PHYSICS

BOOKS - DHANPAT RAI & CO PHYSICS (HINGLISH)

Work, Energy and power

Example

1. How is work done measured when, The force acts along the direction of motion of the body

2. How is work done measured when, The force is inclined to the direction of motion of the body?

3. What is meant by positive work, negative work and zero work ? Illustrate your answer with two examples of each type.

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4. Write the dimensional formula of work.

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5. Define absolute and gravitational units of force state relation between them .

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6. Write an expression for work done in terms of rectangular components of force and displacement.

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7. A gardener pushes a lawn roller through a distance of 20 m. If he applies a force of 20 kg wt in a direction inclined at 60° to the ground , find the work

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8. A person is holding a bucket by applying a force of 10 N. He moves a horizontal distance of 5 m and then climbs up a vertical distance of 10 m. Find the total work done him.

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9. A cyclist comes to a skidding stop in $10m$. During this process, the force on the cycle due to the road is $200N$ and is directly opposite to the motion.

a. How much work does the road do on the cycle?

b. How much work does the cycle do on the road?

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11. A force $\overrightarrow{F} = \hat{i} + 5\hat{j} + 7\hat{k}$ acts on a particle and displaces it through $\overrightarrow{s} = 6\hat{i} + 9\hat{k}$. Caldulate the work done if the force is in newton and displacement in metre.

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12. A force $\overrightarrow{F}\left(y\hat{l}+x\widehat{J}\right)$, where K is a positive constant, acts on a particle moving in the XY-Plane. Starting from the origin, the particle is taken along the positive X-axis to a point (a,0) and then parallel to the y-axis to the point (a,a). Calculate the total work done by the force on the particle.

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13. A uniform chain of length 2 m is kept on a table such that a length of 60 cm hangs freely from the edge of the table. The total mass of the chain is 4 kg. What is the work done in pulling the entire chain on the table?

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14. Calculate the work done in raising a stone of mass 5 kg and specific gravity 3, lying at the bed of a lake through a height of 5 m.

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15. A cluster of clouds at a height of 1000m above the earth burst and enough rain fell to cover an area of $10^6 m^2$ with a depth of 2cm. How much work would have been done in raising water to the height of clouds ? Take $g = 10m/s^2$ and density of water $10^3 kg/m^3$.

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16. A 2kg particle starts at the origin and moves along the positive x-axis. The net force acting on it measured at intervals of 1 m : 27.9, 28.3, 30.9, 34.0, 34.5, 46.9, 48.2, 50.0, 63.5, 13.6, 12.2, 32.7, 46.6 and 27.0 (in newtons). What is the total work done on the particle in this interval?

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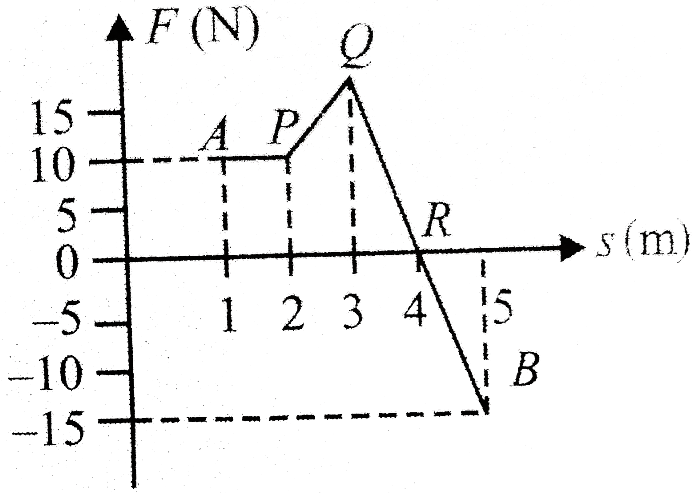
17. A body moves from point A to B under the action of a force, varying in magnitude as shown in figure. Obtain the work done. Force is expressed in newton and displacement in meter.



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18. A woman pushes a trunk on a railway platform which has a rough surface. She applies a force of 100N over a distance of 10m. Thereafter, she gets progressively tired and her applied force reduces linearly with distance to 50N. The total distance through which trunk has been moved is 20m. Plot the force applied by the woman and the frictional force,

which is 50N against the distance. Calculat the work done by the two forces over 20m.

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19. A particle moves along the X-axis from x=0 to x=5 m under the influence of a force given by $F = 7 - 2x + 3x^2$. Find the work done in the process.

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20. Define the term energy. What are its units and dimensions? Name the different forms of energy.

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21. (a) What is mechanical energy ? (b) What is electromagnetic energy ?

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22. Define kinetic energy. Give some examples of bodies possessing kinetic energy.

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23. What do you mean by kinetic energy ? Derive an expression for the kinetic energy of an object of mass m moving with velocity, v.

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24. WORK ENERGY THEOREM

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25. WORK ENERGY THEOREM

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26. A toy rocket of mass 0.1 kg hass a small fuel of mass 0.02 kg, which it burns out in 3s. Starting from rest on a horizontal smooth track, it gets a speed of $20ms^{-1}$ after the fuel is burnt out. What is the approcimate thrust of the rocket ? What is the energy content per unit mass of the fuel ? (Ignore the small mass variation of teh rocket during fuel burning).

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27. A bullet weighing 10 g is fired with a velocity of $800ms^{-1}$. After passing through a mud wall 1 m thick, its velocity decreases to $100ms^{-1}$. Find the average resistance offered by the mud wall.

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28. A shot travelling at the rate of $100ms^{-1}$ is just able to pierce a plank 4 cm thick. What velocity is required to just pierce a plank 9 cm thick ?

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29. In a ballistics demonstration, a police officer fires a bullet mass $50.0g$ with speed $200ms^{-1}$ on soft plywood of thickness 2.00cm. The bullet emerges only with 10% of its initial kinetic energy. What is the emergent speed of the bullet ?

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30. It is well known that a rain drop falls under the influence of the downward gravitational force and the opposing resistive force. The latter is known to be proportional to the speed of the drop, but is otherwise undetermined. Consider a drop of mass 1.0g falling from a height of 1.00km. It hits the ground with a speed of $50.0ms^{-1}$ (a) What is the work done by the gravitational force ? (b) What is the work done by the unknown resistive force ?

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31. A block of mass $m = 1kg$ moving on a horizontal surface with speed $v_i = 2ms^{-1}$ enters a rough patch ranging from $x0.10m \rightarrow x = 2.01m$. The retarding force F_r on the block in this range ins inversely proportional to x over this range

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

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

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32. Two identical 5 kg blocks are moving with same speed of $2m/s$ towards eachother along a frictionless horizontal surface. The two blocks collide, stick together and come to rest. Consider the two blocks as a system. Caluculate work done by (i) external forces (ii) internal forces.

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34. If the linear momentum of a body increases by 20%, what will be the % increase in the kinetic energy of the body ?

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35. If the kinetic energy of kinetic energy of a body increases by 300%, by what % will the linear momentum of the body rease ?

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36. A body of mass $0.3kg$ is taken up an inclined plane of length $10m$ and height $5m$, and then allowed to slide down to the bottom again. The coefficient of friction between the body and the plane is 0.15.

What is the

(a) work done by the gravitational force over the round trip ?

(b) work done by the applied force on the upward journey ?

(c) work done by the frictional force over the round trip ,

(d)kinetic energy of the body at the end of the trip ?

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39. A body of mass 0.3 kg is taken up an inclined plane to length 10 m and height 5 m, and then allowed to slide down to the bottom again. The coefficient of friction between the body and the plane is 0.15. What is the kinetic energy of the body at the end of the trip?

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40. What is meant by the term potential energy ? Give its two examples.

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41. Mention some common types of petential energy?

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42. What do you mean by gravitational potential energy ? Derive an expression for the gravitational potential energy of an object raised to a height h .

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43. CONSERVATIVE FORCES

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44. Explain qualitatively that how is the gravitational force a conservative force?

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45. What are conservative and non-conservative forces, explain with examples. Mention some of their properties.

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46. Define potential energy in context with a conservative force. How can these two quantities be determined from each other ? Write the necessary relations?

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47. Show analytically that gravitational force is a conservative force.

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48. STATEMENT-1 : Mechanical energy is the sum of macroscopic kinetic & potential energies.

STATEMENT-2 : Mechanical energy is that part of total energy which always remain conserved.

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49. CONSERVATIVE FORCES

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50. Show that the total mechanical energy of a freely falling body remains constant throughout its fall?

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51. A vehicle of mass 15 quintal climbs up a hill $200m$ high. It then moves on a level road with a speed of $30ms^{-1}$. Calculate the potential energy gained by it and its total mechanical energy while running on the top of the hill.

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52. Calculate the velocity of the bob of a simple pendulum at its mean position if it is able to rise to a vertical height of 10 cm. Take $g = 9.8ms^{-2}$.

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53. A girl of mass 40 kg sits in a swing formed by a rope of 6 m length. A person pulls the swing to a side so that the rope makies an angle of 60° with the vertical. What is the gain in potential energy of the girl ?

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54. How high must a body be lifted to gain an amount of potential energy equal to the kinetic energy it has when moving at speed $20ms^{-1}$? The value of acceleration due to gravity at a pleace is $g = 9.8ms^{-2}$.

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55. The string of a pendulum is $2.0m$ long. The bob is pulled sideways so that the string becomes horizontal and then the bob is released. What is the speed with which the bob arrives at the lowest point ? Assume theat 10% of initial energy is dissipated against air resistance. Take $g = 10m/s^2$

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56. A ball bounce of 80% of its original height . What fraction of its mechanical energy is lost in each bounce ?

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57. A ball at rest is dropped from a height of 12m. It loses 25% of its kinetic energy in striking the ground, find the height to which it bounces. How do you account for the loss in kinetic energy ?

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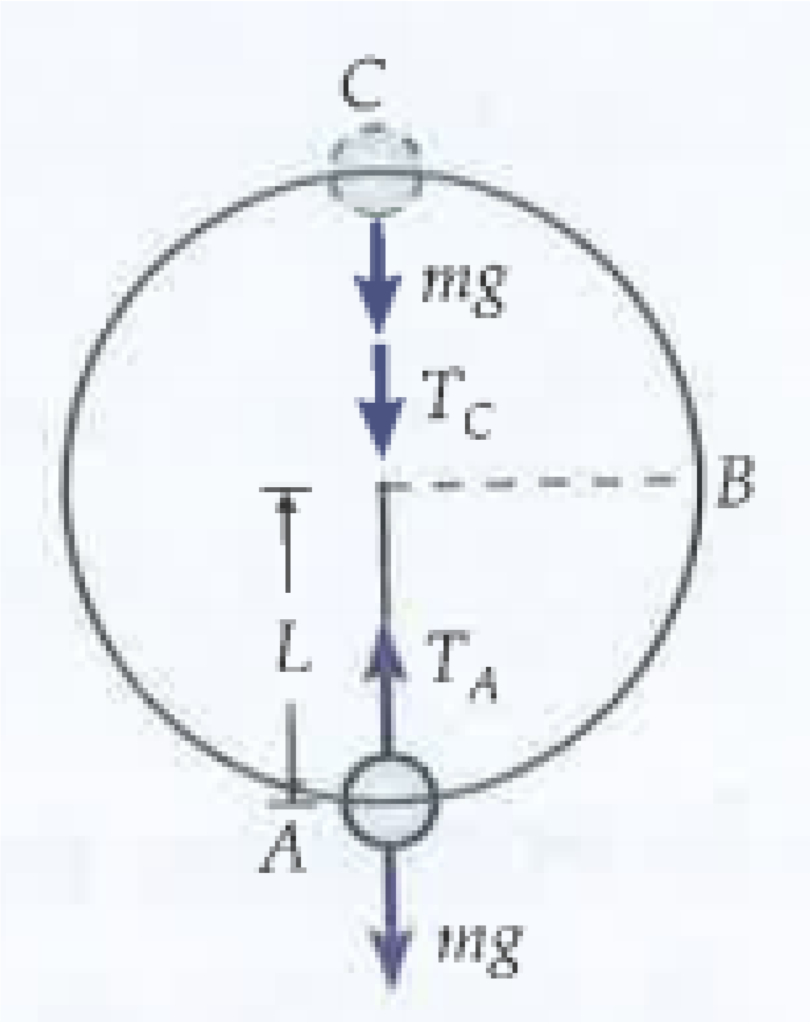
58. A bob of mass m is suspended by a light string of length L. It is imparted a horizontal velocity v_0 at the lowest point a such that it completes a semi-circular trajectory in the vertical plane with the string becoming slack only on reaching the topmost poin, C. This is shown in

Figure. Obtain an expression for v_0



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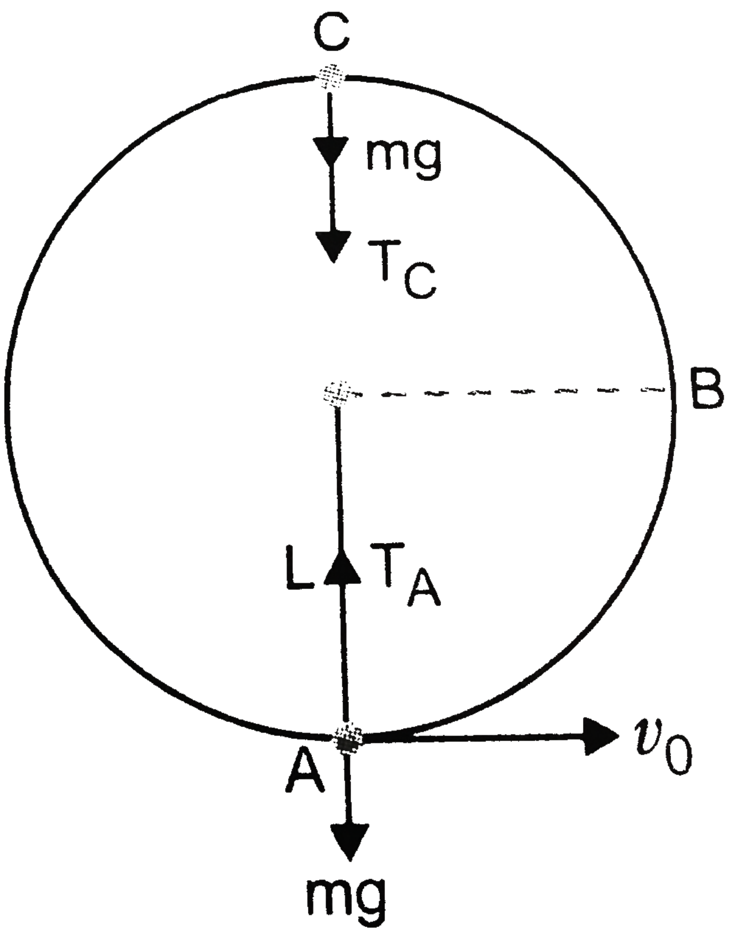
59. A bob of mass m is suspended by a light string of length L. It is imparted a horizontal velocity v_0 at the lowest point A such that it completes a semi-circular trajectory in the vertical plane with the string becoming slack on reaching the topmost point C, figure, Obtain an expression for (i) v_0 (ii) the speeds at points B and C, (ii) the ration of kinetic energies (K_B / K_C) at B and C.

Comment on the nature of the trajectory of the bob after it reahes the poing C.



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60. A bob of mass m is suspended by a light string of length L. It is imparted a horizontal velocity v_0 at the lowest point A such that it completes a semi-circular trajectory in the vertical plane with the string becoming slack on reaching the topmost point C, figure, Obtain an expression for (i) v_0 (ii) the speeds at points B and C, (ii) the ration of kinetic energies (K_B / K_C) at B and C.

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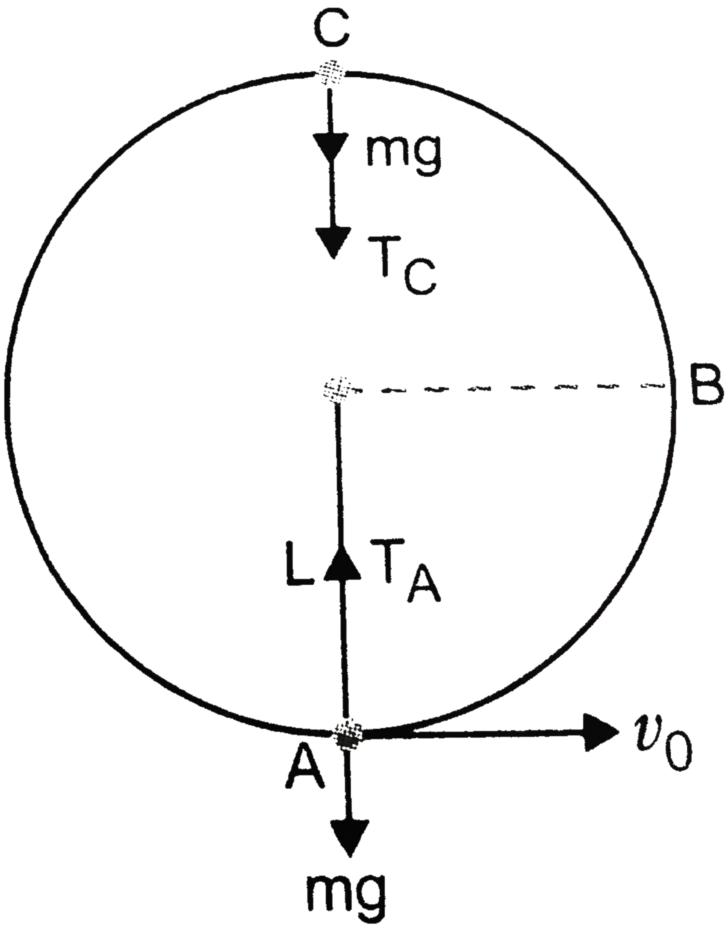

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61. A ball falls under gravity from a height of 10 m with an initial downward velocity u. It collides with the ground, losses 50% of its energy in collision and then rises back to the same height. The initial velocity u is

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62. Show that the elastic force of a spring is a conservative forcce. Hence write an ex,pression for the petenial energy of an elastic stretched spriing.

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63. Draw a plot of spring force F_s and displacement x. Hence find an expresion for the P.E. of an elatic stretched spring,

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64. Two springs have force constants k_1 and $k_2(k_1 > k_2)$. On which spring is more work done, if (i) they are stretched by the same force and (ii) they are stretched by the same amount ?

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66. The length of a steel wire increases by $0 \cdot 5cm$, when it is loaded with a weight of $5 \cdot 0kg$. Calculate force constant of the wire and workdown in stretching the wire. Take $g = 10ms^{-1}$.

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68. The potential energy of a certain spring when stretched through a distance 'S' is 10 joule. The amount of work (in joule) that must be done on this spring to stretch it through an additional distance 'S' will be

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69. To stimulat car accidents, the auto manufacturers study the collisions of moving cars with mounted springs of different spring constants. Consider a typical simulation with a car of mass 1000kg moving with a speed of $18.0km/h$ on a smooth road and colliding with a horizontally mounted spring of spring constant $6.25 \times 10^3 Nm^{-1}$. What is the maximum compression of the spring?

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70. A spring of force constant 24N/m is resting on a frictionless horizontal surface. A force of 10N is applied on the block of mss 4kg at one end of the spring. What is the speed of the block when it has been moved through a distance of 0.5 m ?

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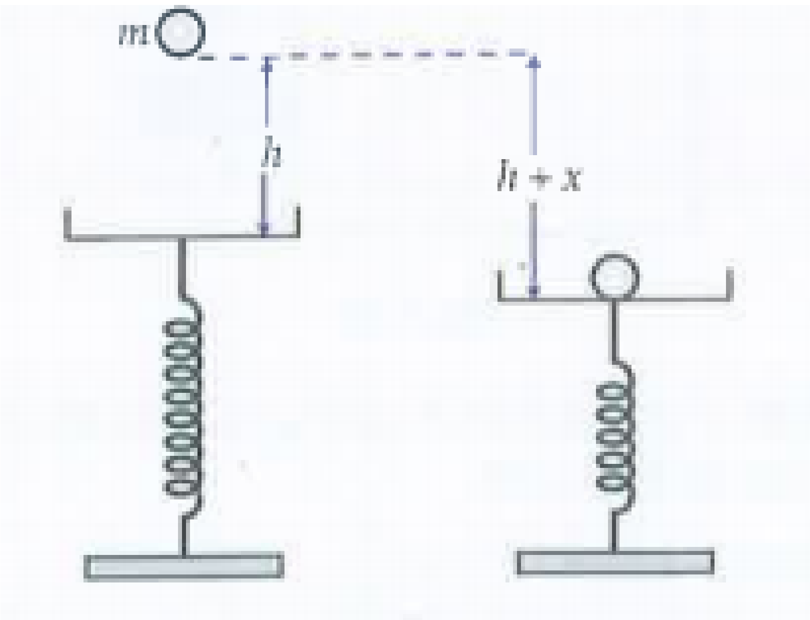
71. A ball of mass m is dropped from a height h on a platform fixed at the top of a vertical spring, as shown in figure. The platform is depressed by a distance x. What is the spring constant k?



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72. A block of mass 2 kg initially at rest is dropped from a height of 1m into a vertical spring having force constant $490Nm^{-1}$. Calculate the maximum distance through which the spring will be compressed.

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73. Describe the verious forms of energy?

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74. What is Einstein's mass-energy equivvalence? Mention some of its practical applications?

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75. State and explain the principle of conservation of energy?

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76. The energy required to break one bond in DNA is $10^{-20}J$. This value in eV is nearly:

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77. Express (a) the energy required to break one bond in DNA $(10^{-10}J)$ in eV.

(b) the kinetic energy of an air molecule $(10^{-21}J)$ in eV.

(c) the daily intake of a human adult $(10^7 J)$ in kilocalories.

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79. How much mass is converted into tenergy per day in a nuclear power plant operated at 10^7 kW?

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80. If $1000kg$ of water is heated from $0^\circ C$ to $100^\circ C$, calculate the increase in mass of water.

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81. Calculate the energy in MeV equivalent to the rest mass of an electron . Given that the rest mass of an electron , $m = 9.1 \times 10^{-31} kg$, $1MeV = 1.6 \times 10^{-13} J$ and speed of light , $c = 3 \times 10^8 ms^{-1}$.

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82. Extimate the amount of energy released in the following nuclear fusion reaction. $\overset{2}{1}H + \overset{2}{1}H \rightarrow \overset{3}{2}He + \overset{1}{0}n$ Given mass of $\overset{2}{1}H = 2.0141$ amu, mass of $\overset{3}{2}He = 3.0160$ amu, mass of $\overset{1}{0}n = 1.0087$ amu and 1 amu = $1.661 \times 10^{-27} kg$. Express your answer in units of MeV?

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83. When slow neutrons are incident on a target containing $\overset{235}{\underset{92}{\vdots}} U$, a possible fission reaction is

$\overset{235}{\underset{92}{\vdots}} U + \overset{1}{\underset{0}{\vdots}} n \rightarrow \overset{141}{\underset{56}{\vdots}} Ba + \overset{92}{\underset{36}{\vdots}} Kr + 3_0^1 n$

Estimate the amount of energy released using the following data Given, mass of $\overset{235}{\underset{92}{\vdots}} U = 235.04 a\mu$, mass of $\overset{1}{\underset{0}{\vdots}} n = 1.0087 a\mu$, mass of $\overset{141}{\underset{56}{\vdots}} Ba = 140.91 a\mu$, mass of $\overset{92}{\underset{36}{\vdots}} Kr = 91.926 a\mu$, and energy equivalent to 1 amu=931 MeV.

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84. Define the term power. Is it a scalar or vector quantity? Give its dimensions and units.

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85. Define instantaneous power. Express it as the scalar product of force and velocity vectors.

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86. Of which physical quantity is the unit kilowatt hour? Define one kilowatt hour. Express it in joules.

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87. A man weighing 60 kg climbs up a staircase carrying a load of 20 kg on his head. The stair case has 20 steps each of height 0.2 m. If he takes 10 s to climb find his power

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88. A car of mass $2000kg$ is lifted up a distance of $30m$ by a crane in 1 minute . A second crane does the same job in 2 minues. Do the cranes consume the same or different amounts of fuel ? What is the power supplied by each crane ? Neglect power disspation against friction.

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89. The human heart discharges 75ml of blood at each beat against a pressure of 0.1m of Hg. Calculate the power of the heart assuming that the pulse frequency is 80 beats per minute. Given, density of mercury $= 13.6 \times 10^3 kg/m^3$

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90. An electric motor is used to lift an elevator and its load (total mass 1500kg) to a height of 20m. The time taken for the job is 20s. What work is done ? What is the rate at which work is done. If efficiency of the motor is 75%, at which rate is the energy supplied to the motor?

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91. Calculate the horse power of a man who can chew ice at the rate of $60g\min.^{-1}$. Given $J = 4.2Jcal^{-1}$ and altent heat of ice $= 80calg^{-1}, 1hp = 746W$.

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92. A machine gun fires 60 bullets per minute with a velocity of $700ms^{-1}$. If each bullet has a mass of 50g, find the power of the gun.

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93. An elevator can carry a maximum load of $1800kg$ (elevator + passengers) is moving up with a constant speed of $2ms^{-1}$. The friction force opposite the motion is $4000N$.What is minimum power delivered by the motor to the elevator?

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94. A well $20m$ deep and $3m$ is diameter contains water to a dept of $14m$. How long will a $5hp$ engine take to empty it ?

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95. The turbine pits at Niagra Falls are 50m deep. The average horse power develop is 5000. If the efficiency of the generator 85% , how much water passes through the turbine per minute ? Take $g = 10m/s^2$.

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96. A man cycles up a hill whose slope is 1 in 20 with a velocity of $6.4 kmh^{-1}$ along the hill. The weight of the man and the cycle is 98kg. What work per minute is the man doing ? What is his horse power ?

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97. In elastic collision,

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98. In an inelastic collision

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99. Which of the following is not a perfectly inelastic collision

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100. Define the terms : head- on collision and oblique collision

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101. Give important characteristics and examples of different types of collisions.

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102. Show that total linear momentum is conserved in all collisions.

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103. What is a perfectly inelastic collision? Show that kinetic energy is invariably lost in such a collision.

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104. Discuss elastic collision in two dimensions. What are the conditions of glancing collision

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105. Discuss elastic collision in two dimensions. What are the conditions of head - on collision?

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106. A force $\vec{F} = \left(7\hat{i} + 6\hat{j}\right)N$ acting on a body, produces a displacement $\vec{s} = \left(6\vec{j} + 5\vec{k}\right.$)m. Work done by the force is

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107. COEFFICIENT OF RESTITUTION

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108. Two bodies of masses 5 kg and 3 kg moving in the same direction along the same straingh line with velocities $5ms^{-1}$ and $3ms^{-1}$ respectively suffer one-dimensional elastic collision . Find their velocities after the collision .

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109. A 10 kg ball and 20 kg ball approach each other with velocities $20ms^{-1}$ and $10ms^{-1}$ respectively . What are their velocities after collision if the collision is perfectly elastic ?

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110. Two ball bearings of mass m each moving in opposite directions with each speeds v collide head on with each other . Predict the outcome of the collision , assuming it to the perfectly elastic.

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111. A railway carriage of mass 9000kg moving with a speed of $36kmh^{-1}$ collides with a stationary carriage of the same mass. After the collision, the two get coupled and move together. What is this common speed ? What type of collision is this?

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112. What percentage of kinetic energy of a moving particle is transferred to a stationary particle, when moving particle strikes with a stationary particle of mass, 9 times in mass

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113. What percentage of $K.E.$ of a moving particle is transferred to a stationary particle, when moving particle strikes with a stationary particle of mass (a) 19 times in mass (b) equal in mass (c) $\frac{1}{19}$ th of its mass ?

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114. What percentage of $K.E.$ of a moving particle is transferred to a stationary particle, when moving particle strikes with a stationary particle of mass (a) 19 times in mass (b) equal in mass (c) $\frac{1}{19}$ th of its mass ?

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115. In a nuclear reactor, a neutron of high speed $\left(\approx 10^{7} ms^{-1}\right)$ must be slowed down to $10^{3} ms^{-1}$ so that it can have a high probality of interacting with isotipe $\_92U^{235}$ and causing it to fission. Show that a neutron can lose most of its K.E. in an elastic collision with a light nuclei like deuterium or carbon which has a mass of only a fewe times the neutron mass. The material making up the light nuclei usually heavy water (D_2O) or graphite is called modertaor.

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116. A ball is droped to the ground from a height of 2 m . The coefficient of restitution is 0.6. To what height will the ball rebound?

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117. A ball is dropped vertically from a height of 3.6 m. It rebounds from a horizontal surface to a height of 1.6 m . Find the coefficient of restitution of the material of the ball.

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118. A ball is dropped from a heigth H. It rebounds from the ground a number of times. If coefficient is e, to what height does it go after nth rebounding ?

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119. Sphere A of mass 'm' moving with a constant velocity u hits another stationary sphere B of the same mass. If e is the co-efficient of restitution, then ratio of velocities of the two spheres $v_A : v_B$ after collision will be :

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120. A ball moving with a speed of $9ms^{-1}$ strikes an identical ball such that after the collision the direction of each ball makes and angle 30° with the original line of motion. Find the speeds of the two balls after the collision.

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121. A ball moving on a horizontal frictionless plane hits an identical ball at rest with a velocity of $0.5m/s$. If the collision is elastic, calculate the speed imparted to the target ball, if the speed of projectile after the collision is $30cm/s$. Show that the two balls will move at right angles to eachother, after the collision.

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122. Consider the collision depicted in Figure, to be between two billiard balls with equal masses $m_1 = m_2$. The first ball is called the cue and the second ball is called the target. The billiard player wants to sink the target ball in a corner pocket, which is at an angle $\theta_2 = \phi = 37^\circ$. Assume that the collision is elastic and that friction and rotational motion are not important. Obtain $\theta_1 = \theta$.

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123. A nucleus of radium $\left(._{88} Ra^{226}\right)$

decays to $._{86} Rn^{222}$

by emisson of $\alpha -$ particle $\left(._{2} He^{4}\right)$ of energy $4.8 MeV$. If meass of $._{86} Rn^{222} = 222.0 a.m.u$ mass of $._{2} He^{4}$ is 4.003 a.m.u. and mass of $._{88} Ra^{226}$ is 226.00826 a.m.u., then calculate the recoil energy of the daughter nucleus. Take $1 a.m.u. = 931 MeV$

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124. The iron Fe^{27} nucleus emits a y-axis of energy 14.4KeV. If mass of nucleus is 56.935u, calculate the recoil energy of the nucleus. Take $1u = 1.66 \times 10^{-27} kg$.

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125. A force acts perpendicular to the direction of motion of a body. What is work done?

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126. A body is moving at constant speed over a frictionless surface. What is the work done by the weight?

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127. The Earth moving round the sun in a circular orbit is acted upon by a force and hence work must be done on the Earth by the force. Do you agree with this statement ?

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128. A body is moving along a circular path. How much work is done by the centripetal force?

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129. Why is the work done by a centripetal force equal to zero?

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130. A body of mass m is moving in a circle of radius r with a constant speed v, The force on the body is $\frac{mv^2}{r}$ and is directed towards the centre what is the work done by the from in moving the body over half the circumference of the circle?

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131. Is it possible that an object is in the state of accelerated motion due to external force acting on it, but no work is being done by the force. Explain it with as example.

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132. How much work is done by a coolie walking on a horizontal platform with a load on his head?

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133. A porter moving vertically up the staris with a suitacase on his head does work. Why?

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134. In a tug of war, one team is giving way to other. What work is being done and by whom?

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135. A amn rowing a boat upstream is at rest with respect to shore. (a) Is he doing any work ? (b) If he stope rowing and moves down with the stream, is any work being done on him ?

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136. Mountain roads rarely go straight up the slope, but wind up gradually. Why?

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137. What sort of energy is associated with a bird flying in air ?

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138. When an arrow is shot from a bow, it has kinetic energy. From where does it get the kinetic energy ?

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139. Can a body have energy without having momentum ?

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140. Can a body have momentum without energy?

Watch Video Solution

141. A light body and a heavy body have same linear momentum. Which one has a greater kinetic energy ?

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142. Two bodies of unequal masses have same linear momentum. Which one has greater K.E. ?

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143. A light body and a heavy body have the same kinetic energy. Which one will have a greater linear momentum ?

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144. How does the kinetic energy of a body change if is momentum is doubled?

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145. Two bodies of masses m_1 and m_2 have the same linear momentum. What is the ratio of their kinetic energies?

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146. Two bodies of masses m_1 and m_2 have equal kinetic energies. What is the ratio of their linear momenta?

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147. Can there be a situation in which E-u < 0?

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148. Can the overall energy of a body be negative?

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149. Does potential energy of a spring decrease / increase when it is compressed or stretched ?

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150. One end of a spring is rigidly fixed. A block attached to the free end of the spring is pulled through a distance x_0. On releasing the block, its amplitude of motion cannot exceed $\pm x_0$. Why?

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151. Springs Aand B are identical except that A is stiffer than B. In which spring more work is done if(a) both are stretched by same amount ? (b) both are stretched by the same force ?

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152. Springs Aand B are identical except that A is stiffer than B. In which spring more work is done if(a) both are stretched by same amount ? (b) both are stretched by the same force ?

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153. Out of kilowatt hour and electron volt, which is bigger unit of energy and by what factor?

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154. Assertion : Water at the foot of the water fall is always at different temperature from that at the top. Reason : The potential energy of water at the top is converted into heat energy during falling.

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155. Assertion : A work done in moving a body over a closed loop is zero for every force in nature. Reason : Work done does not depend on nature of force.

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156. What are central forces? Are they conservative in nature?

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157. When is the exchange of energy maximum during an elastic collision?

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158. Is whol of the kinetic energy lost in any perfectly inelastic collision?

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159. Can you associate potential energy with a non conservative force ?

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160. Two bodies moving towards each other collide and move away in opposite directions. There is some rise of temperature of the bodies in the process. Explain the reason for the rise of temperature and state what type of collision is it.

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161. A spark is produced when two stones strike against each other. Why?

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162. A lorry and a car moving with the same kinetic energy are brought to rest by the application of brakes which provides equal retarding forces.

Which of them will come to rest in a shorter distance?

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163. A truck and a car are moving with the same K.E. on a straight road. Their engines are simultaneously switched off. Which one will stop at a lesser distance ?

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164. A rocket explodes in mid air. What happens to its total momentum and total KE?

Watch Video Solution

165. A rocket explodes in mid air. What happens to its total momentum and total KE?

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166. The velocity of an aeroplane is made twice (a) What will happen to the momentum? Will the momentum remain conserved? (b) What will happen to the K.E.? Will the energy remain conserved ?

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167. The velocity of an aeroplane is made twice (a) What will happen to the momentum? Will the momentum remain conserved? (b) What will happen to the K.E.? Will the energy remain conserved ?

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168. A uniform rectangular parallelopiped of mass m having sides, l, 2l and 4l is placed in turn on each of its three sides on a horizontal surface. What is the potential energy of the parallelopiped in the three positions ? Which position is most stable?

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169. What happens to the potential energy of a body when its height is doubled ?

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170. What happens to electrostatic potential energy of a two electron system, if one electrons brought towards another electron?

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171. A particle is moving in a circular path of given radius with number of rotations per second (i) constant (ii) decreasing (iii) increasing.

What happens to work done in the three cases?

Watch Video Solution

172. A particle is moving in a circular path of given radius with number of rotations per second (i) constant (ii) decreasing (iii) increasing.

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173. A particle is moving in a circular path of given radius with number of rotations per second (i) constant (ii) decreasing (iii) increasing.

What happens to work done in the three cases?

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174. Chemical, gravitational and nuclear energies are nothing but potential energies for different types of forces in nature. Explain this statement clearly with examples.

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175. In a thermal station, coal is used for the generation of electricity. Mention how energyh changes from one form to the other before it is trnsformed into electrical energy?

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176. Explain how fast moving neutrons can be quickly slowed down by passing through water or heavy water?

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177. The spring constant of the spring shown in the figure is $250Nm^{-1}$. Find the maximum compression of the spring?

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178. A body of a mass m moving with speed v collides elastically head on with another body of mass m, initially at rest. Show that the moving body will come to a stop after collision.

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179. A body is moved along a straight line by a machine delivering constant power . The distance moved by the body is time t is proptional to

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180. Why a metal ball rebounds better than a rubber ball?

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181. Throwinig mud on a wall is an example of perfectly inelastic collision. Comment.

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182. Nuclear fission and fusion reactions are examples of conversion of mass into energy. Can we say that strictly speaking, mass is converted into energy even in an exothermic chemical reaction?

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183. What is the minimum energy released in the annhilation of an electron positron pair?

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184. The absolute value of potential energy (and therefore total energy) has no physical significance. It is the difference of potential energies that matters. One can, therefore, add or subtract a constant to the potential energy (provided we do it to potential energy at every position for a given force) without any change in the physical situation. By convention, for forces which fall off to zero at large distances, the potential energy at infinity is taken to be zero. With this choice, is the potential energy positive or negaive for (a) electron bound state, (b) planet-satellite system, (c) electron-electron system?

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187. A locomotive of mass m starts moving so that its velocity varies according to the law $V = \alpha\sqrt{s}$, where α is a constant and s is the distance covered. Find the total work done by all the forces acting on the locomotive during the first t seconds after the beginning of motion.

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188. 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 -

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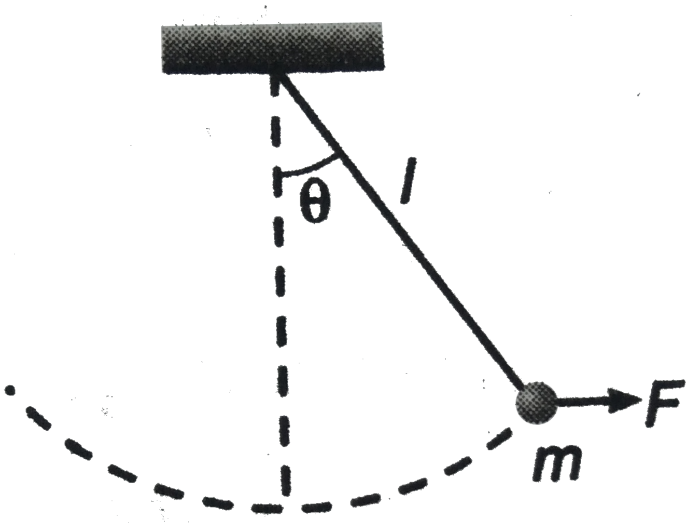
189. An object of mass m is tied to a string of length l and a variable force F is applied on it which brings the string gradually at angle thit θ with the vertical. Find the work done by the force F



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190. A chain is held on a frictionless table with $1/n$ th 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?

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191. A perosn decides to use his bath tub water to generate electric power to run a 40W bulb. The bath tub is located at a height of 10m from the ground and it holds 200 litres of water. He instals a water driven wheel generator on the ground. At what rate should the water drain from the bath tub to light the bulb? How long can he keep the bulb on , if bath tub was full initially ? Efficiency of generator is 90% . Take $g = 9.8m/s^2$

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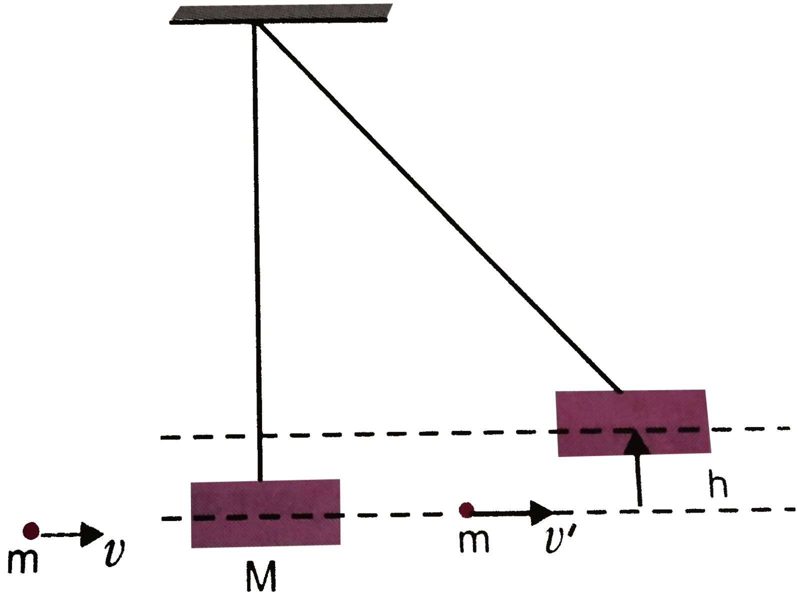
192. A bullet of mass 0.01J kg and travelling at a speed of $500m/s$ strikes a block of mass 2 kg which is suspended by a string of length 5m. The cnetre of gravity of the block is found to rise a vertical distance of 0.1m,

figure. What is the speed of the bullet after it emerges from the block ?

$(g = 9.8m/s^2)$.



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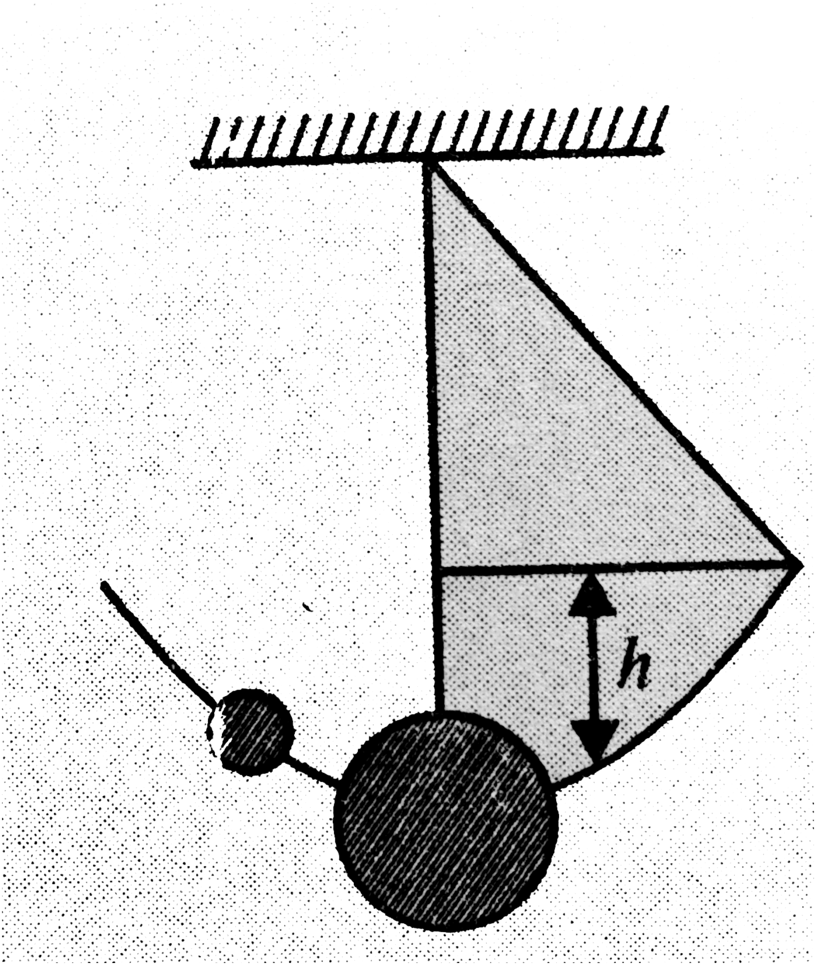
193. A pendulum bob of mass $10^{-2}kg$ is raised to a height 5×10^{-2} m and then released. At the bottom of its swing, it picks up a mass $10^{-3}kg$.

To what height will the combined mass rise?



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194. A particle of mass 1 g moving with a velocity $\vec{v}_1 = 3\hat{i} - 2\hat{j} ms^{-1}$ experiences a perfectly in elastic collision with another particle of mass 2 g and velocity $\vec{v}_2 = 4\hat{j} - 6\hat{k} ms^{-1}$. The velocity of the particle is

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195. A ball whose kinetic energy is E , is projected at an angle of $45(\circ)$ to the horizontal . The kinetic energy of the ball at the highest point of its flight will be

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196. A particle move in a straight line with retardation proportional to its displacement its loss of kinectic energy for any displacement x is proportional to

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197. A body of mass m accelerates uniformly from rest to v_1 in time v_2. As a function of time t, the instantaneous power delivered to the body is

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198. Show that coefficient of restitution for one dimensional elastic collision is equal to one?

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199. The sign of work done by a force is important to understant. State carefully if the following quantities are positive or negative. (a) Work done by a man in lifting a bucket out of a well by means of a rope tied to the bucket. (b) Work done by the gravitational force in the above case. (c) Work done by friction on a body sliding down an inclined plane. (d) Work done by an applied froce on a body moving on a rough horizontal plane with uniform velocity. (e) Work done by the resistive force of air on a vibrating pendulum in bringing it to rest.

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200. A body of mass 2 kg initially at rest moves under the action of an applied horizontal force of 7N on a table with coefficient of kinetic friction $= 0.1$. Calculate the

(a) work done by applied force in 10s. (b) work done by friction in 10s.

(c) work done by the net force on the body in 10s.

(d) change in K.E. of body in 10s, and interpret your result.

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201. Underline the correct alterntaive:

a) when a conservative force does positivie work on a body, the potential energy of the body increase/decreases/remains unaltered.

work done by a body against friction always results in a loss of its kinetic /potential energy.

c) The rate of change of total momentum of a many-particle system is proportional to the external force/ sum of the internal forces on the system.

d) In an inelastic collision of two bodies, the quantities which do not change after the collision are the total kinetic energy/total linear momentum/total enregy of the system of two bodies.

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202. State if each of the following statements is true or false. Give reasons for your answer.

a) In an elastic collision of two bodies, the momentum and energy of each body is conserved.

b)Total energy of a systm is always conserved,no matter what internal and external forces on the body are present.

Work done in the motion of a body over a closed loop is zero for every force in nature.

d) In an inelastic collision, the final kinetic energy is always less than the initial kinetic energy of the sytem.

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203. Anwer carefully, with reasons:

a) In an elastic collision of two billiard balls, is the total kinetic energy conserved during the short time of collision of the balls (i.e. when they are in contact)?

Is the total linear momentum conserved during the short time of an elastic collision of two balls?

c) What are the answers to a) and b) for an inelastic collision?

d) If the potenital energy of two billiard balls depends only on the separation distance between their centers, is the collision elastic or inelastic? (note we are talking here of potential energy corresponding to the force during collision, not gravitational potential energy).

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204. A body is initially at rest. It undergoes one dimensional motion with constant acceleration. The power delivered to it at time t is proportional to

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205. A body is moving undirectionally under the influence of a source of constatn power. It displacement in time t is proportional to (i) $t^{1/2}$ (ii) t (iii) $t^{3/2}$ (iv) t^2

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206. A body constrained to move along the Z-axis of a co-ordinate system is subject to a constant forece $\overrightarrow{F} = -\hat{i} + 2\hat{j} + 3\hat{k}$, where $\hat{i}, \hat{j}, \hat{k}$ are unit vectors along the X-,Y- and Z-axis of the system respectively. What is the work done by this force in moving the body a distance of 4 m along the Z-axis ?

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207. An electron and a proton are detected in a cosmic ray experiment, the first with kinetic energy 10 keV, and the second with 100 keV. Which is faster, the electron or the proton ? Obtain the ratio of their speeds.

(Electron mass $= 9.11 \times 10^{-31} kg$, proton mass $= 1.67 \times 10^{-27} kg, 1eV = 1.60 \times 10^{-19} J)$.

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208. A rain drop of radius 2mm, falls from a height of 500 m above the ground. It falls with decreasing acceleration due to viscous resistance of air until half its original height. It attains its maximum (terminal) speed, and moves with uniform speed there after. What is the work done by the gravitational force on the drop in the first half and second half of its journey ? Take density of water $= 10^3 kg/m^3$. What is the work done by the resistive force in the entire journey if its speed on reaching the ground is $10ms^{-1}$?

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209. A molecules in a gas container hits the wall with speed 200m/s at an angle 30° with the normal, and reboudns with the same speed. Is momentum conserved in the collision ? Is the collision elastic or inelastic ?

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210. A pump on the ground floor of a building can pump of water to fill a tank of volume $30ms^3$ in $15 \min$. If the tank is $40m$ above the ground and the efficiency of the pump is 30% , how much electric power is consumed by the pump? $(\text{Take} g = 10ms^2)$

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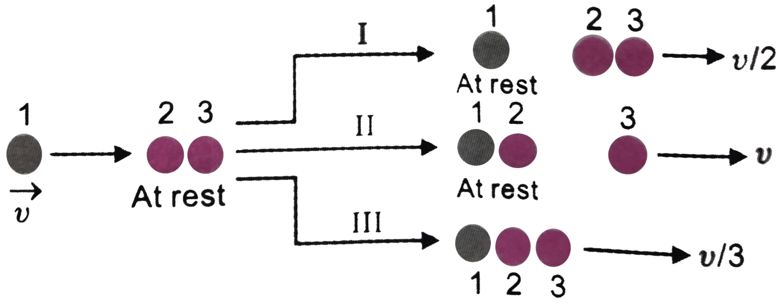
211. Two identical ball bearings in contact with each other and resting on a frictionless table are hit head on by another ball bearing of the same mass moving initially with a speed v, figure,. If the collision is elastic, which of the following is a possible result after collisioin?



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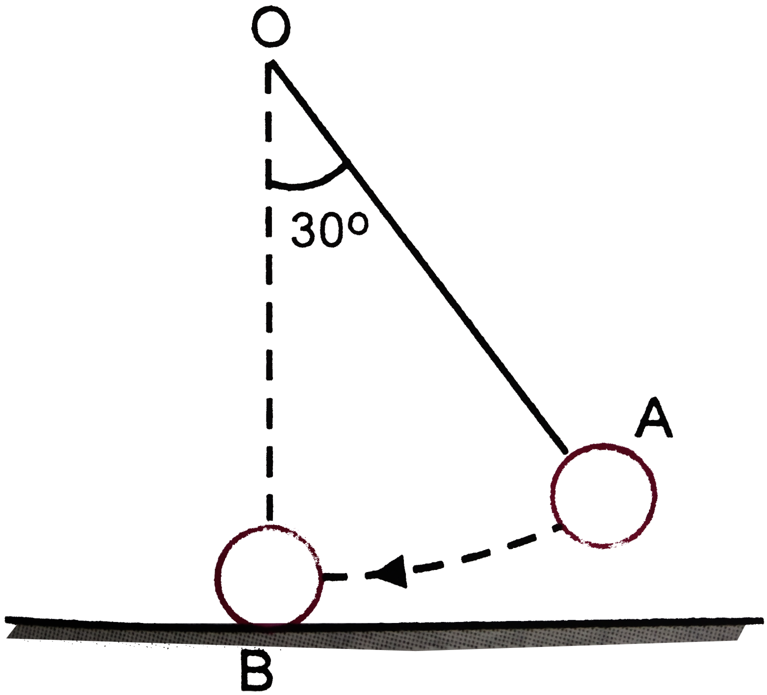
212. The bob A of a simple pendulum released from 30° to the vertical hits another bobo B of the same mass at rest on a table as shown in figure. How high does the bob A rise after the collision ? Neglect the size of the bobs and assume the collision to be elastic.



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213. A trolley of mass 300 ks carrying a sand bag of 25 kg is moving uniformly with a speed of $27km/h$ on a frictionless track. After a while, sand starts leaking out of a hole on the trolley's floor at the rate of $0.05kgs^{-1}$. What is the speed of the trolley after the entire sand bag is empty ?

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214. A particle of mass $0.5kg$ travels in a straight line with velocity $v = ax^{3/2}$ where $a = 5m^{-1/2}s^{-1}$. What is the work done by the net force during its displacement from $x = 0$ to $x = 2m$?

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215. The blades of a windmill sweep out a circle of area A. (a) If the wind flows at a velocity v perpendicular to the circle, what is the mass of the air passing through in time t? (b) What is the kinetic energy of the air? (c) Assume that the windmill converts 25% of the wind's energy into electrical energy, and that $A = 30m^2$, $v = 36kmh^{-1}$ and the density of air is $1.2kgm^{-3}$, what is the electrical power produced?

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216. A person trying to lose weight (dieter) lifts a 10 kg mass through 0.5m, 1000 times, A ssume that the potential energy lost each time she lowers the mass is dissipated (a) How much work does she does against the gravitational force ? (b) Fat supplies $3.8 \times 10^7 J$ of energy per kilogram which is converted to mechanical energy with a 20% efficiency rate. How much fat will the dieter use up ?

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217. A family uses 8kW of power. (a) Direct solar energy is incident on the horizontal surface at an average rate of 200 W per square metre. If 20% of this energy can be converted to useful electrical energy, how large an area is needed to supply 8kW? (a) Compare this area to that of the roof of a typical house.

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218. A bullet of mass 0.012 kg and horizontal speed $70ms^{-1}$ strikes a block of wood of mass 0.4 kg and instantly comes to rest with respect to the block. The block is suspended from the ceiling by thin wire. Calculate the height to which the block rises. Also, estimate the amount of heat produced in the block.

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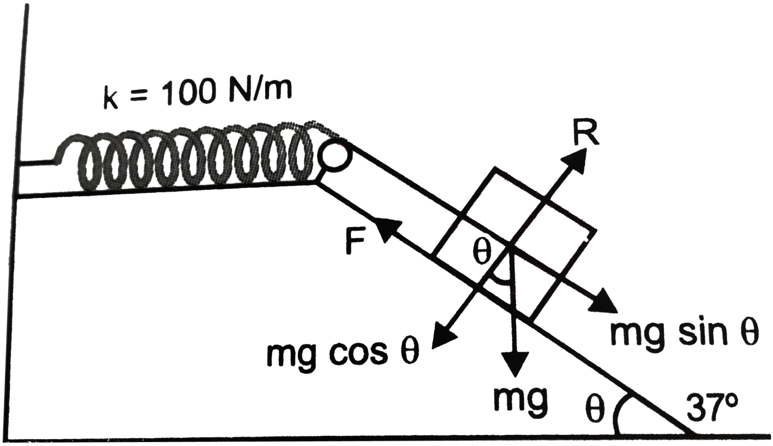
219. A 1kg block situated on a rough incline is connected to a spring of spring constant $100Nm^{-1}$ as shown in figure,. The block is released from rest with the spring in the unstretched position. The block moves 10cm down the incline before coming to rest. Find the coefficient of friction between the block and the incline. Assume that the spring has negligible mass and the pulley is frictionless.



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220. A bob of mass 0.3 kg falls from the ceiling of an elevator moving down with a uniform speed of $7ms^{-1}$. If hits the floor of the elevator (length of the elevator $=$ 3m) and does not rebound. What is the heat produced by the impact ? Would your answer be different if the elevator were stationary ?

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221. A (trolley + child) of total mass 200 kg is moving with a uniform speed of 36 km/h on a frictionless track. The child of mass 20 kg starts running on the trolley from one end to the other (10 m away) with a speed of 10 ms^{-1} relative to the trolley in the direction of the trolley's motion and jumps out of the trolley with the same relative velocity. What is the final speed of the trolley? How much has the trolley moved from the time the child begins to run?

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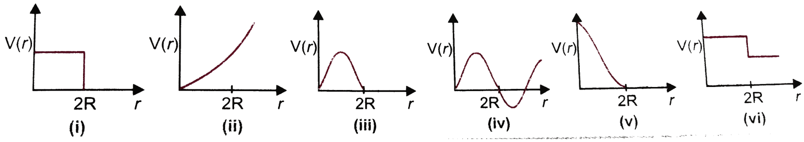
222. Which of the following potential energy curves in figure., cannot possibley describly describe the elastic collision of two billiard balls ? Here r is distance between centres of the balls.



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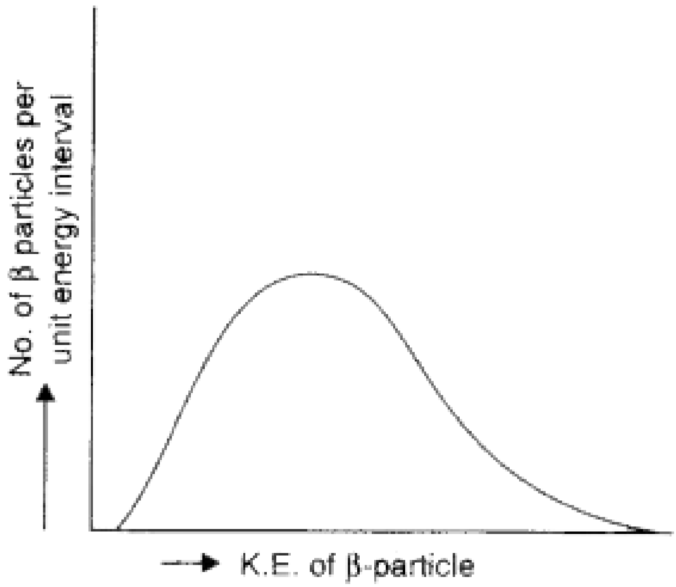
223. Consider the decay of a free neutron at rest: n $\top$ $+e^{-}$ Show that the tow-body dacay of this type must necessarily give an electron of fixed energy and, therefore, cannot for the observed continous energy distribution in the β-decay of a neutron or a nucleus.



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Exercise

1. What is the work done is crrrying a suitcase wighting 10 kg f on his head when he travels a distance of 5 m in the (i) verticl direction and (ii) horizontal direction ? $Take g = 9.8 ms^{-2}$

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2. What is the work done is crrrying a suitcase wighting 10 kg f on his head when he travels a distance of 5 m in the (i) verticl direction and (ii) horizontal direction ? $Take g = 9.8 ms^{-2}$

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3. Calculate the amount of work done by a labourer who carries n bricks, each of mass m, to the roof of a house of height h by climbing up a ladder.

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4. A man moves on a straight horizontal road with a block of mass 2 kg in his hand. If he covers a distance of 340 m with an acceleration of $0.5 \frac{m}{s^2}$

find the work done by the man on the block during the motion.

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5. A force $F = \left(2\hat{i} - 6\hat{j}\right)N$ is applied on a body. which is sliding over a floor. If the body is displaced through $(-3j)m$, how much work is done by the force?

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6. A force $\overrightarrow{F} = \hat{i} + 5\hat{j} + 7\hat{k}$ acts on a particle and displaces it throught $\overrightarrow{s} = 6\hat{I} + 9\hat{k}$. Calculate the work done if the force is in newton and displacement in metre.

(ii) Find the work done by force $\overrightarrow{F} = 2\hat{i} - 3\hat{j} + \hat{k}$ when its point of application moves from the point A(1,2,-3) to the point B (2,0, -5).

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7. A particle is acted upon by constant forces $\overrightarrow{F} = -2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\overrightarrow{F}_2 = -\hat{i} + 2\hat{j} - 3\hat{k}$ is distanced from the point A (2,1,0,) to the point B(-3,-4,2) Find the work done by forces.

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8. A man weighing 50kg f supports a body of 25 kg f on his head. What is the work done when he moves a distance of 20 m up an incline of 1 in 10? Take $g = 9.8ms^{-2}$.

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9. Explain how work done by a variable force may be measured.

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10. A force F=(15+0.50x) acts on a particle in the X-directation ,where F is in newton and x in metre Find the work done ' by this force during a displacecment from x=0 to x=2.0 m .

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11. A force F=a+b x acts on a particle in the X-direction, where a and b are constants. Find the work done by this force during a displacement from x=0 to x=d/

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12. The relation between the displacement x and the time t for a body of mass 2 kg moving under the action of a force is geven by $x = t^3 / 3$, where x is in metre and t in second ,Calculate the ork done by the body in first 2 seconds.

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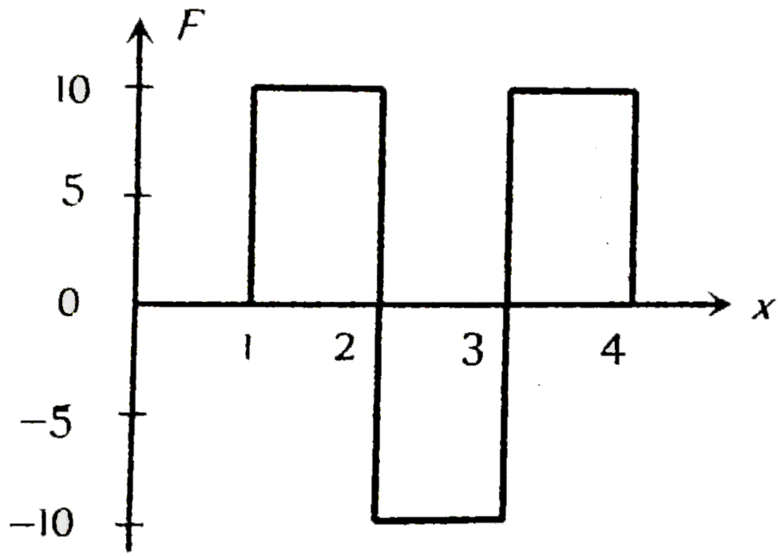

13.

Figrue shows the F-x graph. Where F is the force applied x is the distance covered by the body along a straight line path. Given that F is in newton and x in metre, what is the work done?

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14. Calculate work done in moving the object from $x = 2$ to $x = 3m$ from the graph shown here.

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15. The momentum of a body of masss of 5kg is $500kgms^{-1}$. Find the its K.E.

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16. A bullet of mass 20g is found is found to pass two points 30cm apart in a time interval of 4s. Calculate the kinetic energy of the bullet if it moves with constant speed.

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17. A body of mass $2kg$ is resting on rough horizontal surface. A force $20N$ is applied to it for $10s$ parallel to the surface. If coefficient of kinetic friction between the surfaces in contact in 0.2. Caluculate (i) work done by applied force in $10s$. (ii) change in KE of object in $10s$.

Take $g = 10m/s^2$

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18. A body of mass 2kg is resting on a rough horizontal surface. A force of 20N is now applied to it for 10s, parallel to the surface. If the coefficient of kinetic friction between the surfaces of contact is 0.2. Calculate change in kinetic energy of the object in 10s. (Take $g = 10ms^{-2}$).

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19. A electron and a proton are detected in a cosmic ray experiment, the electron with K.E. of 5eV and the proton with K.E. of 50ev. Find the ratio of their speeds.

Given $m_e = 911 \times 10^{31} kg$ and $m_p - 1.67 \times 10^{27} kg$

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20. A neutron of mass $1.66 \times 10^{-27} kg$ is moving with a speed of $7 \times 10^5 ms^{-1}$. Calculate late its kinetic energy .

Watch Video Solution

21. A neutron of mass $1.66 \times 10^{-27} kg$ is moving with a speed of $7 \times 10^{5} ms^{-1}$. Calculate late its kinetic energy .

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22. A body of masss 1kg is allowed to fall freely under gravity. Find kinetic energy of the body 5 second after it starts falling. Take g=$10 ms^{-2}$

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23. Two bodies of masses 1g and 16g are moving with equal kinetic energies. Find the ratio of the magnitudes of their linear momenta.

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24. If the momentum of a body is increased by 50%, then what will be the perentage increase in the kinetic energey of the body?

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25. The kinetic energy of a body decreases by 20%. What is the percentage decreases in its linear momentum?

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26. A running man has half the KE that a body of half his mass has. The man speeds up by $1.0ms^{-1}$ and then has the same energy as the boy. What were the original speeds of the man and the boy?

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27. While catching a cricket ball of mass $200g$ moving with a velocity of $20ms^{-1}$, the player draws his hands backwards through $20cm$. Find the work done in catching the ball and the average force exerted by the ball on the hand.

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28. A stone of mass 0.4kg is thrown vertically up with a speed of $9.8ms^{-1}$. Find the potential and kinetic energies after half second.

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29. A ball is throuwn vertially up with a velcity of $20ms^{-1}$. At height , will its K.E. be half its orginal value?

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30. 230 joules were spent in lifing a 10 kg weight to a height of 2 m. Calculate the acceleration with which it was raised? Take $g = 10ms^{-2}$

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31. Calculate the work done in lifting a 300 N weight to a height of 10 m with an acceleration $0.5ms^{-2}$. Take $g = 10ms^{-2}$

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32. A bullet of mass 10 g travels horizontally with speed of $100ms^{-1}$ and is absorbed by a wooden block of mass 990 g suspended by a string. Find the vertical height through which the block rises. Take $g = 10ms^{-2}$

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33. A simple pendulum of length $1m$ has a wooden bob of mass $1kg$. It is struck by a bullet of mass $10g$ moving with a speed of $200m/s$. The bullet gets embedded into the bob. Obtain the height to which the bob rises before swinging back.

Take $g = 10m/s^2$.

Watch Video Solution

34. A spring gun has a spring constant of $80Ncm^{-1}$. The spring is compressed $12cm$ by a ball of mass $15g$. How much is the potential energy of the spring ? If the trigger is pulled, what will be the velocity of ball ?

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35. A solid of mass 2 kg moving with a velocity of $10ms^{-1}$ strikes an ideal weightless spring and produces a compression of 25 cm in it. Calculate the force constant of the spring.

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36. A 16kg block moving on a frictionless horiozntal surface with a velocity of $5cm^{-1}$ compreses an ideal spering and comes to rest. If the force constant of the spring be $100Nms^{-1}$, then how much is the spring compressed?

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37. A block of mass $2kg$ is propped from a heught of $40cm$ on a spring where force constant is $1960Nm^{-1}$ The maximum distance thought which the spring compressed by

Watch Video Solution

38. A block of massm, initally at rest is dropped from a height h onto a spring whose force constant is K. Find the maximum distance x through which the spring will be compressed.

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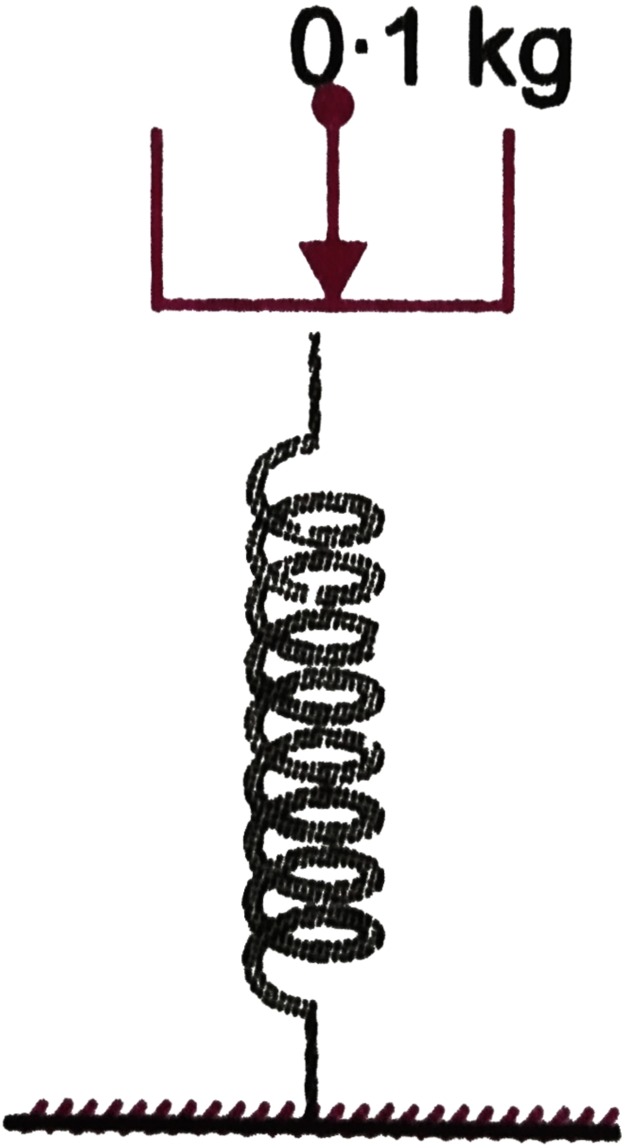
39. An object is attached to a vertical springs and lowered slowly to its equilibrium position. This stretches the spring by a distance d. If the same object is attached to the same vertical spring, but permitted to fall freely, through what distance does it stretch the spring ?

Watch Video Solution

40. A massless platform is kept on a light elastic spring as shown in figure. When a small stone of mass 0.1 kg is dropped on the pan from a height of 0.24 m, the spring compresses by 0.01m. From what height should the stone be droppped to cause a compression of 0.04m in the spring ?



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41. About $4 \times 10^9 kg$ of matter is converted into energy in the sun each second. What is the power output of the sun ?

Watch Video Solution

42. Show that energy equivalent to atomic mass unit equals nearly 933 MeV of energy. Given 1 automic mass unit = $1.66 \times 10^{-27} kg$

Watch Video Solution

43. 500 kg of water is heated from 20° to 100° C . Calculate the increase in the mass of water.Given specific heat of water $= 4.2 \times 10^3 Jkg^{-1} . ^\circ C^{-1}$.

Watch Video Solution

44. 1 mg of uranium is completely destroyed in an atomic bomb. How much energy is liberated ?

Watch Video Solution

45. An electron - positron pair annihilates at rest to produce γ-rays. Calculate the energy produced in MeV if the rest mass of electron is $9.1 \times 10^{-31} kg$.

Watch Video Solution

46. if 10 g of mass is completely converted into energy, then find the corresponding energy produced.

Watch Video Solution

47. A lift is designed to carry a load of 4000kg through 10 floors of a building averaging 6m per floor in 10seconds. Calculate the forse power of the lift.

Watch Video Solution

48. A machine can take out 1000 kg of mud hour from a dept of 100 m . If efficieny of the machine is 0.9 , calculate its power.

Watch Video Solution

49. One coolie takes 1min to raise a box through a height of $2m$. Another one takes $30s$ for the same job and does the same amount of work. Which one of the two has greater power and which one uses greater enegy?

Watch Video Solution

50. An energies of 4.9 K.W power is used to pump water from a well 50 m deep. Calculate the quantity of water in kilo which it can pump out in one hour.

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51. Water is pumped out of a well 10 m deep by mean of a pump rated at 10 kW . Find the efficient of the motor if 4200 kg of water is pumped out every minutes . Take $g = 10ms^{-2}$.

Watch Video Solution

52. A $30m$ deep well is having water up to $15m$. An engine evacuates it in one hour . The power of the engine. If the diameter of the well is $4m$ is

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53. The human heart forces $4000cm^3$ of blood per minute through the arteries under pressure of $130mm$. The density of blood is $1.03g/cc$. What is the horse power of the heart ?

Watch Video Solution

54. A car of mass 1000kg accelerates uniformly from rest to a velocity of $54km/h$ in 5 seconds. Calculate (i) its acceleration (ii) its gain in KE (iii) average power of the engine during this period.

Watch Video Solution

55. A car of mass 1000kg accelerates uniformly from rest to a velocity of $54km/h$ in 5 seconds. Calculate (i) its acceleration (ii) its gain in KE (iii) average power of the engine during this period.

Watch Video Solution

56. A car of mass 1000 kg accelerrates uniformly from rest to a velocity of $54kmh^{-1}$ in 5 seconds. Calculate average power of the engine during this period, neglect friction.

Watch Video Solution

57. A vehicle of mass 30 quintals moving with a speed of $18kmh^{-1}$ collides with another vehicle of mass 90 quintals moving with a speed of $14.4kmh^{-1}$ in the opposite direction. What will be the velocity of each after the collision?

Watch Video Solution

58. A body of mass 2 kg makes an elastic collision with another body at rest and contiues to move in the original direction with a speed equal to one thrid of its original speed. Find the mass of the second body.

Watch Video Solution

59. Ball A of mass m strickes a stationary ball B of mass M and undergoes an elastic collision. After collision ball A has a speed one third of its initial speed. The ratio of M/m is

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60. Two particles of masses 0.5 kg and 0.25kg moving with velocity 4.0 m/s and -3.0m/ collide head on in a perfectly inelastic collision. Find the velocity of the composite particle after collision and KE lost in the collision.

Watch Video Solution

61. Two particles of masses 0.5 kg and 0.25kg moving with velocity 4.0 m/s and -3.0m/ collide head on in a perfectly inelastic collision. Find the velocity of the composite particle after collision and KE lost in the collision.

Watch Video Solution

62. What percentage of the K.E. of a moving particle is transferred to a stationary particle when it strikes the stationary particle four times its mass ?

Watch Video Solution

63. A neutron moving with a speed of $10^6 ms^{-1}$ suffers a head - on collision with a nucleus of mass number 80. What is the fraction of energy retained by the neutron?

Watch Video Solution

64. What percentage of $K.E.$ of a moving particle is transferred to a stationary particle, when moving particle strikes with a stationary particle of mass (a) 19 times in mass (b) equal in mass (c) $\frac{1}{19}$ th of its mass ?

Watch Video Solution

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Watch Video Solution

67. A ball is dropped from a height of 3 m. What is the height upto which the ball will rebound ? The cofficient of restitution is 0.5.

Watch Video Solution

68. A ball is dropped from a height h on to a floor . If the cofficient of restitution is e, calculate the height the ball first rebounds ?

Watch Video Solution

69. A body moves a distance of 10 m under the action of force F=10N. If the work done is 25 J, the angle which the force makes with the direction of motion is

A. 0°

B. 30°

C. 60°

D. none of these

Answer:

Watch Video Solution

70. A force $\overrightarrow{F} = 2\hat{i} - 3\hat{j} + 7\hat{k}(N)$ acts on a particle which undergoes a displacement $\overrightarrow{r} = 7\hat{i} + 3\hat{j} - 2\hat{k}$

(M). Calculate the work done by the force

A. 2 units

B. 4 untis

C. -2 units

D. none of these

Answer:

Watch Video Solution

71. A force $\left(\overrightarrow{F}\right) = 3\hat{i} + c\hat{j} + 2\hat{k}$ acting on a partical causes a displacement: $\left(\overrightarrow{s}\right) = -4\hat{i} + 2\hat{j} + 3\hat{k}$ in its own direction . If the work done is $6j$, then the value of c is

A. 0

B. 6

C. 1

D. 12

Answer:

Watch Video Solution

72. When a body moves with a constant speed along a circle

A. Work done will be zero

B. acceleratin will be zero

C. no force acts on the body

D. its velocity remains constant

Answer:

Watch Video Solution

73. A ball moves on a frictionless inclined table without slipping. The work done by the surface on the ball is :

A. positive

B. negative

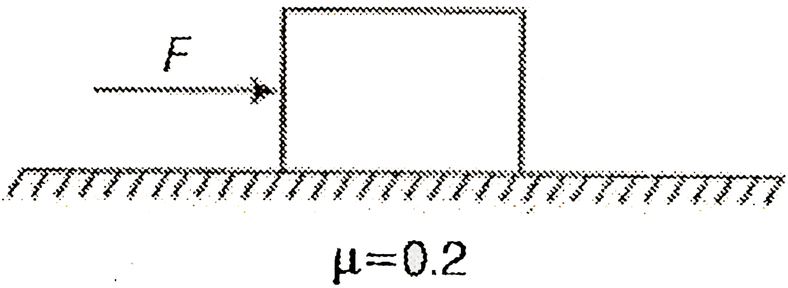
C. zero

D. none of these

Answer:

Watch Video Solution

74. A body of mass 2 kg is placed on rough horizontal plane. The coefficient of friction between body and plane is 0.2 Then,



A. body will move in forward direction if F =5 N

B. body will move in backward direction with acceleration $0.5\frac{m}{s^2}$, if force F =3 N

C. If F =3 N, then body will be in rest condition

D. both and are correct

Answer:

Watch Video Solution

75. $\vec{F}.\vec{d}s$?

A. Torque

B. impulse

C. momentum

D. work

Answer:

Watch Video Solution

76. A particale moves under the effect of a force $F = Cs$ from $x = 0$ to $x = x_1$. The work down in the process is

A. CX_1^2

B. $\frac{CX_1^2}{2}$

C. zero

D. CX_1^3

Answer:

Watch Video Solution

77. A force $F = (10 + 0.5x)$ acts on a particle in the x-direction. What would be the work done by this force during a displacement from $x = 0$ to $x = 2m$ (F is in newton and x in metre)

A. 2.1 J

B. 2.5 J

C. 3.5 J

D. 4.5 J

Answer:

Watch Video Solution

78. The work done by an applied variable force $F = x + x^3$ from x = 0 m to x = 2m, where x is displacement, is

A. 6J

B. 8 J

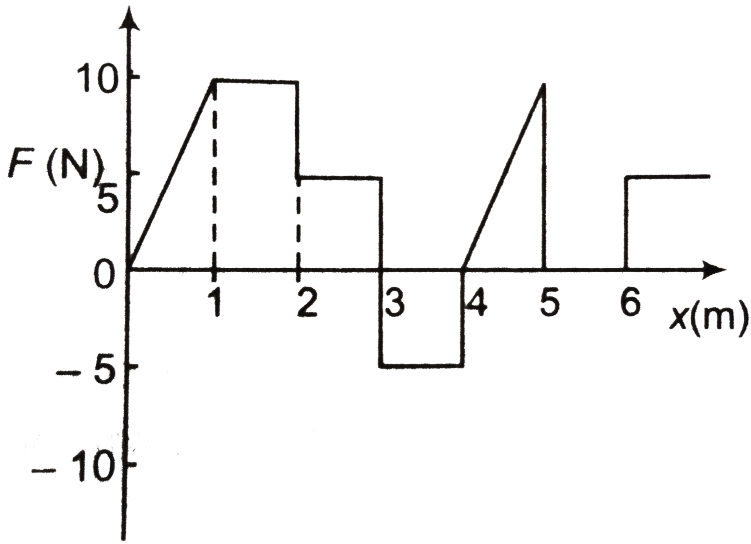
C. 10 J

D. 12 J

Answer:

Watch Video Solution

79. The relationship between the force F and position x of body is as shown in figure. The work done in displacing the body in displacing the body from ($x = 1m$ to $x = 5m$) will be



A. 30 J

B. 15 J

C. 25 J

D. 20

Answer:

Watch Video Solution

80. The kinetic energy of a body of mass 2 kg and momentum of 2 Ns is

A. 1J

B. 3 J

C. 2 J

D. 4 J

Answer:

Watch Video Solution

81. Two bodies of masses m and 4 m are moving with equal K.E. The ratio of their linear momentums is

A. 1: 4

B. 1 : 2

C. 1 : 1

D. 2 : 1

Answer:

Watch Video Solution

82. Two bodies A and B having mass m and M respectively ppossess same kinetic energy. Given that M>m. If p_A and p_B be their moments, then which of the following statements is true?

A. $p_A = p_B$

B.) $p_A > p_B$

C.) $p_A < p_B$

D. It cannot be predicted

Answer:

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83. If momentum is increased by 20% then K.E. increases by

A. 0.4

B. 0.36

C. 0.18

D. 0.08

Answer:

Watch Video Solution

84. If momentum is increased by 20% , then K.E. increase by

A. 0.48

B. 40 %

C. 0.44

D. 0.35

Answer:

Watch Video Solution

85. A body of mass 10 kg initially at rest acquires velocity $10ms^{-1}$. What is the work done ?

A. -500 J

B. 500 J

C. 50 J

D. -50 J

Answer:

Watch Video Solution

86. How much work must work be done by a force on 50 kg body in order to accelerate it in the direction of force from rest to $20ms^{-1}$ is 10 s?

A. $10^3 J$

B. $10^4 J$

C. `2XX10^3J

D. $4XX10^4 j$

Answer:

Watch Video Solution

87. A taxi without any passengers, moving on a frictionless horizontal road, with a velocity u can be stopped in a distance d. Now the passengers and 40% to its weight. What is the stopping distance at veolcity u, if the retardation remains the same?

A. 1.4 s

B. $\sqrt{1.4} s$

C. `(1.4)^2s2

D. $/1.4s$

Answer:

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88. If the potential energy between two molecules is given by $U = -\frac{A}{r^6} + \frac{B}{r^{12}}$, then at equilibrium, separation between molecules, and the potential energy are :

A. $\frac{A^2}{4B}$

B. $\frac{B^2}{4A}$

C. $\frac{2B}{A}$

D. $\frac{B^2}{4A}$

Answer:

Watch Video Solution

89. The potential energy of a particle of mass 5 kg moving in the $x - y$ plane is given by $U = (-7x + 24y)J$, where x and y are given in metre. If the particle starts from rest, from the origin, then the speed of the particle at $t = 2$s is

A. 5 m/s

B. 14 m/s

C. 17.5 m/s

D. 10 m/s

Answer:

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90. A simple pendulum hanging freely and at rest is vertical because in that position

A. kIne energy is zero

B. potential energy is zero

C. kinetic energy is minimum

D. potential energy is minimum

Answer:

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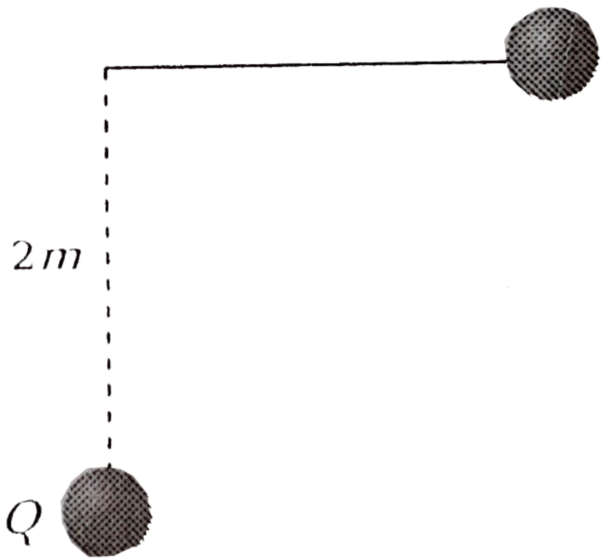
91. A pendulum of length 2 m lift at P . When it reaches Q , it losses 10% of its total energy due to air resistance. The velocity at Q is



A. 6 m/s

B. 1 m/s

C. 2 m/s

D. 8 m/s

Answer:

Watch Video Solution

92. A pendulum bob on a 2 m string is displaced 60° from the vertical and then released. What is the speed of the bob as it passes through the lowest point in its path

A. $\sqrt{2}\frac{m}{s}$

B. $\sqrt{2 \times 9.8}\frac{m}{s}$

C. 4.43 m/s

D. $\frac{1}{\sqrt{2\frac{m}{s}}}$

Answer:

Watch Video Solution

93. 300J of work is done in slinding a 2 kg block up an inclined plane of height 10m. Taking g $=10m/s^2$, work done against friction is

A. 200 J

B. 100 J

C. zero

D. 1000 J

Answer:

Watch Video Solution

94. A body, thrown upward with some velocity reaches the maximum height of $50m$. Another body with double the mass thrown up with double the initial velocity will reach a maximum height of

A. 100 M

B. 200 M

C. 300 M

D. 400 M

Answer:

Watch Video Solution

95. A uniform rope of total length l is at rest on a table with fraction f of its length hanging (see figure). If the coefficient of friction between the table and the chain is μ then

A. $\frac{l}{L-l}$

B. $\frac{L}{l}$

C. l/L`

D. $l\frac{L}{L+l}$

Answer:

Watch Video Solution

96. The dimensions of K in the equation $W=\frac{1}{2}Kx^2$ is

A. $\left[M^1L^0T^{-2}\right]$

B. $\left[M^0L^1T^{-1}\right]$

C. $\left[M^1L^1T^{-2}\right]$

D. $\left[M^1L^0T^{-1}\right]$

Answer:

Watch Video Solution

97. The work done by the external agent in stretching a spring of force constant k from length l_1 to l_2 is

A. $k\left(l_2^2 - l_1^2\right)$

B. $\frac{1}{2}k\left(l_2^2 - l_1^2\right)$

C. $k(l_2 - l_1)$

D. $\frac{k}{2}(l_2 + l_1)$

Answer:

Watch Video Solution

98. A spring of force constant $800N/m$ has an extension of 5cm. The work done in extending it from 5cm to 15cm is

A. 16 J

B. 8 J

C. 32 J

D. 24 J

Answer:

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99. Two springs of spring constants $1500N/m$ and $3000N/m$ respectively are streched by the same force. The potential energy gained by the two springs will be in the ratio

A. 4: 1

B. 2 : 1

C. 1 : 4

D. 1 : 2

Answer:

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100. When a spring is stretched by 2 cm, it stores 100 J of energy. If it is further stretched by 2 cm, the stored energy will be increased by

A. 100 J

B. 200 J

C. 300 J

D. 400 J

Answer:

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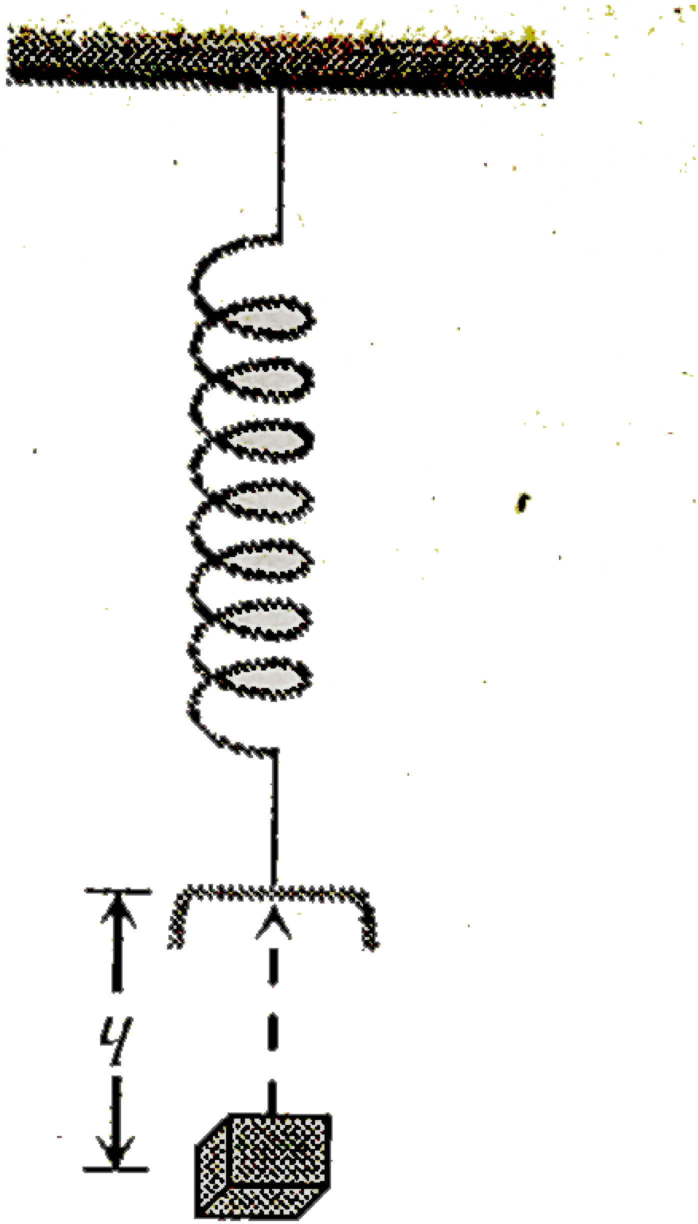

101.

A block of mass m initially at rest is dropped from a height h on to a spring of force constant k . the maximum compression in the spring is x then

A. $\frac{2mgh}{k}$

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

C. $\frac{\sqrt{2mgh}}{k}$

D. none of these

Answer:

Watch Video Solution

102. A $15gm$ ball is shot from a spring whose spring has a force constant of $600N/m$. The spring is compressed by $5cm$. The greater possible horizontal range of the ball for this compression is

A. 6.0 m

B. 10.0 m

C. 12.0 m

D. 8.0 m

Answer:

Watch Video Solution

103. When a spring a stretched through a distance x, it exerts a force given by $F = (-5x - 16x^3)N$. What is the work done, when the spring is stretched from 0.1 m to 0.2 m?

A. $8.2 \times 10^{-2} J$

B. $12.2 \times 10^{-2} J$

C. $8.1 \times 10^{-2} J$

D. $12.2 \times 10^{-1} J$

Answer:

Watch Video Solution

104. The SI unit of power is ________.

A. kilowatt hour

B. kilowatt/hour

C. watt

D. erg

Answer:

Watch Video Solution

105. An electric motor exerts a force of 40 N on a cable and pulls it by a distance of 30 m in one minute. The power supplied by the motor (in Watts) is

A. 10

B. 2

C. 200

D. 20

Answer:

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106. A particle moves with a velocity $\left(5\hat{i} - 3\hat{j} + 6\hat{k}\right)ms^{-1}$ under the influence of a constant force $\overrightarrow{F} = \left(10\hat{i} - 10\hat{j} + 20\hat{k}\right)$ N . The instantaneous power applied to the particle is

A. $200Js^{-1}$

B. $400Js^{-1}$

C. $140Js^{-1}$

D. $170Js^{-1}$

Answer:

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107. A car of mass 1000kg accelerates uniformly from rest to a velocity of $54 km / h$ in 5 seconds. Calculate (i) its acceleration (ii) its gain in KE (iii) average power of the engine during this period.

A. 2000 W

B. 22500 W

C. 5000 W

D. 2250 W

Answer:

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108. A constant force F is pushing a 5 kg mass on a horizontal surface at a constant velocity of 2 m/s. The coefficient of friction between the surface and the mass is 0.3 (Take $g = 10\frac{m}{s^2}$). If F acts along the direction of motion, the rate at which F is doing work (in watt)

A. 30 J

B. 6

C. 10 J

D. 30

Answer:

Watch Video Solution

109. A car of mass m is driven with acceleration a along a straight level road against a constant external resistive force R. When the velocity of the car V, the rate at which the engine of the car is doing work will be

A. R.v

B. ma.v

C. (R+ma).v

D. (ma-R).v

Answer:

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110. Power applied to a particle varices with time as $P = (3t^2 - 2t + 1)$ watt, where t is in second. Find the change in its kinetic energy between time $t = 2s$ and $t = 4s$.

A. 32 J

B. 46 J

C. 61 J

D. 102 J

Answer:

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111. An electric pump is used to fill an overhead tank of capacity 9m3 kept at a height of 10 m above the ground. If the pump takes 5 min to fill the tank by consuming 10 kW power, the efficiency of the pump should be

A. 0.6

B. 0.4

C. 0.2

D. 0.3

Answer:

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112. In an inelastic collision, what is conserved

A. Kinetic energy

B. Momentum

C. Both and

D. Neither nor

Answer:

Watch Video Solution

113. A bullet is fired and gets embedded in a block kept on table. If table is frictionless, then

A. kinetic energy gets conserved

B. potential energy gets conserved

C. momentum gets conserved

D. both a and ©

Answer:

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114. A particle of mass m_1 moves with velocity v_1 and collides with another particle at rest of equal mass. The velocity of the second particle after the elastic collision is

A. $2v_1$

B. v_1

C. $-v_1$

D. 0

Answer:

Watch Video Solution

115. A body of mass M_1 collides elastically with another mass M_2 at rest. There is maximum transfer of energy when :

A. $M_1 > M_2$

B. $M_1 < M_2$

C. $M_1 = M_2$

D. same of all velues of M_1 and M_2

Answer:

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116. A body of mass 5 kg moving with a velocity 10 m/s collides with another body of the mass 20 kg at rest, and comes to rest. The velocity of the second body due to collision is

A. 2.5 m/sec

B. 7.5 m/sec

C. 5 m/sec

D. 10 m/sec

Answer:

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117. A body is moving with a velocity v , breaks up into two equal parts. One of the part retraces back with velocity v . Then the velocity of the other part is

A. v in forward direction

B. 3v in forward direction

C. v in backward direction

D. 3v in backward direction

Answer:

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118. A bomb is kept stationary at a point. It suddenly explodes into two fragments of masses 1 g and 3 g. the total K.E. of the gragments is $6.4 \times 10^4 J$. What is the K.E. of the smaller fragment

A. $2.5 \times 10^4 J$

B. $3.5 \times 10^4 J$

C. $4.8 \times 10^4 J$

D. $5.2 \times 10^4 J$

Answer:

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119. A particle of mass m having velocity v moving towards north collides with similar particle moving with same velocity towards east. The two particlesstick together and move towards north east with a velocity

A. $\sqrt{2}v$

B. $\frac{v}{\sqrt{2}}$

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

D. 2v

Answer:

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120. A mass3in,initially at rest at the origin, explodes into three fragments of equal mass. Two of the fragments have speed v each and move perpendicular to each other. The third fragment will, move with a speed.

A. $\frac{v}{\sqrt{2}}$

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

C. v

D. $\sqrt{2}v$

Answer:

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121. A body of mass 4m at rest explodes into three pieces. Two of the pieces each of mass m move with a speed v each in mutually perpendicular directions. The total kinetic energy released is

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

B. mv^2

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

D. $\frac{5}{2}mv^2$

Answer:

Watch Video Solution

122. A bullet hits and gets embedded in a solid block resting on a frictionless surface. In this process, which of the following is correct ?

A. only momentum is conserved

B. only kinetic energy is conserved

C. neither momentum nor kinetic energy is conserved

D. both momentum and energy are conserved.

Answer:

Watch Video Solution

123. The cofficient of restitution e for a perfectly elastic collision is

A. 0

B. -1

C. 1

D. ∞

Answer:

Watch Video Solution

124. A ball falls from rest from a height h onto a floor, and rebounds to a height $h/4$. The coefficient of restitution between the ball and the floor is

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

B. $\frac{1}{4}$

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

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

Answer:

Watch Video Solution

125. A ball is dropped from a height h on to a floor . If the cofficient of restitution is e, calculate the height the ball first rebounds ?

A. e^2h

B. $e\sqrt{h}$

C. eh

D. $\sqrt{e}h$

Answer:

Watch Video Solution

126. A ball falls vertically onto a floor with momentum p and then bounces repeatedly. If coefficient of restitution is e, then the total momentum imparted by the ball to the floor is

A. p(1+e)

B. $\frac{1}{1-e}$

C. $p\left(\frac{1+e}{1-e}\right)$

D. $p\left(1-\frac{1}{e}\right)$

Answer:

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127. Two springs A and B are identical except that A is stiffer than B. If they are stretched by the same amount, then the work expended in spring A is ----------than in spring B.

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128. Two springs Aand B are identical expect that A isstiffer than B.If they are stretched by the same force, then the work expended in spring A is -------------- than in spring B.

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129. A rocket explodesin midair. Its total momentum ------------while total kinetic energy -------------

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130. The potential energy when two protons are brought closer and the potential energy --------------when one proton and one electron are brought close together.

Watch Video Solution

131. What is work done in holding a 15kg suitcase while waiting for a bus for 15 minutes ?

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132. Assertion : The power of a pump which raises 100 kg of water in 10 sec to a height of 100 m is 10 KW . Reason : The practical unit of power is horse power.

Watch Video Solution

133. A motor boat is moving at a steady speed of$20ms^{-1}$. If the water resistance on the boat is 6000 N, the power of the engine is -----------kW.

Watch Video Solution

134. A stone projected vertically upwards from the ground reaches a maximum height h. When it is at a height $(3h)/(4)$, the ratio of its kinetic and potential energies is

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135. 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 ....

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136. The kinetic energy of a body decreases by 20%. What is the percentage decreases in its linear momentum?

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137. The power of an agent at any instant is equal to the dot product of its -------- and -------vectors at that instant.

Watch Video Solution

138. Two identical particles move -------- to eachother after elastic collision in two dimensions.

Watch Video Solution

139. For a perfectly inelastic collision, the relative velocity of separation is -----------.

Watch Video Solution

140. For a superelastic collision, the coefficient of restitution is--------- unity.

Watch Video Solution

141. Gravitation force is a ---------- force while force of friction is a -------- force.

Watch Video Solution

142. A conservative force is equal to the negative gradient of -----------.

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143. The earth, moving around the sun in a circular orbit, is acted upon by a force and hence work must be done on earth by this force.

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144. True / False type questions : A body is moving along a circular path. No work is done by the centripetal force.

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145. True / False type questions : It is necessary that the work done in the motion of a body over a closed loop is zero for every force in nature.

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146. True / False type questions : Chemical, gravitational and nuclear energies are nothing but potential energiesfor different types of forces in nature.

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147. True / False type questions : Work done by a body against friction results in a loss of its potential energy.

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148. True / False type questions : In an elastic collision of two bodies, the momentum and energy of each body is conserved.

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149. True / False type questions : Total energy of a system is always conserved, no matter what internal and external forces on the body are present.

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150. True / False type questions : In an inelastic collision, the final kinetic energy is always less than the initial kinetic energy of the system.

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151. In an elastic collision of two billiard balls, is the total kinetic energy conserved during the short time of collision of the ball (i.e when they are in contact)?

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152. Assertion: The relative velocity of the two particles in head-on elastic collision is unchanged both in magnitude and direction.

Reason: The relative velocity is unchanged in magnitude but gets reversed in direction.

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153. Matching type Question :

(a)	Positive work	(/>)	Work done by friction when a body slides on a rough horizontal surface
(b)	Negative work	(q)	Work done in moving an immovable stone
		(/')	Work done by gravity when a body falls freely.

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154. Matching type Question :

(.'0	Area under F-t graph	(/')	Change in velocity
(/·)	Area under $F-s$ graph	(<j)	Change in momentum
O')	Area under a-t graph	(r)	Work done

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155. Matching type Question :

00	Elastic collision	(/>)	Collision between two vehicles
(b)	Inelastic collision	(q)	A man jumping into a moving trolley
(<)	Perfectiy inelastic collision	(r)	Collision between two subatomic particles

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156. Matching type Question :

(a)	electron volt	(p)	3.6×10^6 J
(b)	calorie	(q)	1.6×10^{-19} J
(c)	kilowatt hour	(r)	4.186 J

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157. Matching type Question :

(a)	Conservative force	(p)	Force of friction
(b)	Non-conservative force	(q)	Force of viscosity
		(r)	Elastic force of a spring

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158. What do you mean by work done by a force ?

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159. State the factors ono which work done by a force depends.

Watch Video Solution

160. What should be the angel between the direction of force and displacement for maximum and minimum work?

Watch Video Solution

161. State the conditions under which a force does no work.?

Watch Video Solution

162. What is work done in holding a 15kg suitcase while waiting for a bus for 15 minutes ?

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163. A man tries hard to push a loaded truck but fails to move it. In tis case he does

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164. What is work done by the force of tension in the string of a simple pendulum?

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165. Is work a scalar quantity or a vector quantity ?

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166. The area under force-displacement curve represents

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167. Moment of a force and work done by a force have same units. What is the difference between them ?

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168. Name and define SI unit of work.

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169. How many joules make up one erg ?

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170. What do you mean by gravitational unit of work ?

Watch Video Solution

171. State gravitational unit of work in SI.

Watch Video Solution

172. Find the number of joules in the gravitational unit of work in SI.

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173. A man runs a distance on a level road. The same man ascends up a hill with the same velocity through the same distance. When does he do more work ?

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174. Give an example in which a force does work on a body but fails to change its Kinetic energy.

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175. Does the work done in moving a body depend on how fast or how slow the body is moved?

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176. Give an example in which work done is negative.

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177. Has an object in motion ability to do work ?

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178. Does a single force acting an a particle necessarily change its K.E. and momentum

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179. Can the K.E. of a body be negative

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180. Can P.E. of an object be negative?

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181. Out of joule, calorie, kilowatt and electron volt, which one is not the unit of energy?

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182. Define mechanical energy and law of conservation of mechanical energy. Prove conversion of gravitational potential energy in to kinetic energy by the help of law of conservation of mechanical energy. Also draw graph between energy and height.

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183. What type of energy is stored in the spring of a watch?

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184. When an air bubble rises in water, what happens to its potential energy ?

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185. What kind of energy transformations take place at a hydroelectric power station ?

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186. A spring is cut into two equal halves. How is the spring constant of each half affected?

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187. Define power and its SI unit.?

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188. The unit same as the watt second.

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189. What are the dimensions of power ?

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190. How many watts are there in one horse power ?

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191. Name the physical quantity, which is expressed as force times velocity.

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192. For a planet revolving round the sun, when it is nearest to the sun

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193. What is a conservative force ? Give one example.

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194. Which physical quantities are conserved in an elastic collision?

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195. Which physical quantity is conserved in both, elastic and inelastic collision?

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196. If two bodies stick together after collision. Will the collision be elastic or inelastic?

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197. A bullet gets embedded in a wooden block. Where does its KE go?

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198. Give three examples of forces which are conservative in nature.

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199. Friction is non-conservative force. How ?

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200. Name the process in which (i) momentum is conserved but K.E. is not conserved and (ii) momentum changes but K.E. dose not change.

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201. A coolie with load on his head is walking on a horizontal platform. What is work done against gravity.

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202. An artificial satellite is at a height of 36,500 km above earth's surface. What is the work done by earth's gravitational force in keeping it in its orbit ?

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203. Give two examples from daily life where according to physics, work done is zero.

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204. What is the source of KE of falling rain drops ?

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205. State work-energy theorem.

Watch Video Solution

206. What is spring constant ? What are its SI units?

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207. Calculate the number of joules in 1 kWh?

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208. Show that $1J = 10^7$ erg

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209. How will the momentum of a body change if its kinetic energy is doubled ?

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210. Show graphically the variation of potential energy of an object thrown vertically upwards w.r.t. its height.

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211. How does kinetic energy of a moving ball change if its speed is reduced to half of original speed. Take mass of ball = 4 kg and original speed = 20 m/s.

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212. What is the work done by centripetal force in moving a body through half cycle on the circular path of radius 35 m ?

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213. What is an elastic collision ?

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214. Define the term work. Calculate the work done by a constant force. Is work done a scalar or a vector quantity ?

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215. Give the expression for work done if angle between force $\vec{F}$ and displacement $\vec{S}$ is θ. Also find the dimensions and S.I. unit of work.

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216. Define the term work and derive its SI unit. Write an expression for the kinetic energy of a body of mass m moving with a uniform speed v.

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217. How do we calculate work done by a force ? Write any two conditions under which work done by a force is zero.

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218. What is the amount of work done by a weight-lifter in holding a weight of 120 kg on his shoulder for 30 s?

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219. What is the amount of work done by a weight-lifter in holding a locomotive against gravity, if it is travelling on a level plane ?

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220. Derive an expression for the potential energy of an elastic stretched spring.

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221. Define power. Prove that $P = \overrightarrow{F} \cdot \overrightarrow{v}$ where the symbols have their usual meanings.

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222. By what factor the velocity of a body should be increased so that its kinetic energy is increased by a factor of nine ? Justify your answer.

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223. Two bodies A and B weighing 5 kg and 6 kg respectively have equal momenta. Which one has more kinetic energy ?

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224. Define kinetic energy. Give its units and dimensional formula.

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225. Define potential energy. Give its units and dimensional formula.

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226. Draw the variation of potential energy and kinetic energy of a block attached to a spring, which obeys Hooke's law.

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227. State and prove the principle of conservation of mechanical energy.

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228. What is meant by mass energy equivalence ? Discuss its significance in Physics.

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229. In an inelastic collision

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230. Show that in case of one dimensional elastic collision of two bodies, the relative velocity' of sepa ration after the collision is equal to the relative velocity of approach before the collision

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231. What is meant by positive work, negative work and zero work ? Illustrate your answer with two examples of each type.

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232. WORK DONE BY A VARIABLE FORCE

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233. What are conservative and non-conservative forces, explain with examples. Mention some of their properties.

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234. Define kinetic energy. Derive an expression for the kinetic energy of a body moving with a uniform velocity.

Watch Video Solution

235. Define the term potential energy, and derive its dimensions. Write an expression for the gravitational potential energy of a body of mass m raised to a height h above the earth's surface

Watch Video Solution

236. Define elastic potential energy. An elastic spring of force constant k is compressed by an amount x. Show that its pulenlial energy is $\frac{1}{2}kx^2$

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237. What do you mean by kinetic energy ? Derive an expression for the kinetic energy of an object of mass m moving with velocity, v.

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238. WORK ENERGY THEOREM

Watch Video Solution

239. WORK ENERGY THEOREM

Watch Video Solution

240. Define potential energy and conservative force. Write two relations between them.

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241. CONSERVATIVE FORCES

Watch Video Solution

242. What are conservative forces ? Show that gravitational force is a conservative force

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243. Work done by a force is given by $w = \vec{F} . \vec{S}$ where $\vec{F}$ is the force and $\vec{S}$ is the displacement. Show that : Work done is also equal to change in K.E.

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244. Work done by a force is given by $w = \vec{F} . \vec{S}$ where $\vec{F}$ is the force and $\vec{S}$ is the displacement. Show that : Work done is also equal to change in potential energy using this expression.

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245. 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 -

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246. What is meant by power and energy ? Give their units.

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247. Draw a plot of spring force versus displacement x. Hence find an expression for the P.E. of an elastic stretched spring.

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248. Discuss the conservation of energy in an elastic spring. Hence write an expression for the maximum speed of a body of massin oscillating at its one end.

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249. What is the meaning of 'Collision' in physics ? Differentiate between elastic and inelastic collision. Give one example each.

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250. Define the terms Elastic collision and Inelastic collision. What is the difference between an inelastic collision and a completely inelastic collision ?

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251. Prove that bodies of identical masses exchange their velocities after head-on elastic collision.

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252. Identify conservative and non-conservative forces given below and write one main difference between them on the basis of work done : frictional force, electrostatic force, gravitational force and viscous force.

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253. Show that there is a loss of kinetic energy during one dimensional inelastic collision. How will you account for this loss of energy ?

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254. Distinguish between elastic and inelastic collisions

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255. Prove that in a two dimensional elastic collision of a moving ball with another stationary identical ball, the two balls move perpendicular to each other after collision?

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256. Obtain graphically and mathematically work done by a variable force.

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257. WORK ENERGY THEOREM

Watch Video Solution

258. Discuss elastic collision in one dimension. Obtain expressions for velocities of the two bodies after such a collision.

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259. The work done an a particle of mass m by a force

$K\left[\frac{x}{(x^2+y^2)^{3/2}}\hat{i}+\frac{y}{\left(x^2+y^{2^{3/2}}\right)\hat{j}}\right]$ $(Kbe \in gacons\tan tofap \propto riate$ dir

(a,0) $\rightarrow thep \oint$(0,a)` along a circular path of radius a about the origin in x

- y plane is

A. $\frac{2k\pi}{a}$

B. $\frac{k\pi}{a}$

C. $\frac{k\pi}{2a}$

D. 0

Answer:

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260. Two masses of 2 g and 6 are moving with equal kinetic energy. The ratio of the magnitudes of their Linear momenta is,

A. 4: 1

B. $\sqrt{2}:1$

C. 1 : 2

D. 1 : 16

Answer:

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261. If maching is lubricated with oil

A. the mechanical advantage of the machine increases

B. the mechanical efficiency of the machine increases

C. both its mechanical advantage and efficiency increase

D. its efficiency increases, but its mechanical advantage decreases.

Answer:

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262. A spring of force constant k is cut into two pieces such that one piece is double the length of the other. Then the long piece will have a force constant of

A. $\left(\frac{2}{3}\right)k$

B. $\left(\frac{3}{2}\right)k$

C. 3 k

D. 6 k

Answer:

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263. An ideal spring with spring constant k is hung from the ceiling and a block of mass M is attached to its lower end. The mass is released with the spring initially unstretched. Then the maximum extension in the spring is

A. $\frac{4Mg}{k}$)

B. $\frac{2Mg}{k}$

C. $\frac{Mg}{k}$

D. $\frac{Mg}{2k}$

Answer:

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264. A particle of mass m is moving in a circular path of constant radius r such that its centripetal acceleration a_c is varying with time t as $a_c = k^2rt^2$, where k is a constant. The power delivered to the particle by the forces acting on it is :

A. $2\pi mk^2r^2t$

B. mk^2r^2t

C. $\frac{(mk^4r^2t^5)}{3}$

D. zero

Answer:

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265. A wind - powered generator convets and energy into electrical energy . Assume that the generator convents a fixed fraction of the wind energy intercepited by to blades into electrical energy for wind speed V , the electrical power output will be propertional to

A. v

B. v^2

C. v^3

D. v^4

Answer:

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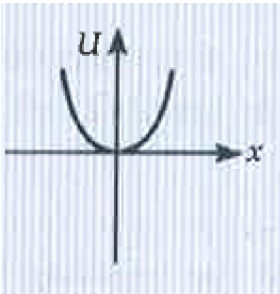
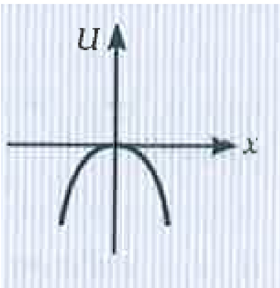
266. A particle is acted by x force $F = Kx$ where K is $a(+ Ve)$ constant its potential mwrgy at $x = 0$ is zero . Which curve correctly represent the variation of putential energy of the block with repect to x

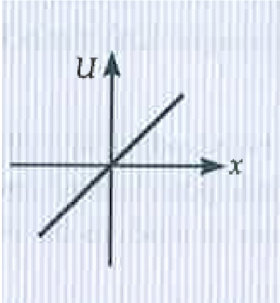
A.



B.



C.



D.

Answer:

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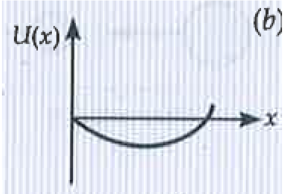
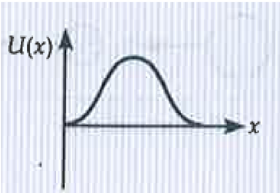
267. A particle which is constant to move along the $x - a\xi s$, is subjected to a force in the same direction which varies with the distance x of the particle from the origin as $F(x) = - Kx + ax^3$. Hero K and a are positive constant . For $x \geq 0$, the fanctional from of the patential every `U(x) of the particle is

A.

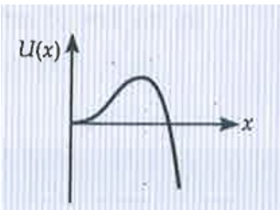


B.



C.

D.



Answer:

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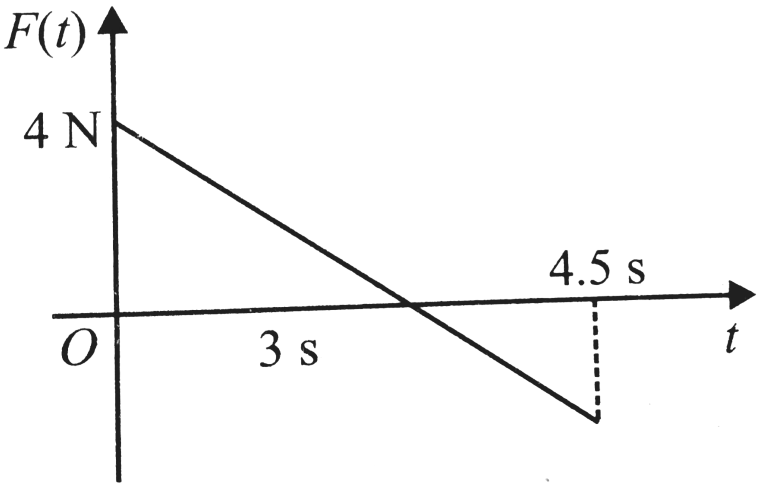
268. A block of mass $2kg$ is free to move along the x-axis. It at rest and from $t = 0$onwards it is subjected to a time-dependent force $F(t)$ in the x direction. The force $F(t)$ varies with t as shown in the figure. The kinetic energy of the block after 4.5 seconds is



A. 4.50 J

B. 7.50 J

C. 5.06 J

D. 14.06 J

Answer:

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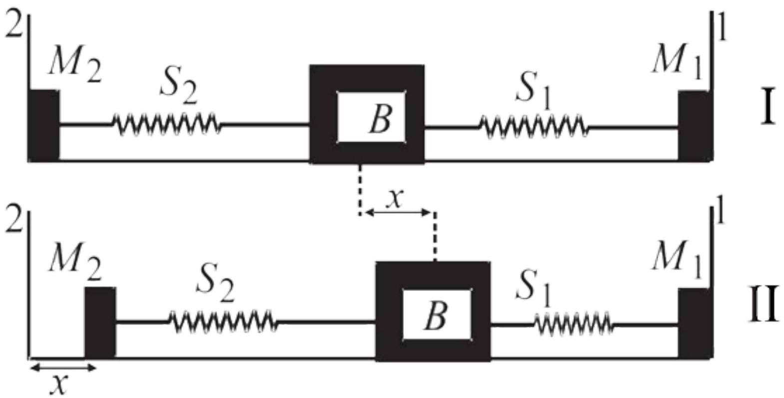
269. A block (B) is attached to two unstriched sprig S_1 and S_(2) with spring constant K and $4K$, respectively (see fig 1) The other ends are atteched in identical support M_1 and M_2 not attached in the walls . The springs and supports have negligible mass . There is no friction anywhere . The block B is displaced toword wall 1 by a small distance z (figure (ii)) and released . THe block return and moves a maximum displacements x and y are musured with reoact to the equalibrum of the block B and the ratio y/x is



A. 4

B. 2

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

D. $\frac{1}{4}$

Answer:

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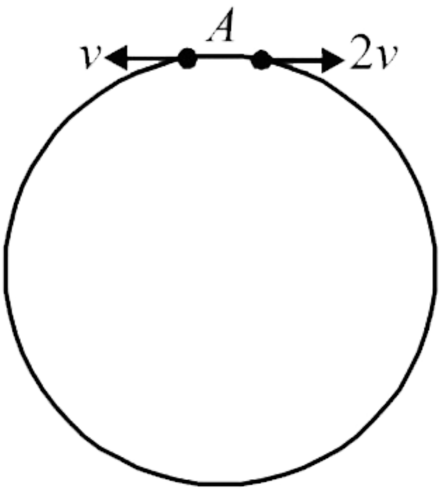
270. Two small particles of equal masses stant moving in opposite direction from a point A in a burtizonetal circule orbic their tangention velocity are V and $2V$, respectively as shown in the figure between collsions , the particals move with constant speed After making how many elastic collition , other the then that at A these two partical will again reach the point A ?



A. 4

B. 3

C. 2

D. 1

Answer:

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271. A particle of mass m is projected from the ground with an initial speed u_0 at an angle α with the horizontal. At the highest point of its trajectory, it makes a completely inelastic collision with another identical particle, which was thrown vertically upward from the ground with the same initial speed u_0. The angle that the composite system makes with the horizontal immediately after the collision is

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

B. $\frac{\pi}{4} + a$

C. $\frac{\pi}{2} - a$

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

Answer:

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272. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle. The motion of the particle takes place in a plane. It follows that

A. its velocity is constant

B. its acceleration is constant

C. its kinetic energy is constant

D. it moves in a circular path.

Answer:

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273. A force $F = -K\left(y\hat{i} + x\hat{j}\right)$ (where K is a positive constant) acts on a particle moving in the x-y plane. Starting from the origin, the particle is taken along the positive x-axis to the point $(a, 0)$, and then parallel to the y-axis to the point (a, a). The total work done by the force F on the particle is

A. $-2Ka^2$

B. $2Ka^2$

C. -Ka^2`

D. Ka^2

Answer:

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274. A body is moved along a straight line by a machine delivering constant power . The distance moved by the body is time t is proptional to

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

B. $t^{\frac{3}{4}}$

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

D. t^2

Answer:

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275. A uniform chain of length L and mass M is lying on a smooth table and one-third of its length is hanging vertically down over the edge of the table. If g is the acceleration due to gravity, the work required to pull the hanging part on to the table is

A. MgL

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

C. $(MgL\frac{)}{9}$

D. $MgL\frac{)}{18}$

Answer:

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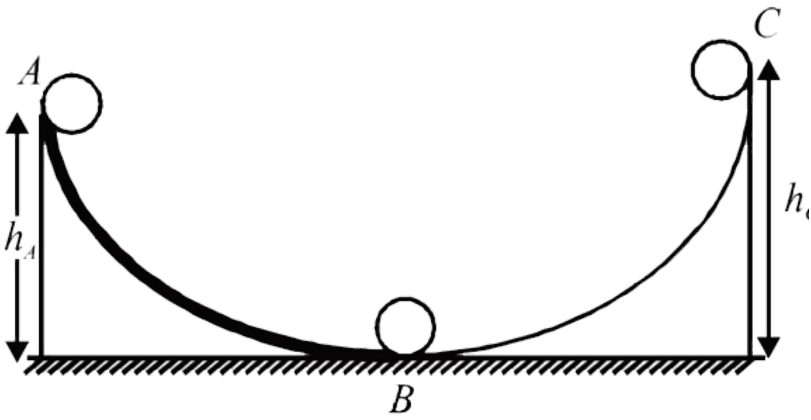
276. A small bell starts moving from A over a fixed track as shown in the figure . Surface AB is friction from A to B the bell roll ralis without sipping BC is friction , $K_A K_B$ andK_C are kinetic energy of the bell at

A, B and C respacecvely.Then



A. $h_A > h_C, K_B > K_C$

B. $h_A > h_C, K_C > K_A$

C. $h_A = h_C, K_B = K_C$

D. $h_A < h_C, K_B > K_C$

Answer:

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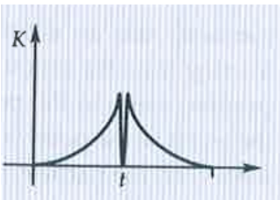
277. A tennis ball dropped on a barizoontal smooth surface , it because back to its original postion after hiting the surface the force on the bell during the collision is propertional to the length of compression of the bell . Which one of the following skethes desches discribe the variation of its kinetic energy K with time 1 mass apporiandly ? The figure as only illistrative and not to the scale .

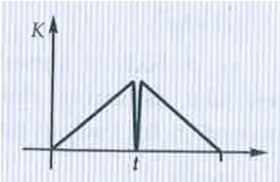
A.

B.



C.

D.



Answer:

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278. A particle of mass m is initially at rest at the origin. It is subjected to a force and starts moving along the x-axis. It kinetic energy K changes with time as $dK/dt = \gamma t$, where γ is a positive constant of appropriate dimensions. Which of the following statement is (are) true?

A. The force applied on the particle is constant.

B. The speed of the particle is proportional to time.

C. The distance of the particle from the origin increases linearly with time.

D. The force is conservative .

Answer:

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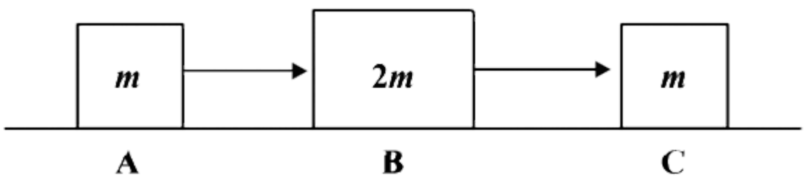
279. There object A, B and C are kept is a straing line a fritionlas horizental surface . These have masses have increase on $2m$ and m repectively . The object A move toward B with a speed 9 m//s and makes as electic collision with a there after B makes complately inclesis with C . All motion over on the same strangth line . Find the first speed of the object C



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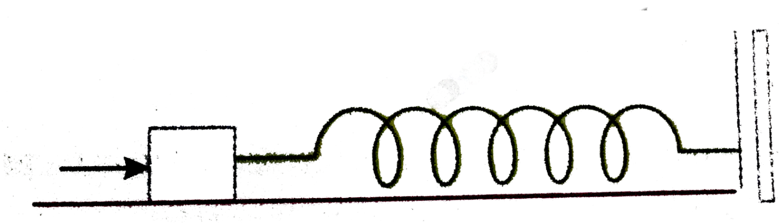
280. A block of mass $0.18kg$ is attached to a spring of force-constant $2N/m$. The coefficient of friction between the block and the floor is 0.1 Initially the block is at rest and the spring is un-stretched. An impulse is given to the block as shown in the figure. The block slides a distance of $0.06m$ and comes to rest for the first time. The initial velocity of the block in m//s is $V = N/10$. Then N is :



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281. A particle of mass $0.2kg$ is moving in one dimension under a force that delivers constant power $0.5W$ to the particle.If the initial speed =0 then the final speed (in ms^{-1}) after $5s$ is.

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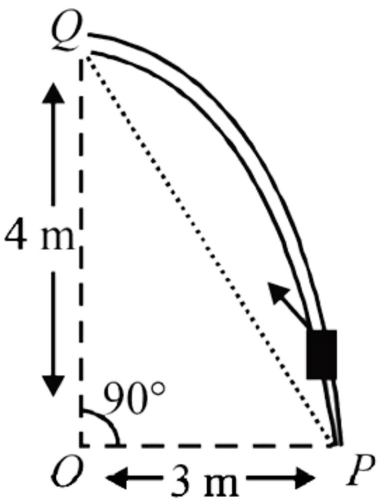
282. Constant as eliptical rail PQ in the varticle plain with $OP = \quad = 3m$ and $OQ = 4m$. A block of mass 1 kg is pailed along the rail from P to Q with a force of $18N$, which is always parallel to less PQ Assuming are frictionless losess , the kinetic energy the block when 0 reches Q is $(n \times 10)$ pales . THe velie of a (Take acceleration due to gravity) $= 10ms^{-2})$



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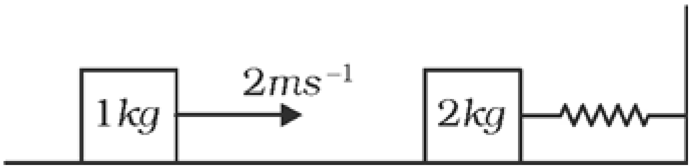
283. A spring-block system is resting on a frictionless floor as shown in the figure. The spring constant is $2.0Nm^{-1}$ and the mass of the block is 2.0 kg. Ignore the mass of the spring. Initially the spring is in an unstretched condition. Another block of mass 1.0 kg moving with a speed of $2.0ms^{-1}$ collides elastically with the first block. The collision is such that the 2.0 kg block does not hit the wall. The distance, in metres, between the two blocks when the spring returns to its unstretched position for the first time after the collision is



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284. A particle of unit mass is moving along the x-axis under the influence of a force and its total energy is conserved. Four possible forms of the potential energy of the particle are given in column-I (a and U0 are constants). Match the potential energies in column-I to the corresponding statement(s) in column-II.

(A) $U_1(x) = \frac{U_0}{2}\left[1-\left(\frac{x}{a}\right)^2\right]^2$	(P) the force acting on the particle
(B) $U_2(x) = \frac{U_0}{2}\left(\frac{x}{a}\right)^2$	(Q) the force acting on the particle
(C) $U_2(x) = \frac{U_0}{2}\left(\frac{x}{a}\right)^2 \exp\left[-\left(\frac{x}{a}\right)\right]$	(R) the force acting on the particle
(D) $U_4(x) = \frac{U_0}{2}\left[\frac{x}{a}-\frac{1}{3}\left(\frac{x}{a}\right)^3\right]$	(S) The particle experiences an att
	(T) The particle with total energy

Watch Video Solution

285. When a rubber-band is stretched by a distance x, it exerts a restoring force of magnitude $F = ax + bx^2$ where a and b are constants. The work done in stretching the unstretched rubber band by L is :

A. $aL^2 + bL_3$

B. $\frac{1}{2}(aL^2 + bL^3)$

C. $\frac{aL^2}{2} + \frac{bL^3}{3}$

D. $\frac{1}{2}\left(\frac{aL^2}{2} + \frac{bL^3}{3}\right)$

Answer:

Watch Video Solution

286. A force $\overrightarrow{F} = \left(5\hat{i} + 3\hat{j} + 2\hat{k}\right)N$ is applied over a particle which displaces it from its origin to the point $\overrightarrow{r} = \left(2\hat{i} - \hat{j}\right)m$. The work done on the particle in joules is-

A. -7

B. 7

C. 10

D. 13

Answer:

Watch Video Solution

287. An athlete in the Olympic gamed covers a distance of $100m$ in $10s$. His kinetic energy can be estimated to be in range.

(1) $200J - 500J$

(2) $2 \times 10^5 J - 3 \times 10^5 J$

(3) $20, 000J - 50, 000J$

(4) $2, 000J - 5, 000J$.

A. 200 J - 500 J

B. $2 \times 10^5 J - 3 \times 10^5 J$

C. 20,000 J - 50,000 J

D. 2000 J - 5000 J

Answer:

Watch Video Solution

288. A particle of mass $100g$ is thrown vertically upwards with a speed of $5m/s$. The work done by the force of gravity during the time the particle goes up is

A. 1.25 J

B. 0.5 J

C. -0.5 J

D. -125 J

Answer:

Watch Video Solution

289. A ball whose kinetic energy is E , is projected at an angle of $45(\circ)$ to the horizontal . The kinetic energy of the ball at the highest point of its flight will be

A. E

B. $\frac{E}{\sqrt{2}}$

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

D. zero

Answer:

Watch Video Solution

290. A particle is projected at $60(\circ)$ to the horizontal with a kinetic energy K. The kinetic energy at the highest point is

A. E

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

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

D. zero

Answer:

Watch Video Solution

291. A particle moves in a straight line with retardation proportional to its displacement. Its loss in kinetic energy for any displacement x is proportional to

A. x^2

B. e^x

C. x

D. $\log_e x$

Answer:

Watch Video Solution

292. The potential energy of a $1kg$ particle free to move along the x- axis is given by $V(x) = \left(\frac{x^4}{4} - \frac{x^2}{2}\right)J$

The total mechainical energy of the particle is $2J$. Then , the maximum speed (in m//s) is

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

B. 2

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

D. $\sqrt{2}$

Answer:

Watch Video Solution

293. Consider the following two statements:

A. Linear momentum of a system of partcles is zero.

B. Kinetic energ of a system of particles is zero.

A. A does not imply B and B does not imply A

B. A implies B but B does not imply A

C. A does not imply B but B implies A

D. A implies B and B implies A

Answer:

Watch Video Solution

294. A spherical ball of mass $20kg$ is stationary at the top of a hill of height $100m$, it rolls down a smooth surface to the ground , then climbs up another bill of height of $30m$ and final rolls down to a horizontal base at a height of $20m$ about the ground . The velocity attained by the ball is

A. $10ms^{-1}$

B. $10\sqrt{30}ms^{-1}$

C. $40ms^{-1}$

D. $20ms^{-1}$

Answer:

Watch Video Solution

295. A uniform chain of length 2 m is kept on a table such that a length of 60 cm hangs freely from the edge of the table. The total mass of the chain is 4 kg. What is the work done in pulling the entire chain on the table?

A. 7.2 J

B. 3.6 J

C. 120 J

D. 1200 J

Answer:

Watch Video Solution

296. A mass of M kg is suspended by a weightless string. The horizontal force that is required to displace it until the string makes an angle of 45° with the initial vertical direction is

A. $\frac{Mg}{\sqrt{2}}$

B. $(\sqrt{2}-1)Mg$

C. $(\sqrt{2}+1)Mg$

D. $\sqrt{2}Mg$

Answer:

Watch Video Solution

297. A spring of spring constant 5×10^2Nm is streched initially by $5cm$ from the unstriched position . Then the work required to streach is further by another $5cm$ is

A. 12.50 Nm

B. 18.75 Nm

C. 25.00 Nm

D. 6.25 Nm

Answer:

Watch Video Solution

298. A spring of force constant $800N/m$ has an extension of 5cm. The work done in extending it from 5cm to 15cm is

A. 16 J

B. 8 J

C. 32 J

D. 24 J

Answer:

Watch Video Solution

299. A 2 kg block slides on a horizontal floor with a speed of 4 m/s. It strikes an uncompressed spring, and compresses it till the block is motionless. The kinetic friction force is 15 N and spring constant is 10000 N/m. The spring is compressed by (in cm):

A. 5.5 cm

B. 2.5 cm

C. 11.0 cm

D. 8.5 cm

Answer:

Watch Video Solution

300. A body of mass m, accelerates uniformly from rest to V_1 in time t_1. The instantaneous power delivered to the body as a function of time t is.

A. $\frac{mv_1t}{t_1}$

B. $\frac{mv_1^2t}{t_1^2}$

C. $\frac{mv_1t^2}{t_1}$

D. $\frac{mv_1^2 t}{t_1}$

Answer:

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301. A body is moved along a straight line by a machine delivering constant power . The distance moved by the body is time t is proptional to

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

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

C. $t^{\frac{1}{4}}$

D. $t^{\frac{1}{2}}$

Answer:

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302. If mass-energy equivalence is taken into account , when water is cooled to form ice, the mass of water should :-(Note: The mass energy of an object is the energy equivalent of its mass , as given by $E = mc^2$, where m= mass of object & c = speed of light)

A. increase

B. remain unchanged

C. decrease

D. first increase then decrease

Answer:

Watch Video Solution

303. A bomb of mass 16kg at rest explodes into two pieces of masses 4 kg and 12 kg. The velolcity of the 12 kg mass is $4ms^{-1}$. The kinetic energy of the other mass is

A. 192 J

B. 96 J

C. 144 J

D. 288 J

Answer:

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304. A block of mass 0.50 kg is moving with a speed of 2.00 m/s on a smooth surface. It strikes another mass of 1.00 kg and then they move together as a single body. The energy loss during the collision is

A. 0.16 J

B. 1.00 J

C. 0.67 J

D. 0.34 J

Answer:

Watch Video Solution

305. A mass m moves with a velocity v and collides inelastically with another identical mass. After collision the 1st mass moves with velocity $\frac{v}{\sqrt{3}}$ in a direction perpendicular to the initial direction of motion. Find the speed of the second mass after collision

A. v

B. $\sqrt{3}v$

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

D. $\frac{v}{\sqrt{3}}$

Answer:

Watch Video Solution

306. A particle of mass m moving in the x direction with speed 2v is hit by another particle of mass 2m moving in they y direction with speed v. If the collision is perfectly inelastic, the percentage loss in the energy during the collision is close to :

A. 0.44

B. 0.5

C. 0.56

D. 0.62

Answer:

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307. A block of mass $m = 0.1kg$ is connceted to a spring of unknown spring constant k. It is compressed to a distance x from its equilibrium position and released from rest. After approaching half the distance $\left(\frac{x}{2}\right)$ from the euilibrium position, it hits another block and comes to rest momentarily, while the other block moves with velocity $3ms^{-1}$. The total initial energy of the spring is :

A. 0.3 J

B. 0.6 J

C. 1.5 J

D. 0.8 J

Answer:

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308. A body of mass $m = 10^{-2} kg$ is moving in a medium and experiences a frictional force $F = -Kv^2$. Its initial speed is $v_0 = 10 ms^{-2}$. If , after $10s$, its energy is $\frac{1}{8} mv_0^2$, the value of k will be

A. $10^{-3} kgm^{-1}$

B. $10^{-3} kgs^{-1}$

C. $10^{-4} kgm^{-1}$

D. $10^{-1} kgm^{-1} s^{-1}$

Answer:

Watch Video Solution

309. A time dependent force $F = 6t$ acts on a particle of mass $1kg$. If the particle starts from rest, the work done by the force during the first $1 \sec.$ will be

A. 4.5 J

B. 22 J

C. 9 J

D. 18 J

Answer:

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310. A person trying to lose weight by burning fat lifts a mass of 10 kg upto a height of 1 m 1000 times. Assume that the potential energy lost each time he lowers the mass is dissipated. How much fat will he use up considering the work done only when the weight is lifted up? Fat supplies $3.8x10^7 J$ of energy per kg which is converted to mechanical energy with a 20% efficiency rate. Take $g = 9.8ms^{-2}$:

A. $6.45 \times 10^{-3} kg$

B. $9.89 \times 10^{-3} kg$

C. $12.89 \times 10^{-3} kg$

D. $2.45 \times 10^{-3} kg$

Answer:

Watch Video Solution

311. A particle is moving in a circular path of radius a under the action of an attractive potential $U = -\frac{k}{2r^2}$. Its total energy is :

A. $-\frac{k}{4a^2}$

B. $\frac{k}{2a^2}$

C. zero

D. $\frac{3}{2}\frac{k}{a^2}$

Answer:

Watch Video Solution

312. In a collinear collision, a particle with an initial speed v_0 strikes a stationary particle of the same mass. If the final total kinetic energy is 50% greater than the original kinetic energy, the magnitude of the relative velocity between the two particles, after collision, is:

A. $\frac{v_0}{4}$

B. $\sqrt{2}v_0$

C. $\frac{v_0}{4}$

D. $\frac{v_0}{\sqrt{2}}$

Answer:

Watch Video Solution

313. This question has statement 1 and statement 2 . Of the four choice given after the Statement , choose the one that best describe the two Statement .

If the spring $S_1$and S_2 of force constant k_1 and k_2 respectively , are streached by the same force , it is found that more work is done on spring S_1 then on spring S_2

Statement -1: If statement by the same answer work done on S_1 work on S_1 is more then S_2

Statement - 2 : $k_1 < k_2$

A. Statement 1 is false, Statement 2 is true

B. Statement 1 is true, Statement 2 is false.

C. Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation for statement 1

D. Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 1.

Answer:

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314. This question has statement I and statement II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement I: A point particle of mass m moving with speed v collides with stationary point particle of mass M. If the maximum energy loss possible glven as $f\left(\frac{1}{2}mv^2\right)$ then $f=\left(\frac{m}{M+m}\right)$

Statement II: Maximum energy loss occurs when the particles get stuck together as a result of the collision.

A.) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 1.

B. Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 1.

C. Statement 1 is true, Statement 2 is false.

D. Statement 1 is false, Statement 2 is true

Answer:

Watch Video Solution

315. Statement 1 : Two particles moving in the same direction do not lose all their energy in a completely inelastic collision.

Statement 2 : The principle of conservation of momentum holds true for all kinds of collisions.

A. Statement - 1 is true, Statement - 2 is false

B. Statement - 1 is tru*e, Statement - 2 is true , Statement - 2 is the correct explanation of Statement-1

C. Statement - 1 is true, Statement - 2 is true , Statement - 2 is not the correct explanation of Statement-1

D. Statement -1 is false, Statement -2 is true

Answer:

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316. Consider the situation - A laborer carrying bricks on his head on a level road from one place to another. Find the work done in the process (a) by gravity, (b) by man (c) by frictional force between man and ground.

A. correct

B. incorrect

C. partly correct

D. insufficient data

Answer:

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317. The force on a particle as the function of displacement x is given by $F = 9 + 0.3x$. The work done corresponding to displacement of particle from x = 0 to x = 2 unit is

A. 25 J

B. 29 J

C. 21 J

D. 18.6 J

Answer:

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318. A body of mass 50 kg is at rest. The work doen to accelerate it by 20m/s in 10 s is

A. $10^3 J$

B. $10^4 J$

C. $2 \times 10^3 J$

D. $4 \times 10^4 J$

Answer:

Watch Video Solution

319. Kinetic energy, with any reference, must be

A. zero

B. positive

C. negative

D. both a and c

Answer:

Watch Video Solution

320. The kinetic energy of a body becomes four times its initial value.The new linear momentum will be:

A. become twice its initial value

B. become thrice its initial value

C. become four times its initial value

D. remain constant

Answer:

Watch Video Solution

321. A body of mass$5kg$ is moving with a momentum of $10kgm/s$. A force of $0.2N$ acts on it in the direction of motion of the body for $10\sec$. The increase in its kinetic energy.

A. 1.1 J

B. 2.2 J

C. 3.3 J

D. 4.4 J

Answer:

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322. A block of mass 20 kg is moving in x-direction with a constant speed of 10 ms^{-1}. It is subjected to a retarding force $F = (-0.1x)N$ during its travel from x=20 m to x=30 m. Its final kinetic energy will be

A. 475 J

B. 450 J

C. 275 J

D. 250 J

Answer:

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323. The decrease in the potential energy of a ball of mass 20 kg which falls from a height of 50 cm is

A. 968 J

B. 98 J

C. 1980 J

D. none of these

Answer:

Watch Video Solution

324. If the water falls from a dam into a turbine wheel 19.6 m below, then the velocity of water at the turbine is $(g = 9.8 m / s^2)$

A. $9.8 ms^{-1}$

B. $19.6ms^{-1}$

C. $39.2ms^{-1}$

D. $98.0ms^{-1}$

Answer:

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325. A gun fires a bullet of mass $50g$ with a velociy of $30m/s$. Due to this, the gun is pushed back with a velocity of $1m/s$, then the mass of the gun is :

A. 5.5 kg

B. 3.5 kg

C. 1.5 kg

D. 0.5 kg

Answer:

Watch Video Solution

326. A body of mass 5 kg is raised vertically to a height of 10 m by a force 170 N. The velocity of the body at this height will be

A. $37ms^{-1}$

B. $22ms^{-1}$

C. $15ms^{-1}$

D. $9.8ms^{-1}$

Answer:

Watch Video Solution

327. A bomb of mass $3.0kg$ explodes in air into two pieces of masses $2.0kg$ and $1.0kg$. The smaller mass goes at a speed of $80m/s$. The total energy imparted to the two fragments is :

A. 1.07 kJ

B. 2.14 kJ

C. 2.4 kJ

D. 4.8 kJ

Answer:

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328. If a spring extends by x on loading, then the energy stored by the spring is (if T is tension in the spring and k is spring constant)

A. $\frac{T^2}{2}x$

B. $\frac{T^2}{2}k$

C. $2\frac{k}{T^2}$

D. $2\frac{T^2}{k}$

Answer:

Watch Video Solution

329. A spring 40 mm long is stretched by the application of a force. If 10 N force required to stretch the spring through 1mm, then the work done in stretching the spring through 40 mm is

A. 23 J

B. 68 J

C. 84 J

D. 8 J

Answer:

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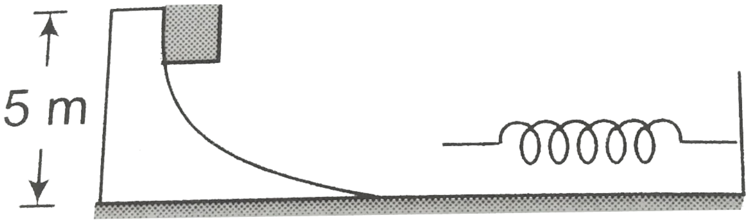

330.

The figure shows a smooth curved track terminating in a smooth horizontal part. A spring of spring constant $400(N)/(m)$ is attached at one end to a wedge fixed rigidly with the horizontal part . A 40 g mass is released from rest at a height of 5 m on the curved track. The maximum compression of the spring will be

A. 9.8 m

B. 9.8 cm

C. .98 m

D. .009 km

Answer:

Watch Video Solution

331. A particle moves along a curve of unknown shape but magnitude of force F is constant and always acts along tangent to the curve.Then

A. F may be conservative

B. F must be conservative

C. F may be non-conservative

D. F must be non-conservative

Answer:

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332. Which of the following is true ?

A. Momentum is conserved in all collisions, but kinetic energy is conserved only in inelastic collisions.

B. Neither momentum nor kinetic energy is conserved in inelastic collisions.

C. Momentum is conserved in all collisions but not kinetic energy

D. Both momentum and kinetic energy are conserved in all collisions

Answer:

Watch Video Solution

333. Two particles are seen to collide and move jointly together after the collision . During such a collision, for the total system,

A. linear momentum is conserved, but not the mechanical energy

B. mechanical energy is conserved, but not the linear momentum

C. both the mechanical energy and the linear momentum are conserved

D. neither the mechanical energy nor the linear momentum is conserved

Answer:

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334. A metal ball of mass 2 kg moving with a velocity of $36km/h$ has a head on collision with a stationery ball of mass 3 kg. If after the collision, the two balls move together, the loss in kinetic energy dur to collision is

A. 40 J

B. 60 J

C. 100 J

D. 140 J

Answer:

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335. A particle of mass m, moving with velocity v collides a stationary particle of mass $2m$. As a result of collision, the particle of mass m

deviates by 45° and has final speed of $\frac{v}{2}$. For this situation mark out the correct statement (s).

A. v/2

B. 2v

C. v/3

D. 3v

Answer:

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336. In an elastic collision

A. $m_1 = m_2$

B. $m_1 > m_2$

C. $m_1 < m_2$

D. $m_1 = 2m_2$

Answer:

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337. A body of mass $4kg$ moving with velocity $12m/s$ collides with another body of mass $6kg$ at rest. If two bodies stick together after collision , then the loss of kinetic energy of system is

A. zero

B. 288 J

C. 172.8 J

D. 144 J

Answer:

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338. A block having mass m collides with an another stationary block having mass 2m. The lighter block comes to rest after collision. If the velocity of first block is v, then the value is coefficient of restitution will must be

A. 0.5

B. 0.4

C. 0.6

D. 0.8

Answer:

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339. A ball is bouncing down a set of stairs. The coefficient of restitution is e. The height of each step is d and the ball bounces one step at each bounce. After each bounce the ball rebounds to a height h above the next lower step. Neglect width of each step in comparison to h and assume the impacts to be effectively head on. Which of the following relation is correct ?

A. $h = \frac{d}{1 - e^2}$

B. $h = \frac{d}{1 + e^2}$

C. $h = \frac{d}{1 + e}$

D. $h = \frac{\sqrt{d}}{1 - e^2}$

Answer:

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340. If linear momentum if increased by 50% then kinetic energy will be increased by

A. 0.5

B. 1

C. 125 %

D. 0.25

Answer:

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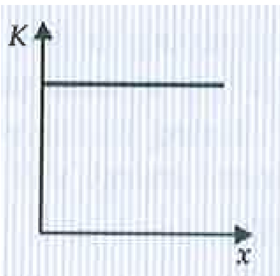
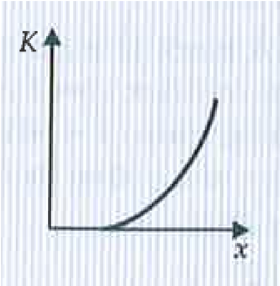
341. A body moves from rest with a constant acceleration. Which one of the following graphs represents the variation of its kinetic energy K with the distance travelled x?

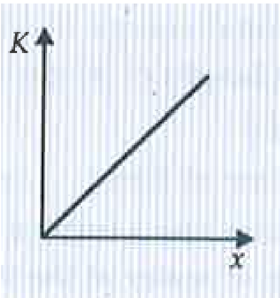
A.



B.



C.



D.

Answer:

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342. A ball collides impinges directly on a similar ball at rest. The first ball is brought to rest after the impact. If half of the kinetic energy is lost by impact, the value of coefficient of restitution (e) is

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

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

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

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

Answer:

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343. A body of mass m_1 collides elastically with another body of mass m_2 at rest. If the velocity of m_1 after collision is $\frac{2}{3}$ times its initial velocity, the ratio of their masses is :

A. 1 : 5

B. 5 : 1

C. 5 : 2

D. 2 : 5

Answer:

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344. When a body moves in a circular path, no work is done by the force since,

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false/assertion is false and reason is true.

Answer:

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345. Assertion: Mass and energy are not conserved separately, but are conserved as a single entity called mass-energy.

Reason: Mass and energy conservation can be obtained by Einstein equation for energy.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false/assertion is false and reason is true.

Answer:

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346. Assertion : In an elastic collision of two billiard balls, the total knetic energy is conserved during the short time of oscillation of the balls (i.e. when they are in contact) .

Reason : Energy spent against friction does not follow the law of conservation of energy .

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false/assertion is false and reason is true.

Answer:

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347. If the momentum of a body increases by 0.01%, its kinetic energy will increase by

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false/assertion is false and reason is true.

Answer:

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348. Assertion: When a ball collised elastically with a floor, it rebounds with the same velocity as with it strikes.

Reason: Momentum of earth + ball system remains constant.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false/assertion is false and reason is true.

Answer:

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349. In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of assertion.

(c) If assertion is true but reason is false.

(d) If assertion and reason are false.

Q. Assertion: Stress is the internal force per unit area of a body.

Reason: Rubber is more elastic than steel:

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false/assertion is false and reason is true.

Answer:

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350. Statement I: In an elastic collision between two bodies, the relative speed of the bodies after collision is equal to the relative speed before the collision.

Statement II: In an elastic collision, the linear momentum of the system is conserved.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false/assertion is false and reason is true.

Answer:

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351. Assertion: A quick collision between two bodies is more violent that show collision , even when initial and final velocity are identical.

Reason: The rate of change of momentum determine that force is small or large.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false/assertion is false and reason is true.

Answer:

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352. Assertion : KE is conserved at every instant of elastic collision.

Reason : NO deformation of matter occurs in elastic collision.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false/assertion is false and reason is true.

Answer:

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353. Statement I. A particle strikes head-on with another stationary particle such that the first particle comes to rest after collision. The collision should necessarily be elastic.

Statement II: In elastic collision, there is no loss of momentum of the system of the particles.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false/assertion is false and reason is true.

Answer:

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354. Assertion : A work done in moving a body over a closed loop is zero for every force in nature. Reason : Work done does not depend on nature of force.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false/assertion is false and reason is true.

Answer:

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355. A body moves a distance of 10 m along a straight line under an action of 5 N force. If work done is 25 J, then angle between the force and firection of motion of the body will be :

A. 60°

B. 75°

C. 30°

D. 45°

Answer:

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356. When a body moves with a constant speed along a circle

A. no work is done on it

B. no acceleration is produced in it

C. its velocity remains constant

D. no force acts on it.

Answer:

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357. A body constrained to move in y direction is subjected to a force given by $\overrightarrow{F} = \left(-2\hat{i} + 15\hat{j} + 6\hat{k}\right)$ N . What is the work done by this force in moving the body through a distance of $10m$ along y-axis ?

A. 150 J

B. 20 J

C. 190 J

D. 160 J

Answer:

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358. A uniform force of $\left(3\hat{i} + \hat{j}\right)$ newton acts on a partical of mass $2kg$. Hence the partical is displaced from position $\left(2\hat{i} + \hat{k}\right)$ metre to possion $\left(4\hat{i} + 3\hat{j} - \hat{k}\right)$ meters. The work done by the force on the partical is

A. 9 J

B. 6 J

C. 13 J

D. 15 J

Answer:

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359. If $\overrightarrow{F} = \left(60\hat{i} + 15\hat{j} - 3\hat{k}\right)N$ and $\overrightarrow{v} = \left(2\hat{i} - 4\hat{j} + 5\hat{k}\right)\frac{m}{s}$, then instantaneous power is

A. 195 watt

B. 45 watt

C. 75 watt

D. 100 watt

Answer:

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360. A position dependent force $F = 7 - 2x + 3x^2$ acts on a small body of mass 2 kg and displaced it from $x = 0$ to $x = 5m$. Calculate the work done in joule.

A. 135

B. 270

C. 35

D. 70

Answer:

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361. A force acts on a 3.0 gm particle in such a way that the position of the particle as a function of time is given by $x = 3t - 4t^2 + t^3$, where xx is in metres and t is in seconds. The work done during the first 4 seconds is

A. 490 mJ

B. 450 mJ

C. 576 mJ

D. 530 mJ

Answer:

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362. A body of mass $3kg$ is under a constant force which causes a displacement s metre in it, given by the relation $s = \frac{1}{3}t^2$, where t is in seconds. Work done by the force in 2 seconds is

A. $\frac{19}{5}J$

B. $\frac{5}{19}J$

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

D. $\frac{8}{3}J$

Answer:

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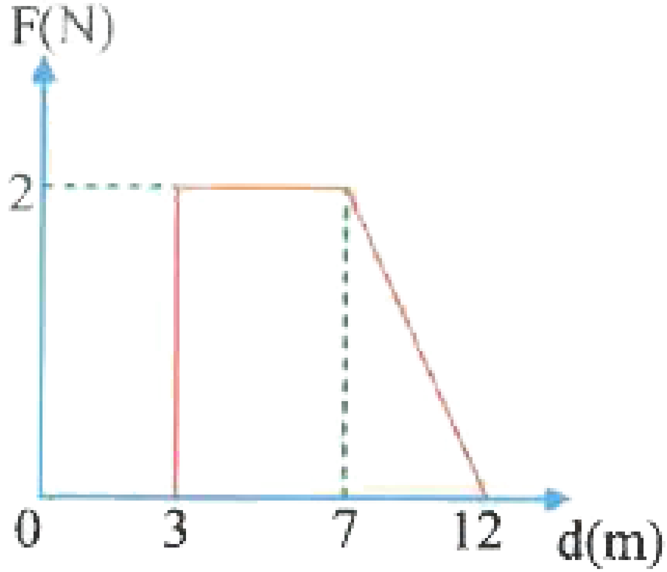
363. Force F on a particle moving in a straight line varies with distance d as shown in figure



The work done on the particle during its displacement of 12 m is

A. 18 J

B. 21 J

C. 26 J

D. 13 J

Answer:

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364. A bomb of mass 30 kg at rest explodes in to two pieces of masses 18 kg and 12 kg. The velocity of 18 kg mass is $6ms^{-1}$. The kinetic energy of the outer mass is

A. 324 J

B. 486 J

C. 256 J

D. 524 J

Answer:

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365. A mass of 1 kg is thrown up with a velocity of 100 m/s. After 5 seconds. It explodes into two parts. One parts of mass 400 g comes down with a velocity 25 m/s Calaculate the velocity of other parts:

A. $40\frac{m}{s}\uparrow$

B. $40\frac{m}{s}\downarrow$

C. $100\frac{m}{s}\uparrow$

D. $60\frac{m}{s}\uparrow$

Answer:

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366. A ball of mass $2kg$ and another of mass $4kg$ are dropped together from a 60 feet tall building . After a fall of 30 feet each towards earth , their respective kinetic energies will be the ratio of

A. $\sqrt{2}:1$

B. 1 : 4

C. 1 : 2

D. $1:\sqrt{2}$

Answer:

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367. A stationary partical explodes into two partical of a masses m_1 and m_2 which move in opposite direction with velocities v_1 and v_2. The ratio of their kinetic energies E_1 / E_2 is

A. $\frac{m_2}{m_1}$

B. $\frac{m_1}{m_2}$

C. 1

D. $m_1 \frac{v_2}{m_2} v_1$

Answer:

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368. A particle of mass m1 is moving with a velocity v_1 and another particle of mass m_2 is moving with a velocity v2. Both of them have the same momentum but their different kinetic energies are E1 and E2 respectively. If $m_1 > m_2$ then

A. $E_1 < E_2$

B. $\frac{E_1}{E_2} = \frac{m_1}{m_2}$

C. $E_1 > E_2$

D. $E_1 = E_2$

Answer:

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369. Two bodies of masses m and 4 m are moving with equal kinetic energies. The ratio of their linear momenta is

A. 1 : 2

B. 1 : 4

C. 4 : 1

D. 1 : 1

Answer:

Watch Video Solution

370. Two bodies with kinetix energies in the ratio of $4:1$ are moving with equal linear momentum. The ratio of their masses is

A. 4 : 1

B. 1 : 1

C. 1 : 2

D. 1 : 4

Answer:

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371. The velocity acquired by a mass m in travelling a certain distance d starting from rest under the action of a constant force is directly proportional to :-

A. m

B. m^0

C. $\sqrt{m}$

D. $\frac{1}{\sqrt{m}}$

Answer:

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372. If kinetic energy of a body is increased by 300%, then percentage change in momentum will be

A. 1

B. 150 %

C. 265 %

D. 73.2 %

Answer:

Watch Video Solution

373. A particle is projected at $60(\circ)$ to the horizontal with a kinetic energy K. The kinetic energy at the highest point is

A. $\frac{K}{\sqrt{2}}$

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

C. $2K$

D. K

Answer:

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374. A particle of mass M is moving in a horizontal circle of radius R with uniform speed V. When it moves from one point to a diametrically opposite point, its

A. kinetic energy changes by $M\frac{v^2}{4}$

B. momentum does not change

C. momentum changes by 2 Mv

D. kinetic energy changes by Mv^2

Answer:

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375. A bullet of mass 10g leaves a rifle at an intial velocity of 1000m/s and strikes the earth at the same level with a velocity of 500m/s. The work done in joule to overcome the resistance of air will be

A. 375

B. 3750

C. 5000

D. 500

Answer:

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376. A block of mass 10 kg, moving in x-direction with a constant speed of $10ms^{-1}$, is subjected to a retarding force $F = 0.1 \times J/m$ during its travel from x=20 m to 30 m. Its final KE will be

A. 450 J

B. 275 J

C. 250 J

D. 475 J

Answer:

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377. A ball is thrown vertically downwards from a height of 20m with an intial velocity v_0. It collides with the ground, loses 50% of its energy in collision and rebounds to the same height. The intial velocity v_0 is (Take, g =10 ms^{-2})

A. $10ms^{-1}$

B. $14ms^{-1}$

C. $20ms^{-1}$

D. $28ms^{-1}$

Answer:

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378. A child is swinging a swing. Minimum and maximum heights fo swing from the earth's surface are 0.75 m and 2 m respectively. The maximum velocity of this swing is

A. 10 m/s

B. 5 m/s

C. 8 m/s

D. 15 m/s

Answer:

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379. 300J of work is done in slinding a 2 kg block up an inclined plane of height 10m. Taking g =$10m/s^2$, work done against friction is

A. 1000 J

B. 200 J

C. 100 J

D. zero

Answer:

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380. The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm the potential energy stored in it is:-

A. u/4

B. 4 untis

C. 8 u

D. 16 u

Answer:

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381. Two springs A and B $(k_A = 2k_B)$ are stretched by applying forces of equal magnitudes at the four ends. If the energy stored in A is E, that in B is :

A. $2E_A$

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

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

D. $4E_A$

Answer:

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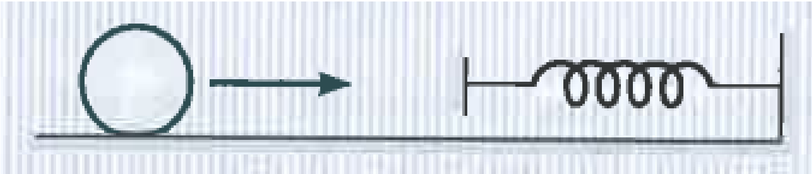
382. A mass of 0.5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface, collides with a nearly weightless spring of force constant k =50 N/m. The maximum compression of the spring would be



A. 0.15 m

B. 0.12 m

C. 1.5 m

D. 0.5 m

Answer:

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383. A vertical spring with force constant k is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls vertically on the spring , so that the spring is compressed by a distance d. The net work done in the process is

A. $mg(h+d)-\frac{1}{2}kd^2$

B. $mg(h-d)-\frac{1}{2}kd^2$

C. $mg(h-d)+\frac{1}{2}kd^2$

D. $mg(h+d)+\frac{1}{2}kd^2$

Answer:

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384. Two similar springs P and Q have spring constant K_P and K_Q such that $K_P > K_Q$. They are stretched, first by the same amount (case a), then the same force (case b). The work done by the spring W_P and W_Q are related as, in case (b), respectively

A. $W_p = W_Q, W_p = W_Q$

B. $W_p > W_Q, W_Q > W_p$

C. $W_p < W_Q, W_Q < W_p$

D. $W_p = W_Q, W_p > W_Q$

Answer:

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385. The potential energy of a particle in a force field is:

$U = \frac{A}{r^2} - \frac{B}{r}$,. Where A and B are positive constants and r is the distance of particle from the centre of the field. For stable equilibrium the distance of the particle is

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

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

C. $\frac{A}{B}$

D. $\frac{B}{A}$

Answer:

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

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

C. x=0

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

Answer:

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387. A body of mass 1 kg is thrown upwards with a velocity $20ms^{-1}$. It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction ? (Take $g=10ms^{-2}$)

A. 30 J

B. 40 J

C. 10 J

D. 20 J

Answer:

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388. An engine pumps water continously through a hose. Water leave the hose with a velocity v and m is the mass per unit length of the Water jet. What is the rate at Which kinetic energy is imparted to water?

A. $\frac{1}{2}m^2v^2$

B. $\frac{1}{2}mv^3$

C. mv^3

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

Answer:

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389. A block of mass m attached in the lower and vertical spring The spring is hung from a calling and force constant value k The mass is released from rest with the spring initially unstreched The maximum value of extension produced in the length of the spring will be

A. $2M\frac{g}{k}$

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

C. $M\frac{g}{2}k$

D. $M\frac{g}{k}$

Answer:

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390. The potential energy of a system increased if work is done

A. upon the system by a non-conservative force

B. by the system against a conservative force

C. by the system against a non-conservative force

D. upon the system by a conservative force

Answer:

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391. A body projected vertically from the earth reaches a height equal to earth's radius before returning to the earth. The power exerted by the gravitational force is greatest.

A. at the highest position of the body

B. at the instant just before the body hits the earth

C. it remains constant all through

D. at the instant just after the body is projected

Answer:

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392. An engine pumps water through a hose pipe. Water passes through the pipe and leaves it with a velocity of $2ms^{1}$. The mass per unit length of water in the pipe is $100kgm^{-1}$. What is the power of the engine?

A. 400 W

B. 200 W

C. 100 W

D. 800 W

Answer:

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393. The heart of a man pumps 5 liters of blood through the arteries per minute at a pressure of 150 mm of mercury. If the density of mercury be $13.6 \times 10^{3} kg/m^{3}$ and $g = 10m/s^{2}$ then the power of heat in watt is :

A. 1.5

B. 1.7

C. 2.35

D. 3

Answer:

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394. A car of mass m starta from rest and accelerates so that the instyantaneous power delivered to the car has a constant magnitude P_0. The instaneous velocity of this car is proportional to

A. $t^2 P_0$

B. $t^{\frac{1}{2}}$

C. $t^{-\frac{1}{2}}$

D. $\frac{t}{\sqrt{m}}$

Answer:

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395. A partical of mass m is driven by a machine that deleveres a constant power k watts. If the partical starts from rest the force on the partical at time t is

A. $\sqrt{mk}t^{-\frac{1}{2}}$

B. $\sqrt{2mk}t^{-\frac{1}{2}}$

C. $\frac{1}{2}\sqrt{mk}t^{-\frac{1}{2}}$

D. $\frac{\sqrt{mk}}{2}t^{-\frac{1}{2}}$

Answer:

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396. Water falls from a height of $60m$ at the rate $15kg/s$ to operate a turbine. The losses due to frictional forces are 10% of energy . How much power is generated to by the turbine? (g=10 m//s^(2))`.

A. 8.1 kW

B. 10.2 kW

C. 12.3 kW

D. 7.0 kW

Answer:

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397. The power of a water pump is 2 kW. If $g = 10m/s^2$, the amount of water it can raise in 1 min to a height of 10 m is :

A. 1000 litres

B. 1200 litres

C. 10 litres

D. 2000 litres

Answer:

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398. 250 N force is required to raise 75 kg mass from a pulley. If rope is pulled 12 m then the load is lifted to 3m, the efficiency of pulley system will be : -

A. 25 %

B. 33.3 %

C. 0.75

D. 0.9

Answer:

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399. A shell in its flight, explodes into four unequal parts. Which of the following is conserved?

A. Potential energy

B. Momentum

C. Kinetic energy

D. both and are correct

Answer:

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400. A body of mass m moving with velocity $3km/h$ collides with a body of mass 2m at rest. Now, the coalesced mass starts to move with a velocity

A. 3 km/hour

B. 4 km/hour

C. 1 km/hour

D. 2 km/hour

Answer:

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401. A metal ball of mass $2kg$ moving with speed of $36Km/h$ has a collision with a stationary ball of mass $3kg$. If after collision, both the ball move together, the loss in Kinetic energy due to collision is :

A. 100 J

B. 140 J

C. 40 J

D. 60 J

Answer:

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402. Two identical balls A and B collide head on elastically. If velocities of A and B, before the collision are $+0.5\frac{m}{s}$ and $-0.3\frac{m}{s}$ respectively, then their velocities, after the collision, are respectively

A. -0.5 m/s and +0.3 m/s

B. +0.5 m/s and +0.3 m/s

C. +0.3 m/s and -0.5 m/s

D. -0.3 m/s and +0.5 m/s

Answer:

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403. The coefficient of restitution e for a perfectly elastic collision is

A. 1

B. 0

C. ∞

D. -125 J

Answer:

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404. A ball moving with velocity $2ms^{-1}$ collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in ms^{-1}) after collision will be

A. 0,1

B. 44197

C. 1, 0.5

D. 0, 2

Answer:

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405. Two particles A and B, move with constant velocities $\overrightarrow{v_1}$ and $\overrightarrow{v_2}$. At the initial moment their position vectors are $\overrightarrow{r_1}$ and $\overrightarrow{r_2}$ respectively. The condition for particle A and B for their collision is

A. $\overrightarrow{r}_1 - \overrightarrow{r}_2 = \overrightarrow{v}_1 - \overrightarrow{v}_2$

B. (oversetrightarrowr_1-oversetrightarrowr_2=oversetrightarrowv_2-oversetrightarrowv_1)/(|oversetrightarrowr_1-oversetrightarrowr_2=oversetrightarrowv_2-oversetrightarrowv_2|)`

C. $\overrightarrow{r}_1 . \overrightarrow{v}_1 = \overrightarrow{r}_2 . \overrightarrow{v}_2$

D. $\overrightarrow{r}_1 \times \overrightarrow{v}_1 = \overrightarrow{r}_2 \times \overrightarrow{v}_2$

Answer:

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406. Two sphere A and B of masses m_1 and m_2 respectivelly colides. A is at rest initally and B is moving with velocity v along x-axis. After collision B has a velocity $\frac{v}{2}$ in a direction perpendicular to the original direction. The mass A moves after collision in the direction.

A. same as that of B

B. opposite to that of B

C. $\theta = \tan^{-1}\left(\frac{1}{2}\right)$ to the x-axis

D. $\theta = \tan^{-1}\left(-\frac{1}{2}\right)$ to the x-axis

Answer:

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407. On a friction surface a block a mass M moving at speed v collides elastic with another block of same mass M which is initially at rest . After collision the first block moves at an angle θ to its initial direction and has a speed $\frac{v}{3}$. The second block's speed after the collision is

A. $\frac{\sqrt{3}}{2}v$

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

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

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

Answer:

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408. Two particles of masses m_1, m_2 move with initial velocities u_1 and u_2. On collision, one of the particles get excited to higher level, after absording enegry. If final velocities of particles be v_1 and v_2 then we must have

A. $\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 - \varepsilon$

B. $\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 - \varepsilon = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$

C. $\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 + \varepsilon = \frac{1}{2}m_1^2v_1^2 + \frac{1}{2}m_2^2v_2^2$

D. $m_1^2u_1 + m_2^2u_2 - \varepsilon = m_1^2v_1 + m_2^2v_2$

Answer:

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409. Consider a drop of rain water having mass 1 g falling from a height of $1km$. It hits the ground with a speed of $50m/s$ Take g constant with a volume $10m/s^2$. The work done by the

(i) gravitational force and the

(ii) resistive force of air is :

A. (i) -10 J (ii) -8.25 J

B. (i) 1.25 J (ii) -8.25 J

C. (i) 100 J (ii) 8.75 J

D. (i) 10 J (ii) -8.75 J

Answer:

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410. A body of mass 1 kg begins to move under the action of a time dependent force $F = \left(2t\hat{i} + 3t^2\hat{j}\right)N$, where $\hat{i}$ and $\hat{j}$ are unit vector along x and y axis. What power will be developed by the force at the time?

A. $\left(2t^2 + 3t^2\right)W$

B. $\left(2t^2 + 4t^4\right)W$

C. $\left(2t^3 + 3t^4\right)W$

D. $\left(2t^3 + 3t^5\right)W$

Answer:

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411. A particle moves From a point $\left(-2\hat{i} + 5\hat{j}\right)$ to $\left(4\hat{j} + 3\hat{k}\right)$ When a force of $\left(4\hat{i} + 3\hat{j}\right)$ N is applied . How much work has been done by the force ?

A. 5J

B. 2 J

C. 8 J

D. 11 J

Answer:

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412. A bullet of mass 10 g moving horizontally with a velocity of $400ms^{-1}$ strikes a wooden block of mass 2kg which is suspended by a light inextensible string of length 5 m. As a result, the centre of gravity of the block is found to rise a vertical distance of 10 cm. The speed of the bullet after it emerges out horizontally from the block will be

A. $120ms^{-1}$

B. $160ms^{-1}$

C. $100ms^{-1}$

D. $80ms^{-1}$

Answer:

Watch Video Solution

413. Two identiacal balls A and B having velocities of 0.5 m/s and $0.3 \quad \mathrm{m}/\mathrm{s}$ respectively collide elastically in one dimension. The velocities of B and A after the collision respectively will be

A. -0.3 m/s and 0.5 m/s

B. 0.3 m/s and 0.5 m/s

C. -0.5 m/s and 0.3 m/s

D. 0.5 m/s and - 0.3 m/s

Answer:

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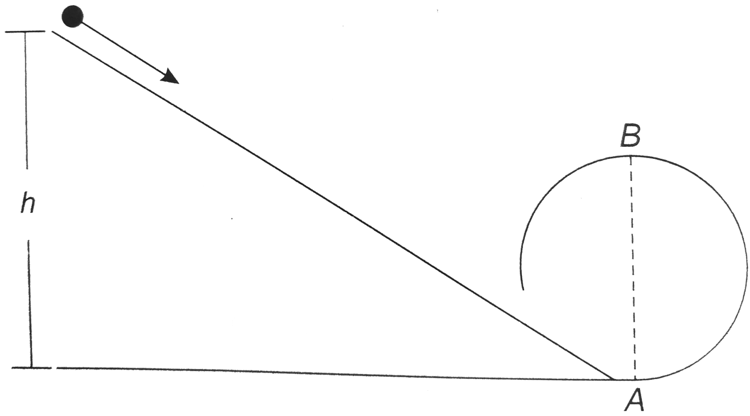
414. A body initially rest and sliding along a frictionless trick from a height h (as shown in the figure) just completes a vertical circle of diameter $AB = D$. The height h is equal to



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

B. $\frac{5}{4}D$

C. 7/5D`

D. D

Answer:

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415. A moving block having mass m, collides with another stationary block having mass 4m. The lighter block comes to rest after collision. When the initial velocity of the lighter block is v, then the values of coefficient of restitution (e) will be

A. 0.25

B. 0.4

C. 0.5

D. 0.5

Answer:

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