PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 40

Physics

1. The energy required to remove the electron from a singly ionized Helium atom is 2.2 times the energy required to remove an electron

from Helium atom. The total energy required to ionize the Helium atom ompletelyis:

A. 34 ev

B. 20 eV

C. 79 eV

D. 109 eV

Answer: C

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2. A ball of mass m_1 is moving with velocity 3v. It collides head on elastically with a stationary ball of mass m_2 . The velocity of both the balls become v after collision. Then the value of the ratio $\frac{m_2}{m_1}$ is

A. 1

B. 2

C. 3

D. 4

Answer: B

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3. A galvanometer having full scale deflection current of 10 mA and resistance 8Ω is joined in circuit as shown. When the terminals A and B are used and C remains open, the range of the ammeter is I. When the terminals A and C are used and B remains open, then the range of the ammeter is

A. I

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

C. $\frac{I}{3}$

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

Answer: B

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4. Why are alloys used for making standard resistance coils?

A. They have high thermal conductivity.

B. Their resistance depend weakly on temperature.

C. They have low thermal conductivity.

D. Their resistance depend strongly on temperature.

Answer: B

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5. The figure shows a long coaxial cable in which a current I flows down through the inner cylinder of radius a and the same current flows back up through the outer cylinder of radius 2a. The cylinders are insulated from each other and the current is uniformly distributed over the area of the cross-section in each cylinder. The strength of the magnetic field at a distance $3a/2$ from the

axis of the cable is

A. $B = \frac{5\mu_0 I}{36\pi a}$

B. $B = \frac{5\mu_0 I}{12\pi a}$

C. $B = \frac{7\mu_0 I}{12\pi a}$

D. $B = \frac{7\mu_0 I}{36\pi a}$

Answer: D

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6. A dipole of dipole moment $\overrightarrow{p} = p\hat{i}$ lies along the x -axis in a non-uniform electric field $\overrightarrow{E} = \frac{c}{x}\hat{i}$. The force acting on the dipole is

A. zero

B. $-\frac{pc}{x^2}\hat{i}$

C. $\frac{pc}{x^2}\hat{i}$

D. $-\frac{pc}{2x^2}\hat{i}$

Answer: B

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7. A hypothetical planet in the shape of a sphere is completely made of an incompressible fluid and has a mass M and radius R. If the pressure at the surface of the planet is zero, then the pressure at the centre of the planet is [G = universal constant of gravitation]

A. $P = \frac{3GM^2}{8\pi R^4}$

B. $P = \frac{3GM^2}{4\pi R^4}$

C. $P = \frac{3GM^2}{8\pi^2 R^4}$

D. $P = \frac{3GM^2}{4\pi^2 R^4}$

Answer: A

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8. The power radiated by a black body is P, and it radiates maximum energy around the wavelength λ_0. If the temperature of the black body is now changed so that it radiates maximum energy around a wavelength $3\lambda_0 / 4$,

the power radiated by it will increase by a factor of

A. $\frac{4}{3}P_0$

B. $\frac{16}{9}P_0$

C. $\frac{64}{27}P_0$

D. $\frac{256}{81}P_0$

Answer: D

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9. The temperature of 5 moles of a gas at constant volume is changed from $100^{\circ}C$ to $120^{\circ}C$. The change in internal energy is 80 J. The total heat capacity of the gas at constant volume will be in $\frac{J}{K}$.

A. 8

B. 4

C. 0.8

D. 0.4

Answer: B

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10. A car is moving along the circle $x^2 + y^2 = a^2$ in the anti-clockwise direction with a constant speed. The x-y plane is a rough horizontal stationary surface. When the car is at the point $(a\cos\theta, a\sin\theta)$, the unit vector in the direction of the friction force acting on the car is

A. $\cos\theta\hat{i} + \sin\theta\hat{i}$

B. $\cos\theta\hat{i} + \sin\theta\hat{i}$

C. $-\cos\theta\hat{i} - \sin\theta\hat{j}$

D. $-\cos\theta\hat{i} + \sin\theta\hat{j}$

Answer: C

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11. Nucleus A decays into B with a decay constant λ_1 and B further decays into C with a decay constant λ_2 . Initially, at t = 0, the number of nuclei of A and B were $3N_0$ and N_0

respectively. If at t = t_0 number of nuclei of B becomes constant and equal to $2N_0$, then

A. $t_0 = \frac{1}{\lambda_1} \ln \left[\frac{3\lambda_1}{2\lambda_2} \right]$

B. $t_0 = \frac{1}{\lambda_1} lm \left[\frac{\lambda_1}{\lambda_2} \right]$

C. $t_0 = \frac{1}{\lambda_1} \ln \left[\frac{2\lambda_1}{3\lambda_2} \right]$

D. $t_0 = \frac{1}{\lambda_2} \ln \left[\frac{3\lambda_1}{2\lambda_2} \right]$

Answer: A

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12. An electron of mass m and charge e initially at rest gets accelerated by a constant electric field E. The rate of change of de-Broglie wavelength of this electron at time t ignoring relativistic effects is

A. $\frac{d\lambda}{dt} = -\frac{h}{eEt}$

B. $\frac{d\lambda}{dt} = -\frac{2h}{eEt}$

C. $\frac{d\lambda}{dt} = -\frac{2h}{eEt^2}$

D. $\frac{d\lambda}{dt} = -\frac{h}{eEt^2}$

Answer: D

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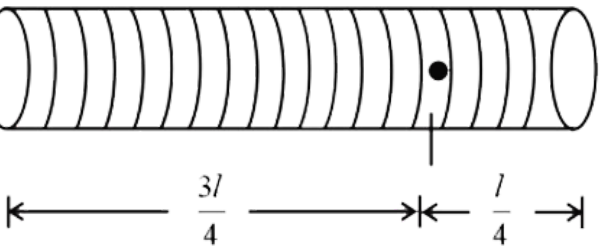
13. A tightly wound solenoid of radius 'a' and length 'l' has n turns per unit length. It carries an electric current i. Magnetic field at a distance $\frac{l}{4}$ from one of the end (inside the solenoid on its axis) is $B = \frac{\mu_0 ni\left(\sqrt{5}+3\right)}{\sqrt{K}}$ for $l = 4a$. Then find the value of K.



A. $T = 2\pi\sqrt{\frac{2L}{3g}\left(\frac{d_1}{d_2 - d_1}\right)}$

B. $T = 2\pi\sqrt{\frac{L}{3g}\left(\frac{d}{d_2 - d_1}\right)}$

C. $T = 2\pi\sqrt{\frac{2L}{g}\left(\frac{d_1}{d_2 - d_1}\right)}$

D. $T = 2\pi\sqrt{\frac{2L}{3g}\left(\frac{d_2 - d_1}{d_1}\right)}$

Answer: A

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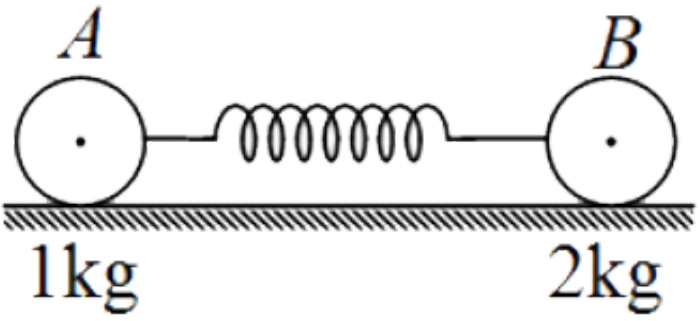
14. Two uniform discs A and B of equal radii but having different masses 1 kg and 2 kg

respectively, are connected (at centres) by a massless spring of spring constant $k = 1000Nm^{-1}$ and then placed on a sufficiently rough horizontal surface. If initially, the system is released from rest with the spring being compressed by 10 cm, then the speed of A when the spring comes back to its natural length, is



A. $v_A = \sqrt{\frac{40}{9}} ms^{-1}$

B. $v_A = \sqrt{\frac{20}{9}} ms^{-1}$

C. $v_A = \sqrt{\frac{20}{3}} ms^{-1}$

D. $v_A = \sqrt{\frac{40}{3}} ms^{-1}$

Answer: A

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15. A common emitter amplifier has a voltage gain of 50, an input impedance of 100Ω and an

output impedance of 200 Ω. The power gain of the amplifier is :-

A. 500

B. 1000

C. 1250

D. 100

Answer: C

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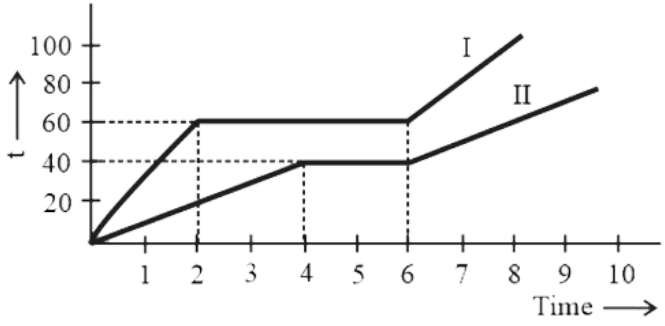
16. Two bodies of equal masses are heated at a uniform rate under identical conditions. The change in temperature in the two cases is shown graphically. The ratio of their specific heats in the solid state is



A. $1:3$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: A

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17. If force F is related with distance x and time t as $F = A\sqrt{x} + Bt^2$, the dimensions of $\frac{A}{B}$ is

A. $M^0L^{-1/2}T$

B. $ML^{-1/2}T^{-2}$

C. $M^0L^{-1/2}T^2$

D. M^0LT^{-2}

Answer: C

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18. A screw gauge with a pitch of $0.5mm$ and a circular scale with 50 divisions is used to measure the thicknes of a thin sheet of Aluminium. Before starting the measurement,

it is found that wen the jaws of the screw gauge are brought in cintact, the 45^{th} division coincide with the main scale line and the zero of the main scale is barely visible. what is the thickness of the sheet if the main scale readind is $0.5mm$ and the $25th$ division coincide with the main scale line?

A. $\Delta f = f\left[\frac{c(c-v)}{v(c+v)}\right]$

B. $\Delta f = f\left[\frac{v(c-v)}{c(c+v)}\right]$

C. $\Delta f = f\left[\frac{c(c+v)}{v(c-v)}\right]$

D. $\Delta f = f\left[\frac{v(c+v)}{c(c-v)}\right]$

Answer: D

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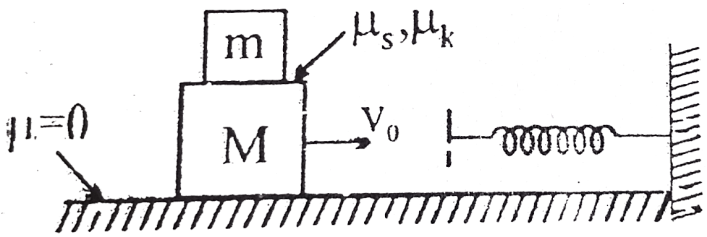
19. A block of mass M slides on a frictionless surface with an initial speed of v_0 On top of block is a small box of mass m. the coefficients of friction between box and block are μ_6 and μ_k. The sliding block encounters and ideal spring with force constant K. Answer following questions. What is maximum value of k for which it remains true that box does

not slide?



A. $\left(\frac{\mu g}{v_0}\right)^2 \frac{(m+M)^2}{m}$

B. $\left(\frac{\mu g}{v_0}\right)^2 (m+M)$

C. $\left(\frac{\mu g}{v_0}\right)^2 \frac{(m+M)^2}{M}$

D. $\left(\frac{\mu g}{v_0}\right)^0 (M-m)$

Answer: B

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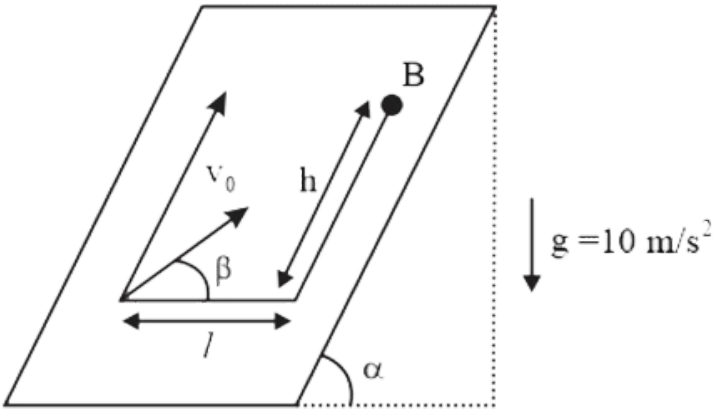
20. An inclined plane is located at angle $\alpha = 53^\circ$ to the horizontal. There is a hole at point B in the inclined plane as shown in the figure. A particle is projected along the plane with speed v_0 at an angle $\beta = 37^\circ$ to the horizontal in such a way so that it gets into the hole. Neglect any type of friction. Find the

speed v_0 (in ms^{-1}) if h = 1 m and l = 8m.



A. 9

B. 3

C. 6

D. 12

Answer: A

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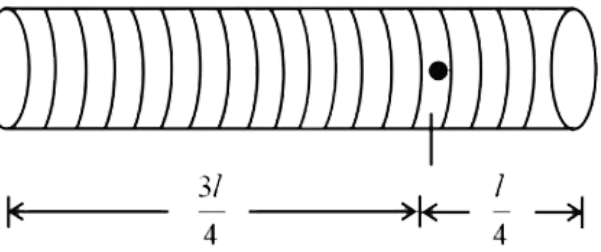
21. A tightly wound solenoid of radius 'a' and length 'l' has n turns per unit length. It carries an electric current i. Magnetic field at a distance $\frac{l}{4}$ from one of the end (inside the solenoid on its axis) is $B = \frac{\mu_0 ni\left(\sqrt{5}+3\right)}{\sqrt{K}}$ for $l = 4a$. Then find the value of K.



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readind is $0.5mm$ and the $25th$ division coincide with the main scale line?

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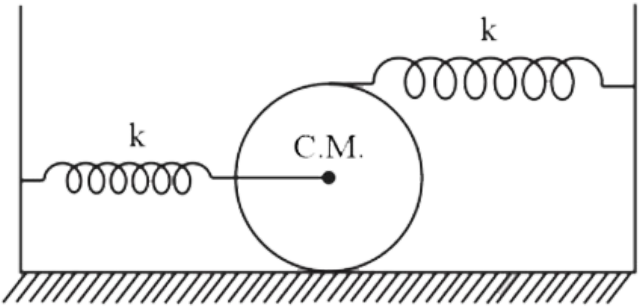
23. A uniform solid cylinder can roll without sliding on a horizontal surface as shown in the figure. The mass of cylinder is 10 kg and the spring constant for both the ideal springs is $300Nm^{-1}$. What is the angular frequency (in rad s^{-1}) of small oscillations of the centre of

the cylinder?



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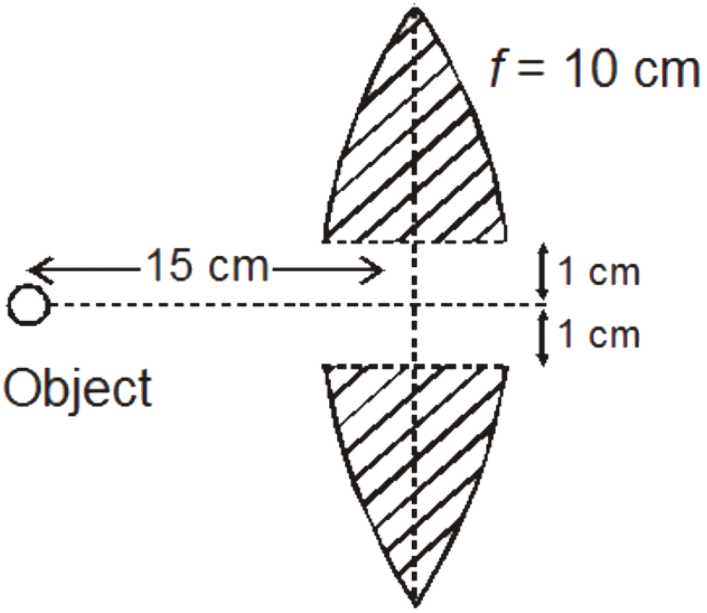
24. A point object is placed as shown. The two pieces are of the same lens of focal length 10 cm. Find the distance (in cm) between the two

images formed by two pieces of the lens.



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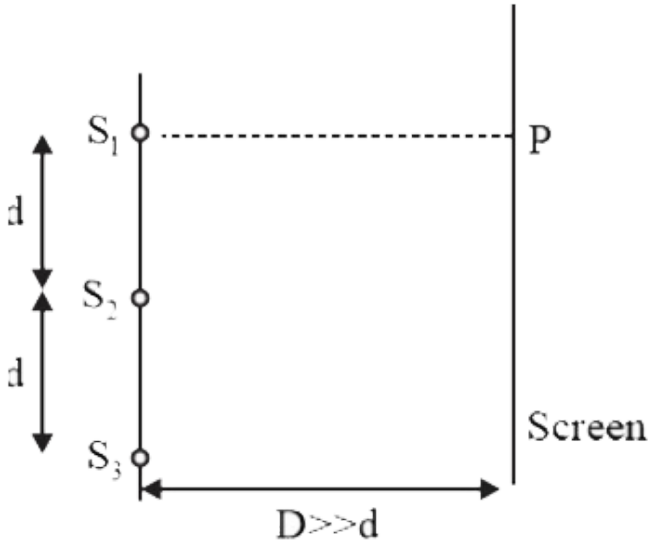
25. Consider the interference at P between waves emitting from three coherent sources in

the same phase located at S_1 , S_2 and S_3 . If the intensity due to each source is $I_0 = 12Wm^{-2}$ at P and $\frac{d^2}{2D} = \frac{\lambda}{3}$ then what will be the resultant intensity $\left(\in Wm^{-2} \right)$ at P?



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