PHYSICS

BOOKS - NTA MOCK TESTS

JEE MOCK TEST 5

Physics

1. The amplitude of a wave disturbance propagating in the positive x-direction is given by

$y = \frac{1}{1+x^2}$ at $t = 0$ and $y = \frac{1}{1+(x-1)^2}$ at $t = 2s$

where, x and y are in meter. The shape of the wave disturbance does not change during the propagation. what is the velocity of the wave?

A. $0.5ms^{-1}$

B. $2.0ms^{-1}$

C. $1.0ms^{-1}$

D. $4.0ms^{-1}$

Answer: A

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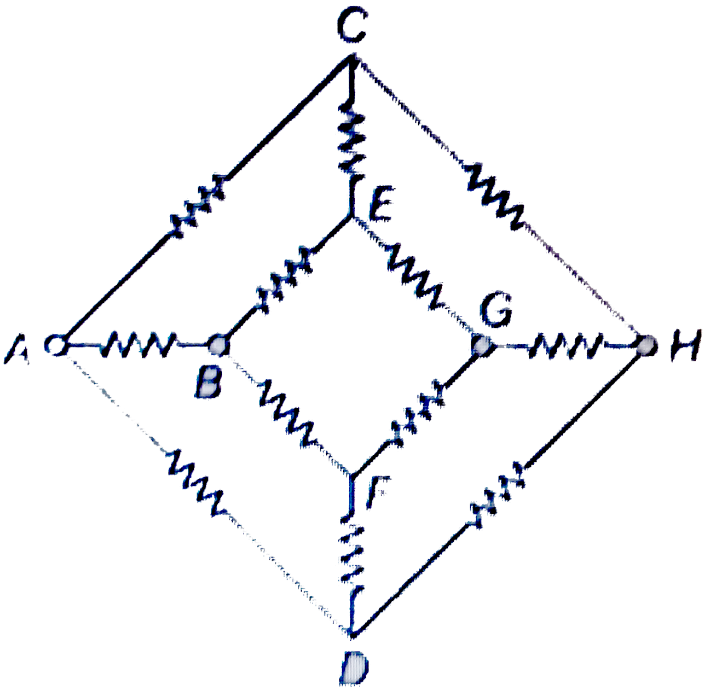
2. Twelve resistors each of resistance 1Ω are connected in the circuit shown in figure. Net resistance between point A and H would be



A. $\frac{5}{6}\Omega$

B. 1Ω

C. $\frac{3}{4}\Omega$

D. 4Ω

Answer: C

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3. A uniform rod of length 2.0 m is suspended through its endpoint about which it performs

small angular oscillations in the vertical plane, its time period is nearly

A. 1.6s

B. 1.8 s

C. 2.0 s

D. 2.3 s

Answer: D

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4. There is a hole at the bottom of a large open vessel. If water is filled upto a height h, it flows out in time t. if water is filled to a height 4h, it will flow out in time

A. t

B. 4t

C. 2t

D. $\frac{t}{4}$

Answer: C

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5. A simple pendulum with a bob of mass m and a conducting wire of length L, swings under gravity with an angular amplitude 2θ. If the horizontal component of the earth's magnetic field perpendicular to the plane of motion of the pendulum is B, then the maximum emf induced across the pendulum is

A. $2BL\sin\left(\frac{\theta}{2}\right)(gL)^{1/2}$

B. $BL\sin\left(\frac{\theta}{2}\right)(2gL)^{1/2}$

C. $2BL\sin\left(\frac{\theta}{2}\right)(gL)^{3/2}$

D. $BL\sin\left(\frac{\theta}{2}\right)(gL)^{2}$

Answer: A

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6. The angular velocity of a particle is $\vec{w} = 4\hat{i} + \hat{j} - 2\hat{k}$ about the origin. If the position vector of the particle is $2\hat{i} + 3\hat{j} - 3\hat{k}$, then its linear velocity is

A. $5\hat{i} + 8\hat{j} - 14\hat{k}$

B. $3\hat{i} + 8\hat{j} + 10\hat{k}$

C. $8\hat{i} + 3\hat{j} - 10\hat{k}$

D. $-8\hat{i} + 3\hat{j} - 2\hat{k}$

Answer: B

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7. A thermally insulated piece of metal is heated under atmospheric pressure by an electric current so that it receives electric

energy at a constant power P. This leads to an increase of absolute temperature T of the metal with time t as follows: $T(t) = T_0[1 + a(t - t_0)]^{1/4}$. Here, a, t_0 and T_0 are constants. The heat capacity $C_p(T)$ of the metal is

A. $\frac{4P}{aT_0}$

B. $\frac{4PT^3}{aT_0^4}$

C. $\frac{2PT^3}{aT_0^4}$

D. $\frac{2P}{aT_0}$

Answer: B

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8. An 8 kg metal block of dimensions 16 cm $\times$ 8 cm $\times$ 6 cm is lying on a table with its face of largest area touching the table. If $g = 10ms^{-2}$, then the minimum amount of work done in making it stand with its length vertical is

A. 8 J

B. 6.4 J

C. 4 J

D. 12.8 J

Answer: C

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9. Assuming f to be the frequency of the electromagnetic wave corresponding to the first line in Balmer series, the frequency of the immediate next line is

A. 0.5 f

B. 1.35 f

C. 2.05 f

D. 2.70 f

Answer: B

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10. A particle of unit mass undergoes one-dimensional motion such that its velocity varies according to

$v(x) = \beta x^{-2n}$

where β and n are constant and x is the position of the particle. The acceleration of the particle as a function of x is given by.

A. $-2n\beta^2 x^{-2n-1}$

B. $-2n\beta^2 x^{-4n-1}$

C. $-2n\beta^2 x^{-2n+1}$

D. $-2n\beta^2 x^{-4n+1}$

Answer: B

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11. A massive vertical wall is approaching a man at a speed μ. When it is at a distance of 10m, the man throws a ball with speed 10 m/s at an angle of 37°, which after having a completely elastic collision with the wall, reaches back directly into the hands of the man. The velocity of the wall is

A. $\frac{13}{3} m/s$

B. $\frac{18}{2}$ m/s

C. $\frac{26}{4}$ m/s

D. $\frac{31}{5}$ m/s

Answer: A

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12. In Young's double-slit experiment, the ratio of intensities of a bright band and a dark band is $16:1$. The ratio of amplitudes of interfering waves will be

A. $16:1$

B. $4:1$

C. $3:1$

D. $5:3$

Answer: D

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13. If the distance between the Earth and the sun shrinks to half the present distance, then find the new duration of the year.

A. 45 days

B. 100 days

C. 182 days

D. 129 days

Answer: D

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14. If r is the total radius and v is the orbital velocity of an electron in a hydrogen atom, then its magnetic dipole moment is

A. $\frac{evr}{2\pi}$

B. evr

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

D. ev

Answer: C

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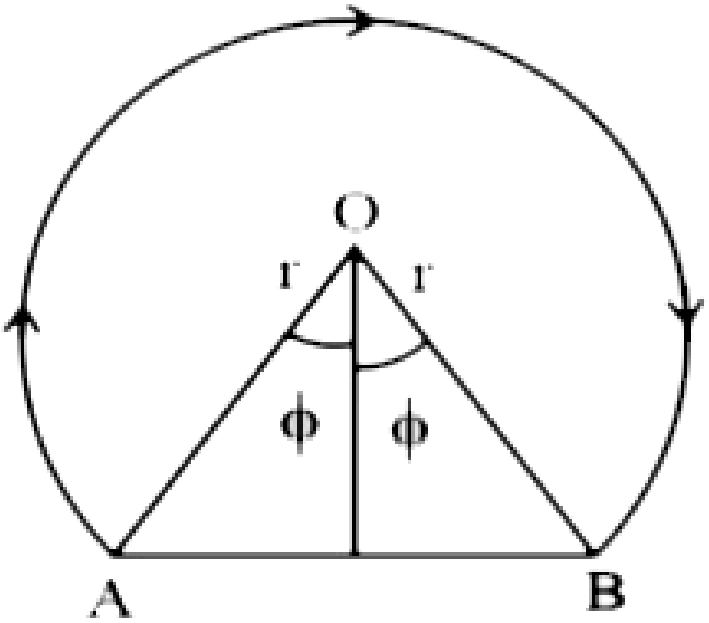
15. A wire is bent in the form of a circular arc of radius r with a straight portion AB. If the current in the wire is i, then the magnetic

induction at point O is



A. $\frac{\mu_0 i}{2\pi r}\tan\phi$

B. $\frac{\mu_0 i}{2\pi r}(\pi-\phi)$

C. $\frac{\mu_0 i}{2\pi r}(\pi-\phi+\tan\phi)$

D. $\frac{\mu_0 i}{2\pi r}(\pi+\tan\phi)$

Answer: C

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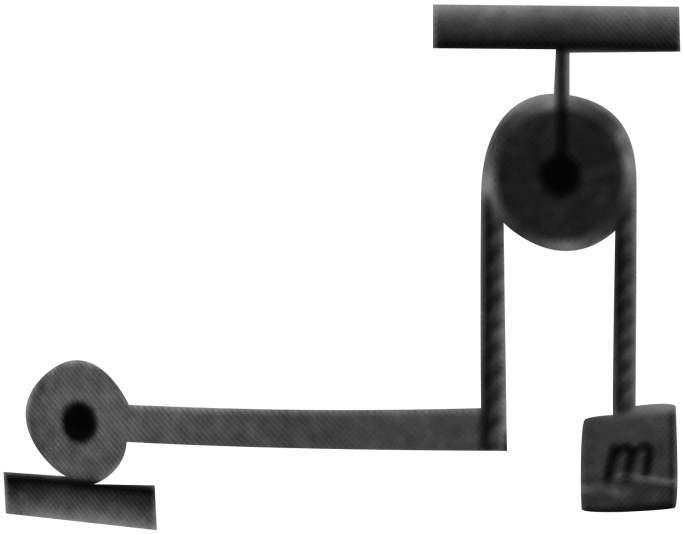

16.

Uniform rod AB is hinged at end A in horizontal position as shown in the figure. The other end is connected to a block through a

massless string as shown. The pulley is smooth and massless. Mass of block and rod is same and is equal to m Then acceleration of block just after release from this position is

A. $\frac{6g}{13}$

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

C. $\frac{3g}{8}$

D. None

Answer: C

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17. There are two radioactive substance A and B. Decay constant of B is two times that of A. Initially, both have equal number of nuclei. After n half-lives of A,rates of disintegration of both are equal. The value of n is .

A. 4

B. 2

C. 1

D. 5

Answer: C

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18. A student performs an experiment to determine the Young's modulus of a wire, exactly $2m$ long, by Searle's method. In a particular reading, the student measures the extension in the length of the wire to be $0.8mm$ with an uncertainty of $\pm 0.05mm$ at a load of exactly $1.0kg$, the student also measures the diameter of the wire to be

$0.4mm$ with an uncertainty of $\pm 0.01mm$. Take $g = 9.8m/s^2$ (exact). the Young's modulus obtained from the reading is

A. $(2.0 \pm 0.3) \times 10^{11} Nm^{-2}$

B. $(2.0 \pm 0.2) \times 10^{11} Nm^{-2}$

C. $(2.0 \pm 0.1) \times 10^{11} Nm^{-2}$

D. $(2.0 \pm 0.5) \times 10^{11} Nm^{-2}$

Answer: B

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19. An aircraft loops the loop of radius R = 500 m with a constant velocity $v = 360km/h$. The weight of the flyer of mass m = 70 kg in the lower, upper and middle points of the loop will respectively be-

A. $2.1\text{kN}, 0.7kN, 1.5kN$

B. 0.7 kN, 1.5 kN, 2.1 kN

C. 1.5 kN,2.1 kN, 0.7 kN

D. None of these

Answer: A

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20. Given

$R_1 = 5.0 \pm 0.2\Omega, \text{ and } R_2 = 10.0 \pm 0.1\Omega.$

What is the total resistance in parallel with possible $\%$ error?

A. $15\Omega \pm 2\,\%$

B. $3.3\Omega \pm 3\,\%$

C. $15\Omega \pm 3\,\%$

D. $3.3\Omega \pm 7\,\%$

Answer: B

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21. Two plans mirrors are inclined to each other at some angle .A ray of light incident at 30° on one,after reflection form the other retraces its path .The angles between the mirrors is:

A. 30°

B. 45°

C. 60°

D. 90°

Answer: 30°

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22. Three charges Q, +q and + q are placed at the vertices of a right -angle isosceles triangle as shown below. The net electrostatic energy of the configuration is zero if the value of Q is

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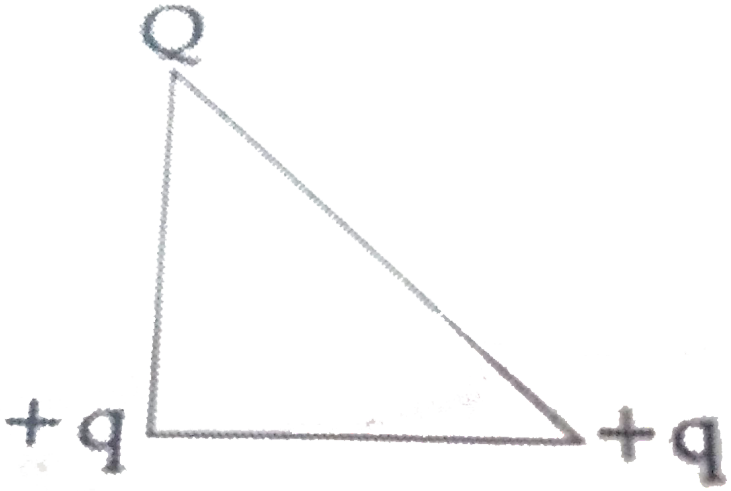

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23. A binary star consists of two stars A(mass $= 22M_s$) and B (mass $= 11M_s$) where M_s is the mass of the sun, they are separated by

distance d and are rotating about their center of mass, which is stationary. The ratio of the total angular momentum of the binary to the angular momentum of star B about the centre of mass is

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24. Liquids A and B are at 30° C and 20° C, respectively. When mixed in equal masses,the temperature of the mixture is found to be 26° C, The specific heats of A and B are in the ratio

of $m:n$, where m and n are integers, then find minimum value of $m+n$.

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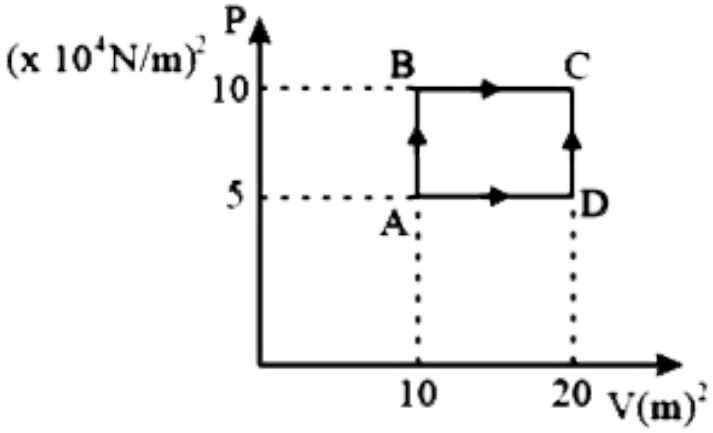
25. A sample of 2kg monoatomic helium gas (assumed ideal) is taken through the process ABC and another samples of 2 kg of the same gas is taken through the process ADC. Given that the molecular mass of helium = 4 amu, find the temperature of helium in the state D. [Take the universal gas constant

$R = \frac{25}{3} Jmol^{-1}K^{-1}]$



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