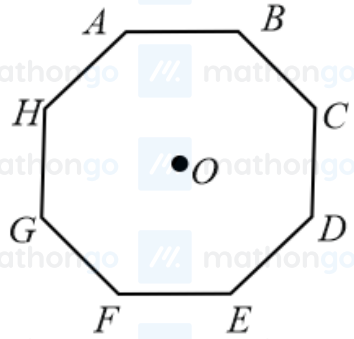
Q1. In an octagon $ABCDEFGH$ of equal side, what is the sum of $\overrightarrow{AB}+\overrightarrow{AC}+\overrightarrow{AD}+\overrightarrow{AE}+\overrightarrow{AF}+\overrightarrow{AG}+\overrightarrow{AH}$, if, $\overrightarrow{AO}=2\hat{i}+3\hat{j}-4\hat{k}$



(1) $16\hat{i}+24\hat{j}-32\hat{k}$ (2) $16\hat{i}-24\hat{j}+32\hat{k}$
(3) $16\hat{i}+24\hat{j}+32\hat{k}$ (4) $-16\hat{i}-24\hat{j}+32\hat{k}$

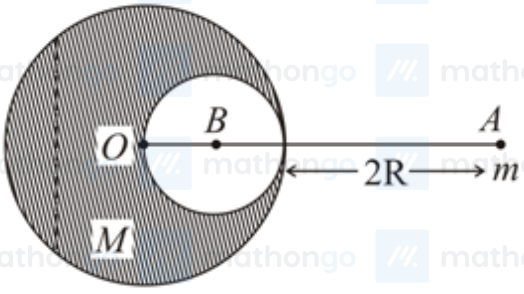
Q2. Match List - I with List - II :

	List − I		List − II
(a)	h (Planck's constant)	(i)	$\left[\mathrm{ML T^{-1}}\right]$
(b)	E (kinetic energy)	(ii)	$\left[\mathrm{ML^2\ T^{-1}}\right]$
(c)	V (electric potential)	(iii)	$\left[\mathrm{ML^2\ T^{-2}}\right]$
(d)	P (linear momentum)	(iv)	$\left[\mathrm{ML^2 I^{-1}\ T^{-3}}\right]$

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

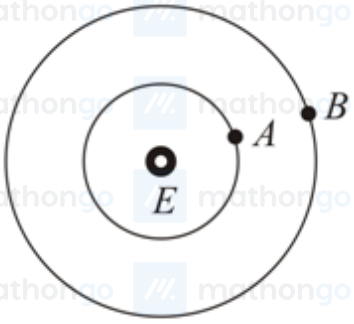
Q3. An engine of a train, moving with uniform acceleration, passes the signal-post with velocity u and the last compartment with velocity v. The velocity with which middle point of the train passes the signal post is :
(1) $\frac{u+v}{2}$ (2) $\sqrt{\frac{v^2+u^2}{2}}$
(3) $\frac{v-u}{2}$ (4) $\sqrt{\frac{v^2-u^2}{2}}$

Q4. A solid sphere of radius R gravitationally attracts a particle placed at $3R$ from its centre with a force F_1. Now a spherical cavity of radius $\left(\frac{R}{2}\right)$ is made in the sphere (as shown in figure) and the force becomes F_2. The value of $F_1 : F_2$ is:



(1) 41 : 50 (2) 50 : 41
(3) 25 : 36 (4) 36 : 25

Q5. Two satellites A and B of masses 200 kg and 400 kg are revolving round the earth at height of 600 km and 1600 km respectively. If T_A and T_B are the time periods of A and B respectively then the value of $T_B - T_A$:



[Given : radius of earth = 6400 km, mass of earth = 6×10^{24} kg]

(1) 4.24×10^3 s
(2) 3.33×10^2 s
(3) 1.33×10^3 s
(4) 4.24×10^2 s

Q6. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : The escape velocities of planet A and B are same. But A and B are of unequal mass.

Reason R: The product of their mass and radius must be same. $M_1R_1 = M_2R_2$ In the light of the above statements, choose the most appropriate answer from the options given below :

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

Q7. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : When a rod lying freely is heated, no thermal stress is developed in it.

Reason R : On heating, the length of the rod increases.

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

(1) Both A and R are true and R is the correct explanation of A
(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) A is true but R is false

Q8. A diatomic gas, having $C_P = \frac{7}{2}R$ and $C_V = \frac{5}{2}R$, is heated at constant pressure. The ratio $dU : dQ : dW$

(1) 3 : 5 : 2
(2) 5 : 7 : 3
(3) 5 : 7 : 2
(4) 3 : 7 : 2

Q9. If the time period of a two meter long simple pendulum is 2 s, the acceleration due to gravity at the place where pendulum is executing S.H.M. is:

(1) $2\pi^2$ m s^{-2}
(2) 16 m s^{-2}
(3) π^2 m s^{-2}
(4) 9.8 m s^{-2}

Q10. A student is performing the experiment of the resonance column. The diameter of the column tube is 6 cm. The frequency of the tuning fork is 504 Hz. Speed of the sound at the given temperature is 336 m s^{-1}. The zero of the meter scale coincides with the top end of the resonance column tube. The reading of the water level in the column when the first resonance occurs is:

(1) 14.8 cm
(2) 18.4 cm
(3) 16.6 cm
(4) 13 cm

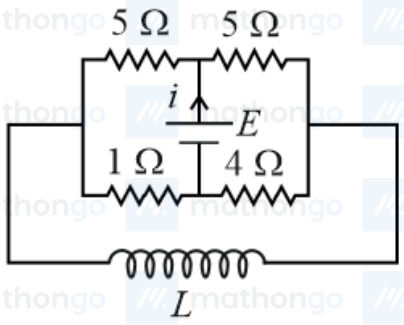
Q11. A proton, a deuteron and an α particle are moving with same momentum in a uniform magnetic field. The ratio of magnetic forces acting on them _____ is and their speed is _____ in the ratio.

(1) $2:1:1$ and $4:2:1$
(2) $1:2:4$ and $2:1:1$
(3) $4:2:1$ and $2:1:1$
(4) $1:2:4$ and $1:1:2$

Q12. Magnetic fields at two points on the axis of a circular coil at a distance of 0.05 m and 0.2 m from the centre are in the ratio $8:1$. The radius of coil is _____ .

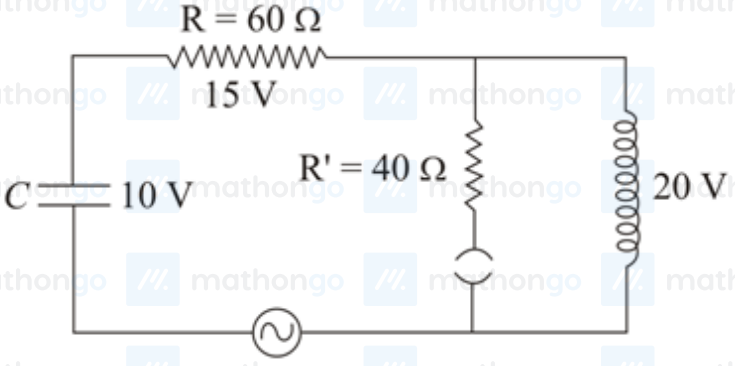
(1) 0.15 m
(2) 0.2 m
(3) 0.1 m
(4) 1.0 m

Q13. The current (i) at time $t = 0$ and $t = \infty$ respectively for the given circuit is :



(1) $\frac{5E}{18}, \frac{18E}{55}$
(2) $\frac{5E}{18}, \frac{10E}{33}$
(3) $\frac{10E}{33}, \frac{5E}{18}$
(4) $\frac{18E}{55}, \frac{5E}{18}$

Q14. The angular frequency of alternating current in a L-C-R circuit is 100 rad s^{-1}. The components connected are shown in the figure. Find the value of inductance of the coil and capacity of condenser.



(1) 1.33 H and 150 μF
(2) 0.8 H and 150 μF
(3) 1.33 H and 250 μF
(4) 0.8 H and 250 μF

Q15. Two coherent light sources having intensity in the ratio $2x$ produce an interference pattern. The ratio $\frac{I_{max}-I_{min}}{I_{max}+I_{min}}$ will be

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

Q16. An α particle and a proton are accelerated from rest by a potential difference of 200 V. After this, their de Broglie wavelengths are λ_α and λ_p respectively. The ratio $\frac{\lambda_p}{\lambda_\alpha}$ is :

(1) 8 (2) 3.8

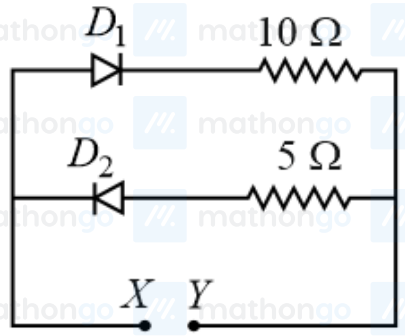
(3) 2.8 (4) 7.8

Q17. Two radioactive substances X and Y originally have N_1 and N_2 nuclei respectively. Half life of X is half of the half life of Y. After three half lives of Y, number of nuclei of both are equal. The ratio $\frac{N_1}{N_2}$ will be equal to :

(1) $\frac{1}{3}$ (2) $\frac{8}{1}$

(3) $\frac{3}{1}$ (4) $\frac{1}{8}$

Q18. A 5 V battery is connected across the points X and Y. Assume D_1 and D_2 to be normal silicon diodes. Find the current supplied by the battery if the $+ve$ terminal of the battery is connected to point X.



(1) ~0.86 A (2) ~0.5 A

(3) ~1.5 A (4) ~0.43 A

Q19. Given below are two statements:

Statement I : A speech signal of 2 kHz is used to modulate a carrier signal of 1 MHz. The bandwidth requirement for the signal is 4 kHz.

Statement II : The side band frequencies are 1002 kHz and 998 kHz. In the light of the above statements, choose the correct answer from the options given below:

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

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

Q20. The pitch of the screw gauge is 1 mm and there are 100 divisions on the circular scale. When nothing is put in between the jaws, the zero of the circular scale lies 8 divisions below the reference line. When a wire is placed between the jaws, the first linear scale division is clearly visible while 72^{nd} division on circular scale coincides with the reference line. The radius of the wire is

(1) 1.64 mm (2) 0.82 mm

(3) 0.90 mm (4) 1.80 mm

Q21. A small bob tied at one end of a thin string of length 1 m is describing a vertical circle so that the maximum and minimum tension in the string is in the ratio 5 : 1. The velocity of the bob at the highest position is _____ m s^{-1}. (Take $g = 10\ \text{m s}^{-2}$)

Q22. The potential energy (U) of a diatomic molecule is a function dependent on r (interatomic distance) as $U = \frac{\alpha}{r^{10}} - \frac{\beta}{r^5} - 3$ where, α and β are positive constants. The equilibrium distance between two atoms will be $\left(\frac{2\alpha}{\beta}\right)^{\frac{a}{b}}$, where $a =$_____.

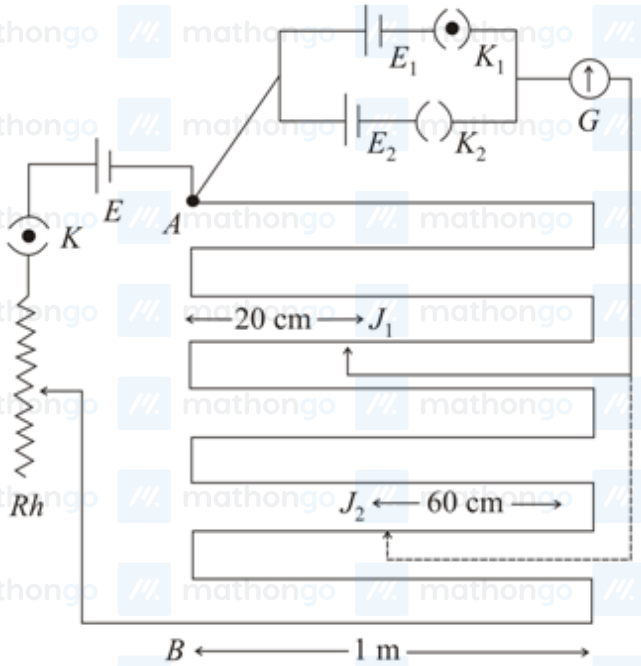
Q23. In a certain thermodynamical process, the pressure of a gas depends on its volume as kV^3. The work done when the temperature changes from 100 °C to 300 °C will be xnR where n denotes number of moles of a gas find x ;

Q24. A monoatomic gas of mass $4.0\ u$ is kept in an insulated container. The container is moving with velocity 30 m s^{-1}. If the container is suddenly stopped then a change in temperature of the gas (R =gas constant) is $\frac{x}{3R}$. Value of x is,

Q25. The electric field in a region is given by $\vec{E} = \left(\frac{3}{5}E_0\hat{i} + \frac{4}{5}E_0\hat{j}\right)$ N C^{-1}. The ratio of flux of reported field through the rectangular surface of area $0.2\ m^2$ (parallel to $y-z$ plane) to that of the surface of area $0.3\ m^2$ (parallel to $x-z$ plane) is $a:b = a:2$, where $a =$? [Here $\hat{i}$, $\hat{j}$ and $\hat{k}$ are unit vectors along x, y and z -axes respectively]

Q26. 512 identical drops of mercury are charged to a potential of 2 V each. The drops are joined to form a single drop. The potential of this drop is V in Volt.

Q27. In the given circuit of potentiometer, the potential difference E across AB(10 m length) is larger than E_1 and E_2 as well. For key K_1 (closed), the jockey is adjusted to touch the wire at point J_1 so that there is no deflection in the galvanometer. Now the first battery (E_1) is replaced by second battery (E_2) for working by making K_1 open and K_2 closed. The galvanometer gives then null deflection at J_2. The value of $\frac{E_1}{E_2}$ is $\frac{a}{2}$,



where $a =$_____.

Q28. A coil of inductance 2 H having negligible resistance is connected to a source of supply whose voltage is given by $V = 3t$ volt. (where t is in second). If the voltage is applied when $t = 0$, then the energy stored in the coil

after 4 s in J,

Q29. A transmitting station releases waves of wavelength 960 m. A capacitor of $2.56\ \mu F$ is used in the resonant circuit. The self-inductance of coil necessary for resonance is $x \times 10^{-8}$ H. find x

Q30. The same size images are formed by a convex lens when the object is placed at 20 cm or at 10 cm from the lens. The focal length of convex lens is

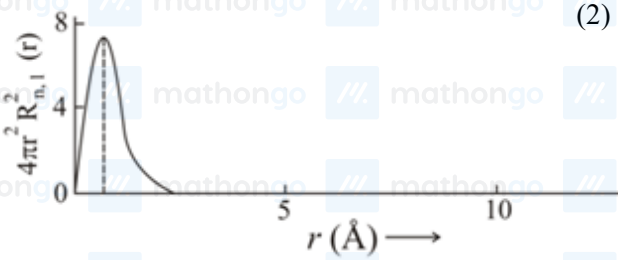
Q31. Complete combustion of 1.80 g of an oxygen containing compound ($C_xH_yO_z$) gave 2.64 g of CO_2 and 1.08 g of H_2O. The percentage of oxygen in the organic compound is :

(1) 53.33 (2) 50.33

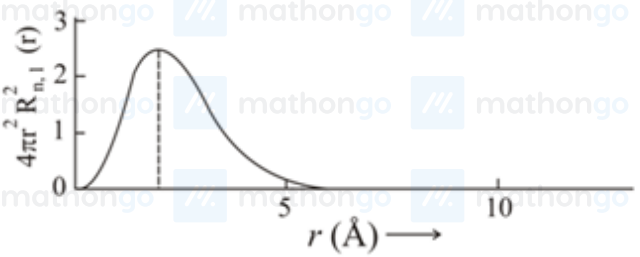
(3) 51.63 (4) 63.53

Q32. The plots of radial distribution functions for various orbitals of hydrogen atom against ' r' are given below. The correct plot for 3s orbital is :

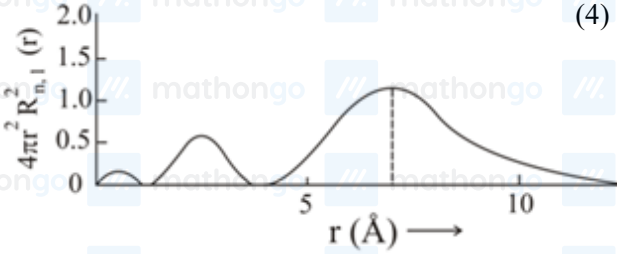
(1)



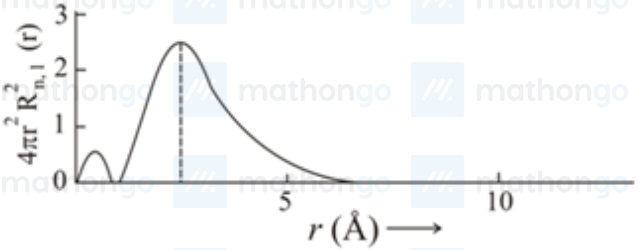
(2)



(3)



(4)



Q33. According to molecular orbital theory, the species among the following that does not exist is:

(1) He_2^- (2) O_2^{2-}

(3) He_2^+ (4) Be_2

Q34. The solubility of AgCN in a buffer solution of pH = 3 is x. The value of x is: [Assume : No cyano complex is formed ; $K_{sp}(AgCN) = 2.2 \times 10^{-16}$ and $K_a(HCN) = 6.2 \times 10^{-10}$]

(1) 1.9×10^{-5} (2) 2.2×10^{-16}

(3) 0.625×10^{-6} (4) 1.6×10^{-6}

Q35. Which of the following equation depicts the oxidizing nature of H_2O_2?

(1) $2I^- + H_2O_2 + 2H^+ \rightarrow I_2 + 2H_2O$ (2) $I_2 + H_2O_2 + 2\,OH^- \rightarrow 2I^- + 2H_2O + O_2$

(3) $Cl_2 + H_2O_2 \rightarrow 2HCl + O_2$ (4) $KIO_4 + H_2O_2 \rightarrow KIO_3 + H_2O + O_2$

Q36. The incorrect statement about B_2H_6 is :

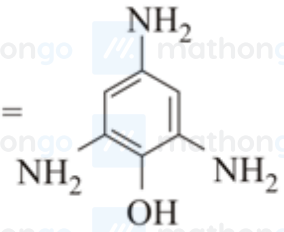
(1) All B – H – B angles are of 120°

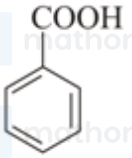
(2) The two B – H – B bonds (bridged and terminal) are not of same length.

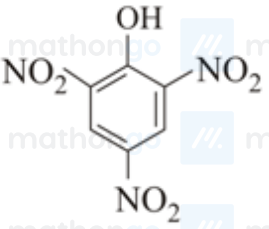
(3) Terminal B – H bonds have less p -character when compared to bridging bonds.

(4) Its fragment, BH_3, behaves as a Lewis acid.

Q37. Compound(s) which will liberate carbon dioxide with sodium bicarbonate solution is/are :

A = 

B = 

C = 

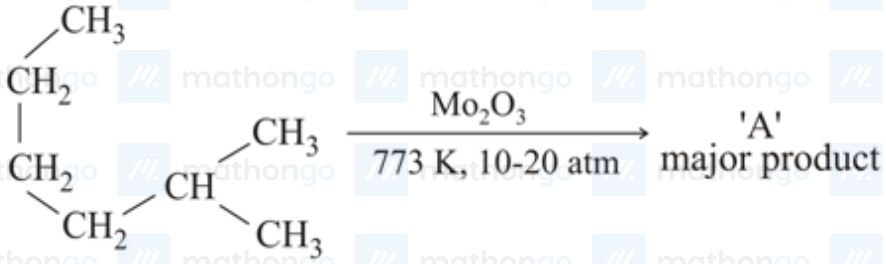
(1) A and B only

(2) B and C only

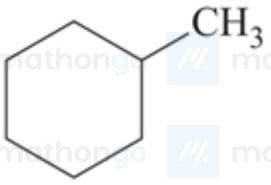
(3) C only

(4) B only

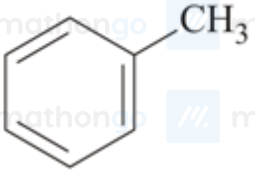
Q38. Identify *A* in the given chemical reaction.



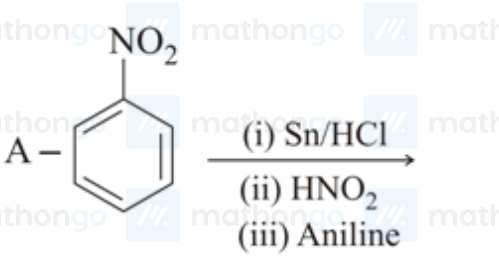
(1)

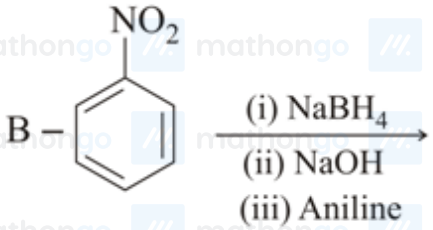
(2) 

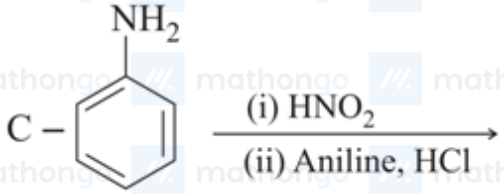
(3)

(4) 

Q39. Which of the following reaction/s will not give *p* -aminoazobenzene?

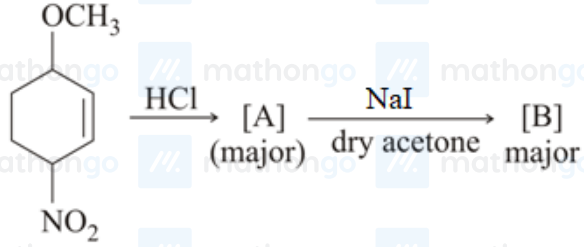




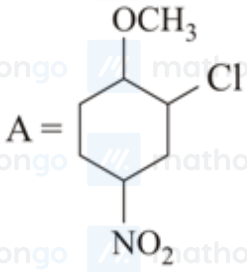


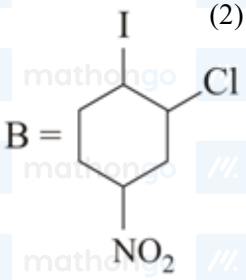
(1) B only
(2) A only
(3) C only
(4) A and B

Q40. Identify A and B in the chemical reaction.

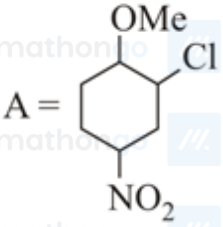


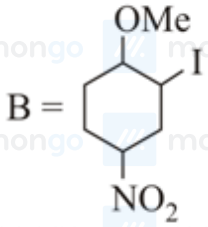
(1)



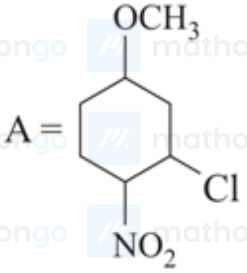


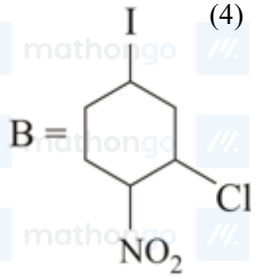
(2)



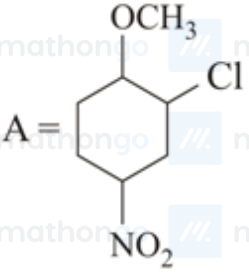


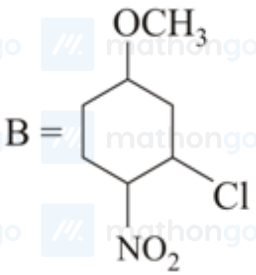
(3)





(4)





Q41. Given below are two statements:

Statement I : An allotrope of oxygen is an important intermediate in the formation of reducing smog.
Statement II : Gases such as oxides of nitrogen and sulphur present in troposphere contribute to the formation of photochemical smog. 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

Q42. In Freundlich adsorption isotherm at moderate pressure, the extent of adsorption $\left(\frac{x}{m}\right)$ is directly proportional to P^x. The value of x is :

(1) zero
(2) $\frac{1}{n}$
(3) 1
(4) ∞

Q43. Ellingham diagram is a graphical representation of :

(1) ΔG vs P
(2) $(\Delta G - T\Delta S)$ vs T
(3) ΔH vs T
(4) ΔG vs T

Q44. Given below are two statements:
Statement I : CeO_2 can be used for oxidation of aldehydes and ketones.
Statement II : Aqueous solution of $EuSO_4$ is a strong reducing agent. In the light of the above statements, choose the correct answer from the options given below:

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

Q45. In which of the following pairs, the outermost electronic configuration will be the same?

(1) Cr^+ and Mn^{2+}
(2) Ni^{2+} and Cu^+
(3) Fe^{2+} and Co^+
(4) V^{2+} and Cr^+

Q46. The hybridization and magnetic nature of $[Mn(CN)_6]^{4-}$ and $[Fe(CN)_6]^{3-}$, respectively are :

(1) $sp^3 d^2$ and diamagnetic
(2) $d^2 sp^3$ and paramagnetic
(3) $sp^3 d^2$ and paramagnetic
(4) $d^2 sp^3$ and diamagnetic

Q47. Which one of the following reactions will not form acetaldehyde?

(1) $CH_3CH_2OH \xrightarrow{CrO_3-H_2SO_4}$
(2) $CH_2 = CH_2 + O_2 \frac{Pd(II)/Cu(II)}{H_2O}$
(3) $CH_3CN \frac{i)\ DIBAL-H}{ii\ )H_2O} >$
(4) $CH_3CH_2OH \frac{Cu}{573\ K} >$

Q48. The major product of the following chemical reaction is :

$$CH_3CH_2CN \xrightarrow[(3)\ Pd/BaSO_4,\ H_2]{(1)\ H_3O^+,\ \Delta \\ (2)\ SOCl_2} ?$$

(1) CH_3CH_2CHO
(2) $CH_3CH_2CH_2OH$
(3) $CH_3CH_2CH_3$
(4) $(CH_3CH_2CO)_2O$

Q49. Which statement is correct?

(1) Synthesis of Buna-S needs nascent oxygen.

(2) Buna-S is a synthetic and linear thermosetting polymer.

(3) Buna-N is a natural polymer.

(4) Neoprene is an addition copolymer used in plastic bucket manufacturing.

Q50. Which of the glycosidic linkage between galactose and glucose is present in lactose?

(1) $C-1$ of glucose and $C-4$ of galactose

(2) $C-1$ of glucose and $C-6$ of galactose

(3) $C-1$ of galactose and $C-4$ of glucose

(4) $C-1$ of galactose and $C-6$ of glucose

Q51. A car tyre is filled with nitrogen gas at 35 psi at 27 $^{\circ}$C. It will burst if pressure exceeds 40 psi. The temperature in $^{\circ}$C at which the car tyre will burst is (Rounded-off to the nearest integer)

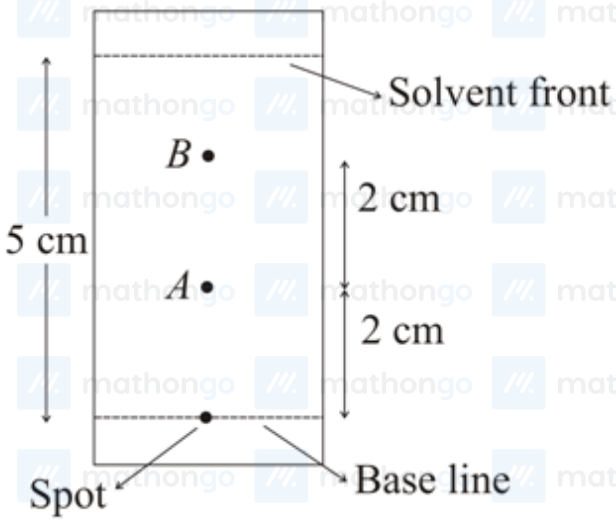
Q52. The reaction of cyanamide, $NH_2CN_{(s)}$ with oxygen was run in a bomb calorimeter and ΔU was found to be $-742.24\ kJ\ mol^{-1}$. The magnitude of ΔH_{298} for the reaction $NH_2CN_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow N_{2(g)} + O_{2(g)} + H_2O_{(l)}$ is kJ. (Rounded off to the nearest integer) [Assume ideal gases and $R = 8.314\ J\ mol^{-1}\ K^{-1}$]

Q53. The ionization enthalpy of Na^+ formation from $Na_{(g)}$ is $495.8\ kJ\ mol^{-1}$, while the electron gain enthalpy of Br is $-325.0\ kJ\ mol^{-1}$. Given the lattice enthalpy of NaBr is $-728.4\ kJ\ mol^{-1}$. The energy for the formation of NaBr ionic solid is $(-)_____10^{-1}\ kJ\ mol^{-1}$

Q54. 0.4 g mixture of $NaOH, Na_2CO_3$ and some inert impurities was first titrated with $\frac{N}{10}HCl$ using phenolphthalein as an indicator, 17.5 mL of HCl was required at the end point. After this methyl orange was added and titrated. 1.5 mL of same HCl was required for the next end point. The weight percentage of Na_2CO_3 in the mixture is (Rounded-off to the nearest integer)

Q55. In basic medium CrO_4^{2-} oxidises $S_2O_3^{2-}$ to form ${SO_4}^{2-}$ and itself changes into $Cr(OH)_4^-$.The volume of $0.154\,M CrO_4^{2-}$ required to react with 40 mL of $0.25\,M {S_2O_3}^{2-}$ is _____ mL. (Rounded-off to the nearest integer)

Q56. Using the provided information in the following paper chromatogram:



Paper chromatography for compounds A and B.

The calculated R_f value of A is _____ $\times 10^{-1}$.

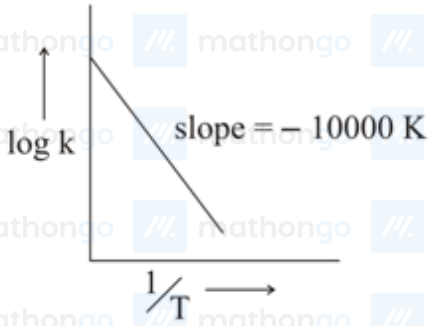
Q57. Consider the following chemical reaction.

$CH \equiv CH \xrightarrow[2)\ CO,HCl,AlCl_3]{1)\ Red\ hot\ Fe\ tube,\ 873\ K} >$ Product

The number of sp^2 hybridized carbon atom(s) present in the product is

Q58. 1 molal aqueous solution of an electrolyte A_2B_3 is 60% ionised. The boiling point of the solution at 1 atm is _____ K. (Rounded-off to the nearest integer) [Given K_b for $(H_2O) = 0.52\ K\ kg\ mol^{-1}$]

Q59. For the reaction, $aA + bB \rightarrow cC + dD$, the plot of log k v/s $\frac{1}{T}$ is given below:



The temperature at which the rate constant of the reaction is $10^{-4}\ s^{-1}$ is _____ K.
(Rounded-off to the nearest integer) [Given : The rat5e constant of the reaction is $10^{-5}\ s^{-1}$ at 500 K.]

Q60. Among the following, the number of halide(s) which is/ are inert to hydrolysis is

(A) BF_3
(B) $SiCl_4$
(C) PCl_5
(D) SF_6

Q61. The integer k, for which the inequality $x^2 - 2(3k-1)x + 8k^2 - 7 > 0$ is valid for every x in R is:

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

Q62. Let the lines $(2-i)z=(2+i)\overline{z}$ and $(2+i)z+(i-2)\overline{z}-4i=0$, (here $i^2=-1$) be normal to a circle C. If the line $iz+\overline{z}+1+i=0$ is tangent to this circle C, then its radius is :

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

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

Q63. The total number of positive integral solutions $(x,\ y,\ z)$ such that $xyz=24$ is :

(1) 45 (2) 30

(3) 36 (4) 24

Q64. If $0<\theta,\phi<\frac{\pi}{2}, x=\sum_{n=0}^{\infty}\cos^{2n}\theta, y=\sum_{n=0}^{\infty}\sin^{2n}\phi$ and $z=\sum_{n=0}^{\infty}\cos^{2n}\theta\cdot\sin^{2n}\phi$ then :

(1) $xy-z=(x+y)z$ (2) $xy+yz+zx=z$

(3) $xy+z=(x+y)\ z$ (4) $xyz=4$

Q65. All possible values of $\theta\in[0,2\pi]$ for which $\sin 2\theta+\tan 2\theta>0$ lie in :

(1) $\left(0,\frac{\pi}{2}\right)\cup\left(\pi,\frac{3\pi}{2}\right)$ (2) $\left(0,\frac{\pi}{2}\right)\cup\left(\frac{\pi}{2},\frac{3\pi}{4}\right)\cup\left(\pi,\frac{7\pi}{6}\right)$

(3) $\left(0,\frac{\pi}{4}\right)\cup\left(\frac{\pi}{2},\frac{3\pi}{4}\right)\cup\left(\pi,\frac{5\pi}{4}\right)\cup\left(\frac{3\pi}{2},\frac{7\pi}{4}\right)$ (4) $\left(0,\frac{\pi}{4}\right)\cup\left(\frac{\pi}{2},\frac{3\pi}{4}\right)\cup\left(\frac{3\pi}{2},\frac{11\pi}{6}\right)$

Q66. The image of the point $(3,5)$ in the line $x-y+1=0$, lies on :

(1) $(x-2)^2+(y-4)^2=4$ (2) $(x-4)^2+(y-4)^2=8$

(3) $(x-4)^2+(y+2)^2=16$ (4) $(x-2)^2+(y-2)^2=12$

Q67. A tangent is drawn to the parabola $y^2=6x$ which is perpendicular to the line $2x+y=1$. Which of the following points does NOT lie on it?

(1) $(0,3)$ (2) $(4,5)$

(3) $(5,4)$ (4) $(-6,0)$

Q68. If the curves, $\frac{x^2}{a}+\frac{y^2}{b}=1$ and $\frac{x^2}{c}+\frac{y^2}{d}=1$ intersect each other at an angle of 90°, then which of the following relations is TRUE?

(1) $a-c=b+d$ (2) $a-b=c-d$

(3) $a+b=c+d$ (4) $ab=\frac{c+d}{a+b}$

Q69. $\lim\limits_{n\to\infty}\left(1+\frac{1+\frac{1}{2}+\ldots\ldots+\frac{1}{n}}{n^2}\right)^n$ is equal to

(1) $\frac{1}{e}$ (2) 0

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

Q70. The statement $A\rightarrow(B\rightarrow A)$ is equivalent to :

(1) $A\rightarrow(A\wedge B)$ (2) $A\rightarrow(A\vee B)$

(3) $A\rightarrow(A\leftrightarrow B)$ (4) $A\rightarrow(A\rightarrow B)$

Q71. A man is observing, from the top of a tower, a boat speeding towards the tower from a certain point A, with uniform speed. At that point, angle of depression of the boat with the man's eye is 30° (Ignore man's height). After sailing for 20 seconds, towards the base of the tower (which is at the level of water), the boat has reached a point B, where the angle of depression is 45°. Then the time taken (in seconds) by the boat from B to reach the base of the tower is :

(1) 10 (2) $10\left(\sqrt{3}-1\right)$
(3) $10\sqrt{3}$ (4) $10\left(\sqrt{3}+1\right)$

Q72. Let $f, g: N \to N$ such that $f(n+1) = f(n) + f(1)\ \forall\ n \in N$ and g be any arbitrary function. Which of the following statements is NOT true?
(1) If f is onto, then $f(n) = n \forall n \in N$ (2) If g is onto, then fog is one-one
(3) f is one-one (4) If fog is one-one, then g is one-one

Q73. If Rolle's theorem holds for the function $f(x) = x^3 - ax^2 + bx - 4, x \in [1, 2]$ with $f'\left(\frac{4}{3}\right) = 0$, then ordered pair $(a,\ b)$ is equal to :
(1) $(-5, -8)$ (2) $(-5, 8)$
(3) $(5, 8)$ (4) $(5, -8)$

Q74. The value of the integral $\int \frac{\sin\theta \cdot \sin 2\theta\left(\sin^6\theta + \sin^4\theta + \sin^2\theta\right)\sqrt{2\sin^4\theta + 3\sin^2\theta + 6}}{1-\cos 2\theta} d\theta$ is (where c is a constant of integration)
(1) $\frac{1}{18}\left[11 - 18\sin^2\theta + 9\sin^4\theta - 2\sin^6\theta\right]^{\frac{3}{2}} + c$ (2) $\frac{1}{18}\left[9 - 2\sin^6\theta - 3\sin^4\theta - 6\sin^2\theta\right]^{\frac{3}{2}} + c$
(3) $\frac{1}{18}\left[11 - 18\cos^2\theta + 9\cos^4\theta - 2\cos^6\theta\right]^{\frac{3}{2}} + c$ (4) $\frac{1}{18}\left[9 - 2\cos^6\theta - 3\cos^4\theta - 6\cos^2\theta\right]^{-\frac{3}{2}} + c$

Q75. The value of $\int_{-1}^{1} x^2 e^{[x^3]} dx$, where $[t]$ denotes the greatest integer $\leq t$, is :
(1) $\frac{e+1}{3}$ (2) $\frac{e-1}{3e}$
(3) $\frac{1}{3e}$ (4) $\frac{e+1}{3e}$

Q76. If a curve passes through the origin and the slope of the tangent to it at any point $(x,\ y)$ is $\frac{x^2-4x+y+8}{x-2}$, then this curve also passes through the point:
(1) $(5, 4)$ (2) $(4, 4)$
(3) $(4, 5)$ (4) $(5, 5)$

Q77. Let α be the angle between the lines whose direction cosines satisfy the equations $l + m - n = 0$ and $l^2 + m^2 - n^2 = 0$. Then the value of $\sin^4\alpha + \cos^4\alpha$ is :
(1) $\frac{5}{8}$ (2) $\frac{1}{2}$
(3) $\frac{3}{8}$ (4) $\frac{3}{4}$

Q78. The equation of the line through the point $(0, 1, 2)$ and perpendicular to the line $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{-2}$ is :
(1) $\frac{x}{3} = \frac{y-1}{-4} = \frac{z-2}{3}$ (2) $\frac{x}{3} = \frac{y-1}{4} = \frac{z-2}{3}$
(3) $\frac{x}{-3} = \frac{y-1}{4} = \frac{z-2}{3}$ (4) $\frac{x}{3} = \frac{y-1}{4} = \frac{z-2}{-3}$

Q79. The coefficients $a,\ b$ and c of the quadratic equation, $ax^2 + bx + c = 0$ are obtained by throwing a dice three times. The probability that this equation has equal roots is:
(1) $\frac{1}{72}$ (2) $\frac{1}{36}$
(3) $\frac{1}{54}$ (4) $\frac{5}{216}$

Q80. When a missile is fired from a ship, the probability that it is intercepted is $\frac{1}{3}$ and the probability that the missile hits the target, given that it is not intercepted, is $\frac{3}{4}$. If three missiles are fired independently from the ship, then the probability that all three hit the target, is:
(1) $\frac{3}{8}$ (2) $\frac{1}{27}$
(3) $\frac{1}{8}$ (4) $\frac{3}{4}$

Q81. The total number of numbers, lying between 100 and 1000 that can be formed with the digits $1, 2, 3, 4, 5$, if the repetition of digits is not allowed and numbers are divisible by either 3 or 5, is

Q82. Let $A_1, A_2, A_3, \ldots\ldots$ be squares such that for each $n \geqslant 1$, the length of the side of A_n equals the length of diagonal of A_{n+1}. If the length of A_1 is 12 cm, then the smallest value of n for which area of A_n is less than one, is

Q83. The locus of the point of intersection of the lines $\left(\sqrt{3}\right)kx + ky - 4\sqrt{3} = 0$ and $\sqrt{3}x - y - 4\left(\sqrt{3}\right)k = 0$ is a conic, whose eccentricity is

Q84. If $A = \begin{bmatrix} 0 & -\tan\left(\frac{\theta}{2}\right) \\ \tan\left(\frac{\theta}{2}\right) & 0 \end{bmatrix}$ and $(I_2 + A)(I_2 - A)^{-1} = \begin{bmatrix} a & -b \\ b & a \end{bmatrix}$, then $13\left(a^2 + b^2\right)$ is equal to _____ .

Q85. Let $A = \begin{bmatrix} x & y & z \\ y & z & x \\ z & x & y \end{bmatrix}$, where $x,\ y$ and z are real numbers such that $x + y + z > 0$ and $xyz = 2$. If $A^2 = I_3$, then the value of $x^3 + y^3 + z^3$ is

Q86. If the system of equations

$kx + y + 2z = 1$

$3x - y - 2z = 2$

$-2x - 2y - 4z = 3$

has infinitely many solutions, then k is equal to _____ .

Q87. The number of points, at which the function $f(x) = |2x + 1| - 3|x + 2| + \left|x^2 + x - 2\right|, x \in R$ is not differentiable, is

Q88. Let $f(x)$ be a polynomial of degree 6 in x, in which the coefficient of x^6 is unity and it has extrema at $x = -1$ and $x = 1$. If $\lim\limits_{x \to 0} \frac{f(x)}{x^3} = 1$, then $5 \cdot f(2)$ is equal to

Q89. The graphs of sine and cosine functions, intersect each other at a number of points and between two consecutive points of intersection, the two graphs enclose the same area A. Then A^4 is equal to

Q90. Let $\vec{a} = \hat{i} + 2\hat{j} - \hat{k}$, $\vec{b} = \hat{i} - \hat{j}$ and $\vec{c} = \hat{i} - \hat{j} - \hat{k}$ be three given vectors. If $\vec{r}$ is a vector such that $\vec{r} \times \vec{a} = \vec{c} \times \vec{a}$ and $\vec{r} \cdot \vec{b} = 0$, then $\vec{r} \cdot \vec{a}$ is equal to

ANSWER KEYS

1. (1)	**2.** (1)	**3.** (2)	**4.** (2)	**5.** (3)	**6.** (4)	**7.** (3)	**8.** (3)
9. (1)	**10.** (1)	**11.** (1)	**12.** (3)	**13.** (2)	**14.** (4)	**15.** (3)	**16.** (3)
17. (2)	**18.** (4)	**19.** (2)	**20.** (2)	**21.** (5)	**22.** (1)	**23.** (50)	**24.** (3600)
25. (1)	**26.** (128)	**27.** (1)	**28.** (144)	**29.** (10)	**30.** (15)	**31.** (1)	**32.** (3)
33. (4)	**34.** (1)	**35.** (1)	**36.** (1)	**37.** (2)	**38.** (4)	**39.** (1)	**40.** (2)
41. (1)	**42.** (2)	**43.** (4)	**44.** (1)	**45.** (1)	**46.** (2)	**47.** (1)	**48.** (1)
49. (1)	**50.** (3)	**51.** (70)	**52.** (741)	**53.** (5576)	**54.** (4)	**55.** (173)	**56.** (4)
57. (7)	**58.** (375)	**59.** (526)	**60.** (1)	**61.** (3)	**62.** (3)	**63.** (2)	**64.** (3)
65. (3)	**66.** (1)	**67.** (3)	**68.** (2)	**69.** (4)	**70.** (2)	**71.** (4)	**72.** (2)
73. (3)	**74.** (3)	**75.** (4)	**76.** (4)	**77.** (1)	**78.** (3)	**79.** (4)	**80.** (3)
81. (32)	**82.** (9)	**83.** (2)	**84.** (13)	**85.** (7)	**86.** (21)	**87.** (2)	**88.** (144)
89. (64)	**90.** (12)						