PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 65

Physics

1. A proton is fired from very far away towards a nucleus with charge Q = 120 e, where e is the electronic charge. It makes a closest approach of

$10fm$ to the nucleus. The de - Broglie wavelength (in units of fm) of the proton at its start is take the proton mass, $m_p = 5/3 \times 10^{-27} kg, h/e = 4.2 \times 10^{-15} J - s/C$, $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 m/F, 1fm = 10^{-15}$.

A. 7

B. 5

C. 9

D. 3

Answer: A

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2. A 12 kg bomb at rest explodes into two pieces of 4 kg and 8 kg. If the momentum of 4 kg piece is 20 Ns, the kinetic energy of the 8 kg piece is

A. 25 J

B. 20 J

C. 50 J

D. 40 J

Answer: A

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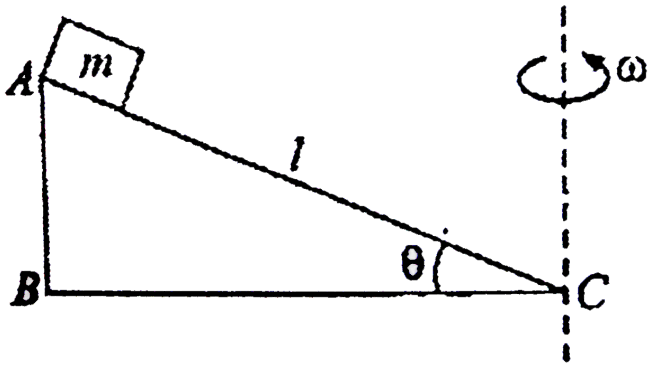
3. A block of mass m is placed at the top of a smooth wedge ABC. The wedge is rotated about an axis passing through C as shown in the figure - 3.81. The minimum value of angular speed ω such that the block does not slip on the wedge is :



A. $\left(\sqrt{\frac{g\sin\theta}{l}}\right)\sec\theta$

B. $\left(\sqrt{\frac{g}{l}}\right)\cos\theta$

C. $\left(\sqrt{\frac{g}{l\cos\theta}}\right)\cos\theta$

D. $\sqrt{\frac{g\sin\theta}{l}}a$

Answer: A

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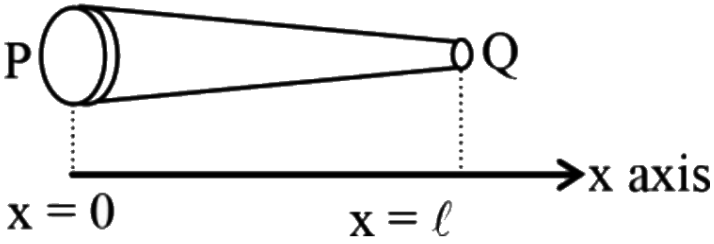
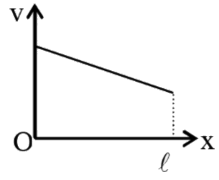
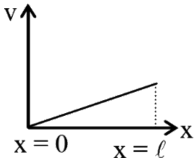
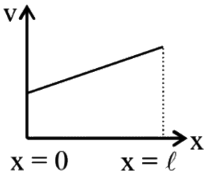
4. A wire of length l tapers uniformly from end P to end Q with the diameter at P twice that at Q. A potential difference is applied across the ends of the wire. Which graph represents the variation of

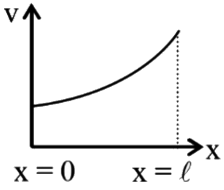
the drift velocity V of the conduction electrons with distance x?



A. 

B. 

C. 

D. 

Answer: D

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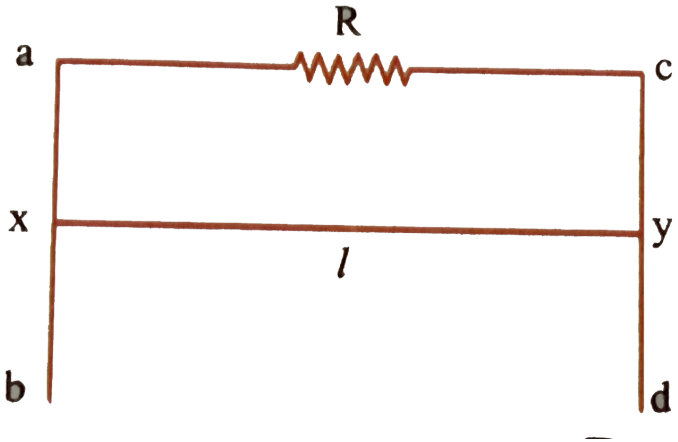
5. A conducting wire xy of lentgh l and mass m is sliding without friction on vertical conduction rails ab and cd as shown in figure. A uniform magnetic field B exists perpendicular to the plane of the rails, x moves with a constant

velocity of



A. $\frac{mgr}{B^2l^2}$

B. $\frac{mgr}{2B^2l^2}$

C. $\frac{mgr}{2Bl^2}$

D. $\frac{mgr}{Bl^2}$

Answer: A

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6. Two spheres of electric charges $+2nC$ and $-8nC$ are placed at a distance d apart. If they are allowed to touch each other, whatis the new distance between them to get a repulsive force of same magnitude as before?

A. d

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

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

D. $\frac{4d}{4}$

Answer: C

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7. The motion of a body falling from rest in a resisting medium is described by the equation $(dv)/(dt) = a - bv$ where a and b are constant . The velocity at any time t is given by

A. $a\left(1 - b^{2t}\right)$

B. $\frac{a}{b}\left(1 - e^{-bt}\right)$

C. abe^{-1}

D. $ab^2(1-t)$

Answer: B

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8. The gravitational force acting on a particle due to a solid sphere of uniform density and radius R, at a distance of 3R from the center of the sphere is F_1 . A spherical hole of radius (R/2) is now made in the sphere as shown in the figure . The sphere with hole now exert a force F_2 on the same particle , Ratio of F_1 and F_2 is

A. $\frac{9}{50}$

B. $\frac{41}{50}$

C. $\frac{3}{25}$

D. $\frac{22}{25}$

Answer: B

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9. A black body emits radiation at the rate P when its temperature is T. At this temperature the wavelength at which the radiation has maximum

intensity is λ_0, If at another temperature T' the power radiated is P' and wavelength at maximum intensity is $\frac{\lambda_0}{2}$ then

A. P'T' = 32 PT

B. P'T' = 16 PT

C. P'T' = 8 PT

D. P'T' = 4 PT

Answer: A

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10. A diatomic ideal gas is used in a Carnot engine as the working substance. If during the adiabatic expansion part of the cycle the volume of the gas increase from V to 32V, the efficiency of the engine is

A. 0.5

B. 0.75

C. 0.99

D. 0.25

Answer: B

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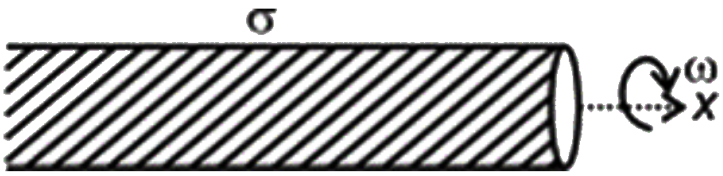
11. A long thin non-conducting cylindrical pipe of radius R carrying a uniform surface charge density σ is rotating about its axis with a constant angular speed ω . The energy density of the magnetic field inside the tube is



A. $\frac{\mu_0 \sigma^2 \omega^2 R^4}{2}$

B. $\frac{\mu_0 \sigma^2 \omega^2 R^2}{2}$

C. $\frac{\mu_0 \sigma^2 \omega^2 R^2}{4}$

D. $\frac{\mu_0 \sigma^2 \omega^2 R^4}{4}$

Answer: B

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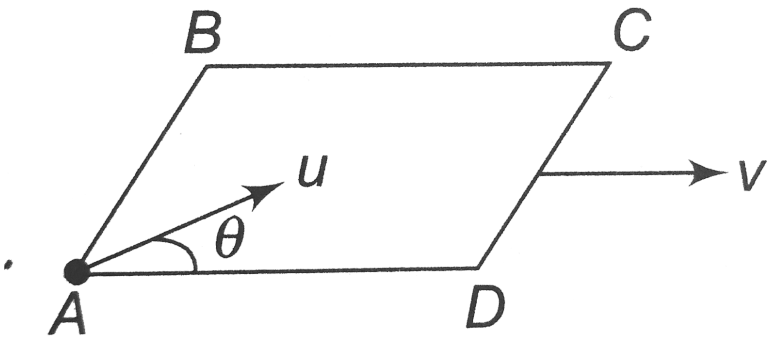
12. A smooth square plateform ABCD is moving towards right with a uniform speed v. At what angle θ must a particle be projected from A with

speed u so that it strikes the point B



A. $\sin^{-1}\left(\frac{u}{v}\right)$

B. $\cos^{-1}\left(\frac{v}{u}\right)$

C. $\cos^{-1}\left(\frac{u}{v}\right)$

D. $\sin^{-1}\left(\frac{v}{u}\right)$

Answer: B

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13. A block is kept on a smooth inclined plane of angle of inclination 30° that moves with a constant acceleration so that the block does not slide relative to the inclined plane. Let F_1 be the the contact force between the block and the plane . Now the inclined plane stops and let F_2 be the contact force between the two in this case. Then, F_1 / F_2 is

A. 1

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

C. 2

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

Answer: B

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14. A particle starts simple harmonic motion from the mean position. Its amplitude is a and total energy E . At one instant its kinetic energy is 3E/4 . Its displacement at that instant is

A. $\frac{a}{\sqrt{2}}$

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

C. $\frac{a}{\sqrt{\left(\frac{3}{2}\right)}}$

D. $\frac{a}{\sqrt{3}}$

Answer: B

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15. On a photosensitive material, when frequency of incident radiation is increased by 30% kinetic energy of emitted photoelectrons increases from

$0.4eV$ to $0.9eV$. The work function of the surface is

A. 1 eV

B. 1.267 Ev

C. 1.4 eV

D. 1.8 eV

Answer: B

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16. The lengths of two metal wires are l_1 when the tension in it is F_1 and l_2 when the tension is F_2 .then the original length of the wire is

A. $\frac{L_1F_1 + L_2F_2}{F_1 + F_2}$

B. $\frac{L_2 - L_1}{F_1 + F_2}$

C. $\frac{F_1L_2 - F_2L_1}{F_1 - F_2}$

D. $\frac{F_1L_1 - F_2L_2}{F_1 - F_2}$

Answer: C

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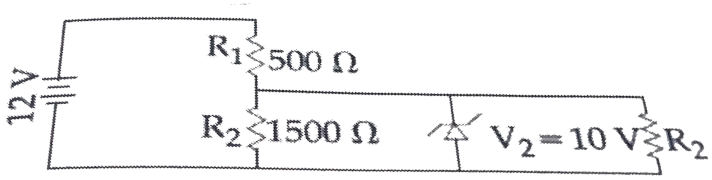
17. In the given circuit the current through Zener Diode is close to :



A. 4 mA

B. 0.6 mA

C. 6 mA

D. Zero

Answer: D

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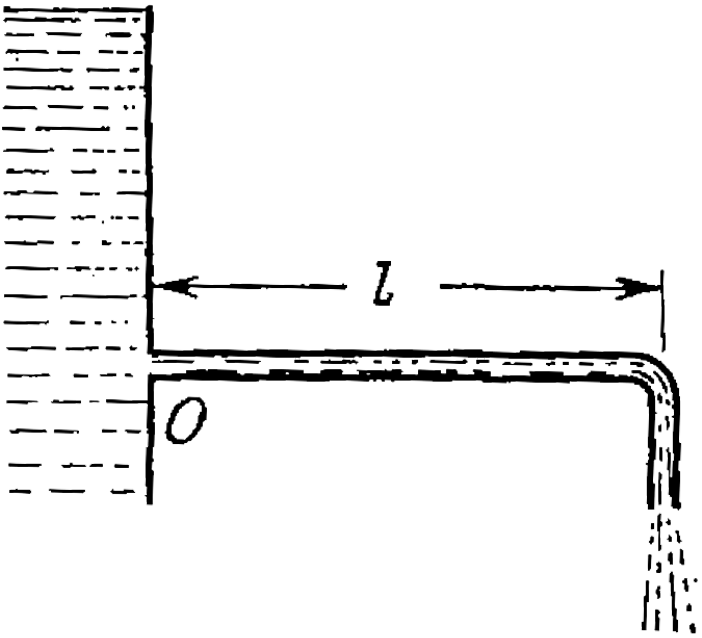
18. Water flows out of a big tank along a tube bent at right angles, the inside radius of the tube is equal to $r = 0.50cm$ (figure). The length of the horizontal section of the tube is equal to $l = 22cm$. The water flow rate is $Q = 0.50$ litres per second. Find the moment of reaction forces of flowing water, acting on the tube's walls,

relative to the point O.



A. $\frac{\rho Q^2 l}{\pi r^2}$

B. $\frac{\rho Q^2 l}{\pi r}$

C. $-\frac{\rho Q^2 l}{\pi r^2}$

D. $\frac{\rho Q l}{\pi r^2}$

Answer: A

19. A bus is moving with a velocity of $5ms^{-1}$ towards a huge wall. The driver sound a horn of frequency 165 Hz. If the speed of sound in air is $335ms^{-1}$, the number of beats heard per second by a passenger inside the bus will be

A. 3

B. 4

C. 5

D. 6

Answer: C

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20. A uniform chain of length L and mass M overhangs a horizontal table with its two third part on the table. The friction coefficient between the table and the chain is μ. The work done by the friction during the period the chain slips off the table is $\left[-\frac{2}{k}\mu MgL\right]$. Find the value of k.

A. $-\frac{2}{g}\mu MgL$

B. $-\frac{6}{9}\mu MgL$

C. $-\frac{1}{4}\mu MgL$

D. $-\frac{4}{9}\mu MgL$

Answer: A

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21. A block having 12 g of an element is placed in a room. This element is a radioactive element

with a half-life of 15 years. After how many years will there be just 1.5 g of the element in the box ?

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22. A photographic camera with a lens of focal length 5 cm is used for capturing images. The vertical length of the film used is 24 mm in which image of a 1.68 m tall man is to be captured. Find the minimum distance (in m) of the man from the lens such that his complete image can be obtained.

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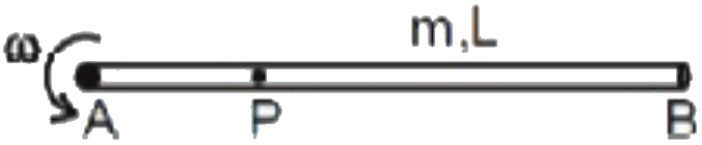
23. A uniform thin rod AB of length L and mass m is undergoing rotation about a fixed axis passing through end A and perpendicular to the rod, such that end A remains stationary as shown. The kinetic energy of section AP of the rod is equal to the kinetic energy of section BP of the rod at an instant. Then what is the value of $\left(\frac{AB}{AP}\right)^3$? (AB and AP are lengths of respectively parts of the

rod)



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24. Water from a tap emerges vertically downward with an initial speed of $1.0ms^{-1}$. The cross-sectional area of the tap is $10^{-4}m^2$. Assume that the flow is steady. What is the cross-sectional area of the stream 0.15 m below the tap? Use $g = 10ms^{-2}$.

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25. Fraunhoffer diffraction pattern of a single slit is obtained in the focal plane of lens of focal length $1m$. If third maximum is formed at a distance of 5mm from the central maximum and wavelength of light used is 5000Å, then width of the slit will be –

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