PHYSICS

BOOKS - MTG PHYSICS (ENGLISH)

WORK , ENERGY AND POWER

Mcq

1. The work-energy theorem states that the change in

A. kinetic energy of a particle is equal to the work done on it by the net force

B. kinetic energy of a particle is equal to the work done by one of the forces acting on it

C. potential energy of a particle is equal to the work done on it by the net force

D. potential energy of a particle is equal to the work done by one of the forces acting on it

Answer: A

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2. A raindrop of mass 1 g falling from a height of 1 km hits the ground with a speed of $50ms^{-1}$. If the resistive force is proportional to the speed of the drop, then the work done by the resistive force is (Take $g = 10ms^{-2}$)

A. 10 J

B. -10 J

C. 8.75J

D. $-8.75J$

Answer: D

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3. A body of mass 4 kg is moving with momentum of $8kgms^{-1}$. A force of 0.2 N acts on it in the direction of motion of the body for 10 s. The increase in kinetic energy is

A. 10 J

B. 8.5 J

C. 4.5 J

D. 4 J

Answer: C

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4. An object of mass m is released from rest from the top of a smooth inclined plane of height h. Its speed at the bottom of the plane is proportional to

A. m^0

B. m

C. m^2

D. m^{-1}

Answer: A

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5. A body is being raised to a height h from the surface of earth. What is the sign of work done by

(a) applied force (b) gravitational force ?

A. Positive, Positive

B. Positive, Negative

C. Negative, Positive

D. Negative, Negative

Answer: B

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6. The correct relation between joule and erg is

A. $1J = 10^{-5}$ erg

B. $1J = 10^{5}$ erg

C. $1J = 10^{-7}$ erg

D. $1J = 10^{7}$ erg

Answer: D

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7. A weight lifter lifts a weight off the ground and holds is up, then

A. work is done in lifting as well as holding the weight.

B. no work is done in both lifting and holding the weight.

C. work is done in lifting the weight but no work is required to done in holding it up.

D. no work is done in lifting the weight but work is required to be done in holding it up.

Answer: C

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8. The angle between force $\overrightarrow{F} = \left(3\hat{i} + 4\hat{j} - 5\hat{k}\right)$ unit and displacement $\overrightarrow{d} = \left(5\hat{i} + 4\hat{j} + 3\hat{k}\right)$ unit is

A. $\cos^{-1}(0.16)$

B. $\cos^{-1}(0.32)$

C. $\cos^{-1}(0.24)$

D. $\cos^{-1}(0.64)$

Answer: B

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9. A body constrained to move along y-axis is subjected to a constant force $\overrightarrow{F} = -\hat{i} + 2\hat{j} + 3\hat{k}N$. The work done by this force in moving the body a distance of 4 m along y-axis is

A. 4J

B. 8 J

C. 12J

D. 24 J

Answer: B

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10. A particle acted upon by constant forces $4\hat{i}+\hat{j}-4\hat{k}$ and $3\hat{i}+\hat{j}-\hat{k}$ is displacment from the point $\hat{i}+2\hat{j}+\hat{k}$ to point $5\hat{i}+4\hat{j}+\hat{k}$.Total work done by the forces in SI unit is :

A. 20

B. 40

C. 50

D. 30

Answer: B

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

A. 12.9J

B. 6.3 J

C. 3.6 J

D. 2.0 J

Answer: C

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

A. MgL

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

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

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

Answer: D

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13. A block of mass 2 kg initially at rest moves under the action of an applied horizontal force of 6 N on a rough horizontal surface. The coefficient of friction between block and surface is 0.1. The work done by the applied force in 10 s is (Take $g = 10ms^{-2}$)

A. 200J

B. $-200J$

C. 600 J

D. $-600J$

Answer: C

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14. A block of mass 2kg initially at rest moves under the action of an applied horizontal force of 6 N on a rough horizontal surface. The coefficient of friction between the block and surface is 0.1. the work done by friction in 10 s is

A. 1) 200J

B. 2) $-200J$

C. 3) 600 J

D. 4) $-600J$

Answer: B

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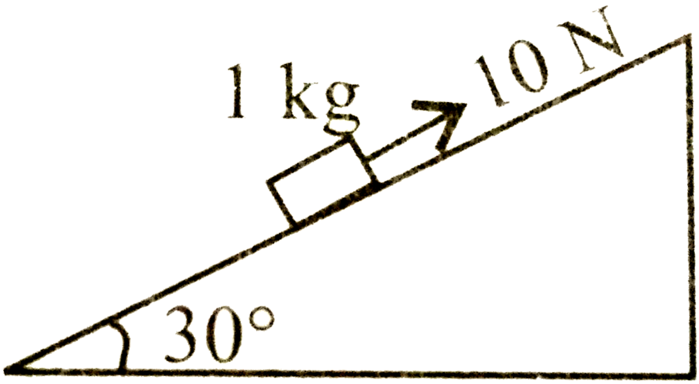
15. A block of mass 1 kg is pushed up a surface inclined to horizontal at an angle of 30° by a force of 10 N parallel to the inclined surface as shown in the figure.

The coefficient of friction between block and the incline is 0.1. If the block is pushed up by 10 m along the incline, then the work against gravity is (Take $g = 10ms^{-2}$)



A. 10 J

B. 50 J

C. 100 J

D. 150 J

Answer: B

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16. the work done against force of friction is

A. 8.7 J

B. 10.7 J

C. 7.8 J

D. 12.7 J

Answer: A

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17. the work done by applied force is

A. 10 J

B. 50 J

C. 100 J

D. 150 J

Answer: C

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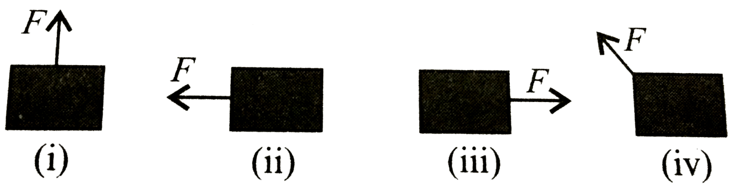
18. Figure shows four situations in which a force is applied to a block. In all four cases, the force has the same magnitude, and the displacement of the block is to the right and of the same magnitude. Which of the following cases work done by the applied force on the block zero?



A. (i)

B. (ii)

C. (iii)

D. (iv)

Answer: A

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19. The work done by a body against friction always results in

A. loss of kinetic energy

B. loss of potential energy

C. gain of kinetic energy

D. gain of potential energy

Answer: A

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20. Which of the following statements is incorrect?

A. Kinetic energy may be zero, positive or negative

B. Power, energy and work are all scalars

C. Potential energy may be zero, positive or negative

D. Ballistic pendulum is a device for measuring the speed of bullets

Answer: A

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21. If the force acting on a body is inversely proportional to its speed, then its kinetic energy is

A. linearly related to time

B. inversely proportional to time

C. inversely proportional to the square of time

D. a constant

Answer: A

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22. A truck and a car moving with the same kinetic energy are brought to rest by the application of brakes which provide equal retarding forces. Which of them will come to rest in a shorter distance?

A. The truck

B. The car

C. Both will travel the same distance before coming to rest

D. Cannot be predicted

Answer: C

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23. 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 emerges 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 the target ?

A. The velocity of the bullet remains the same.

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

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

D. The bullet will continue to move along the same parabolic path.

Answer: C

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24. A 120 g mass has a velocity $\overrightarrow{v} = 2\hat{i} + 5\hat{j} ms^{-1}$ at a certain instant. Its kinetic energy is

A. 3 J

B. 4 J

C. 5 J

D. 1.74 J

Answer: D

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25. The blades of a windmill sweep out a circle of area A. If the wind flows at a velocity v perpendicular to the circle, then the mass of the air of density ρ passing through it in time t is

A. $Av\rho t$

B. $2Av\rho t$

C. $Av^2\rho t$

D. $\frac{1}{2}Av\rho t$

Answer: A

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26. the kinetic energy of the air is

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

B. $\frac{1}{2}A\rho v^2t$

C. $\frac{1}{2}A\rho v^3t$

D. $2A\rho v^3t$

Answer: C

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27. For a moving particle (mass m, velocity v) having a momentum p, which one of the following correctly describes the kinetic energy of the particle?

A. $\frac{p^2}{2m}$

B. $\frac{p}{2m}$

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

D. $\frac{v}{2m}$

Answer: A

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28. In the non-relativistic regime, if the momentum, is increased by 100%, the percentage increase in kinetic energy is

A. 100

B. 200

C. 300

D. 400

Answer: C

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29. The momentum of a body is increased by 25%. The kinetic energy is increased by about

A. 25%

B. 5%

C. 56%

D. 38%

Answer: C

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

A. $2\sqrt{10}ms^{-1}$

B. $20\sqrt{10}ms^{-1}$

C. $10\sqrt{2}ms^{-1}$

D. $10\sqrt{20}ms^{-1}$

Answer: B

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31. A man who is running has half the kinetic energy of a boy of half his mass. The man speeds up by 1 ms^{-1} and then has the same kinetic energy as the boy. The original speeds of the man and the boy was:

A. $2.4ms^{-1}, 1.2ms^{-1}$

B. $1.2ms^{-1}, 4.4ms^{-1}$

C. $2.4ms^{-1}, 4.8ms^{-1}$

D. $4.8ms^{-1}, 2.4ms^{-1}$

Answer: C

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32. 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. The ratio of their speeds is

(where m_e and m_p are masses of electron and proton respectively)

A. $\sqrt{\frac{1}{10}\frac{m_e}{m_p}}$

B. $\sqrt{\frac{1}{10}\frac{m_p}{m_e}}$

C. $\frac{1}{10}\frac{m_e}{m_p}$

D. $\frac{1}{10}\frac{m_p}{m_e}$

Answer: B

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33. Two bodies A and B have masses 20 kg and 5 kg respectively. Each one is acted upon by a force of 4 kg wt. If they acquire the same kinetic energy in times t_A and t_B, then the ratio $\frac{t_A}{t_B}$ is

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

B. 2

C. $\frac{2}{5}$

D. $\frac{5}{6}$

Answer: B

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34. The area under force-displacement curve represents

A. velocity

B. acceleration

C. impulse

D. work done

Answer: D

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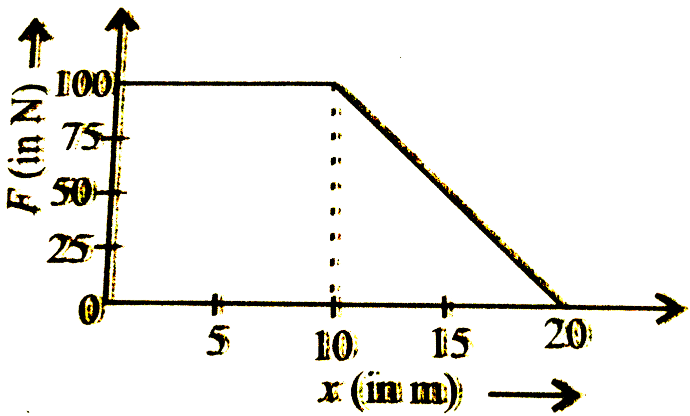
35. A force F acting on an object varies with distance x as shown in the figure. The work done by the force in moving the object from x=0 to x = 20 m is



A. 500 J

B. 1000 J

C. 1500 J

D. 2000 J

Answer: C

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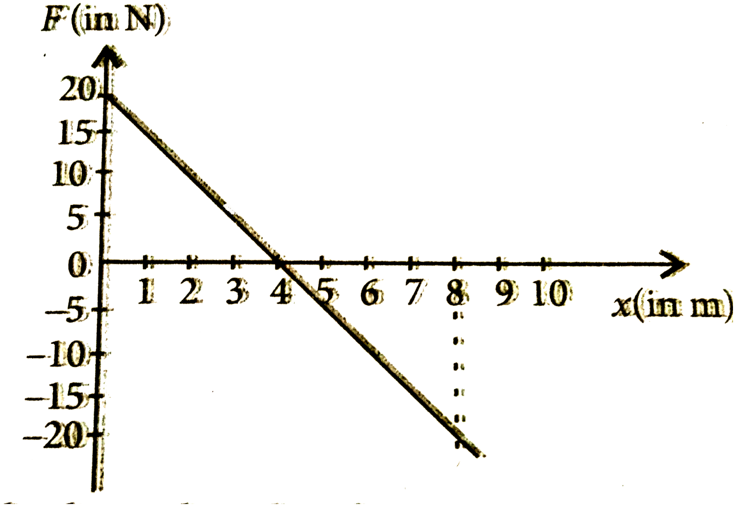
36. A force F acting on an object varies with distance x



The work done by the force in moving the object from x=0 to x=8 m is

A. zero

B. 80 J

C. $-40J$

D. $40J$

Answer: A

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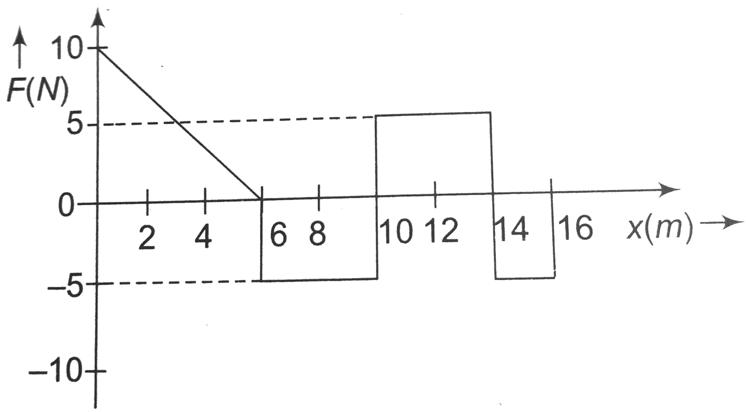
37. A particle is acted upon by a force F which varies with position x is shown in figure .If the particle at $x = 0$ kinetic energy of $25J$ then the kinetic energy of the particle at $x = 16m$

is



A. 45 J

B. 30 J

C. 70 J

D. 20 J

Answer: A

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38. A block of mass $10kg$ is moving in x-direction with a constant speed of $10m/s$. it is subjected to a retarding force $F = -0.1xJ/m$. During its travel from $x = 20m$ to $x = 30m$. Its final kinetic energy will be .

A. 250 J

B. 275 J

C. 450 J

D. 475 J

Answer: D

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39. A varable force, given by the 2- dimensional vector $\overline{F} = \left(3 \times^2 \hat{i} + 4\hat{j}\right)$, acts on a particle. The force is in newton and x is in metre. What is the change in the kinetic energy of the particle as it moves from the point with coordinates (2,3) to (3,0) (The coornates are in metres)

A. $-7J$

B. zero

C. $+7J$

D. $+19J$

Answer: C

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40. The potential energy of a system increased if work is done

A. upon the system by a non conservative force

B. by the system against a conservative force

C. by the system against a non conservative force

D. upon the system by a conservative force

Answer: B

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41. The negative of the work done by the conserative internal forces on a system equals the change iln

A. total energy

B. kinetic energy

C. potential energy

D. none of these

Answer: C

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

A. Force of friction

B. Magnetic force

C. Gravitational force

D. Electrostatic force

Answer: A

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43. Identify the false statement from the following

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

B. Work-energy theorem holds in all inertial frames.

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

D. Work done is a scalar quantity

Answer: C

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44. Which of the following statements is incorrect?

A. No work is done if the displacement is perpendicular to the direction of the applied force.

B. If the angle between the force and displacement Vectors is obtuse, then the work done is negative

C. Frictional force is a non-conservative

D. All the central forces are non-conservative

Answer: D

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

A. 0.20

B. 0.60

C. 0.40

D. 1

Answer: A

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

A. 10 J

B. 20 J

C. 30 J

D. 40 J

Answer: C

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47. A bolt of mass 0.2 kg falls from the ceiling of an elevator moving down with a uniform speed of $5ms^{-1}$. It hits the floor of the elevator (length of the elevator = 5 m) and does not rebound. The amount of heat produced by the impact is (Take $g = 10ms^{-2}$)

A. 5 J

B. 10 J

C. 15 J

D. 20 J

Answer: B

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48. A particle in a certain conservative force field has a potential energy given by $V = \frac{20xy}{z}$. The force exerted on it is

A. $\left(\frac{20y}{z}\right)\hat{i}+\left(\frac{20x}{z}\right)\hat{j}+\left(\frac{20xy}{z^2}\right)\hat{k}$

B. $-\left(\frac{20y}{z}\right)\hat{i}-\left(\frac{20x}{z}\right)\hat{j}+\left(\frac{20xy}{z^2}\right)\hat{k}$

C. $-\left(\frac{20y}{z}\right)\hat{i}-\left(\frac{20x}{z}\right)\hat{j}-\left(\frac{20xy}{z^2}\right)\hat{k}$

D. $\left(\frac{20y}{z}\right)\hat{i}+\left(\frac{20x}{z}\right)\hat{j}-\left(\frac{20xy}{z^2}\right)\hat{k}$

Answer: B

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

RegionA:$U > E$ Region B:$U < E$

Region C:$K < E$ Region D:$U > E$

State with reason in each case whether a particle can be found in the given region or not.

A. Region A

B. Region B

C. Region C

D. Region D

Answer: A

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50. A raindrop of mass $1g$ falling from a height of $1km$ hits is the ground with a speed of $50ms^{-1}$. Which of the following statements is correct? $\left(\text{Taking} g = 10ms^{-2}\right)$.

A. The loss of potential energy of the drop is 10 J

B. The gain in kinetic energy of the drop is 1.25 J

C. The gain in kinetic energy of the drop is not equal to the loss of potential energy of the drop.

D. All of these

Answer: D

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51. A simple pendulum of length 1 m has a wooden bob of mass 1 kg. It is struck by a bullet of mass 10^{-2} kg moving with a speed of $2 \times 10^2 ms^{-1}$. The height to which the bob rises before swinging back is (Take $g = 10ms^{-2}$)

A. 0.2 m

B. 0.6 m

C. 8 m

D. 1 m

Answer: A

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52. In a shotput event an athlete throws the shotput of mass 20 kg with an initial speed of $2ms^{-1}$ at 45° from height 3 m above ground. Assuming air resistance to be negligible and acceleration due to gravity to be $10ms^{-2}$, the kinetic energy of the shotput when it just reaches the ground will be

A. 2.5J

B. 5J

C. 525J

D. 640 J

Answer: D

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

A. $-\frac{k}{r}$

B. $-\frac{k}{2r}$

C. $\frac{k}{2r}$

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

Answer: B

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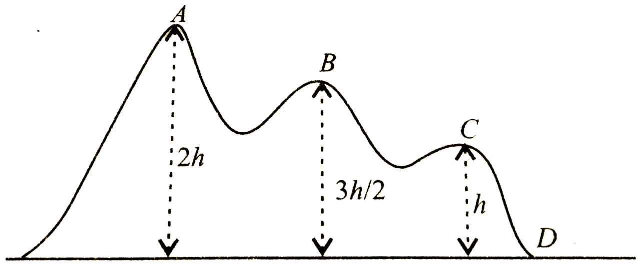
54. A small roller coaster starts at point A with a speed u on a curved track as shown in the figure



The friction between the roller coaster and the track is negligible and it always remains in contact with the track. The speed of roller coaster at point D on the track will be

A. $\left(u^2 + gh\right)^{1/2}$

B. $\left(u^2 + 2gh\right)^{1/2}$

C. $\left(u^2 + 4gh\right)^{1/2}$

D. u

Answer: C

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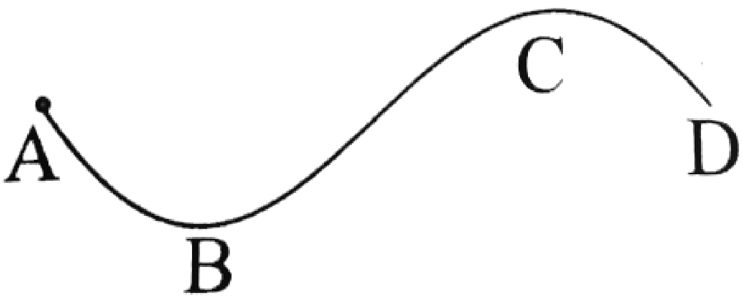
55. 

A curved suface is shown in figure. The portion

BCD is free of friction. There are three spherical balls of identical radii and masses. Balls are released from rest one by one from A which is at a slightly greater height than C. Wioth the surface AB, ball 1 has large enough friction to cause rolling down without slipping, ball 2 has a small friction and ball 3 has a negligible friction.

(a) For which ball 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?

A. 1 and 2

B. 1

C. 2

D. Cannot be predicted

Answer: C

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56. which ball can reach D?

A. 1

B. 2

C. 1 and 2

D. Cannot be predicted

Answer: B

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57. A bullet of mass m moving horizontally with a velocity v strikes a block of wood of mass M and gets embedded in the block. The block is suspended from the ceiling by a massless string. The height to which block rises is

A. $\frac{v^2}{2g}\left(\frac{m}{M+m}\right)^2$

B. $\frac{v^2}{2g}\left(\frac{M+m}{m}\right)^2$

C. $\frac{v^2}{2g}\left(\frac{m}{M}\right)^2$

D. $\frac{v^2}{2g}\left(\frac{M}{m}\right)^2$

Answer: A

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58. The bob of a pendulum is released from a horizontal position. If the length of pendulum is 2 m, what is the speed with which the bob arrives at the lower most point. Assume that 10% of its energy is dissipated against air resistance.

(Take $g = 10ms^{-2}$)

A. $4ms^{-1}$

B. $6ms^{-1}$

C. $8ms^{-1}$

D. $10ms^{-1}$

Answer: B

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59. A ball of mass m is dropped from a cliff of height H. The ratio of its kinetic energy to the potential energy when it is fallen through a height 3/4 H is

A. $3:4$

B. $4:3$

C. $1:3$

D. $3:1$

Answer: C

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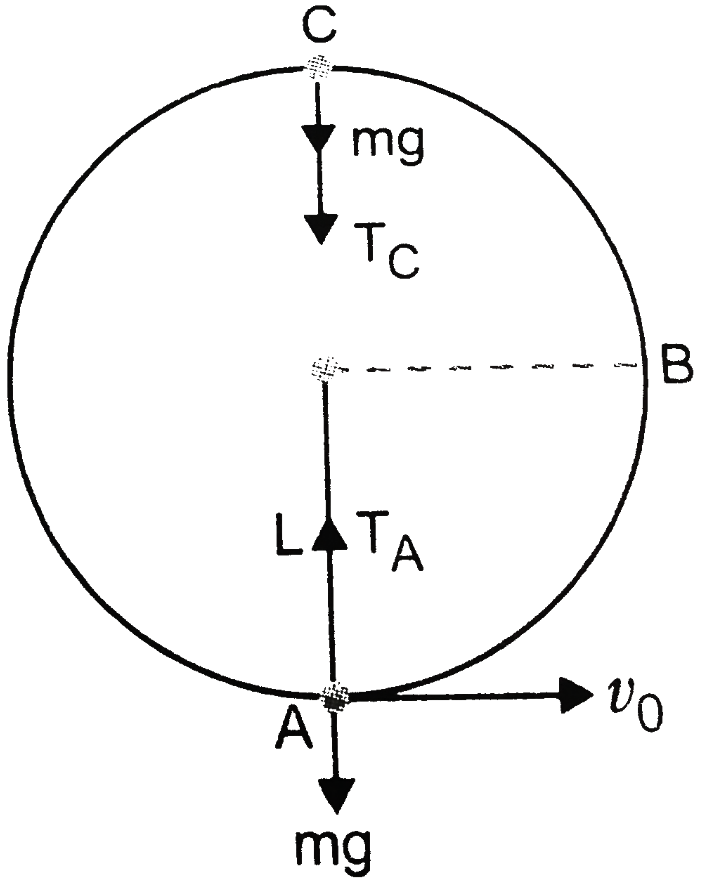
60. A bob of mass m is suspended by a light string of length L. It is imparted a horizontal velocity v_0 at the lowest point A such that it completes a semi-circular trajectory in the vertical plane with the string becoming slack on reaching the topmost point C, figure, Obtain an expression for (i) v_0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

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



A. A-p,B-q,C-s,D-r

B. A-q,B-r,C-q,D-s

C. A-r,B-s,C-q,D-p

D. A-s,B-p,C-r,D-q

Answer: C

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61. When a long spring is stretched by 2 cm, its potential energy is V. If the spring is stretched by 10 cm, the potential energy in it will be

A. 10 V

B. 25 V

C. $\frac{V}{5}$

D. 5V

Answer: B

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62. Two springs of spring constants $1000Nm^{-1}$ and $2000Nm^{-1}$ are stretched with same force. They will have potential energy in the ratio of

A. $2:1$

B. $2^2:1^2$

C. $1:2$

D. $1^2:2^2$

Answer: A

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

A. 6 m

B. 8 m

C. 10 m

D. 12 m

Answer: C

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64. A car of mass 1000 kg moving with a speed $18 kmh^{-1}$ on a smooth road and colliding with a horizontally mounted spring of spring constant $6.25 \times 10^{3} Nm^{-1}$. The maximum compression of the spring is

A. 1 m

B. 2 m

C. 3 m

D. 4 m

Answer: B

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

A. 5 cm

B. 15 cm

C. 20 cm

D. 10 cm

Answer: D

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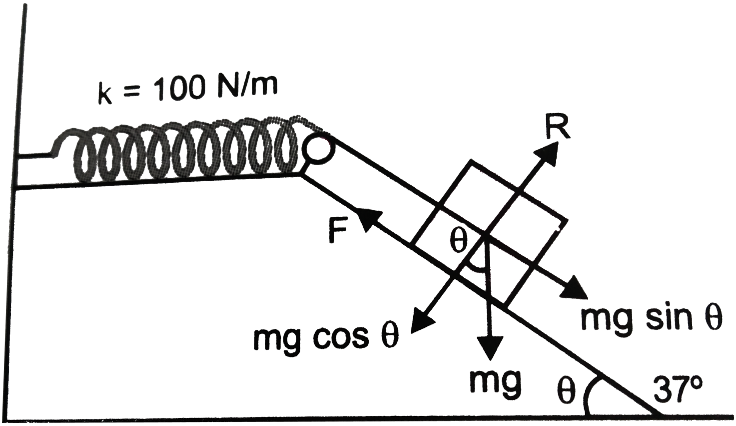
66. A 1kg block situated on a rough incline is connected to a spring of spring constant $100Nm^{-1}$ as shown in figure,. The block is released from rest with the spring in the unstretched position. The block moves 10cm down the incline before coming to rest. Find the coefficient of friction between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



A. 0.2

B. 0.3

C. 0.5

D. 0.6

Answer: B

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67. Which of the following statements is correct?

A. Heat is absorbed in exothermic reaction.

B. Heat is released in endothermic reaction.

C. Energy released in burning 1 litre of gasoline is 300 MJ.

D. Chemical energy is associated with the forces that give rise to the stability of substances

Answer: D

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68. One man takes 1 minute to raise a box to a height of 1 metre and another man takes 1/2 minute to do so. The energy of the two is

A. different

B. same

C. energy of the first is more

D. energy of the second is more

Answer: B

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69. An adult weighing 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 jogs for 6 km, the energy utilised by him in jogging is

A. 9×10^6 J

B. 9×10^5 J

C. 6×10^6 J

D. 6×10^5 J

Answer: B

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70. Calculate the amount of energy released in MeV due to a loss of mass of 1 kg.

A. 3 MJ

B. 30 MJ

C. 300 MJ

D. 3000 MJ

Answer: B

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71. Energy required to break one bond in DNA is approximately

A. 10^{-10} J

B. 10^{-18} J

C. 10^{-7} J

D. 10^{-20} J

Answer: D

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72. One milligram of matter is converted into energy. The energy released will be

A. 9×10^{6} J

B. 9×10^{8} J

C. 9×10^{10} J

D. 9×10^{12} J

Answer: C

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73. Which of the following units is a unit of power?

A. kilowatt hour

B. watt

C. erg

D. calorie

Answer: B

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74. 1 kilowatt hour (kWh) is equal to

A. 2.25×10^{22} eV

B. 2.25×10^{23} eV

C. 2.25×10^{25} eV

D. 2.25×10^{27} eV

Answer: C

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75. Match the column I with column II.

Column I		Column II	
(A)	When a body does work against friction, its kinetic energy	(p)	independent of time
(B)	Work done by a body is	(q)	time
(C)	Power of a body varies inversely as	(r)	force must be conservative
(D)	When work done over a closed path is zero	(s)	decreases

A. A-p,B-q,C-r,D-s

B. A-q,B-r,C-s,D-p

C. A-s,B-r,C-q,D-p

D. A-s,B-p,C-q,D-r

Answer: D

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

A. 313.6 W

B. 120.6 W

C. 510 W

D. 0

Answer: A

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77. A crane lifts a mass of 100 kg to a height of 10 m in 20 s. The power of the crane is (Take $g = 10ms^{-2}$)

A. 100 W

B. 200 W

C. 250 W

D. 500 W

Answer: D

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

A. 11.55 kW

B. 1155 kW

C. 23.10 kW

D. 2310 kW

Answer: A

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79. A force $\left(4\hat{i} + \hat{j} - 2\hat{k}\right)$ N acting on a body maintains its velocity at $\left(2\hat{i} + 2\hat{j} + 3\hat{k}\right)ms^{-1}$. The power exerted is

A. 4 W

B. 6 W

C. 2 W

D. 8 W

Answer: B

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80. 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. $t^{1/2}$

B. t

C. $t^{3/2}$

D. t^2

Answer: B

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81. Two men with weights in the ratio 4:3 run up a staircase in time in the ratio 12:11. The ratio of power of the first to that of second is

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

B. $\frac{12}{11}$

C. $\frac{48}{33}$

D. $\frac{11}{9}$

Answer: D

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82. The power of a water pump is 2 kW. If $g = 10m/s^2$, the amount of water it can raise in 1 min to a height of 10 m is :

A. 2000 litre

B. 1000 litre

C. 100 litre

D. 1200 litre

Answer: D

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

A. 22 kW

B. 44 kW

C. 66 kW

D. 88 kW

Answer: B

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

A. 36.5 kW

B. 50 kW

C. 52.5 kW

D. 60.5 kW

Answer: B

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85. Water is flowing in a river at $2ms^{-1}$. The river is $50m$ wide and has an average depth of $5m$. The power available from the current in the river is (Density of water $= 1000kgm^3$

A. 0.5 MW

B. 1 MW

C. 1.5 MW

D. 2 MW

Answer: B

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86. Consider the following statements A and B. Identify the correct choice in the given answers

A. In a one dimensional perfectly elastic collision between two moving bodies of equal masses the bodies merely exchange their velocities after collision.

B. If a lighter body at rest suffers perfectly elastic collision with a very heavy body moving with a certain velocity, then after collision both travel with same velocity.

A. A and B are correct

B. Both A and B are wrong

C. A is correct, B is wrong

D. A is wrong, B is correct

Answer: C

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87. When two spheres of equal masses undergo glancing elastic collision with one of them at rest after collision they will move

A. opposite to one another

B. in the same direction

C. together

D. at right angle to each other

Answer: D

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88. A spherical ball of mass m_1 collides head on with another ball of mass m_2 at rest . The collision is elastic . The fraction of kinetic energy lost by m_1 is :

A. $\dfrac{4m_1m_2}{(m_1+m_2)^2}$

B. $\dfrac{m_1}{m_1+m_2}$

C. $\dfrac{m_2}{m_1+m_2}$

D. $\dfrac{m_1m_2}{(m_1+m_2)^2}$

Answer: A

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89. Fast neutrons can easily be slowed down by

A. the use of lead shield

B. passing them through heavy water

C. elastic collision with heavy nucleus

D. applying a strong electric field

Answer: C

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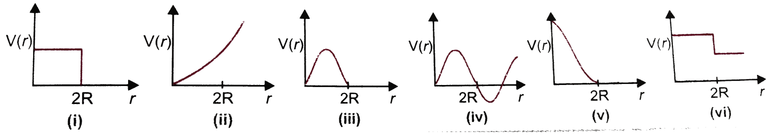
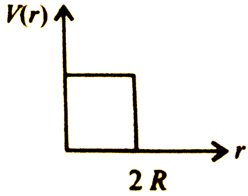
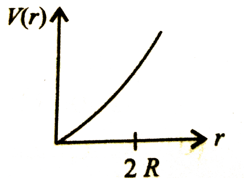
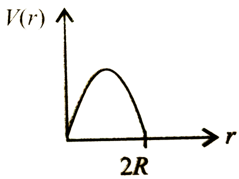
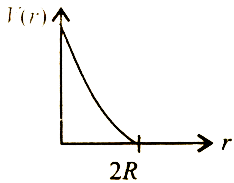
90. Which of the following potential energy curves in figure., cannot possibley describly describe the elastic collision of two billiard balls ? Here r is distance between centres of the balls.



A. 

B. 

C. 

D. 

Answer: C

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

A. $2.3ms^{-1}$

B. $4.6ms^{-1}$

C. $9.2ms^{-1}$

D. $6ms^{-1}$

Answer: B

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

A. $7ms^{-1}$

B. $25ms^{-1}$

C. $14ms^{-1}$

D. $28ms^{-1}$

Answer: C

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93. A ball of mass m moving with a speed $2v_0$ collides head-on with an identical ball at rest. If e is the coefficient of restitution, then what will be the ratio of velocity of two balls after collision?

A. $\dfrac{1-e}{1+e}$

B. $\dfrac{1+e}{1-e}$

C. $\dfrac{e-1}{e+1}$

D. $\dfrac{e+1}{e-1}$

Answer: A

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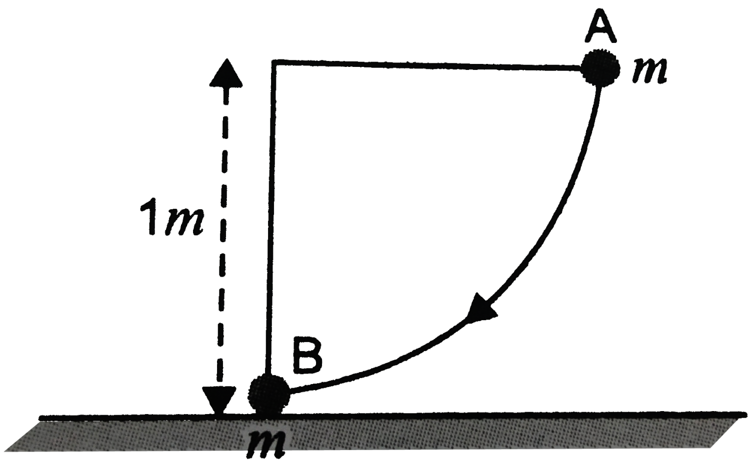
94. The bob A of a pendulum released from horizontal to the vertical hits another bob B of the same mass at rest on a table as shown in figure.

If the length of the pendulum is 1m, calculate

(a) the height to which bob A will rise after collision.

(b) the speed with which bob B starts moving.

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



A. $4.47 ms^{-1}$

B. $5.47ms^{-1}$

C. $6.47ms^{-1}$

D. $3.47ms^{-1}$

Answer: A

Watch Video Solution

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

A. e^2h

B. eh^2

C. e^4h

D. $\frac{h}{e^4}$

Answer: C

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96. A ball of mass m collides with a wall with speed v and rebounds on the same line with the same speed. If the mass of the wall is taken as infinite, then the work done by the ball on the wall is

A. mv^2

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

C. $2mv$

D. zero

Answer: D

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97. A sphere P of mass m and velocity v_i undergoes an oblique and perfectly elastic collision with an identical sphere Q initially at rest. The angle θ between the velocities of the spheres after the collision shall be

A. 0

B. 45°

C. 90°

D. 180°

Answer: C

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98. A spherical ball A of mass 4 kg, moving along a straight line strikes another spherical ball B of mass 1 kg at rest. After the collision, A and B move with velocities $v_1 ms^{-1}$ and $v_2 ms^{-1}$ respectively making angles of 30° and 60° with respect to the original direction of motion of A. The ratio $\frac{v_1}{v_2}$ will be

A. $\frac{\sqrt{3}}{4}$

B. $\frac{4}{\sqrt{3}}$

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

D. $\sqrt{3}$

Answer: A

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99. A neutron collides, head-on with a deuterium at rest. What fraction of the neutron's energy would be transferred to the deuterium?

A. 89%

B. 11%

C. 79%

D. 21%

Answer: A

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100. A neutron in a nuclear reactor collides head on elastically with the nucleus of a carbon atom initially at rest. The fraction of kinetic energy transferred from the neutron to the carbon atom is

A. $\frac{11}{12}$

B. $\frac{2}{11}$

C. $\frac{48}{121}$

D. $\frac{48}{169}$

Answer: D

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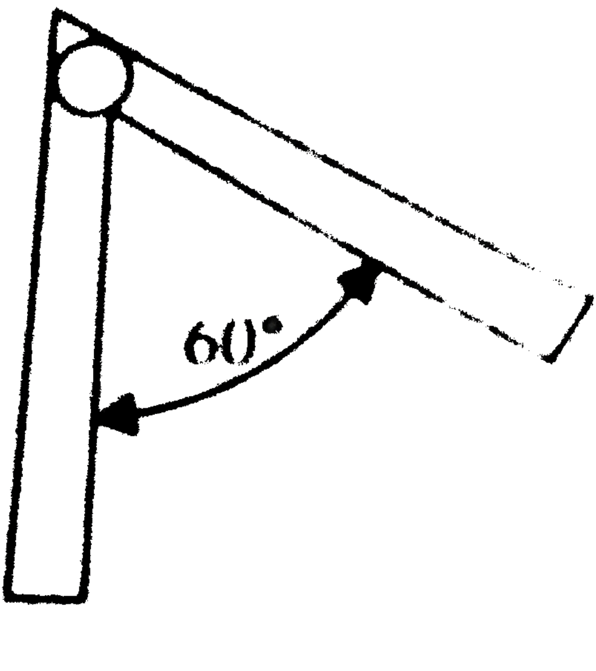
101. A metre stick weighing 600 g, is displaced through an angle of 60° in vertical plane as shown. The change in its potential energy is ($g = 10 m s^{-2}$)



A. 1.5 J

B. 15 J

C. 30 J

D. 45 J

Answer: A

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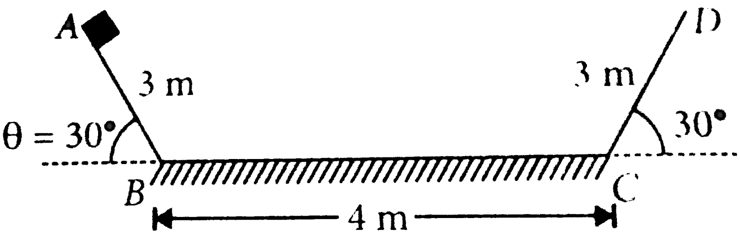
102. A track has two inclined surface AB and DC each of length 3 m and angle of inclination of 30° with the horizontal and a central horizontal part of length 4m shown in figure.

A block of mass 0.2 kg slides from rest from point A. The inclined surfaces are frictionless. If the coefficient of friction between the block and the horizontal flat surface is 0.2, where will the block finally come to rest ? [in $10^{-1} m$]



A. 0.5 m away from point B

B. 3.5 m away from point B

C. 0.5 m away from point C

D. 1.5 m away from point C

Answer: A

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103. A bob of mass m, suspended by a string of length l_1 is given a minimum velocity required to complete a full circle in the vertical plane. At the highest point, it collides elastically with another bob of mass m suspended by a string of length l_2, which is initially at rest. Both the strings are mass-less and inextensible. If the second bob, after collision acquires the minimum speed required to complete a full circle in the vertical plane, the ratio $\frac{l_1}{l_2}$ is

A. 1

B. 3

C. 5

D. $1/5$

Answer: C

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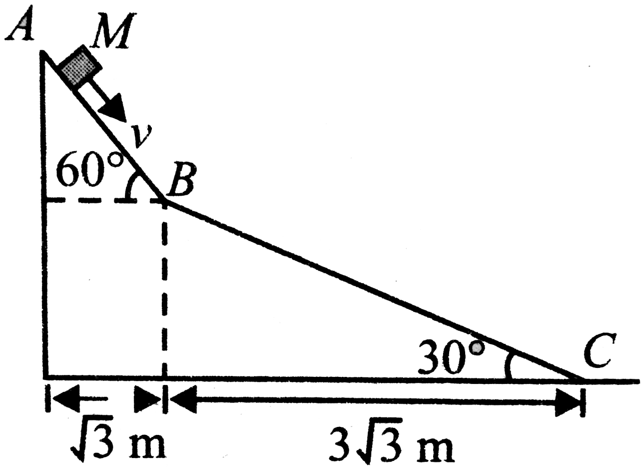
104. A small block of mass M moves on a frictionless surface of an inclined plane, as shown in the figure. The angle of the incline suddenly changes from 60° to 30° at point B. The block is many at rest at A. Assume that collisions between the block id the incline are totally inelastic.

The speed of the block at point B immediately after it strikes the second incline is



A. $\sqrt{60}$ m/s

B. $\sqrt{45}$ m/s

C. $\sqrt{30}$ m/s

D. $\sqrt{15}$ m/s

Answer: B

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105. the speed of the block at point C, immediately before it leaves the second incline is

A. $\sqrt{120}$ m/s

B. $\sqrt{105}$ m/s

C. $\sqrt{90}$ m/s

D. $\sqrt{75}$ m/s

Answer: B

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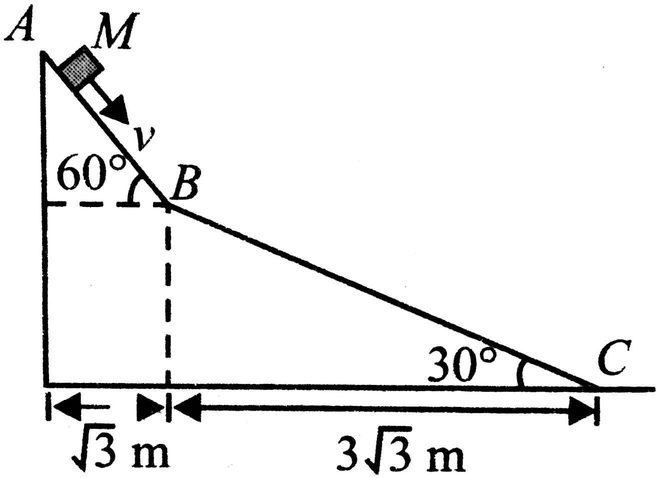
106. A small block of mass M moves on a friction-less surface of an inclined plane, as shown in the figure. The angle of the incline suddenly changes from 60° to 30° at point B. The block is initially at rest at A.

If collision between the block and the incline is completely elastic, then the vertical (upward) component of the velocity of the blocks at point B, immediately after it strikes the second incline is



A. $\sqrt{30}$ m/s

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

C. 0

D. $-\sqrt{15}$ m/s

Answer: C

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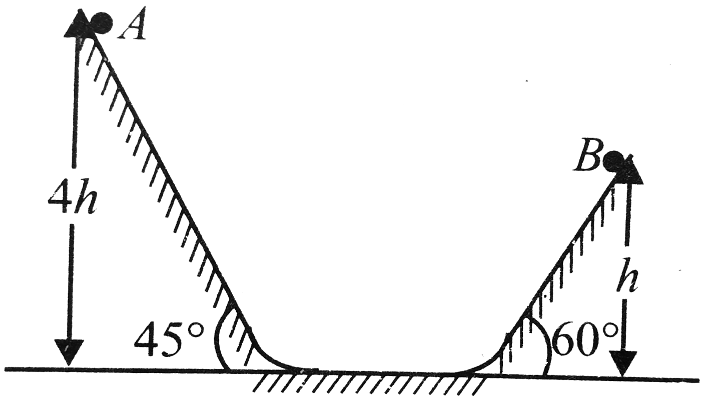
107. Two identical balls A and B are released from the position shown in Fig. They collide elastically with each other on the horizontal portion. The ratio of heights attained by A and B after collision is (neglect friction)



A. $1:4$

B. $2:1$

C. $4:13$

D. $2:11$

Answer: C

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108. An object of mass 5 kg is projecte with a velocity of $20ms^{-1}$ at an angle of 60° to the horizontal. At the highest point of its path , the projectile explodes and breaks up into two fragments of masses 1kg and 4 kg. The fragments separate horizontally after the explosion, which releases internal energy such that $K.E.$ of the system at the highest point is doubled. Calculate the separation betweent the two fragments when they reach the ground.

A. 11 m

B. 22 m

C. 44 m

D. 66 m

Answer: C

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Ncert

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 no 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 ini which the charged particle is also a proton and in another, a position. In the same time t, the work done on the two moving charged particles 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 weakens.

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 squatting on the ground gets straight up and stand. The force of reaction of ground on the man 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 bicyclist comes to a skidding stop in $10m$. During this process, the force on the bicycle due to the road is $200N$ and is directly opposed to the motion. The work done by the cycle on the road is

A. +2000 J

B. -200 J

C. zero

D. -20000 J

Answer: C

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5. 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: 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

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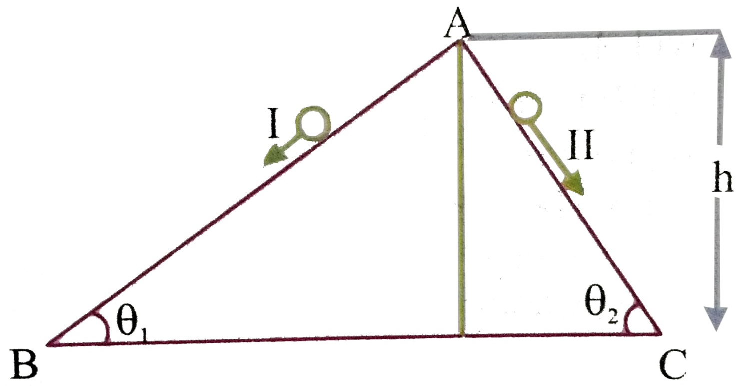
7. Two inclined frictionless tracks, one gradual and the other steep meet at a from where two stones are allowed to slide down from rest, one on each track as shown in Figure. Which of the following statement is correct ?



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 speed 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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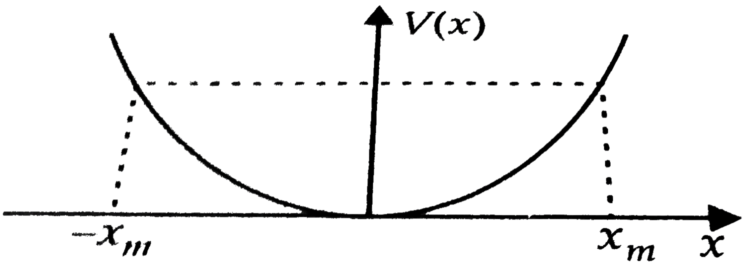
8. The potential energy function for a particle executing linear SHM is given by $V(x) = \frac{1}{2}kx^2$ where k is the force constant of the oscillator. For $k = 0.5Nm^{-1}$, the graph of V(x) versus x is shown in the figure A particle of total energy E turns back when it reaches $x = \pm x_m$.if V and K indicate the potential energy and kinetic energy 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 lt K, K=0

D. V=0, K lt E

Answer: B

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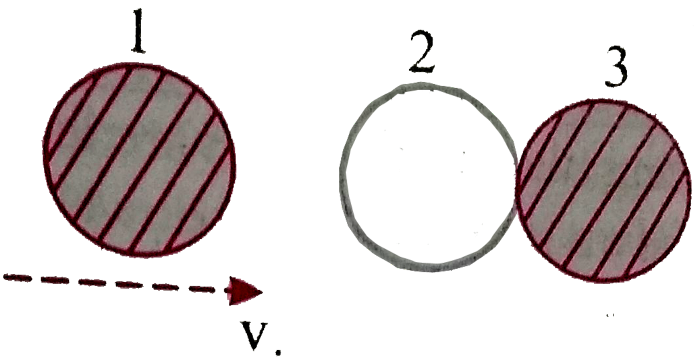
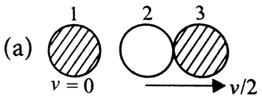
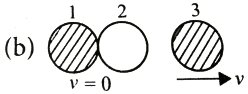
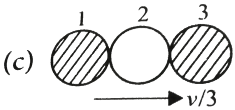
9. Two identical ball bearings in contact with each other and resting on a frictionless table are hit heat-on by another ball bearing of the same mass moving initially with a speed V as shown in figure.

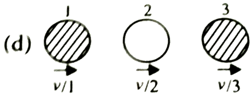


If the collision is elastic, which of the following (figure) is a possible result after collision ?

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 $v = kx^{3/2}$ where

$k = 5m^{-1/2}s^{-1}$. The work done by the net force during its displacement from x=0 to x=2 m is

A. A. 1.5 J

B. B. 50 J

C. C. 10 J

D. D. 100 J

Answer: B

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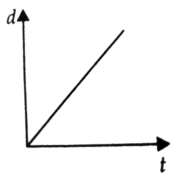
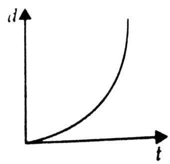
11. A body is moving unidirectionally under the influence of a source of constant power supplying energy. Which of the diagrams shown in figure. Correctly shows the displacement-time curve for its motion ?

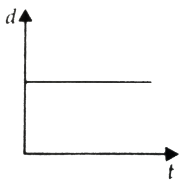
A. (a)

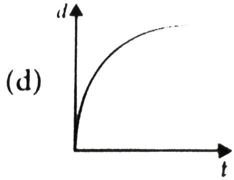


B. (b)



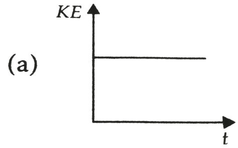
C. (c)

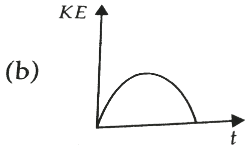


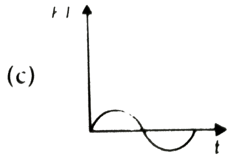
D. 

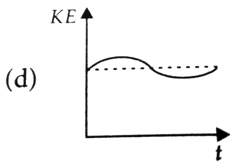
Answer: B

12. Which of the diagrams shown in figure. Most closely shows the variation inkinetic energy of the earth as it moves once around the sun in its elliptical orbit ?

A. 

B. 

C. 

D. 

Answer: D

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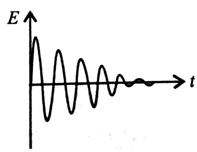
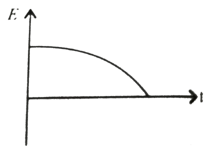
13. Which of the diagram shown in figures respresents variation of total mechanical energy of a pendulam oscillation in air as function of time?

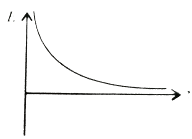
A. (a)



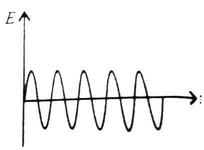
B. (b)



C. (c)



D. (d)



Answer: C

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14. A mass of $5kg$ is moving along a circular path or radius $1m$. If the mass moves with 300 revolutions per minute, its kinetic energy would be

A. $250\pi^2 J$

B. $100\pi^2 J$

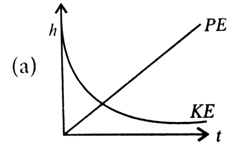
C. $5\pi^2 J$

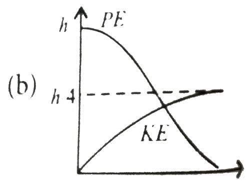
D. 0 J

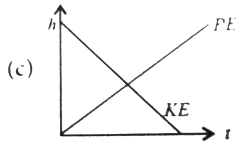
Answer: A

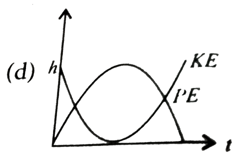
Watch Video Solution

15. A raindrop falling from a height h above ground, attains a near terminal velocity when it has fallen through a height $(3/4)h$. Which of 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

Watch Video Solution

16. In a shotput event an athlete throws the shotput of mass 20 kg with an initial speed of $2ms^{-1}$ at 45° from height 3 m above ground. Assuming air resistance to be negligible and acceleration due to gravity to be $10ms^{-2}$, the kinetic energy of the shotput when it just reaches the ground will be

A. 2.5 J

B. 5.0 J

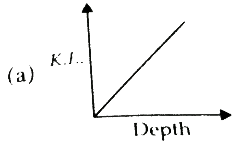
C. 52.5 J

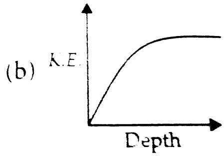
D. 155.0 J

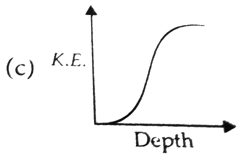
Answer: D

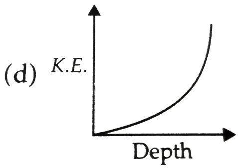
Watch Video Solution

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 if a terminal velocity ?

A. 

B. 

C. 

D. 

Answer: B

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18. A cricket ball of mass $150g$ moving with a speed of $126km/h$ hits at the middle of the bat, held firmly at its position by the batman. 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 $0.001s$, the force that the batsman had to apply to hold the bat firmly at its place would be

A. 10.5 N

B. 21 N

C. 1.05×10^4 N

D. 2.1×10^4 N

Answer: C

Watch Video Solution

Assertion Reason

1. Assertion , No work is done if the displacement is zero

Reason: Work done by the force is defined to be the product of component of the force in the the direction of the displacement and the magnitude of displacement.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

2. Assertion: Work done by the friction or viscous force on a moving body in negative.

Reason: Work done is a scalar quantity which cannot be negative like mass.

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

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

C. If assertion is true but reason is false

D. If assertion is false and reason is true

Answer: C

Watch Video Solution

3. Assertion: A light body and a heavy body have same momentum. Then they also have same kinetic energy.

Reason: Kinetic energy does not depand on mass of the body.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

4. Assertion:The work done by a conservative force such as gravity depends on the initial and final positions only

Reason: The work done by a force can not be calculated if the exact nature of the force is not known.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

5. Assertion : For two bodies , the sum of the mutual forces exerted between them is zero from Newton's third law. Reason : The sum of work done by the two forces must always cancel.

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

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

explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

6. Assertion: Work done by the force of friction in moving a body around a closed loop is zero.

Reason: Work done does not depend upon the nature of force.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

7. Assertion: Work done by friction over a closed path is not zero and no potential energy can be associated with friction.

Reason: Every force encountered in mechanics have an associated potential energy.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

Watch Video Solution

8. Assertion: A spring has potential energy , both when it is compressed or stretched.

Reason: In compressing or stretching, work is done on the spring against the restoring force.

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

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

explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

9. Assertion : The work done by the spring force in a cyclic process is zero. Reason : Spring force is a conservative force.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

10. Assertion: Universe as a whole may be viewed an isolted system.

Reason: Total energy of an isolated system remain constant or stretched.

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

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

explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

11. Assertion: Energy can neither be created nor destroyed.

Reason: The principle of conservation of energy cannot be proved.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

12. Assertion: Energy associated with a mere kilogram of matter is $9 \times 10^{16} J$

Reason: It follows from the relation $E = mc^2$.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

13. Assertion : Kilowatt hour is the unit of power.

Reason: One kilowatt hour is equivalent to 3.6×10^5 J

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D

Watch Video Solution

14. Assertion: The conservation of kinetic energy in elastic collision applies after the collision is over and does not hold at every instant of the collision.

Reason: During a collision the total linear momentum is conserved at each instant of the collision.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

15. Assertion: In a perfectly inelastic collision in the absence of external forces , the kinetic energy is never conserved.

Reason: The objects deformed and stick together in this type of collision.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

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Motion Of Work And Kinetic Energy The Work Energy Theorem

1. The work-energy theorem states that the change in

A. kinetic energy of a particle is equal to the work done on it by the net force

B. kinetic energy of a particle is equal to the work done by one of the forces acting on it

C. potential energy of a particle is equal to the work done on it by the net force

D. potential energy of a particle is equal to the work done by one of the forces acting on it

Answer: A

Watch Video Solution

2. A raindrop of mass 1 g falling from a height of 1 km hits the ground with a speed of $50ms^{-1}$. If the resistive force is proportional to the speed of the drop, then the work done by the resistive force is (Take $g = 10ms^{-2}$)

A. 10 J

B. -10 J

C. 8.75J

D. $-8.75J$

Answer: D

Watch Video Solution

3. A body of mass 4 kg is moving with momentum of $8kgms^{-1}$. A force of 0.2 N acts on it in the direction of motion of the body for 10 s. The increase in kinetic energy is

A. 10 J

B. 8.5 J

C. 4.5 J

D. 4 J

Answer: C

Watch Video Solution

Watch Video Solution

4. An object of mass m is released from rest from the top of a smooth inclined plane of height h. Its speed at the bottom of the plane is proportional to

A. m^0

B. m

C. m^2

D. m^{-1}

Answer: A

Watch Video Solution

Work

1. A body is being raised to a height h from the surface of earth. What is the sign of work done by

(a) applied force (b) gravitational force ?

A. Positive, Positive

B. Positive, Negative

C. Negative, Positive

D. Negative, Negative

Answer: B

Watch Video Solution

2. The correct relation between joule and erg is

A. $1J = 10^{-5}$ erg

B. $1J = 10^5$ erg

C. $1J = 10^{-7}$ erg

D. $1J = 10^7$ erg

Answer: D

Watch Video Solution

3. A weight lifter lifts a weight off the ground and holds is up, then

A. work is done in lifting as well as holding the weight.

B. no work is done in both lifting and holding the weight.

C. work is done in lifting the weight but no work is required to done in holding it up.

D. no work is done in lifting the weight but work is required to be done in holding it up.

Answer: C

Watch Video Solution

4. The angle between force $\overrightarrow{F} = \left(3\hat{i} + 4\hat{j} - 5\hat{k}\right)$ unit and displacement $\overrightarrow{d} = \left(5\hat{i} + 4\hat{j} + 3\hat{k}\right)$ unit is

A. $\cos^{-1}(0.16)$

B. $\cos^{-1}(0.32)$

C. $\cos^{-1}(0.24)$

D. $\cos^{-1}(0.64)$

Answer: B

Watch Video Solution

5. A body constrained to move along y-axis is subjected to a constant force $\vec{F} = -\hat{i} + 2\hat{j} + 3\hat{k}N$. The work done by this force in moving the body a distance of 4 m along y-axis is

A. 4J

B. 8 J

C. 12J

D. 24 J

Answer: B

Watch Video Solution

6. A particle acted upon by constant forces $4\hat{i} + \hat{j} - 4\hat{k}$ and $3\hat{i} + \hat{j} - \hat{k}$ is displacment from the point $\hat{i} + 2\hat{j} + \hat{k}$ to point $5\hat{i} + 4\hat{j} + \hat{k}$.Total work done by the forces in SI unit is :

A. 20

B. 40

C. 50

D. 30

Answer: B

Watch Video Solution

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

A. 12.9J

B. 6.3 J

C. 3.6 J

D. 2.0 J

Answer: C

Watch Video Solution

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

A. MgL

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

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

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

Answer: D

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9. A block of mass 2 kg initially at rest moves under the action of an applied horizontal force of 6 N on a rough horizontal surface. The coefficient of friction between block and surface is 0.1. The work done by the applied force in 10 s is (Take $g = 10ms^{-2}$)

A. 200J

B. $-200J$

C. 600 J

D. $-600J$

Answer: C

Watch Video Solution

10. A block of mass 2kg initially at rest moves under the action of an applied horizontal force of 6 N on a rough horizontal surface. The coefficient of friction between the block and surface is 0.1. the work done by friction in 10 s is

A. 200J

B. $-200J$

C. 600 J

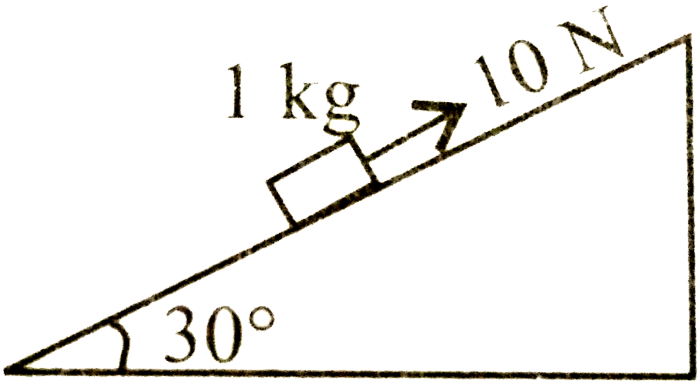
D. $-600J$

Answer: B

Watch Video Solution

11. 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 as shown in the figure.

The coefficient of friction between block and the incline is 0.1. If the block is pushed up by 10 m along the incline, then the work against gravity is (Take $g = 10ms^{-2}$)



A. 10 J

B. 50 J

C. 100 J

D. 150 J

Answer: B

Watch Video Solution

12. the work done against force of friction is

A. 8.7 J

B. 10.7 J

C. 7.8 J

D. 12.7 J

Answer: A

View Text Solution

13. the work done by applied force is

A. 10 J

B. 50 J

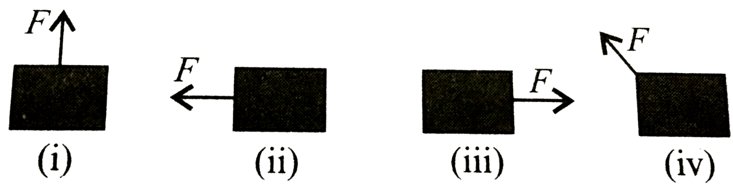
C. 100 J

D. 150 J

Answer: C

View Text Solution

14. Figure shows four situations in which a force is applied to a block. In all four cases, the force has the same magnitude, and the displacement of the block is to the right and of the same magnitude. Which of the following cases work done by the applied force on the block zero?



A. (i)

B. (ii)

C. (iii)

D. (iv)

Answer: A

Watch Video Solution

Kinetic Energy

1. The work done by a body against friction always results in

A. loss of kinetic energy

B. loss of potential energy

C. gain of kinetic energy

D. gain of potential energy

Answer: A

Watch Video Solution

2. Which of the following statements is incorrect?

A. Kinetic energy may be zero, positive or negative

B. Power, energy and work are all scalars

C. Potential energy may be zero, positive or negative

D. Ballistic pendulum is a device for measuring the speed of bullets

Answer: A

Watch Video Solution

3. If the force acting on a body is inversely proportional to its speed, then its kinetic energy is

A. linearly related to time

B. inversely proportional to time

C. inversely proportional to the square of time

D. a constant

Answer: A

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4. A truck and a car moving with the same kinetic energy are brought to rest by the application of brakes which provide equal retarding forces. Which of them will come to rest in a shorter distance?

A. The truck

B. The car

C. Both will travel the same distance before coming to rest

D. Cannot be predicted

Answer: C

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5. 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 emerges 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 the target ?

A. The velocity of the bullet remains the same.

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

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

D. The bullet will continue to move along the same parabolic path.

Answer: C

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6. A 120 g mass has a velocity $\vec{v} = 2\hat{i} + 5\hat{j} ms^{-1}$ at a certain instant. Its kinetic energy is

A. 3 J

B. 4 J

C. 5 J

D. 1.74 J

Answer: D

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7. The blades of a windmill sweep out a circle of area A. If the wind flows at a velocity v perpendicular to the circle, then the mass of the air of density ρ passing through it in time t is

A. $A v \rho t$

B. $2 A v \rho t$

C. $A v^2 \rho t$

D. $\frac{1}{2} A v \rho t$

Answer: A

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8. the kinetic energy of the air is

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

B. $\frac{1}{2}A\rho v^2 t$

C. $\frac{1}{2}A\rho v^3 t$

D. $2A\rho v^3 t$

Answer: C

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9. For a moving particle (mass m, velocity v) having a momentum p, which one of the following correctly describes the kinetic energy of the particle?

A. $\frac{p^2}{2m}$

B. $\frac{p}{2m}$

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

D. $\frac{v}{2m}$

Answer: A

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Watch Video Solution

10. In the non-relativistic regime, if the momentum, is increased by 100%, the percentage increase in kinetic energy is

A. 100

B. 200

C. 300

D. 400

Answer: C

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11. The momentum of a body is increased by 25%. The kinetic energy is increased by about

A. 25%

B. 5%

C. 56%

D. 38%

Answer: C

Watch Video Solution

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

A. $2\sqrt{10}ms^{-1}$

B. $20\sqrt{10}ms^{-1}$

C. $10\sqrt{2}ms^{-1}$

D. $10\sqrt{20}ms^{-1}$

Answer: B

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13. A man who is running has half the kinetic energy of a boy of half his mass. The man speeds up by 1 ms^{-1} and then has the same kinetic energy as the boy. The original speeds of the man and the boy was:

A. $2.4ms^{-1}, 1.2ms^{-1}$

B. $1.2ms^{-1}, 4.4ms^{-1}$

C. $2.4ms^{-1}, 4.8ms^{-1}$

D. $4.8ms^{-1}, 2.4ms^{-1}$

Answer: C

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14. 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. The ratio of their speeds is

(where m_e and m_p are masses of electron and proton respectively)

A. $\sqrt{\frac{1}{10}\frac{m_e}{m_p}}$

B. $\sqrt{\frac{1}{10}\frac{m_p}{m_e}}$

C. $\frac{1}{10}\frac{m_e}{m_p}$

D. $\frac{1}{10}\frac{m_p}{m_e}$

Answer: B

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15. Two bodies A and B have masses 20 kg and 5 kg respectively. Each one is acted upon by a force of 4 kg wt. If they acquire the same kinetic energy in times t_A and t_B, then the ratio $\frac{t_A}{t_B}$ is

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

B. 2

C. $\frac{2}{5}$

D. $\frac{5}{6}$

Answer: B

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Work Done By A Variable Force

1. The area under force-displacement curve represents

A. velocity

B. acceleration

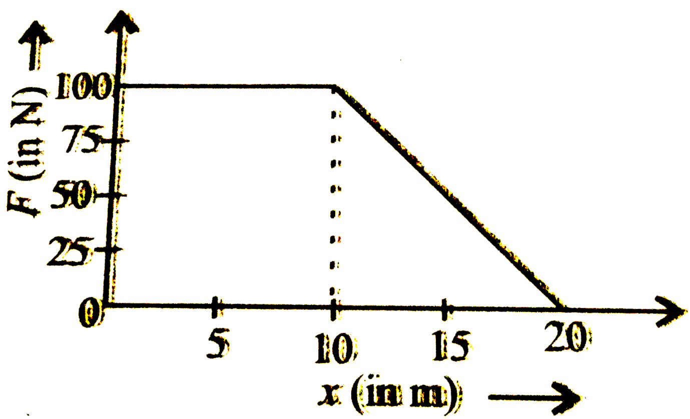
C. impulse

D. work done

Answer: D

Watch Video Solution

2. A force F acting on an object varies with distance x as shown in the figure. The work done by the force in moving the object from x=0 to x = 20 m is



A. 500 J

B. 1000 J

C. 1500 J

D. 2000 J

Answer: C

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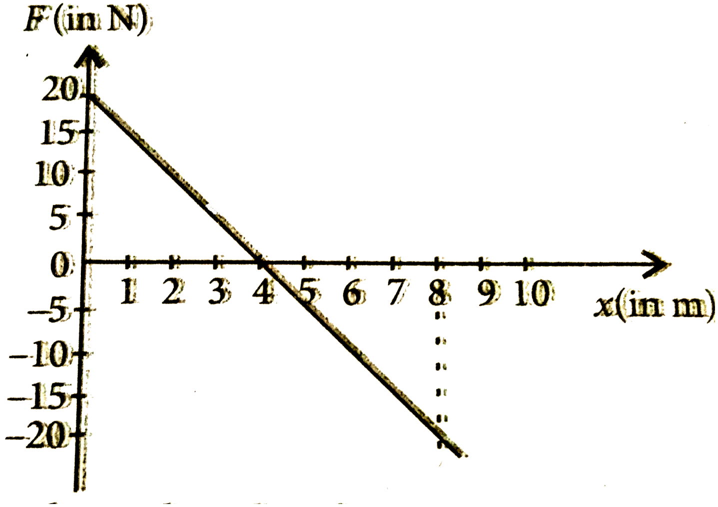
3. A force F acting on an object varies with distance x



The work done by the force in moving the object from x=0 to x=8 m is

A. zero

B. 80 J

C. $-40J$

D. $40J$

Answer: A

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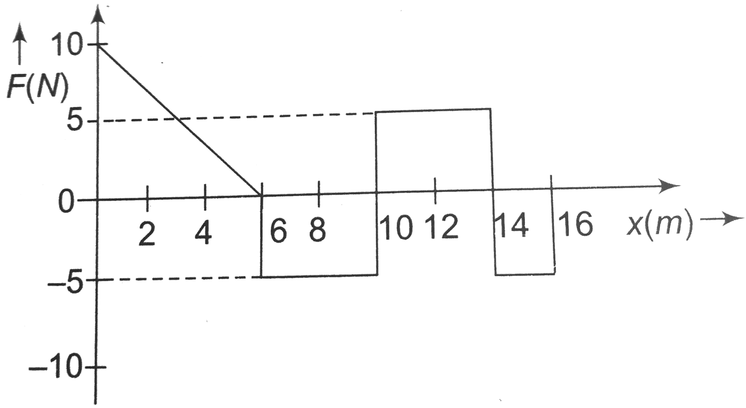
The Work Energy Theorem For A Variable Force

1. A particle is acted upon by a force F which varies with position x is shown in figure .If the particle at $x = 0$ kinetic energy of $25J$ then the kinetic energy of the particle at $x = 16m$

is



A. 45 J

B. 30 J

C. 70 J

D. 20 J

Answer: A

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2. A block of mass $10kg$ is moving in x-direction with a constant speed of $10m/s$. it is subjected to a retarding force $F = -0.1xJ/m$. During its travel from $x = 20m$ to $x = 30m$. Its final kinetic energy will be .

A. 250 J

B. 275 J

C. 450 J

D. 475 J

Answer: D

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3. A varable force, given by the 2- dimensional vector$\overline{F} = \left(3 \times^2 \hat{i} + 4\hat{j}\right)$, acts on a particle. The force is in newton and x is in metre. What is the change in the kinetic energy of the particle as it moves from the point with coordinates (2,3) to (3,0) (The coornates are in metres)

A. $-7J$

B. zero

C. $+7J$

D. $+19J$

Answer: C

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The Concept Of Potential Energy

1. The potential energy of a system increased if work is done

A. upon the system by a non conservative force

B. by the system against a conservative force

C. by the system against a non conservative force

D. upon the system by a conservative force

Answer: B

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2. The negative of the work done by the conserative internal forces on a system equals the change iln

A. total energy

B. kinetic energy

C. potential energy

D. none of these

Answer: C

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

A. Force of friction

B. Magnetic force

C. Gravitational force

D. Electrostatic force

Answer: A

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4. Identify the false statement from the following

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

B. Work-energy theorem holds in all inertial frames.

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

D. Work done is a scalar quantity

Answer: C

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5. Which of the following statements is incorrect?

A. No work is done if the displacement is perpendicular to the direction of the applied force.

B. If the angle between the force and displacement Vectors is obtuse, then the work done is negative

C. Frictional force is a non-conservative

D. All the central forces are non-conservative

Answer: D

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

A. 0.20

B. 0.60

C. 0.40

D. 1

Answer: A

Watch Video Solution

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

A. 10 J

B. 20 J

C. 30 J

D. 40 J

Answer: C

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8. A bolt of mass 0.2 kg falls from the ceiling of an elevator moving down with a uniform speed of $5ms^{-1}$. It hits the floor of the elevator (length of the elevator = 5 m) and does not rebound. The amount of heat produced by the impact is (Take $g = 10ms^{-2}$)

A. 5 J

B. 10 J

C. 15 J

D. 20 J

Answer: B

Watch Video Solution

9. A particle in a certain conservative force field has a potential energy given by $V = \frac{20xy}{z}$. The force exerted on it is

A. $\left(\frac{20y}{z}\right)\hat{i} + \left(\frac{20x}{z}\right)\hat{j} + \left(\frac{20xy}{z^2}\right)\hat{k}$

B. $-\left(\frac{20y}{z}\right)\hat{i} - \left(\frac{20x}{z}\right)\hat{j} + \left(\frac{20xy}{z^2}\right)\hat{k}$

C. $-\left(\frac{20y}{z}\right)\hat{i} - \left(\frac{20x}{z}\right)\hat{j} - \left(\frac{20xy}{z^2}\right)\hat{k}$

D. $\left(\frac{20y}{z}\right)\hat{i} + \left(\frac{20x}{z}\right)\hat{j} - \left(\frac{20xy}{z^2}\right)\hat{k}$

Answer: B

Watch Video Solution

The Conservation Of Mechanical Energy

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

RegionA:$U > E$ Region B:$U < E$

Region C:$K < E$ Region D:$U > E$

State with reason in each case whether a particle can be found in the given region or not.

A. Region A

B. Region B

C. Region C

D. Region D

Answer: A

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2. A raindrop of mass $1g$ falling from a height of $1km$ hits is the ground with a speed of $50ms^{-1}$. Which of the following statements is correct? $(\text{Taking} g = 10ms^{-2})$.

A. The loss of potential energy of the drop is 10 J

B. The gain in kinetic energy of the drop is 1.25 J

C. The gain in kinetic energy of the drop is not equal to the loss of potential energy of the drop.

D. All of these

Answer: D

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3. A simple pendulum of length 1 m has a wooden bob of mass 1 kg. It is struck by a bullet of mass 10^{-2} kg moving with a speed of $2 \times 10^2 ms^{-1}$. The height to which the bob rises before swinging back is (Take $g = 10ms^{-2}$)

A. 0.2 m

B. 0.6 m

C. 8 m

D. 1 m

Answer: A

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4. In a shotput event an athlete throws the shotput of mass 20 kg with an initial speed of $2ms^{-1}$ at 45° from height 3 m above ground. Assuming air resistance to be negligible and acceleration due to gravity to be $10ms^{-2}$, the kinetic energy of the shotput when it just reaches the ground will be

A. 2.5J

B. 5J

C. 525J

D. 640 J

Answer: D

Watch Video Solution

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

A. $-\dfrac{k}{r}$

B. $-\dfrac{k}{2r}$

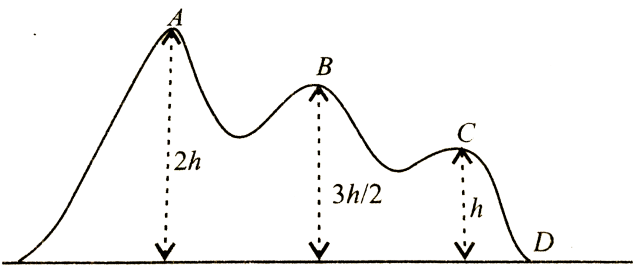
C. $\dfrac{k}{2r}$

D. $\dfrac{2k}{r}$

Answer: B

Watch Video Solution

6. A small roller coaster starts at point A with a speed u on a curved track as shown in the figure



The friction between the roller coaster and the track is negligible and it always remains in contact with the track. The speed of roller coaster at point D on the track will be

A. $\left(u^2 + gh\right)^{1/2}$

B. $\left(u^2 + 2gh\right)^{1/2}$

C. $\left(u^2 + 4gh\right)^{1/2}$

D. u

Answer: C

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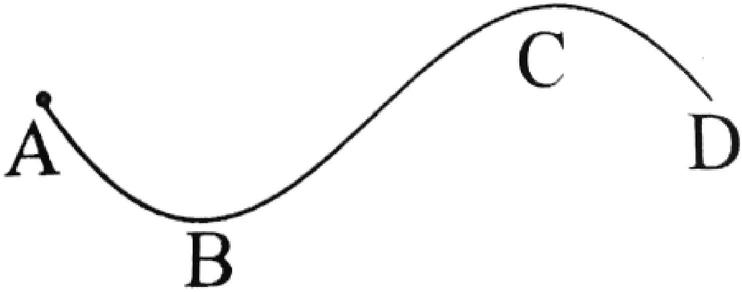
7. 

A curved suface is shown in figure. The portion BCD is free of friction. There are three spherical balls of identical radii and masses. Balls are released from rest one by one from A which is at a slightly greater height than C. Wioth the surface AB, ball 1 has large enough friction to cause rolling down without slipping, ball 2 has a small friction and ball 3 has a negligible friction.

(a) For which ball 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?

A. 1 and 2

B. 1

C. 2

D. Cannot be predicted

Answer: C

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8. which ball can reach D?

A. 1

B. 2

C. 1 and 2

D. Cannot be predicted

Answer: B

View Text Solution

9. A bullet of mass m moving horizontally with a velocity v strikes a block of wood of mass M and gets embedded in the block. The block is suspended from the ceiling by a massless string. The height to which block rises is

A. $\frac{v^2}{2g}\left(\frac{m}{M+m}\right)^2$

B. $\frac{v^2}{2g}\left(\frac{M+m}{m}\right)^2$

C. $\frac{v^2}{2g}\left(\frac{m}{M}\right)^2$

D. $\frac{v^2}{2g}\left(\frac{M}{m}\right)^2$

Answer: A

Watch Video Solution

10. The bob of a pendulum is released from a horizontal position. If the length of pendulum is 2 m, what is the speed with which the bob arrives at the lower most point. Assume that 10% of its energy is dissipated against air resistance.

(Take $g = 10ms^{-2}$)

A. $4ms^{-1}$

B. $6ms^{-1}$

C. $8ms^{-1}$

D. $10ms^{-1}$

Answer: B

Watch Video Solution

11. A ball of mass m is dropped from a cliff of height H. The ratio of its kinetic energy to the potential energy when it is fallen through a height 3/4 H is

A. $3 : 4$

B. $4 : 3$

C. $1 : 3$

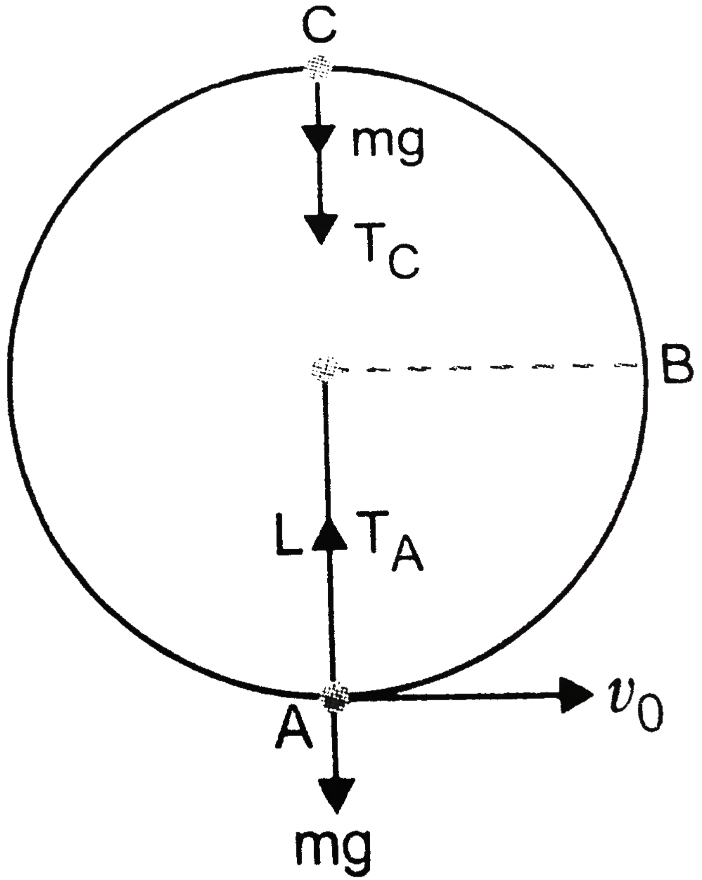
D. $3 : 1$

Answer: C

View Text Solution

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

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



A. A-p,B-q,C-s,D-r

B. A-q,B-r,C-q,D-s

C. A-r,B-s,C-q,D-p

D. A-s,B-p,C-r,D-q

Answer: C

Watch Video Solution

The Potential Energy Of A Spring

1. When a long spring is stretched by 2 cm, its potential energy is V. If the spring is stretched by 10 cm, the potential energy in it will be

A. 10 V

B. 25 V

C. $\frac{V}{5}$

D. 5V

Answer: B

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2. Two springs of spring constants $1000Nm^{-1}$ and $2000Nm^{-1}$ are stretched with same force. They will have potential energy in the ratio of

A. $2:1$

B. $2^2:1^2$

C. $1:2$

D. $1^2:2^2$

Answer: A

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

A. 6 m

B. 8 m

C. 10 m

D. 12 m

Answer: C

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4. A car of mass 1000 kg moving with a speed $18 km h^{-1}$ on a smooth road and colliding with a horizontally mounted spring of spring constant $6.25 \times 10^{3} N m^{-1}$. The maximum compression of the spring is

A. 1 m

B. 2 m

C. 3 m

D. 4 m

Answer: B

Watch Video Solution

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

A. 5 cm

B. 15 cm

C. 20 cm

D. 10 cm

Answer: D

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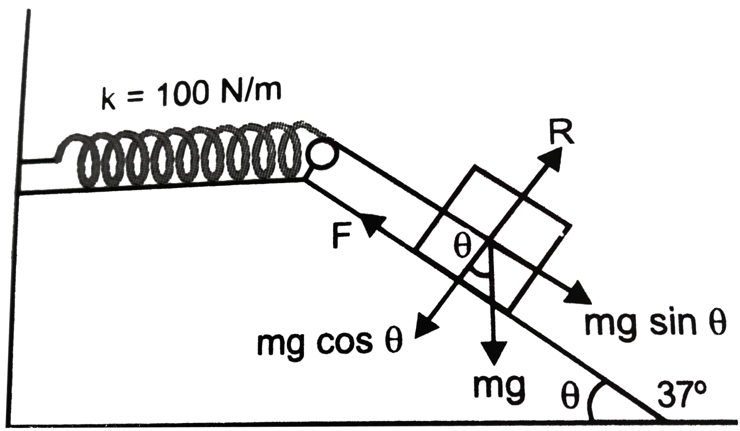
6. A 1kg block situated on a rough incline is connected to a spring of spring constant $100Nm^{-1}$ as shown in figure,. The block is released from rest with the spring in the unstretched position. The block moves 10cm down the incline before coming to rest. Find the coefficient of friction between the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



A. 0.2

B. 0.3

C. 0.5

D. 0.6

Answer: B

View Text Solution

Various Forms Of Energy The Law Of Conservation Of Energy

1. Which of the following statements is correct?

A. Heat is absorbed in exothermic reaction.

B. Heat is released in endothermic reaction.

C. Energy released in burning 1 litre of gasoline is 300 MJ.

D. Chemical energy is associated with the forces that give rise to the stability of substances

Answer: D

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2. One man takes 1 minute to raise a box to a height of 1 metre and another man takes 1/2 minute to do so. The energy of the two is

A. different

B. same

C. energy of the first is more

D. energy of the second is more

Answer: B

Watch Video Solution

3. An adult weighing 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 jogs for 6 km, the energy utilised by him in jogging is

A. 9×10^6 J

B. 9×10^5 J

C. 6×10^6 J

D. 6×10^5 J

Answer: B

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4. Calculate the amount of energy released in MeV due to a loss of mass of 1 kg.

A. 3 MJ

B. 30 MJ

C. 300 MJ

D. 3000 MJ

Answer: B

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5. Energy required to break one bond in DNA is approximately

A. 10^{-10} J

B. 10^{-18} J

C. 10^{-7} J

D. 10^{-20} J

Answer: D

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6. One milligram of matter is converted into energy. The energy released will be

A. 9×10^{6} J

B. 9×10^{8} J

C. 9×10^{10} J

D. 9×10^{12} J

Answer: C

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Power

1. Which of the following units is a unit of power?

A. kilowatt hour

B. watt

C. erg

D. calorie

Answer: B

View Text Solution

2. 1 kilowatt hour (kWh) is equal to

A. 2.25×10^{22} eV

B. 2.25×10^{23} eV

C. 2.25×10^{25} eV

D. 2.25×10^{27} eV

Answer: C

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3. Match the column I with column II.

Column I		Column II	
(A)	When a body does work against friction, its kinetic energy	(p)	independent of time
(B)	Work done by a body is	(q)	time
(C)	Power of a body varies inversely as	(r)	force must be conservative
(D)	When work done over a closed path is zero	(s)	decreases

A. A-p,B-q,C-r,D-s

B. A-q,B-r,C-s,D-p

C. A-s,B-r,C-q,D-p

D. A-s,B-p,C-q,D-r

Answer: D

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

A. 313.6 W

B. 120.6 W

C. 510 W

D. 0

Answer: A

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5. A crane lifts a mass of 100 kg to a height of 10 m in 20 s. The power of the crane is (Take $g = 10ms^{-2}$)

A. 100 W

B. 200 W

C. 250 W

D. 500 W

Answer: D

Watch Video Solution

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

A. 11.55 kW

B. 1155 kW

C. 23.10 kW

D. 2310 kW

Answer: A

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7. A force $\left(4\hat{i}+\hat{j}-2\hat{k}\right)$ N acting on a body maintains its velocity at $\left(2\hat{i}+2\hat{j}+3\hat{k}\right)ms^{-1}$. The power exerted is

A. 4 W

B. 6 W

C. 2 W

D. 8 W

Answer: B

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8. 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. $t^{1/2}$

B. t

C. $t^{3/2}$

D. t^{2}

Answer: B

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9. Two men with weights in the ratio 4:3 run up a staircase in time in the ratio 12:11. The ratio of power of the first to that of second is

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

B. $\frac{12}{11}$

C. $\frac{48}{33}$

D. $\frac{11}{9}$

Answer: D

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10. The power of a water pump is 2 kW. If $g = 10m/s^2$, the amount of water it can raise in 1 min to a height of 10 m is :

A. 2000 litre

B. 1000 litre

C. 100 litre

D. 1200 litre

Answer: D

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

A. 22 kW

B. 44 kW

C. 66 kW

D. 88 kW

Answer: B

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

A. 36.5 kW

B. 50 kW

C. 52.5 kW

D. 60.5 kW

Answer: B

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13. Water is flowing in a river at $2ms^{-1}$. The river is $50m$ wide and has an average depth of $5m$. The power available from the current in the river is (Density of water $= 1000kgm^3$

A. 0.5 MW

B. 1 MW

C. 1.5 MW

D. 2 MW

Answer: B

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Collisions

1. Consider the following statements A and B. Identify the correct choice in the given answers

A. In a one dimensional perfectly elastic collision between two moving bodies of equal masses the bodies merely exchange their velocities after collision.

B. If a lighter body at rest suffers perfectly elastic collision with a very heavy body moving with a certain velocity, then after collision both travel with same velocity.

A. A and B are correct

B. Both A and B are wrong

C. A is correct, B is wrong

D. A is wrong, B is correct

Answer: C

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2. When two spheres of equal masses undergo glancing elastic collision with one of them at rest after collision they will move

A. opposite to one another

B. in the same direction

C. together

D. at right angle to each other

Answer: D

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3. A spherical ball of mass m_1 collides head on with another ball of mass m_2 at rest . The collision is elastic . The fraction of kinetic energy lost by m_1 is :

A. $\dfrac{4m_1m_2}{(m_1+m_2)^2}$

B. $\dfrac{m_1}{m_1+m_2}$

C. $\dfrac{m_2}{m_1+m_2}$

D. $\dfrac{m_1 m_2}{(m_1 + m_2)^2}$

Answer: A

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4. Fast neutrons can easily be slowed down by

A. the use of lead shield

B. passing them through heavy water

C. elastic collision with heavy nucleus

D. applying a strong electric field

Answer: C

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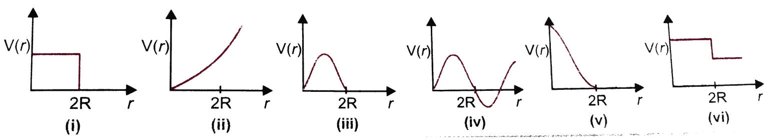
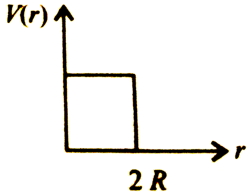
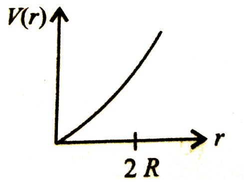
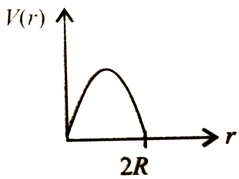
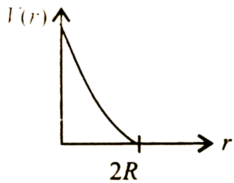
5. Which of the following potential energy curves in figure., cannot possibley describly describe the elastic collision of two billiard balls ? Here r is distance between centres of the balls.



A. 

B. 

C. 

D. 

Answer: C

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

A. $2.3 ms^{-1}$

B. $4.6 ms^{-1}$

C. $9.2 ms^{-1}$

D. $6 ms^{-1}$

Answer: B

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

A. $7ms^{-1}$

B. $25ms^{-1}$

C. $14ms^{-1}$

D. $28ms^{-1}$

Answer: C

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8. A ball of mass m moving with a speed $2v_0$ collides head-on with an identical ball at rest. If e is the coefficient of restitution, then what will be the ratio of velocity of two balls after collision?

A. $\frac{1-e}{1+e}$

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

C. $\dfrac{e-1}{e+1}$

D. $\dfrac{e+1}{e-1}$

Answer: A

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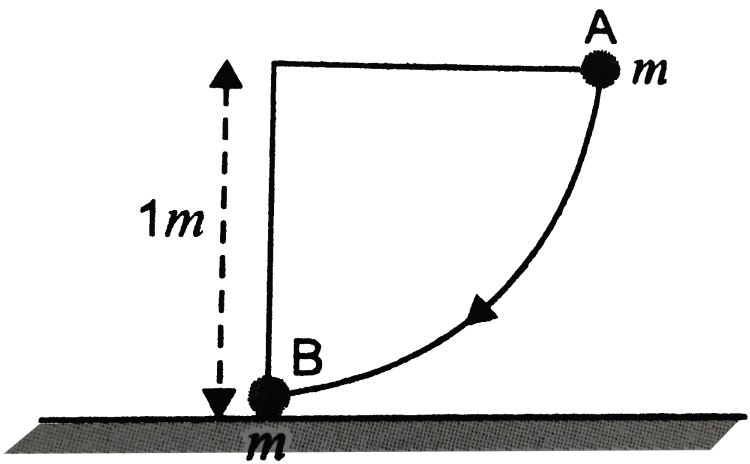
9. The bob A of a pendulum released from horizontal to the vertical hits another bob B of the same mass at rest on a table as shown in figure.

If the length of the pendulum is 1m, calculate

(a) the height to which bob A will rise after collision.

(b) the speed with which bob B starts moving.

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



A. $4.47ms^{-1}$

B. $5.47ms^{-1}$

C. $6.47ms^{-1}$

D. $3.47ms^{-1}$

Answer: A

Watch Video Solution

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

A. e^2h

B. eh^2

C. e^4h

D. $\frac{h}{e^4}$

Answer: C

Watch Video Solution

11. A ball of mass m collides with a wall with speed v and rebounds on the same line with the same speed. If the mass of the wall is taken as infinite, then the work done by the ball on the wall is

A. mv^2

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

C. $2mv$

D. zero

Answer: D

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12. A sphere P of mass m and velocity v_i undergoes an oblique and perfectly elastic collision with an identical sphere Q initially at rest. The angle θ between the velocities of the spheres after the collision shall be

A. 0

B. 45°

C. 90°

D. 180°

Answer: C

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13. A spherical ball A of mass 4 kg, moving along a straight line strikes another spherical ball B of mass 1 kg at rest. After the collision, A and B move with velocities $v_1 ms^{-1}$ and $v_2 ms^{-1}$ respectively making angles of 30° and 60° with respect to the original direction of motion of A. The ratio $\frac{v_1}{v_2}$ will be

A. $\frac{\sqrt{3}}{4}$

B. $\frac{4}{\sqrt{3}}$

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

D. $\sqrt{3}$

Answer: A

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14. A neutron collides, head-on with a deuterium at rest. What fraction of the neutron's energy would be transferred to the deuterium?

A. 89%

B. 11%

C. 79%

D. 21%

Answer: A

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15. A neutron in a nuclear reactor collides head on elastically with the nucleus of a carbon atom initially at rest. The fraction of kinetic energy transferred from the neutron to the carbon atom is

A. $\frac{11}{12}$

B. $\frac{2}{11}$

C. $\frac{48}{121}$

D. $\frac{48}{169}$

Answer: D

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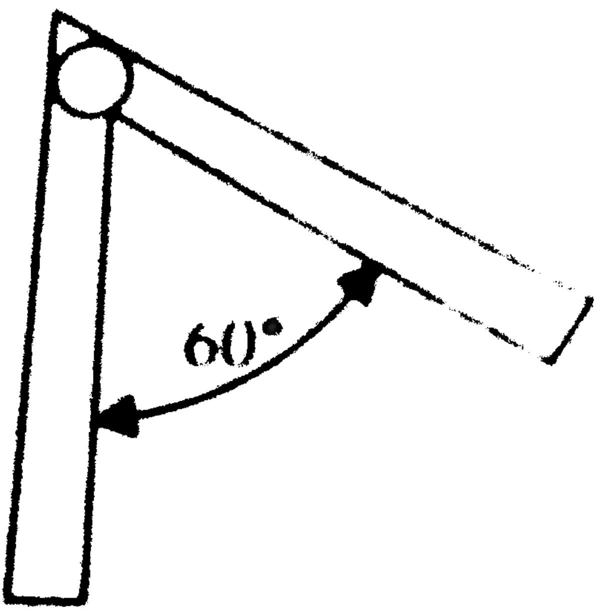
Higher Order Thinking Skills

1. A metre stick weighing 600 g, is displaced through an angle of 60° in vertical plane as shown. The change in its potential energy is ($g = 10 ms^{-2}$)



A. 1.5 J

B. 15 J

C. 30 J

D. 45 J

Answer: A

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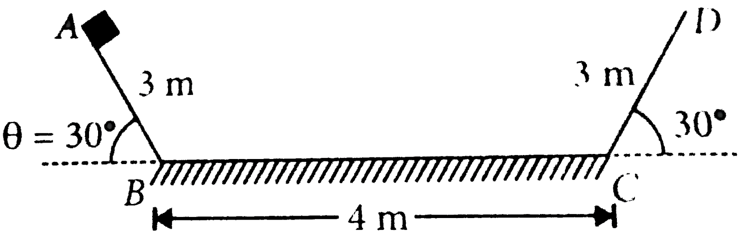
2. A track has two inclined surface AB and DC each of length 3 m and angle of inclination of 30° with the horizontal and a central horizontal part of length 4m shown in figure. A block of mass 0.2 kg slides from rest from point A. The inclined surfaces are frictionless. If the coefficient of friction between the block and the horizontal flat surface is 0.2, where will the block finally come to rest ? [in $10^{-1}m$]



A. 0.5 m away from point B

B. 3.5 m away from point B

C. 0.5 m away from point C

D. 1.5 m away from point C

Answer: A

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3. A bob of mass m, suspended by a string of length l_1 is given a minimum velocity required to complete a full circle in the vertical plane. At the highest point, it collides elastically with another bob of mass m suspended by a string of length l_2, which is initially at rest. Both the strings are mass-less and inextensible. If the second bob, after collision acquires the minimum speed required to complete a full circle in the vertical plane, the ratio $\frac{l_1}{l_2}$ is

A. 1

B. 3

C. 5

D. $1/5$

Answer: C

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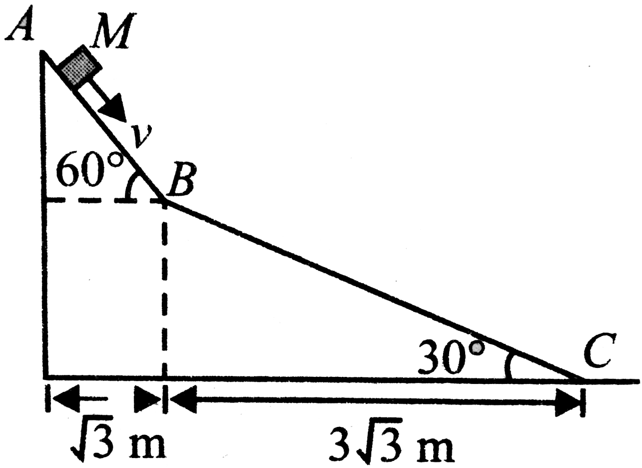
4. A small block of mass M moves on a frictionless surface of an inclined plane, as shown in the figure. The angle of the incline suddenly changes from 60° to 30° at point B. The block is many at rest at A. Assume that collisions between the block id the incline are totally inelastic.

The speed of the block at point B immediately after it strikes the second incline is



A. $\sqrt{60}$ m/s

B. $\sqrt{45}$ m/s

C. $\sqrt{30}$ m/s

D. $\sqrt{15}$ m/s

Answer: B

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5. the speed of the block at point C, immediately before it leaves the second incline is

A. $\sqrt{120}$ m/s

B. $\sqrt{105}$ m/s

C. $\sqrt{90}$ m/s

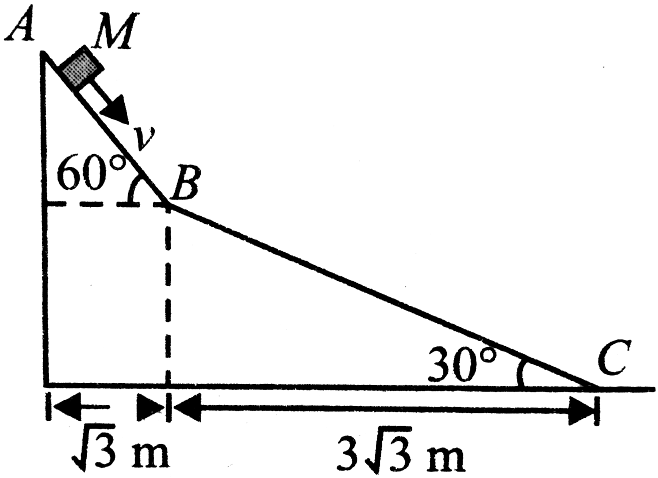
D. $\sqrt{75}$ m/s

Answer: B

View Text Solution

6. A small block of mass M moves on a friction-less surface of an inclined plane, as shown in the figure. The angle of the incline suddenly changes from 60° to 30° at point B. The block is initially at rest at A.

If collision between the block and the incline is completely elastic, then the vertical (upward) component of the velocity of the blocks at point B, immediately after it strikes the second incline is



A. $\sqrt{30}$ m/s

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

C. 0

D. $-\sqrt{15}$ m/s

Answer: C

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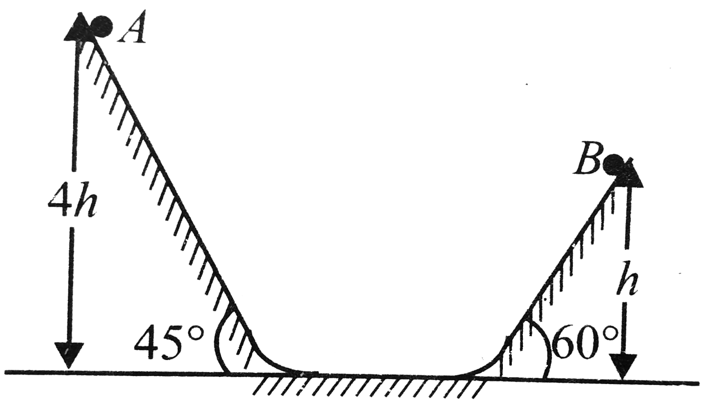
7. Two identical balls A and B are released from the position shown in Fig. They collide elastically with each other on the horizontal portion. The ratio of heights attained by A and B after collision is (neglect friction)



A. $1:4$

B. $2:1$

C. $4:13$

D. $2:11$

Answer: C

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8. An object of mass 5 kg is projecte with a velocity of $20ms^{-1}$ at an angle of 60° to the horizontal. At the highest point of its path , the projectile explodes and breaks up into two fragments of masses 1kg and 4 kg. The fragments separate horizontally after the explosion, which releases internal energy such that $K.E.$ of the system at the highest point is doubled. Calculate the separation betweent the two fragments when they reach the ground.

A. 11 m

B. 22 m

C. 44 m

D. 66 m

Answer: C

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Ncert Exemplar

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 no 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 ini which the charged particle is also a proton and in another, a position. In the same time t, the work done on the two moving charged particles 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 weakens.

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 squatting on the ground gets straight up and stand. The force of reaction of ground on the man 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 bicyclist comes to a skidding stop in $10m$. During this process, the force on the bicycle due to the road is $200N$ and is directly opposed to the motion. The work done by the cycle on the road is

A. +2000 J

B. -200 J

C. zero

D. -20000 J

Answer: C

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5. 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: 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

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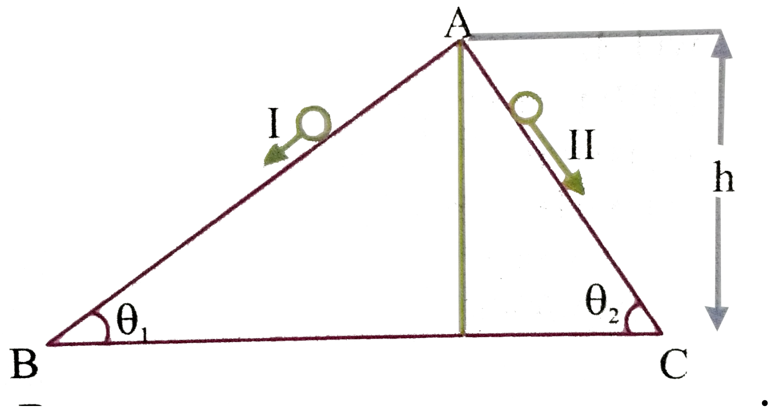
7. Two inclined frictionless tracks, one gradual and the other steep meet at a from where two stones are allowed to slide down from rest, one on each track as shown in Figure. Which of the following statement is correct ?



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 speed 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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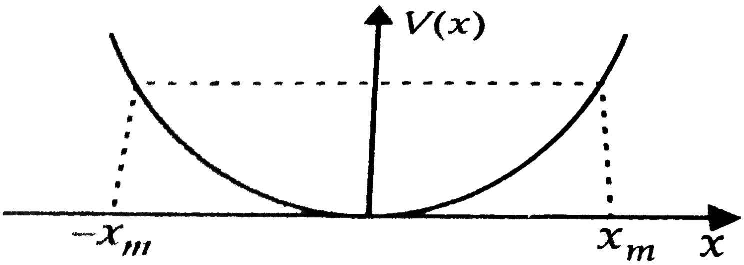
8. The potential energy function for a particle executing linear SHM is given by $V(x) = \frac{1}{2}kx^2$ where k is the force constant of the oscillator. For $k = 0.5Nm^{-1}$, the graph of V(x) versus x is shown in the figure A particle of total energy E turns back when it reaches $x = \pm x_m$.if V and K indicate the potential energy and kinetic energy 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 lt K, K=0

D. V=0, K lt E

Answer: B

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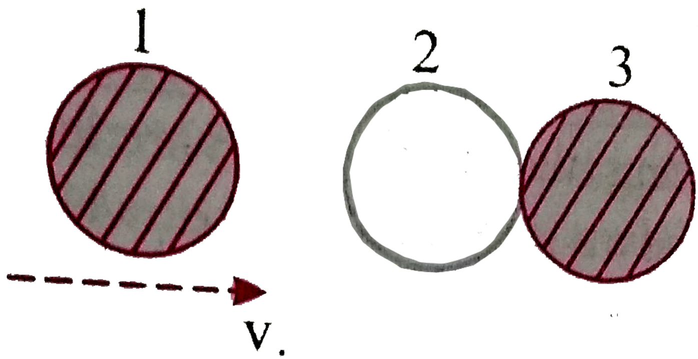
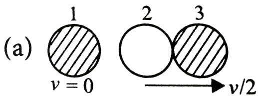
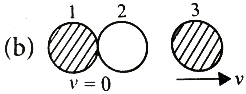
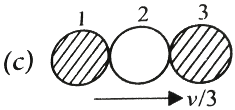
9. Two identical ball bearings in contact with each other and resting on a frictionless table are hit heat-on by another ball bearing of the same mass moving initially with a speed V as shown in figure.

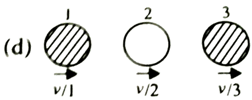


If the collision is elastic, which of the following (figure) is a possible result after collision ?

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 $v = kx^{3/2}$ where

$k = 5m^{-1/2}s^{-1}$. 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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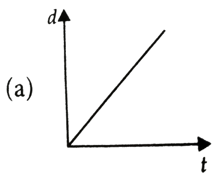
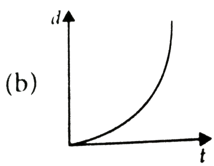
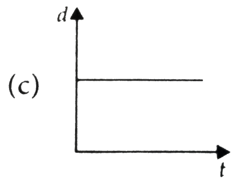
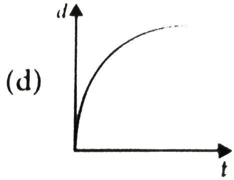
11. A body is moving unidirectionally under the influence of a source of constant power supplying energy. Which of the diagrams shown in figure. Correctly shows the displacement-time curve for its motion ?

A. 

B. 

C. 

D. 

Answer: B

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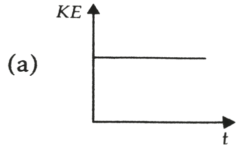
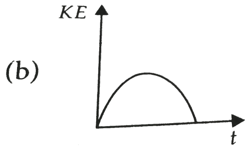
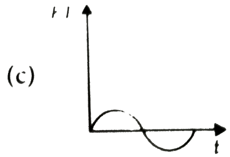
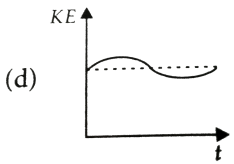
12. Which of the diagrams shown in figure. Most closely shows the variation inkinetic energy of the earth as it moves once around the sun in its elliptical orbit ?

A. 

B. 

C. 

D. 

Answer: D

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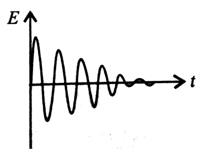
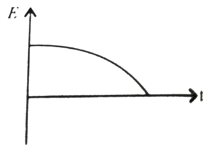
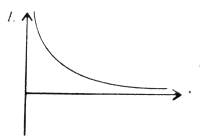
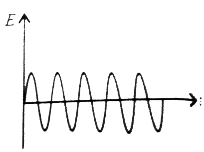
13. Which of the diagram shown in figures respresents variation of total mechanical energy of a pendulam oscillation in air as function of time?

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: C

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14. A mass of $5kg$ is moving along a circular path or radius $1m$. If the mass moves with 300 revolutions per minute, its kinetic energy would be

A. $250\pi^2 J$

B. $100\pi^2 J$

C. $5\pi^2 J$

D. 0 J

Answer: A

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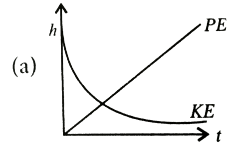
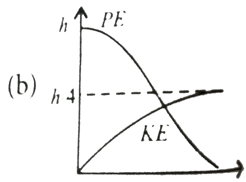
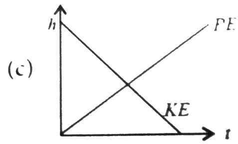
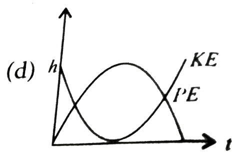
15. A raindrop falling from a height h above ground, attains a near terminal velocity when it has fallen through a height $(3/4)h$. Which of the diagrams shown in figure correctly shows the change in kinetic and potential energy of the drop during its fall up to the ground ?

A. 

B. 

C. 

D. 

Answer: B

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16. In a shotput event an athlete throws the shotput of mass 20 kg with an initial speed of $2ms^{-1}$ at 45° from height 3 m above ground. Assuming air resistance to be negligible and acceleration due to gravity to be $10ms^{-2}$, the kinetic energy of the shotput when it just reaches the ground will be

A. 2.5 J

B. 5.0 J

C. 52.5 J

D. 155.0 J

Answer: D

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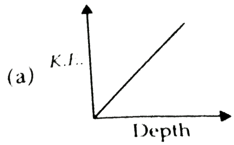
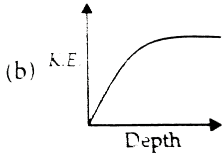
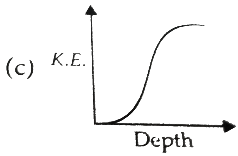
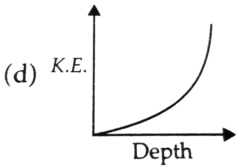
17. Which of the diagrams in figure, correctly shows the change in kinetic energy of an iron sphere falling freely in a lake having sufficient depth to impart if a terminal velocity ?

A. 

B. 

C. 

D. 

Answer: B

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18. A cricket ball of mass $150g$ moving with a speed of $126km/h$ hits at the middle of the bat, held firmly at its position by the batman. 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 $0.001s$, the force that the batsman had to apply to hold the bat firmly at its place would be

A. 10.5 N

B. 21 N

C. 1.05×10^4 N

D. 2.1×10^4 N

Answer: C

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Assertion And Reason

1. Assertion , No work is done if the displacement is zero

Reason: Work done by the force is defined to be the product of component of the force in the the direction of the displacement and the magnitude of displacement.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

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2. Assertion: Work done by the friction or viscous force on a moving body in negative.

Reason: Work done is a scalar quantity which cannot be negative like mass.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

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3. Assertion: A light body and a heavy body have same momentum. Then they also have same kinetic energy.

Reason: Kinetic energy does not depand on mass of the body.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D

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4. Assertion:The work done by a conservative force such as gravity depends on the initial and final positions only

Reason: The work done by a force can not be calculated if the exact nature of the force is not known.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

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5. Assertion : For two bodies , the sum of the mutual forces exerted between them is zero from Newton's third law. Reason : The sum of work done by the two forces must always cancel.

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

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

explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

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6. Assertion: Work done by the force of friction in moving a body around a closed loop is zero.

Reason: Work done does not depend upon the nature of force.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D

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7. Assertion: Work done by friction over a closed path is not zero and no potential energy can be associated with friction.

Reason: Every force encountered in mechanics have an associated potential energy.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

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8. Assertion: A spring has potential energy , both when it is compressed or stretched.

Reason: In compressing or stretching, work is done on the spring against the restoring force.

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

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

explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

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9. Assertion : The work done by the spring force in a cyclic process is zero. Reason : Spring force is a conservative force.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

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10. Assertion: Universe as a whole may be viewed an isolted system.

Reason: Total energy of an isolated system remain constant or stretched.

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

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

explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

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11. Assertion: Energy can neither be created nor destroyed.

Reason: The principle of conservation of energy cannot be proved.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

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12. Assertion: Energy associated with a mere kilogram of matter is $9 \times 10^{16} J$

Reason: It follows from the relation $E = mc^2$.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

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13. Assertion : Kilowatt hour is the unit of power.

Reason: One kilowatt hour is equivalent to 3.6×10^5 J

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D

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14. Assertion: The conservation of kinetic energy in elastic collision applies after the collision is over and does not hold at every instant of the collision.

Reason: During a collision the total linear momentum is conserved at each instant of the collision.

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

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

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

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15. Assertion: In a perfectly inelastic collision in the absence of external forces , the kinetic energy is never conserved.

Reason: The objects deformed and stick together in this type of collision.

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

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

explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

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