PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 106

Physics

1. A thin bar of length L has a mass per unit length λ, that increases linerarly with distance from one end. If its total mass is M and its

mass per unit length at the lighter end is λ_0, then the distance of the centre of mass from the lighter end is

A. $\frac{L}{3} + \frac{\lambda_0 L^2}{8M}$

B. $\frac{L}{3} + \frac{\lambda_0 L^2}{4M}$

C. $\frac{L}{2} - \frac{\lambda_0 L^2}{4M}$

D. $\frac{2L}{3} - \frac{\lambda_0 L^2}{6M}$

Answer: D

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2. In a circular motion of a particle , the tangential acceleration of the particle is given by $a_t = 9ms^{-2}$. The radius of the circle is 4m . The particle was initially at rest. Time after which total acceleration of the particle makes an angle of 45° with the radial acceleration is

A. $\frac{1}{3}s$

B. $\frac{5}{3}s$

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

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

Answer: B

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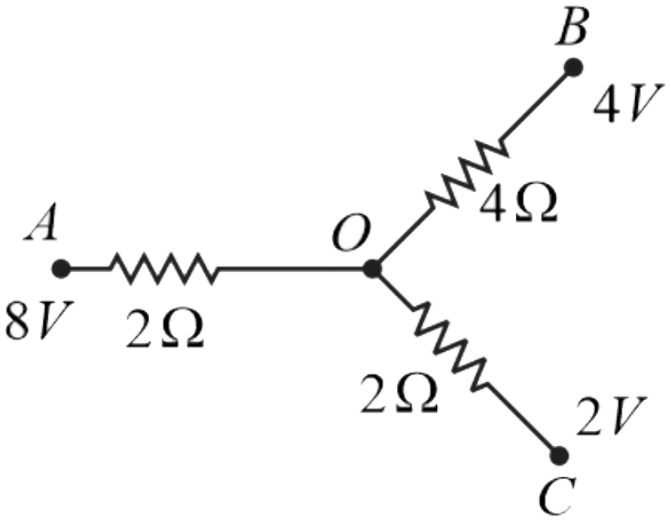
3. In the following network, the potential at O is



A. 4 V

B. 3 V

C. 6 V

D. 4.8 V

Answer: D

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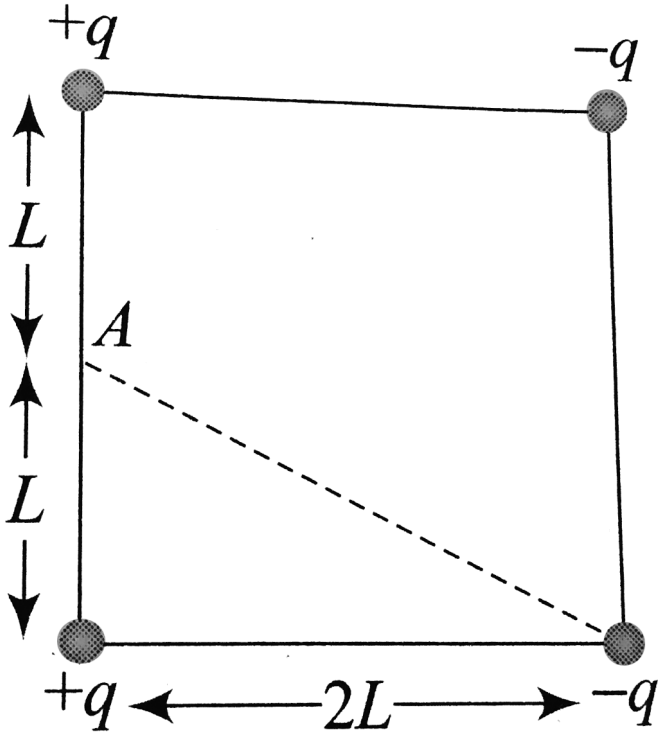
4. Four electric charges $+q,\ +q,\ -q$ and $-q$ are placed at the corners of a square of side 2L (see figure). The electric potential at point A,

mid-way between the two charges $+q$ and $+q$,

is



A. $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1+\sqrt{5}\right)$

B. $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1+\frac{1}{\sqrt{5}}\right)$

C. zero

D. $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1-\frac{1}{\sqrt{5}}\right)$

Answer: D

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5. A galvanometer of resistance 50Ω is connected to a battery of 3V along with a resistance of 2950Ω in series. A full scale deflection of 30 division is obtained in the galvanometer. In order to reduce this

deflection to 20 division, the resistance in series should be:-

A. 5050Ω

B. 5550Ω

C. 6050Ω

D. 4450Ω

Answer: D

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6. If R is the radius of the Earth then the height above the Earth's surface at which the acceleration due to gravity decreases by $20\,\%$ is

A. $\left(\frac{\sqrt{5}}{2}-1\right)R$

B. $\left(\frac{\sqrt{5}}{2}+1\right)R$

C. $\left(5\sqrt{2}-1\right)R$

D. $\left(5\sqrt{2}+1\right)R$

Answer: A

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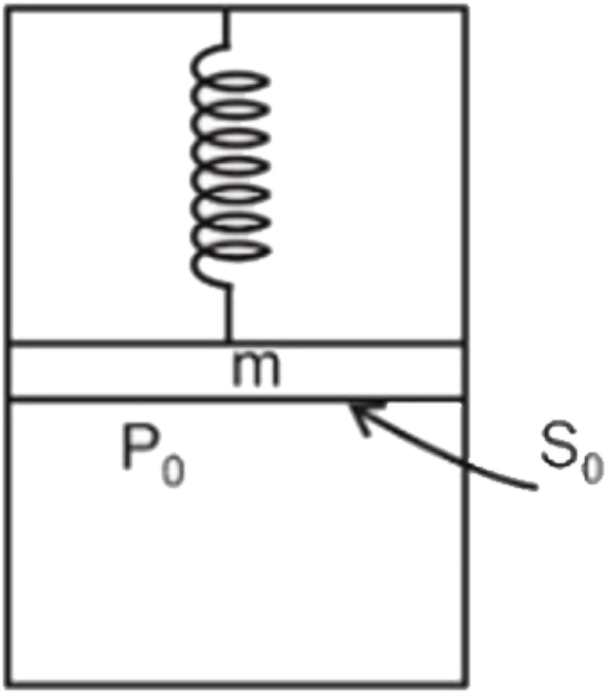
7. A non - conducting piston of mass m and are S_0 divides a non - conducting, closed cylinder as shown in the figure. A piston having mass m is connected with the top wall of the cylinder by a spring of force constant k. The top part is evacuated and the bottom part is evacuated and the bottom part contains an ideal gas at a pressure P_0 in the equilibrium position. Adiabatic exponent γ and in equilibrium length of each part is l. (neglect friction). Find

the angular frequency for small oscillation.



A. $\frac{\sqrt{kl + \gamma P_0 S_0}}{2ml}$

B. $\frac{\sqrt{3kl + \gamma P_0 S_0}}{ml}$

C. $\sqrt{\frac{k}{m}}$

D. $\frac{\sqrt{kl+\gamma P_0 S_0}}{ml}$

Answer: D

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8. A sound wave passing through air at NTP produces a pressure of $0.001\frac{\text{dyne}}{cm^2}$ during a compression. The corresponding change in temperature (given $\gamma = 1.5$ and assume gas to be ideal) is

A. $8.97 \times 10^{-4} K$

B. $9.87 \times 10^{-6} K$

C. $8.97 \times 10^{-8} K$

D. $9.87 \times 10^{-4} K$

Answer: C

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9. A steady current flows in a long wire. It is bent into a circular loop of one turn and the magnetic field at the center of the coil is B. If the same wire is bent into a circular loop of n

turns, the magnetic field at the center of the coil is

A. $\frac{B}{n}$

B. nB

C. nB^2

D. n^2B

Answer: D

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10. In a vernier callipers, one main scale division is x cm and n divisions of the vernier scale coincide with (n-1) divisions of the main scale. The least count (in cm) of the callipers is :-

A. $\frac{p}{q}(p-1)$

B. $\frac{p}{q}$

C. $\frac{q-1}{pq}$

D. $\frac{1}{pq}$

Answer: D

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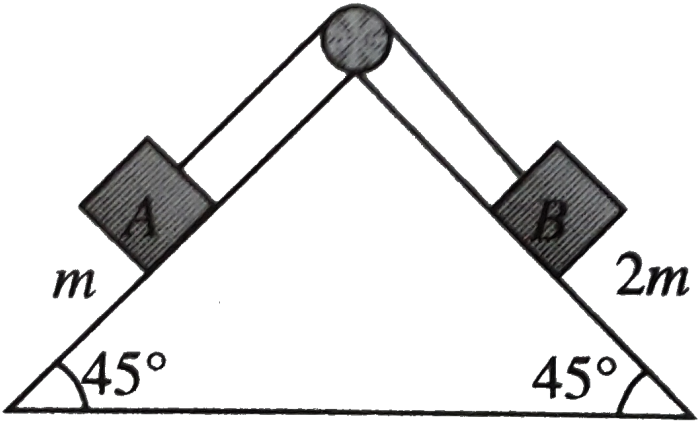
11. Block A of mass m and block B of mass $2m$ are placed on a fixed traingular wedge by means of a massless inextensible string and a frictionless pulley as shown in figure The wedge is inclined at 45° to the horizontal on both sides .The coefficient of friction between blocks A and the wedge is $2/3$ and that between block B and the wedge is $1/3$. If the system A and B is released from rest find the following



The acceleration of A is

A. 0

B. 1

C. 2

D. 3

Answer: A

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12. A and B are two radioactive substances whose half lives are 1 and 2 years respectively. Initially $10gm$ of A and $1gm$ of B is taken. The time (approximate) after which they will have same quantity remaining is.

A. 6.62 years

B. 5 years

C. 3.2 years

D. 7 years

Answer: A

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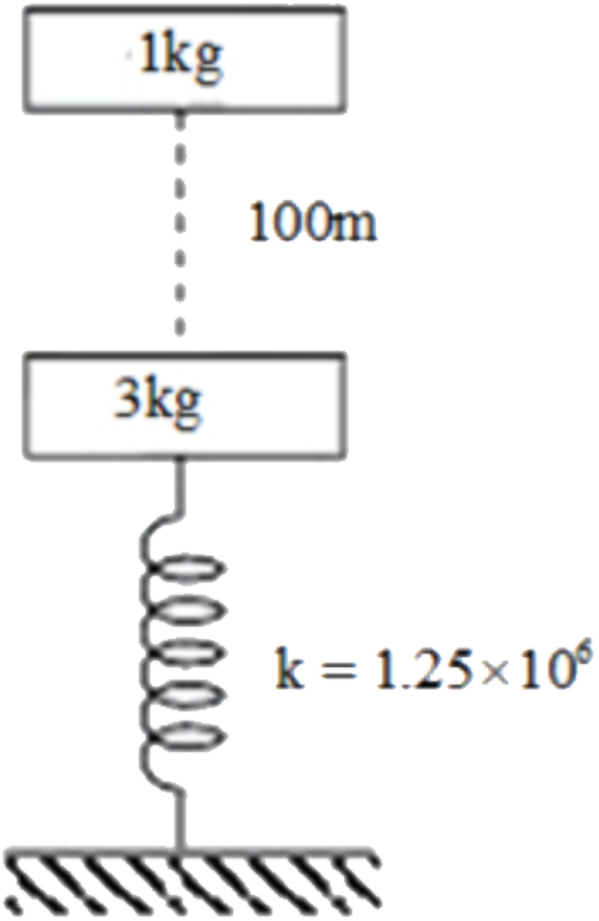
13. A block of mass 1kg is dropped on a spring - mass system as shown in the figure. The block traves 100 meters in the air before strinking the 3 kg mass. Calculate maximum compression in the spring, if both the blocks move together after the collision. Spring

constant of the string $k = 1.25 \times 10^6$.



A. 2 cm

B. 4 cm

C. 8 cm

D. 16 cm

Answer: A

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14. Cathode rays of velocity $10^6 ms^{-1}$ d escribe an approximate circular path of the radius 1m in an electric field $300\ \mathrm{V\ cm}^{=-1}$. If the velocity of cathode rays are doubled. The value of

electric field so that the rays describe the same circular path, will be

A. $120\ \mathrm{V\ cm^{-1}}$

B. $600\ \mathrm{V\ cm^{-1}}$

C. $1200\ \mathrm{V\ cm^{-1}}$

D. $12000\ \mathrm{V\ cm^{-1}}$

Answer: C

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15. A tube of length 1 and radius R carries a steady flow of fluid whose density is ρ and viscosity η. The velocity v of flow is given by $v = v_0\left(1 - r^2 / R^2\right)$ Where r is the distance of flowing fluid from the axis.

A. $4\pi\eta l V_0$

B. $2\pi\eta l V_0$

C. $\pi\eta l V_0$

D. $\frac{2}{3}\pi\eta l V_0$

Answer: A

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16. A lens is made of flint glass (refractive index $= 1.5$). When the lens is immersed in a liquid of refractive index 1.25 , the focal length:

A. Increases by a factor of 1.25

B. Increases by a factor of 2.5

C. Increases by a f actor of 1.2

D. Decreases by a factor of 1.2

Answer: B

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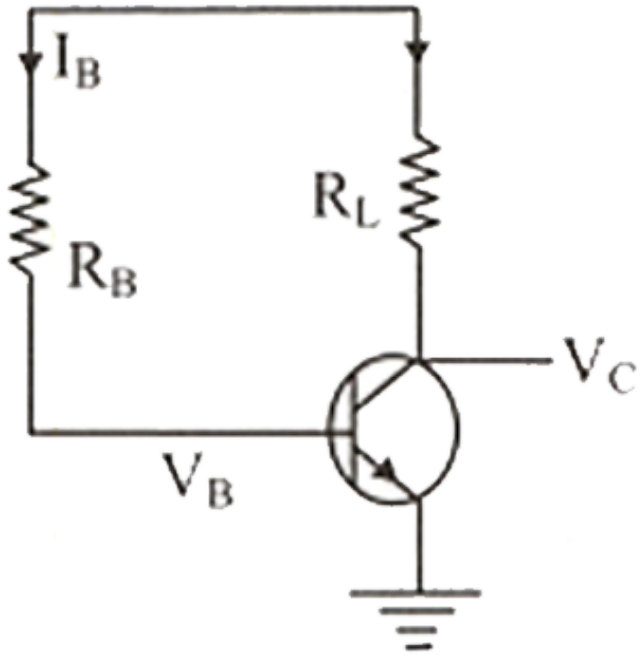
17. In the circuit of CE amplifier, a silicon transistor is used. The value of $V_{CC} = +20V, R_L = 3k\Omega$, collector voltage $= 5v, \beta = 100$. Then the base resistance R_B should be $\ldots\ldots \times 10^5\Omega$

(Take input voltage drop across Si transistor =

0.7 V)



A. $3.86 \times 10^6 \Omega$

B. $2.16 \times 10^4 \Omega$

C. $1.36 \times 10^4 \Omega$

D. $5.44 \times 10^5 \Omega$

Answer: A

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18. Calculate the compressional force required to prevent the metallic rod length lcm and cross-sectional area Acm^2 when heated through $t^\circ C$, from expanding along length wise. The Young's modulus of elasticity of the metal is E and mean coefficient of linear expansion is α per degree Celsius

A. $EA\alpha t$

B. $\frac{EA\alpha t}{(1+\alpha t)}$

C. $\frac{EA\alpha t}{(1-\alpha t)}$

D. $El\alpha t$

Answer: B

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19. If E = energy , G= gravitational constant, I =impulse and M=mass, then dimensions of

$\frac{GIM^2}{E^2}$ are same as that of

A. Time

B. Mass

C. Length

D. Force

Answer: A

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20. A band playing music at a frequency f is moving towards a wall at a speed v_b. A motorist is following the band with a speed v_m. If v is the speed of sound, obtain an expression for the beat frequency heard by the motorist.

A. $\dfrac{(v+v_m)f}{v+v_0}$

B. $\dfrac{(v+v_m)f}{v-v_0}$

C. $\dfrac{2v_0(v+v_m)f}{v^2-v_0^2}$

D. $\dfrac{2v_m(v+v_b)f}{v^2-v_b^2}$

Answer: C

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21. The radius of germanium (Ge) nuclide is measured to be twice the radius of $._4^9 Be$. The number of nucleons in Ge are

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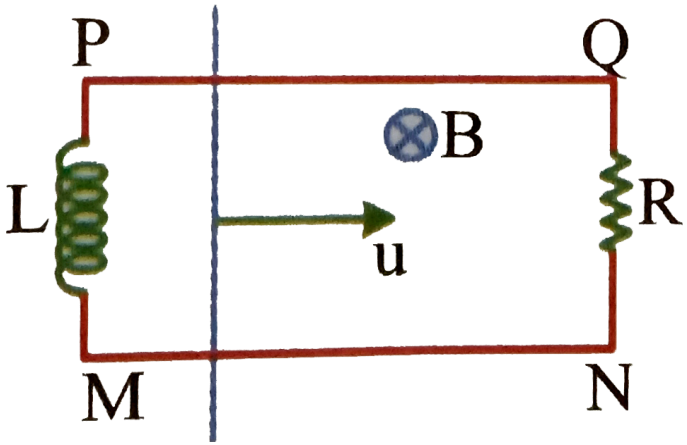
22. In the figure, a conducting rod of length $l = 1$ meter and mass $m = 1kg$ moves with

initial velocity $u = 5m/s$. On a fixed horizontal frame containing inductor $L = 2H$ and resistance $R = 1W$. PQ and MN are smooth, conducting wires. There is a uniform magnetic field of strength $B = 1T$. Initially there is no current in the inductor. Find the total charge in coulomb, flown through the inductor by the time velocity of rod becomes $v_f = 1m/s$ and the rod has travelled a

distance $x = 3$ meter.



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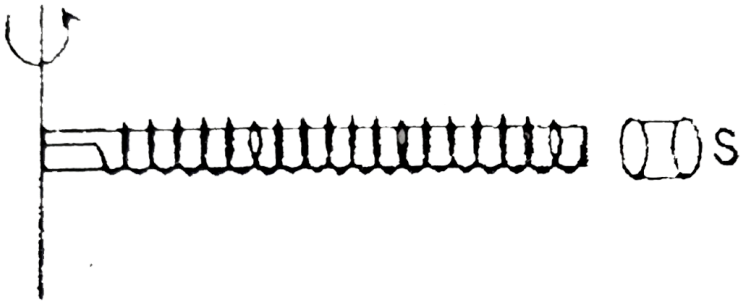
23. A rod of length $l = 2m$ is maintained to rotate with a constant angular velocity $\omega = 1rad/s$ about vertical axis passing through one end (fig). There is a spring of

spring constant $k = 1N/m$ which just encloses rod inside it in natural length. One end of the spring is attached to axis of rotation. S is sleeve of mass $m = 1kg$ which can just fix on rod. All surfaces are smooth. With what minimum kinetic energy (in J) sleeve should be projected so that it enters on the rod without impulse and completely compresses the spring.



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24. An inteference is observed due to two coherent sources A and B separated by a distance 4λ along Y-axis, where λ is the wavelength of light. A detector 'D' is moved alog the positive X-axis. Find the total number of maxima observe on the X-axis excluding the points $x = 0$ and $x = \infty$?

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25. In a photoelectric experiment a parallel beam of monochromatic light with power of 200W is incident on a perfectly absorbing cathode of work function 6.25. The frequency of light is just above the threshold frequency so that the photoelectrons are emitted with negligible kinetic energy. Assume that the photoelectron emission efficiency is 100%. A potential difference of 500V is applied between the cathode and the anode. All the emitted electrons are incident normally on the anode and are absorbed. The anode

experiences a force $n \times 10^{-4} N$ due to the impact of the electrons. The value of n is _____. Mass of the electron $9.1 \times 10^{-31} Kg$ and charge is $1.6 \times 10^{-19} C$

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