PHYSICS

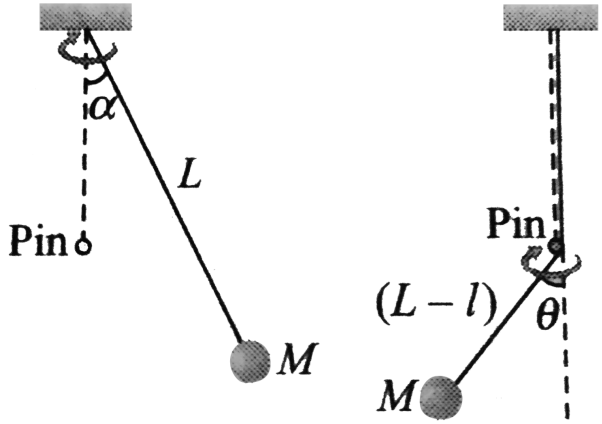
BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 49

Physics

1. A simple pendulum consisting of a mass M attached to a string of length L is released from rest at an angle α. A pin is located at a

distance l below the pivot point. When the pendulum swings down, the string hits the pin as shown in figure. The maximum angle θ which the string makes with the vertical after hitting the pin is



A. $\cos^{-1}\left[\frac{L\cos\alpha + l}{L + l}\right]$

B. $\cos^{-1}\left[\frac{L\cos\alpha - l}{L - l}\right]$

C. $\cos^{-1}\left[\frac{L\cos\alpha + l}{L - l}\right]$

D. $\cos^{-1}\left[\frac{L\cos\alpha - l}{L + l}\right]$

Answer: B

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2. A solid ball of radius R has a charge density ρ given by $\rho = \rho_0\left(1 - \frac{r}{R}\right)f$ or $0 \leq r \leq R$

The electric field outside the ball is :

A. $\frac{\rho_0 R^3}{\varepsilon_0 r^2}$

B. $\frac{4\rho_0 R^3}{3\varepsilon_0 r^2}$

C. $\frac{3\rho_0 R^3}{4\varepsilon_0 r^2}$

D. $\frac{\rho_0 R^3}{12\varepsilon_0 r^2}$

Answer: D

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3. The steady - state current through L_1 after the switch has been closed for a very long time is

A. $\frac{V_0}{R}$

B. $\frac{V_0 L_1}{R(L_1 + L_2)}$

C. $\frac{V_0 L_2}{R(L_1 + L_2)}$

D. None of these

Answer: C

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4. A charged particle having charge q and mass m moves rectilinearly under the action of the electric field $E(x) = (4 - 3x)N/C$ where

x is the distance was initially at rest. The distance travelled by the particle till it comes instantaneously to rest again for the first time, is

A. $\frac{2}{3}m$

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

C. 2m

D. $\frac{8}{3}m$

Answer: D

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5. A comet revolves around the sun in an eliptical orbit. When it is closest to the sun at a distance d, its corresponding kinetic energy is k_0. If it is farthest from the sun at distance 3d then the corresponding kinetic energy will be

A. $\frac{k_0}{9}$

B. $\frac{8k_0}{9}$

C. $\frac{k_0}{4}$

D. $\frac{4k_0}{9}$

Answer: A

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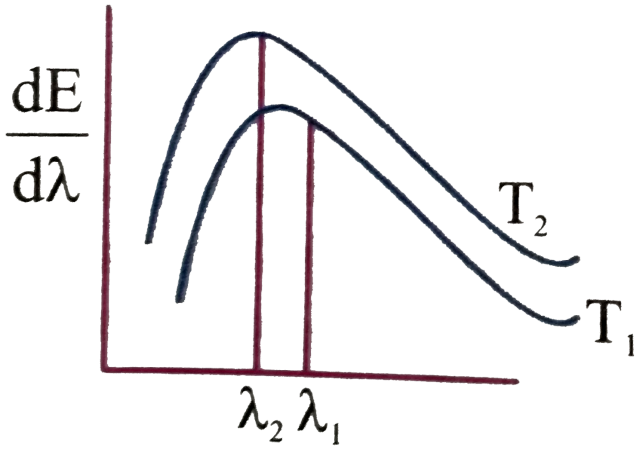
6. The spectral emissive power E_λ for a body at temperature T_1 is poltted againist the wavelenght and area under the curve is found to be $9A$. At a different temperature T_2 the

area is found to be A then $\lambda_1 / \lambda_2 =$



A. 3

B. $\frac{1}{3}$

C. $\frac{1}{\sqrt{3}}$

D. $\sqrt{3}$

Answer: D

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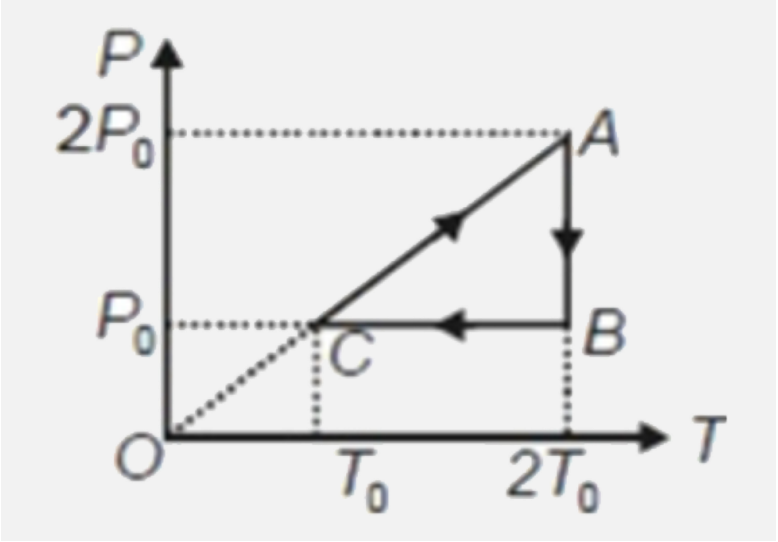
7. Three moles of an ideal gas undergo a cyclic process shown in figure. The work done by the gas during the process is $[\text{Take } \ln(2) = 0.693]$



A. $2.36RT_0$

B. $0.58RT_0$

C. $1.16RT_0$

D. $-0.58RT_0$

Answer: C

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8. A metallic wire is folded to form a square loop a side $'a'$. It carries a current $'I'$ and is kept perpendicular to a uniform magnetic

field. If the shape of the loop is changed from square to a circle without changing the length of the wire and current, the amount of work done in doing so is

A. $iBa^2(\pi + 2)$

B. $iBa^{2\pi - 2}$

C. $iBa^2(4/\pi + 1)$

D. $iBa^2\left(1 - \frac{4}{\pi}\right)$

Answer: D

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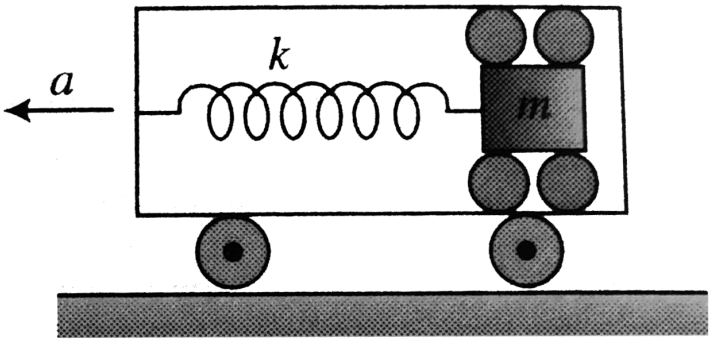
9. A block of mass m is connected to a spring of spring constant k as shown in figure. The frame in which the block is placed is given an acceleration a towards left. Neglect friction between the block and the frame walls. The maximum velocity of the block relative to the frame is



A. $\frac{F}{\sqrt{mL}}$

B. $\frac{F}{2\sqrt{mK}}$

C. $\frac{F}{\sqrt{2mK}}$

D. $\frac{2F}{\sqrt{mK}}$

Answer: A

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10. A projectile is projected with a speed u at an angle θ with the horizontal. What is the

speed when its direction of motion makes an angle $\theta/2$ with the horizontal

A. $-mgu\cos\theta\tan(\theta/2)$

B. $-mgu\tan\theta\cos(\theta/2)$

C. $-2mgu\tan\theta\sin(\theta/2)$

D. $-2mgu\sin\theta\tan(\theta/2)$

Answer: A

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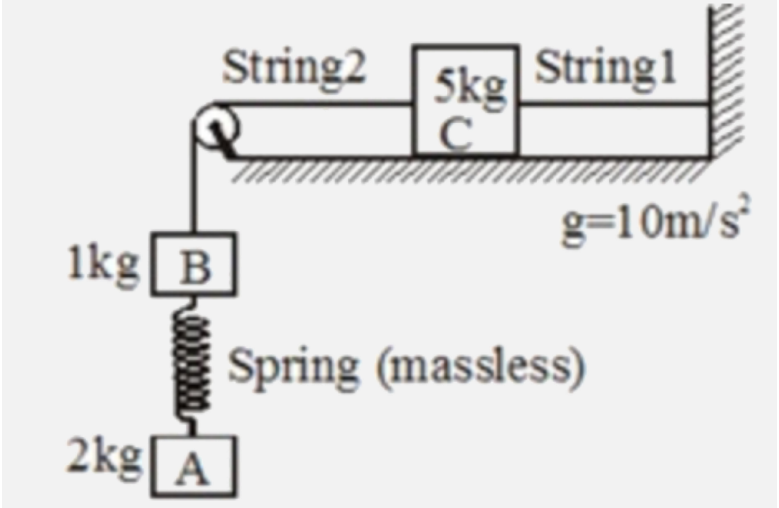
11. The system shown in the figure is in equilibrium and all the blocks are at rest. Assume that the masses of the strings, the pulley and the spring and negligible with respect to the masses of the blocks and friction is absent. Find the acceleration of block C, just after cutting the spring 1.

$[g = 10ms^{-2}]$



A. $5ms^{-2}$

B. $3ms^{-2}$

C. $2ms^{-2}$

D. $6ms^{-2}$

Answer: A

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12. A nuclear reactor starts producing a radionuclide of half - life T at a constant rate R starting at time t = 0 The activity of the radionuclide at t = T is found to the A. Then $\frac{R}{4}$ is

A. $2:1$

B. $3:2$

C. $4:1$

D. $2:3$

Answer: A

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13. A particle executes simple harmonic motion and is located at $x = a$, b at times $t_0, 2t_0$ and $3t_0$ respectively. The frequency of the oscillation is :

A. $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{a+b}{2b}\right)$

B. $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{a+2b}{3c}\right)$

C. $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{a+b}{2c}\right)$

D. $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{2a+3c}{b}\right)$

Answer: A

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14. An electron is an excited state of Li^{2+} ion has angular momentum $3h/2\pi$. The de Broglie wavelength of the electron in this

state is $p\pi a_0$ (where a_0 is the Bohr radius)

The value of p is

A. $\lambda = 2\pi a_0$

B. $\lambda = 4\pi a_0$

C. $\lambda = \pi a_0$

D. $\lambda = 3\pi a_0$

Answer: A

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15. The stress along the length of a rod with rectangular cross section) is 1% of the Young's modulus of its material. What is the approximate percentage of change of its volume? (Poisson's ratio of the material of the rod is 0.3)

A. 3%

B. 1%

C. 0.7%

D. 0.4%

Answer: D

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16. A thin convex lens of refractive index 1.5cm has 20cm focal length in air. If the lens in completely immersed in a liquid of refractive index. 1.6, then its focal length will be

A. $-160cm$

B. $-100cm$

C. $+160cm$

D. $+100cm$

Answer: A

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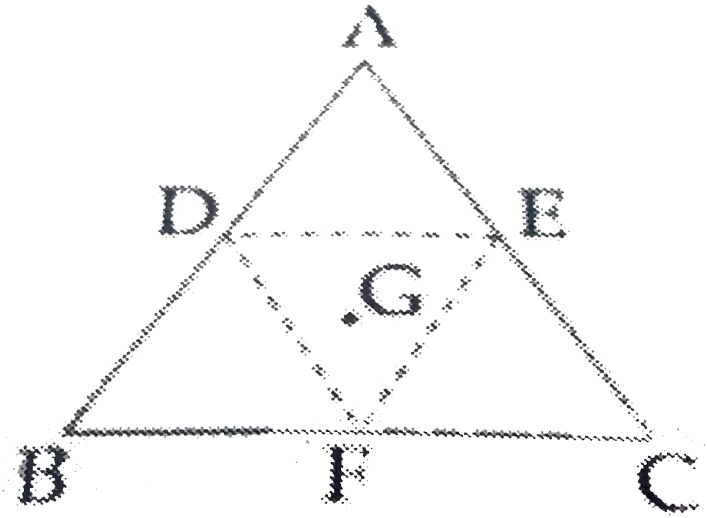
17. An equilateral triangle ABC is cut from a thin solid sheet of wood .(see figure) D,E and F are the mid-points of its sides as shown and G is the centre of the triangle.The moment of inertia of the triangle about an axis passing through G and perpendicular to the plane to

the triangle is I_0 If the smaller triangle DEF is removed from ABC , the moment of inertia of the remaining figure about the same axis is I. Then :



A. $I = \frac{3}{4} I_0$

B. $I = \frac{15}{16} I_0$

C. $I = \frac{9}{16} I + (0)$

D. $I = \frac{I_0}{4}$

Answer: B

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18. $2kg$ ice at $-20^\circ C$ is mixed with $5kg$ water at $20^\circ C$. Then final amount of water in the mixture will be: [specific heat of ice $= 0.5cal/gm^\circ C$, Specific heat of water $= 1cal/gm^\circ C$, Latent heat of fusion of ice $= 80cal/gm$]

A. 7 kg

B. 6 kg

C. 4 kg

D. 3 kg

Answer: B

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19. Young's double slit experiment is made in a liquid. The tenth bright fringe in liquid lies in screen where 6th dark fringe lies in vacuum.

The refractive index of the liquid is approximately

A. 1.8

B. 1.54

C. 1.67

D. 1.2

Answer: C

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20. A string is stretched between fixed points separated by $75.0cm$. It is observed to have resonant frequencies of $420Hz$ and $315Hz$. There are no other resonant frequencies between these two. Then, the lowest resonant frequency for this string is

A. 105 Hz

B. 52.5 Hz

C. 140 Hz

D. 65 Hz

Answer: A

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21. Consider a hydrogen-like ionized atom with atomic number with a single electron. In the emission spectrum of this atom, the photon emitted in the 2 to 1 transition has energy 74.8 higher than the photon emitted in the 3 to 2 transition. The ionization energy of the hydrogen atom is 13.6. The value of is _____.

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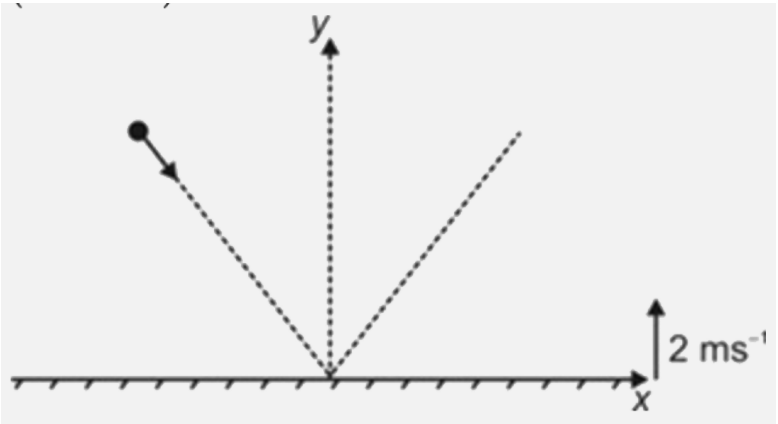
22. Consider a horizontal surface moving vertically upward with velocity $2ms^{-1}$. A small ball of mass 2 kg is moving with velocity $\left(2\hat{i}-2\hat{j}\right)ms^{-2}$ If the coefficient of restitution and coefficient of friction are $\frac{1}{2}$ and $\frac{1}{3}$ respectively, find the horizontal velocity $\left(\text{in } ms^{-1}\right)$ of the ball after the

collision.



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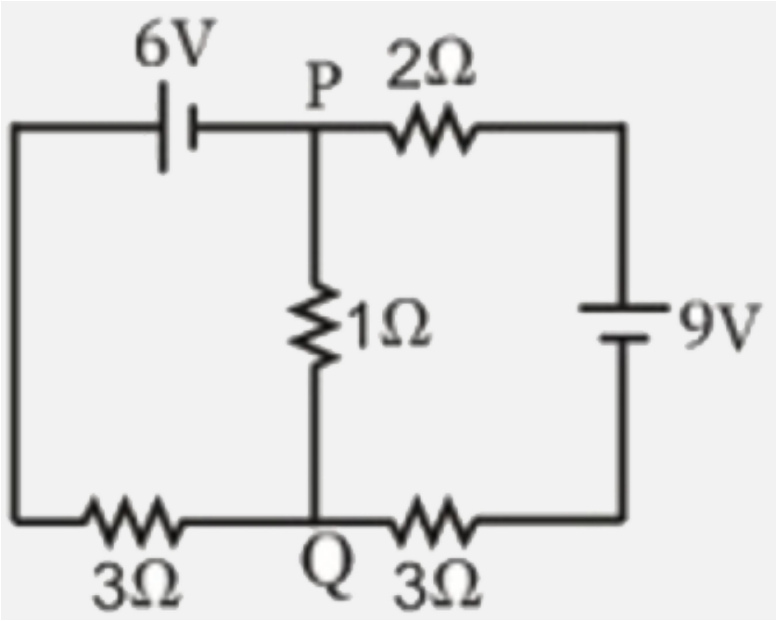
23. 

In the circuit shown, what is the current (in A) in the 1Ω resistor?

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24. A CE amplifier, has a power gain of 40 dB. The input resistance and output load resistance are $500\Omega \text{ and } 2k\Omega$ respectively. Find the value of common - emitter current gain.

$$\left[\text{take gain in dB} \quad = 10\log\left(\frac{P_{\text{out}}}{P_{\text{in}}}\right)\right]$$

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25. A uniform rope of mass 6 kg and length 6 m hangs vertically from a rigid support. A

block of mass 2 kg is attached to the free end of the rope. A transverse pulse of wavelength 0.075 m is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is K cm where K is

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