PHYSICS

BOOKS - NTA MOCK TESTS

JEE MOCK TEST 6

Physics

1. Two strips of metal are riveted together at their ends by four rivets, each of diameter 6 mm. Assume that each rivet is to carry one

quarter of the load. If the shearing stress on the rivet is not to exceed $6.9 \times 10^7 Pa$, the maximum tension that can be exerted by the riveted strip is

A. $7.8 \times 10^3 N$

B. $6.9 \times 10^3 N$

C. $3.14 \times 10^3 N$

D. none of these

Answer: A

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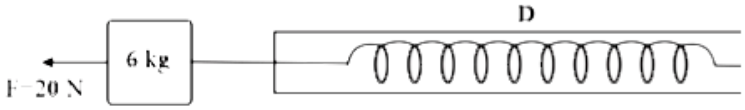
2. A dynamometer D, which is a device used to measure force, is attached to two blocks of masses 6 kg and 4 kg. Forces of 20 N and 10 N are applied on the blocks as shown in the figure. The reading of the dynamometer is



A. 10 N

B. 20 N

C. 6 N

D. 14 N

Answer: D

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3. A conducting circular loop is placed in a uniform magnetic field $0.04T$ with its plane perpendicular to the magnetic field. The radius of the loop starts shrinking at $2mm/\sec$. The induced emf in the loop when the radius is $2cm$ is

A. $4.8\pi\mu V$

B. $0.8\pi\mu V$

C. $1.6\pi\mu V$

D. $3.2\pi\mu V$

Answer: D

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4. Find the velocity of photoelectrons liberated by electromagnetic radiation of

wavelength $\lambda = 18.0nm$ from stationary He^+ ions in the ground state.

A. $2.3 \times 10^6 ms^{-1}$

B. $1.3 \times 10^6 ms^{-1}$

C. $2.3 \times 10^5 ms^{-1}$

D. $1.3 \times 10^3 ms^{-1}$

Answer: A

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5. The total length of a sonometer wire fixed between two bridges is 110 cm. Now, two more bridges are placed to divide the length of the wire in the ratio $6:3:2$. If the tension in the wire is 400 N and the mass per unit length of the wire is $0.01\,\mathrm{kg\,m^{-1}}$, then the minimum common frequency with which all the three parts can vibrate, is

A. 1000 Hz

B. 1100 Hz

C. 100 Hz

D. 110 Hz

Answer: A

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6. A neutron travelling with a velocity v and kinetic energy E collides perfectly elastically head on with the nucleus of an atom of mass number A at rest. The fraction of the total kinetic energy retained by the neutron is

A. $\left(\frac{1-A}{A+1}\right)^2$

B. $\left(\frac{A+1}{A-1}\right)^2$

C. $\left(\frac{A-1}{A}\right)^2$

D. $\left(\frac{A+1}{A}\right)^2$

Answer: A

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7. A lead bullet strikes a target with velocity of 480 m/s. if the bullet falls dead, then the rise in temperature of bullet is, (Assuming that heat produced is equally shared between the

bullet and target).

$\left(J = 4.2 \times 10^3 J / kcal, C = 0.03 kcal / kgK\right)$

A. $557^\circ C$

B. $457^\circ C$

C. $857^\circ C$

D. $754^\circ C$

Answer: B

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8. Two beams of light having intensities I and 4I interfere to produce a fringe pattern on a screen. The phase difference between the beams is $\frac{\pi}{2}$ at point A and π at point B. Then the difference between the resultant intensities at A and B is

A. 2I

B. 4I

C. 5I

D. 7I

Answer: B

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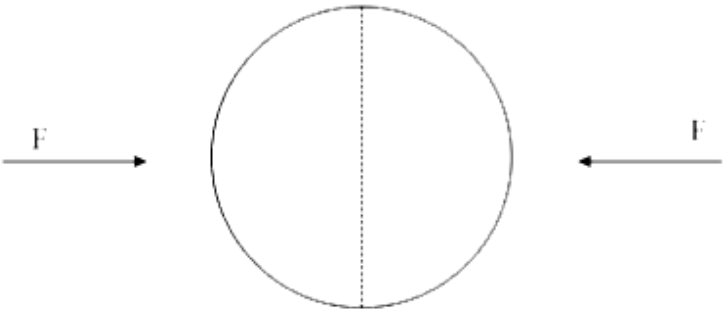
9. A thin spherical shell of radius R is cut into two equal halves and then each of its halves is charged to the same uniform surface charge density σ. If F is the force exerted on each half to keep them at equilibrium, then F is

proportional to



A. $\frac{1}{\varepsilon_0}\sigma^2 R$

B. $\frac{1}{\varepsilon_0}\frac{\sigma^2}{R}$

C. $\frac{1}{\varepsilon_0}\frac{\sigma}{R^2}$

D. $\frac{1}{\varepsilon_0}\frac{\sigma^2}{R^2}$

Answer: D

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10. A point source of light is placed at a distance h below the surface of a large deep late. What is the percentage of light energy that escapes directly form the water surface is μ of the water=$4/3$?(neglect partial reflection)

A. $50\ \%$

B. $25\ \%$

C. $20\ \%$

D. $17\ \%$

Answer: D

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11. An ideal gas expands isothermally from volume V_1 to V_2 and is then compressed to original volume V_1 adiabatically. Initialy pressure is P_1 and final pressure is P_3. The total work done is W. Then

A. $p_3 > p_1, W > 0$

B. $p_3 < p_1, W < 0$

C. $p_3 > p_1, W < 0$

D. $p_3 = p_1, W = 0$

Answer: C

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12. One end of a copper rod of uniform cross section and length 1.5 m is kept in contact with ice and the other end with water at $100^\circ C$. At what point along its length should a temperature of $200^\circ C$ be maintained so

that in the steady state, the mass of ice melting be equal to that of the steam produced in same interval of time. Assume that the whole system is insulated from surroundings:

$[L_{\text{ice}} = 80 cal/g, L_{\text{steam}} = 540 cal/g]$

A. 10.34 cm

B. $16.48 cm$

C. $21.68 cm$

D. $27.87 cm$

Answer: A

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13. A coil having N turns is would tightly in the form of a spiral with inner and outer radii a and b respectively. When a current I passes through the coil, the magnetic field at the centre is.

A. $\frac{\mu_0 NI}{b}$

B. $\frac{\mu_0 NI}{a}$

C. $\frac{\mu_0 NI}{2(b-a)} \ln\left(\frac{b}{a}\right)$

D. $\frac{\mu_0 NI}{(b-a)} \ln\left(\frac{b}{a}\right)$

Answer: C

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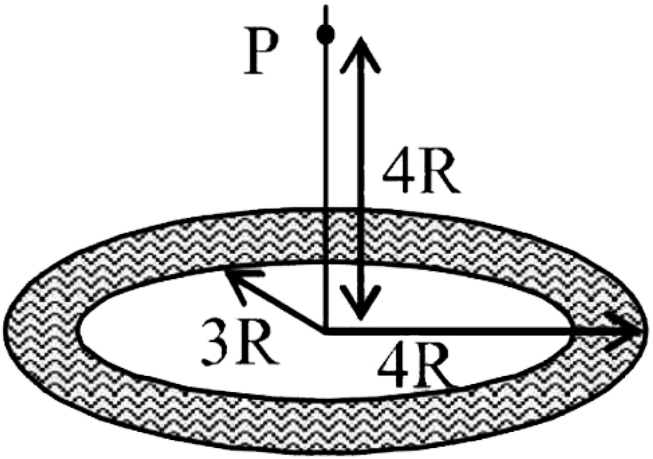
14. A thin uniform disc (see figure) of mass M has outer radius 4R and inner radius 3R. The work required to take a unit mass for point P

on its axis to infinity is



A. $\frac{2GM}{7R}\left(4\sqrt{2}-5\right)$

B. $-\frac{2GM}{7R}\left(4\sqrt{2}-5\right)$

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

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

Answer: A

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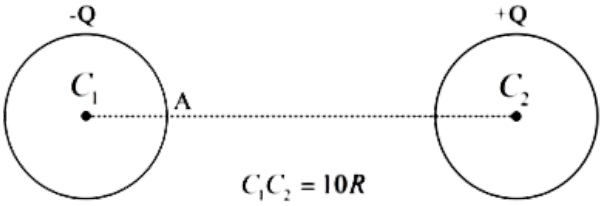
15. Two uniformaly charged nonconducting spheres, each of radius R,are fixed in a gravity free space as shwon in the figure. If an electron is released at rest from the point A, then its speed just before striking the other sphere is [mass of electron $= m_e$]



A. $\sqrt{\frac{2Q_e}{9\pi\varepsilon_0 m_e R}}$

B. $\sqrt{\frac{8Qe}{9\pi\varepsilon_0 m_e R}}$

C. $\sqrt{\frac{16Qe}{9\pi\varepsilon_0 m_e R}}$

D. $\sqrt{\frac{4Qe}{9\pi\varepsilon_0 m_e R}}$

Answer: B

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16. The binding energy per nucleon of deuterium and helium nuclei are 1.1 MeV and 7.0 MeV respectively. When two deuterium

nuclei fuse to form a helium nucleus the energy released in the fusion is

A. 2.2 MeV

B. 23.6 MeV

C. 28.0 MeV

D. 30.2 MeV

Answer: B

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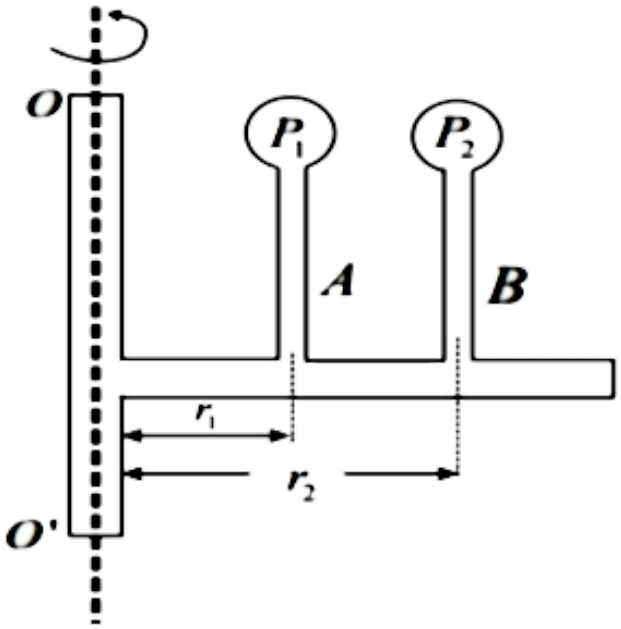
17. A closed tube filled with water is rotating uniformly in a horizontal plane about the axis OO as shown in the figure. The manometers A and B which are fixed on the tube at distances r_1 and r_2, indicate pressures P_1 and P_2 respectively. The angular velocity (ω) of the

tube is



A. $\omega = \sqrt{\dfrac{2(P_2 - P_1)}{\rho(r_2^2 - r_1^2)}}$

B. $\omega = \sqrt{\dfrac{2(P_2 + P_1)}{\rho(r_2^2 - r_1^2)}}$

C. $\omega = \sqrt{\dfrac{2(P_2 + P_1)}{\rho(r_2^2 + r_1^2)}}$

D. $\omega = \sqrt{\dfrac{2(P_2 - P_1)}{\rho(r_2^2 + r_1^2)}}$

Answer: 1

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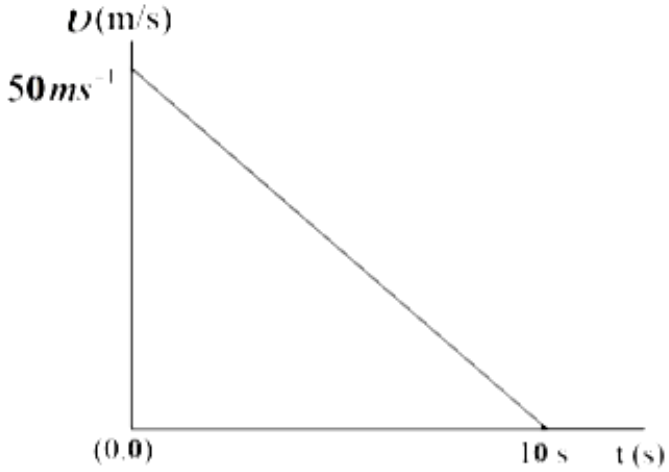
18. The velocity - time graph of a particle of mass 10 kg is shown in the figure. The net work done on the particle in the first two seconds

of the motion is



A. $-9300J$

B. $12000J$

C. $-4500J$

D. $-12000J$

Answer: C

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19. The maximum and the minimum equivalent resistance obtained by combining n identical resistors of resistance R, are $R_{\max}$ and $R_{\min}$ respectively. The ratio $\frac{R_{\max}}{R_{\min}}$ is equal to

A. n

B. n^2

C. $n^2 - 1$

D. n^3

Answer: B

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20. A simple pendulum has time period T_1 The point of suspension is now moved upward according to the relation $y = kt^2 \left(k = 1m/s^2\right)$ where y is vertical displacement, the time period now becomes T_2. The ratio of $\left(\frac{T_1}{T_2}\right)^2$ is : $\left(g = 10m/s^2\right)$

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

B. $\frac{6}{5}$

C. $\frac{5}{60}$

D. 1

Answer: B

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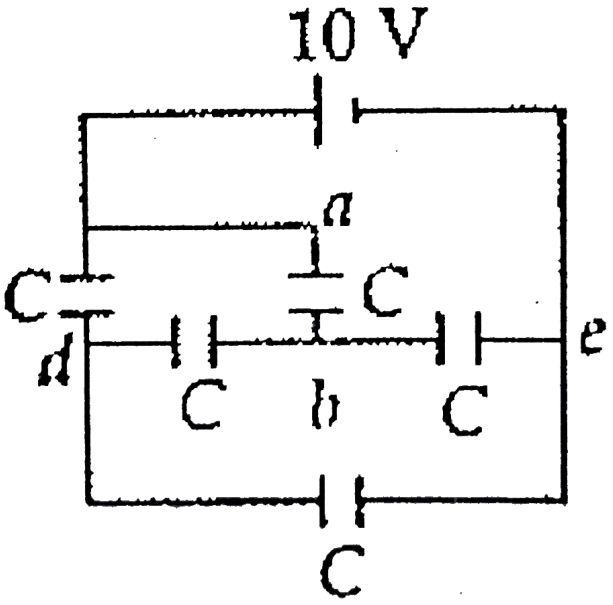
21. What is the energy stored in the capacitor between terminals a and b of the network shown in the figure ? (Capacitance of each

capacitance $C = 1\mu F$)



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22. A solid sphere made out of metal having a bulk modulus of $2 \times 10^{11} \mathrm{Mn}^{-2}$is charged uniformly to a surface charge density

$\sigma = \sqrt{\alpha\varepsilon_0}Cm^{-2}$, where ε_0 is the permittivity of free space and α (magnitude = 1) is a positive constant of appropriate dimensions. If the volume strain produced in the sphere after charging is $x \times 10^{-11}$ then the value of x is

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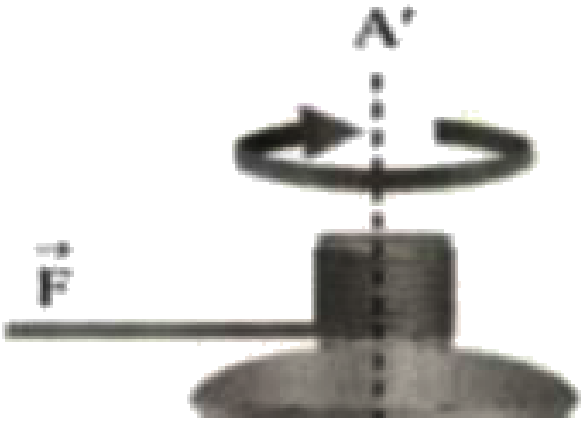
23. The toy-top (initially at rest) shown in the figure, has a moment of inertia $4 \times 10^{-4}\text{kg m}^2$ and it is free to rotate about

the stationary axis AA'. The string wrapped around the peg of the toy-top is pulled outwards without letting it slip and simultaneously maintaining a constant tension of $5.625N$. If ω is the angular speed (in $\mathrm{rad\,s^{-1}}$) of the top after 80 cm of string has been pulled of the peg, then mark your answer as $\frac{\omega}{100}$.



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24. An open pipe is suddenly closed at one end with the result that the frequency of third harmonic of the closed pipe is found to be higher by $100Hz$ then the fundamental frequency of the open pipe. The fundamental frequency of the open pipe is

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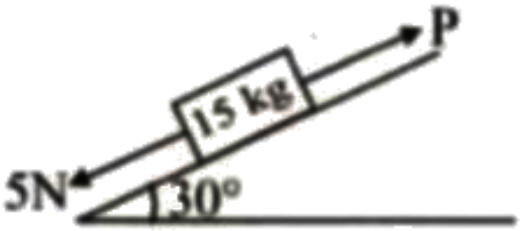
25. The figure below shown a block of mass 15 kg, kept on a rough inclined plane of angle 30° and coefficient of static friction equal to 0.5. It is being acted upon by two forces. What should be the minimum value of P (in N) so that the block doesn't slip downwards ?

$\left[\text{Take g} = 10\ \text{ms}^{-2}\ \text{and}\ \sqrt{3} = 1.7\right]$ ltbr.



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