# PHYSICS

# BOOKS - NTA MOCK TESTS

# NTA JEE MOCK TEST 103

## Physics

**1.** A diminished image of an object is to be obtained on a screen 1.0 m from it. This can be achieved by appropriately placing

A. A convex mirror of suitable focal length

B. A concave mirror of suitable focal length

C. A convex lens of focal length less than 0.25 m

D. A concave lens of suitable focal length

**Answer: C**

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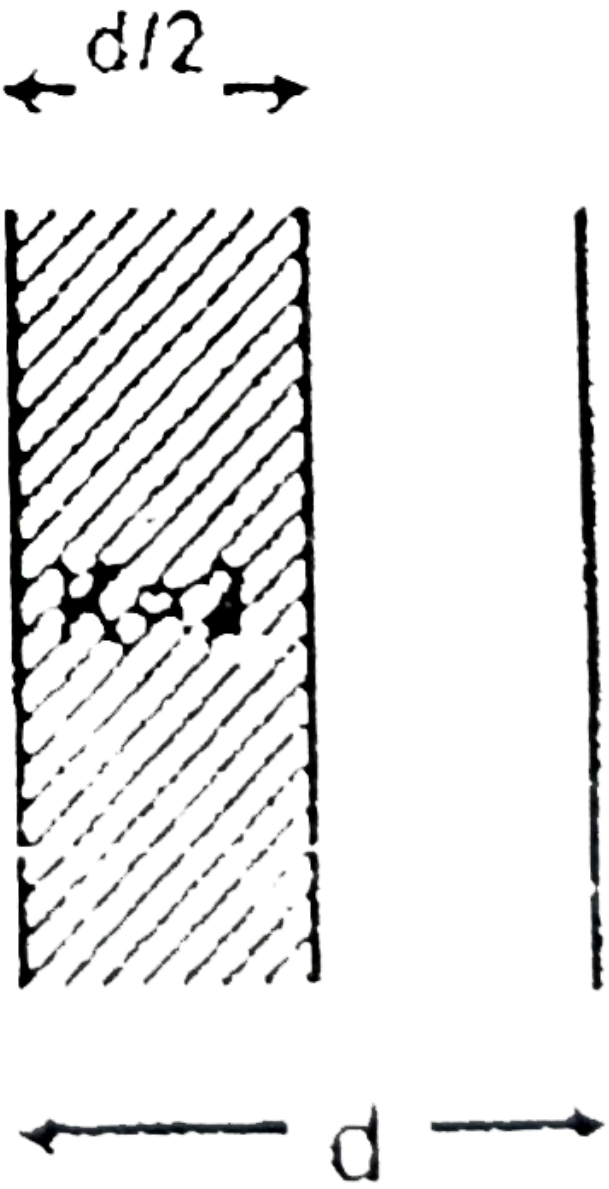
**2.** A certain series $RC$ circuit is formed using a resistance $R$, a capacitor without dieiectric having a capacitance $C = 2F$ and a battery of emf $E = 3V$. The circuit is completed and it is allowed to attain the steady state. After this, at $t = 0$, half the thickness of the capacitor is filed with a dielectric of constant $K = 2$ as shown in the figure. The system is again allowed to attain a steady state. What will be the heat generated (in joule) in the capacitor

between $t = 0$ and $t = \infty$ ?



A. 3

B. 5

C. 2

D. 6

**Answer: A**

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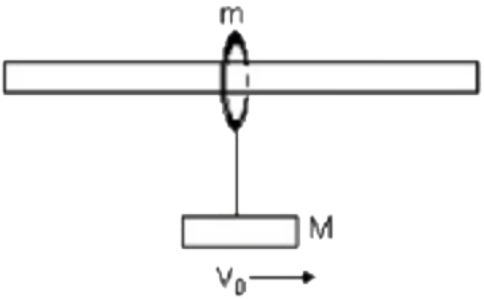
**3.** A ring of mass m free to slide on a fixed smooth horizontal rod is attached to a particle of mass M kg by a inextensible string

of length l. Initially, both M and m are at rest and the string is vertical. A horizontal velocity $v_0$ is imparted to the particle. The maximum height up to which block will rise w.r.t its initial position is (M = 2m)




A. $\frac{v_0^2}{2g}$

B. $\frac{v_0^2}{4g}$

C. $\frac{v_0^2}{6g}$

D. $\frac{v_0^2}{8g}$

**Answer: C**

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**4.** A thin circular plate of mass M and radius R has its density varying as $\rho(r) = \rho_0 r$ with $\rho_0$ as constant and r is the distance from its center. The moment of Inertia of the circular plate about an axis perpendicular to the plate

and passing through its edge is $I = aMR^2$

The value of the coefficient a is :

A. $\frac{3}{5}$

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

C. $\frac{8}{5}$

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

**Answer: C**

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**5.** The binding energies per nucleon for deuteron ($._1 H^2$) and helium ($._2 He^4$) are $1.1MeV$ and $7.0MeV$ respectively. The energy released when two deutrons fuse to form a helium nucleus ($._2 He^4$) is.....

A. 13.9 MeV

B. 26.9 MeV

C. 23.6 MeV

D. 19.2 MeV

**Answer: C**

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**6.** A monkey of mass $20kg$ is holding a vertical rope. The rope will not break when a mass of $25kg$ is suspended from it but will break it the mass exeeds $25kg$ . What is the maximum acceleration with which the monkey can climb up along the rope? $\left(g = 10m/s^2\right)$ .

A. $2.5ms^{-2}$

B. $5ms^{-2}$

C. $10ms^{-2}$

D. $25ms^{-2}$

**Answer: A**

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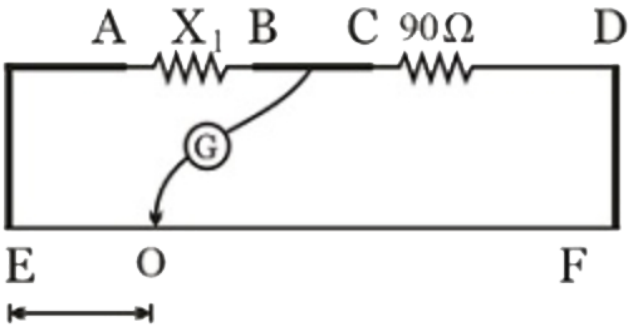
**7.** Let the end error on the LHS and RHS be equal to 1 cm. For the balance point at O, find out the $\%$ error in the value of X ? (If the end error is 1 cm from both sides then it means the correct reading will become 10 cm $+1$ cm

from LHS and 90 cm $+1$ cm from the RHS)




A. $4.2\%$

B. $8.1\%$

C. $9.2\%$

D. None

**Answer: B**

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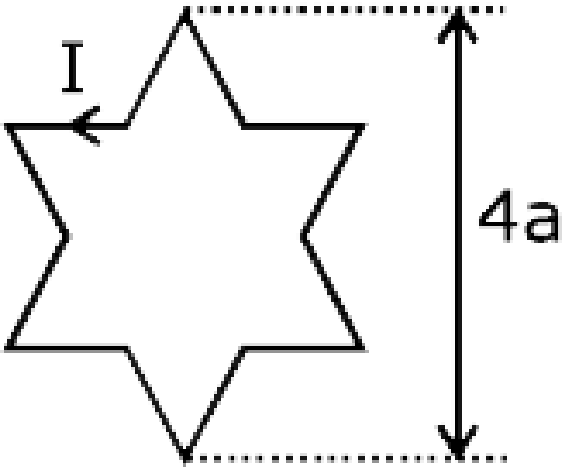
**8.** A symmetric star shaped conducting wire loop is carrying a steady state current I as shown in the figure. The distance between the diametrically opposite vertices of the star is 4a. The magnitude of the magnetic field at the

center of the loop is




A. $\frac{\mu_0 I}{4\pi a} 3\left[\sqrt{3}-1\right]$

B. $\frac{\mu_0 I}{4\pi a} 6\left[\sqrt{3}-1\right]$

C. $\frac{\mu_0 I}{4\pi a} 6\left[\sqrt{3}+1\right]$

D. $\frac{\mu_0 I}{4\pi a} 3\left[2-\sqrt{3}\right]$

**Answer: B**

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**9.** A particle A of mass m and initial velocity v collides with a particle of mass $m/2$ which is at rest. The collision is head on, and elastic. The ratio of the de-broglie wavelength $\lambda_A$ and $\lambda_B$ after the collision is

A. $\frac{\lambda_A}{\lambda_B} = \frac{1}{2}$

B. $\frac{\lambda_A}{\lambda_B} = \frac{1}{3}$

C. $\frac{\lambda_A}{\lambda_B} = 2$

D. $\frac{\lambda_A}{\lambda_B} = \frac{2}{3}$

**Answer: C**

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**10.** A diesel engine takes in 1 mole of air at 300 K, 1 atm pressure and compresses it adiabatically to $\frac{1}{32}th$ of the original volume. Considering air as a diatomic ideal gas, the change in temperature is

A. 900 K

B. 1200 K

C. 600 K

D. 2400 K

**Answer: A**

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**11.** A fully charged capacitor C with initial charge $q_0$ is connected to a coil of self inductance L at t=0. The time at which the

energy is stored equally between the electric and the magnetic fields is

A. $\pi\sqrt{LC}$

B. $\frac{\pi}{4}\sqrt{LC}$

C. $\frac{\pi}{2}\sqrt{LC}$

D. $\frac{\pi}{6}\sqrt{LC}$

**Answer: B**

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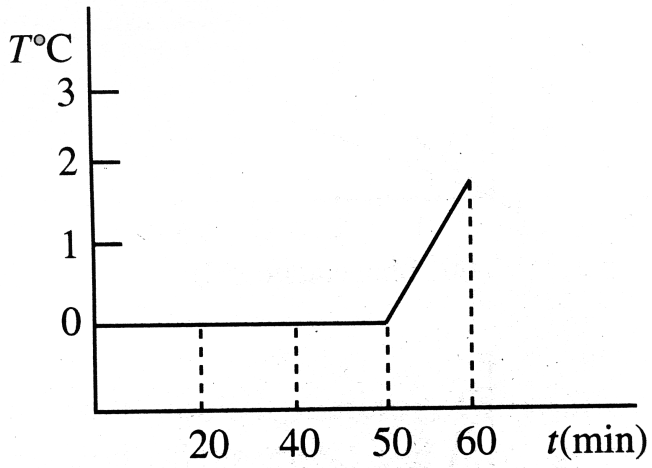


**12.**

A cooking vessel on a slow burner contains 5 kg of water and an unknown mass of ice in equilibrium at $0^\circ C$ at time $t = 0$. The temperature of the mixture is measured at various times and the result is plotted as shown in Fig. During the first 50 min the mixture remains at $0^\circ C$. From 50 min to 60

min, the temperature increases to $2^{\circ}C$ Neglecting the heat capacity of the vessel, the initial mass of the ice is

A. $\frac{10}{7}kg$

B. $\frac{5}{7}kg$

C. $\frac{5}{4}kg$

D. $\frac{5}{8}kg$

**Answer: B**

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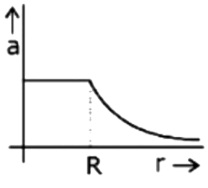
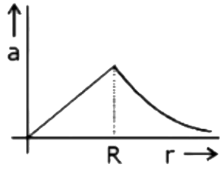
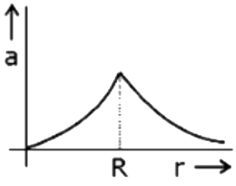
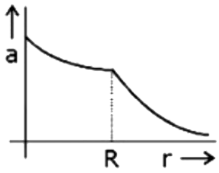
**13.** The mass density of a spherical body is given by $\rho(r) = \frac{k}{r}$ for $r \leq R$ and $\rho(r) = 0$ for r > R , where r is the distance from the centre. The correct graph that describes qualitatively the acceleration, a, of a test particle as a function of r is :

A. 


B. 


C. 

D. 


**Answer: A**

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**14.** If linear density of a rod of length 3m varies as $\lambda = 2 + x,$ them the position of the centre of gravity of the rod is

A. $\frac{7}{3}m$

B. $\frac{12}{7}m$

C. $\frac{10}{7}m$

D. $\frac{9}{7}m$

**Answer: B**

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**15.** From the top of a tower of height 50m, a ball is thrown vertically upwards with a certain velocity. It hits the ground 10 s after it is thrown up. How much time does it take to

cover a distance AB where A and B are two points 20m and 40m below the edge of the tower ? $\left(g = 10ms^{-2}\right)$

A. 2.0 s

B. 1.0 s

C. 0.5 s

D. 0.4 s

**Answer: D**

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**16.** Kinetic energy of a particle moving along a circle of radisu R depends on the distance covered as $K = as^2$ where a is a constant . Find the force acting on the particle as a function of s.

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

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

C. 2as

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

**Answer: B**

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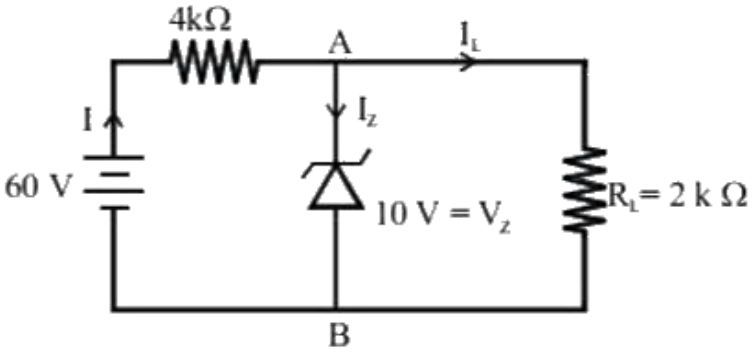
**17.** A Zener diode is connected to a battery and a load as shown below. The currents $l, l_Z$ and $l_L$ are respectively :-




A. 12.5 mA, 7.5 mA, 5 mA

B. 15 mA, 7.5 mA, 7.5 mA

C. 12.5 mA, 5 mA, 7.5 mA

D. 15 mA, 5 mA, 10 mA

**Answer: A**

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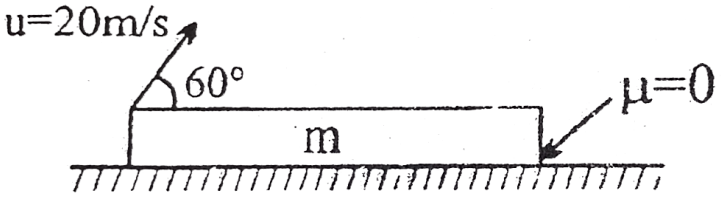
**18.** A particle of mass m is projected at an angle of $60^\circ$ with a velocity of $20m/s$ relative to the ground from a plank of same mass m which is placed on smooth surface Initially Plank was at rest The minimum length of the

plank for which the ball will fall on the plank itself is $(g = 10m/s^2)$




A. $40\sqrt{3}$

B. $20\sqrt{3}$

C. $10\sqrt{3}$

D. $60\sqrt{3}$

**Answer: A**

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**19.** A capacitor of capacitance $10\mu F$ is connected to an AC source and an AC Ammeter. If the source voltage varies as $V = 50\sqrt{2}\sin 100t$, the reading of the ammeter is

A. 50 mA

B. 70.7 mA

C. 5.0 mA

D. 7.07 mA

**Answer: A**

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**20.** A uniform wire of length I and mass M is stretched between two fixed points, keeping a tension F. A sound of frequency $\mu$ is impressed on it. Then the maximum vibrational energy is existing in the wire when $\mu$

A. $\frac{1}{2}\sqrt{\frac{ML}{F}}$

B. $\sqrt{\frac{FL}{M}}$

C. $2 \times \sqrt{\frac{FM}{L}}$

D. $\frac{1}{2}\sqrt{\frac{F}{ML}}$

**Answer: D**

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**21.** Find the wavelength of the $K_\alpha$ line in copper $(Z = 29)$, if the wave length of the $K_\alpha$ line in iron $(Z = 26)$ is known to be equal to $193\text{pm}$ (Take $b = 1$)

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**22.** A calorimeter of negligible heat capacity contains $100$ of water at $40^{\circ}C$ . The water cools to $35^{\circ}C$ in $5$ minutes. The water is now replaced by k-oil of equal volume at $40^{\circ}C$ . Find the time taken for the temperature to become $35^{\circ}C$ under similar conditions. Specific heat capacities of water and K-oil are $4200Jkg^{-1}K^{-1}$ and $2100Jkg^{-1}K^{-1}$ respectively. Density of K-oil $= 800kgm^{-3}$ .

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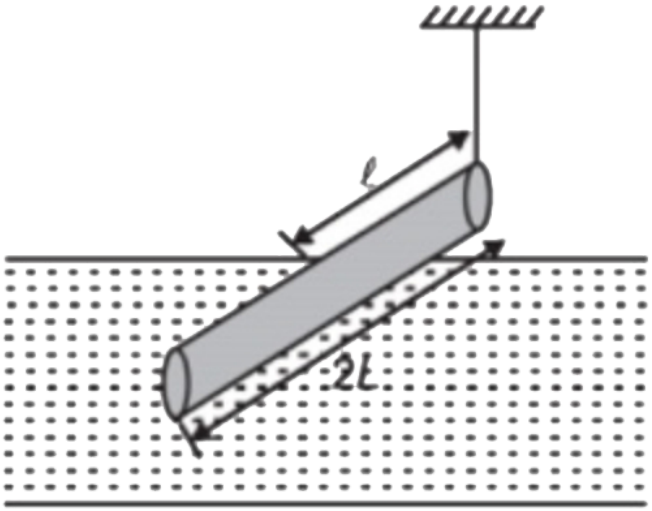
**23.** A slender homogeneous rod of length 2L floats partly immersed in water, being supported by a string fastened to one of its ends, as shown in the figure. The specific gravity of the rod is 0.36. The length of the rod that extends out of the water is $\frac{KL}{10}$ Find the value of K.



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**24.** In Young's experiment interference bands are produced on the screen placed at $1.5m$ from the slits $0.15mm$ apart and illuminated by light of wavelength $6000\text{Å}$. If the screen is now taken away from the slit by 50 cm the change in the fringe width will be

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**25.** A stationary source emits the sound of frequency $f_0 = 492$ Hz. The sound is reflected by a large car approaching the source with a speed of $2ms^{-1}$. The reflected signal is received by the source and superposed with the original. What will be the beat frequency of the resulting signal in Hz? (Given that the speed of sound in air is $330ms^{-1}$ and the car reflects the sound at the frequency it has received).

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