PHYSICS

BOOKS - NTA MOCK TESTS

JEE MOCK TEST 4

Physics Single Choice

1. In the spectrum of hydrogen atom, the ratio of the longest wavelength in Lyman series to the longest wavelength in the Balmer series is:

A. $\frac{5}{27}$

B. $\frac{1}{93}$

C. $\frac{4}{9}$

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

Answer: A

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2. Three very large plates of same area are kept parallel and close to each other. They are considered as ideal black surfaces and have high thermal conductivity. The first and third plates are maintained at temperatures 2T and 3T respectively. The temperature of the middle (i.e., second) plate under steady state condition is

A. $\left(\frac{65}{2}\right)^{1/4} T$

B. $\left(\frac{97}{4}\right)^{1/4} T$

C. $\left(\frac{97}{2}\right)^{1/4} T$

D. $97^{1/4} T$

Answer: C

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3. The natural frequency of an LC- circuit is 1,25,000 cycles per second. Then the capacitor C is replaced by another capacitor with a dielectric medium of dielectric constant k. In this case, the frequency decreases by 25 kHz. The value of k is

A. 3.05

B. 2.18

C. 1.56

D. 1.74

Answer: C

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4. A magnetic dipole is placed in a uniform magnetic field of intensity B, oriented along the direction of the field. If the magnetic dipole moment is M, then the maximum work an external agent can perform in rotating the dipole will be

A. $\frac{1}{2}MB$

B. $4MB$

C. $2MB$

D. MB

Answer: C

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5. A capillary tube of radius r is lowered into a liquid of surface tension T and density ρ. Given angle of contact $\theta = 0^\circ$. During the process in which the liquid rises in the capillary. The work done by surface tension will be

A. $\frac{\pi T^2}{\rho g}$

B. $\frac{4\pi T^2}{\rho g}$

C. $\frac{T^2}{\rho g}$

D. $\frac{2T^2}{\rho g}$

Answer: B

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6. A point object at 15 cm from a concave mirror of radius of curvature 20 cm is made to oscillate along the principal axis with amplitude 2 mm. The amplitude of its image will be

A. 2 mm

B. 4mm

C. 8mm

D. 16 mm

Answer: C

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7. Two redioactive materials X_1 and X_2 have decay constants 10λ and λ, respecitvely. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to that of X_2 will be 1/e after a time

A. $\frac{1}{10\lambda}$

B. $\frac{1}{11\lambda}$

C. $\frac{11}{10\lambda}$

D. $\frac{1}{9\lambda}$

Answer: D

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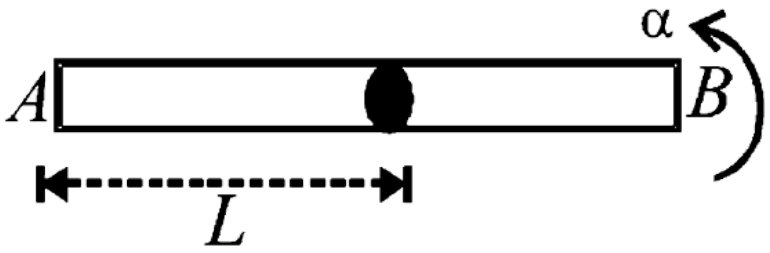
8. A long horizontal rod has a bead which can slide along its length and initially placed at a distance L from one end A of the rod. The rod is set in angular motion about A with constant angular acceleration α. if the coefficient of friction between the rod and the bead is μ, and gravity is

neglected, then the time after which the bead starts



slipping is

A. $\sqrt{\frac{\mu}{\alpha}}$

B. $\frac{\mu}{\sqrt{\alpha}}$

C. $\frac{1}{\sqrt{\mu\alpha}}$

D. infinitesimal

Answer: A

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9. A charge Q is place at each of the opposite corners of a square. A charge q is placed at each of the other two corners. If the net electrical force on Q is zero, then Q/q equals:

A. $Q = -2\sqrt{2}q$

B. $Q = -\frac{q}{2}$

C. $Q = -\sqrt{8}q$

D. $Q - 2q$

Answer: A

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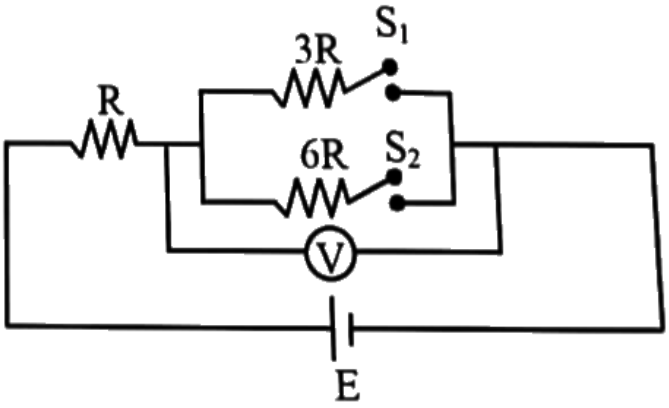
10. In the circuit shown in the figure, the reading of the voltmeter is V_1 when only S_1 is closed,V_2 when only S_2 is closed and V_3 when both S_1 and S_2 are closed. From this we can conclude that



A. $V_3 > V_2 > V_1$

B. $V_2 > V_1 > V_3$

C. $V_3 > V_1 > V_2$

D. $V_1 > V_2 > V_3$

Answer: B

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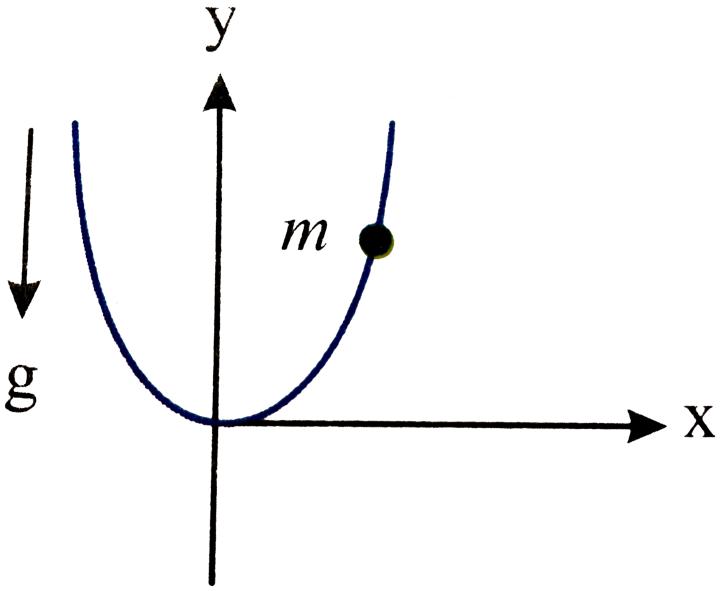
11. A particle of mass m is allowed to oscillate near the minimum of a vertical parabolic path having the equaiton $x^2 = 4ay$. The angular frequency of small oscillation is given by



A. $\sqrt{\frac{8g}{a}}$

B. $\sqrt{\frac{2g}{a}}$

C. $\sqrt{\frac{g}{a}}$

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

Answer: D

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12. A wire 3 m is length and 1 mm is diameter at 30° C is kept in a low temperature at $-170^\circ C$ and is stretched by hanging a weight of 10 kg at one end. The change in length of the wire is

[Take,

$Y = 2 \times 10^{11} N/m^2, g = 10 m/s^2$ and $\alpha = 1.2 \times 10^{-5}/^{\circ} C$

]

A. 5.2 mm

B. 2.5 mm

C. 7.2 mm

D. 3.5 mm

Answer: A

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13. The resistance of metal is given by $V = IR$, The voltage in the resistance is $V = (8 \pm 0.5)V$ and current in the

resistance is $I = (2 \pm 0.2)A$, the value fo resistance with its percentage error is

A. $4 \pm 16.25\ \%$

B. $4 \pm 6.25\ \%$

C. $4 \pm 10\ \%$

D. $4 \pm 8\ \%$

Answer: A

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14. A body is projected at an angle of 60° with horizontal. If its kinetic energy at its maximum height is 10 J, then the height at which its potential energy and kinetic energy

have equal values is (consider potential energy at the point of projection to be zero)

A. half of the maximum height

B. two third of the maximum height

C. one sixth of the maximum height

D. insufficient data to solve the problem

Answer: B

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15. A particle is moving with velocity $\vec{v} = \hat{i} + 3\hat{j}$ and it produces an electrostatic field at a point given by $\vec{E} = 2\hat{k}$.

It will produce magnetic field at that point equal to (all quantities are in S.I. units and speed of light is c)

A. $\frac{6\hat{i}-2\hat{j}}{c^2}$

B. $\frac{6\hat{i}+2\hat{j}}{c^2}$

C. zero

D. data insufficient

Answer: A

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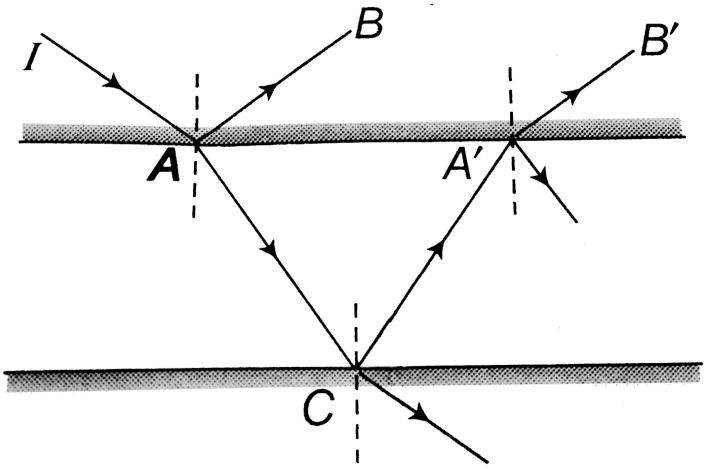
16. A ray of light intensity I is incident on a parallel glass-slab at a point A as shown in figure. It undergoes partial reflection and refraction. At each reflection $25\,\%$ of

incident energy is reflected. The rays AB and $A'B'$ undergo interference. The ratio $I_{\max}/I_{\min}$ is



A. $4:1$

B. $8:1$

C. $7:1$

D. $49:1$

Answer: D

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17. Two small balls of the same size and of mass m_1 and $m_2(m_1 > m_2)$ are tied by a thin weightless thread and dropped from a ballon. Determine the tension T of the thread during the flight after the motion of the balls has become steady-state.

A. $(m_1 - m_2)g$

B. $(m_1 - m_2)\frac{g}{2}$

C. $(m_1 + m_2)g$

D. $(m_1 + m_2)\frac{g}{2}$

Answer: B

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18. A 500 g ball is released from a height of 4m. Each time it makes contact with the ground, it loses 25% of its kinetic energy. Find the kinetic energy it possess just after the 3^{rd} hit

A. 15 J

B. 11.25 J

C. 8.44 J

D. none of these

Answer: C

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19. A whistle of frequency 500 Hz tied to the end of a string of length 1.2 m revolves at 400 rev/min. A listener standing some distance away in the plane of rotation of whistle hears frequencies in the range (speed of sound = 340 m/s)

A. 386 Hz - 436 Hz

B. 426 Hz - 474 Hz

C. 426 Hz - 586 Hz

D. 436 Hz - 586 Hz

Answer: D

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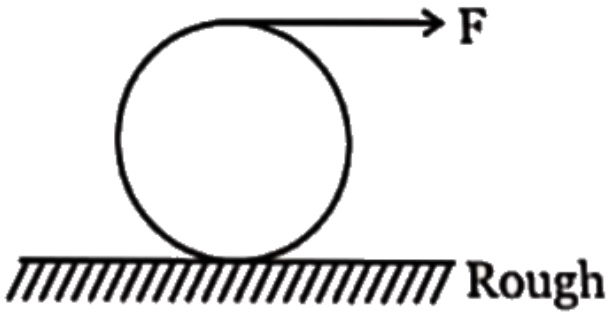
20. A solid sphere of radius R and mass M is rolled by a force F acting at the top of the sphere as shown in the figure. The sphere starts from rest and rolls without slipping, then



A. work done by force F when the centre moves a distance S is 2 FS

B. work done by force F when the centre moves a distance S is 3 FS

C. work done by force F when the center moves a distance S is FS

D. work done by force F when the center moves a distance S is 4FS

Answer: A

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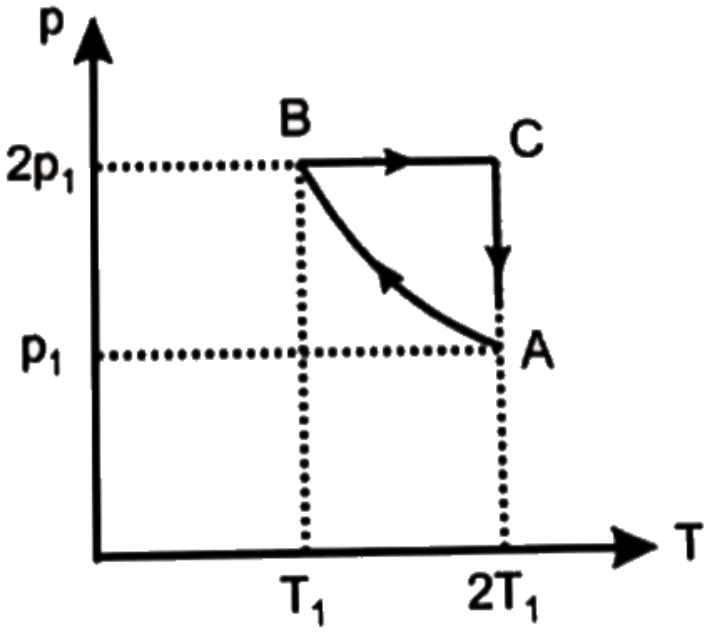
Physics Subjective Numerical

1. Two moles of an ideal monoatomic gas is taken through a cycle ABCA as shown in the p - T diagram. During the process AB, the pressure and temperature of the gas vary

such that pT = constant. If $T_1 = 300K$ and the amount of heat released by the gas during the process AB is $Q = -xR$, then the value of x is



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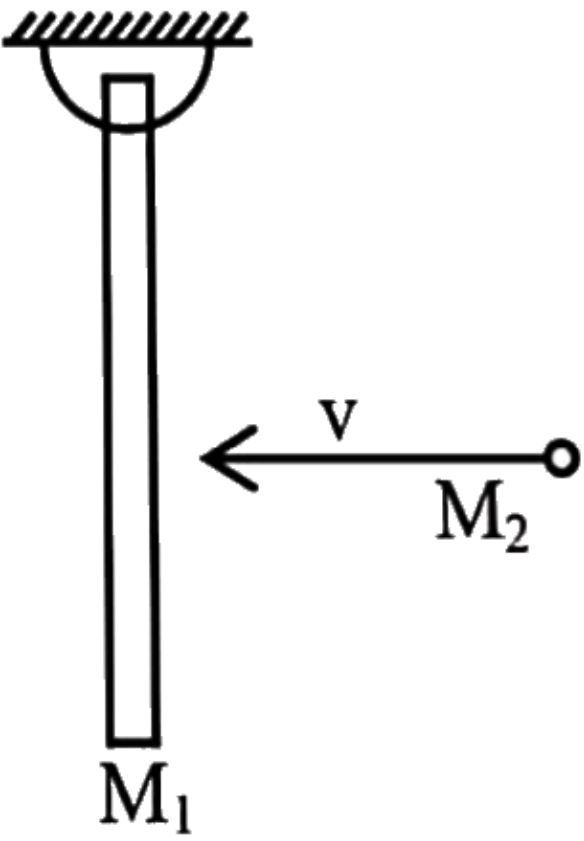
2. A uniform rod of mass M_1 is hinged at its upper end as shown in the figure . A particle of mass M_2 which is moving horizontally, strikes the rod elastically at its midpoint. If the particle comes to rest after collision then the value of

$\frac{M_1}{M_2}$ is



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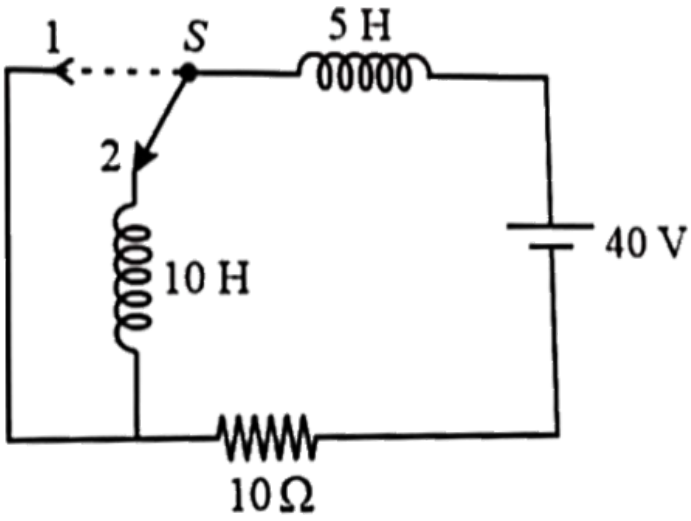
3. In the circuit shown in the figure, the switch was kept in position - 1 for a very long time and then at t = 0 it is shifted to position - 2. The current in the circuit immediately after that is $i = \frac{a}{b}$ A, then the value of $a + b$ is



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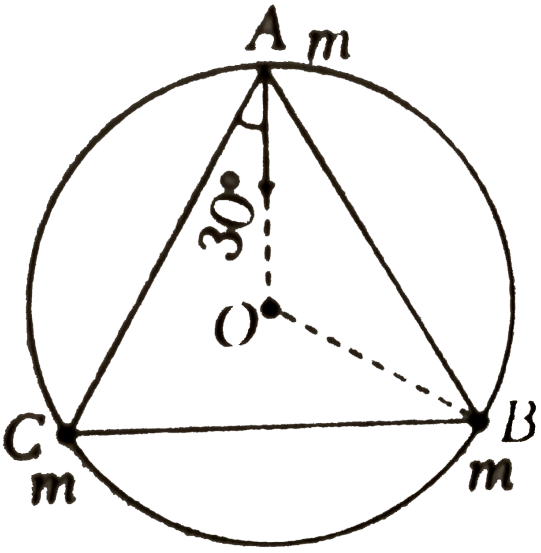
4. Three particle each of mass m, are located at the vertices of an equilateral triangle of side a. At what speed must they move if they all revolve under the influence of their gravitational force of attraction in a circular orbit circumscribing the triangle while still preserving the equilateral triangle is $v = n\sqrt{G}$, then the value of n is ?



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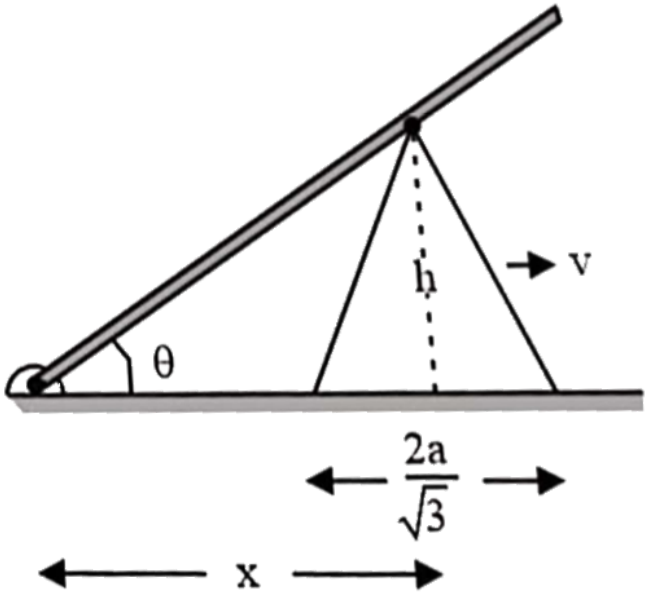
5. In the given arrangement, the rod is free to rotate about the hinge and it is in constant contact with the equilateral triangular block of base length $\frac{2a}{\sqrt{3}}$. If the block is moving horizontally with a speed $v = 20ms^{-1}$, then find the magnitude of the angular velocity of the rod (in rad. s^{-1})at the instant when $\theta = 30^{\circ}$. [Given that $a = 1m$]



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