PHYSICS

BOOKS - A2Z PHYSICS (HINGLISH)

WORK, ENERGY, POWER AND COLLISION

Concept Of Work Done

1. if a number of force act on a body and the body is in state or dynamic force equalibrium , then .

A. work done by any individual force mucst be zero

B. Net work done by all the force is $+ve$

C. Net work done by all the force is $-ve$

D. Net work done by all the force is zero

Answer: D

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2. A man pushes a wall and falls to displace it

He does

A. negative work

B. positive work

C. no work at all

D. can not any

Answer: C

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3. A weightlifter lift a weight off the ground and holds it 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 by 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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4. when the bob of a simple pendulum swings, the work done by bob in the string is :

A. > 0

B. < 0

C. zero

D. maximum

Answer: C

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5. In case of circular motion a body , if tangential force also acts on the body in addition to centripetal force , then work done

A. by both the force is zero

B. by both the force is positive

C. by centripetal force is zero but work done by the tangential force is not zero

D. by centripetal force is zero by work done by tangential force is not zero

Answer: C

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6. Given that a force F acts on a body for time t_1 and displaces the body by $\vec{d}$. In which of the following cases the velocity of the body must increases ?

A. $F > d$

B. $F < d$

C. F||d`

D. hatF _|_ hatd `

Answer: C

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7. In a tug of war , both the terms A and B remain in equilibrium, then

A. work done by term A is positive

B. work done by term B is positive

C. work done by both the terms is negative

D. work done by both the terms is zero

Answer: D

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8. In a certain situation , $\overrightarrow{F}$ and $\overrightarrow{S}$ are not equal to zero but the work done is zero from this , we conclude that

A. $\overrightarrow{F}$ and $\overrightarrow{S}$ are at right angles

B. $\overrightarrow{F} > \overline{S}$

C. $\overrightarrow{F}$ and $\overrightarrow{S}$ are in the same direction

D. $\overrightarrow{F}$ and $\overrightarrow{S}$ are in the opposite direction

Answer: A

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

A. $\frac{mv^2}{\pi r^2}$

B. zero

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

D. $\frac{\pi r^2}{mv^2}$

Answer: B

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10. You lift a heavy book from the floor of the room and keep it in the book shelf having a height $2m$ in this process you take 5 seconds. The work done by you will depend upon

A. Mass of the book and time taken

B. Weight of the book and height of the book-shelf

C. Height of the book shelf and time taken

D. Mass of the book,height ofbody - shelf and time taken

Answer: B

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11. A body of mass mkg lifted by a man to a height of one metre in $30 \sec$. Another man lifted the same mass to the same height in $60 \sec$. The work done by them are in the ratio.

A. $1:2$

B. $1:1$

C. $2:1$

D. $4:1$

Answer: B

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

A. -7 joules

B. $+13$ joules

C. $+7$ joules

D. $+11$ joules

Answer: C

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13. A worker pushes a wheelbarrow with a horizontal force of $50N$ on level ground over a distance of $5.0m$. If a friction force on the $43N$ acts on the wheelbarrow in a direction opposite that to of worker, what work is done on the wheelbarrow by the worker?

A. $250J$

B. $215J$

C. $35J$

D. $10J$

Answer: A

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14. A cart is set rolling across a level table , at the same speed on every trial. If it runs into a patch of sand, the cart exerts on the sand an average horizontal force of $6N$ and travels a distance of $6cm$ through the sand as it comes to a stop. If instead the cart runs into on a path of gravel on which the cart exerts an average horizontal force of $9N$ how far into the gravel will the cart roll before stopping?

A. $9cm$

B. $6cm$

C. $4cm$

D. $3cm$

Answer: C

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15. If a person is pushing a box inside a moving train , the work in the frame of earth will be:

$\overrightarrow{s}_0$= displacement of the train relative to ground.

$\overrightarrow{s}$ =displacement of the box w.r.t. train.

A. zero

B. $\overrightarrow{F} \cdot (\bar{x} + \bar{s}_0)$

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

D. $\overrightarrow{F} \cdot \overrightarrow{S}_0$

Answer: B

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16. A body is a acted upon a force which is proportional to the distance covered .If distance covered be decound by s, then work done by the force will be prepotion to

A. x

B. x^2

C. $x^{3/2}$

D. none of these

Answer: B

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17. A body is acted upon by a which is invensely propertional to the distance x .The wolt done will be preportional to

A. x

B. x^2

C. $x^{3/2}$

D. none of these

Answer: D

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18. A particle moved from position $\overrightarrow{r}_1 = 3\hat{i} + 2\hat{j} - 6\hat{k}$to position $\overrightarrow{r}_2 = 14\hat{i} + 13\hat{j} + 9\hat{k}$ undre the action of a force $\left(4\hat{i} + \hat{j} + 3\hat{k}\right)$ newtons . Find the work done .

A. $10J$

B. $100J$

C. $0.01J$

D. $1J$

Answer: B

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19. A force $\overrightarrow{F} = 2x\hat{i} + 2\hat{j} + 3z^2\hat{k}N$ is acting on a particle .Find the work done by this force in displacing the body from $(1, 2, 3)m$ to $(3, 6, 1)m$

A. $-10J$

B. $100J$

C. $10J$

D. $1J$

Answer: A

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20. Th work done in moving a body of mass $4kg$ with uniform velocity of $5ms^{-1}$ for 10 second on a surface of

$\mu = 0.4 is (take g = 9.8 m / s^2)$

A. $584J$

B. $784J$

C. $684J$

D. $484J$

Answer: B

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21. The work done in dragging a stone of mass $100kg$ up an inclined plane 1 in 100 through a distance of $10m$ is $\left(\text{take} g = 9.8m / s^2\right)$

A. zero

B. $980J$

C. $9800J$

D. $98J$

Answer: D

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22. A lawn roller is displaced through $1km$ using a force of $200N$ in a direction making an angle of 60° with the lawn .The work down is:

A. $10^5 J$

B. $10^4 J$

C. $10^6 J$

D. $10^3 J$

Answer: A

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23. A mass M is lowered with the help of a string by a distance h at a distance acceleration $g/2$. The work done by the string will be

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

B. $-\frac{Mgh}{2}$

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

D. $-\frac{Mgh}{2}$

Answer: B

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24. A body of mass $6kg$ is under a force which causes displacement in it given by $S = \frac{t^2}{4}$ maters where t is time . The work done by the force in 2 sec is

A. $12J$

B. $9J$

C. $6J$

D. $3J$

Answer: D

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25. A particale moves under the effect of a force $F = Cs$ from $s = 0$ to $s = s_1$. The work down in the process is

A. Cx_1^2

B. $\frac{1}{2}Cx_1^2$

C. Cx_1

D. Zero

Answer: B

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26. Two springs have their force constant as k_1 and $k_2(k_1 > k_2)$. When they are stretched by the same force.

A. net work is done in case of both the same springs

B. Equal work is done in case of both the springs

C. More work is done in case of both the second springs

D. More work is done in case of both the first springs

Answer: C

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27. A body of mass $3kg$ is under a force , which causes a displacement in it is given by $S = \frac{t^3}{3}$

(in metres). Find the work done by the force in first 2 seconds.

A. $2J$

B. $3.8J$

C. $5.2J$

D. $24J$

Answer: D

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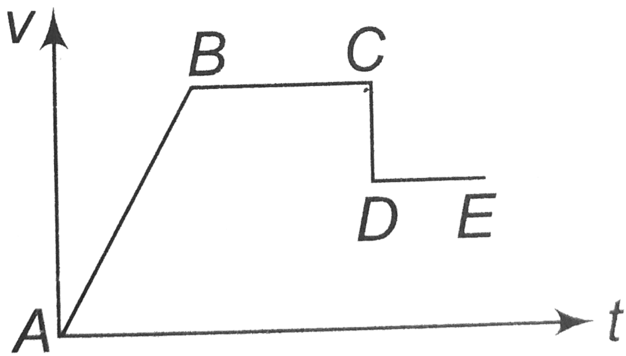
28. The adojoining diagram showns the velocity versus time plot for a partical . The work done by the force on the partical is positive from



A. A to$B$

B. B to C

C. C to D

D. D to E

Answer: A

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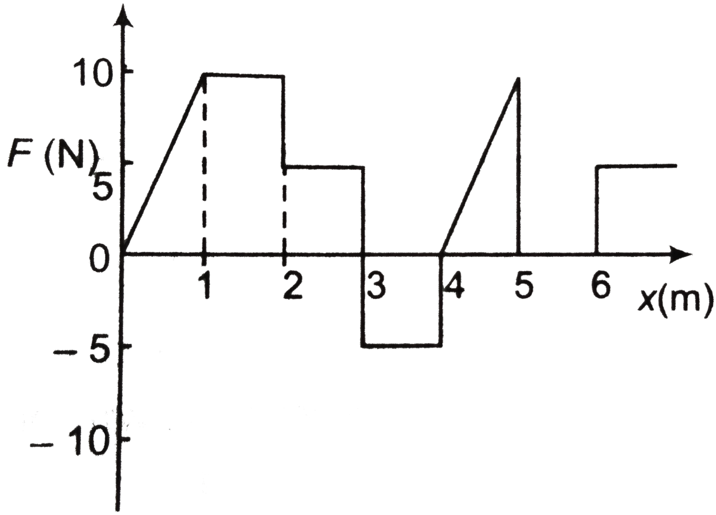
29. The relationship between the force F and position x of body is as shown in figure. The work done in displacing the body from (

$x = 1m$ to $x = 5m$) will be



A. $30J$

B. $15J$

C. $25J$

D. $20J$

Answer: B

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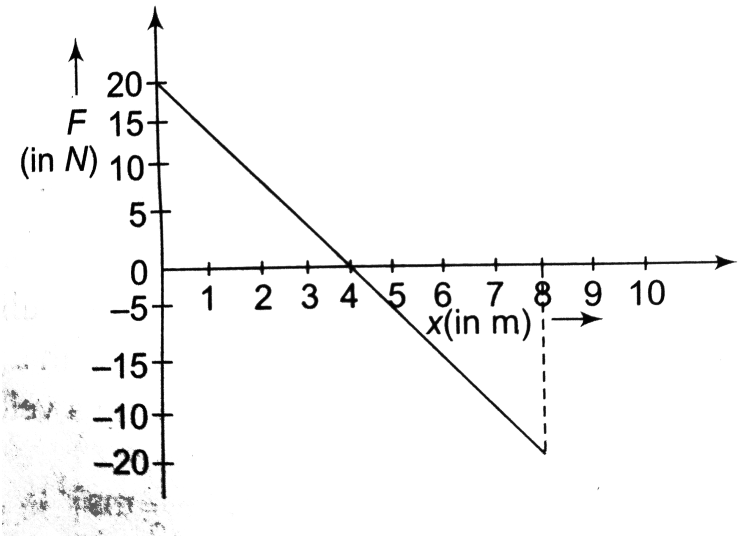
30. A Force F acting on an object varies with distance x as shown in the figure.



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

A. zero J

B. $80J$

C. $-40J$

D. $40J$

Answer: A

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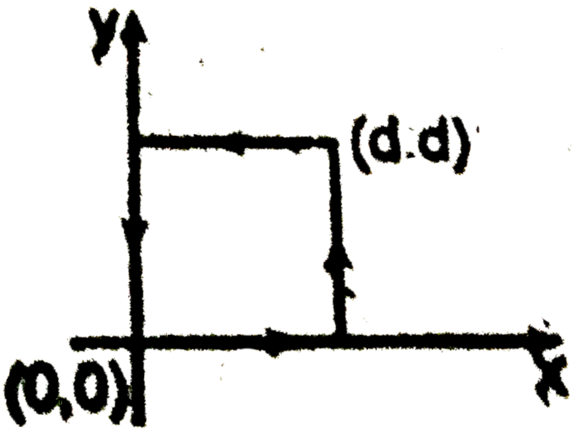
31. The work done by the force $\vec{F} = A\left(y^2\hat{i} + 2x^2\hat{j}\right)$, where A is a constant and x & y are in meters around the path shown is :



A. zero

B. A d

C. Ad^2

D. Ad^3

Answer: D

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32. A force $F = -K\left(y\hat{I} + x\hat{j}\right)$ (where K is a posive constant) acts on a particle moving in the xy plane . Starting form the original , the partical is taken along in the positive x axis to the point $(a, 0)$ and then partical to they axis the point (a, a) . The total work done by the force F on the particls is

A. $-2Ka^2$

B. $2Ka^2$

C. $-Ka^2$

D. Ka^2

Answer: C

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

A. $12.9J$

B. $6.3J$

C. $3.6J$

D. $2.0J$

Answer: C

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

A. MgL

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

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

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

Answer: D

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35. A body of mass m is acceleratad uniformaly from rest to a speed v in a time T . The instanseous power delivered to the body as a function of time is given by

A. $\frac{1}{2}m\frac{v}{t_1}t^2$

B. $m\frac{v}{t_1}t^2$

C. $\frac{1}{2}\left(\frac{mv}{t_1}\right)^2t^2$

D. $\frac{1}{2}mv^2\left(\frac{t}{t_1}\right)^2$

Answer: D

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Work-Energy Theorem

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

A. It's velocity is constant

B. It's acceleration is constant

C. It's kinetic energy is constant

D. It moves in a straight line

Answer: C

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2. Identify the correct statement about work energy theorem.

A. external force only

B. internal forces only

C. conservative forces only

D. all type of forces

Answer: D

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3. If the net work done by external force on a partical is zero which is the following statement about the partical must be true?

A. Its velocity is constant

B. Its velocity is decreased

C. Its velocity is unchanged

D. Its speed is unchanged

Answer: D

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4. A ball of mass m moves with speed v and stricks a wall having infinite mass and it returns with same speed then the work done by the ball on the wall is

A. Zero

B. $mvjo\underline{e}s$

C. $m/vjo\underline{e}s$

D. $v/mjo\underline{e}s$

Answer: A

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5. Is the work required to be done by an external force on an object on a frictionless , horizontal surface to accelerate it from a speed v to a speed $2v$

A. equal to the work required to accelerate the object from $t = 0$ to v.

B. twice the work required to accelerate the object from $v = 0$ to v.

C. three time the work required to accelerate the object from $v = 0$ to v.

D. four time the work required to accelerate the object from 0 to v. Or

Answer: C

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6. A force act on a $30gm$ particle in such a way that the position of the particle as a function of time is given by $x = 3t - 4t^2 + t^3$, where x

is in metros and t is in seconds. The work done during the first 4 second is

A. $5.28J$

B. $450mJ$

C. $490mJ$

D. $530mJ$

Answer: A

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7. A certain spring that obeys Hook's law is stretched by an external agents. The work done in stretching the spring by 10 cm is 4 J . How much additional work is required to stretch the spring an additional $10cm$?

A. $2J$

B. $4J$

C. $8J$

D. $12J$

Answer: D

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8. A $3.00kg$ object has a velocity $\left(6.00\hat{i} - 2.00\hat{j}\right)m/s$. What is the net work done on the object if its velocity changes to $\left(8.00\hat{i} - 4.00\hat{j}\right)m/s$?

A. $64.5J$

B. $64.5J$

C. $64.5J$

D. $64.5J$

Answer: D

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9. Two identical $5kg$ blocks are moving with same speed of $2m/s$ towards each other along a frictionless horizontal surface . The two blocks collide , stick together and come to rest. Consider the two blocks as a system . The work done by the external and ijnternal force are respectively:

A. $0, 0$

B. $0, 20J$

C. $0, \ -20J$

D. $21J, \ -20J$

Answer: C

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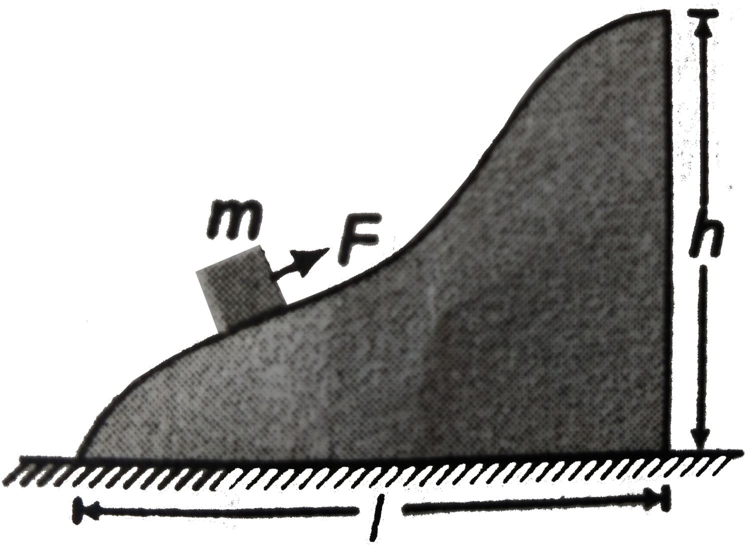
10. A body of mass m was slowly hauled up the hill as shown in the fig. by a force F which at each point was directed along a tangent to the trajectory. Find the work performed by this force, if the height of the hill is h, the length of its base is l and the coefficient ot friction is μ.



A. mgl

B. $-mgl$

C. mgh

D. zero

Answer: C

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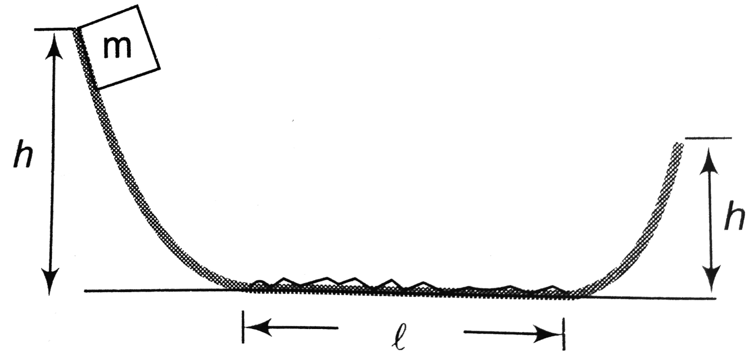
11. A block is released from rest from a height $h = 5m$. After travelling through the smooth curved surface it moves on the rough horizontal surface through a length $l = 8m$ and climbs on to the other smooth curve surface through a height h'. If $\mu = 0.5$ find h'

.



A. $2m$

B. $3m$

C. $1m$

D. zero

Answer: C

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12. A bullet when fixed at a target with a velocity of $100 ms^{-1}$, penetrates one metre into it. If the bullet is fired with the same velocity as a similar target with a thickness 0.5 metre, then it will emerge from it with a velocity of

A. $50\sqrt{2} ms^{-1}$

B. $\dfrac{50}{\sqrt{2}} ms^{-1}$

C. $50 ms^{-1}$

D. $10ms^{-1}$

Answer: A

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13. The displacement of a body of mass $2kg$ varies with time t as $S = t^2 + 2t$, where S is in seconds. The work done by all the forces acting on the body during the time interval $t = 2s$ to $t = 4s$ is

A. $36J$

B. $64J$

C. $100J$

D. $120J$

Answer: B

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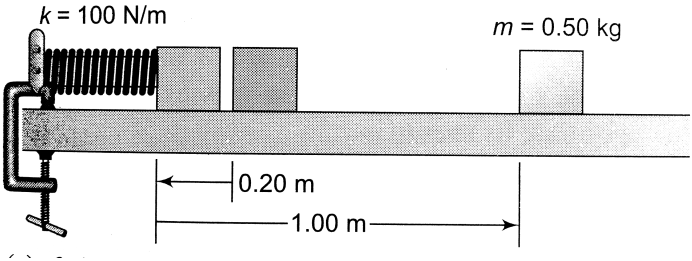
14. A block with mass $0.50kg$ is forced against a horizontal spring of negligible mass , compressing the spring a distance of $0.20m$ (figure). When released, the block moves on a horizontal table top for $1.00 N/m$. What is the coefficient of kinetic friction μ_k, between the block and the block and the table?



A. 0.40

B. 0.50

C. 0.25

D. none of these

Answer: A

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15. A particle is projected from a point P with a velocity v at an angle θ with horizontal. At a certain point Q it moves at right angles to its initial direction. Then

A. $mv^2 \sin\theta$

B. zero

C. $-mv^2 \sin\theta$

D. $-\dfrac{mv^2 \sin\theta}{2}$

Answer: D

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16. Under the action of a force, a $2kg$ body moves such that its position x as a function of time is given by $x = \frac{t^3}{3}$ where x is in metre and t in second. The work done by the force in the first two seconds is .

A. $1.6J$

B. $16J$

C. $160J$

D. $1600J$

Answer: B

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17. The displacement x of particle moving in one dimension, under the action of a constant force is related to the time t by the equation

$t = \sqrt{x} + 3$

where $x is \in meters$ and $t \in \sec onds$. Find

(i) The displacement of the particle when its velocity is zero , and

(ii) The work done by the force in the first $6\sec onds$.

A. $18m$

B. zero

C. $9m/2$

D. $36m$

Answer: B

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18. A body of mass m is accelerated uniformly from rest to a speed v in a time T . The instantaneous power delivered to the body as a function of time is given by

A. $m\frac{v^2}{T^2}t$

B. $m\frac{v^2}{T^2}t^2$

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

D. $m\frac{v^2}{2T^2}t^2$

Answer: A

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19. An open knife of mass m is dropped from a height h on a wooden floor. If the blade penetrates up to the depth d into the wood. The average resistance offered by the wood to the knife edge is .

A. $Mg\left(\frac{h}{d}\right)$

B. $Mg\left(1+\frac{h}{d}\right)$

C. $Mgh+Mgd$

D. $Mg\left(1-\frac{h}{d}\right)$

Answer: B

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20. A small head of m is pleced in the bottom of which glass of value radius R It is displaced by $(h < < R)$ along the glass surface and released calculate the total distance described by it before it comes to rst of the botom μ is the coefficient of friction between bead and the watch glass

A. h / μ

B. $h / 2\mu$

C. $h\sqrt{\mu}$

D. $\frac{h}{\mu R}$

Answer: A

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21. A raindrop of mass $1g$ falling from a height of $1km$ hits is the ground with a speed of $50ms^{-1}$ If the resistence force is properition to the speed of the drop .then the work done

by the resistence force is $\left(\text{Taking} g : 10ms^{-2}\right)$.

A. $10J$

B. $-10J$

C. $8.75J$

D. $-8.75J$

Answer: D

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22. A block of mass m is released from the top of a mooth inclined plane of height h its speed at the bottom of the plane is proportion to

A. m^0

B. m

C. m^2

D. m^{-1}

Answer: A

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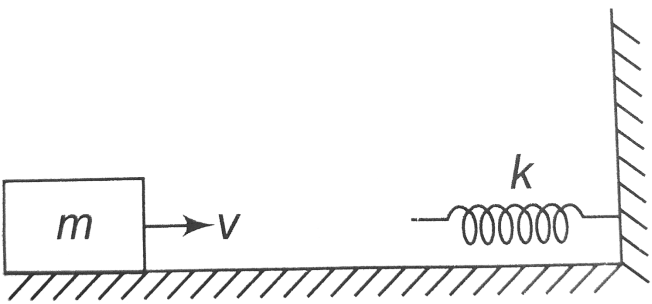
23. A block of mass m is moving with a speed v on a horizontal rough surface and collides with a horizontal mounted spring of spring constant k as shown in the figure .The coefficient of friction between the block and the floor is μ The maximum compression of the spring is



A. $-\frac{\mu mg}{k}+\frac{1}{k}\sqrt{(\mu mg)^2+mkv^2}$

B. $\frac{\mu mg}{k}+\frac{1}{k}\sqrt{(\mu mg)^2+mkv^2}$

C. $-\frac{\mu mg}{k}+\frac{1}{k}\sqrt{(\mu mg)^2-mkv^2}$

D. $\frac{\mu mg}{k}+\frac{1}{k}\sqrt{(\mu mg)^2+mkv^2}$

Answer: A

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24. A bodu of mass $4kg$ is moving with momentant of $8kgms^{-1}$ A force of $0.2N$ acts on it in the direction of motion of the body for

$10s$ The increases in kinetic energy is

A. $10J$

B. $0.5J$

C. $4.5J$

D. $4J$

Answer: C

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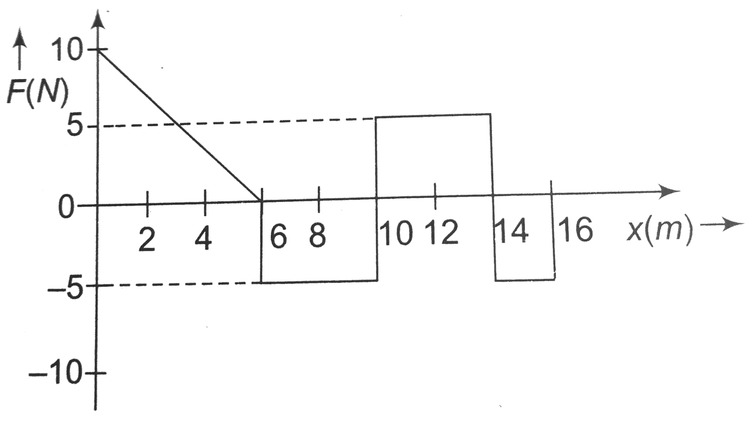
25. A particle is acted upon by a force F which varies with position x is shown in figure .If the particle at $x=0$ kinetic energy of $25J$ then the kinetic energy of the particle at $x=16m$ is



A. $45J$

B. $30J$

C. $70J$

D. $20J$

Answer: A

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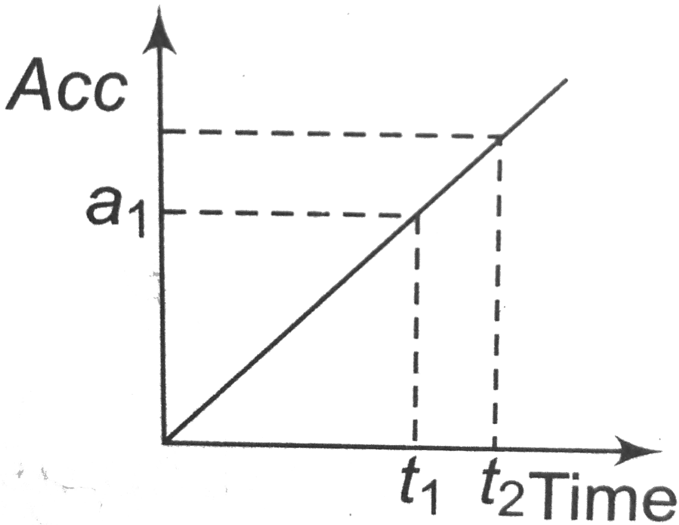
26. Acceleration time graph of a particle is shown work done by all the force acting on the particle of mass m in line internalt_1 and t_2 while a_1 is the acceleration at time t_1 given by

$t=0$ particle was at rest



A. $\dfrac{ma_1^2}{4t_1}\left(t_2^3-t_1^2\right)$

B. $\dfrac{ma_1^2}{8t_1^2}\left(t_2^4-t_1^4\right)$

C. $\dfrac{ma_1^2}{4t_1^2}\left(t_2^4-t_1^4\right)$

D. $\dfrac{ma_1}{4t_1}\left(t_2^2-t_1^2\right)$

Answer: B

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27. A force $\overrightarrow{F} = (3xN)\hat{i} + (4N)\hat{j}$, with x in meter, acts on a particle, changing only the kinetic energy of the particle. How mcuh work is done on the particle as it moves from coordinates $(2m, 3m, 5m)$ to $(3m, 0m, 6m)$? Does the speed of the particle increase, decrease, or remain the same?

A. $-7J$

B. zero

C. $+7J$

D. $+19J$

Answer: C

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Potential Energy, Conservative And Non-Conservative Forces

1. Which are the following is not a conservative force?

A. Force of friction

B. Magnetic force

C. Gravitational force

D. Electrostatic force

Answer: A

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2. Asseration : If work by done conservative forces is positive, kinetic energy will increase.

Reason : Because potential energy will decrease.

A. both conservative and none conservative force

B. conservative forces only

C. Non-conservative forces only

D. nether conservative nor none conservative force

Answer: B

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3. Work done by the conservative force on a system is equal to :

A. the change in kinetic energy of system

B. the change in potential energy of system

C. the change in total machanical energy of system

D. None of the above

Answer: B

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4. Which of the following statement is correct ?

A. kinetic energy of the system can be changed without chainging its momentum

B. kinetic energy of the system can not be changed without chainging its momentum

C. Momentum of a the system can not be changed without chainging its kinetic energy

D. A system connot have energy without having momentum

Answer: A

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5. A shell explodes and many pieces fly off in different directions. Which of the following is conserved?

A. kinetic energy

B. Momentum

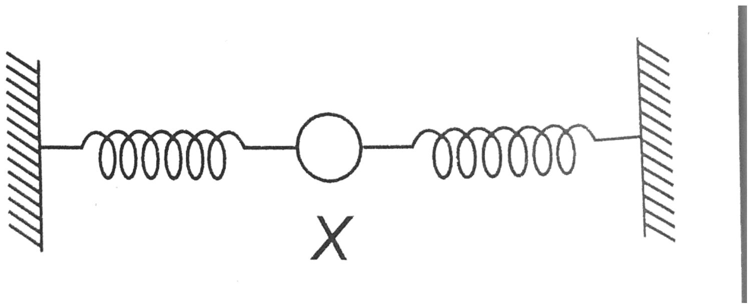
C. Neither momentum nor KE

D. Momentum and KE

Answer: B

Watch Video Solution

6. A bead x resting on a smooth horizontal surface is connected to two adentiacal spring and is made to oscillate to and fro along the line of the springs.which stetament is correct about the work done on the cabinet - earth system ?



A. mostly potential energy

B. all potential energy

C. half potential energy and half kinetic energy

D. all kinetic energy

Answer: D

Watch Video Solution

7. Alex and john are loding adentical cabinates onto a truck .Alex lifts his cabinet strainght up from the ground to the bed of the truck , whereas john slides his cabinet up a rough ramp to the truck .which statement correct about the work on the cabinet- Earth system ?

A. Alex and john do the same amount of work

B. Alex does more work then john

C. john does more work then alex

D. None of those statement is necessarily true because the force the friction is unknown

Answer: C

Watch Video Solution

8. Mark and David are loading adentaical cement blocks on to David's pickup truck .Mark lifts his block straight up from the ground to the truck , whereas David slides his block up a ramp contining frictionless roles .Which statement is true about the work done on the block - Earth system?

A. Mark does more work then David

B. Mark and David do the same amount of work

C. David does more work then mark

D. None of those statement is necessarily true because the angle of the inclined is incline is unknown

Answer: B

Watch Video Solution

9. A pile driver drivers posts into the groubd the by repeatedly dropping a heavy object on then .Assume the object is dropped from the same height each time .By what factor does the energy of th pile driver - Earth systen change when the mass of the object being droped is bouled ?

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

B. 1: The energy of the same

C. 2

D. 4

Answer: C

Watch Video Solution

10. A Weight W suspeded from a spring is raised through a height h so that the spring becomes just slack .If E was the energy of the stretched spring , then the gain in gravitational potential energy is

A. Wh

B. $Wh + E$

C. $Wh - E$

D. E

Answer: B

Watch Video Solution

11. If a compressed spring is dissolved in acid, what happens to the elastic potential energy of the spring ?

A. is completely lost

B. appearas in the form of electromagnetic waves

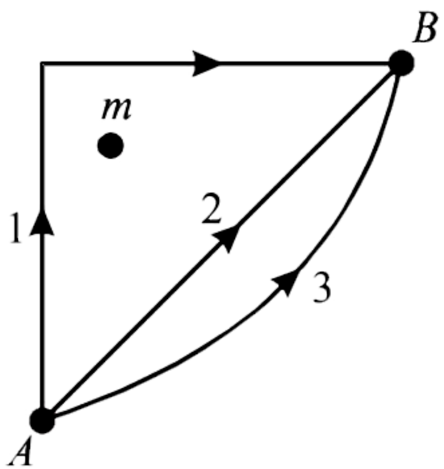
C. appearas in the form head raising the tempetature of acid

D. appearas in the form of KE by splashing acid drops

Answer: C

Watch Video Solution

12. If W_1, W_2 and W_3 represent the work done in moving a particle from A to B along three different paths 1.2 and3 respectively (as hown) in the gravitational field of a point mass m, find the correct relation between W_1, W_2 and W_3



A. $W_1 > W_2 > W_3$

B. $W_1 = W_2 = W_3$

C. $W_1 < W_2 < W_3$

D. $W_1 > W_2 > W_3$

Answer: B

Watch Video Solution

13. An ice cube has been given a push and slides without friction on a level table . Which is correct?

A. It is stable equilibrium.

B. It is unstable equilibrium.

C. It is neutral equilibrium.

D. It is not in equilibrium.

Answer: C

Watch Video Solution

14. A long elastic spring is stretched by $2cm$ and its potential energy is U. If the spring is stretched by $10cm$, the PE will be

A. $\frac{U}{25}$

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

C. $5U$

D. $25U$

Answer: D

Watch Video Solution

15. A certain spring that obeys Hook's law is stretched by an external agent. The work done in stretching the spring by $10 cm is 4J$. How much additional work is required to stretch the spring an additional $10cm$?

A. 10J`

B. 20 J`

C. $30J$

D. $40J$

Answer: C

Watch Video Solution

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

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

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

C. $k(l_2 - l_1)$

D. $k/2(l_2 - l_1)$

Answer: B

Watch Video Solution

17. A body of mass m is suspended from a massless spring of natural length l. It stretches the spring through a vertical distance y. The potential energy of the stretched spring is

A. $mg(l+y)$

B. $\frac{1}{2}mg(l+y)$

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

D. Mgy

Answer: C

Watch Video Solution

18. K is the force constant of a spring. The work done in increasing its extension from l_1 to l_2 will be

A. $-150J$

B. $50J$

C. $150J$

D. None of these

Answer: C

Watch Video Solution

19. An elastic spring of unstretched length L and force constant K is stretched by amoun t x .It is further stretched by another length y The work done in the second streaching is

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

B. $\frac{1}{2}K(x^2+y^2)$

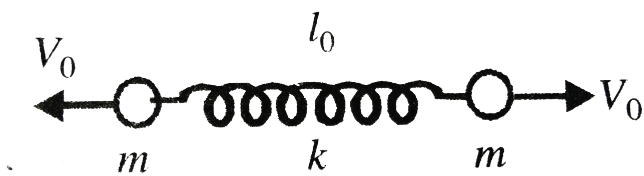
C. $\frac{1}{2}K(x+y)^2\Big)$

D. $\frac{1}{2}Ky(2x+y)$

Answer: D

Watch Video Solution

20. A system comprises of two small spheres with the same masses m. Initially, the spring is non deformed. The spheres set in motion in a gravity space at the velocities as shown in the diagram.



The maximum elastic potential energy stored in the system is

A. $\frac{mv_0^2}{2\sqrt{2}}$

B. mv_0^2

C. $\frac{1}{2}mv_0^2$

D. $2mv_0^2$

Answer: B

Watch Video Solution

21. A particle of mass m is moving is a horizontal circle of radius x under a centripetal force equal to $-\left(kv^2\right)$ where it is 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

Watch Video Solution

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

A. $5cm$

B. $15cm$

C. $26cm$

D. $10cm$

Answer: D

Watch Video Solution

23. Two spring constant $1000Nm^{-1}$ and $2000Nm^{-1}$ are ateched with same time .They will have potential energy is the value is

A. $2:1$

B. $2^2:1^2$

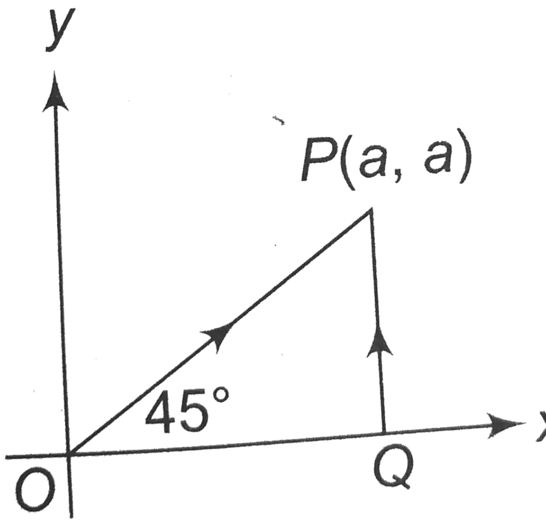
C. $1:2$

D. $1^2:2^2$

Answer: A

Watch Video Solution

24. A particle is moved from $(0, 0)$to (a, a) under a force $\overline{F} = \left(3\hat{i} + 4\hat{j}\right)$ and path $2isOQP$.Let W_1 and W_2 be the work by done this force in these to paths .Then .



A. $W_1 = W_2$

B. $W_1 = 2W_2$

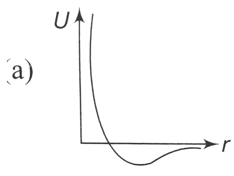
C. $W_2 = 2W_1$

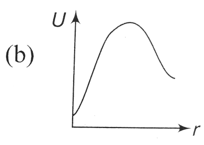
D. $W_2 = 4W_1$

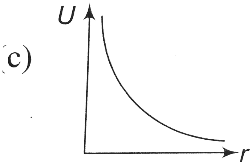
Answer: A

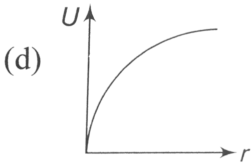
Watch Video Solution

25. The diagram respresent the potential energy U of a function of the inter atomic distance r. Which diagram corresponding to slabe molecules found in nature?

A. 

B. 

C. 

D. 

Answer: A

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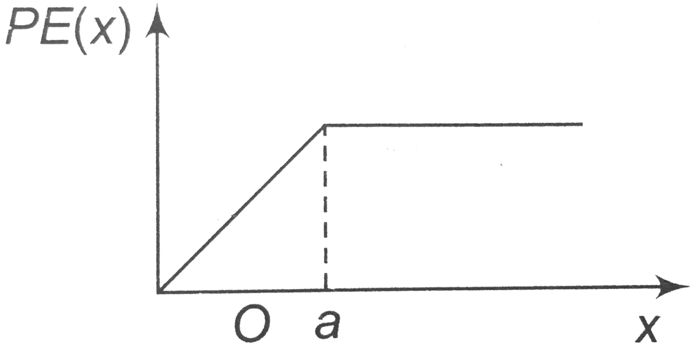
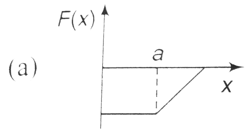
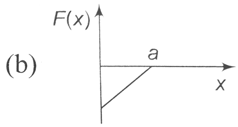
26. The potential energy of the system is represented in the first figure. The force acting on the system will be represented by:



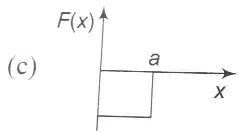
A.



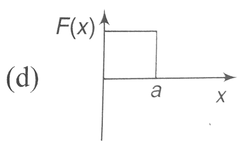
B.



C.



D.



Answer: C

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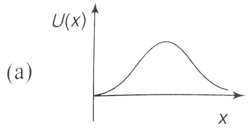
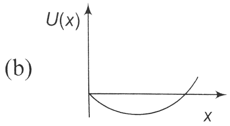
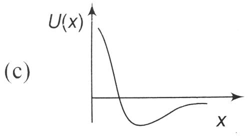
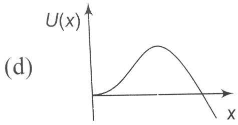
27. A particle which is constant to move along the x- axis , is subjected to a force in the same direction which varies with the distance x of the particle from the origin as $F(x) = -Kx + ax^3$. Hero K and a are positive constant . For $x \geq 0$, the functional from of the potential every $U(x)$ of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

A. 

B. 

C. 

D. 

Answer: D

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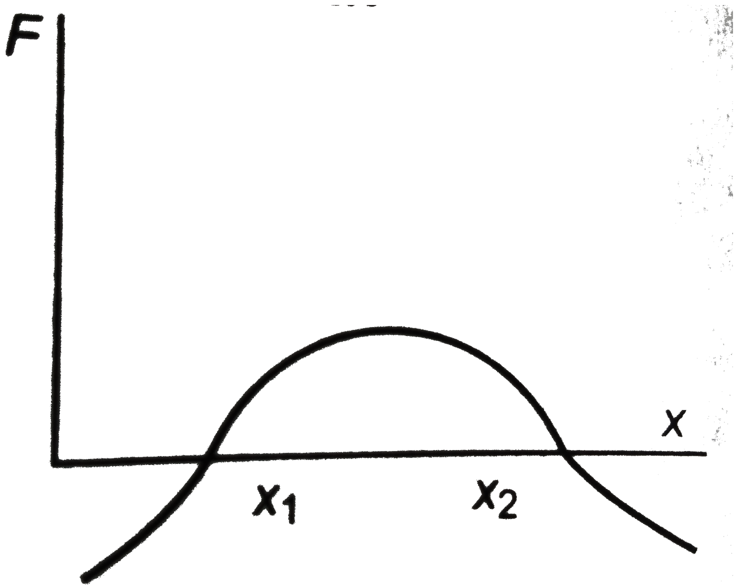
28. The force acting on a body moving along x-axis varitian of the particle particle shown in the figure. The body is in stable equlilbrium at



A. $x = x_1$

B. $x = x_2$

C. both x_1 and x_2

D. neither x_1 nor x_2

Answer: B

Watch Video Solution

Conservation Of Mechanical Energy And Linear Momentum

1. A heavy weight is suspended from a spring . A person raises the weight till the spring becomes slack . The done by him is W. The energy storeed in the stretched spring was E . What will be the gain in gravitational potential energy?

A. W

B. E

C. $W+E$

D. $W-E$

Answer: C

Watch Video Solution

2. A body is falling under gravity . When it loses a gravitational potential energy U, its speed is$v$. The mass of the body shell be

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

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

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

D. $\frac{U}{2v^2}$

Answer: C

Watch Video Solution

3. A block is mass m is dropped from the fourth of an office building and hits the sidewalk below at speed v . From what floor should the block the dropped to double that impact speed?

A. the either floor

B. the thenth floor

C. the twelfth floor

D. the sixteenth floor

Answer: D

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4. A cart is set rolling across a level table , at the same speed on every trial. If it runs into a patch of sand, the cart exerts on the sand an average horizontal force of $6N$ and travels a distance of $6cm$ through the sand as it comes to a stop. If instead the cart runs into a patch of gravel on which the cart exerts an average horizontal force of $9N$ how far into the gravel will the cart roll before stopping?

A. $2N$

B. $3N$

C. $6N$

D. $18N$

Answer: A

Watch Video Solution

5. An athlete jumping vertically on a trampoline leaveles the surface with a velocity of $8.5 m / s$ upwards. What maximum height does the reach?

A. $10 m$

B. $2.5 m$

C. $5.0 m$

D. $0.50 m$

Answer: C

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Watch Video Solution

6. A ball of clay falls to the hard floor. It does not bounce noticeably, and it very quickly comes to rest. What , then has happened to the energy the ball had while it was falling?

A. It has been used up in producing the downward motion.

B. It has been transformed back into potential energy

C. It has been transformed into the ball by heat.

D. it is in the ball and floor (and wall) as energy of invisible molecular motion.

Answer: D

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7. The force constant of a weightless spring is $16Nm^{-1}$. A body of mass $1.0kg$ suspended from it is pulled down through $5cm$ and then released. The maximum energy of the sysytem (spring + body) will be

A. $2 \times 10^2 J$

B. $4 \times 10^2 J$

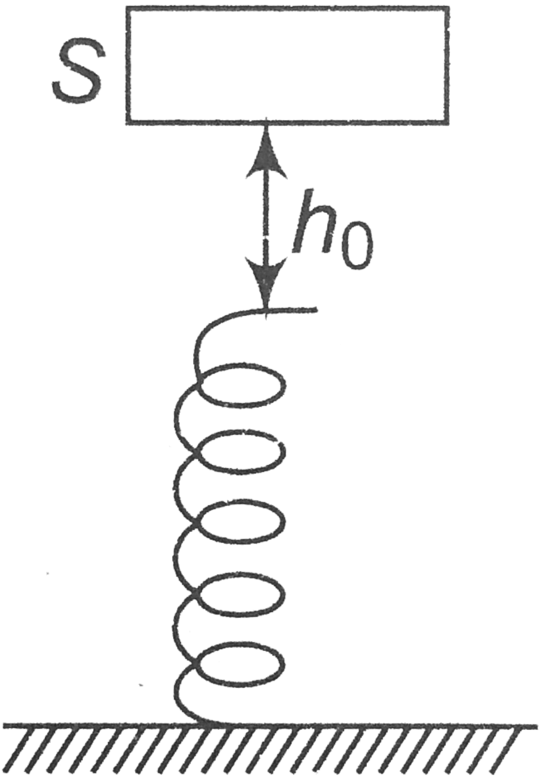
C. $8 \times 10^2 J$

D. $16 \times 10^2 J$

Answer: A

Watch Video Solution

8. A slab S of mass m released from a height h_0, from the top of a spring of force constant k. The maximum compression x of the spring is given by the equation.



A. $mgh_0 = \frac{1}{2}kx^2$

B. $mg(h_0 - x) = \frac{1}{2}kx^2$

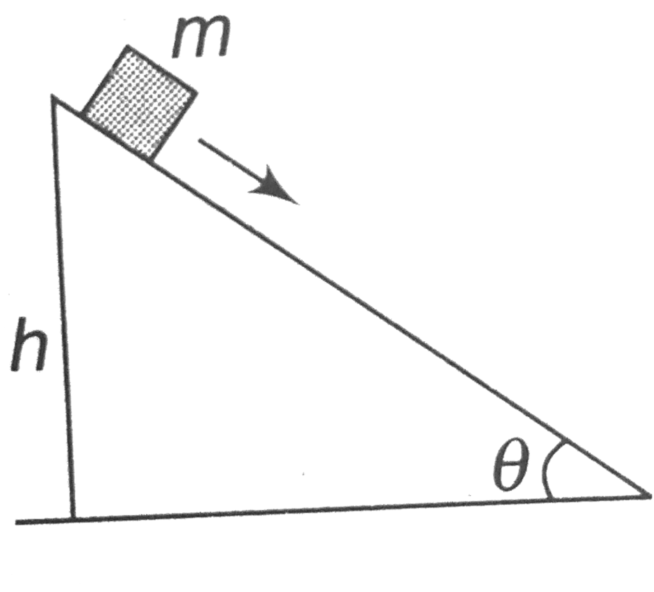
C. $mgh_0 = \frac{1}{2}k(h_0 + x)^2$

D. $mg(h_0 + x) = \frac{1}{2}kx^2$

Answer: D

Watch Video Solution

9. A block of mass m sliding down an inclined at constant speed is initial at a height h shown the ground as shown in the figure above . The coefficient of kinetic friction between the mass and the inclined is μ . If the mass constinues to slide down the inclined at a constant speed how much energy is displaced by friction by the time the mass reaches the bottom of the incline?



A. mgh / θ

B. mgh

C. $\mu mgh / \sin\theta$

D. $mgh \sin\theta$

Answer: B

Watch Video Solution

10. A spring is held compressed so that its stored energy is $2.4J$. Its ends are in contact with masses $1g$ and $48g$ placed on a frictionless table. When the spring in released, the heavier mass will acquire a speed of:

A. $\frac{2.4}{49} ms^{-1}$

B. $\frac{2.4 \times 48}{49} ms^{-1}$

C. $\frac{10^3}{7} cms^{-1}$

D. $\frac{10^6}{7} cms^{-1}$

Answer: C

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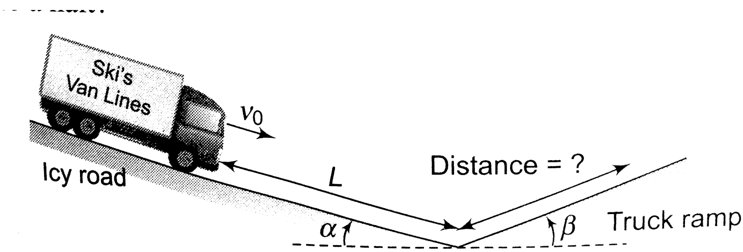
11. A truck with mass m has a brake failure while going down an icy mountain road of constant downwards slope angle α (see figure) . Initial , the truck is moving downhill at speed v_0 . After carrying downhill a distance L with negligible friction for the truck driver steers the runaway vehicle onto a runway truck rump of constant upward slope angle $B\eta$. The truck rump has to soft sand surface for which the coefficient of rolling friction is μ_r . What is the distance that the truck moves up the rump before coming to a halt?



A. $\dfrac{\left(v_0^2/2g\right) + L\sin\alpha}{\sin\beta + \mu_r, \cos\beta}$

B. $\dfrac{\left(v_0^2 g\right) - L\sin\alpha}{\left(\sin\beta + \mu_r, \cos\beta\right)}$

C. $\dfrac{\left(v_0^2/2g\right) + L\sin\alpha}{\sin\beta - \mu_r, \cos\beta}$

D. None of these

Answer: A

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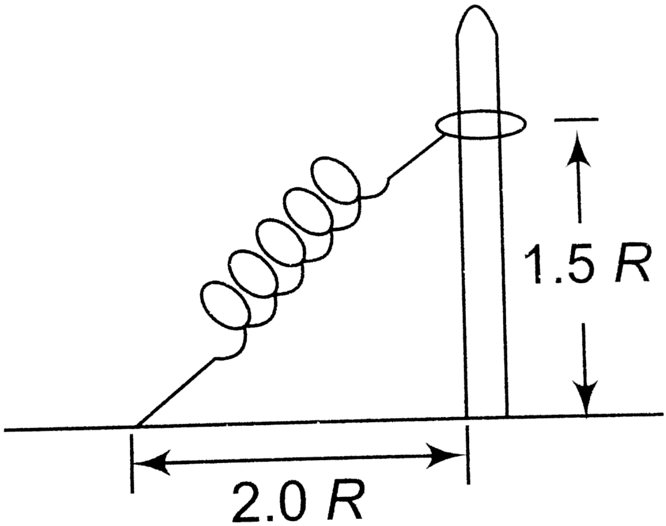
12. A ring of mass m can slide over a smooth vertical rod as shown in figure. The ring is connected to a spring of force constant $k = 4mg/R$, where $2R$ is the natural length of the spring . The other end of spring is fixed to the ground at a horizontal distance $2R$ from base of the rod . If the mass is released at a height $1.5J$ then the velocity of the ring as it reaches the ground is



A. $\sqrt{gR}$

B. $2\sqrt{gR}$

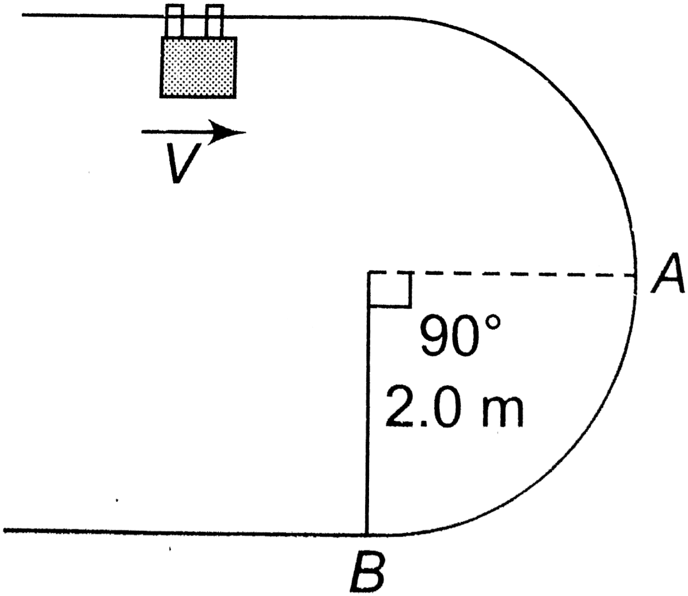
C. $\sqrt{2gR}$

D. $\sqrt{3gR}$

Answer: B

Watch Video Solution

13. A $1kg$ mass is projected down a rough circule track $(redius = 2.0m)$ placed in vertical plane as shown. The speed of the mass at point A is $3m/s$ and at point B, it is $6.0m/s$. How much is work is done on the mass between A and B by the force of friction?



A. $-7.5J$

B. $-8.5J$

C. $-6.5J$

D. $-24J$

Answer: C

Watch Video Solution

14. Concerete block of mass m_A and m_B. The gravitutional potential energy of each system is zero at the equilibrium position of the springs. Which ststement is true for the total machanical energy of the springs. Which system when the block , are balanced on the springs?

A. $E_A = E_B$

B. $E_A = 2E_B$

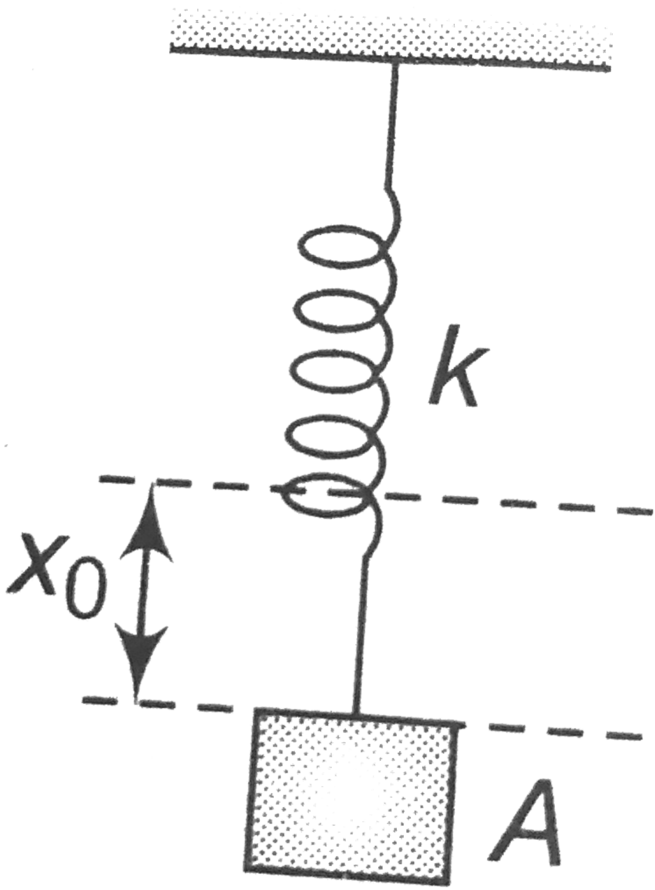
C. $E_A = 4E_B$

D. $E_A = -2E_B$

Answer: C

Watch Video Solution

15. Block A of the mass M in the figure is released from rest when the extension in the spring is x_0. The maximum downwards displacement of the block is (assume $x_0 < Mg/k$).



A. $2\left(\frac{Mg}{k}-x_0\right)$

B. $\frac{Mg}{2k}+x_0$

C. $\frac{2Mg}{k}-x_0$

D. $\frac{2Mg}{k}+x_0$

Answer: A

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16. A raindrop of mass $1g$ falling from a height of $1km$ hits is the ground with a speed of

$50 ms^{-1}$. Which of the following statements is correct? $(\text{Taking} g = 10 ms^{-2})$.

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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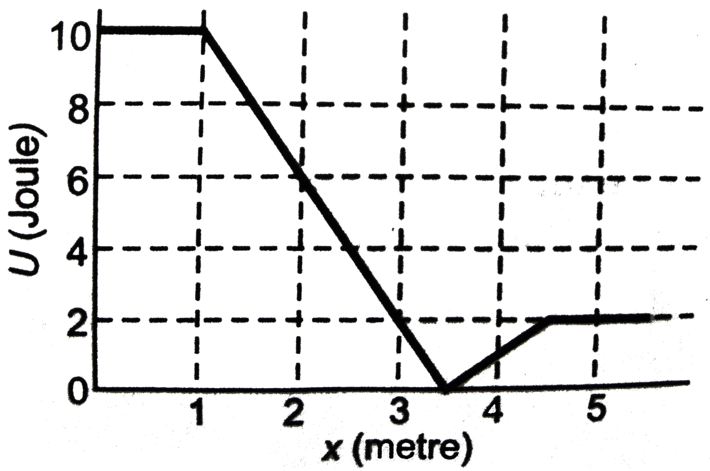
17. A body with mass $1kg$ moves in one direction in the presence of a force which is described by the potential energy graph. If the body is releasd from rest at $x = 2m$, than its speed when it crosses $x = 5m$, is (Neglect dissipative forces).



A. zero

B. $1ms^{-1}$

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

D. $3ms^{-1}$

Answer: C

Watch Video Solution

18. A toy gun a spring of force constant k. When changed before being triggered in the upward direction, the spring is compressed by a distance x. If the mass of the shot is m, on the being triggered it will go up to a height of

A. $\frac{Kx^2}{8g}$

B. $\frac{x^2}{8g}$

C. $\frac{Kx^2}{2mg}$

D. $\frac{K^2x^2}{mg}$

Answer: C

Watch Video Solution

19. A particle of mass m moving with velocity V_0 strikes a simple pendulum of mass m and sticks to it. The maximum height attained by the pendulum will be

A. $\frac{V_0^2}{8g}$

B. $\sqrt{V_0 g}$

C. $2\sqrt{\frac{V_0}{g}}$

D. $\frac{V_0^2}{4g}$

Answer: A

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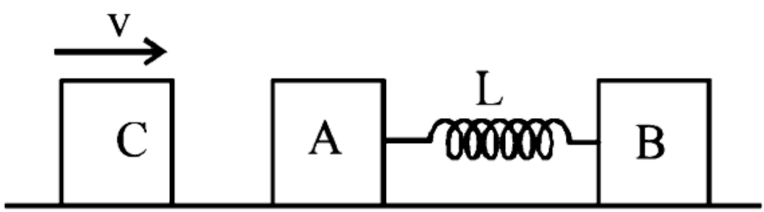
20. Two blocks A and B, each of mass m, are connected by a masslesss spring of natural length L and spring constant K. The blocks are initially resting on a smooth horizontal floor with the spring at its natural length, as shown in fig. A third identical block C, also of mass m, moves on the floor with a speed v along the line joining A and B, and collides elastically with A. Then, maximum compression of the spring is



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

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

C. $\sqrt{\frac{mv}{k}}$

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

Answer: A

Watch Video Solution

21. A bomb of mass $9kg$ explodes into 2 pieces of mass $3kg$ and $6kg$. The velocity of mass $3kgis1.6m/s$. The $K.E. ofmass6kg$ is

A. $3.84J$

B. $9.6J$

C. $1.92J$

D. $2.92J$

Answer: C

Watch Video Solution

22. A sphere of mass m , moving with velocity V, enters a hanging bag of sand and stop. If the mass of the bag is M and it is raised by height h, then the velocity of the sphere will be

A. $\dfrac{M+m}{m}\sqrt{2gh}$

B. $\dfrac{M}{m}\sqrt{2gh}$

C. $\dfrac{m}{M+m}\sqrt{2gh}$

D. $\dfrac{m}{M}\sqrt{2gh}$

Answer: A

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23. A free body of mass $8kg$ is travelling at 2 mater per second in a straight line. At a certain instant , the body splits into two equal parts due to internal wxplosion which releases `16 joules of energy . Neither part leves the original line of motion. Finally

A. Both parts continous to move in the same in the same direction as that of the original boidy

B. One part comes to rest and the other moves in the same direction as that of the original body

C. One part comes to rest and the other moves in the direction opposite to that of the original body

D. One part moves in the same direction and the other in the dirrection opposite to that of the original body

Answer: B

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

A. 2.8 joules

B. 3.2 joules

C. 3.8 joules

D. 4.4 joules

Answer: D

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Mechanical Power

1. Water is falling on the blades of a turbine from a height of $25m$. $3 \times 10^3 kg$ of water pours on the blade per minute. If the whole of energy is transferred to the turbine, power delivered is $g = 9.8m/s^2$

A. $12250W$

B. $16250W$

C. $8250W$

D. $20250W$

Answer: A

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2. What average power is genereted by a $90.0kg$ mountain climbs who climbs a summit of height $600m$ in 90.0 min ?

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3. A constant power P is applied to a partical of mass m. The distance travelled by the partical when its velocity increases from v_1 to v_2 is (neglect friction):

A. $\frac{m}{3P}(v_2^3 - v_1^3)$

B. $\frac{m}{3P}(v_2 - v_1)$

C. $\frac{3p}{m}(v_2^2 - v_1^2)$

D. $\frac{m}{3P}(v_2^2 - v_1^2)$

Answer: A

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4. An $800N$ marine in basic training climbs a $12.0m$ vertical rope at a constant speed in $8.00s$. What is his power output?

A. $1.8kW$

B. $1.2kW$

C. $2.2kW$

D. $2.8kW$

Answer: B

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5. When an automobile moves with constant speed down a highway , most of the power developed by the engain is used to compensate on the car by the air and the road, friction forces exerted on the car by the air and the road. If the power developed by an engine is $175hp$, estimate the total friction force (apporox) acting on the car when it is moving at a speed of $25m/s$. One horsepower equals $746W$.

A. $360kN$

B. $373kN$

C. $250kN$

D. $500kN$

Answer: D

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6. A certain rain cloud at an altitude of $2.0km$ contains $3.6 \times 10^7 kg$ of water vapour. How long would it take a $2.0kW$ pump to raise the same amount of water from the Earth's surface to the cloud's position?

A. $2 \times 10^5 h$

B. $5 \times 10^5 h$

C. $5 \times 10^3 h$

D. $2 \times 10^3 h$

Answer: B

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7. An elastic scooter has a bettery capable of supplying $120Wh$ of energy. If friction force and other losses account for 60.0% of the energy usage , what altitude change can a rider achieve when driving in hilly terrain if the rider and sector have a combined weight of $900N$?

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8. An older-model car accelerates from 0 to speed v in a time interval of Δt. A newer, more powerful sports car accelerates from $0 \rightarrow 2v$ in the same time period. Assuming the energy coming from the engine appears only as kinetic energy of the cars. Choose correct statement.

A. The power of the sports car is four times that of the older-model car.

B. The power of the sports car is two times that of the older-model car.

C. The power of the sports car is equal to that of the older-model car.

D. The power of the sports car cannot be compared from given data.

Answer: A

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9. An engine accelerate a car of mass $800kg$ to a speod of $72km/h$. If the frictional force is $10N$ per tonne, the power developed by the engine is:

A. $10kW$

B. $15kW$

C. $20kW$

D. $5kW$

Answer: D

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10. A train having 60 wagons each weighing 25 tonnes moving with a speed of $72km/h$. If the force $10N$ per tonne, the power development is:

A. $3 \times 10^5 W$

B. $3 \times 10^6 W$

C. $3 \times 10^7 W$

D. $3 \times 10^4 W$

Answer: A

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11. An athlete mass $60kg$ skips at the rete of 20 steps per minute through an aberage height of $25cm$. The power devolepment is:

A. $98W$

B. $49W$

C. $14W$

D. $21W$

Answer: B

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12. The power of a heart which pumps 5×10^3 cc of blood per minute at a pressure of $120mm$ of mercury $\left(g = 10ms^{-2}\right.$ and density of $\left.Hg = 13.6 \times 10^3 km^3\right)$ is

A. $1.36W$

B. $13.6W$

C. $0.136W$

D. $136W$

Answer: A

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13. The human heart discharges $75cm^3$ of blood per beat against an average pressure of $10cm$ of Hg. Assuming that the pulse frequency is 75 per minute, the power of the heart is (density of $Hg = 13.6gmcm^{-3}$)

A. $11.9W$

B. $1.19W$

C. $0.119W$

D. $119W$

Answer: B

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14. A body of mass m is acceleratad uniformaly from rest to a speed v in a time T. The instanseous power delivered to the body as a function of time is given by

A. $\frac{V}{T}t$

B. $\frac{V^2}{T}t^2$

C. $\frac{V^2}{T^2}t$

D. $\frac{V^2}{T^2}t^2$

Answer: C

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15. A man M_1 of mass $80kg$ runs up a staircase in $15s$. Another man M_2 also of mass $80kg$

runs up the same staircase in $20s$. The ratio of the power development by then will be:

A. 1

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

C. $\frac{16}{9}$

D. none of these

Answer: B

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16. An engine pumps up $100kg$ water through a height of $10m$ in $5s$. If effcienecy of the engine is 60%. What is the power of the engine? $Take g = 10ms^2$.

A. $33kW$

B. $3.3kW$

C. $0.33kW$

D. $0.033kW$

Answer: B

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17. A pump motor is used to deliver water at a certain rate from a given pipe. To obtain 'n' times water from the same pipe in the same time by what amount (a) the force and (b) power of the motor should be increased ?

A. n^2 times

B. n^3 times

C. n times

D. $n^{3/2}$ times

Answer: B

Watch Video Solution

18. A pump motor is used to deliver water at a certain rate from a given pipe. To obtain 'n' times water from the same pipe in the same time, by what amount the power of the motor should be increased?

A. n^2 times

B. n^3 times

C. n times

D. $n^{3/2}$ times

Answer: B

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19. For power to constant, the force has to very with speed as:

A. $F \propto \frac{1}{v}$

B. $F \propto \frac{1}{\sqrt{v}}$

C. $F \propto v$

D. $F \propto v^2$

Answer: A

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20. Power supplied to a mass 2 kg varies with time as $P = \frac{3t^2}{2}$ watt. Here t is in second. If velocity of particle at $t = 0$ is $v = 0$, the velocity of particle at time $t = 2s$ will be:

A. $1m / s$

B. $4m / s$

C. $2m / s$

D. $2\sqrt{2}m / s$

Answer: C

Watch Video Solution

21. A constant power P is applied to a particle of mass m. The distance traveled by the particle when its velocity increases from v_1 to v_2 is (neglect friction):

A. $\frac{m}{3P}\left(v_2^3 - v_1^3\right)$

B. $\frac{m}{3P}\left(v_2 - v_1\right)$

C. $\frac{3P}{m}\left(v_2^2 - v_1^2\right)$

D. $\frac{m}{3P}\left(v_2^2 - v_1^2\right)$

Answer: A

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

A. $22kW$

B. $44kW$

C. $66kW$

D. $88kW$

Answer: B

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

A. $100W$

B. $200W$

C. $250W$

D. $500W$

Answer: D

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24. A $30m$ deep well is having water upto $15m$. An engine evacutes it in one hour . The power of the engine. If the diameter of the well is $4m$ is

A. $11.55kW$

B. $1155kW$

C. $25.10kW$

D. $2310kW$

Answer: A

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

A. $36.5kW$

B. $44.4kW$

C. $52.5kW$

D. $60.5kW$

Answer: B

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Circular Motion In Vertical Plane

1. In case of circular motion a body, if tangential force also acts on the body in addition to centripetal force, then work done:

A. by tangenitial force is zero by work done by centripetal force is not zero.

B. by tangenitial force is zero but work done by tangential force is not zero.

C. by both the forces is positive

D. by both the forces is zero

Answer: B

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2. A stone is fastened to one end of a string and is whirled in a vertical circle of radius R. Find the minimum speed the stone can have at the highest point of the circle.

A. Rg

B. $(Rg)^2$

C. R/g

D. $\sqrt{Rg}$

Answer: D

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3. What minimum horizontal speed should be given to the bob of a simple pendulum of length l so tht it describes a complete circle?

A. gl

B. $2gl$

C. $\sqrt{2gl}$

D. $\sqrt{5gl}$

Answer: D

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4. A stone of mass 1 kg tied to a light inextensible string of lenth $L = \frac{10}{3}m$, whirling in a circular path in a vertical plane. The ratio of maximum tension to the minimum tension in the string is 4. If g is taken to be

$10ms^{-2}$, the speed of the stone at the highest point of the circle is

A. $20m/\sec$

B. $10\sqrt{3}m/\sec$

C. $5\sqrt{2}m/\sec$

D. $10m/\sec$

Answer: D

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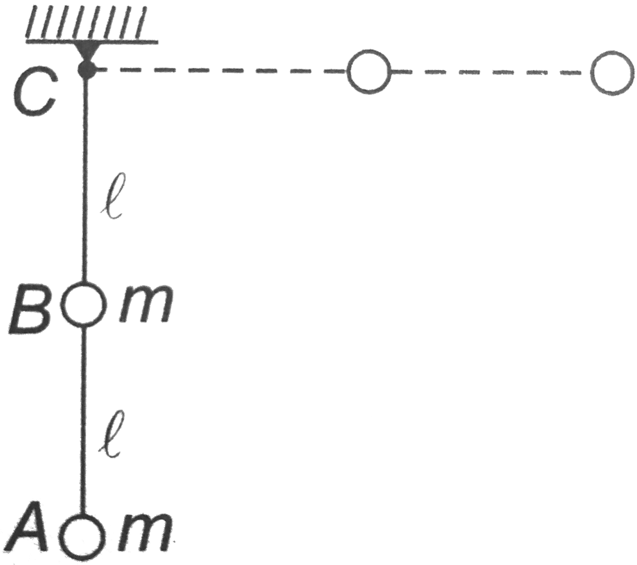
5. A weightless rod of length $2l$ carries two equal masses 'm', one tied at lower end A and the other at the middle of the rod at B. The rod can rotate in vertical plane about a fixed horizontal axis passing thriugh C . The rod of is released from rest in horizontal possion. The speed of the mass B at the instant rod become vertical is:



A. $\sqrt{\frac{3gl}{5}}$

B. $\sqrt{\frac{4gl}{5}}$

C. $\sqrt{\frac{6gl}{5}}$

D. $\sqrt{\frac{7gl}{5}}$

Answer: C

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6. A particle is rotated in a vertical circle by connecting it to a string of length l and keeping the other end of the string fixed. The minimum speed of the particle when the string is horizontal for which the particle will complete the circle is

A. $\sqrt{gl}$

B. $\sqrt{2gl}$

C. $\sqrt{3gl}$

D. none

Answer: B

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7. A partical originally at rest at the highest point of a smooth vertical circle is slightly displaced. It will leave the circle at a vertical distance h below the highest points, such that h is equal to

A. R

B. $R/4$

C. $R/2$

D. $R/3$

Answer: D

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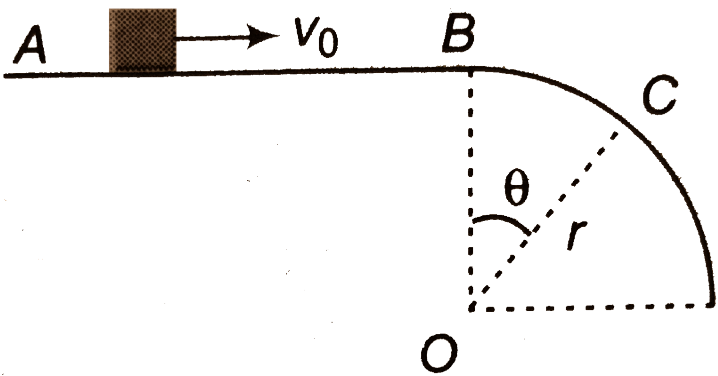
8. A small block slides with velocity $0.5\sqrt{gr}$ on the horizontal frictionless surface as shown in the figure. The block leaves the surface at point C. Calculate angle θ in the figure.



A. $\cos^{-1}. \frac{4}{9}$

B. $\cos^{-1}. \frac{3}{4}$

C. $\cos^{-1}. \frac{1}{4}$

D. $\cos^{-1}. \frac{4}{5}$

Answer: B

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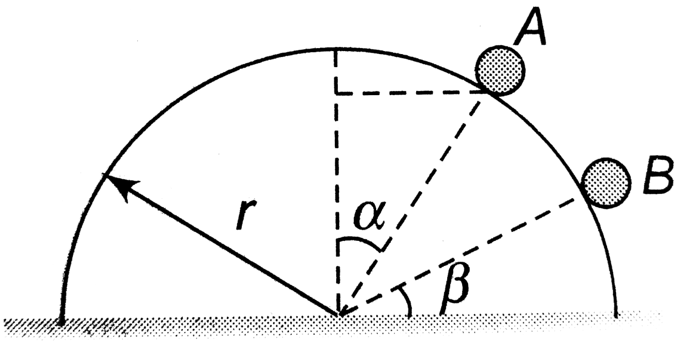
9. A practical moves from rest at A on the surface of a smooth circular cylinder of radius r as shown . At B it leaves the cylinder. The equation relating α and β is



A. $3 \sin \alpha = 2 \sin \beta$

B. $2 \sin \alpha = 3 \cos \beta$

C. $3 \sin \beta = 2 \cos \alpha$

D. $2 \sin \beta = 3 \cos \alpha$

Answer: C

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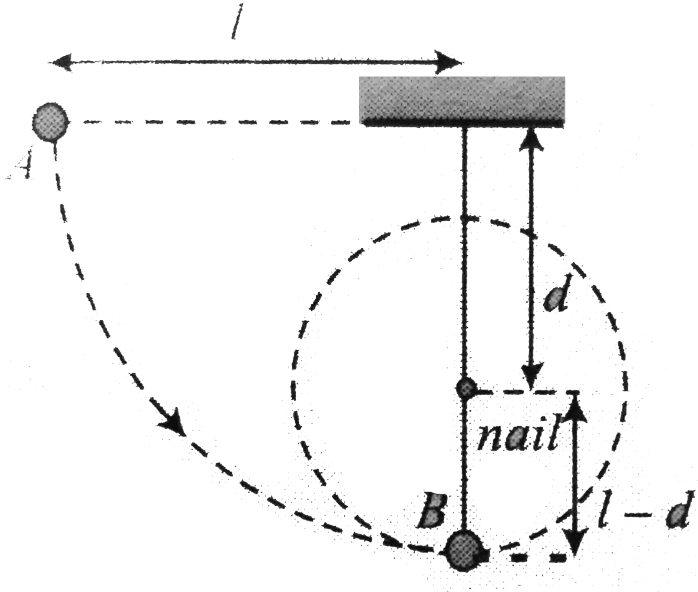
10. In the given system, when the ball of mass m is released, it will swing down the dotted arc.

a. How fast will it reach the lowest point in its swing? A nail is located at a distance d below the point of suspension.



b. Show that d must at $0.6l$, if the ball is to swing completely around a circle centered along the nail.

c. If $d = 0.6l$, find the change in tension in the string just after it touches the nail.

A. $15cm$

B. $4cm$

C. $9cm$

D. None of threr

Answer: C

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11. A pendulum bob has a speed 3m/s while passing through its lowest position. What is its speed (in m/s) when it makes an angle of

60^0 with the vertical? The length of the pendulum is 0.5m Take $g = 10\frac{m}{s^2}$.

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12. A heavy particle hanging from a fixed point by a light inextensible string of length l is projected horizontally with speed $\sqrt{gl}$. Find the speed of the particle and the inclination of the string to the vertical at the instant of the motion when the tension in the string is equal to the weight of the particle.

A. $\sqrt{2gl}$

B. $\sqrt{3gl}$

C. $\sqrt{gl/2}$

D. $\sqrt{gl/3}$

Answer: D

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13. The kinetic energy of partical moving along a circule of radius R depends upon the distance covered S and given by $K = aS$

where a is a constant. The the force acting on the partical is

A. $\frac{aS}{R}$

B. $\frac{2aS^2}{R}$

C. $\frac{aS^2}{R^2}$

D. $\frac{2aS}{R}$

Answer: D

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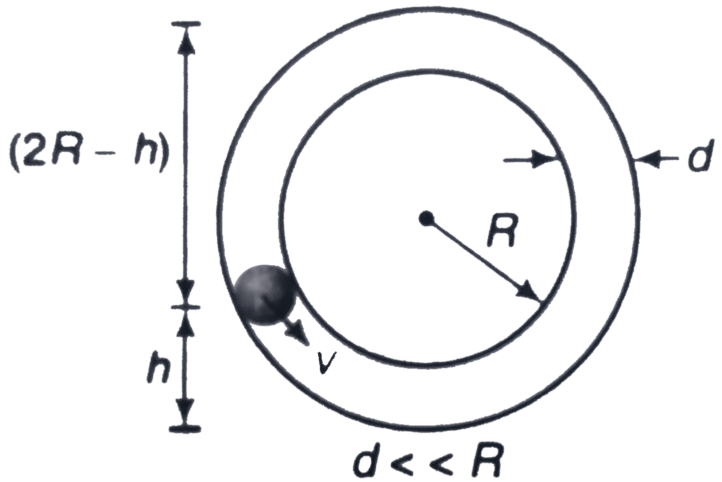
14. With what minimum speed v must a small ball should be pushed inside a smooth vertical tube from a height h so that it may reach the top of the tube? Radius of the tube is R .



A. $\sqrt{2g(h+2R)}$

B. $\frac{5}{2}R$

C. $\sqrt{g(5R-2h)}$

D. $\sqrt{2g(2R-h)}$

Answer: D

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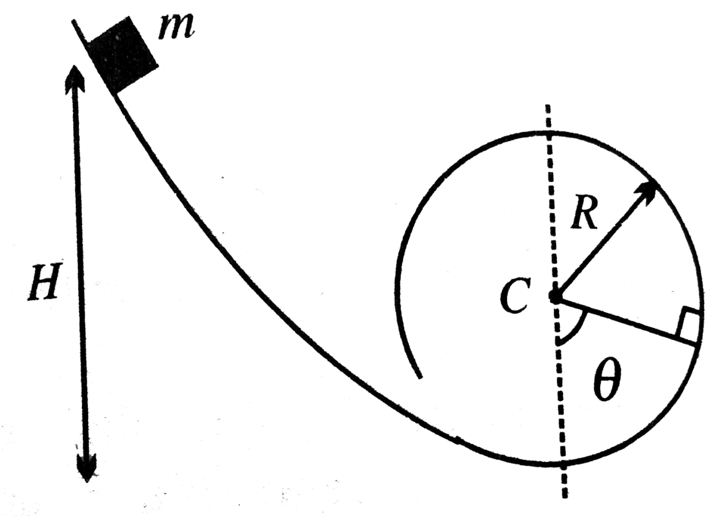
15. A particle of mass m is released from a height H on a smooth curved surface which ends into a vertical loop of radius R, as shown.

Choose the correct alernative(s) if $H = 2R$.



A. $H = \frac{3R}{2}$

B. $H = 5R$

C. $H = \frac{5R}{2}$

D. None of these

Answer: A

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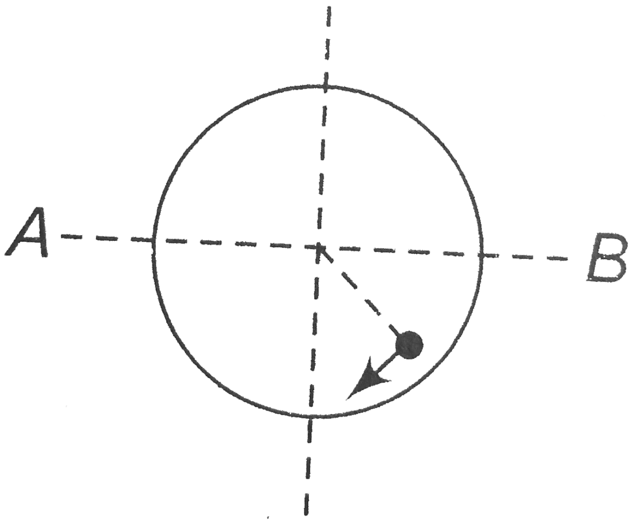
16. A particle of mass m oscillates along the horizontal diameter AB inside a smooth spherical shell of radius R. At any instant $K.E.$ of the partical is K. Then force applied

by particle on the shell at this instant is:



A. $\frac{K}{R}$

B. $\frac{2K}{R}$

C. $\frac{3K}{R}$

D. $\frac{K}{2R}$

Answer: C

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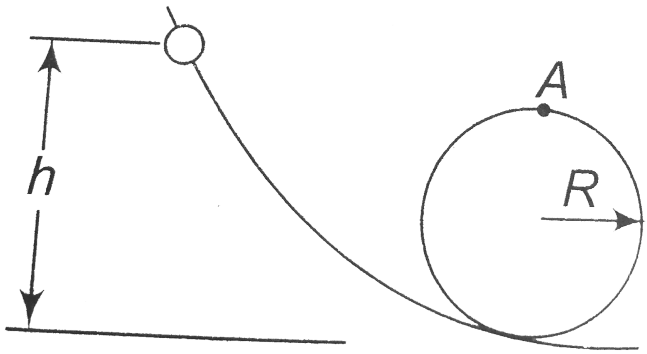
17. A head slide without friction around a loop the (figure). The bead slide is released is from rest at a height $h = 3.50R$. How large is the normal force on the bead at point (A) if its mass is $50g$?



A. $0.10N$ downward

B. $0.10N$ upward

C. $1.0N$ downward

D. $1.0N$ upward

Answer: C

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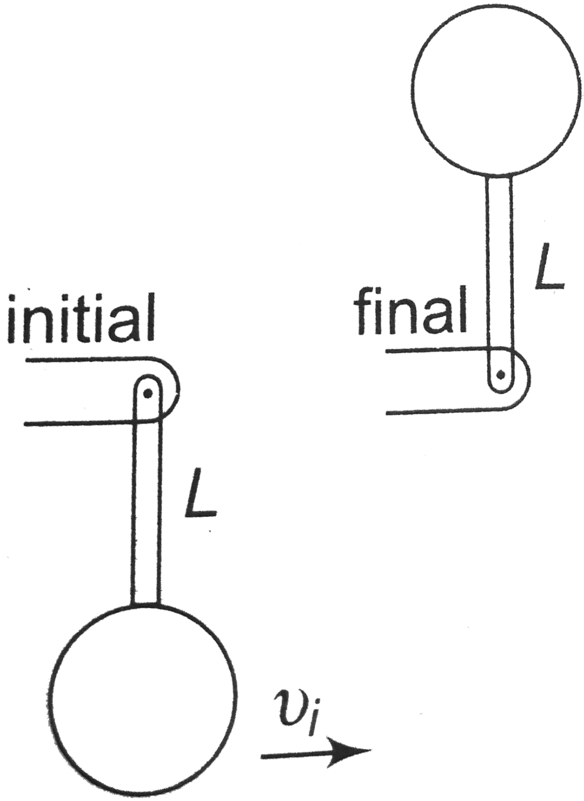
18. A light , right rod is $40.0cm$ long.Its top end is pivoted on a frictionless, horizontal axle. The rod hangs straight down at rest with a small , massive ball attached to its bottom end. You strike the ball, suddenly giving it a horizontal velocity so that it swings around in a full cirle. What minimum speed at the bottom is required to make the ball go over the top of the circle?



A. $2.5m / s$

B. $4.0m / s$

C. $3.0m / s$

D. $5.0m/s$

Answer: B

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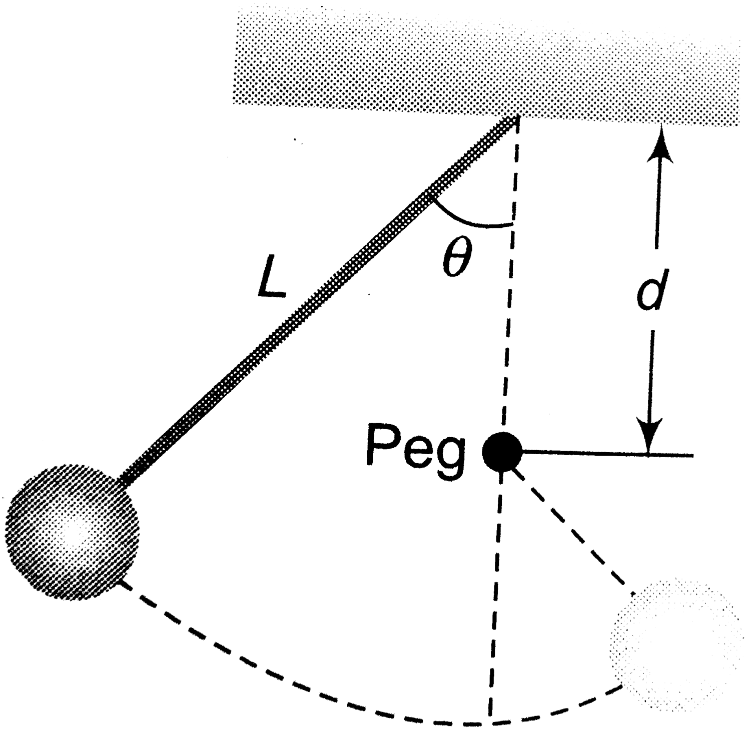
19. A pendulum comprising a light string of length L and small sphere, swings in the vertical plane . The string hits a peg located a distance of bellow the point of suspension (figure). If the pendulum is released from rest at the horizontal possition $(\theta = 90^{\circ})$ and is to swing in a complete circule centered on the peg, the minimum value of d is



A. $\dfrac{L}{4}$

B. $\dfrac{2L}{4}$

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

D. $\frac{3L}{5}$

Answer: D

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20. A ball whirls around in a vertical circle at the end of a string . The other end of the string is fixed at the centre of the circle. Assuming the total energy of the ball-Earth system remains constant. What is the difference of tension in string at bottom and top during circular motion (T_b - T_t = ?)

A. $5mg$

B. $3mg$

C. $6mg$

D. $3.5mg$

Answer: C

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21. A partical is moving in the vertical plane . It is attached at one end of a string of length l whose other end is fixed. The velocity at the lower point is u. The tension in the string is $\overrightarrow{T}$ and velocity of the partical is $\overrightarrow{v}$ at any position. Then, which of the following quantity will remain constant.

A. $\overrightarrow{T} \cdot \overrightarrow{v}$

B. kinetic energy

C. Gravitational potential energy

D. $\overrightarrow{T} \times \overrightarrow{v}$

Answer: A

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Collision

1. When two bodies collide elastic, then:

A. KE of the system along is conserved

B. only momentum is conserved

C. both KE and momentum are conserved

D. neither KE nor momentum is conserved

Answer: C

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2. During inclined collision of two particle

A. $KE_{f \in al} - KE_{\in itial}$

B. $KE_{f \in al}$ must be greater than $KE_{\in itial}$

C. $KE_{f \in al}$ must be less than $KE_{\in itial}$

D. $KE_{f \in al}$ may be greater or less than $KE_{\in itial}$

Answer: C

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3. Two ball at the same temperature collide which is consved?

A. Temperature

B. velocity

C. kinetic energy

D. Momentum

Answer: D

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4. In perfectily inelastaic collition the relative velocity of the bodies

A. before impect it zero

B. before impect is equal the after impact

C. before impect is zero

D. is characterized by none of the above

Answer: C

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5. A body just droppeed from a tower explodes into two placed of equal mass in mid -air which of the following is not posible?

A. Each part will follow parabolic path

B. Only one part will follow parabolic path

C. Both part move along a verticle line

D. One part reaches the ground earlier than the other

Answer: B

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6. An inelestc ball of mass m moves at speed a toward mother ineclasits ball of mass m at rest They collide and stick togather both moving at speed is nothing else is known about the condition under which the collision take plane which of the fpllowing statement is the most correct?

A. Nether total kinetic energy not total linear momenr=tum can be conserved

B. This is at clastic collision in which both total kinetic energy and total linear momentum are conserved the fixed speed is $v = u/2$

C. This is an inelistic collision and in such collision , total linear momentum is always conserved the final speed is $v = u/4$

D. This is an inelistic collision and in which total linear momentum is conserved provided no external force can deliver to the system (of two ball) di=uring the collision

Answer: D

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7. Which of the following statement is true concening the elastic collision of two object (It is given that no net external force acts on the system of two object and the do not exen force on each other exept during collision)

A. No net work on any of the two objects since there is no external on the system of given two object

B. The net work done by the first object on the second is equal in the net work done by the second on the first

C. The net work done by the first object on the second is execity the opposite of the net work done by the second on the fist

D. No net work done on the system depends on the angle of colision

Answer: C

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8. During a collision between a closed system of particle in the absence of exerted force

A. The total kinetic energy of the system remain constant

B. The momentum of each particle remains constant

C. Momentum is exchanged between different particles

D. Momentum and kinetic energy both are exchanged between different particles

Answer: A

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9. If u_1 and u_2 be the initial velocity and v_1 and v_2 be the final velocities of the colliding partical then we define coefficient of restitution e as:

$$e = \frac{v_1 - v_2}{u_1 - u_2}$$

For perfectly inelastic collision 'e' is

A. zero

B. 1

C. < 1

D. > 1

Answer: A

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10. A ball of mass M_1 collides elastically and head on with another ball of mass M_2 initially at rest . In which the following cases the transfer of momentum will be maximum?

A. $M_1 = M_2$

B. $M_1 > M_2$

C. $M_1 < M_2$

D. Data is not sufficient to predict it

Answer: B

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11. A billiard ball moving with a speed of $5m / s$ collides with an identical ball, originally at rest. If the first ball stop dead after collision, then the second ball will move forward with a speed of:

A. $10m / s$

B. $5m / s$

C. $2.5m / s$

D. $1m / s$

Answer: B

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12. A body is allowed to fall on the ground from a height h_1. If it is rebound to a height h_2 then the coefficient of restitution is:

A. $\frac{h_2}{h_1}$

B. $\sqrt{\frac{h_2}{h_1}}$

C. $\frac{h_1}{h_2}$

D. $\sqrt{\frac{h_1}{h_2}}$

Answer: A

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13. A ball is let fall from a height h_0. There are n collisions with the earth. If the velocity of rebound after n collision is v_n and the ball rises to a height h_n then coefficient of restitution e is given by

A. $e^n = \sqrt{\frac{h_n}{h_0}}$

B. $e^n = \sqrt{\frac{h_0}{h_n}}$

C. $ne = \sqrt{\frac{h_n}{h_0}}$

D. $\sqrt{ne} = \sqrt{\frac{h_n}{h_0}}$

Answer: A

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14. A body X with a momentum p collides with another identical stationary body Y one dimensionally. During the collision, Y gives an impulse J to body X. Then coefficient of restitution is

A. $\frac{2J}{P}-1$

B. $\frac{J}{P}+1$

C. $\frac{J}{P} - 1$

D. $\frac{J}{2P} - 1$

Answer: B

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15. A pendulum consists of a wooden bob of mass m and of length L. A bullet of mass m_1 is fired towards the pendulum with a speed v_1. The bullet emerges out of the bob with a speed $v_1/3$ and the just completes motion along a vertical circle. Then v_1 is:

A. $\left(\frac{m}{m_1}\right)\sqrt{5gl}$

B. $\frac{3}{2}\left(\frac{m}{m_1}\right)\sqrt{5gl}$

C. $\frac{2}{3}\left(\frac{m}{m_1}\right)\sqrt{5gl}$

D. $\left(\frac{m_1}{m}\right)\sqrt{gl}$

Answer: B

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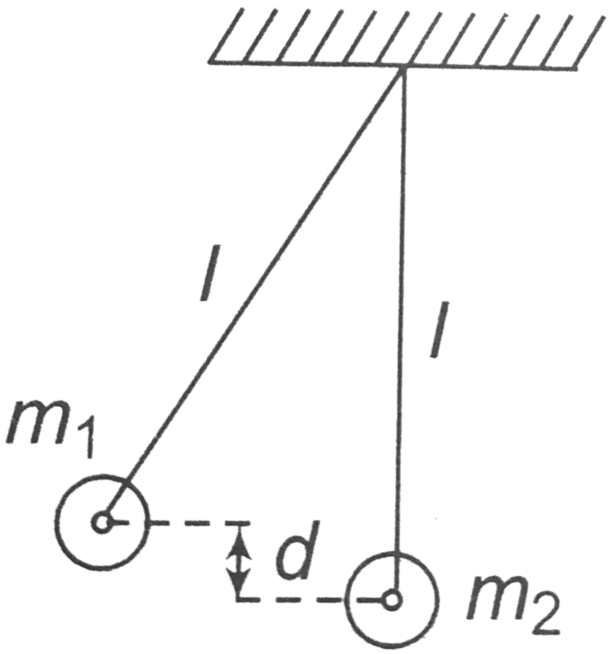
16. Two pendulum each of length l are initial situated as shown in figure. The first pendulum is released and strikes the second . Assume that the collision is completely inelastic and neglect the mass of the string and any frictional effects. How high does the center of mass rise after the collision?



A. $d\left[\dfrac{m_1}{(m_1+m_2)}\right]^2$

B. $d\left[\dfrac{m_1}{(m_1+m_2)}\right]$

C. $\frac{d(m_1+m_2)^2}{m_2}$

D. $d\left[\frac{m_2}{(m_1+m_2)}\right]^2$

Answer: A

Watch Video Solution

17. A mass 'm' moves with a velocity 'v' and collides inelastieally with another identical mass . After collision the 1^{st} mass moves with velocity $\frac{v}{\sqrt{3}}$ in a direction perpendicular to the initial direction of motion. Find the speed of the 2^{nd} mass after collision.

$$\underset{\underset{collision}{bef\ \text{or}\ e}}{\overset{\cdot \quad \rightarrow}{m}} \quad \overset{\cdot}{m} \quad \Bigg\uparrow v/\sqrt{3} \quad \underset{collision}{after} \Bigg\rangle$$

A. $\dfrac{2}{\sqrt{3}}v$

B. $\dfrac{v}{\sqrt{3}}$

C. v

D. $\sqrt{3}v$

Answer: A

Watch Video Solution

18. A ball is projected vertically down with an initial velocity from a height of $20m$ onto a horizontal floor. During the impact it loses 50% of its energy and rebounds to the same height. The initial velocity of its projection is

A. $20ms^{-1}$

B. $15ms^{-1}$

C. $10ms^{-1}$

D. $5ms^{-1}$

Answer: A

Watch Video Solution

19. A partical falls from a height h upon a fixed horizontal plane and rebounds. If e is the coefficient of restitution, the total distance travelled before rebounding has stopped is

A. $h\left(\frac{1+e^2}{1-e^2}\right)$

B. $h\left(\frac{1-e^2}{1+e^2}\right)$

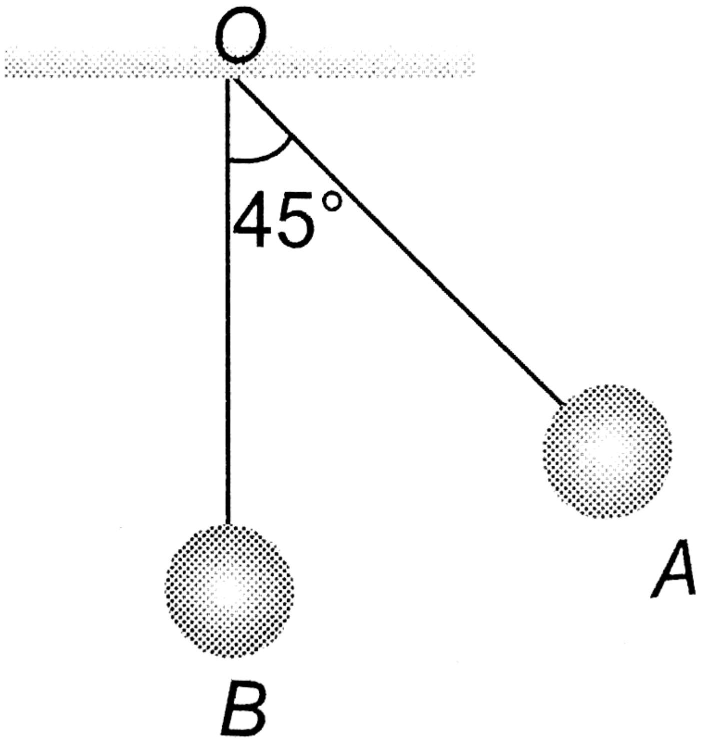
C. $\frac{h}{2}\left(\frac{1-e^2}{1+e^2}\right)$

D. $\frac{h}{2}\left(\frac{1+e^2}{1-e^2}\right)$

Answer: D

Watch Video Solution

20. The bob A of a simple pendulum is released when the string makes an angle of 45° with the vertical. It hits another bob B of the same meterial and same mass kept at rest on the table. If the collision is elastic, then



A. Both A and B rise to the same height

B. Both A and B comes to rest at B

C. Both A and B move with the same velocity of A

D. A comes to rest and B move with the same velocity of A

Answer: D

Watch Video Solution

21. Two particle moving in the same direction with speeds $4m/s$ and $2m/s$ collide elastically (the collision being head on). After collision , the velocity of first particle becomes $3m/s$ in the same direction . The velocity of the second should be

A. $2m/s$ in same direction

B. $4m/s$ in same direction

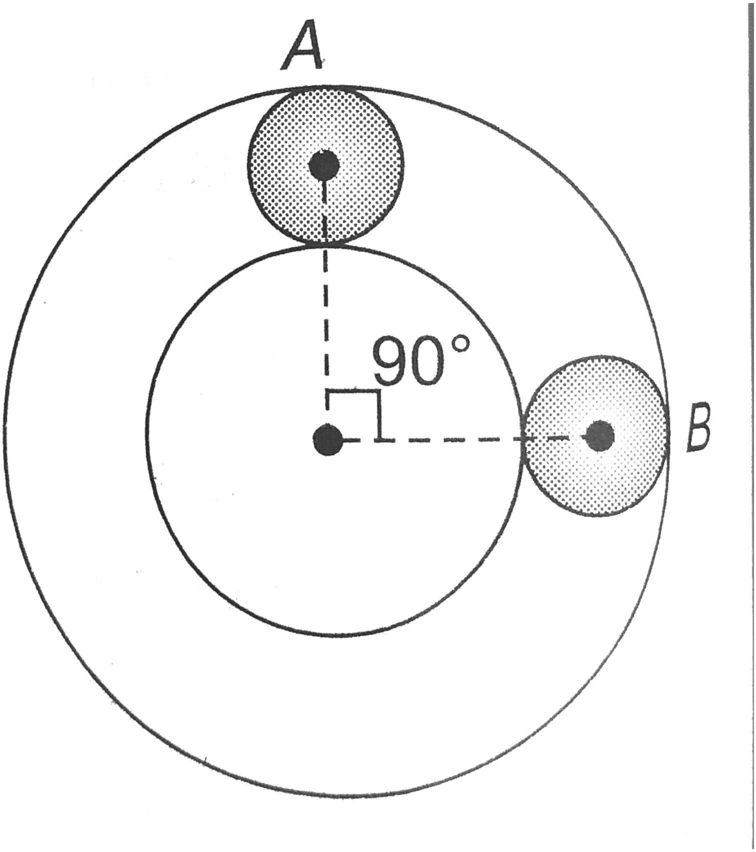
C. $4m/s$ in opposite direction

D. $5m/s$ in same direction

Answer: D

Watch Video Solution

22. Body $A$of mass m and B of mass $3m$ move towards each other with velocities V and $2V$ respectivally from the positions as shown , along a smooth horizontal circule track of redius r. After the first elastic collision , they will collide again after the time:



A. $\dfrac{2\pi r}{V}$

B. $\dfrac{\pi r}{2V}$

C. $\dfrac{\pi r}{V}$

D. $\frac{2\pi r}{3V}$

Answer: B

Watch Video Solution

23. A ball of mass m is moving normally towards a walll of mass $M(>>m)$ with the velocity $4m/s$. The wall is also moving. After striking elastically with the wall, velocity of ball becomes $8m/s$. Find the speed of the wall:

A. $4m/s$

B. $2m/s$

C. $2\sqrt{2}m/s$

D. $4\sqrt{2}m/s$

Answer: D

Watch Video Solution

24. The velocity vector of a sphere after it hits a vertical wall which is pallel to $\hat{j}$ is $\left(-\hat{i}+3\hat{j}\right)$ on a smooth horizontal surface.

The coefficient of restitution between ball and wall is $(1/2)$. Final the velocity vector of sphere immediately before collision.

A. $\hat{i} + 3\hat{j}$

B. $-2\hat{i} + 3\hat{j}$

C. $-\hat{i} + 3\hat{j}$

D. $2\hat{i} + 3\hat{j}$

Answer: B

Watch Video Solution

25. A partical of mass m_1 collides head on with a stationary partical of mass m_2. If $\frac{m_1}{m_2} > e$ where e is the coefficient of restitution, then :

A. m_1 will return back

B. m_1 will move in same direction

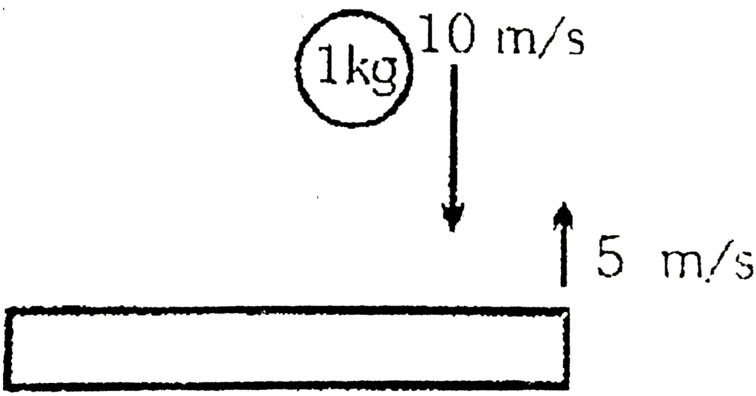
C. m_1 will stop

D. unpredicatable

Answer: D

Watch Video Solution

26. A ball of mass $1kg$ strikes a heavy platform, elastically, moving upwards with a velocity of $5m/s$. The speed of the ball just before the collision is $10m/s$ downwards. Then the impulse imparted by the platform on the ball is :-



A. $15N-s$

B. $10N - s$

C. $20N - s$

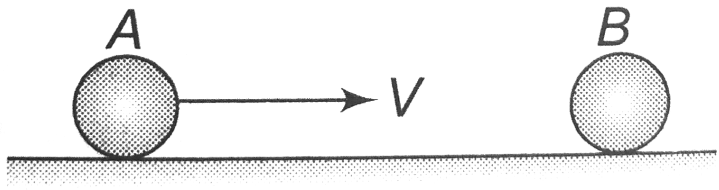
D. $30N - s$

Answer: C

Watch Video Solution

27. The sphere A of mass m_1 moves with velocity V on a frictionless horizontal surface and strikes with sphere B of mass m_2 at rest. The sphere A comes back with speed $V/10$.

Choose the correct option.



A. $m_1 > m_2$

B. $m_1 = m_2$

C. $m_1 < m_2$

D. none of these

Answer: A

Watch Video Solution

28. A sphere A of mass m moving with a velocity hits another stationary sphere B of same mass. If the ratio of the velocity of the sphere after collision is $\frac{v_A}{v_B} = \frac{1-e}{1+e}$ where e is the cofficient of restitution, what is the initial

velocity of sphere A with which it strikes?

A. $v_A + v_B$

B. $v_A - v_B$

C. $v_B - v_A$

D. $\dfrac{(v_A + v_B)}{2}$

Answer: B

Watch Video Solution

29. A ball strickes a horizontal floor at 45°. 25% of its kinetic energy is lost in collision. Find the coefficient of restitution.

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

B. $\dfrac{1}{\sqrt{2}}$

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

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

Answer: C

Watch Video Solution

30. N identical balls are placed on a smooth horizontal surface. An another ball of same mass collides elastically with velocity u with first ball of N balls. A process of collision is thus started in which first ball collides with second ball and the with the third ball and so on. The coefficient of restitution for each collision is e. Find the speed of Nth ball.

A. $(1+e)^N u$

B. $u(1+e)^{N-1}$

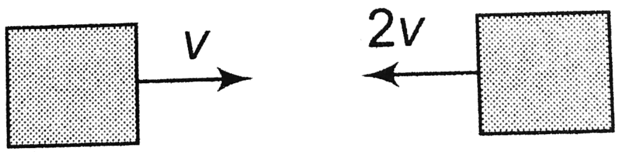
C. $\frac{u(1+e)^{N-1}}{2^{N-1}}$

D. $u^N(1+e)^N$

Answer: C

Watch Video Solution

31. A plank of mass m moving with a velocity v along a frictionless horizontal track and a body of mass $m/2$ moving with $2v$ collides with plank elastically. Final speed of the plank is:



A. $\frac{5v}{3}$

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

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

D. none of these

Answer: D

Watch Video Solution

Problems Based On Mixed Concepts

1. A boy weighing $50kg$ finished long jump at a distance of $8m$. Considering that he moved along a parabolic path and his angle of jumps was 45°, his initial KE will be $g = 9.8m/s^2$

A. $960J$

B. $1560J$

C. $2460J$

D. $1960J$

Answer: B

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2. If KE of a body increases by 300%, by what $\%$ will the linear momentum of the body increase?

A. 50%

B. 100%

C. 150%

D. 300%

Answer: D

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3. Momentum of a particle is increased by 50%. By how much percentage kinetic energy of particle will increase?

A. 25%

B. 50%

C. 100%

D. 125%

Answer: D

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4. Two bodies of mass $1kg$ and $2kg$ have equal momentum. The ratio of their kinetic energies is:

A. $1:1$

B. $2:1$

C. $1:3$

D. $3:1$

Answer: D

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5. Two bodies with masses $1kg$ and $2kg$ have equal kinetic energies. If p_1 and P_2 are their repective momenta, then p_1 / P_2 is equal to :

A. $M_1 : M_2$

B. $M_2 : M_1$

C. $M_1^2 : M_2^2$

D. $\sqrt{M_1} : \sqrt{M_2}$

Answer: A

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6. A particle moves in the x-y plane under the action of a force $\overrightarrow{F}$ such that the value of its linear momentum $\overrightarrow{P}$ at any time t is

$P_x = 2\cos t$ and $P_y = 2\sin t$. What is the angle θ between $\overrightarrow{F}$ and P at a given time t?

A. 90°

B. 0°

C. 180°

D. 30°

Answer: A

Watch Video Solution

7. A body moving with velocity v has momentum and kinetic energy mumerically equal. What is the value of v?

A. $2m/s$

B. $\sqrt{2}m/s$

C. $1m/s$

D. $0.2m/s$

Answer: B

Watch Video Solution

8. A light body A and a heavy B have equal linear momentum. Then the KE of the body A is

A. equal to that of B

B. greater then that of B

C. smaller then that of B

D. zero

Answer: B

Watch Video Solution

9. A block of mass m is pulled slowly by a minimum constant force (F) on a horizontal surface thorugh a distance x. The coefficient of kinetic friciton is μ. Find the work done by the force (F).

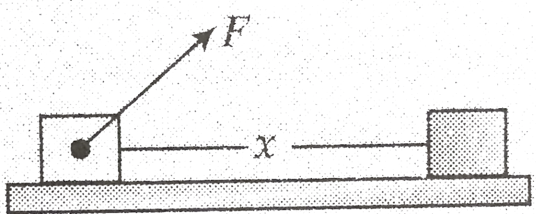

Fig. 8.46

A. $\dfrac{\mu m g x}{1+\mu^2}$

B. $\dfrac{\mu m g x}{1-\mu^2}$

C. $\dfrac{\mu mgx}{\sqrt{1+\mu^2}}$

D. None of these

Answer: A

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10. A body of mass $6kg$ is under a force which causes displacement in it given by $S=\dfrac{t^2}{4}$ metres where t is time . The work done by the force in 2 sec is

A. $12J$

B. $9J$

C. $6J$

D. $3J$

Answer: D

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11. The displacement x of particle moving in one dimension, under the action of a constant force is related to the time t by the equation

$t = \sqrt{x} + 3$

where $x is \in meters$ and $t \in \sec onds$. Find

(i) The displacement of the particle when its velocity is zero , and

(ii) The work done by the force in the first $6 \sec onds$.

A. $9J$

B. $6J$

C. $0J$

D. $3J$

Answer: C

Watch Video Solution

12. A partical is realeased from the top of two inclined rought surface of height h each. The angle of inclination of the two planes are 30° and 60° respectively. All other factors (e.g. coefficient of friction , mass of the block etc) are same in both the cases. Let K_1 and K_2 be the kinetic energy of the partical at the bottom of the plane in two cases. Then

A. $K_1 = K_2$

B. $K_1 > K_2$

C. $K_1 < K_2$

D. data insufficient

Answer: B

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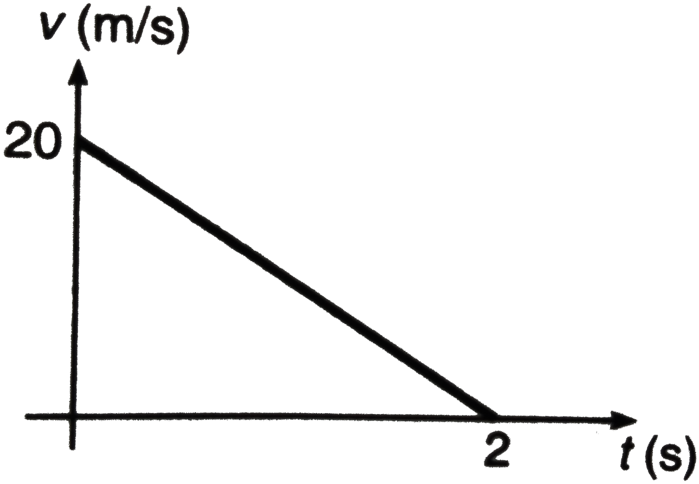
13. Velocity-time graph of a particle of mass (2 kg) moving in a straight line is as shown in Fig. Find the work done by all the forces acting on the particle.



.

A. $400J$

B. $-400J$

C. $-200J$

D. $200J$

Answer: B

Watch Video Solution

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

A. $6.0m$

B. $12.0m$

C. $10.0m$

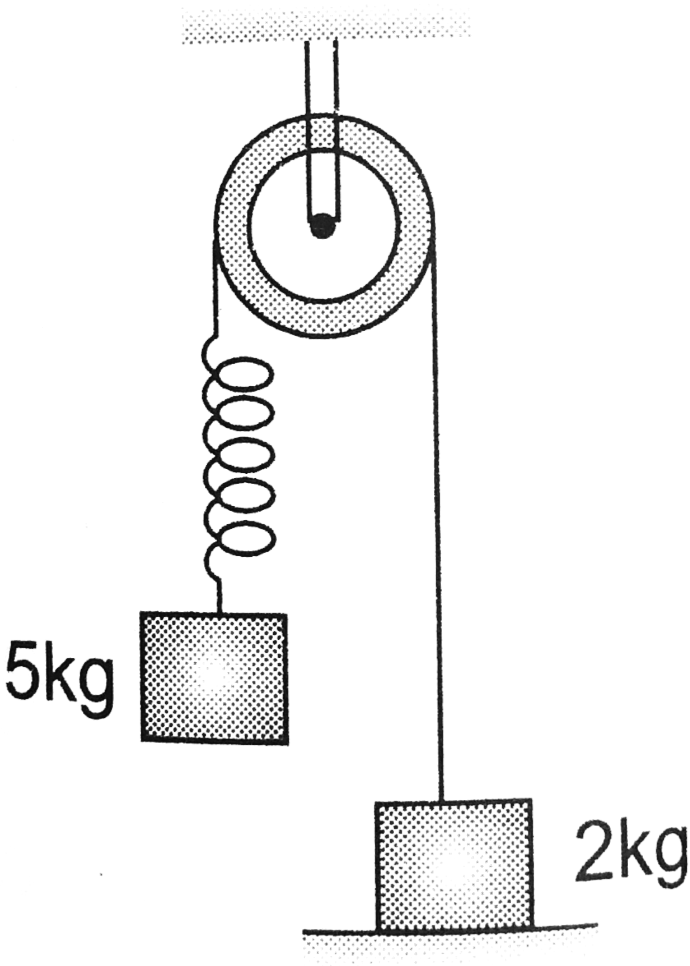
D. $8.0m$

Answer: B

Watch Video Solution

15. System shown in figure is released from rest . Pulley and spring is massless and friction is absent everywhere. The speed of $5kg$ block when $2kg$ block leaves the contact with ground is (force constant of spring

$k = 40N/m$ and $g = 10m/s^2$)



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

B. $2\sqrt{2}m/s$

C. $2m/s$

D. $4\sqrt{2}m/s$

Answer: B

Watch Video Solution

16. A partical of mass m is projected with velocity u at an angle α with horizontal. During the period when the partical desconds from highest point to the position where its velocity vector makes an angle $\frac{\alpha}{2}$ with horizontal. Wiork done by gravity force is

A. $\frac{1}{2}\mu^2 \tan^2 \alpha$

B. $\frac{1}{2}\mu^2 \frac{\cos^2(\alpha)}{2}$

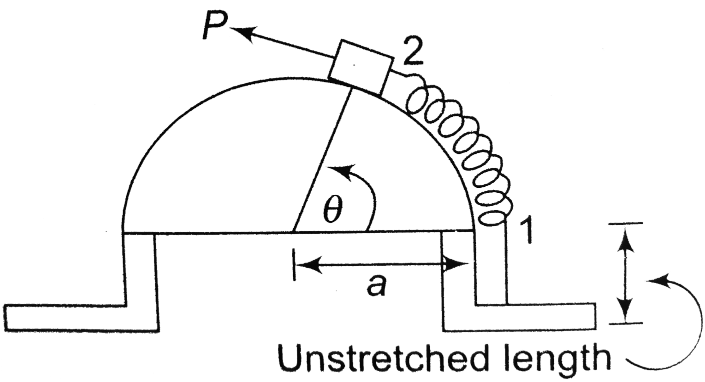
C. $\frac{1}{2}\mu^2 \cos^2 \alpha \frac{\tan^2(\alpha)}{2}$

D. $\frac{1}{2}\mu^2 \frac{\cos^2(\alpha)}{2} \sin^2 \alpha$

Answer: D

Watch Video Solution

17. A varible force P is amintained targent to a frictionless cylinder surface of radius a as shown in the figure. By slowly varying this force, a block of weight W is moved and the spring to which it is streched from position 1 to position 2. The work done by the force P is:



A. $Wa\sin\theta$

B. $\frac{1}{2}ka^2\theta^2$

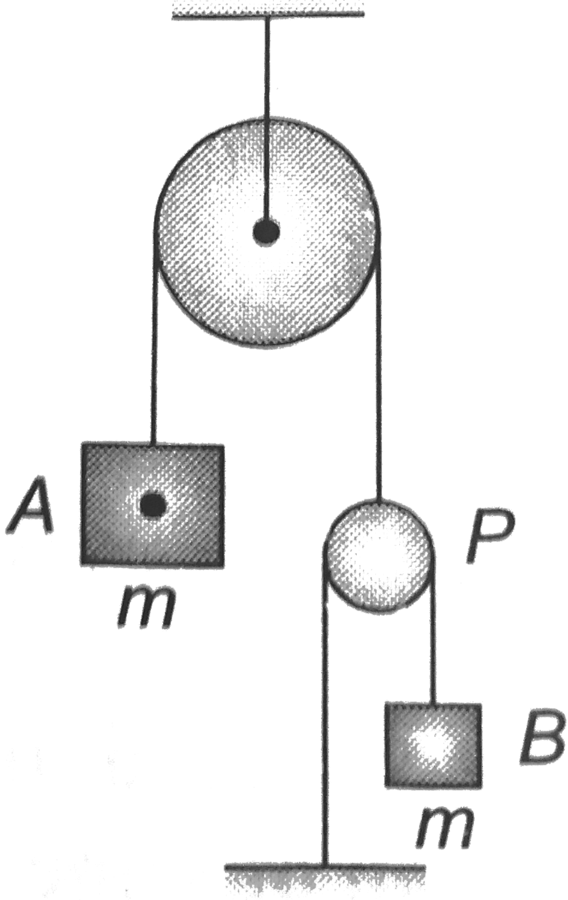
C. $Wa\sin\theta + ka^2\theta^2$

D. $Wa\sin\theta + \frac{1}{2}ka^2\theta^2$

Answer: B

Watch Video Solution

18. In the figure shown, the system is released frrom rest. Find the velocity of block A when block B has fallen a distance l. Assume all pulleys to be massless and frictionless.



A. $v = \sqrt{\frac{2gl}{5}}$

B. $v = \sqrt{\frac{gl}{5}}$

C. $v = \sqrt{\frac{gl}{2}}$

D.

Answer: A

Watch Video Solution

19. A ball falls undal gravity from a height of 10m with an initial downward velocity u. It collides with ground, loses halft its energy and then rises back to the same height. Find the initial velocity u.

A. $\sqrt{2gh}$

B. $\sqrt{gh}$

C. $\sqrt{3gh}$

D. $\sqrt{2.5gh}$

Answer: A

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20. The kinetic energy of partical moving along a circule of radius R depends upon the distance covered S and given by $K = aS$

where a is a constant. The the force acting on the partical is

A. constant

B. proportional to v

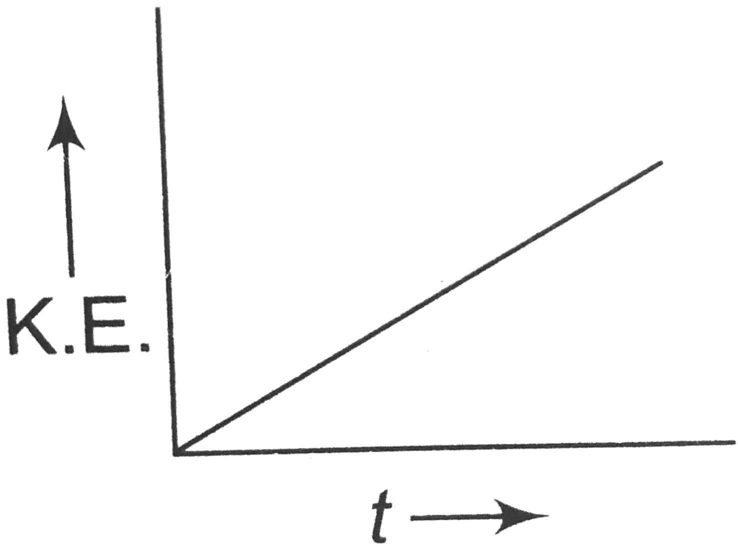
C. proportional to v^2

D. inversely proportional to v

Answer: D

Watch Video Solution

21. The kinetic energy of a body moving along a straight line varies with time as shown in figure. The force acting on the body:



A. zero

B. constant

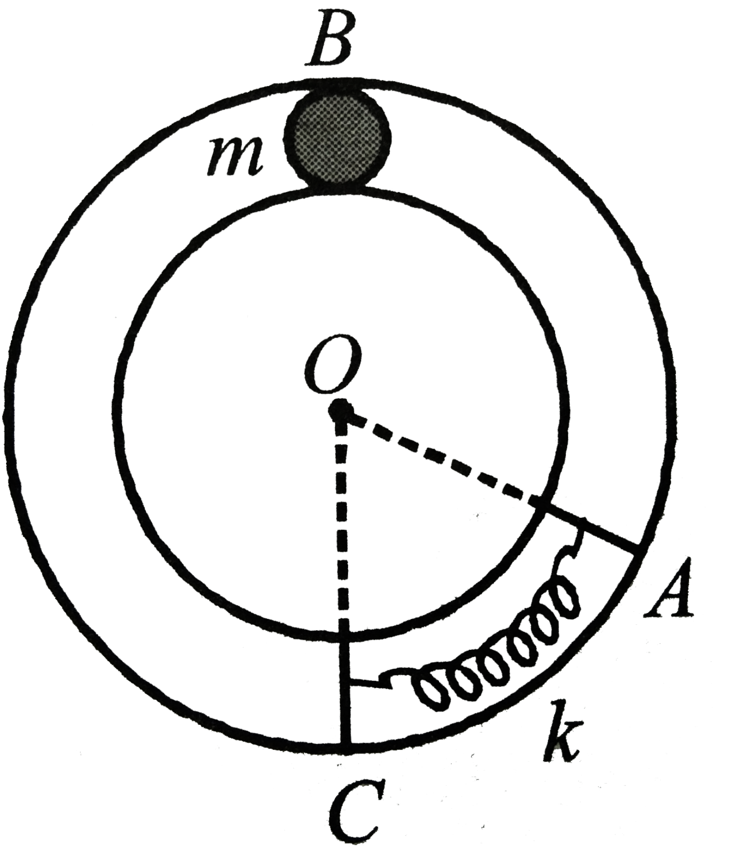
C. directly proportional to velocity

D. inversely proportional to velocity

Answer: B

Watch Video Solution

22. In the figure shown, there is a smooth tube of radius R, fixed in the vertical plane. A ball B of mass m is released from the top of the tube. B slides down due to gravity and compresses the spring is fixed and end A is free., Initially, line OA makes an angle 60° with OC and finally it makes an angle of 30° after compression. Find the spring constant of the spring.



A. $\dfrac{12mg\left(2+\sqrt{3}\right)}{\pi^2 R}$

B. $\dfrac{36mg\left(2+\sqrt{3}\right)}{\pi^2 R}$

C. $\dfrac{18mg}{\pi^2 R}$

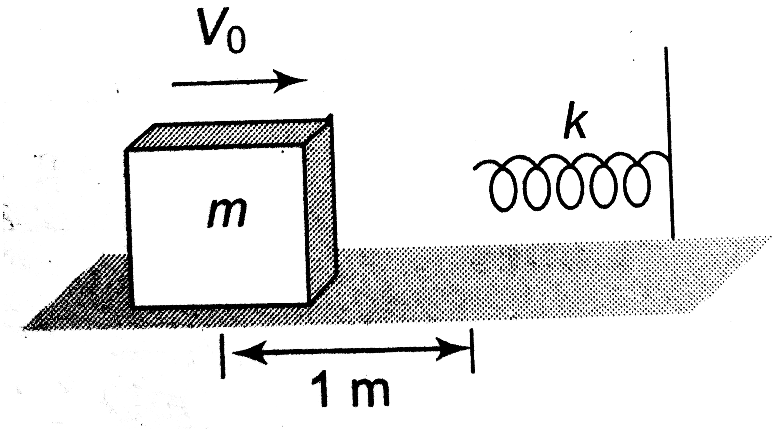
D. None of these

Answer: D

Watch Video Solution

23. A block mass $m = 2kg$ is moving with velocity v_0 towards a massless unstretched spring of the force constant $k = 10 N / m$.

Coefficient of friction between the block and the ground is $\mu = 0.2$. Find the maximum value of v_0 so that after pressing the spring the block does not return back but stops there permanently.



A. $2\sqrt{\frac{2}{5}} m / s$

B. $\sqrt{\frac{1}{5}} m / s$

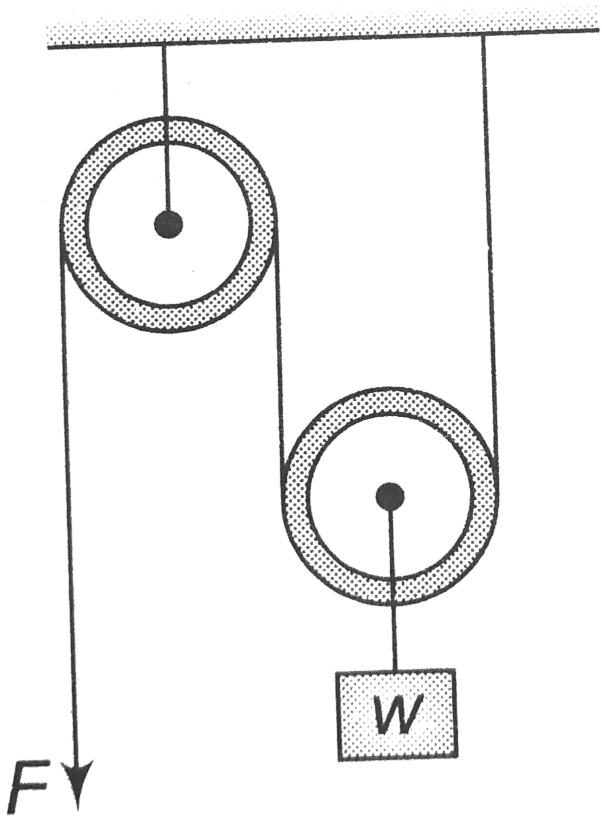
C. $4\sqrt{\frac{1}{5}}m/s$

D. $4\sqrt{\frac{2}{5}}m/s$

Answer: D

Watch Video Solution

24. In figure a force of magnitude F acts on the free end of the card. If the weight is move up alowly by a distance b. How much work is done on the weight by the rope connecting pulley and weight?



A. Fh

B. $2Fh$

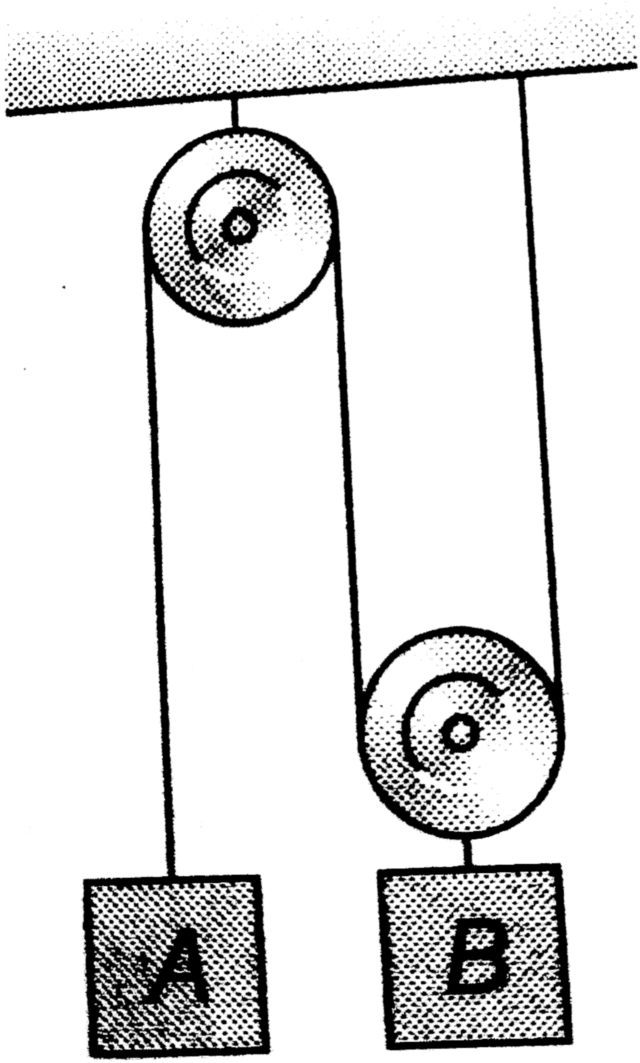
C. $Fh/2$

D. None of these

Answer: C

Watch Video Solution

25. The system shown in the figure consider of a light , inextenslible cord, light, frictionless pulley, and blocks of equal mass. Notice that block B is attached to one of the pulleys. The system is initial held at rest so that the ground . The blocks are then released. Find the speed of block A at the moment the vertical separation of the blocks is h.



A. $\sqrt{\frac{6gh}{15}}$

B. $\sqrt{\frac{8gh}{13}}$

C. $\sqrt{\frac{8gh}{15}}$

D. $\sqrt{\frac{6gh}{13}}$

Answer: B

Watch Video Solution

26. While running a person transforms about $0.60J$ chemical energy to mechanical energy per stop per kilogram of body mass. If a $60kg$

runner transform energy at a rate of $72W$ during a race, how fast is the person running? Assume that a running step is $1.5m$ long

A. $2.0m / s$

B. $3.0m / s$

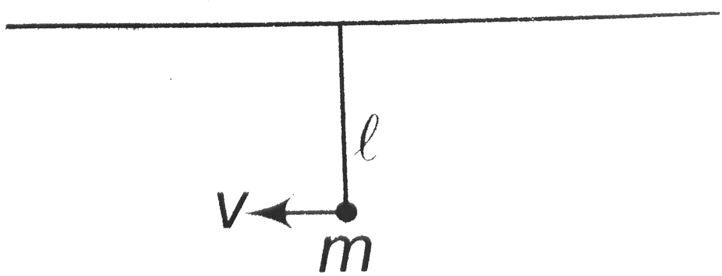
C. $2.5m / s$

D. $\sqrt{\frac{6gh}{13}}$

Answer: D

Watch Video Solution

27. A simple pendulum of length hangs from a horizontal roof as shown in figure. The bob of mass m is given an initial horizontal velocity of magnitude $\sqrt{5gl}$ as shown in figure. The coefficient of restitution $e = \frac{1}{2}$. After how many collisions the bob shall no long come into constant with the horizonrtal roof?



A. 1

B. 2

C. 4

D. none of these

Answer: A

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28. A mass of $2.9kg$ is suspended from a string of length $50cm$ and is at rest . Another body of mass $100gm$ which is moving horizontal with a velocity of $150m/s$ strikes it . After striking the two bodies combine together . Tension in the string , when it is at an angle of 60° with the velocity is : $g = 10m / s^2$

A. $135N$

B. $125N$

C. $140N$

D. $90N$

Answer: D

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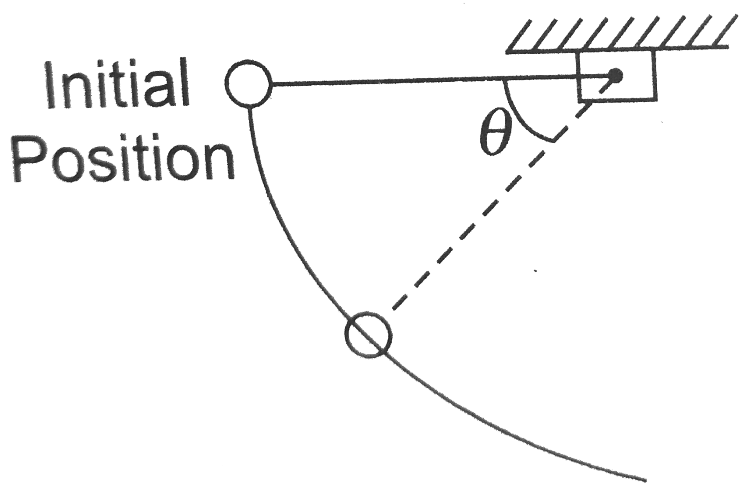
29. The given figure shows a small mass connected to a string which is atteched to a string , which is attached to a vertical post. If the mass is released from rest when the string is horizontal as shown the magnitude of the total acceleration of the mass as friction of the angle θ is



A. $2g\sin\theta$

B. $2g\cos\theta$

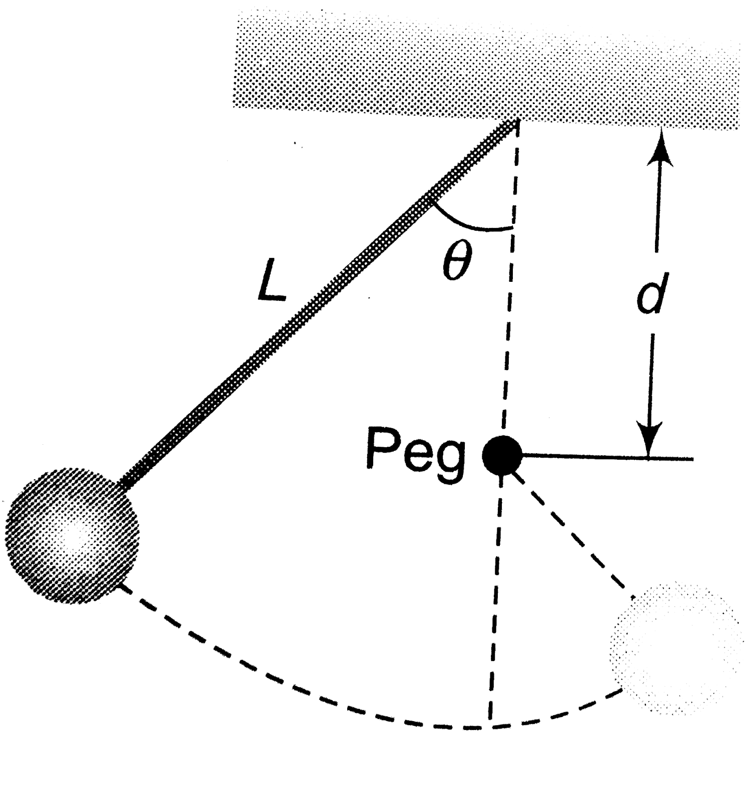
C. $g\sqrt{3\cos^2\theta+1}$

D. $g\sqrt{3\sin^2\theta+1}$

Answer: C

Watch Video Solution

30. A pendulum comprising a light string of length L and small sphere, swings in the vertical plane . The string hits a peg located a distance of bellow the point of suspension (figure). If the pendulum is released from rest at the horizontal possition ($\theta = 90^\circ$) and is to swing in a complete circle centered on the peg, the minimum value of d is



A. $0.75m$

B. $0.5m$

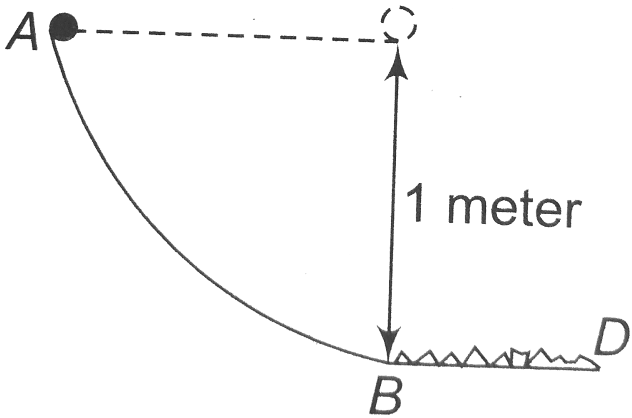
C. $0.25m$

D. $0.2m$

Answer: A

Watch Video Solution

31. In the track shown in figure section AB is a quandrant of a circle of 1 metre redius. A block is released at A and slides without friction until it reaches B. After B it moves on a rought horizontal floor and comes to rest at distance 3 meters from B. What is the coefficient of friction between floor and body?



A. $1/3$

B. $2/3$

C. $1/4$

D. $3/8$

Answer: B

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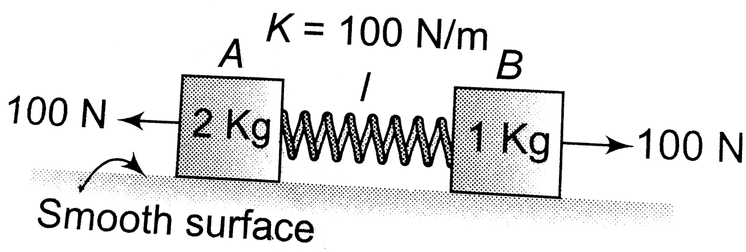
32. In the figure shown initial spring is in unstretched state and blocks are at rest. Now $100N$ force is applied on block A and B as shown in figure. After same time velocity of 'a' becomes $2m/s$ and that of 'B' $4m/s$ and block A displaced by amount $10cm$ and spring is spring is streched by amount $30 cm$. Then work done by spring force on A will be:



A. $9/3J$

B. $-6J$

C. $6J$

D. None of these

Answer: B

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Assertion Reasoning

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 but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason are false.

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2. Assertion: The change in kinetic energy of a partical is equal to the work done on it by the net force.

Reason: Change in kinetic energy of partical is equal to the work done in case of a system of one partical.

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

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

C. If assertion is true but reason is false.

D. If assertion and reason are false.

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3. Assertion: A spring has potential energy , both when it is compresed or stretched.

Reason: In compressing or stretching, work is done on the spring against the resotoring 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 but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason are false.

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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 but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason are false.

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5. Assertion: The conservation of kinetic energy in elastic collision applies after the collision is over and does not hold at very 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 but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason are false.

Watch Video Solution

6. 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 assertion and reason are false.

Watch Video Solution

7. 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 but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason are false.

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8. 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 but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason are false.

Watch Video Solution

9. 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 but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason are false.

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 but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason are false.

Watch Video Solution

11. 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 but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason are false.

Watch Video Solution

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

Reason: If two bodies stick to each other , after colliding , the collision is said to be perfectly elastic.

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

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

C. If assertion is true but reason is false.

D. If assertion and reason are false.

Watch Video Solution

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

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

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

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

C. If assertion is true but reason is false.

D. If assertion and reason are false.

Watch Video Solution

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

Reason: If two bodies stick to each other , after colliding , the collision is said to be perfectly elastic.

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

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

C. If assertion is true but reason is false.

D. If assertion and reason are false.

Watch Video Solution

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

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

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

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

C. If assertion is true but reason is false.

D. If assertion and reason are false.

Watch Video Solution

16. Assertion: In a elastic collision $(e = 1)$ between two bodies, conservation of kinetic

energy holds true. i.e., $(K_1 + K_2)_i = (K_1 + K_2)_f$.

Reason: Conservation of momentum holds true i.e., $(P_1 + P_2)_i = (P_1 + P_2)_f$.

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

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

C. If assertion is true but reason is false.

D. If assertion and reason are false.

Watch Video Solution

17. Assertion:The principal of conservation of energy is valid for inelastic collision.

Reason: The principal of conservation of energy holds good in both elastic and inelastic collision. In case of inelastic collision kinetic energy before and after collision is not same.

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

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

C. If assertion is true but reason is false.

D. If assertion and reason are false.

Watch Video Solution

1. A force of $2\hat{i} + 3\hat{j} + 4\hat{k}N$ acts on a body for 4 second and produces a displacement of $\left(3\hat{i} + 4\hat{j} + 5\hat{k}\right)m$. The power used is

A. $9.5W$

B. $7.5W$

C. $6.5W$

D. $4.5W$

Answer: A

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2. The mass of two substance are $4gm$ and $9gm$ respectively. If their kinetic energy are the same, then the ratio of their momrntum will be

A. $4:9$

B. $9:4$

C. $3:2$

D. $2:3$

Watch Video Solution

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

A. 0

B. 1

C. 6

D. 12

Watch Video Solution

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

A. 30

B. 40

C. 10

D. 20

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5. A force $\vec{F} = \left(5\hat{i} + 4\hat{j}\right)N$ acts on a body and produces a displacement $\vec{s} = \left(6\hat{i} - 5\hat{j} + 3\hat{k}\right)m$. The work done will be

A. $10J$

B. $20J$

C. $30J$

D. $40J$

Watch Video Solution

6. A long elastic spring is stretched by $2cm$ and its potential energy is U. If the spring is stretched by $10cm$, the PE will be

A. $\frac{U}{5}$

B. U

C. $5U$

D. $25U$

Answer: D

Watch Video Solution

7. A stationary partical explodes into two partical of a masses m_1 and m_2 which move in opposite direction with velocities v_1 and v_2

. The ratio of their kinetic energies E_1 / E_2 is

A. m_1 / m_2

B. 1

C. $m_1 v_2 / m_2 v_1$

D. m_2 / m_1

Watch Video Solution

8. A mass of $0.5kg$ moving with a speed of $1.5m\,/\,s$ on a horizontal smooth surface, collides with a nearly weightless spring of force constant $k = 50N\,/\,m$ The maximum compression of the spring would be.

A. $0.15m$

B. $0.12m$

C. $1.5m$

D. $0.5m$

Answer: A

Watch Video Solution

9. A stone tied to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time the stone is at lowest position and has a speed u . Find the magnitude of the change in its velocity as it reaches a position, where the string is horizontal.

A. $\sqrt{2(u^2 - gl)}$

B. $\sqrt{u^2 - gl}$

C. $u-\sqrt{u^2-2gl}$

D. $\sqrt{2gl}$

Answer: A

Watch Video Solution

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

A. $\sqrt{2}:1$

B. $2:1$

C. $1:2$

D. $1:\sqrt{2}$

Answer: C

Watch Video Solution

11. A bomb of mass $30kg$ at rest explodes into two pieces of mass $18kg$ and $12kg$. The velocity of mass $18kg$ is 6 m//s`. The kinetic energy of the other mass is

A. $256J$

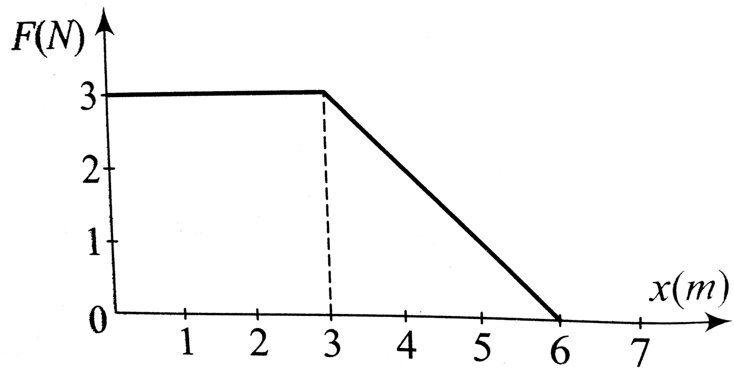
B. $486J$

C. $524J$

D. $324J$

Watch Video Solution

12. A Force F acting on an object varies with distance x as shown in the here . The force is in newton and x in metre. The work done by the force in moving the object from $x = 0$ to $x = 6m$ is



A. $4.5J$

B. $13.5J$

C. $9.0J$

D. $18.0J$

Watch Video Solution

13. A body of mass $3kg$ is under a force , which causes a displacement in it is given by $S = \frac{t^3}{3}$ (in metres). Find the work done by the force in first 2 seconds.

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

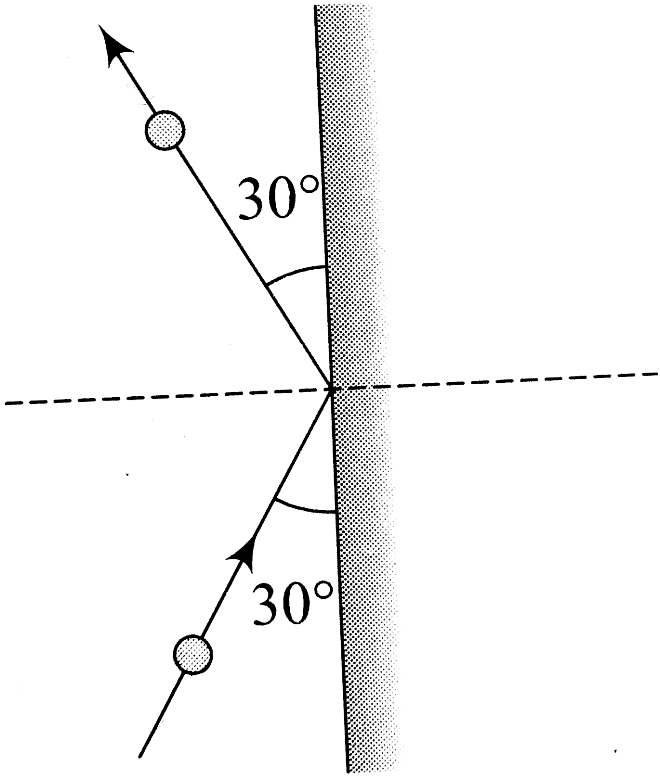
B. $\frac{3}{8}J$

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

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

Watch Video Solution

14. A $0.5kg$ ball moving with a speed of $12m/s$ strikes a hard wall at an angle of 30° with the wall. It is reflected with the same speed and at the same angle . If the ball is in contact with the wall for $0.25s$, the average force acting on the wall is



A. $48N$

B. $24N$

C. $12N$

D. $96N$

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15. $300J$of work is done in slide a $2kg$ block up an inclined plane of height $10m$. Take $g = 10m/s^2$, work done against friction is

A. $200J$

B. $100J$

C. zero

D. $1000J$

Answer: B

Watch Video Solution

16. A vertical spring with force constant k is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls vertically on the spring, so that the spring is compressed by a distance d. The net work done in the process is

A. $mg(h+d)+\frac{1}{2}kd^2$

B. $mg(h+d)-\frac{1}{2}kd^2$

C. $mg(h-d)-\frac{1}{2}kd^2$

D. $mg(h-d)+\frac{1}{2}kd^2$

Answer: B

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17. Water falls from a height of $60m$ at the rate $15kg/s$ to operate a turbine. The losses due to frictional forces are 10% of energy . How much power is generated to by the turbine? (g=10 m//s^(2))`.

A. $8.1kW$

B. $10.2kW$

C. $12.3kW$

D. $7.0kW$

Answer: A

Watch Video Solution

18. A shell of mass $200g$ is ejected from a gun of mass $4kg$ by an explosion that generate $1.05kJ$ of energy. The initial velocity of the shell is

A. $100ms^{-1}$

B. $80ms^{-1}$

C. $40ms^{-1}$

D. $120ms^{-1}$

Watch Video Solution

19. An engine pumps water continously through a hose. Water leave the hose with a velocity v and m is the mass per unit length of the Water jet. What is the rate at Which kinetic energy is imparted to water?

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

B. mv^3

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

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

Watch Video Solution

20. An explosion blows a rock into three parts. Two parts go off at right angles to each other . These two are $1kg$ first part moving with a velocity of $12ms^{-1}$ and $2kg$ second part moving with a velocity of $8ms^{-1}$. If the third part flies off with a velocity of $4ms^{-1}$. Its mass would be

A. $5kg$

B. $7kg$

C. $17kg$

D. $3kg$

Watch Video Solution

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

A. $20J$

B. $30J$

C. $40J$

D. $10J$

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22. A ball moving with velocity $2ms^{-1}$ collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in ms^{-1}) after colllision will be

A. 0.1

B. 1.1

C. 1.05

D. 0.2

Watch Video Solution

23. An engine pumps water through a hose pipe. Water passes through the pipe and leaves it with a velocity of $2ms^1$. The mass per unit length of water in the pipe is $100kgm^{-1}$. What is the power of the engine?

A. $400W$

B. $200W$

C. $100W$

D. $800W$

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

A. by the system against a conservative force

B. by the system against a nonconservative force

C. upon the system by a conservative force

D. upon the system by a nonconservative force

Answer: A

Watch Video Solution

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

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

B. it remains constant all through

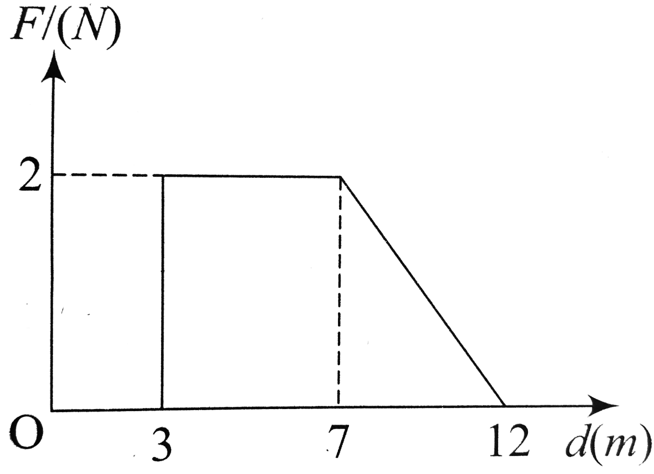
C. at the instant just after the body is projected

D. at the highest position of the body

Answer: A

Watch Video Solution

26. force F on a partical moving in a straight line veries with distance d as shown in the figure. The work done on the partical during its displacement of $12m$ is



A. $21J$

B. $26J$

C. $13J$

D. $18J$

Answer: C

Watch Video Solution

27. A mass m moving horizontal (along the x-axis) with velocity v collides and stricks to mass of $3m$ moving vertically upward (along the y-axis) with velocity $2v$. The final velocity of the combination is

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

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

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

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

Watch Video Solution

28. Two sphere A and B of masses m_1 and m_2 respectivelly colides. A is at rest initally and B is moving with velocity v along x-axis. After collision B has a velocity $\frac{v}{2}$ in a direction perpendicular to the original direction. The mass A moves after collision in the direction.

A. $\theta = \tan^{-1}(-1/2)$ to the x axis

B. same as that of B

C. opposite to that of B

D. $\theta = \tan^{-1}(1/2)$ to the x axis

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29. A car of mass m starts from rest and accelerates so that the instantaneous power delivered to the car has a constant magnitude

P_0. The instantaneous velocity of this car is proportional to

A. $t^2 P_0$

B. $t^{1/2}$

C. $t^{-1/2}$

D. $t/\sqrt{m}$

Answer: B

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

A. $9J$

B. $6J$

C. $13J$

D. $15J$

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31. The upper half of an inclined plane with inclination ϕ is perfectly smooth while the lower half is rough. A body starting from rest at the top will again come to rest at the bottom if the coefficient of friction for the lower half is given by

A. $\mu = \frac{1}{\tan\theta}$

B. $\mu = \frac{2}{\tan\theta}$

C. $\mu = 2\tan\theta$

D. $\mu = \tan\theta$

Answer: C

Watch Video Solution

32. An explosion blows a rock into three parts. Two parts go off at right angles to each other . These two are $1kg$ first part moving with a velocity of $12ms^{-1}$ and $2kg$ second part moving with a velocity of $8ms^{-1}$. If the third part flies off with a velocity of $4ms^{-1}$. Its mass would be

A. $3kg$

B. $5kg$

C. $7kg$

D. $17kg$

Watch Video Solution

33. A particle of mass 4 m which is at rest explodes into three fragments. Two of the fragments each of mass m are found to move with a speed v each in mutually perpendicular directions. The total energy released in the process of explosion is ....

A. mv^2

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

C. $2mv^2$

D. $4mv^2$

Watch Video Solution

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

A. $475J$

B. $450J$

C. $275J$

D. $250J$

Answer: A

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35. Two springs have force constants K_1 and K_2 , where $K_1 > K_2$. On which spring, more work is downe if

(i) they are stretched by the same force?

(ii) they are stretched by the same amount?

A. $W_P = W_Q, W_P > W_Q$

B. $W_P = W_Q, W_P = W_Q$

C. $W_P = W_Q, W_Q > W_P$

D. $W_P < W_Q, W_Q < W_P$

Watch Video Solution

36. A particle of mass m is driven by a machine that delivers a constant power k watts. If the particle starts from rest the force on the particle at time t is

A. $\left(\sqrt{\frac{mk}{2}}\right)t^{-\frac{1}{2}}$

B. $(\sqrt{mk})t^{-\frac{1}{2}}$

C. $(\sqrt{2mk})t^{-\frac{1}{2}}$

D. $\left(\frac{1}{2}\sqrt{mk}\right)t^{-\frac{1}{2}}$

Watch Video Solution

37. Two point masses 1 and 2 move with uniform velocities $\overrightarrow{v}_1$ and $\overrightarrow{v}_2$, respectively. Their initial position vectors are $\overrightarrow{r}_1$ and $\overrightarrow{r}_2$, respectively. Which of the following should be satisfied for the collision of the point masses?

A. $\overrightarrow{r}_1 - \overrightarrow{r}_2 = \overrightarrow{v}_1 - \overrightarrow{v}_2$

B. $\dfrac{\overrightarrow{r}_1 - \overrightarrow{r}_2}{\left|\overrightarrow{r}_1 - \overrightarrow{r}_2\right|} = \dfrac{\overrightarrow{v}_2 - \overrightarrow{v}_1}{\left|\overrightarrow{v}_2 - \overrightarrow{v}_1\right|}$

C. $\overrightarrow{r}_1 . \overrightarrow{v}_2 = \overrightarrow{r}_2 . \overrightarrow{v}_2$

D. $\overrightarrow{r}_1 \times \overrightarrow{v}_1 = \overrightarrow{r}_2 \times \overrightarrow{v}_2$

Watch Video Solution

38. A ball is projected vertically down with an initial velocity from a height of $20m$ onto a horizontal floor. During the impact it loses 50% of its energy and rebounds to the same height. The initial velocity of its projection is

A. $10ms^{-1}$

B. $14ms^{-1}$

C. $20ms^{-1}$

D. $28ms^{-1}$

Watch Video Solution

39. On a friction surface a block a mass M moving at speed v collides elastic with another block of same mass M which is initially at rest . After collision the first block moves at an angle θ to its initial direction and has a speed $\frac{v}{3}$. The second block's speed after the collision is

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

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

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

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

Watch Video Solution

40. The power of a heart which pumps 5×10^3 of blood per minute at a pressure of $120mm$ of meteury $\left(g = 10ms^{-2}\right.$ and density of $\left.Hg = 13.6 \times 10^3 km^3\right)$ is

A. 1.50

B. 1.70

C. 2.35

D. 3.0

Watch Video Solution

41. A paritcal of mass $10g$ moves along a circle of radius $6.4cm$ with a constant tangennitial acceleration. What is the magnitude of this acceleration . What is the magnitude of this acceleration if the kinetic energy of the partical becomes equal to $8 \times 10^{-4} J$ by the end of the second revolution after the beginning of the motion?

A. $0.2 m / s^2$

B. $0.1 m / s^2$

C. $0.15 m / s^2$

D. $0.18 m / s^2$

Watch Video Solution

42. What is the minimum velocity with which a body of mass m must enter a vertical loop of radius R so that it can complete the loop?

A. $\sqrt{5gR}$

B. $\sqrt{gR}$

C. $\sqrt{2gR}$

D. $\sqrt{3gR}$

Answer: A

Watch Video Solution

43. Acceleration of a particle in x-y plane varies with time as $a = \left(2t\hat{i} + 3t^2\hat{j}\right)m/s^2$ At time $t = 0,$ velocity of particle is $2m/s$ along positive x direction and particle starts from origin. Find velocity and coordinates of particle at $t = 1s.$

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

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

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

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

Watch Video Solution

44. A bullet of mass $10g$ moving horizontally with a velocity of $400ms^{-1}$ strikes a wooden block of mass $2kg$ which is suspended by a light in-extensible string of length $5m$. As a result, the center of gravity of the block is found to rise a vertical distance of $10cm$. The speed of the bullet after it emerges out horizontally from the block will be

A. $120 m s^{-1}$

B. $160 m s^{-1}$

C. $100 m s^{-1}$

D. $80 m s^{-1}$

Answer: A

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

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

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

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

D. $0.5m/s$ and $-0.3m/s$

Answer: D

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46. A partical moves from a point $\left(-2\hat{i}+5\hat{j}\right)$ to $\left(4\hat{i}+3\hat{j}\right)$ when a force of (4hati + 3hatj) N` is applied . How much work has been done by the force?

A. $5J$

B. $2J$

C. $18J$

D. $11J$

Answer: C

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47. A raindrop of mass $1g$ falling from a height of $1km$ hits is the ground with a speed of $50ms^{-1}$ If the resistance force is proportion to the speed of the drop, then the work done by the resistance force is $(\text{Taking } g : 10ms^{-2})$.

A. $-8.25J$

B. $8.75J$

C. $-8.75J$

D. $8.25J$

Watch Video Solution

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

A. 0.4

B. 0.5

C. 0.8

D. 0.25

Answer: D

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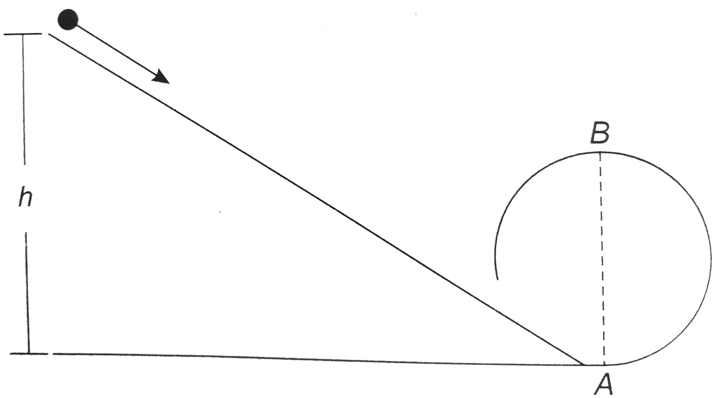
49. A body initially rest and sliding along a frictionless trick from a height h (as shown in the figure) just completes a vertical circle of diameter $AB = D$. The height h is equal to



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

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

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

D. D

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AIIMS Questions

1. A force of $\left(3\hat{i}+4\hat{j}\right)$ Newton acts on a body and it by $\left(3\hat{i}+4\hat{j}\right)m$. The work done by the force is

A. $10J$

B. $12J$

C. $16J$

D. $25J$

Watch Video Solution

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

A. remain as the initial value

B. four times that of initial value

C. twice of the initial value

D. eight times that of initial value

Watch Video Solution

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

:

A. $1.07kJ$

B. $2.14kJ$

C. $2.4kJ$

D. $4.8kJ$

Watch Video Solution

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5. A vertical spring with force constant k is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls vertically on the spring , so that the spring is compressed by a distance d. The net work done in the process is

A. $mg(h+d)+\frac{1}{2}kd^2$

B. $mg(h+d)-\frac{1}{2}kd^2$

C. $mg(h-d)-\frac{1}{2}kd^2$

D. $mg(h-d)+\frac{1}{2}kd^2$

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6. The potential energy of a body is given by $U = A - Bx^2$ (where x is the displacement). The magnitude of force acting on the partical is

A. constant

B. Proportional to x

C. Proportional to x^2

D. Inversely proportional to x

Answer: B

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7. A body of mass m is acceleratad uniformaly from rest to a speed v in a time T . The instanseous power delivered to the body as a function of time is given by

A. $\frac{1}{2}m\frac{v}{t_1}t^2$

B. $m\frac{v}{t_1}t^2$

C. $\frac{1}{2}\left(\frac{mv}{t_1}\right)^2t^2$

D. $\frac{1}{2}m\frac{v^2}{t_1^2}t^2$

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8. A ball is projected with an velocityV_0 at an angle of elevation 30°. Mark of the correct statement.

A. Kinetic energy will be zero at highest point of the trajectory.

B. Vertical component of momentum will be conserved

C. Horizontal component of momentum will be conserved

D. Gravitational potential energy will be minimum at the highest pointof the trajectory

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9. A steel ball of radius $2cm$ is at rest on a frictionless surface. Another ball of radius $4cm$ moving at a velocity of $81cm/\sec$ collides elastically with first ball. After collision the smaller ball moves with speed of

A. $81cm/\sec$

B. $63cm/\sec$

C. $144cm/\sec$

D. None of these

Answer: C

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

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

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

C. $\dfrac{1}{2\sqrt{3}}$

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

Answer: D

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11. A neutron with velocity V strikes a stationary deuterium atom, its kinetic energy changes by a factor of

A. $\dfrac{15}{16}$

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

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

D. None of these

Answer: D

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12. Assertion: In an elasticcollision of two billard balls, the total KE is conservation during the short times of collision of the balls`(i.e., when they are in constant).

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

A. If both assertion and reason are true and reason is a true 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 is and reason are false.

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13. Assertion: Frictional force are conservative forces.

Reason: Potential energy change can be assorciated with frictional forces.

A. If both assertion and reason are true and reason is a true 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 is and reason are false.

Answer: d

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14. Assertion: According to law of conservation of machainical energy change in potential energy is equal and opposite to the change in kinetic energy

Reason: Mechanical energy is not a conserved quantity.

A. If both assertion and reason are true and reason is a true 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 is and reason are false.

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15. Assertion: The instantcous power of an agent is measured as the dot product of

instaneous velocity and the force acting on it at that instant.

Reason: The unit of instaneous power is watt.

A. If both assertion and reason are true and reason is a true 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 is and reason are false.

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16. 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 a true 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 is and reason are false.

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

Reason: If two bodies stick to each other , after colliding , the collision is said to be perfectly elastic.

A. If both assertion and reason are true and reason is a true 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 is and reason are false.

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18. 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 a true 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 is and reason are false.

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19. Assertion: Power of machine gun is determined by body both the number of bullet fired per secondand kinetic energy of bullets.

Reason: Power of any machine is defined as work done(by it) per unit time.

A. If both assertion and reason are true and reason is a true 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 is and reason are false.

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

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

A. If both assertion and reason are true and reason is a true 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 is and reason are false.

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Chapter Test

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

A. $2000W$

B. $45000W$

C. $2250W$

D. $22500W$

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2. A stone of mass $1kg$ tied to a light inextensible string of length $L = \frac{10}{3}m$ is whirling in a circular path of radius L is a vertical plane . If the ratio in the string is 4 and if g is taken to be $10m / \sec^2$, the speed of the stone at the highest point of the circle is

A. $5\sqrt{2}m / s$

B. $20m / s$

C. $5\sqrt{3}m / s$

D. $10m / s$

Answer: D

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

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

B. $2.4, 3.4ms^{-1}$

C. $3.4, 4.8ms^{-1}$

D. $3.4, 6.8ms^{-1}$

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4. A box of mass $25kg$ starts from rest and slide down as inclined plane 8 metre long and 5 meter length . It is found to move at the bottom at $7m/s$. What is the force of friction?

A. $79.6N$

B. $96.6N$

C. $76.6N$

D. $116.6N$

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5. A aprtical moves on a rough horizontal ground with same initial velocity say v_0. If $(3/4)th$ of its kinetic energy is lost in friction in time t_0 , then coefficient of friction between the partical and the ground is:

A. $\frac{v_0}{2gl_0}$

B. $\frac{v_0}{4gl_0}$

C. $\frac{3v_0}{4gl_0}$

D. $\frac{v_0}{gl_0}$

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6. 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. 30

B. 40

C. 10

D. 20

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7. A bullet when fixed at a target with a velocity of $100 ms^{-1}$, penetrates one metre into it. If the bullet is fired with the same velocity as a similar target with a thickness 0.5 metre, then it will emerge from it with a velocity of

A. $50\sqrt{2}m/s$

B. $\frac{50}{\sqrt{2}}m/s$

C. $50m/s$

D. $10m/s$

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8. A bullet having a speed of $100m/see$ crashes through a plank of wood. After passing through a plank , its speed is $80m/s$. Another bullet of the same mass and size , but traveling at $80m/s$ is fired at the plank . The speed of the second bullet after traveling through the plank is (Assume that resistance of the plank is independent of the speed of the bullet) :

A. $10\sqrt{7}ms^{-1}$

B. $20\sqrt{7}ms^{-1}$

C. $30\sqrt{7}ms^{-1}$

D. $20\sqrt{7}ms^{-1}$

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9. A mass of $50kg$ is raised through a certain height by a machine whose efficiency is 90% , the energy spend is $5000J$. If the mass is now released, its KE on hitting the ground shall be:

A. $5000J$

B. $4500J$

C. $4000J$

D. $5500J$

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10. A block is moved from rest through a distance at $4m$ along a string line path . The mass of the block is $5kg$ and the force acting on it is $20N$. If the kinetic energy acquired by the block be $40J$, at what angle to the path is the force acting?

A. 30°

B. 45°

C. 60°

D. None of these

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11. An object of mass m is allowed to fall from rest along a rough inclined plane. The speed of the object on reaching the bottom of the plane is proportional to:

A. m^0

B. m

C. m^2

D. m^{-1}

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12. Given that the position of the body in m is a function of time as follows : $x = 2t^4 + 5t + 4$

The mass of the body is $2kg$. What is the increase in its kinetic energy onesecond after the stert of motion?

A. $168J$

B. $169J$

C. $32J$

D. $144J$

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13. If v be the instantaneous velocity of the body dropped from the top of a power, when

it is located at height h, then which of the following remains constant?

A. $gh + v^2$

B. $gh + \frac{v^2}{2}$

C. $gh - \frac{v^2}{2}$

D. $gh - v^2$

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14. Two springs have their force constant as k_1 and $k_2 (k_1 > k_2)$. When they are streched by the same force.

A. more work is done on B i.e., $W_B > W_A$

B. more work is done on B i.e., $W_A > W_B$

C. work done on A and B are equal

D. work done dependsupon the way in which they are streched.

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15. 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. $2000 litres$

B. $1000 litres$

C. $100 litres$

D. $1200 litres$

Answer: D

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

A. $0.5 MW$

B. $1 MW$

C. $1.5 MW$

D. $2 MW$

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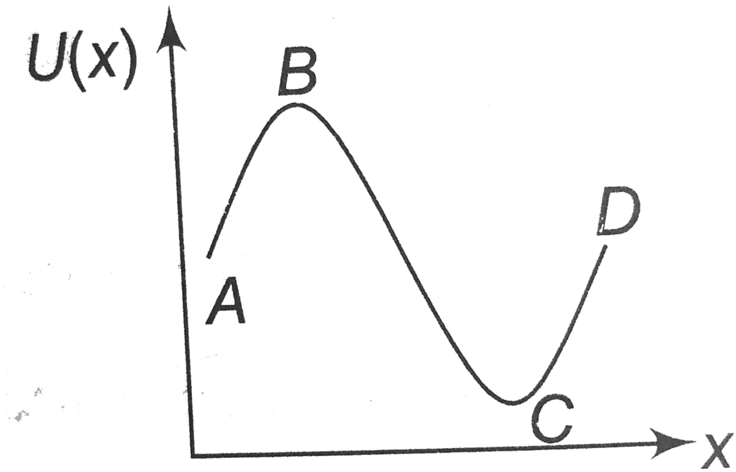
17. The potential energy of a partical veries with distance x as shown in the graph.



The force acting on the partical is zero at

A. C

B. B

C. B and C

D. A and D

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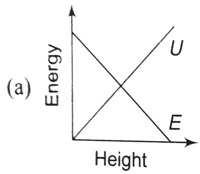
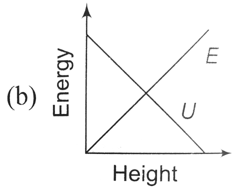
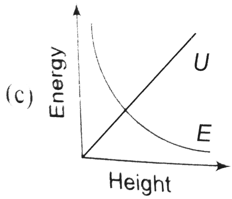
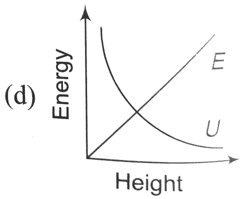
18. Which of the following graph is correct between kinetic energy E, potential energy (U) and height (h) from the ground of the partical

A. 

B. 

C. 

D. 

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19. A ball hits a floor and rebounds after an inelastic collision. In this case

A. The momentum of the ball just after the collision is the same as that justbefore the collision

B. The mechanical energy of the ball remain the same collision

C. The total momentum of the ball and the earth is conserved

D. The total energy of the ball and the earth is conserved

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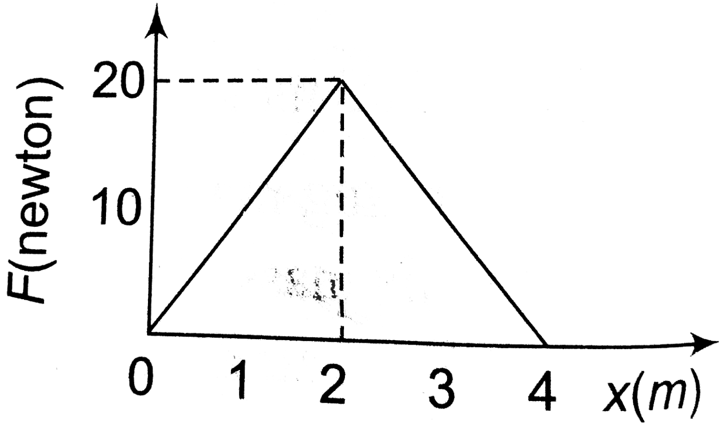
20. The graph between the resistive force F acting on a body and the distance covered by the body is shown in the figure. The mass of the body is $25kg$ and initial velocity is $2m/s$. When the distance covered by the body is $4m$, its kinetic energy would be



A. $50 J$

B. $40 J$

C. $20 J$

D. $10 J$

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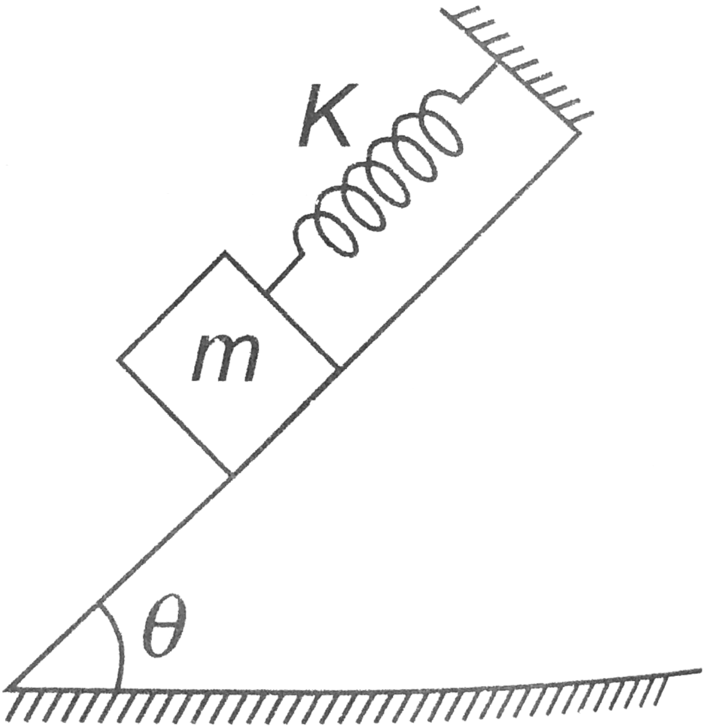
21. In the figure shown, a spring of spring constant K is fixed at on end and the other end is attached to the mass 'm' . The coefficient of friction between block and the inclined plane is μ. The block is released when the spring is in tis natural length. Assuming that the $\theta > \mu$, the maximum speed of the block during the motion is.



A. $(\cos\theta + \mu\sin\theta)g\sqrt{\frac{m}{k}}$

B. $(\cos\theta - \mu\sin\theta)g\sqrt{\frac{m}{k}}$

C. $(\sin\theta + \mu\cos\theta)g\sqrt{\frac{m}{k}}$

D. $(\sin\theta - \mu\cos\theta)g\sqrt{\frac{m}{k}}$

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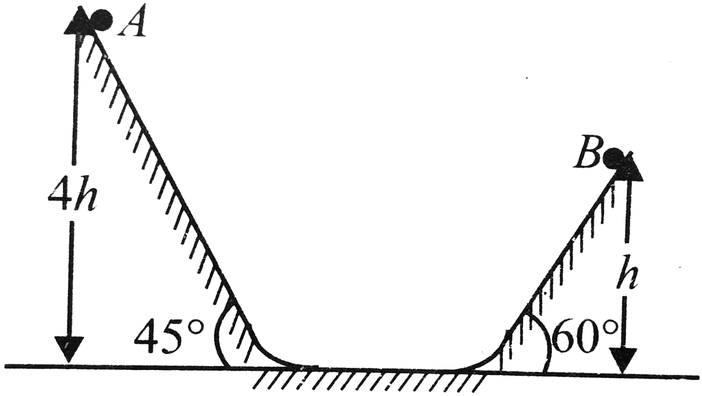
22. Two identical balls A and B are released from the position shown in Fig. They collide elastically with each other on the horizontal portion. The ratio of heights attained by A

and B after collision is (neglect friction)



A. $1:4$

B. $2:1$

C. $4:13$

D. $2:5$

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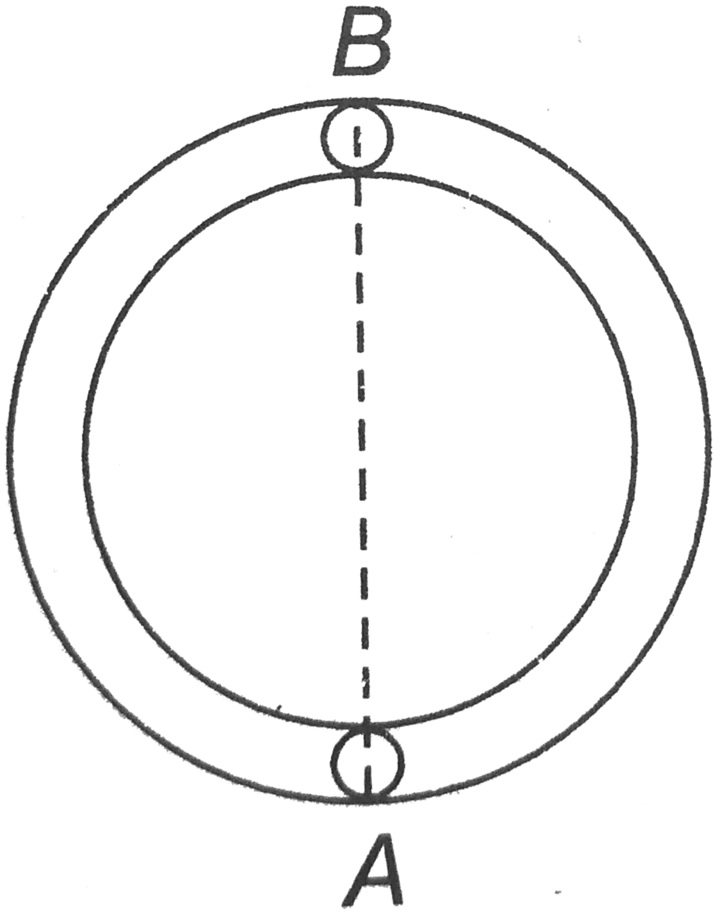
23. Two equal sphere A and b lie on a smooth horizontal circle groove at opposite ends of a diameter. At time $t = 0$, A is projected along the groove and tis first implings on$B$ at time $t = T_1$ and $aga \in attime$t = T_(2). If e is the coefficient of restitution, the ratio T_2 / T_1 is



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

B. $\frac{(2+e)}{2}$

C. $\dfrac{2(e+1)}{e}$

D. $\dfrac{2+e}{e}$

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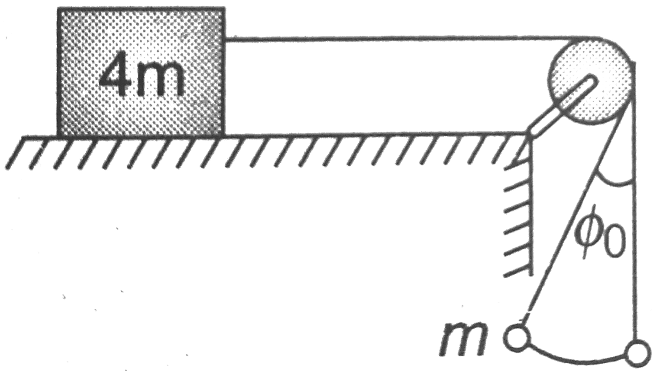
24. Two bodies of mass m and $4m$ are attached with string of length l is excurting oscillations of angular amplitude θ_0 while the other body is at rest . The minimum coefficient of friction between the mass $4m$ and the horizontal surface should be:



A. $\left(\frac{2-\cos\theta_0}{3}\right)$

B. $2\cos^2\left(\frac{\theta_0}{2}\right)$

C. $\left(\frac{1-\cos\theta_0}{2}\right)$

D. $\left(\frac{3-\cos\theta_0}{4}\right)$

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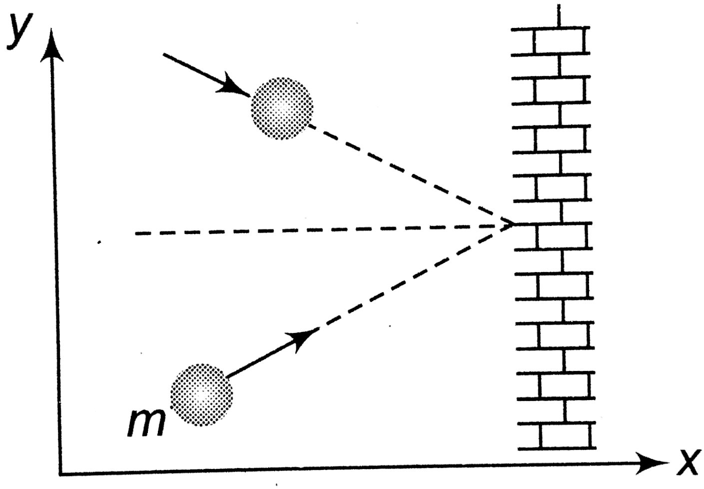
25. A ball of mass m moving with velocity $\overrightarrow{u} = u_x\hat{i} + u_y\hat{j}$ hits a vertical wall of infinite mass as shown in the figure. The ball slips up along the wall for the duration of collision and there is friction between the ball and the wall. Neglect the effect of gravity. Pick up the correct alternative.



A. The wall provides the ball with net impulse along the negative x-axis for the duration of collision.

B. The collision change only the x-component of velocity of thr ball

C. The collision change only the y-component of velocity of thr ball

D. The impulse provides by friction force to the ball for the duration of collision cannot be neglected in comparison to impulse provided by normal reaction

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26. A set of a identical cubical blocks lies at rest parallel to each other along a line on a smooth horizontal surface. The separation between the near surface of any two adjacent blocks is L. The block at one and is given a speed v towards the next one at time $t = 0$. All collisiona are completely inelastic , then the last block starts moving at

A. $\frac{(n-1)L}{v}$

B. $\frac{n(n-1)L}{2v}$

C. $\frac{(n+1)L}{v}$

D. $\dfrac{n(n+1)L}{2v}$

Answer: B

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27. 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 a the correct explanation of assertion.

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

C. If assertion is true but reason is false.

D. If assertion is true and reason are false.

Answer: C

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28. Assertion: According to law of conservation of machainical energy change in potential energy is equal and opposite to the change in kinetic energy

Reason: Mechanical energy is not a conserved quantity.

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

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

C. If assertion is true but reason is false.

D. If assertion is true and reason are false.

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29. 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 a the correct explanation of assertion.

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

C. If assertion is true but reason is false.

D. If assertion is true and reason are false.

Answer: A

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