PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 56

Physics

1. A hydrogen - like neutral species in some excited state A, on absorbing a photon of energy 3.066 eV get excited to a new state B.

When the electron from state B returns back, photons of a maximum ten different wavelengths can be observed in which some photons are of energy smaller than 3.066 eV, some are of equal energy and only four photons are having energy greater than 3.066 eV. The ionization energy of this atom is

A. 14.6 eV

B. 3.066 eV

C. 6.132 eV

D. 9.2 eV

Answer: A

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2. A ball (initially at rest) falls vertically for 2 s and hits a smooth plane inclined at 30° to the horizontal. The coefficient of restitution is $\frac{5}{8}$. The distance along the plane between the first and second impact of the ball is

A. 40.63 m

B. 20.63 m

C. 30.63 m

D. 50.63

Answer: A

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3. The kinetic energy K of a particle moving along a circle of radius R depends upon the distance s as $K = as^2$. The force acting on the particle is

A. $2a\frac{s^2}{R}$

B. $2as\left(1+\frac{s^2}{R^2}\right)^{\frac{1}{2}}$

C. $2as$

D. $2a$

Answer: B

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4. A target is made of two plates, one of wood and the other of iron. The thickness of the

wooden plate is 4 cm and that of iron plate is 2 cm. A bullet fired goes through the wood first and then penetrates 1 cm into iron. A similar bullet fired with the same velocity from opposite direction goes through iron first and then penetrates 2 cm into wood. If a_1 and a_2 be the retardations offered to the bullet by wood and iron plates, respectively, then

A. $a_1 = 2a_2$

B. $a_2 = 2a_1$

C. $a_1 = a_2$

D. Data insufficient

Answer: B

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5. A metal bar AB can slide on two parallel thick metallic rails separated by a distance l. A resistance R and an inductance L are connected to the rails as shown in the figure. A long straight wire carrying a constant current I_0 is placed in the plane of the rails

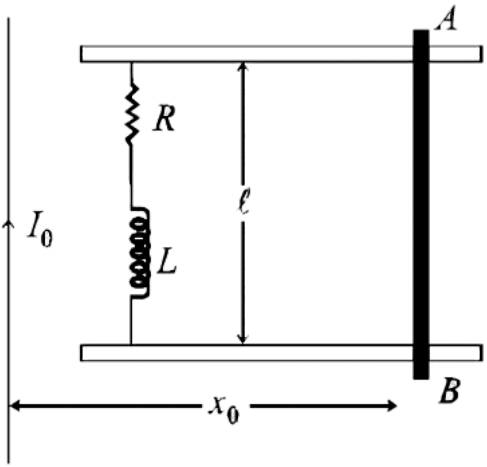
and perpendicular to them as shown. The bar AB is held at rest at a distance x_0 from the long wire. At t=0, it is made to slide on the rails away from wire. Answer the following questions.

(a) Find a relation among i, $\frac{di}{dt}$ and $\frac{d\phi}{dt}$, where i is the current in the circuit and ϕ is the flux of the megnetic field due to the long wire through the circuit.

(b) It is observed that at time t=T, the metal bar AB si at a distance of $2x_0$ from the long wire and the resistance R carries a current (i_1) . Obtain an expression for the net charge that

has flown through riesistance R form t=0 to t=T.

(c) THe bar is suddenly stopped at time T. THe current through resistance R is found to be $\frac{i_1}{4}$ at time 2T. Find the value of $\frac{L}{R}$ in terms of hte other given quantities.



A. $\frac{1}{R}\left[\frac{\mu_0 l}{2\pi}\ln(2) - Li_1\right]$

B. $\frac{1}{R}\left[\frac{\mu_0 I_0 l}{\pi}\ln(2) - Li_1\right]$

C. $\frac{1}{R}\left[\frac{\mu_0 I_0 l}{2\pi}\ln(2) - Li_1\right]$

D. $\frac{1}{R}\left[\frac{\mu_0 I_0}{2\pi}\ln(2) - Li_1\right]$

Answer: C

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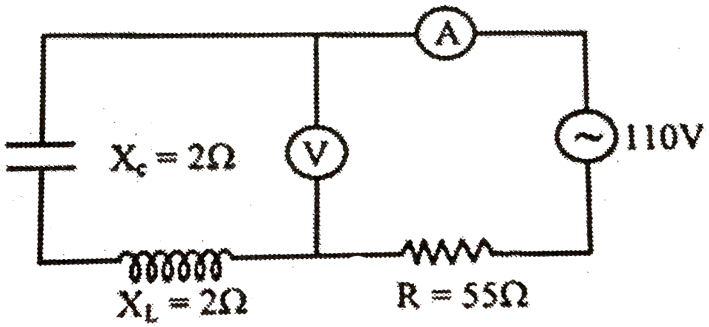
6. The reading of the ammeter and voltmeters are (Both the instruments are ac meters and

measures rms value)-



A. 2A, 110 V

B. 2A, 0 V

C. 2 A, 55 V

D. 1 A, 0 V

Answer: B

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7. A circle of radius a has charge density given by $\lambda = \lambda_0 \cos^2\theta$ on its circumference, where λ_0 is a positive constant and θ is the angular position of a point on the circle with respect to some reference line. The potential at the centre of the circle is

A. $\frac{\lambda_0}{4\varepsilon_0}$

B. zero

C. $\frac{\lambda_0}{2\varepsilon_0}$

D. $\frac{\lambda_0}{\varepsilon_0}$

Answer: A

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8. Find the minimum attainable pressure of an ideal gas in the process $T = T_0 + \alpha V^2$, Where T_0 and α are positive constant and V is the volume of one mole of gas. Draw the approximate $T - V$ plot of this process.

A. $2R\sqrt{\alpha T_0}$

B. $3R\sqrt{\alpha T_0}$

C. 3R

D. $3R\sqrt{\frac{\alpha T_0}{2}}$

Answer: A

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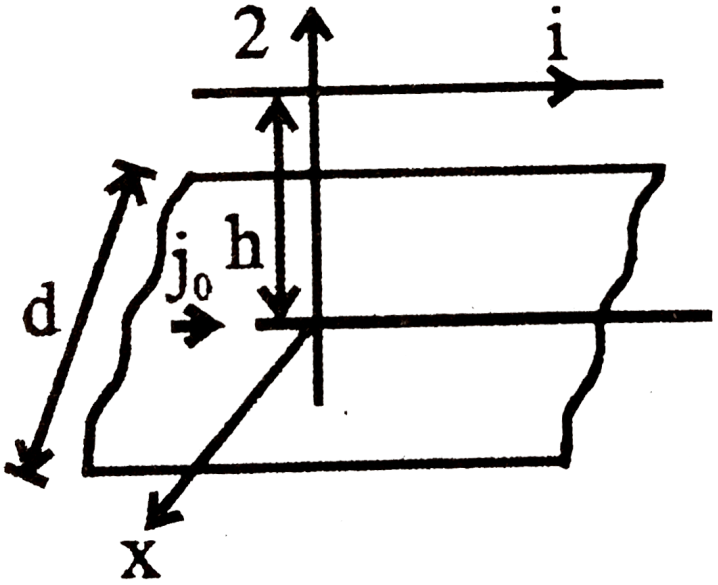
9. A condutor carrying current I is placed parallel to a current per unit width j_0 and width d, as shown in the Find the force per

unit length on the conductor



A. $\frac{\mu_0 j_0 i}{\pi} \tan^{-1}\left(\frac{d}{2h}\right)\left(-\hat{k}\right)$

B. $\frac{\mu_0 j_0 i}{\pi} \tan^{-1}\left(\frac{2h}{d}\right)\left(-\hat{k}\right)$

C. $\frac{j_0 i}{\mu_0 \pi} \tan^{-1}\left(\frac{2h}{d}\right)\left(-\hat{k}\right)$

D. $\frac{j_0 i}{\mu_0 \pi} \tan^{-1}\left(\frac{d}{2h}\right)\left(-\hat{k}\right)$

Answer: A

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10. A $2-m$ wide truck is moving with a uniform speed $v_0 = 8ms^{-1}$ along a straight horizontal road. A pedestrian starts to cross the road with a uniform speed v when the truck is $4m$ away from him, The minimum value of v so that he can cross the road safely is .

A. $\frac{6}{\sqrt{5}} ms^{-1}$

B. $\frac{4}{\sqrt{5}} ms^{-1}$

C. $\frac{8}{\sqrt{5}} ms^{-1}$

D. $\frac{2}{\sqrt{5}} ms^{-1}$

Answer: C

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11. The wavelength of a photon and de - Broglie wavelength an electron have the same value. Given that v is the speed of electron and

c is the velocity of light. E_e, E_p is the kinetic energy of electron and energy of photon respectively while p_e, p_h is the momentum of electron and photon respectively. Then which of the following relation is correct?

A. $\frac{E_e}{E_p} = \frac{v}{2c}$

B. $\frac{E_e}{E_p} = \frac{2c}{v}$

C. $\frac{p_e}{p_h} = \frac{v}{2c}$

D. $\frac{p_e}{p_h} = \frac{2c}{v}$

Answer: A

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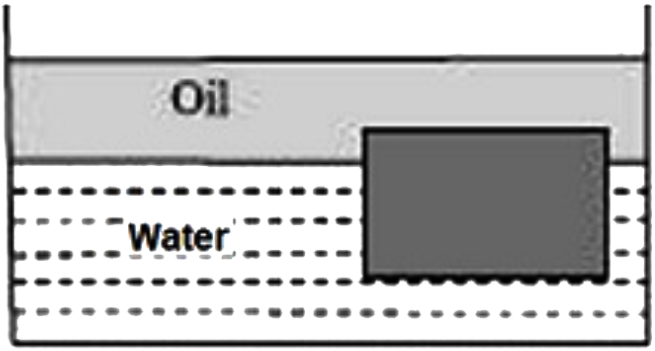
12. A layer of oil with density 724 kg m^{-3} floats on water of density $1000 kgm^{-3}$. A block floats on the oil-water interface with $1/6$ of its volume in oil and $5/6$ of its volume in water, as shown in the figure. What is the density of the block?



A. $1024\ \mathrm{kg\ m^{-3}}$

B. $1276\ \mathrm{kg\ m^{-3}}$

C. $776\ \mathrm{kg\ m^{-3}}$

D. $954\ \mathrm{kg\ m^{-3}}$

Answer: D

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13. An object 2.4 m in front of a lens forms a sharp image on a film 12 cm behind the lens. A glass plate 1 cm thick, of refractive index 1.50 is

interposed between lens and film with its plane faces parallel to film. At what distance (from lens) should object shifted to be in sharp focus of film?

A. 2.4 m

B. 3.2 m

C. 5.6 m

D. 7.2 m

Answer: C

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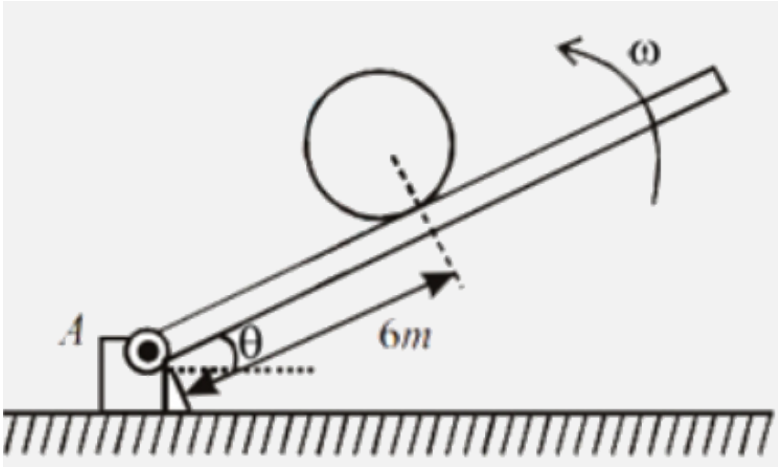
14. A cylinder weighing 450 N with a radius of 30 cm is held fixed on an incline that is rotating at $0.5\,\mathrm{rad\,s^{-1}}$. The cylinder is released when the incline is at position θ equal to 30°. If the cylinder is 6 m from the bottom A at the instant of release, what is the initial acceleration of the centre of the cylinder relative to the incline, if there is no

slipping ? $(g = 10ms^{-2})$



A. $2.33\ \text{ms}^{-2}$

B. $4.66\ \text{ms}^{-2}$

C. $1.33\ \text{ms}^{-2}$

D. $3.33\ \text{ms}^{-2}$

Answer: A

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15. A TV tower has a height of $150m$. The area of the region covered by the TV broadcast is (Radius of earth $= 6.4 \times 10^6 m$)

A. $9.6\pi \times 10^8 km^2$

B. $19.2\pi \times 10^8 km^2$

C. $19.2\pi \times 10^8 km^2$

D. $1.92\pi \times 10^8 km^2$

Answer: D

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16. The co-efficient of thermal expansion of a rod is temperature dependent and is given by the formula $\alpha = aT$, where a is a positive constant at T $\text{in}^\circ C$. if the length of the rod is l at temperature $0^\circ C$, then the temperature at which the length will be $2l$ is

A. $10^\circ C$

B. $20^\circ C$

C. $200^\circ C$

D. $100^\circ C$

Answer: C

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17. If E and B denote electric and magnetic fields respectively, which of the following is dimensionless?

A. $\sqrt{\mu_0 \varepsilon_0} \frac{E}{B}$

B. $\mu_0 \varepsilon_0 \frac{E}{B}$

C. $\mu_0 \varepsilon_0 \left(\frac{B}{E} \right)^2$

D. $\frac{\mu_0 E}{B e_0}$

Answer: A

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18. Frequency of the em signal emitted by a rocket I $4 \times 10^7 Hz$. If apparent frequency observed on earth is $3.2 \times 10^7 Hz$, then velocity with which rocket is moving away is [speed of light = c]

A. 0.5 c

B. 0.7 c

C. 0.9 c

D. 0.2 c

Answer: D

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19. Waves $y_1 = A\cos(0.5\pi x - 100\pi t)$ and $y_2 = A\cos(0.46\pi x - 92\pi t)$ are travelling along x-axis. (Here x is in m and t is in second)

(3) The number of times $y_1 + y_2 = 0$ at $x = 0$ in $1\,\text{sec}$ is

A. 46

B. 48

C. 192

D. 100

Answer: D

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20. A body of mass m, accelerates uniformly from rest to V_1 in time t_1. The instantaneous power delivered to the body as a function of time t is.

A. $\frac{m\nu_1 t}{t_1}$

B. $\frac{\nu_1^2 t}{t_1^2}$

C. $\frac{m\nu_1 t^2}{t_1}$

D. $\frac{m\nu_1^2 t}{t_1}$

Answer: B

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21. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius (1.01) R. The period of the second satellite is larger than the first one by approximately

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22. A body cools in 7 minutes from $60^{\circ}C$ to $40^{\circ}C$. What will be its temperature after the

next 7 minutes? The temperature of the surroundings is $10^{\circ} C$.

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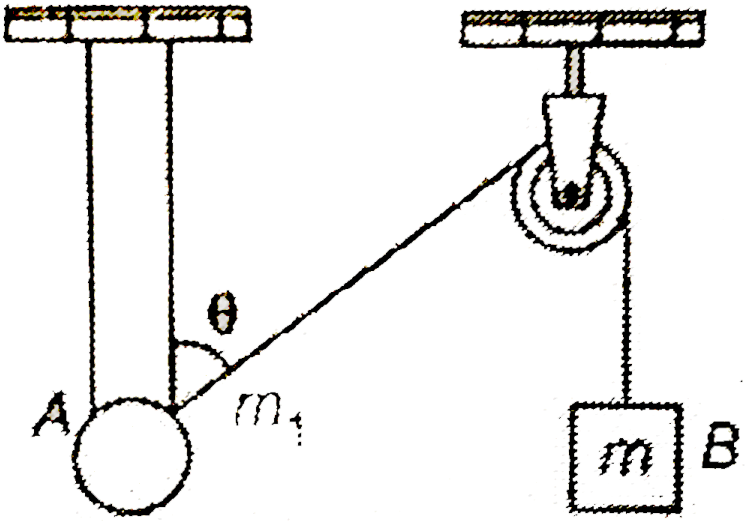
23. A ring of mass 5 kg sliding on a frictionless vertical rod connected by a clock B of mass 10 kg by the help of a massless string.

Then, at the equilibrium of the system, the

value of θ is



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24. which a U^{238} nucleus original at rest , decay by emitting an alpha particle having a

speed u , the recoil speed of the residual nucleus is

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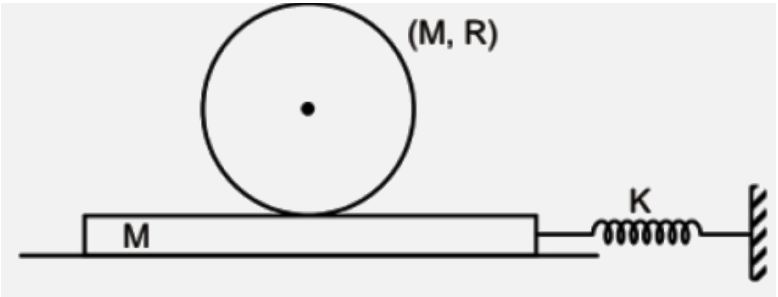
25. A cylinder of mass M = 2 kg and radius R = 12 cm lies on a plank of the same mass as shown in the figure. The surface between plank and ground is smooth but there is friction between cylinder and plank. If the coefficient of friction between the cylinder and the plank is $\mu = 0.4$, then what maximum

initial compression (in cm) can be given to the spring such that the cylinder moves without slipping with respect to the plank ?

$\left[\text{Given, } \; k = 200 \text{ N m}^{-1}\right]$



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