PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 45

Physics

1. In a Coolidge tube, the potential difference used to accelerate the electrons is increased from 24. 8 kV to 49.6 kV . As a result, the difference between the wavelength of K_α -line and minimum wavelength becomes two times. The initial wavelength of the K_α line is [Take $\frac{hc}{e} = 12.4 kV \text{Å}$]

A. $\frac{3}{2}$Å

B. $\frac{3}{4}$Å

C. $\frac{5}{2}$Å

D. $\frac{5}{4}$Å

Answer: B

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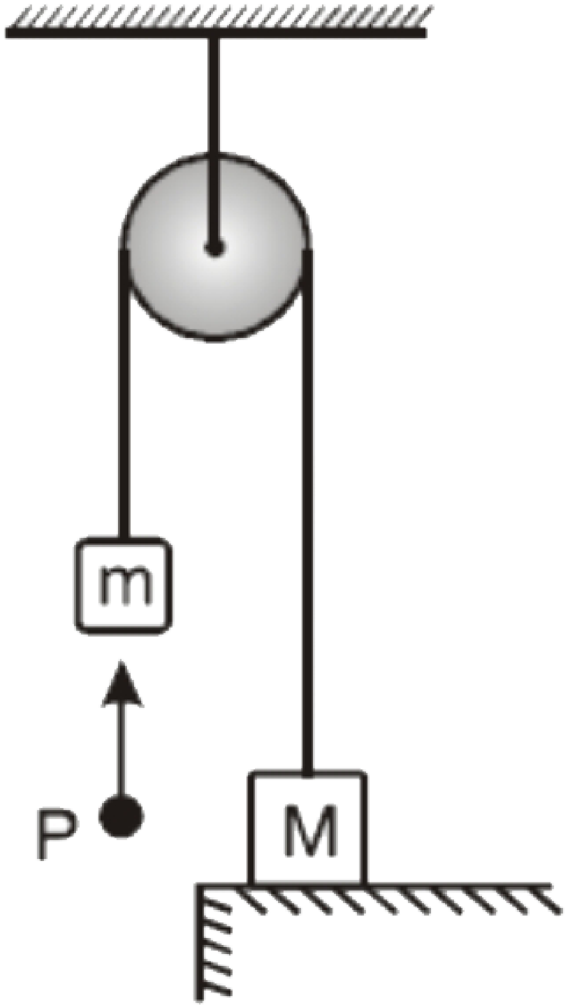
2. A light inelastic thread passes over a small frictionless pulley. Two blocks of masses m = 1 kg and M = 3 kg, respectively, are attached with the thread and heavy block rests on a surface. A particle P of mass 1 kg moving upward with a velocity of $10 ms^{-1}$ collides with the lighter block and sticks to it. The speed of the bigger block just after the string is taut will be $\left[g = 10ms^{-2}\right]$



A. $2.5ms^{-1}$

B. $4ms^{-1}$

C. $5ms^{-1}$

D. $2ms^{-1}$

Answer: D

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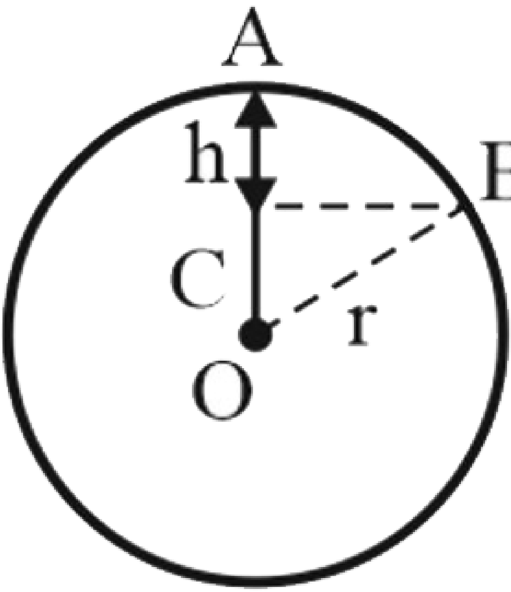
3. In figure, a particle is placed at the highest point A of a smooth sphere of radius r. It is given slight push, and it leaves the sphere at B, at a depth h vertically below A. The value of h is



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

B. $\frac{1}{4}r$

C. $\frac{1}{3}r$

D. $\frac{1}{2}r$

Answer: C

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4. In the experiment for the determination of the speed of sound in air using the resonance column method, the length of the air column that resonates in the fundamental mode, with a tuning fork is $0.1m$. When this length is changed to $0.35m$, the same tuning fork resonates with the first overtone. Calculate the end correction.

A. 0.012 m

B. 0.025 m

C. 0.05 m

D. 0.024 m

Answer: B

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5. A long cylindrical conductor of cross-sectional area A and radius a is made of material whose resistivity depends only on a distance r from the axis of conductor, given by $\rho = \frac{c}{r^2}$, where c is a constant. Find the resistance per unit length of the conductor and the electric field strength due to which a current I flows in it.

A. $R = \frac{4\alpha l}{\pi a^3}$

B. $R = \frac{2\alpha l}{\pi a^4}$

C. $R = \frac{4\alpha}{\pi l a^3}$

D. $R = \frac{2l}{\pi \alpha a^3}$

Answer: B

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6. A conducting bubble of radius a, thickness t ($t < < a$) has a potential V. Now the bubble transforms into a droplet. Find the potential on the surface of the droplet.

A. $v' = v\left(\frac{a}{3t}\right)^{\frac{1}{3}}$

B. $v' = v\left(\frac{a}{3t}\right)^{\frac{1}{2}}$

C. $v' = v\left(\frac{a}{3t}\right)$

D. None of these

Answer: A

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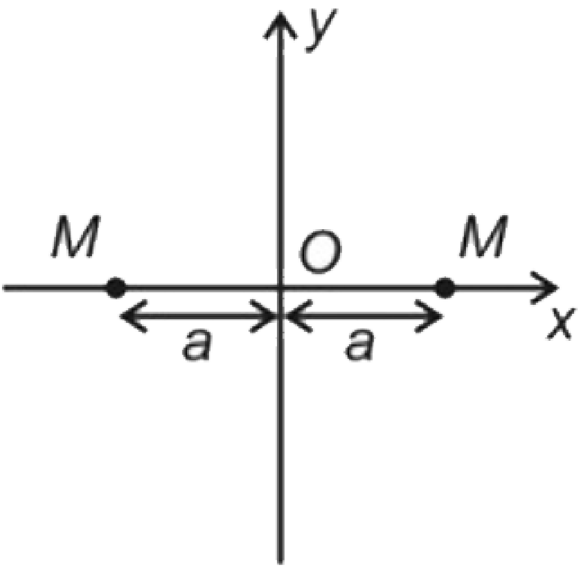
7. Two point masses M are kept fixed on the x-axis at a distance a from the origin, another point mass m is moving in a circular path of radius R (in y - z plane) under the influence of gravitational force of attraction, then speed of m will be (Assume no forces are acting on m other than the gravitational forces by two M)



A. $\sqrt{\dfrac{2GMR^2}{(R^2+a^2)^{\frac{3}{2}}}}$

B. $\sqrt{\dfrac{GMR^2}{(R^2+a^2)^{\frac{3}{2}}}}$

C. $\sqrt{\dfrac{3GMR^2}{(R^2+a^2)^{\frac{3}{2}}}}$

D. $\sqrt{\dfrac{5GMR^2}{(R^2+a^2)^{\frac{3}{2}}}}$

Answer: A

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8. If the filament of a 100 W bulb has an area $0.25cm^2$ and behaves as a perfect block body. Find the wavelength corresponding to the maximum in its energy distribution. Given that Stefan's constant is $\sigma = 5.67 \times 10^{-8} J/m^2 s K^4$.

A. 8751.23

B. 2898.14

C. 9971.9

D. 7055.5

Answer: C

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9. The molar heat capacity C for an ideal gas going through a given process is given by $C = \frac{a}{T}$, where 'a' is a constant. If $\gamma = \frac{C_p}{C_v}$, the work done by one mole of gas during heating from T_0 to ηT_0 through the given process will be

A. $\frac{1}{a} 1n(\eta)$

B. $a1n(\eta) - RT_0\left[\frac{\eta - 1}{\gamma - 1}\right]$

C. $a1n(\eta) - (\gamma - 1)RT_0$

D. $\left[\frac{\eta - 1}{\gamma - 1}\right]RT_0$

Answer: B

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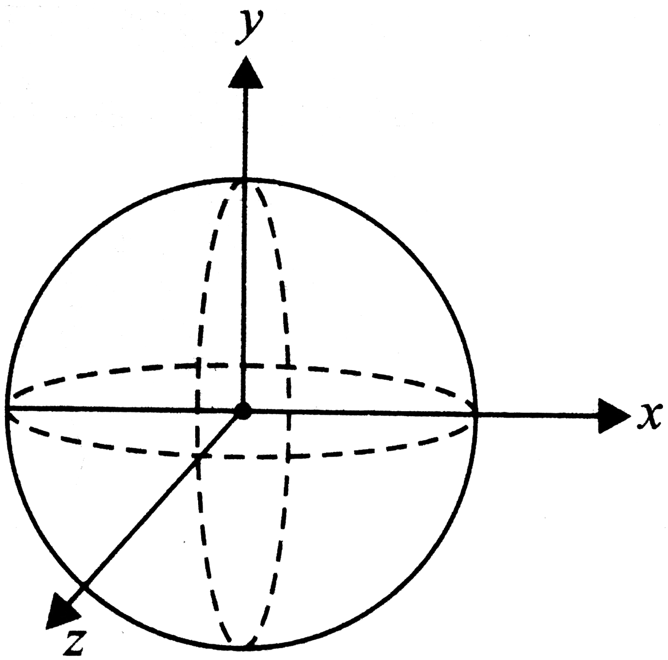
10. Three rings, each having equal radius R, are placed mutually perpendicular to each other and each having its centre at the origin of coordinate system. If current I is flowing through each ring, then the magnitude of the magnetic field at the common centre is



A. $\sqrt{3}\frac{\mu_0 I}{2R}$

B. zero

C. $\left(\sqrt{2}-1\right)\frac{\mu_0 I}{2R}$

D. $\left(\sqrt{3}-\sqrt{2}\right)\frac{\mu_0 I}{2R}$

Answer: A

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11. A running man has the same kinetic energy as that of a boy of half his mass. The man speed up by $2ms^{-1}$ and the boy changes his speed by xms^{-1} so that the kinetic energies of the boy and the man are again equal. Then x in ms^{-1} is

A. $-2\sqrt{2}$

B. $+2\sqrt{2}$

C. $\sqrt{2}$

D. 2

Answer: B

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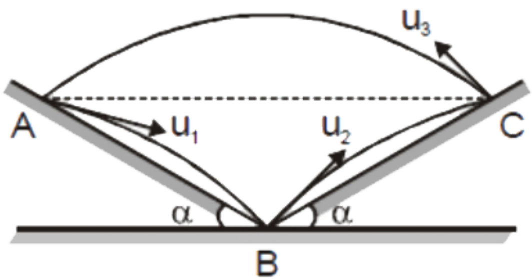
12. Three particles are projected in the air with the minimum possible speeds, such that the first goes from A to B, the second goes from B to C and the third goes from C to A. Points A and C are at the same horizontal level. The two inclines make the same angle α with the horizontal, as shown. The relation among the projection speeds of the three particles is



A. $u_3 = u_1 + u_2$

B. $u\frac{2}{3} = 2u_1u_2$

C. $\frac{1}{u_3} = \frac{1}{u_1} + \frac{1}{u_2}$

D. $u\frac{2}{3} = u\frac{2}{1} + u\frac{2}{2}$

Answer: B

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13. A mixture consists of two radioactive materials A_1 and A_2 with half-lives of $20s$ and $10s$ respectively. Initially the mixture has $40g$ of A_1 and $160g$ of a_2. The amount the two in the mixture will become equal after

A. 60 s

B. 80 s

C. 20 s

D. 40 s

Answer: D

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14. The time period of a physical pendulum about some pivot point is T. When we take another pivot point, opposite of the first one such that the centre of mass of the physical pendulum lies on the line joining these two pivot points, we obtain the same time period. If the two points are separated by a distance L, then the time period T is

A. $2\pi\sqrt{\frac{L}{g}}$

B. $\pi\sqrt{\frac{L}{g}}$

C. $2\pi\sqrt{\frac{L}{2g}}$

D. $\pi\sqrt{\frac{2L}{g}}$

Answer: A

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15. If the mass of neutron = 1.7×10^{-27} kg, then the de-Broglie wavelength of neutron of energy 3 eV is $\left(h = 6.6 \times 10^{-34} Js\right)$

A. $1.6 \times 10^{-16} m$

B. $1.6 \times 10^{-11} m$

C. $1.4 \times 10^{-10} m$

D. $1.4 \times 10^{-11} m$

Answer: B

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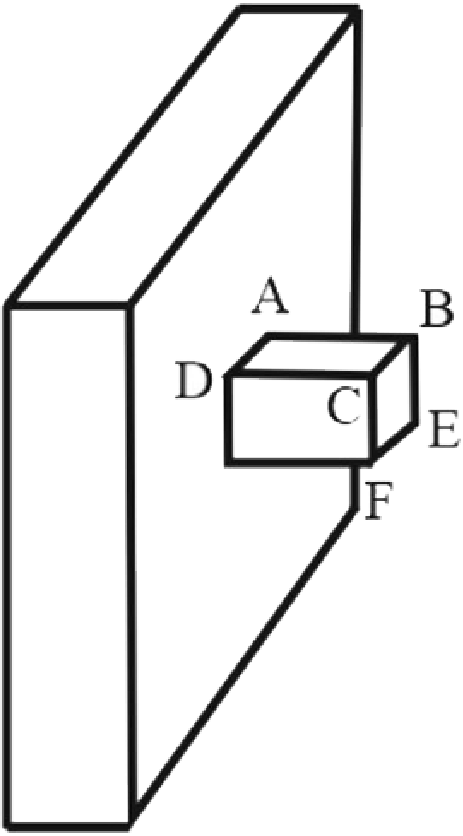
16. A steel rod is projecting out of a rigid wall. The shearing strength of steel is $345 MNm^{-2}$. The dimensions AB = 5 cm, BC = BE = 2 cm. The maximum load that can be put on the face ABCD

is : (neglect bending of the rod) ($g = 10ms^{-2}$)



A. 3450 kg

B. 1380 kg

C. 13800 kg

D. 345 kg

Answer: C

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17. Two loops P and Q are made from a uniform wire. The radii of P and Q are R_1 and R_2, respectively, and their moments of inertia about their axis of rotation are I_1 and I_2, respectively. If $\frac{I_1}{I_2} = 4$, then $\frac{R_2}{R_1}$ is

A. $4^{\frac{2}{3}}$

B. $4^{\frac{1}{3}}$

C. $4^{-\frac{2}{3}}$

D. $4^{-\frac{1}{3}}$

Answer: B

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18. For a CE transistor amplifier, the audio signal voltage across the collector resistance of $2k\Omega$ is $2V$. Suppose the current amplification factor of the transistor is 100. The value of R_B in series with V_{BB} supply of $2V$, if the DC base current has to be 10 times the signal current is.

A. $7k\Omega$

B. $26k\Omega$

C. $10k\Omega$

D. $14k\Omega$

Answer: D

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19. An earthen pitcher loses 1 g of water per minute due to evaporation. If the water equivalent of pitcher is 0.5 kg and the pitcher contains 9.5 kg of water, calculate the time required for the water in the pitcher to cool to $28^\circ C$ from its original temperature of $30^\circ C$ Neglect radiation effect. Latent heat of vapourization of water in this range of temperature is 580 cal/g and specific heat of water is $1 kcal / gC^\circ$

A. 38.6 min

B. 30. 5 min

C. 34. 5 min

D. 41.2 min

Answer: C

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20. A wire has a mass $0.3 \pm 0.003g$, radius $0.5 \pm 0.005mm$ and length $6 \pm 0.06cm$. The maximum percentage error in the measurement of its density is

A. 1

B. 2

C. 3

D. 4

Answer: D

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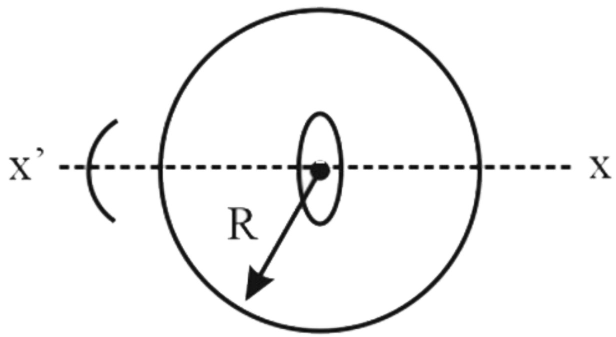
21. A non-conducting ring of radius R having uniformly distributed charge Q starts rotating about x-x' axis passing through diameter with an angular acceleration α, as shown in the figure. Another small conducting ring having radius

$a(a < < R)$ is kept fixed at the centre of bigger ring is such a way that axis xx' is passing through its centre and perpendicular to its plane. If the resistance of small ring is $r = 1\Omega$, find the induced current in it in ampere.

(Given

$$q = \frac{16 \times 10^2}{\mu_0} C, R = 1m, a = 0.1m, \alpha = 8\text{rad s}^{-2}$$



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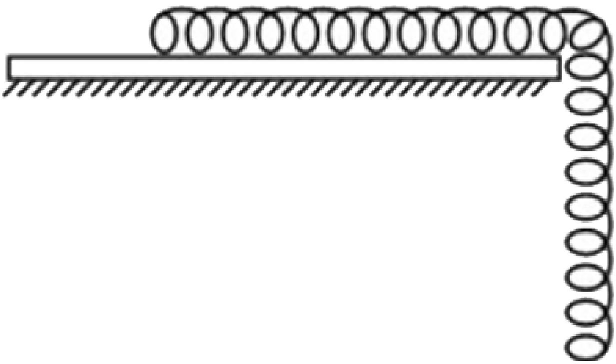
22. A chain is placed on a rough table, partially hanging, as shown in the figure. The coefficient of static friction between the chain and the table is μ = 0.4. If the maximum possible length of the hanging part is x and the length of the chain is L, then what is the value of $\frac{L}{x}$?



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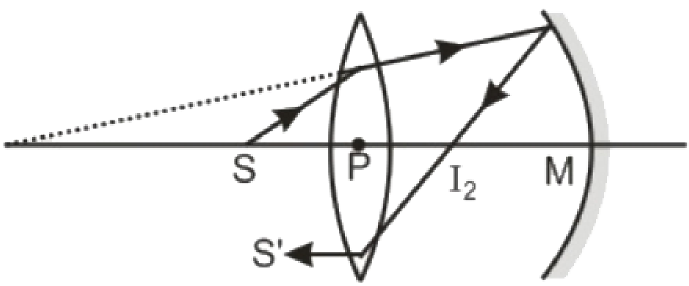
23. A converging lens of focal length 15 cm and a converging mirror of focal length 20 cm are placed with their principal axes coinciding. A point source S is placed on the principal axis at a distance of 12 cm from the lens, as shown in figure. It is found that the final beam comes out parallel to the principal axis. Let the separation between the mirror and the lens be $10 \times k$. Find k.



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24. In Young's double slit experiment, how many maxima can be obtained on a screen (including central maxima). If $d = \frac{5\lambda}{2}$ (where λ is the wavelength of light)?

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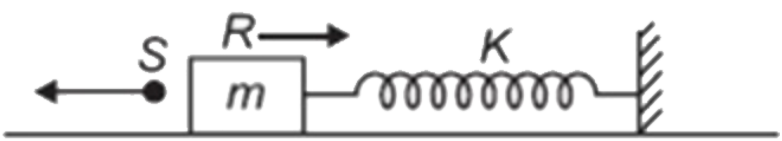
25. A sound source S, emitting a sound of frequency 400 Hz and a receiver R of mass m are at the same point. R is performing SHM with the help of a spring of force constant K. At a time t = 0, R is at the mean position and moving towards the right, as shown. At the same time, the source starts moving away from R with some acceleration a. The frequency registered by the receiver at a time t = 10 s is 250 Hz. What is the time (in seconds) at which the corresponding registered frequency of 250 Hz was emitted by the source? [Given that $\frac{m}{K} = \frac{25}{\pi^2}$ and amplitude of oscillation = $\frac{100}{\pi}m$, V_{sound} = 320 m s^(-1)]`



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