $Zn - Cu$ couple and alcohol gives ethane.
(2) The reaction of methyl magnesium bromide with acetone gives butanol-2.
(3) Alkyl halides follow the following reactivity sequence on reaction with alkenes.

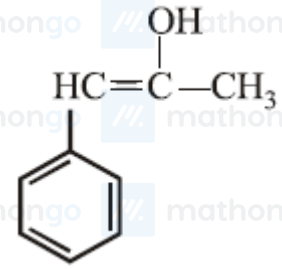
$$R - I > R - Br > R - Cl > R - I$$

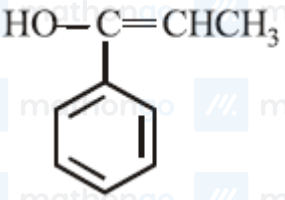
(4) $C_2H_4Cl_2$ may exist in two isomeric forms

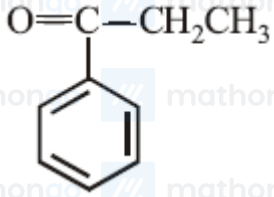
Q56.

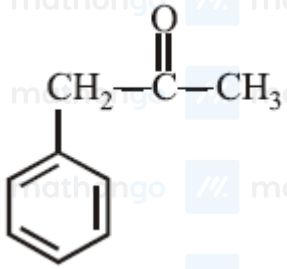


In the given reaction, the product 'A' is

(1) 

(2) 

(3) 

(4) 

Q57. The conversion of benzene diazonium chloride to bromobenzene can be accomplished by

(1) Reimer-Tiemann reaction
(2) Friedel-Crafts reaction
(3) Gattermann reaction
(4) Azo-coupling reaction

Q58. Synthetic polymer bakelite can be prepared from following compounds

(1) Styrene and vinyl chloride
(2) Acrylonitrile and vinyl chloride
(3) Adipic acid and ethylene glycol
(4) Phenol and formaldehyde

Q59. Chemically heroin is

(1) morphine monoacetate
(2) morphine dibenzoate
(3) morphine diacetate
(4) morphine monobenzoate

Q60. Amylopectin is a polymer of

(1) $\alpha - D-$ glucose
(2) amino acid
(3) $\beta - D-$ glucose
(4) amylase.

Q61. If a, b, c, d and p are distinct real numbers such that $\left(a^2+b^2+c^2\right)p^2 - 2p(ab+bc+cd) + \left(b^2+c^2+d^2\right) \leq 0$, then

(1) a, b, c, d are in A.P.
(2) $ab = cd$
(3) $ac = bd$
(4) a, b, c, d are in G.P.

Q62. If the sum of the square of the roots of the equation $x^2 - (\sin\alpha - 2)x - (1+\sin\alpha) = 0$ is least, then α is equal to

(1) $\frac{\pi}{6}$
(2) $\frac{\pi}{4}$
(3) $\frac{\pi}{3}$
(4) $\frac{\pi}{2}$

Q63. The area of the triangle whose vertices are complex numbers $z, iz, z+iz$ in the Argand diagram is

(1) $2|z|^2$
(2) $1/2|z|^2$
(3) $4|z|^2$
(4) $|z|^2$

Q64. The sum of the series

$$\frac{1}{1+\sqrt{2}}+\frac{1}{\sqrt{2}+\sqrt{3}}+\frac{1}{\sqrt{3}+\sqrt{4}}+\cdots$$

upto 15 terms is

(1) 1 (2) 2

(3) 3 (4) 4

Q65. The number of terms in the expansion of $\left(y^{1/5}+x^{1/10}\right)^{55}$, in which powers of x and y are free from radical signs are

(1) six (2) twelve

(3) seven (4) five

Q66. If the point $(1, a)$ lies between the straight lines $x+y=1$ and $2(x+y)=3$ then a lies in interval

(1) $\left(\frac{3}{2}, \infty\right)$ (2) $\left(1, \frac{3}{2}\right)$

(3) $(-\infty, 0)$ (4) $\left(0, \frac{1}{2}\right)$

Q67. If two vertices of a triangle are $(5,-1)$ and $(-2,3)$ and its orthocentre is at $(0,0)$, then the third vertex is

(1) $(4,-7)$ (2) $(-4,-7)$

(3) $(-4,7)$ (4) $(4,7)$

Q68. The area of triangle formed by the lines joining the vertex of the parabola, $x^2=8y$, to the extremities of its latus rectum is

(1) 2 (2) 8

(3) 1 (4) 4

Q69. If P_1 and P_2 are two points on the ellipse $\frac{x^2}{4}+y^2=1$ at which the tangents are parallel to the chord joining the points $(0,1)$ and $(2,0)$, then the distance between P_1 and P_2 is

(1) $2\sqrt{2}$ (2) $\sqrt{5}$

(3) $2\sqrt{3}$ (4) $\sqrt{10}$

Q70. The logically equivalent preposition of $p \Leftrightarrow q$ is

(1) $(p \Rightarrow q \wedge) q \Rightarrow p \quad)$ (2) $p \wedge q$

(3) $(p \wedge q \vee) q \neq p \quad)$ (4) $(p \wedge q \Rightarrow q \vee (p \quad)$

Q71. If the mean of $4, 7, 2, 8, 6$ and a is 7 , then the mean deviation from the median of these observations is

(1) 8 (2) 5

(3) 1 (4) 3

Q72. If in a triangle ABC, $\frac{b+c}{11}=\frac{c+a}{12}=\frac{a+b}{13}$, then cos A is equal to

(1) $5/7$ (2) $1/5$

(3) $35/19$ (4) $19/35$

Q73. If $A=\{x \in z^{+}: x<10$ and x is a multiple of 3 or $4\}$, where $z^{+}$is the set of positive integers, then the total number of symmetric relations on A is

(1) 2^5 (2) 2^{15}
(3) 2^{10} (4) 2^{20}

Q74. Let A and B be real matrices of the form $\begin{bmatrix}\alpha & 0\\ 0 & \beta\end{bmatrix}$ and $\begin{bmatrix}0 & \gamma\\ \delta & 0\end{bmatrix}$, respectively. Statement 1: $AB-BA$ is always an invertible matrix. Statement 2 : $AB-BA$ is never an identity matrix.

(1) Statement 1 is true, Statement 2 is false. (2) Statement 1 is false, Statement 2 is true.
(3) Statement 1 is true, Statement 2 is true; Statement 2 is a correct explanation of Statement 1 . (4) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.

Q75. If $\begin{vmatrix}-2a & a+b & a+c\\ b+a & -2b & b+c\\ c+a & b+c & -2c\end{vmatrix}$

$$=\alpha(a+b()b+c()c+a)\neq 0$$

then α is equal to
(1) $a+b+c$ (2) abc
(3) 4 (4) 1

Q76. Statement 1: If A and B be two sets having p and q elements respectively, where $q>p$. Then the total number of functions from set A to set B is q^p Statement 2: The total number of selections of p different objects out of q objects is ${}^{q}\mathrm{C}_{p}$.

(1) Statement 1 is true, Statement 2 is false. (2) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.
(3) Statement 1 is false, Statement 2 is true (4) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation of Statement 1.

Q77. Statement 1: A function $f: R\to R$ is continuous at x_0 if and only if $\lim_{x\to x_0} f(x)$ exists and $\lim_{x\to x_0} f(x)=f\left(x_0\cdot\right)$ Statement 2: A function $f: R\to R$ is discontinuous at x_0 if and only if, $\lim_{x\to x_0} f(x)$ exists and $\lim_{x\to x_0} f(x)\neq f\left(x_0.\right)$

(1) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1. (2) Statement 1 is false, Statement 2 is true.
(3) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation of Statement 1. (4) Statement 1 is true, Statement 2 is false.

Q78. If $f'(x)=\sin(\log x)$ and $y=f\left(\frac{2x+3}{3-2x}\right)$, then $\frac{dy}{dx}$ equals

(1) $\sin\left[\log\left(\frac{2x+3}{3-2x}\right)\right]$ (2) $\frac{12}{(3-2x^2)}$
(3) $\frac{12}{(3-2x^2)}\sin\left[\log\left(\frac{2x+3}{3-2x}\right)\right]$ (4) $\frac{12}{(3-2x^2}\cos\left[\log\left(\frac{2x+3}{3-2x}\right)\right]$

Q79. Consider a rectangle whose length is increasing at the uniform rate of 2 m/sec, breadth is decreasing at the uniform rate of 3 m/sec and the area is decreasing at the uniform rate of 5 m^2/sec. If after some time the breadth of the rectangle is 2 m then the length of the rectangle is

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

Q80. If $f(x) = xe^{x(1-x)}, x \in R$, then $f(x)$ is

(1) decreasing on $[-1/2, 1]$
(2) decreasing on R
(3) increasing on $[-1/2, 1]$
(4) increasing on R

Q81. The integral of $\frac{x^2-x}{x^3-x^2+x-1}$ w.r.t. x is

(1) $\frac{1}{2}\log\left(x^2+1+c\right)$
(2) $\frac{1}{2}\log\left|x^2-1\right|+c$
(3) $\log\left(x^2+1+c\right)$
(4) $\log\left|x^2-1\right|+c$

Q82. If $\frac{d}{dx}G(x) = \frac{e^{\tan x}}{x}, x \in (0, \pi/2)$, then $\int_{1/4}^{1/2} \frac{2}{x} \cdot e^{\tan(\pi x^2)} dx$ is equal to

(1) $G(\pi/4) - G(\pi/16)$
(2) $2[G(\pi/4) - G(\pi/16)]$
(3) $\pi[G(1/2) - G(1/4)]$
(4) $G(1/\sqrt{2}) - G(1/2)$

Q83. The area enclosed by the curves $y = x^2, y = x^3$, $x = 0$ and $x = p$, where $p > 1$, is $1/6$. The p equals

(1) $8/3$
(2) $16/3$
(3) 2
(4) $4/3$

Q84. If a straight line $y - x = 2$ divides the region $x^2 + y^2 \leq 4$ into two parts, then the ratio of the area of the smaller part to the area of the greater part is

(1) $3\pi - 8 : \pi + 8$
(2) $\pi - 3 : 3\pi + 3$
(3) $3\pi - 4 : \pi + 4$
(4) $\pi - 2 : 3\pi + 2$

Q85. Statement 1: The degrees of the differential equations $\frac{dy}{dx} + y^2 = x$ and $\frac{d^2y}{dx^2} + y = \sin x$ are equal. Statement 2: The degree of a differential equation, when it is a polynomial equation in derivatives, is the highest positive integral power of the highest order derivative involved in the differential equation, otherwise degree is not defined.

(1) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.
(2) Statement 1 is false, Statement 2 is true.
(3) Statement 1 is true, Statement 2 is false.
(4) Statement 1 is true, Statement 2 is true; Statement 2 is a correct explanation of Statement 1.

Q86. If $\vec{u} = \hat{j} + 4\hat{k}, \vec{v} = \hat{i} + 3\hat{k}$ and $\vec{w} = \cos\theta\hat{i} + \sin\theta\hat{j}$ are vectors in 3-dimensional space, then the maximum possible value of $|\vec{u} \times \vec{v} \cdot \vec{w}|$ is

(1) $\sqrt{3}$
(2) 5
(3) $\sqrt{14}$
(4) 7

Q87. Statement 1: If the points $(1, 2, 2), (2, 1, 2)$ and $(2, 2, z)$ and $(1, 1, 1)$ are coplanar, then $z = 2$. Statement 2: If the 4 points P, Q, R and S are coplanar, then the volume of the tetrahedron $PQRS$ is 0.

(1) Statement 1 is false,, Statement 2 is true.
(2) Statement 1 is true, Statement 2 is false.
(3) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation of Statement 1.
(4) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.

Q88. A unit vector which is perpendicular to the vector $2\hat{i}-\hat{j}+2\hat{k}$ and is coplanar with the vectors $\hat{i}+\hat{j}-\hat{k}$ and $2\hat{i}+2\hat{j}-\hat{k}$ is

(1) $\frac{2\hat{j}+\hat{k}}{\sqrt{5}}$
(2) $\frac{3\hat{i}+2\hat{j}-2\hat{k}}{\sqrt{17}}$
(3) $\frac{3\hat{i}+2\hat{j}+2\hat{k}}{\sqrt{17}}$
(4) $\frac{2\hat{i}+2\hat{j}-\hat{k}}{3}$

Q89. The coordinates of the foot perpendicular from the point $(1,0,0)$ to the line $\frac{x-1}{2}=\frac{y+1}{-3}=\frac{z+10}{8}$ are

(1) $(2,-3,8)$
(2) $(1,-1,-10)$
(3) $(5,-8,-4)$
(4) $(3,-4,-2)$

Q90. A number n is randomly selected from the set $\{1,2,3,\ldots,1000\}$. The probability that $\frac{\sum_{i=1}^{n} i^2}{\sum_{i=1}^{n} i}$ is an integer is

(1) 0.331
(2) 0.333
(3) 0.334
(4) 0.332

ANSWER KEYS

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