Q1. If $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$, then the angle between A and B is

(1) π (2) $\pi/3$

(3) $\pi/2$ (4) $\pi/4$

Q2. Which one of the following represents the correct dimensions of the coefficient of viscosity?

(1) $\mathrm{ML^{-1}\,T^{-2}}$ (2) $\mathrm{MLT^{-1}}$

(3) $\mathrm{ML^{-1}\,T^{-1}}$ (4) $\mathrm{ML^{-2}\,T^{-2}}$

Q3. A ball is released from the top of a tower of height h metres. It takes T seconds to reach the ground. What is the position of the ball in $\mathrm{T}/3$ seconds?

(1) $\mathrm{h}/9$ metres from the ground (2) $7\ \mathrm{h}/9$ metres from the ground

(3) $8\ \mathrm{h}/9$ metres from the ground (4) $17\ \mathrm{h}/18$ metres from the ground.

Q4. An automobile travelling with speed of 60 km/h, can brake to stop within a distance of 20 cm. If the car is going twice as fast, i.e 120 km/h, the stopping distance will be

(1) 20 m (2) 40 m

(3) 60 m (4) 80 m

Q5. A ball is thrown from a point with a speed v_0 at an angle of projection θ. From the same point and at the same instant person starts running with a constant speed $v_0/2$ to catch the ball. Will the person be able to catch the ball? If yes, what should be the angle of projection?

(1) yes, 60° (2) yes, 30°

(3) no (4) yes, 45°

Q6. A projectile can have the same range R for two angles of projection. If T_1 and T_2 be the time of flights in the two cases, then the product of the two time of flights is directly proportional to

(1) $1/R^2$ (2) $1/\mathrm{R}$

(3) R (4) R^2

Q7. If t_1 and t_2 are the times of flight of two particles having the same initial velocity u and range R on the horizontal, then $\mathrm{t_1^2 + t_2^2}$ is equal to

(1) $\frac{u^2}{g}$ (2) $\frac{4u^2}{g^2}$

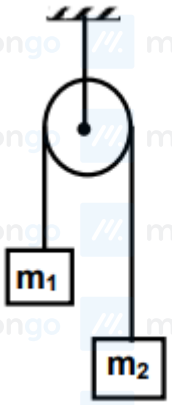
(3) $\frac{u^2}{2g}$ (4) 1

Q8. A machine gun fires a bullet of mass 40 g with a velocity 1200 $\mathrm{ms^{-1}}$. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can he fire per second at the most?

(1) one (2) four

(3) two (4) three

Q9. Two masses $m_1 = 5$ kg and $m_2 = 4.8$ kg tied to a string are hanging over a light frictionless pulley. What is the



acceleration of the masses when lift free to move $\left(\mathrm{g} = 9.8\ \mathrm{m/s^2}\right)$

(1) $0.2\ \mathrm{m/s^2}$ (2) $9.8\ \mathrm{m/s^2}$

(3) $5\ \mathrm{m/s^2}$ (4) $4.8\ \mathrm{m/s^2}$

Q10. A block rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.8. If the frictional force on the block is 10 N, the mass of the block (in kg) is (take $\mathrm{g} = 10\ \mathrm{m/s^2}$)

(1) 2.0 (2) 4.0

(3) 1.6 (4) 2.5

Q11. A particle moves in a straight line with retardation proportional to its displacement. Its loss of kinetic energy for any displacement x is proportional to

(1) x^3 (2) e^x

(3) x (4) $\log_e x$

Q12. Which of the following statements is false for a particle moving in a circle with a constant angular speed?

(1) The velocity vector is tangent to the circle. (2) The acceleration vector is tangent to the circle.

(3) The acceleration vector points to the centre of the circle. (4) The velocity and acceleration vectors are perpendicular to each other.

Q13. A uniform chain of length 2 m is kept on a table such that a length of 60 cm hangs freely from the edge of the table. The total mass of the chain is 4 kg. What is the work done in pulling the entire chain on the table?

(1) 7.2 J (2) 3.6 J

(3) 120 J (4) 1200 J

Q14. A force $\vec{F} = (5\hat{i} + 3\hat{j} + 2\hat{k})N$ is applied over a particle which displaces it from its origin to the point $\vec{r} = (2\hat{i} - \hat{j})m$. The work done on the particle in joules is

(1) -7 (2) $+7$

(3) $+10$ (4) $+13$

Q15. A body of mass m, accelerates uniformly from rest to v_1 in time t_1. The instantaneous power delivered to the body as a function of time t is

(1) $\frac{mv_1t}{t_1}$ (2) $\frac{mv_1^2t}{t_1^2}$
(3) $\frac{mv_1t^2}{t_1}$ (4) $\frac{mv_1^2t}{t_1}$

Q16. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle, the motion of the particle takes place in a plane. It follows that
(1) its velocity is constant (2) its acceleration is constant
(3) its kinetic energy is constant (4) it moves in a straight line.

Q17. A wire fixed at the upper end stretches by length by applying a force F. The work done in stretching is
(1) $\mathrm{F}/2$ (2) $\mathrm{F}\ell$
(3) $2\ \mathrm{F}\ell$ (4) $\mathrm{F}\ell/2$

Q18. A solid sphere is rotating in free space. If the radius of the sphere is increased keeping mass same which one of the following will not be affected?
(1) moment of inertia (2) angular momentum
(3) angular velocity (4) rotational kinetic energy.

Q19. One solid sphere A and another hollow sphere B are of same mass and same outer radii. Their moment of inertia about their diameters are respectively $\mathrm{I_A}$ and $\mathrm{I_B}$ such that
(1) $I_A = I_B$ (2) $I_A > I_B$
(3) $I_A < I_B$ (4) yes, 45° $I_A/I_B = d_A/d_B$ Where d_A and d_B are their densities.

Q20. A satellite of mass m revolves around the earth of radius R at a height x from its surface. If g is the acceleration due to gravity on the surface of the earth, the orbital speed of the satellite is
(1) gx (2) $\frac{\mathrm{gR}}{\mathrm{R-x}}$
(3) $\frac{g^2}{R+x}$ (4) $\left(\frac{gR^2}{R+x}\right)^{1/2}$

Q21. The time period of an earth satellite in circular orbit is independent of
(1) the mass of the satellite (2) radius of its orbit
(3) both the mass and radius of the orbit (4) neither the mass of the satellite nor the radius of its orbit.

Q22. If g is the acceleration due to gravity on the earth's surface, the gain in the potential energy of object of mass m raised from the surface of the earth to a height equal to the radius R of the earth is
(1) $2\mathrm{mgR}$ (2) $\frac{1}{2}\mathrm{mgR}$
(3) $\frac{1}{4}\mathrm{mgR}$ (4) mgR

Q23. Suppose the gravitational force varies inversely as the nth power of distance. Then the time period planet in circular orbit of radius R around the sun will be proportional to
(1) $R^{(\frac{n+1}{2})}$ (2) $R^{(\frac{n-1}{2})}$
(3) $\mathrm{R^n}$ (4) $\mathrm{R}^{(\frac{n-2}{2})}$

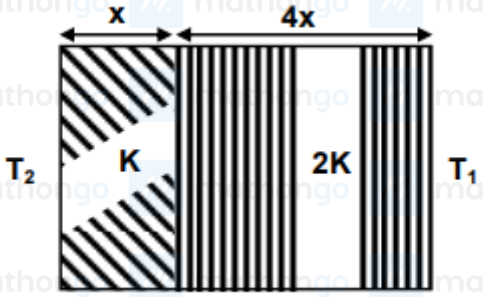
Q24. Spherical balls of radius R are falling in a viscous fluid of viscosity η with a velocity v. The retarding viscous force acting on the spherical ball is

(1) directly proportional to R but inversely proportional to v.
(2) directly proportional to both radius R and velocity v.
(3) inversely proportional to both radius R and velocity v.
(4) inversely proportional to R but directly proportional to velocity v.

Q25. If two soap bubbles of different radii are connected by a tube,
(1) air flows from the bigger bubble to the smaller bubble till the sizes are interchanged.
(2) air flows from bigger bubble to the smaller bubble till the sizes are interchanged
(3) air flows from the smaller bubble to the bigger.
(4) there is no flow of air.

Q26. If the temperature of the sun were to increase from T to $2T$ and its radius from R to $2R$, then the ratio of the radiant energy received on earth to what it was previously will be
(1) 4
(2) 16
(3) 32
(4) 64

Q27. The temperature of two outer surfaces of a composite slab, consisting of two materials having coefficients of thermal conductivity K and $2K$ and thickness x and $4x$, respectively are T_2 and T_1 $(T_2 > T_1)$. The rate of heat transfer through the slab, in a steady state is $\left(\frac{A(T_2-T_1)K}{x}\right)f$, with f equal to



(1) 1
(2) $1/2$
(3) $2/3$
(4) $1/3$

Q28. The thermistors are usually made of
(1) metals with low temperature coefficient of resistivity
(2) metals with high temperature coefficient of resistivity
(3) metal oxides with high temperature coefficient of resistivity "
(4) semiconducting materials having low temperature coefficient of resistivity.

Q29. Time taken by a 836 W heater to heat one litre of water from 10°C to 40°C is
(1) 50 s
(2) 100 s
(3) 150 s
(4) 200 s

Q30. The thermo emf of a thermocouple varies with the temperature θ of the hot junction as $\mathrm{E} = \mathrm{a}\theta + \mathrm{b}\theta^2$ in volts where the ratio a/b is 700°C. If the cold junction is kept at 0°C, then the neutral temperature is
(1) 700°C
(2) 350°C
(3) 1400°C
(4) no neutral temperature is possible for this thermocouple.

Q31. Which of the following statements is correct for any thermodynamic system?

(1) The internal energy changes in all processes.
(2) Internal energy and entropy are state functions.
(3) The change in entropy can never be zero.
(4) The work done in an adiabatic process is always zero.

Q32. One mole of ideal monoatomic gas ($\gamma = 5/30$) is mixed with one mole of diatomic gas ($\gamma = 7/5$). What is γ for the mixture? γ denotes the ratio of specific heat at constant pressure, to that at constant volume.

(1) $3/2$
(2) $23/15$
(3) $35/23$
(4) $4/3$

Q33. Two thermally insulated vessels 1 and 2 are filled with air at temperatures (T_1, T_2), volume (V_1, V_2) and pressure (P_1, P_2) respectively. If the valve joining two vessels is opened, the temperature inside the vessel at equilibrium will be

(1) $\mathrm{T_1 + T_2}$
(2) $(\mathrm{T_1 + T_2})/2$
(3) $\frac{\mathrm{T_1\,T_2(P_1\,V_1+P_2\,V_2)}}{\mathrm{P_1\,V_1\,T_2+P_2\,V_2\,T_1}}$
(4) $\frac{\mathrm{T_1\,T_2(P_1\,V_1+P_2\,V_2)}}{\mathrm{P_1\,V_1\,T_1+P_2\,T_2\,T_2}}$

Q34. The bob of a simple pendulum executes simple harmonic motion in water with a period t, while the period of oscillation of the bob is t_0 in air. Neglecting frictional force of water and given that the density of the bob is $\left(\frac{4}{3}\right) \times 1000\ \mathrm{kg/m^3}$. What relationship between t and t_0 is true?

(1) $t = t_0$
(2) $t = t_0/2$
(3) $t = 2t_0$
(4) $\mathrm{t = 4t_0}$

Q35. A particle at the end of a spring executes simple harmonic motion with a period t_1, while the corresponding period for another spring is t_2. If the period of oscillation with the two springs in series is t, then

(1) $\mathrm{T = t_1 + t_2}$
(2) $\propto \mathrm{x^2}$
(3) $\mathrm{T^{-1} = t_1^{-1} + t_2^{-1}}$
(4) $\mathrm{T^{-2} = t_1^2 + t_2^2}$

Q36. The total energy of particle, executing simple harmonic motion is

(1) $\propto \mathbf{X}$
(2) $\propto x^2$
(3) independent of x
(4) $\propto x^{1/2}$

Q37. A particle of mass m is attached to a spring (of spring constant k) and has a natural angular frequency ω_0. An external force $F(t)$ proportional to $\cos \omega t$ $(\omega \neq \omega_0)$ is applied to the oscillator. The time displacement of the oscillator will be proportional to

(1) $\frac{\mathrm{m}}{\omega_0^2 - \omega^2}$
(2) $\frac{1}{m(\omega_0^2 - \omega^2)}$
(3) $\frac{1}{m(\omega_0^2 + \omega^2)}$
(4) $\frac{m}{\omega_0^2 + \omega^2}$

Q38. In forced oscillation of a particle the amplitude is maximum for a frequency ω_1 of the force, while the energy is maximum for a frequency ω_2 of the force, then

(1) $\omega_1 = \omega_2$
(2) $\omega_1 > \omega_2$
(3) $\omega_1 < \omega_2$ when damping is small and $\omega_1 > \omega_2$ when damping is large
(4) $\omega_1 < \omega_2$

Q39. The displacement y of a particle in a medium can be expressed as $y = 10^{-6} \sin(110t + 20x + \pi/4)m$, where t is in seconds and x in meter. The speed of the wave is

(1) $2000\ \mathrm{m/s}$ (2) $5\ \mathrm{m/s}$
(3) $20\ \mathrm{m/s}$ (4) $5\pi \mathrm{m/s}$

Q40. Two spherical conductor B and C having equal radii and carrying equal charges in them repel each other with a force F when kept apart at some distance. A third spherical conductor having same radius as that of B but uncharged brought in contact with B, then brought in contact with C and finally removed away from both. The new force of repulsion, between B and C is
(1) $\mathrm{F}/4$ (2) $3F/4$
(3) $\mathrm{F}/8$ (4) $3\ \mathrm{F}/8$.

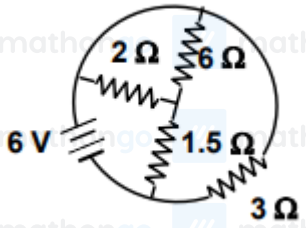
Q41. A charged particle q is shot towards another charged particle Q which is fixed, with a speed v it approaches Q upto a closest distance r and then returns. If q were given a speed $2v$, the closest distances of approach would be
(1) r (2) $2r$
(3) $\mathrm{r}/2$ (4) $\mathrm{r}/4$

Q42. Four charges equal to $-Q$ are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium the value of q is
(1) $-\frac{Q}{4}(1+2\sqrt{2})$ (2) $-\frac{Q}{2}(1+2\sqrt{2})$
(3) $-\frac{Q}{2}(1+2\sqrt{2})$ (4) $\frac{Q}{2}(1+2\sqrt{2})$

Q43. A charged oil drop is suspended in a uniform field of $3\times10^{4}\ \mathrm{V/m}$ so that it neither falls nor rises. The charge on the drop will be (take the mass of the charge $=9.9\times10^{-15}$ kg and $\mathrm{g}=10\ \mathrm{m/s^2}$)
(1) $3.3\times10^{-18}\mathrm{C}$ (2) $3.2\times10^{-18}\mathrm{C}$
(3) $1.6\times10^{-18}\mathrm{C}$ (4) $4.8\times10^{-18}\mathrm{C}$

Q44. An α-particle of energy 5MeV is scattered through 180° by a fixed uranium nucleus. The distance of the closest approach is of the order of
(1) $1\mathring{A}$ (2) 10^{-10} cm
(3) 10^{-12} cm (4) 10^{-15} cm

Q45.



The total current supplied to the circuit by the battery is
(1) 1 A (2) 2 A
(3) $4A$ (4) 6 A

Q46. The resistance of the series combination of two resistances is S. When they are joined in parallel through total resistance is P. If $S=nP$, then the minimum possible value of n is

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

Q47. An electric current is passed through a circuit containing two wires of the same material, connected in parallel. If the length and radii of the wires are in the ratio of $4/3$ and $2/3$, then the ratio of the currents passing through the wire will be
(1) 3 (2) $1/3$
(3) $8/9$ (4) 2

Q48. In a metre bridge experiment null point is obtained at 20 cm from one end of the wire when resistance X is balanced against another resistance Y. If $X < Y$, then where will be the new position of the null point from the same end, if one decides to balance a resistance of $4X$ against Y?
(1) 50 cm (2) 80 cm
(3) 40 cm (4) 70 cm

Q49. The electrochemical equivalent of a metal is 3.3×10^{-7} kg per coulomb. The mass of the metal liberated at the cathode when a 3 A current is passed for 2 seconds will be
(1) 19.8×10^{-7} kg (2) 9.9×10^{-7} kg
(3) 6.6×10^{-7} kg (4) 1.1×10^{-7} kg

Q50. A piece of copper and another of germanium are cooled from room temperature to 77 K, the resistance of
(1) each of them increases (2) each of them decreases
(3) copper decreases and germanium increases (4) copper increases and germanium decreases

Q51. The length of a magnet is large compared to its width and breadth. The time period of its width and breadth. The time period of its oscillation in a vibration magnetometer is 2 s. The magnet is cut along its length into three equal parts and three parts are then placed on each other with their like poles together. The time period of this combination will be
(1) 2 s (2) $2/3$ s
(3) $2\sqrt{3}$ s (4) $2/\sqrt{3}$ s

Q52. The materials suitable for making electromagnets should have
(1) high retentivity and high coercivity (2) low retentivity and low coercivity
(3) high retentivity and low coercivity (4) low retentivity and high coercivity

Q53. A current I ampere flows along an infinitely long straight thin-walled tube, then the magnetic induction at any point inside the tube is
(1) infinite (2) zero
(3) $\frac{\mu_0}{4\pi}\frac{2i}{r}$ tesla (4) $2n^2$ B

Q54. A long wire carries a steady current. It is bent into a circle of one turn and the magnetic field at the centre of the coil is B. It is then bent into a circular loop of n turns. The magnetic field at the centre of the coil will be
(1) nB (2) n^2 B
(3) 2nB (4) $2n^2B$

Q55. The magnetic field due to a current carrying circular loop of radius 3 cm at a point on the axis at a distance of 4 cm from the centre is 54μT. What will be its value at the centre of the Loop?

(1) 250μT (2) 150μT

(3) 125μT (4) 75μT

Q56. Two long conductors, separated by a distance d carry current I_1 and I_2 in the same direction. They exert a force F on each other. Now the current in one of them increased to two times and its direction reversed. The distance is also increased to 3 d. The new value of the force between them is

(1) -2 F (2) F/3

(3) $-2F/3$ (4) $-$F/3

Q57. A coil having n turns and resistance 4RΩ. This combination is moved in time t seconds from a magnetic field W_1 weber to W_2 weber. The induced current in the circuit is

(1) $-\frac{W_2-W_1}{5Rnt}$ (2) $-\frac{(W_2-W_1)}{5Rt}$

(3) $-\frac{W_2-W_1}{Rnt}$ (4) $-\frac{n(W_2-W_1)}{Rt}$

Q58. In a uniform magnetic field of induction B a wire in the form of semicircle of radius r rotates about the diameter of the circle with angular frequency ω. The axis of rotation is perpendicular to the field. If the total resistance of the circuit is R the mean power generated per period of rotation is

(1) $\frac{B\pi r^2\omega}{2R}$ (2) $\frac{(B\pi r^2\omega)^2}{2R}$

(3) $\frac{(B\pi r\omega)^2}{2R}$ (4) $\frac{(B\pi r\omega^2)^2}{8R}$

Q59. A metal conductor of length 1 m rotates vertically about one of its ends at angular velocity 5 radians per second. If the horizontal component of earth's magnetic field is 0.3×10^{-4} T, then the e.m.f. developed between the two ends of the conductor is

(1) depends on the nature of the metal used (2) depends on the intensity of the radiation

(3) depends both on the intensity of the radiation and the metal used (4) is the same for all metals and independent of the intensity of the radiation.

Q60. Alternating current can not be measured by D.C. ammeter because

(1) A.C. cannot pass through D.C. (2) A.C. changes direction

(3) average value of current for complete cycle is zero (4) D.C. ammeter will get damaged.

Q61. In an LCR series a.c. circuit, the voltage across each of the components, L, C and R is 50 V. The voltage across the LC combination will be

(1) 50 V (2) $50\sqrt{2}$ V

(3) 100 V (4) 0 V (zero)

Q62. In a LCR circuit capacitance is changed from C to $2C$. For the resonant frequency to remain unchanged, the inductance should be changed from L to

(1) 4 L (2) 2 L

(3) L/2 (4) L/4

Q63. An electromagnetic wave of frequency $v = 3.0\text{MHz}$ passes from vacuum into a dielectric medium with permittivity $\varepsilon = 4.0$. Then

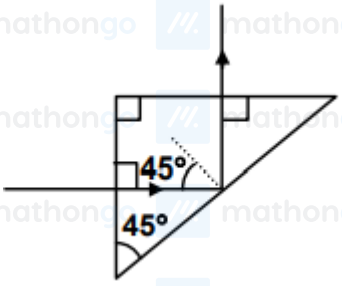
(1) wavelength is doubled and the frequency remains unchanged

(2) wavelength is doubled and frequency becomes half

(3) wavelength is halved and frequency remains unchanged

(4) wavelength and frequency both remain unchanged.

Q64. A light ray is incident perpendicular to one face of a 90° prism and is totally internally reflected at the glass-air interface. If the angle of reflection is 45°, we conclude that the refractive index n



(1) $\text{n} < \frac{1}{2}$

(2) $\text{n} > \sqrt{2}$

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

(4) $\text{n} < \sqrt{2}$

Q65. A plane convex lens of refractive index 1.5 and radius of curvature 30 cm is silvered at the curved surface. Now this lens has been used to form the image of an object. At what distance from this lens an object be placed in order to have a real image of the size of the object?

(1) 20 cm

(2) 30 cm

(3) 60 cm

(4) 80 cm

Q66. The angle of incidence at which reflected light totally polarized for reflection from air to glass (refractive index n), is

(1) $\sin^{-1}(n)$

(2) $\sin^{-1}(1/n)$

(3) $\tan^{-1}(1/n)$

(4) $\tan^{-1}(n)$

Q67. The maximum number of possible interference maxima for slit-separation equal to twice the wavelength in Young's double-slit experiment is

(1) infinite

(2) five

(3) three

(4) zero

Q68. A radiation of energy E falls normally on a perfectly reflecting surface. The momentum transferred to the surface is

(1) E/c

(2) $2\text{E}/\text{c}$

(3) Ec

(4) E/c^2

Q69. According to EInstein's photoelectric equation, the plot of the kinetic energy of the emitted photo electrons from a metal V_s the frequency, of the incident radiation gives straight line whose slope

(1) depends on the nature of the metal used
(2) depends on the intensity of the radiation
(3) depends both on the intensity of the radiation and the metal used
(4) is the same for all metals and independent of the intensity of the radiation.

Q70. The work function of a substance is 4.0eV. Then longest wavelength of light that can cause photoelectron emission from this substance approximately
(1) 540 nm
(2) 400 nm
(3) 310 nm
(4) 220 nm

Q71. The manifestation of band structure in solids is due to
(1) Heisenberg's uncertainty principle
(2) Pauli's exclusion principle
(3) Bohr's correspondence principle
(4) Boltzmann's law

Q72. A nucleus disintegrates into two nuclear parts which have their velocities in the ratio $2:1$. The ratio of their nuclear sizes will be
(1) $2^{1/3}:1$
(2) $1:3^{1/2}$
(3) $3^{1/2}:1$
(4) $1:2^{1/3}$

Q73. The binding energy per nucleon of deuteron $\left({}_1^2\mathrm{H}\right)$ and helium nucleus $\left({}_2^4\mathrm{He}\right)$ is 1.1MeV and 7MeV respectively. If two deuteron nuclei react to form a single helium nucleus, then the energy released is
(1) 13.9MeV
(2) 26.9MeV
(3) 23.6MeV
(4) 19.2MeV

Q74. When npn transistor is used as amplifier
(1) electrons move from base to collector
(2) holes move from emitter to base
(3) electrons move from collector to base
(4) holes move from base to emitter.

Q75. For a transistor amplifier in common emitter configuration having load impedance of $1\mathrm{k}\Omega$ ($\mathrm{h_{fe}}=50$ and $h_{oe}=25$) the current gain is
(1) -5.2
(2) -15.7
(3) -24.8
(4) -48.78

Q76. When p-n junction diode is forward biased
(1) the depletion region is reduced and barrier height is increased
(2) the depletion region is widened and barrier height is reduced
(3) both the depletion region and barrier height reduced
(4) both the depletion region and barrier height increased.

Q77. 6.02×10^{20} molecules of urea are present in 100ml of its solution. The concentration of urea solution is
(1) 0.001M
(2) 0.1M
(3) 0.02M
(4) 0.01M

Q78. To neutralize completely 20 mL of 0.1M aqueous solution of phosphorous acid $(\mathrm{H_3PO_3})$, the volume of 0.1M aqueous KOH solution required is
(1) 10 mL
(2) 60 mL
(3) 40 mL
(4) 20 mL

Q79. Which of the following sets of quantum numbers is correct for an electron in 4f orbital?

(1) $n=4, \mathrm{l}=3, \mathrm{m}=+4, \mathrm{s}=+\frac{1}{2}$ (2) $n=3, I=2, m=-2, S=+\frac{1}{2}$

(3) $n=4, I=3, m=+1, s=+\frac{1}{2}$ (4) $n=4, I=4, m-4, s=-\frac{1}{2}$

Q80. Consider the ground state of Cr atom $(Z=24)$. The number of electrons with the azimuthal quantum numbers I $=1$ and 2 are respectively

(1) 12 and 4 (2) 16 and 5

(3) 16 and 4 (4) 12 and 5

Q81. The wavelength of the radiation emitted, when in hydrogen atom electron falls from infinity to stationary state 1 , would be (Rydberg constant $=1.097 \times 10^{7}\ \mathrm{m}^{-1}$)

(1) 91 nm (2) 9.1×10^{-8} nm

(3) 406 nm (4) 192 nm

Q82. Which one the following sets of ions represents the collection of isoelectronic species?

(1) $\mathrm{K}^{+}, \mathrm{Ca}^{2+}, \mathrm{Sc}^{3+}, \mathrm{Cl}^{-}$ (2) $\mathrm{Na}^{+}, \mathrm{Mg}^{2+}, \mathrm{Al}^{3+}, \mathrm{Cl}^{-}$

(3) $\mathrm{K}^{+}, \mathrm{Cl}^{-}, \mathrm{Mg}^{2+}, \mathrm{Sc}^{3+}$ (4) $\mathrm{Na}^{+}, \mathrm{Ca}^{2+}, \mathrm{Sc}^{3+}, \mathrm{F}^{-}$

Q83. Which one the following ions has the highest value of ionic radius?

(1) Li^{+} (2) F^{-}

(3) O^{2-} (4) B^{3+}

Q84. Consider the following nuclear reactions

$$
\begin{aligned}
&{}_{92}^{238}\mathrm{M} \rightarrow {}_{\mathrm{y}}^{\mathrm{x}}\mathrm{N} + {}_{2}^{4}\mathrm{He} \\
&{}_{\mathrm{y}}^{\mathrm{N}}\mathrm{N} \rightarrow {}_{\mathrm{B}}^{\mathrm{A}}\mathrm{L} + 2\beta^{+}
\end{aligned}
$$

The number of neutrons in the element L is

(1) 142 (2) 146

(3) 140 (4) 144

Q85. The correct order of bond angles (smallest first) in $\mathrm{H}_2\mathrm{S}, \mathrm{NH}_3, \mathrm{BF}_3$ and SiH_4 is

(1) $\mathrm{H}_2\mathrm{S} < \mathrm{SiH}_4 < \mathrm{NH}_3 < \mathrm{BF}_3$ (2) $\mathrm{H}_2\mathrm{S} < \mathrm{NH}_3 < \mathrm{BF}_3 < \mathrm{SiH}_4$

(3) $\mathrm{H}_2\mathrm{S} < \mathrm{NH}_3 < \mathrm{SiH}_4 < \mathrm{BF}_3$ (4) $\mathrm{NH}_3 < \mathrm{H}_2\mathrm{S} < \mathrm{SiH}_4 < \mathrm{BF}_3$

Q86. The bond order in NO is 2.5 while that in $\mathrm{NO}^{+}$is 3 . Which of the following statements is true for these two species?

(1) Bond length in $\mathrm{NO}^{+}$is greater than in NO (2) Bond length is unpredictable

(3) Bond length in NO^{+}in equal to that in NO (4) Bond length in NO is greater than in NO^{+}

Q87. The states of hybridization of boron and oxygen atoms in boric acid $(\mathrm{H}_3\mathrm{BO}_3)$ are respectively

(1) sp^2 and sp^2 (2) sp^3 and sp^3

(3) sp^3 and sp^2 (4) sp^2 and sp^3

Q88. Which one of the following has the regular tetrahedral structure?

(1) XeF_4 (2) $[Ni(CN)_4]^{2-}$
(3) $BF_4{}^{-4}$ (4) SF_4

Q89. The maximum number of 90° angles between bond pair of electrons is observed in
(1) dsp ^{3} hybridization (2) $sp^3 d^2$ hybridization
(3) dsp^2 hybridization (4) sp^3 d hybridization

Q90. Which one of the following aqueous solutions will exhibit highest boiling point?
(1) $0.01M Na_2SO_4$ (2) 0.015M glucose
(3) 0.015M urea (4) $0.01M KNO_3$

Q91. Which one the following does not have sp^2 hybridized carbon?
(1) Acetone (2) Acetamide
(3) Acetonitrile (4) Acetic acid

Q92. As the temperature is raised from $20^\circ C$ to $40^\circ C$, the average kinetic energy of neon atoms changes by a factor of which of the following?
(1) $1/2$ (2) 2
(3) $\frac{313}{293}$ (4) $\sqrt{\frac{313}{293}}$

Q93. In Vander Waals equation of state of the gas law, the constant ' b ' is a measure of
(1) intermolecular repulsions (2) intermolecular collisions per unit volume
(3) Volume occupied by the molecules (4) intermolecular attraction

Q94. The formation of the oxide ion $O^{2-}(g)$ requires first an exothermic and then an endothermic step as shown below $O(g) + e^- O^-(g) \Delta H^\circ = -142 kJ mol^{-1}$ $O^-(g) + e^- O^{2-}(g) \Delta H^\circ = 844 kJ mol^{-1}$
(1) Oxygen is more electronegative (2) O^- ion has comparatively larger size than oxygen atom
(3) O^- ion will tend to resist the addition of another electron (4) Oxygen has high electron affinity

Q95. An ideal gas expands in volume from $1 \times 10^{-3} m^3$ to $1 \times 10^{-2} m^3$ at 300 K against a constant pressure of $1 \times 10^5 Nm^{-2}$. The work done is
(1) -900 J (2) 900 kJ
(3) 2780 kJ (4) -900 kJ

Q96. The enthalpies of combustion of carbon and carbon monoxide are -393.5 and -283 kJ mol^{-1} respectively. The enthalpy of formation of carbon monoxide per mole is
(1) 110.5 kJ (2) -110.5 kJ
(3) -676.5 kJ (4) 676.5 kJ

Q97. What is the equilibrium expression for the reaction $P_{4(s)} + 5O_{2(g)} \rightleftharpoons P_4O_{10(s}$?
(1) $Kc = [P_4O_{10}]/P_4][O_2]^5$ (2) $Kc = 1/[O_2]^5$
(3) $Kc = [O_2]^5$ (4) $Kc = [P_4O_{10}]/5\,[P_4]\,[O_2]$

Q98. For the reaction, $CO(g) + Cl_2(g) \rightleftharpoons COCl_2(g)$ the $\frac{K_p}{K_c}$ is equal to

(1) $\frac{1}{RT}$ (2) 1.0
(3) $\sqrt{RT}$ (4) RT

Q99. The equilibrium constant for the reaction $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ at temperature T is 4×10^{-4}. The value of Kc for the reaction $NO(g) \rightleftharpoons \frac{1}{2} N_2(g) + \frac{1}{2} O_2(g)$ at the same temperature is
(1) 2.5×10^2 (2) 0.02
(3) 4×10^{-4} (4) 50

Q100. Among Al_2O_3, SiO_2, P_2O_3 and SO_2 the correct order of acid strength is
(1) $SO_2 < P_2O_3 < SiO_2 < Al_2O_3$ (2) $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$
(3) $Al_2O_3 < SiO_2 < SO_2 < P_2O_3$ (4) $SiO_2 < SO_2 < Al_2O_3 < P_2O_3$

Q101. The conjugate base of $H_2PO_4^-$ is
(1) PO_4^{3-} (2) HPO_4^{2-}
(3) H_3PO_4 (4) P_2O_5

Q102. The molar solubility product is K_{sp}. ' s ' is given in terms of K_{sp} by the relation
(1) $s = \left(\frac{K_{sp}}{128}\right)^{1/4}$ (2) $s = \left(\frac{K_{sp}}{256}\right)^{1/5}$
(3) $S = (256\ K_{sp})^{1/5}$ (4) $s = (128\ K_{sp})^{1/4}$

Q103. Excess of KI reacts with $CuSO_4$ solution and then $Na_2S_2O_3$ solution is added to it. Which of the statements is incorrect for this reaction?
(1) Cu_2I_2 is reduced (2) Evolved I_2 is reduced
(3) $Na_2S_2O_3$ is oxidized (4) CuI_2 is formed

Q104. Among the properties (a) reducing (b) oxidising (c) complexing, the set of properties shown by CN^- ion towards metal species is
(1) a, b, c (2) a, b, c
(3) c, a (4) b, c

Q105. Beryllium and aluminium exhibit many properties which are similar. But the two elements differ in
(1) exhibiting maximum covalency in compound (2) exhibiting amphoteric nature in their oxides
(3) forming covalent halides (4) forming polymeric hydrides

Q106. Aluminium chloride exists as dimer, Al_2Cl_6 in solid state as well as in solution of non-polar solvents such as benzene. When dissolved in water, it gives
(1) $Al^{3+} + 3Cl^-$ (2) $Al_2O_3 + 6HCl$
(3) $[Al(OH)_6]^{3-}$ (4) $[Al(H_2O)_6]^{3+} + 3Cl^-$

Q107. The soldiers of Napolean army while at Alps during freezing winter suffered a serious problem as regards to the tin buttons of their uniforms. White metallic tin buttons got converted to grey powder. This transformation is related to

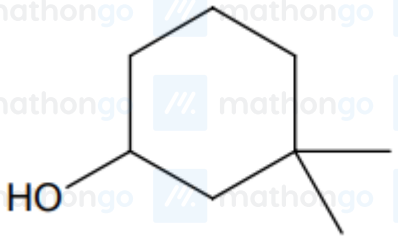
(1) an interaction with nitrogen of the air at very low temperatures
(2) an interaction with water vapour contained in the humid air
(3) a change in the partial pressure of oxygen in the air
(4) a change in the crystalline structure of tin

Q108. For which of the following parameters the structural isomers C_2H_5OH and CH_3OCH_3 would be expected to have the same values? (Assume ideal behaviour)
(1) Heat of vaporization
(2) Gaseous densities at the same temperature and pressure
(3) Boiling points
(4) Vapour pressure at the same temperature

Q109. The compound formed in the positive test for nitrogen with the Lassaigne solution of an organic compound is
(1) $Fe_4[Fe(CN)_6]_3$
(2) $Na_4\,[Fe(CN)_5NOS]$
(3) $Fe(CN)_3$
(4) $Na_3\,[Fe(CN)_6]$

Q110. The ammonia evolved from the treatment of 0.30 g of an organic compound for the estimation of nitrogen was passed in 100 mL of 0.1M sulphuric acid. The excess of acid required 20 mL of 0.5M sodium hydroxide solution hydroxide solutio for complete neutralization. The organic compound is
(1) acetamide
(2) thiourea
(3) urea
(4) benzamide

Q111.



The IUPAC name of the compound
(1) 3, 3- dimethyl -1- hydroxy cyclohexane
(2) 1,1-dimethyl -3- cyclohexanol
(3) 3,3- dimethyl -1- cyclohexanol
(4) 1,1 - dimethyl -3- hydroxy cyclohexane

Q112. Which of the following will have meso-isomer also?
(1) 2- chlorobutane
(2) 2- hydroxyopanoic acid
(3) 2,3 - dichloropentane
(4) 2-3- dichlorobutane

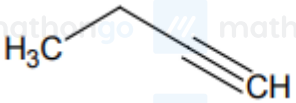
Q113.

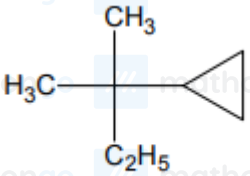
is fastest when Z is

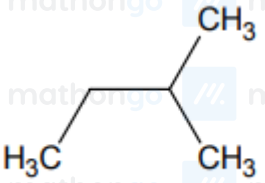
Rate of the reaction
(1) Cl
(2) $OCOCH_3$
(3) OC_2H_5
(4) NH_2

Q114. Amongst the following compound, the optically active alkane having lowest molecular mass is

(1) 

(2) 

(3) 

(4) 

Q115. Which of the following compound is not chiral?

(1) 1- chloropentane
(2) 3-chloro-2- methyl pentane
(3) 1-chloro -2- methyl pentane
(4) 2- chloropentane

Q116. Which one of the following has the minimum boiling point?

(1) n-butane
(2) isobutane
(3) 1- butene
(4) 1- butyne

Q117. The smog is essentially caused by the presence of

(1) O_2 and O_3
(2) O_3 and N_2
(3) Oxides of sulphur and nitrogen
(4) O_2 and N_2

Q118. What type of crystal defect is indicated in the diagram below? $Na^+Cl^-Na^+Cl^-Na^+Cl^-$ $Cl^-\square Cl^-\square Na^+\square Na^+$ $Na^+Cl^-\square Cl^-Na^+Cl^-$ $Cl^-Na^+Cl^-Na^+\square Na^+$

(1) Frenkel defect
(2) Frenkel and Schottky defects
(3) Interstitial defect
(4) Schottky defect

Q119. Which of the following liquid pairs shows a positive deviation from Raoult's law?

(1) Water - hydrochloric acid
(2) Acetone - chloroform
(3) Water - nitric acid
(4) Benzene - methanol

Q120. In hydrogen - oxygen fuel cell, combustion of hydrogen occurs to

(1) generate heat
(2) remove adsorbed oxygen from electrode surfaces
(3) produce high purity water
(4) create potential difference between the two electrodes

Q121. Consider the following E° values

$$E^\circ_{Fe^{3+}/Fe^{2+}} = 0.77\ V$$
$$E^\circ_{Sn^{2+}/Sn} = -0.14\ V$$

Under standard conditions the potential for the reaction $Sn(s) + 2Fe^{3+}(aq) \longrightarrow 2Fe^{2+}(aq) + Sn^{2+}(aq)$ is

(1) 1.68 V
(2) 0.63 V
(3) 0.91 V
(4) 1.40 V

Q122. The standard e.m.f of a cell, involving one electron change is found to be 0.591 V at 25°C. The equilibrium constant of the reaction is $(F = 96,500 C mol^{-1} : R = 8.314 JK^{-1}\ mol^{-1})$

(1) 1.0×10^{1} (2) 1.0×10^{30}
(3) 1.0×10^{10} (4) 1.0×10^{5}

Q123. The limiting molar conductivities Λ° for NaCl, KBr and KCl are 126,152 and 150 S cm^2 mol^{-1} respectively. The Λ° for NaBr is
(1) 128 S cm^2 mol^{-1} (2) 302 S cm^2 mol^{-1}
(3) 278 S cm^2 mol^{-1} (4) 176 S cm^2 mol^{-1}

Q124. In a cell that utilises the reaction $Zn(s) + 2H^{+}(aq) \longrightarrow Zn^{2+}(aq) + H_2(g)$ addition of H_2SO_4 to cathode compartment, will
(1) lower the E and shift equilibrium to the left (2) increases the E and shift equilibrium to the left
(3) increase the E and shift equilibrium to the right (4) Lower the E and shift equilibrium to the right

Q125. The $E^{\circ}_{M^{+3}/M^{2+}}$ values for Cr, Mn, Fe and Co are $-0.41, +1.57, +0.77$ and $+1.97$ V respectively. For which one of these metals the change in oxidation state form $+2$ to $+3$ is easiest?
(1) Cr (2) Co
(3) Fe (4) Mn

Q126. In first order reaction, the concentration of the reactant decreases from 0.8M to 0.4M in 15 minutes. The time taken for the concentration to change from 0.1M to 0.025M is
(1) 30 minutes (2) 60 minutes
(3) 7.5 minutes (4) 15 minutes

Q127. The rate equation for the reaction $2\ A + B \longrightarrow C$ is found to be: rate $k[A][B]$. The correct statement in relation to this reaction is that the
(1) unit of K must be s^{-1} (2) values of k is independent of the initial concentration of A and B
(3) rate of formation of C is twice the rate of disappearance of A (4) $t_{1/2}$ is a constant

Q128. The half - life of a radioisotope is four hours. If the initial mass of the isotope was 200 g, the mass remaining after 24 hours undecayed is
(1) 1.042 g (2) 4.167 g
(3) 3.125 g (4) 2.084 g

Q129. Which one of the following ores is best concentrated by froth - floatation method?
(1) Magnetite (2) Malachite
(3) Galena (4) Cassiterite

Q130. Which among the following factors is the most important in making fluorine the strongest oxidizing halogen?
(1) Electron affinity (2) Bond dissociation energy
(3) Hydration enthalpy (4) Ionization enthalpy

Q131. Which one the following statement regarding helium is incorrect?

(1) It is used to fill gas balloons instead of hydrogen because it is lighter and non inflammable
(2) It is used in gas - cooled nuclear reactors
(3) It is used to produce and sustain powerful superconducting reagents
(4) It is used as cryogenic agent for carrying out experiments at low temperatures

Q132. One mole of magnesium nitride on the reaction with an excess of water gives
(1) one mole of ammonia
(2) two moles of nitric acid
(3) two moles of ammonia
(4) one mole of nitric acid

Q133. Of the following outer electronic configurations of atoms, the highest oxidation state is achieved by which one of them?
(1) $(n-1)d^8ns^2$
(2) $(n-1)d^5ns^2$
(3) $(n-1)d^3ns^2$
(4) $(n-1)d^5\ \mathrm{ns}^{-1}$

Q134. Cerium $(Z=58)$ is an important member of the lanthanoids. Which of the following statements about cerium is incorrect?
(1) The common oxidation states of cerium are $+3$ and $+4$
(2) Cerium (IV) acts as an oxidizing agent
(3) The $+4$ oxidation state of cerium is not known in solutions
(4) The $+3$ oxidation state of cerium is more stable than the $+4$ oxidation state

Q135. The coordination number of central metal atom in a complex is determined by
(1) the number of ligands around a metal ion bonded by sigma bonds
(2) the number of only anionic ligands bonded to the metal ion
(3) the number of ligands around a metal ion bonded by sigma and pi- bonds both
(4) the number of ligands around a metal ion bonded by pi-bonds

Q136. Which one of the following complexes in an outer orbital complex?
(1) $[\mathrm{Fe(CN)_6}]^{4-}$
(2) $[\mathrm{Ni(NH_3)_6}]^{2+}$
(3) $[\mathrm{Co(NH_3)_6}]^{3+}$
(4) $[\mathrm{Mn(CN)_6}]^{4-}$

Q137. Coordination compound have great importance in biological systems. In this context which of the following statements is incorrect?
(1) Chlorophylls are green pigments in plants and contains calcium
(2) Carboxypeptidase $-\mathrm{A}$ is an enzyme and contains zinc
(3) Cyanocobalamin is $\mathrm{B_{12}}$ and contains cobalt
(4) Haemoglobin is the red pigment of blood and contains iron

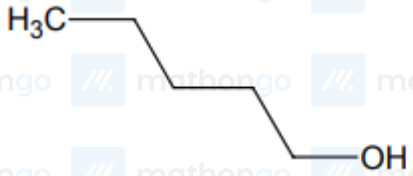
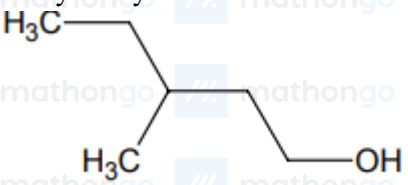
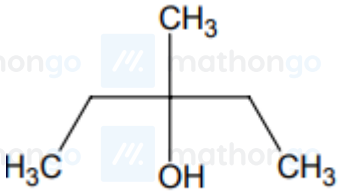
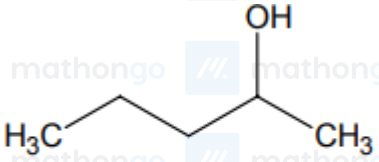
Q138. Which one the following has largest number of isomers?
(1) $\left[\mathrm{Ru(NH_3)_4Cl_2^+}\right]$
(2) $[\mathrm{Co(en)_2Cl_2}]^+$
(3) $[\mathrm{lr\,(PR_3)_2H(CO)}]^{2+}$
(4) $[\mathrm{Co(NH_3)_5Cl}]^{2+}$ (R-= alkyl group, en = ethylenediamine)

Q139. The correct order of magnetic moments (spin only values in B.M.) among is

(1) $[MnCl_4]^{2-} > [CoCl_4]^{-2} > [Fe(CN)_6]^{-4}$
(2) $[Fe(CN)_6]^{-4} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$
(3) $[Fe(CN)_6]^{4-} > [MnCl_4]^{2-} > [CoCl_4]^{2-}$
(4) $[MnCl_4]^{2-} > [Fe(CN)_6]^{4-} > [CoCl_4]^{2-}$
(Atomic numbers: $Mn = 25; Fe = 26, Co = 27$)

Q140. The compound formed on heating chlorobenzene with chloral in the presence concentrated sulphuric acid is
(1) gammexene
(2) hexachloroethane
(3) Freon
(4) DDT

Q141. Acetyl bromide reacts with excess of CH_3MgI followed by treatment with a saturated solution of NH_4Cl given
(1) acetone
(2) acetyl iodide
(3) 2- methyl -2-propanol
(4) acetamide

Q142. Among the following compound which can be dehydrated very easily is
(1) 
(2) 
(3) 
(4) 

Q143. Which one of the following reduced with zinc and hydrochloric acid to give the corresponding hydrocarbon?
(1) Ethyl acetate
(2) Butan -2-one
(3) Acetamide
(4) Acetic acid

Q144. Consider the acidity of the carboxylic acids:
(1) $PhCOOH$
(2) $O - NO_2C_6H_4COOH$
(3) $p - NO_2C_6H_4COOH$
(4) $m - NO_2C_6H_4COOH$

Q145. On mixing ethyl acetate with aqueous sodium chloride, the composition of the resultant solution is
(1) $CH_3COOC_2H_5 + NaCl$
(2) $CH_3Cl + C_2H_5COONa$
(3) $CH_3COCl + C_2H_5OH + NaOH$
(4) $CH_3COONa + C_2H_5OH$

Q146. Which of the following undergoes reaction with 50% sodium hydroxide solution to give the corresponding alcohol and acid?
(1) Phenol
(2) Benzoic acid
(3) Butanal
(4) Benzaldehyde

Q147. Which of the following is the strongest base?

(1) < smiles>Nc1ccccc1 < /smiles>
(2) < smiles>NCc1ccccc1 < /smiles>
(3) < smiles>Cc1ccccc1N < /smiles>
(4) < smiles>CNc1ccccc1 < /smiles>

Q148. Identify the correct statements regarding enzymes
(1) Enzymes are specific biological catalysts that can normally function at very high temperature ($T \sim 1000$ K)
(2) Enzymes are specific biological catalysts that the posses well - defined active sites
(3) Enzymes are specific biological catalysts that can not be poisoned
(4) Enzymes are normally heterogeneous catalysts that are very specific in their action

Q149. Insulin production and its action in human body are responsible for the level of diabetes. This compound belongs to which of the following categories?
(1) A co- enzyme
(2) An antibiotic
(3) An enzyme
(4) A hormone

Q150. Which one of the following statements is false?
(1) Raoult's law states that the vapour pressure of a components over a solution is proportional to its mole fraction
(2) Two sucrose solutions of same molality prepared in different solvents will have the same freezing point depression
(3) The correct order of osmotic pressure for 0.01M aqueous solution of each compound is $BaCl_2 > KCl > CH_3COOH >$ sucrose
(4) The osmotic pressure $(\pi) = MRT$, where M is the molarity of the solution

Q151. Which base is present in RNA but not in DNA?
(1) Uracil
(2) Thymine
(3) Guanine
(4) Cytosine

Q152. Let two numbers have arithmetic mean 9 and geometric mean 4. Then these numbers are the roots of the quadratic equation
(1) $x^2 + 18x + 16 = 0$
(2) $x^2 - 18x - 16 = 0$
(3) $x^2 + 18x - 16 = 0$
(4) $x^2 - 18x + 16 = 0$

Q153. If $(1 - p)$ is a root of quadratic equation $x^2 + px + (1 - p) = 0$, then its roots are
(1) 0,1
(2) $-1, 2$
(3) $0, -1$
(4) $-1, 1$

Q154. If one root of the equation $x^2 + px + 12 = 0$ is 4 , while the equation $x^2 + px + q = 0$ has equal roots, then the value of ' q ' is
(1) $\frac{49}{4}$
(2) 4
(3) 3
(4) 12

Q155. Let z, w be complex numbers such that $\bar{z} + i\bar{w} = 0$ and $\arg zw = \pi$. Then $\arg z$ equals
(1) $\frac{\pi}{4}$
(2) $\frac{5\pi}{4}$
(3) $\frac{3\pi}{4}$
(4) $\frac{\pi}{2}$

Q156. If $z = x - iy$ and $z^{\frac{1}{3}} = p + iq$, then $\frac{\left(\frac{x}{p}+\frac{y}{q}\right)}{(p^2+q^2)}$ is equal to

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

Q157. If $|z^2 - 1| = |z|^2 + 1$, then z lies on

(1) the real axis (2) an ellipse
(3) a circle (4) the imaginary axis.

Q158. How many ways are there to arrange the letters in the word GARDEN with the vowels in alphabetical order?

(1) 120 (2) 480
(3) 360 (4) 240

Q159. The number of ways of distributing 8 identical balls in 3 distinct boxes so that none of the boxes is empty is

(1) 5 (2) ${}^8C_3$
(3) 3^8 (4) 21

Q160. Let T_r be the rth term of an A.P. whose first term is a and common difference is d. If for some positive integers $m, n, m \neq n, T_m = \frac{1}{n}$ and $T_n = \frac{1}{m}$, then $a - d$ equals

(1) 0 (2) 1
(3) $\frac{1}{\mathrm{mn}}$ (4) $\frac{1}{m} + \frac{1}{n}$

Q161. The sum of the first n terms of the series $1^2 + 2 \cdot 2^2 + 3^2 + 2 \cdot 4^2 + 5^2 + 2 \cdot 6^2 + \ldots$ is $\frac{n(n+1)^2}{2}$ when n is even. When n is odd the sum is

(1) $\frac{3n(n+1)}{2}$ (2) $\frac{\mathrm{n}^2(\mathrm{n}+1)}{2}$
(3) $\frac{n(n+1)^2}{4}$ (4) $\left[\frac{\mathrm{n}(\mathrm{n}+1)}{2}\right]^2$

Q162. The sum of series $\frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + \ldots$ is

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

Q163. If $u = \sqrt{a^2\cos^2\theta + b^2\sin^2\theta} + \sqrt{a^2\sin^2\theta + b^2\cos^2\theta}$, then the difference between the maximum and minimum values of u^2 is given by

(1) $2\left(a^2 + b^2\right)$ (2) $2\sqrt{a^2 + b^2}$
(3) $(a + b)^2$ (4) $(a - b)^2$

Q164. Let $S(K) = 1 + 3 + 5 + \ldots + (2K - 1) = 3 + K^2$. Then which of the following is true?

(1) $S(1)$ is correct (2) Principle of mathematical induction can be used to prove the formula
(3) $S(K) \neq S(K + 1)$ (4) $\mathrm{S(K)} \Rightarrow \mathrm{S(K + 1)}$

Q165. The coefficient of the middle term in the binomial expansion in powers of x of $(1 + \alpha x)^4$ and of $(1 - \alpha x)^6$ is the same if α equals

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

Q166. The coefficient of x^n in expansion of $(1+x)(1-x)^n$ is

(1) $(n-1)$ (2) $(-1)^n(1-n)$

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

Q167. If $S_n = \sum_{r=0}^{n} \frac{1}{{}^nC_r}$ and $t_n = \sum_{r=0}^{n} \frac{r}{{}^nC_r}$, then $\frac{t_n}{S_n}$ is equal to

(1) $\frac{1}{2}$n (2) $\frac{1}{2}n - 1$

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

Q168. Let α, β be such that $\pi < \alpha - \beta < 3\pi$. If $\sin\alpha + \sin\beta = -\frac{21}{65}$ and $\cos\alpha + \cos\beta = -\frac{27}{65}$, then the value of $\cos\frac{\alpha-\beta}{2}$ is

(1) $-\frac{3}{\sqrt{130}}$ (2) $\frac{3}{\sqrt{130}}$

(3) $\frac{6}{65}$ (4) $-\frac{6}{65}$

Q169. Let $A(2,-3)$ and $B(-2,1)$ be vertices of a triangle ABC. If the centroid of this triangle moves on the line $2x+3y=1$, then the locus of the vertex C is the line

(1) $2x+3y=9$ (2) $2x-3y=7$

(3) $3x+2y=5$ (4) $3x-2y=3$

Q170. The equation of the straight line passing through the point $(4,3)$ and making intercepts on the co-ordinate axes whose sum is -1 is

(1) $\frac{x}{2}+\frac{y}{3}=-1$ and $\frac{x}{-2}+\frac{y}{1}=-1$ (2) $\frac{x}{2}-\frac{y}{3}=-1$ and $\frac{x}{-2}+\frac{y}{1}=-1$

(3) $\frac{x}{2}+\frac{y}{3}=1$ and $\frac{x}{2}+\frac{y}{1}=1$ (4) $\frac{x}{2}-\frac{y}{3}=1$ and $\frac{x}{-2}+\frac{y}{1}=1$

Q171. If one of the lines given by $6x^2 - xy + 4cy^2 = 0$ is $3x+4y=0$, then c equals

(1) 1 (2) -1

(3) 3 (4) -3

Q172. A line makes the same angle θ, with each of the x and z axis. If the angle β, which it makes with y-axis, is such that $\sin^2\beta = 3\sin^2\theta$, then $\cos^2\theta$ equals

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

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

Q173. If a circle passes through the point (a,b) and cuts the circle $x^2+y^2=4$ orthogonally, then the locus of its centre is

(1) $2ax+2by+\left(a^2+b^2+4\right)=0$ (2) $2ax+2by-\left(a^2+b^2+4\right)=0$

(3) $2ax-2by+\left(a^2+b^2+4\right)=0$ (4) $2ax-2by-\left(a^2+b^2+4\right)=0$

Q174. If the lines $2x+3y+1=0$ and $3x-y-4=0$ lie along diameters of a circle of circumference 10π, then the equation of the circle is

(1) $x^2+y^2-2x+2y-23=0$ (2) $x^2+y^2-2x-2y-23=0$

(3) $x^2+y^2+2x+2y-23=0$ (4) $x^2+y^2+2x-2y-23=0$

Q175. The intercept on the line $y=x$ by the circle $x^2+y^2-2x=0$ is AB. Equation of the circle on AB as a diameter is

(1) $x^2+y^2-x-y=0$ (2) $x^2+y^2-x+y=0$
(3) $\mathrm{x}^2+\mathrm{y}^2+\mathrm{x}+\mathrm{y}=0$ (4) $x^2+y^2+x-y=0$

Q176. A variable circle passes through the fixed point $A(p,q)$ and touches x-axis. The locus of the other end of the diameter through A is
(1) $(x-p)^2=4qy$ (2) $(x-q)^2=4py$
(3) $(y-p)^2=4qx$ (4) $(y-q)^2=4px$

Q177. If $a\neq 0$ and the line $2bx+3cy+4d=0$ passes through the points of intersection of the parabolas $y^2=4ax$ and $x^2=4ay$, then
(1) $d^2+(2b+3c)^2=0$ (2) $d^2+(3b+2c)^2=0$
(3) $d^2+(2b-3c)^2=0$ (4) $d^2+(3b-2c)^2=0$

Q178. The eccentricity of an ellipse, with its centre at the origin, is $\frac{1}{2}$. If one of the directrices is $x=4$, then the equation of the ellipse is
(1) $3x^2+4y^2=1$ (2) $3x^2+4y^2=12$
(3) $4x^2+3y^2=12$ (4) $4x^2+3y^2=1$

Q179. If $\lim_{x\to\infty}\left(1+\frac{a}{x}+\frac{b}{x^2}\right)^{2x}=e^2$, then the values of a and b, are
(1) $a\in \underline{\underline{R}},\ \mathrm{b}\in \underline{\underline{=}}$ (2) $a=1, b\in \underline{R}$
(3) $a\in \underline{\underline{R}}, b=2$ (4) $a=1$ and $b=2$

Q180. Let $f(x)=\frac{1-\tan x}{4x-\pi}, x\neq\frac{\pi}{4}, x\in\left[0,\frac{\pi}{2}\right]$. If $f(x)$ is continuous in $\left[0,\frac{\pi}{2}\right]$, then $f\left(\frac{\pi}{4}\right)$ is
(1) 1 (2) $\frac{1}{2}$
(3) $-\frac{1}{2}$ (4) -1

Q181. $\lim_{n\to\infty}\sum_{r=1}^{n}\frac{1}{n}e^{\frac{r}{n}}$ is
(1) e (2) $e-1$
(3) $1-e$ (4) $e+1$

Q182. Consider the following statements: Mode can be computed from histogram Median is not independent of change of scale Variance is independent of change of origin and scale.
(1) only (a) (2) only (b)
(3) only (a) and (b) (4) (a), (b) and (c)

Q183. In a series of $2n$ observations, half of them equal a and remaining half equal $-a$. If the standard deviation of the observations is 2 , then $|a|$ equals
(1) $\frac{1}{n}$ (2) $\sqrt{2}$
(3) 2 (4) $\frac{\sqrt{2}}{n}$

Q184. A person standing on the bank of a river observes that the angle of elevation of the top of a tree on the opposite bank of the river is 60° and when he retires 40 meter away from the tree the angle of elevation becomes 30°. The breadth of the river is
(1) 20 m (2) 30 m
(3) 40 m (4) 60 m

Q185. A particle moves towards east from a point A to a point B at the rate of 4 km/h and then towards north from B to C at the rate of 5 km/h. If $AB = 12$ km and $BC = 5$ km, then its average speed for its journey from A to C and resultant average velocity direct from A to C are respectively

(1) $\frac{17}{4}$ km/h and $\frac{13}{4}$ km/h
(2) $\frac{13}{4}$ km/h and $\frac{17}{4}$ km/h
(3) $\frac{17}{9}$ km/h and $\frac{13}{9}$ km/h
(4) $\frac{13}{9}$ km/h and $\frac{17}{9}$ km/h

Q186. The sides of a triangle are $\sin\alpha, \cos\alpha$ and $\sqrt{1+\sin\alpha\cos\alpha}$ for some $0 < \alpha < \frac{\pi}{2}$. Then the greatest angle of the triangle is

(1) 60°
(2) 90°
(3) 120°
(4) 150°

Q187. Let $R = \{(1,3),(4,2),(2,4),(2,3),(3,1)\}$ be a relation on the set $A = \{1,2,3,4\}$. The relation R is

(1) a function
(2) reflexive
(3) not symmetric
(4) transitive

Q188. Let $A = \begin{pmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{pmatrix}$ The only correct statement about the matrix A is

(1) A is a zero matrix
(2) $A^2 = I$
(3) A^{-1} does not exist
(4) $A = (-1)I$, where I is a unit matrix

Q189. Let $A = \begin{pmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{pmatrix}$ $(10)B = \begin{pmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{pmatrix}$. If B

(1) -2
(2) 5
(3) 2
(4) -1

Q190. If $a_1, a_2, a_3, \ldots, a_n, \ldots$ are in G.P., then the value of the determinant

$$\begin{vmatrix} \log a_n & \log a_{n+1} & \log a_{n+2} \\ \log a_{n+3} & \log a_{n+4} & \log a_{n+5} \\ \log a_{n+6} & \log a_{n+7} & \log a_{n+8} \end{vmatrix}, \text{ is}$$

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

Q191. The range of the function $f(x) = {}^{7-x}P_{x-3}$ is

(1) $\{1,2,3\}$
(2) $\{1,2,3,4,5\}$
(3) $\{1,2,3,4\}$
(4) $\{1,2,3,4,5,6\}$

Q192. If $f : R \to S$, defined by $f(x) = \sin x - \sqrt{3}\cos x + 1$, is onto, then the interval of S is

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

Q193. The graph of the function $y = f(x)$ is symmetrical about the line $x = 2$, then

(1) $f(x+2) = f(x-2)$
(2) $f(2+x) = f(2-x)$
(3) $f(x) = f(-x)$
(4) $f(x) = -f(-x)$

Q194. The domain of the function $f(x)=\frac{\sin^{-1}(x-3)}{\sqrt{9-x^2}}$ is

(1) $[2,3]$
(2) $[2,3)$
(3) $[1,2]$
(4) $[1,2)$

Q195. If $x=e^{y+e^{y+..10\infty}}, x>0$, then $\frac{dy}{dx}$ is

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

Q196. A point on the parabola $y^2=18x$ at which the ordinate increases at twice the rate of the abscissa is

(1) $(2,4)$
(2) $(2,-4)$
(3) $\left(\frac{-9}{8},\frac{9}{2}\right)$
(4) $\left(\frac{9}{8},\frac{9}{2}\right)$

Q197. A function $y=f(x)$ has a second order derivative $f''(x)=6(x-1)$. If its graph passes through the point $(2,1)$ and at that point the tangent to the graph is $y=3x-5$, then the function is

(1) $(x-1)^2$
(2) $(x-1)^3$
(3) $(x+1)^3$
(4) $(x+1)^2$

Q198. The normal to the curve $x=a(1+\cos\theta), y=a\sin\theta$ at ' θ ' always passes through the fixed point

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

Q199. If $2a+3b+6c=0$, then at least one root of the equation $ax^2+bx+c=0$ lies in the interval

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

Q200. If the sum of the slopes of the lines given by $x^2-2cxy-7y^2=0$ is four times their product, then c has the value

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

Q201. If $\int\frac{\sin x}{\sin(x-\alpha)}dx=Ax+B\log\sin(x-\alpha)+C$, then value of (A,B) is

(1) $(\sin\alpha,\cos\alpha)$
(2) $(\cos\alpha,\sin\alpha)$
(3) $(-\sin\alpha,\cos\alpha)$
(4) $(-\cos\alpha,\sin\alpha)$

Q202. $\int\frac{dx}{\cos x-\sin x}$ is equal to

(1) $\frac{1}{\sqrt{2}}\log\left|\tan\left(\frac{x}{2}-\frac{\pi}{8}\right)\right|+C$
(2) $\frac{1}{\sqrt{2}}\log\left|\cot\left(\frac{x}{2}\right)\right|+C$
(3) $\frac{1}{\sqrt{2}}\log\left|\tan\left(\frac{x}{2}-\frac{3\pi}{8}\right)\right|+C$
(4) $\frac{1}{\sqrt{2}}\log\left|\tan\left(\frac{x}{2}+\frac{3\pi}{8}\right)\right|+C$

Q203. The value of $\int_{-2}^{3}\left|1-x^2\right|dx$ is

(1) $\frac{28}{3}$
(2) $\frac{14}{3}$
(3) $\frac{7}{3}$
(4) $\frac{1}{3}$

Q204. The value of $I=\int_0^{\pi/2}\frac{(\sin x+\cos x)^2}{\sqrt{1+\sin 2x}}dx$ is

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

Q205. If $\int_0^{\pi} xf(\sin x)dx = A\int_0^{\pi/2} f(\sin x)dx$, then A is

(1) 0 (2) π

(3) $\frac{\pi}{4}$ (4) 2π

Q206. If $f(x) = \frac{e^x}{1+e^x}, l_1 = \int_{f(-a)}^{f(a)} xg\{x(1-x)\}dx$ and $I_2 = \int_{f(-a)}^{f(a)} g\{x(1-x)\}dx$ then the value of $\frac{l_2}{l_1}$ is

(1) 2 (2) -3

(3) -1 (4) 1

Q207. The area of the region bounded by the curves $y = |x-2|, x = 1, x = 3$ and the x-axis is

(1) 1 (2) 2

(3) 3 (4) 4

Q208. The differential equation for the family of curves $x^2 + y^2 - 2ay = 0$, where a is an arbitrary constant is

(1) $2\left(x^2 - y^2\right)y' = xy$ (2) $2\left(x^2 + y^2\right)y' = xy$

(3) $\left(x^2 - y^2\right)y' = 2xy$ (4) $\left(x^2 + y^2\right)y' = 2xy$

Q209. The solution of the differential equation $ydx + \left(x + x^2y\right)dy = 0$ is

(1) $-\frac{1}{xy} = C$ (2) $-\frac{1}{xy} + \log y = C$

(3) $\frac{1}{xy} + \log y = C$ (4) $\log y = Cx$

Q210. If the straight lines $x = 1 + s, y = -3 - \lambda s, z = 1 + \lambda s$ and $x = \frac{t}{2}, y = 1 + t, z = 2 - t$ with parameters s and t respectively, are co-planar then λ equals

(1) -2 (2) -1

(3) $-\frac{1}{2}$ (4) 0

Q211. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three non-zero vectors such that no two of these are collinear. If the vector $\vec{a} + 2\vec{b}$ is collinear with $\vec{c}$ and $\vec{b} + 3\vec{c}$ is collinear with $\vec{a}$ (λ being some non-zero scalar) then $\vec{a} + 2\vec{b} + 6\vec{c}$ equals

(1) $\lambda\vec{a}$ (2) $\lambda\vec{b}$

(3) $\lambda\overrightarrow{\mathbf{c}}$ (4) 0

Q212. A particle is acted upon by constant forces $4I + J - 3k$ and $3I + J - k$ which displace it from a point $\hat{i} + 2\hat{j} + 3\hat{k}$ to the point $5\hat{i} + 4\hat{j} + \hat{k}$. The work done in standard units by the forces is given by

(1) 40 (2) 30

(3) 25 (4) 15

Q213. If $\bar{a}, \bar{b}, \bar{c}$ are non-coplanar vectors and λ is a real number, then the vectors $\bar{a} + 2\bar{b} + 3\bar{c}, \lambda\bar{b} + 4\bar{c}$ and $(2\lambda - 1)\bar{c}$ are non-coplanar for

(1) all values of λ (2) all except one value of λ

(3) all except two values of λ (4) no value of λ

Q214. Let $\bar{a}, \bar{b}$ and $\bar{c}$ be non-zero vectors such that $(\bar{a} \times \bar{b}) \times \bar{c} = \frac{1}{3}|\bar{b}||\bar{c}|\bar{a}$. If θ is the acute angle between the vectors $\bar{b}$ and $\bar{c}$, then $\sin\theta$ equals

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

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

Q215. With two forces acting at a point, the maximum effect is obtained when their resultant is 4 N. If they act at right angles, then their resultant is 3 N. Then the forces are

(1) $(2+\sqrt{2})N$ and $(2-\sqrt{2})N$ (2) $(2+\sqrt{3})$N and $(2-\sqrt{3})$N

(3) $\left(2+\frac{1}{2}\sqrt{2}\right)$N and $\left(2-\frac{1}{2}\sqrt{2}\right)$N (4) $\left(2+\frac{1}{2}\sqrt{3}\right)$N and $\left(2-\frac{1}{2}\sqrt{3}\right)$N

Q216. In a right angle $\triangle$ABC, $\angle$A $= 90^\circ$ and sides a, b, c are respectively, 5 cm, 4 cm and 3 cm. If a force $\vec{F}$ has moments 0,9 and 16 in N cm. units respectively about vertices A, B and C, then magnitude of $\vec{F}$ is

(1) 3 (2) 4

(3) 5 (4) 9

Q217. Three forces $\vec{P}, \vec{Q}$ and $\vec{R}$ acting along IA, IB and IC, where I is the incentre of a $\triangle ABC$, are in equilibrium. Then $\vec{P} : \vec{Q} : \vec{R}$ is

(1) $\cos\frac{A}{2} : \cos\frac{B}{2} : \cos\frac{C}{2}$ (2) $\sin\frac{A}{2} : \sin\frac{B}{2} : \sin\frac{C}{2}$

(3) $\sec\frac{A}{2} : \sec\frac{B}{2} : \sec\frac{C}{2}$ (4) $\text{cosec}\frac{A}{2} : \text{cosec}\frac{B}{2} : \text{cosec}\frac{C}{2}$

Q218. A velocity $\frac{1}{4}$ m/s is resolved into two components along OA and OB making angles 30° and 45° respectively with the given velocity. Then the component along OB is

(1) $\frac{1}{8}$ m/s (2) $\frac{1}{4}(\sqrt{3}-1)$m/s

(3) $\frac{1}{4}$ m/s (4) $\frac{1}{8}(\sqrt{6}-\sqrt{2})$m/s

Q219. Distance between two parallel planes $2x+y+2z=8$ and $4x+2y+4z+5=0$ is

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

(3) $\frac{7}{2}$ (4) $\frac{9}{2}$

Q220. A line with direction cosines proportional to $2, 1, 2$ meets each of the lines $x = y + a = z$ and $x + a = 2y = 2z$. The co-ordinates of each of the point of intersection are given by

(1) $(3a, 3a, 3a), (a, a, a)$ (2) $(3a, 2a, 3a), (a, a, a)$

(3) $(3a, 2a, 3a), (a, a, 2a)$ (4) $(2a, 3a, 3a), (2a, a, a)$

Q221. The intersection of the spheres $x^2+y^2+z^2+7x-2y-z=13$ and $x^2+y^2+z^2-3x+3y+4z=8$ is the same as the intersection of one of the sphere and the plane

(1) $x-y-z=1$ (2) $x-2y-z=1$

(3) $x-y-2z=1$ (4) $2x-y-z=1$

Q222. Let $\bar{u}, \bar{v}, \bar{w}$ be such that $|\bar{u}|=1, |\bar{v}|=2, |\bar{w}|=3$. If the projection $\bar{v}$ along $\bar{u}$ is equal to that of $\overline{\text{w}}$ along $\overline{\text{u}}$ and $\overline{\text{v}}, \overline{\text{w}}$ are perpendicular to each other then $|\overline{\text{u}}-\overline{\text{v}}+\overline{\text{w}}|$ equals

(1) 2 (2) $\sqrt{7}$

(3) $\sqrt{14}$ (4) 14

Q223. The probability that A speaks truth is $\frac{4}{5}$, while this probability for B is $\frac{3}{4}$. The probability that they contradict each other when asked to speak on a fact is

(1) $\frac{3}{20}$ (2) $\frac{1}{5}$

(3) $\frac{7}{20}$ (4) $\frac{4}{5}$

Q224. A random variable X has the probability distribution:

X :	1	2	3	4	5	6	7	8
p(X) :	0.15	0.23	0.12	0.10	0.20	0.08	0.07	0.05

For the events $E = \{X \text{ is a prime number }\}$ and $F = \{X < 4\}$, the probability $P(E \cup F)$ is

(1) 0.87
(2) 0.77
(3) 0.35
(4) 0.50

Q225. The mean and the variance of a binomial distribution are 4 and 2 respectively. Then the probability of 2 successes is

(1) $\frac{37}{256}$
(2) $\frac{219}{256}$
(3) $\frac{128}{256}$
(4) $\frac{28}{256}$

ANSWER KEYS

1. (1)	**2.** (3)	**3.** (3)	**4.** (4)	**5.** (1)	**6.** (3)	**7.** (2)	**8.** (4)
9. (1)	**10.** (1)	**11.** (1)	**12.** (2)	**13.** (2)	**14.** (2)	**15.** (2)	**16.** (3)
17. (4)	**18.** (2)	**19.** (3)	**20.** (4)	**21.** (1)	**22.** (2)	**23.** (1)	**24.** (2)
25. (3)	**26.** (4)	**27.** (4)	**28.** (3)	**29.** (3)	**30.** (4)	**31.** (2)	**32.** (1)
33. (3)	**34.** (3)	**35.** (2)	**36.** (3)	**37.** (2)	**38.** (1)	**39.** (2)	**40.** (4)
41. (4)	**42.** (2)	**43.** (1)	**44.** (3)	**45.** (3)	**46.** (1)	**47.** (2)	**48.** (1)
49. (1)	**50.** (4)	**51.** (2)	**52.** (2)	**53.** (2)	**54.** (2)	**55.** (1)	**56.** (3)
57. (2)	**58.** (2)	**59.** (2)	**60.** (3)	**61.** (4)	**62.** (3)	**63.** (3)	**64.** (2)
65. (1)	**66.** (4)	**67.** (2)	**68.** (2)	**69.** (4)	**70.** (3)	**71.** (2)	**72.** (2)
73. (3)	**74.** (1)	**75.** (4)	**76.** (3)	**77.** (4)	**78.** (3)	**79.** (3)	**80.** (4)
81. (1)	**82.** (1)	**83.** (3)	**84.** (4)	**85.** (3)	**86.** (4)	**87.** (4)	**88.** (3)
89. (2)	**90.** (1)	**91.** (3)	**92.** (3)	**93.** (3)	**94.** (3)	**95.** (1)	**96.** (2)
97. (2)	**98.** (1)	**99.** (4)	**100.** (2)	**101.** (2)	**102.** (2)	**103.** (4)	**104.** (3)
105. (1)	**106.** (4)	**107.** (4)	**108.** (2)	**109.** (1)	**110.** (3)	**111.** (3)	**112.** (4)
113. (1)	**114.** (3)	**115.** (1)	**116.** (2)	**117.** (3)	**118.** (4)	**119.** (4)	**120.** (4)
121. (3)	**122.** (3)	**123.** (1)	**124.** (3)	**125.** (1)	**126.** (1)	**127.** (2)	**128.** (3)
129. (3)	**130.** (2)	**131.** (1)	**132.** (3)	**133.** (2)	**134.** (3)	**135.** (1)	**136.** (2)
137. (1)	**138.** (2)	**139.** (1)	**140.** (4)	**141.** (3)	**142.** (3)	**143.** (2)	**144.** (2)
145. (1)	**146.** (4)	**147.** (2)	**148.** (2)	**149.** (4)	**150.** (2)	**151.** (1)	**152.** (4)
153. (3)	**154.** (1)	**155.** (3)	**156.** (2)	**157.** (4)	**158.** (3)	**159.** (4)	**160.** (1)
161. (2)	**162.** (2)	**163.** (4)	**164.** (4)	**165.** (3)	**166.** (2)	**167.** (1)	**168.** (1)
169. (1)	**170.** (4)	**171.** (4)	**172.** (3)	**173.** (2)	**174.** (1)	**175.** (1)	**176.** (1)
177. (1)	**178.** (2)	**179.** (2)	**180.** (3)	**181.** (2)	**182.** (3)	**183.** (3)	**184.** (1)
185. (1)	**186.** (3)	**187.** (3)	**188.** (2)	**189.** (2)	**190.** (1)	**191.** (1)	**192.** (4)
193. (2)	**194.** (2)	**195.** (3)	**196.** (4)	**197.** (2)	**198.** (1)	**199.** (1)	**200.** (3)
201. (2)	**202.** (4)	**203.** (1)	**204.** (3)	**205.** (2)	**206.** (1)	**207.** (1)	**208.** (3)
209. (2)	**210.** (1)	**211.** (4)	**212.** (1)	**213.** (3)	**214.** (4)	**215.** (3)	**216.** (3)
217. (1)	**218.** (4)	**219.** (3)	**220.** (2)	**221.** (4)	**222.** (3)	**223.** (3)	**224.** (2)
225. (4)							