



# PHYSICS

## BOOKS - NTA MOCK TESTS

### NTA JEE MOCK TEST 39

#### Physics

1. If the wavelength of  $K_{\alpha}$  radiation emitted an atom of atomic number  $Z = 41$  is  $\lambda$ , then

the atomic number for an atom that emits  $K_{\alpha}$  radiation with the wavelength  $4\lambda$ , is

A. 21

B. 28

C. 11

D. 36

**Answer: A**



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2. A nucleus of mass  $M + \Delta m$  is at rest and decays into two daughter nuclei of equal mass  $M/2$  each. Speed of light is  $C$ .

The speed of daughter nuclei is

A.  $c \frac{\Delta}{M + \Delta m}$

B.  $c \sqrt{\frac{2\Delta m}{M}}$

C.  $c \sqrt{\frac{\Delta m}{M}}$

D.  $c \sqrt{\frac{\Delta m}{M + \Delta m}}$

**Answer: B**



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3. The horizontal component of the earth's magnetic field is  $3.6 \times 10^{-5} T$  where the dip is  $60^\circ$ . Find the magnitude of the earth's magnetic field.

A.  $2.8 \times 10^{-4}$  tesla

B.  $2.1 \times 10^{-4}$  tesla

C.  $7.2 \times 10^{-5}$  tesla

D.  $3.6 \times 10^{-5}$  tesla

**Answer: C**



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4. Two copper spheres of the same radii one hollow and the other solid are charged to same potential then

- A. Sphere x will have more charge
- B. Sphere y will have more charge
- C. Charge on both the spheres are equal
- D. Charges on both the sphere are zero

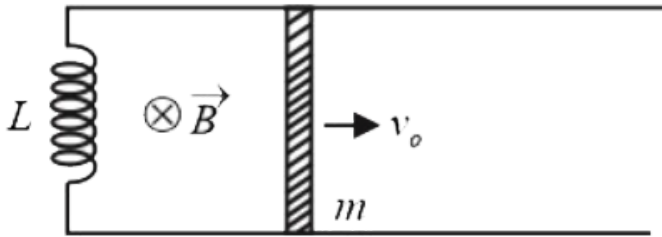
**Answer: C**



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5. As shown in figure, the two parallel conducting rails, in a horizontal plane, are connected at one end by an inductor of inductance  $L$ . A slider (metallic) of mass  $m$ , is imparted a Velocity  $v_0$ , upon the rails, as shown in figure. The period of oscillation of

the conducting rod is



A.  $\frac{\pi}{2} \frac{\sqrt{mL}}{Bl}$

B.  $\frac{2\pi\sqrt{mL}}{3Bl}$

C.  $\frac{2\pi\sqrt{mL}}{Bl}$

D.  $\frac{3\pi\sqrt{mL}}{2Bl}$

**Answer: C**

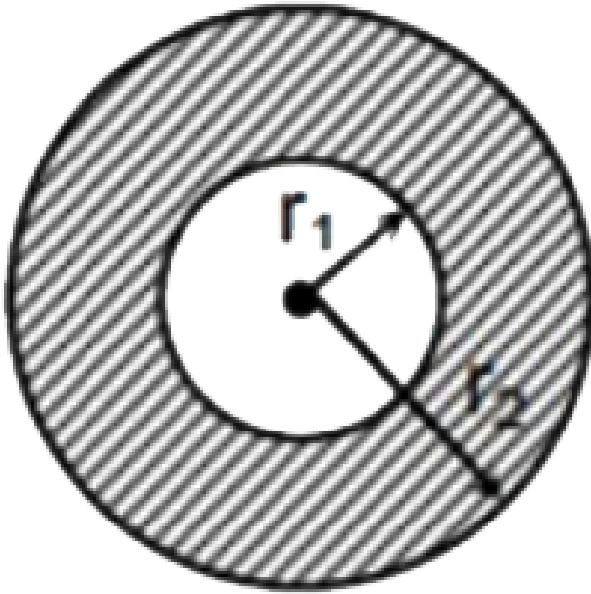


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**6.** In the given diagram, there is a conducting sphere of radius  $r$  which is surrounded by a dielectric of relative permittivity  $\epsilon_r$ . If conducting sphere is given charge  $q$ , then surface density of polarization charges, on the



outer surface of the dielectric layer, is



- A.  $\frac{\epsilon_r q}{4\pi r_2^2}$
- B.  $\frac{q}{4\pi\epsilon_r r_2^2}$
- C.  $\frac{(\epsilon_r - 1)q}{4\pi r_2^2}$
- D.  $\frac{(\epsilon_r - 1)q}{4\pi\epsilon_r r_2^2}$

**Answer: D**



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7. Two stars of masses  $3 \times 10^{31}$  kg each, and at distance  $2 \times 10^{11}$  m rotate in a plane about their common centre of mass O. A meteorite passes through O moving perpendicular to the star's rotation plane. In order to escape from the gravitational field of this double star, the minimum speed that meteorite should

have at O is (Take Graviational constant

$$G = 6.67 \times 10^{-11} Nm^2 kg^{-2})$$

A.  $2.4 \times 10^4 ms^{-1}$

B.  $3.8 \times 10^4 ms^{-1}$

C.  $2.8 \times 10^5 ms^{-1}$

D.  $1.4 \times 10^5 ms^{-1}$

**Answer: C**



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8. The temperature of a liquid drops from 365 K to 361 K in 2 minutes . Find the time during which temperature of the liquid drops from 344 K to 342 K. Temperature of room is 293 K

A. 84 s

B. 72 s

C. 66 s

D. 60 s

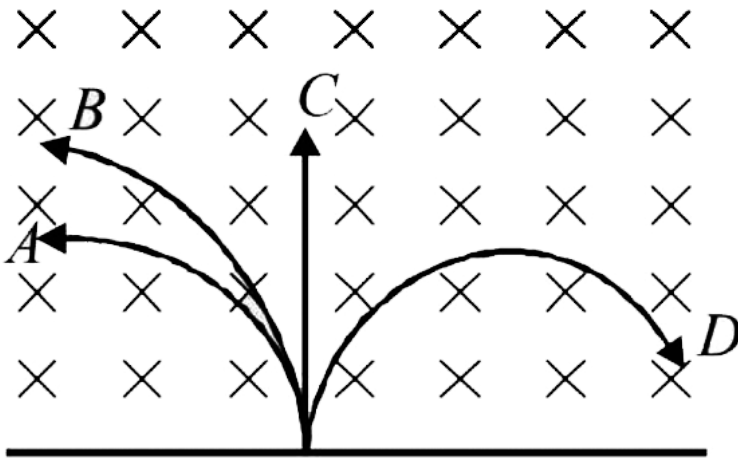
**Answer: A**



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9. A neutron, a proton, and an electron and an alpha particle enter a region of constant magnetic field with equal velocities. The magnetic field is along the inward normal to the plane of the paper. The tracks of the particles are labelled in fig. the electron follows track ... and the alpha particle follows

track.....



A. D

B. C

C. B

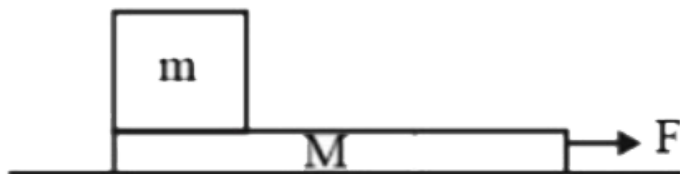
D. A

**Answer: A**



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10. A block of mass  $m = 2 \text{ kg}$  is placed on a plank of mass  $M = 10 \text{ kg}$ , which is placed on a smooth horizontal plane as shown in the figure. The coefficient of friction between the block and the plank is  $\mu = \frac{1}{3}$ . If a horizontal force  $F$  is applied on the plank, then the maximum value of  $F$  for which the block and the plank move together is ( $g = 10 \text{ m/s}^2$ )



A. 50 N

B. 40 N

C. 120 N

D. 100 N

**Answer: B**



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**11.** Two nuclei have mass numbers in the ratio 8 : 125. What is the ratio of their nuclear radii ?



A. 5:3

B. 3:5

C. 5:2

D. 2:5

**Answer: D**



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**12.** An object of mass 1kg executes simple harmonic oscillations along the x-axis, with a frequency of  $\frac{2}{\pi} Hz$ . At the position  $x = 1$  m, the

object has a kinetic energy of 24 J. The amplitude of the oscillation is

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

B.  $2m$

C.  $4m$

D.  $8m$

**Answer: B**



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13. A  $50 \text{ W m}^{-2}$  energy density of sunlight is incident normally on the surface of a solar panel. Some part of incident energy (25 %) is reflected from the surface and the rest is absorbed. The force exerted on  $1 \text{ m}^2$  surface area will be close to

$$(c = 3 \times 10^8 \text{ m s}^{-1})$$

A.  $25 \times 10^{-8} \text{ N}$

B.  $20 \times 10^{-8} \text{ N}$

C.  $10 \times 10^{-8} \text{ N}$

$$D. 35 \times 10^{-8} N$$

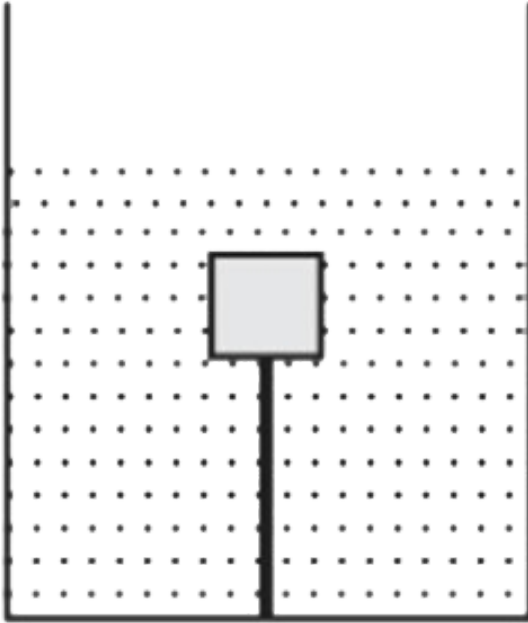
**Answer: B**



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**14.** A wooden block of mass 1kg and density  $800 \text{Kg m}^{-3}$  is held stationery, with the help of a string, in a container filled with water of density  $1000 \text{kg m}^{-3}$  as shown in the figure. If the container is moved upwards with an acceleration of  $2 \text{m s}^{-2}$ , then the tension in

the string will be ( take  $g = 10\text{ms}^{-2}$  )



A. 2N

B. 3N

C. 5N

D. 6N

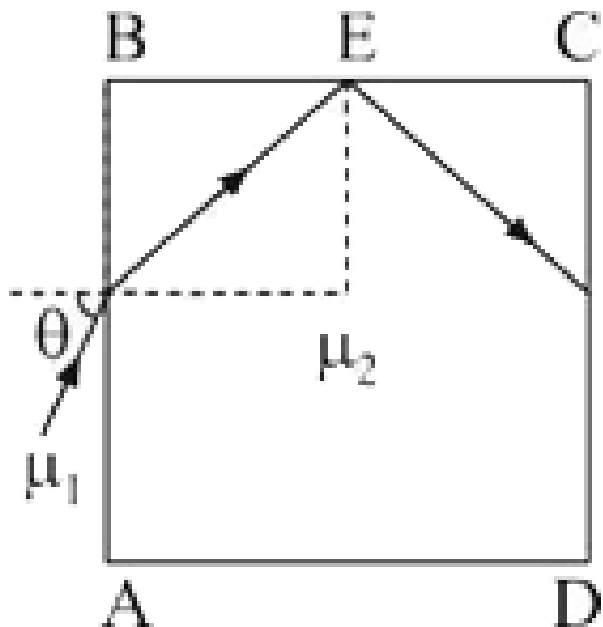
**Answer: B**



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**15.** A transparent cube of side  $d$ , made of a material of refractive index  $\mu_2$ , is immersed in a liquid of refractive index  $\mu_1$  ( $\mu_1 < \mu_2$ ). A ray is incident on the face  $AV$  at an angle  $\theta$  (shown in the figure). Total internal reflection takes place at point  $E$  on the face  $BC$ . Then must

satisfy:



A.  $\theta < \sin^{-1} \sqrt{\frac{n_2^2}{n_1^2} - 1}$

B.  $\theta > \frac{\sin^{-1}(\mu_1)}{\mu_2}$

C.  $\theta < \sin^{-1} \cdot \frac{n_1}{\mu_2}$

$$D. \theta > \sin^{-1} \sqrt{\frac{\mu_2^2}{\mu_1^2} - 1}$$

**Answer: A**

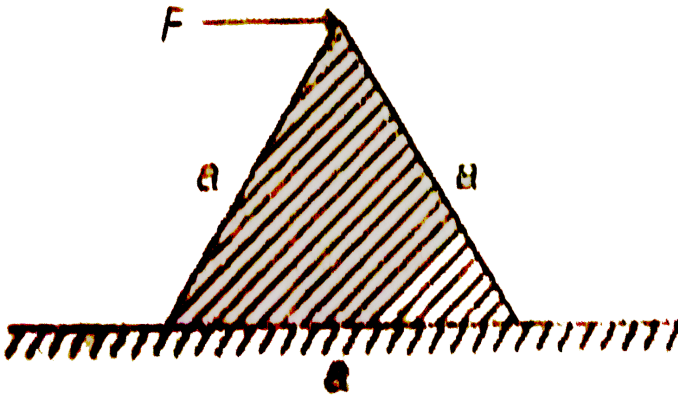


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**16.** An equilateral prism of mass  $m$  rests on a rough horizontal surface with coefficient of friction  $\mu$ . A horizontal force  $F$  is applied on the prism as shown in the figure. If the coefficient of the friction is sufficiently high so that the prism does not slide before toppling,



then the minimum force required to topple the prism is



A.  $\frac{mg}{\sqrt{3}}$

B.  $\frac{mg}{4}$

C.  $\frac{\mu mg}{\sqrt{3}}$

D.  $\frac{\mu mg}{4}$

**Answer: A**



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17. A Zener diode with a breakdown voltage of 4 V is connected in series with a resistance  $R$  to a battery of emf 10 V. The maximum power dissipation rating for the Zener diode is 1 W. The value of  $R$  to ensure maximum power dissipation across the diode is

A.  $12\Omega$

B.  $24\Omega$

C.  $36\Omega$

D.  $6\Omega$

**Answer: B**



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**18.** The dimensions of  $\frac{a}{b}$  in the equation

$P = \frac{a - t^2}{bx}$  where  $P$  is pressure  $x$  is distance

and  $t$  is time, are

A.  $[M^2LT^{-3}]$

B.  $[ML^{-2}]$

C.  $[ML^3T^{-1}]$

D.  $[LT^{-3}]$

**Answer: C**



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**19.** An unpolarized light of intensity  $I_0$  passes through three polarizers, such that the transmission axis of last polarizer is perpendicular to that of first. If the intensity of emergent light is  $\frac{3I_0}{32}$  and the angle between

the transmission axis of first two polarizers is  $\theta$ , then

A.  $\theta = 45^\circ$

B.  $\theta = 37^\circ$

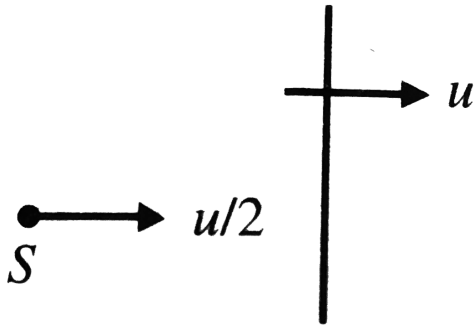
C.  $\theta = 30^\circ$

D.  $\theta = 53^\circ$

**Answer: C**



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20.

A wall is moving with velocity  $u$  and a source of sound moves with velocity  $\frac{u}{2}$  in the same direction as shown in the figure. Assuming that the sound travels with velocity  $10u$ , the ratio of incident sound wavelength on the wall to the reflected sound wavelength by the wall is equal to

A. 9: 11

B. 11: 9

C. 4: 5

D. 5: 4

**Answer: A**



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**21.** In a resonance tube experiment to determine the speed of sound in air, a pipe of diameter  $5\text{cm}$  is used . The column in pipe

resonates with a tuning fork of frequency  $480\text{Hz}$  when the minimum length of the air column is  $16\text{cm}$ . Find the speed in air column at room temperature.



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**22.** The main scale of a vernier calliper reads in mm and its vernier scale is divided into 8 divisions, which coincides with 7 divisions of the main scale. It was also observed that, when the two jaws are brought in contact, the zero



of the vernier scale coincided with the zero of the main scale. The edge length of a cube is measured using this vernier calliper. The main scale reads 12 mm and 2<sup>nd</sup> division of the vernier scale coincides with the main scale. The edge length (in mm) of the cube is



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**23.** Rain drops fall vertically at a speed of  $20\text{ m / s}$ . At what angle do they fall on the wind screen of a car moving with a velocity of  $15\text{ m / s}$ .

, if the wind screen velocity inclined at an angle of  $23^\circ$  to the vertical  $\left( \cot^{-1} \frac{4}{3} \approx 37^\circ \right)$



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24. How many degrees of freedom have the gas molecules, if under standard conditions the gas density is  $1.3 \text{kgm}^{-3}$  and the velocity of sound propagation in it is  $C = 330 \text{ms}^{-1}$ .



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25. A block of mass  $m = 1\text{kg}$  moving on a horizontal surface with speed  $v_i = 2\text{ms}^{-1}$  enters a rough patch ranging from  $x = 0.10\text{m} \rightarrow x = 2.01\text{m}$ . The retarding force  $F_r$  on the block in this range is inversely proportional to  $x$  over this range

$$F_r = -\frac{k}{x} \text{ for } 0.1 < x < 2.01\text{m}$$

$= 0$  for  $x < 0.1\text{m}$  and  $x > 2.01\text{m}$  where  $k = 0.5\text{J}$ . What is the final K.E. and speed  $v_f$  of the block as it crosses the patch?



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