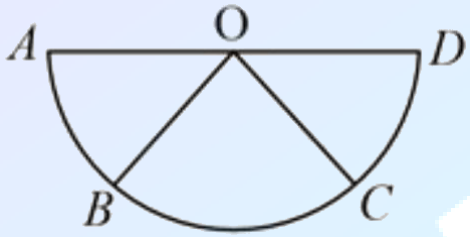
Q1. Assertion A : If A, B, C, D are four points on a semi-circular arc with a centre at O such that $|\overrightarrow{AB}| = |\overrightarrow{BC}| = |\overrightarrow{CD}|$. Then, $\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} = 4\overrightarrow{AO} + \overrightarrow{OB} + \overrightarrow{OC}$

Reason R : Polygon law of vector addition yields $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD} + \overrightarrow{AD} = 2\overrightarrow{AO}$



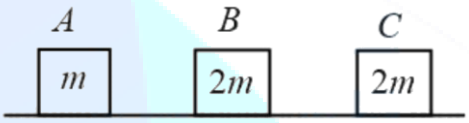
In the light of the above statements, choose the most appropriate answer from the options given below.

(1) A is correct but R is not correct.
(2) A is not correct but R is correct.
(3) Both A and R are correct and R is the correct explanation of A.
(4) Both A and R are correct but R is not the correct explanation of A.

Q2. A ball is thrown up with a certain velocity so that it reaches a height h. Find the ratio of the two different times of the ball reaching $\frac{h}{3}$ in both the directions.

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

Q3. Three objects A, B and C are kept in a straight line on a frictionless horizontal surface. The masses of A, B and C are $m, 2m$ and $2m$ respectively. A moves towards B with a speed of 9 m s^{-1} and makes an elastic collision with it. Thereafter B makes a completely inelastic collision with C. All motions occur along the same straight line. The final speed of C is :



(1) 6 m s^{-1}
(2) 9 m s^{-1}
(3) 4 m s^{-1}
(4) 3 m s^{-1}

Q4. List-I

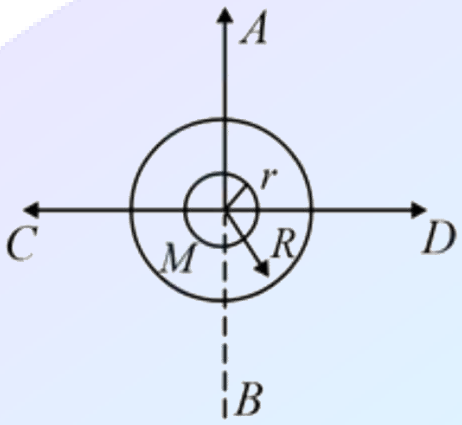
List-II

(a) MI of the rod (length L, Mass M, about an axis $\perp$ to the rod passing (i) through the midpoint)
$\frac{8ML^2}{3}$
(b) MI of the rod (length L, Mass 2 M , about an axis $\perp$ to the rod passing through one of its end)
(ii) $\frac{ML^2}{3}$
(c) MI of the rod (length 2 L , Mass M, about an axis $\perp$ to the rod passing through its midpoint)
(d) MI of the rod (Length $2L$, Mass 2 M , about an axis $\perp$ to the rod passing through one of its end)
(iii)
$\frac{ML^2}{12}$

Choose the correct answer from the options given below:

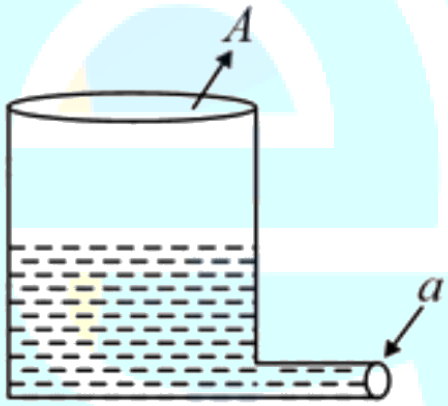
(1) (a) - (ii), (b) - (iii), (c) - (i), (d) - (iv)
(2) (a) - (ii), (b) - (i), (c) - (iii), (d) - (iv)
(3) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)
(4) (a) - (iii), (b) - (iv), (c) - (i), (d) - (ii)

Q5. The figure shows two solid discs with radius R and r respectively. If mass per unit area is the same for both, what is the ratio of MI of bigger disc around axis AB (Which is $\perp$ to the plane of the disc and passing through its centre) of MI of smaller disc around one of its diameters lying on its plane? Given M is the mass of the larger disc. (MI stands for a moment of inertia)



(1) $R^2 : r^2$
(2) $2r^4 : R^4$
(3) $2R^2 : r^2$
(4) $2R^4 : r^4$

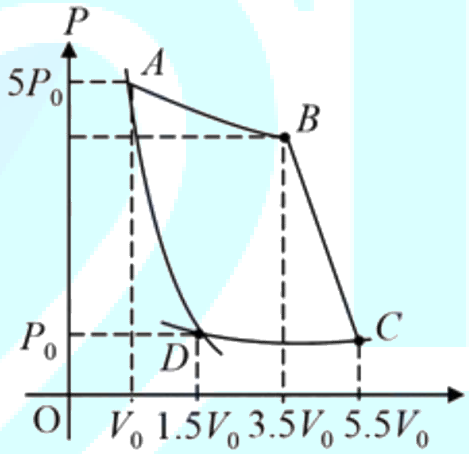
Q6. A light cylindrical vessel is kept on a horizontal surface. Area of the base is A. A hole of cross-sectional area a is made just at its bottom side. The minimum coefficient of friction necessary to prevent sliding the vessel due to the impact force of the emerging liquid is



(1) $\frac{A}{2a}$
(2) None of these
(3) $\frac{2a}{A}$
(4) $\frac{a}{A}$

Q7. A body takes 4 min to cool from 61°C to 59°C. If the temperature of the surroundings is 30°C, the time taken by the body to cool from 51°C to 49°C is:
(1) 4 min .
(2) 3 min .
(3) 8 min .
(4) 6 min .

Q8. In the reported figure, there is a cyclic process $ABCDA$ on a sample of 1 mol of a diatomic gas. The temperature of the gas during the process $A \rightarrow B$ and $C \rightarrow D$ are T_1 and $T_2 (T_1 > T_2)$ respectively.



Choose the correct option out of the following for work done if processes BC and DA are adiabatic.
(1) $W_{AB} = W_{DC}$
(2) $W_{AD} = W_{BC}$
(3) $W_{BC} + W_{DA} > 0$
(4) $W_{AB} < W_{CD}$

Q9. The number of molecules in one litre of an ideal gas at 300 K and 2 atmospheric pressure with mean kinetic energy 2×10^{-9} J per molecule is:
(1) 0.75×10^{11}
(2) 3×10^{11}
(3) 1.5×10^{11}
(4) 6×10^{11}

Q10. A particle starts executing simple harmonic motion (SHM) of amplitude a and total energy E. At any instant, its kinetic energy is $\frac{3E}{4}$, then its

displacement y is given by:
(1) $y = a$
(2) $y = \frac{a}{\sqrt{2}}$
(3) $y = \frac{a\sqrt{3}}{2}$
(4) $y = \frac{a}{2}$

Q11. Two identical tennis balls each having mass m and charge q are suspended from a fixed point by threads of length l. What is the equilibrium separation when each thread makes a small angle θ with the vertical?

(1) $x = \left(\frac{q^2 l}{2\pi\varepsilon_0 mg}\right)^{\frac{1}{2}}$

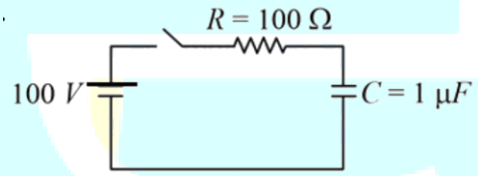
(2) $x = \left(\frac{q^2 l}{2\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$

(3) $x = \left(\frac{q^2 l^2}{2\pi\varepsilon_0 m^2 g}\right)^{\frac{1}{3}}$

(4) $x = \left(\frac{q^2 l^2}{2\pi\varepsilon_0 m^2 g^2}\right)^{\frac{1}{3}}$

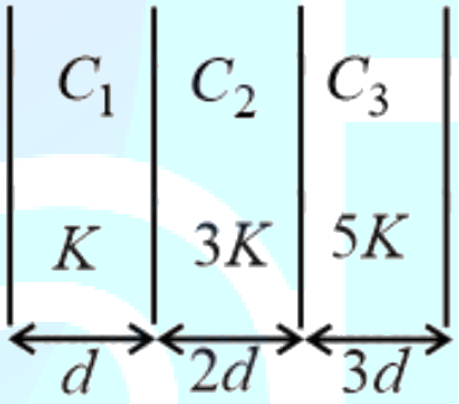
Q12. The relative permittivity of distilled water is 81 . The velocity of light in it will be: (Given $\mu_r = 1$)
(1) 4.33×10^7 m s^{-1}
(2) 2.33×10^7 m s^{-1}
(3) 3.33×10^7 m s^{-1}
(4) 5.33×10^7 m s^{-1}

Q13.



A capacitor of capacitance $C = 1\mu$ F is suddenly connected to a battery of 100 V through a resistance $R = 100\Omega$. The time taken for the capacitor to be charged to get 50 V is:
(Take $\ln 2 = 0.69$)
(1) 1.44×10^{-4} s
(2) 3.33×10^{-4} s
(3) 0.69×10^{-4} s
(4) 0.30×10^{-4} s

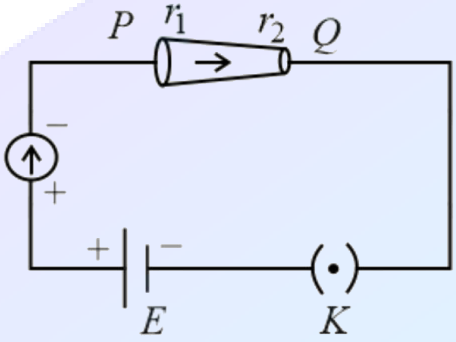
Q14. In the reported figure, a capacitor is formed by placing a compound dielectric between the plates of parallel plate capacitor. The expression for the capacity of the said capacitor will be: (Given the area of the plate $= A$)



(1) $\frac{15}{34}\frac{K\varepsilon_0 A}{d}$
(2) $\frac{15}{6}\frac{K\varepsilon_0 A}{d}$
(3) $\frac{25}{6}\frac{K\varepsilon_0 A}{d}$
(4) $\frac{9}{6}\frac{K\varepsilon_0 A}{d}$

Q15. Two capacitors of capacities $2C$ and C are joined in parallel and charged up to potential V. The battery is removed and the capacitor of capacity C is filled completely with a medium of dielectric constant K. The potential difference across the capacitors will now be:
(1) $\frac{V}{K+2}$
(2) $\frac{V}{K}$
(3) $\frac{3V}{K+2}$
(4) $\frac{3V}{K}$

Q16. In the given figure, a battery of emf E is connected across a conductor PQ of length l and different area of cross-sections having radii r_1 and $r_2 (r_2 < r_1)$.



Choose the correct option as one moves from P to Q.
(1) Drift velocity of electron increases.
(2) Electric field decreases.
(3) Electron current decreases.
(4) All of these

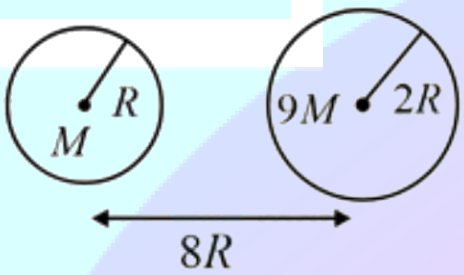
Q17. A 0.07 H inductor and a 12Ω resistor are connected in series to a $220\ \text{V}, 50\ \text{Hz}$AC source. The approximate current in the circuit and the phase angle between current and source voltage are respectively.
[Take π as $\frac{22}{7}$]
(1) 8.8 A and $\tan^{-1}\left(\frac{11}{6}\right)$
(2) 88 A and $\tan^{-1}\left(\frac{11}{6}\right)$
(3) 0.88 A and $\tan^{-1}\left(\frac{11}{6}\right)$
(4) 8.8 A and $\tan^{-1}\left(\frac{6}{11}\right)$

Q18. In Young's double slit experiment, if the source of light changes from orange to blue then:
(1) the central bright fringe will become a dark fringe.
(2) the distance between consecutive fringes will decrease.
(3) the distance between consecutive fringes will increase.
(4) the intensity of the minima will increase.

Q19. If f denotes the ratio of the number of nuclei decayed (N_d) to the number of nuclei at $t = 0, (N_0)$ then for a collection of radioactive nuclei, the rate of change of f with respect to time is given as:
[λ is the radioactive decay constant]
(1) $-\lambda\left(1 - e^{-\lambda t}\right)$
(2) $\lambda\left(1 - e^{-\lambda t}\right)$
(3) $\lambda e^{-\lambda t}$
(4) $-\lambda e^{-\lambda t}$

Q20. Assertion A : If in five complete rotations of the circular scale, the distance travelled on the main scale of the screw gauge is 5 mm and there are 50 total divisions on a circular scale, then the least count is 0.001 cm .
Reason R :
Least Count $= \frac{\text{Pitch}}{\text{Total divisions on circular scale}}$
In the light of the above statements, choose the most appropriate answer from the options given below.
(1) A is not correct but R is correct.
(2) Both A and R are correct and R is the correct explanation of A.
(3) A is correct but R is not correct.
(4) Both A and R are correct and R is NOT the correct explanation of A.

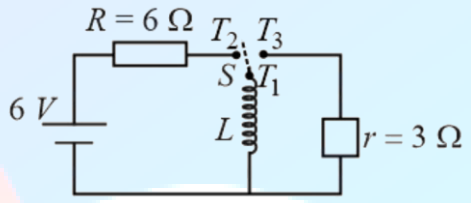
Q21. Suppose two planets (spherical in shape) of radii R and $2R$, but mass M and $9M$ respectively have a centre to centre separation $8R$ as shown in the figure. A satellite of mass m is projected from the surface of the planet of mass M directly towards the centre of the second planet. The minimum speed v required for the satellite to reach the surface of the second planet is $\sqrt{\frac{a}{7}\frac{GM}{R}}$, then the value of a is
[Given : The two planets are fixed in their position]



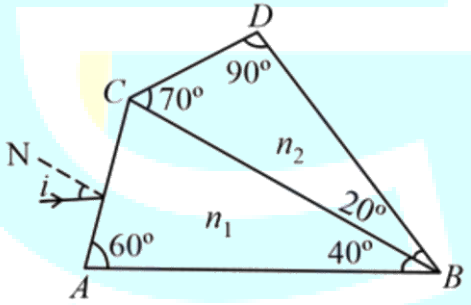
Q22. A stone of mass 20 g is projected from a rubber catapult of length 0.1 m and area of cross section 10^{-6} m^2 stretched by an amount 0.04 m . The velocity of the projected stone is ms^{-1}.
(Young's modulus of rubber $= 0.5 \times 10^9$ N m^{-2})

Q23. In a uniform magnetic field, the magnetic needle has a magnetic moment 9.85×10^{-2} A m^{-2} and moment of inertia 5×10^{-6} kg m^2. If it performs 10 complete oscillations in 5 seconds then the magnitude of the magnetic field is mT [Take π^2 as 9.85]

Q24. Consider an electrical circuit containing a two way switch S. Initially S is open and then T_1 is connected to T_2. As the current in $R = 6\Omega$ attains a maximum value of steady-state level, T_1 is disconnected from T_2 and immediately connected to T_3. Potential drop across $r = 3\Omega$ resistor immediately after T_1 is connected to T_3 is __-____V. (Round off to the Nearest Integer)



Q25. A prism of refractive index n_1 and another prism of refractive index n_2 are stuck together (as shown in the figure). n_1 and n_2 depend on λ, the wavelength of light, according to the relation $n_1 = 1.2 + \frac{10.8\times10^{-14}}{\lambda^2}$ and $n_2 = 1.45 + \frac{1.8\times10^{-14}}{\lambda^2}$ The wavelength for which rays incident at any angle on the interface BC pass through without bending at that interface will be nm .



Q26. A particle of mass 9.1×10^{-31} kg travels in a medium with a speed of 10^6 m s^{-1} and a photon of radiation of linear momentum 10^{-27} kg m s^{-1} travels in a vacuum. The wavelength of the photon is times the wavelength of the particle.

Q27. In Bohr's atomic model, the electron is assumed to revolve in a circular orbit of radius 0.5Å. If the speed of electron is 2.2×10^6 m s^{-1}. Then the current associated with the electron will be $\times 10^{-2}$ mA. [Take π as $\frac{22}{7}$]

Q28. A radioactive sample has an average life of 30 ms and is decaying. A capacitor of capacitance 200μ F is first charged and later connected with resistor R. If the ratio of the charge on the capacitor to the activity of the radioactive sample is fixed with respect to time then the value of R should be Ω.

Q29. A transistor is connected in common emitter circuit configuration, the collector supply voltage is 10 V and the voltage drop across a resistor of 1000Ω in the collector circuit is 0.6 V . If the current gain factor (β) is 24 , then the base current is μA. (Round off to the Nearest Integer)

Q30. The amplitude of upper and lower side bands of AM wave where a carrier signal with frequency 11.21 MHz , peak voltage 15 V is amplitude modulated by a 7.7 kHz sine wave of 5 V amplitude are $\frac{a}{10}$ V and $\frac{b}{10}$ V respectively. Then the value of $\frac{a}{b}$ is .

Q31. Given below are two statements :
Statement I : Rutherford's gold foil experiment cannot explain the line spectrum of hydrogen atom. Statement II : Bohr's model of hydrogen atom contradicts Heisenberg's uncertainty principle. 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) Statement I is true but statement II is false.
(3) Both statement I and statement II are false.
(4) Both statement I and statement II are true.

Q32. Match List - I with List - II :

	List -I		List- II
(a)	NaOH	(i)	Acidic

(b) $Be(OH)_2$ (ii) Basic

(c) $Ca(OH)_2$ (iii) Amphoteric

(d) $B(OH)_3$
(e) $Al(OH)_3$

Choose the most appropriate answer from the options given below
(1) (a) - (ii), (b) - (ii), (c) - (iii), (d) - (ii), (e)
(2)(ii) - (ii), (b) - (iii), (c) - (ii), (d) - (i), (e) - (iii)
(3) (a) - (ii), (b) - (ii), (c) - (iii), (d) - (i), (e) - (4iifl) - (ii), (b) - (i), (c) - (ii), (d) - (iii), (e) - (iii)

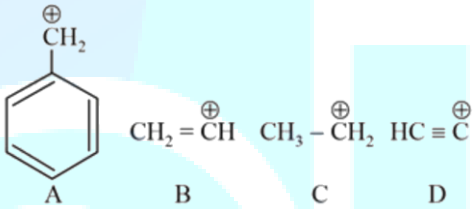
Q33. Given below are two statements: One is labelled as Assertion A and the other labelled as Reason R.
Assertion A : Lithium halides are some what covalent in nature.
Reason R : Lithium possess high polarisation capability.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) A is true but R is false
(2) A is false but *R* is true
(3) Both A and R are true but R is NOT the correct explanation of A
(4) Both A and R are true and *R* is the correct explanation of A

Q34. The oxidation states of IP' in $H_4P_2O_7, H_4P_2O_5$ and $H_4P_2O_6$, respectively, are :
(1) 7,5 and 6
(2) 5, 4 and 3
(3) 5, 3 and 4
(4) 6,4 and 5

Q35. Given below are two statements :
Statement I : Aniline is less basic than acetamide.
Statement II : In aniline, the lone pair of electrons on nitrogen atom is delocalised over benzene ring due to resonance and hence less available to a proton.
Choose the most appropriate option ;
(1) Statement I is true but statement II is false.
(2) Statement I is false but statement II is true.
(3) Both statement I and statement II are true.
(4) Both statement I and statement II are false.

Q36. Staggered and eclipsed conformers of ethane are:
(1) Polymers
(2) Rotamers
(3) Enantiomers
(4) Mirror images

Q37.



The correct order of stability of given carbocation is:
(1) A > C > B > D
(2) D > B > C > A
(3) D > B > A > C
(4) C > A > D > B

Q38. Presence of which reagent will affect the reversibility of the following reaction, and change it to a irreversible reaction :

$$CH_4 + I_2 \underset{\text{Reversible}}{\overset{hv}{\rightleftharpoons}} CH_3 - I + HI$$

(1) HOCl
(2) dilute HNO_2
(3) Liquid NH_3
(4) Concentrated HIO_3

Q39. Which one of the following statements is NOT correct?
(1) Eutrophication indicates that water body is polluted
(2) The dissolved oxygen concentration below 6 ppm inhibits fish growth
(3) Eutrophication leads to increase in the oxygen
(4) Eutrophication leads to anaerobic conditions level in water

Q40. The parameters of the unit cell of a substance are $a = 2.5, b = 3.0, c = 4.0, \alpha = 90°, \beta = 120° \gamma = 90°$. The crystal system of the substance is :
(1) Hexagonal
(2) Orthorhombic

(3) Monoclinic
(4) Triclinic

Q41.For a reaction of order n , the unit of the rate constant is :
(1) $mol^{1-n}\ L^{1-n}s$
(2) $mol^{1-n}L^{2n}s^{-1}$
(3) $mol^{1-n}L^{n-1}\ s^{-1}$
(4) $mol^{1-n}L^{1-n^{-1}}$

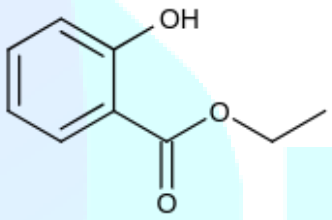
Q42. The statement that is INCORRECT about Ellingham diagram is
(1) provides idea about the reaction rate.
(2) provides idea about free energy change.
(3) provides idea about changes in the phases during
(4) provides idea about reduction of metal oxide. the reaction.

Q43. The product obtained from the electrolytic oxidation of acidified sulphate solutions, is :
(1) HSO_4^-
(2) HO_3SOOSO_3H
(3) HO_2SOSO_2H
(4) HO_3SOSO_3H

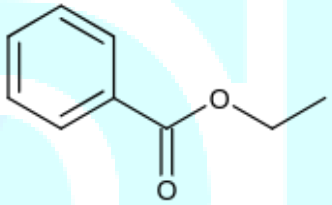
Q44. The type of hybridisation and magnetic property of the complex $[MnCl_6]^{3-}$, respectively, are:
(1) $sp^3\ d^2$ and diamagnetic
(2) d^2sp^3 and diamagnetic
(3) d^2sp^3 and paramagnetic
(4) $sp^3\ d^2$ and paramagnetic

Q45. The number of geometrical isomers found in the metal complexes $[PtCl_2(NH_3)_2]$, $[Ni(CO)_4]$, $[Ru(H_2O)_3Cl_3]$ and $[CoCl_2(NH_3)_4]^+$respectively, are:
(1) 1,1,1,1
(2) 2,0,2,2
(3) 2,1,2,2
(4) 2,1,2,1

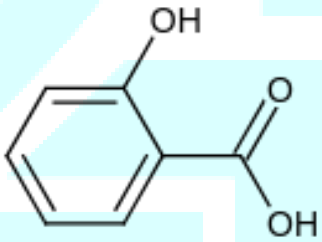
Q46. Which one of the following compounds will give orange precipitate when treated with 2,4 -dinitrophenyl hydrazine?
(1)



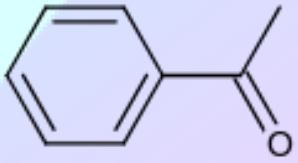
(2)



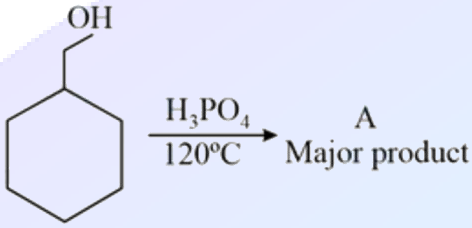
(3)



(4)



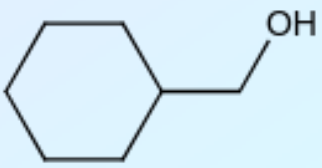
Q47.



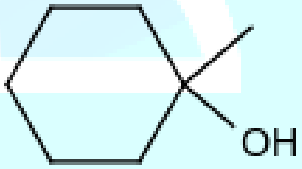
$\xrightarrow[H_2O_2/OH,H_2O]{(BH_3)_2}$ P
Major product

Consider the above reaction and identify the Product P :

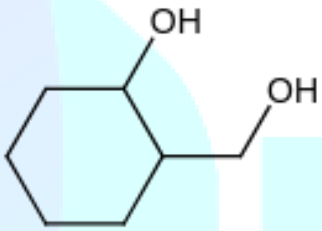
(1)



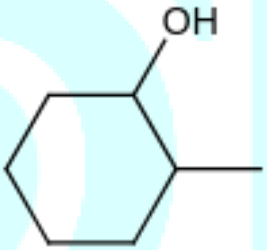
(2)



(3)



(4)



Q48.
List -I
(Drug)

List- II
(Class of Drug)

(a) Furacin
(i) Antibiotic
(b) Arsphenamine
(ii) Tranquilizers
(c) Dimetone
(iii) Antiseptic
(d) Valium
(iv) Synthetic antihistamines

Choose the most appropriate match :
(1) (a) - (i), (b) - (iii), (c) - (iv), (d) - (ii)
(2) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)
(3) (a) - (ii), (b) - (i), (c) - (iii),
(d) - (iv)
(4) (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)

Q49. Which one among the following chemical tests is used to distinguish monosaccharide from

disaccharide ?
(1) Seliwanoff's test
(2) Iodine test
(3) Barfoed test
(4) Tollen's test

Q50.

(A)

The compound *I* A/ is a complementary base of in DNA strands.
(1) Uracil
(2) Guanine
(3) Adenine
(4) Cytosine

Q51. The density of NaOH solution is $1.2\ \text{g cm}^{-3}$. The molality of this solution is m (Round off to the Nearest Integer):
[Use : Atomic masses : Na: 23.0u O : 16.0u H: 1.0u
Density of H_2O: $1.0\ \text{g cm}^{-3}$]
Q52. In gaseous triethyl amine the $\| - C - N - C - \|$ bond angle is degree.

Q53. The difference between bond orders of CO and $NO^{\oplus}$ is $\frac{x}{2}$ where x = (Round off to the Nearest Integer)

Q54. For water at 100°C and 1 bar , $\Delta_{vap} H - \Delta_{vap} U = \_ \times 10^2\ \text{J mol}^{-1}$
(Round off to the Nearest Integer)
[Use : $R = 8.31\ \text{J mol}^{-1}\ \text{K}^{-1}$]
[Assume volume of $H_2O(l)$ is much smaller than volume of $H_2O(g)$. Assume $H_2O(g)$ treated as an ideal gas]
Q55. $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ $K_c = 1.844$
3.0 moles of PCl_5 is introduced in a 1 L closed reaction vessel at 380 K . The number of moles of PCl_5 at equilibrium is $- \times 10^{-3}$
(Round off to the Nearest Integer)
Q56. An organic compound is subjected to chlorination to get compound A using 5.0 g of chlorine. When 0.5 g of compound A is reacted with $AgNO_3$ [Carius Method], the percentage of chlorine in compound A is when it forms 0.3849 g of AgCl . (Round off to the Nearest Integer)
(Atomic masses of Ag and Cl are 107.87 and 35.5 respectively)

Q57.1.46 g of a biopolymer dissolved in a 100 mL water at 300 K exerted an osmotic pressure of 2.42×10^{-3} bar

The molar mass of the biopolymer is $- \times 10^4\ \text{g mol}^{-1}$. (Round off to the Nearest Integer)
[Use: $R = 0.083\ \text{L bar mol}^{-1}\ \text{K}^{-1}$]
Q58. The conductivity of a weak acid HA of concentration $0.001\ \text{mol L}^{-1}$ is $2.0 \times 10^{-5}\ \text{S cm}^{-1}$. If $\Lambda_m^0(\text{HA}) = 190\ \text{S cm}^2\ \text{mol}^{-1}$, the ionization constant (K_a) of HA is equal to $\times 10^{-6}$ (Round off to the Nearest Integer)

Q59. CO_2 gas adsorbs on charcoal following Freundlich adsorption isotherm. For a given amount of charcoal, the mass of CO_2 adsorbed becomes 64 times when the pressure of CO_2 is doubled.
The value of n in the Freundlich isotherm equation is $\times 10^2$. (Round off to the Nearest Integer)

Q60. The number of geometrical isomers possible in triamminetrinitrocobalt (III) is X and in trioxalatochromate (III) is Y . Then the value of X + Y is _.

Q61. Let α, β be two roots of the equation $x^2 + (20)^{1/4}x + (5)^{1/2} = 0$. Then $\alpha^8 + \beta^8$ is equal to
(1) 10
(2) 100
(3) 50
(4) 160

Q62. Let C be the set of all complex numbers. Let
$S_1 = \{z \in C : |z - 3 - 2i|^2 = 8\}$,
$S_2 = z \in C \mid \text{Re}(z) \geq 5$ and
$S_3 = \{z \in C : |z - \bar{z}| \geq 8\}$.
Then the number of elements in $S_1 \cap S_2 \cap S_3$ is equal to
(1) 1
(2) 0
(3) 2
(4) Infinite

Q63.If the coefficients of x^7 in $\left(x^2 + \frac{1}{bx}\right)^{11}$ and x^{-7} in $\left(x - \frac{1}{bx^2}\right)^{11}$, $b \neq 0$, are equal, then the value of b is equal to:

(1) 2
(2) -1
(3) 1
(4) -2

Q64.If $\sin\theta + \cos\theta = \frac{1}{2}$, then $16(\sin(2\theta) + \cos(4\theta) + \sin(6\theta))$ is equal to:
(1) 23
(2) -27
(3) -23
(4) 27

Q65. Two tangents are drawn from the point $P(-1,1)$ to the circle $x^2 + y^2 - 2x - 6y + 6 = 0$. If these tangents touch the circle at points A and B, and if D is a point on the circle such that length of the segments AB and AD are equal, then the area of the triangle ABD is equal to:
(1) 2
(2) $(3\sqrt{2} + 2)$
(3) 4
(4) $3(\sqrt{2} - 1)$

Q66. Let P and Q be two distinct points on a circle which has center at $C(2,3)$ and which passes through origin O. If OC is perpendicular to both the line segments CP and CQ, then the set $\{P, Q\}$ is equal to
(1) $\{(4,0), (0,6)\}$
(2) $\{(2 + 2\sqrt{2}, 3 - \sqrt{5}), (2 - 2\sqrt{2}, 3 + \sqrt{5})\}$
(3) $\{(2 + 2\sqrt{2}, 3 + \sqrt{5}), (2 - 2\sqrt{2}, 3 - \sqrt{5})\}$
(4) $\{(-1,5), (5,1)\}$

Q67. Let $A = \{(x, y) \in R \times R \mid 2x^2 + 2y^2 - 2x - 2y = 1\}$
$B = \{(x, y) \in R \times R \mid 4x^2 + 4y^2 - 16y + 7 = 0\}$ and
$C = \{(x, y) \in R \times R \mid x^2 + y^2 - 4x - 2y + 5 \leq r^2\}$. Then the minimum value of $|r|$ such that $A \cup B \subseteq C$ is equal to
(1) $\frac{3+\sqrt{10}}{2}$
(2) $\frac{2+\sqrt{10}}{2}$
(3) $\frac{3+2\sqrt{5}}{2}$
(4) $1 + \sqrt{5}$

Q68. A ray of light through $(2,1)$ is reflected at a point P on the y - axis and then passes through the point $(5,3)$. If this reflected ray is the directrix of an ellipse with eccentricity $\frac{1}{3}$ and the distance of the nearer focus from this directrix is $\frac{8}{\sqrt{53}}$, then the equation of the other directrix can be:
(1) $11x + 7y + 8 = 0$ or $11x + 7y - 15 = 0$
(2) $11x - 7y - 8 = 0$ or $11x + 7y + 15 = 0$
(3) $2x - 7y + 29 = 0$ or $2x - 7y - 7 = 0$
(4) $2x - 7y - 39 = 0$ or $2x - 7y - 7 = 0$

Q69. Let $f: R \to R$ be a function such that $f(2) = 4$ and $f'(2) = 1$. Then, the value of $\lim_{x\to 2} \frac{x^2 f(2) - 4f(x)}{x-2}$ is equal to:
(1) 4
(2) 8
(3) 16
(4) 12

Q70. The compound statement $(P \vee Q) \wedge (\sim P) \Rightarrow Q$ equivalent to:
(1) $P \vee Q$
(2) $P \wedge \sim Q$
(3) $\sim (P \Rightarrow Q)$
(4) $\sim (P \Rightarrow Q) \Leftrightarrow P \wedge \sim Q$

Q71. If the mean and variance of the following data: $6,10,7,13, a, 12, b, 12$ are 9 and $\frac{37}{4}$ respectively, then $(a - b)^2$ is equal to:
(1) 24
(2) 12
(3) 32
(4) 16

Q72. Let$A = \begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$. If $A^{-1} = \alpha I + \beta A, \alpha, \beta \in R, I$ is a 2×2 identity matrix, then $4(\alpha - \beta)$ is equal to :
(1) 5
(2) $\frac{8}{3}$
(3) 2
(4) 4

Q73.
Let $f: \left(-\frac{\pi}{4}, \frac{\pi}{4}\right) \to R$ be defined as, $f(x) = \begin{cases} (1 + |\sin x|)^{\frac{3a}{\sin x}}, & -\frac{\pi}{4} < x < 0 \\ b & , x = 0 \\ e^{\cot 4x / \cot 2x} & , 0 < x < \frac{\pi}{4} \end{cases}$ If f is continuous at $x = 0$ then the value of $6a + b^2$ is equal to:

(1) $1-e$
(2) $e-1$
(3) $1+e$
(4) e

Q74. The value of $\lim_{n\to\infty}\frac{1}{n}\sum_{j=1}^{n}\frac{(2j-1)+8n}{(2j-1)+4n}$ is equal to:
(1) $5+\log_e\left(\frac{3}{2}\right)$
(2) $2-\log_e\left(\frac{2}{3}\right)$
(3) $3+2\log_e\left(\frac{2}{3}\right)$
(4) $1+2\log_e\left(\frac{3}{2}\right)$

Q75. The value of the definite integral $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}}\frac{dx}{(1+e^{x\cos x})(\sin^4 x+\cos^4 x)}$ is equal to :
(1) $-\frac{\pi}{2}$
(2) $\frac{\pi}{2\sqrt{2}}$
(3) $-\frac{\pi}{4}$
(4) $\frac{\pi}{\sqrt{2}}$

Q76. If the area of the bounded region $R=\left\{(x,y):\max\{0,\log_e x\}\le y\le 2^x,\frac{1}{2}\le x\le 2\right\}$ is, $\alpha(\log_e 2)^{-1}+\beta(\log_e 2)+\gamma$ then the value of $(\alpha+\beta-2\gamma)^2$ is equal to:
(1) 8
(2) 2
(3) 4
(4) 1

Q77. Let $y=y(x)$ be solution of the differential equation $\log_e\left(\frac{dy}{dx}\right)=3x+4y$, with $y(0)=0$. If $y\left(-\frac{2}{3}\log_e 2\right)=\alpha\log_e 2$, then the value of α is equal to:
(1) $-\frac{1}{4}$
(2) $\frac{1}{4}$
(3) 2
(4) $-\frac{1}{2}$

Q78. Let $\vec{a}=\hat{\imath}+\hat{\jmath}+2\vec{k}$ and $\vec{b}=-\hat{\imath}+2\hat{\jmath}+3\hat{k}$. Then the vector product $(\vec{a}+\vec{b})\times((\vec{a}\times((\vec{a}-\vec{b})\times\vec{b}))\times\vec{b})$ is equal to :
(1) $5(34\hat{\imath}-5\hat{\jmath}+3\hat{k})$
(2) $7(34\hat{\imath}-5\hat{\jmath}+3\hat{k})$
(3) $7(30\hat{\imath}-5\hat{\jmath}+7\hat{k})$
(4) $5(30\hat{\imath}-5\hat{\jmath}+7\hat{k})$

Q79. Let the plane passing through the point $(-1,0,-2)$ and perpendicular to each of the planes $2x+y-z=2$ and $x-y-z=3$ be $ax+by+cz+8=0$. Then the value of $a+b+c$ is equal to:
(1) 3
(2) 8
(3) 5
(4) 4

Q80. The probability that a randomly selected 2 - digit number belongs to the set $\{n\in N:(2^n-2)$ is a multiple of $3\}$ is equal to
(1) $\frac{1}{6}$
(2) $\frac{2}{3}$
(3) $\frac{1}{2}$
(4) $\frac{1}{3}$

Q81. If $\log_3 2,\log_3(2^x-5),\log_3\left(2^x-\frac{7}{2}\right)$ are in an arithmetic progression, then the value of x is equal to .

Q82. For real numbers α and β, consider the following system of linear equations: $x+y-z=2, x+2y+\alpha z=1$ and $2x-y+z=\beta$. If the system has infinite solutions, then $\alpha+\beta$ is equal to .

Q83. Let $f(x)=\begin{vmatrix}\sin^2 x & -2+\cos^2 x & \cos 2x\\ 2+\sin^2 x & \cos^2 x & \cos 2x\\ \sin^2 x & \cos^2 x & 1+\cos 2x\end{vmatrix}, x\in[0,\pi]$. Then the maximum value of $f(x)$ is equal to

Q84. Let the domain of the function $f(x)=\log_4\left(\log_5\left(\log_3(18x-x^2-77)\right)\right)$ be (a,b). Then the value of the integral $\int_a^b\frac{\sin^3 x}{(\sin^3 x+\sin^3(a+b-x))}$ is equal to –

Q85. Let S = {1,2,3,4,5,6,7}. Then the number of possible functions $f:S\to S$ such that $f(m\cdot n)=f(m)\cdot f(n)$ for every $m,n\in S$ and $m\cdot n\in S$, is equal to .

Q86. Let $f:[0,3] \to R$ be defined by $f(x) = \min\{x - [x], 1 + [x] - x\}$ where $[x]$ is the greatest integer less than or equal to x. Let P denote the set containing all $x \in [0,3]$ where f is discontinuous, and Q denote the set containing all $x \in (0,3)$ where f is not differentiable. Then the sum of number of elements in P and Q is equal to .

Q87. Let $F:[3,5] \to R$ be a twice differentiable function on $(3,5)$ such that $F(x) = e^{-x}\int_3^x (3t^2 + 2t + 4F'(t))dt$. If $F'(4) = \frac{\alpha e^{\beta} - 224}{(e^{\beta} - 4)^2}$, then $\alpha + \beta$ is equal to .

Q88. If $y = y(x), y \in \left[0, \frac{\pi}{2}\right)$ is the solution of the differential equation $\sec y \frac{dy}{dx} - \sin(x + y) - \sin(x - y) = 0$, with $y(0) = 0$, then $5y'\left(\frac{\pi}{2}\right)$ is equal to .

Q89. Let $\vec{a} = \hat{\imath} + \hat{\jmath} + \vec{k}, \vec{b}$ and $\vec{c} = \hat{\jmath} - \hat{k}$ be three vectors such that $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{a} \cdot \vec{b} = 1$. If the length of projection vector of the vector $\vec{b}$ on the vector $\vec{a} \times \vec{c}$ is l, then the value of $3l^2$ is equal to .

Q90. Let a plane P pass through the point $(3,7,-7)$ and contain the line, $\frac{x-2}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$. If distance of the plane P from the origin is d, then d^2 is equal to

ANSWER KEYS

1. (4) atho	2. (3)	ma. (4)	4. (3)	5. (4) a atho	6. (3)	ma. (4)	8. (2)
9. (3)	10. (4)	11. (2)	12. (3)	13. (3)	14. (1)	15. (3)	16. (1)
17. (1) atho	18. (2)	mat 19. (3)	20. (1)	21. (4)	22. (20)	mo 23. (8)	24. (3)
25. (600)	26. (910)	27. (112)	28. (150)	29. (25)	30. (1)	31. (4)	32. (2)
33. (4)	34. (3)	35. (2)	36. (2)	37. (1)	38. (4)	39. (3)	40. (3)
41. (3)	42. (1)	43. (2)	44. (4)	45. (2)	46. (4)	47. (4)	48. (4)
49. (3)	50. (3)	51. (5)	52. (108)	53. (0)	54. (31)	55. (1400)	56. (19)
57. (15) tho	58. (12)	59. (17)	60. (2)	61. (3) ath	62. (1)	mo63. (3)	64. (3)
65. (3)	66. (4)	67. (3)	68. (3)	69. (4)	70. (4)	71. (4)	72. (4)
73. (3)	74. (4)	75. (2)	76. (2)	77. (1)	78. (2)	79. (4)	80. (3)
81. (3)	82. (5)	83. (6)	84. (1)	85. (490)	86. (5)	87. (16)	88. (2)
89. (2)	90. (3)						