PHYSICS

BOOKS - MAXIMUM PUBLICATION

WORK ENERGY AND POWER

Example

1. Find the dot product of $\vec{A} = A_x\hat{i} + A_y\hat{j} + A_z\hat{k}$ and $\vec{B} = B_x\hat{i} + B_y\hat{j} + B_z\hat{k}$

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2. Prove conservation of energy for a freely falling body.

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Exercise

1. Find the odd one out and find the relation connecting the remaining quantities. Joule,

Calorie,Kilowatt, electron volt

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

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

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4. In atom, an electron is revolving around the nucleus. What is the work done?

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5. What is the type of collision when macroscopic particles collide?

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6. Name the parameter which is a measure of degree of elasticity of a body.

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7. What is the source of kinetic energy for falling rain drops?

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8. The law of conversation of energy States that energy can neither be created nor be destroyed but can only change from one form into another. A bus and a car moving with the same kinetic energy are brought to rest by applying an equal ratardation force by the braking systems. Which one will come to rest at a shorter distance. Give the reason behind your answer.

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9. A body constrained to move along the Z-axis of a co-ordinate system is subjected to a constant force $\vec{F} = \left(\hat{i} + 2\hat{j} + 3\hat{k}\right) N$. What is the work done by this force in moving the body over a distance of 4m along z-axis ?

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10. A car of mass 1000kg moving with a speed 18mk/h on a horizontal road collides with a horizontally mounted spring of spring

constant 6.25×10^3N/m. What do you mean by Spring constant?

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11. A car of mass 1000kg moving with a speed 18mk/h on a horizontal road collides with a horizontally mounted spring of spring constant 6.25×10^3N/m. What is the maximum compression of the spring?

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12. A man tries to lift a mass 200 kg with a force 100N. Is he doing work ? Explain.

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13. A man tries to lift a mass 200 kg with a force 100N. Is he doing work ? Explain.

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14. A man tries to lift a mass 200 kg with a force 100N. If it is lifted to 2m in 10s find the power.

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15. Two cricket balls are colliding each other. Name the collision and explain?

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16. Two cricket balls are colliding each other. Name the collision and explain?

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17. Choose the correct alternative: In an inelastic collision of two bodies, the quantities which do not change after the collision are the total kinetic energy/total linear momentum of the system of two bodies.

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18. Two cars A and B travelling with speed 20m/s and 10m/s respectively applied brakes, so that A comes to rest in 15 second and B in 7.5s. From the graph determine which of the two cars travelled further after brakes were applied and by how much distance it travelled?

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19. Two cars A and B travelling with speed 20m/s and 10m/s respectively applied brakes, so that A comes to rest in 15 second and B in 7.5s . Draw the velocity time graph of A and B in the same graph.

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20. Two cars A and B travelling with speed 20m/s and 10m/s respectively applied brakes, so that A comes to rest in 15 second and B in

7.5s . In the above process, the wear and tear of which the cars get affected more?

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21. Define coefficient of restitution.

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22. From the table given below Estimate the work done.

Force	2N	4N	6N	8N	10N
Displacement	1m	2m	3m	4m	5m

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23. From the table given below Estimate the work done.

Force	2N	4N	6N	8N	10N
Displacement	1m	2m	3m	4m	5m

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24. Raju increased the speed of moving mass '50kg' from 2m/s to 4m/s. How much force will be required, if velocity change takes place with in 0.2 sec?

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25. A car and a truck have the same kinetic energies at a certain instant while they are moving along two parallel roads . (Assume

that the truck is heavier than the car). Which one will have greater momentum?

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26. Write the relationship between kinetic energy and linear momentum.

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27. A car and a truck have the same kinetic energies at a certain instant while they are

moving along two parallel roads . (Assume that the truck is heavier than the car). If the mass of the truck is 100 times greater than that of the car ,find the ratio between their velocities.

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28. Raju dropped a rubber ball of mass m from a height h to the ground . He observed that the ball rebounds vertically and along the same line to a height h_1 which is less than h.

Find the velocity with which it strikes the ground?

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29. Raju dropped a rubber ball of mass m from a height h to the ground . He observed that the ball rebounds vertically and along the same line to a height h_1 which is less than h. Find the velocity with which it strikes the ground?

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30. Raju dropped a rubber ball of mass m from a height h to the ground . He observed that the ball rebounds vertically and along the same line to a height h_1 which is less than h. If the rubber ball is allowed to fall on a spring placed on the ground then what change will Raju note is in the height of rebound?

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31. Raju dropped a rubber ball of mass m from a height h to the ground . He observed that the ball rebounds vertically and along the same line to a height h_1 which is less than h. If the rubber ball is allowed to fall on a spring placed on the ground then what change will Raju note is in the height of rebound?

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32. A man tries to lift a mass 200 kg with a force 100N. Is he doing work ? Explain.

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33. A man tries to lift a mass 200 kg with a force 100N. If it is lifted to 2m in 10s find the power.

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34. Show that total mechanical energy is conserved for a freely falling body.

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35. An elevator of total mass 1800 kg is moving up with a constant speed of $2\frac{m}{s}$. A frictional force of 400 N acts on this motion. The direction of frictional force is $\cdots$

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36. An elevator of total mass 1800 kg is moving up with a constant speed of $2\frac{m}{s}$. A frictional force of 4000 N acts on this motion. What is the power exerted by gravitational force ?

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37. An elevator of total mass 1800 kg is moving up with a constant speed of $2\frac{m}{s}$. A frictional force of 4000 N acts on this motion. Determine the minimum power delivered to the elevator.

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38. A stone of mass m is to be thrown to a height h. What is the acceleration of the stone?

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39. A stone of mass m is to be thrown to a height h. With what minimum velocity should it be thrown?

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40. A stone of mass m is to be thrown to a height h. At what height does the KE and PE become equal?

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41. A stone of mass m is to be thrown to a height h. Find the velocity at that height when PE and KE are equal.

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42. A toy gun with a spring compressor 3 cm is used to project a stone of mass 50 gm to a height of 10m. What is the potential energy of spring?

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43. A toy gun with a spring compressor 3 cm is used to project a stone of mass 50 gm to a height of 10m. How much it should be

compressed to throw the stone to a height 5m?

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44. A toy gun with a spring compressor 3 cm is used to project a stone of mass 50 gm to a height of 10m. Find out the physical constant associated with the spring.

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45. Find the odd one out and find the relation connecting the remaining quantities. Joule, Calorie,Kilowatt, electron volt

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46. A graph paper is situated on a board. Near the graph paper a spring is placed. A pencil is attached to the end of the spring. The pencil is free to move on the graph paper. A stone of mass 50g m is placed 1 m above the spring.

[Spring constant $k = 98\frac{N}{m}$] . the energy possessed by the stone due to its height is called $\cdots$.

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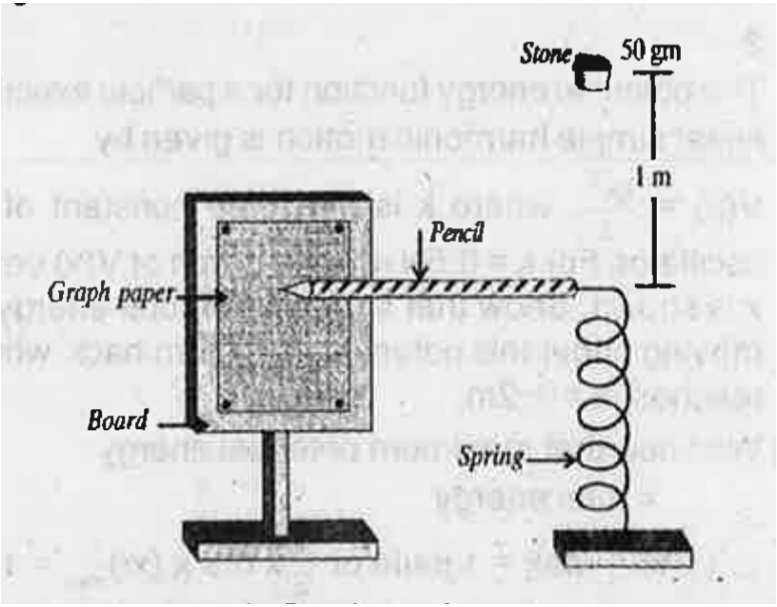
47. A graph paper is situated on a board as shown in figure. Near the graph paper a spring is placed. A pencil attached to the end of the spring as shown in figure. The pencil is free to move on the graph paper. A stone of mass 50g m is placed 1 m above the spring. [Spring

constant $k = 98\frac{N}{m}$]. What will happen to the length of mark if spring having smaller spring constant is used? Justify.



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48. 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: work done by a man in lifting a bucket out of a well by means of a rope tied to the bucket.

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49. 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: work done by gravitational force in the above case.

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50. 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: work done by friction on a body moving sliding down an inclined plane.

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51. 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: work done by an applied force on a body moving on a rough horizontal plane with uniform velocity.

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52. 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: work done by the resistive force of air on vibrating pendulum in bringing it to rest.

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53. Choose the correct alternative: When a conservative force does positive work on a body, the potential energy of the body increases/decreases/remains inaltered.

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54. Choose the correct alternative: Work done by a body against friction always results in a loss of its kinetic/potential energy.

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55. Choose the correct alternative: 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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56. Choose the correct alternative: In an inelastic collision of two bodies, the quantities which do not change after the collision are the total kinetic energy/total linear momentum of the system of two bodies.

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57. State if each of the following statements is true or false. In an elastic collision of two bodies, the momentum and energy of each body is conserved.

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58. State if each of the following statements is true or false. Total energy of a system is always conserved, no matter what internal and external forces on the body are present.

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59. State if each of the following statements is true or false. Work done in the motion of a body over a closed loop is zero for every force in nature.

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60. State if each of the following statements is true or false. In an inelastic collision, the final

kinetic energy is always less then the initial kinetic energy of the system.

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61. A rain drop of radius 2mm falls from a height of 500m 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 $10 \mathrm{m} s^{-1}$?

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62. A bullet of mass 0.012 kg and horizontal speed 70 $\mathrm{m} s^{-1}$ strikes a block of wood of mass 0.4 kg and instantly comes to rest with respect to the block. The block is suspended

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

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63. What is the quantity that remains conserved in all types of collisions?

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64. Suppose an electron and a proton are projected with equal kinetic energy, what will be the ratio of their linear momentums if the proton is 1830 times heavier than an electron?

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65. Collision between two particles need not be the physical contact of two particles as in the case of scattering of the alpha - particle by a nucleus.

C)The bob of the pendulum released from 30 degree to the vertical hits on another bob of equal mass at rest. How high does the first bob rise after the collision? (Assume that the collision is elastic and the size of the bobs are negligible.)

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66. Work is related to force and displacement over which it acts. A man tries to pull a rigid

wall for long time but fails to displace it. What is the external work done by him?

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67. Work is related to force and displacement over which it acts. Suggest two conditions for the work done by a force to be zero.

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68. Work is related to force and displacement over which it acts. A body of mass 1 kg travels in a straight line with a velocity $kx^{3/2}$ where k = 5 SI units. (Calculate the work done by the net force to displace from $x = 0$ to $x = 2m$.

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69. A ball moves along a circle under the infulence of centripetal force. What is the work done by the centripetal force on the ball?

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70. An arrow shot from a bow has kinetic energy. How does it get this kinetic energy?

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71. Show that total mechanical energy is conserved for a freely falling body.

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72. When brakes are applied on a moving vehicle, it stops after travelling a distance. The distance is called stopping distance.Write an expressionof stopping distance in terms of initial velocity (u) and retardation (a).

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73. When brakes are applied on a moving vehicle, it stops after travelling a distance. The distance is called stopping distance. If the initial speed is doubled keeping the

retardation same, by how much will the stopping distance change?

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74. Ramesh lifts a body of mass 'm' to a height 'h' near surface of the earth in a time 't'. Draw the force-displacement graph. If 'A' is the area of the graph, what quantity does $\left(\frac{A}{t}\right)$ indicate?

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75. According to the work- energy theorem, work done by a force on a body is equal to change in its kinetic energy. Prove the theorem.

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76. A lorry and a car moving with the same kinectic energy are stopped by applying brakes which provides the same retardation. Which of them will come to a rest in a shorter distance? Explain.

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77. A force is required to do work. The work done by a force is the product of displacement and the component of force in the direction of displacement. Prove this statement.

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78. Consider a body falling freely through the atmosphere. Neglecting the air resistance

prove that the total mechanical energy of the body remains constant throughout the fall.

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79. Say True or False : The total energy of a body is equal to the work it can do in being brought to rest.

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80. Work is required to lift a body through a height from the ground, Calculate the work done in lifting a body of mass $10kg$ to a height of $10m$ above the ground.

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81. Work is required to lift a body through a height from the ground. Prove the law of conservation of energy of a freely falling body

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82. Work is required to lift a body through a height from the ground, Draw the variation of KE and PE with the height of the body.

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83. State and prove the law of conservation of energy for a freely falling body.

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84. State and explain the work done in the following situation : A person carrying a heavy load walks on a level road.

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85. State and explain the work done in the following situation : A man spending his energy by pushing on a concrete wall.

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86. A constant force of $200N$ displaces a body through $5m$ in the direction of the force. Find the work done on the body.

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87. A car is moving with a constant speed on a straight line. What is the net work done by the external force on the car?

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88. State work energy theorem.

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89. A bullet of mass $10g$ and velocity $800\frac{m}{s}$ is passed through a mud wall of thickness $1m$. Its velocity reduces to $100\frac{m}{s}$. Find the average resistance offered by the mud wall.

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90. From the table given below: Draw the force-displacement graph. 

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91. From the table given below: Draw the force-displacement graph. 

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92. Consider two point masses, m_1 and m_2, moving along a straight line in the same direction with speeds u_1, and u_2. Let them undergo one-dimensional collision and retrieve each other with velocities v_1 and v_2 .how that $(u_1 - u_2) = -(v_1 - v_2)$ i.e, after collision, their relative velocities are equal.

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93. The scalar product of force and displacement gives work. It can be negative, zero or positive. The work done in sliding a load is .... with respect to frictional force. (zero, positive, nega tive, infinity)

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94. State and prove the work energy theorem for constant force.

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95. A pump on the ground floor of a building can pump water to fill a tank of volume $30m^3$ in $15\ \text{min}\ utes$. If the tank is $40m$ above the ground and the efficiency of the pump is $30\ \%$, how much electric power is consumed by the pump?

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96. Several games such as billiards, marbles or carrom involve collisions. When two objects

collide, after collision they could move together, the collision is..... (elastic, completely elastic, inelastic, completely inelastic)

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97. Show that in a perfectly elastic collision in one dimension, relative velocity after collision is equal to relative velocity before collision.

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98. A ball at rest is dropped from a height of $12m$. It loses $25\,\%$ of its kinetic energy on striking the ground. Find the height to which it bounces.

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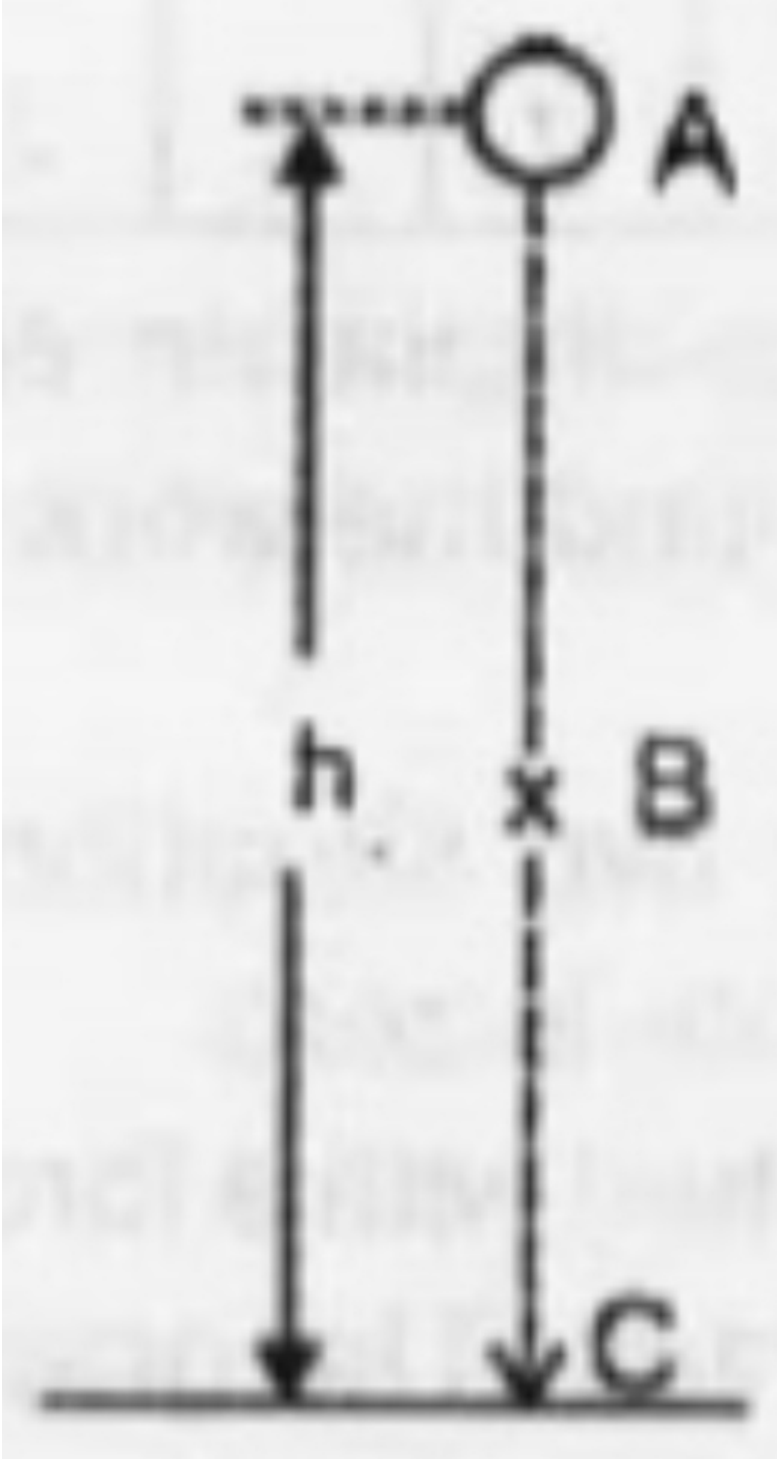
99. The figure shows a body of mass m placed at a height h. A, B and C are the three points on the trajectory of this body. Which is the type of energy possessed by this body at a

height h?


A
h
x
B
C

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100. Name the energy possessed by the body at maximum height. Write an equation for it.

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101. Force is required to lift a body from the ground to a height h and work is measured as the product of force and magnitude of displacement. A man of mass $60kg$ carries a stone of mass $20kg$ to the top of a

multistoreyed building of height $50m$. Calculate the total energy spent by him? $\left(g = 9.8\frac{m}{s^2}\right)$

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102. State work energy theorem.

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103. Show that the potential energy of a body is completely converted into kinetic energy

during its free fall under the gravity.

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104. A man carefully brings down a glass sheet from a height $2m$ to the ground. The work done by him is...

A. negative

B. positive

C. zero

D. unpredictable

Answer: A

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105. Energy of a body is defined as its capacity of doing work. The energy possessed by a body by virtue of motion is known as....

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106. Energy of a body is defined as its capacity of doing work. A body of mass $5kg$ initially at

rest is subjected to a horizontal force of $20N$. What is the kinetic energy acquired by the body at the end of $10s$?

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107. Energy of a body is defined as its capacity of doing work. State whether the following statement is TRUE or FALSE. "The change in kinetic energy of a particle is equal to the work done on it by the net force"

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