PHYSICS

BOOKS - DISHA PHYSICS (HINGLISH)

WORK, ENERGY AND POWER

Physics

1. A body is acted upon by a force $\vec{F} = -\hat{i} + 2\hat{j} + 3\hat{k}$. The work done by the

force in displacing it from (0,0,0) to (0,0,4m) will be -

A. 12J

B. 10J

C. 8J

D. 6J

Answer:

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2. The work done in pulling a body of mass 5 kg along an inclined plane (angle 60°) with coefficient of friction 0.2 through 2 m, will be -

A. 98.08 J

B. 94.08 J

C. 90.08 J

D. 91.08 J

Answer:

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3. A force $\vec{F} = (7 - 2x + 3x^2)$ N is applied on a 2 kg mass which displaces it from x = 0 to x = 5 m. Work done in joule is -

A. 70

B. 270

C. 35

D. 135

Answer:

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4. An automobile of mass m accelerates from rest. If the engine supplies a constant power P, the velocity at time t is given by -

A. $V = \frac{Pt}{m}$

B. $V = \frac{2Pt}{m}$

C. $\sqrt{\frac{Pt}{m}}$

D. $\sqrt{\frac{2Pt}{m}}$

Answer:

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5. In the above question, the position (s) at time (t) is given by -

A. $\left(\frac{2Pt}{m}\right)t$

B. $\left(\frac{8P}{9m}\right)^{\frac{1}{2}}t^{3/2}$

C. $\left(\frac{9P}{8m}\right)^{\frac{1}{2}}t^{1/2}$

D. $\left(\frac{8P}{9m}\right)^{\frac{1}{2}}t$

Answer:

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6. A particle moving in a straight line is acted by a force, which works at a constant rate and changes its velocity from u to v in passing over a distance x. The time taken will be -

A. $x = \frac{v-u}{v^2+u^2}$

B. $x\left(\frac{v+u}{v^2+u^2}\right)$

C. $\frac{3}{2}(x)\left(\frac{v^2-u^2}{v^3-u^3}\right)$

D. $x\left(\frac{v}{u}\right)$

Answer:

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7. A chain of linear density 3 kg /m and length 8 m is lying on the table with 4 m of chain hanging from the edge. The work done in lifting the chain on the table will be -

A. 117.6 J

B. 235.2 J

C. 98 J

D. 196 J

Answer:

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8. The work done in lifting water from a well of depth 6 m using a bucket of mass 0.5 kg and volume 2 litre, will be-

A. 73.5 J

B. 147 J

C. 177.6 J

D. 98 J

Answer:

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9. An object of mass 5 kg falls from rest through a vertical distance of 20 m and reaches a velocity of 10 m/s. How much work is done by the push of the air on the object ? $\left(g = 10m/s^2\right)$.

A. 350 J

B. 750 J

C. 200 J

D. 300 J

Answer:

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10. A boy pulls a 5 kg block 20 metres along a horizontal sur- face at a constant speed with a force directed 45° above the horizontal. If the coefficient of kinetic friction is 0.20, how much work does the boy do on the block?

A. 163.32 J

B. 11.55 J

C. 150 J

D. 115 J

Answer:

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11. A uniform chain is held on a frictionless table with one third of its length hanging over the edge. IF the chain has a length l and a

mass m, how much work is required to pull the hanging part back on the table ?

A. mgl/10

B. mgl/5

C. mgl/50

D. mgl/2

Answer:

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12. A bus of mass 1000 kg has an engine which produces a constant power of 50 kW. If the resistance to motion, assumed constant is 1000 N. The maximum speed at which the bus can travel on level road and the acceleration when it is travelling at 25 m/s, will respectively be -

A. $50m/s, 1.0m/s^2$

B. $1.0m/s, 50\frac{m}{s^2}$

C. $5.0m/s, 10m/s^2$

D. $10m/s, 5m/s^2$

Answer:

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13. The power output of a $_92U^{235}$ reactor if it takes 30 days to use up 2 kg of fuel and if each fission gives 185 MeV of energy (Avogadro number`=6xx10^(23)//mole) will be -

A. 58.4MW

B. 5.84 MW

C. 584 MW

D. 5840MW

Answer:

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14. The stopping distance for a vehicle of mass M moving with a speed v along a level road, will be - (μ is the coefficient of friction between tyres and the road)

A. $\frac{v^2}{\mu g}$

B. $\frac{2v^2}{\mu g}$

C. $\frac{v^2}{2\mu g}$

D. $\frac{v}{\mu g}$

Answer:

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15. The earth circles the sun once a year. How much work would have to be done on the earth to bring it to rest relative to the sun,

(ignore the rotation of earth about - its own axis) Given that mass of the earth is 6×10^{24} kg and distance between the sun and earth is 1.5×10^{8} km-

A. 2.7×10^{33}

B. 2.7×10^{24}

C. 1.9×10^{23}

D. 1.9×10^{24}

Answer:

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16. A particle of mass m is moving in a horizontal circle of radius r, under a centripetal force equal to $\left(-K/r^2 \right)$, where k is a constant. The total energy of the particle is -

A. $K/2r$

B. $-K/2r$

C. Kr

D. $-K/r$

Answer:

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17. The work done by a person in carrying a box of mass 10 kg through a vertical height of 10 m is 4900 J. The mass of the person is -

A. 60kg

B. 50kg

C. 40kg

D. 130kg

Answer:

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18. A uniform rod of length 4 m and mass 20 kg is lying horizontal on the ground. The work done in keeping it vertical with one of its ends touching the ground, will be -

A. 784 J

B. 392 J

C. 196 J

D. 98 J

Answer:

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19. If g is the acceleration due to gravity on the earth's surface, the gain in the potential energy of an object of mass m raised from surface of the earth to a height equal to radius R of the earth is - [M = mass of earth]

A. $\frac{GMm}{2R}$

B. $\frac{GM}{R}$

C. $\frac{GMm}{R}$

D. $\frac{GM}{2R}$

Answer:

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20. The potential energy between two atoms in a molecule is given by, $U_{(x)} = \frac{a}{x^{12}} - \frac{b}{x^6}$, where a and b are positive constant and x is

the distance between the atoms. The atoms is an stable equilibrium, when-

A. $x = 0$

B. $x = \left(\frac{a}{2b}\right)^{1/6}$

C. $x = \left(\frac{2a}{b}\right)^{1/6}$

D. $x = \left(\frac{11a}{5b}\right)^{1/6}$

Answer:

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21. A man pushes a wall and fails to displace it.He does

A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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22. Choose the correct options –

(1))The work done by forces may be equal to change in kinetic energy

(2)The work done by forces may be equal to change in potential energy

(3) The work done by forces may be equal to change in total energy

(4) The work done by forces must be equal to change in potential energy.

A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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23. The system is released from rest with both the springs in unstretched positions. Mass of each block is 1 kg and force constant of each spring is 10 N/m. Extension of horizontal

spring in equilibrium is:

A. 0.2 m

B. 0.4 m

C. 0.6 m

D. 0.8 m

Answer:

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24. The system is released from rest with both the springs in unstretched positions. Mass of each block is 1 kg and force constant of each spring is 10 N/m. Extension of horizontal spring in equilibrium is:

A. 0.2 m

B. 0.4 m

C. 0.6 m

D. 0.8 m

Answer:

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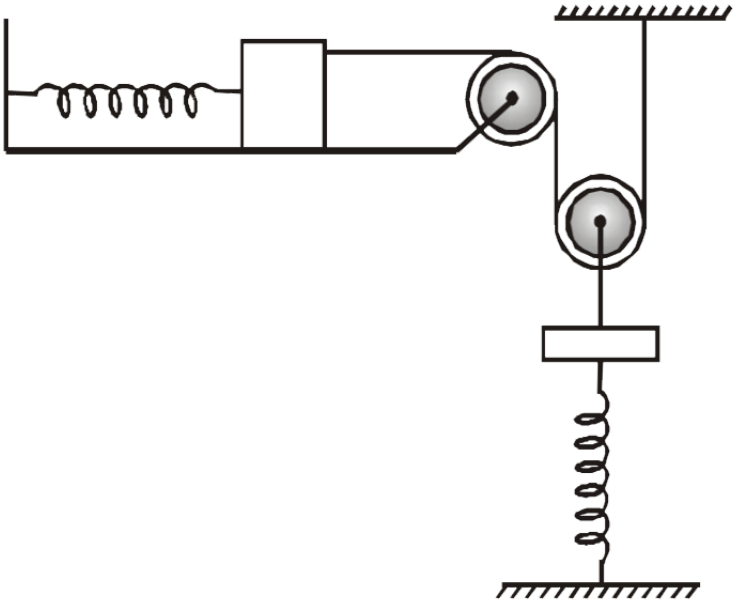
25. In the figure shown, the system is released from rest with both the springs in unstretched positions. Mass of each block is 1 kg and force constant of each spring is 10 N/m.



Maximum speed of the block placed horizontally is:

A. 3.21 m/s

B. 2.21m/s

C. 1.93m/s

D. 1.26m/s

Answer:

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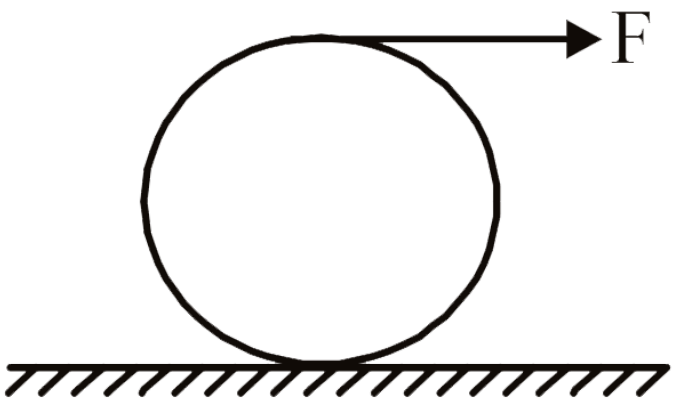
26. As shown in the figure, a uniform sphere is rolling on a horizontal surface without slipping, under the action of a horizontal force F.



Statement - 1 : Power developed due to friction force is zero. Statement - 2 : Power developed by gravity force is non-zero.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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27. Statement - 1 : Sum of work done by the Newton's 3rd law pair internal forces, acting between two particles may be zero. Statement -

2 : If two particles undergo same displacement then work done by Newton's 3rd law pair forces on them is of opposite sign and equal magnitude.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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28. Statement - 1: A particle moves along a straight line with constant velocity. Now a constant non-zero force is applied on the particle in direction opposite to its initial velocity. After the force is applied, the net work done by this force may be zero in certain time intervals. Statement - 2 : The work done by a force acting on a particle is zero in any time interval if the force is always perpendicular to velocity of the particle.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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29. A rifle man, who together with his rifle has a mass of $100kg,$ stands on a smooth surface and fires 10 shots horizontally. Each bullet. has a mass $10g$ and a muzzle velocity of $800m/s,$

a. What velocity does the rifle man acquire at the end of 10 shots?

b. If the shots are fired in $10s$, what will he the average force exerted on him?

c. Compare his kinetic energy with that of 10 bullets

A. 0.8m/s

B. 0.5m/s

C. 0.3m/s

D. 1.2m/s

Answer:

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30. A bullet of mass 10 g travelling horizontally with a velocity of 300 m/s strikes a block of wood of mass 290 g which rests on a rough horizontal floor. After impact the block and the bullet move together and come to rest when the block has travelled a distance of 15 m. The coefficient of friction between the block and the floor will be - (Duration of impact is very short)

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

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

C. $\frac{1}{3}$

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

Answer:

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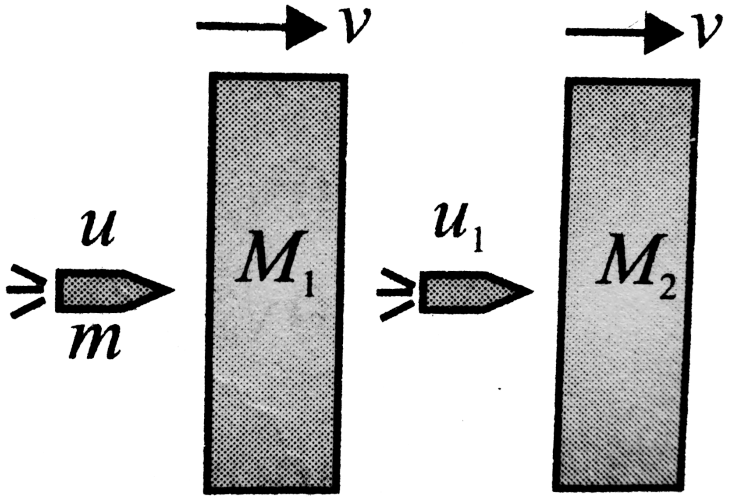
31. A $20g$ bullet pierces through a plate of mass $M_1 = 1kg$ and then comes to rest inside a second plate of mass $M_2 = 2.98kg$ as shown in Fig. It is found that the two plates, initially at rest, now move with equal

velocities. Find the percentage loss in the initial velocity of the bullet when it is between M_1 and M_2. Neglect any loss of material of the plates due to the action of bullet.



A. 20%

B. 25%

C. 30%

D. 45%

Answer:

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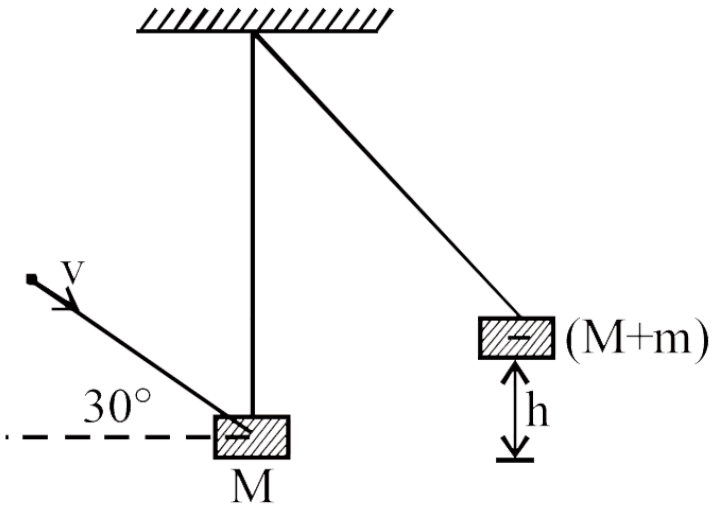
32. A bullet of mass 20 g hits a block of mass 1.98 kg suspended from a massless string of length 100 cm and sticks to it. The bullet flies down at an angle of 30 to the horizontal with a velocity of 200 m/s. Through what

height the block will rise-



A. 0.15 m

B. 0.30 m

C. 0.45 m

D. 0.75 m

Answer:

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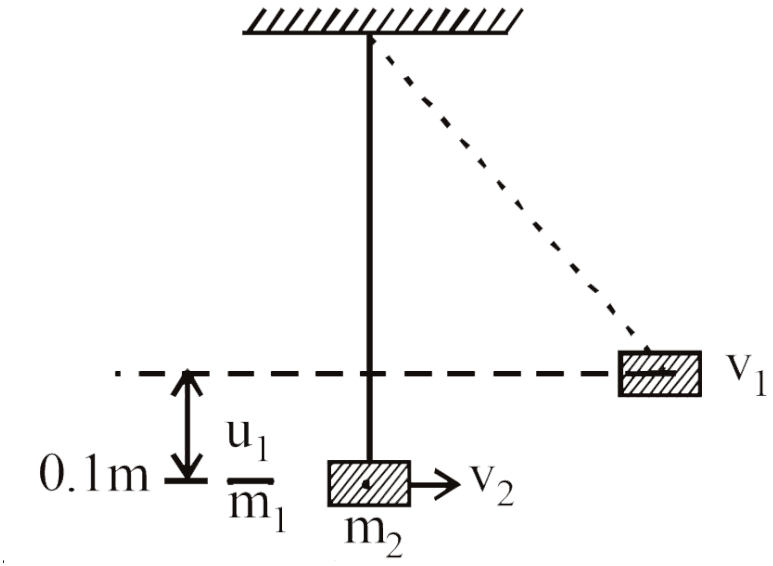
33. A bullet of mass 0.01 kg travelling at a speed of 500 m/s strikes a block of mass 2 kg, which is suspended by a string of length 5 m. The centre of gravity of the block is found to rise a vertical distance of 0.1 m. The speed of the bullet after it emerges from the block will

be -



A. 1.4m/s

B. 110 m/s

C. 220 m/s

D. 14 m/s

Answer:

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34. The rate of burning of fuel in a rocket is 50 gm/sec. and comes out with and velocity 4×10^3 m/s. The force exerted by gas on rocket will be -

A. 200 N

B. 250 N

C. $2.5 \times 10^6 N$

D. $2.5 \times 10^4 N$

Answer:

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35. A body of mass 1 kg strikes elastically with another body at rest and continues to move in the same direction with one fourth of its initial velocity. The mass of the other bodyis-

A. 0.6 kg

B. 2.4 Kg

C. 3kg

D. 4kg

Answer:

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36. A ball moving with a speed of $9m/s$ strikes an identical ball at rest, such that after the collision, the direction of each ball makes an

angle of 30° with the original line of motion.

Find the speeds of the two balls after collision.

A. $3\sqrt{3}m/s, no$

B. $3\sqrt{3}m/s, no$

C. $6\sqrt{3}m/s, no$

D. 0,yes

Answer:

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37. The mass of a rocket is 500 kg and the relative velocity of the gases ejecting from it is 250 m/s with respect to the rocket. The rate of burning of the fuel in order to give the rocket an initial acceleration $20m/s^2$ in the vertically upward direction $g = 10\frac{m}{s^2}$, will be -

A. 30kg/s

B. 60kg/s

C. 45kg/s

D. 10kg/s

Answer:

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38. A slow moving electron collides elastically with a hydrogen atom at rest. The initial and final motions are along the same straight line. What fraction of electron's kinetic energy is transferred to the hydrogen atom? The mass of hydrogen atom is 1850 times the mass of electron.

A. 0.217%

B. 2.17%

C. 0.0217%

D. 21.7%

Answer:

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39. A particle of mass 4 m which is at rest explodes into three fragments. Two of the fragments each of mass m are found to move

with a speed v each in mutually perpendicular directions. The total energy released in the process of explosion is .....

A. $\frac{1}{2}mv^2$

B. mv^2

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

D. $2mv^2$

Answer:

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40. A body of mass M splits into two parts aM and $(1-\alpha)$ M by an internal explosion, which generates kinetic energy T. After explosion if the two parts move in the same direction as before, their relative speed will be -

A. $\sqrt{\frac{T}{(1-\alpha)M}}$

B. $\sqrt{\frac{2T}{\alpha(1-\alpha)M}}$

C. $\sqrt{\frac{T}{2(1-\alpha)M}}$

D. $\sqrt{\frac{2T}{2(1-\alpha)M}}$

Answer:

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41. A body of mass $1kg$, initially at rest, explodes and breaks into three fragments of masses in the ratio $1:1:3$. The two pieces of equal mass fly off perpendicular to each other with a speed of $30m/s$ each. What is the velocity of the heavier fragment?

A. $10\sqrt{2}m/s$

B. $15\sqrt{2}m/s$

C. $5\sqrt{2}m/s$

D. $20\sqrt{2}m/s$

Answer:

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42. A body of mass m moving with a velocity v in the x direction collides with another body of mass M moving in y direction with a velocity V. They coalesce into one body during collision.

A. $\sqrt{(mv_1)+(Mv_2)}, \tan^{-1}\left(\frac{Mv_2}{mv_1}\right)$

B. $\sqrt{(mv_1)+(Mv_2)}, \tan^{-1}\left(\frac{Mv_1}{mv_2}\right)$

C. $\sqrt{(mv_1)^2+(Mv_2)^2}, \tan^{-1}\left(\frac{Mv_2}{mv_1}\right)$

D. $\sqrt{(mv_1)^2+(Mv_2)^2}, \tan^{-1}\left(\frac{Mv_1}{mv_2}\right)$

Answer:

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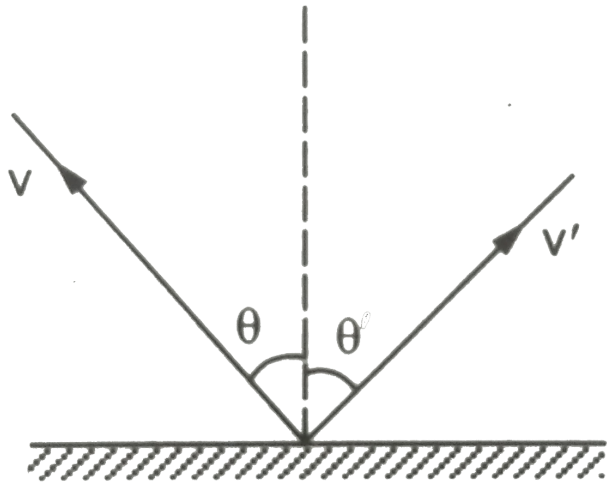
43. A ball of a mass m hits the floor with as speed v making an angle of incidence θ with the normal. The coefficient of restitution is e. Find the speed of the reflected ball and the

angle of reflection of the ball.



A. $\tan^{-1}\left(\frac{\tan\theta}{e}\right), v\sqrt{\sin^2\theta + e^2\cos^2\theta}$

B. $\tan^{-1}\left(\frac{e}{\tan\theta}\right), \frac{1}{v}\sqrt{e^2\sin^2\theta + \cos^2\theta}$

C. $\tan^{-1}(e\ \ \tan\theta), \frac{v}{e}\tan\theta$

D. $\tan^{-1}(e\ \ \tan\theta), v\sqrt{\sin^{-2}\theta + e^2}$

Answer:

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44. A tennis ball dropped from a height of 2 m rebounds only 1.5 metre after hitting the ground. What fraction of energy is lost in the impact?

A. $1/2$

B. $1/4$

C. $1/8$

D. $1/16$

Answer:

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45. A bullet is fired from the gun. The gun recoils, the kinetic energy of the recoil shall be-

A. equal to the kinetic energy of the bullet

B. less than the kinetic energy of the bullet

C. greater than the kinetic energy of the bullet

D. double that of the kinetic energy of the bullet

Answer:

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46. Principle of conservation of linear momentum is duduced from

A. Newton's second law of motion

B. Newton's first law of motion

C. Newton's third law of motion

D. Conservation of angular momentum.

Answer:

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47. During inelastic collision between two bodies, which of the following quantities always remain conserved ?

A. momentum is conserved but kinetic energy is not conserved

B. momentum is not conserved but kinetic energy is conserved

C. neither momentum nor kinetic energy is conserved

D. both the momentum and kinetic energy are conserved

Answer:

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48. Inelastic collision is the-

A. collision of ideal gas molecules with the walls of the container

B. collision of electron and positron to an inhilate each other.

C. collision of two rigid solid spheres lying on a frictionless table

D. scattering of a-particles with the nucleus of gold atom

Answer:

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49. Which of the following statements is false for collisions-

(1)Momentum is conserved in elastic collisions but not in inelastic collisions.

(2)Total-kinetic energy is conserved in elastic

collisions but momentum is not conserved.

(3)Total kinetic energy and momentum both are conserved in all types of collisions

(4)Total kinetic energy is not conserved in inelastic collisions but momentum is conserved

A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer: A

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50. Two balls of mass m_1 and m_2 where $m_2 = 0.5m_1$, undergo head on collision as shown in figue.

After collision the situation is as shown

If $V_3 = 0.5v_1$. Value of V_4 is

A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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51. Two balls at the same temperature collide inelastically. Which of the following is not conserved?

(1) Kinetic energy

(2) Velocity

(3) Temperature

(4) Momentum

A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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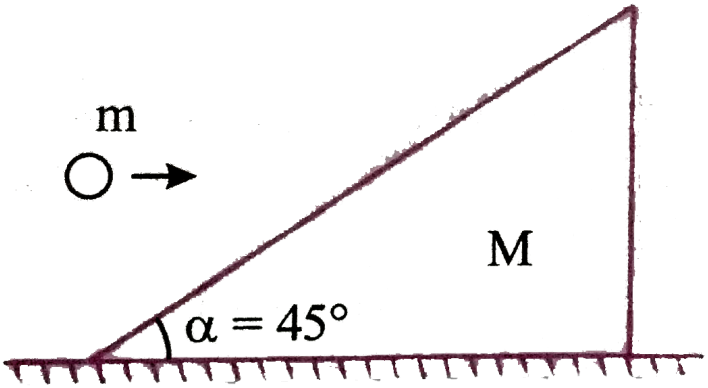
52. A small particle of mass $m = 2kg$ moving with constant horizontal velocity $u = 10m/s$ strikes a wedge shaped block of mass $M = 4kg$ placed on smooth horizontal surface on its inclined surface as shown in figure. After collision particle starts moving up the inclined plane. Calculate the velocity of wedge immediately after collision.



A. approx 5.0m/s

B. approx10 m/s

C. approx.15.0m/s

D. approx20.0 m/s

Answer:

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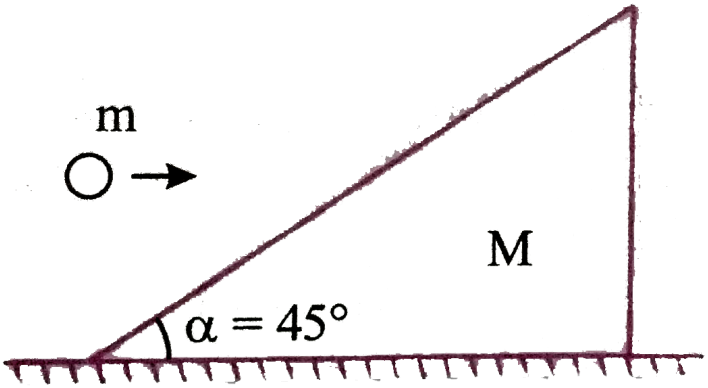
53. A small particle of mass $m = 2kg$ moving with constant horizontal velocity $u = 10m/s$ strikes a wedge shaped block of mass

$M = 4kg$ placed on smooth horizontal surface on its inclined surface as shown in figure. After collision particle starts moving up the inclined plane. Calculate the velocity of wedge immediately after collision.



A. 27/43m/s

B. 30/43m/s

C. 35/43 m/s

D. 40/43 m/s

Answer:

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54. A sphere of mass m and radius r rolls without slipping on the horizontal surface with speed v. During its motion it encounters a fixed rectangular block of height $h = \frac{r}{4}$ as shown. The collision is inelastic. Find the

angular speed of sphere immediately after collision. The body rolls without slipping.

A. zero

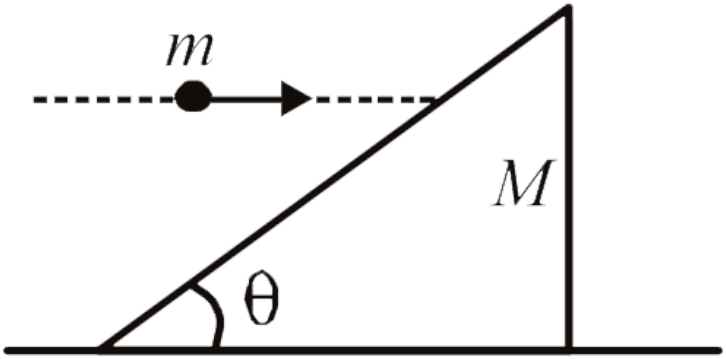
B. 2rad/sec

C. 2.5 rad/sec

D. 3rad/sec

Answer:

55. A particle of mass m strikes a wedge of mass M horizontally as shown in the figure.



Statement - 1 : If collision is perfectly inelastic then, it can be concluded that the particle sticks to the wedge.

Statement - 2 : In perfectly inelastic collision velocity of both bodies is same along common normal just after collision.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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56. In an elastic collision between two particles

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation

for Statement-1.

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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