PHYSICS

BOOKS - MTG GUIDE PHYSICS (HINGLISH)

WORK, ENERGY AND POWER

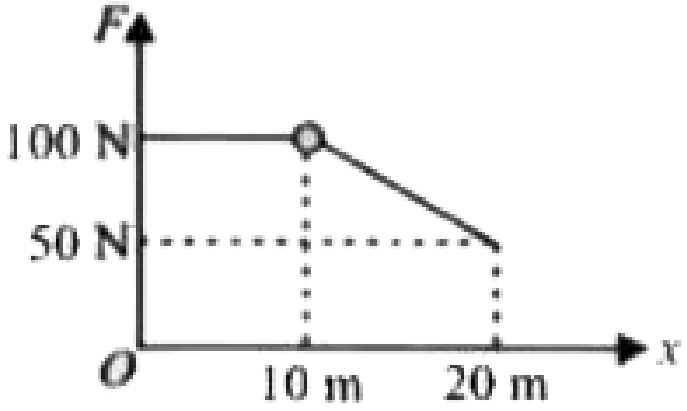
Illustrations

1. A cyclist comes to a studding stop in 10 m. During this process, the force on the cycle due to the road is 200 N and is directly opposed to the

motion. How much work does the road do on the cycle?

View Text Solution

2. A woman pushes a trunk on a railway platform that has a rough surface, She applies a force F over a distance of 20 m as shown by the graph.



Calculate the work done by the woman.

View Text Solution

3. Under the action of a force, a 3 kg body moves such that $x = \frac{t^2}{2}$, where position x is in metre and t is in second. What is the work done by the force in first 3 second?

View Text Solution

4. A particle of mass 100 g is thrown vertically upwards with a speed of 5 m/s. The work done by

the force of gravity during the time the particle goes up is

A. $0.5J$

B. $-0.5J$

C. $-1.25J$

D. $1.25J$

Answer: C

View Text Solution

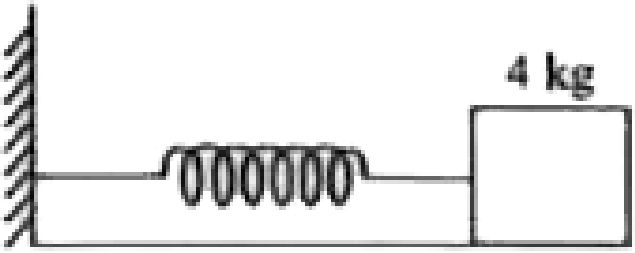
5. A uniform chain of length L and mass m is lying on a smooth table. One-third of its length is hanging vertically down over the edge of the table. How much work need to be done to pull the hanging part back to the table?

View Text Solution

6. A particle is moving in a potential region defined by $U = K\left(x^2 + y^2 + z^2\right)$. Calculate the force acting on the particle.

View Text Solution

7. A block of mass 4 kg while at rest is attached to an unstretched spring. The force constant of spring is $24Nm^{-1}$. If a constant horizontal force of 10 N is applied on the block, the spring gets compressed by 0.5m. What is the speed of the block at this point?



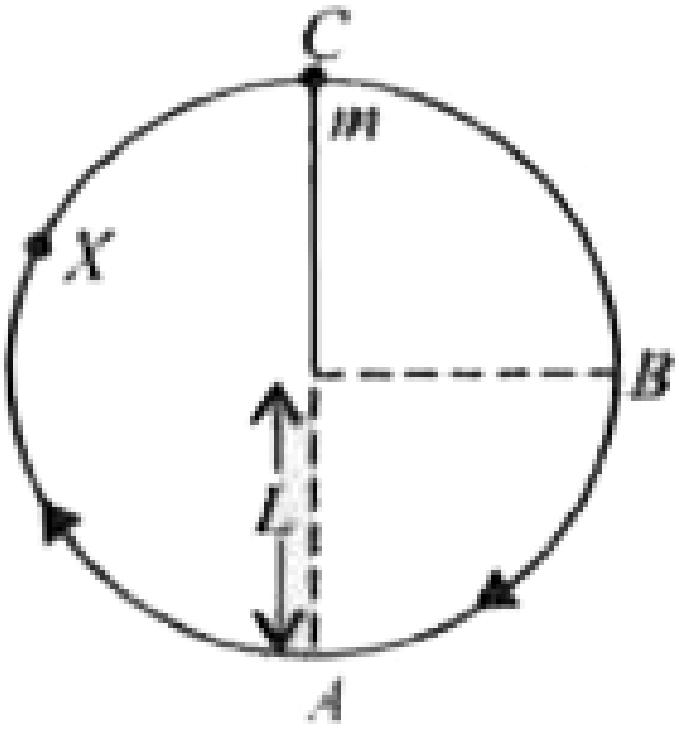
View Text Solution

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

(a) Point B

(b) Point C

(c) Point X



View Text Solution

9. A body of mass m, accelerates uniformly from rest to v_1 in time t_1. Find the instantaneous power delivered to the body as a function of time t.

View Text Solution

10. An elevator can carry a maximum load of 1800 kg (elevator + passengers) is moving up with a constant speed of $2ms^{-1}$. The frictional force opposing the motion is 4000 N. Determine the

minimum horse power delivered by motor to the elevator.

View Text Solution

11. A body of mass m collides elastically with a stationary body of mass M. After collision, m has a speed equal to one-third of its initial speed. Calculate the ratio (m/M).

View Text Solution

12. Two identical bodies A and B moving with velocities 13 m/s and - 15 m/s respectively collide head-on elastically. What will be their velocities after collision?

View Text Solution

13. A massive ball moving with speed v collides with a tiny ball by negligible mass. The collision is elastic. Find the speed with which the second tiny ball will move.

View Text Solution

14. A neutron travelling with a velocity v and kinetic energy E collides head-on elastically with a nucleus of mass number A at rest. Calculate the fraction of total energy retained by the neutron.

View Text Solution

15. A block of mass 0.50 kg is moving with a speed of $2.00ms^{-1}$ on a smooth surface. It strikes another mass of 1.00 kg and then they move together as a single body. What is the energy loss during the collision?

View Text Solution

Neet Cafe Topicwise Practice Questions Work Done By A Constant Force And Variable Force

1. A block of mass m is pulled along a horizontal surface by applying a force at an angle θ with the horizontal. If the block travels with a uniform velocity and has a displacement d and the coefficient of friction is μ, then the work done by the applied force is

A. $\frac{\mu mgd}{\cos\theta + \mu \sin\theta}$

B. $\frac{\mu mgd\cos\theta}{\cos\theta+\mu\cos\theta}$

C. $\frac{\mu mgd\sin\theta}{\cos\theta+\mu\sin\theta}$

D. $\frac{\mu mgd\cos\theta}{\cos\theta-\mu\sin\theta}$

Answer: B

View Text Solution

2. A force $\overrightarrow{F}=3\hat{i}-2\hat{j}+4\hat{k}$ displaces a body from a point A(8, -2, -3) to the point B(-2, 0,6). The work done is

A. 1 unit

B. 2 units

C. 3 units

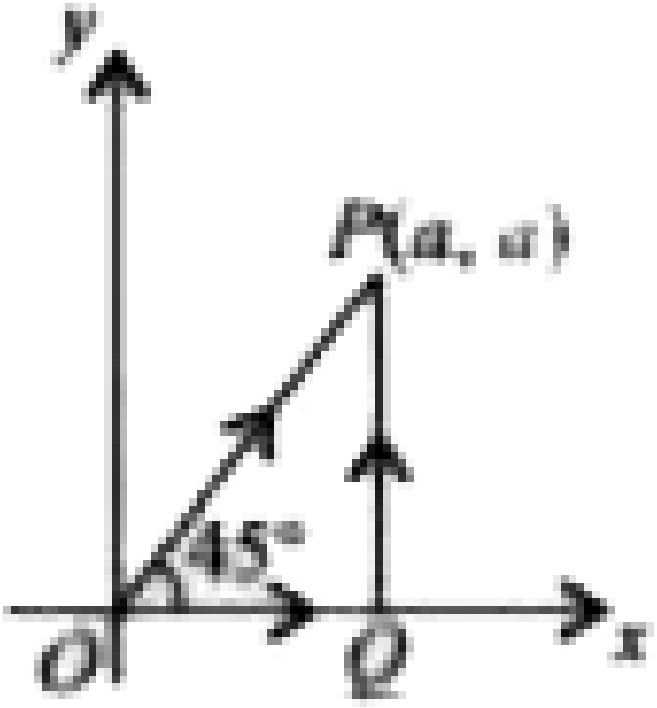
D. 4 units

Answer: B

View Text Solution

3. A particle is moved from (0,0) to (a, a) under a force $\vec{F} = \left(3\hat{i} + 4\hat{j}\right)$ from two paths. Path 1 is OP and path 2 is OQP. Let W and W be the work

done by this force in these two paths.Then



A. W = W2

B. W = 2W

C. W = 2W

D. W = 4W

Answer: A

View Text Solution

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

A. 2J

B. 3.8J

C. 5.2J

D. 2.6 J

Answer: D

View Text Solution

5. A force acts on a 3 g particle in such a way that position of particle as a function of time is given by $x = 3t - 4t^2 + t^3$ where x is in metre and is in sec. The work done during first 4 s is

A. 570 mJ

B. 450 mJ

C. 490 mJ

D. 528 mJ

Answer: D

View Text Solution

6. A particle is displaced from a position $\left(2\hat{i}-\hat{j}+\hat{k}\right)$ to another position $\left(3\hat{i}+2\hat{j}-2\hat{k}\right)$ under the action of the force $\left(2\hat{i}+\hat{j}-\hat{k}\right)$. The work done by the force in arbitrary unit is

A. 8

B. 10

C. 12

D. 16

Answer: A

View Text Solution

7. A body constrained to move in y-direction is subjected to a force given by

$\overrightarrow{F} = \left(-2\hat{i} + 15\hat{j} + 6\hat{k} \right) N.$

The work done by this force in moving the body a distance of 10 m along the y-axis is

A. 20 J

B. 150 J

C. 160 J

D. 190J

Answer: B

View Text Solution

8. The amount of work done in pumping water out of a cubical vessel of height 1 m is nearly

A. 5000 J

B. 10000 J

C. 50 J

D. 10 J

Answer: A

View Text Solution

9. A force $F = -K\left(y\hat{i} + x\hat{j}\right)$, acts on a particle moving in the x-y plane. Starting from the origin, the particle is taken along the positive x-axis to the point (a,0) and then parallel to the y-axis to

the point (a, a). The total work done by the force is

A. $-2Ka^2$

B. $2Ka^2$

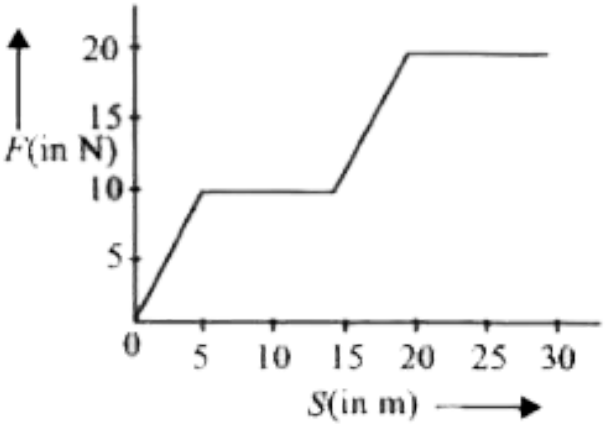
C. $-Ka^2$

D. Ka^2

Answer: C

View Text Solution

10. The work done by a force acting on a body is as shown in the graph. The total work done in covering an initial distance of 20 m is



A. 225 J

B. 200 J

C. 400 J.

D. 175 J

Answer: B

View Text Solution

11. A force F is related to the position of a particle by the relation $F = \left(10x^2\right)N$. The work done by the force when the particle moves from x= 2 m to x = 4 m is

A. $\frac{56}{3}J$

B. $560J$

C. $\frac{560}{3}J$

D. $\frac{3}{560}J$

Answer: C

View Text Solution

12. A man drags a block through 10 mon rough surface $(\mu = 0.5)$. A force of $\sqrt{3}$ kN$act \in gat$ 30^@` to the horizontal. The work done by applied force is

A. zero

B. 15 kJ

C. 5 kJ

D. 10 kJ

Answer: B

View Text Solution

13. A force $F = \left(6\hat{i} + 2\hat{j} - 3\hat{k}\right)$ acts on a particle and produces a displacement of $\overrightarrow{s} = \left(2\hat{i} - 3\hat{j} + x\hat{k}\right)$. If work done is zero, the value of x is

A. -2

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

C. 6

D. 2

Answer: D

View Text Solution

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

A. 25 J

B. 50 J

C. 100 J

D. 150J

Answer: B

View Text Solution

15. A car weighing 500 kg working against a resistance of 500 N accelerates from rest to 20 m

s. in 10 s. The work done by the engine will be (Take $g = 10ms^{-2}$)

A. $1.05 \times 10^5 J$

B. $1.0 \times 10^5 J$

C. $1.5J$

D. $1.5 \times 10^5 J$

Answer: B

View Text Solution

16. A body constrained to move in the z direction, is subjected to a force given by $\overrightarrow{F} = 2\hat{i} + 15\hat{j} + 6\hat{k}N.$

What is the work done by the force in moving the body a distance 10 m along the z-axis?

A. 20 J

B. 150J

C. 60J

D. 80J

Answer: C

View Text Solution

View Text Solution

17. A gardener pushes a lawn roller through a distance 20 m. If he applies a force of 20 kg-wt in a direction inclined at 60° to the ground, the work done by him is

A. 1960 J

B. 196J

C. 1.96J

D. 196 kJ

Answer: A

View Text Solution

18. The work done in time t on a body of mass m which is accelerated from rest to a speed v in time t_1 as a function of time t is given by

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

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

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

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

Answer: D

View Text Solution

View Text Solution

19. A particle of mass 100 g is thrown vertically upwards with a speed of $5ms^{-1}$. The work done by the force of gravity during the time the particle goes up is

A. $-0.5J$

B. $-1.25J$

C. $1.25J$

D. $0.5J$

Answer: B

View Text Solution

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

A. mv^2

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

C. $2mv$

D. Zero

Answer: D

View Text Solution

21. Force of 4 N is applied on a body of mass 20 kg. The work done in 3^{rd} second is

A. 3 joule

B. 2 joule

C. 4 joule

D. 1 joule

Answer: B

View Text Solution

Neet Cafe Topicwise Practice Questions Kinetic Energy

1. The kinetic energy K of a particle moving in a straight line depends on the distances as $K = as^2$. The force acting on the particle is (where a is a constant)

A. 2as

B. as

C. 2a

D. $\sqrt{as^2}$

Answer: A

View Text Solution

2. A body of mass 5 kg is moving with a momentum of $10 kgms^{-1}$. A force of 0.2 N acts on it in the direction of motion of body for 10 s. The increase in its kinetic energy is

A. 2.8 J

B. 3.2 J

C. 3.8 J

D. 4.4 J

Answer: D

View Text Solution

3. A running man has the same kinetic energy as that of a boy of half his mass. The man speeds up by $2ms^{-1}$ and the boy changes his speed by xms^{-1} so that the kinetic energies of the boy and the man are again equal. Then x in ms^{-1} is

A. 1/2

B. $2\sqrt{2}$

C. $\sqrt{2}$

D. 2

Answer: B

View Text Solution

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

A. parabola

B. Ellipse

C. straight line with positive slope

D. straight line with negative slope

Answer: A

View Text Solution

5. Two bodies of masses M and 4M are moving with equal kinetic energy. The ratio of their linear momenta is

A. $1:8$

B. $1:4$

C. $1:2$

D. $4:1$

Answer: C

View Text Solution

6. A man running has half the kinetic energy of a boy of half his mass. The man speeds up by 1 m/s and then has kinetic energy as that of the boy. What were the original speeds of man and the boy ?

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

B. $(\sqrt{2}-1)m/s : 2(\sqrt{2}-1)m/s$

C. $(\sqrt{2}+1)m/s : 2(\sqrt{2}+1)m/s$

D. $\frac{1}{\sqrt{2}}m/s, \sqrt{2}m/s$

Answer: C

View Text Solution

7. An engine pump is used to pump a liquid of density ρ continuously through a pipe of cross-sectional area A. If the speed of flow of the liquid

in the pipe is v, then the rate at which kinetic energy is being imparted to the liquid is

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

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

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

D. $A\rho v$

Answer: A

View Text Solution

8. A car starts from rest and moves on a surface in which the coefficient of friction between the road and the tyres increases linearly with distance (x). The car moves with the maximum possible acceleration. The kinetic energy (E) of the car will depend on x as

A. $E \propto \frac{1}{x^2}$

B. $E \propto \frac{1}{x}$

C. $E \propto x$

D. $E \propto x^2$

Answer: D

View Text Solution

9. If the linear momentum is increased by 50%, then kinetic energy will be increased by

A. 50%

B. 100%

C. 125%

D. 25%

Answer: C

View Text Solution

10. A body of mass 1 kg accelerates uniformly from rest to a velocity of $1ms^{-1}$ in 15 seconds. At what time the kinetic energy of the body will be $\frac{2}{9}J$?

A. 4s

B. 8s

C. 10s

D. 12 s

Answer: C

View Text Solution

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

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

B. 2

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

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

Answer: B

View Text Solution

12. The momentum of a body is increased by 25%.

The kinetic energy is increased by about

A. 25%

B. 5%

C. 56%

D. 38%

Answer: C

View Text Solution

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

A. linearly related to time

B. inversely proportional to time

C. inversely proportional to the square of time

D. a constant

Answer: A

View Text Solution

14. A body of mass 4m at rest explodes into three fragments. Two of the fragments each of mass m move with speed v in mutually perpendicular directions. Total energy released in the process is

A. mv^2

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

C. $2mv^2$

D. $3mv^2$

Answer: B

View Text Solution

15. A bomb of mass 9 kg explodes into two pieces of masses 3 kg and 6 kg. The velocity of mass 3 kg is $16ms^{-1}$. The kinetic energy of mass 6 kg in joule is

A. 96

B. 384

C. 192

D. 768

Answer: C

View Text Solution

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

A. 100%

B. 200%

C. 3

D. 400%

Answer: C

View Text Solution

17. Two bodies of masses 4 kg and 5 kg are moving with equal momentum. Then the ratio of their respective kinetic energies is

A. $4:5$

B. $2:1$

C. $1:3$

D. $5:4$

Answer: D

View Text Solution

18. A particle of mass 2 mg moves with constant speed and is found to pass two points 5.0 m apart in a time interval of 5 ms. The kinetic energy of the particle is

A. $1.0J$

B. $2.0J$

C. $3.0J$

D. $4.0J$

Answer: A

View Text Solution

Neet Cafe Topicwise Practice Questions Work Energy Theorem

1. Consider a car moving along a straight horizontal road with a speed of 72 km/h. If the coefficient of static friction between road and tyres is 0.5, the shortest distance in which the car can be stopped is

A. 30 m

B. 40 m

C. 72 m

D. 20 m

Answer: B

View Text Solution

2. The displacement x and time for a particle are related to each other as $t = \sqrt{x} + 3$. What is work done in first six seconds of its motion?

A. 6J

B. zero

C. 4J

D. 2J

Answer: B

View Text Solution

3. A particle of mass m at rest is acted upon by a force P for a time t. Its kinetic energy after an interval t is

A. $\frac{P^2t^2}{m}$

B. $\frac{P^2t^2}{2m}$

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

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

Answer: B

View Text Solution

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

A. $-7J$

B. Zero

C. $+7J$

D. $+19J$

Answer: C

View Text Solution

5. A vehicle of mass m is moving on a rough horizontal road with momentum p. If the coefficient of friction between the tyres and the road be μ, then the stopping distance is

A. $\frac{p}{2\mu mg}$

B. $\frac{p^2}{2\mu mg}$

C. $\frac{p}{2\mu m^2 g}$

D. $\frac{p^2}{2\mu m^2 g}$

Answer: D

View Text Solution

6. If K_i and K_f are the initial and final values of kinetic energy of a body respectively, then the work done by the net force on the body is equal to

A. $\frac{K_f K_i}{K_f - K_i}$

B. $K_f + K_i$

C. $\frac{K_f + K_i}{2}$

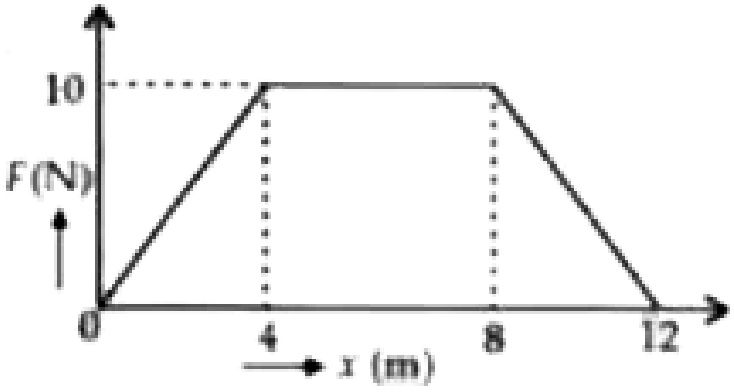
D. $K_f - K_i$

Answer: D

View Text Solution

7. A particle of mass 0.1 kg is subjected to a force which varies with distance as shown in figure. If it starts its journey from rest at x = 0, its velocity at

x = 12 m is



A. $0m/s$

B. $40m/s$

C. $20\sqrt{2}m/s$

D. $20m/s$

Answer: B

View Text Solution

8. A block of mass 5 kg is resting on a smooth surface. At what angle a force of 20 N be acted on the body so that it will acquired a kinetic energy of 40 J after moving 4 m?

A. 30°

B. 45°

C. 60°

D. 120°

Answer: C

View Text Solution

9. A block of mass 10 kg is moving in x-direction with a constant speed of $10ms^{-1}$. It is subjected to a retarding force $F = -0.1xJm^{-1}$ during its travel from x = 20 m to x = 30 m. Its final kinetic energy will be

A. 475 J

B. 450 J

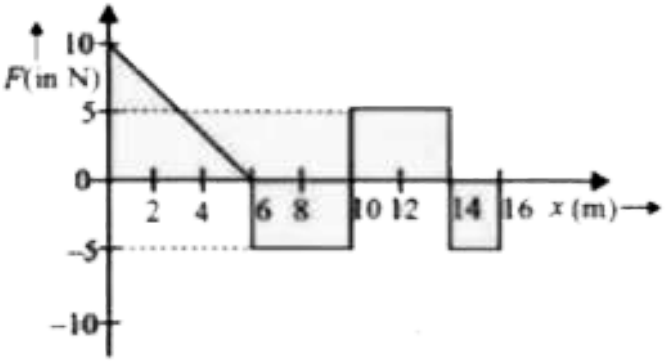
C. 275 J

D. 250 J

Answer: A

View Text Solution

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



A. 45 J

B. 30 J

C. 70J

D. 20 J

Answer: A

View Text Solution

11. According to work-energy theorem, the work done by the net force on a particle is equal to the change in its

A. kinetic energy

B. potential energy

C. linear momentum

D. angular momentum

Answer: A

View Text Solution

Neet Cafe Topicwise Practice Questions Power

1. Water is falling from a height of 100 m at the rate of 100 kg/sec. The power delivered to the turbine is approximately equal to

A. 100 kW

B. 10 kW

C. 1 kW

D. 1000 kW

Answer: A

View Text Solution

2. A particle moves with a velocity $\left(5\hat{i} - 3\hat{j} + 6\hat{k}\right)$ m/s under the influence of a constant force $\overrightarrow{F} = \left(10hsti + 10\hat{j} + 20\hat{k}\right)N.$

The instantaneous power applied to the particle is

A. 200 W

B. 40 W

C. 140 W

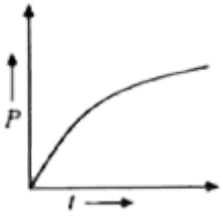
D. 170 W

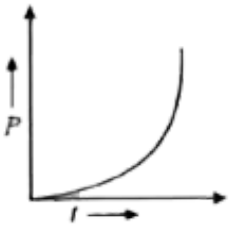
Answer: C

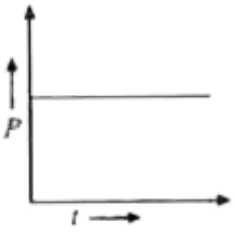
View Text Solution

3. A motor drives a body along a straight line with a constant force. The power P developed by the motor must vary with time t as

A. 

B. 

C. 

D. 

Answer: A

View Text Solution

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

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

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

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

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

Answer: D

View Text Solution

5. A force of $\left(7\hat{i}+6\hat{k}\right)$ newton makes a body move on a rough plane with a velocity of $\left(3\hat{j}+4\hat{k}\right)ms^{-1}$. The power in watt is

A. 24

B. 34

C. 21

D. 45

Answer: A

View Text Solution

6. A body of mass 2 kg starts from rest and moves in a uniform acceleration. It acquires a velocity of $20ms^{-1}$ in 4 s. The power exerted on the body at 2 s in watt is

A. 50

B. 100

C. 150

D. 200

Answer: B

View Text Solution

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

A. 12.3 kW

B. 7.0 kW

C. 8.1 kW

D. 10.2 kW

Answer: C

View Text Solution

8. Power supplied to a particle of mass 2 kg varies with time as $P = \frac{3t^2}{2}$, where t is in seconds. If

velocity 2 of particle at t = 0 is v = 0, the velocity of particle at t = 2 s will be

A. $1m/s$

B. $4m/s$

C. $2m/s$

D. $272m/s$

Answer: C

View Text Solution

9. An engine pumps up 1 quintal of coal from a mine 100 m deep in 0.5 s. If its efficiency is 60%, power of the engine is (Take $g = 10m/s^2$)

A. 330 kW

B. 100 kW

C. 200 kW

D. 400 kW

Answer: A

View Text Solution

10. A machine gun fires six bullets per second into a target. The mass of each bullet is 3 g and the speed 500 m/s. The power delivered to the bullets is

A. 1.5 kW

B. 2.25 kW

C. 0.75 kW

D. 375 W

Answer: B

View Text Solution

11. How many 2.5 kg bricks can man carry up a staircase 3.6 m high in one hour if he works at an average rate of 9.8 watt?

A. 800

B. 200

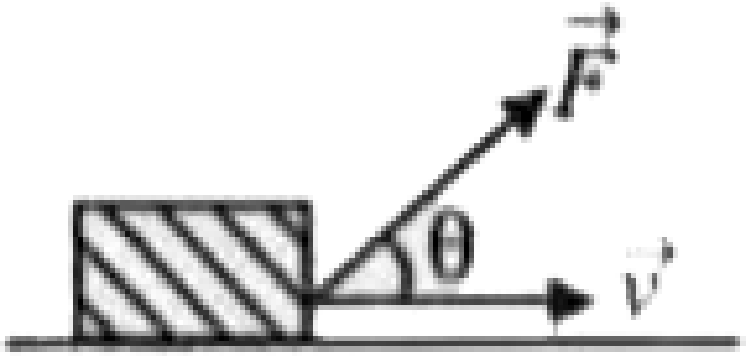
C. 600

D. 400

Answer: D

View Text Solution

12. 40V A constant force $\vec{F}$ is acting on a body of mass m makes it move with constant velocity $\vec{v}$ as shown in the M figure. The power P exerted is



A. $F\cos\theta v$

B. $\dfrac{F\cos\theta}{mg}$

C. $\dfrac{Fmg\cos\theta}{v}$

D. $\dfrac{mg\sin\theta}{F}$

Answer: A

View Text Solution

13. A body is initially at rest. It undergoes one dimensional motion with constant acceleration. The power delivered to it at time t is proportional to

A. $t^{1/2}$

B. t

C. $t^{3/2}$

D. t^2

Answer: B

View Text Solution

14. A train of weight $10^7 N$ is running on a level track with uniform speed of $36 kmh^{-1}$. The frictional force is 0.5 kg f per quintal. If $g = 10 ms^{-2}$, power of engine is

A. 500 kW

B. 50 kW

C. 5 kW

D. 0.5 kW

Answer: A

View Text Solution

15. A force Facting on a body depends on its displacement Sas $F \propto S^{-1/3}$. The power delivered by F will depend on displacement as

A. $S^{2/3}$

B. $S^{1/2}$

C. S

D. S°

Answer: D

View Text Solution

16. The height of the dam, in an hydroelectric power station is 10 m. In order to generate 1 MW of electric power, the mass of water (in kg) that must fall per second on the blades of the turbine is

A. 10^6

B. 10^5

C. 10^3

D. 10^4

Answer: D

View Text Solution

17. The power of a water pump is 2 kW. If $g = 10ms^{-12}$, the amount of water it can raise in one minute to a height of 10 m is

A. 2000 litre

B. 1000 litre

C. 100 litre

D. 1200 litre

Answer: D

View Text Solution

18. A body is moved along a straight line by a machine delivering a constant power. The

distance moved by the body in time t is proportional to

A. $t^{3/4}$

B. $t^{1/2}$

C. $t^{1/4}$

D. $t^{1/2}$

Answer: B

View Text Solution

19. The SI unit of power is

A. joule

B. erg

C. newton

D. watt

Answer: D

View Text Solution

20. A 500 kg car, moving with a velocity of $36kmh^{-1}$ on a straight road undirectionally, doubles its velocity in one minute. The power

delivered by the engine for doubling the velocity is

A. 750 W

B. 1050 W

C. 1150 W

D. 1250 W

Answer: D

View Text Solution

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

A. 4 W

B. 5 W

C. 2 W

D. 8 W

Answer: A

View Text Solution

22. The kilowatt-hour is the unit of

A. time

B. power

C. energy

D. force

Answer: C

View Text Solution

Neet Cafe Topicwise Practice Questions Potential Energy And Conservative Forces

1. One man takes 1 minute to raise a box to a height of 1 metre and another man takes $\frac{1}{2}$ minute to do so. The energy of the two is

A. different

B. same

C. energy of the first is more

D. energy of the second is more

Answer: B

View Text Solution

2. An elastic spring of unstretched length L and force constant k is stretched by a small length x. It is further stretched by another small length y. The work done in the second stretching is

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

B. $\frac{1}{2}k\left(x^2+y^2\right)$

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

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

Answer: D

View Text Solution

3. The potential energy of a particle of mass 5 kg moving in the x-y plane is given by $U = (-7x + 24y)J$, x and y being in metre. If the particle starts from origin, then the speed of particle at t = 2 s is

A. 5 m/s

B. 14 m/s

C. 17.5 m/s

D. 10 m/s

Answer: D

View Text Solution

View Text Solution

4. 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 additional distance S will be

A. 30

B. 40

C. 10

D. 20

Answer: A

View Text Solution

5. Two springs of spring constants 1000 N/m and 2000 N/m are stretched with same force. They will have potential energy in the ratio of

A. $2:1$

B. $2^2:1^2$

C. $1:2$

D. $1^2:2^2$

Answer: A

View Text Solution

6. The potential energy for a conservative system is given by

$U = ax^2 - bx$

where a and b are positive constants. The law of the force governing the system is

A. F = constant

B. $F = bx - 2a$

C. $F = b - 2ax$

D. $F = 2ax$

Answer: C

View Text Solution

7. If the potential energy of a gas molecule is $U = \frac{M}{r^6} - \frac{N}{r^{12}}M$ and N being positive constants, then the potential energy at equilibrium must be

A. zero

B. $\frac{M^2}{4N}$

C. $\frac{N^2}{4M}$

D. $\frac{MN^2}{4}$

Answer: B

View Text Solution

8. A spring of force constant $800Nm^{-1}$has an extension of 5 cm. The work done in extending it from 5 cm to 15 cm is

A. 16J

B. 8J

C. 32J

D. 24 J

Answer: B

View Text Solution

9. Two springs A and B are identical but A is harder than B $(k_A > k_B)$. Let Wand Wg represent the work done when the springs are stretched through the same distance and $W_{\dot{A}}$ and $W_{\dot{B}}$ are the work done when these are stretched by equal forces, then which of the following is true?

A. $W_A > W_B$ and $W_{\dot{A}} = W_{\dot{B}}$

B. $W_A > W_B$ and $W_{\dot{A}} < W_{\dot{B}}$

C. $W_A > W_B$ and $W_{\dot{A}} > W_{\dot{B}}$

D. $W_A < W_B$ and $W_{\dot{A}} < W_{\dot{B}}$

Answer: B

View Text Solution

10. Two springs A and B are identical except that A is stiffer than B i.e., $k_A > k_B$. If the two springs are stretched by the same force, then

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

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

C. work done on A and B are equal

D. work done depends upon the way in which they are stretched

Answer: A

View Text Solution

11. Which one of the following is not a conservative force?

A. Gravitational force

B. Electrostatic force between two charges

C. Magnetic force between two magnetic dipoles

D. Frictional force

Answer: D

View Text Solution

12. An 8 kg metal block of dimensions $16cm \times 8cm \times 6cm$ is lying on a table with its

face of largest area touching the table. If $g = 10ms^{-2}$, the minimum amount of work done in making it stand with its length vertical is

A. $0.4J$

B. $6.4J$

C. $4J$

D. $12.8J$

Answer: C

View Text Solution

13. A spring, which is initially in its unstretched condition, is first stretched by a length x and then again by a further length x. The work done in the first case is W_1 and in the second case is W_2. Then

A. $W_2 = W_1$

B. $W_2 = 2W_1$

C. $W_2 = 3W_1$

D. $W_2 = 4W_1$

Answer: C

View Text Solution

View Text Solution

14. A spring of spring constant $5 \times 10^3 . Nm^{-1}$ is stretched initially by 5 cm from the unstretched position. The work required to stretch it further by another 5 cm is

A. 6.25 Nm

B. 1250 Nm

C. 18.75 Nm

D. 25.00 Nm

Answer: C

View Text Solution

15. If two springs A and B with spring constants 2k and k, are stretched separately by same suspended weight, then the ratio between the work done in stretching A and B is

A. $1:2$

B. $1:4$

C. $4:1$

D. $2:1$

Answer: A

View Text Solution

16. The potential energy of a conservative system is given by $V(x) = \left(x^2 - 3x\right)$ joule. Then its equilibrium position is at

A. $x = 1.5m$

B. $x = 2m$

C. $x = 2.5m$

D. $x = 3m$

Answer: A

View Text Solution

17. Choose the incorrect statement.

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

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

C. Frictional force is non-conservative.

D. All the central forces are non-conservative.

Answer: D

View Text Solution

18. A rod of mass m and length / is made to stand at an angle of 60° with the vertical. Potential energy of the rod in this position is

A. mgl

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

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

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

Answer: D

View Text Solution

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

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

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

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

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

Answer: B

View Text Solution

Neet Cafe Topicwise Practice Questions Conservation Of Mechanical Energy

1. A ball falls under gravity from a height 10 m with an initial velocity v_0. It hits the ground, loses 50% of its energy in collision and it rises to the same height, what is the value of v_0?

A. 14 m/s

B. 7 m/s

C. 28 m/s

D. 9.8 m/s

Answer: A

View Text Solution

2. The potential energy of a 1 kg particle free to move along the x-axis is given by

$$V(x)\left(\frac{x^4}{4}-\frac{x^2}{2}\right)J$$

The total mechanical energy of the particle is 2 J. Then, the maximum speed (in m/s) is

A. 2

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

C. $\sqrt{2}$

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

Answer: B

View Text Solution

3. A body is allowed to fall freely under gravity from a height of 10 m. If it loses 25% of its energy

on impact with the ground, to what height will it rise after one impact?

A. 2.5 m

B. 5.0 m

C. 7.5 m

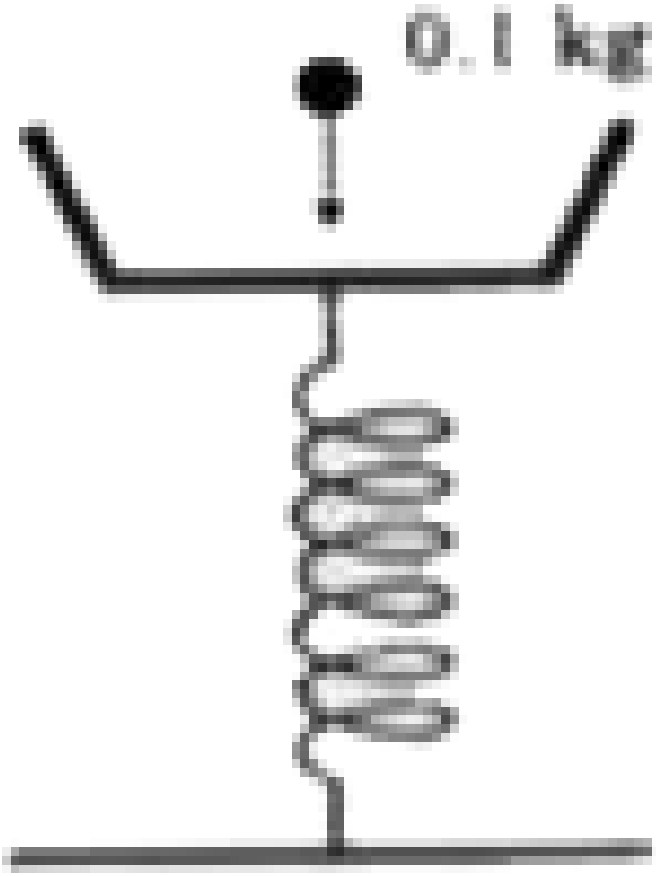
D. 9.0 m

Answer: C

View Text Solution

4. A massless platform is kept on a light elastic spring, as shown in the figure. When particle of mass 0.1 kg is dropped on the pan from a height of 0.24 m, the particle strikes the pan, and the spring is compressed by 0.01 m. From what height should the particle be dropped to cause a

compression of 0.04 m?



A. 0.96 m

B. 2.96 m

C. 3.96 m

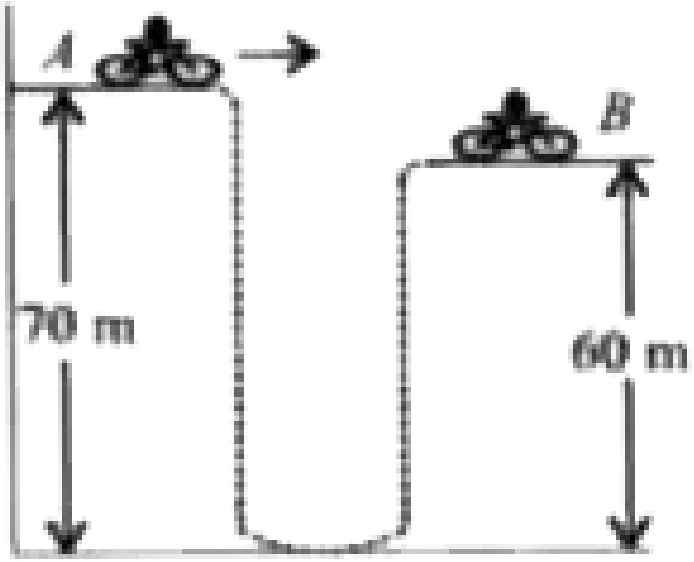
D. 0.48 m

Answer: C

View Text Solution

5. A motor cyclist is trying to jump across a path as shown by driving horizontally off a cliff A at a speed of $5ms^{-1}$. Ignore air resistance and take $g = 10ms^{-2}$. The speed with which he touches

the cliff B is



A. $2.0ms^{-1}$

B. $12ms^{-1}$

C. $25ms^{-1}$

D. $15ms^{-1}$

Answer: D

View Text Solution

6. A girl in a swing is 2.5 m above ground at the maximum height and at 1.5 m above the ground at the lowest point. Her maximum velocity in the swing is $(g = 10ms^{-2})$

A. $5\sqrt{2}ms^{-1}$

B. $2\sqrt{5}ms^{-1}$

C. $2\sqrt{3}ms^{-1}$

D. $3\sqrt{2}ms^{-1}$

Answer: B

View Text Solution

7. A particle is released from a height h. At a certain height, its kinetic energy is two times its potential energy. Height and speed of the particle at that instant are

A. $\frac{h}{3}\sqrt{\frac{2gh}{3}}$

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

C. $\frac{2h}{3}\sqrt{\frac{2gh}{3}}$

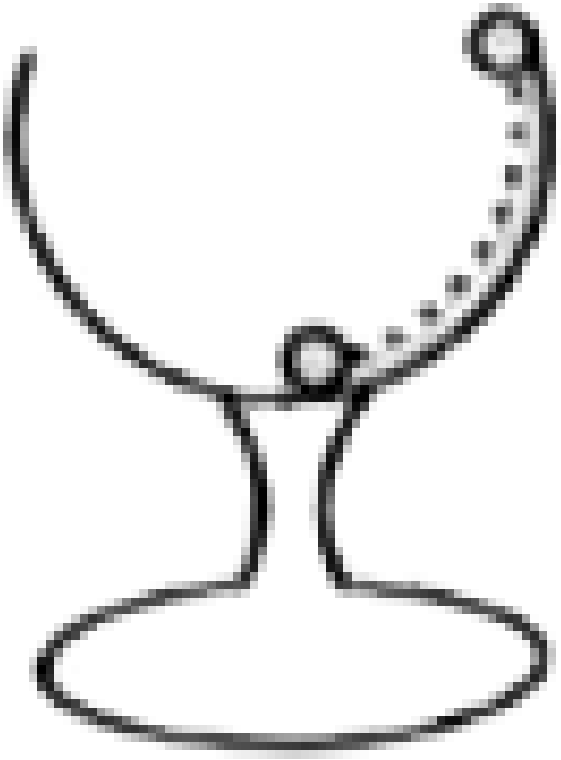
D. $\frac{h}{3}\sqrt{2gh}$

Answer: B

View Text Solution

8. A 2 g ball of glass is released from the edge of a hemispherical cup whose radius is 20 cm. What is the speed of the ball when it reaches the bottom

of the cup? (Take $g = 10ms^{-2}$)



A. $2ms^{-1}$

B. $4ms^{-1}$

C. $8ms^{-1}$

D. $10ms^{-1}$

Answer: A

View Text Solution

9. A body of mass 1 kg falls from rest through a distance of 200 m and acquires a speed of 50 m/s. Work done against friction of air is (Take $g = 10m/s^2$)

A. 700 J

B. 1250 J

C. 750 J

D. 1960 J

Answer: C

View Text Solution

10. A stone of mass 2 kg is projected upward with kinetic energy of 98 J. The height at which the kinetic energy of the stone becomes half its original value, is given by

A. 5 m

B. 2.5 m

C. 1.5 m

D. 0.5 m

Answer: B

View Text Solution

11. A stone is projected vertically up to reach maximum height h. The ratio of its kinetic energy to its potential energy at a heighth $\frac{4}{5}h$, will be

A. $5:4$

B. $4:5$

C. $1:4$

D. $4:1$

Answer: C

View Text Solution

12. Energy required to break one bond in DNA is

A. $10^{-10}J$

B. $10^{-18}J$

C. $10^{-7} J$

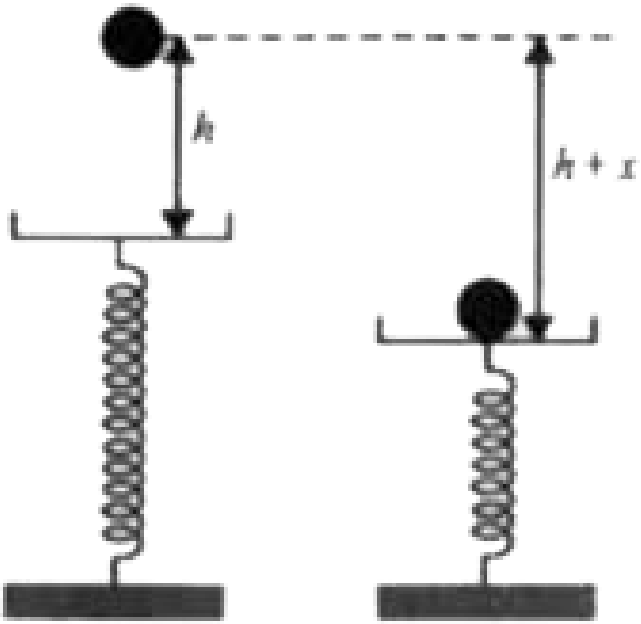
D. $10^{-20} J$

Answer: D

View Text Solution

13. A ball of mass m is dropped from a heighth on a platform fixed at the top of a vertical spring, as shown in figure. The platform is depressed by a

distance x. Then the spring constant is



A. $\dfrac{mg}{(h+x)}$

B. $\dfrac{mg}{(h+2x)}$

C. $\dfrac{2mg(h+x)}{x^2}$

D. $\dfrac{mg}{(2h+x)}$

Answer: C

View Text Solution

14. A ball dropped from a height of 2 m rebounds to a height of 1.5 m after hitting the ground. Then the percentage of energy lost is

A. 25%

B. 30%

C. 50%

D. 100%

Answer: A

View Text Solution

15. The average energy consumed by a human being in a day

A. 2400 cal

B. 2400 J

C. 2400 kJ

D. 2400 kcal

Answer: D

View Text Solution

16. A particle is released from a height S. At certain height its kinetic energy is three times its potential energy. The height and speed of the particle at that instant are respectively

A. $\frac{S}{4}, \frac{3gS}{2}$

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

C. $\frac{S}{2} \frac{\sqrt{3gS}}{S}$

D. $\frac{S}{4} \frac{\sqrt{3gS}}{S}$

Answer: D

View Text Solution

17. A spring gun of spring constant $90Ncm^{-1}$ is compressed 12 cm by a ball of mass 16 g. If the trigger is pulled, the velocity of the ball is

A. $50ms^{-1}$

B. $40ms^{-1}$

C. $60ms^{-1}$

D. $90ms^{-1}$

Answer: D

View Text Solution

Neet Cafe Topicwise Practice Questions Motin In A Vertical Circle

1. A stone of mass 1 kg tied to a light inextensible string of length $L = \frac{5}{3}m$, is whirling in a vertical circle of radius L. If the ratio of the maximum and minimum tension in the string is 4 and $g = 10m/s^2$, the speed of stone at the highest point of the circle is

A. $5m/s$

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

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

D. $10m/s$

Answer: C

View Text Solution

2. The velocity of a body moving in a vertical circle of radius r is $\sqrt{7gr}$ at the lowest point of the

circle. What is the ratio of maximum and minimum tension ?

A. $4:1$

B. $\sqrt{7}:1$

C. $3:1$

D. $2:1$

Answer: A

View Text Solution

3. An object is tied to a string and rotated in a vertical circle of radius r. Constant speed is maintained along the trajectory. If $\frac{T_{\max}}{T_{\min}} = 2$, where, $T_{\max}$ = maximum tension and $T_{\min}$ = minimum tension, then $\frac{v^2}{rg}$ is

A. 1

B. 2

C. 3

D. 4

Answer: C

View Text Solution

4. A body of mass 1 kg is moving in a vertical circular path of radius 1 m. The difference between the kinetic engeries at the highest and lowest position is

A. 20 J

B. 10 J

C. $4\sqrt{5}J$

D. $10\left(\sqrt{5}-1\right)J$

Answer: A

View Text Solution

5. A body of mass m tied to a string is moved in a vertical circle of radius r. The difference in tensions at the lowest point and the highest point is

A. 2mg

B. 6mg

C. 4mg

D. 8mg

Answer: B

View Text Solution

6. A fighter aircraft is looping in a vertical plane. The minimum velocity at the highest point is (given r = radius of the loop)

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

B. $\sqrt{2gr}$

C. $\sqrt{gr}$

D. $\sqrt{3gr}$

Answer: C

View Text Solution

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

A. 7 kg

B. 17 kg

C. 3 kg

D. 5 kg

Answer: D

View Text Solution

Neet Cafe Topicwise Practice Questions Collisions

1. The coefficient of restitution for a perfectly elastic collision is

A. 1

B. zero

C. ∞

D. none of these

Answer: A

View Text Solution

2. A sphere of mass m moving with a constant velocity u hits another stationary sphere of the same mass and of coefficient of restitution (e). The ratio of velocities of the two spheres, after collision, will be

A. $\frac{e}{(e+1)}$

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

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

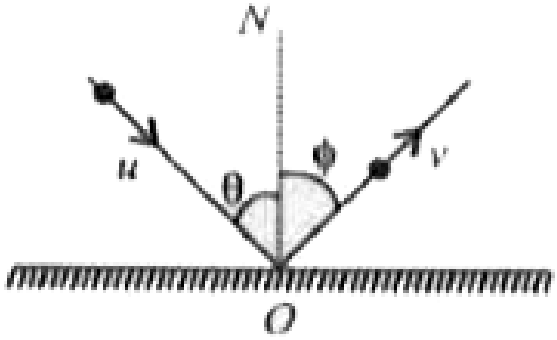
D. $\left(\frac{e+1}{e}\right)$

Answer: B

View Text Solution

3. A particle strikes a horizontal frictionless floor with a speed u at an angle θ with the vertical, and rebounds with a speed v at an angle ϕ with

vertical. The coefficient of restitution between the particle and floor is e. The magnitude of v is



A. eu

B. $(1-e)u$

C. $u\sqrt{e^2\sin^2\theta+\cos^2\theta}$

D. $u\sqrt{\sin^2\theta+e^2\cos^2\theta}$

Answer: D

View Text Solution

4. A ball moving with a velocity of 6 m/s strikes an identical stationary ball. After collision each ball moves at angle of 30° with the original line of motion. Assuming that the collision is elastic, what are the speeds of the balls after the collision?

A. $\frac{\sqrt{3}}{2} m/s, 2\sqrt{3} m/s$

B. $3m/s, 2\sqrt{3} m/s$

C. $2\sqrt{3} m/s, 2\sqrt{3} m/s$

D. $\sqrt{3}\frac{m}{s}, \sqrt{3} m/s$

Answer: C

View Text Solution

5. Two masses m, and m, moving with velocities v_a and v_b in opposite direction collide elastically and after the collision m_a and m_b move with velocities v_b and v_a respectively. Then the ratio $\frac{m_a}{m_b}$ is

A. $\left(\frac{v_a - v_b}{v_a + v_b}\right)$

B. $\frac{v_a + v_b}{v_a + v_b}$

C. 1

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

Answer: C

View Text Solution

6. A particle falls from a height h on a fixed horizontal plate and rebounds. If e is the coefficient of restitution, the total distance travelled by the particle before it stops rebounding is

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

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

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

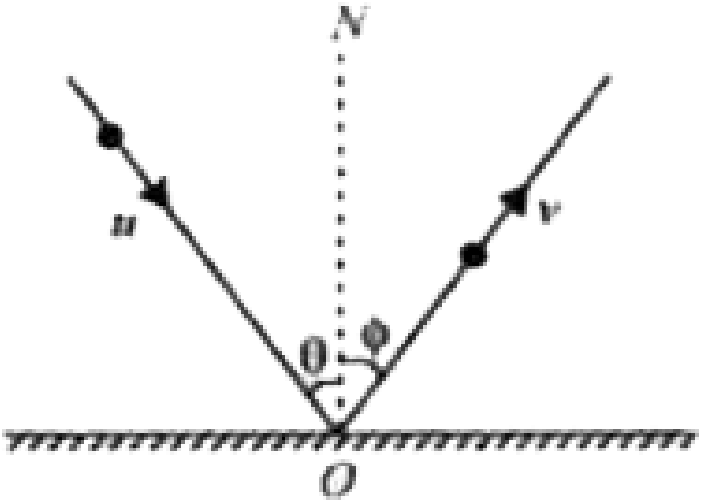
D. $\frac{h(1+e^2)}{2(1-e^2)}$

Answer: A

View Text Solution

7. A particle strikes a horizontal frictionless floor with a speed u at an angle θ with the vertical, and rebounds with a speed v at an angle ϕ with vertical. The coefficient of restitution between the

particle and floor is e. The angle ϕ is equal to



A. θ

B. $(1+e)\theta$

C. $\tan^{-1}(e\tan\theta)$

D. $\tan^{-1}\left(\frac{1}{e}\tan\theta\right)$

Answer: D

View Text Solution

8. A body of mass m moving with a uniform velocity of $40ms^{-1}$ collides with another body of mass m, at rest and then the two together begin to move with a uniform velocity of $30ms^{-1}$ The ratio of their masses $\left(\frac{m_1}{m_2}\right)$ is

A. 0.75

B. 0.33

C. 3

D. 1.33

Answer: C

View Text Solution

9. Particle A makes a perfectly elastic collision with another particle B at rest. They fly apart in opposite directions with equal speeds. The ratio of their masses m_A / m_B is

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

B. $\frac{1}{3}$

C. $\frac{1}{4}$

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

Answer: B

View Text Solution

10. A bullet of mass M hits a block of mass M.. The transfer of energy is maximum, when

A. $M. = M$

B. $M. = 2M$

C. $M. < < M$

D. $M. > > M$

Answer: A

View Text Solution

11. A ball impinges directly on a similar ball at rest. The first ball is brought to rest by the impact. If half of the kinctic energy is lost by impact, the value of coefficient of restitution is

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

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

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

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

Answer: C

View Text Solution

12. A ball of mass m moving with a speed v makes a head on collision with an identical ball at rest. The kinetic energy after collision of the balls is three fourth of the original kinetic energy. The coefficient of restitution is

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

B. $\frac{1}{3}$

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

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

Answer: C

View Text Solution

13. A ball is dropped on to a horizontal plate from a height h = 9 m above it. If the coefficient of restitution is e = 1/2, the total distance travelled before the ball comes to rest is

A. 10 m

B. 15 m

C. 20 m

D. 25 m

Answer: B

View Text Solution

14. Two identical spheres P and I lie on a smooth horizontal circular groove at opposite ends of diameter. Pis projected along the groove and at

the end of time t, impinges on Q. If e is coefficient of restitution, the second impact will occur after a shortest time of

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

B. $\frac{\pi t}{e}$

C. $\frac{t}{e}$

D. $\frac{2t}{e}$

Answer: D

View Text Solution

15. When two spheres of equal masses undergo glancing clastic collision with one of them at rest, after collision they will move

A. opposite to one another

B. in the same direction

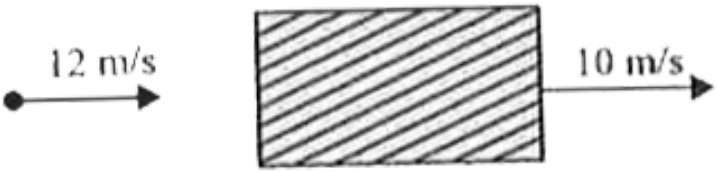
C. together

D. at right angle to each other

Answer: D

View Text Solution

16. A light particle moving horizontally with a speed of 12 m/s strikes a very heavy block moving in the same direction at 10 m/s. The collision is one dimensional and elastic. After the collision, the particle will be



A. move at 2 m/s in its original direction

B. move at 8 m/s in its original direction

C. move at 8 m/s opposite to its original direction

D. move at 12 m/s opposite to its original direction

Answer: B

View Text Solution

17. A 10 kg object collides with a stationary 5 kg object and after collision, they stick together and move forward with velocity $4ms^{-1}$. What is the velocity with which the 10 kg object hits the second one ?

A. $4ms^{-1}$

B. $6ms^{-1}$

C. $10ms^{-1}$

D. $12ms^{-1}$

Answer: B

View Text Solution

18. Two particles having position vectors $\vec{r_1} = \left(3\hat{i} + 5\hat{j}\right)m$ and $\vec{r_2} = \left(-5\hat{i} - 3\hat{j}\right)$ m are moving with velocities $\vec{v_1} = \left(4\hat{i} + 3\hat{j}\right)ms^{-1}$ and

$\overrightarrow{v_2} = \left(a\hat{i} + 7\hat{j}\right) ms^{-1}$. If they collide after 2 seconds, the value of a is

A. 2

B. 4

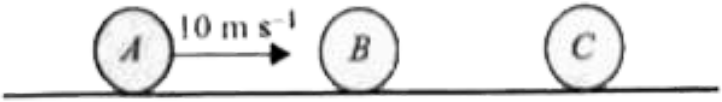
C. 6

D. 8

Answer: D

View Text Solution

19. Three identical spherical balls A, B and C are placed on a table as shown in the figure along a straight line. B and Care at rest initially.



The ball A hits B head on with a speed of $10ms^{-1}$. Then after all collisions (assumed to be elastic) A and B are brought to rest and C takes off with a velocity of

A. $5ms^{-1}$

B. $10ms^{-1}$

C. $2.5ms^{-1}$

D. $7.5ms^{-1}$

Answer: B

View Text Solution

20. Which of the following statements is correct?

A. Kinetic energy and momentum both are conserved in all types of collisions.

B. Kinetic energy is not conserved but momentum is conserved in inelastic collisions.

C. Momentum is conserved in elastic collisions but not in inelastic collisions.

D. Kinetic energy is conserved in inelastic collisions but momentum is not conserved in elastic collisions

Answer: B

View Text Solution

21. A block of mass 0.50 kg is moving with a speed of $2.00ms^{-1}$ on a smooth surface. It strikes

another mass of 1.00 kg which is at rest and then they move together as a single body. The energy which is lost during the collision is

A. 0.16J

B. 1.00 J

C. 0.67J

D. 0.34 J

Answer: C

View Text Solution

22. If two bodies stick together after collision and move as a single body, the collision is said to be

A. perfectly inelastic

B. elastic

C. inelastic

D. perfectly elastic

Answer: A

View Text Solution

23. The first ball of mass m moving with a velocity u collides head on with the second ball of mass m at rest. If the coefficient of restitution is e, the ratio of final velocity of the second ball to the initial velocity of the first ball is

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

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

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

D. $\frac{1-e}{2}$

Answer: C

View Text Solution

View Text Solution

24. Ball 1 collides with an another identical ball 2 at rest as shown in figure. For what value of coefficient of restitution e, the velocity of ball 2 becomes two times that of ball I after collision?

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

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

C. $\frac{1}{4}$

D. $\frac{1}{6}$

Answer: A

View Text Solution

25. A metal ball of mass 2 kg moving with speed of $36kmh^{-1}$ has a head on collision with a stationary ball of mass 3 kg. If after collision, both the balls move together, then the loss in kinetic energy due to collision is

A. 40 J

B. 60J

C. 100 J

D. 140 J

Answer: B

View Text Solution

26. A 2 kg ball moving at $24ms^{-1}$ undergoes head on collision with a 4 kg ball moving in the opposite direction at $48ms^{-1}$. If the coefficient of restitution is $\frac{2}{3}$, their velocities in ms^{-1} after collision are

A. $-56, \ -8$

B. $-28, \ -4$

C. $-14, \ -2$

D. $-7, \ -1$

Answer: A

View Text Solution

27. A particle of mass m moving towards the east with speed v collides with another particle of the same mass and same speed v moving towards the north. If the two particles stick to each other, the new particle of mass 2m will have a speed of

A. v

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

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

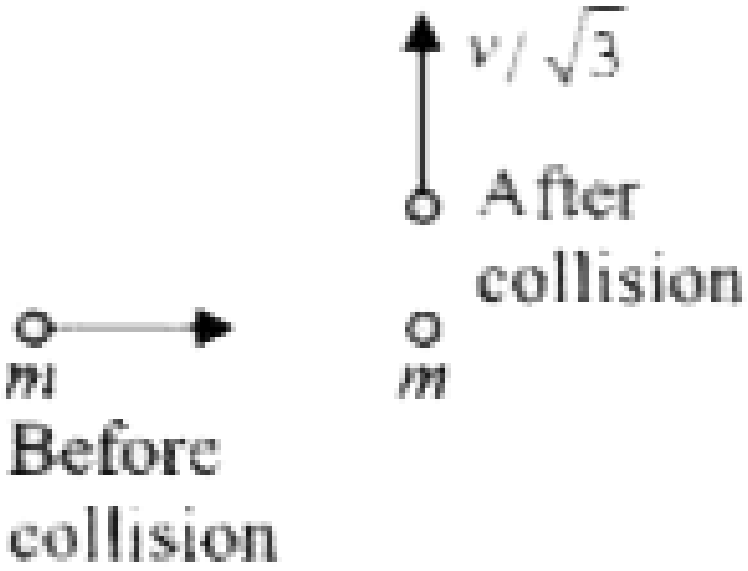
D. $v\sqrt{2}$

Answer: C

View Text Solution

28. A mass m moves with a velocity v and collides inelastically with another identical mass at rest. After collision, the first mass moves with velocity

$\frac{v}{\sqrt{3}}$ in a direction perpendicular to Before collision the initial direction of motion. The speed of the 2^{nd} mass after collision



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

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

C. v

D. $\sqrt{3}v$

Answer: A

View Text Solution

29. A glass marble dropped from a certain height above the horizontal surface reaches the surface in time t and then continues to bounce up and down. The time in which the marble finally comes to rest is

(where e is the coefficient of restitution)

A. $e^n t$

B. $e^2 t$

C. $t\left[\frac{1+e}{1-e}\right]$

D. $t\left[\frac{1-e}{1+e}\right]$

Answer: C

View Text Solution

30. Two identical mass M moving with velocity u_1 and u_2 collide perfectly inelastically. The loss in kinetic energy is

A. $\frac{M}{2}(u_2 - u_1)^2$

B. $\frac{M}{2}\left(u_1^2 - u_2^2\right)$

C. $\frac{M}{4}\left(u_2 - u_1\right)^2$

D. $\frac{M}{4}\left(u_1^2 - u_2^2\right)$

Answer: C

View Text Solution

31. In elastic collision

A. both momentum and kinetic energy are conserved.

B. both momentum and kinetic energy are not conserved.

C. only mechanical energy is conserved.

D. only momentum is conserved.

Answer: A

View Text Solution

32. A car of mass 400 kg and travelling at $72kmh^{-1}$ crashes into a truck of mass 4000 kg and travelling at $9kmh^{-1}$ in the same direction.

The car bounces back at a speed of $18kmh^{-1}$. The speed of the truck after the impact is

A. $9kmh^{-1}$

B. $18kmh^{-1}$

C. $27kmh^{-1}$

D. $36kmh^{-1}$

Answer: B

View Text Solution

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

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

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

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

D. $\sqrt{3}$

Answer: A

View Text Solution

34. A bullet of mass in travelling with a speed v hits a block of mass M initially at rest and gets embedded in it. The combined system is free to move and there is no other force acting on the system. The heat generated in the process will be

A. zero

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

C. $\frac{Mmv^2}{2(M-m)}$

D. $\frac{mMv^2}{2(M+m)}$

Answer: D

View Text Solution

35. A body of mass 1.0 kg strikes elastically with another body at rest and continues to move in the same direction with one-fourth of its initial velocity. The mass of the other body is

A. 0.6 kg

B. 2.4 kg

C. 3.0 kg

D. 4.0 kg

Answer: A

View Text Solution

Check Your Neet Vitals

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

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

B. $\left(\sqrt{2}-1\right)ms^{-1}$

C. $\left(\sqrt{2}+1\right)ms^{-1}$

D. None of these

Answer: C

View Text Solution

2. A body A is projected upwards with velocity v. Another body B of same mass is projected at an

angle of 45°. Both reach the same height. What is the ratio of their initial kinetic energies?

A. 1/4

B. 1/3

C. 1/2

D. 1

Answer: C

View Text Solution

3. A sand bag of 10 kg mass is suspended by a 3 m long weightless string. A 0.2 kg mass bullet enters the bag with a velocity of $20ms^{-1}$ and gets embedded into it. The loss in KE in the collision is

A. 40.2 J

B. 38.2 J

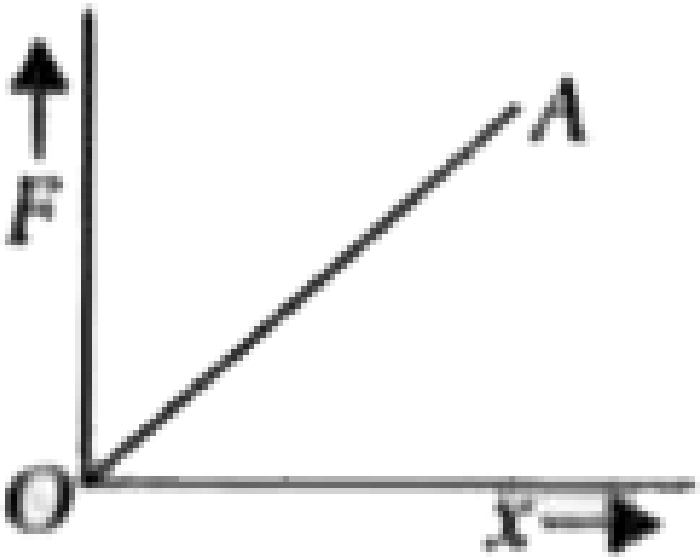
C. 49.2 J

D. 39.2 J

Answer: D

View Text Solution

4. The force required to stretch a spring varies with the distance as shown in figure. If the experiment is performed with the above spring of half the length, the line OA will



A. shift towards F-axis

B. shift towards X-axis

C. remains as it is

D. become double in length.

Answer: A

View Text Solution

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

A. 10 J

B. $-10J$

C. $8.75J$

D. $-8.75J$

Answer: D

View Text Solution

6. Match the Column I with Column II.

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

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

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

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

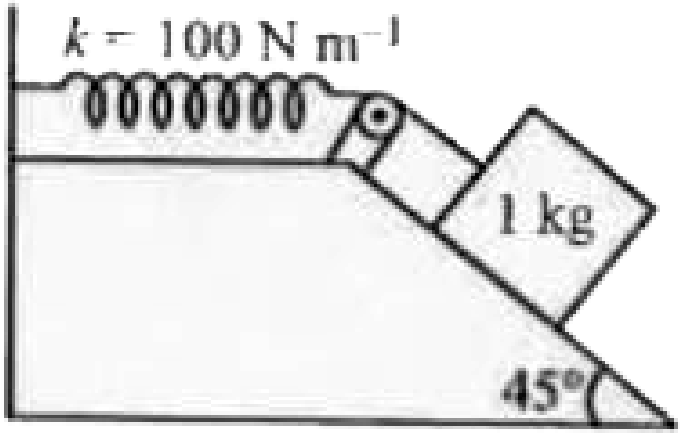
D. A - s, B - p, C - q , D - r

Answer: D

View Text Solution

7. A 1 kg block situated on a rough incline is connected to a spring of negligible mass having spring constant $100Nm^{-1}$ as shown in the figure.The block is released from rest with the spring in the unstretched position. The block moves 10 cm down the incline before coming to rest. The coefficient of friction between the block and the incline is (Take $g = 10ms^{-2}$ and assume

that the pulley is frictionless)



A. 0.2

B. 0.3

C. 0.5

D. 0.6

Answer: B

View Text Solution

8. The kinetic energy of a body is increased by 56%. The momentum is increased by about

A. 25%

B. 5%

C. 56%

D. 38%

Answer: A

View Text Solution

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

A. 10 J

B. 8.5J

C. 4.5 J

D. 4J

Answer: C

View Text Solution

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

A. MgL

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

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

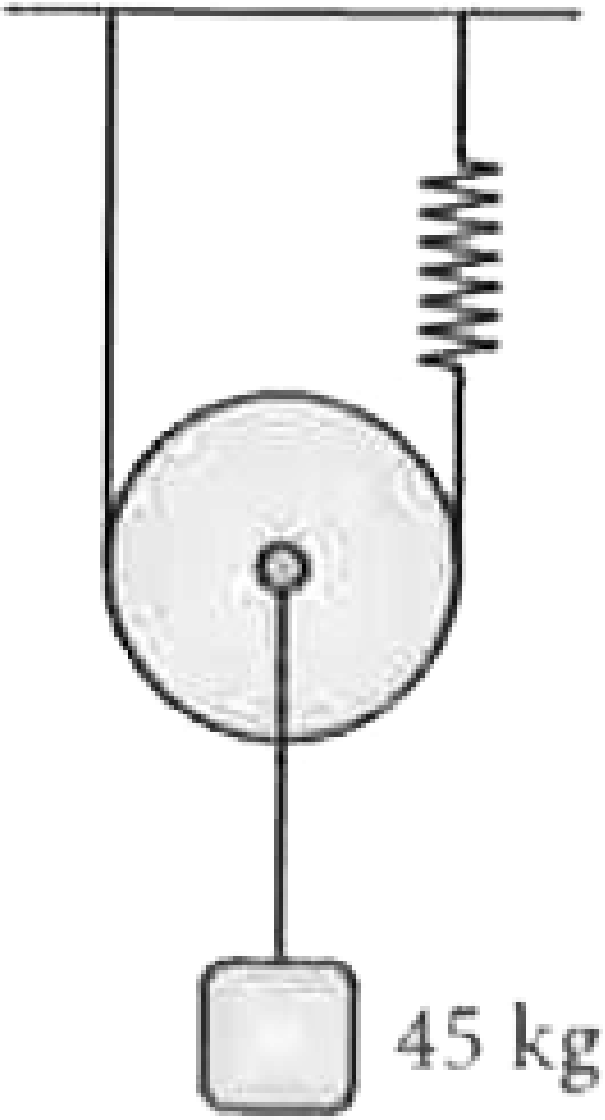
D. $\frac{MgL}{18}$

Answer: D

View Text Solution

11. The system is released from rest with the spring initially stretched 75 mm. Calculate the velocity of the block after it has dropped $12mm$. The spring has a stiffness of $1050Nm^{-1}$. Neglect

the mass of the small pulley.



A. $0.371ms^{-1}$

B. $0.45ms^{-1}$

C. $5ms^{-1}$

D. $2.2ms^{-1}$

Answer: A

View Text Solution

12. A car manufacturer claims that his car can be accelerated from rest to a velocity of $10ms^{-1}$ in 5s. If the total mass of the car and its

occupants is 1000 kg, then the average horse power developed by the engine is

A. $\frac{10^3}{746}$

B. $\frac{10^4}{746}$

C. $\frac{10^5}{746}$

D. 8

Answer: B

View Text Solution

13. A gun of mass 20 kg has bullet of mass 0.1 kg in it. The gun is free to recoil and 804 J of recoil energy is released on firing the gun. The speed of bullet (in ms^{-1}) is

A. $\sqrt{804 \times 2010}$

B. $\sqrt{\frac{2010}{804}}$

C. $\sqrt{\frac{804}{2010}}$

D. $\sqrt{804 \times 4 \times 10^3}$

Answer: D

View Text Solution

14. A body of mass m, moving with a uniform velocity of $30ms^{-1}$ collides with another body of mass m2 at rest and then the two together begin to move with a uniform velocity of $20ms^{-1}$. The ratio of their masses $\left(\frac{m_1}{m_2}\right)$ is

A. 0.75

B. 0.25

C. 4

D. 2

Answer: D

View Text Solution

15. A block of mass 10 kg is moving in x-direction with a constant speed of $10ms^{-1}$. It is subjected to a retarding force $F = -0.1.xJm^{-1}$ during its travel from $x = 20m$ to $x = 30m$. Its final kinetic energy will be

A. 25 J

B. 50 J

C. 75 J

D. 100 J

Answer: A

View Text Solution

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

A. same as that of B

B. opposite to that of B

C. $\theta = \tan^{-1}\left(\frac{1}{2}\right)$ to the axis

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

Answer: D

View Text Solution

17. A girl in a swing is 2.5 m above ground at the maximum height and at 1.5 m above the ground at the lowest point, Her maximum velocity in the swing is $(g = 10ms^{-2})$

A. $5\sqrt{2}ms^{-1}$

B. $2\sqrt{5}ms^{-1}$

C. $2\sqrt{3}ms^{-1}$

D. $32ms^{-1}$

Answer: B

View Text Solution

18. An open watertight railway wagon of mass $5 \times 10^3 kg$ is moving with an initial velocity of $1.2ms^{-1}$ without friction on a railway track. Rain falls vertically downwards into the wagon. What

change will occur in the kinetic energy of wagon, when it has colleted 10^3 kg of water ?

A. $1200J$

B. $300J$

C. $600J$

D. $900J$

Answer: C

View Text Solution

19. A truck accelerates from speed v to 2v. Work done during this is

A. three times as the work done in accelerating it from rest to v.

B. same as the work done in accelerating it from rest to v.

C. four times as the work done in accelerating it from rest to v.

D. less than the work done in accelerating it from rest to v

Answer: A

View Text Solution

20. One boy takes 2 min to raise a box to a height of 1 m and another boy takes 3 min to do so. The energy of the two boys is

A. different

B. same

C. energy of the first is more

D. energy of the second is more

Answer: B

View Text Solution

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

A. 10 U

B. 25 U

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

D. $5U$

Answer: B

View Text Solution

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

A. 36 J

B. 64 J

C. 100 J

D. 120 J

Answer: B

View Text Solution

23. The work done by 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. $\frac{1}{2}k(l_2 + l_1)$

Answer: B

View Text Solution

24. One end of an unstretched vertical spring is attached to the ceiling and an object attached to the other end is slowly lowered to its eqilibrium position. If S be gain in spring energy and G be loss in gravitational potential energy in the process, then

A. $S = G$

B. $S = 2G$

C. $G = 2S$

D. None of these

Answer: C

View Text Solution

25. Concrete blocks of masses m_A and m_B are balanced on two identical vertical springs $m_A = 2m_B$. The gravitational potential energy of each system is zero at the equilibrium position of the springs. Which statements is true for the total

mechanical energy of the systems when the blocks 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

View Text Solution

Aipmt Neet Mcqs

1. A ball moving with velocity 2 m/s collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in m/s) after collision will be

A. 0,1

B. 1,1

C. 1, 0.5

D. 0,2

Answer: A

View Text Solution

2. An engine pumps water through a hose pipe. Water passes, through the pipe and leaves it with a velocity of 2 m/s. The mass per unit length of water in the pipe is 100 kg//m. What is the power of the engine ?

A. 400 W

B. 200 W

C. 100 W

D. 800 W

Answer: D

View Text Solution

View Text Solution

3. A particle of mass M, starting from rest, undergoes uniform acceleration. If the speed acquired in time T is V, the power delivered to the particle is

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

B. $\frac{1}{2}\frac{MV^2}{T^2}$

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

D. $\frac{1}{2}\frac{MV^2}{T}$

Answer: D

View Text Solution

4. The potential energy of a system increases if work is done

A. upon the system by a nonconservative force

B. by the system against a conservative force

C. by the system against a nonconservative force

D. upon the system by a conservative force

Answer: B

View Text Solution

5. 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 highest position of the body

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

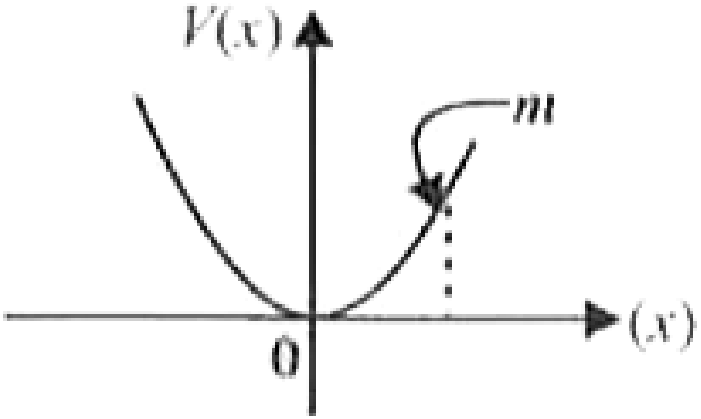
C. it remains constant all through

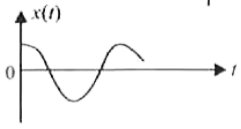
D. at the instant just after the body is projected

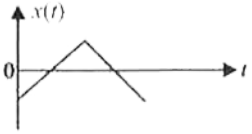
Answer: B

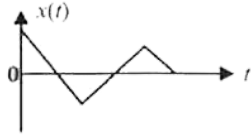
View Text Solution

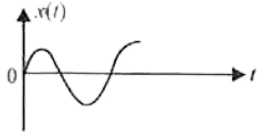
6. A particle of mass m is released from rest and follows a particle as a function of time?



A. 

B. 

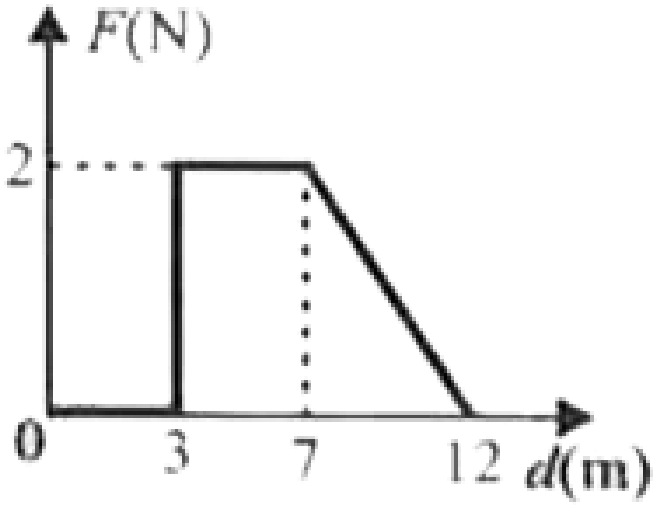
C. 

D. 

Answer: A

View Text Solution

7. Force F on a particle moving in a straight line varies with distance d as shown in figure. The work done on the particle during its displacement of 12 m is



A. 18 J

B. 21 J

C. 26 J

D. 13 J

Answer: D

View Text Solution

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

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

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

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

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

Answer: B

View Text Solution

9. A solid cylinder of mass 3 kg is rolling on a horizontal surface with velocity $4ms^{-1}$. It collides with a horizontal spring of force constant $200Nm^{-1}$. The maximum compression produced in the spring will be

A. 0.5 m

B. 0.6 m

C. 0.7 m

D. 0.2 m

Answer: B

View Text Solution

10. Two spheres a and B of masses m_1 and m_2 respectively collide. A is at rest initially and B is moving with velocity v along x-axis. After collision

B has a velocity $v/2$ in a direction perpendicular to the original direction. The mass A moves after collision in the direction

A. same as that of B

B. opposite to that of B

C. $\theta = \tan^{-1}\left(\frac{1}{2}\right)$ to the x-axis

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

Answer: D

View Text Solution

11. The potential energy of a particle in a force field is

$$U = \frac{A}{r^2} - \frac{B}{r}$$

where A and B are positive constants and r is the distance of particle from the centre of the field. For stable equilibirum, the stable equilibrium , the distance of the particle is

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

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

C. $\frac{A}{B}$

D. $\frac{B}{A}$

Answer: B

View Text Solution

12. 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. $\frac{t}{\sqrt{m}}$

Answer: B

View Text Solution

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

A. 13 J

B. 15 J

C. 9 J

D. 6 J

Answer: C

View Text Solution

14. A body of mass (4m) is lying in x-y plane at rest. It suddenly explodes into three pieces. Two pieces, each of mass (m) move perpendicular to each other with equal speeds (v). The total kinetic energy generated due to explosion is

A. mv^2

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

C. $2mv^2$

D. $4mv^2$

Answer: B

View Text Solution

15. A particle of mass m is driven by a machine that delivers a constant power k watts. If the

partilcle starts from rest the force on the particle at time t is

A. $\sqrt{2mk}t^{-1/2}$

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

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

D. $\sqrt{mk}t^{-1/2}$

Answer: C

View Text Solution

16. A block of mass 10 kg , moving in x direction with a constant speed of $10ms^{-1}$, is subjected to a retarding force $F = 0.1xJ/m$ during its travel from $x = 20m$ to $30m$. Its final KE will be

A. 275 J

B. 250 J

C. 475 J

D. 450 J

Answer: C

View Text Solution

17. Two similar springs P and Q have spring constants K_p and K_Q, such that $K_p > K_Q$. They are stretched first by the same amount (case a), then by the same force (case b). The work done by the springs W_P and W_Q are related as, in case (a) and case (b) respecitively

A. $W_P > W_Q, W_Q > W_P$

B. $W_P < W_Q, W_Q < W_P$

C. $W_P < W_Q, W_Q < W_P$

D. $W_P = W_Q, W_Q = W_P$

Answer: A

View Text Solution

18. Two particles of masses m_1, m_2 move with initial velocities u_1 and u_2. On collision , one of the particles get excited to higher level , after absorbing energy ε. If final velocities of particles be v_1 and v_2 then we must have

A.

$$\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 - \varepsilon = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$$

B.

$$\frac{1}{2}m_1 21u_1^2 + \frac{1}{2}m_2^2u_2^2 - \varepsilon = \frac{1}{2}m_1^2v_1^2 + \frac{1}{2}m_2^2v_2^2$$

C. $m_1^2 u_1 + m_2^2 u_2 - \varepsilon = m_1^2 v_1 + m_2^2 v_2$

D.

$$\frac{1}{2} m_1 u_1^2 + \frac{1}{2} m_2 u_2^2 = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 - \varepsilon$$

Answer: A

View Text Solution

19. Two particle A and B, move with constant velocities $\overrightarrow{v_1}$ and $\overrightarrow{v_2}$. At the initial moment their position vectors are $\overrightarrow{r_1}$ and $\overrightarrow{r_2}$ respectively . The condition for particles A and B for their collision is

A. $\overrightarrow{r_1} \times \overrightarrow{v_1} = \overrightarrow{r_2} \times \overrightarrow{v_2}$

B. $\overrightarrow{r_1} - \overrightarrow{r_2} = \overrightarrow{v_1} - \overrightarrow{v_2}$

C. $\frac{\overrightarrow{r_1} - \overrightarrow{r_2}}{\left|\overrightarrow{r_1} - \overrightarrow{r_2}\right|} = \frac{\overrightarrow{v_2} - \overrightarrow{v_1}}{\left|\overrightarrow{v_2} - \overrightarrow{v_1}\right|}$

D. $\overrightarrow{r_1} . \overrightarrow{v_1} = \overrightarrow{r_2} . \overrightarrow{v_2}$

Answer: C

View Text Solution

20. The heart of a man pumps 5 liters of blood through the arteries per minutes at a pressure of 150 mm of mercury. If the density of mercury by

$13.6 \times 10^3 kg/m^3$ and $g = 10m/s^2$ then the power of heart in watt is

A. 3.0

B. 1.50

C. 1.70

D. 2.35

Answer: C

View Text Solution

21. A ball is thrown vertically downwards from a height of 20 m with an initial velocity v_0. It collides with the ground, loses 50 percent of its energy in collision and rebounds to the same height. The initial velocity v_0 is

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

A. $28ms^{-1}$

B. $10ms^{-1}$

C. $14ms^{-1}$

D. $20ms^{-1}$

Answer: D

View Text Solution

22. On a frictionless surface, a block of mass M moving at speed v collides elastically 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. $\frac{3}{\sqrt{2}}v$

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

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

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

Answer: C

View Text Solution

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

A. $0.18m/s^2$

B. $0.2m/s^2$

C. $0.1m/s^2$

D. $0.15m/s^2$

Answer: C

View Text Solution

24. A body of mass 1 kg begins to move under the action of a time dependent force $\vec{F} = \left(2t\hat{i} + 3t^2\hat{j}\right)N$, where $\hat{i}$ and $\hat{j}$ are unit

vectors along x and y axis. What power will be developed by the force at the time?

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

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

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

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

Answer: B

View Text Solution

25. 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. $\sqrt{3gR}$

B. $\sqrt{5gR}$

C. $\sqrt{gR}$

D. $\sqrt{2gR}$

Answer: B

View Text Solution

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

A. $100ms^{-1}$

B. $80ms^{-1}$

C. $120ms^{-1}$

D. $160ms^{-1}$

Answer: C

View Text Solution

27. Two identical balls A and B having velocities of $0.5ms^{-1}$ and $-0.3ms^{-1}$ respectively collides elastically in one dimension. The velocities of B and A after the collision will be

A. $-0.5ms^{-1}$ and $0.3ms^{-1}$

B. $0.5ms^{-1}$ and $-0.3ms^{-1}$

C. $-0.3ms^{-1}$ and $0.5ms^{-1}$

D. $0.3ms^{-1}$ and $0.5ms^{-1}$

Answer: B

View Text Solution

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

A. 8J

B. 11 J

C. 5 J

D. 2 J

Answer: C

View Text Solution

29. Consider a drop of rain water having mass 1 g falling from a height of 1 km. It hits the ground with a speed of $50ms^{-1}$. Take .g. constant with a value $10ms^{-2}$. The work done by the (i) gravitational force and the (ii) resistive force of air is

A. (i) $1.25J$ (ii) $-8.25J$

B. (i) $100J$ (ii) $8.75J$

C. (i) $10J$ (ii) $-8.75J$

D. (i) $-10J$ (ii) $-8.25J$

Answer: C

View Text Solution

30. A moving block having mass m, collides with another stationary block having mass 4 m. The lighter block comes to rest after collision. When

the initial velocity of the lighter block is v, then the value of coefficient of restitution (e) will be

A. 0.5

B. 0.25

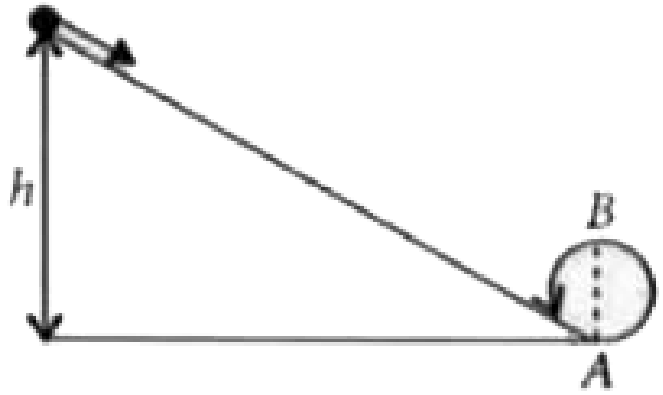
C. 0.8

D. 0.4

Answer: B

View Text Solution

31. A body initially at rest sliding along a frictionaless track 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. $\frac{3}{2}D$

B. D

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

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

Answer: D

View Text Solution

32. Body A of mass 4 m moving with speed u collides with another body B of mass 2m, at rest. The collision is head on and elastic in nature. After the collision the fraction of energy lost by the colliding body A is

A. $5/9$

B. $1/9$

C. $8/9$

D. $4/9$

Answer: C

View Text Solution

33. A force $F = 20 + 10y$ acts on a particle in y-direction where F is in newton and y in meter. Work done by this force to move the particle form $y = 0$ to $y = 1$ m is

A. $20J$

B. $30J$

C. $5J$

D. $25J$

Answer: D

View Text Solution

34. A mass m is attached to a thin wire and whirled in a verticle circle. The wire is most likely to break when

A. inclined at an angle of 60° from vertical

B. the mass is at the highest point

C. the wire is horizontal

D. the mass is at the lowest point

Answer: D

View Text Solution