PHYSICS

BOOKS - NTA MOCK TESTS

JEE MOCK TEST 9

Physics

1. When photones of energy 4.0 eV fall on the surface of a metal A, the ejected photoelectrons have maximum kinetic energy

T_A (in eV) and a de-Broglie wavelength λ_A. When the same photons fall on the surface of another metal B, the maximum kinetic energy of ejected photoelectrons is $T_B = T_A - 1.5eV$. If the de-Broglie wavelength of these photoelectrons is $\lambda_B = 2\lambda_A$, then the work function of metal B is

A. 2eV

B. 3eV

C. 2.5 eV

D. 3.5 eV

Answer: D

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2. Two particles having de-Broglie wavelengths λ_1 and λ_2, while moving along mutually perpendicular directions, undergo perfectly inelastic collision. The de-Broglie wavelength λ , of the final particle is

A. $\lambda = \frac{\lambda_1 \lambda_2}{\sqrt{\lambda_1^2 + \lambda_2^2}}$

B. $\lambda = \sqrt{\lambda_1 \lambda_2}$

C. $\lambda = \sqrt{\lambda_1 + \lambda_2}$

D. $\lambda = \frac{\lambda_1 + \lambda_2}{2}$

Answer: A

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3. An electron of charge e is moving in a circular orbit of radius r around a nucleus, at a

frequency v. The magnetic moment associated with the orbital motion of the electron is

A. $2\pi ver^2$

B. $\frac{\pi vr^2}{2}$

C. πevr^2

D. $\frac{\pi vr^2}{4}$

Answer: C

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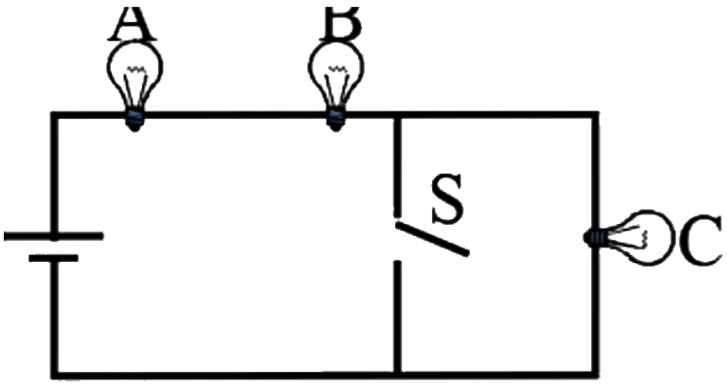
4. A circuit consists of three identical lamps connected to a battery as shown in the figure. When the switch S is closed then the intensities of lamps A and B



A. will increase by eight times

B. will decrease by two times

C. will increase by more than two times

D. will remain the same

Answer: C

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5. The volume of air increases by 5% in its adiabatic expansion. The precentage decrease in its pressure will be

A. 0.05

B. 0.06

C. 0.07

D. 0.08

Answer: C

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6. A parallel plate capacitor of capacitance $1\mu F$ has a charge of $+2\mu C$ on one of the plates and a charge of $+4\mu C$ on the other. The potential difference developed across the capacitor is

A. 5V

B. 2V

C. 3V

D. 1V

Answer: D

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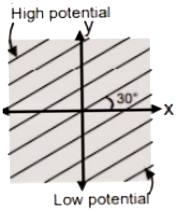
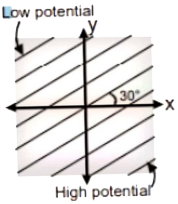
7. The electric field intensity at all points in space is given by $\overrightarrow{E} = \sqrt{3}\hat{i} - \hat{j}\ V/m$. The

nature of equipotential lines is x-y plane is given by

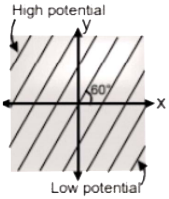
A.



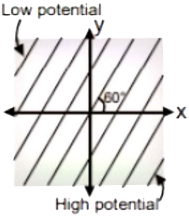
B.



C.



D.



Answer: C

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8. For an infinitely long solid cylinder of radius R having a uniform density , the gravitational field at a distance r_1 is E_1 and at a distance r_2 is E_2 , then

A. $E_1 < E_2$ for $r_1 < r_2 < R$

B. $E_1 > E_2$ for $R < r_1 < r_2$

C. both 1 and 2

D. none of the above

Answer: C

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9. A particle (mass = m and charge = q) is moving in a region in which there exists a uniform electric field $E\vec{i}$ and a uniform magnetic field $B\hat{k}$. At t = 0 , the particle is at (0,a) and is moving with $v\hat{i}$. After some time, the particle is located at (2a, 0) and has a

velocity $-2v\hat{j}$, then which of the following is true ?

A. $E = \frac{3}{2}\left(\frac{mv^2}{qa}\right)$

B. at the initial moment, the rate of work done by electric field is $\frac{3}{4}\left(\frac{mv^3}{a}\right)$

C. $E = \frac{3}{8}\left(\frac{mv^2}{qa}\right)$

D. at the initial moment, the rate of work done by electric field is $\frac{3}{16}\left(\frac{mv^3}{a}\right)$

Answer: B

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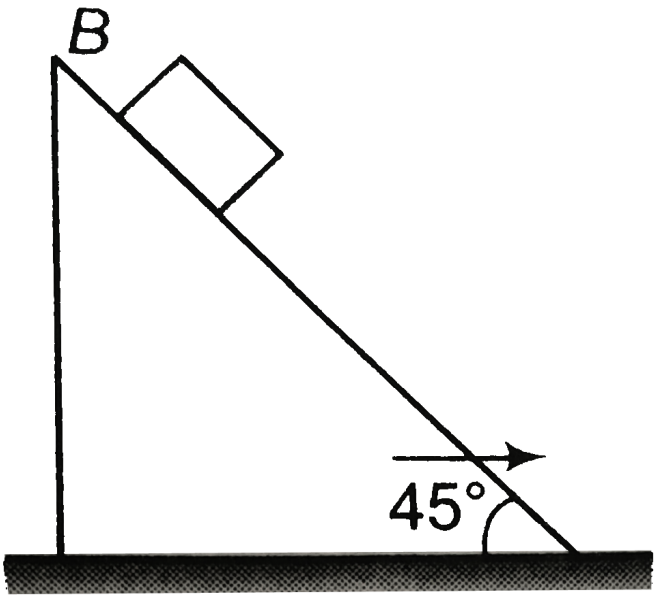
10. If the coefficient of friction between A and B is μ, the maximum acceleration of the wedge A for which B will remain at rest with respect to the wedge is



A. μg

B. $g\left(\frac{1+\mu}{1-\mu}\right)$

C. $\frac{g}{\mu}$

D. $g\left(\frac{1-\mu}{1+\mu}\right)$

Answer: B

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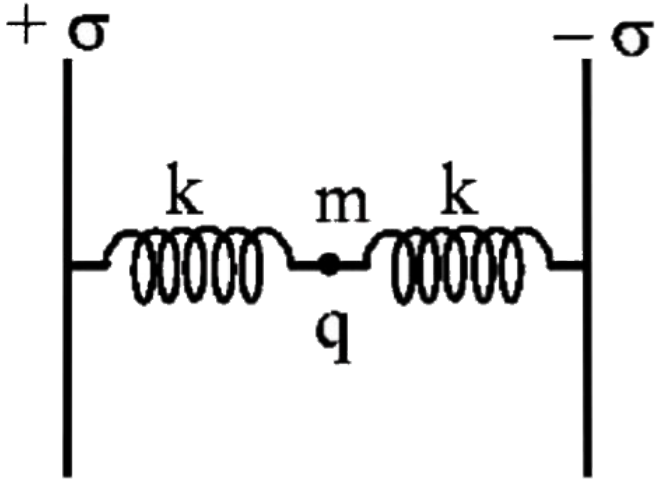
11. Two large insulating plates having surface charge densities $+\sigma$ and $-\sigma$ are fixed some distance apart in a gravity -free region and two ideal insulating springs of force constant

k are connected to the plates as shown in the figure. A particle of charge q and mass m which is attached to the junction of the spring is released from rest, then the partice will cross its equilibrium position with a speed



A. $v = \frac{q\sigma}{\varepsilon_0}\sqrt{\frac{k}{m}}$

B. $v = \frac{q\sigma}{\varepsilon_0}\sqrt{\frac{1}{2mk}}$

C. $v = \frac{q\sigma}{\varepsilon_0}\sqrt{\frac{2k}{m}}$

D. $v = \frac{q\sigma}{2\varepsilon_0}\sqrt{\frac{k}{m}}$

Answer: B

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12. Photo-electrons are produced from a metal surface using a radiation of wavelength 6561Å . These photo-electrons, when made to enter a uniform magnetic field of intensity 3×10^{-4} T,

move along different circular paths with a maximum radius of 10mm, then the work function of the metal is close to

A. 3.1eV

B. 0.1eV

C. 2.1eV

D. 1.1eV

Answer: D

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13. The rate of water gushing out of a pipe of radius 5 cm is $100Lmin^{-1}$. The Reynolds number for the flow is of the orderof [density of water = $1000kgm^{-3}$,coefficient of viscosity of water = 1m Pa s]

A. 10^6

B. 10^4

C. 10^3

D. 10^2

Answer: B

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14. An object is placed at a distance of 40 cm from a convex lens of focal length 20cm. On the far side of the lens, a concave mirror of focal length 10cm is placed such that the distance of the object from the concave mirror is 100 cm. Then the final image which is formed after refraction from the lens, reflection from the mirror and again refraction from the lens, will be

A. at a distance of 40cm from the lens and of the same size of the object

B. at a distance of 20cm from the lens and of the same size of the object

C. at a distance of 20cm from the lens

D. at a distance of 40 cm from the lens and of half the size of the object

Answer: A

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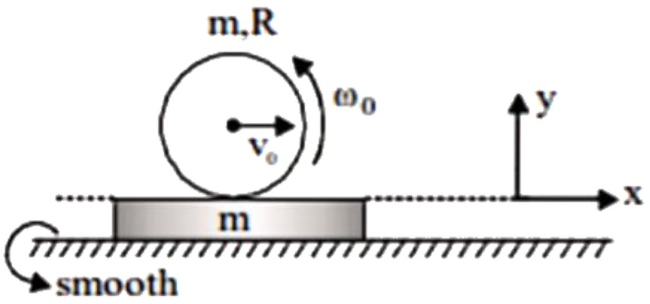
15. A solid cylinder is given a velocity v_0 and an angular speed ω_0 in the anticlockwise direction and then it is placed gently on a very long rough plank (initially at rest) as shown in the figure. Then, choose the incorrect statement :



A. the friction force on the disc is in the backward direction till pure rolling starts

B. the friction force between the disc and the plank is kinetic in nature till pure rolling starts

C. the total momentum of system (disc and plank) is conserved

D. the angular momentum of the disc about any point on the horizontal surface remains conserved

Answer: D

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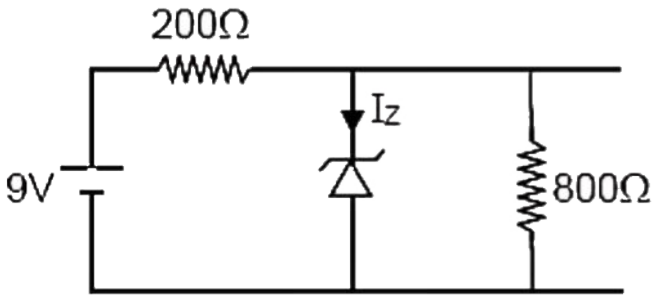
16. In the figure, the reverse breakdown voltage of a Zener diode is 5.6V, then the current I_Z through the diode is



A. 17mA

B. 15mA

C. 10 mA

D. 7mA

Answer: C

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17. For an ideal gas, the specific heat capacity during an isentropic process is always

A. zero

B. infinite

C. positive

D. negative

Answer: A

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18. Time for 20 oscillations of a pendulum is measured as $t_1 = 39.6s, t_2 = 39.9s, t_3 = 39.5.$ What is

the precision in the measurements ? What is the accuracy of the measurement ?

A. $\pm 0.2s$

B. $\pm 0.3s$

C. $\pm 0.5s$

D. $\pm 0.4s$

Answer: A

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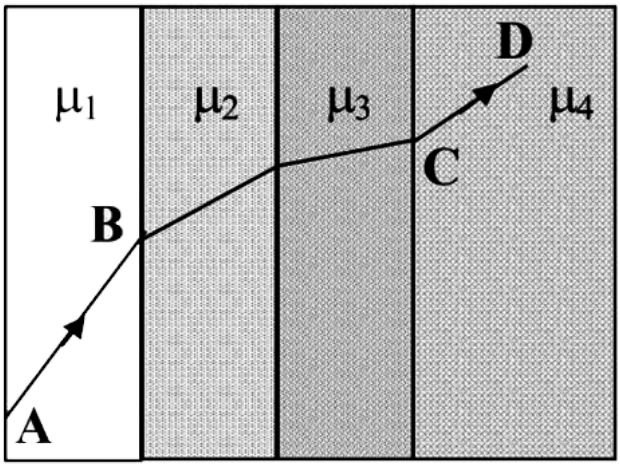
19. A ray of light passes through four transparent media with refractive indices μ_1,μ_2 ,μ_3 and μ_4 as shown in the figure. The surfaces of all media are parallel. If the emergent ray CD is parallel to the incident ray AB, we must have



A. $\mu_1 = \mu_2$

B. $\mu_2 = \mu_3$

C. $\mu_3 = \mu_4$

D. $\mu_4 = \mu_{10}$

Answer: D

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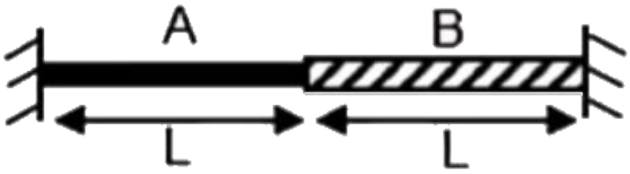
20. A composite wire of length 2L is made by joining two different wires A and B having the same length, made of the same material but of different radii r and 2r respectively . The

composite wire is vibrating at such a frequency, that the junction of the two wires form a node. If the number of antinodes in the wire A is p and that in the wire B is q, then the ratio $p:q$ is



A. $1:2$

B. $3:5$

C. $1:4$

D. $4:9$

Answer: A

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21. In Wheatstone bridge, four resistors of resistances $15\Omega, 12\Omega, 4\Omega$ and 10Ω respectively, are connected in cyclic order. The resistance (in Ω) that is to be connected in parallel with the resistance of 10Ω to balance the network is

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22. There is crater of depth $R/100$ on the surface of the moon (raduis R). A projectile is fired vertically upwards from the crater with a velocity, which is equal to the escape velocity v from the surface of the moon. The maximum height attained by the projectile, is :

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23. A steady current I goes through a wire loop PQR having shape of a right angle triangle with $PQ = 3x, PR = 4x$ and $QR = 5x$. If the magnitude of the magnetic field at P due to this loop is $k\left(\frac{\mu_0 I}{48\pi x}\right)$, find the value of K.

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24. A cube of aluminium of side 6 cm is subjected to a tangential force such that the

top face is shears through 0.012cm relative to the bottom face. The tangential force is $k \times 10^{10}$ dyne. What is the value of k? [Shear modulus of the material is $\eta = 2 \times 10^{11}$ dyne cm^{-2}]

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25. The ratio of the nuclear radius, of an atom with mass number A and $\frac{4}{2}He$ is $(14)^{1/3}$. What is the value of A ?

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