PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 47

Physics

1. A ball is dropped on a smooth inclined plane and is observed to move horizontally after the impact. The coefficient of restitution between

the plane and ball is e. The inclination of the plane is

A. 45°

B. $\tan^{-1} e$

C. $\tan^{-1} \sqrt{e}$

D. $\tan^{-1}\left(\frac{e}{2}\right)$

Answer: C

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2. A hollow vertical cylinder of radius R and height h has a smooth internal surface. A small particle is held in contact with the inner side of upper rim at a point P. It is given a horizontal speed v_0 tangential to rim. It leaves the lower rim at point Q, vertically below P. The number of revolutions made by the particle will be [Take acceleration due to gravity g]

A. $\frac{h}{2\pi R}$

B. $\frac{v_0}{h}\sqrt{\frac{h}{2g}}$

C. $\frac{v_0}{2\pi R}\sqrt{\frac{2h}{g}}$

D. $\frac{v_0\pi}{g}\sqrt{\frac{2gh}{2R}}$

Answer: C

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3. The length of a magnet is large compared to its width and breadth. The time period of its oscillation in a vibration magnetometer is $2s$. The magnet is cut along its length into three equal parts and these parts are then placed

on each other with their like poles together .

The time period of this combination will be

A. 2s

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

C. $2\sqrt{3}s$

D. $2/\sqrt{3}s$

Answer: B

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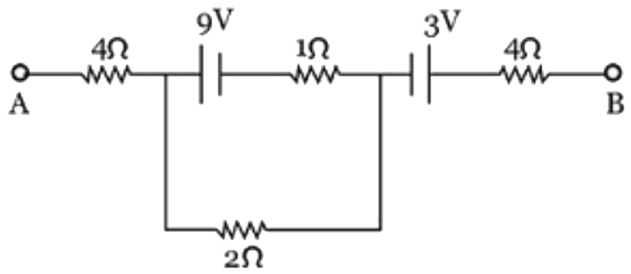
4. In the part of the circuit shown in the figure, the potential difference between points $V_A - V_B = 16V$. The current passing through the 2Ω resistance will be



A. 2.5 A

B. 3.5 A

C. 4.0 A

D. zero

Answer: B

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5. The power factor of an L-R series circuit is 0.5 and that of a C-R series circuit is 0.2. If the elements (L, C and R) of the two circuit are joined in series and connected to the same ac source, the power factor of this circuit is found to be 1. The ratio of the resistance in

the L-R circuit to the resistance in the C-R circuit is

A. 2

B. $\sqrt{2}$

C. $2\sqrt{2}$

D. 4

Answer: C

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6. Two thin spherical shells made of metal are at a large distance apart. One of radius 10cm carries a charge of $+0.5\mu C$ and the other of radius 20cm carries a charge of $+0.7\mu C$. The charge on each, when they are connected by a suitable conducting wire is respectively

A. $0.4 \text{ and } 0.8\mu C$

B. $+0.425 \text{ and } +0.85\mu C$

C. $+0.5 \text{ and } +0.7\mu C$

D. $+0.6 \text{ and } +0.6\mu C$

Answer: A

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7. A sphere of mass m and radius r is projected in a gravity free space with speed v. If coefficient of viscosity of the medium in which it moves is $\frac{1}{6\pi}$, the distance travelled by the body before it stops is

A. $\frac{mv}{2r}$

B. $\frac{2mv}{r}$

C. $\frac{mv}{r}$

D. $\frac{mv}{4r}$

Answer: C

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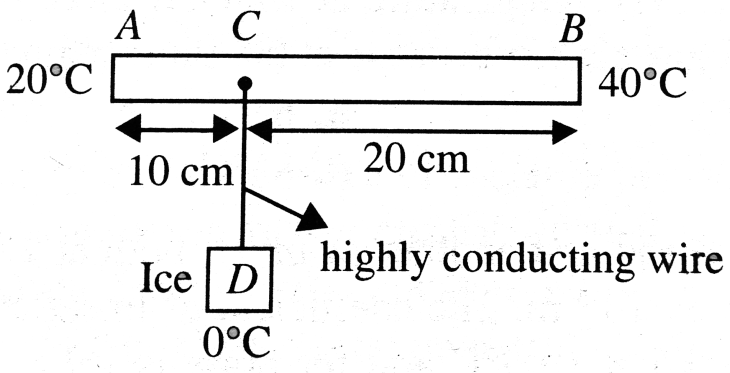
8.



As shown in Fig. AB is rod of length 30 cm and

area of cross section $1.0cm^2$ and thermal conductivity 336 SI units. The ends A and B are maintained at temperatures $20^\circ C$ and $40^\circ C$, respectively .A point C of this rod is connected to a box D, containing ice at $0^\circ C$ through a highly conducting wire of negligible heat capacity. The rate at which ice melts in the box is (assume latent heat of fusion for ice $L_f = 80cal/g$)

A. $84\ \mathrm{mg\ s^{-1}}$

B. $84\ \mathrm{m\ s^{-1}}$

C. $20\ \mathrm{mg\ s^{-1}}$

D. $40\ \mathrm{mg\,s^{-1}}$

Answer: D

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9. A Carnot's engine is made to work between $200^\circ C$ and $0^\circ C$ first and then between $0^\circ C$ and $-200^\circ C$. The ratio of efficiencies of the engine in the two cases is

A. $1:2$

B. $1:1$

C. $1.73:1$

D. $1:1.73$

Answer: D

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10. A bucket full of water weighs 5 kg, it is pulled from a well 20 m deep. There is a small hole in the bucket through which water leaks at a constant rate. If it is observed that for

every meter the bucket loses 0.2 kg mass of water, then the total work done in pulling the bucket up from the well is $[g = 10ms^{-2}]$

A. 600 J

B. 400 J

C. 100 J

D. 500 J

Answer: A

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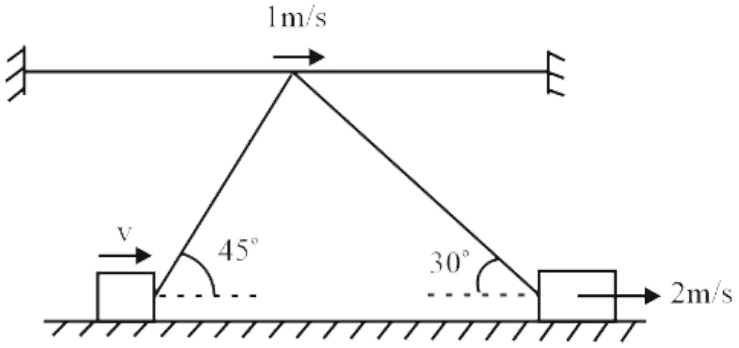
11. Consider the following diagram in which an inextensible string connects two blocks passing via ring. The first block moves with a velocity of $2ms^{-1}$ and the second one moves with a velocity of vms^{-1}. If the ring slides on horizontal rod then the value of v is $(\text{in } ms^{-1})$



A. $\frac{\sqrt{3}}{2}+1$

B. $\sqrt{\frac{3}{2}+1}$

C. $\sqrt{\frac{2}{3}+1}$

D. $\sqrt{\frac{2}{3}+1}$

Answer: B

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12. The displacement of a particle varies with time according to the relation $y = a\sin\omega t + b\ \cos\omega t.$

A. The motion is oscillatory but not SHM

B. The motion is SHM with amplitude $a + b$

C. The motion is SHM with amplitude $a^2 + b^2$

D. The motion is SHM with amplitude $\sqrt{a^2 + b^2}$

Answer: D

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13. Mixed He^+ and O^{2+} ions (mass of He^+=4 amu and that of $O^{2+} = 16$ amu) beam passes a region of constant perpendicular magnetic field. If kinetic energy of all the ions is same then

A. He^+ ions will be deflected more than those of O^{2+}

B. He^+ ions will be deflected less than that of O^{2+}

C. All the ions will be deflected equally

D. No ions will be deflected

Answer: C

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14. The length of an elastic string is a metre when the longitudinal tension is 4 N and b metre when the longitudinal tension is 5 N. The length of the string in metre when the longitudinal tension is 9 N is

A. 4a-5b

B. 5b-4a

C. 9b-9a

D. a+b

Answer: B

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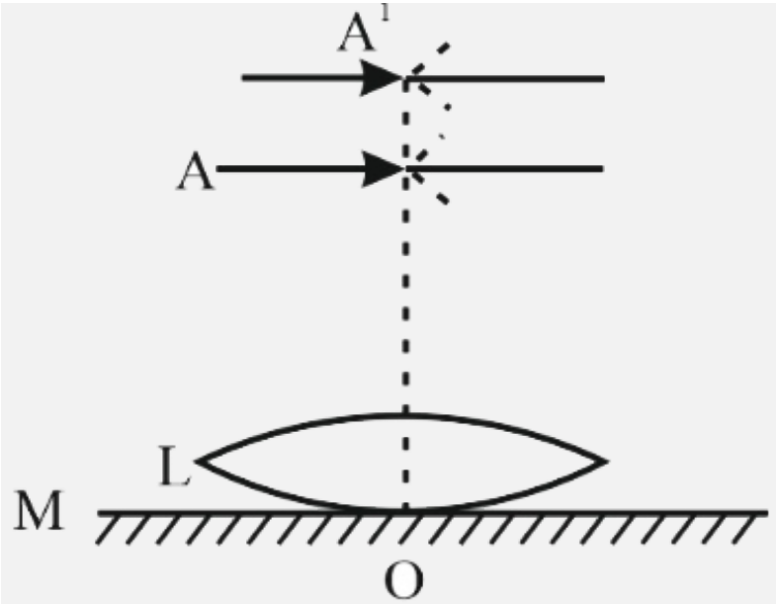
15. A thin convex lens L (refractive index = 1.5) is placed on a plane mirror M. When a pin is placed at A, such that OA = 18 cm, its real inverted image is formed at A itself, as shown

in figure. When liquid of refractive index is put between the lens and the mirror , the oin has to moved to A', such that OA'=27cm, to get its inverted real imaged at A' itself. The value of μ_l will be



A. $\frac{4}{3}$

B. $\sqrt{3}$

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

D. $\sqrt{2}$

Answer: A

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16. A uniform smooth rod (mass m and length l) placed on a smooth horizontal floor is hit by a particle (mass m) moving on the floor, at a distance $\frac{l}{4}$ from one end elastically $(e = 1)$.

The distance travelled by the centre of the rod after the collision when it has completed three revolutions will be

A. $2\pi l$

B. $3\pi l$

C. πl

D. $4\pi l$

Answer: A

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17. A beaker of height H is made up of a material whose coefficient of linear thermal expansion is 3α. It is filled up to the brim by a liquid whose coefficient of volume expansion is 3α. If now the beaker along with its contents is uniformly heated through a small temperature T, the level of liquid will reduced by $(\text{Given, } \alpha T << 1)$

A. αTH

B. $3\alpha TH$

C. $9\alpha TH$

D. $6\alpha TH$

Answer: B

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18. If the time period $(T)$of vibration of a liquid drop depends on surface tension (S) , radius(r) of the drop , and density (ρ) of the liquid , then find the expression of T.

A. $T = k\sqrt{\rho r^3 / S}$

B. $T = k\sqrt{\rho^{1/2} r^3 / S}$

C. $T = k\sqrt{\rho^3 / S^{1/2}}$

D. None of these

Answer: A

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19. A beam of light travelling in water strikes a glass plate, which is also immersed in water. When the angle of incidence is 51°, the reflected beam is found to be plane polarised .

What is the refractive index of glass if the refractive index of water is $\frac{4}{3}$? $[\tan 51^\circ = 1.235]$

A. 1.605

B. 1.305

C. 1.33

D. 1.805

Answer: A

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20. A metallic rod of length 1 m, young's modulus $3 \times 10^{11} Nm^{-3}$ and density is clamped at its middle. Longitudinal stationary vibrations are produced in the rod with the total number of displacement nodes equal to 3. The frequency of vibrations is

A. 30,000 Hz

B. 10,000 Hz

C. 3000 Hz

D. 1500 Hz

Answer: A

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21. The shortest wavelength of the Brackett series of a hydrogen-like atom (atomic number of Z) is the same as the shortest wavelength of the Balmer series of hydrogen atom. The value of z is

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22. IF B is the magnetic field at the centre of a circular loop of area A and its magnetic dipole moment is found to be $n\frac{BA^m}{\mu_0\sqrt{\pi}}$, then what is the value of $n+m$?

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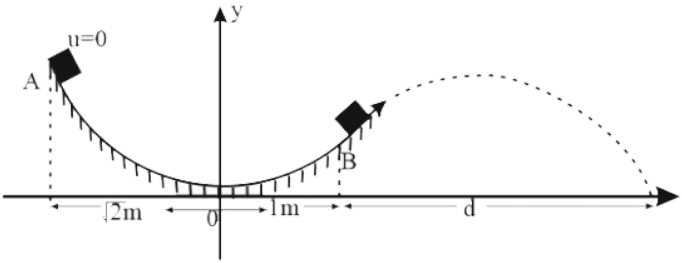
23. A small body is released from point A of smooth parabolic path $y=x^2$, where y is vertical axis and x is horizontal axis at ground, as shown. The body leaves the surface from

point B. If $g = 10ms^{-2}$ then what is the value of d (in m)?



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24. If in a nuclear fission, piece of uranium of mass $0.5g$ is lost, the energy obtained in kWh is.

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25. A bandwidth of 10 MHz is available for AM transmission. If the maximum audio signal frequency used for modulating the carrier is not to exceed 5 kHz, how many stations can be broadcasted within this band simultaneously without interfering with each other ?

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