PHYSICS

BOOKS - KUMAR PRAKASHAN KENDRA PHYSICS (GUJRATI ENGLISH)

WORK, ENERGY AND POWER

Section A Questions Answers Introduction

1. Explain with illustration meaning of work , energy and power in everyday life and state that this meaning in physics

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2. Explain the kinds of multiplication operations for vectors .

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3. Explain the geometrical interpretation of scalar product of two vectors .

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4. Show that the scalar product of two vectors obeys the law of commutative .

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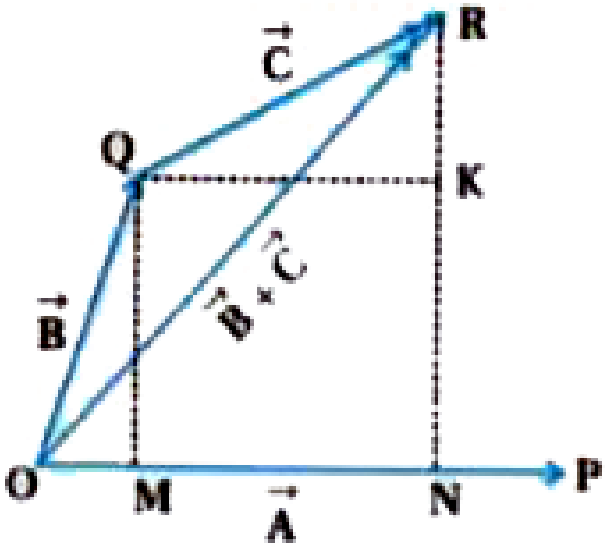
5. Show that the scalar product of two vectors obeys the law of disrtrictive



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6. Show that the magnitude of a vector is equal to the square root of the scalar product of the vector with itself .

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7. Obtain the scalar product of two mutually perpendicular vectors .

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8. Obtain the scalar product of unit vectors in Cartesian co - ordinate system .

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9. Obtain scalar product in terms of Cartesian component of vectors .

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10. Find the angle between two vectors with the help of scalar product .

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11. What is kinetic energy ? Derive an expression for the kinetic energy of a body of mass 'm' moving at a speed 'v'. (AS_1)

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12. Explain work energy theorem .

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13. Explain work done by a constant force .

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14. When is the work done by a force is positive and negative ?

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15. When is the work done on the body said to be zero ?

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16. Mention the MKS and GGS unit of work and define them and also write the dimensional formula of work .

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17. Define kinetic energy .Give its unit and dimensional formula and mention works by using it .

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18. Obtain the equation of work by variable force in one dimension .

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19. Derive the work energy theorem for a variable force exerted on a body in one dimension .

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20. State the importance of work energy theorem .

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21. Mention the cause of earthquake .

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22. What is potential energy ? Explain gravitational potential energy .

Watch Video Solution

23. What are conservative force , non - conservative force , conservative field and non - conservative field ?

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24. Obtain the relation between potential energy and force for conservative force .

Watch Video Solution

25. Prove $F = -\frac{dV}{dx}$ for conservative force .

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26. State and establish principle of conservation of mechanical energy .

Watch Video Solution

27. Write a principle of non - conservative force for mechanical energy .

Watch Video Solution

28. Give the definitions of conservative force .

Watch Video Solution

29. Explain the conservative of mechanical energy for a free fall body .

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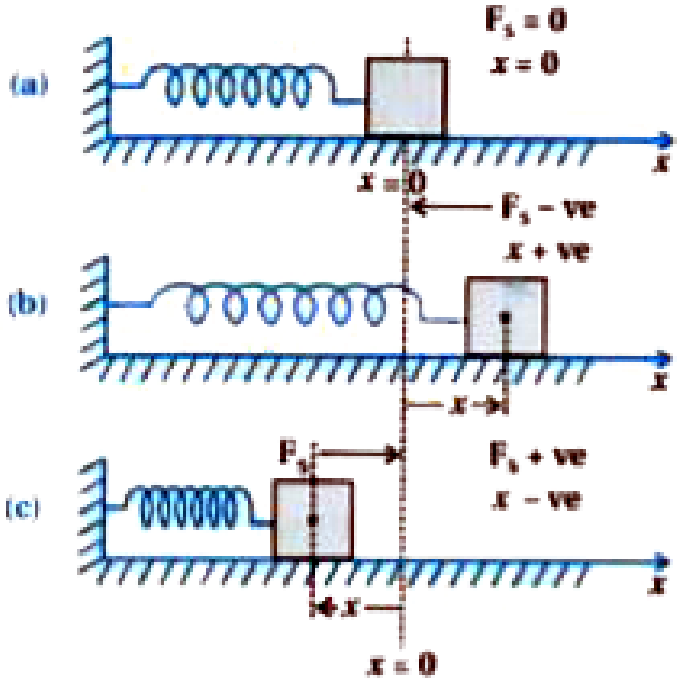
30. Explain the elastic potential energy of spring and obtain an expression for this energy .



(a)

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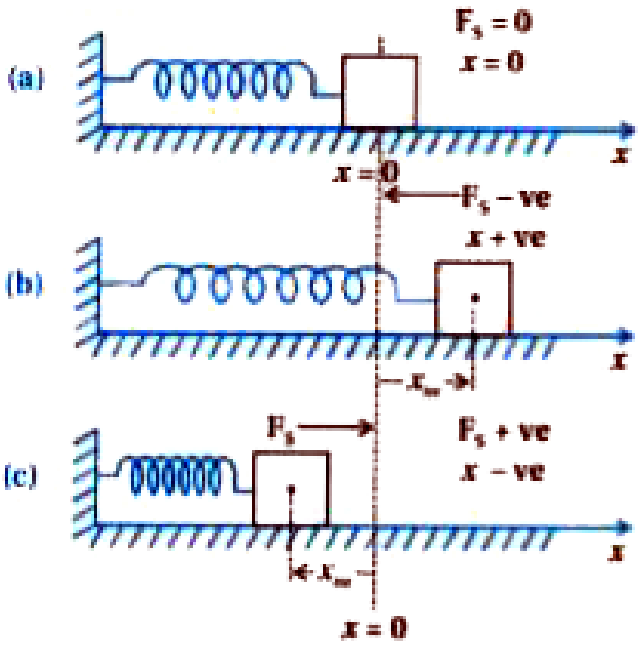
31. Show that the law of conservation of mechanical energy is obeyed by pulling or compressing the block tied at the end of a

spring



(a)

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32. Draw a plots of mechanical energy , potential energy and kinetic versus dispalcement for different position of a motion of block attached to a spring .

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33. Write few remarks on censervative forces .

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34. Explain the different forms of energy .

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35. Write a note on Power .

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36. Explain the total linear momentum is conserved in an elastic collision and also explain the inelastic collision and completely elastic collision .

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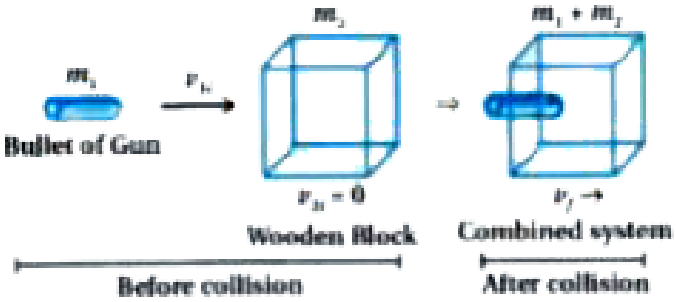
37. Discuss the completely inelastic collision in one dimension .



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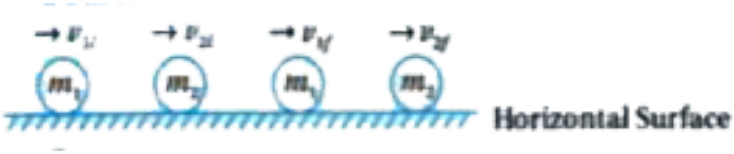
38. Obtain expression for velocities of the two bodies after elastic collision in one dimension .



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39. Explain the special caes of elastic collision in one dimension .

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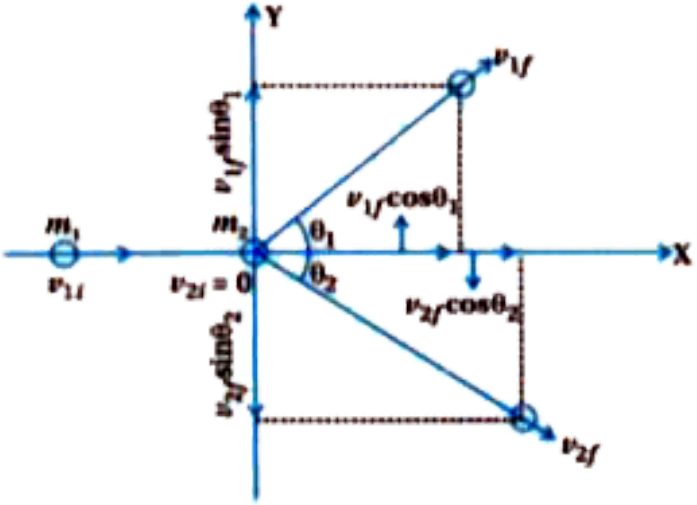
40. Discuss elastic collision in two dimesnsion .



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41. Explain oblique collision .

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42. What is head -on collision ?

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Section A Questions Answers Try Yourself Vsqs

1. Define the scalar product of two vectors .

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2. Mention the direction of scalar product .

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3. Define the scalar product and obtain the magnitude of a vector from it .

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4. Obtain the commutative law of scalar product for two vectors .

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5. Write the necessary condition for the scalar product of two mutually perpendicular vectors .

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6. Define work

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7. Define kinetic energy .Give its unit and dimensional formula and mention works by using it .

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8. If the kinetic energy of body increases them ?

Watch Video Solution

9. If the kinetic energy of body increases then?

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10. Work done on the body by force or work done by the body ?

Watch Video Solution

11. Define work

Watch Video Solution

12. What is the work done by earth's gravitational force in keeping the moon uniformly circulating around the earth ?

Watch Video Solution

13. Is the work done by a frictional froce be positive or negative ?

Watch Video Solution

14. How many erg equal to : Joule ?

Watch Video Solution

15. How many Joule equal to 1 eV ?

Watch Video Solution

16. How many Joule equal to 1 kWh ?

Watch Video Solution

17. Define kinetic energy .Give its unit and dimensional formula and mention works by using it .

Watch Video Solution

18. Define kinetic energy .Give its unit and dimensional formula and mention works by using it .

Watch Video Solution

19. Is kinetic energy a scalar quantity or vector quantity ?

Watch Video Solution

20. If the displacement is done by the force then when does the force is consider as constant ?

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21. What is variable force ?

Watch Video Solution

22. Obtain the equation of work by variable force in one dimension .

Watch Video Solution

23. What will be the area under the graph of variable force versus position ?

Watch Video Solution

24. Define kinetic energy

Watch Video Solution

25. Define kinetic energy .Give its unit and dimensional formula and mention works by using it .

Watch Video Solution

26. Is kinetic energy a scalar quantity or vector quantity ?

Watch Video Solution

27. Show that the rate of change of kinetic energy is a power .

Watch Video Solution

28. Whether the work energy theorem is a scalar or a vector ?

Watch Video Solution

29. If the kinetic energy of body increases them ?

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30. What are conservative force , non - conservative force , conservative field and non - conservative field ?

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31. Which quantity is obtained by taking negative detective of potential energy w.r.t to displacement in the case of conservative

force ?

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32. What is potential energy ? Explain gravitational potential energy .

Watch Video Solution

33. What is potential energy ? Explain gravitational potential energy .

Watch Video Solution

34. Write the dimensional formula of gravitational potential energy .

Watch Video Solution

35. What are conservative force , non - conservative force , conservative field and non - conservative field ?

Watch Video Solution

36. State and establish principle of conservation of mechanical energy .

Watch Video Solution

37. Write a principle of non - conservative force for mechanical energy .

Watch Video Solution

38. Write the equation of total mechanical energy of a body having mass m and stationary at height H .

Watch Video Solution

39. Write the equation of total mechanical energy of a body having mass m and stationary at height H .

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40. Find the speed of a body at the ground when it fall freely at height 2m . $\left(g = 10ms^{-2}\right)$

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41. What is variable force ?

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42. Write the formula of Hock's law .

Watch Video Solution

43. What is spring constant ?

Watch Video Solution

44. On which the work done by a spring depends ?

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45. Mention the work done by spring force in cylic process .

Watch Video Solution

46. Whether the springforce is conservative or non- conservative ?

Watch Video Solution

47. Write the dimensional formula of $\frac{k}{m}$.

Watch Video Solution

48. What is spring constant ?

Watch Video Solution

49. How much energy will be released by cooling 1 kg of water upto temperature of 10° C ?

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50. By what reasons chemical energy produced in chemical process ?

Watch Video Solution

51. What is exothermic reaction ?

Watch Video Solution

52. What is exothermic reaction ?

Watch Video Solution

53. How much energy producedin burning of 1 kg coal ?

Watch Video Solution

54. How much electric energy consumed by Indian house hold in one second ?

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55. Write the equation of mass energy equivalence .

Watch Video Solution

56. What is the energy equivalent to one kilogram .

Watch Video Solution

57. By which process the energy released from sun ?

Watch Video Solution

58. Mention the use of uncontrolled nuclear fission ?

Watch Video Solution

59. Mention the use of uncontrolled nuclear fission ?

Watch Video Solution

60. Whether the springforce is conservative or non- conservative ?

Watch Video Solution

61. Write the law of conservation of energy for conservative forces ?

Watch Video Solution

62. Whether a split of water is a exothermic or a endothermic process ?

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63. Write the similarity between various forms of energy .

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64. Write a note on Power .

Watch Video Solution

65. Is power a vector or scalar quantity ?

Watch Video Solution

66. Write the dimensional formula of power .

Watch Video Solution

67. Mention the unit of power in British unit system .

Watch Video Solution

68. Define kilowat hour

Watch Video Solution

69. "1 kWh is a unit of power " . This statement is true or false ? If it is wrong then correct it .

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70. 1 unit = ... electric energy .

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71. How many units are consumed if 100 W of electric bulb is kept ON for 10 hours ?

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72. Define elastic collision.

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73. Define inelastic collision.

Watch Video Solution

74. What is head -on collision ?

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Section B Numericals Numerical From Textual Illustration

1. Find the angle between force $\vec{F} = \left(3\hat{i} + 4\hat{j} - 5\hat{k}\right)$ unit and displacement $\vec{d} = \left(5\hat{i} + 4\hat{j} + 3\hat{k}\right)$ unit , Also find the projection of F on d .

Watch Video Solution

2. It is well known that a raindrop 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 1.00 g falling from a hwight 1.00 km .It hits the ground with a speed of

$50.0ms^{-1}$ (a) What is the work done gravitational force ? (b) What is the work done by the unknown resistive force ?

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3. A cyclist comes to a skidding stop in 10 m . During this process , the force on the cycle due to the road is 200 N and is directly opposed to the motion . (a) How much work does the road do on the cycle ? (b) How much work does the cycle do on road ?

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

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

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6. A block of mass m = 1 kg , moving on a horizontal surface with speed $v_i = 2ms^{-1}$ enters a rough patch ranging from $v_i = 2ms^{-1}$ enters a rough patch ranging from $x = 0.10$ m to

$x = 2.01$ m The retarding force F_r on the block in this rangeis inversely proportional to x over this range ,

$F_r = \frac{-k}{x}$ for $0.1 < x < 2.01m = 0$ for $x < 0.1m$ and $x > 2.01$

where k 0.5 J .What is the final kinetic energy and speed v_f of the block as it crosses this patch ?

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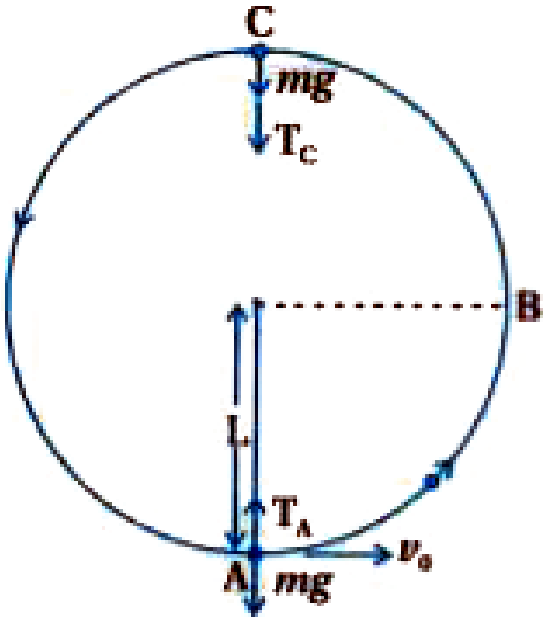
7. A bob of mass m is suspeded by a light string of length L . It is imparted a horizontal velocity v_0 at the lowest point A such that it completes a semicircular trajectroy in the vertical plane with the string becoming slack only on reaching the topmost point C . Thisis shown in figure .Obtain a expression for (i) v_0 (ii) the ratio of the kinetic energies $\left(\frac{K_B}{K_C}\right)$ at B and C . Comment on the

nature of the trajectroy of the bob after it reaches the point C .



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8. To simulate car accidents , auto manufactures study the collisions of moving cars with mounted springs of different spring constants. Consider a typical simulation with a car of mass 1000 kg moving with a speed 18.0 km/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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9. Consider Example 6.8 taking the coefficient of friction , μ to be and calculate the maximum compression of the spring .

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10. Examine Tables 61. -6.3 and express (a) the energy required to break one bond in DNA in eV, (b) The kinetic energy of an air molecule $\left(10^{-21} J\right)$ in eV , (c) The daily intake of a human adult in kilocalories .

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11. An elevator can carry a maximum load of 1800 kg (elevator +passengers) is moving up with a constant speed of $2ms^{-1}$ .The frictional force opposing the motion is 4000 N . Determine the minimum power delivered by the motor to the elevator in watss as well as in horse power .

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12. In a nuclear reactor a neutron of high speed (typically $10^7 ms^{-1}$) must be slowed to of interacting with isotope $._{92}^{235}U$ and causing it to fission . Show that a neutron can lose most of its kinetic energy in an elastic collision with a light nuclei like deuterium or carbon which has a mass of only a few times the neutron mass . the material making up the light nuclei , usually heavy water (D_2O) or graphite is called a moderator .

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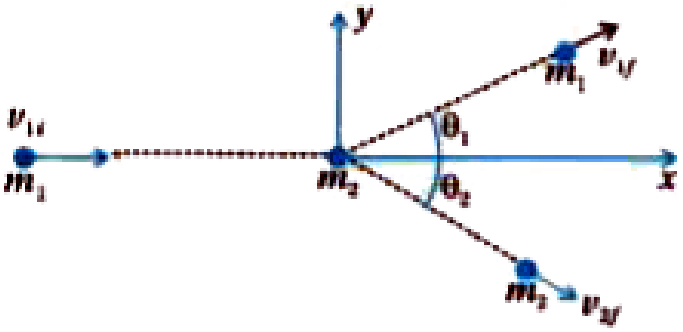
13. Consider the collision depicted in figure to be between two billiard balls are equal masses $m_1 = m_2$. The first ball is called the cue while the second ball is called the target . The billiard player wants to 'sink ' the target ball in a corner pocket , which is at angle $\theta_2 = 37^\circ$ .Assume that the collision is elastic and that friction and rotational motion are not important . Obtain θ_1 .



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14. Find the angle between $\vec{P} = -2\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{Q} = \hat{i} + 2\hat{j} - 4\hat{k}$

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15. If the angle between $\vec{A} = 2\hat{i} + 4\hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} + \hat{k}$ is 30°, then find the projection of $\vec{B}$ on A.

Watch Video Solution

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$F_r = \frac{-k}{x}$ for $0.1 < x < 2.01m = 0$ for $x < 0.1m$ and $x > 2.01$

where k 0.5 J .What is the final kinetic energy and speed v_f of the block as it crosses this patch ?

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21. To stimulate car accident , auto manufacturers study the collision of moving car with mounted springs of different spring constants . Consider a typical stimulation with a car of mass 800 kg moving with a speed 36.0 km/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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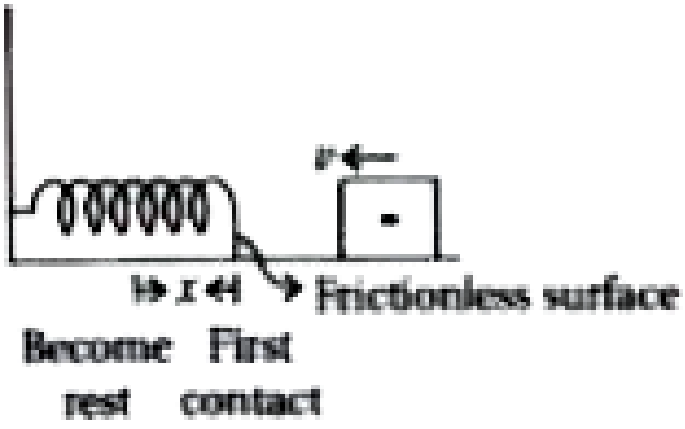
22. As shown in fig. a block of mass m = 0.40 kg is moving on a frictionless surface at a speed of v = $0.50 m/s$ .A block of force constant k = 750 N /m comprised the spring and becomes rest for a instant . How much spring will be compressed ?



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23. A spring of spring constant 500 N/m is attached on a rough surface at one side . Coefficient of friction for rough surface is 0.75. A block of mass 100 kg collide with the free end of spring at

a speed of $10\sqrt{2}ms^{-1}$, then how much will spring be compressed ? $\left(g = 10ms^{-2}\right)$

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24. Express incident average solar energy of 5×10^{24} J on earth in eV .

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25. Work done by one heartbeat of human is 0.5 J , then express it in eV .

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26. Energy released by th explosion of supernova is 10^{44} J , then express it in electron volt unit .

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27. The elevator can carry a maximum load of 2800 kg (elevator +passengers) is moving up with a constant speed of $2ms^{-1}$. The frictional force opposing the motion is 5000 N .Determine the minimum power delivered by the motor to the elevator in watts as well as in horse power .

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28. A railway coach of mass 8000 kg moving with speed of $54ms^{-1}$ collide with rest coach of same like . Find the decrease in kinetic energy in this process.

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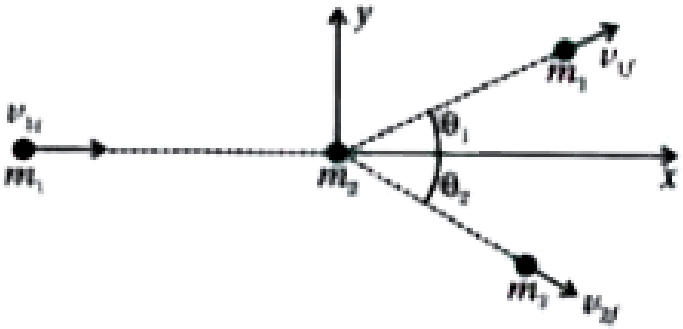
29. Consider the collision depicted in gif . To be between two billiard balls with equal masses second ball is called the target .The billiard player wants to 'sink' the target ball in corner pocket , what is at an angle $\theta_2 = 32^\circ$



Assume that collision is elastic and that friction and rotational motion are not important Obtain θ_1.

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Section B Numericals Numerical From Textual Exercise

1. The sign of work done by a force on a body is important to understand .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 gravitational force in the above case ,

(c) work done by friction on a body siding down an inclined plane ,

(d) workdone by an applied force on a body moving on a rough horizontal plane woth uniform velocity .

(d) work done by the resistive force of air on a vibrating pendulum in bringing it to rest .

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

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

(b) work done by friction in 10 s .

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

(d) Change in kinetic energy of the body in 10 s and interpret your details .

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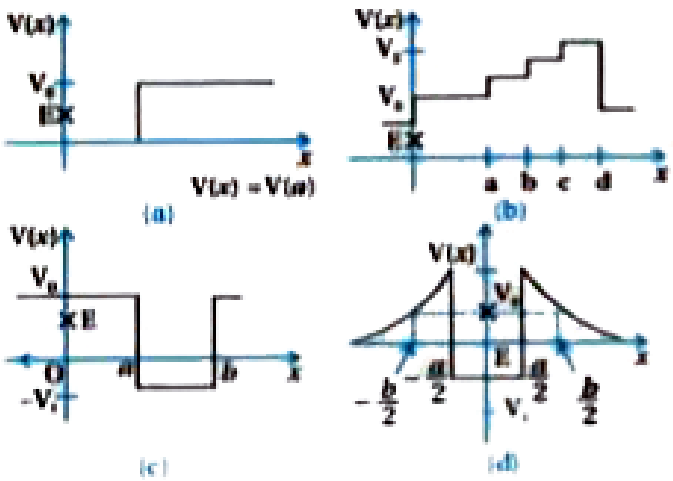
3. Given in figure are examples of some potential energy functions in one dimension. The total energy of the aprticle is indicated by a cross on the ordinate axis . In each case , specify the regions ,if any , in which the particle cannot be found for the given energy .Also , indicate the minimum total energy the

particle must have in each case . Think of simple physical contexts for which these potential energy shapes are relvant .



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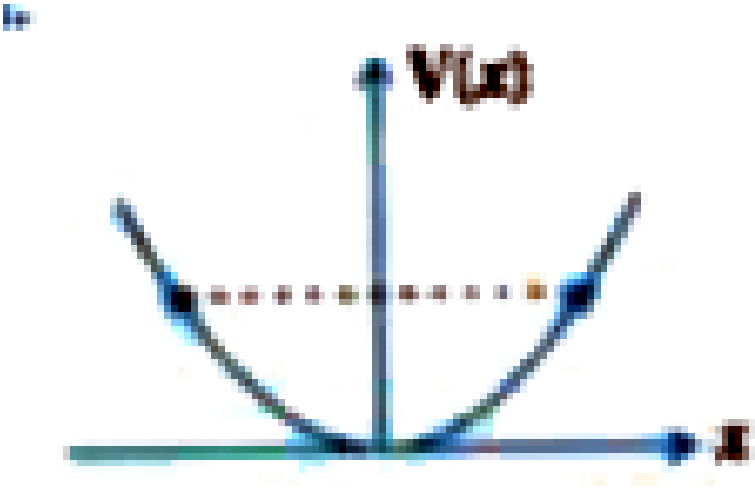
4. The potential energy function for a particle executing linear simple harmonic motion is given by $V(x) = \frac{kx^2}{2}$ where k is the force constant of the oscillator . For $k = 0.5\mathrm{Nm}^{-1}$, the graph of V(x) versus x is shown in figure . Show that a particle of total energy 1 J movng under this potential must 'turn back ' when it

reaches $x = \pm 2m$.



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5. The spring of a rocket in flight burns up due to friction .At whose expense is the heat energy required for burning obtained ? The rocket or the atmosphere ?

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6. Comets move around the sun in highly elliptical orbits . The gravitational force on the comet due to the sun is not normal to the comet's velocity in general. yet the work done by the gravitational force over energy complete orbit of the comet is zero . Why ?

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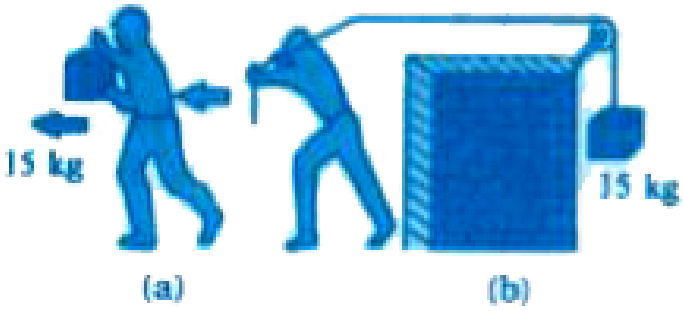
7. An artificial satellite orbiting the earth in very thin atmosphere loses its energy gradually due to dissipation against atmospheric resistance , however small .Why then does its speed increase progressively as it comes closer and closer the earth ?



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8. In figure (i) the man walks 2 m carrying a mass of 15 kg on his hands .In figure (ii) , he walks the same distance pulling the rope behind him . The rope goes over a pulley , and a mass of 15 kg hangs at its other end . In which case is the work done greater ?

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9. When a conservative force does positive work on a body , the potential energy of the body increases /decreases/ remains unaltered .

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

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11. 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 .

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12. 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 energy of the system of two bodies.

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

Watch Video Solution

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

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

Watch Video Solution

16. In an elastic collision , the final kinetic energy is always less than the initial kinetic energy of the system .

Watch Video Solution

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

Watch Video Solution

18. Explain the total linear momentum is conserved in an elastic collision and also explain the inelastic collision and completely elastic collision .

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19. Practically, if 10kJ of energy is supplied to a device, how much energy will the device give back?

A. Equal to10kJ

B. Less than 10kJ

C. More than 10kJ

D. Zero

Answer:

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20. If the potential energy of two billiard balls depends only on the separation distance between their centres , 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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21. 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

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

B. t

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

D. t^2

Answer: B

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22. A body is moving indirectionally under the influence of a source of constant power . Its displacement in time t is proportional to

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

B. t

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

D. t^2

Answer: C

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23. A body constrained to move along the z -axis of a coordinate system is subject to a constant force F given by $\overrightarrow{F} = \left(-\hat{i} + 2\hat{j} + 3\hat{k} \right) N$ 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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24. 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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25. A rain drop of radius 2 mm falls from a height of 500 m above the ground .It falls with decreasing acceleration (due to viscous

resistance of the air) until at half its original height , it attains its maximum (terminal) speed, and moves with uniform speed thereafter .What is the work done by the gravitational force on the drop in the first and second half of its journey ?What is the work done by the resistive force in the entire journey if its speed on reaching the ground is $1ms^{-1}$?

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26. A molecule in a gas container hits a horizontal wall with speed $200ms^{-1}$ and angle 30° with the normal , and rebounds with the same speed . Is momentum conserved in the collision ? Is the collision elastic or inelastic ?

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27. A pump on the ground floor of a building can pump up water tofill a tank of volume $30m^3$ in 15 min . If the tank is 40 m above the ground , and the efficiency of the pump is 30% how much electric power is consumed by the pump?

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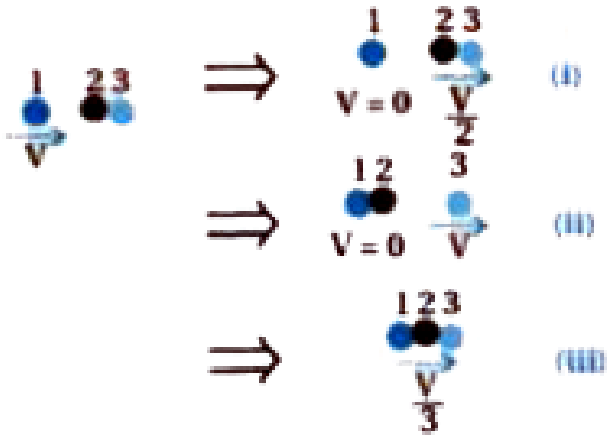
28. Two identical ball bearings in contact with each other and resting on a frictionless table are hit head - on by another ball bearing of the same mass moving initially with a speed V. If the collision is elastic , which of the following fgures is a possible

result after collision ?



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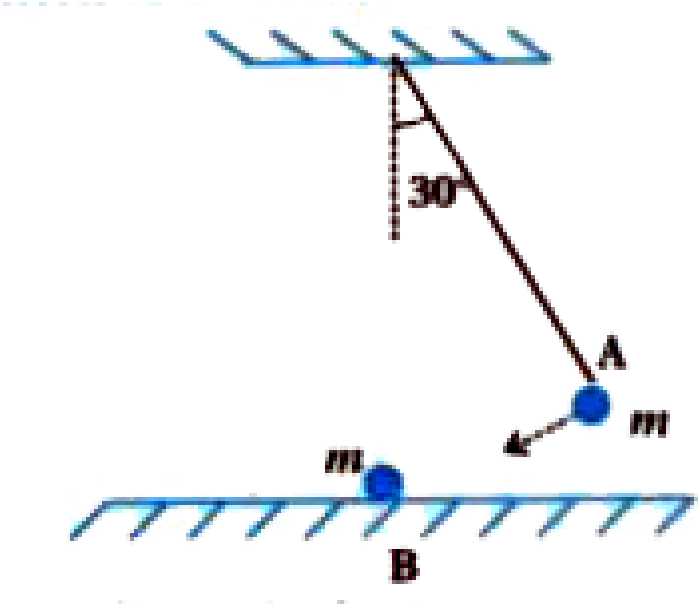
29. The bob A of a pendulum released from 30° to the vertical hits another bob B of the same mass at rest on a table as shown in figure . How high does the bob A rise after the collision ? Neglect the size of the bobs and assume the collision to be

elastic .



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30. The bob of pendulum is released from a horizontal position . If the length of the pendulum is $1.5m$,what is the speed with which the bob arrives at the speed with which the bob arrives at the lowermost point , given that it dissipated 5 % of its intial energy against air resistance ?

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31. A trolley of mass 30 kg carrying a sandbag of 25 kg is moving uniformly with a speed of 27 km/h on a frictionless track . After a while , sand starts leaking out of hole on the floor of the trolley of the rate of $0.05 \ \mathrm{kg\,s^{-1}}$ .What is the speeed of the trolley after the entire sand bad is empty ?

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

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33. 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 it 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 = 30 m^2 , v = 36 km/h and the density of air is $1.2m^2$ v = 36 km/h and the density of air is 1.2 kg m^{-3} .What is the electrical power produced ?

Watch Video Solution

34. A person trying to lose weight (dieter) lifts a 10 kg mass , one thousand times , to a height of 0.5 m each time .Assume that the potential energy lost each time she lowers the mass is dissipated . (a) How much work does she do against the gravitational force ? (b) Fat supplies 3.8×10^7 J of energy per kilogram which is

converted to mechanical energy with a 20 % efficiency rate . How much fat will the dieter use up ?

Watch Video Solution

35. A family uses 8 kW of power.

Direct solar energy is incident on the horizontal surface at an average rate of 200 W per square meter. If 20% of this energy can be converted to useful electrical energy, how large an area is needed to supply 8 kW?

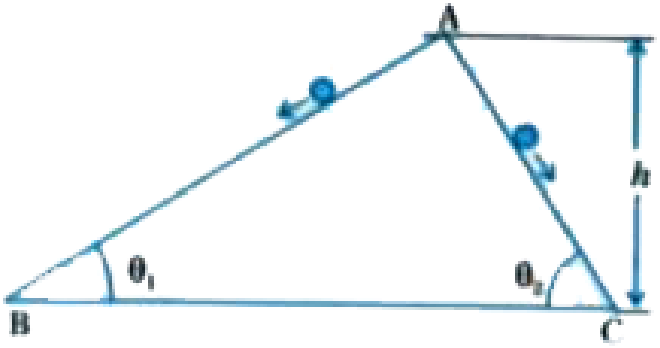
Watch Video Solution

36. A bullet of mass $0.012kg$ and horizontal speed $70ms^{-1}$ strikes a block of wood of mass $0.4kg$ and instantly comes to rest with respect to the block. The block is suspended from the ceiling

by means of thin wires. Calculate the height to which the block rises. Also, estimate the amount of heat produced in the block.

Watch Video Solution

37. Two inclined frictionless tracks , one gradual and the other steep meet at A from where two stones are allowed to slide down from rest , one on each track as shown in figure . Will the stones reach there with the same speed ? Explain . Given $\theta_1 = 30^\circ, \theta_2 = 60^\circ$ and $h = 10m$ What are the speeds and times taken by the two stones ?



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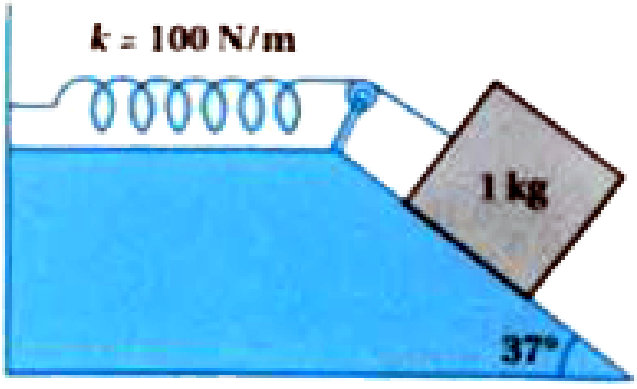
38. A 1 kg block situated on a rough incline is connected to a spring constant $100Nm^{-1}$ as shown in figure . The block is released from rest with the spring in the unstretched position . The block moves 10 cm down the incline before coming to rest . Find the coefficient of friction between the block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



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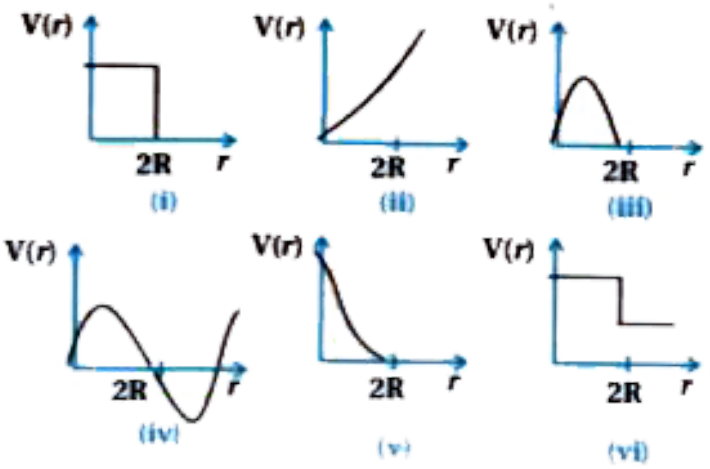
39. A bolt of mass $0.3kg$ falls from the ceiling of an elevator moving down with an uniform speed of $7ms^{-1}$. It hits the floor of the elevator (length of the elevator = 3m) and does not rebound. What is the heat produced by the impact? Would your answer be different if the elevator were stationary?

Watch Video Solution

40. A trolley of mass 200 kg moves with a uniform speed of 36 km/h on a frictionless track. A child of mass 20 kg runs on the trolley from one end to the other (10 m away) with a speed of $4ms^{-1}$ relative to the trolley in a direction opposite to the its motion, and jumps out of the trolley. What is the final speed of the trolley? How much has the trolley moved from the time the child begins to run?

Watch Video Solution

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



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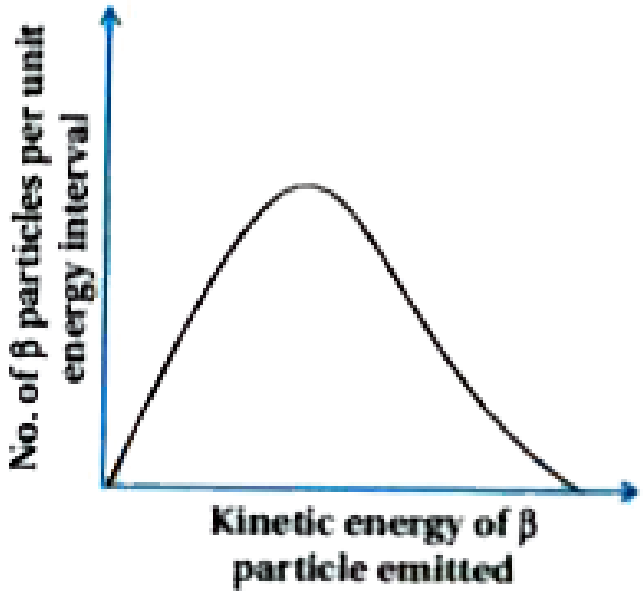
42. Consider the decay of a free neutron at rest :

$n \rightarrow p + e^{-}$

Show that the two body decay of this type must necessary give

an electron of fixed energy and therefore cannot account distribution in the $\beta -$ decay of a neutron or a nucleous as shown in figure .



[Note : The simple result of this exercise was one among the several arguments advanced by W . Pauli to perdict the existence of a third particle in the decay products of $\beta -$ decay . This particle is known as neutrino spin $\frac{1}{2}$ (like e^- p or n) but is neutral ad either massless or having an extremely small mass (compared to the mass of electron) and which interacts very

weakly with matter . The correct decay process of neutron is :

$n \rightarrow p + e(-) + v)$

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Section B Numericals Numerical From Darpan Based On Textbook

1. A body while being acted upon by a force $\vec{F}(x) = (3x^2 - 2x + 7)\hat{i}$ N gets displaced from x = 0 to x = 10 m in the direction of X -axis .Find the work done $\left[\int x^n dx = \frac{x^{n+1}}{n+1}\right]$

Watch Video Solution

2. A body of mass 2 kg is rest on a smooth horizontal surface . When a horizontal force of 0.5 N acts on this bofy it is displaced

in the direction of the force . Find the work done by the force in 8.0 s .Show that this work is equal to the change in kinetic energy of the body .

Watch Video Solution

3. A block of mass 1 kg falls freely on a spring form a height of 20 cm as shown in figure . Find the compression in the spring if its

force constant is 10^3 N/m . (Take $g = 10.0 m / s^2$)

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4. A particle of mass m moves on a circular path of radius r . Its centripetal acceleration is kt^2 , where k is a constant and t is time

. Express power as function of t .

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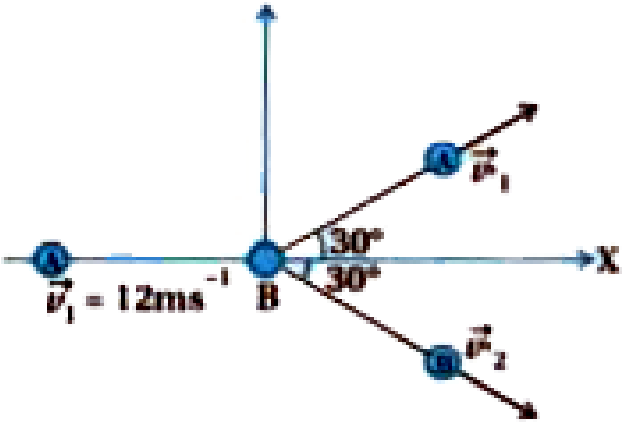
5. A ball moving with a velocity of $12ms^{-1}$ collides with another identical stationary ball . After the collision they move as shown in figure . Find the speed of the balls after the collision . Also , decide whether the condition is elastic or not .



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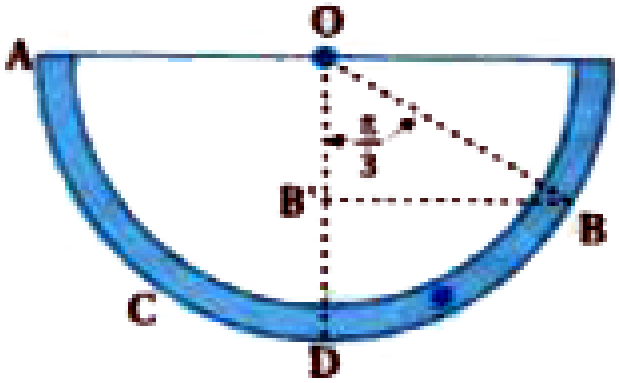
6. A tube is fixed in a vertical plane as shown in figure .Form point A a sphere of mass 0.314 kg is released .During its motion in the tube it faces a constant resistive force R . At B its velocity becomes zero . Calculate (i) the constant resistive force R and (if) work done by resistive force (average radisu of semicircular path is 1 m) .



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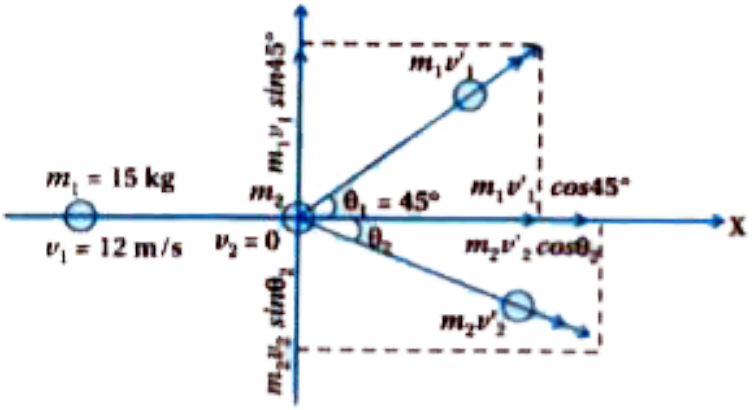
7. A sphere of steel of mass 1 kg moving with a velocity of 12m/s ,along X-axis collides elastically with a stationary sphere after the

collision is 8 m/s and is moving at an angle of 45° with X -axis , find the magnitude and direction of the second sphere after the collision .



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8. The relation between position and time f for a particle , performing one dimensional motion is as under : $t = \sqrt{x} + 3$

Here x is in metre and t is in second .

(1) Find the displacement of the particle when its velocity becomes zero .

(2) If a constant force acts on the particle , find the work done in first 6 second .

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9. A spring of force constant k is kept in the compressesd condition between two blocks masses m and M on the smooth surface of a table as shown in figure .When the spring is released , both the blocks move in opposite directions .When the spring attains the orginal (normal) position . both blocks lose the constacts with the spring . If x is the intial compression of the spring find the speeds of block while getting detached from the spring .

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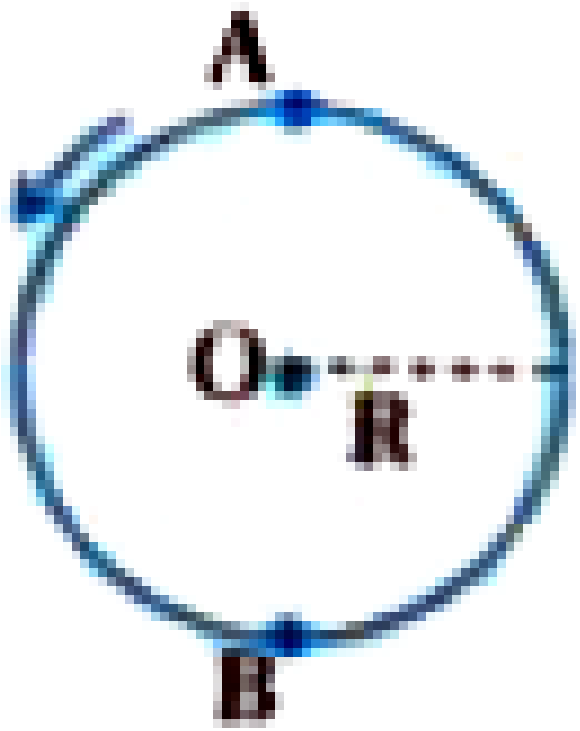
10. Two beads of masses m_1 and m_2 are closed threaded on a smooth circular loop of wire of radius R. Intially both the beads are in position A and B in vertical plane .

Now , the bead A is pushed slightly so that it slide on the wire and collides with B . if B rises to the height of the centre , the centre of the loop O on the wire and becomes stationary after

the collision , prove $m_1 : m_2 = 1 : \sqrt{2}$



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11. A bullet is fired into a huge wooden block . The bullet while moving inside the block loses half the velocity when it travles 6

cm inside the block . hOe far , then would it go inside the block ?

And becomes rest .

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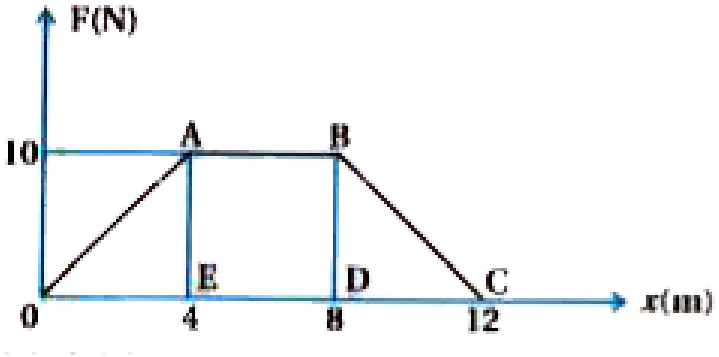
12. Force F on the particle of mass 0.1 kg varies with distance x as shown in figure . If particle with distance x as shown in figure .If particle move from rest x = 0 , that at x = 12 cm , what will be its velocity ?



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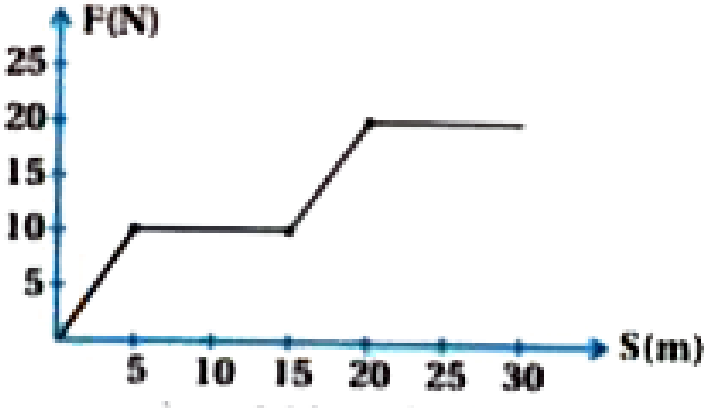
13. Work done by a body is shown as in figure . Calculate the work done during first 20 m distance covered .



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14. The centripetal force on a particle moving in a uniform circular motion on a horizontal circle of radius r is $\frac{-\sigma}{r^2}$, then find the mechanical energy of this particle .

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15. By increasing the volume of water coming out per second the water pump to n times , what is the power of motor has to be increases ?

Watch Video Solution

Section C Objective Questions Vsqs

1. If $\vec{A} = 2\hat{i} - 2\hat{j}$ and $\vec{B} = 2\hat{k}$ then $\vec{A} . \vec{B} \ldots\ldots$

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2. When is the work done by a force is positive and negative ?

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3. If $\vec{P} . \vec{Q} = 0$, then what is the angle between $\vec{P}$ and $\vec{Q}$?

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4. If $\vec{P} . \vec{Q} = 1$, then what is the angle between $\vec{P}$ and $\vec{Q}$?

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5. If a friction of 200 N exerted opposite to the motion of a object dragged up to 10m , then what will be the work done by the friction force on the road ?

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6. If $\vec{A} = (2, -3, 1)$ and $\vec{B} = (3, 4, n)$ are mutually perpendicular then find the value of n .

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7. If $\vec{P} = (k, 2, 3)$ and $\vec{Q} = (0, 3, k)$ and $\vec{P} \perp \vec{Q}$, then find the value of k .

Watch Video Solution

8. Find the work done by electric force on an electron revolves around the nucleus ?

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9. The work done by a gravitational force acting on a free fall body will be positive , negative or zero ?

Watch Video Solution

10. Negative sign in W = -mgh denotes what ?

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11. Whether the potential energy increases or decreases in the case of rising bubbles in water ?

Watch Video Solution

12. Define 1 eV:

Watch Video Solution

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

Watch Video Solution

14. Can kinetic energy of a body by negative ? Potential energy be negative ?

Watch Video Solution

15. What is the work done on the body moving in uniform circular motion ?

Watch Video Solution

16. What is the area under the graph of $F \to x$? (F = external force , x = change of spring length)

Watch Video Solution

17. The momentum of two unequal bodies is same , then which onehas larger kinetic energy ?

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18. The momentum of a body increased doubled .What is the percentage of increment in its kinetic energy ?

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19. A body is thrown upward at intial velocity of $7ms^{-1}$, then at which height it's kinetic energy becomes half ?

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20. Obtain an equation of momentum in terms of mass and kinetic energy .

Watch Video Solution

21. Mention the dimensional formula of spring constant .

Watch Video Solution

22. What is necessary for work done when the force is exerted on the body ?

Watch Video Solution

23. Equal force is applied on one heavy weight and one light weight body . Which body experiences more work by applied force ?

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24. When two bodies A and B are collide with each other . They work on each other .Its this true ?

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25. One body is displaced in the direction of X - axis up to 4 meter under influence of $(-1, 2, 3)$ N force. Find work done by the force .

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26. What will be the work done on the body moving with constant speed ?

Watch Video Solution

27. Find the kinetic energy when 2 gm bullet moves with the velocity of 500 m/s .

Watch Video Solution

28. The unit of spring constant is Jm^{-2} .Is the statement true or false ? If it is false then correct it .

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29. Which physical quantity is obtain by negative value of derivative of potential energy with respect to its position ?

Watch Video Solution

30. 1 Meg watt = ... erg/second .

Watch Video Solution

31. Why potential energy of a body increases when it is carried from the earth's surface ?

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32. Which nuclear process occur in atom bomb ? Or write the principle of 'Atom Bomb' ?

Watch Video Solution

33. Which nuclear process occur in hydrogen bomb ? Or write the principle of 'Hydrogen Bomb' ?

Watch Video Solution

34. In which condition ,work done on the body does nit increase its kinetic energy ?

Watch Video Solution

35. If two bodies experience collision when they are moving opposite to each other .When does its total kinetic energy becomes zero ?

Watch Video Solution

36. It work done positive or negative for stretched spring ?

Watch Video Solution

37. What happens in a eleastic collision of two identical bodies moving opposite to each other ?

Watch Video Solution

38. Write the condition for conservative forces .

Watch Video Solution

39. Is the work done by non conservative force is always negative ? Discuss .

Watch Video Solution

40. What is head -on collision ?

Watch Video Solution

41. At which position (point) pendulum of a clock have maximum speed ?

Watch Video Solution

42. If mechanical work done on the body then kinetic energy increases or decreases ?

Watch Video Solution

43. If $E - V < 0$,then this position is possible ?

Watch Video Solution

44. Write the types of collision .

(a) Collision between negative charged body and positive charged body .

(b) Collision of very large bodies .

(c) Collision between two quartz balls .

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45. When arrow is released from bow , then from which source arrow get kinetic energy ?

Watch Video Solution

46. When the maximum energy during elastic collision will be exchanged ?

Watch Video Solution

47. By which number the elastic collision if the body be measured ?

Watch Video Solution

48. Why fractional force is a non - conservative force ?

Watch Video Solution

49. Which physical quantityis conserved in elastic as well as inelastic collision ?

Watch Video Solution

50. What is an angle between two equal bodies of same mass one of them is rest and experiences oblique collision to each other ?

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51. "1 kWh is a unit of power " . This statement is true or false ? If it is wrong then correct it .

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52. If bulb of 100 W continued for 10 hour then how much electric energy will be consumed ?

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Section D Ncert Exemplar Solutions Multiple Choice Questions

1. An electron and a proton are moving under the influence of mutual forces . In calculating the change in the kinetic energy of

the system during motion , one ignores the magnetic force of one on another . This is , because

A. the two magnetic forces are equal and opposite ,so they produce no net effect

B. the magnetic forces do not work on each particle

C. the magnetic forces do equal and opposite (but non -zero) work on each particle .

D. the magnetic forces are necessarily negligible .

Answer: B

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2. A proton is kept at rest . A positively charged particle is released from rest at a distance d in its field .Consider two

experiments , one in which the charged particle is also a proton and in another , a position . In same time t , the work done on the two moving charged particle is

A. same as the same force law is involved in the two experiments

B. less for the case of a positron , as the positron moves away more rapidly and the force on it weakness

C. more for the case of a positron , as the positron moves away a larger distance

D. same as the work done by charged particle on the stationary proton .

Answer: C

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3. A man squating on the ground gets straight up and stand . The force of reaction of ground on the main during the process is

A. constant and equal to mg in magnitude

B. constant and greater than mg in magnitude

C. variable but always greater than mg

D. at first greater than mg and later becomes equal to mg

Answer: D

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4. A cyclist comes to a skidding stop in 10 m . During this process , the force on the cycle due to the road is 200 N and is directly opposed to the motion . (a) How much work does the road do on the cycle ? (b) How much work does the cycle do on road ?

A. $+2000$

B. -200 J

C. zero

D. $-20,000$ J

Answer: C

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5. A body is falling freely under the action of gravity alone in vacumm . Which of the following quantities remain constant during the fall ?

A. Kinetic energy

B. Potential energy

C. Total mechanical energy

D. Total linear momentum

Answer: C

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

A. Total kinetic energy

B. Total mechanical energy

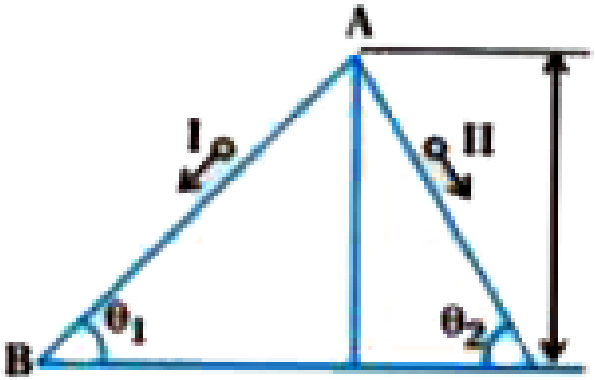
C. Total linear momentum

D. Speed of each body

Answer: C

Watch Video Solution

7. Two inclined frictionless tracks , one gradual and the other steep meet at A from where two stones are allowed to slide down from rest , one on each track as shown in figure . Which of the following statement is correct ?



A. Both the stones reach the bottom at the same time but not with the same speed

B. Both the stones reach the bottom with the same speed and stone I reaches the bottom earlier than stone II

C. Both the stones reach the bottom with the same apeed and stone II reaches the bottom earlier than stone I

D. Both the stones reach the bottom at different times and with different speeds .

Answer: C

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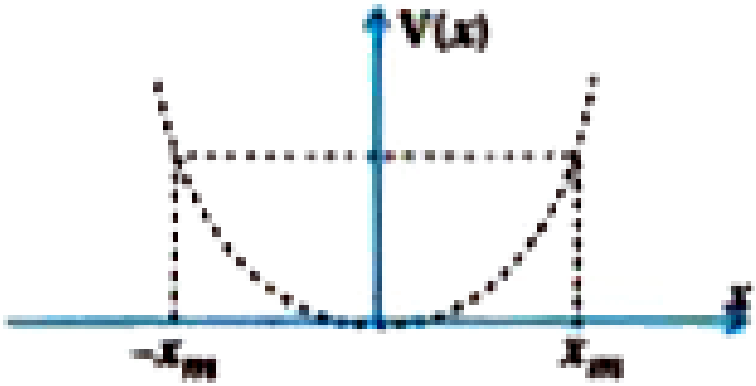
8. The potential energy function for a particle executing linear SHM is given by $V(x) = \frac{1}{2}kx^2$ wher e k is the force constant of the oscillator (figure). For k = 0.5 N/m ,the graph ofV(x) versus x is shown in the figure . A particle of total energy E turns back when it reaches $x = \pm x_m$. If V and K indicate the PE and KE , respectively of the particle at $x = +x_m$, then which of the

following is correct ?



A. V =0 ,K=E

B. V = E,K=0

C. $V < E, K = 0$

D. $V = 0, K = 0$

Answer: B

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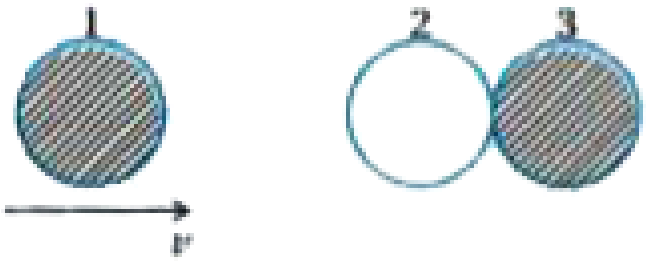
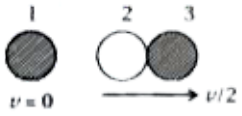
9. Two identical ball bearing in contact each other and resting on a frictionless table are hit head - on by another ball bearing of the same mass moving intially with a speed c as shown in figure .

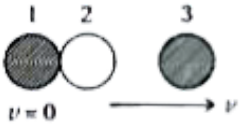


If the collision is elastic mwhich of the following (figure) is a possible result after collision ?

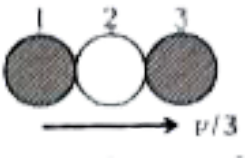
A.

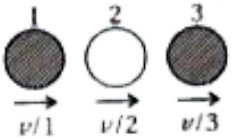


B.



C.



D. 

Answer: B

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

A. 1.5 J

B. 50 J

C. 10 J

D. 100 J

Answer: B

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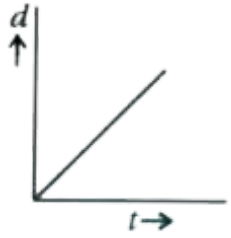
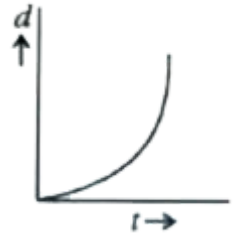
11. A body is moving unidirectionally under the influence of a source of constant power supplying energy . Which of the diagram shown infigure correctly shown the displacement time curve for its motion ?

A.



B.



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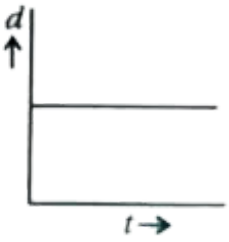

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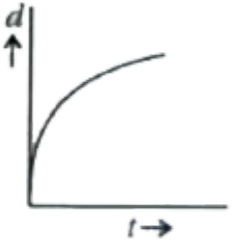
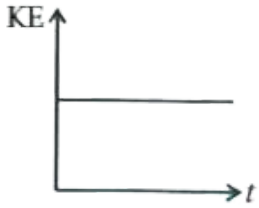


Answer: B

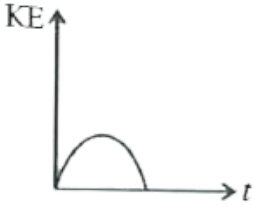
Watch Video Solution

12. Which of the diagram shown in figure most closely shows the variation in kinetic energy of the earth as it moves once around the sun in its elliptical orbit ?

A.



B.



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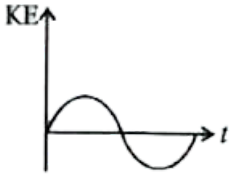
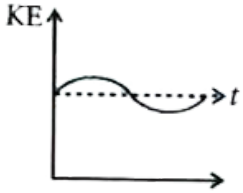


D.



Answer: D

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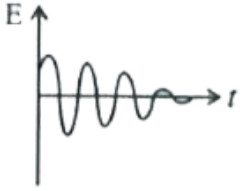
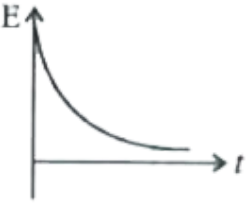
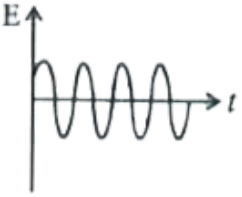
13. Which of the diagram shown in figure represents variation of total mechanical energy of a pendulum oscillating in air as function of time?

A. 

B. 

C. 

D. 

Answer: C

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14. A mass of 5 kg is moving along a circular path of radius 1 m . If the mass moves with 300 rev/min , its kinetic energy would be

A. $250\pi^2$

B. $100\pi^2$

C. $5\pi^2$

D. 0

Answer: A

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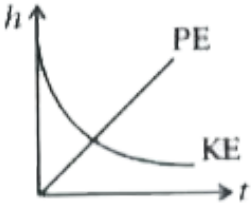
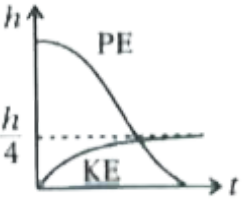
15. A raindrop falling from a height h above ground , attains a near terminal velocity when it has fallen through a height $\left(\frac{3}{4}\right)$

h . Which f the diagrams shown in figure correctly shows the change in kinetic and potential energy of the drop during its fall up to the ground ?

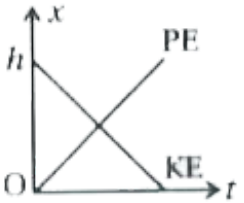
A.



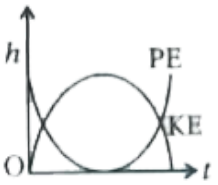
B.



C.



D.



Answer: B

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16. In a shot put event an athlete throws the shot put of mass 10 kg with an initial speed of $1ms^{-1}$ at 45° from a height 1.5 m above ground . Assuming air resistance to be negligible and acceleration due to gravity to be $10ms^{-2}$ the kinetic energy of the shot put when it just reaches the ground will be

A. 2.5J

B. 5.0J

C. 52.5 J

D. 155.0J

Answer: D

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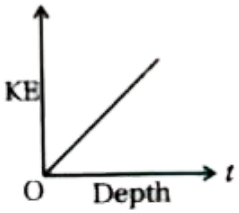
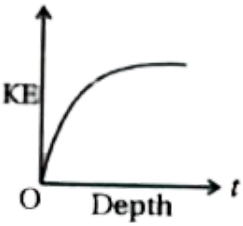
17. Which of the diagrams in figure correctly shows the change in kinetic energy of an iron sphere falling freely in a lake having sufficient depth to impart it a terminal velocity ?

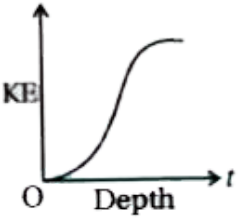
A.



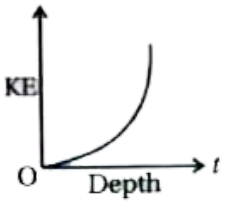
B.



C.



D.



Answer: B

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18. A cricket ball of mass 150 g moving with a speed of 126 km/h hits at the middle of the bat , held firmly at its position by the batsman . The ball moves straight back to the bowler after hitting the bat . Assuming that collision between ball and bat is completely elastic and the two remain in contact for $0.001s$ s , the force that the batsman had to apply tohold the bat firmly at its place would be

A. 10.5 N

B. 21 N

C. $1.05 \times 10^4 N$

D. 2.1×10^4N

Answer: C

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19. A man of mass m , standing at the bottom of the staircase of height L climbs it and stands at its top .

A. Work done by all forces on man is equal to the rise in potential energy mgL .

B. Work done by all forces on man is zero

C. The bullet will move in a different parabolic path

D. The reaction from a step does not do work because the point of application of the forces does not move while the force exists .

Answer: B::D

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20. A bullet of mass m fired at 30° to the horizontal leaves the barrel of the gun with a velocity v . The bullet hits a soft target at a height h above the ground while it is moving downward and ground while it is moving downward and emerge out with half the kinetic energy it had before hitting the target . Which of the following statements are correct in respect of bullet after it emerges out of teh target ?

A. The velocity of the bullet will be reduced to half its initial value

B. The velocity of the bullet will be more than half of its earlier velocity

C. The bullet will move in a different parabolic path

D. The internal energy of the particles of the target will increase .

Answer: B::D

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21. Two blocks M_1 and M_2 having equal mass are free to move on a horizontal frictionless surface . M_2 is attached to a massless spring as shown in figure .Intially M_2 is at rest and M_1 is moving toward M_2 with speed v and collides head - on with M_2 .

A. While spring is fully compressed all the KE of M_1 is stored as PE of spring .

B. While spring fully compressed the system momentum is not conserved ,through final momentum is equal to intial momentum .

C. If spring surface on which blocksare moving has friction , then collision cannot be elastic

D. If the surface o which blocks are moving has friction ,then collision cannot be elastic

Answer: C

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Section D Ncert Exemplar Solutions Very Short Answer Type Questions

1. A through inclined is placed on car moving with a constant velocity u on horizontal ground . A block of mass M rests on the inclined plane . Is any work done by force of friction then a dissipation of energy ?

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2. Why is electrical power required at all when the elevator is descending ? Why should there be a limit on the number of passengers in this case ?

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3. A body is being raised to height h from the surface of earth. What is the sign of work done by (a) applied force and (b) gravitational force ?

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4. Calculate the work done by a car against gravity in moving along a straight horizontal road . The mass of the car is 400 kg and the distance moved is 2 m .

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5. A body falls towards earth in air. Will its total mechanical energy be conserved during the fall ? Justify.

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6. A body is moved along a closed loop. Is the work done in moving the the body necessarily zero ? If not, state the condition

under which work done over a closed path is always zero.

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7. In an elastic collision of two billiard balls,which of the the following quantities remain conserved during the short time of collision of the balls ? (i.e. when they are in contact)

(a) Kinetic energy.

(b) Total linear momentum.

Give reason for your answer in each case.

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8. Calculate the power of a crane in watts, which lifts a mass of 100 kg to a height of 10 m in 20 s.

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9. The average work done by a human heart while it beats once is 0.5 J. Calcute the power used by heart if it beats 72 times in a minute.

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10. Give example of situation in which an applied force does not result in a change in kinetic energy .

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11. Two bodies of unequal mass are moving in the same direction with equal kinetic energy .The two bodies are brought to rest by applying regarding force of same magnitude . How would the distance moved by them before coming to rest compare ?

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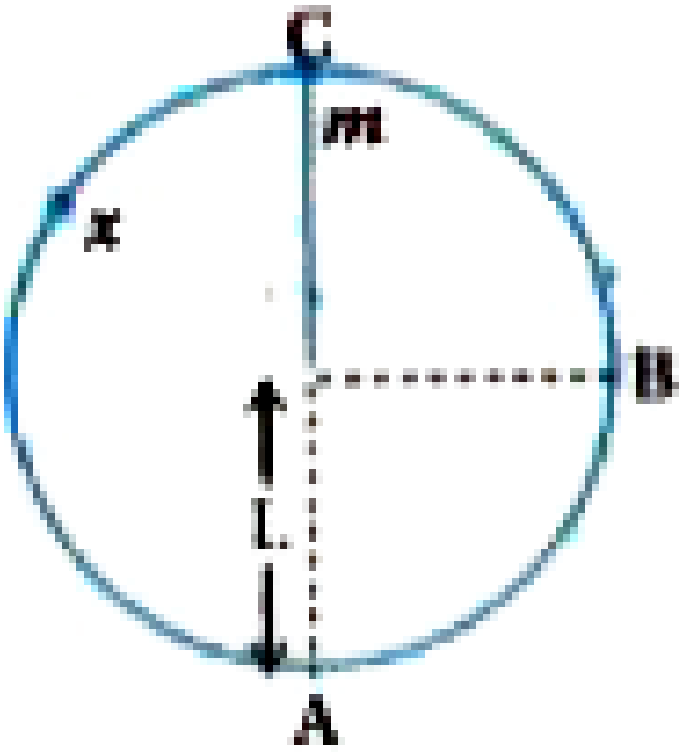
12. A bob of mass m suspended by a light string of length L is whirled into a vertical circle as shown figure . What will be the trajectory of the particle , if the string is cut at

(a) point B ? (b) point C ? (C) Point X ?



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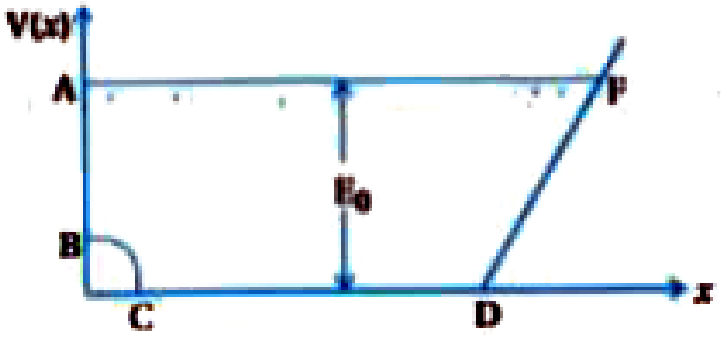
Section D Ncert Exemplar Solutions Short Answer Type Questions

1. A graph of potential energy V(x) verses x is shown in figure .A particle of energy E_0 is executing motion in it . Draw graph of velocity and kinetic energy verses x for one complete cycle AFA.



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2. A ball of mass m , moving with a speed $2v_0$ collides inelastically $(e > 0)$ with an identical ball at rest . Show that

(a) For head - on collision , both the balls move forward .

(b) For a general collision , the angle between the two velocities of scattered balls is less than 90°

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3. Consider a one -dimensional motion of a particle with total energy E. There are four regions A,B,C and D in which the relation between potential energy E. There are four regions A,B,C and D in which the relation between potential energy V, kinetic energy (K) and total energy E is as given below

Region $A: V > E$ Region $B: V < E$

Region $C: K > E$ Region $D: V > E$.

State with reasons in each

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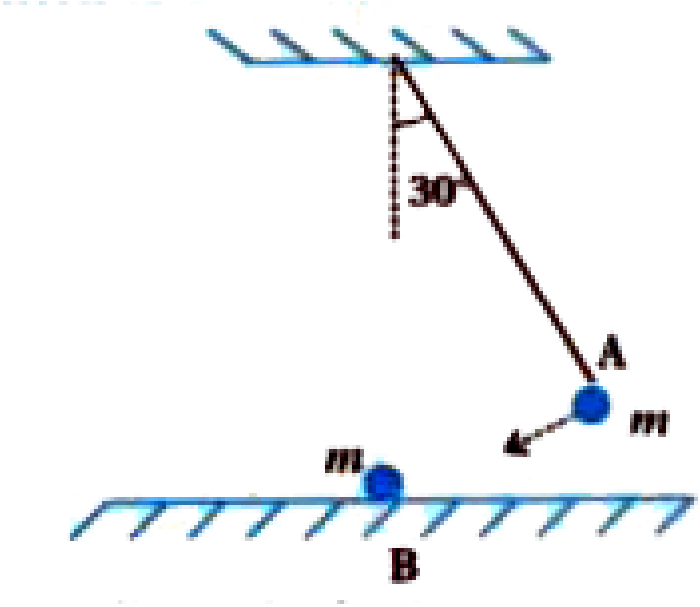
4. The bob A of a pendulum released from 30° to the vertical hits another bob B of the same mass at rest on a table as shown in figure . How high does the bob A rise after the collision ? Neglect the size of the bobs and assume the collision to be elastic .



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5. A raindrop of mass 1.00 g falling from a height of 1m hits the ground with a speed of $50ms^{-1}$ Calculate

(a) the loss of PE of the drop

(b) the gain in KE of the drop

(c) Is the gain in KE equal to loss of PE ? If not why ?

Take,$g = 10ms^{-2}$

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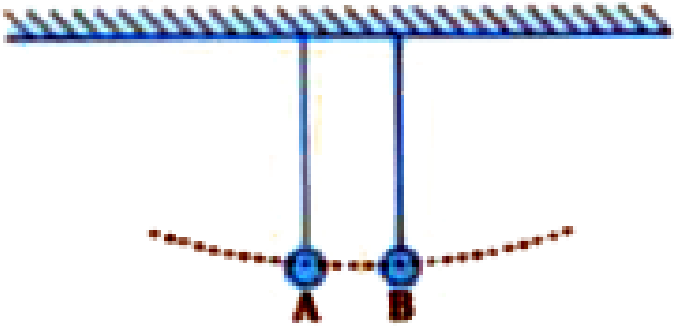
6. Two pendulums with identical bobs and lengths are suspended from a common support such that in real position the two bobs are in contact (figure). One of the bobs is released after being displaced by10° so that it collides elastically head-on with the other bob.

(a) Describe the motion of two bobs.

(b) Draw a graph showing variation in energy of either

pendumlum with time, for $0 \leq t \leq 2T$, where T is the period of each pendulum.



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7. Suppose the average mass of raindrops is $3.0 \times 10^{-5} kg$ and their average terminal velocity $9ms^{-1}$. Calculate the energy transferred by rain to each square metre of the surface at a place which receives $100cm$ of rain in a year.

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8. An engine is attached to a wagon through a shock absorber of length $1.5m$. The system with a total mass of 50,000 kg is moving with a speed of $36^{k}mh(- 1)$ when the brakes are applied to bring it to rest, the spring of the shock absorber gets compressed by 1.0 m. If $90\ \%$ of energy of the wagon is lost due to friction, calculate the spring constant.

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9. An adult weighting 600 N raises the centre of gravity of his body by 0.25 m while taking each step of 1 m length in jogging. If he jog for 6 km, calculate the energy utillised by him in jogging assuming that there is no energy loss due to friction of ground and air. Assuming that the body of the adult is capable of converting 10% of energy intake in the form of food. calculate the

energy equivalents of food that would required to compensate energy utilised for jogging.

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10. On complete combustion a litre of petrol gives off heat equivalent to 3×10^7J. In a test drive, a car weighing 1200 kg including the mass of driver, runs 15 km per litre while moving with a uniform speed on a straight track. Assuming that friction offered by the road surface and air to be uniform. calculate the force of friction acting on the car during the test drive. if the efficiency of the car engine were 0.5.

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Section D Ncert Exemplar Solutions Long Answer Type Questions

1. A block of mass 1 kg is pushed up a surface inclined to horizontal at an angle of 30° by a force of 10 N parallel to the inclined surface (figure) . The coefficient of friction between block and the incline is 0.1 .If the block is pushed up by 10 m along teh inclined calculate

(a) work done against gravity

(b) work done against force of friction

(c) increases in potential energy

(d) increases in kinetic energy

(e) work done by applied force

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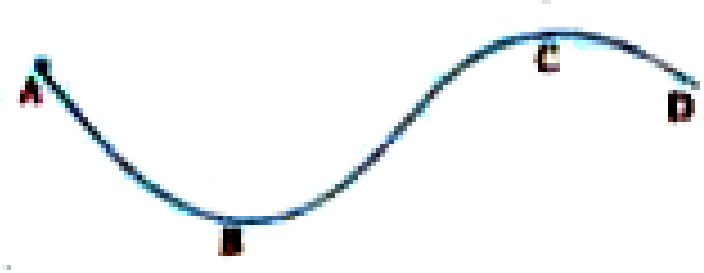
2. A curved surface is shown figure . The portion BCD is free of friction .There are three spherical balls of identical radii and masses . Balls are released from at rest one by one from A which is at a slighly greater height than C .



with the surface Ab , ball 1 has large eneough friction to cause rolling down without slipping , ball 2 has a small friction and ball 3 has a negligible friction .

(a) For which balls is total mechanical energy conserved ?

(b) Which ball (s) can reach D ?

(c) For ball which do not reach D, which of the balls can reach back A ?

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3. A rocket accelerates straight up by ejecting gas downwards . In small time interval Δt , it ejects a gas of mass Δm at a relative speed u . Calculate kE of the entire system at $t + \Delta t \text{ and } t$ and show that the device that ejects gas does work = $\left(\frac{1}{2}\right)\Delta \mathrm{mu}^2$ in this time interval (negative gravity).

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4. Two identical steel cubes (masses 50 g , side 1 cm) collide head -on face to face with a space of 10 cm/s each . Find the maximum compression of each .Young's modulus for steel $= Y = 2 \times 10^{11} N/m^2$

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5. A ballon filled with helium rises against gravity increasing its potential energy . The speed of thee ballon also increases as it rises . How do you reconcile this with the law of conservation of mechanical energy ? You can neglect viscous drag of air and assume that density of air is constant .

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Section E Multiple Choice Questions Mcqs

1. The potential energy of 1 kg particle , free to move allong is given by $U(x) = \left(\frac{x^3}{3} - \frac{x^2}{2}\right)I.$ if its mechanical energy is 2J . Its maximum speed is ..... ms^{-1}

A. $\sqrt{\frac{13}{3}}$

B. $\sqrt{\frac{9}{7}}$

C. $\sqrt{\frac{7}{9}}$

D. $\sqrt{\frac{7}{6}}$

Answer: A

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2. When 1 N force is applied increase in length of the spring is 1 cm . Find elastic potential energy stored during this in it .

A. $10 \times 10^{-3} J$

B. 10^{-3} J

C. $5 \times 10^{-3} J$

D. $20 \times 10^{-3} J$

Answer: C

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3. A body is displaced by 2m in Z - direction by a force $(-4, 2, 6)N$. Find the work done . . . . . .

A. $-8J$

B. 10 J

C. 12 J

D. 4 J

Answer: C

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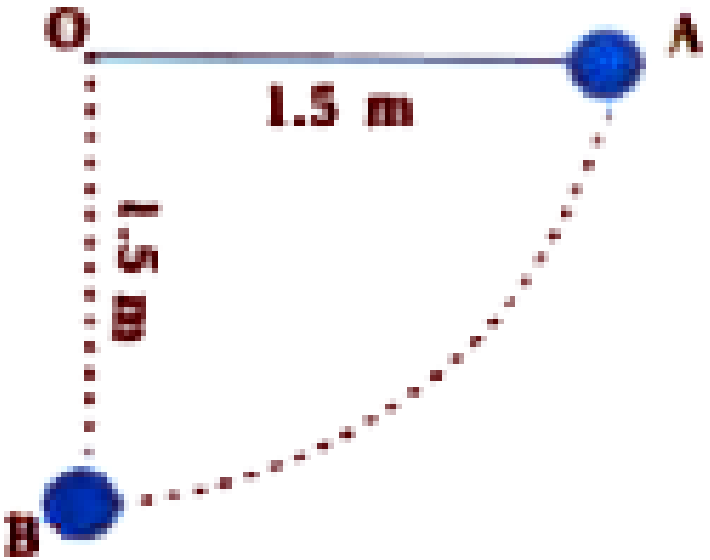
4. The bob of mass 50 gm of a pendulum is released from a horizontal position A as shown in the figure . .If the length of the

pendulum is 1.5 m , what is its kinetic energy at the lower most point B ? $\left(g = 10\frac{m}{s^2}\right)$



A. 2.5×10^{-11} J

B. $15 \times 10^{-1} J$

C. $5 \times 10^{-1} J$

D. $7.5 \times 10^{-1} J$

Answer: D

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5. Mass of a bus is 2400 kg . . . . . J . Work is to be done in producing velocity $36\frac{km}{h}$ in .it

A. 1.2×10^6

B. 120×10^6

C. 1.2×10^5

D. 12×10^5

Answer: C

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6. Under influence of a force $\vec{F}(x) = \left(3x^2 - 2x + 5\right)\hat{i}$ N , there is displacement of a particle from x = 0 and x = 5 m on X - axis .So

work done is . . . . . J .

A. 100

B. 150

C. 125

D. 120

Answer: C

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7. A particle of mass m moves on a circular path of radius r . Its centripetal acceleration is kt^2 , where k is a constant and t is time . Express power as function of t .

A. kmt

B. ktmr

C. km/t

D. kmr/t

Answer: B

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8. A spherical ball of mass 20 kg is stationary at the top of the hill of height 100 m . It rolls down smooth surface to ground then climb up another hill of height 40 m and finally rolls down to a horizontal base at a height of 15 m above the ground . The maximum velocity attained by a ball is ..... $\left(g = 9.8m/s^2\right)$

A. $40ms^{-1}$

B. $40.\ 8ms^{-1}$

C. $34.3ms^{-1}$

D. None of these

Answer: B

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9. If the magnitude of the vector product $\left|\vec{A} \times \vec{B}\right|$ of two vector is equal to the magnitude of their scalar product $\left|\vec{A} . \vec{B}\right|$, then the angle between $\vec{A}$ and $\vec{B}$ is .....

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

B. $\frac{\pi}{6}$

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

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

Answer: C

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10. The length of a spring is increased by 2.5cm the elastic potential energy stored in the spring is U . If the length is increased by 5 cm its elastic potential energy become . . . . . .

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

B. 4U

C. 2U

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

Answer: B

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11. The mass of a car is 1500 kg. How much work is required to be done on it to make with a speed of 72 km/h ?

A. $30 \times 10^5 J$

B. $3 \times 10^5 J$

C. $1.6 \times 10^6 J$

D. $3 \times 10^4 J$

Answer: B

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12. If a bulb of 60 W is kept ON for 200 hours then . . . . . unit of electrical energy has tobe spend .

A. 1.2

B. 12

C. 12000

D. 120

Answer: B

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13. The potential energy of a system under the influence of conservative force at position x is $V(x) = \left[3x^2 + 4x + 5\right]$ .At x = 2 m the conservative force acting on the system is . . . . . .

A. -20 N

B. $+16N$

C. $+20N$

D. $-16N$

Answer: B

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14. When force (3,2,1) Newton acts on a body , dispalcement of the body in the direction of Y - axis s 5 meter . Work done is .....

A. 15 Joule

B. 10 Joule

C. 5 Joule

D. None of these

Answer: B

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15. A body of mass 'm' moving with velocity v_1 along X - axis undergo elastic collision with another body of same mass 'm'

moving velocity v_2 along X - axis . The velocity of second body after collision is equal to

A. v_1

B. $2v_1 - v_2$

C. v_2

D. 0

Answer: A

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16. How much power is required a lift a body of mass 50 kg to a height of 120 m in 1 minute ? $\left(g = 9.8m/s^2\right)$.

A. 100 W

B. 9.8 W

C. 980 W

D. 1980 W

Answer: C

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17. 1 unit = ... electric energy .

A. 3600

B. $36, 00, 000$

C. $36, 000$

D. $3, 60, 000$

Answer: B

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18. A particle moves form x = 0 to x = 2 m on X - axis under the effect of a force $\overrightarrow{F}x = \left(4x^3 - 3x^2 + 2x\right)\hat{i}$ newton .

The work done on the particle is

A. 22 Joule

B. 36 Joule

C. 46 Joule

D. None of these

Answer: A

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19. If linear momentum of a body is increased by 50 % Its kinetic energy increases by . . . . . .

A. 0.5

B. 1.5

C. 1

D. 1.25

Answer: D

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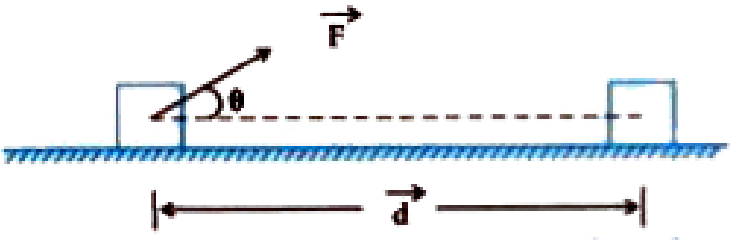
20.



A block lying on a rough horizontal surfaces as show in figure . Its mass is M and it is dispalced through a distance d by a force $\vec{F}$ acting at an angle θ with horizontal . If μ is the coefficient of

friction between a block and the surface and mass of block is M .

then work done is ..... .

A. $W = [F(\sin\theta + \mu\cos\theta) - \mu Mg]d$

B. $W = [F(\cos\theta + \mu\sin\theta) - \mu Mg]d$

C. $W = [F\sin\theta + \mu\cos\theta) + \mu Mg]d$

D. $W = [F(\cos\theta - \mu\sin\theta) + \mu Mg]d$

Answer: B

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21. From the given information ,select appropriate pair .

(1)	Power	(a)	Js^{-1}	(j)	$\frac{P^2}{2m}$
(2)	1 unit	(b)	Nm	(k)	746 W
(3)	Kinetic energy	(c)	$F \cos \theta$	(l)	ML^2T^{-2}
(4)	Work	(d)	$\frac{1}{2} kx^2$	(m)	$3.6 \times 10^6 J$
		(e)	KWH	(n)	$M^1L^0T^{-2}$
		(f)	$\frac{1}{2} mv^2$	(p)	ML^2T^{-3}

A. $1-(a),(l),2-(f),(m),3-(b),(j),4-(d),(n)$

B. $1-(b),(p),2-(e),(m),(3)-(d),(l),4-(b),(j)$

C. $1-(f),(j),(2)-(a),(k),3-(e),(n)4-(c),(l)$

D. $1-(a),(p),(2)-(e),(m),3-(f),4-(b),(l)$

Answer: D

Watch Video Solution

22. Force $\vec{F} = \left(60\hat{i} + 50\hat{j} - 3\hat{k}\right) N$ is applied on a particle , the value of velocity is $\vec{v} = \left(2\hat{i} + 4\hat{j} + 5\hat{k}\right)$ m/s , then power will be ..... W.

A. 305

B. 450

C. 45

D. 90

Answer: C

Watch Video Solution

23. A body is displaced by 6 m in Y - direction by a force (5,2,3) N , so work done ..... .

A. 12 N

B. 12 V

C. 12 m

D. 12 J

Answer: D

Watch Video Solution

24. With which velocity should a student of mass 80 kg run , so that his kinetic energy becomes 320 ?

A. 2

B. $\sqrt{2}$

C. 3

D. $2\sqrt{2}$

Answer: D

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25. If an electron and a proton have equal kinetic energy , then the speed of the electron will be ..... times the speed of the proton .

A. 6

B. 21.42

C. 42.83

D. 83.42

Answer: C

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26. A bullet is fired into a huge wooden block . The bullet while moving inside the block loses half the velocity when it travles 6 cm inside the block . hOe far , then would it go inside the block ? And becomes rest .

A. 3.0cm

B. 2.5 cm

C. 2.0cm

D. 1.5 cm

Answer: D

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27. The electric energy consumed by a 500 W bulb in 2 hours is . . . . . unit .

A. 1000

B. 250

C. 10

D. 1

Answer: D

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28. If linear momentum of a body is increases by 2 % its kinetic energy increases by . . . . . .

A. 0.02

B. 0.04

C. 0

D. 0.1

Answer: B

Watch Video Solution

29. How fast should a student of mass 50 kg run , so that his kinetic energy becomes 625 J ?

A. 12.5 m/s

B. 2.5 m/s

C. 50.0m/s

D. 5.0 m/s

Answer: D

Watch Video Solution

30. When force (3,2,1) Newton acts on a body , dispalcement of the body in the direction of Y - axis s 5 meter . Work done is . . . . . .

A. 15 J

B. 10 J

C. 5 J

D. 30 J

Answer: B

Watch Video Solution

31. An engine pumps water through a hose pipe water passes through the pipe and leaves it with velocity of 2 m/s. The mass

per unit length of water in the pipe is 100 kg/m .What is the power of the engine ?

A. 400 W

B. 200 W

C. 100 W

D. 800 W

Answer: A

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32. The potential energy of a system increase if work is done .....

A. Upon the system by non conservative force

B. By the system against a conservative force

C. By the system against non conservative force

D. upon the system by conservative force

Answer: D

Watch Video Solution

33. A body projected vertically from the earth reaches a height to earth's radius before returning to the earth . The power exterted by the gravitational force is greatest . . . . . .

A. at maximum height of body

B. at the instant just before the body hits the earth

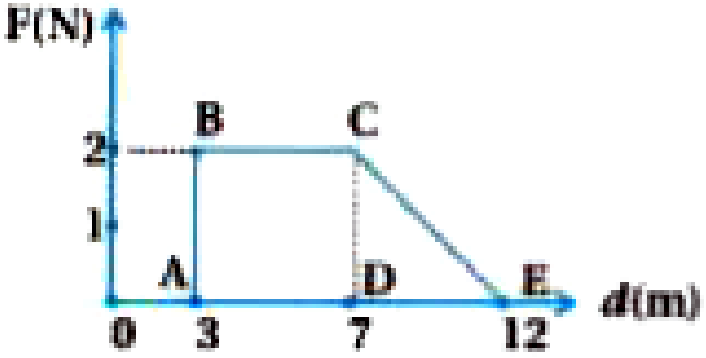
C. remains constant throughout motion

D. at the instant just after the body is projected

Answer: B

Watch Video Solution

34. A particle is subjected to a force which varies with distance as shown in figure . The work done on the particle at in dispalcement of 12 m is . . . . . .



A. 18 J

B. 21 J

C. 26 J

D. 13 J

Answer: D

Watch Video Solution

35. A mass m moving horizontally (along the X-axis) with velocity v collides and sticks to a mass of 3 m moving vertically upward (along the Y - axis) with velocity 2v. The final velocity of the combination is . . . . . .

A. $\frac{1}{4}v\hat{i} + \frac{3}{2}v\hat{j}$

B. $\frac{1}{3}v\hat{i} + \frac{2}{3}v\hat{j}$

C. $\frac{2}{3}v\hat{i} + \frac{1}{3}v\hat{j}$

D. $\frac{3}{2}v\hat{j} + \frac{1}{4}v\hat{j}$

Answer: A

Watch Video Solution

36. A uniform force of $\left(3\hat{i}+\hat{j}\right)$ N acts on an particle of mass 2 kg . Hence the particle is displaced from position $\left(2\hat{i}+\hat{k}\right)$ m to position $\left(4\hat{i}+3\hat{j}-\hat{k}\right)$ m . The work done by the force on the particle is

A. 15 J

B. 9 J

C. 6 J

D. 13 J

Answer: B

Watch Video Solution

37. 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 by the same force (case b) . The work done by the springs W_P and W_Q are related as , in case (a) and case (b) , respectively :

A. $W_P = W_Q, W_P > W_Q$

B. $W_P > W_Q, W_Q > Q_P$

C. $W_P < W_Q, W_Q < W_P$

D. $W_P = W_Q, W_Q > W_P$

Answer: B

Watch Video Solution

38. A particle of mass m id driven by a machine that delivers a constant power k watts . If the particle starts from at rest the force on the particle 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. $\sqrt{\frac{mk}{2}}t^{-\frac{1}{2}}$

Answer: D

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39. Two particle of masses $m_1 . m_2$ moves with initial velocities u_1 and u_2 . On collision one of the particles get excited to

higher level after absorbing energy ε . 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. $\frac{1}{2}m_1^2u_1^2 + \frac{1}{2}m_2^2u_2^2 + \varepsilon = \frac{1}{2}m_1^2v_1^2 + \frac{1}{2}m_2^2v_2^2$

D. $m_1^2u_1 + m_2^2u_2 - e\pi lon = m_1^2v_1 + m_2^2v_2$

Answer: B

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40. A ball is thrown vertically downwards from a height of 20 m with an initial velocity v_0 It collides with the ground , loses 50 percent of its energy in collision and rebounds to the same height .the initial velocity v_0 is : (Take $g = 10ms^{-2}$)

A. $10ms^{-1}$

B. $14ms^{-1}$

C. $20ms^{-1}$

D. $28ms^{-1}$

Answer: C

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41. On a frictionless surface , a block of mass . M moving at speed v collides elastically with another block of same mass M which is intially at rest /After collision the first block moes 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. $\frac{2\sqrt{2}}{3}v$

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

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

Answer: B

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42. The heart of a man pumps 5 litre 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 heart in watt is :

A. 1.50

B. 1.70

C. 2.35

D. 3.00

Answer: B

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43. A body of mass 1 kg begins to move under the action of a time dependent force $\vec{F} = \left(2t\hat{i} + 3t^2\hat{j}\right)$ N . Where $\hat{i}$ and $\hat{j}$ are unit vectors along X and Y axis . What power will be developed by the force at the time t .

A. $\left(2t^2 + 4t^4\right)W$

B. $\left(2t^3 + 3t^4\right)W$

C. $\left(2t^3 + 3t^5\right)W$

D. $\left(2t^2 + 3t^3\right)W$

Answer: C

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44. A piece of ice balls from a height 'h' so that it melts completely .Only one quarter of the heat produced is absorbed by the ice and all energy . Of ice gets converted in to heat during its fall. The value of h is :

$$\left[\text{latent heat of ice is } \ 3.4 \times 10^5 \text{J/kg and } \ g = 10 \frac{N}{kg} \right]$$

A. 544 km

B. 136 km

C. 68 km

D. 34 km

Answer: B

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45. Two identical balls A and B having velocities of 0.5 m/s and -0.3 m/s respectively collide elastically in one dimension. The velocities of B and A after the collision repsectively will be .....

A. $-0.3m/s, 0.5m/s$

B. $0.3m/s, 0.5m/s$

C. $-0.5m/s, 0.3m/s$

D. $0.5m/s, \ -0.3m/s$

Answer: A

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46. 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 by the force ?

A. 5 J

B. 2J

C. 8 J

D. 11 J

Answer: A

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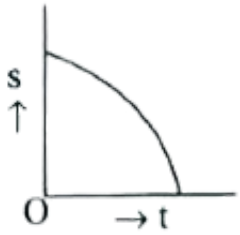
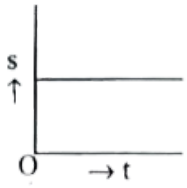
47. Under the source of constant power a body start to move . Which one of following graph truly represents the change of displacement (s) with time (t) ?

A.

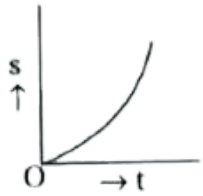


B.

C.



D.



Answer: D

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48. A body of mass 5 kg climb a height of 10 m by the force of 170 N . Its velocity at this height wil be . . . . . .

A. 15 m/s

B. 37 m/s

C. 9.8 m/s

D. 22 m/s

Answer: D

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49. If spring extends by x on loading , then enrgy stored by the spring is . . . . . (If T is the tension of the spring and K is the spring constant)

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

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

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

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

Answer: B

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50. A spring 40 mm long is stretched by the application of a force . If 10 N force required to stretch the spring through 40 mm is . . . . . .

A. 23 J

B. 68 J

C. 84 J

D. 8 J

Answer: D

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51. A particle of mass m moving with velocity v is collide with a stationary particle of mass 2 m . The speed of the system , after collision will be . . . . . .

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

B. 2v

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

D. 3v

Answer: C

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52. A person carrying a box on his head is walking on a level road from one place to naother on a straight road is doing no work . The statement is . . . . . .

A. partly correct

B.

C. incorrect

D. insufficient data

Answer: B

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53. A body of mass 5 kg has momentum of 10 kg ms^{-1} when a force of 0.2 N is applied on it for 10 seconds , what is the change

in the kinetic energy ?

A. 1.1 J

B. 2.2J

C. 3.3 J

D. 4.4 J

Answer: D

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54. Which of the following is true ?

A. Momentum is conserved in all collisions but kinetic energy is conserved in elastic collision .

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

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

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

Answer: C

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

A. $-7J$

B. $+7$ J

C. $+10$J

D. 13 J

Answer: B

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56. A uniform cylinder of length L and mass M having cross - sectional area A is suspended , with its length vertical from a fixed point by a massless spring , such that it is half submerged in a liquid of density σ at equilibrium position . The extension x_0 of the spring when it is in equilibrium is .

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

B. $\frac{Mg}{k}\left(1-\frac{LA\sigma}{M}\right)$

C. $\frac{Mg}{k}\left(1-\frac{LA\sigma}{2M}\right)$

D. $\frac{Mg}{k}\left(1+\frac{LA\sigma}{M}\right)$

Answer: C

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57. 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 is given as $f\left(\frac{1}{2}mv^2\right)$ $\text{then} F=\left(\frac{m}{M+m}\right)$

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

A. Statement - I is true , Statement - II is true Statement - II is a correct explanation of Statement -I

B. Statement -I is true , Statement -II is true Statement -II is not a correct explanation of Statement -I

C. Statement -I is true , Statement -II is false .

D. Statement -I is false , Statement -II is true .

Answer: D

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58. A particle of mass m moving in the x - direction with speed 2c is hit by another particle of mass 2m moving in the y - direction with with speed v . If the collision is perfectly inelastic , the percentage loss in the enrgy during the collision is close to .

A. 0.44

B. 0.5

C. 0.56

D. 0.62

Answer: C

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

A. 9 J

B. 18 J

C. 4.5 J

D. 22 J

Answer: C

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

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

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

C. zero

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

Answer: C

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61. In a collinear collision a particle with an intial speed v_0 strike 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. $\frac{v_0}{2}$

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

Answer: B

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62. It is found that if a neutron suffers an elastic collinear collision with deuerium at rest , fractional loss of energy is P_d while for its similar collision with carbon nucleous at rest , fractional loss of energy is P_c are respectively .....

A. $(.89, .28)$

B. $(-28, .89)$

C. (0,0)

D. $(0, 1)$

Answer: A

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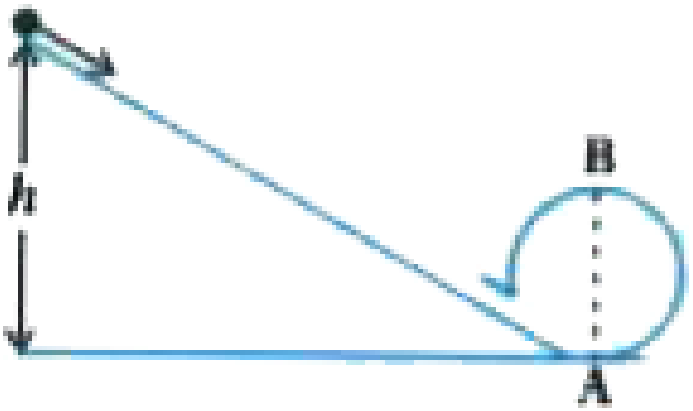
63. A body initially at rest and sliding along a frictionlss track from a height h (as shown in the figure) jut completes a vertical

circle of diameter AB = D .the height h is equal to . . . . . .



A. $\frac{5}{4}$D

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

C. $\frac{7}{5}$ D

D. D

Answer: A

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64. A moving block having mass m , collides with another stationary block having mass 4m , The lighter block comes to rest after collision . When the intial velocity of the lighter block is v, then the value of coefficient of restitution (e) will be

A. 0.4

B. 0.5

C. 0.8

D. 0.25

Answer: D

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Section F Questions From Module Sample Questions For Preparation Of Competitive Exams

1. A Sphere makes an inslastic collision with another sphere of same mass , then both the spheres are moving .The angle between their direction of motion will be . . . . . .

A. 0°

B. 45°

C. Different from 90°

D. 90°

Answer: A

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2. A body displaced 10m under the force of 10 N . If the work done on the body is 50 J , then the angle between the force and displacement will be . . . . . .

A. 120°

B. 90°

C. 60°

D. None of these

Answer: C

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3. A sphere of mass 50 g moving with velocity of 10m/s collide with the rest block at mass 950 g and embeded . The kinetic energy lost by sphere will be . . . . . .

A. 1

B. 0.95

C. 0.5

D. 0.05

Answer: B

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4. A particle fall freely from height s . At certain height its kinetic energy is three time to its potential energy ,them at any one instant its height and speed respectively . . . . . .

A. $\frac{s}{4}, \frac{3gs}{2}$

B. $\frac{s}{4}, \frac{\sqrt{3gs}}{2}$

C. $\frac{s}{2}, \frac{\sqrt{3gs}}{2}$

D. $\frac{s}{4}, \sqrt{\frac{3gs}{2}}$

Answer: B

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5. A body of mass 3 kg fall freely from the building of height 60 m . Its kinetic energy after 3s will be . . . . . .

A. 557 J

B. 246 J

C. 1048 J

D. 1297 J

Answer: D

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6. A mass of 0.5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface collides with string of force constant

50 N/m . How much maximum compression on the spring will be ?

A. $0.5m$

B. $0.15m$

C. $0.12m$

D. $1.5m$

Answer: B

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7. inelastic collision of two sphere of right body . . . . . .

A. total kinetic energy is converted

B. total potential enersy is conserved

C. linear momentum is not conserved

D. linear momentum is conserved

Answer: D

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8. Two bodies of mass 1 g and 4 g moving with equal kinetic energy then the ratio of its linear momentum will be . . . . . .

A. $4:1$

B. $\sqrt{2}:1$

C. $1:2$

D. $1:16$

Answer: C

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9. How much work done in pulling up a block of wood weighing 2kN for length of 10 m on smooth incline plane at angle 15° with horizontal ?

A. 9.82J

B. 89 J

C. 4.35 kJ

D. 5.17 kJ

Answer: D

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10. The kinetic energy of a body becomes four times its intial value , the new linear momentum will be . . . . . .

A. four times the initial value

B. three times the initial value

C. twice the initial value

D. same as initial value

Answer: C

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11. An electron , a proton a deutron and $\alpha -$ particle have the same kinetic energy . Which of these particle has the larger momentum ?

A. an elctron

B. a proton

C. a deutron

D. α - particle

Answer: D

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12. If a body of mass 100 kg takes hight 60 m in 1 minute how much power is needed ? $\left(g = 9.8m / s^{-2}\right)$

A. 100 W

B. 980 W

C. 9.8 W

D. 1980 W

Answer: B

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13. An engine delivered power of 30 kW to a car of mass 1250 kg and velocity of 30 m/s . If the friction force of surface is 750N what will be the maximum acceleration of car ?

A. $\frac{1}{3}ms^{-2}$

B. $\frac{1}{4}ms^{-2}$

C. $\frac{1}{5}ms^{-2}$

D. $\frac{1}{6}ms^{-2}$

Answer: C

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14. Which one of the following force is non- conservative ?

A. Electrostatic force

B. Viscous force

C. internal force

D. Gravitational force

Answer: B

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15. A body of mass 1 kg is thrown upwards with a velocity $20ms^{-1}$ .It momentarily come to rest after attaining a height of 18 m . How much energy is lost due to air friction $\left(g = 10m/s^{-2}\right)$

A. 30 J

B. 40 J

C. 10 J

D. 20 J

Answer: D

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16. If the kinetic energy of the body is increased by 300 % then , the increase in momentum will be . . . . . .

A. 1

B. 1.5

C. 2

D. 1.75

Answer: A

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

A. Rv

B. mav

C. $(R + ma)v$

D. $(ma - R)v$

Answer: C

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18. A man whose mass is 50 kg climbs up 20 steps of the stairs with mass of 20 kg on his head .If each step of stair is 0.25 m in height , then work done by a man will be . . . . . .

A. 475 J

B. 3500 J

C. 1715 J

D. 3430 J

Answer: D

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19. A sphere of mass 2 kg moving at 36 km/hr collides head on with another sphere of mass 3 kg kept at rest . If after collision

both spheres moves together then kinetic energy decreases by collision will be . . . . . .

A. 40 J

B. 60 J

C. 100 J

D. 140 J

Answer: B

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20. Two bodies of masses m_1 and m_2 have same linear momentum . The ratio of their kinetic energies $\frac{E_1}{E_2}$ will be . . . . . .

A. $\sqrt{m_1} : \sqrt{m_2}$

B. $m_1 : m_2$

C. $m_2 : m_1$

D. $m_{12} : m_{22}$

Answer: C

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21. An elastic balls falls from a height of 10 m . If lose 80 % of its total energy due to impact . The ball will now rise to a height of ?

A. 80 m

B. 40 m

C. 60 m

D. 20 m

Answer: D

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22. A ball moving with velocity 2m/s collides head on with another stationary ball of double the mass . If coefficient of restitution is 0.5 then their velocities after collision will be $\ldots\ldots\ldots ms^{-1}$.

A. 0,1

B. 1,1

C. $1, 0.05$

D. 0,2

Answer: A

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23. A bullet is fired from agun . If it recoils freely then kinetic energy of gun is . . . . . .

A. equal to the kinetic energy of bullet

B. more then the kinetic energy of bullet

C. less than the kinetic energy of bullet

D. equal or less the kinetic energy of bullet .

Answer: C

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Question Paper Section A

1. When force is exerted on a body what is necessary for work done ?

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2. The momentum of two unequal bodies is same , then which onehas larger kinetic energy ?

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3. State the importance of work energy theorem .

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4. How many Joule equal to 1 eV ?

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5. If bulb of 100 W continued for 10 hour then how much electric energy will be consumed ?

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6. What is non - conservative force ?

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Question Paper Section B

1. Write the formula for work . Explain with illustrations when does work will be positive , negative and zero ?

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2. Obtainwork energy theorem of a particle moving in one dimension under the variable force .

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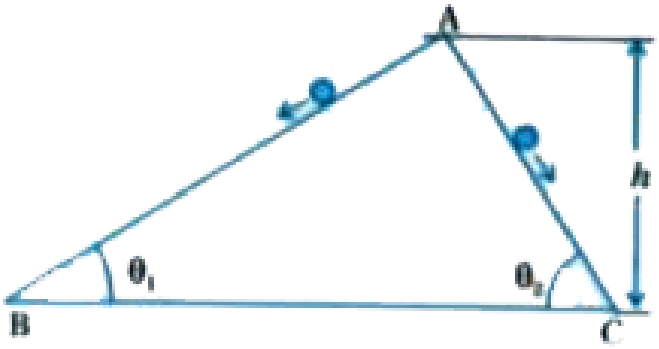
Question Paper Section C

1. Two inclined frictionless tracks , one gradual and the other steep meet at A from where two stones are allowed to slide down from rest , one on each track as shown in figure . Will the stones reach there with the same speed ? Explain . Given $\theta_1 = 30^\circ, \theta_2 = 60^\circ$ and $h = 10m$ What are the speeds and

times taken by the two stones ?



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2. A bolt of mass $0.3kg$ falls from the ceiling of an elevator moving down with an uniform speed of $7ms^{-1}$. It 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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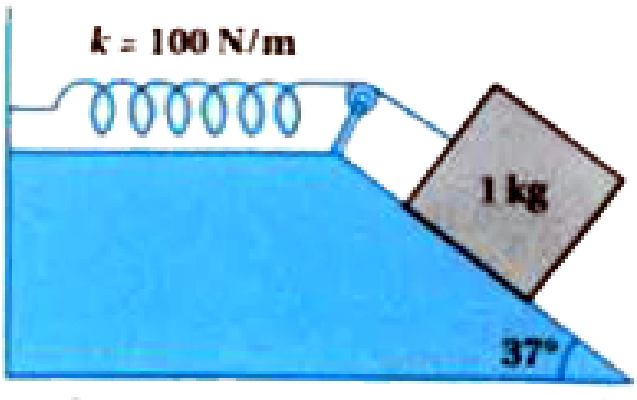
Question Paper Section D

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



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