PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 58

Physics

1. An electron is moving in an orbit of a hydrogen atom from which there can be a maximum of six transition. An which there can

be a maximum of three transition. Find ratio of the velocities of the electron in these two orbits.

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

B. $\frac{2}{3}$

C. $\frac{5}{4}$

D. $\frac{3}{4}$

Answer: D

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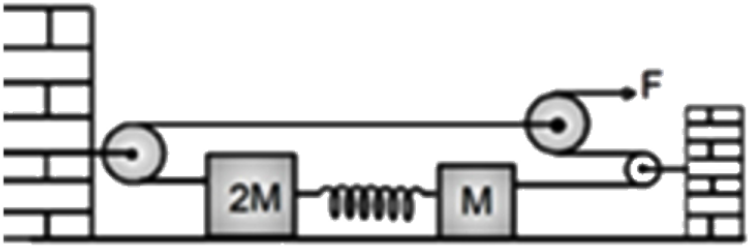
2. In the diagram shown, no friction at any contact surface. Initailly, the spring has no deformation .What will be the maximum deformation in the spring? Consider all the strings to be sufficiently large. Consider the spring constant to be K.



A. $\frac{4F}{3K}$

B. $\frac{8F}{3K}$

C. $\frac{F}{3K}$

D. None of these

Answer: B

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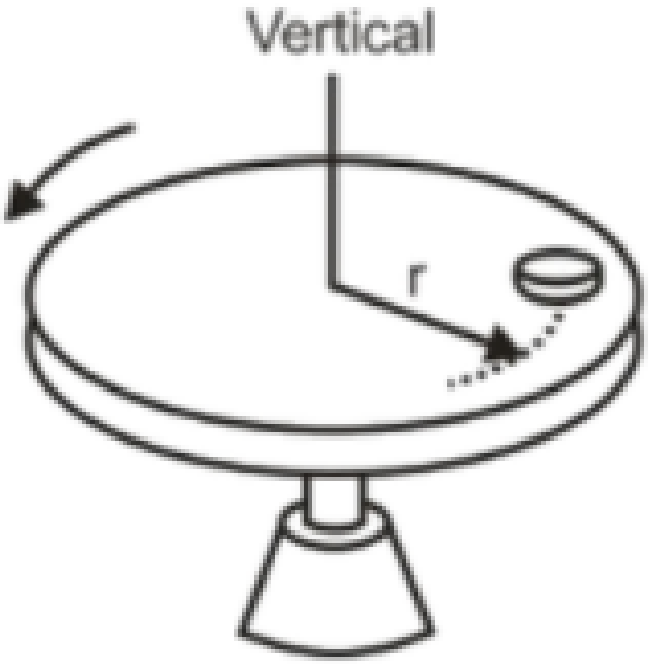
3. A small coin of mass 40 g is placed on the horizontal surface of a rotating disc. The disc starts from rest and is given a constant angular acceleration $\alpha = 2\,\mathrm{rad\,s^{-2}}$. The coefficient of static friction between the coin and the disc is $\mu_s = 3/4$ and the coefficient of

kinetic friction is $\mu_k = 0.5$. The coin is placed at a distance $r = 1m$ from the centre of the disc. The magnitude of hte resultant force on the coin exerted by the disc just before it starts slipping on the disc is :



A. 0.2 N

B. 0.3 N

C. 0.4 N

D. 0.5 N

Answer: D

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4. A cell of emf E and internal resistance r supplies currents for the same time t through external resistances

$R_1 = 100\Omega$ and $R_2 = 40\Omega$ separately. If the heat developed in both cases is the same, then the internal resistance of the cell is

A. 28.6Ω

B. 70Ω

C. 63.3Ω

D. 140Ω

Answer: C

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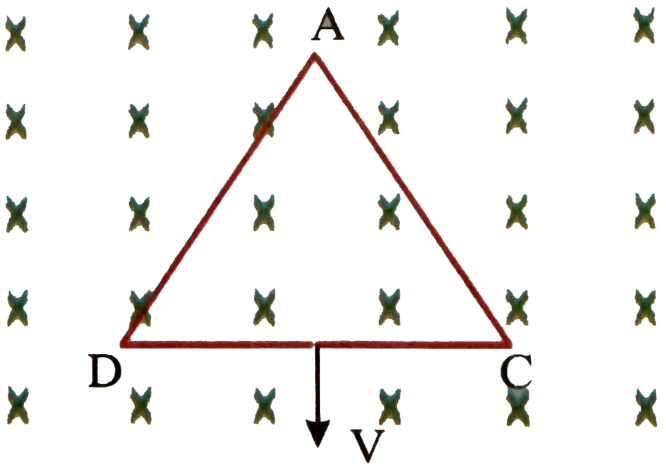
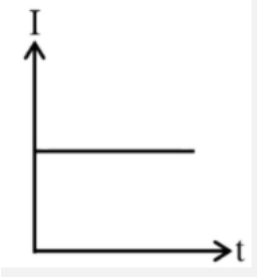
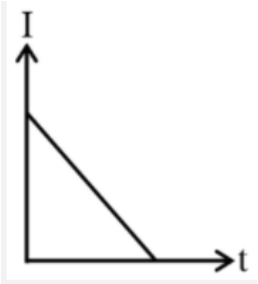
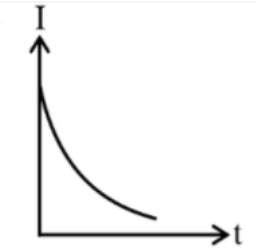
5. An equilateral triangular loop ADC having some resistance is pulled with a constant velocity v out of a uniform magnetic field directed inot the paper. At time $t = 0$, side DC of the loop at is at edge of the magnetic field.

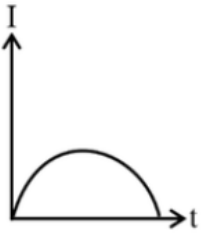


The induced current (i) versus time (t) graph will be as

A. 

B. 

C. 

D. 

Answer: B

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6. An insulating solid sphere of the radius R is charged in a non - uniform manner such that the volume charge density $\rho = \frac{A}{r}$, where A is a positive constant and r is the distance from the centre. The potential difference between the centre and surface of the sphere is

A. $\frac{AR}{8\varepsilon_0}$

B. $\frac{AR}{4\varepsilon_0}$

C. $\frac{AR}{\varepsilon_0}$

D. $\frac{AR}{2\varepsilon_0}$

Answer: D

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7. Suppose the gravitational force varies inversely as the n^{th} power of distance. Then the time period of a planet in circular orbit of radius R around the sun will be proportional to-

A. R^{-n}

B. $R^{\frac{(n-1)}{2}}$

C. $R^{\frac{(n+1)}{2}}$

D. R^n

Answer: C

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8. A rod of length l (laterally thermally insulated) of the uniform cross sectional area A consists of a material whose thermal conductivity varies with temperature as

$K = \frac{K_0}{a + bT'}$ where K_0, a and b are constants. T_1 and $T_2 (< T_1)$ are the temperatures of the ends of the rod. Then, the rate of flow of heat across the rod is

A. $\frac{AK_0}{bl}\left(\frac{a + bT_1}{a + bT_2}\right)$

B. $\frac{AK_0}{bl}\left(\frac{a + bT_2}{a + bT_1}\right)$

C. $\frac{K_0 A}{bl}\ln\left[\frac{a + bT_1}{a + bT_2}\right]$

D. $\frac{AK_0}{bl}\ln\left[\frac{a + bT_2}{a + bT_1}\right]$

Answer: C

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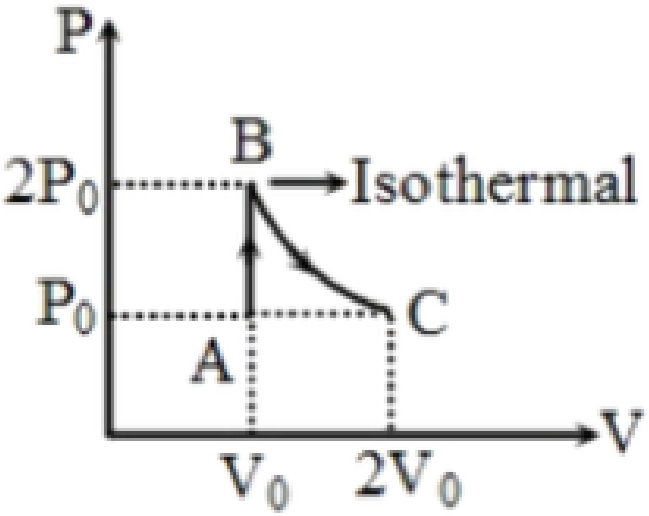
9. An ideal diatomic gas undergoes a thermodynamic process as shown in the $P - V$ diagram. The process AB is isochoric while the process BC is isothermal. The total heat gain to the gas in the process is nearly (use $\ln 2 = 0.7$)



A. $2.5P_0V_0$

B. $1.4P_0V_0$

C. $3.9P_0V_0$

D. $1.1P_0V_0$

Answer: C

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10. A man crosses a river in a boat. If he cross the river in minimum time he takes $10\ \text{min}$ with a drift $120m$. If he crosses the river

taking shortest path, he takes $12.5\ \min$, find

(a) width of the river

(b) velocity of the boat with respect to water

(c) speed of the current

A. 215 m

B. 150 m

C. 100 m

D. 200 m

Answer: D

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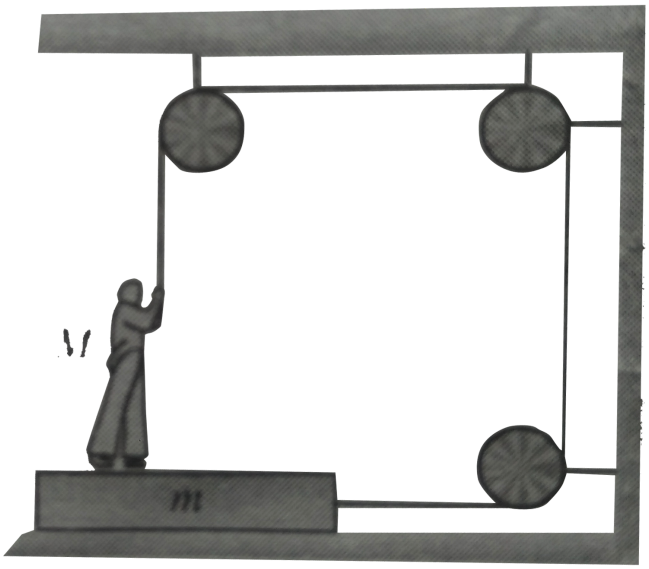
11. The friction coefficient between the board and the floor shown in figure is μ Find the maximum force that the man can exert on the rope so that the board does not slip on the floor



A. $\frac{\mu(m+n)g}{(2+\mu)}$

B. $\frac{\mu(m+M)g}{(1+\mu)}$

C. $\frac{\mu(m+M)g}{(2-\mu)}$

D. $\frac{\mu(m+M)g}{(1-\mu)}$

Answer: B

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12. A radionuclide with half - life 1620 s is produced in a reactor at a constant rate of 1000 nuclei per second. During each decay

energy, 200 MeV is released. If the production of radionuclides started at t = 0, then the rate of release of energy at t = 3240 s is

A. $1.5 \times 10^5 \ \text{MeV s}^{-1}$

B. $1.5 \times 10^2 \ \text{MeV s}^{-1}$

C. $2.5 \times 10^2 \ \text{MeV s}^{-1}$

D. $3.5 \times 10^5 \ \text{MeV s}^{-1}$

Answer: A

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13. A disc of radius R and mass M is pivoted at the rim and it set for small oscillations. If simple pendulum has to have the same period as that of the disc, the length of the simple pendulum should be

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

B. $\frac{2}{3}R$

C. $\frac{3}{4}R$

D. $\frac{3}{2}R$

Answer: D

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14. In a photoelectric effect experiment, stopping potential changes by 30 volt if we change frequency of the radiation. Then the magnitude of change in the frequency is : $\left(h = 6 \times 10^{-34} J - s\right)$

A. $4 \times 10^{-15} s^{-1}$

B. $8 \times 10^{15} s^{-1}$

C. $10^{16} s^{-1}$

D. $18 \times 10^{15} s^{-1}$

Answer: B

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15. The length of a metal wire is l_1 when the tension in it is T_1 and is l_2 when the tension is T_2. Then natural length of the wire is

A. $\frac{l_1 + l_2}{2}$

B. $\sqrt{l_1 l_2}$

C. $\frac{l_1 T_2 - l_2 T_1}{T_2 - T_1}$

D. $\frac{l_1 T_2 + l_2 T_1}{T_2 + T_1}$

Answer: C

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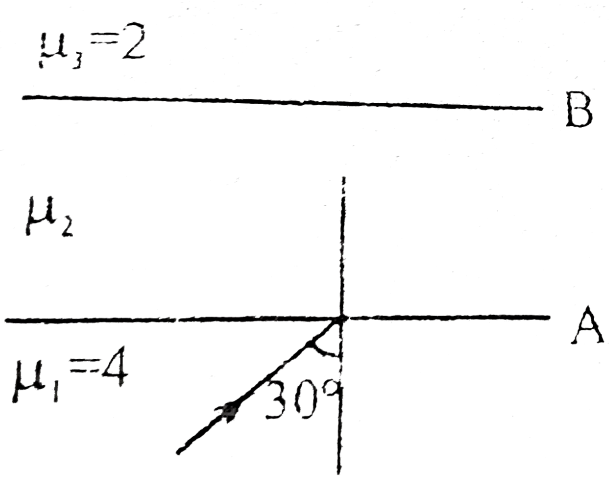
16. A light ray is incident on lower medium boundary at an angle 30° with the normal. Which of following statement is/are true ?



A. If $\mu_2 > 2$, then total deviation is 60°

B. If $\mu_2 < 2$, then total deviation is 30°

C. If $\mu_2 > 2$, then the deviation is 120°

D. If $\mu_2 < 2$, then total deviation is 180°

Answer: A

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17. 1000 kHz carrier wave is amplitude modulated by the signal frequency 200-4000Hz . The channel width of this case is

A. 8 kHz

B. 4 kHz

C. 7.6 kHz

D. 400 kHz

Answer: A

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18. A pendulum clock (fitted with a small heavy bob that is connected with a metal rod) is 5 seconds fast each day at a temperature of

$15^\circ C$ and 10 seconds slow at a temperature of $30^\circ C$. The temperature at which it is designed to give correct time, is

A. $18^\circ C$

B. $22^\circ C$

C. $20^\circ C$

D. $25^\circ C$

Answer: C

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19. The unit of electric permittivity is $\frac{C^2}{Nm^2}$.

Find the dimensions of electric permittivity

A. $\left[a^2M^{-1}L^{-3}T^4\right]$

B. $\left[A^2M^{-1}L^{-3}T^0\right]$

C. $\left[AM^{-1}L^{-3}T^4\right]$

D. $\left[A^2M^0L^{-3}T^4\right]$

Answer: A

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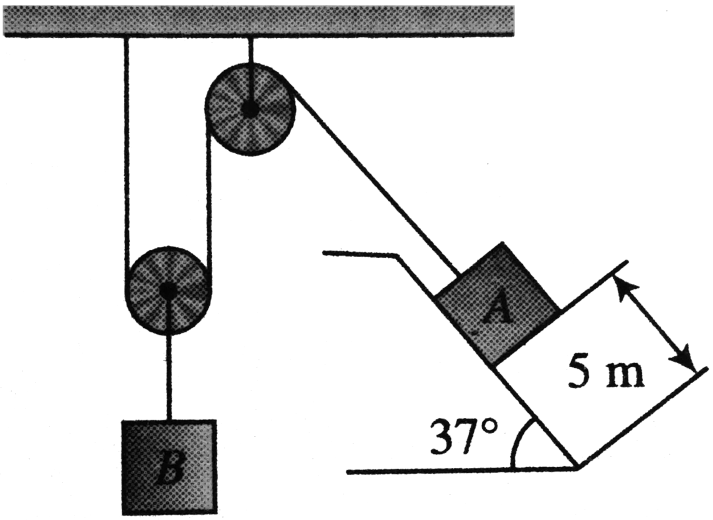
20. The blocks A and B shown in figure have masses $M_A = 5kg$ and $M_B = 4kg$. The system is released from rest. The speed of B after A has travelled a distance $1m$ along the incline is



A. $\sqrt{\frac{15}{2}}$

B. $\sqrt{\frac{15}{8}}$

C. $\sqrt{\frac{5}{6}}$

D. $\sqrt{\frac{5}{2}}$

Answer: C

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21. A boat covers 24 km upstream and 36 km downstream in 6 hours while it covers 36 km upstream and 24 km downstream in $6\frac{1}{2}$ hours.

The velocity of the current is $1\,km/hr$ b. $1.5\,km/hr$ c. $2\,km/hr$ d. $2.\,km/hr$

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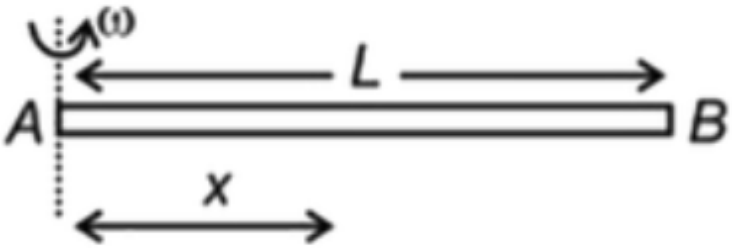
22. A non - conducting rod of length L with linear charge density $\lambda = \lambda_0 x$ where x is the distance from end A is rotating with constant angular speed ω about the same end. If the angular velocity of the rod (ω) is large, then the magnetic dipole moment of the system is

$\frac{\omega\lambda_0 L^4}{n}$. What is the value of n?



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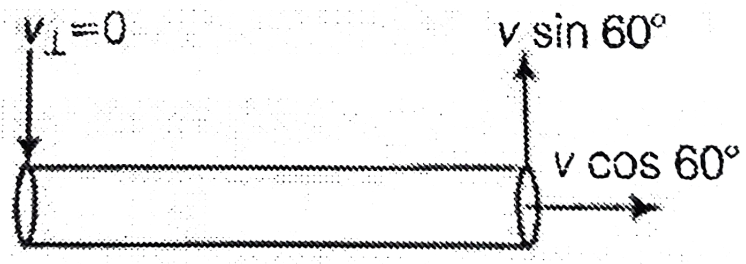
23. The instaneous velocity of point B of the given rod of length 0.5 is 3m/s in the represented direction. The angualr velocity of

the rod for minimum velocity of end A is



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24. In Young's double - slit experiment, the distance between slits is d = 0.25 cm and the distance of the screen D = 120 cm from the slits. If the wavelength of light used is $\lambda = 6000\text{Å}$ and I_0 is the intensity of central

maximum, then the minimum distance of the point from the centre, where the intensity is $\frac{I_0}{2}$ is $k \times 10^{-5} m$. What is the value of k?

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25. An observer standing on a railway crossing receives frequencies 2.2 kHz and 1.8 kHz when the train approaches and recedes from the observer. Find the velocity of the train (speed of sound in air is 300 m/s).

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