

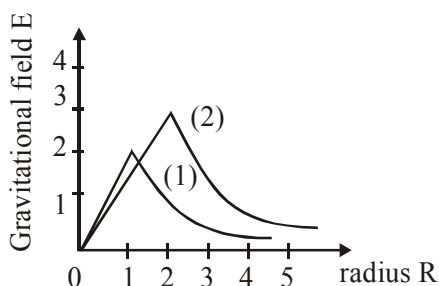
7. The dimension of stopping potential V_0 in photoelectric effect in units of Planck's constant 'h', speed of light 'c' and Gravitational constant 'G' and ampere A is :
- (1) $h^2 G^{3/2} c^{1/3} A^{-1}$ (2) $h^{-2/3} c^{-1/3} G^{4/3} A^{-1}$
 (3) $h^{1/3} G^{2/3} c^{1/3} A^{-1}$ (4) $h^{2/3} c^{5/3} G^{1/3} A^{-1}$

NTA Ans. (4)

ALLEN Ans. (Bonus)

8. Consider two solid spheres of radii $R_1 = 1m$, $R_2 = 2m$ and masses M_1 and M_2 , respectively. The gravitational field due to sphere (1) and (2)

are shown. The value of $\frac{M_1}{M_2}$ is :



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

NTA Ans. (4)

ALLEN Ans. (4)

9. In finding the electric field using Gauss Law

the formula $|\vec{E}| = \frac{q_{enc}}{\epsilon_0 |A|}$ is applicable. In the

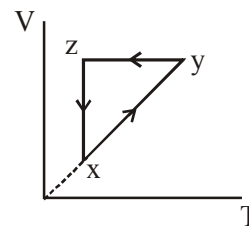
formula ϵ_0 is permittivity of free space, A is the area of Gaussian surface and q_{enc} is charge enclosed by the Gaussian surface. The equation can be used in which of the following situation?

- (1) Only when the Gaussian surface is an equipotential surface.
 (2) Only when $|\vec{E}| = \text{constant}$ on the surface.
 (3) For any choice of Gaussian surface.
 (4) Only when the Gaussian surface is an equipotential surface and $|\vec{E}|$ is constant on the surface.

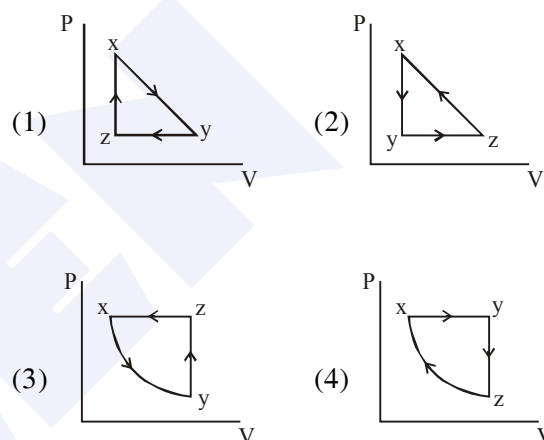
NTA Ans. (4)

ALLEN Ans. (4)

10. A thermodynamic cycle $xyzx$ is shown on a V-T diagram.



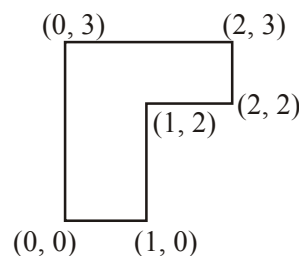
The P-V diagram that best describes this cycle is : (Diagrams are schematic and not to scale)



NTA Ans. (4)

ALLEN Ans. (4)

11. The coordinates of centre of mass of a uniform flag shaped lamina (thin flat plate) of mass 4kg. (The coordinates of the same are shown in figure) are :



- (1) (1.25m, 1.50m) (2) (1m, 1.75m)
 (3) (0.75m, 0.75m) (4) (0.75m, 1.75m)

NTA Ans. (4)

ALLEN Ans. (4)

12. The magnifying power of a telescope with tube 60 cm is 5. What is the focal length of its eye piece ?

- (1) 30 cm (2) 40 cm
(3) 20 cm (4) 10 cm

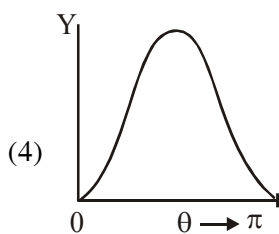
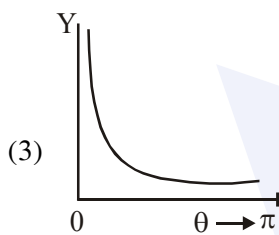
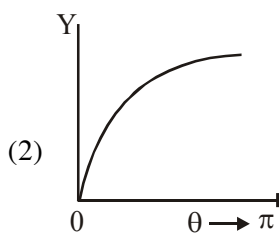
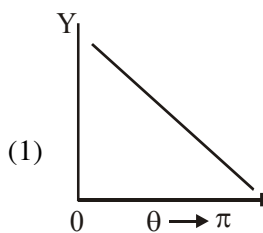
NTA Ans. (4)

ALLEN Ans. (4)

13. The graph which depicts the results of Rutherford gold foil experiment with α -particles is :

θ : Scattering angle

Y : Number of scattered α -particles detected
(Plots are schematic and not to scale)



NTA Ans. (3)

ALLEN Ans. (3)

14. A particle of mass m is fixed to one end of a light spring having force constant k and unstretched length ℓ . The other end is fixed. The system is given an angular speed ω about the fixed end of the spring such that it rotates in a circle in gravity free space. Then the stretch in the spring is :

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

NTA Ans. (2)

ALLEN Ans. (2)

15. The critical angle of a medium for a specific wavelength, if the medium has relative

permittivity 3 and relative permeability $\frac{4}{3}$ for

this wavelength, will be :

- (1) 60° (2) 15°
(3) 45° (4) 30°

NTA Ans. (4)

ALLEN Ans. (4)

16. A leak proof cylinder of length 1m, made of a metal which has very low coefficient of expansion is floating vertically in water at 0°C such that its height above the water surface is 20 cm. When the temperature of water is increased to 4°C , the height of the cylinder above the water surface becomes 21 cm. The density of water at $T = 4^\circ\text{C}$, relative to the density at $T = 0^\circ\text{C}$ is close to :

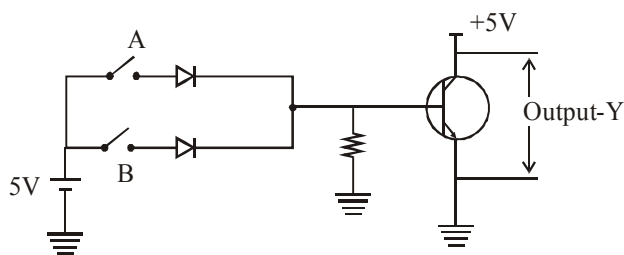
- (1) 1.01 (2) 1.04
(3) 1.03 (4) 1.26

NTA Ans. (1)

ALLEN Ans. (1)



17. Boolean relation at the output stage-Y for the following circuit is :

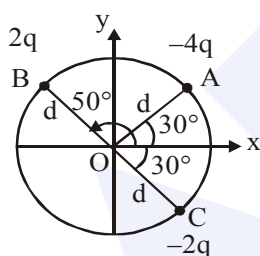


- (1) $A + B$ (2) $\bar{A} + \bar{B}$
 (3) $\bar{A} \cdot \bar{B}$ (4) $A \cdot B$

NTA Ans. (3)

ALLEN Ans. (3)

18. Three charged particle A, B and C with charges $-4q$, $2q$ and $-2q$ are present on the circumference of a circle of radius d . The charged particles A, C and centre O of the circle formed an equilateral triangle as shown in figure. Electric field at O along x-direction is :

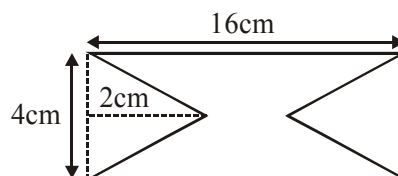


- (1) $\frac{2\sqrt{3}q}{\pi\epsilon_0 d^2}$ (2) $\frac{\sqrt{3}q}{4\pi\epsilon_0 d^2}$
 (3) $\frac{3\sqrt{3}q}{4\pi\epsilon_0 d^2}$ (4) $\frac{\sqrt{3}q}{\pi\epsilon_0 d^2}$

NTA Ans. (4)

ALLEN Ans. (4)

19. At time $t = 0$ magnetic field of 100 Gauss is passing perpendicularly through the area defined by the closed loop shown in the figure. If the magnetic field reduces linearly to 500 Gauss, in the next 5s, then induced EMF in the loop is :



- (1) $36 \mu\text{V}$ (2) $48 \mu\text{V}$
 (3) $56 \mu\text{V}$ (4) $28 \mu\text{V}$

NTA Ans. (3)

ALLEN Ans. (3)

20. Effective capacitance of parallel combination of two capacitors C_1 and C_2 is $10 \mu\text{F}$. When these capacitors are individually connected to a voltage source of 1V, the energy stored in the capacitor C_2 is 4 times that of C_1 . If these capacitors are connected in series, their effective capacitance will be :

- (1) $3.2 \mu\text{F}$ (2) $8.4 \mu\text{F}$
 (3) $1.6 \mu\text{F}$ (4) $4.2 \mu\text{F}$

NTA Ans. (3)

ALLEN Ans. (3)

21. Four resistances of 15Ω , 12Ω , 4Ω and 10Ω respectively in cyclic order to form Wheatstone's network. The resistance that is to be connected in parallel with the resistance of 10Ω to balance the network is _____ Ω .

NTA Ans. (10.00)

ALLEN Ans. (10.00)

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22. A point object in air is in front of the curved surface of a plano-convex lens. The radius of curvature of the curved surface is 30 cm and the refractive index of the lens material is 1.5, then the focal length of the lens (in cm) is _____.

NTA Ans. (60.00)

ALLEN Ans. (60.00)

23. A body A, of mass $m = 0.1$ kg has an initial velocity of $3\hat{i}$ ms⁻¹. It collides elastically with another body, B of the same mass which has an initial velocity of $5\hat{j}$ ms⁻¹. After collision, A moves with a velocity $\vec{v} = 4(\hat{i} + \hat{j})$. The energy of B after collision is written as $\frac{x}{10}$ J.

The value of x is _____.

NTA Ans. (16.00)

ALLEN Ans. (1.00)

24. A particle is moving along the x-axis with its coordinate with the time 't' given by $x(t) = 10 + 8t - 3t^2$. Another particle is moving the y-axis with its coordinate as a function of time given by $y(t) = 5 - 8t^3$. At $t = 1$ s, the speed of the second particle as measured in the frame of the first particle is given as \sqrt{v} . Then v (in m/s) is _____.

NTA Ans. (13.00)

ALLEN Ans. (580.00)

25. A one metre long (both ends open) organ pipe is kept in a gas that has double the density of air at STP. Assuming the speed of sound in air at STP is 300 m/s, the frequency difference between the fundamental and second harmonic of this pipe is _____ Hz.

NTA Ans. (106.00)

ALLEN Ans. (106.06 to 106.07)