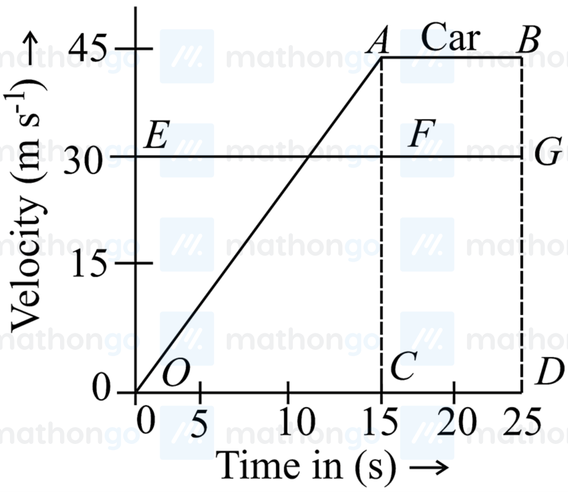
Q1. The relative error in the determination of the surface area of a sphere is α. The relative error in the determination of its volume is

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

Q2. The velocity time graphs of a car and a scooter are shown in the figure. (i) The difference between the distance travelled by the car and the scooter in 15 s and (ii) the time at which the car will catch up with the scooter are, respectively.



(1) 112.5 m and 22.5 s
(2) 337.5 m and 25 s
(3) 225.5 m and 10 s
(4) 112.5 m and 15 s

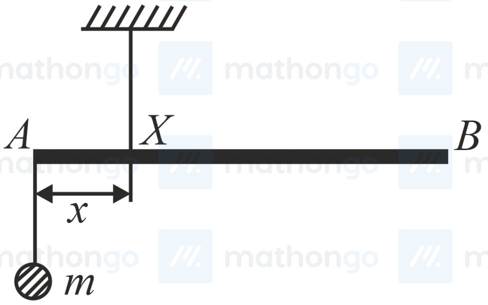
Q3. An automobile, traveling at 40 km h^{-1}, can be stopped at a distance of 40 m by applying brakes. If the same automobile is traveling at 80 km h^{-1}, the minimum stopping distance in metres is (Assume no skidding):

(1) 150 m
(2) 100 m
(3) 75 m
(4) 160 m

Q4. A given object takes n times more time to slide down a 45^o rough inclined plane as it takes to slide down a perfectly smooth 45^o incline. The coefficient of kinetic friction between the object and the incline is:

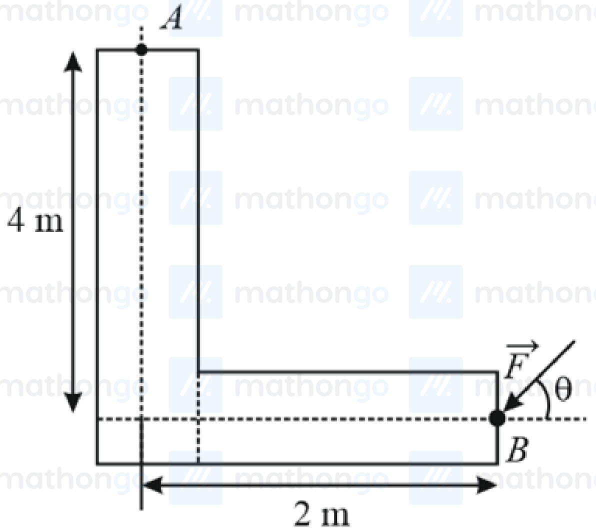
(1) $\sqrt{1-\frac{1}{n^2}}$
(2) $1-\frac{1}{n^2}$
(3) $\frac{1}{2-n^2}$
(4) $\sqrt{\frac{1}{1-n^2}}$

Q5. A uniform rod AB is suspended from a point X, at a variable distance x from A, as shown. To make the rod horizontal, a mass m is suspended from its end A. A set of $(m,\ x)$ value is recorded. The appropriate variables that give a straight line, when plotted, are:



(1) m, x^2
(2) $m, \frac{1}{x^2}$
(3) $m, \frac{1}{x}$
(4) m, x

Q6. A force of 40 N acts on a point B at the end of an L-shaped object as shown in the figure. The angle θ that will produce the maximum moment of the force about point A is given by:



(1) $\tan\theta = 4$
(2) $\tan\theta = \frac{1}{4}$
(3) $\tan\theta = \frac{1}{2}$
(4) $\tan\theta = 2$

Q7. A body of mass m is moving in a circular orbit of radius R about a planet of mass M. At some instant, it splits into two equal masses. The first mass moves in a circular orbit of radius $\frac{R}{2}$. And the other mass, in a circular orbit of radius $\frac{3R}{2}$. The difference between the final and the initial total energies is

(1) $+\frac{Gm}{6R}$
(2) $-\frac{Gm}{2R}$
(3) $-\frac{Gm}{6R}$
(4) $\frac{Gm}{2R}$

Q8. Take the mean distance of the moon and the sun from the earth to be 0.4×10^6 km and 150×10^6 km, respectively. Their masses are 8×10^{22} kg and 2×10^{30} kg, respectively. The radius of the earth is 6400 km. Let ΔF_1 be the difference in the forces exerted by the moon at the nearest and farthest point on the earth, and ΔF_2 be the difference in the forces exerted by the sun at the nearest and farthest points on the earth. Then, the number closest to $\frac{\Delta F_1}{\Delta F_2}$ is,

(1) 6
(2) 10^{-2}
(3) 2
(4) 0.6

Q9. A thin uniform tube is bent into a circle of radius r in the vertical plane. Equal volumes of two immiscible liquids, Whose densities are ρ_1 and ρ_2 ($\rho_1 > \rho_2$), fill half the circle. The angle θ between the radius vector passing through the common interface and the vertical is:

(1) $\theta = \tan^{-1}\frac{\pi}{2}\left(\frac{\rho_1+\rho_2}{\rho_1-\rho_2}\right)$
(2) $\theta = \tan^{-1}\left[\left(\frac{\rho_1-\rho_2}{\rho_1+\rho_2}\right)\right]$
(3) $\theta = \tan^{-1}\frac{\pi}{2}\left(\frac{\rho_2}{\rho_1}\right)$
(4) $\theta = \tan^{-1}\pi\left(\frac{\rho_1}{\rho_2}\right)$

Q10. One mole of an ideal monatomic gas is compressed isothermally in a rigid vessel to double its pressure at room temperature, $27^{\circ}\mathrm{C}$. The magnitude of work done on the gas will be:

(1) $300R$
(2) $300R\ln 2$
(3) $300\ln 6$
(4) $300R\ln 7$

Q11. A Carnot's engine works like a refrigerator between 250 K and 300 K. It receives 500 cal heat from the reservoir at a lower temperature. The amount of work done in each cycle to operate the refrigerator is,

(1) 772 J
(2) 420 J
(3) 2100 J
(4) 2520 J

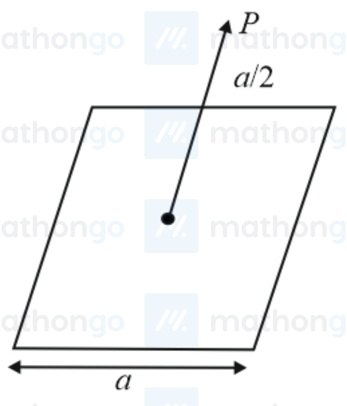
Q12. A body of mass M and charge q is connected to a spring of spring constant k. It is oscillating along x-direction about its equilibrium position in the horizontal plane, taken to be at $x=0$, with an amplitude A. An electric field E is applied along the x-direction. Which of the following statements is correct?

(1) The total energy of the system is $\frac{1}{2}m\omega^2A^2+\frac{1}{2}\frac{q^2E^2}{k}$
(2) The new equilibrium position is at a distance $\frac{2qE}{k}$ from $x=0$
(3) The new equilibrium position is at a distance $\frac{qE}{2k}$ from $x=\ 0$
(4) The total energy of the system is $\frac{1}{2}m\omega^2A^2-\frac{1}{2}\frac{q^2E^2}{k}$.

Q13. A tuning fork vibrates with frequency 256 Hz and gives one beat per second with the third normal mode of vibration of an open pipe. What is the length of the pipe? (speed of sound in air is $340\ \mathrm{m\ s^{-1}}$)

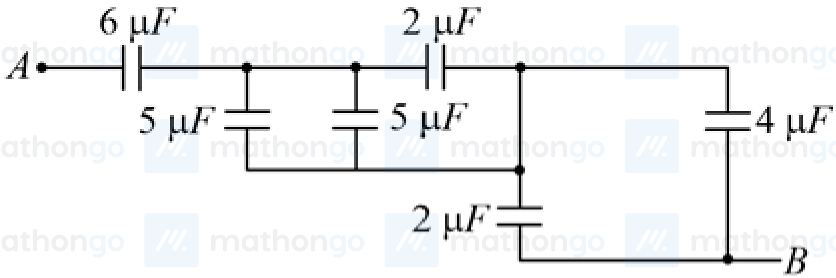
(1) 220 cm
(2) 200 cm
(3) 190 cm
(4) 180 cm

Q14. A charge Q is placed at a distance $^{a}/_{2}$ above the centre of a square surface of side length a. The electric flux through the square surface due to the charge would be?



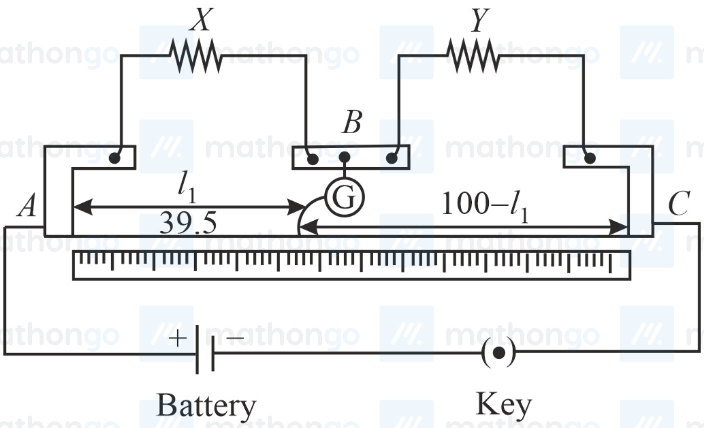
(1) $\frac{Q}{6\epsilon_0}$
(2) $\frac{Q}{2\epsilon_0}$
(3) $\frac{Q}{3\epsilon_0}$
(4) $\frac{Q}{\epsilon_0}$

Q15. The equivalent capacitance between A and B in the circuit is given below.



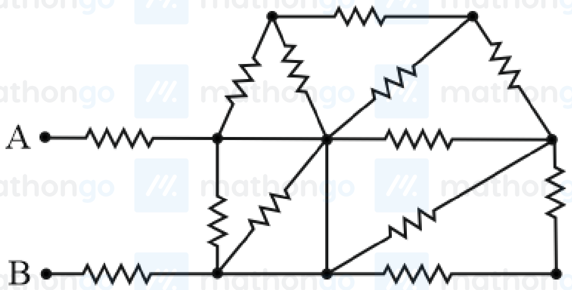
(1) 3.6 μF
(2) 2.4 μF
(3) 4.9 μF
(4) 5.4 μF

Q16. In a meter bridge as shown in the figure, it is given that resistance $Y = 12.5\ \Omega$ and that the balance is obtained at a distance 39.5 cm from end A (by jockey J). After interchanging the resistances X and Y a new balance point is found at a distance l_2 from end A. What are the values of X (in Ω) and l_2?



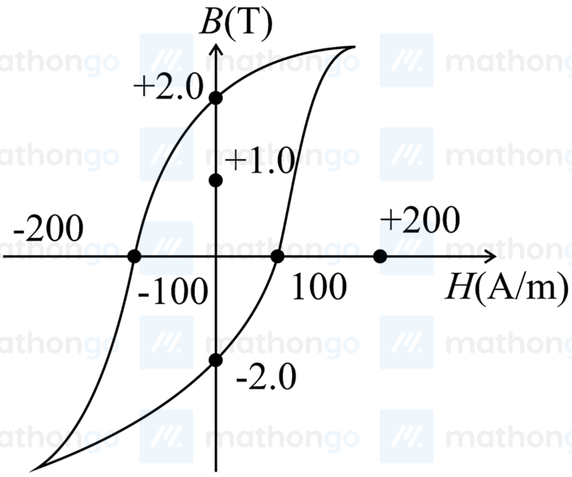
(1) 19.15 Ω and 39.5 cm
(2) 8.16 Ω and 60.5 cm
(3) 8.16 Ω and 39.5 cm
(4) 19.15 Ω and 60.5 cm

Q17. In the given circuit all resistance is of the value of R ohm each. The equivalent resistance between A and B is:



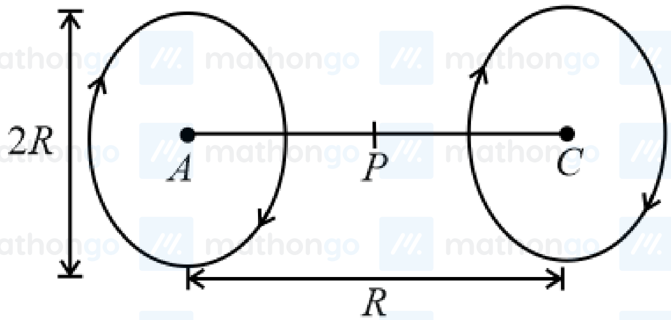
(1) $\frac{5R}{2}$
(2) 3R
(3) $\frac{5R}{3}$
(4) $2R$

Q18. The $B - H$ curve for a ferromagnet is shown in the figure. The ferromagnet is placed inside a long solenoid with 1000 turns cm^{-1}. The current that should be passed in the solenoid to demagnetize the ferromagnet completely is,



(1) 2 mA
(2) 20 μA
(3) 1 mA
(4) 40 μA

Q19. A Helmholtz coil has a pair of loops, each with N turns and radius R. They are placed coaxially at distance R and the same current I flows through the loops in the same direction. The magnitude of the magnetic field at P, midway between the centres A and C, is given by [Refer to figure given below]:

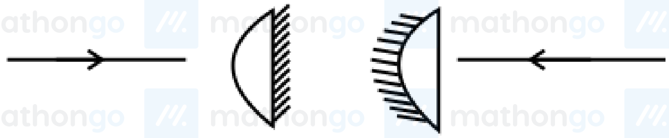


(1) $\frac{8N\mu_0 I}{5^{1/2}R}$
(2) $\frac{4N\mu_0 I}{5^{3/2}R}$
(3) $\frac{4N\mu_0 I}{5^{1/2}R}$
(4) $\frac{8N\mu_0 I}{5^{3/2}R}$

Q20. An ideal capacitor of capacitance 0 .2 μF is charged to a potential difference of 10 V. The charging battery is then disconnected. The capacitor is then connected to an ideal inductor of self inductance 0. 5 mH. The current at a time when the potential difference across the capacitor is 5 V is:
(1) 0. 15 A
(2) 0. 17 A
(3) 0. 34 A
(4) 0. 25 A

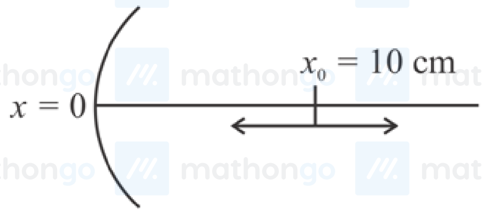
Q21. A monochromatic beam of light has a frequency $v=\frac{3}{2\pi}\times 10^{12}$ Hz and is propagating along the direction $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$. It is polarized along the $\hat{k}$ direction. The acceptance form the magnetic field is:
(1) $\frac{E_0}{C}\left(\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$ Cos $\left[10^4\frac{\left(\hat{i}+\hat{j}\right)}{\sqrt{2}}.\vec{r}-\left(3\times 10^{12}\right)t\right]$
(2) $\frac{E_0}{C}\,\hat{k}$ Cos $\left[10^4\frac{\left(\hat{i}+\hat{j}\right)}{\sqrt{2}}.\vec{r}+\left(3\times 10^{12}\right)t\right]$
(3) $\frac{E_0}{C}\frac{\left(\hat{i}-\hat{j}\right)}{\sqrt{2}}$ Cos $\left[10^4\frac{\left(\hat{i}+\hat{j}\right)}{\sqrt{2}}.\vec{r}+\left(3\times 10^{12}\right)t\right]$
(4) $\frac{E_0}{C}\frac{\left(\hat{i}+\hat{j}+\hat{k}\right)}{\sqrt{3}}$Cos $\left[10^4\frac{\left(\hat{i}+\hat{j}\right)}{\sqrt{2}}.\vec{r}+\left(3\times 10^{12}\right)t\right]$

Q22. A plano-convex lens becomes an optical system of 28 cm focal length when its plane surface is silvered and illuminated from left to right as shown in fig$-A$ If the same lens is instead silvered on the curved surface and illuminated from another side as in fig-B, it acts as an optical system of focal length 10 cm. The refractive index of the material of the lens is:



(1) 1.55 (2) 1.50
(3) 1.75 (4) 1.51

Q23. A particle is oscillating on the x-axis with an amplitude 2 cm about the point $x_0 = 10 \text{ cm}$ with a frequency. A concave mirror of focal length 5 cm is placed at the origin (see figure).



Identify the correct statements?
(i) The image executes periodic motion.
(ii) The image executes non-periodic motion.
(iii) The turning points of the image are asymmetric with respect to the image of the point at $X = 10 \text{ cm}$.
(iv) The distance between the turning points of the oscillation of the image is $\frac{100}{21} \text{ cm}$.
(1) (ii, iii) (2) (i, iii, iv)
(3) (i, iv) (4) (ii, iv)

Q24. Light of wavelength 550 nm falls normally on a slit of width $22.0 \times 10^{-5} \text{ cm}$. The angular position of the second minima from the central maximum will be (in radians):
(1) $\frac{\pi}{4}$ (2) $\frac{\pi}{8}$
(3) $\frac{\pi}{12}$ (4) $\frac{\pi}{6}$

Q25. Two electrons are moving with non-relativistic speeds perpendicular to each other. If corresponding de brogile wavelengths are λ_1 and λ_2, their de brogile wavelength in the frame of reference attached to their centre of mass is:
(1) $\frac{1}{\lambda_{CM}} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$ (2) $\lambda_{CM} = \frac{2\lambda_1\lambda_2}{\sqrt{\lambda_1{}^2 + \lambda_2{}^2}}$
(3) $\lambda_{CM} = \lambda_1 = \lambda_2$ (4) $\lambda_{CM} = \frac{\lambda_1 + \lambda_2}{2}$

Q26. The energy required to remove the electron from a singly ionized Helium atom is 2.2 times the energy required to remove an electron from helium atom. The total energy required to ionize the Helium atom completely is close to

(1) $34\ \text{eV}$ (2) $20\ \text{eV}$
(3) $79\ \text{eV}$ (4) $109\ \text{eV}$

Q27. A solution containing active cobalt ${}^{60}_{27}\text{Co}$ having an activity of $0.8\ \mu\text{Ci}$ and decay constant λ is injected in an animal's body. When $1\ \text{cm}^3$ blood is drawn from the animal's body after 10 h of injection, the activity was found to be $300\ \text{dpm}$(decays per minute), then the total volume of blood in the animal's body is close to $\left[1\ \text{Ci} = 3.7\times10^{10}\ \text{dps(decays per second) and at } t = 10\ \text{h the value of } e^{-\lambda t} = 0.84\right]$
(1) 4 L (2) 6 L
(3) 5 L (4) 7 L

Q28. In a common emitter configuration with suitable bias, it is given that R_L is the load resistance and R_{BE} is small-signal dynamic resistance (input side). Then, voltage gain, current gain and power gain are given, respectively, by: β is current gain, I_B, I_C and I_E are respectively base, collector, and emitter currents.
(1) $\beta\frac{R_L}{R_{BE}}, \frac{\Delta I_C}{\Delta I_B}, \beta^2\frac{R_L}{R_{BE}}$ (2) $\beta\frac{R_L}{R_{BE}}, \frac{\Delta I_E}{\Delta I_B}, \beta^2\frac{R_L}{R_{BE}}$
(3) $\beta^2\frac{R_L}{R_{BE}}, \frac{\Delta I_C}{\Delta I_B}, \beta\frac{R_L}{R_{BE}}$ (4) $\beta^2\frac{R_L}{R_{BE}}, \frac{\Delta I_C}{\Delta I_E}, \beta^2\frac{R_L}{R_{BE}}$

Q29. The number of amplitude-modulated broadcast stations that can be accommodated in a $300\ \text{kHz}$ bandwidth for the highest modulating frequency $15\ \text{kHz}$ will be:
(1) 15 (2) 20
(3) 8 (4) 10

Q30. In a screw gauge, 5 complete rotations of the screw cause it to move a linear distance of $0.25\ \text{cm}$. There are 100 circular scale divisions. The thickness of a wire measured by this screw gauge gives a reading of 4 main scale divisions and 30 circular scale divisions. Assuming negligible error, the thickness of the wire is
(1) $0.4300\ \text{cm}$ (2) $0.3150\ \text{cm}$
(3) $0.0430\ \text{cm}$ (4) $0.2150\ \text{cm}$

Q31. A sample of $NaClO_3$ is converted by heat to NaCl with a loss of 0.16 g of oxygen. The residue is dissolved in water and precipitated as AgCl. The mass of AgCl (in g) obtained will be: (Given: Molar mass of $\text{AgCl} = 143.5\ \text{g mol}^{-1}$)
(1) 0.35 (2) 0.54
(3) 0.41 (4) 0.48

Q32. Ejection of the photoelectron from metal in the photoelectric effect experiment can be stopped by applying 0.5 V, when the radiation of $250\ \text{nm}$ is used. The work function of the metal is
(1) $4\ \text{eV}$ (2) $5.5\ \text{eV}$
(3) $4.5\ \text{eV}$ (4) $5\ \text{eV}$

Q33. For Na^+, Mg^{2+}, F^- and O^{2-}, the correct order of increasing ionic radii is:
(1) $O^{2-} < F^- < Na^+ < Mg^{2+}$ (2) $Na^+ < Mg^{2+} < F^- < O^{2-}$
(3) $Mg^{2+} < Na^+ < F^- < O^{2-}$ (4) $Mg^{2+} < O^{2-} < Na^+ < F^-$

Q34. In the molecular orbital diagram for the molecular ion N_2^+, the number of electrons in the σ_{2p} molecular orbital is

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

Q35. Identify the pair in which the geometry of the species is T-shaped and square-pyramidal, respectively,
(1) ICl_2^- and ICl_5.
(2) IO_3^- and $IO_2F_2^-$.
(3) ClF_3 and IO_4^-.
(4) $XeOF_2$ and $XeOF_4$.

Q36.

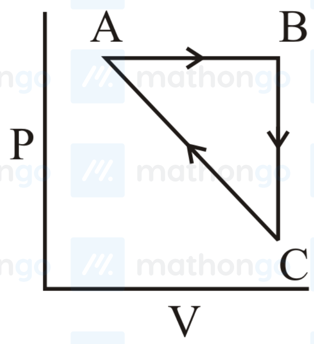

In the above compound, the bond orders of bonds (I) and (II) are:
(1) (I) < 2, (II) > 2
(2) (I) > 2, (II) > 2
(3) (I) > 2, (II) < 2
(4) (I) < 2, (II) < 2

Q37. In graphite and diamond, the percentage of p-characters of the hybrid orbitals in hybridization respectively, are
(1) 33 and 25
(2) 67 and 75
(3) 50 and 75
(4) 33 and 75

Q38. The decreasing order of bond angles in BF_3, NH_3, PF_3 and I_3^- is:
(1) $I_3^- > BF_3 > NH_3 > PF_3$
(2) $BF_3 > I_3^- > PF_3 > NH_3$
(3) $BF_3 > NH_3 > PF_3 > I_3^-$
(4) $I_3^- > NH_3 > PF_3 > BF_3$

Q39. For which of the following reactions, ΔH is equal to ΔU?
(1) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$
(2) $2HI(g) \rightarrow H_2(g) + I_2(g)$
(3) $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$
(4) $2NO_2(g) \rightarrow N_2O_4(g)$

Q40. An ideal gas undergoes a cyclic process as shown in the figure



$\Delta U_{BC} = -5\,KJmol^{-1}, q_{AB} = 2\,KJmol^{-1}$
$W_{AB} = -5\,KJmol^{-1}, W_{CA} = 3\,KJmol^{-1}$
Heat absorbed by the system during process CA is
(1) $-5\,KJmol^{-1}$
(2) $+5\,KJmol^{-1}$
(3) $-18\,KJmol^{-1}$
(4) $18\,KJmol^{-1}$

Q41. In which of the following reactions, an increase in the volume of the container will favour the formation of products?

(1) $4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(l)$
(2) $2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$
(3) $3O_2(g) \rightleftharpoons 2O_3(g)$
(4) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

Q42. Which of the following is a Lewis acid?
(1) PH_3
(2) NF_3
(3) NaH
(4) $B(CH_3)_3$

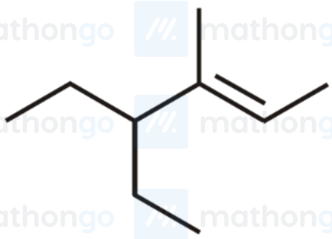
Q43. The minimum volume of water required to dissolve 0.1 g lead (II) chloride to get a saturated solution (K_{sp} of $PbCl_2 = 3.2 \times 10^{-8}$;atomic mass of $Pb = 207\ u$) is:
(1) 1.798 L
(2) 0.36 L
(3) 17.98 L
(4) 0.18 L

Q44. The correct match between items of List-I and List-II is

List - I		List - II	
(A)	Coloured impurity	(P)	Steam distillation
(B)	Mixture of o – nitrophenol and p –nitrophenol	(Q)	Fractional distillation
(C)	Crude Naphtha	(R)	Charcoal treatment
(D)	Mixture of glycerol and sugars	(S)	Distillation under reduced pressure

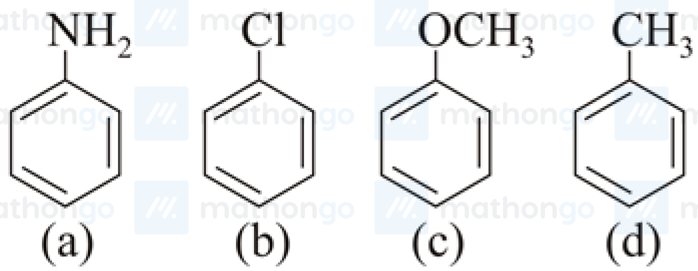
(1) (A) – (R), (B) – (S), (C) – (P), (D) – (Q)
(2) (A) – (P), (B) – (S), (C) – (R), (D) – (Q)
(3) (A) – (R), (B) – (P), (C) – (Q), (D) – (S)
(4) (A) – (R), (B) – (P), (C) – (S), (D) – (Q)

Q45. The IUPAC name of the following compound is



(1) 3–ethyl–4–methylhex–4–ene
(2) 4, 4–diethyl–3–methylbut–2–ene
(3) 4–methyl–3–ethylhex–4–ene
(4) 4–ethyl–3–methylhex–2–ene

Q46. The increasing order of nitration in the acidic medium of the following compounds is:



(1) (a) < (b) < (d) < (c)
(2) (a) < (b) < (c) < (d)
(3) (b) < (a) < (c) < (d)
(4) (b) < (a) < (d) < (c)

Q47. Which of the following arrangements shows the schematic alignment of magnetic moments of antiferromagnetic substance?

(1) 

(2) 

(3) 

(4) 

Q48. When an electric current is passed through acidified water, 112 mL of hydrogen gas at N.T.P was collected at the cathode in 965 seconds. The current passed, in ampere, is:

(1) 2.0
(2) 0.1
(3) 0.5
(4) 1.0

Q49. N_2O_5 decomposes to NO_2 and O_2 follows the first order kinetics. After 50 minutes, the pressure inside the vessel increases from $50\ \text{mm}\ \ \text{Hg}$ to $87.5\ \text{mm}\ \ \text{Hg}$. The pressure of the gaseous mixture after 100 minutes at constant temperature will be:

(1) $136.5\ \text{mm}\ \ \text{Hg}$
(2) $106.25\ \text{mm}\ \ \text{Hg}$
(3) $175.0\ \text{mm}\ \ \text{Hg}$
(4) $116.25\ \text{mm}\ \ \text{Hg}$

Q50. Which of the following statements about colloids is false?

(1) When silver nitrate solution is added to potassium iodide solution a negatively charged colloidal solution is formed.
(2) Freezing point of colloidal solution is lower than true solution at same concentration of a solute.
(3) Colloidal particles can pass through ordinary filter paper.
(4) When excess of electrolyte is added to colloidal solution, colloidal particle will be precipitated.

Q51. Xenon hexafluoride on partial hydrolysis produces compounds 'X' and 'Y' and the respective oxidation states of Xe are:

(1) $XeOF_2\ (+4)\ \text{and}\ \ XeO_3\ (+6)$
(2) $XeOF_4\ (+6)\ \text{and}\ \ XeO_3\ (+6)$
(3) $XeO_2F_2\ (+6)\ \text{and}\ \ XeO_2\ (+4)$
(4) $XeOF_4\ (+6)\ \text{and}\ \ XeO_2F_2\ (+6)$

Q52. A white sodium salt dissolves readily in water to give a solution which is neutral to litmus. When silver nitrate solution is added to the before mentioned solution, a white precipitate is obtained which does not dissolve in dilute nitric acid. The anion is:

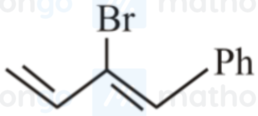
(1) CO_3^{2-}
(2) SO_4^{2-}
(3) S^{2-}
(4) Cl^{-}

Q53. The correct combination is

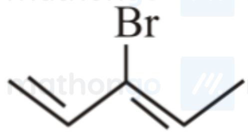
(1) $[NiCl_4]^{2-}$ – Square planar; $[Ni(CN)_4]^{2-}$ – paramagnetic
(2) $[Ni(CN)_4]^{2-}$ – tetrahedral; $[Ni(CO)_4]^{2-}$ – paramagnetic
(3) $[NiCl_4]^{2-}$ – paramagnetic; $[Ni(CO)_4]$ – tetrahedral
(4) $[NiCl_4]^{2-}$ – diamagnetic; $[Ni(CO)_4]$ – square-planar

Q54. Which of the following will most readily give the dehydrohalogenation product?

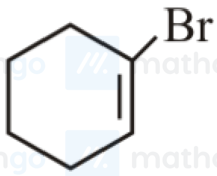
(1)



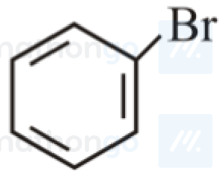
(2)



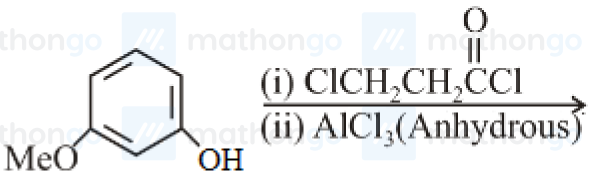
(3)



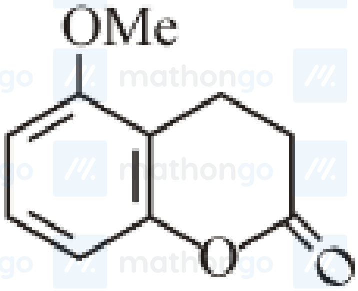
(4)



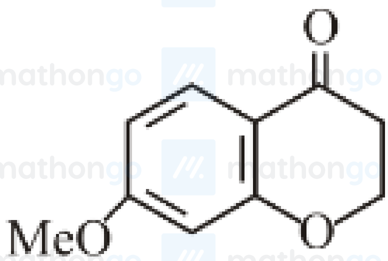
Q55. The major product of the following reaction is:



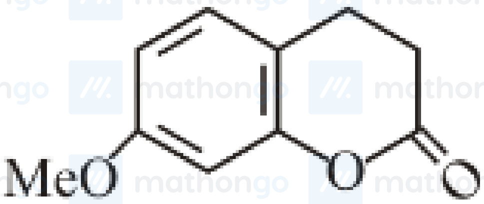
(1)



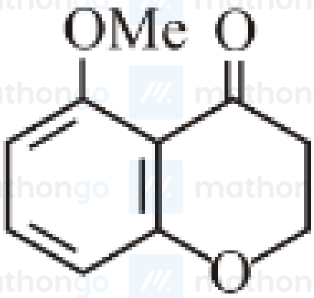
(2)



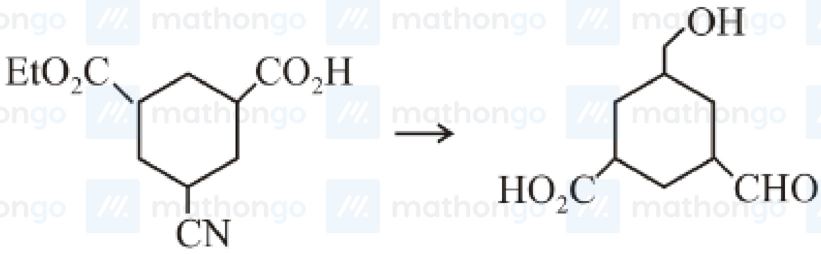
(3)



(4)

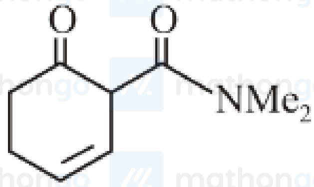


Q56. The reagent(s) required for the following conversion are:

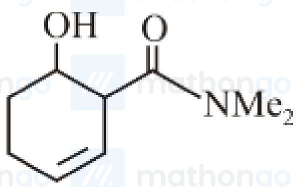


(1) (i) $NaBH_4$ (ii) Raney Ni/H_2 (iii) H_3O^+
(2) (i) $LiAlH_4$ (ii) H_3O^+
(3) (i) B_2H_6 (ii) DIBAL − H (iii) H_3O^+
(4) (i) B_2H_6 (ii) $SnCl_2/HCl$ (iii) H_3O^+

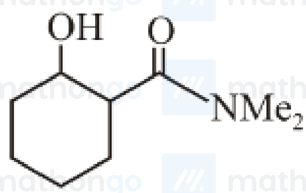
Q57. The main reduction product of the following compound with $NaBH_4$ in methanol is:



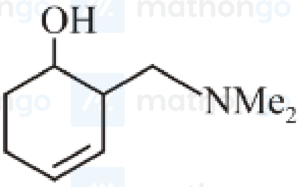
(1)



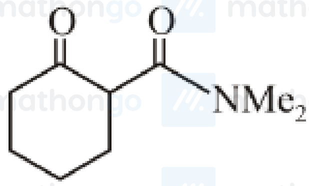
(2)



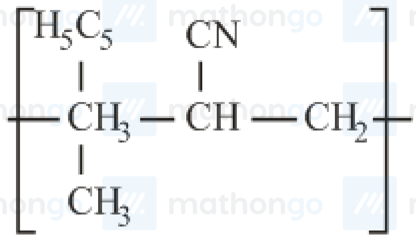
(3)

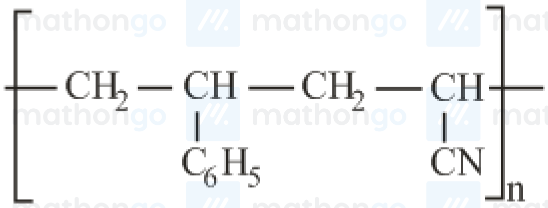


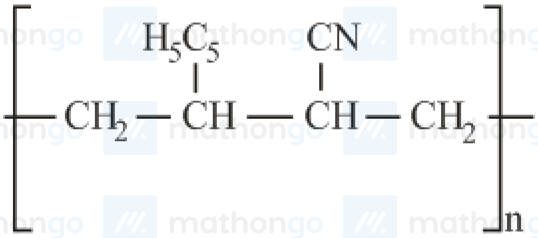
(4)

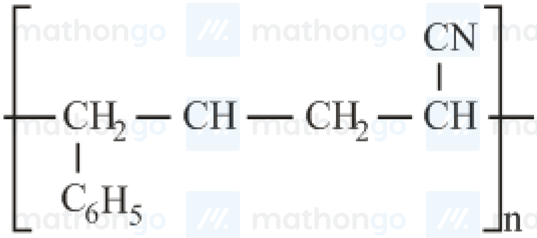


Q58. The copolymer formed by addition polymerization of styrene and acrylonitrile in the presence of peroxide is

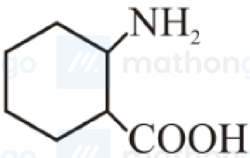
(1) 

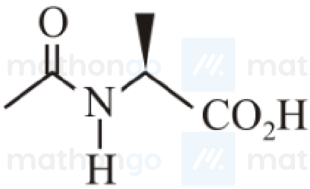
(2) 

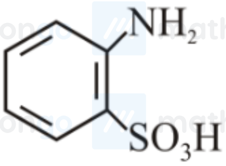
(3) 

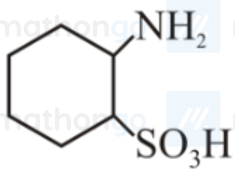
(4) 

Q59. Which of the following will not exist in Zwitterionic form at pH = 7?

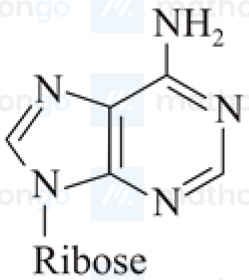
(1) 

(2) 

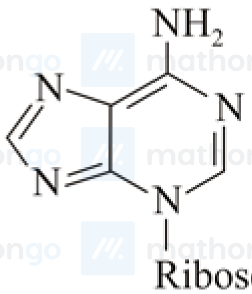
(3) 

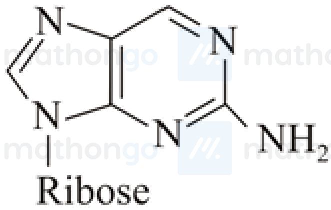
(4) 

Q60. Which of the following is the correct structure of adenosine?

(1) 

(2) 

(3) 

(4) 

Q61. If $\lambda \in R$ is such that the sum of the cubes of the roots of the equation $x^2 + (2 - \lambda)x + (10 - \lambda) = 0$ is minimum, then the magnitude of the difference of the roots of this equation is :

(1) $4\sqrt{2}$ (2) 20
(3) $2\sqrt{5}$ (4) $2\sqrt{7}$

Q62. If $\tan A$ and $\tan B$ are the roots of the quadratic equation $3x^2 - 10x - 25 = 0$, then the value of $3\sin^2(A+B) - 10\sin(A+B)\cos(A+B) - 25\cos^2(A+B)$ is :

(1) -25 (2) 10
(3) -10 (4) 25

Q63. The set of all $\alpha \in R$, for which $w = \frac{1+(1-8\alpha)z}{1-z}$ is a purely imaginary number, for all $z \in C$ satisfying $|z| = 1$ and $\mathrm{Re(z)} \neq 1$, is :

(1) $\{0\}$ (2) $\{0, \frac{1}{4}, -\frac{1}{4}\}$
(3) equal to R (4) an empty set

Q64. n-digit numbers are formed using only three digits $2,\ 5$ and 7. The smallest value of n for which 900 such distinct numbers can be formed is :

(1) 9 (2) 7
(3) 8 (4) 6

Q65. If b is the first term of an infinite geometric progression whose sum is five, then b lies in the interval

(1) $[10,\ \infty)$ (2) $(-\infty,\ -10]$
(3) $(-10,\ 0)$ (4) $(0,\ 10)$

Q66. If $x_1,\ x_2,\ \ldots\ldots,\ x_n$ and $\frac{1}{h_1},\ \frac{1}{h_2},\ \ldots\ldots,\ \frac{1}{h_n}$ are two A.P.s such that $x_3 = h_2 = 8$ & $x_8 = h_7 = 20$, then $x_5 \cdot h_{10}$ is equal to

(1) 3200 (2) 1600
(3) 2650 (4) 2560

Q67. If n is the degree of the polynomial, $\left[\frac{2}{\sqrt{5x^3+1}-\sqrt{5x^3-1}}\right]^8 + \left[\frac{2}{\sqrt{5x^3+1}+\sqrt{5x^3-1}}\right]^8$ and m is the coefficient of x^n in it, then the ordered pair $(n,\ m)$ is equal to

(1) $\left(8,\ 5(10)^4\right)$ (2) $\left(12,\ 8(10)^4\right)$
(3) $\left(12,\ (20)^4\right)$ (4) $\left(24,\ (10)^8\right)$

Q68. A circle passes through the points $(2, 3)$ and $(4, 5)$. If its centre lies on the line $y - 4x + 3 = 0$, then its radius is equal to :

(1) $\sqrt{5}$ (2) $\sqrt{2}$
(3) 2 (4) 1

Q69. Two parabolas with a common vertex and with axes along the x-axis and y-axis respectively, intersect each other in the first quadrant. If the length of the latus rectum of each parabola is 3, then the equation of the common tangent to the two parabolas is :

(1) $3(x+y)+4=0$ (2) $8(2x+y)+3=0$
(3) $x+2y+3=0$ (4) $4(x+y)+3=0$

Q70. If β is one of the angles between the normals to the ellipse $x^2+3y^2=9$ at the points $\left(3\cos\theta, \sqrt{3}\sin\theta\right)$ and $\left(-3\sin\theta, \sqrt{3}\cos\theta\right)$; $\theta \in \left(0, \frac{\pi}{2}\right)$; then $\frac{2\cot\beta}{\sin 2\theta}$ is equal to :

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

Q71. If the tangent drawn to the hyperbola $4y^2=x^2+1$ intersect the co-ordinates axes at the distinct points A and B, then the locus of the midpoint of AB is :

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

Q72. If $(p \wedge \sim q) \wedge (p \wedge r) \rightarrow \sim p \vee q$ is false, then the truth values of $p,\ q$ and r are respectively

(1) $T,\ T,\ T$
(2) $F,\ T,\ F$
(3) $T,\ F,\ T$
(4) $F,\ F,\ F$

Q73. The mean of a set of 30 observation is 75. If each observations is multiplied by non-zero number λ and then each of them is decreased by 25, their mean remains the same. Then, λ is equal to :

(1) $\frac{4}{3}$
(2) $\frac{1}{3}$
(3) $\frac{10}{3}$
(4) $\frac{2}{3}$

Q74. An aeroplane flying at a constant speed, parallel to the horizontal ground, $\sqrt{3}$ km above it is observed at an elevation of 60° from a point on the ground. If after five seconds, its elevation from the same point is 30°, then the speed (in km / hr) of the aeroplane is

(1) 720
(2) 1500
(3) 750
(4) 1440

Q75. In a triangle ABC, coordinates of A are $(1,\ 2)$ and the equations of the medians through B and C are respectively, $x+y=5$ and $x=4$. Then area of ΔABC (in sq. units) is :

(1) 12
(2) 4
(3) 9
(4) 5

Q76. Consider the following two binary relations on the set
$A=\{a,\ b,\ c\}\ :\ R_1=\{(c,\ a),\ (b,\ b),\ (a,\ c),\ (c,\ c),\ (b,\ c),\ (a,\ a)\}$ and
$R_2=\{(a,\ b),\ (b,\ a),\ (c,\ c),\ (c,\ a),\ (a,\ a),\ (b,\ b),\ (a,\ c)\}$, then :

(1) R_2 is symmetric but it is not transitive
(2) both R_1 and R_2 are not symmetric
(3) both R_1 and R_2 are transitive
(4) R_1 is not symmetric but it is transitive

Q77. Let A be a matrix such that $A\cdot\begin{bmatrix}1 & 2\\ 0 & 3\end{bmatrix}$ is a scalar matrix and $|3A|=108$. Then, A^2 equals :

(1) $\begin{bmatrix}4 & 0\\ -32 & 36\end{bmatrix}$
(2) $\begin{bmatrix}36 & -32\\ 0 & 4\end{bmatrix}$
(3) $\begin{bmatrix}36 & 0\\ -32 & 4\end{bmatrix}$
(4) $\begin{bmatrix}4 & -32\\ 0 & 36\end{bmatrix}$

Q78. If $f(x)=\begin{vmatrix}\cos x & x & 1\\ 2\sin x & x^2 & 2x\\ \tan x & x & 1\end{vmatrix}$, then $\lim_{x\to 0}\frac{f'(x)}{x}$

(1) does not exist
(2) exists and is equal to -2
(3) exists and is equal to 0
(4) exists and is equal to 2

Q79. Let S be the set of all real values of k for which the system of linear equations

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

has a unique solution. Then, S is :

(1) equal to $R-\{0\}$
(2) an empty set
(3) equal to R
(4) equal to $\{0\}$

Q80. Let $S=\{(\lambda,\ \mu)\in R\times R\ :\ f(t)=\left(|\lambda|e^{|t|}-\mu\right)\sin(2|t|),\ t\in R$ is a differential function$\}$. Then, S is a subset of :

(1) $(-\infty\ ,\ 0)\times R$
(2) $R\times[0\ ,\ \infty)$
(3) $[0\ ,\ \infty)\times R$
(4) $\mathrm{R}\times(-\infty\ ,\ 0)$

Q81. If $x^2+y^2+\sin y=4$, then the value of $\frac{d^2y}{dx^2}$ at the point $(-2,\ 0)$ is :

(1) -34
(2) 4
(3) -2
(4) -32

Q82. If a right circular cone, having maximum volume, is inscribed in a sphere of radius 3 cm, then the curved surface area (in cm^2) of this cone is :

(1) $8\sqrt{2}\pi$
(2) $6\sqrt{2}\pi$
(3) $8\sqrt{3}\pi$
(4) $6\sqrt{3}\pi$

Q83. If $f\left(\frac{x-4}{x+2}\right)=2x+1,\ (x\in R-\{1,-2\})$, then $\int f(x)dx$ is equal to

(1) $12\ln|1-x|-3x+C$
(2) $-12\ln|1-x|-3x+C$
(3) $12\ln|1-x|+3x+C$
(4) $-12\ln|1-x|+3x+C$

Q84. The value of the integral $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\sin^4 x\left(1+\ln\left(\frac{2+\sin x}{2-\sin x}\right)\right)dx$ is

(1) $\frac{3}{4}$
(2) $\frac{3}{8}\pi$
(3) 0
(4) $\frac{3}{16}\pi$

Q85. The area (in sq. units) of the region $\{x\in R:\ x\geq 0\ ,\ y\geq 0\ ,\ y\geq x-2$ and $y\leq\sqrt{x}\}$ is

(1) $\frac{13}{3}$
(2) $\frac{8}{3}$
(3) $\frac{10}{3}$
(4) $\frac{5}{3}$

Q86. Let $y=y(x)$ be the solution of the differential equation $\frac{dy}{dx}+2y=f(x)$, where $f(x)=\begin{cases}1, & x\in[0,\ 1]\\ 0, & \text{otherwise}\end{cases}$. If $y(0)=0$, then $y\left(\frac{3}{2}\right)$ is

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

Q87. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a}+2\vec{b}+2\vec{c}=\vec{0}$, then $|\vec{a}\times\vec{c}|$ is equal to :

(1) $\frac{1}{4}$
(2) $\frac{15}{16}$
(3) $\frac{\sqrt{15}}{4}$
(4) $\frac{\sqrt{15}}{16}$

Q88. A variable plane passes through a fixed point $(3, 2, 1)$ and meets x, y and z-axes at A, B & C respectively. A plane is drawn parallel to the $yz-$ plane through A, a second plane is drawn parallel to the $zx-$ plane through B and a third plane is drawn parallel to the xy- plane through C. Then the locus of the point of intersection of these three planes, is

(1) $\frac{3}{x}+\frac{2}{y}+\frac{1}{z}=1$
(2) $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=\frac{11}{6}$
(3) $x+y+z=6$
(4) $\frac{x}{3}+\frac{y}{2}+\frac{z}{1}=1$

Q89. An angle between the plane $x+y+z=5$ and the line of intersection of the planes, $3x+4y+z-1=0$ and $5x+8y+2z+14=0$ is

(1) $\cos^{-1}\left(\sqrt{\frac{3}{17}}\right)$
(2) $\cos^{-1}\left(\frac{3}{\sqrt{17}}\right)$
(3) $\sin^{-1}\left(\frac{3}{\sqrt{17}}\right)$
(4) $\sin^{-1}\left(\sqrt{\frac{3}{17}}\right)$

Q90. A box A contains 2 white, 3 red and 2 black balls. Another box B contains 4 white, 2 red and 3 black balls. If two balls are drawn at random, without replacement from a randomly, selected box and one ball turns out to be white while the other ball turns out to be red, then the probability that both balls are drawn from box B is :

(1) $\frac{7}{8}$
(2) $\frac{9}{16}$
(3) $\frac{7}{16}$
(4) $\frac{9}{32}$

ANSWER KEYS

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