PHYSICS

BOOKS - JBD PUBLICATION

WORK,ENERGY AND POWER

Exercise

1. If under the action of variable force $\vec{F}$,a body is displaced by $\vec{S}$,the work done is given by:

A. FS

B. $\overrightarrow{F} \cdot \overrightarrow{S}$

C. $\int_0^S \overrightarrow{F} . \overrightarrow{ds}$

D. $\overrightarrow{F} \times \overrightarrow{F}$.

Answer:

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2. Work is done only when:

A. applied force is strong

B. applied force generates motion

C. applied force is normal to displacement

D. force is applied.

Answer:

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3. What is the work done by centripetal force?/

A. > 0

B. < 0

C. zero

D. none of these.

Answer:

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4. Two identical 5 kg blocks are moving with same speed of $2ms^{-1}$ towards each other along a frictionless horizontal surrface.the two blocks collide,stick together and come to rest.Consider the two blocks as a system.The

work done by external and internal forces are respectively:

A. $0, 0$

B. $0, 20J$

C. $0, -20J$

D. $20J, -20J.$

Answer:

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5. Potential energy is the energy possessed by a body by virtue of its:

A. position

B. motion

C. mass

D. none of these.

Answer:

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6. When K.E. of a body is increased by 300 %, the momentum of the body is increased by

A. $50\ \%$

B. $100\ \%$

C. $150\ \%$

D. $300\ \%$.

Answer:

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

A. $\sqrt{2}:1$

B. $1:4$

C. `1:2

D. $1:\sqrt{2}.$

Answer:

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8. What is the work done by a force of 1 gf in diplacing a body of 5 g through 1 cm?

A. 50 J

B. 5 J

C. 0.01 J

D. 0.0001 J

Answer:

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9. When a person lift a body from the ground,work done by the lifting force is :

A. $+ve$

B. $-ve$

C. zero

D. 1

Answer:

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10. Two masses of 1g and 9 g are moving with equal kinetic energies. The ratio of the magnitudes of their respective linear momentum is

A. $1:9$

B. $9:1$

C. $1:3$

D. $3:1.$

Answer:

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11. When the bob of a simple pendulum swings,the work done bby tension in string is :

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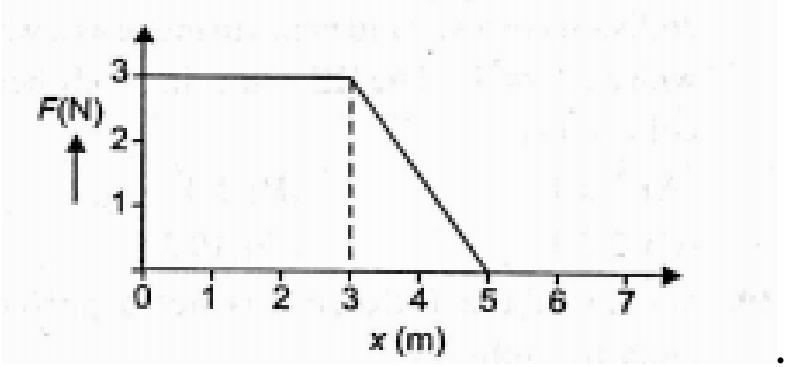
12. A force F acting on the object varies with distance x as shown in fig.The force is in N and x is in m.The work done by the force in moving

the object from x =0 to x=6 m is :



A. `18.0 J

B. 13.5 J

C. $9.0J$

D. 4.5 J.

Answer:

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13. Which of the following is not an examp[le of perfectly inelastic collision?

A. A bullet fired into a block if bullet gets embedded into block.

B. Capture of electrons by an atom.

C. A man jumping onto a moving boat.

D. A ball bearing striking another ball bearing.

Answer:

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14. The centripriptal acceleration of a particle varies inversely with the square of the radius r of the circular path.the KE of the particle varies directly as :

A. r

B. r^2

C. r^{-1}

D. r^{-2}.

Answer:

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15. A ball is dropped from a height of 1 m.If coefficient of restitution between surface and ball is 0.6 ,the ball rebounds to a height of :

A. $0.6m$

B. $0.4m$

C. $1m$

D. $0.36m$.

Answer:

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16. A human heart discharges 75 cc of blood the through the artcries at each beat against an average pressure of 10 cm ofmercutry.Assuming that the pulse frequency is 72 per minute,the rate of working of heart is

watt is (density of mercury = $13.6gcm^{-3}$ and $g = 9.8ms^{-2}$):

A. 11.9 W

B. 1.19 W

C. 0.119 W

D. 119 W.

Answer:

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17. An inelastic ball is dropped from a height of 100 m.Due to earth 20 % of its energy is lost.to what height will the ball rise?

A. 80 m

B. 40 m

C. 60 m

D. 20 m.

Answer:

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18. A body of mass 5 kg strikes another bodfy of mass 2.5 kg initially at rest.The bodies after collision coalesce and begin to move as a whole with a KE of 5 j.the KE of the first body before collision is:

A. 7.5 J

B. 5 J

C. 2.5 J

D. 10 J

Answer:

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19. Which of the following is not a perfectly inelastic collision?

A. Shrinking of two glass balls

B. A bullet striking a bag of sand

C. An electron captured by a proton

D. A man jumping into a moving cart.

Answer:

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20. Which of the following statement is incorrect?

A. Most of the collisions on the macroscopic scale are inelastic collision.

B. In a perfectly inelastic collision,there is a complete loss of K.E.

C. Forces involved in elastic collision are conservative in nature.

D. Oblique collision is that collision in which the colliding bodies do not move along the same straight line path.

Answer:

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21. A man pushes against a wall but fails to move it .He does:

A. negative work

B. positive work but not maximum work

C. maximum positive work

D. no work at all.

Answer:

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22. The potential energy of a system increases if work is dones:

A. upon the system by a non-conservative force

B. by the system aainst a conservative force

C. by the systerm agaist a non-conservative force

D. upon the systerm by a conservative force.

Answer:

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23. Which of the following statement is incorrect?

A. The work done by sun in rotating planets around it is zero.

B. Two vehicles having equal masses and equal speeds moving in opposite directions posses equal kinetic energy.`

C. Potential energy arisig from attractive forces is always positive.

D.

Answer:

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

A. the total kinetic energy is conserved

B. the linear momentum is not conserved

C. the total mechanical energy is not conserved

D. the linear momentum is conserved.

Answer:

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25. An engine pumps out water continously through a hose with a veclocity v.If m is the mass per unit length of the water jet ,the rater at which the kinetic energy is imparted to water is :

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

B. $\frac{1}{2}mv^3$

C. $\frac{1}{2}m^2v^2$

D. mv^3.

Answer:

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26. A particle is acted upon by a constant power.then which of the following pysical quantity remains constant?

A. speed

B. rate of change of acceleration

C. K.E.

D. rate of change of K.E..

Answer:

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27. Identify the wrong statement from the following:

A. Work-enregy theorem holds in all inertial frames

B. Work-energy theorem is not independent of Newton's second law

C. Work done by friction over a closed path is zero

D. Work done is scalar quantity.

Answer:

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28. The shape of the curve representing the relation between the speed and kinetic energy of a moving object is :

A. parabola

B. ellipse

C. straight line with positive slope

D. straight line with negative slope

Answer:

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29. State if each of the following statements is true or false. Give reasons for your answer:- In an elastic collision of two bodies, the momentum and energy of each body is conserved.

A. both memntum and kinetic energy are conservd.

B. neither momentum is conserved

C. only kinetic energy is conserved

D. forces involved in the interactin are non-conservative.

Answer:

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30. In a nuclear moderators slow down the neutrons which come out in a fission process. The moderator used have light nuclei. Heavy nuclei will not serve the purpose because

A. using a lead sheild

B. passing them through water

C. elastic collision with heavy nuclei

D. applying strong magnetic field

Answer:

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31. In which case does the ptential energy decrease?

A. On compressing the spring

B. On stretching the spring

C. On moving a ball against gravitational pull

D. On the raising of an air bubble in water.

Answer:

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32. A moving ball of mass m undergoes a head - on elastic collision with another ball of mass 2 m at rest .Show that the colliding ball loses $\frac{8}{9}th$ of its K.E. energy after collision.

A. $1/9$ of its initial kinetic energy

B. $1/4$ of its initial knetic energy

C. $1/2$ of its initial kinetic energy

D. $8/9$ of its initial kinetic energy.

Answer:

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33. Under the action of a constant force,a particle is experiencing a constant acceleration.the power is :

A. positive constant

B. negative constant

C. increasing uniformly with time

D. decresing uniformly with time.

Answer:

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34. 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:

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35. A body is falling freely under the action of gravity alone in vacuum. 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:

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Example

1. What is SI unit of work?

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2. What is the relation between watt and horse power?

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3. What is the S.I. unit of energy?

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4. What is the SI unit of power ?

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5. Can acceleration be produced without doing any work?

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6. What is the work done in holding a 15 kg suitcase whiel waiting for a bus for 15 mimnutes?

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7. An arrow is shot from a bow, from where does it get kinetic energy?

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8. What kind of energy is stored in a dam?

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9. What kind of energy is stored in a spring?

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10. Is mass of a body conserved?

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11. What is the work done by centripetal force?/

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12. What it Einstein's mass energy relation?

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13. For a force to do maximum work, what should be the angle between force and displacement vectors?

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14. Can potential nergy of an object be negative?

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15. Can KE of a system be increased or decreased without the application of external force?

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16. Is linear momentum of any system always conserved?

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17. Name motion in which momentum changes but K.E. remains constant.

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18. Out of joule ,calories ,kilowatt and million electron volt,which one is not the unit of energy?

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19. Does the work done in raising a box on a platform depend upon how fast it is raised up? If not, why?

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20. How many ergs are there in one joule?

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21. How many joules are there in MeV?

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

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23. What is coefficient of restitution? What is its value for perfectly elastic and inelastic collisions?

Watch Video Solution

24. What is coefficient of restitution? What is its value for perfectly elastic and inelastic collisions?

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25. Define elastic collision. Show thaat in an elastic collision, relative velocity of approach before collision is equal to relative velocity of separation after collisions.

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26. The collision between two hydrogen atoms is perfectly elastic ,so the momentum is consered.Do you agree with this statement?

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27. State if each of the following statements is true or false. Give reasons for your answer:- In an elastic collision of two bodies, the

momentum and energy of each body is conserved.

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28. When two identical spheres collide obliquely with one of them initialyly at rest,then fly off making an angle θ.What is the value of angle θ if the collision is elastic?

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29. What is common feature of all types of collisions?

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30. Which physical quantity is conserved during both elastic and inelastic collisions?

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31. What are the conditions so that transfer of kinetic energy is maximum during collision?

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32. A ball of mass M_1 collides elastically and head on with another ball of mass M_2 initially at rest.When will transfer of energy from first body to second body he maximum?

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33. A moving ball of mass m undergoes a head - on elastic collision with another ball of mass 2 m at rest .Show that the colliding ball loses $\frac{8}{9}th$ of its K.E. energy after collision.

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34. When is mechanical work done?

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35. What is a joule?

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36. In a tug of war ,what is work done?

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37. Explain with an example that a body may possess energy even when it is not in motion.

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38. Is there any work done by a man wh climbbs up the stairs of his house?Give reasons.

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39. What is conservative force?

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40. What is non-conservative force?

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41. Moment of a force and work done by a force have same units.then what is the difference between them?State at least one point of difference.

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42. A bus and car have the same momentum .Which of them has greater kinetic energy?

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43. What is the significance of work-energy theorem?

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44. What is power ? Write its SI unit also.

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45. A person walking on a horizontal road with a load on his head does no work.Explain.

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46. A meteorite burns in the atmosphere before it reaches the earth's surface. what happens to its momentum?

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47. 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 `t

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48. 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 `t

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49. 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 `t

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50. 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 `t

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51. A rough incline plane is placed on a cart moving with a constnat velocity u on horizontal ground. A block of mass M rests on the incline. Is any work done by fore of friction between the block and incline? Is there then a dissipation of energy?

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52. 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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53. 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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54. A body falls towards earth in air. Will its total mechanical energy be conserved during the fall? Justify.

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55. What is a collision?

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56. If two bodies collide and one is initially at rest,

is it possible for both to be at rest after collision?

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57. If two bodies collide and one is initially at rest,

is it possible for any one to be at rest after collision?

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58. Distinguish between a head on and an oblique collision.

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59. Is it possible to have a collision in which the whole of KE is lost?

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60. What conclusion can you draw about the masses of projectile and target in case of head on elatic collision

If projectile stops

Watch Video Solution

61. What conclusion can you draw about the masses of projectile and target in case of head on elatic collision

If projectile stops

Watch Video Solution

62. What conclusion can you draw about the masses of projectile and target in case of head on elatic collision

If target flies ahead of projectile?

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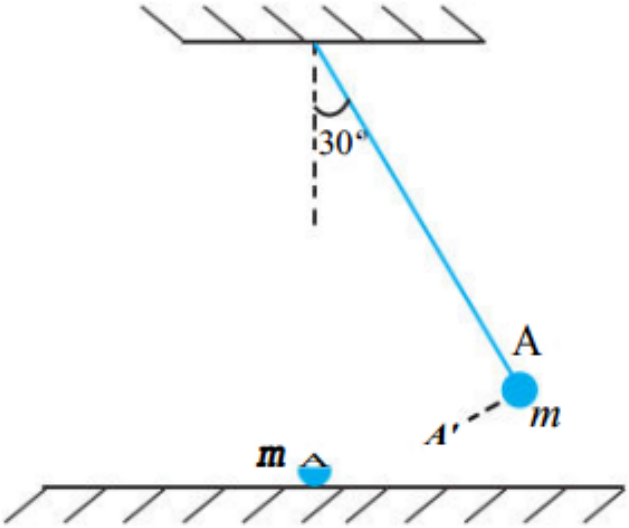
63. The bob A of a pendulum released from 30° to the vertical hits another bob B of the same mass at rest on a table as shown in Fig. 6.15. How high does the bob A rise after the

collision ? Neglect the size of the bobs and assume the collision to be elastic.



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64. A molecule in a gas container hits a horizontal wall with speed 200 m s_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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65. Answer carefully, with reasons :-In an elastic collision of two billiard balls, is the total kinetic energy conserved during the short time of collision of the balls (i.e. when they are in contact) ?

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

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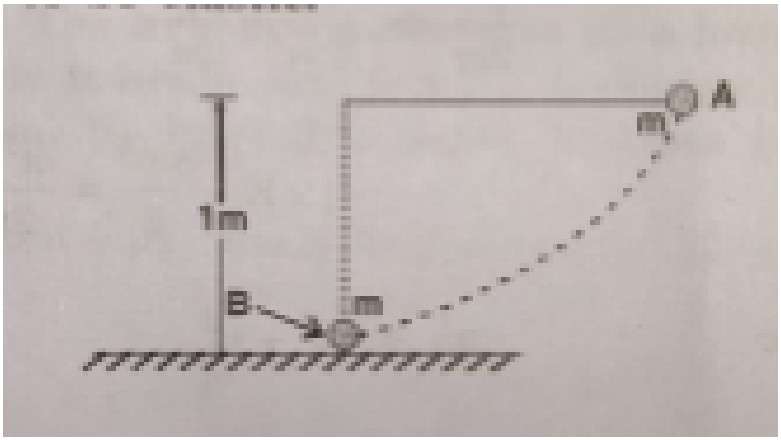
67. The bob A of a pendulum released from horizontal to the vertical hits another bob B of the same mass at rest on a table as shown in the figure. If the length of the pendulum is 1m,

calculate the height to which bob A will rise after collision.



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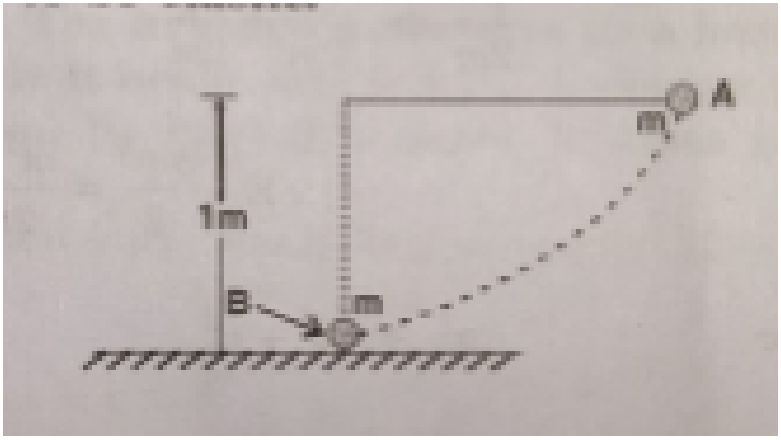
68. The bob A of a pendulum released from horizontal to the vertical hits another bob B of the same mass at rest on a table as shown in

the figure. If the length of the pendulum is 1m, calculate the height to which bob A will rise after collision.



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69. A throwing mud on the wall is one of the examples of a perfectly inelastic collision

.Explain.

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70. A block of mass m moving at a speed v collides with another block of mass 2 m at rest.The lighter block comes to rest after the collision.Find the coefficient of restitution.

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71. A 100 quintal freight car running freely at $10kmh^{-1}$ collides with and is coupled to a 70 quintal car originally at rest.Find the speed with which the cars move after collision.

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72. A ball of $0.1kg$ makes an elastic head on collision with a ball of unknown mass that is intitially at rest.If the 0.1 kg ball rebound at

one third of its original speed ,what is the mass of the other ball?

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73. Write dimensions and units off power.

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74. What is the relation between kinetic energy and momentum?

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75. What do you mean by "internal energy"?

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76. Define law of conservatin of mechanical energy.

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

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

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79. Two protons are brought together. How will potential energy of the system alter?

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80. a particle moves from position vector $\left(3\hat{i}+2\hat{j}-6\hat{k}\right)$ to the position vector $\left(14\hat{i}+13\hat{j}+9\hat{k}\right)$ in metres under the action off a constant force of $\left(4\hat{i}+\hat{j}+3\hat{k}\right)$ newton.Calculate the worrk done by the force.

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81. A particle moves alog the x - axis from x=0 to x=5 m under the influence off a force given

by $F = 7 - 2x + 3x^2$.Calculate the work done in doing so.

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82. Why are mountain roads generally made winding upwards rather than going straight up?

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83. What kind of energy is possessed by the following and why?

a wound spring of a clock

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84. What kind of energy is possessed by the following and why?

a stretched bow

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85. What kind of energy is possessed by the following and why?

wind - mill

Watch Video Solution

86. What kind of energy is possessed by the following and why?

a bullet fired from a gun.

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87. A light and a heavy body have same linear momentum. Which one has greater K.E.?

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88. A lighter body and a heavier body have same K.E. Which one has greater momentum?

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89. It is well known that a rain drop falls under the influence of the downward gravitational

force and the opposing resistive force. The latter is known to be proportional to the speed of the drop, but is otherwise undetermined. Consider a drop of mass 1.0g falling from a height of 1.00km. It hits the ground with a speed of 50.0ms^(-1)

(a) What is the work done by the gravitational force ?

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

(b) What is the work done by the unknown resistive force ?

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91. To stimulate car accidents auto manufacturers 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 km/h on a smooth road and colliding with a horizontally mounted spring of a spring constant 6.25 10^3N/m. what is the maximum compression of the spring?

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92. A ball is dropped from a height 4 m.what is the height upto which the ball will rebound if teh coefficient of restitution is 0.5?

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93. What is scalar product?

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94. Define the term collision. Discuss its types with examples.

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95. A and B are two particles having the same mass m. A is moving along X-axis with a speed of 10ms^(-1) and B is at rest. After undergoing a perfectly elastic collision with B, particle A gets scattered through an angle of 30^(@). What is th edirection of motion of B, and the speeds of A and B, after the collision?

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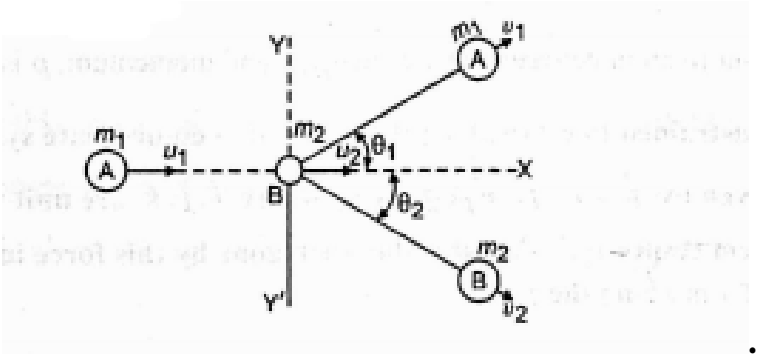
96. Consider the collision depicted in Figure, to be between two billiard balls with equal masses $m_1 = m_2$. The first ball is called the cue and the second ball is called the target. The billiard player wants to sink the target ball in a corner pocket, which is at an angle $\theta_2 = \phi = 37^\circ$. Assume that the collision is elastic and that friction and rotational motion are not important. Obtain theta_(1)`



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97. What is scalar product?

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98. Define kinetic energy?

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99. A body constrained to move along the z-axis of a coordinate system is subject to a constant force F given by $F = -\hat{i} + 2\hat{j} + 3\hat{k}N$ 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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100. A trolley of mass 200 kg moves with a uniform speed of $36km/h$ 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 ?

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101. A 2 kg ball moving at 24 ms undergoes inelastic head on collision with a 4 kg ball moving in the opposite direction at 48 ms. If the coefficient of restitution is 2/3, their velocities in ms-after impact are

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102. A body of mass M at rest is struck by a moving body of mass m.Prove that the fraction of the initial kinetic energy of mass

transformed to the struck body is $\frac{4Mm}{(m+M)^2}$.

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103. State and prove work-energy theorem.

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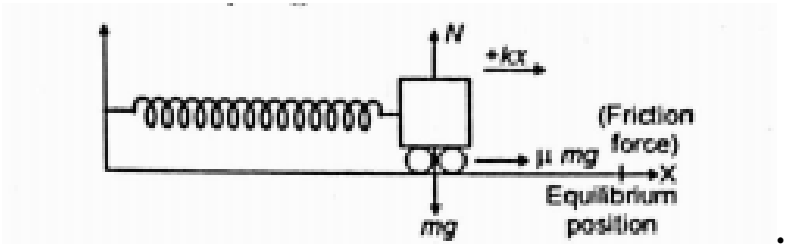
104. Consider the following figure taking the coefficient fo friction,μ to be 0.5 and calculate

the maximum compression of teh spring.



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105. What is non-conservative force?

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106. Define work.Write it's units.

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107. What is spring constant ? What are the SI units?

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108. Write short note on power.

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109. Which of the following is not a perfectly inelastic collision?

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