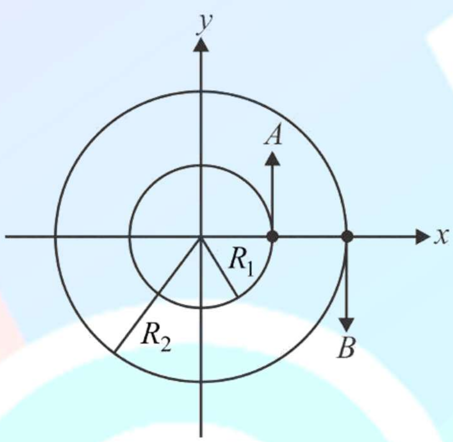
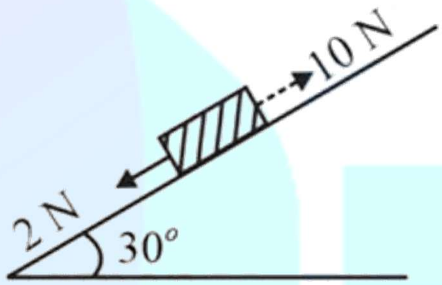
Q1.Let L, R, C and V represent inductance, resistance, capacitance and voltage, respectively. The dimension of $\frac{L}{RCV}$ in SI units will be:
(1) $[LTA]$
(2) $[A^{-1}]$
(3) $[LT^2]$
(4) $[LA^{-2}]$

Q2. Two particles A, B are moving on two concentric circles of radii R_1 and R_2 with equal angular speed ω. At $t=0$, their positions and direction of motion are shown in the figure:



The relative velocity $\overrightarrow{V_A} - \overrightarrow{V_B}$ at $t = \frac{\pi}{2\omega}$ is given by:
(1) $\omega(R_1 + R_2)\hat{\imath}$
(2) $-\omega(R_1 + R_2)\hat{\imath}$
(3) $\omega(R_2 - R_1)\hat{\imath}$
(4) $\omega(R_1 - R_2)\hat{\imath}$

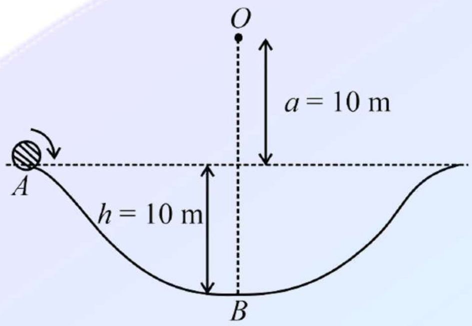
Q3. A block kept on a rough inclined plane, as shown in the figure, remains at rest upto a maximum force $2N$ down the inclined plane. The maximum external force up the inclined plane that does not move the block is 10 N . The coefficient of static friction between the block and the plane is: [Take $g = 10\ \text{m/s}^2$]



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

Q4. A vertical closed cylinder is separated into two parts by a frictionless piston of mass m and of negligible thickness. The piston is free to move along the length of the cylinder. The length of the cylinder above piston is l_1, and that below the piston is l_2, such that $l_1 > l_2$. Each part of the cylinder contains n moles of an ideal gas at equal temperature T. If the piston is stationary, its mass m will be given by:
(R is universal gas constant and g is the acceleration due to gravity)
(1) $\frac{RT}{ng}\left[\frac{l_1 - 3l_2}{l_1 l_2}\right]$
(2) $\frac{nRT}{g}\left[\frac{l_1 - l_2}{l_1 l_2}\right]$
(3) $\frac{RT}{g}\left[\frac{2l_1 + l_2}{l_1 l_2}\right]$
(4) $\frac{RT}{gl}\left[\frac{2l_1 + l_2}{l_1 l_2}\right]$

Q5. A particle of mass 20 g is released with an initial velocity $5\ \text{m s}^{-1}$ along the curve from the point A, as shown in the figure. The point A is at height h from point B. The particle slides along the frictionless surface. When the particle reaches point B, its angular momentum about O will be: (Take $g = 10\ \text{m s}^{-2}$)

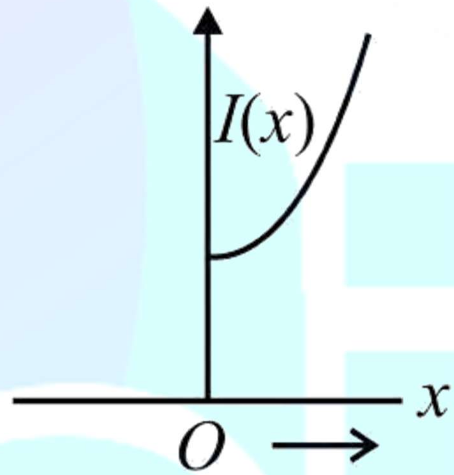


(1) 3 kg m^2 s^{-1}
(2) 2 kg m^2 s^{-1}
(3) 6 kg m^2 s^{-1}
(4) 8 kg m^2 s^{-1}

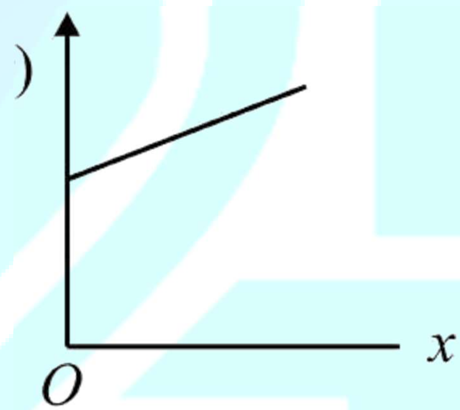
Q6. An alpha- particle of mass m suffers 1-dimensional elastic collision with a nucleus at rest of unknown mass. It is scattered directly backwards losing 64% of its initial kinetic energy. The mass of the nucleus is
(1) 1.5 m
(2) $4m$
(3) 3.5 m
(4) 5 m

Q7. A long cylindrical vessel is half filled with a liquid. When the vessel is rotated about its own vertical axis, the liquid rises up near the wall. If the radius of vessel is 5 cm and its rotational speed is 2 rotations per second, then the difference in the heights between the center and the sides, in cm, will be:
(1) 0.4
(2) 2.0
(3) 1.2
(4) 0.1

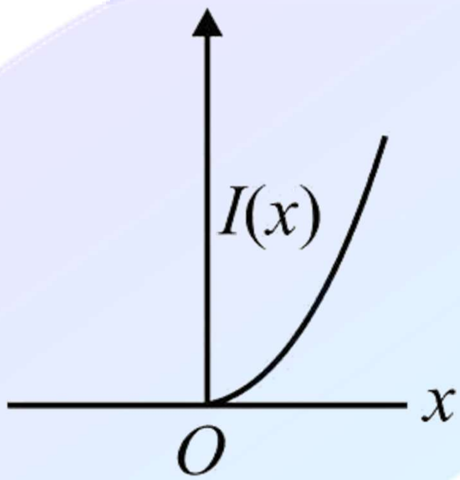
Q8. The moment of inertial of a solid sphere, about an axis parallel to its diameter and at a distance of x from it, is $I(x)'$. Which one of the graphs represents the variation of $I(x)$ with x correctly?
(1)



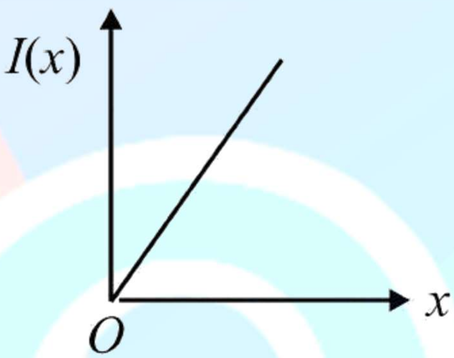
(2) $I(x)$



(3)



(4)

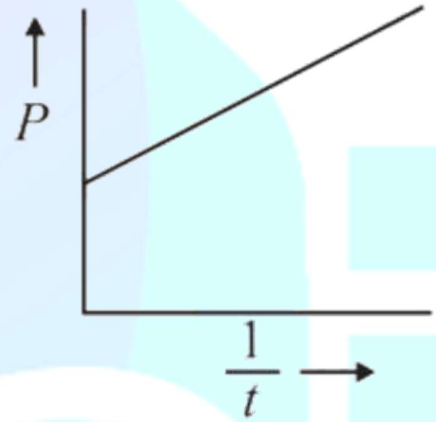


Q9. Two satellites, A and B , have masses m and $2m$ respectively. A is in a circular orbit of radius R and B is in a circular orbit of radius $2R$ around the earth. The ratio of their kinetic energies, $\frac{K_A}{K_B}$ is:

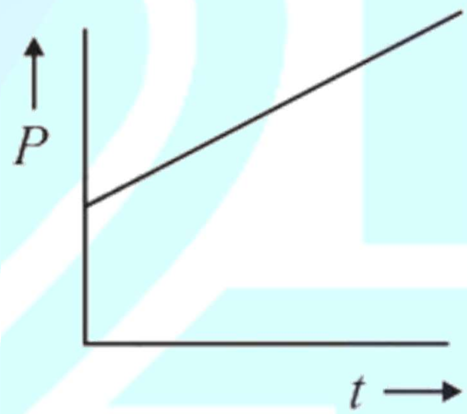
(1) 2
(2) $\frac{1}{2}$
(3) 1
(4) $\sqrt{\frac{1}{2}}$

Q10. A soap bubble, blown by a mechanical pump at the mouth of a tube increases in volume with time at a constant rate. The graph that correctly depicts the time dependence of pressure inside the bubble is given by:

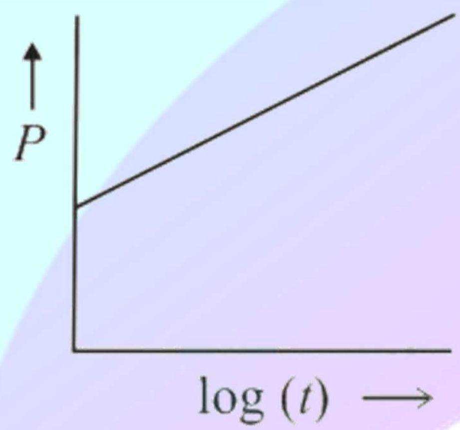
(1)



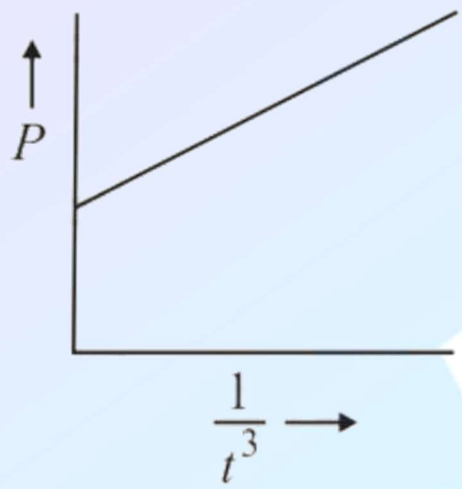
(2)



(3)



(4)



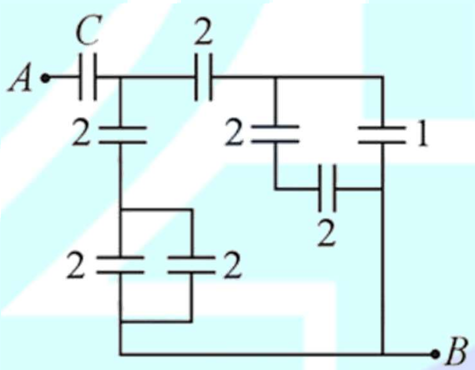
Q11. An ideal gas is enclosed in a cylinder at pressure of 2 atm and temperature, 300 K . The mean time between two successive collisions is $6 \times 10^{-8} s$. If the pressure is doubled and temperature is increased to 500 K , the mean time between two successive collisions will be close to:
(1) 2×10^{-7} s
(2) $3 \times 10^{-6} s$
(3) 0.5×10^{-8} s
(4) $4 \times 10^{-8} s$

Q12. A simple harmonic motion is represented by:
$y = 5(\sin 3\pi t + \sqrt{3}\cos 3\pi t)$cm
The amplitude and time period of the motion are:
(1) 5 cm, $\frac{2}{3}$ s
(2) 10 cm, $\frac{2}{3}$ s
(3) 5 cm, $\frac{3}{2}$ s
(4) 10 cm, $\frac{3}{2}$ s

Q13. A resonance tube is old and has a jagged end. It is still used in the laboratory to determine the velocity of sound in air. A tuning fork of frequency 512 Hz produces first resonance when the tube is filled with water to a mark 11 cm below a reference mark, near the open end of the tube. The experiment is repeated with another fork of frequency 256 Hz which produces first resonance when water reaches a mark 27 cm below the reference mark. The velocity of sound in air, obtained in the experiment, is close to
(1) 335 m s^{-1}
(2) 341 m s^{-1}
(3) 322 m s^{-1}
(4) 328 m s^{-1}

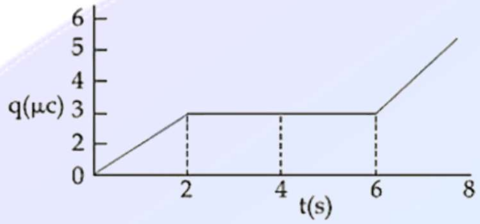
Q14. A parallel plate capacitor with plates of area 1 m^2 each, are at a separation of 0.1 m . If the electric field between the plates is 100 N/C, the magnitude of charge on each plate is: (Take $\epsilon_0 = 8.85 \times 10^{-12} \frac{C^2}{N-m^2}$)
(1) 8.85×10^{-10}C
(2) 6.85×10^{-10}C
(3) $9.85 \times 10^{-10} C$
(4) 7.85×10^{-10}C

Q15. In the circuit shown, find C if the effective capacitance of the whole circuit is to be $0.5\mu F$. All values in the circuit are in μF.



(1) $\frac{7}{10}\mu F$
(2) $4\mu F$
(3) $\frac{7}{11}\mu F$
(4) $\frac{6}{5}\mu F$

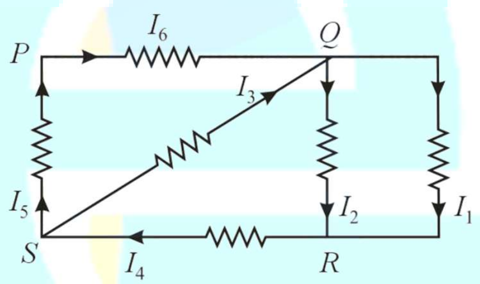
Q16. The charge on a capacitor plate in a circuit, as a function of time, is shown in the figure:



What is the value of current at $t = 4s$?
(1) 1.5μ A
(2) $2\mu A$
(3) Zero
(4) 3μ A

Q17. A galvanometer, whose resistance is 50 ohm, has 25 divisions in it. When a current of 4×10^{-4} A passes through it, its needle (pointer) deflects by one division. To use this galvanometer as a voltmeter of range 2.5 V it should be connected to a resistance of:
(1) 6250 ohm
(2) 250 ohm
(3) 6200 ohm
(4) 200 ohm

Q18. In the given circuit diagram, the currents, $I_1 = -0.3A, I_4 = 0.8A$ and $I_5 = 0.4A$, are flowing as shown. The currents I_2, I_3 and I_6, respectively, are:

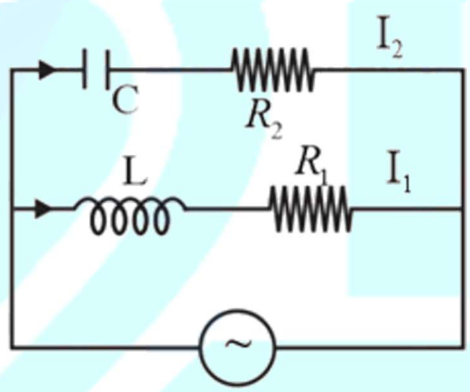


(1) $0.4A, 1.1A, 0.4A$
(2) $1.1A, -0.4A, 0.4A$
(3) $1.1A, 0.4A, 0.4A$
(4) $-0.4A, 0.4A, 1.1A$

Q19. A paramagnetic material has 10^{28} atoms m^{-3}. Its magnetic susceptibility at temperature 350 K is 2.8 Ã $- 10^{-4}$. Its susceptibility at 300 K is
(1) 3.726×10^{-4}
(2) 2.672×10^{-4}
(3) 3.267×10^{-4}
(4) 3.672×10^{-4}

Q20. A 10 m long horizontal wire extends from North East to South West. It is falling with a speed of 5.0 m s^{-1}, at right angles to the horizontal component of the earth's magnetic field of 0.3×10^{-4} Wb m^{-2}. The value of the induced emf in the wire is:
(1) 0.3×10^{-3} V
(2) 1.1×10^{-3} V
(3) 2.5×10^{-3} V
(4) 1.5×10^{-3} V

Q21.

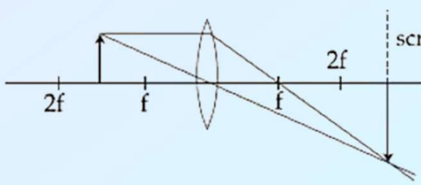


In the above circuit, $C = \frac{\sqrt{3}}{2}\mu F, R_2 = 20\Omega, L = \frac{\sqrt{3}}{10}H$ and $R_1 = 10\Omega$. Current in $L - R_1$ path is I_1 and in $C - R_2$ path it is I_2. The voltage of AC source is given by, $V = 200\sqrt{2}\sin(100t)$ volts. The phase difference between I_1 and I_2 is:
(1) 60°
(2) 0°
(3) 30°
(4) 150°

Q22. The mean intensity of radiation on the surface of the Sun is about 10^8 W/m^2. The rms value of the corresponding magnetic field is closest to:
(1) $1T$
(2) $10^{-2}T$
(3) $10^{2}T$
(4) $10^{-4}T$

Q23. A plano - convex lens (focal length f_2, refractive index μ_2, radius of curvature R) fits exactly into a plano concave lens (focal length f_1, refractive index μ_1, radius of curvature R). Their plane surfaces are parallel to each other. Then, the focal length of the combination will be:
(1) $\frac{R}{\mu_2-\mu_1}$
(2) $f_1 - f_2$
(3) $f_1 + f_2$
(4) $\frac{2f_1f_2}{f_1+f_2}$

Q24. Formation of real image using a biconvex lens is shown below:



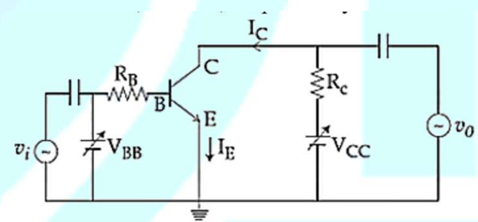
If the whole set up is immersed in water without disturbing the object and the screen positions, what will one observe on the screen?
(1) Image disappears
(2) Magnified image
(3) Erect real image
(4) No change

Q25. When a certain photosensitive surface is illuminated with a monochromatic light of frequency ν, the stopping potential of the photo current is $-\frac{V_0}{2}$. When the surface is illuminated by monochromatic light of frequency $\frac{\nu}{2}$, the stopping potential is $-V_0$. The threshold frequency for photoelectric emission is
(1) $\frac{5v}{3}$
(2) $\frac{3v}{2}$
(3) $\frac{4}{3}v$
(4) $2v$

Q26. In a Frank - Hertz experiment, an electron of energy 5.6 eV passes through mercury vapour and emerges with an energy 0.7 eV . The minimum wavelength of photons emitted by mercury atoms is close to:
(1) 250 nm
(2) 1700 nm
(3) 220 nm
(4) 2020 nm

Q27. In a radioactive decay chain, the initial nucleus is $^{232}_{90}$Th. At the end, there are 6α-particles and 4β-particles which are emitted. If the end nucleus is $^{A}_{Z}$X, A and Z are given by:
(1) $A = 208; Z = 82$
(2) $A = 208; Z = 80$
(3) $A = 200; Z = 81$
(4) $A = 202; Z = 80$

Q28. In the figure, given that V_{BB} supply can vary from 0 to 5.0 V, $V_{CC} = 5$ V, $\beta_{dc} = 200$, $R_B = 100$kΩ, $R_C = 1k\Omega$ and $V_{BE} = 1.0$ V. The minimum base current and the input voltage at which the transistor will go to saturation, will be, respectively:



(1) 25μ A and 2.8 V
(2) 20μ A and 2.8 V
(3) 25μ A and 3.5 V
(4) 20μ A and 3.5 V

Q29. To double the covering range of a TV transmitting tower, its height should be multiplied by:
(1) $\frac{1}{\sqrt{2}}$
(2) 4
(3) 2
(4) $\sqrt{2}$

Q30.A load of mass M kg is suspended from a steel wire of length 2 m and radius 1.0 mm in Searle's apparatus experiment. The increase in length produced in the wire is 4.0 mm . Now the load is fully immersed in a liquid of relative density 2 . The relative density of the material of load is 8 . The new value of increase in length of

the steel wire is:
(1) 4.0 mm
(2) Zero
(3) 5.0 mm
(4) 3.0 mm

Q31.8 g of NaOH is dissolved in 18 g of H_2O. Mole fraction of NaOH in solution and molality (in $molkg^{-1}$) of the solution respectively are:
(1) 0.167,11.11
(2) 0.167,22.20
(3) 0.2,11.11
(4) 0.2,22.20

Q32. If the de Broglie wavelength of the electron in n^{th} Bohr orbit in a hydrogenic atom is equal to $1.5\pi a_0$ (a_0 is Bohr radius), then the value of $\frac{n}{z}$ is:
(1) 1.50
(2) 1.0
(3) 0.4
(4) 0.75

Q33. The element that does not show catenation is
(1) Sn
(2) Si
(3) Ge
(4) Pb

Q34. The correct order of atomic radii is:
(1) Ce > Eu > Ho > N
(2) N > Ce > Eu > Ho
(3) Ho > N > Eu > Ce
(4) Eu > Ce > Ho > N

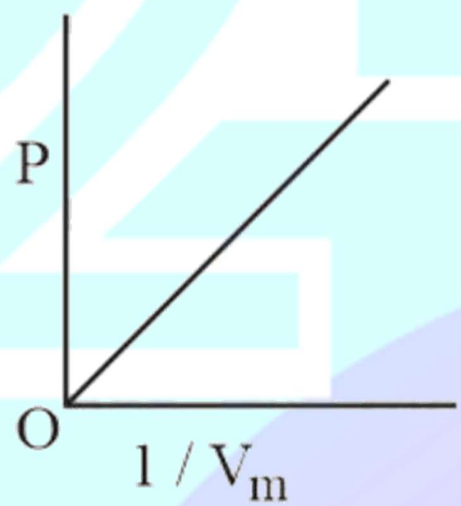
Q35. The element that shows greater ability to form $p\pi - p\pi$ multiple bonds is:
(1) Sn
(2) C
(3) Si
(4) Ge

Q36. An open vessel at $27^\circ C$ is heated until two fifth of the air (assumed as an ideal gas) in it has escaped from the vessel. Assuming that the volume of the vessel remains constant, the temperature to which the vessel has heated is:
(1) 750°C
(2) 500°C
(3) 750 K
(4) 500 K

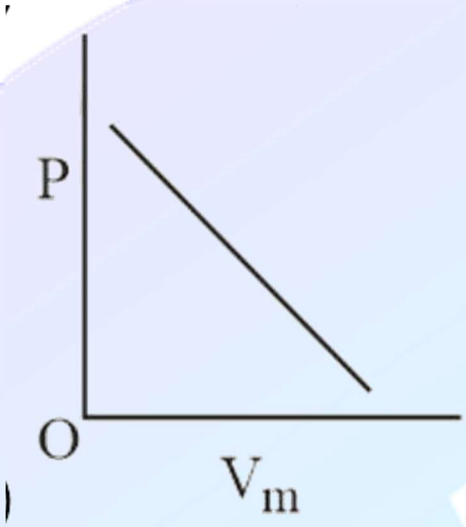
Q37. Given:
(i) C (graphite) $+ O_2(g) \rightarrow CO_2(g); \Delta rH^\ominus = x kJ mol^{-1}$
(ii) C (graphite) $+ \frac{1}{2}O_2(g) \rightarrow CO(g); \Delta rH^\ominus = y kJ mol^{-1}$
(iii) $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g); \Delta rH^\ominus = z kJ mol^{-1}$

Based on the above thermochemical equations, find out which one of the following algebraic relationships is correct?
(1) $x = y + z$
(2) $z = x + y$
(3) $y = 2z - x$
(4) $x = y - z$

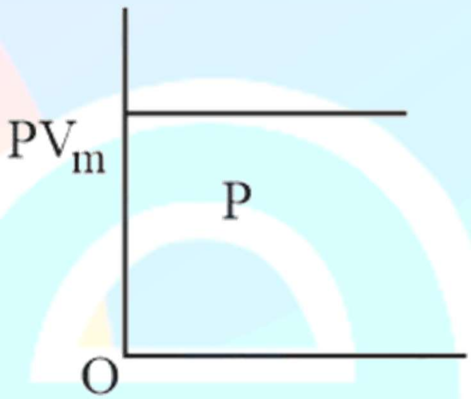
Q38. The combination of plots which does not represent isothermal expansion of an ideal gas is
(A)



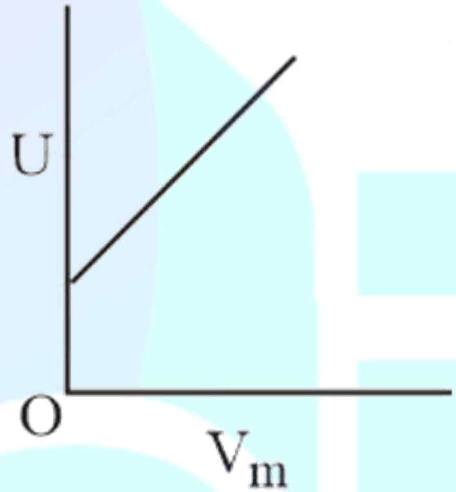
(B)



(C)



(D)

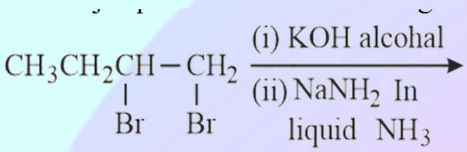


(1) (A) and (D)
(2) (B) and (C)
(3) (B) and (D)
(4) (A) and (C)

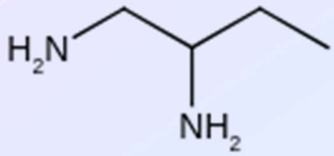
Q39. If K_{sp} of Ag_2CO_3 is 8×10^{-12}, the molar solubility of Ag_2CO_3 in $0.1 M AgNO_3$ is:
(1) 8×10^{-1} M
(2) 8×10^{-11}M
(3) $8 \times 10^{-12} M$
(4) 8×10^{-10}M

Q40. The volume strength of $1 M H_2O_2$ is:
(Molar mass of $H_2O_2 = 34 \text{ g mol}^{-1}$)
(1) 5.6
(2) 22.4
(3) 11.2
(4) 16.8

Q41. The major product of the following reaction is:

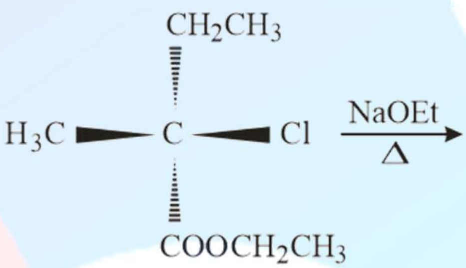


(1)

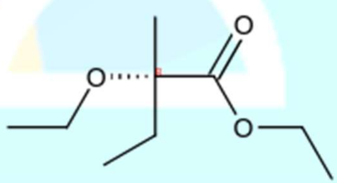


(2) $CH_3CH = CHCH_2NH_2$
(3) $CH_3CH_2C \equiv CH$
(4) $CH_3CH = C = CH_2$

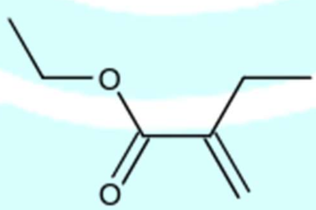
Q42. The major product of the following reaction is:



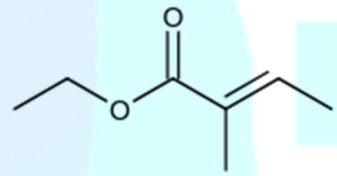
(1)



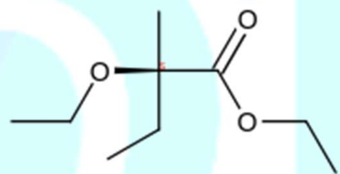
(2)



(3)



(4)



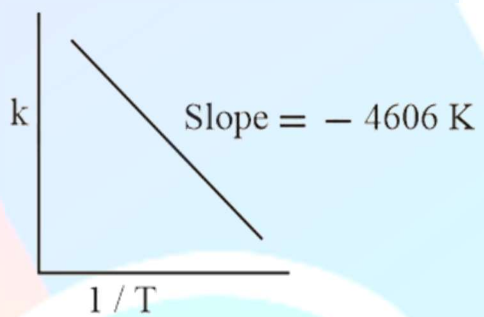
Q43. The compound that is NOT a common component of photochemical smog is:
(1) O_3
(2) CF_2Cl_2
(3) $H_3C - C - OONO_2$
(4) $CH_2 = CHCHO$
O

Q44. The upper stratosphere consisting of the ozone layer, protects us from the sun's radiation that falls in the wavelength region of
(1) $200 - 315$ nm
(2) $600 - 750$ nm
(3) $400 - 550$ nm
(4) $0.8 - 1.5$ nm

Q45. Molecules of benzoic acid (C_6H_5COOH) dimerise in 30 g of benzene. ' w ' g of benzoic acid shows a depression in freezing point equal to 2 K . If the percentage association of the acid to form dimer in the solution is 80 , then w is: (Given that $K_f = 5 Kmol^{-1}$, molar mass of benzoic acid $= 122 gmol^{-1}$)
(1) 1.0 g
(2) $2.4g$
(3) $1.8g$
(4) 1.5 g

Q46. Λ_m° for NaCl, HCl and NaA are 126.4,425.9 and 100.5 $S\ cm^2\ mol^{-1}$ respectively. If the conductivity of 0.001 M HA is $5 \times 10^{-5}\ S\ cm^{-1}$, degree of dissociation of HA is
(1) 0.125
(2) 0.75
(3) 0.25
(4) 0.50

Q47.For a reaction, consider the plot of $\ln k$ versus $1/T$ given in the figure. If the rate constant of this reaction at 400 K is $10^{-5}\ s^{-1}$, then the rate constant at 500 K is:
ln k



(1) $10^{-4} s^{-1}$
(2) $10^{-6} s^{-1}$
(3) $2 \times 10^{-4} s^{-1}$
(4) $4 \times 10^{-4} s^{-1}$

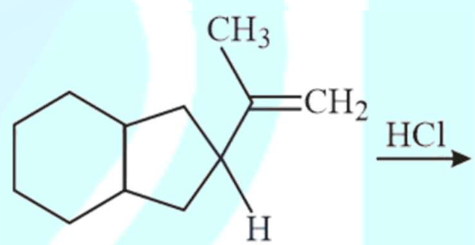
Q48. Among the following, the false statement is:
(1) Latex is a colloidal solution of rubber particles which are positively charged
(3) It is possible to cause artificial rain by throwing electrified sand carrying charge opposite to the one on clouds from an aeroplane.
(2) Tyndall effect can be used to distinguish between a colloidal solution and a true solution.
(4) Lyophilic sols can be coagulated by adding an electrolyte.

Q49. The pair that does not require calcination is
(1) ZnO and $Fe_2O_3 \cdot xH_2O$
(2) ZnO and MgO
(3) $ZnCO_3$ and CaO
(4) Fe_2O_3 and $CaCO_3 . MgCO_3$

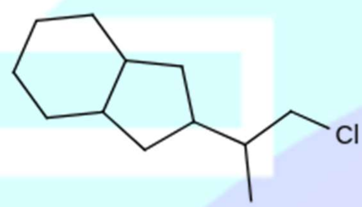
Q50. Chlorine on reaction with hot and concentrated sodium hydroxide gives.
(1) $Cl^-$and ClO_2^-
(2) $Cl^-$and ClO_3^-
(3) $Cl^-$and ClO^-
(4) $ClO_3^-$and ClO_2^-

Q51. The magnetic moment of an octahedral homoleptic Mn(II) complex is 5.9 B . M. . The suitable ligand for this complex is:
(1) CN^-
(2) CO
(3) Ethylenediamine
(4) NCS^-

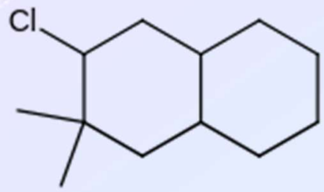
Q52. The major product of the following reaction is:



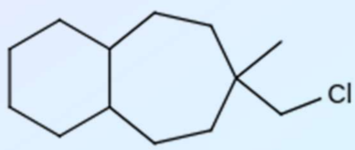
(1)



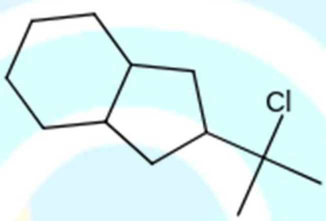
(2)



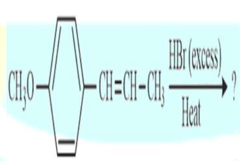
(3)



(4)

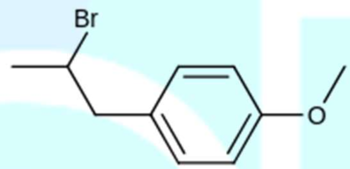


Q53. The major product in the following conversion is

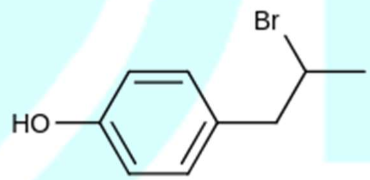


(1)

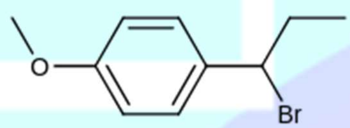
(2)



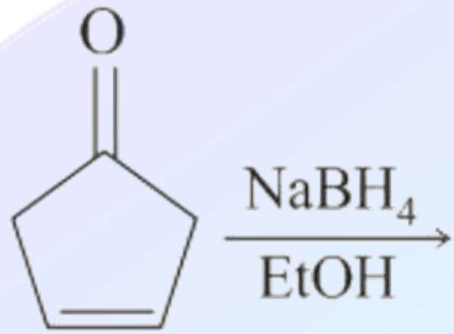
(3)



(4)

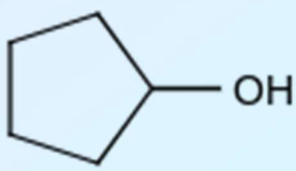


Q54.

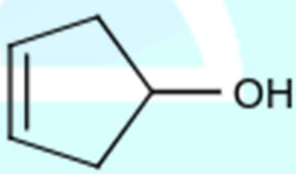


The major product of the following reaction is:

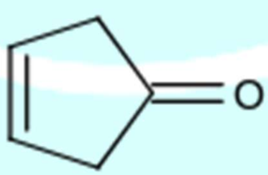
(2)



(3)

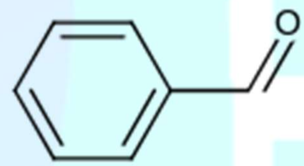


(4)

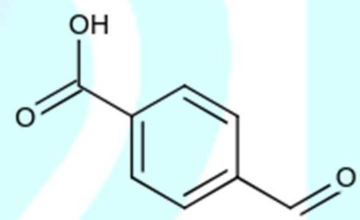


Q55. The aldehydes which will not form Grignard product with one equivalent of Grignard reagents are

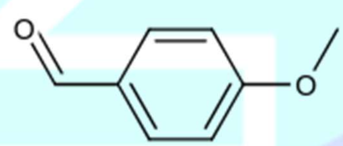
(A)



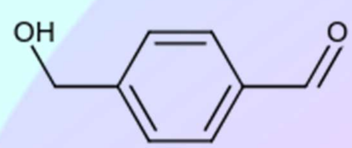
(B)



(C)



(D)

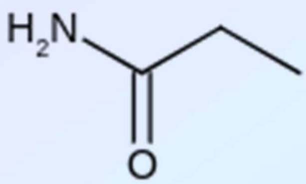


(1) (B), (C)

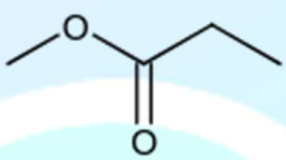
(2) (B), (C), (D)

(3) (C), (D)
(4) (B), (D)

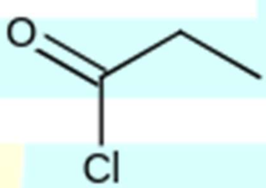
Q56. The increasing order of the reactivity of the following with $LiAlH_4$ is:
(A)



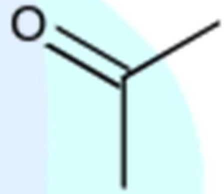
(B)

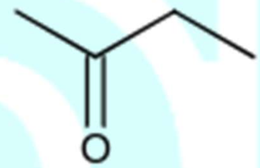


(C)



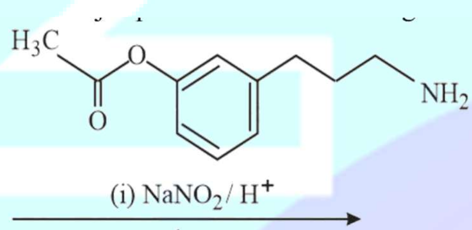
(D) C_2H_5



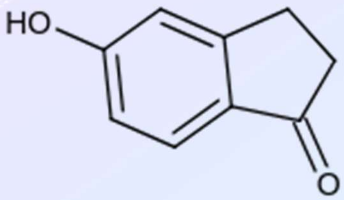


(1) $(B) < (A) < (D) < (C)$
(2) $(A) < (B) < (C) < (D)$
(3) (A) < (B) < (D) < (C)
(4) $(B) < (A) < (C) < (D)$

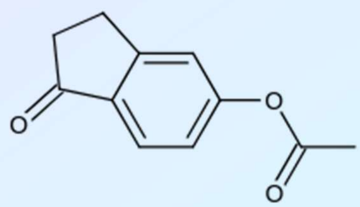
Q57. The major product of the following reaction is:



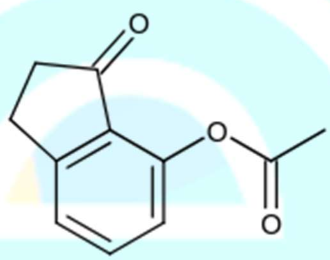
(ii) CrO_3/H^+
(iii) H_2SO_4 (concentrated), Δ
(1)



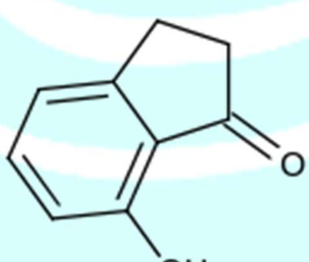
(2)



(3)



(4)



Q58. The two monomers for the synthesis of nylon 6,6 are
(1) $HOOH(CH_2)_4COOH, H_2\ N(CH_2)_4NH_2$
(2) $HOOC(CH_2)_4COOH, H_2\ N(CH_2)_6NH_2$
(3) $HOOC(CH_2)_6COOH, H_2\ N(CH_2)_4NH_2$
(4) $HOOC(CH_2)_6COOH, H_2\ N(CH_2)_6NH_2$

Q59. The correct statement(s) among I to III with respect to potassium ions that are abundant within the cell fluids, is/are
I. They activate many enzymes.
II. They participate in the oxidation of glucose to produce ATP.
III. Along with sodium ions, they are responsible for the transmission of nerve signals.
(1) I , II and III
(2) III only
(3) I and II only
(4) I and III only

Q60. The correct structure of histidine in a strongly acidic solution (pH $= 2$) is
(1)

(2)

(3)

(4)

Q61. The number of integral values of m for which the quadratic expression $(1+2m)x^2 - 2(1+3m)x + 4(1+m), x \in R$ is always positive, is
(1) 7
(2) 3
(3) 6
(4) 8

Q62. Let z_1 and z_2 be two complex numbers satisfying $|z_1| = 9$ and $|z_2 - 3 - 4i| = 4$. Then the minimum value of $|z_1 - z_2|$ is :
(1) 2
(2) $\sqrt{2}$
(3) 0
(4) 1

Q63. There are m men and two women participating in a chess tournament. Each participant plays two games with every other

participant. If the number of games played by the men between themselves exceeds the number of games played between the men and the women by 84 , then the value of m is :
(1) 11
(2) 12
(3) 7
(4) 9

Q64. If the sum of the first 15 terms of the series $\left(\frac{3}{4}\right)^3+\left(1\frac{1}{2}\right)^3+\left(2\frac{1}{4}\right)^3+3^3+\left(3\frac{3}{4}\right)^3+\cdots$ is equal to 225 K , then K is equal to :
(1) 9
(2) 27
(3) 54
(4) 108

Q65. If $\sin^4\alpha+4\cos^4\beta+2=4\sqrt{2}\sin\alpha\cos\beta, \alpha,\beta\in[0,\pi]$, then $\cos(\alpha+\beta)-\cos(\alpha-\beta)$ is equal to
(1) -1
(2) $-\sqrt{2}$
(3) $\sqrt{2}$
(4) 0

Q66. If ${}^nC_4$, ${}^nC_5$ and ${}^nC_6$ are in A.P., then n can be
(1) 9
(2) 14
(3) 12
(4) 11

Q67. The total number of irrational terms in the binomial expansion of $\left(7^{\frac{1}{5}}-3^{\frac{1}{10}}\right)^{60}$ is
(1) 48
(2) 55
(3) 54
(4) 49

Q68. If a straight line passing through the point $P(-3,4)$ is such that its intercepted portion between the coordinate axes is bisected at P, then its equation is :
(1) $4x+3y=0$
(2) $4x-3y+24=0$
(3) $3x-4y+25=0$
(4) $x-y+7=0$

Q69. If a circle of radius R passes through the origin O and intersects the coordinate axes at A and B, then the locus of the foot of perpendicular from O on AB is :
(1) $(x^2+y^2)(x+y)=R^2xy$
(2) $(x^2+y^2)^3=4R^2x^2y^2$
(3) $(x^2+y^2)^2=4R^2x^2y^2$
(4) $(x^2+y^2)^2=4Rx^2y^2$

Q70. The equation of a tangent to the parabola, $x^2=8y$, which makes an angle θ with the positive direction of $x-$ axis, is
(1) $y=x\tan\hat{\text{I}},+2\cot\hat{\text{I}},$
(2) $y=x\tan\hat{\text{I}},-2\cot\hat{\text{I}},$
(3) $x=y\cot\hat{I},+2\tan\hat{I},$
(4) $x=y\cot\hat{I},-2\tan\hat{I},$

Q71. Let S and S' be the foci of an ellipse and B be any one of the extremities of its minor axis. If $\Delta S'BS$ is a right angled triangle with right angle at B and area $(\Delta S'BS)=8$ sq. units, then the length of a latus rectum of the ellipse is :
(1) $2\sqrt{2}$
(2) 2
(3) 4
(4) $4\sqrt{2}$

Q72. $\lim_{x\to1^-}\frac{\sqrt{\pi}-\sqrt{2\sin^{-1}x}}{\sqrt{1-x}}$ is equal to
(1) $\sqrt{\pi}$
(2) $\sqrt{\frac{2}{\pi}}$
(3) $\frac{1}{\sqrt{2\pi}}$
(4) $\sqrt{\frac{\pi}{2}}$

Q73. The expression $\sim(\sim p\to q)$ is logically equivalent to
(1) $p\wedge\sim q$
(2) $\sim p\wedge\sim q$
(3) $p\wedge q$
(4) $\sim p\wedge q$

Q74. The mean and the variance of five observations are 4 and 5.20 , respectively. If three of the observations are 3,4 and 4 ; then the absolute value of the difference of the other two observations, is :
(1) 3
(2) 5

(3) 7
(4) 1

Q75. If the angle of elevation of a cloud from a point P which is $25m$ above a lake be $30°$ and the angle of depression of reflection of the could in the lake from P be $60°$, then the height of the cloud (in meters) from
the surface of the lake is :
(1) 50
(2) 60
(3) 45
(4) 42

Q76. Let Z be the set of integers. If $A = \{x \in Z: 2^{(x+2)(x^2-5x+6)} = 1\}$ and $B = \{x \in Z: -3 < 2x - 1 < 9\}$, then the number of subsets of the set $A \times B$, is :
(1) 2^{12}
(2) 2^{10}
(3) 2^{18}
(4) 2^{15}

Q77.
If $A = \begin{bmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{bmatrix}$, then for all $\theta \in \left(\frac{3\pi}{4}, \frac{5\pi}{4}\right)$, $\det(A)$ lies in the interval :
(1) $\left(1, \frac{5}{2}\right]$
(2) $\left[\frac{5}{2}, 4\right)$
(3) $\left(\frac{3}{2}, 3\right]$
(4) $\left(0, \frac{3}{2}\right]$

Q78. The set of all values of λ for which the system of linear equations
$x - 2y - 2z = \lambda x$
$x + 2y + z = \lambda y$
$-x - y = \lambda z$
has a non-trivial solution :
(1) is an empty set
(2) contains more than two elements
(3) is a singleton
(4) contains exactly two elements

Q79. Let f be a differentiable function such that $f(1) = 2$ and $f'(x) = f(x)$ for all $x \in R$. If $h(x) = f(f(x))$, then $h'(1)$ is equal to :
(1) $4e^2$
(2) $2e$
(3) $4e$
(4) $2e^2$

Q80. The tangent to the curve $y = x^2 - 5x + 5$, parallel to the line $2y = 4x + 1$, also passes through the point :
(1) $\left(\frac{1}{4}, \frac{7}{2}\right)$
(2) $\left(\frac{7}{2}, \frac{1}{4}\right)$
(3) $\left(-\frac{1}{8}, 7\right)$
(4) $\left(\frac{1}{8}, -7\right)$

Q81. If the function f given by $f(x) = x^3 - 3(a-2)x^2 + 3ax + 7$, for some $a \in R$ is increasing in $(0,1]$ and decreasing in $[1,5)$, then a root of the equation, $\frac{f(x)-14}{(x-1)^2} = 0, (x \neq 1)$ is :
(1) 7
(2) -7
(3) 6
(4) 5

Q82. The integral $\int \frac{3x^{13}+2x^{11}}{(2x^4+3x^2+1)^4} dx$, is equal to
(1) $\frac{x^4}{6(2x^4+3x^2+1)^3} + C$
(2) $\frac{x^4}{(2x^4+3x^2+1)^3} + C$
(3) $\frac{x^{12}}{(2x^4+3x^2+1)^3} + C$
(4) $\frac{x^{12}}{6(2x^4+3x^2+1)^3} + C$

Q83. The integral $\int_1^e \left\{\left(\frac{x}{e}\right)^{2x} - \left(\frac{e}{x}\right)^x\right\} \log_e x dx$ is equal to
(1) $\frac{3}{2} - e - \frac{1}{2e^2}$
(2) $\frac{1}{2} - e - \frac{1}{e^2}$
(3) $-\frac{1}{2} + \frac{1}{e} - \frac{1}{2e^2}$
(4) $\frac{3}{2} - \frac{1}{e} - \frac{1}{2e^2}$

Q84. $\lim_{n\to\infty} \left(\frac{n}{n^2+1^2} + \frac{n}{n^2+2^2} + \frac{n}{n^2+3^2} + \cdots \ldots + \frac{1}{5n^2}\right)$ is equal to
(1) $\frac{\pi}{4}$
(2) $\tan^{-1}(2)$
(3) $\frac{\pi}{2}$
(4) $\tan^{-1}(3)$

Q85. If a curve passes through the point $(1,-2)$ and has slope of the tangent at any point (x,y) on it as $\frac{x^2-2y}{x}$, then the curve also passes through the point
(1) $(\sqrt{3},0)$
(2) $(-1,2)$
(3) $(-\sqrt{2},1)$
(4) $(3,0)$

Q86. Let $\vec{a},\vec{b}$ and $\vec{c}$ be three unit vectors, out of which vectors $\vec{b}$ and $\vec{c}$ are non-parallel. If α and β are the angles which vector $\vec{a}$ makes with vectors $\vec{b}$ and $\vec{c}$ respectively and $\vec{a}\times(\vec{b}\times\vec{c})=\frac{1}{2}\vec{b}$, then $|\alpha-\beta|$ is equal to :
(1) 90°
(2) 60°
(3) 45°
(4) 30°

Q87. If an angle between the line, $\frac{x+1}{2}=\frac{y-2}{1}=\frac{z-3}{-2}$ and the plane, $x-2y-kz=3$ is $\cos^{-1}\left(\frac{2\sqrt{2}}{3}\right)$, then a value of k is
(1) $\sqrt{\frac{5}{3}}$
(2) $\sqrt{\frac{3}{5}}$
(3) $-\frac{3}{5}$
(4) $-\frac{5}{3}$

Q88. Let S be the set of all real values of λ such that a plane passing through the points $(-\lambda^2,1,1),(1,-\lambda^2,1)$ and $(1,1,-\lambda^2)$ also passes through the point $(-1,-1,1)$. Then S is equal to :
(1) $\{\sqrt{3}\}$
(2) $\{3,-3\}$
(3) $\{1,-1\}$
(4) $\{\sqrt{3},-\sqrt{3}\}$

Q89. In a class of 60 students, 40 opted for NCC, 30 opted for NSS and 20 opted for both NCC and NSS. If one of these students is selected at random, then the probability that the student selected has opted neither for NCC nor for NSS is :
(1) $\frac{1}{6}$
(2) $\frac{5}{6}$
(3) $\frac{1}{3}$
(4) $\frac{2}{3}$

Q90. In a game, a man wins Rs. 100 if he gets 5 or 6 on a throw of a fair die and loses Rs. 50 for getting any other number on the die. If he decides to throw the die either till he gets a five or a six or to a maximum of three throws, then his expected gain/loss (in rupees) is :
(1) $\frac{400}{3}$ gain
(2) $\frac{400}{9}$ gain
(3) $\frac{400}{3}$ loss
(4) 0

ANSWER KEYS

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