PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 100

Physics

1. If radius of the ${}_{13}^{27}Al$ nucleus is estimated to be 3.6 Fermi, then the radius of ${}_{52}^{125}Te$ nucleus be nearly:

A. 6 Fermi

B. 8 Fermi

C. 4 Fermi

D. 5 Fermi

Answer: A

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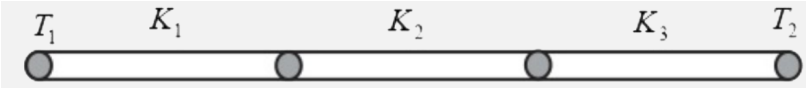
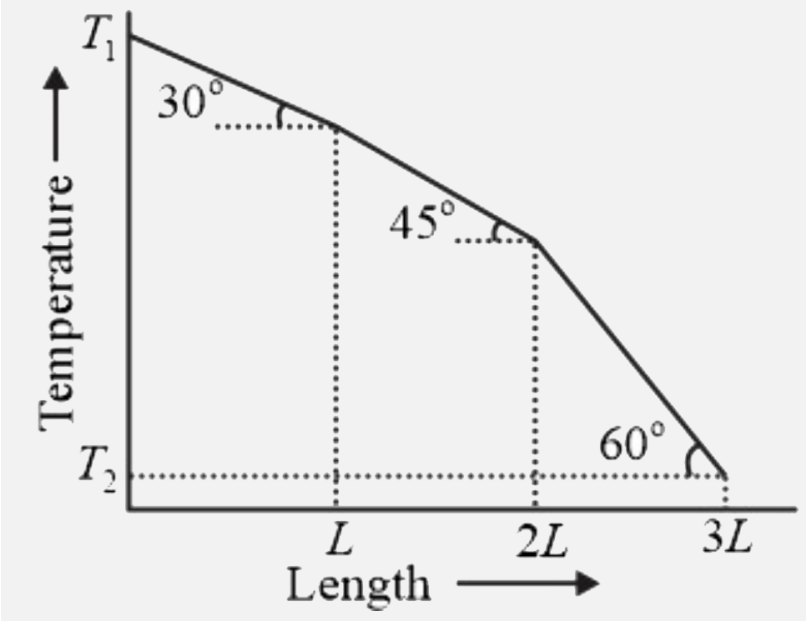
2. Three rods of the same length and the same area of the cross-section are joined. The temperature of two ends one T_1 and T_2 as shown in the figure.



As we move along the rod the variation of temperature are as shown in the following [Rods are insulated from the surrounding except at

the faces]



A. $\frac{K_1}{\sqrt{3}} = \frac{K_2}{3} = \frac{K_3}{1}$

B. $\frac{K_1}{3} = \frac{K_2}{1} = \frac{K_3}{\sqrt{3}}$

C. $\frac{K_1}{3} = \frac{K_2}{\sqrt{3}} = \frac{K_3}{1}$

D. $\frac{K_1}{\sqrt{3}} = \frac{K_2}{1} = \frac{K_3}{3}$

Answer: C

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3. The rates of cooling of two different liquids put in exactly similar calorimeters and kept in identical surroundings are the same if

A. Equal masses of the liquids at the same temperature are taken

B. Equal volumes of the liquids at the same temperature are taken

C. Both 1 and 2

D. Insufficient information

Answer: B

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4. What is the strength of transverse magnetic field required to bend all the photoelectrons within a circle of a radius 50 cm when light of wavelength 3800Å is incident on a barium emitter ? (Given that work function of barium is $2.5eV, h = 6.63 \times 10^{-34} js, e = 1.6 \times 10^{19} C, m = 9.1 \times 10^{-31} kg$

A. $4.88 \times 10^{-4} T$

B. $32 \times 10^{-5} T$

C. $6.32 \times 10^{-6} T$

D. $7.6 \times 10^{-8} T$

Answer: C

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5. $F = \alpha\beta e^{\left(-\frac{x}{\alpha kt}\right)}$

k = Boltzmann constant

t = temperature

x = distance

The dimensions of B is

A. $\left[MLT^{-4}\right]$

B. $\left[M^2L^2T^{-4}\right]$

C. $\left[MLT^{-2}\right]$

D. $\left[M^2LT^{-1}\right]$

Answer: B

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6. A particle of mass $2m$ is projected at an angle of 45° with horizontal with a velocity of $20\sqrt{2}m/s$. After $1s$ explosion takes place and the particle is broken into two equal pieces. As a result of explosion one part comes to rest. Find the maximum height attained by the other part. Take $g = 10m/s^2$.

A. 35 m

B. 40 m

C. 15 m

D. 20 m

Answer: A

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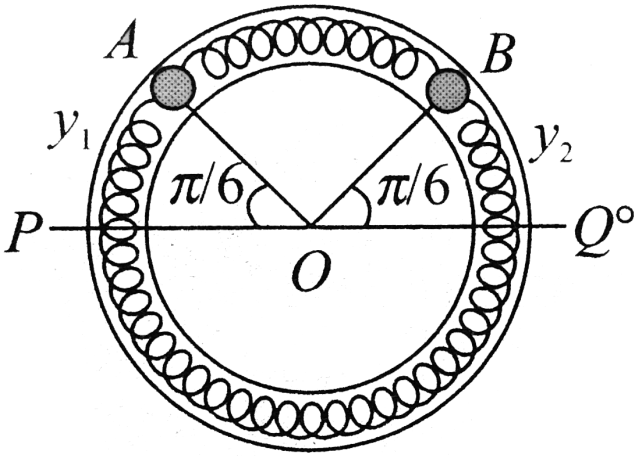
7. Two identical balls A and B each of mass $0.1kg$ are attached to two identical mass less is springs. The spring-mass system is constrained to move inside a right smooth pipe bent in the form of a circle as shown in figure . The pipe is fixed in a horizontal plane. The center of the balls can move in a circle of radius $0.06m$. Each spring has a natural length of $0.06\pi m$ and force constant $0.1N/m$. Initially, both the balls are displaced by an angle $\theta = \pi/6$ radians with respect to diameter PQ of the circle and released from rest.

a. Calculate the frequency of oscillation of the ball B.

b. What is the total energy of the system ?

c. Find the speed of the ball A when A and B are at the two ends

of the diameter PQ.



A. $\frac{1}{2\pi} Hz$

B. $\frac{1}{2\pi} Hz$

C. $\frac{1}{\pi} Hz$

D. $\frac{1}{4\pi} Hz$

Answer: C

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8. A point moves with decleration along the circle of radius R so that at any moment of time its tangential and normal accelerations

are equal in moduli. At the initial moment $t = 0$ the velocity of the point equals v_0. Find:

(a) the velocity of the point as a function of time and as a function of the distance covered s_1,

(b) the total acceleration of the point as a function of velocity and the distance covered.

A. $v = v_0 e^{-\frac{2S}{R}}$

B. $v = v_0 e^{-\frac{S}{R}}$

C. $v = v_0 e^{-SR}$

D. $v = v_0 e^{-2SR}$

Answer: B

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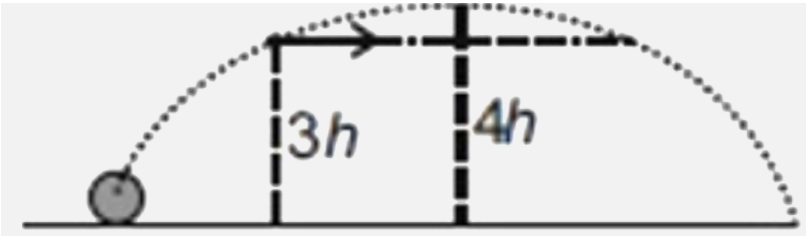
9. A stone is projected from a point on the ground in such a way so as to hit a bird at height 3h and could attain a maximum height 4h above the ground. If at the instant of projection, the bird flies away horizontally with speed $10ms^{-1}$ and the stone still hits the bird while descending, then the horizontal velocity of stone is



A. $8ms^{-1}$

B. $15ms^{-1}$

C. $12ms^{-1}$

D. $9ms^{-1}$

Answer: B

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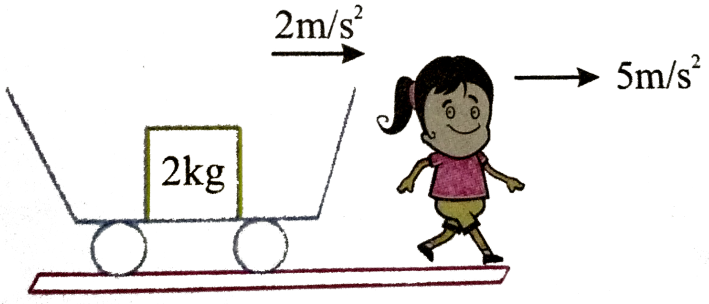
10. An observed and a vehicle, both starts moving together from rest with accelerations $5m/s^2$ and $2m/s^2$, respectively. There is a $2kg$ block on the floor of the vehicle, and $\mu = 0.3$ between their surfaces. Find the work done by friction on the block with respect to the running observer, during first 2 seconds of the motion.



A. 24 J

B. -24 J

C. 16 J

D. -16 J

Answer: B

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11. The antenna current of an AM transmitter is $8A$ when only the carrier is sent but increases to $8.96A$ when the carrier is modulated sinusoidally . The percentage modulation is

A. $60.1\ \%$

B. $70.1\ \%$

C. $80.1\ \%$

D. $50.1\ \%$

Answer: B

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12. A sound source emitting sound of frequency 450 Hz is approaching a stationary observer with velocity $30ms^{-1}$ and another identical source is going away from the observer with the same velocity. If the velocity of sound is $330ms^{-1}$, then the difference of frequencies heard by observer is

A. 103. 5 Hz

B. 82.5 Hz

C. 33. 5 Hz

D. 92.5 Hz

Answer: B

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13. The earth receives at its surface radiation from the sun at the rate of $1400 Wm^{-2}$. The distance of the centre of the sun from the surface of the earth is $1.5 \times 10^{11} m$ and the radius of the sun is $7 \times 10^{8} m$. Treating the sun as a black body, it follows from the above data that its surface temperature is .....K

A. 5801 K

B. $10^{6} K$

C. 50. 1 K

D. $5801^{\circ} C$

Answer: A

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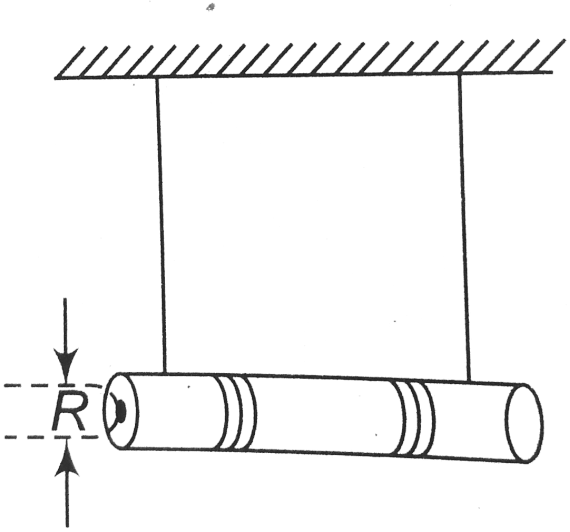
14. A cylindrical rod of mass M, length L and radius R has two cords wound around it whose ends are attached to the ceiling. The rod is held horizontally with the two cords vertical. When the rod is released, the cords unwind and the rod rotates the linear acceleration of the cylinder as it falls, is :



A. $\frac{g}{3}$

B. $\frac{2g}{3}$

C. $\frac{3g}{2}$

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

Answer: B

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15. Convex lens made up of glass $\left(\mu_g = 1.5\right)$ and radius of curvature R is dipped into water. Its focal length will be (Refractice index of water =4/3)

A. 4R

B. 2R

C. R

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

Answer: A

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16. Nucleus A is converted into C through the following reactions,

$A \rightarrow B + \alpha$

$B \rightarrow C + 2\beta$

then,

A. A and C are isobars

B. A and C are isotopes

C. A and B are isobars

D. A and B are isotopes

Answer: B

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17. In Young's double-slit experiment, the distance between the two identical slits is 6.1 times larger than the slit width. Then the number of intensity maxima observed within the central maximum of the single-slit diffraction pattern is

A. 3

B. 6

C. 24

D. 12

Answer: D

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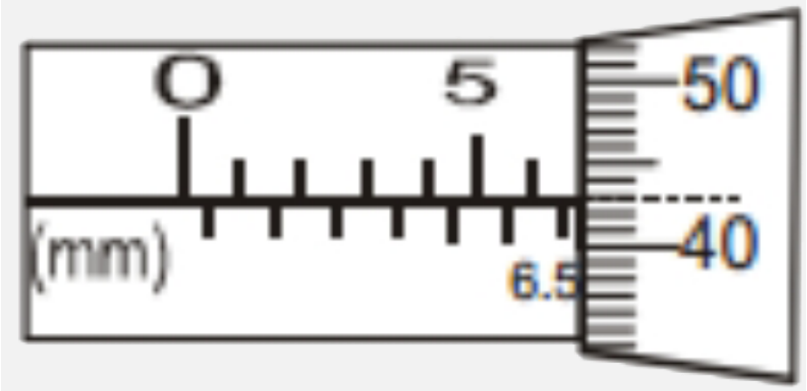
18. The figure shown below is a screwgauge. When the circular scale division matches the main scale at 43, the 6.5 mm mark on

the main scale is just visible. The main scale has $\frac{1}{2}mm$ marks. In complete rotation, the screw advances by $\frac{1}{2}$ mm and circular scale has 50 divisions. The reading of the screwgauge is



A. 6.93 mm

B. 5.93 mm

C. 4.93 mm

D. 7.93 mm

Answer: A

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19. A suitcase is gently dropped on a conveyor belt moving at $3m/s$. If the coefficient of friction between the belt and the suitcase is 0.5. Find the displacement of suitcase relative to conveyor belt before the slipping between the two is stopped $(g = 10m/s^2)$

A. 2.7 m

B. 1.8 m

C. 0.9 m

D. 1.2 m

Answer: C

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20. A glass bulb of volume $400cm^3$ is connected to another bulb of volume $200cm^3$ by means of a tube of negligible volume. The bulbs contain dry air and are both at a common temperature and pressure of $20^\circ C$ and 1.000 atm, respectively. The larger bulb is immersed in steam at $100^\circ C$ and the smallar in melting ice at 0°. Find the final common pressure.

A. 1.13 atm

B. 1.23 atm

C. 1.43 atm

D. 1.53 atm

Answer: A

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21. A hydrogen like atom with atomic number Z is in an excited state of quantum number 2n. It can emit a maximum energy photon of 204 eV. If it makes a transition to quantum state n, a photon of energy 40.8 eV is emitted. Find n, Z and the ground state energy (in eV) of this atom. Also calculate the minimum energy (in eV) that can be emitted by this atom during de-excitation. Ground state energy of hydrogen atom is – 13. 6 eV.

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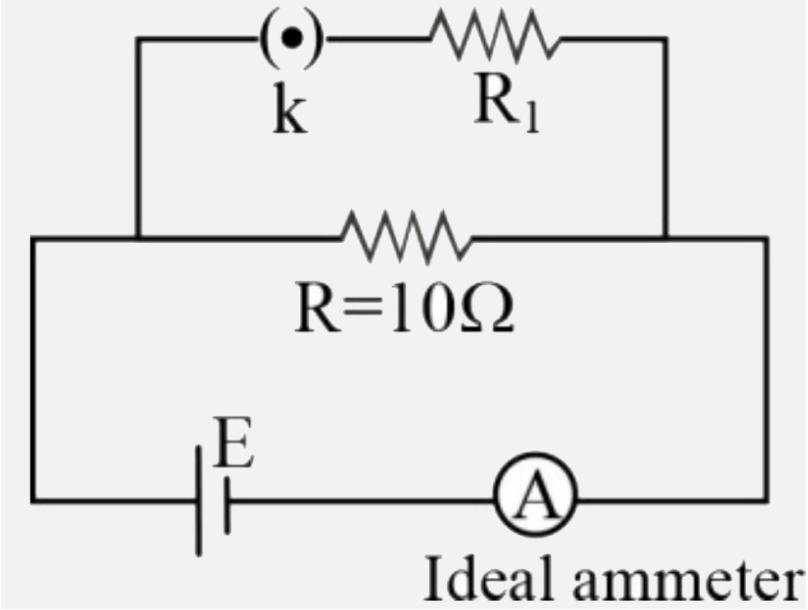
22. The internal resistance of the cell shown in the figure is negligible. On closing the key k, the ammeter reading changes from 0.25 A to $\frac{5}{12}$ A, then what is the value of resistance R_1 (in

ohm) ?



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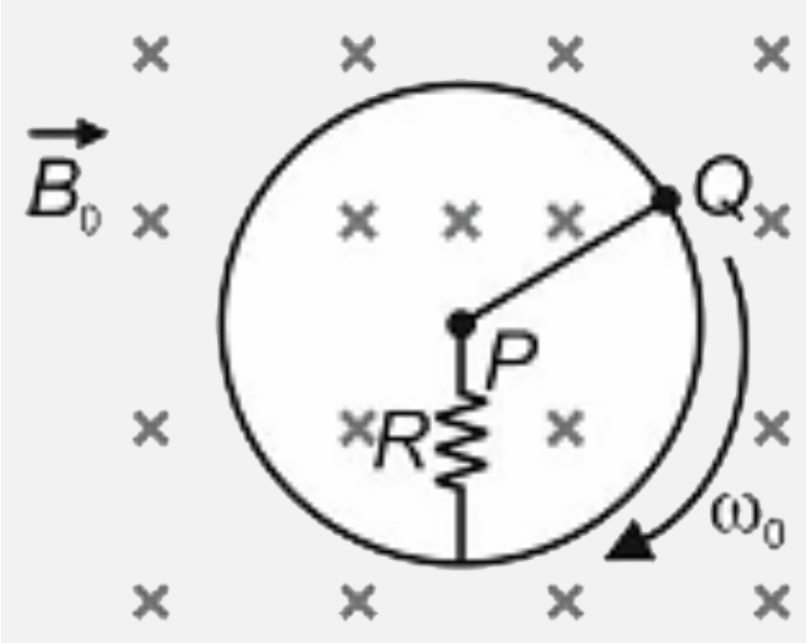
23. A uniform rod PQ of length I and mass m is placed on a smooth horizontal surface. It is hinged at one of its ends and touches the conducting circular loop at another end. The system is subjected to vertical magnetic field B_0. Rod is given angular velocity ω_0 about the axis passing through P. If the time

after which its angular velocity becomes half is $\frac{a}{b}\frac{mR\ln 2}{B^2t^2}$. Find the value of $(a+b)$, where a and b are smallest positive integers.



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24. A solid sphere of radius R has a charge Q distributed in its volume with a charge density $\rho = kr^a$, where k and a are

constants and r is the distance from its centre. If the electric field at $r = \frac{R}{2}$ is $\frac{1}{8}$ times that $r = R$, find the value of a.

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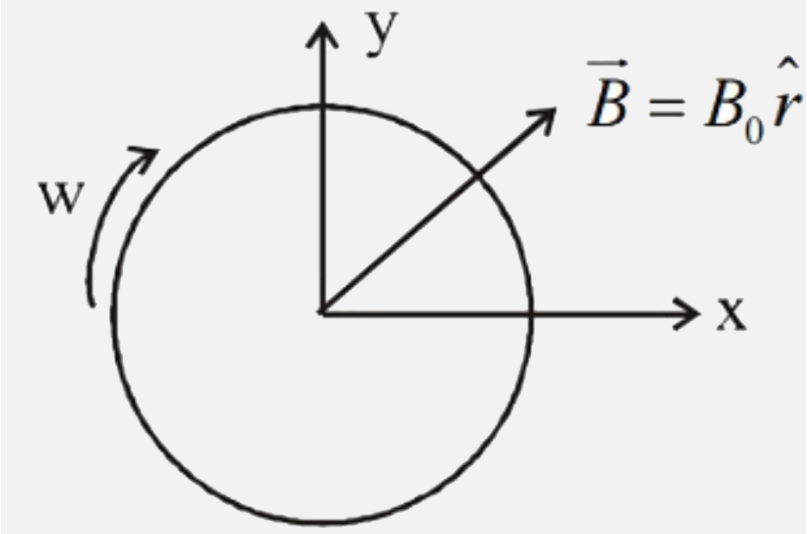
25. A thin non conducting disc of mass M = 2 kg, charge $Q = 2 \times 10^{2-} C$ and radius $R = \frac{1}{6} m$ is placed on a frictionless horizontal plane with its centre at the origin of the coordinate system. A non- uniform, radial magnetic field $\vec{B} = B_0 \hat{r}$ is exists in space, where $B_0 = 10T$ and $\hat{r}$ is a unit vector in the radially outward direction. The disc is set in motion with an angular velocity $\omega = x \times 10^2 \ \text{rad s}^{-1}$, about an axis passing through its centre and perpendicular to its plane, as shown in the figure. At what value of x, the disc will lift

off from the surface.



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