PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 31

Physics

1. Two radioactive substance A and B have decay constants 5λ and λ respectively. At $t = 0$ they have the same number of nuclei. The ratio of number of

nuclei of nuclei of A to those of B will be $\left(\frac{1}{e}\right)^2$ after a time interval

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

B. $\frac{1}{2\lambda}$

C. $\frac{2}{\lambda}$

D. $\frac{1}{4\lambda}$

Answer: B

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2. A ball is dropped from height 'H' onto a horizontal surface. If the coefficient of restitution is 'e' then the total time after which it comes to rest is

A. $\sqrt{\frac{2H}{g}}\left(\frac{1-e}{1+e}\right)$

B. $\sqrt{\frac{2H}{g}}\left(\frac{1+e}{1-e}\right)$

C. $\sqrt{\frac{2H}{g}}\left(\frac{1+e^2}{1-e^2}\right)$

D. $\sqrt{\frac{2H}{g}}\left(\frac{1-e^2}{1+e^2}\right)$

Answer: B

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3. For protecting a sensitive equipment from the external magnetic field, it should be

A. Wrap insulation around it

B. place inside an iron can

C. Surround with fine copper sheet

D. Place inside an aluminum can

Answer: B

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4. A 24 V battery of internal resistance 4.0Ω is connected to a variable resistance. At what value of the current drawn from the battery is the rate of heat produced in the resistor maximum?

A. 2A

B. 3A

C. 4A

D. 6A

Answer: B

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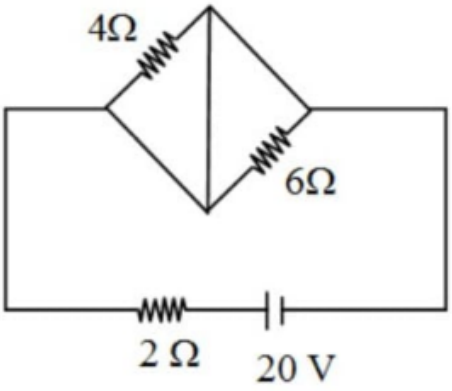
5. In the circuit shown, the current flowing from the battery is



A. 11/50 A

B. 10A

C. 5/3A

D. Infinite current

Answer: B

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6. Two conducting spheres of radii r_1 and r_2 having charges Q_1 and Q_2 respectively are connected to each other. There is

A. no change in the energy of the system

B. an increase in the energy of the system

C. always a decrease in the energy of the system

D. a decrease in the energy of the system unless

$$q_1 R_2 = q_2 R_1$$

Answer: D

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7. A large hollow metal sphere of radius R has a small opening at the top. Small drops of mercury, each of radius r and charged to a potential of the sphere becomes V' after N drops fall into it.Then

A. $V' = \mathrm{V}$ for any value of N

B. $V' = V \quad \text{for} \quad N = \left(\frac{R}{r}\right)^{2/3}$

C. $V' = V \quad \text{for} \quad N = \left(\frac{R}{r}\right)^{1/3}$

D. $V' = V \quad \text{for} \quad N = \frac{R}{r}$

Answer: D

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8. A body is projected upwards with a velocity of $4 \times 11.2 \mathrm{km\ s}^{-1}$ from the surface of earth.What will be the velocity of the body when it escapes from the gravitational pull of earth ?

A. $11.2 kms^{-1}$

B. $2 \times 11.2 kms^{-1}$

C. $3 \times 11.2 kms^{-1}$

D. $\sqrt{15} \times 11.2 kms^{-1}$

Answer: D

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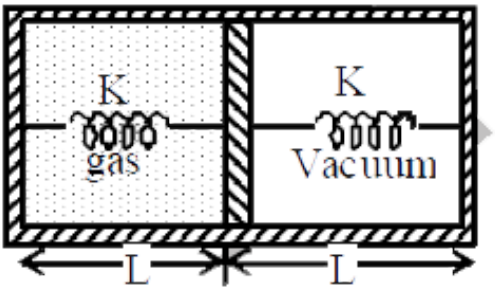
9. When heat is supplied to the gas it expands and displaces piston by L/2 where natural length of springs are L = 1 m. Spring constant K = 100 N/m. Area of piston is $1m^2$. The pressure of gas in final situation is



A. $50Nm^{-2}$

B. $100Nm^{-2}$

C. $200Nm^{-2}$

D. $400Nm^{-2}$

Answer: B

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10. Two coaxial long solenoids of equal length have current, i_1, i_2, number of turns per unit length n_1, n_2 and radius r_1, r_2 respectively. If $n_1 i_1 = n_2 i_2$ and the two solenoids carry current in opposite sense, the magnetic energy stored per unit length is $[r_2 > r_1]$

A. $\frac{\mu_0}{2} n_1^2 i_1^2 \pi \left(r_2^2 - r_1^2\right)$

B. $\mu_0 n_1^2 i_1^2 \pi \left(r_2^2 - r_1^2\right)$

C. $\frac{\mu_0}{2} n_1^2 i_1^2 \pi r_1^2$

D. $\frac{\mu_0}{2} n_2^2 i_2^2 \pi r_2^2$

Answer: A

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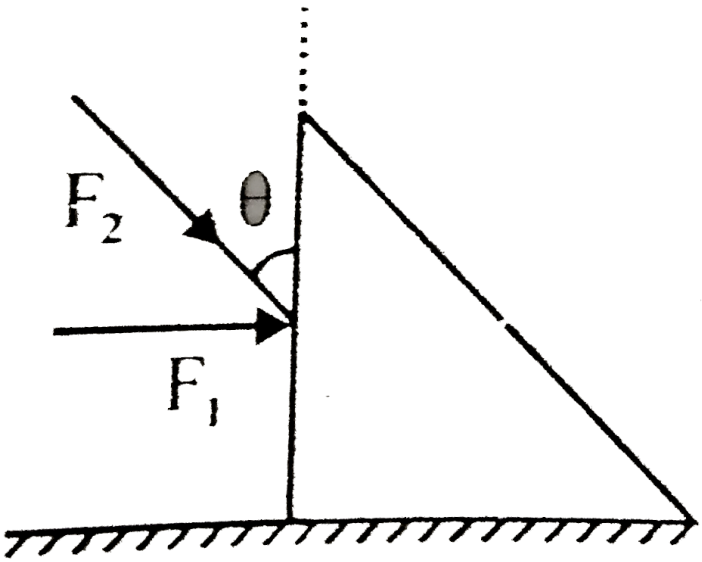

11.

A wedge of mass m, lying on a rough horizontal plane, is acted upon by a horizontal force F_1 and another force F_2, inclined at an angle θ to the vertical. The block is in equilibrium, then minimum coefficient of friction between it and te surface is

A. $\frac{F_2 \sin\theta}{(mg + F_2 \cos\theta)}$

B. $\left(\frac{F_1 \cos\theta + F_2}{mg - F \sin\theta}\right)$

C. $\frac{(F_1 + F_2 \sin\theta)}{(mg + F_2 \cos\theta)}$

D. $\left(\frac{F_1 \sin\theta - F_2}{(mg - F_2 \cos\theta)}\right.$

Answer: C

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12. The length of a simple pendulum executing simple harmonic motion is increased by $21\,\%$. The percentage increase in the time period of the pendulum of increased length is

A. $11\ \%$

B. $21\ \%$

C. $42\ \%$

D. $10\ \%$

Answer: D

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13. A 27 mW laser beam has a cross-sectional maximum electric field in this electromagnetic wave is given by :

[Given permittivity of space $\in_0 = 9 \times 10^{12}$ SI units, Speed of light $c = 3 \times 10^8 m/s$]

A. $1\ \mathrm{k\ V\ m^{-1}}$

B. $1.4\ \mathrm{k\ V\ m^{-1}}$

C. $0.7\ \mathrm{kV\ m^{-1}}$

D. $2\ \mathrm{kV\ m^{-1}}$

Answer: B

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14. The level of water in a tank is 5 m high . A hole of the area $10cm^2$ is made in the bottom of the tank .

The rate of leakage of water from the hole is

A. $10^{-2}m^3s^{-1}$

B. $10^2m^3s^{-1}$

C. $10m^3s^{-1}$

D. $10^{-4}m^{-3}s^{-1}$

Answer: A

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15. A wire suspended vertically from one of the its ends is stretched by attaching a weight of 200 N to

the lower end. The weight stretches the wire by 1 mm. then the elastic energy stored in the wire is

A. 0.2 J

B. 10 J

C. 20 J

D. 0.1 J

Answer: D

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16. The maximum fequency for reflection of sky waves from a certain layer bof the ionosphere is

found to be $f_{\max} = 9(N_{\max})^{1/2}$, Where N _max is the maximum electron density at that layer of the ionosphere.On a certain day it is observed that signals of frequencies higher than 5 MHz are not received by reflection from the F_1 layer of the ionosphere while signals of frequencies higher than 8 MHz are not received by reflection from the F_2 layer of the ionosphere. Estimate the maximum electron densities of the F_1 and F_2 layers on that day.

A. $7.9 \times 10^{11} m^{-3}$

B. $8.9 \times 10^{11} m^{-3}$

C. $1.9 \times 10^{11} m^{-3}$

D. $7.1 \times 10^{11} m^{-3}$

Answer: A

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17. 1% of 10^{12} Hz of a satellite link was used for telephony . What is the number of channels (or subscribers) , if the bandwidth of each channel is 8 KHz ?

A. 2.5×10^{7}

B. 1.25×10^{6}

C. 2.5×10^{8}

D. 1.25×10^8

Answer: B

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18. The wave of wavelength 5900Å emitted by any atom or molecule must have some finite total length which known as coherence length. For sodium light, this length is $2.4cm$. The number of oscillation in this length will be,

A. 4.068×18^8

B. 4.068×10^4

C. 4.068×10^6

D. 4.068×10^5

Answer: B

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19. A light string is tied at one end to a fixed support and to a heavy string of equal length L at the other end A as shown in the figure (Total length of both strings combined is 2L). A block of mass M is tied to the free end of heavy string. Mass per unit lenght of the string are μ and 16μ and tensions is T . Find

lowest positive value of frequency such that junction point A is a node.

A. $\frac{1}{L}\sqrt{\frac{T}{\mu}}$

B. $\frac{5}{2L}\sqrt{\frac{T}{\mu}}$

C. $\frac{3}{2L}/\sqrt{\frac{T}{um}}$

D. $\frac{1}{2L}\sqrt{\frac{T}{\mu}}$

Answer: D

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20. A particle starts with speed v_0 from x = 0 along x - axis with retardation proportional to the square of its displacement. Work done by the force acting on the particle is proportional to

A. $x^{\frac{5}{2}}$

B. x^3

C. e^x

D. x^2

Answer: B

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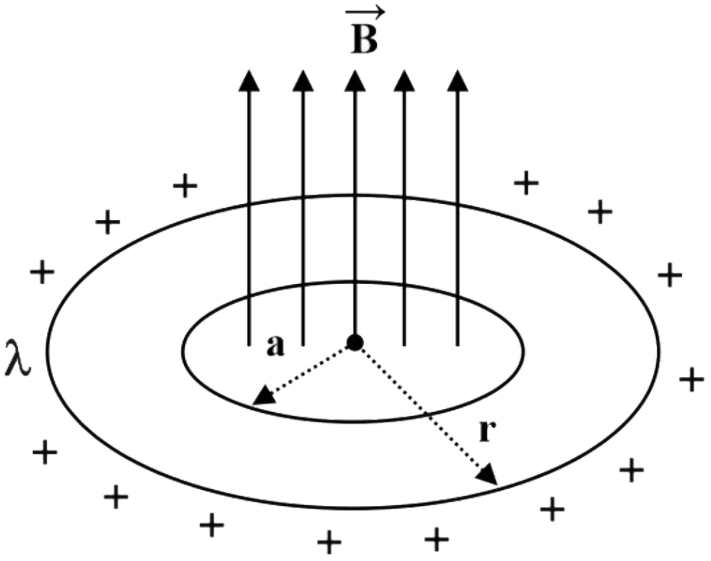
21. A ring of mass 4 kg is uniformaly charged with a linear charge density $\lambda = 4\,\mathrm{C\,cm^{-1}}$ and kept on a rough horizontal surface with a friction coefficient of $\mu = \frac{\pi}{4}$, A time - varying magnetic field $B = B_0 t^2$ is applied in a circular region of radius $(a < r)$ perpendicular to the plane of the ring as shown in the figure. Find out the time when the ring just starts to rotate on the surface .

$\left(\text{take a} = 5\ \text{cm}, \text{g} = 10\ \text{m s}^{-2}\ \text{and}\ B_0 = 125\ \text{SI units}\right)$



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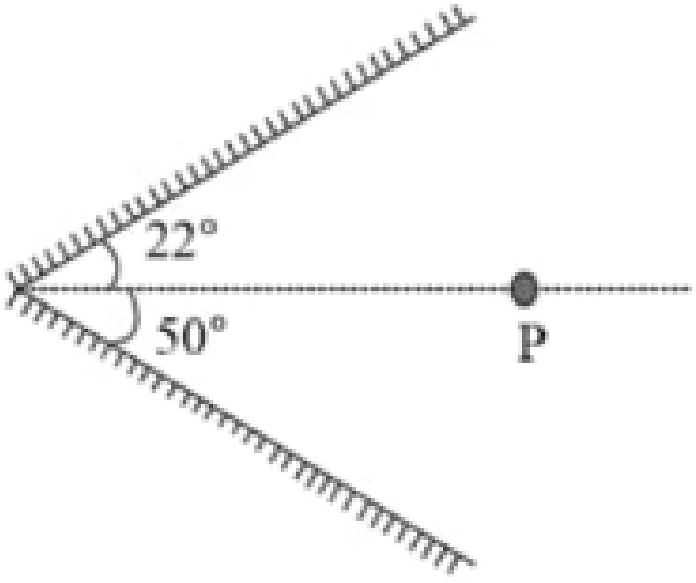
22. An object P is kept in front of two plane mirrors as shown in the figure. The number of image formed

is k. Find out the value of k.



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23. Four solid sphereas each of diameter $\sqrt{5}cm$ and mass $0.5kg$ are placed with their centres at the corners of a square of side $4cm$. The moment of

inertia of the system about the diagonal of the square is $N \times 10^{-4} kg - m^2$, the N is -

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24. Two ideal monoatomic and diatomic gases are mixed with one another to form an ideal gas mixture. The equation of the adiabatic process of the mixture is $PV^{\gamma} =$ constant, where $\gamma = \frac{11}{7}$ If n_1 and n_2 are the number of moles of the monoatomic and diatomic gases in the mixture respectively, find the ratio $\frac{n_1}{n_2}$

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25. The density of a sphere is measured by measuring the mass and diameter. If it is known that the maximum percentage errors in measurement of mass and diameter are 2% and 3% respectively then the maximum percentage error in the measurement of density is

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