PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 107

Physics

1. If K_1 and K_2 are maximum kinetic energies of photoelectrons emitted when light of wavelength λ_1 and λ_2 respectively are

incident on a metallic surface. If $\lambda_1 = 3\lambda_2$ then

A. $K_1 > \left(\frac{K_2}{3}\right)$

B. $K_1 < \left(\frac{K_2}{3}\right)$

C. $K_1 = 3K_2$

D. $K_2 = 3K_1$

Answer: B

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2. A solid sphere and a hollow sphere of equal mass and radius are placed over a rough horizontal surface after rotating it about its mass centre with same angular velocity ω_0. Once the pure rolling starts let v_1 and v_2 be the linear speeds of their centres of mass. Then

A. $v_1 = v_2$

B. $v_1 > v_2$

C. $v_1 o < v_2$

D. Data is insufficient

Answer: C

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3. A hollow charged metal sphere has radius r. If the potential difference between its surface and a point at a distance $3r$ from the centre is V, then electric field intensity at a distance $3r$ is

A. $\frac{V}{6r}$

B. $\frac{V}{4r}$

C. $\frac{V}{3r}$

D. $\frac{V}{2r}$

Answer: A

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4. A sphere of radius $0.1m$ and mass $8\pi\ kg$ is attached to the lower end of a steel wire of length $5.0m$ and diameter $10^{-3}m$. The wire is suspended from $5.22m$ high ceiling of a room .

When the sphere is made to swing as a simple pendulum, it just grazes the floor at its lowest point. Calculate the velocity of the sphere at the lowest position . Young's modulus of steel is $\left(1.994 \times 10^{11} N/m^2\right)$.

A. $7.7ms^{-1}$

B. $4.4ms^{-1}$

C. $2.2ms^{-1}$

D. $8.8ms^{-1}$

Answer: D

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5. A small ring of mass m is constrained to slide along a horizontal wire fixed between two rigid supports. The ring is connected to a particle of same mass by an ideal string & the whole system is released from rest as shown in the figure. If the coefficient of friction between ring A and wire is $\frac{3}{5}$, the ring will start sliding when the connecting string will make an angle θ with the vertical, then θ will be (particle is free to move and ring can slide

only)

A. 30°

B. 45°

C. 60°

D. None of these

Answer: B

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6. Estimate the distance for which for which ray optics is good approximation for an aperture of $4mm$ and wavelength $400nm$.

A. 24 m

B. 40 m

C. 18 m

D. 30 m

Answer: B

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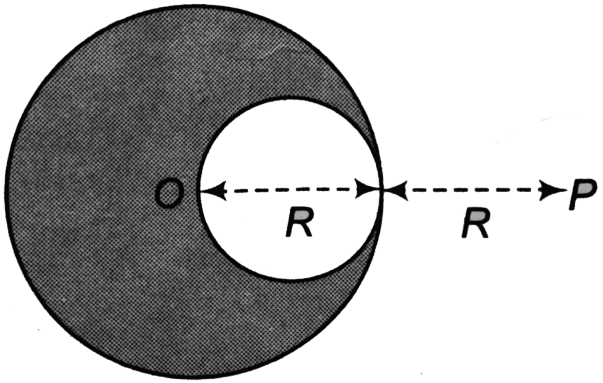
7. A solid sphere of uniform density and radius R applies a gravitational force of attraction equal to F_1 on a particle placed at P, distance $2R$ from the centre O of the sphere. A spherical cavity of radius $R/2$ is now made in the sphere as shown in figure. The particle with cavity now applies a gravitational force F_2 on same particle placed at P. The radio

F_2 / F_1 will be



A. $\frac{1}{2}$

B. $\frac{7}{9}$

C. 3

D. 7

Answer: B

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8. A ball is projected from point A with velocity $10ms^{-1}$ perpendicular to the inclined plane as shown in figure. Range of the ball on the inclined plane is

A. $\frac{40}{3}m$

B. $\frac{20}{13}m$

C. $\frac{13}{20}m$

D. $\frac{13}{40}m$

Answer: A

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9. If the series limit wavelength of the Lyman series of hydrogen atom is $912Å$, then the series limit wavelength of the Balmer series of the hydrogen atom is

A. $912Å$

B. $1824Å$

C. $3648Å$

D. 456Å

Answer: C

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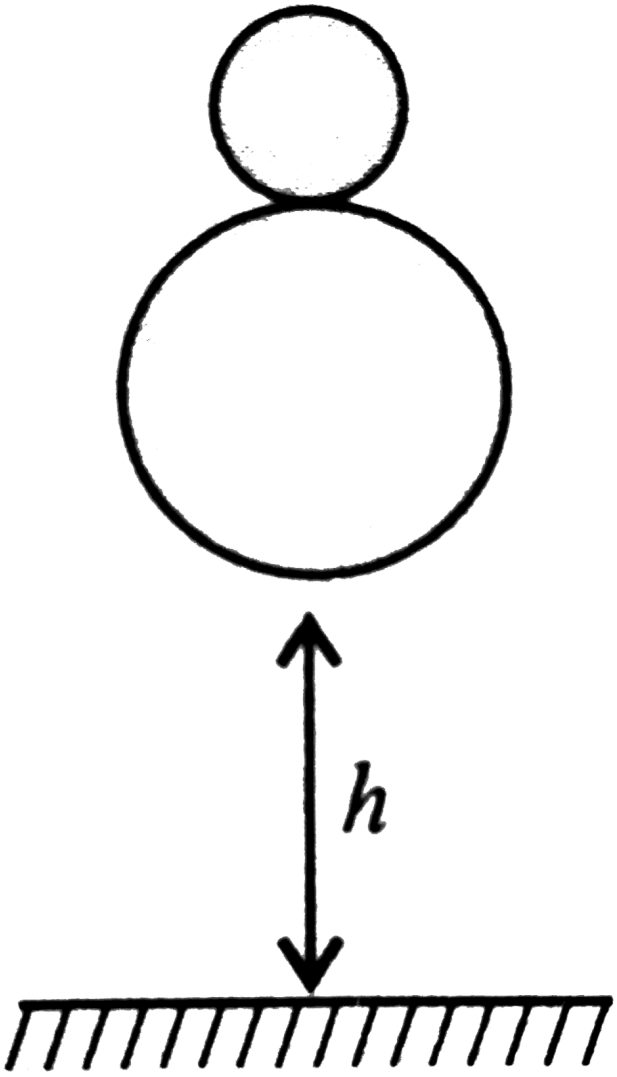
10. A tennis ball with (small) mass m_2 rests on the top of a basketball of mass $m_1$which is at a height h above the ground, and the bottom of the tennis ball is at height $h + d$ above the ground. The balls are dropped. To what height does the tennis ball bounce with respect to

ground? (Assume all collisions to be elastic and $m_1 > > m_2$)



A. h

B. 2h

C. 3h

D. 9h

Answer: D

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11. The density of an electron-hole pair in a pure germanium is $3 \times 10^{16} m^{-3}$ at room temperature. On doping with aluminium, the

hole density increases to $4.5 \times 10^{22} m^{-3}$. Now the electron density (in m^{-3}) in doped germanium will be

A. 1×10^{10}

B. 2×10^{10}

C. 0.5×10^{10}

D. 4×10^{10}

Answer: B

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12. The potnetial energy for a force field $\vec{F}$ is given by $U(x, y) = \cos(x + y)$. The force acting on a particle at the position given by coordinates $(0, \pi/4)$ is

A. $-\frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j}\right)$

B. $\frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j}\right)$

C. $\left(\frac{1}{2}\hat{i} + \frac{\sqrt{3}}{2}\hat{j}\right)$

D. $\left(\frac{1}{2}\hat{i} - \frac{\sqrt{3}}{2}\hat{j}\right)$

Answer: B

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13. A long rigid wire lies along the X - axis and carries a current of 10 A in the positive X - direction. Round the wire, the external magnetic field is $\overrightarrow{B} = \hat{i} + 2x^2\hat{j}$ with x in meters and B is Tesla. The magnetic force (in SI units) on the segment of the wire between x = 1 m and x = 4 m is

A. 1260

B. $\frac{1280}{3}$

C. 1310

D. 420

Answer: D

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14. A point object O is placed on the principal axis of a convex lens of focal length $f = 20cm$ at a distance of 40 cm to the left of it. The diameter of the lens is 10. An eye is placed 60 cm to right of the lens and a distance h below

the principal axis. The maximum value of h to see the image is

A. 0

B. 2.5 cm

C. 5 cm

D. 10 cm

Answer: B

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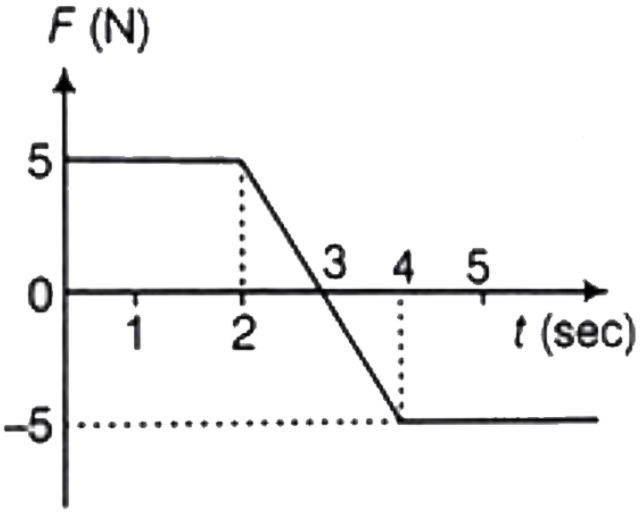
15. A block of the mass of 1 kg is moving on the x -axis. A force F acting on the block is shown. The veloity of the block at time t = 2 s is $-3ms^{-1}$. What is the speed of the block at time t = 4 s?



A. $8ms^{-1}$

B. $2ms^{-1}$

C. $3ms^{-1}$

D. $5ms^{-1}$

Answer: C

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16. The time period of oscillation of a simple pendulum is given by $T = 2\pi\sqrt{l/g}$

The length of the pendulum is measured as $l = 10 \pm 0.1$ cm and the time period as

$T = 0.5 \pm 0.02s$. Determine percentage error in te value of g.

A. 5%

B. 8%

C. 7%

D. None of these

Answer: B

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17. Ice starts forming in lake with water at $0^\circ C$ and when the atmospheric temperature is $-10^\circ C$. If the time taken for $1cm$ of ice be 7 hours. Find the time taken for the thickness of ice to change from $1cm$ to $2cm$

A. 7 hours

B. 14 hours

C. 10.5 hours

D. 21 hours

Answer: D

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18. One mole of ideal gas goes through process $P = \frac{2V^2}{1+V^2}$. Then change in temperature of gas when volume changes from $V = 1m^2$ to $2m^2$ is :

A. $-\frac{4}{5R}K$

B. $\frac{11}{5R}K$

C. $-\frac{5}{2R}K$

D. 2K

Answer: B

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19. The isotopic masses of $._1^2 H$ and $._2^4 He$ are 2.0141 and 4.0026 amu respectively and the velocity of light in vacuum is $2.998 \times 10^8 m/s$. Calculate the quantity of energy (in J) liberated when two mole of $._1^2 H$ undergo fusion to form one mole of $._2^4 He$

A. $2.3 \times 10^{12} J$

B. $3.3 \times 10^{12} J$

C. $5.3 \times 10^{12} J$

D. $2.9 \times 10^{12} J$

Answer: A

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20. A car is moving towards a high cliff. The car driver sounds a horn of frequency f. The reflected sound heard by the driver has a frequency $2f$. if v be the velocity of sound,

then the velocity of the car, in the same velocity units, will be

A. $\frac{v}{\sqrt{2}}$

B. $\frac{v}{3}$

C. $\frac{v}{4}$

D. $\frac{v}{2}$

Answer: B

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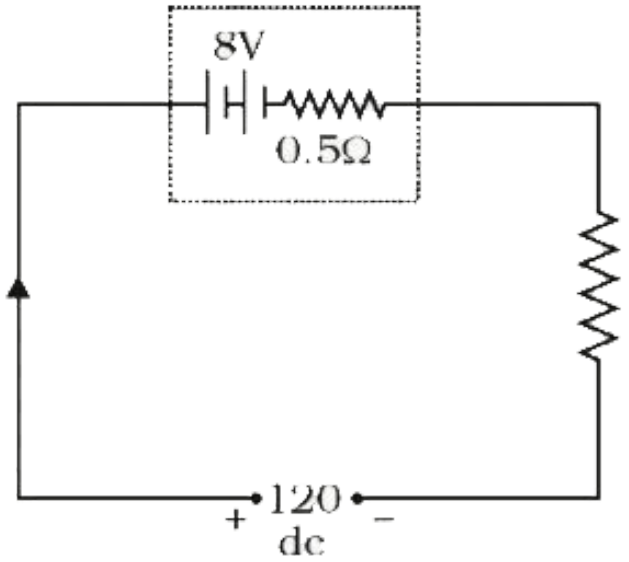
21. A storage battery of emf 8V and internal resistance is being charged by a 120 V D.C. supply using a series resistor of What is the terminal voltage of the battery during charging? What is the purpose of having a series resistor in the charging circuit?



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22. A long solenoid of cross-sectional radius a has a thin insulates wire ring tightly put on its winding, one half of the ring has the resistance η times that of the other half. The magnetic induction produced by the solenoid varies with the time as $B = bt$, where b is a constant. Find the magnitude of the electric field strength in the ring.

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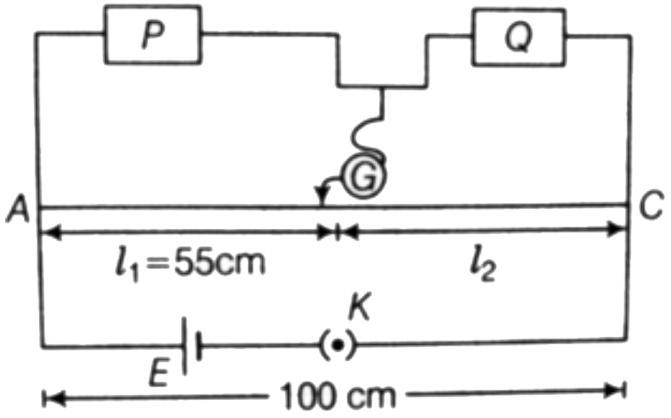
23. In a meter bridge experiment, resistances are connected as shown in figure. The balancing length $l_1 = 55cm$. Now, an unknown resistance x is connected in series with P and the new balancing length is found to be 75 cm. What is the value of The value of 11x (in ohm)? (Given, $P = 4\Omega$)



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24. A Carnot reversible engine converts $1/6$ of heat input into work. When the temperature of the sink is redused by 62 K, the efficiency of Carnot's cycle becomes $1/3$. The sum of temperature (in kelvin) of the source and sink will be

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25. The amplitude of a simple pendulum is 10 cm. When the pendulum is at a displacement of 4 cm from the mean position, the ratio of kinetic and potential energies at that point is

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