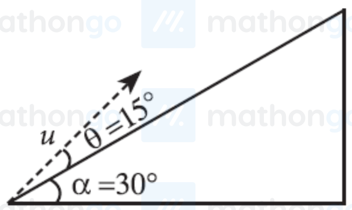
Q1. In the formula $X = 5YZ^2$, X and Z have dimensions of capacitance and magnetic field, respectively. What are the dimensions of Y in SI units?

(1) $M^{-1} L^{-2} T^4 A^2$
(2) $M^{-2} L^0 T^{-4} A^{-2}$
(3) $M^{-2} L^{-2} T^6 A^3$
(4) $M^{-3} L^{-2} T^8 A^4$

Q2. A bullet of mass 20 g has an initial speed of 1 m s^{-1}, just before it starts penetrating a mud wall of thickness 20 cm. If the wall offers a mean resistance of 2.5×10^{-2} N, the speed of the bullet after emerging from the other side of the wall is close to:

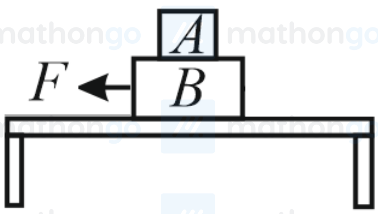
(1) 0.7 m s^{-1}
(2) 0.3 m s^{-1}
(3) 0.1 m s^{-1}
(4) 0.4 m s^{-1}

Q3. A plane is inclined at an angle $\alpha = 30°$ with respect to the horizontal. A particle is projected with a speed $u = 2 \text{ m s}^{-1}$, from the base of the plane, making an angle $\theta = 15°$ with respect to the plane as shown in the figure. The distance from the base, at which the particle hits the plane is close to:
(Take $g = 10 \text{ m s}^{-2}$)



(1) 20 cm
(2) 18 cm
(3) 14 cm
(4) 26 cm

Q4. Two blocks A and B of masses $m_A = 1$ kg and $m_B = 3$ kg are kept on the table as shown in figure. The coefficients of friction between A and B is 0.2 and between B and the surface of the table is also 0.2. The maximum force F that can be applied on B horizontally, so that the block A does not slide over the block B is :
[Take $g = 10 \text{ m / s}^2$]

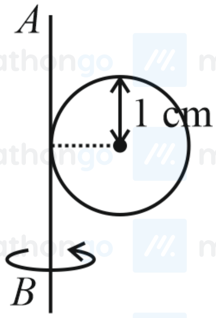


(1) 16 N
(2) 12 N
(3) 40 N
(4) 8 N

Q5. A solid sphere of mass M and radius R is divided into two unequal parts. The first part has a mass of $\frac{7M}{8}$ and is converted into uniform disc of radius 2R. The second part is converted into a uniform solid sphere. Let I_1 be the moment of inertia of the disc about its axis and I_2 be the moment of inertia of the new sphere about its axis. The ratio I_1 / I_2 is given by:

(1) 140
(2) 185
(3) 65
(4) 285

Q6. A metal coin of mass 5 g and radius 1 cm is fixed to a thin stick AB of negligible mass as shown in the figure. The system is initially at rest. The constant torque, that will make the system rotate about AB at 25 rotations per second in 5 s, is close to:



(1) 1.6×10^{-5} N m
(2) 2.0×10^{-5} N m
(3) 7.9×10^{-6} N m
(4) 4.0×10^{-6} N m

Q7. The time dependence of the position of a particle of mass $m = 2$ is given by $\vec{r}t = 2t\hat{i} - 3t^2\hat{j}$. Its angular momentum, with respect to the origin, at time $t = 2$ is:
(1) $36\hat{k}$
(2) $48\hat{i} + \hat{j}$
(3) $-48\hat{k}$
(4) $-34\hat{k} - \hat{i}$

Q8. A spaceship orbits around a planet at a height of 20 km from its surface. Assuming that only gravitational field of the planet acts on the spaceship, what will be the number of complete revolutions made by the spaceship in 24 hours around the planet?
[Given: Mass of planet $= 8 \times 10^{22}$ kg,
Radius of planet $= 2 \times 10^{6}$ m,
Gravitational constant $G = 6.67 \times 10^{-11}\ Nm^2 / kg^2$]
(1) 17
(2) 9
(3) 13
(4) 11

Q9. The elastic limit of brass is 379 MPa. The minimum diameter of a brass rod if it is to support a 400 N load without exceeding its elastic limit will be
(1) 1.00 mm
(2) 1.36 mm
(3) 1.16 mm
(4) 0.90 mm

Q10. In an experiment, brass and steel wires of length 1 m each with areas of cross section 1 mm^2 are used. The wires are connected in series and one end of the combined wire is connected to a rigid support and other end is subjected to elongation. The stress required to produce a net elongation of 0.2 mm is,
[Given, the Young's Modulus for steel and brass are, respectively, $120 \times 10^9\ N / m^2$ and $60 \times 10^9\ N / m^2$]
(1) $8.0 \times 10^6\ N / m^2$
(2) $1.2 \times 10^6\ N / m^2$
(3) $0.2 \times 10^6\ N / m^2$
(4) $1.8 \times 10^6\ N / m^2$

Q11. A cubical block of side 0.5 m floats on water with 30% of its volume under water. What is the maximum weight that can be put on the block without fully submerging it under water?
[Take, density of water $= 10^3\ kg / m^3$]

(1) 87.5 kg (2) 65.4 kg
(3) 30.1 kg (4) 46.3 kg

Q12. Water from a tap emerges vertically downwards with an initial speed of $1.0\ ms^{-1}$. The cross - sectional area of the tap is $10^{-4}\ m^2$. Assume that the pressure is constant throughout the stream of water and that the flow is streamlined. The cross - sectional area of the stream, 0.15 m below the tap would be:
(Take $g = 10\ ms^{-2}$)
(1) $1 \times 10^{-5}\ m^2$ (2) $5 \times 10^{-4}\ m^2$
(3) $2 \times 10^{-5}\ m^2$ (4) $5 \times 10^{-5}\ m^2$

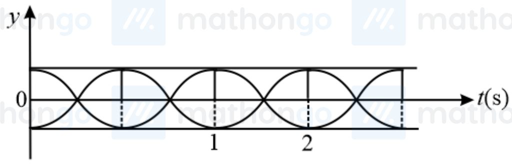
Q13. A submarine experiences a pressure of 5.05×10^6 Pa at a depth of d_1 in a sea. When it goes further to a depth of d_2 , it experiences a pressure of 8.08×10^6 Pa . Then $d_2 - d_1$ is approximately (density of water $= 10^3\ kg / m^3$ and acceleration due to gravity $= 10\ ms^{-2}$):
(1) 600 m (2) 500 m
(3) 300 m (4) 400 m

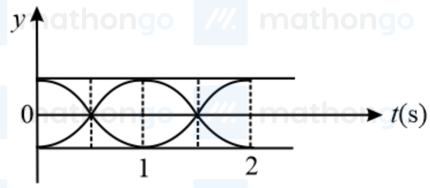
Q14. One mole of an ideal gas passes through a process where pressure and volume obey the relation $P = P_o 1 - \frac{1}{2}\frac{V_o}{V}^2$. Here P_o and V_o are constants. Calculate the change in the temperature of the gas if its volume changes from V_o to $2V_o$.
(1) $\frac{1}{4}\frac{P_0V_0}{R}$ (2) $\frac{5}{4}\frac{P_0V_0}{R}$
(3) $\frac{1}{2}\frac{P_0V_0}{R}$ (4) $\frac{3}{4}\frac{P_0V_0}{R}$

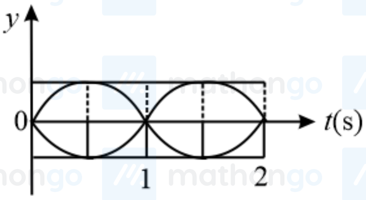
Q15. When heat Q is supplied to a diatomic gas of rigid molecules, at constant volume its temperature increases by ΔT . The heat required to produce the same change in temperature, at a constant pressure is:
(1) $\frac{3}{2}Q$ (2) $\frac{7}{5}Q$
(3) $\frac{5}{3}Q$ (4) $\frac{2}{3}Q$

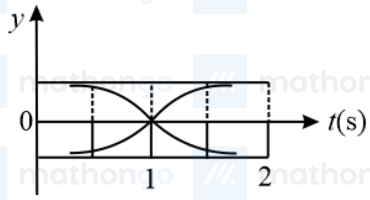
Q16. A source of sound S is moving with a velocity of $50\ m\ \ s^{-1}$ towards a stationary observer. The observer measures the frequency of the source as 1000 Hz. What will be the apparent frequency of the source when it is moving away from the observer after crossing him? (Take velocity of sound in air is $350\ m\ \ s^{-1}$)
(1) 750 Hz (2) 857 Hz
(3) 1143 Hz (4) 807 Hz

Q17. The correct figure that shows, schematically, the wave pattern produced by the superposition of two waves of frequencies 9 Hz and 11 Hz, is

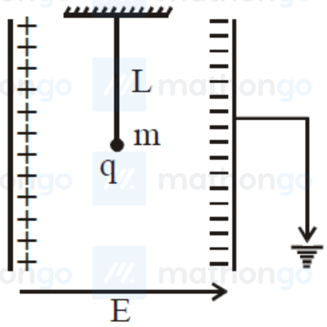
(1) 

(2) 

(3) 

(4) 

Q18. A simple pendulum of length L is placed between the plates of a parallel plate capacitor having electric field E, as shown in figure. Its bob has mass m and charge q. The time period of the pendulum is given by:



(1) $2\pi\sqrt{\frac{L}{\sqrt{g^2+\frac{qE}{m}^2}}}$

(2) $2\pi\sqrt{\frac{L}{g+\frac{qE}{m}}}$

(3) $2\pi\sqrt{\frac{L}{g-\frac{qE}{m}}}$

(4) $2\pi\sqrt{\frac{L}{\sqrt{g^2-\frac{q^2E^2}{m^2}}}}$

Q19. In free space, a particle A of charge 1 μC is held fixed at point P. Another particle B of the same charge and mass 4 μg is kept at a distance of 1 mm from P. If B is released, then its velocity at a distance of 9 mm from P is:

[Take $\frac{1}{4\pi\epsilon_0}=9\times10^9\ \mathrm{N\ m^2\ C^{-2}}$]

(1) $1.0\ \mathrm{m\ s^{-1}}$

(2) $1.5\times10^2\ \mathrm{m\ s^{-1}}$

(3) $2.0\times10^3\ \mathrm{m\ s^{-1}}$

(4) $3.0\times10^4\ \mathrm{m\ s^{-1}}$

Q20. Space between two concentric conducting spheres of radii a and b $(b>a)$ is filled with a medium of resistivity ρ. The resistance between the two spheres will be:

(1) $\frac{\rho}{4\pi}\frac{1}{a}+\frac{1}{b}$

(2) $\frac{\rho}{2\pi}\frac{1}{a}+\frac{1}{b}$

(3) $\frac{\rho}{4\pi}\frac{1}{a}-\frac{1}{b}$

(4) $\frac{\rho}{2\pi}\frac{1}{a}-\frac{1}{b}$

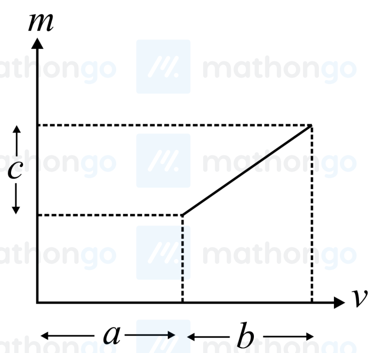
Q21. A square loop is carrying a steady current I and the magnitude of its magnetic dipole moment is m. If this square loop is changed to a circular loop and it carries the same current, the magnitude of the magnetic dipole moment of circular loop will be:

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

Q22. The magnitude of the magnetic field at the centre of an equilateral triangular loop of side 1 m which is carrying a current of 10 A is:
[Take $\mu_0 = 4\pi \times 10^{-7}$ N A^{-2}]
(1) 3 μT (2) 1 μT
(3) 18 μT (4) 9 μT

Q23. A coil of self inductance 10 mH and resistance of 0.1 Ω is connected through a switch to a battery of internal resistance 0.9 Ω . After the switch is closed, the time taken for the current to attain 80% of the saturation value is: [ln5 = 1.6]
(1) 0.103 s (2) 0.002 s
(3) 0.324 s (4) 0.016 s

Q24. The graph shows how the magnification m produced by a thin lens varies with image distance v. The focal length of the lens used is



(1) $\frac{b}{c}$ (2) $\frac{a}{c}$
(3) $\frac{b^2 c}{a}$ (4) $\frac{b^2}{ac}$

Q25. In a Young's double-slit experiment, the ratio of the slit's width is 4 : 1 . The ratio of the intensity of maxima to minima, close to the central fringe on the screen, will be
(1) 25 : 9 (2) 9 : 1
(3) $\sqrt{3} + 1^4 : 16$ (4) 4 : 1

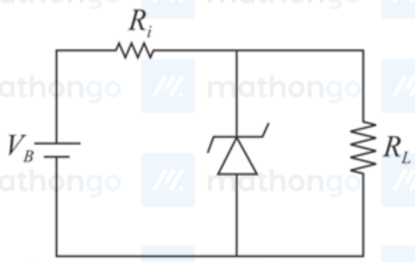
Q26. Light is incident normally on a completely absorbing surface with an energy flux of 25 W cm^{-2} . If the surface has an area of 25 cm^2 , the momentum transferred to the surface in 40 min time duration will be:
(1) 6.3×10^{-4} N s (2) 5.0×10^{-3} N s
(3) 3.5×10^{-6} N s (4) 1.4×10^{-6} N s

Q27. A 2 mW laser operates at a wavelength of 500 nm . The number of photons that will be emitted per second is:
[Given Planck's constant $h = 6.6 \times 10^{-34}$ J s, speed of light $c = 3.0 \times 10^8$ m / s]
(1) 1.5×10^{16} (2) 5×10^{15}
(3) 2×10^{16} (4) 1×10^{16}

Q28. In Li^{++}, electron in first Bohr orbit is excited to a level by a radiation of wavelength λ. When the ion gets de excited to the ground state in all possible ways (including intermediate emissions), a total of six spectral lines are observed. What is the value of λ ?
(Given: $h = 6.63 \times 10^{-34}$ J s ; $c = 3 \times 10^{8}$ m s^{-1})
(1) 10.8 nm
(2) 9.4 nm
(3) 11.4 nm
(4) 12.3 nm

Q29. Two radioactive substances A and B have decay constants 5λ and λ respectively. At $t = 0$, a sample has the same number of the two nuclei. The time taken for the ratio of the number of nuclei to become $\frac{1}{e}^{2}$ will be
(1) $\frac{1}{\lambda}$
(2) $\frac{1}{2\lambda}$
(3) $\frac{2}{\lambda}$
(4) $\frac{1}{4\lambda}$

Q30. The figure represents a voltage regulator circuit using a Zener diode. The breakdown voltage of the Zener diode is 6 V and the load resistance is, $R_L = 4\ k\Omega$. The series resistance of the circuit is $R_i = 1\ k\Omega$. If the battery voltage V_B varies from 8 V to 16 V , what are the minimum and maximum values of the current through Zener diode?



(1) 0.5 mA; 6 mA
(2) 1 mA; 8.5 mA
(3) 0.5 mA; 8.5 mA
(4) 1.5 mA; 8.5 mA

Q31. The minimum amount of $O_2 g$ consumed per gram of reactant is for the reaction:
(Given atomic mass: Fe = 56, O = 16, Mg = 24, P = 31, C = 12, H = 1)
(1) $P_4 s + 5O_2 g \rightarrow P_4O_{10} s$
(2) $2\ Mg s + O_2 g \rightarrow 2MgO s$
(3) $4Fe s + 3O_2 g \rightarrow 2Fe_2O_3 s$
(4) $C_3H_8 g + 5O_2 g \rightarrow 3CO_2 g + 4H_2O\ (l)$

Q32. The ratio of the shortest wavelength of two spectral series of hydrogen spectrum is found to be about 9. The spectral series are:
(1) Paschen and Pfund
(2) Balmer and Brackett
(3) Lyman and Paschen
(4) Brackett and Pfund

Q33. The correct order of the first ionization enthalpies is:
(1) Ti < Mn < Zn < Ni
(2) Ti < Mn < Ni < Zn
(3) Mn < Ti < Zn < Ni
(4) Zn < Ni < Mn < Ti

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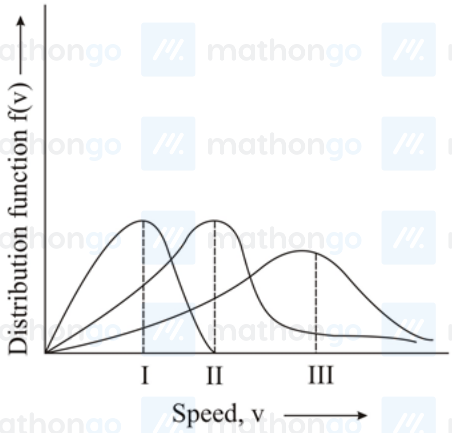
Q34. Points I, II and III in the following plot respectively correspond to (V_{mp}: most probable velocity)



(1) V_{mp} of N_2 300 K; V_{mp} of H_2 300 K; V_{mp} of O_2 400 K;
(2) V_{mp} of H_2 300 K; V_{mp} of N_2 300 K; V_{mp} of O_2 400 K;
(3) V_{mp} of N_2 300 K; V_{mp} of O_2 400 K; V_{mp} of H_2 300 K;
(4) V_{mp} of O_2 400 K; V_{mp} of N_2 300 K; V_{mp} of H_2 300 K;

Q35. The difference between ΔH and ΔU is ΔH - ΔU, when the combustion of one mole of heptane l is carried out at a temperature T , is equal to:

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

Q36. For the reaction,

$2SO_2 g + O_2 g \rightleftharpoons 2SO_3 g$,

$\Delta H =$ - 57.2 kJ mol^{-1} and $K_c = 1.7 \times 10^{16}$.

Which of the following statements is incorrect?

(1) The equilibrium constant is large suggestive of reaction going to completion and so, no catalyst is required.
(2) The equilibrium will shift in forward direction as the pressure increases.
(3) The equilibrium constant decreases as the temperature increases.
(4) The addition of inert gas at constant volume will not affect the equilibrium constant.

Q37. The pH of a 0.02 M NH_4Cl solution will be [Given: $K_b NH_4OH = 10^{-5}$ and $\log 2 = 0.301$]

(1) 4.65
(2) 2.65
(3) 4.35
(4) 5.35

Q38. The correct statements among a to d are:

a Saline hydrides produce H_2 gas when reacted with H_2O.
b Reaction of $LiAlH_4$ with BF_3 leads to B_2H_6.
c PH_3 and CH_4 are electron - rich and electron - precise hydrides, respectively.
d HF and CH_4 are called as molecular hydrides.

(1) a, b and c only.
(2) a, c and d only.
(3) c and d only.
(4) a, b, c and d

Q39. A hydrated solid X on heating initially gives a monohydrated compound Y. Y upon heating above 373 K leads to an anhydrous white powder Z. X and Z, respectively, are;

(1) washing soda and soda ash.
(2) baking soda and soda ash.
(3) washing soda and dead burnt plaster.
(4) baking soda and dead burnt plaster.

Q40. The number of pentagons in C_{60} and trigons (triangles) in white phosphorus, are;

(1) 12 and 3
(2) 20 and 4
(3) 20 and 3
(4) 12 and 4

Q41. The increasing order of nucleophilicity of the following nucleophiles is;

(i) $CH_3CO_2^{\ominus}$
(ii) H_2O
(iii) $CH_3SO_3^{\ominus}$
(iv) $\overset{\ominus}{O}H$

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

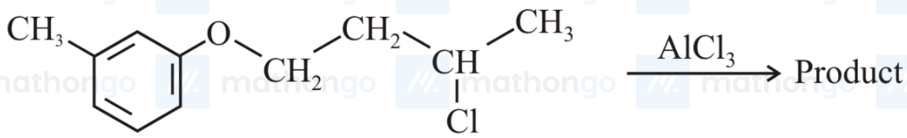
Q42. In chromatography, which of the following statements is incorrect for R_f?

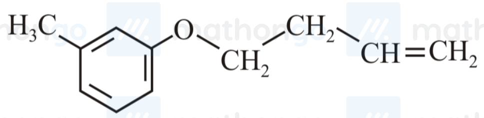
(1) Higher R_f value means higher adsorption.
(2) The value of R_f cannot be more than one.
(3) R_f value depends on the type of chromatography.
(4) R_f value of dependent on the mobile phase.

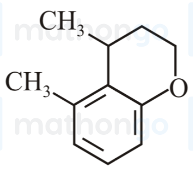
Q43. Which of these factors does not govern the stability of a conformation in acyclic compounds?

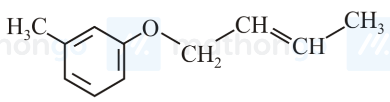
(1) Steric interactions
(2) Angle strain
(3) Torsional strain
(4) Electrostatic forces of interaction

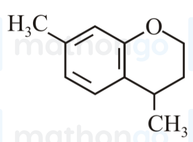
Q44. The major product obtained in the given reaction is:



(1) 

(2) 

(3) 

(4) 

Q45. Air pollution that occurs in sunlight is

(1) Acid rain
(2) Reducing smog
(3) Fog
(4) Oxidising smog

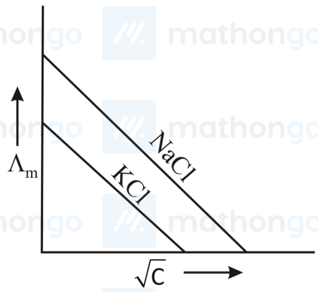
Q46. The noble gas that does not occur in the atmosphere is;

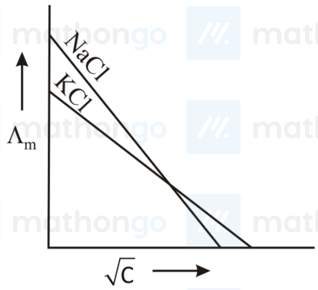
(1) Kr
(2) Ne
(3) Ra
(4) He

Q47. 1 g of a non-volatile non-electrolyte solute is dissolved in 100 g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1: 5. The ratio of the elevation in their boiling points, $\frac{\Delta T_b A}{\Delta T_b B}$, is: (assuming they have the same molar mass)

(1) 10: 1
(2) 1: 5
(3) 1: 0.2
(4) 5: 1

Q48. Which one of the following graphs between molar conductivity Λ_m versus $\sqrt{C}$ is correct?

(1)


(2)


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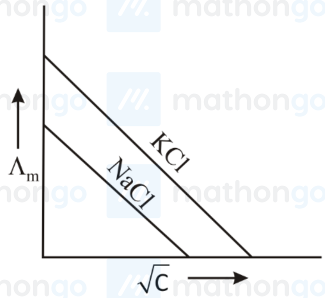

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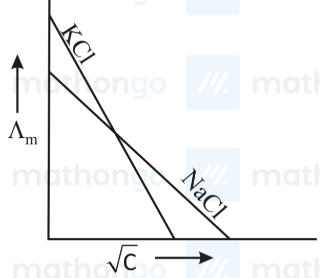


Q49. For the reaction of H_2 with I_2, the rate constant is 2.5×10^{-4} $dm^3 mol^{-1} s^{-1}$ at $327^\circ C$ and 1.0 dm^3 mol-1s^{-1} at 527°C . The activation energy for the reaction, in kJ mol-1 is:
$R = 8.314 \ JK^{-1} mol^{-1}$

(1) 166
(2) 59
(3) 72
(4) 150

Q50. The correct option among the following is.

(1) Brownian motion in colloidal solution is faster if the viscosity of the solution is very high.
(2) Colloidal particles in lyophobic sols can be precipitated by electrophoresis.
(3) Colloidal medicines are more effective because they have small surface area.
(4) Addition of alum to water makes it unfit for drinking.

Q51. The correct statement is:

(1) Aniline is a froth stabilizer.
(2) Zone refining process is used for the refining of titanium.
(3) Zincite is a carbonate ore.
(4) Sodium cyanide cannot be used in the metallurgy of silver.

Q52. The highest possible oxidation states of uranium and plutonium, respectively, are

(1) 4 and 6
(2) 7 and 6
(3) 6 and 4
(4) 6 and 7

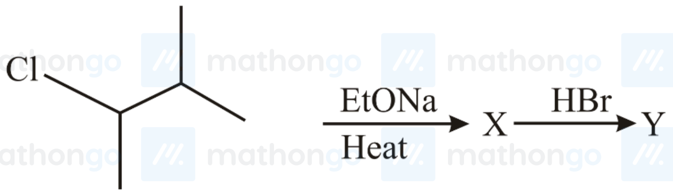
Q53. The incorrect statement is.

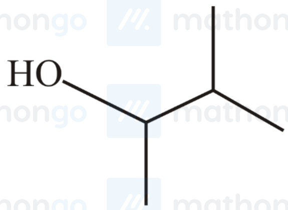
(1) The spin-only magnetic moments of $FeH_2O_6^{2+}$ and $CrH_2O_6^{2+}$ are nearly similar.
(2) The spin-only magnetic moment of $NiNH_{34}H_2O_2^{2+}$ is 2.83 BM.
(3) The gemstone, ruby, has Cr^{3+} ions occupying the octahedral sites of beryl.
(4) The color of $CoClNH_{35}^{2+}$ is violet as it absorbs the yellow light.

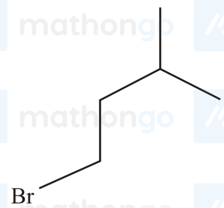
Q54. The crystal field stabilization energy (CFSE) of $FeH_2O_6Cl_2$ and K_2NiCl_4, respectively, are:

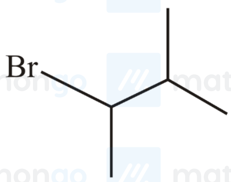
(1) $-0.4\Delta_0$ and $-1.2\Delta_t$
(2) $-2.4\Delta_0$ and $-1.2\Delta_t$
(3) $-0.4\Delta_0$ and $-0.8\Delta_t$
(4) $-0.6\Delta_0$ and $-0.8\Delta_t$

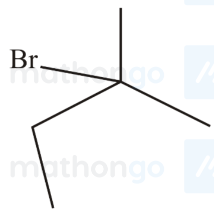
Q55. The major product 'Y' in the following reaction is:



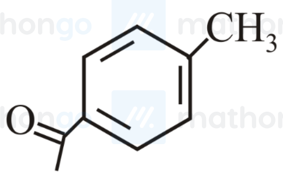
(1)


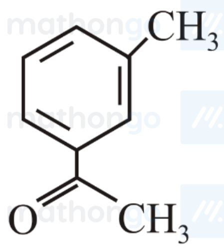
(2)


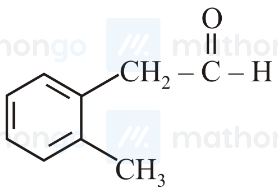
(3)


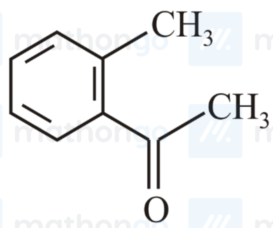
(4)


Q56. Compound $AC_9H_{10}O$ shows positive iodoform test. Oxidation of A with $KMnO_4$ / KOH gives acid $BC_8H_6O_4$. Anhydride of B is used for the preparation of phenolphthalein. Compound A is:

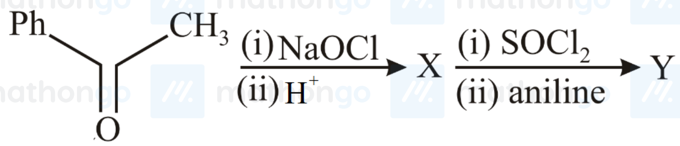
(1) 

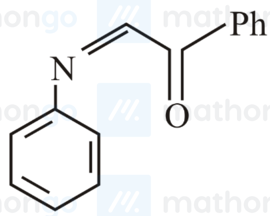
(2) 

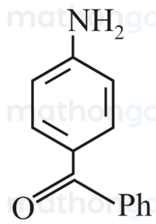
(3) 

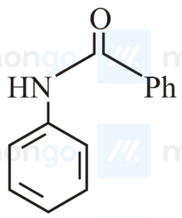
(4) 

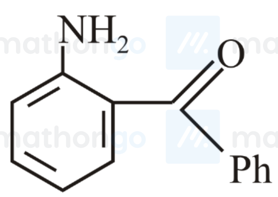
Q57. The major product Y in the following reaction is:



(1) 

(2) 

(3) 

(4) 

Q58. Which of the following is not a correct method of the preparation of benzyl amine from cyano benzene?

(1) H_2 / Ni
(2) (i) HCl / H_2O (ii) $NaBH_4$
(3) (i) $SnCl_2$ + HClgas (ii) $NaBH_4$
(4) (i) $LiAlH_4$ (ii) H_3O^+

Q59. The correct match between Item - I and Item - II is:

	Item - I		Item - II
(a)	High density polythene	(I)	Peroxide catalyst
(b)	Polyacrylonitrile	(II)	Condensation at high temperature & pressure
(c)	Novolac	(III)	Ziegler-Natta catalyst
(d)	Nylon 6	(IV)	Acid or base catalyst

(1) a → IV, b → (II), (c) → (I), (d) → (III)
(2) (a) → III, (b) → (I), (c) → (IV), (d) → (II)
(3) (a) → III, (b) → (I), (c) → (II), (d) → (IV)
(4) (a) → II, b → IV, c → I, d → III

Q60. Number of stereo centers present in linear and cyclic structures of glucose are respectively:
(1) 4 and 4 (2) 5 and 5
(3) 4 and 5 (4) 5 and 4

Q61. The number of real roots of the equation $5 + 2^x - 1 = 2^x 2^x - 2$ is :
(1) 2 (2) 3
(3) 1 (4) 4

Q62. If z and ω are two complex numbers such that $z\omega = 1$ and $arg z - arg(\omega) = \frac{\pi}{2}$, then:
(1) $z\bar{\omega} = \frac{1 - i}{\sqrt{2}}$ (2) $\bar{z}\omega = i$
(3) $z\bar{\omega} = \frac{-1 + i}{\sqrt{2}}$ (4) $\bar{z}\omega = -i$

Q63. Suppose that 20 pillars of the same height have been erected along the boundary of circular stadium. If the top of each pillar has been connected by beams with the top of all its non-adjacent pillars, then the total number of beams is:
(1) 170 (2) 180
(3) 210 (4) 190

Q64. The sum $1 + \frac{1^3 + 2^3}{1 + 2} + \frac{1^3 + 2^3 + 3^3}{1 + 2 + 3} + ... + \frac{1^3 + 2^3 + 3^3 + ... + 15^3}{1 + 2 + 3 + ... + 15} - \frac{1}{2} 1 + 2 + 3 + ... + 15$ is equal to
(1) 620 (2) 1240
(3) 1860 (4) 660

Q65. Let $a_1, \quad a_2, \quad a_3 ...$ be an $A.P.$ with $a_6 = 2$. Then, the common difference of this $A.P.$, which maximise the product $a_1 \cdot a_4 \cdot a_5$, is :
(1) $\frac{2}{3}$ (2) $\frac{3}{2}$
(3) $\frac{6}{5}$ (4) $\frac{8}{5}$

Q66. Let $a, \quad b$ and c be in $G.P.$ with common ratio r, where $a \neq 0$ and $0 < r \leq \frac{1}{2}$. If $3a, \quad 7b$ and $15c$ are the first three terms of an $A.P.$, then the 4^{th} term of this $A.P.$ is :
(1) a (2) $\frac{7}{3}a$
(3) $5a$ (4) $\frac{2}{3}a$

Q67. The smallest natural number n, such that the coefficient of x in the expansion of $x^2 + \frac{1}{x^3}^n$ is ${}^nC_{23}$, is
(1) 58 (2) 38
(3) 35 (4) 23

Q68. Lines are drawn parallel to the line $4x - 3y + 2 = 0$, at a distance $\frac{3}{5}$ units from the origin. Then which one of the following points lies on any of these lines?

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

Q69. The locus of the centres of the circles, which touch the circle, $x^2+y^2=1$ externally, also touch the y-axis and lie in the first quadrant, is:
(1) $y=\sqrt{1+2x}, \quad x\geq 0$
(2) $y=\sqrt{1+4x}, \quad x\geq 0$
(3) $x=\sqrt{1+2y}, \quad y\geq 0$
(4) $x=\sqrt{1+4y}, \quad y\geq 0$

Q70. If the line $ax+y=c$, touches both the curves $x^2+y^2=1$ and $y^2=4\sqrt{2}x$, then c is equal to:
(1) $\frac{1}{2}$
(2) $\sqrt{2}$
(3) $\frac{1}{\sqrt{2}}$
(4) 2

Q71. The tangent and normal to the ellipse $3x^2+5y^2=32$ at the point $P2,\ 2$ meet the x-axis at Q and R, respectively. Then the area (in sq. units) of the triangle PQR is:
(1) $\frac{68}{15}$
(2) $\frac{16}{3}$
(3) $\frac{14}{3}$
(4) $\frac{34}{15}$

Q72. If $5x+9=0$ is the directrix of the hyperbola $16x^2-9y^2=144,$ then its corresponding focus is:
(1) -5, 0
(2) 5, 0
(3) $-\frac{5}{3}$, 0
(4) $\frac{5}{3}$, 0

Q73. If $\lim_{x\to 1}\frac{x^2-ax+b}{x-1}=5,$ then $a+b$ is equal to:
(1) 1
(2) 5
(3) -4
(4) -7

Q74. The negation of the Boolean expression $\sim s\vee \sim r\wedge s$ is equivalent to
(1) r
(2) $s\wedge r$
(3) $s\vee r$
(4) $\sim s\wedge \sim r$

Q75. If both the mean and the standard deviation of 50 observations $x_1,\ x_2,\ \ldots,\ x_{50}$ are equal to 16, then the mean of $x_1-4^2,\ x_2-4^2,\ \ldots,x_{50}-4^2$ is
(1) 525
(2) 480
(3) 400
(4) 380

Q76. The angles $A,\quad B\quad \&\quad C$ of a ΔABC are in $A.P.$ and $a:b=1:\sqrt{3}$. If $c=4\quad cm,$ then the area (in $sq.\quad cm$) of this triangle is:
(1) $2\sqrt{3}$
(2) $\frac{2}{\sqrt{3}}$
(3) $\frac{4}{\sqrt{3}}$
(4) $4\sqrt{3}$

Q77. The sum of the real roots of the equation

$$\begin{vmatrix} x & -6 & -1 \\ 2 & -3x & x-3 \\ -3 & 2x & x+2 \end{vmatrix}=0,$$ is equal to:

(1) 0
(2) -4
(3) 6
(4) 1

Q78. Let λ be a real number for which the system of linear equations

$x + y + z = 6,$

$4x + \lambda y - \lambda z = \lambda - 2$ and

$3x + 2y - 4z = -5$

has infinitely many solutions. Then λ is a root of the quadratic equation:

(1) $\lambda^2 + 3\lambda - 4 = 0$
(2) $\lambda^2 - \lambda - 6 = 0$
(3) $\lambda^2 - 3\lambda - 4 = 0$
(4) $\lambda^2 + \lambda - 6 = 0$

Q79. If $\cos^{-1}x - \cos^{-1}\frac{y}{2} = \alpha$, where $-1 \le x \le 1$, $-2 \le y \le 2$, $x \le \frac{y}{2}$, then for all x, y, $4x^2 - 4xy\cos\alpha + y^2$ is equal to :

(1) $4\cos^2\alpha + 2x^2y^2$
(2) $4\sin^2\alpha - 2x^2y^2$
(3) $2\sin^2\alpha$
(4) $4\sin^2\alpha$

Q80. Let $fx = \log_e \sin x$, $0 < x < \pi$ and $gx = \sin^{-1}(e^{-x})$, $(x \ge 0)$. If α is a positive real number such that $a = fog'(\alpha)$ and $b = fog(\alpha)$, then

(1) $a\alpha^2 + b\alpha + a = 0$
(2) $a\alpha^2 + b\alpha - a = -2\alpha$
(3) $a\alpha^2 - b\alpha - a = 0$
(4) $a\alpha^2 - b\alpha - a = 1$

Q81. If the tangent to the curve $y = \frac{x}{x^2 - 3}$, $x \in R$, $x \ne \pm\sqrt{3}$, at a point $\alpha, \beta \ne 0, 0$ on it is parallel to the line $2x + 6y - 11 = 0$, then:

(1) $2\alpha + 6\beta = 19$
(2) $2\alpha + 6\beta = 11$
(3) $6\alpha + 2\beta = 19$
(4) $6\alpha + 2\beta = 9$

Q82. A spherical iron ball of radius 10 cm is coated with a layer of ice of uniform thickness that melts at a rate of 50 cm^3/min. When the thickness of the ice is 5 cm, then the rate at which the thickness (in cm/min) of the ice decreases, is :

(1) $\frac{1}{9\pi}$
(2) $\frac{1}{36\pi}$
(3) $\frac{1}{18\pi}$
(4) $\frac{5}{6\pi}$

Q83. If $\int x^5 e^{-x^2} dx = gxe^{-x^2} + c$, where c is a constant of integration, then g-1 is equal to

(1) $-\frac{5}{2}$
(2) -1
(3) 1
(4) $-\frac{1}{2}$

Q84. The integral $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \sec^{\frac{2}{3}}x \cdot \operatorname{cosec}^{\frac{4}{3}}x\,dx$ is equal to

(1) $3^{\frac{7}{6}} - 3^{\frac{5}{6}}$
(2) $3^{\frac{4}{3}} - 3^{\frac{1}{3}}$
(3) $3^{\frac{5}{6}} - 3^{\frac{2}{3}}$
(4) $3^{\frac{5}{3}} - 3^{\frac{1}{3}}$

Q85. The area (in sq. units) of the region bounded by the curves $y = 2^x$ and $y = x + 1$, in the first quadrant is

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

Q86. Let $y = yx$ be the solution of the differential equation, $\frac{dy}{dx} + y\tan x = 2x + x^2\tan x$, $x \in -\frac{\pi}{2}, \frac{\pi}{2}$, such that $y0 = 1$. Then

(1) $y'\frac{\pi}{4} - y'-\frac{\pi}{4} = \pi - \sqrt{2}$
(2) $y'\frac{\pi}{4} + y'-\frac{\pi}{4} = -\sqrt{2}$
(3) $y\frac{\pi}{4} - y-\frac{\pi}{4} = \sqrt{2}$
(4) $y'\frac{\pi}{4} + y'-\frac{\pi}{4} = \frac{\pi^2}{2} + 2$

Q87. The distance of the point having position vector $-\hat{i} + 2\hat{j} + 6\hat{k}$ from the straight line passing through the point $2, 3, -4$ and parallel to the vector, $6\hat{i} + 3\hat{j} - 4\hat{k}$ is
(1) $4\sqrt{3}$
(2) 6
(3) $2\sqrt{13}$
(4) 7

Q88. If the plane $2x - y + 2z + 3 = 0$ has the distances $\frac{1}{3}$ and $\frac{2}{3}$ units from the planes $4x - 2y + 4z + \lambda = 0$ and $2x - y + 2z + \mu = 0$, respectively, then the maximum value of $\lambda + \mu$ is equal to:
(1) 9
(2) 15
(3) 13
(4) 5

Q89. A perpendicular is drawn from a point on the line $\frac{x-1}{2} = \frac{y+1}{-1} = \frac{z}{1}$ to the plane $x + y + z = 3$ such that the foot of the perpendicular Q also lies on the plane $x - y + z = 3$. Then the coordinates of Q are
(1) $2, \quad 0, \quad 1$
(2) $-1, \quad 0, \quad 4$
(3) $4, \quad 0, \quad -1$
(4) $1, \quad 0, \quad 2$

Q90. Minimum number of times a fair coin must be tossed so that the probability of getting at least one **head** is more than 99% is:
(1) 8
(2) 6
(3) 5
(4) 7

ANSWER KEYS

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