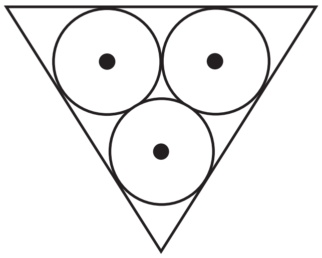
Q1. In an equilateral triangle, 3 coins of radii 1 unit each are kept so that they touch each other and also the sides of the triangle. Area of the triangle is-



(a) $4+2\sqrt{3}$

(b) $6+4\sqrt{3}$

(c) $12+\frac{7\sqrt{3}}{4}$

(d) $3+\frac{7\sqrt{3}}{4}$

Q2. In a triangle the sum of two sides is x and the product of the same sides is y. If $x^2 - c^2 = y$, where c is the third side of the triangle, then the ratio of the in radius to the circum-radius of the triangle is-

(a) $\frac{3y}{2x(x+c)}$

(b) $\frac{3y}{2c(x+c)}$

(c) $\frac{3y}{4x(x+c)}$

(d) $\frac{3y}{2c(x+c)}$

Q3. If 0 < x < 1, then

$\sqrt{1+x^2}$ [{x cos(cot^{-1} x) + sin(cot^{-1} x)}2 - 1]$^{1/2}$ =

(a) $\frac{x}{\sqrt{1+x^2}}$

(b) x

(c) $x\sqrt{1+x^2}$

(d) $\sqrt{1+x^2}$

Q4. The value of $\cot\left(\sum_{n=1}^{23}\cot^{-1}\left(1+\sum_{k=1}^{n}2k\right)\right)$ is-

(a) $\frac{23}{25}$

(b) $\frac{25}{23}$

(c) $\frac{23}{24}$

(d) $\frac{24}{23}$

Q5. A bird is sitting on the top of a vertical pole 20 m high and its elevation from a point O on the ground is 45° . It flies off horizontally straight away from the point O. After one second, the elevation of the bird from O is reduced to 30°. Then the speed(in m/s) of the bird is-

(a) $20\sqrt{2}$

(b) $20\left(\sqrt{3}-1\right)$

(c) $40\left(\sqrt{2}-1\right)$

(d) $40\left(\sqrt{3}-\sqrt{2}\right)$

Q6. AB is a vertical pole with B at the ground level and A at the top. A man finds that the angle of elevation of the point A from a certain point C on the ground is 60°. He moves away from the pole along the line BC to a point D such that CD = 7 m. From D the angle of elevation of the point A is 45°. Then the height of the pole is-

(a) $\frac{7\sqrt{3}}{2}\frac{1}{\sqrt{3}-1}m$

(b) $\frac{7\sqrt{3}}{2}\left(\sqrt{3}+1\right)m$

(c) $\frac{7\sqrt{3}}{2}\left(\sqrt{3}-1\right)m$

(d) $\frac{7\sqrt{3}}{2}\frac{1}{\sqrt{3}+1}m$

Q7. The sides of a triangle are $3x + 4y$, $4x + 3y$ and $5x + 5y$ where $x, y > 0$ then the triangle is-

(a) Right angled

(b) Obtuse angled

(c) Equilateral

(d) None of these

Q8. In a triangle ABC, the median to the side BC is of length $\frac{1}{\sqrt{11-6\sqrt{3}}}$ and it divide the angle A into angles 30° and 45°, then the length of side BC is-

(a) 1 unit

(b) 3 unit

(c) 2 unit

(d) 4 unit

Q9. In a triangle of base a the ratio of the other two sides is r (< 1) then the altitude of the triangle is-

(a) $\leq \frac{ar}{1-r^2}$

(b) $\geq \frac{ar}{1-r^2}$

(c) $> \frac{ar}{1-r^2}$

(d) $< \frac{ar}{1-r^2}$

Q10. If I_n is the area of n sided regular polygon inscribed in a circle of unit radius and O_n be the area of polygon circumscribing the given circle then I_n =

(a) $\frac{O_n}{2}\left(1-\sqrt{1+\left(\frac{2I_n}{n}\right)^2}\right)$

(b) $\frac{O_n}{2}\left(1+\sqrt{1-\left(\frac{2I_n}{n}\right)^2}\right)$

(c) $2O_n\left(1-\sqrt{1-\left(\frac{2I_n}{n}\right)^2}\right)$

(d) $2O_n\left(1+\sqrt{1-\left(\frac{2I_n}{n}\right)^2}\right)$

Q11. The sides of a triangle are sin α, cos α and $\sqrt{1+\sin\alpha\ \cos\alpha}$ for some 0 < α < Π/2. Then the greatest angle of the triangle is-

(a) 150°

(b) 90°

(c) 120°

(d) 60°

Q12. If in a ΔABC $a\cos^2\left(\frac{C}{2}\right)+c\cos^2\left(\frac{A}{2}\right)=\frac{3b}{2}$ then the sides a, b and c

(a) Satisfy $a + b = c$
(b) Are in A.P
(c) Are in G.P
(d) Are in H.P

Q13. The minimum value of $3\cos x + 4\sin x + 5$ is-

(a) 5
(b) 9
(c) 7
(d) 0

Q14. If $\alpha + \beta - \gamma = \pi$ then $\sin^2\alpha + \sin^2\beta - \sin^2\gamma =$

(a) $2\sin\alpha\ \sin\beta\cos\gamma$
(b) $2\cos\alpha\ \cos\beta\cos\gamma$
(c) $2\sin\alpha\ \sin\beta\sin\gamma$
(d) $2\sin\alpha\ \sin\gamma\cos\beta$

Q15. If $\tan x+\tan\left(\frac{\pi}{3}+x\right)+\tan\left(\frac{\pi}{3}+x\right)=3$ then-

(a) $\tan x = 1$
(b) $\tan 2x = 1$
(c) $\tan 3x = 1$
(d) None of these

Q16. If $f(x) = \cos^2 x + \sec^2 x$, then $f(x)$ cannot be-

(a) $f(x) < 1$
(b) $f(x) = 1$
(c) $2 < f(x) < 1$
(d) $f(x) \geq 2$

Q17. The number of solutions of equation $\tan x + \sec x = 2\cos x$ lying in the interval $[0, 2\pi]$ is-

(a) 0
(b) 1
(c) 2
(d) 3

Q18. If $\frac{\sin^4 x}{2}+\frac{\cos^4 x}{3}=\frac{1}{5}$ then-

(a) $\tan^2 x=\frac{2}{3}$
(b) $\frac{\sin^8 x}{8}+\frac{\cos^8 x}{27}=\frac{1}{125}$
(c) $\tan^2 x=\frac{1}{3}$
(d) $\frac{\sin^8 x}{8}+\frac{\cos^8 x}{27}=\frac{2}{125}$

Q19. For $0 < \phi < \frac{\pi}{2}$, if $x=\sum_{n=0}^{\infty}\cos^{2n}\phi$, $y=\sum_{n=0}^{\infty}\sin^{2n}\phi$, $z=\sum_{n=0}^{\infty}\sin^{2n}\phi$, then xyz =

(a) xy + z
(b) xz + y
(c) x + y + z
(d) yz + x

Q20. The value of

$$\sum_{k=1}^{13} \frac{1}{\sin\left(\frac{\pi}{4}+\frac{(k-1)\pi}{6}\right)\sin\left(\frac{\pi}{4}+\frac{k\pi}{6}\right)}$$

is equal to-

(a) $3-\sqrt{3}$

(b) $2\left(3-\sqrt{3}\right)$

(c) $2\left(\sqrt{3}-1\right)$

(d) $2\left(2+\sqrt{3}\right)$

Q21. General solution of

$\sin x+\cos x=\min\limits_{9\in IR}\{1,a^2-4a+6\}$

is-

(a) $\frac{n\pi}{2}+(-1)^n\frac{\pi}{4}$

(b) $2n\pi+(-1)^n\frac{\pi}{4}$

(c) $n\pi+(-1)^{n+1}\frac{\pi}{4}$

(d) $n\pi+(-1)^n\frac{\pi}{4}-\frac{\pi}{4}$

Q22. If in any ΔABC, $\cot\frac{A}{2},\ \cot\frac{B}{2},\ \cot\frac{C}{2}$

are in A. P. then-

(a) $\cot\frac{A}{2}\cot\frac{B}{2}=4$

(b) $\cot\frac{A}{2}\cot\frac{C}{2}=3$

(c) $\cot\frac{B}{2}\cot\frac{C}{2}=1$

(d) $\cot\frac{B}{2}\cot\frac{C}{2}=0$

Q23. The value of θ lying between θ = 0 and θ = Π/2 and satisfying the equation-

$$\begin{vmatrix} 1+\sin^2\theta & \cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & 1+\cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & \cos^2\theta & 1+4\sin 4\theta \end{vmatrix}=0, \text{ are}$$

(a) $\frac{7\pi}{24}$

(b) $\frac{5\pi}{24}$

(c) $\frac{11\pi}{24}$

(d) $\frac{\pi}{24}$

Q24. For 0 < θ < π/2, The solution(s) of

$$\sum_{m=1}^{6} \operatorname{cosec}\left(\theta+\frac{(m-1)\pi}{4}\right)\operatorname{cosec}\left(\theta+\frac{m\pi}{4}\right)=4\sqrt{2}$$

Is (are)-

(a) $\frac{\pi}{4}$

(b) $\frac{\pi}{6}$

(c) $\frac{\pi}{12}$

(d) $\frac{5\pi}{12}$

Q25. If In = sinⁿθ + cosⁿθ, then $\frac{T_6-T_4}{T_6}=m$

holds for values of m satisfying-

(a) $m\in\left[-1,\ \frac{-1}{3}\right]$

(b) $m\in\left[0,\ \frac{1}{3}\right]$

(c) $m\in[-1,\ 0]$

(d) $m\in\left[-1,\ \frac{-1}{2}\right]$

Q26. If $\alpha = 3\sin^{-1}\left(\frac{6}{11}\right)$

and $\beta = 3\cos^{-1}\left(\frac{4}{9}\right)$,

where the inverse trigonometric functions take only the principle values, then the correct option(s) is (are)-

(a) $\cos\beta > 0$

(b) $\sin\beta > 0$

(c) $\cos(\alpha + \beta) > 0$

(d) $\cos\alpha < 0$

Q27. The trigonometric equation $\sin^{-1}x = 2\sin^{-1}\alpha$ has a solution for

(a) $|a| \le \frac{1}{\sqrt{2}}$

(b) $\frac{1}{2} < |a| < \frac{1}{\sqrt{2}}$

(c) All real values of a

(d) $|a| < \frac{1}{\sqrt{2}}$

Q28. Let $\tan^{-1}y = \tan^{-1}x + \tan^{-1}\left(\frac{2x}{1-x^2}\right)$,

where $|x| < \frac{1}{\sqrt{3}}$ then a value of y is-

(a) $\frac{3x - x^3}{1 + 3x^2}$

(b) $\frac{3x + x^3}{1 + 3x^2}$

(c) $\frac{3x - x^3}{1 - 3x^2}$

(d) $\frac{3x + x^3}{1 - 3x^2}$

Q29. In a triangle ABC, $2ac\sin\frac{1}{2}(A - B + C) =$

(a) $a^2 + b^2 - c^2$

(b) $c^2 + a^2 - b^2$

(c) $b^2 - c^2 - a^2$

(d) $c^2 - a^2 - b^2$

Q30. In a triangle XYZ, let x, y, z be the lengths of sides opposite to the angles X, Y, Z, respectively, and $2s = x + y + z$.

If $\frac{s-x}{4} = \frac{s-y}{3} = \frac{s-z}{2}$ and area of incircle of the triangle XYZ is $\frac{8\pi}{3}$, then-

(a) Area of the triangle XYZ is $6\sqrt{6}$

(b) The radius of circumcircle of the triangle XYZ is $\frac{35}{6}\sqrt{6}$

(c) $\sin\frac{X}{2}\sin\frac{Y}{2}\sin\frac{Z}{2} = \frac{4}{35}$

(d) $\sin^2\left(\frac{X+Y}{2}\right) = \frac{3}{5}$

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(d) $|a| < \frac{1}{\sqrt{2}}$

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where $|x| < \frac{1}{\sqrt{3}}$ then a value of y is-

(a) $\frac{3x-x^3}{1+3x^2}$

(b) $\frac{3x+x^3}{1+3x^2}$

(c) $\frac{3x-x^3}{1-3x^2}$

(d) $\frac{3x+x^3}{1-3x^2}$

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(d) $\sin^2\left(\frac{X+Y}{2}\right) = \frac{3}{5}$

Q37. A thin uniform rod of length l and mass m is swinging freely about a horizontal axis passing through its end. Its maximum angular speed is ω. Its centre of mass rises to a maximum height of-

(a) $\frac{1}{6}\frac{l\omega}{g}$

(b) $\frac{1}{2}\frac{l^2\omega^2}{g}$

(c) $\frac{1}{6}\frac{l^2\omega^2}{g}$

(d) $\frac{1}{3}\frac{l^2\omega^2}{g}$

Q38. A mass m hangs with the help of a string wrapped around a pulley on a frictionless bearing. The pulley has mass m and radius R. Assuming Pulley to be a perfect uniform circular disc, the acceleration of the mass m, if the string does not slip on the pulley, is-

(a) g

(b) $\frac{2}{3}g$

(c) $\frac{g}{3}$

(d) $\frac{3}{2}g$

Q39. A pulley of radius 2 m is rotated about its axis by a force $F = (20t - 5t^2)$ newton (where t is measured in seconds) applied tangentially. If the moment of inertia of the pulley about its axis of rotation is $10\ kg\text{-}m^2$ the number of rotations made by the pulley before its direction of motion is reversed, is-

(a) More than 3 but less than 6

(b) More than 6 but less than 9

(c) More than 9

(d) Less than 3

Q40. A hoop of radius r and mass m rotating with an angular velocity ω_0 is placed on a rough horizontal surface. The initial velocity of the centre of the hoop is zero. What will be velocity of the centre of the hoop when it ceases to slip?

(a) $\frac{r\omega_0}{4}$

(b) $\frac{r\omega_0}{3}$

(c) $\frac{r\omega_0}{2}$

(d) $r\omega_0$

Q41. A bob of mass m attached to an inextensible string of length l is suspended from a vertical support. The bob rotates in a horizontal circle with an angular speed ω rad/s about the vertical. About the point of suspension-

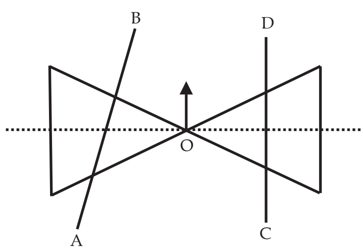
(a) Angular momentum is conserved.

(b) Angular momentum changes in magnitude but not in direction

(c) Angular momentum changes in direction but not in magnitude

(d) Angular momentum changes both in direction and magnitude

Q42. A roller is made by joining together two cones at their vertices *O*. It is kept on two rails *AB* and *CD*, which are placed asymmetrically (see figure), with its axis perpendicular to *CD* and its centre *O* at the centre of line joining *AB* and *Cd* (see figure). It is given a light push so that it stars rolling with its centre *O* moving parallel to *CD* in the direction shown . As it moves, the roller will tend to-



(a) Go straight.

(b) Turn left and right alternately.

(c) Turn left

(d) Turn right.

Q43. Two spherical bodies of mass *M* and *5M* & radii *R* & *2R* respectively are released in free space with initial separation between their centres equal to *12R*. If they attract each other due to gravitational force only, then the distance covered by the smaller body just before collision is-

(a) 2.5 *R*

(b) 4.5 *R*

(c) 7.5 *R*

(d) 1.5 *R*

Q44. Suspose the gravitational force varies inversely as the nth power of distance. Then the time period of a planet in circular orbit of radius '*R*' around the sum will be proportional to-

(a) R^n

(b) $R^{\left(\frac{n-1}{2}\right)}$

(c) $R^{\left(\frac{n+1}{2}\right)}$

(d) $R^{\left(\frac{n-2}{2}\right)}$

Q45. Four particles, each of mass *M* and equidistant from each other, move along a circle of radius *R* under the action of their mutual gravitational attraction. The speed of each particle is-

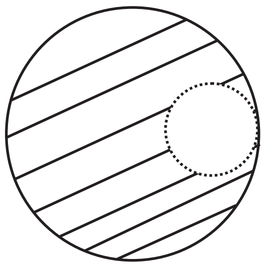
(a) $\sqrt{\frac{GM}{R}}$

(b) $\sqrt{2\sqrt{2}\frac{GM}{R}}$

(c) $\sqrt{\frac{GM}{R}\left(1+2\sqrt{2}\right)}$

(d) $\frac{1}{2}\sqrt{\frac{GM}{R}\left(1+2\sqrt{2}\right)}$

Q46. From a solid sphere of mass M and radius R, a spherical portion of radius $R/2$ is removed, as shown in the figure. Taking gravitational potential $V = 0$ at $r = \infty$, the potential at the centre of the cavity thus formed is-
(G = gravitational constant)



(a) $\frac{-2GM}{3R}$

(b) $\frac{-2GM}{R}$

(c) $\frac{-GM}{2R}$

(d) $\frac{-GM}{R}$

Q47. A satellite is revolving in a circular orbit at a height 'h' from the earth's surface (radius of earth R; $h \ll R$). The minimum increase in its orbital velocity required, so that the satellite could escape from the earth's gravitational field, is close to:(Neglect the effect of atmosphere.)

(a) $\sqrt{\frac{gR}{2}}$

(b) $\sqrt{gR}\left(\sqrt{2}-1\right)$

(c) $\sqrt{2gR}$

(d) $\sqrt{gR}$

Q48. Two bodies of masses m and $4\,m$ are placed at a distance r. The gravitational potential at a point on the line joining them where the gravitational field is zero is-

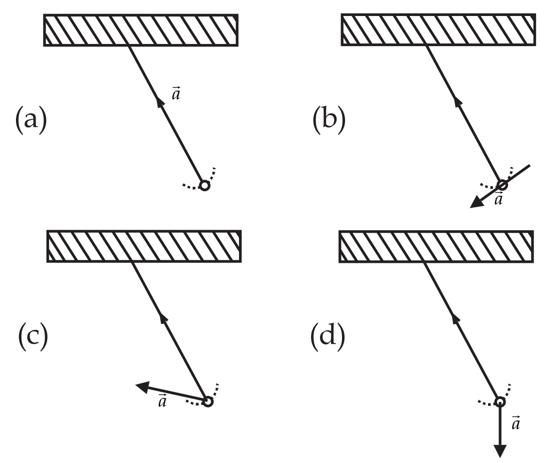
(a) $-\frac{4Gm}{r}$

(b) $-\frac{6Gm}{r}$

(c) $-\frac{9Gm}{r}$

(d) Zero

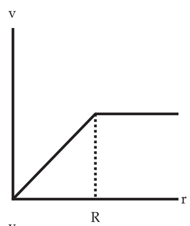
Q49. A simple pendulum is oscillating without damping. When the displacement of the bob is less than maximum, its acceleration vector $\vec{a}$ is correctly shown in-

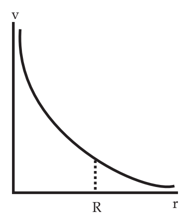


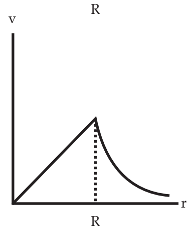
Q50. A spherically symmetric gravitational system of particles has a mass density

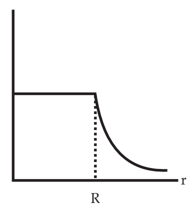
$$\rho = \begin{cases} \rho_0 & \text{for } r \le R \\ 0 & \text{for } r > R \end{cases}$$

where ρ_0 is a constant. A test mass can undergo circular motion under the influence of the gravitational field of particles. Its speed v as a function of distance r ($0 < r < \infty$) from the centre of the system is represented by-

(a) 

(b) 

(c) 

(d) 

Q51. A thin uniform annular disc (see figure) of mass M has outer radius $4R$ and inner radius $3R$. The work required to take a unit mass from point P on its axis to infinity is-

(a) $\frac{2GM}{7R}\left(4\sqrt{2}-5\right)$

(b) $-\frac{2GM}{7R}\left(4\sqrt{2}-5\right)$

(c) $\frac{GM}{4R}$

(d) $\frac{2GM}{5R}\left(\sqrt{2}-1\right)$

Q52. A planet of radius $R = \frac{1}{10} \times$ (radius of Earth) has the same mass density as earth. Scientists dig a well of depth $R/5$ on it and lower a wire of the same length and a linear mass density $10^{-3}\ kg\ m^{-1}$ into it. If the wire is not touching anywhere, the force applied at the top of the wire by a person holding it in place is (take the radius of Earth = $6 \times 10^{6}\ m$ and the acceleration due to gravity on Earth is $10\ ms^{-2}$)-

(a) 96N

(b) 108N

(c) 120N

(d) 150N

Q53. A particle perform simple harmonic motion with amplitude A. Its speed is trebled at the instant that it is at a distance $\frac{2A}{3}$ form equilibrium position. The new amplitude of the motion is-

(a) $A\sqrt{3}$

(b) $\frac{7A}{3}$

(c) $\frac{A}{3}\sqrt{41}$

(d) $3A$

Q54. A pendulum made of a uniform wire of cross sectional area *A* has time period *T*. When an additional mass *M* is added to its bob, the time period changes to T_M. If the young's modulus of the material of the wire is *Y* then $\frac{1}{Y}$ is equal to-
(g = gravitational acceleration)

(a) $\left[1-\left(\frac{T_M}{T}\right)^2\right]\frac{A}{Mg}$

(b) $\left[1-\left(\frac{T}{T_M}\right)^2\right]\frac{A}{Mg}$

(c) $\left[\left(\frac{T_M}{T}\right)^2-1\right]\frac{A}{Mg}$

(d) $\left[\left(\frac{T_M}{T}\right)^2-1\right]\frac{A}{Mg}$

Q55. A particle moves with simple harmonic motion in a straight line. In first τs, after starting from rest it travels a distance *a*, and in next τ s it travels 2*a*, in same direction, then-

(a) Amplitude of motion is 3*a*

(b) Time period of oscillations is 8τ

(c) Amplitude of motion is 4*a*

(d) Time period of oscillations is 6τ

Q56. An ideal gas enclosed in a vertical cylindrical container supports a freely moving piston of mass *M*. The piston and the cylinder have equal cross sectional area *A*. When the piston is in equilibrium, the volume of the gas is V_0 and its pressure is P_0. The piston is slightly displaced from the equilibrium position and released. Assuming that the system is completely isolated from its surrounding, the piston executes a simple harmonic motion with frequency-

(a) $\frac{1}{2\pi}\frac{A\gamma P_0}{V_0 M}$

(b) $\frac{1}{2\pi}\frac{V_0 M P_0}{A^2\gamma}$

(c) $\frac{1}{2\pi}\sqrt{\frac{A^2\gamma P_0}{MV_0}}$

(d) $\frac{1}{2\pi}\sqrt{\frac{MV_0}{A\gamma P_0}}$

Q57. The amplitude of a damped oscillator decreases to 0.9 times its original magnitude in 5s. In another 10s it will decrease to α times its original magnitude, where α equals-

(a) 0.7

(b) 0.81

(c) 0.729

(d) 0.6

Q58. A mass M is suspended from a spring from a spring of negligible mass. The spring is pulled a little and then released so that the mass executes SHM of time period T. If the mass is increased by m, the period becomes $\frac{5T}{3}$

Then the ratio of $\frac{m}{M}$ is-

(a) $\frac{3}{5}$

(b) $\frac{25}{9}$

(c) $\frac{16}{9}$

(d) $\frac{5}{3}$

Q59. 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 $(4/3) \times 1000$ kg/m^3. What relationship between t and t_0 is true-

(a) $t = 2t_0$

(b) $t = t_0/2$

(c) $t = t_0$

(d) $t = 4t_0$

Q60. Two particles are executing simple harmonic motion of the same amplitude A and frequency ω along the x-axis. Their mean position is separated by distance $X_0(X_0 > A)$. If the maximum separation between them is $(X_0 + A)$, the phase difference between their motion is-

(a) $\frac{\pi}{3}$

(b) $\frac{\pi}{4}$

(c) $\frac{\pi}{6}$

(d) $\frac{\pi}{2}$

Q61. The wavelength associated with a golf ball weighing 200 g and moving with a speed of 5 m/hr is of the order of-

(a) 10^{-10} m

(b) 10^{-29} m

(c) 10^{-30} m

(d) 10^{-40} m

Q62. The number of nodal planes in p_x - orbital is-

(a) one

(b) two

(c) three

(d) zero

Q63. The electronic configuration of an element is $1s^2\ 2s^2\ 2p^6,\ 3s^2\ 3p^6\ 3d^5,\ 4s^1$. This represents-

(a) Excited state

(b) Ground state

(c) Cationic state

(d) Anionic state

Q64. The quantum numbers $+\frac{1}{2}$ and $-\frac{1}{2}$ for the electron spin represents-

(a) Rotation of the electron in clockwise and anticlockwise directions respectively

(b) Rotation of the electron in anticlockwise and clockwise directions respectively

(c) Magnetic moment of electron pointing up and down respectively

(d) Two quantum mechanical spin states which have no classical analogues

Q65. Rutherford's experiment, which established the nuclear model of the atom, used a beam of-

(a) β-particles, which impinged on a metal foil and got absorbed

(b) γ-rays, which impinged on a metal foil and ejected electrons

(c) Helium atoms, which impinged on a metal foil and got scattered

(d) Helium nuclei, which impinged on a metal foil and got scattered

Q66. How many moles of electrons weigh one kilogram?
(Mass of electron = 9.108×10^{-31} kg, Avogadro's number = 6.023×10^{23})–

(a) 6.023×10^{23}

(b) $\frac{1}{9.108} \times 10^{31}$

(c) $\frac{6.023}{9.108} \times 10^{54}$

(d) $\frac{1}{9.108 \times 6.023} \times 10^{8}$

Q67. If the electronic configuration of nitrogen had $1s^7$, it would have energy lower than that of the normal ground state configuration $1s^2\ 2s^2\ 2p^3$ because the electrons would be closer to the nucleus. Yet $1s^7$ is not observed because it violates-

(a) Heisenberg uncertainty principle

(b) Hund's rule

(c) Pauli's exclusion principle

(d) Bohr postulates of stationary orbits

Q68. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is (a_0 is Bohr radius)-

(a) $\frac{h^2}{4\pi^2 m a_0^2}$

(b) $\frac{h^2}{16\pi^2 m a_0^2}$

(c) $\frac{h^2}{32\pi^2 m a_0^2}$

(d) $\frac{h^2}{64\pi^2 m a_0^2}$

Q69. A light whose frequency is equal to 6×10^{14} Hz is incident on a metal whose work function is 2eV ($h = 6.63 \times 10^{-34}$ Js, 1eV = 1.6×10^{-19} J). The maximum energy of electrons emitted will be-

(a) 2.49 eV

(b) 4.49 eV

(c) 0.49 eV

(d) 5.49 eV

Q70. Which one of the following sets of quantum numbers is not possible for an electron in the ground state of an atom with atomic number 19?

(a) $n = 2, l = 0, m = 0$

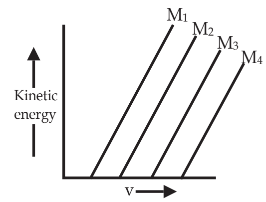
(b) $n = 2, l = 1, m = 0$

(c) $n = 3, l = 1, m = -1$

(d) $n = 3, l = 2, m = \pm 2$

(e) $n = 4, l = 0, m = 0$

Q71. A plot of the kinetic energy $\frac{1}{2}mv^2$ of ejected electrons as a function of the frequency (v) of incident radiation for four alkali metals (M_1, M_2, M_3, M_4) is given below-



The alkali metals M_1, M_2, M_3, M_4 are respectively

(a) Li, Na, K and Rb

(b) Rb, K, Na and Li

(c) Na, K, Li and Rb

(d) Rb, Li, Na and K

Q72. In Sommerfeld's modification of Bohr's theory, the trajectory of an electron in a hydrogen atom is-

(a) Perfect ellipse

(b) A closed ellipse like curve, narrower at the perihelion position and flatter at the aphelion position

(c) A closed loop on spherical surface

(d) A rosette

Q73. Energy of an electron is given by,

$$E = -2.178 \times 10^{-18} \left(\frac{Z^2}{n^2}\right) J$$

Wavelength of light required to excite an electron in hydrogen atom from level $n = 1$ to $n = 2$ will be ($h = 6.62 \times 10^{-34}$ Js and $c = 3 \times 10^8$ ms^{-1})-

(a) 6.500×10^{-7} m

(b) 8.500×10^{-7} m

(c) 1.214×10^{-7} m

(d) 2.816×10^{-7} m

Q74. The correct set of four quantum numbers for the valence electron of rubidium atom (Z = 37) is-

(a) $5, 1, 1, +\frac{1}{2}$

(b) $5, 0, 1, +\frac{1}{2}$

(c) $5, 0, 0, +\frac{1}{2}$

(d) $5, 1, 0, +\frac{1}{2}$

Q75. Which of the following is the energy of a possible excited state of hydrogen?

(a) +6.8 eV

(b) +13.6 eV

(c) -6.8 eV

(d) +3.4 eV

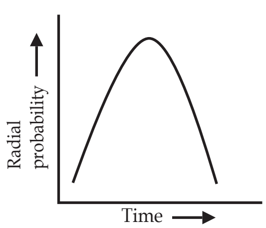
Q76. Radial probability distribution curve is shown for s-orbital. The curve is-

(a) 1*s*

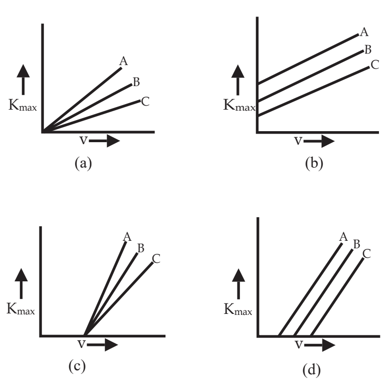
(b) 2*s*

(c) 3*s*

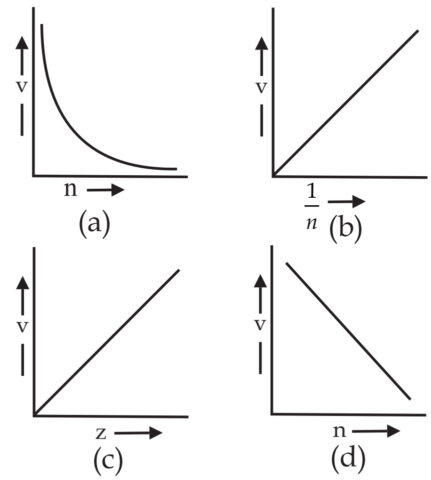
(d) 4*s*



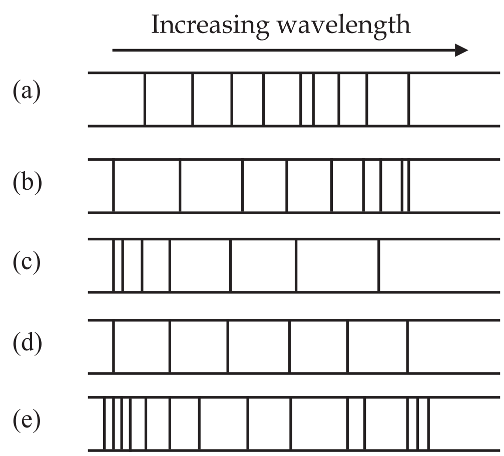
Q77. For three different metals *A, B, C* photoemission is observed one by one. The graph of maximum kinetic energy versus frequency of incident radiation are sketched as-



Q78. Which of the following graphs is incorrect?



Q79. Which diagram represents the best appearance of the line spectrum of atomic hydrogen in the visible region?



Q80. Hydrogen $\left({}^{1}_{1}H\right)$, deuterium $\left({}^{2}_{1}H\right)$, singly ionised helium $\left({}^{4}_{2}He^{+}\right)$ and doubly ionised lithium $\left({}^{6}_{3}Li^{2+}\right)$ all have one electron around the nucleus, Consider an electron transition from $n = 2$ to $n = 1$. If the wavelengths of emitted radiation are λ_1, λ_2, λ_3, and λ_4 respectively. Then approximately which one of the following is correct?

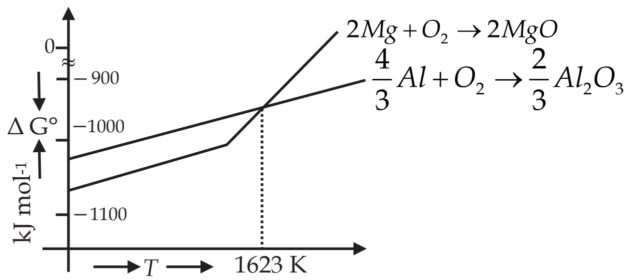
(a) $\lambda_1 = \lambda_2 = 4\lambda_3 = 9\lambda_4$

(b) $\lambda_1 = 2\lambda_2 = 3\lambda_3 = 4\lambda_4$

(c) $4\lambda_1 = 2\lambda_2 = 2\lambda_3 = \lambda_4$

(d) $\lambda_1 = 2\lambda_2 = 2\lambda_3 = \lambda_4$

Q81. Which of the following statement is **correct** w.r.t. The following graph?



(a) Below 1623 K, Mg reduces Al_2O_3

(b) Above 1623 K, Mg reduces Al_2O_3

(c) Both (1) & (2) are correct

(d) Both (1) & (2) are wrong

Q82. Aluminum is extracted from Alumina (Al_2O_3) by electrolysis of a molten mixture of-

(a) $Al_2O_3 + Na_3AlF_6 + CaF_2$

(b) $Al_2O_3 + KF + Na_3AlF_6$

(c) $Al_2O_3 + HF + NaAlF_4$

(d) $Al_2O_3 + CaF_2 + NaAlF_4$

Q83. Which of the following does not contain aluminum?

(a) Cryolite

(b) Fluorspar

(c) Feldspar

(d) Mica

Q84. The following reactions take place in yhe blast furnace in the preparation of impure iron. Identity the reaction pertaining to the formation of the slag-

(a) $CaO(s) + SiO_2(s) \rightarrow CaSiO_3(s)$

(b) $2C(s) + O_2(g) \rightarrow CO(g)$

(c) $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(I) + 3CO_2(g)$

(d) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

Q85. The general representation of the symbol of element 'X' is (Z = Atomic number, A= Mass number)-

(a) $^{A}_{X}Z$

(b) $^{A}_{Z}X$

(c) $_{A+1}X^{Z+1}$

(d) $_{X}A^{Z}$

Q86. The formula for Heisenberg's uncertainty principle is-

(a) $\lambda = \frac{h}{mv}$

(b) $\Delta x \times \Delta p \geq \frac{h}{4\pi}$

(c) $\Delta x \times \Delta p \geq \frac{h}{2\pi}$

(d) $mvr = n\frac{h}{2\pi}$

Q87. For n = 4, which one of the following values of *l* is not possible?

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

Q88. The bond between carbon atom (1) and carbon atoms (2) in compound, $N\equiv C-CH=CH_2$ involves the overlapping
(1) (2)
between-

(a) *sp* and sp^2
(b) sp^2 and sp^3
(c) *sp* and sp^3
(d) *sp* and *sp*

Q89. Both ionic and covalent bonds are present in-

(a) CH_4
(b) NaOH
(c) KCl
(d) SO_2

Q90. The hydrogen bond is strongest in-

(a) O−H------S
(b) N−H------N
(c) F−H------F
(d) O−H------S