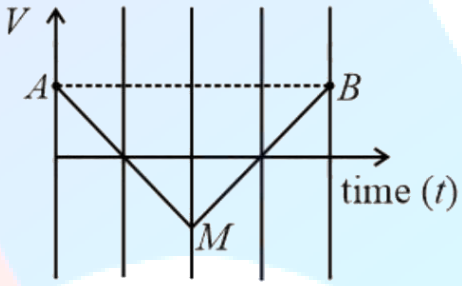
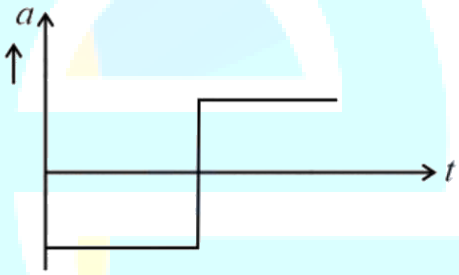
Q1. The work done by a gas molecule in an isolated system is given by, $W = \alpha\beta^2 e^{-\frac{x^2}{\alpha k T}}$, where x is the displacement, k is the Boltzmann constant and T is the temperature. α and β are constants. Then the dimensions of β will be:
(1) $M^2\ L\ T^2$
(2) $ML^2\ T^{-2}$
(3) MLT^{-2}
(4) $M^0\ L\ T^0$

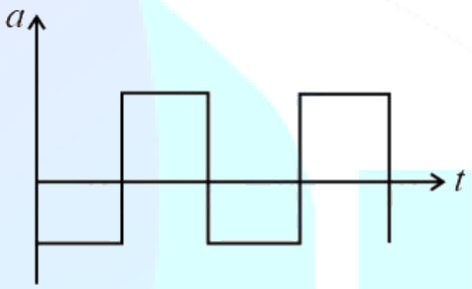
Q2. If the velocity-time graph has the shape AMB, what would be the shape of the corresponding acceleration-time graph?



(1)



(2)



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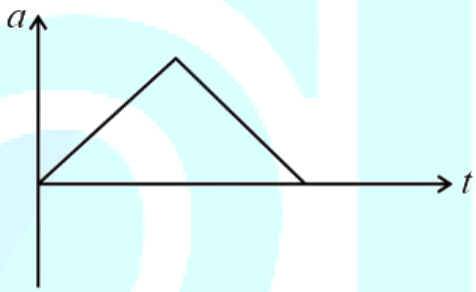
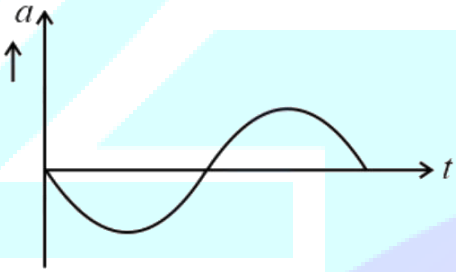


(4)



Q3. Moment of inertia M. I . of four bodies, having same mass and radius, are reported as;
I_1 = M.I. of thin circular ring about its diameter,
I_2 = M.I. of circular disc about an axis perpendicular to disc and going through the centre,
I_3 = M.I. of solid cylinder about its axis and
I_4 = M.I. of solid sphere about its diameter.
Then:
(1) $I_1 + I_2 = I_3 + \frac{5}{2}I_4$.
(2) $I_1 + I_3 < I_2 + I_4$
(3) $I_1 = I_2 = I_3 > I_4$
(4) $I_1 = I_2 = I_3 < I_4$

Q4. Consider two satellites S_1 and S_2 with periods of revolution 1 hr and 8 hr respectively revolving around a planet in circular orbits. The ratio of angular velocity of satellite S_1 to the angular velocity of satellite S_2 is:
(1) 8: 1
(2) 2: 1
(3) 1: 4
(4) 1: 8

Q5. Four identical particles of equal masses 1 kg made to move along the circumference of a circle of radius 1 m under the action of their own mutual gravitational attraction. The speed of each particle will be:
(1) $\sqrt{G1+2\sqrt{2}}$
(2) $\sqrt{\frac{G}{2}1+2\sqrt{2}}$
(3) $\sqrt{\frac{G}{2}2\sqrt{2}-1}$
(4) $\frac{\sqrt{1+2\sqrt{\ }ZG}}{2}$

Q6. Two stars of masses m and $2m$ at a distance d rotate about their common centre of mass in free space. The period of revolution is
(1) $2\pi\sqrt{\frac{d^3}{3Gm}}$
(2) $2\pi\sqrt{\frac{3Gm}{d^3}}$
(3) $\frac{1}{2\pi}\sqrt{\frac{3Gm}{d^3}}$
(4) $\frac{1}{2\pi}\sqrt{\frac{d^3}{3Gm}}$

Q7. If Y, K and η are the values of Young's modulus, bulk modulus and modulus of rigidity of any material respectively. Choose the correct relation for these parameters.
(1) $Y=\frac{9K\eta}{3K-\eta}\text{Nm}^{-2}$
(2) $\eta=\frac{3YK}{9K+Y}$ N m m^{-2}
(3) $K=\frac{Y\eta}{9\eta-3Y}\times\text{m}^{-2}$
(4) $Y=\frac{9K\eta}{2\eta+3K}$ N m m^{-2}

Q8. Each side of a box made of metal sheet in cubic shape is a at room temperature T, the coefficient of linear expansion of the metal sheet is α. The metal sheet is heated uniformly, by a small temperature ΔT, so that its new temperature is $T+\Delta T$. Calculate the increase in the volume of the metal box.
(1) $4a^3\alpha\Delta T$
(2) $3a^3\alpha\Delta T$
(3) $4\pi a^3\alpha\Delta T$
(4) $\frac{4}{3}\pi a^3\alpha\Delta T$

Q9. Match List I with List II .

List I

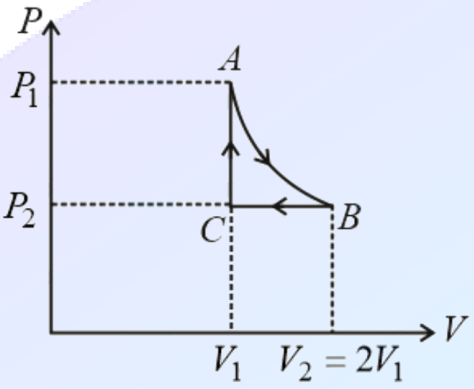
(a) Isothermal
(b) Isochoric
(c) Adiabatic
(d) Isobaric

List II

(i) Pressure constant
(ii) Temperature constant
(iii) Volume constant
(iv) Heat content is constant

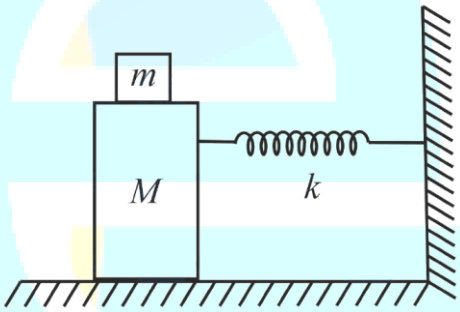
Choose the correct answer from the options given below:
(1) (a) → (ii), (b) → (iii), (c) → (iv), (d) → (i)
(2) (a) → (iii), (b) → (ii), (c) → (i), (d) → (iv)
(3) (a) → (i), (b) → (iii), (c) → (ii), (d) → (iv)
(4) (a) → (ii), (b) → (iv), (c) → (iii) , (d) → (i)

Q10. n mole of a perfect gas undergoes a cyclic process $ABCA$ (see figure) consisting of the following processes.
$A\rightarrow B$: Isothermal expansion at temperature T so that the volume is doubled from V_1 to $V_2=2V_1$ and pressure changes from P_1 to P_2
$B\rightarrow C$: Isobaric compression at pressure P_2 to initial volume V_1.
$C\rightarrow A$: Isochoric change leading to change of pressure from P_2 to P_1
Total work done in the complete cycle $ABCA$ is:



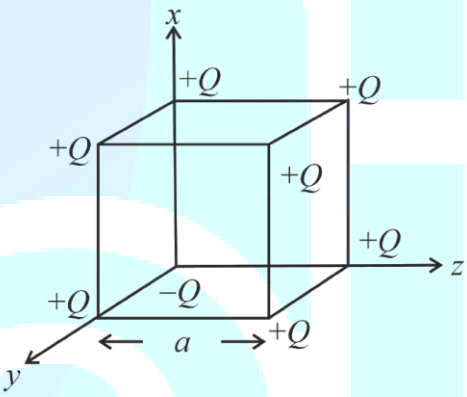
(1) $nRT\ln 2 - \frac{1}{2}$
(2) $nRT\ln 2$
(3) $nRT\ln 2 + \frac{1}{2}$
(4) 0

Q11. In the given figure, a mass M is attached to a horizontal spring which is fixed on one side to a rigid support. The spring constant of the spring is k. The mass oscillates on a frictionless surface with time period T and amplitude A. When the mass is in equilibrium position, as shown in the figure, another mass m is gently fixed upon it. The new amplitude of oscillation will be:



(1) $A\sqrt{\frac{M+m}{M}}$
(2) $A\sqrt{\frac{M}{M-m}}$
(3) $A\sqrt{\frac{M-m}{M}}$
(4) $A\sqrt{\frac{M}{M+m}}$

Q12. A cube of side a has point charges $+Q$ located at each of its vertices except at the origin where the charge is -Q. The electric field at the centre of cube is:

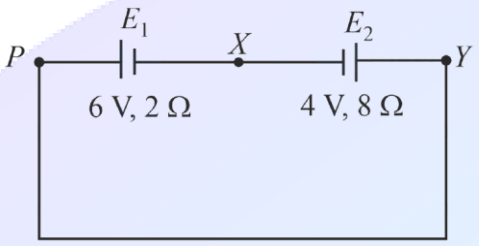


(1) $\frac{-Q}{3\sqrt{3}\pi\varepsilon_0 a^2}\hat{x} + \hat{y} + \hat{z}$
(2) $\frac{Q}{3\sqrt{3}\pi\varepsilon_0 a^2}\hat{x} + \hat{y} + \hat{z}$
(3) $\frac{-2Q}{3\sqrt{3}\pi\varepsilon_0 a^2}\hat{x} + \hat{y} + \hat{z}$
(4) $\frac{2Q}{3\sqrt{3}\pi\varepsilon_0 a^2}\hat{x} + \hat{y} + \hat{z}$

Q13. Two equal capacitors are first connected in series and then in parallel. The ratio of the equivalent capacities in the two cases will be:
(1) 1: 2
(2) 1: 4
(3) 4: 1
(4) 2: 1

Q14. A current through a wire depends on time as $i = \alpha_0 t + \beta t^2$, where $\alpha_0 = 20$ A s^{-1} and $\beta = 8$ A s^{-2}. Find the charge crossed through a section of the wire in 15 s .
(1) 2250 C
(2) 11250 C
(3) 2100 C
(4) 260 C

Q15. A cell E_1 of emf 6 V and internal resistance 2Ω is connected with another cell E_2 of emf 4 V and internal resistance 8Ω (as shown in the figure). The potential difference across points X and Y is:



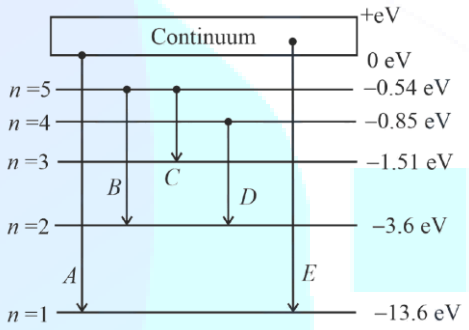
(1) 10.0 V
(2) 5.6 V
(3) 2.0 V
(4) 3.6 V

Q16. The focal length f is related to the radius of curvature r of the spherical convex mirror by:
(1) $f = -\frac{1}{2}r$
(2) $f = +\frac{1}{2}r$
(3) $f = r$
(4) $f = -r$

Q17. In a Young's double slit experiment, the width of the one of the slit is three times the other slit. The amplitude of the light coming from a slit is proportional to the slit-width. Find the ratio of the maximum to the minimum intensity in the interference pattern.
(1) 1: 4
(2) 2: 1
(3) 3: 1
(4) 4: 1

Q18. Given below are two statements:
Statement I: Two photons having equal linear momenta have equal wavelengths.
Statement II: If the wavelength of the photon is decreased, then the momentum and energy of a photon will also decrease.
In the light of the above statements, choose the correct answer from the options given below.
(1) Both Statement I and Statement II are false
(2) Both Statement I and Statement II are true
(3) Statement I is true but Statement II is false
(4) Statement I is false but Statement II is true

Q19. In the given figure, the energy levels of hydrogen atom have been shown along with some transitions marked A, B, C, D and E.
The transitions A, B and C respectively represent



(1) The ionization potential of hydrogen, second member of Balmer series and third member of Paschen series.
(2) The series limit of Lyman series, second member of Balmer series and second member of Paschen series.
(3) The series limit of Lyman series, third member of (4) Balmer series and second member of Paschen series.
(4) The first member of the Lyman series, third member of Balmer series and second member of Paschen series.

Q20. If an emitter current is changed by 4 mA , the collector current changes by 3.5 mA . The value of β will be:
(1) 3.5
(2) 0.5
(3) 0.875
(4) 7

Q21. The coefficient of static friction between a wooden block of mass 0.5 kg and a vertical rough wall is 0.2 . The magnitude of the horizontal force that should be applied on the block to keep it adhere to the wall will be N.
$g = 10 \text{ m s}^{-2}$

Q22. An inclined plane is bent in such a way that the vertical cross-section is given by $y = \frac{x^2}{4}$ where y is in vertical and x in horizontal direction. If the upper surface of this curved plane is rough with coefficient of friction $\mu = 0.5$, the maximum height in cm at which a stationary block will not slip downward is cm .

Q23. A ball with a speed of 9 m s^{-1} collides with another identical ball at rest. After the

collision, the direction of each ball makes an angle of 30° with the original direction. If the ratio of velocities of the balls after the collision is $x:y$, then what is the value of x ?

Q24. A hydraulic press can lift 100 kg when a mass m is placed on the smaller piston. It can lift kg when the diameter of the larger piston is increased by 4 times and that of the smaller piston is decreased by 4 times keeping the same mass m on the smaller piston.

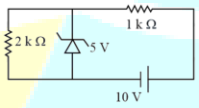
Q25. A common transistor radio set requires 12 V D.C. for its operation. The D.C. source is constructed by using a transformer and a rectifier circuit, which are operated at 220 V A.C. on standard domestic A.C. supply. The number of turns of secondary coil are 24 , then the number of turns of primary are

Q26. A resonance circuit having inductance and resistance 2×10^{-4}H and 6.28Ω respectively oscillates at 10 MHz frequency. The value of quality factor of this resonator is $\pi = 3.14$

Q27. An electromagnetic wave of frequency 5 GHz , is travelling in a medium whose relative electric permittivity and relative magnetic permeability both are 2 . Its velocity in this medium is $\times 10^7$ m s^{-1}.

Q28. An unpolarized light beam is incident on the polarizer of a polarization experiment and the intensity of light beam emerging from the analyzer is measured as 100 Lumens. Now, if the analyzer is rotated around the horizontal axis (direction of light) by 30° in clockwise direction, the intensity of emerging light will be
Lumens.

Q29. In connection with the circuit drawn below, the value of current flowing through 2kΩ resistor is $\times 10^{-4}$ A.



Q30. An audio signal $v_m = 20\sin 2\pi 1500t$ amplitude modulates a carrier $v_c = 80\sin 2\pi 100{,}000t$. The value of percent modulation is

Q31. Consider the elements Mg, Al, S, P and Si , the correct increasing order of their first ionisation enthalpy is:
(1) Al < Mg < Si < S < P
(2) Al < Mg < S < Si < P
(3) Mg < Al < Si < P < S
(4) Mg < Al < Si < S < P

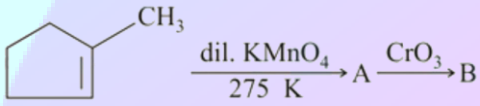
Q32. Which of the following are isostructural pairs?
A. SO_4^{2-} and CrO_4^{2-}
B. $SiCl_4$ and $TiCl_4$
C. NH_3 and NO_3^-
D. BCl_3 and $BrCl_3$
(1) A and C only
(2) B and C only
(3) A and B only
(4) C and D only

Q33. (A) $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$
(B) $I_2 + H_2O_2 + 2OH^- \rightarrow 2I^- + 2H_2O + O_2$

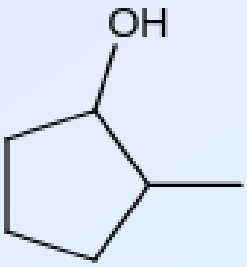
Choose the correct option.
(1) H_2O_2 act as oxidizing and reducing agent respectively in equations (A) and (B).
(3) H_2O_2 acts as reducing and oxidising agent respectively in equations (A) and (B).
(2) H_2O_2 acts as oxidising agent in equations (A) and (B).
(4) H_2O_2 acts as reducing agent in equations (A) and (B).

Q34. Al_2O_3 was leached with alkali to get X . The solution of X on passing of gas Y , forms Z . X, Y and Z respectively are
(1) $X = AlOH_3, Y = CO_2\ ', Z = Al_2O_3$
(2) $X = NaAlOH_4, Y = SO_2, Z = Al_2O_3$
(3) $X = AlOH_3, Y = SO_2, Z = Al_2O_3 \cdot xH_2O$
(4) $X = NaAlOH_4, Y = CO_2, Z = Al_2O_3, xH_2O$

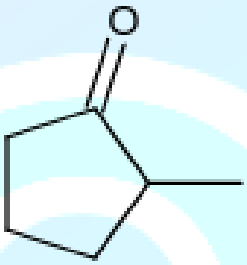
Q35. Identify products A and B.



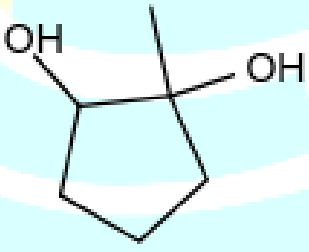
(1)
A :



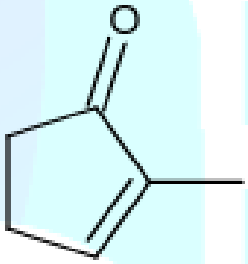
B



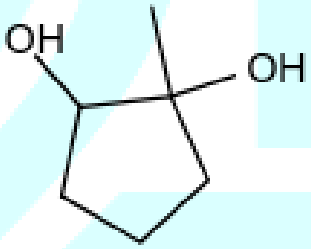
(2)
A :



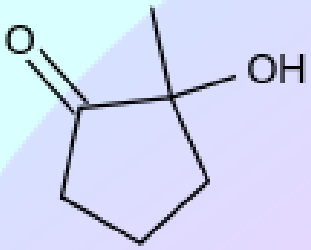
B :



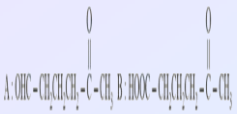
(3)
A :



B :

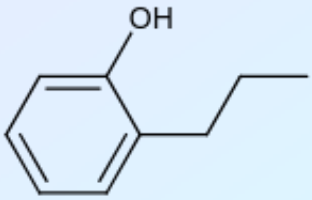


(4)

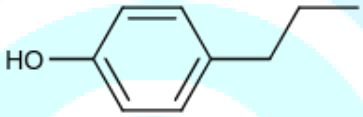


Q36. Which of the following compound gives pink colour on reaction with phthalic anhydride in conc. H_2SO_4 followed by treatment with NaOH ?

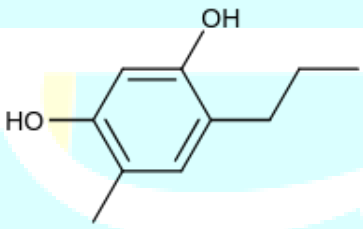
(1)



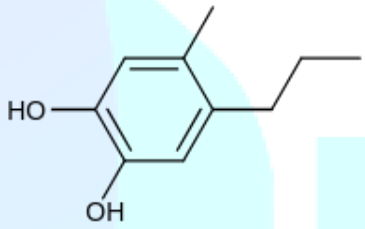
(2)



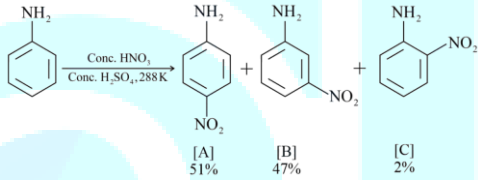
(3)



(4)



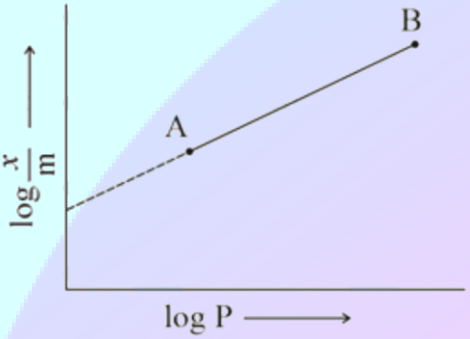
Q37. In the following reaction, the reason why meta-nitro product also formed is:



(1) Formation of anilinium ion
(2) $-NH_2$ group is highly meta-directive
(3) $-NO_2$ substitution always takes place at metaposition
(4) low temperature

Q38. The gas released during anaerobic degradation of vegetation may lead to:
(1) Corrosion of metals
(2) Ozone hole
(3) Global warming and cancer
(4) Acid rain

Q39. In Freundlich adsorption isotherm, slope of AB line is:



(1) $\frac{1}{n}$ with $\frac{1}{n} = 0$ to 1

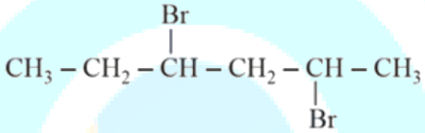
(2) n with n = 0.1 to 0.5
(3) $\log_n^1$ with $n < 1$
(4) logn with $n > 1$

Q40. Which of the following ore is concentrated using group 1 cyanide salt?
(1) Malachite
(2) Calamine
(3) Siderite
(4) Sphalerite

Q41. The major components in "Gun Metal" are:
(1) Cu, Sn and Zn
(2) Al, Cu, Mg and Mn
(3) Cu, Ni and Fe
(4) Cu, Zn and Ni

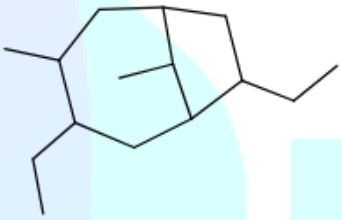
Q42. The electrode potential of M^{2+}/M of 3 d - series elements shows positive value for?
(1) Co
(2) Fe
(3) Zn
(4) Cu

Q43.

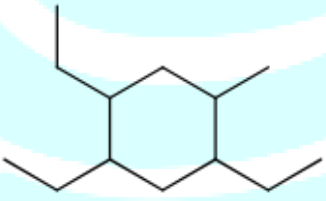


with

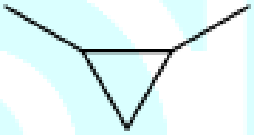
The product formed in the first step of the reaction of with excess $Mg/Et_2OEt = C_2H_5$ is
(1)



(2)

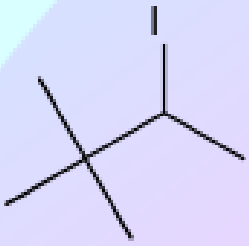


(3)

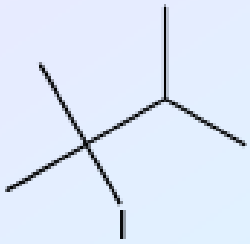


What is the major product formed by HI on reaction with

Q44.
(1)



(2)



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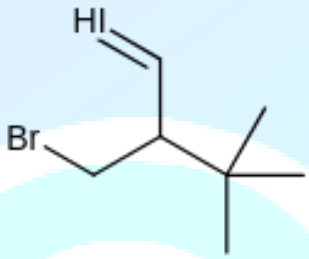
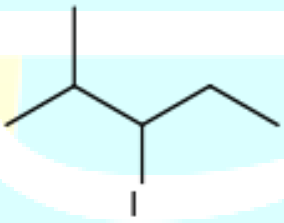
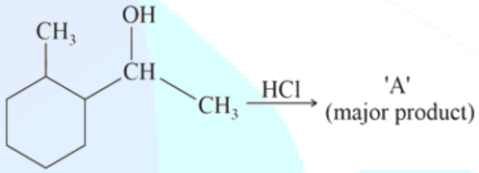


(4)

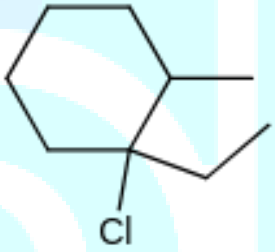


Q45. What is the final product (major) 'A' in the given reaction?

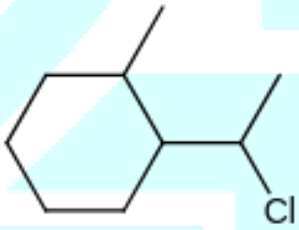


Major product among the following is?

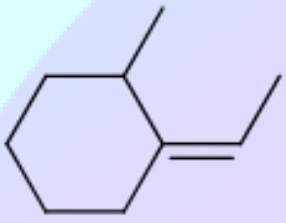
(1)



(2)



(3)



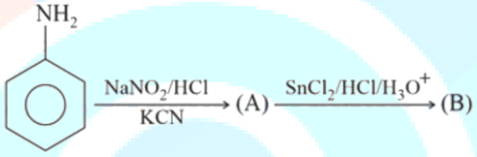
(4)

Q46. Which of the following reagent is used for the following reaction?

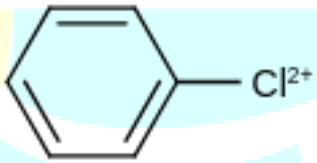
$CH_3CH_2CH_3 \rightarrow CH_3CH_2CHO$

(1) Copper at high temperature and pressure
(2) Manganese acetate
(3) Molybdenum oxide
(4) Potassium permanganate

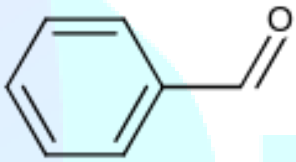
Q47. A and B in the following reactions are:



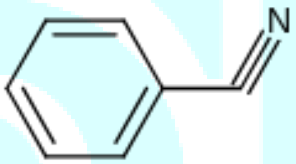
(1)
(A) :



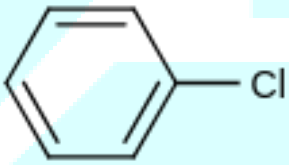
(B) :



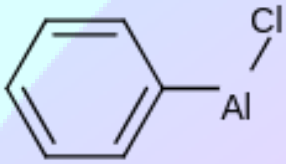
(2)
(A) :



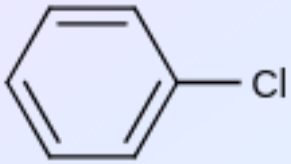
(B) :



(3)
(A) :

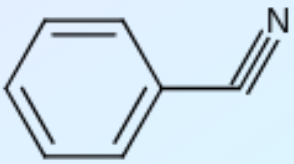


(B) :

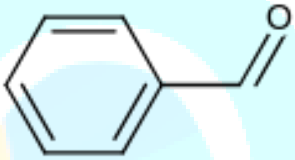


(4)

(A) :



(B) :



Q48. Match List I with List II.

List I (Monomer Unit)

(a) Caprolactum
(b) 2 - Chloro-1,3-butadiene
(c) Isoprene
(d) Acrylonitrile

List II (Polymer)

(i) Natural rubber
(ii) Buna-N
(iii) Nylon 6
(iv) Neoprene

Choose the correct answer from the options given below:
(1) a → iii, b → iv, c → i, d → ii
(2) a → i, b → ii, c → iii, d → iv
(3) a → ii, b → i, c → iv, d → iii
(4) a → iv, b → iii, $c \rightarrow ii, d$ → i

Q49. Given below are two statements:
Statement I: Colourless cupric metaborate is reduced to cuprous metaborate in a luminous flame.
Statement II: Cuprous metaborate is obtained by heating boric anhydride and copper sulphate in a nonluminous flame.
In the light of the above statements, choose the most appropriate 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) Both Statement I and Statement II are true
(4) Statement I is true but Statement II is false

Q50. Out of the following, which type of interaction is responsible for the stabilisation of α-helix structure of proteins?
(1) Covalent bonding
(2) Ionic bonding
(3) Hydrogen bonding
(4) vander Waals forces

Q51.4.5 g of compound AM. W. $= 90$ was used to make 250 mL of its aqueous solution. The molarity of the solution in M is $x \times 10^{-1}$. The value of x is (Rounded off to the nearest integer)

Q52. A proton and a Li^{3+} nucleus are accelerated by the same potential. If λ_{Li} and λ_p denote the de Broglie wavelengths of Li^{3+} and proton respectively, then the value of $\frac{\lambda_{Li}}{\lambda_p}$ is $x \times 10^{-1}$.
The value of x is (Rounded off to the nearest integer) [Mass of $Li^{3+} = 8.3$ mass of proton]

Q53. For the reaction $A_g \rightarrow B_g$, the value of the equilibrium constant at 300 K and 1 atm is equal to 100.0. The value of ΔG^0 for the reaction at 300 K and 1 atm in $Jmol^{-1}$ is $-x$R, where x is (Rounded off to the nearest integer) R = 8.31 J mol^{-1} K^{-1} and ln 10 = 2.3

Q54. The stepwise formation of $CuNH_{34}{}^{2+}$ is given below:

$Cu^{2+} + NH_3 \underset{K_2}{\rightleftharpoons} CuNH_3^{2+}$

$CuNH_3{}^{2+} + NH_3 \underset{K_3}{\rightleftharpoons} CuNH_{32}{}^{2+}$

$CuNH_3{}^{2+} + NH_3 \underset{K_4}{\rightleftharpoons} CuNH_3{}^{2+}$

$CuNH_{33}{}^{2+} + NH_3 \rightleftharpoons CuNH_{34}{}^{2+}$

The value of stability constants K_1, K_2, K_3 and K_4 are $10^4, 1.58 \times 10^3, 5 \times 10^2$ and 10^2 respectively. The overall equilibrium constants for dissociation of $CuNH_{34}{}^{2+}$ is $x \times 10^{-12}$. The value of x is (Rounded off to the nearest integer)

Q55. At 1990 K and 1 atm pressure, there are equal number of Cl_2 molecules and Cl atoms in the reaction mixture. The value of K_p for the reaction $Cl_{2\,g} = 2Cl_g$ under the above conditions is $x \times 10^{-1}$. The value of x is (Rounded off to the nearest integer)

Q56. The reaction of sulphur in alkaline medium is given below:

$S_{8\,s} + aOH^-_{aq} \rightarrow b\,S^{2-}_{aq} + cS_2O^{2-}_{3aq} + dH_2O_l$

The values of ' a ' is (Integer answer)

Q57. Number of amphoteric compounds among the following is

(A) BeO
(B) BaO
(C) $BeOH_2$
(D) $SrOH_2$

Q58. The coordination number of an atom in a body-centered cubic structure is
[Assume that the lattice is made up of atoms.]

Q59. When 9.45 g of $ClCH_2COOH$ is added to 500 mL of water, its freezing point drops by 0.5°C. The dissociation constant of $ClCH_2COOH$ is $x \times 10^{-3}$. The value of x is off to the nearest integer)

$K_{fH_2O} = 1.86$ K kg mol $^{-1}$

Q60. Gaseous cyclobutene isomerizes to butadiene in a first order process which has a ' K ' value of 3.3×10^{-4} s^{-1} at 153°C. The time in minutes it takes for the isomerization to proceed 40% to completion at this temperature is . (Rounded off to the nearest integer)

Q61. Let p and q be two positive numbers such that $p + q = 2$ and $p^4 + q^4 = 272$. Then p and q are roots of the equation:

(1) $x^2 - 2x + 2 = 0$
(2) $x^2 - 2x + 8 = 0$
(3) $x^2 - 2x + 136 = 0$
(4) $x^2 - 2x + 16 = 0$

Q62. A scientific committee is to be formed from 6 Indians and 8 foreigners, which includes at least 2 Indians and double the number of foreigners as Indians. Then the number of ways, the committee can be formed, is:

(1) 1050
(2) 1625
(3) 575
(4) 560

Q63. If $e^{\cos^2 x + \cos^4 x + \cos^6 x + \cdots \infty \log_e 2}$ satisfies the equation $t^2 - 9t + 8 = 0$, then the value of $\frac{2\sin x}{\sin x + \sqrt{3}\cos x}$, where $0 < x < \frac{\pi}{2}$, is equal to

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

Q64. A man is walking on a straight line. The arithmetic mean of the reciprocals of the intercepts of this line on the coordinate axes is $\frac{1}{4}$. Three stones A, B and C are placed at the points 1,1,2,2 and 4,4 respectively. Then which of these stones is / are on the path of the man?

(1) C only
(2) All the three
(3) B only
(4) A only

Q65. The value of $-{}^{15}C_1 + 2 \cdot {}^{15}C_2 - 3 \cdot {}^{15}C_3 + \cdots . -15 \cdot {}^{15}C_{15} + {}^{14}C_1 + {}^{14}C_3 + {}^{14}C_5 + \cdots + {}^{14}C_{11}$ is equal to

(1) 2^{14}
(2) $2^{13} - 13$
(3) $2^{16} - 1$
(4) $2^{13} - 14$

Q66. The locus of the mid-point of the line segment joining the focus of the parabola $y^2 = 4ax$ to a moving point of the parabola, is another parabola whose directrix is:

(1) $x = a$
(2) $x = 0$
(3) $x = -\frac{a}{2}$
(4) $x = \frac{a}{2}$

Q67. The statement among the following that is a tautology is:
(1) $A \vee A \wedge B$
(2) $A \wedge A \vee B$
(3) $B \rightarrow A \wedge A \rightarrow B$
(4) $A \wedge A \rightarrow B \rightarrow B$

Q68. Two vertical poles are 150 m apart and the height of one is three times that of the other. If from the middle point of the line joining their feet, an observer finds the angles of elevation of their tops to be complementary, then the height of the shorter pole (in meters) is:
(1) 25
(2) 30
(3) $20\sqrt{3}$
(4) $25\sqrt{3}$

Q69. The system of linear equations
$3x - 2y - kz = 10$
$2x - 4y - 2z = 6$
$x + 2y - z = 5\ m$
is inconsistent if :
(1) $k = 3, m \neq \frac{4}{5}$
(2) $k = 3, m = \frac{4}{5}$
(3) $k \neq 3, m \in R$
(4) $k \neq 3, m \neq \frac{4}{5}$

Q70. Let $f: R \rightarrow R$ be defined as $fx = 2\ x - 1$ and $g: R - 1 \rightarrow R$. be defined as $gx = \frac{x-\frac{1}{2}}{x-1}$. Then the composition function fgx is:
(1) neither one-one nor onto
(2) one-one but not onto
(3) onto but not one-one
(4) both one-one and onto

Q71.If $f: R \rightarrow R$ is a function defined by $fx = x - 1\cos\frac{2x-1}{2}\pi$, where $\cdot$ denotes the greatest integer function, then f is:
(1) discontinuous only at $x = 1$
(2) discontinuous at all integral values of x except at $x = 1$
(3) continuous only at $x = 1$
(4) continuous for every real x

Q72. The function $fx = \frac{4x^3-3x^2}{6} - 2\sin x + 2x - 1\cos x$:
(1) increases in $\frac{1}{2}, \infty$
(2) decreases in $-\infty, \frac{1}{2}$
(3) decreases in $\frac{1}{2}, \infty$
(4) increases in - $\infty, \frac{1}{2}$

Q73. If the tangent to the curve $y = x^3$ at the point Pt, t^3 meets the curve again at Q, then the ordinate of the point which divides PQ internally in the ratio 1 : 2 is:
(1) 0
(2) $-2t^3$
(3) $-t^3$
(4) $2t^3$

Q74. If $\int \frac{\cos x - \sin x}{\sqrt{8 - \sin 2x}} dx = a\sin^{-1}\frac{\sin x + \cos x}{b} + c$, where c is a constant of integration, then the ordered pair a, b is equal to:
(1) $1, -3$
(2) 3,1
(3) $-1,3$
(4) 1,3

Q75. $\lim_{x\rightarrow 0} \frac{\int_0^{x^2} \sin\sqrt{t}dt}{x^3}$ is equal to:
(1) 0
(2) $\frac{2}{3}$
(3) $\frac{3}{2}$
(4) $\frac{1}{15}$

Q76. The area (in sq. units) of the part of the circle $x^2 + y^2 = 36$, which is outside the parabola $y^2 = 9x$, is equal to
(1) $12\pi + 3\sqrt{3}$
(2) $24\pi + 3\sqrt{3}$
(3) $24\pi - 3\sqrt{3}$
(4) $12\pi - 3\sqrt{3}$

Q77. The population $P = Pt$ at time t of a certain species follows the differential equation $\frac{dP}{dt} = 0.5P$ - 450. If $P0 = 850$, then the time at which population becomes zero is:

(1) $\log_e 9$
(2) $2\log_e 18$
(3) $\log_e 18$
(4) $\frac{1}{2}\log_e 18$

Q78. The distance of the point 1, 1,9 from the point of intersection of the line $\frac{x-3}{1} = \frac{y-4}{2} = \frac{z-5}{2}$ and the plane $x + y + z = 17$ is:
(1) $19\sqrt{2}$
(2) $2\sqrt{19}$
(3) $\sqrt{38}$
(4) 38

Q79. The equation of the plane passing through the point $1,2,-3$ and perpendicular to the planes $3x + y - 2z = 5$ and $2x - 5y - z = 7$, is
(1) $11x + y + 17z + 38 = 0$
(2) $3x - 10y - 2z + 11 = 0$
(3) $6x - 5y + 2z + 10 = 0$
(4) $6x - 5y - 2z - 2 = 0$

Q80. An ordinary dice is rolled for a certain number of times. If the probability of getting an odd number 2 times is equal to the probability of getting an even number 3 times, then the probability of getting an odd number for odd number of times is:
(1) $\frac{1}{32}$
(2) $\frac{5}{16}$
(3) $\frac{3}{16}$
(4) $\frac{1}{2}$

Q81. If the least and the largest real values of α, for which the equation $z + \alpha z - 1 + 2i = 0 z \in C$ and $i = \sqrt{-1}$ has a solution, are p and q respectively; then $4p^2 + q^2$ is equal to .

Q82. If one of the diameters of the circle $x^2 + y^2 - 2x - 6y + 6 = 0$ is a chord of another circle ' C ', whose center is at 2,1 , then its radius is .

Q83. Let $A = \{n \in N: n$ is a 3 - digit number $\} B = 9k + 2: k \in N$ and $C = 9k + l: k \in N$ for some $l 0 < l < 9$. If the sum of all the elements of the set $A \cap B \cup C$ is 274×400, then l is equal to

Q84. $\begin{matrix} 3 & -1 & -2 \\ 2 & 0 & \alpha \\ 3 & -5 & 0 \end{matrix}$
Let $P =$, where $\alpha \in R$. Suppose $Q = q_{ij}$ is a matrix satisfying $PQ = kI_3$ for some non-zero $k \in R$. If $q_{23} = -\frac{k}{8}$ and $Q = \frac{k^2}{2}$, then $\alpha^2 + k^2$ is equal to .

Q85. Let M be any 3×3 matrix with entries from the set 0,1,2. The maximum number of such matrices, for which the sum of diagonal elements of $M^T M$ is seven, is .

Q86. $\lim_{n\to\infty} \tan \sum_{r=1}^{n} \tan^{-1} \frac{1}{1+r+r^2}$ is equal to .

Q87. The minimum value of α for which the equation $\frac{4}{\sin x} + \frac{1}{1-\sin x} = \alpha$ has at least one solution in $0, \frac{\pi}{2}$ is .

Q88. If $\int_{-a}^{a} x + x - 2dx = 22, a > 2$ and x denotes the greatest integer $\leq x$, then $\int_{a}^{-a} x + xdx$ is equal to Q89. Let three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ be such that $\vec{c}$ is coplanar with $\vec{a}$ and $\vec{b}, \vec{a} \cdot \vec{c} = 7$ and $\vec{b}$ is perpendicular to $\vec{c}$, where $\vec{a} = -\hat{\imath} + \hat{\jmath} + \hat{k}$ and $\vec{b} = 2\hat{\imath} + \hat{k}$, then the value of $2\vec{a} + \vec{b} + \vec{c}^2$ is

Q90. Let $B_i i = 1,2,3$ be three independent events in a sample space. The probability that only B_1 occur is α, only B_2 occurs is β and only B_3 occurs is γ. Let p be the probability that none of the events B_i occurs and these 4 probabilities satisfy the equations $\alpha - 2\beta p = \alpha\beta$ and $\beta - 3\gamma p = 2\beta\gamma$ (All the probabilities are assumed to lie in the interval 0,1 Then $\frac{PB_1}{PB_3}$ is equal to $-$

ANSWER KEYS

1. (3) hatho	2. (1)	3. (3)	4. (1)	5. (4) Matho	6. (1)	ma 7. (3)	8. (2)
9. (1)	10. (1)	11. (4)	12. (3)	13. (2)	14. (2)	15. (2)	16. (2)
17. (4)	18. (3)	19. (3)	20. (4)	21. (25)	22. (25)	mo23. (1)	24. (25600)
25. (440)	26. (2000)	) 27.(15)	28. (75)	29. (25)	30. (25)	31. (1)	32. (3)
33. (4)	34. (4)	35. (3)	36. (1)	37. (1)	38. (3)	39. (1)	40. (4)
41. (1)	42. (4)	43. (1)	44. (2)	45. (1)	46. (3)	47. (4)	48. (1)
49. (2)	50. (3)	51. (2)	52. (2)	53. (1380)	54. (1)	55. (5)	56. (12)
57. (2)	58. (8)	59. (36)	60. (26)	61. (4)	62. (2)	mo63. (2)	64. (3)
65. (4)	66. (2)	67. (4)	68. (4)	69. (1)	70. (2)	71. (4)	72. (1)
73. (2)	74. (4)	75. (2)	76. (3)	77. (2)	78. (3)	79. (1)	80. (4)
81. (10)	82. (3)	83. (5)	84. (17)	85. (540)	86. (1)	87. (9)	88. (3)
89. (75)	90. (6)						