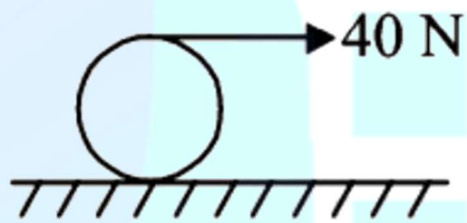
Q1. A particle moves from the point $(2.0\hat{i}+4.0\hat{j})\mathrm{m}$, at $\mathrm{t}=0$, with an initial velocity $(5.0\hat{i}+4.0\hat{j})\mathrm{ms}^{-1}$. It is acted upon by a constant force which produces a constant acceleration $(4.0\hat{i}+4.0\hat{j})\mathrm{ms}^{-2}$. What is the distance of the particle from the origin at time 2 s ?
(1) 15 m
(2) $20\sqrt{2}$ m
(3) 5 m
(4) $10\sqrt{2}$ m

Q2. If speed (V), acceleration (A) and force (F) are considered as fundamental units, the dimension of Young's modulus will be :
(1) $V^{-2}A^{2}F^{-2}$
(2) $V^{-2}A^{2}F^{2}$
(3) $V^{-4}A^{-2}F$
(4) $V^{-4}A^{2}F$

Q3. A particle of mass m is moving in a straight line with momentum p . Starting at time $t=0$, a force $F=k\mathrm{t}$ acts in the same direction on the moving particle during time interval T so that its momentum changes from p to 3 p . Here k is a constant. The value of T is
(1) $2\sqrt{\frac{k}{p}}$
(2) $2\sqrt{\frac{\mathrm{p}}{k}}$
(3) $\sqrt{\frac{2k}{p}}$
(4) $\sqrt{\frac{2p}{\mathrm{k}}}$

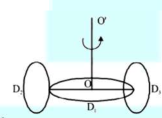
Q4. The magnitude of torque on a particle of mass 1 kg is 2.5 Nm about the origin. If the force acting on it is 1 N , and the distance of the particle from the origin is 5 m , the angle between the force and the position vector is (in radians):
(1) $\frac{\pi}{6}$
(2) $\frac{\pi}{3}$
(3) $\frac{\pi}{8}$
(4) $\frac{\pi}{4}$

Q5. a string is wound around a hollow cylinder of mass 5 kg and radius 0.5 m . If the string is now pulled with a horizontal force of 40 N , and the cylinder is rolling without slipping on a horizontal surface (see figure), then the angular acceleration of the cylinder will be (Neglect the mass and thickness of the string)



(1) $20\mathrm{rad/s}^{2}$
(2) $16\mathrm{rad/s}^{2}$
(3) $12\mathrm{rad/s}^{2}$
(4) $10\mathrm{rad/s}^{2}$

Q6. A circular disc D_1 of mass M and radius R has two identical discs D_2 and D_3 of the same mass M and radius R attached rigidly at its opposite ends (see figure). The moment of inertia of the system about the axis OO',



passing through the centre of D_1, as shown in the figure, will be
(1) MR^2
(2) $3\mathrm{MR}^2$
(3) $\frac{4}{5}\mathrm{MR}^2$
(4) $\frac{2}{3}\mathrm{MR}^2$

Q7. The mass and the diameter of a planet are three times the respective values for the Earth. The period of oscillation of a simple pendulum on the Earth is 2 s . The period of oscillation of the same pendulum on the planet would be:
(1) $\frac{\sqrt{3}}{2}$ s
(2) $\frac{2}{\sqrt{3}}$ s
(3) $\frac{3}{2}s$
(4) $2\sqrt{3}$ s

Q8. Two rods A and B of identical dimensions are at temperature 30°C. If A is heated upto 180°C and B upto T°C, then the new lengths are the same. If the ratio of the coefficients of linear expansion of A and B is $4:3$, then the value of T is
(1) 230°C
(2) 270°C
(3) 200°C
(4) 250°C

Q9. A thermometer graduated according to a linear scale reads a value x_0 when in contact with boiling water, and $x_0/3$ when in contact with ice. What is the temperature of an object in °C, if this thermometer in the contact with the object reads $x_0/2$?
(1) 25
(2) 60
(3) 40
(4) 35

Q10. In a process, temperature and volume of one mole of an ideal monoatomic gas are varied according to the relation $\mathrm{VT}=\mathrm{K}$, where K is a constant. In this process the temperature of the gas is increased by $\Delta\mathrm{T}$. The amount of heat absorbed by gas is (R is gas constant):
(1) $\frac{1}{2}R\Delta T$
(2) $\frac{1}{2}\mathrm{KR}\Delta\mathrm{T}$
(3) $\frac{3}{2}R\Delta T$
(4) $\frac{2K}{3}\Delta T$

Q11. When 100 g of a liquid A at 100°C is added to 50 g of a liquid B at temperature 75°C, the temperature of the mixture becomes 90°C. The temperature of the mixture, if 100 g of liquid A at 100°C is added to 50 g of liquid B at 50°C, will be:
(1) 85°C
(2) 60°C
(3) 80°C
(4) 70°C

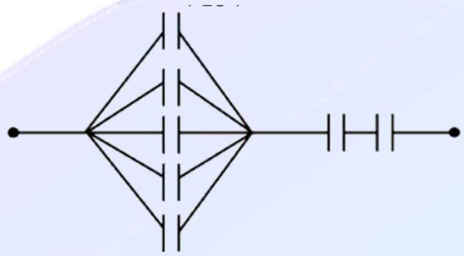
Q12. A metal ball of mass 0.1 kg is heated upto 500°C and dropped into a vessel of heat capacity $800\mathrm{JK}^{-1}$ and containing 0.5 kg water. The initial temperature of water and vessel is 30°C. What is the approximate percentage increment in the temperature of the water? [Specific Heat Capacities of water and metal are, respectively, $4200\mathrm{Jkg}^{-1}\ \mathrm{K}^{-1}$ and $400\mathrm{Jkg}^{-1}\ \mathrm{K}^{-1}$]
(1) 15%
(2) 30%
(3) 25%
(4) 20%

Q13. A pendulum is executing simple harmonic motion and its maximum kinetic energy is K_1. If the length of the pendulum is doubled and it performs simple harmonic motion with the same amplitude as in the first case, its maximum kinetic energy is K_2
(1) $K_2=2K_1$
(2) $\mathrm{K}_2=\frac{\mathrm{K}_1}{2}$
(3) $K_2=\frac{K_1}{4}$
(4) $K_2=K$

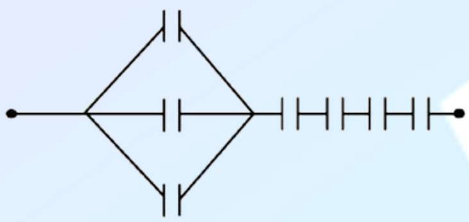
Q14. A simple pendulum of length 1 m is oscillating with an angular frequency $10\mathrm{rad/s}$. The support of the pendulum starts oscillating up and down with a small angular frequency of $1\mathrm{rad/s}$ and an amplitude of 10^{-2} m . The relative change in the angular frequency of the pendulum is best given by :
(1) $10^{-3}\mathrm{rad/s}$
(2) $1\mathrm{rad/s}$
(3) $10^{-1}\mathrm{rad/s}$
(4) $10^{-5}\mathrm{rad/s}$

Q15. An electric field of $1000\ \mathrm{V/m}$ is applied to an electric dipole at angle of 45°. The value of electric dipole moment is $10^{-29}\mathrm{C}\cdot\mathrm{m}$. What is the potential energy of the electric dipole?
(1) -20×10^{-18} J
(2) -7×10^{-27} J
(3) -10×10^{-29} J
(4) -9×10^{-20} J

Q16. Seven capacitors, each of capacitance 2μ F, are to be connected in a configuration to obtain an effective capacitance of $\left(\frac{6}{13}\right)\mu$F. Which of the combinations, shown in figures below, will achieve the desired value?
(1)



(2)



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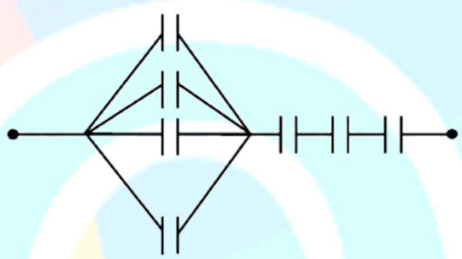

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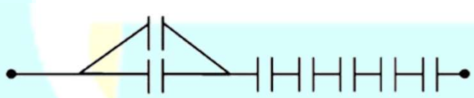
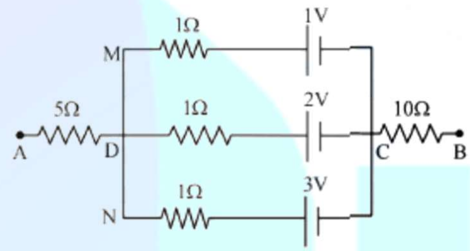


Q17.

In the circuit shown, the potential difference between A and B is



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

Q18. A galvanometer having a resistance of 20Ω and 30 division on both sides has figure of merit 0.005 ampere/ division. The resistance that should be connected in series such that it can be used as a voltmeter upto 15 volt, is:
(1) 100Ω
(2) 120Ω
(3) 80Ω
(4) 125Ω

Q19. A paramagnetic substance in the form of a cube with sides 1 cm has a magnetic dipole moment of 20×10^{-6} J/T when a magnetic intensity of 60×10^{3} A/m is applied. Its magnetic susceptibility is:
(1) 3.3×10^{-2}
(2) 4.3×10^{-2}
(3) 2.3×10^{-2}
(4) 3.3×10^{-4}

Q20. The region between $y = 0$ and $y = \mathrm{d}$ contains a magnetic field $\vec{\mathrm{B}} = \mathrm{B}\hat{\mathrm{z}}$. A particle of mass m and charge q enters the region with a velocity $\vec{v} = v\hat{\imath}$. if $\mathrm{d} = \frac{mv}{2\mathrm{qB}}$, the acceleration of the charged particle at the point of its emergence at the other side is :
(1) $\frac{\mathrm{q}v\ \mathrm{B}}{\mathrm{m}}\left(\frac{1}{2}\hat{\imath} - \frac{\sqrt{3}}{2}\hat{\jmath}\right)$
(2) $\frac{\mathrm{q}v\mathrm{B}}{\mathrm{m}}\left(\frac{\sqrt{3}}{2}\hat{\imath} + \frac{1}{2}\hat{\jmath}\right)$
(3) $\frac{\mathrm{q}v\ \mathrm{B}}{\mathrm{m}}\left(\frac{-\hat{\jmath}+\hat{\imath}}{\sqrt{2}}\right)$
(4) None of the above

Q21. A particle of mass m and charge q is in an electric and magnetic field given by

$$\vec{E}=2\hat{\imath}+3\hat{\jmath}; \vec{B}=4\hat{\jmath}+6\hat{k}$$

The charged particle is shifted from the origin to the point $P(x=1; y=1)$ along a straight path. The magnitude of the total work done is :
(1) $(0.35)q$
(2) $5q$
(3) (2.5) q
(4) $(0.15)q$

Q22. A copper wire is wound on a wooden frame, whose shape is that of an equilateral triangle. If the linear dimension of each side of the frame is increased by a factor of 3 , keeping the number of turns of the coil per unit length of the frame the same, then the self inductance of the coil:
(1) decreases by a factor of 9
(2) increases by a factor of 27
(3) increases by a factor of 3
(4) decreases by a factor of $9\sqrt{3}$

Q23. A 27 mW laser beam has a cross-sectional area of $10\ mm^2$. The magnitude of the maximum electric field in this electromagnetic wave is given by: [Given permittivity of space $\epsilon_0=9\times10^{-12}$ SI units, Speed of light $c=3\times10^8\ m/s$]
(1) $2 kV/m$
(2) $0.7 kV/m$
(3) $1 kV/m$
(4) $1.4 kV/m$

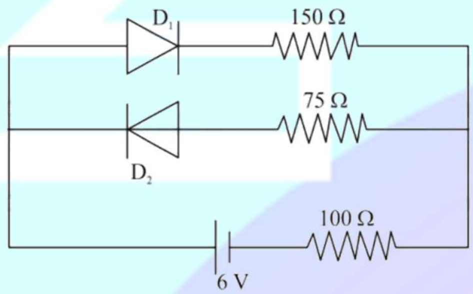
Q24. A monochromatic light is incident at a certain angle on an equilateral triangular prism and suffers minimum deviation. If the refractive index of the material of the prism is $\sqrt{3}$, then the angle of incidence is :
(1) 90°
(2) 30°
(3) 60°
(4) 45°

Q25. In a double-slit experiment, green light (5303 A) falls on a double slit having a separation of 19.44μ m and a width of 4.05μ m. The number of bright fringes between the first and the second diffraction minima is
(1) 10
(2) 5
(3) 4
(4) 9

Q26. In a photoelectric experiment, the wavelength of the light incident on a metal is changed from 300 nm to 400 nm . The decrease in the stopping potential is close to : $\left(\frac{hc}{e}=1240\ nm-V\right)$
(1) 0.5 V
(2) 1.5 V
(3) 1.0 V
(4) 2.0 V

Q27. In a hydrogen like atom, when an electron jumps from the M -shell to the L -shell, the wavelength of emitted radiation is L. If an electron jumps from N -shell to the L -shell, the wavelength of emitted radiation will be:
(1) $\frac{27}{20}\lambda$
(2) $\frac{16}{25}\lambda$
(3) $\frac{25}{16}\lambda$
(4) $\frac{20}{27}\lambda$

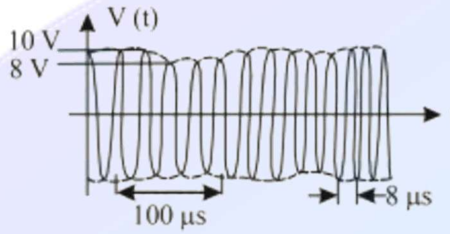
Q28. The circuit shown below contains two ideal diodes, each with a forward resistance of 50Ω. If the battery voltage is 6 V , the current through the 100Ω resistance (in Amperes) is:



(1) 0.036
(2) 0.02
(3) 0.027
(4) 0.03

Q29.

An amplitude modulated signal is plotted below:



Which one of the following best describes the above signal?

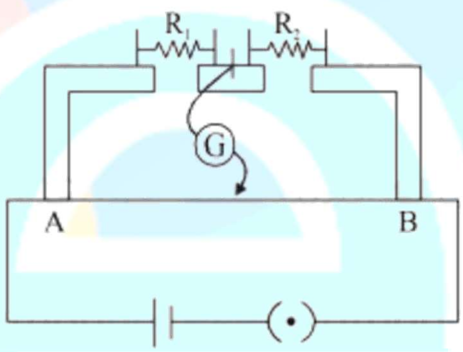
(1) $(9 + \sin(2.5\pi \times 10^5 t))\sin(2\pi \times 10^4 t)V$

(2) $(1 + 9\sin(2\pi \times 10^4 t))\sin(2.5\pi \times 10^5 t)V$

(3) $(9 + \sin(2\pi \times 10^4 t))\sin(2.5\pi \times 10^5 t)V$

(4) $(9 + \sin(4\pi \times 10^4 t))\sin(5\pi \times 10^5 t)V$

Q30. In the experimental set up of metre bridge shown in the figure, the null point is obtaine data distance of 40 cm from A. If a 10Ω resistor is connected in series with R_1, the null point shifts by 10 cm . The resistance that should be connected in parallel with $(R_1 + 10)\Omega$ such that the null point shifts back to its initial position is



(1) 20Ω

(2) 40Ω

(3) 60Ω

(4) 30Ω

Q31.25 mL of the given HCl solution requires 30 mL of 0.1 M sodium carbonate solution. What is the volume of this HCl solution required to titrate 30 mL of 0.2 M aqueous NaOH solution?

(1) 25 mL

(2) 75 mL

(3) 50 mL

(4) 12.5 mL

Q32. The de Broglie wavelength (λ) associated with a photoelectron varies with the frequency (v) of the incident radiation as, [v_0 is threshold frequency]:

(1) $\lambda \propto \frac{1}{(v-v_0)}$

(2) $\lambda \propto \frac{1}{(v-v_0)^{\frac{1}{4}}}$

(3) $\lambda \propto \frac{1}{(v-v_0)^{\frac{3}{2}}}$

(4) $\lambda \propto \frac{1}{(v-v_0)^{\frac{1}{2}}}$

Q33. The correct option with respect to the Pauling electronegativity values of the elements is:

(1) Te > Se

(2) Ga < Ge

(3) Si < Al

(4) P > S

Q34. The reaction $MgO(s) + C(s) \rightarrow Mg(s) + CO(g)$, for which $\Delta H^\circ = +491.1\ kJ\ mol^{-1}$ and $\Delta S^\circ = 198.0 JK^{-1}\ mol^{-1}$ is not feasible at 298 K . Temperature above which reaction will be feasible is

(1) 2040.5 K

(2) 1890.0 K

(3) 2480.3 K

(4) 2380.5 K

Q35. The standard reaction Gibbs energy for a chemical reaction at an absolute temperature T is given by $\Delta G^\circ = A - BT$ where A and B are non-zero constants. Which of the following is true about this reaction?

(1) Exothermic if $B < 0$

(2) Endothermic if $A > 0$

(3) Endothermic if $A < 0$ and $B > 0$

(4) Exothermic if $A > 0$ and $B < 0$

Q36. For the equilibrium $2H_2O \rightleftharpoons H_3O^+ + OH^-$; the value of ΔG° at 298 K is approximately:

(1) $100\ kJ\ mol^{-1}$

(2) $-80\ kJ\ mol^{-1}$

(3) $80\ kJ\ mol^{-1}$

(4) $-100\ kJ\ mol^{-1}$

Q37. Match the following items in column I with the corresponding items in column II.

Column-I

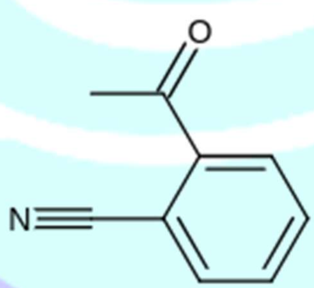
Column-II

(i) $Na_2CO_3 \cdot 10H_2O$
(A) Portland cement ingredient
(ii) $Mg(HCO_3)_2$
(B) Castner-Kellner process
(iii) NaOH
(C) Solvay process
(iv) $Ca_3Al_2O_6$
(D) Temporary hardness
(1) (i) → (B); (ii) → (C);
(iii) → (A); (iv) → (D)
(2) (i) → (C); (ii) → (B); (iii) → (D); (iv) → (A)
(3) (i) → (D); (ii) → (A); (iii) → (B); (iv) → (C)
(4) (i) → (C); (ii) → (D); (iii) → (B); (iv) → (A)

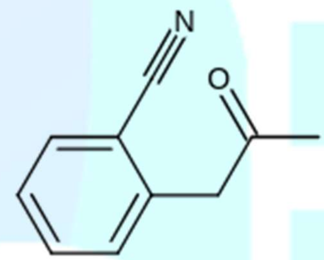
Q38. The hydride that is NOT electron deficient is:
(1) SiH_4
(2) B_2H_6
(3) GaH_3
(4) AlH_3

Q39. The relative stability of +1 oxidation state of group 13 elements follows the order
(1) $Al < Ga < Tl < In$
(2) $T\ 1 < In < Ga < Al$
(3) $Ga < Al < ln < Tl$
(4) $Al < Ga < In < Tl$

Q40. Which of the following compounds reacts with ethylmagnesium bromide and also decolourizes bromine water solution?
(1)



(2)



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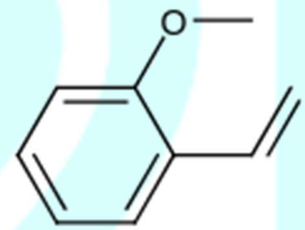

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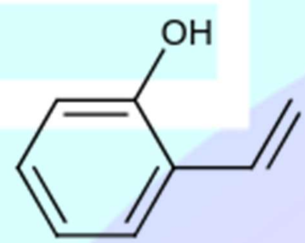
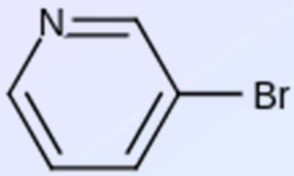
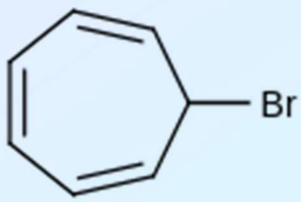


Q41. Which of the following compounds will produce a precipitate with $AgNO_3$?
(1)



(2)



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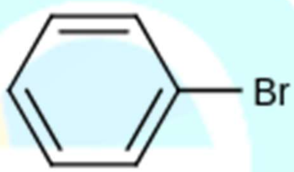

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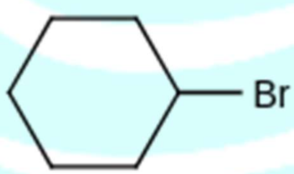


Q42. Taj Mahal is being slowly disfigured and discoloured. This is primarily due to
(1) Global warming
(2) Acid rain
(3) Water pollution
(4) Soil pollution

Q43. The higher concentration of which gas in air can cause stiffnes of flower buds?
(1) NO
(2) CO_2
(3) SO.
(4) CO

Q44. The radius of the largest sphere which fits properly at the centre of the edge of a body centred cubic unit cell is : (Edge length is represented by 'a')
(1) 0.027 a
(2) 0.047 a
(3) 0.134 a
(4) 0.067 a

Q45. K_2HgI_4 is 40% ionised in aqueous solution. The value of its van't Hoff factor (i) is:
(1) 1.6
(2) 1.8
(3) 20
(4) 22

Q46. Given the equilibrium constant: K_C of the reaction: $Cu(s) + 2Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$ is 10×10^{15} calculate the E^0_{cell} of this reaction at 298 K $\left[2.303 \frac{RT}{F} \text{ at } 298\text{ K} = 0.059\text{ V}\right]$
(1) 0.04736 mV
(2) 0.4736 mV
(3) 0.4736 V
(4) 0.04736 V

Q47. The reaction $2X \rightarrow B$ is a zeroth order reaction. If the initial concentration of X is 0.2 M , the half-life is 6 h .
When the initial concentration of X is 0.5 M , the time required to reach its final concentration of 0.2 M will be
(1) 9.0 h
(2) 12.0 h
(3) 18.0 h
(4) 7.2 h

Q48. Among the colloids cheese (C), milk (M) and smoke (S), the correct combination of the dispersed phase and dispersion medium,

respectively is :
(1) C : liquid in solid; M: liquid in solid; S: solid in (2)
C : liquid in solid; M : liquid in liquid; S: solid gas in gas
(3) C : solid in liquid; M : liquid in liquid; S : gas in (4) C : solid in liquid; M : solid in liquid; S : solid in solid gas

Q49. The reaction that does NOT define calcination is:

(1) $Fe_2O_3 \cdot xH_2O \xrightarrow{\Delta} Fe_2O_3 + xH_2O$

(2) $2Cu_2S + 3O_2 \xrightarrow{\Delta} 2Cu_2O + 2SO_2$

(3) $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

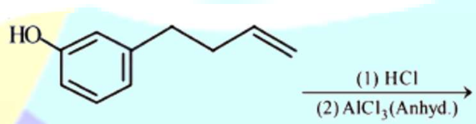
(4) $CaCO_3 \cdot MgCO_3 \xrightarrow{\Delta} CaO + MgO + 2CO_2$

Q50. A $\xrightarrow{4KOH,O_2}$ $\underset{\text{(Green)}}{2\,B}$ $+ 2H_2O$ B $\xrightarrow{4HCl}$ $\underset{\text{(Purple)}}{2C}$ + $MnO_2 + 2H_2O$ 2C $\xrightarrow{H_2O,KI}$ 2 A + KOH + D In the above sequence of reactions, A and D , respectively, are:
(1) KI and $KMnO_4$
(2) MnO_2 and KIO_3
(3) KIO_3 and MnO_2
(4) KI and K_2MnO_4

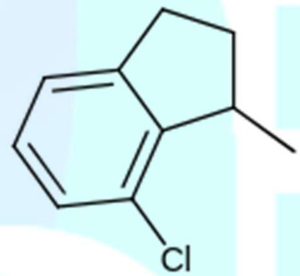
Q51. The coordination number of Th in $K_4[Th(C_2O_4)_4(H_2O)_2]$ is: ($C_2O_4^{2-}$ = oxalato)
(1) 14
(2) 6
(3) 8
(4) 10

Q52. The number of bridging CO ligand(s) and Co − Co bond(s) in $Co_2(CO)_8$, respectively are:
(1) 2 and 1
(2) 2 and 0
(3) 0 and 2
(4) 4 and 0

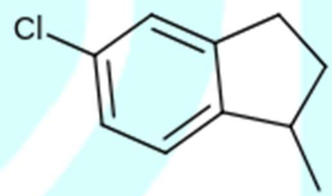
Q53. The major product of the following reaction is:



(1)



(2)



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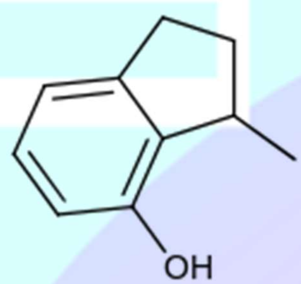

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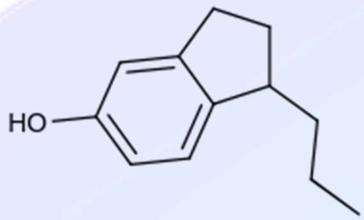
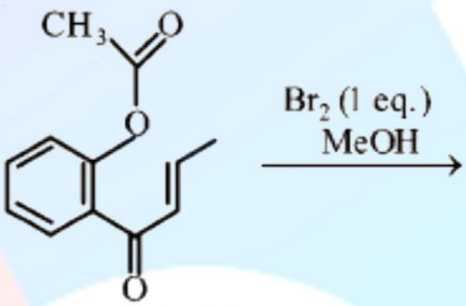
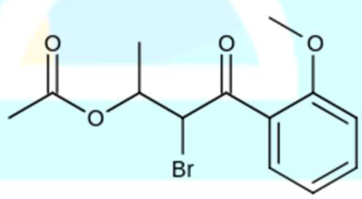


Q54.

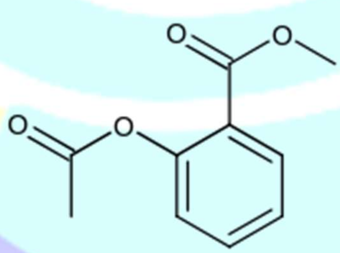
The major product obtained in the following conversion is:



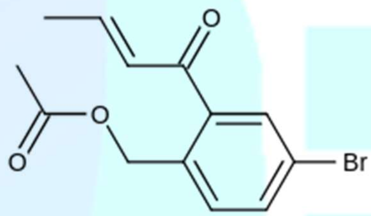
(1)



(2)



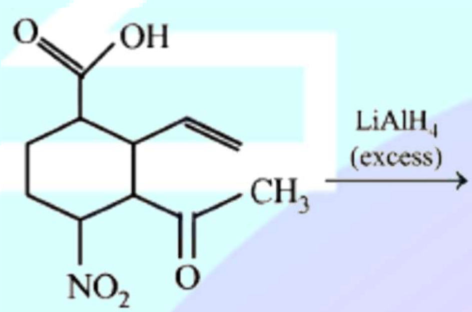
(3)



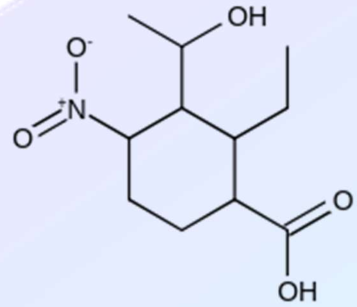
(4)

Q55.

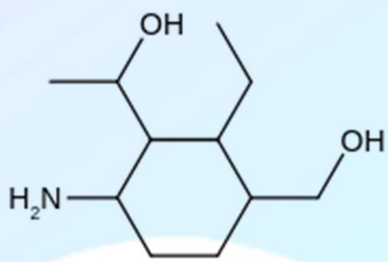
The major product obtained in the following reaction is:



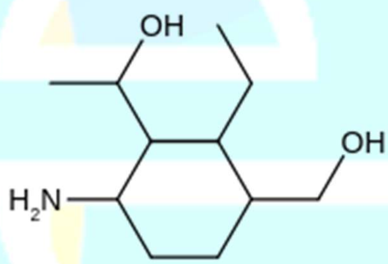
(1)



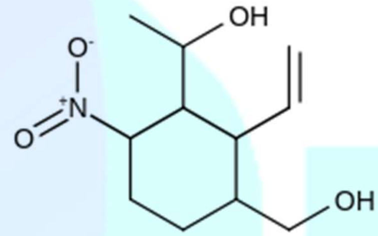
(2)



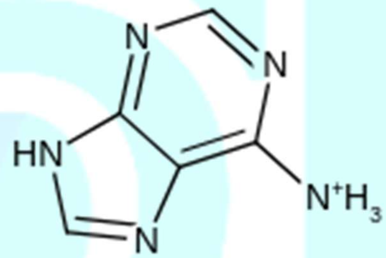
(3)



(4)



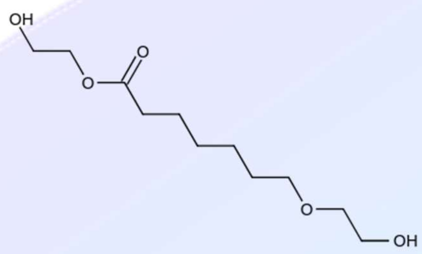
Q56.



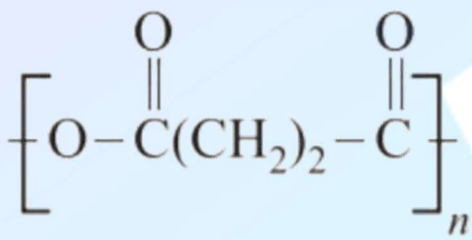
In the following compound,
the favourable site/s for protonation is/are :
(1) (a) and (e)
(2) (b), (c) and (d)
(3) (a) and (d)
(4) (a)

Q57. A compound ' X ' on treatment with $Br/NaOH$, provided C_3H_9 N, which gives positive carbylamine test. Compound X' is:
(1) $CH_3COCH_2NHCH_3$
(2) $CH_3CH_2COCH_2NH_2$
(3) $CH_3CH_2CH_2CONH_2$
(4) $CH_3CON(CH_3)_2$

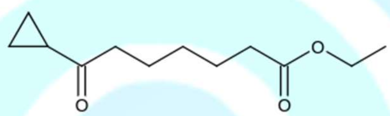
Q58. The homopolymer formed from 4-hydroxy-butanoic acids is.
(1)



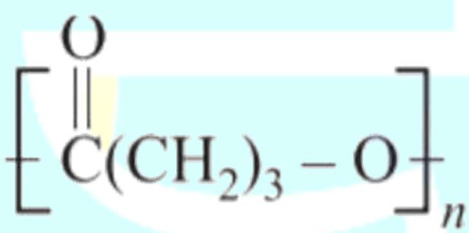
(2)



(3)



(4)



Q59.

Item I

(A) Allosteric effect
(B) Competitive inhibitor
(C) Receptor
(D) Poison

Item II

(P) Molecule binding to the active site of enzyme
(Q) Molecule crucial for communication in the body
(R) Molecule binding to a site other than the active site of enzyme
(S) Molecule binding to the enzyme covalently

The correct match between Item I and Item II is:
(1) (A) → (R); (B) → (P); (C) → (Q); (D) → (S)
(2) (A) → (P); (B) → (R); (C) → (Q); (D) → (S)
(3) (A) → (R); (B) → (P); (C) → (S); (D) → (Q)
(4) (A) → (P); (B) → (R); (C) → (S); (D) → (Q)

Q60.

Item I

(A) Ester test	(P) Tyr
(B) Carbylamine test	(Q) AsP
(C) Phthalein dye test	(R) Ser

(S) Lys

The correct match between Item I and Item II is:

Item II

(C) → (P)
(1) (A) → (Q, R); (B) → (S); (C) → (P)
(2) (A) → (R);
(B) → (Q);
(4) (A) → (Q); (B) → (S); (C) → (R)
(3) (A) → (R); (B) → (S); (C) → (Q)

Q61. Let α and β be the roots of the quadratic equation $x^2 \sin\theta - x(\sin\theta\cos\theta + 1) + \cos\theta = 0 (0 < \theta < 45°)$, and $\alpha < \beta$. Then $\sum_{n=0}^{\infty}\left(\alpha^n + \frac{(-1)^n}{\beta^n}\right)$ is equal to :
(1) $\frac{1}{1-\cos\theta} - \frac{1}{1+\sin\theta}$
(2) $\frac{1}{1+\cos\theta} + \frac{1}{1-\sin\theta}$

(3) $\frac{1}{1-c \quad \theta}+\frac{1}{1+\sin \theta}$
(4) $\frac{1}{1+co \quad \theta}-\frac{1}{1-\sin \theta}$

Q62. Let z be a complex number such that $|z|+z=3+i$(where $i=\sqrt{-1}$) Then $|z|$ is equal to :
(1) $\frac{\sqrt{34}}{3}$
(2) $\frac{5}{3}$
(3) $\frac{\sqrt{41}}{4}$
(4) $\frac{5}{4}$

Q63.If 19 th term of a non-zero A.P. is zero, then its (49th term): (29th term) is:
(1) $4: 1$
(2) $1: 3$
(3) $3: 1$
(4) $2: 1$

Q64. Let $S_n=1+q+q^2+\cdots+q^n$ and $\mathrm{T}_{\mathrm{n}}=1+\left(\frac{\mathrm{q}+1}{2}\right)+\left(\frac{\mathrm{q}+1}{2}\right)^2+\cdots+\left(\frac{\mathrm{q}+1}{2}\right)^{\mathrm{n}}$ where q is a real number and $q \neq 1$. If ${}^{101}\mathrm{C}_1+{}^{101}\mathrm{C}_2 \cdot \mathrm{~S}_1+\cdots .+{}^{101}\mathrm{C}_{101} \cdot \mathrm{~S}_{100}=\alpha \mathrm{T}_{100}$, then α is equal to :
(1) 2^{99}
(2) 202
(3) 200
(4) 2^{100}

Q65. Let $(x+10)^{50}+(x-10)^{50}=\mathrm{a}_0+\mathrm{a}_1 x+\mathrm{a}_2 x^2+\cdots+\mathrm{a}_{50} x^{50}$, for all $x \in \mathbf{R}$; then $\frac{\mathrm{a}_2}{\mathrm{a}_0}$ is equal to :
(1) 12.5
(2) 12
(3) 12.25
(4) 12.75

Q66. If in a parallelogram ABDC , the coordinates of A, B and C are respectively (1,2), (3,4) and (2,5), then the equation of the diagonal AD is :
(1) $5x-3y+1=0$
(2) $5x+3y-11=0$
(3) $3x-5y+7=0$
(4) $3x+5y-13=0$

Q67. A circle cuts a chord of length 4 a on the x-axis and passes through a point on the y-axis, distant 2 b from the origin. Then the locus of the centre of this circle, is:
(1) a hyperbola
(2) an ellipse
(3) a straight line
(4) a parabola

Q68. If the area of the triangle whose one vertex is at the vertex of the parabola, $y^2+4(x-a^2)=0$ and the other two vertices are the points of intersection of the parabola and y-axis, is 250 sq. units, then a value of ' a ' is :
(1) $5\sqrt{5}$
(2) $5(2^{1/3})$
(3) $(10)^{33}$
(4) 5

Q69. Let the length of the latus rectum of an ellipse with its major axis along x-axis and centre at the origin, be 8 . If the distance between the foci of this ellipse is equal to the length of its minor axis, then which one of the following points lies on it?
(1) $(4\sqrt{2}, 2\sqrt{2})$
(2) $(4\sqrt{3}, 2\sqrt{2})$
(3) $(4\sqrt{3}, 2\sqrt{3})$
(4) $(4\sqrt{2}, 2\sqrt{3})$

Q70.If a hyperbola has length of its conjugate axis equal to 5 and the distance between its foci is 13 , then the eccentricity of the hyperbola is:
(1) $\frac{13}{12}$
(2) 2
(3) $\frac{13}{6}$
(4) $\frac{13}{8}$

Q71. $\lim_{x \rightarrow 0} \frac{x\cot(4x)}{\sin^2 x\cot^2(2x)}$ is equal to:
(1) 0
(2) 2
(3) 4
(4) 1

Q72. Contrapositive of the statement "If two numbers are not equal, then their squares are not equal". is :
(1) If the squares of two numbers are not equal, then the numbers are equal.
(2) If the squares of two numbers are equal, then the numbers are not equal.
(3) If the squares of two numbers are equal, then

the numbers are equal.
(4) If the squares of two numbers are not equal, then the numbers are not equal.

Q73. Given $\frac{b+c}{11}=\frac{c+a}{12}=\frac{a+b}{13}$ for a ΔABC with usual notation. If $\frac{\cos A}{\alpha}=\frac{\cos B}{\beta}=\frac{\cos C}{\gamma}$, then the ordered triad (α,β,γ) has a value
(1) $(7,19,25)$
(2) $(3,4,5)$
(3) $(5,12,13)$
(4) $(19,7,25)$

Q74. $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)(x+a+b+c)^2, x \neq 0$ and $a+b+c \neq 0$, then x is equal to
(1) abc
(2) $-(a+b+c)$
(3) $2(a+b+c)$
(4) $-2(a+b+c)$

Q75. Let A and B be two invertible matrices of order 3×3. If $\det(\mathrm{ABA^T}) = 8$ and $\det(\mathrm{AB^{-1}}) = 8$, then $\det(\mathrm{BA^{-1}\,B^T})$ is equal to
(1) $\frac{1}{4}$
(2) 1
(3) $\frac{1}{16}$
(4) 16

Q76. All x satisfying the inequality $(\cot^{-1}x)^2 - 7(\cot^{-1}x) + 10 > 0$, lie in the interval :
(1) $(-\infty, \cot 5) \cup (\cot 4, \cot 2)$
(2) $(\cot 2, \infty)$
(3) $(-\infty, \cot 5) \cup (\cot 2, \infty)$
(4) $(\cot 5, \cot 4)$

Q77. Let a function $f: (0,\infty) \to (0,\infty)$ be defined by $f(x) = \left|1-\frac{1}{x}\right|$. Then f is :
(1) not injective but it is surjective
(2) injective only
(3) neither injective nor surjective
(4) None of the above

Q78. The number of functions f from $\{1,2,3,\dots,20\}$ onto $\{1,2,3,\dots,20\}$ such that $f(k)$ is a multiple of 3 , whenever k is a multiple of 4 is:
(1) $6^5 \times (15)!$
(2) $5! \times 6!$
(3) $(15)! \times 6!$
(4) $5^6 \times 15$

Q79. Let K be the set of all real values of x where the function $f(x) = \sin|x| - |x| + 2(x-\pi)\cos|x|$ is not differentiable. Then the set K is equal to :
(1) ϕ (an empty set)
(2) $\{\pi\}$
(3) $\{0\}$
(4) $\{0,\pi\}$

Q80. Let $f(x) = \frac{x}{\sqrt{a^2+x^2}} - \frac{d-x}{\sqrt{b^2+(d-x)^2}}, x \in \mathbb{R}$ wherea, b and d are non-zero real constants. Then :
(1) f is an increasing function of x
(2) f is a decreasing function of x
(3) f' is not a continuous function of x
(4) f is neither increasing nor decreasing function of x

Q81. Let x, y be positive real numbers and m, n positive integers. The maximum value of the expression $\frac{x^m y^n}{(1+x^{2m})(1+y^{2n})}$ is :
(1) 1
(2) $\frac{1}{2}$
(3) $\frac{1}{4}$
(4) $\frac{m+n}{6mn}$

Q82. If $\int \frac{x+1}{\sqrt{2x-1}}\,dx = f(x)\sqrt{2x-1} + C$, where C is a constant of integration, then $f(x)$ is equal to:
(1) $\frac{1}{3}(x+1)$
(2) $\frac{2}{3}(x+2)$
(3) $\frac{2}{3}(x-4)$
(4) $\frac{1}{3}(x+4)$

Q83. The integral $\int_{\pi/6}^{\pi/4} \frac{dx}{\sin 2x(\tan^5 x+\cot^5 x)}$ equals:
(1) $\frac{1}{20}\tan^{-1}\left(\frac{1}{9\sqrt{3}}\right)$
(2) $\frac{1}{10}\left(\frac{\pi}{4} - \tan^{-1}\left(\frac{1}{9\sqrt{3}}\right)\right)$
(3) $\frac{\pi}{40}$
(4) $\frac{1}{5}\left(\frac{\pi}{4} - \tan^{-1}\left(\frac{1}{3\sqrt{3}}\right)\right)$

Q84. The area (in sq. units) in the first quadrant bounded by the parabola, $y = x^2 + 1$, the tangent to it at the point $(2,5)$ and the coordinate axes is :
(1) $\frac{8}{3}$
(2) $\frac{37}{24}$
(3) $\frac{187}{24}$
(4) $\frac{14}{3}$

Q85. The solution of the differential equation, $\frac{\mathrm{d}y}{\mathrm{d}x} = (x-y)^2$, when $y(1) = 1$, is:
(1) $\log_e\left|\frac{2-x}{2-y}\right| = x - y$
(2) $-\log_e\left|\frac{1-x+y}{1+x-y}\right| = 2(x-1)$
(3) $-\log_e\left|\frac{1+x-y}{1-x+y}\right| = x + y - 2$
(4) $\log_e\left|\frac{2-y}{2-x}\right| = 2(y-1)$

Q86. Let $\sqrt{3}\hat{\imath} + \hat{\jmath}, \hat{\imath} + \sqrt{3}\hat{\jmath}$ and $\beta\hat{\imath} + (1-\beta)\hat{\jmath}$ respectively be the position vectors of the points A, B and C with respect to the origin O . If the distance of C from the bisector of the acute angle between OA and OB is $\frac{3}{\sqrt{2}}$, then the sum of all possible values of β is:
(1) 4
(2) 3
(3) 2
(4) 1

Q87. Two lines $\frac{x-3}{1} = \frac{y+1}{3} = \frac{z-6}{-1}$ and $\frac{x+5}{7} = \frac{y-2}{-6} = \frac{z-3}{4}$ intersect at the point R. The reflection of R in the $xy-$ plane has coordinates:
(1) $(2,-4,-7)$
(2) $(2,4,7)$
(3) $(2,-4,7)$
(4) $(-2,4,7)$

Q88. If the point $(2,\alpha,\beta)$ lies on the plane which passes through the points $(3,4,2)$ and $(7,0,6)$ and is perpendicular to the plane $2x - 5y = 15$, then $2\alpha - 3\beta$ is equal to :
(1) 12
(2) 7
(3) 5
(4) 17

Q89. Let $S = \{1,2, \dots \dots ,20\}$. A subset B of S is said to be "nice", if the sum of the elements of B is 203 . Than the probability that a randomly chosen subset of S is "nice" is :
(1) $\frac{7}{2^{20}}$
(2) $\frac{5}{2^{20}}$
(3) $\frac{4}{2^{20}}$
(4) None of the above

Q90. A bag contains 30 white balls and 10 red balls. 16 balls are drawn one by one randomly from the bag with replacement. If X be the number of white balls drawn, then $\left(\frac{\text{mean of } X}{\text{standard deviation of } X}\right)$ is equal to:
(1) 4
(2) $4\sqrt{3}$
(3) $3\sqrt{2}$
(4) $\frac{4\sqrt{3}}{3}$

ANSWER KEYS

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