Kishor Career Point

Subject : Physics
Standard : 11
Total Mark : 8

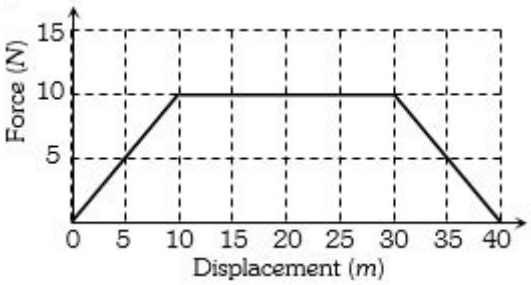
WPE and collision

Paper Set : 1
Date : 15-10-2025
Time : 0H:0M

Physics - Section A (MCQ) (Attempt any 1)

(1) When two bodies stick together after collision, the collision is said to be
(A) Partially elastic (B) Total elastic
(C) Total inelastic (D) None of the above

(2) Adjacent figure shows the force-displacement graph of a moving body, the work done in displacing body from $x = 0$ to $x = 35\,m$ is equal to ..... J



(A) 50 (B) 25
(C) 287.5 (D) 200

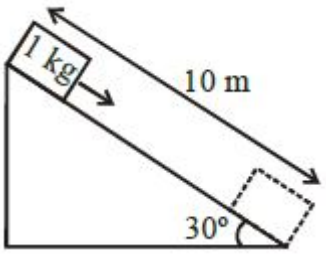
(3) If the kinetic energy of a body increases by 0.1%, the percent increase of its momentum will be ..... %
(A) 0.05 (B) 0.1
(C) 1 (D) 10

(4) A body of mass $2\,kg$ moving with a velocity of $3\,m/sec$ collides head on with a body of mass $1\,kg$ moving in opposite direction with a velocity of $4\,m/sec$. After collision, two bodies stick together and move with a common velocity which in m/sec is equal to
(A) $1/4$ (B) $1/3$
(C) $2/3$ (D) $3/4$

(5) If the water falls from a dam into a turbine wheel $19.6\,m$ below, then the velocity of water at the turbines, is ..... m/s (take $g = 9.8\,m/s^2$)
(A) 9.8 (B) 19.6
(C) 39.2 (D) 98

(6) If the momentum of a body is increased n times, its kinetic energy increases
(A) n times (B) $2n$ times
(C) $\sqrt{n}$times (D) n^2 times

(7) Find work done by friction if block reaches to the end with constant velocity



(A) $-50\,N$ (B) $-50\sqrt{3}\,N$
(C) $-100\,N$ (D) None of these

(8) A body of mass $40\,kg$ having velocity $4\,m/s$ collides with another body of mass $60\,kg$ having velocity $2\,m/s$. If the collision is inelastic, then loss in kinetic energy will be ..... J
(A) 440 (B) 392
(C) 48 (D) 144

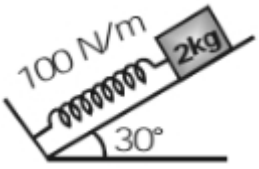
(9) An open knife edge of mass $50g$ is dropped from a height $2m$ on a wooden floor. If the blade penetrates upto depth $10\,cm$ into the wood, the average resistance offered by the wood to the knife edge is ....N
(A) 10.5 (B) 20.5
(C) 15.5 (D) 12.0

(10) A clay ball of mass m and speed v strikes another metal ball of same mass m, which is at rest. They stick together after collision. The kinetic energy of the system after collision is
(A) $mv^2/2$ (B) $mv^2/4$
(C) $2mv^2$ (D) mv^2

(11) Two masses of $1\,gm$ and $4\,gm$ are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is
(A) $4:1$ (B) $\sqrt{2}:1$
(C) $1:2$ (D) $1:16$

(12) A string is used to pull a block of mass m vertically up by a distance h at a constant acceleration $\frac{g}{3}$. The work done by the tension in the string is .....
(A) $\frac{2}{3}mgh$ (B) $\frac{-mgh}{3}$
(C) mgh (D) $\frac{4}{3}mgh$

(13) A block of mass $2\,kg$ is placed on a rough inclined plane as shown in the figure $(\mu = 0.2)$ so that it just touches the spring. The block is allowed to move downwards. The spring will be compressed to a maximum of ..... cm



(A) 0.1 (B) 6.6
(C) 1 (D) 13

(14) A particle moves in a straight line with retardation proportional to its displacement. Its loss of kinetic energy for any displacement x is proportional to

(A) x^2 (B) e^x

(C) x (D) $\log_e x$

(15) Two identical balls P and Q moving in the $x-y$ plane collide at the origin $(x=0, y=0)$ of the coordinate system. Their velocity components just before the moment of impact were, for ball P, $v_x = 6\ m/s$, $v_y = 0$; for ball Q, $v_x = -5\ m/s$, $v_y = 2\ m/s$. As a result of the collision, the ball P comes to rest. The velocity components of the ball Q just after collision will be

(A) $v_x = 0, v_y = 2\ m/s$ (B) $v_x = 1\ m/s, v_y = 0$

(C) $v_x = -11\ m/s, v_y = 0$ (D) $v_x = 1\ m/s, v_y = 2\ m/s$

(16) A man does a given amount of work in $10sec$. Another man does the same amount of work in $20sec$. The ratio of the output power of first man to the second man is

(A) 1 (B) 0.5

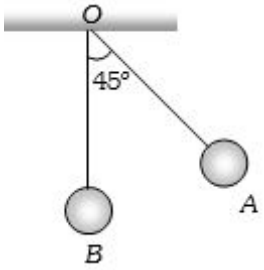
(C) 2 (D) None of these

(17) A wooden block of mass M is suspended by a cord and is at rest. A bullet of mass m, moving with a velocity v passes through the block and comes out with a velocity $v/2$ in the same direction. If there is no loss in kinetic energy, then upto what height the block will rise

(A) $m^2v^2/2M^2g$ (B) $m^2v^2/8M^2g$

(C) $m^2v^2/4Mg$ (D) $m^2v^2/2Mg$

(18) The bob A of a simple pendulum is released when the string makes an angle of $45^o$with the vertical. It hits another bob B of the same material and same mass kept at rest on the table. If the collision is elastic



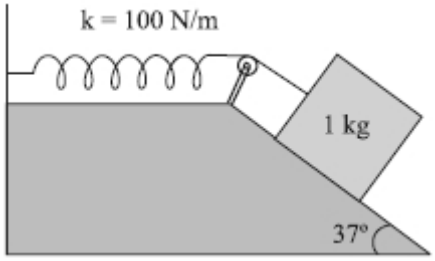
(A) Both A and B rise to the same height

(B) Both A and B come to rest at B

(C) Both A and B move with the same velocity of A

(D) A comes to rest and B moves with the velocity of A

(19) A $1\ kg$ block situated on a rough incline is connected to a spring of spring constant $100\ Nm^{-1}$ as shown in 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. Find the coefficient of friction between the block and the incline. Assume that the spring has a negligible mass and the pulley is frictionless.



(A) 0.564 (B) 0.368

(C) 0.115 (D) 0.256

(20) The potential energy of a certain particle is given by $U = \frac{1}{2}\left(x^2 - z^2\right)$. The force on it is

(A) $-x\hat{i} + z\hat{k}$ (B) $x\hat{i} + z\hat{k}$

(C) $\frac{1}{2}\left(x\hat{i} + z\hat{k}\right)$ (D) $\frac{1}{2}\left(x\hat{i} - z\hat{k}\right)$

Physics - Section B (MCQ) (Attempt any 1)

(21) Two persons A and B perform same amount of work in moving a body through a certain distance d with application of forces acting at angle $45°$ and $60°$ with the direction of displacement respectively. The ratio of force applied by person A to the force applied by person B is $\frac{1}{\sqrt{x}}$. The value of x is ..... .

(A) 2 (B) 3

(C) 1 (D) 4

(22) A particle experiences a variable force $\overrightarrow{F} = \left(4x\hat{i} + 3y^2\hat{j}\right)$ in a horizontal $x-y$ plane. Assume distance in meters and force is newton. If the particle moves from point $(1,2)$ to point $(2,3)$ in the $x-y$ plane, the Kinetic Energy changes by.....J

(A) 50.0 (B) 12.5

(C) 25 (D) 0

(23) Two balls in free space are colliding with each other. Which of the following statement regarding linear momentum conservation of the system is true ?

(A) is conserved

(B) is not conserved

(C) Will depend on type of collision (head on or oblique)

(D) Will depend on type of collision (elastic or inelastic)

(24) A ball is dropped from a height of $80\ m$ on a surface which is at rest. Find the height attainded by ball after 2^{nd} collision if coefficient of restitution $e = 0.5$ ..... m

(A) 5 (B) 10

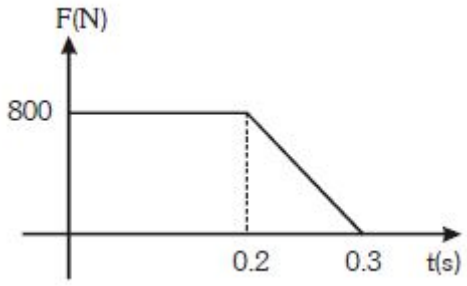
(C) 40 (D) 80

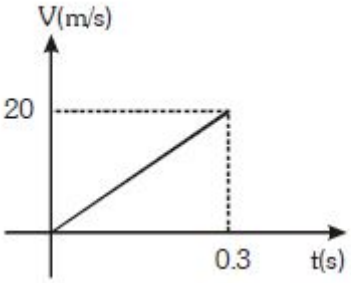
(25) Two bodies of masses m_1 and m_2 have equal kinetic energies. If p_1 and p_2 are their respective momentum, then ratio $p_1 : p_2$ is equal to

(A) $m_1 : m_2$ (B) $m_2 : m_1$

(C) $\sqrt{m_1} : \sqrt{m_2}$ (D) $m_1^2 : m_2^2$

(26) A baseball having mass of $0.4\ kg$ is thrown such that one of the force acting on it varies with time as shown in the first graph. Also, the velocity of the ball is in the same direction as the force. The velocity varies with time as shown in the second graph. Then choose incorrect option (till $0.3\ sec$)





(A) The graph of power delivered to the baseball and time is straight line.

(B) Net force on the baseball is constant.

(C) For $t > 0.2\,sec$ the graph of power delivered to the baseball and time is parabola.

(D) Net force on the baseball is in direction of velocity.

(27) A sphere P of mass m and moving with velocity v undergoes an oblique and perfectly elastic collision with an identical sphere Q initially at rest. The angle θ between the velocities of the spheres after the collision shall be ..... ^{o}

(A) 0 (B) 45

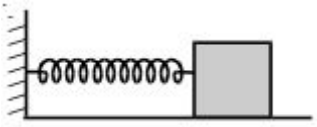
(C) 90 (D) 180

(28) A car of mass $'m'$ is driven with acceleration $'a'$ along a straight level road against a constant external resistive force $'R'$. When the velocity of the car is $'V'$, the rate at which the engine of the car is doing work will be

(A) RV (B) maV

(C) $(R + ma)V$ (D) $(ma - R)V$

(29) A spring block system is placed on a rough horizontal floor. The block is pulled towards right to give spring an elongation less than $\frac{2\mu mg}{K}$ but more than $\frac{\mu mg}{K}$ and released.The correct statement is



(A) The block will cross the mean position.

(B) The block will come to rest when the forces acting on it are exactly balanced

(C) The block will come to rest when the work done by friction becomes equal to the change in energy stored in spring.

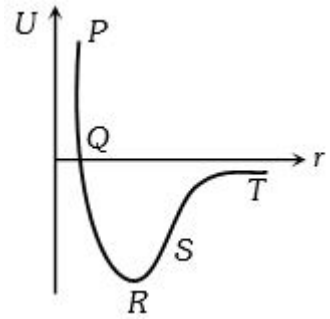
(D) None

(30) A spring of force constant $10\,N/m$ has an initial stretch $0.20\,m$. In changing the stretch to $0.25\,m$, the increase in potential energy is about.....$joule$

(A) 0.1 (B) 0.2

(C) 0.3 (D) 0.5

(31) The points of maximum and minimum attraction in the curve between potential energy (U) and distance (r) of a diatomic molecules are respectively



(A) S and R (B) T and S

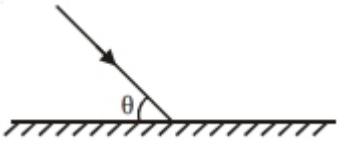
(C) R and S (D) S and T

(32) A block of mass $1\,kg$ slides down on a rough inclined plane of inclination $60°$ starting from its top. If the coefficient of kinetic friction is 0.5 and length of the plane is $1\,m$, then work done against friction is ..... J

(A) 9.82 (B) 4.94

(C) 2.45 (D) 1.96

(33) A ball of mass m moving with speed u collides with a smooth horizontal surface at angle θ with it as shown in figure. The magnitude of impulse imparted to surface by ball is [Coefficient of restitution of collision is e]



(A) $mu(1 + e)\cos\theta$ (B) $mu(1 - e)\sin\theta$

(C) $mu(1 - e)\cos\theta$ (D) $mu(1 + e)\sin\theta$

(34) A bullet is fired from a gun. If the gun recoils freely, the kinetic energy of the gun will be

(A) Less than that of bullet

(B) Equal to that of bullet

(C) Greater than that of bullet

(D) Zero

(35) Which of the following is not an example of perfectly inelastic collision

(A) A bullet fired into a block if bullet gets embedded into block

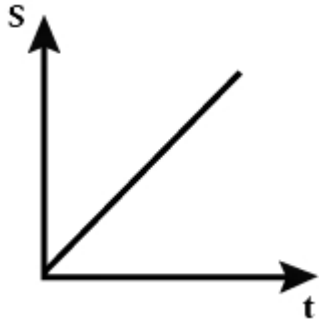
(B) Capture of electrons by an atom

(C) A man jumping on to a moving boat

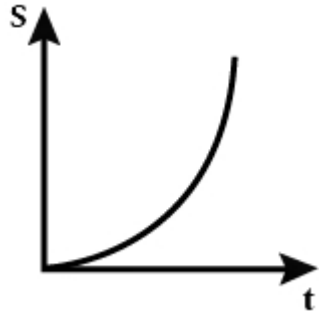
(D) A ball bearing striking another ball bearing

(36) A body starts moving unidirectionally under the influence of a sourceof constant power. Which one of the graph correctly shows the variation of displacement (s) with time (t)?

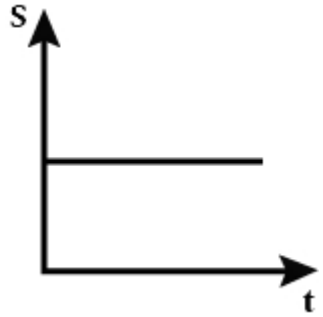
(A)



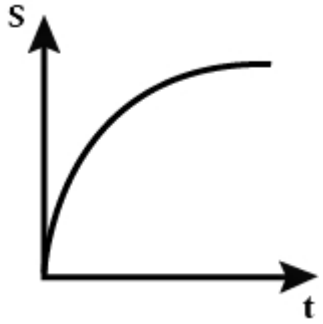
(B)



(C)



(D)



(37) Two springs of spring constants $1500\,N/m$ and $3000\,N/m$ respectively are stretched with the same force. They will have potential energy in the ratio

(A) $4:1$ (B) $1:4$

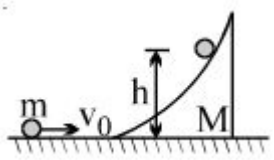
(C) $2:1$ (D) $1:2$

(38) An engine pumps up $100kg$ of water through a height of $10m$ in $5s$. Given that the efficiency of the engine is 60% . If $g = 10ms^{-2}$, the power of the engine is ..... kW

(A) 3.3 (B) 0.33

(C) 0.033 (D) 33

(39) A particle of mass m moving horizontally with v_0 strikes a smooth wedge of mass M, as shown in figure. After collision, the ball starts moving up the inclined face of the wedge and rises to a height h. When the particle has risen to a height h on the wedge, then choose the correct alternative (s)



(A) The particle is stationary with respect to ground

(B) Both are stationary with respect to the centre of mass

(C) The kinetic energy with respect to centre of mass is converted into potential energy

(D) Both (B) and (C)

(40) Two bodies of masses m and $2m$ have same momentum. Their respective kinetic energies E_1 and E_2 are in the ratio

(A) $1:2$ (B) $2:1$

(C) $1:\sqrt{2}$ (D) $1:4$

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(Answer Key)

Paper Set : 1
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Physics - Section A (MCQ)

1 - C	2 - C	3 - A	4 - C	5 - B	6 - D	7 - A	8 - C	9 - A	10 - B
11 - C	12 - D	13 - D	14 - A	15 - D	16 - C	17 - B	18 - D	19 - C	20 - A

Physics - Section B (MCQ)

21 - A	22 - C	23 - A	24 - A	25 - C	26 - C	27 - C	28 - C	29 - C	30 - A
31 - D	32 - C	33 - D	34 - A	35 - D	36 - B	37 - C	38 - A	39 - D	40 - B

Kishor Career Point

Subject : Physics
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WPE and collision

(Solutions)

Paper Set : 1
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Physics - Section A (MCQ) (Attempt any 1)

(1) When two bodies stick together after collision, the collision is said to be

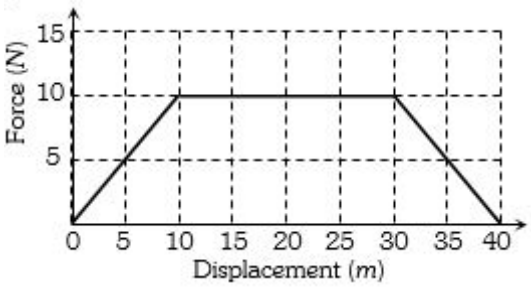
(A) Partially elastic (B) Total elastic

(C) Total inelastic (D) None of the above

Solution:(Correct Answer:C)

(c) In perfectly inelastic collision, the two colliding bodies gets stuck together and move with a common velocity.
For perfectly inelastic collision, $e = 0$
In perfectly inelastic collision, total momentum of the system remains conserved just before and just after the collision but some kinetic energy is lost during the collision.

(2) Adjacent figure shows the force-displacement graph of a moving body, the work done in displacing body from $x = 0$ to $x = 35\,m$ is equal to ..... J

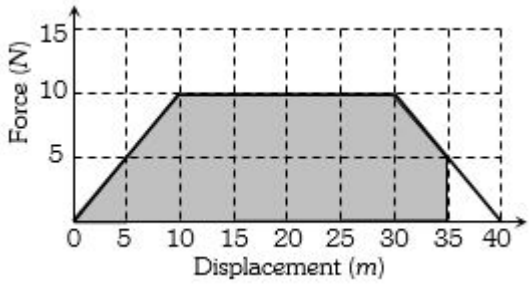


(A) 50 (B) 25

(C) 287.5 (D) 200

Solution:(Correct Answer:C)

(c)Work done = (Shaded area under the graph between $x = 0$ to $x = 35\,m$) $= 287.5\,J$



(3) If the kinetic energy of a body increases by 0.1%, the percent increase of its momentum will be ..... %

(A) 0.05 (B) 0.1

(C) 1 (D) 10

Solution:(Correct Answer:A)

(a)$P = \sqrt{2\,mE}\;P \propto \sqrt{E}$

Percentage increase in $P = \frac{1}{2}$(percentage increase in E)
$= \frac{1}{2}(0.1\%) = 0.05\%$

(4) A body of mass $2\,kg$ moving with a velocity of $3\,m/sec$ collides head on with a body of mass $1\,kg$ moving in opposite direction with a velocity of $4\,m/sec$. After collision, two bodies stick together and move with a common velocity which in m/sec is equal to

(A) $1/4$ (B) $1/3$

(C) $2/3$ (D) $3/4$

Solution:(Correct Answer:C)

(c)$m_1v_1 - m_2v_2 = (m_1 + m_2)v$
$\Rightarrow 2 \times 3 - 1 \times 4 = (2 + 1)\,v$
$\Rightarrow v = \frac{2}{3}\,m/s$

(5) If the water falls from a dam into a turbine wheel $19.6\,m$ below, then the velocity of water at the turbines, is ..... m/s (take $g = 9.8\,m/s^2$)

(A) 9.8 **(B)** 19.6

(C) 39.2 (D) 98

Solution:(Correct Answer:B)

$v^2 - u^2 = 2as \Rightarrow v^2 - 0^2 = 2 \times 9.8 \times 19.6$
(Initial velocity $= 0$ as water falls from rest)
$\Rightarrow v = \sqrt{2 \times 9.8 \times 2 \times 9.8}$
$= 2 \times 9.8 = 19.6\,m/s$

(6) If the momentum of a body is increased n times, its kinetic energy increases

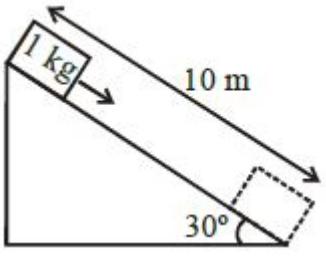
(A) n times (B) $2n$ times

(C) $\sqrt{n}$times **(D)** n^2 times

Solution:(Correct Answer:D)

(d)$E = \frac{P^2}{2m}$
$E \propto P^2$
i.e. if P is increased n times then E will increase n^2 times.

(7) Find work done by friction if block reaches to the end with constant velocity



(A) $-50\,N$ (B) $-50\sqrt{3}\,N$

(C) $-100\,N$ (D) None of these

Solution:(Correct Answer:A)

$W_f = -w_g \quad [W_{net} = \Delta KE = 0]$
$W_f = -(mg\sin\theta)(10)$
$W_f = -1 \times 10 \times \frac{1}{2} \times 10$
$W_f = -50J$

(8) A body of mass $40\,kg$ having velocity $4\,m/s$ collides with another body of mass $60\,kg$ having velocity $2\,m/s$. If the collision is inelastic, then loss in kinetic energy will be ..... J

(A) 440 (B) 392

(C) 48 (D) 144

Solution:(Correct Answer:C)

(c)Loss in kinetic energy

$= \frac{1}{2}\frac{m_1 m_2 (u_1-u_2)^2}{m_1+m_2} = \frac{1}{2}\left(\frac{40\times 60}{40+60}\right)(4-2)^2 = 48\,Joule$

(9) An open knife edge of mass $50g$ is dropped from a height $2m$ on a wooden floor. If the blade penetrates upto depth $10\,cm$ into the wood, the average resistance offered by the wood to the knife edge is ....N

(A) 10.5 (B) 20.5

(C) 15.5 (D) 12.0

Solution:(Correct Answer:A)

$W_{mg} + W_{\text{resistive } f} = KE_f - KE_i$

$mg(h+x) + F(x)(-1) = 0 - 0$

$F = \frac{mg(h+x)}{x}$

$F = \frac{50\times 10^{-3}\times 10(2+0.1)}{0.1}$

$F = 5 \times 2.1$

$= 10.5$ newton.

(10) A clay ball of mass m and speed v strikes another metal ball of same mass m, which is at rest. They stick together after collision. The kinetic energy of the system after collision is

(A) $mv^2/2$ **(B)** $mv^2/4$

(C) $2mv^2$ (D) mv^2

Solution:(Correct Answer:B)

(b)

Given situation is

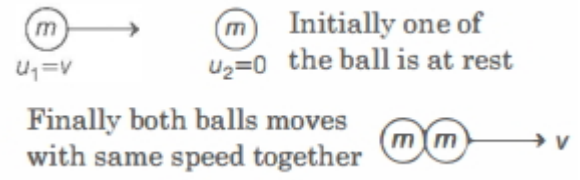
Conservation of momentum, gives

$mv = 2mV \Rightarrow V = \frac{v}{2}$

So, kinetic energy after collision is

$K_f = \frac{1}{2}(2m)V^2 = \frac{1}{2}\times 2m \times \left(\frac{v}{2}\right)^2$

$= \frac{1}{4}mv^2$



(11) Two masses of $1\,gm$ and $4\,gm$ are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is

(A) 4 : 1 (B) $\sqrt{2}$: 1

(C) 1 : 2 (D) 1 : 16

Solution:(Correct Answer:C)

(c)$P = \sqrt{2mE}$. If E are same then $P \propto \sqrt{m}$

$\Rightarrow \frac{P_1}{P_2} = \sqrt{\frac{m_1}{m_2}} = \sqrt{\frac{1}{4}} = \frac{1}{2}$

(12) A string is used to pull a block of mass m vertically up by a distance h at a constant acceleration $\frac{g}{3}$. The work done by the tension in the string is .....

(A) $\frac{2}{3}mgh$ (B) $\frac{-mgh}{3}$

(C) mgh **(D)** $\frac{4}{3}mgh$

Solution:(Correct Answer:D)

(d)

$T - mg = ma$

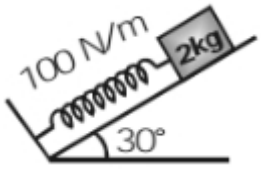
$T = m(g+a)$

$= \frac{4}{3}mg$

Work $(w) = T.h$

$= \frac{4}{3}mgh$

(13) A block of mass $2\,kg$ is placed on a rough inclined plane as shown in the figure $(\mu = 0.2)$ so that it just touches the spring. The block is allowed to move downwards. The spring will be compressed to a maximum of ..... cm



(A) 0.1 (B) 6.6

(C) 1 **(D)** 13

Solution:(Correct Answer:D)

By WET $W_g + W_{f_r} + W_{RF} = 0$

$mg\sin 30x - \mu mg\cos 30x - 1/2kx^2 = 0$

After solving $x = 13$cm

(14) A particle moves in a straight line with retardation proportional to its displacement. Its loss of kinetic energy for any displacement x is proportional to

(A) x^2 (B) e^x

(C) x (D) $\log_e x$

Solution:(Correct Answer:A)

(a)This condition is applicable for simple harmonic motion. As particle moves from mean position to extreme position its potential energy increases according to expression $U = \frac{1}{2}kx^2$ and accordingly kinetic energy decreases.

(15) Two identical balls P and Q moving in the $x-y$ plane collide at the origin $(x=0, y=0)$ of the coordinate system. Their velocity components just before the moment of impact were, for ball P, $v_x = 6\ m/s$, $v_y = 0$; for ball Q, $v_x = -5\ m/s$, $v_y = 2\ m/s$. As a result of the collision, the ball P comes to rest. The velocity components of the ball Q just after collision will be

(A) $v_x = 0, v_y = 2\ m/s$ (B) $v_x = 1\ m/s, v_y = 0$

(C) $v_x = -11\ m/s, v_y = 0$ **(D)** $v_x = 1\ m/s, v_y = 2\ m/s$

Solution:(Correct Answer:D)

Momentum conservation

(16) A man does a given amount of work in $10sec$. Another man does the same amount of work in $20sec$. The ratio of the output power of first man to the second man is

(A) 1 (B) 0.5

(C) 2 (D) None of these

Solution:(Correct Answer:C)

(c)Power $= \frac{W}{t}$. If W is constant then $P \propto \frac{1}{t}$

i.e. $\frac{P_1}{P_2} = \frac{t_2}{t_1} = \frac{20}{10} = \frac{2}{1}$

(17) A wooden block of mass M is suspended by a cord and is at rest. A bullet of mass m, moving with a velocity v passes through the block and comes out with a velocity $v/2$ in the same direction. If there is no loss in kinetic energy, then upto what height the block will rise

(A) $m^2v^2/2M^2g$ **(B)** $m^2v^2/8M^2g$

(C) $m^2v^2/4Mg$ (D) $m^2v^2/2Mg$

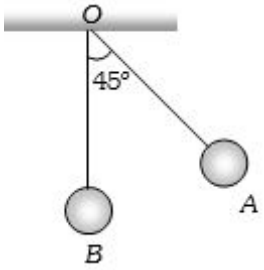
Solution:(Correct Answer:B)

$mv + M \times 0 = m\frac{v}{2} + M \times V$

$\Rightarrow V = \frac{m}{2M}v$

$h = \frac{V^2}{2g} = \frac{(mv/2M)^2}{2g} = \frac{m^2v^2}{8M^2g}$.

(18) The bob A of a simple pendulum is released when the string makes an angle of $45^o$with the vertical. It hits another bob B of the same material and same mass kept at rest on the table. If the collision is elastic



(A) Both A and B rise to the same height

(B) Both A and B come to rest at B

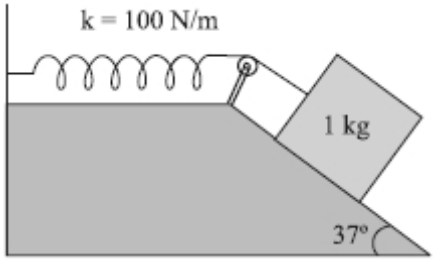
(C) Both A and B move with the same velocity of A

(D) A comes to rest and B moves with the velocity of A

Solution:(Correct Answer:D)

(d)Due to the same mass of A and B as well as due to elastic collision velocities of spheres get interchanged after the collision.

(19) A $1\ kg$ block situated on a rough incline is connected to a spring of spring constant $100\ Nm^{-1}$ as shown in 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. Find the coefficient of friction between the block and the incline. Assume that the spring has a negligible mass and the pulley is frictionless.



(A) 0.564 (B) 0.368

(C) 0.115 (D) 0.256

Solution:(Correct Answer:C)

Mass of the block, $m = 1kg$

Spring constant, $k = 100Nm^{-1}$

Displacement in the block, $x = 10cm = 0.1m$

The given situation can be shown as in the following figure.

At equilibrium:

Normal reaction, $R = mg\cos 37°$

Frictional force, $f = \mu_R = mg\sin 37°$

Where, μ is the coefficient of friction

Net force acting on the block $= mg\sin 37° - f$

$= mg\sin 37° - \mu mg\cos 37°$

$= mg\,(\sin 37° - \mu\cos 37°)$

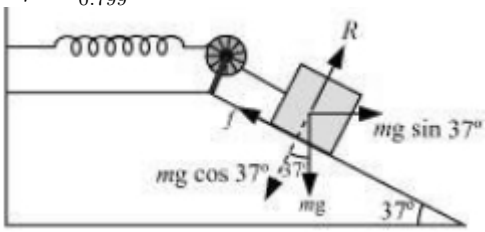
At equilibrium, the work done by the block is equal to the potential energy of the spring, i.e.,

$mg\,(\sin 37° - \mu\cos 37°)\,x = \frac{1}{2}kx^2$

$1 \times 9.8\,(\sin 37° - \mu\cos 37°) = \frac{1}{2} \times 100 \times 0.1$

$0.602 - \mu \times 0.799 = 0.510$

$\therefore \mu = \frac{0.092}{0.799} = 0.115$



(20) The potential energy of a certain particle is given by $U = \frac{1}{2}\left(x^2 - z^2\right)$. The force on it is

(A) $-x\hat{i} + z\hat{k}$ (B) $x\hat{i} + z\hat{k}$

(C) $\frac{1}{2}\left(x\hat{i} + z\hat{k}\right)$ (D) $\frac{1}{2}\left(x\hat{i} - z\hat{k}\right)$

Solution:(Correct Answer:A)

$F_x = \frac{-dU}{dx} = x\frac{-d}{dx}\left(\frac{x^2-z^2}{2}\right) = -x$

$F_Z = \frac{-dU}{dz} = \frac{-d}{dz}\left(\frac{x^2-z^2}{2}\right) = z$

$\therefore \overrightarrow{F} = -x\hat{i} + z\hat{k}$

Physics - Section B (MCQ) (Attempt any 1)

(21) Two persons A and B perform same amount of work in moving a body through a certain distance d with application of forces acting at angle $45°$ and $60°$ with the direction of displacement respectively. The ratio of force applied by person A to the force applied by person B is $\frac{1}{\sqrt{x}}$. The value of x is ..... .

(A) 2 (B) 3

(C) 1 (D) 4

Solution:(Correct Answer:A)

Given $W_A = W_B$

$F_A d\cos 45° = F_B d\cos 60°$

$F_A \times \frac{1}{\sqrt{2}} = F_B \times \frac{1}{2}$

$\frac{F_A}{F_B} = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$

$x = 2$

(22) A particle experiences a variable force $\overrightarrow{F} = \left(4x\hat{i} + 3y^2\hat{j}\right)$ in a horizontal $x - y$ plane. Assume distance in meters and force is newton. If the particle moves from point $(1, 2)$ to point $(2, 3)$ in the $x - y$ plane, the Kinetic Energy changes by.....J

(A) 50.0 (B) 12.5

(C) 25 (D) 0

Solution:(Correct Answer:C)

$F = 4x\hat{i} + 3y^2\hat{j}$

$WD = \Delta KE$

$W = \int \overrightarrow{F} \cdot (dx\hat{i} + dy\hat{j})$

$= \int_1^2 4xdx + \int_2^3 3y^2dx$

$= \left(2x^2\right)_1^2 + \left(y^3\right)_2^3$

$= (8 - 2) + (27 - 8)$

$= 6 + 19 = 25\,J$

(23) Two balls in free space are colliding with each other. Which of the following statement regarding linear momentum

conservation of the system is true ?

(A) is conserved

(B) is not conserved

(C) Will depend on type of collision (head on or oblique)

(D) Will depend on type of collision (elastic or inelastic)

Solution:(Correct Answer:A)

Momentum is conserved in all types of collision.

(24) A ball is dropped from a height of $80\,m$ on a surface which is at rest. Find the height attainded by ball after 2^{nd} collision if coefficient of restitution $e = 0.5$ ..... m

(A) 5 (B) 10

(C) 40 (D) 80

Solution:(Correct Answer:A)

$h_n = e^{2n}h \quad h_2 = e^4 h$

$h_2 = \left(\frac{1}{2}\right)^4 h \Rightarrow \frac{1}{16} \times 80 = 5m$

(25) Two bodies of masses m_1 and m_2 have equal kinetic energies. If p_1 and p_2 are their respective momentum, then ratio $p_1 : p_2$ is equal to

(A) $m_1 : m_2$ (B) $m_2 : m_1$

(C) $\sqrt{m_1} : \sqrt{m_2}$ (D) $m_1^2 : m_2^2$

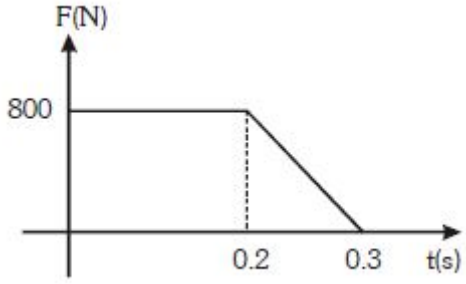
Solution:(Correct Answer:C)

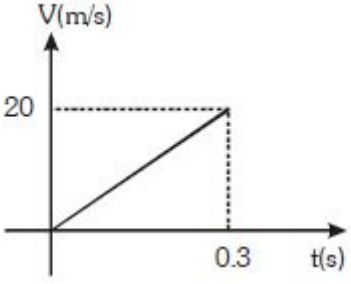
(c)$P = \sqrt{2mE}$

$P \propto \sqrt{m}$ (if$E$ = const.))

$\frac{P_1}{P_2} = \sqrt{\frac{m_1}{m_2}}$

(26) A baseball having mass of $0.4\,kg$ is thrown such that one of the force acting on it varies with time as shown in the first graph. Also, the velocity of the ball is in the same direction as the force. The velocity varies with time as shown in the second graph. Then choose incorrect option (till $0.3\,sec$)





(A) The graph of power delivered to the baseball and time is straight line.

(B) Net force on the baseball is constant.

(C) For $t > 0.2\,sec$ the graph of power delivered to the baseball and time is parabola.

(D) Net force on the baseball is in direction of velocity.

Solution:(Correct Answer:C)

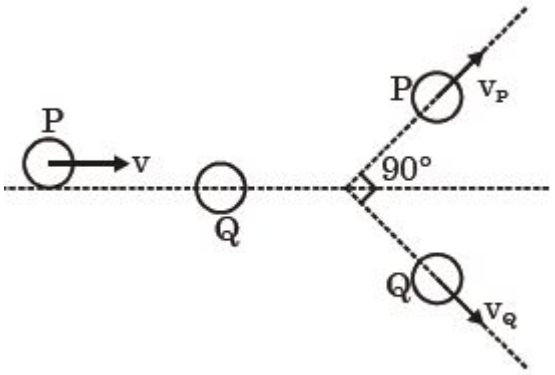
Because acceleration of base ball is constant and positive so force is constant and in direction of velocity and $P = F.V$ Graph straight line.

(27) A sphere P of mass m and moving with velocity v undergoes an oblique and perfectly elastic collision with an identical sphere Q initially at rest. The angle θ between the velocities of the spheres after the collision shall be ..... ^{o}

(A) 0 (B) 45

(C) 90 (D) 180

Solution:(Correct Answer:C)



(28) A car of mass $'m'$ is driven with acceleration $'a'$ along a straight level road against a constant external resistive force $'R'$. When the velocity of the car is $'V'$, the rate at which the engine of the car is doing work will be

(A) RV (B) maV

(C) $(R + ma)V$ (D) $(ma - R)V$

Solution:(Correct Answer:C)

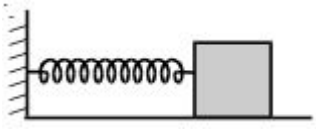
(c)Force required to move with constant velocity

Power $= FV$

Force is required to oppose the resistive force R and also to accelerate the body of mass with acceleration a.

Power = $(R + ma)V$

(29) A spring block system is placed on a rough horizontal floor. The block is pulled towards right to give spring an elongation less than $\frac{2\mu mg}{K}$ but more than $\frac{\mu mg}{K}$ and released.The correct statement is



(A) The block will cross the mean position.

(B) The block will come to rest when the forces acting on it are exactly balanced

(C) The block will come to rest when the work done by friction becomes equal to the change in energy stored in spring.

(D) None

Solution:(Correct Answer:C)

(30) A spring of force constant $10\,N/m$ has an initial stretch $0.20\,m$. In changing the stretch to $0.25\,m$, the increase in potential energy is about.....$joule$

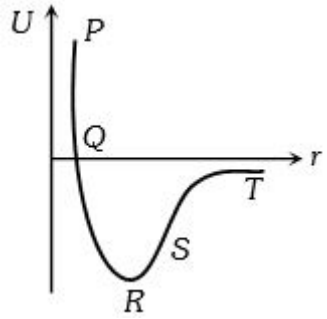
(A) 0.1 (B) 0.2

(C) 0.3 (D) 0.5

Solution:(Correct Answer:A)

(a)ΔP.E.$= \frac{1}{2}k(x_2^2 - x_1^2) = \frac{1}{2} \times 10[(0.25)^2 - (0.20)^2]$
$= 5 \times 0.45 \times 0.05 = 0.1\ J$

(31) The points of maximum and minimum attraction in the curve between potential energy (U) and distance (r) of a diatomic molecules are respectively



(A) S and R (B) T and S

(C) R and S **(D)** S and T

Solution:(Correct Answer:D)

(d) Attraction will be minimum when the distance between the molecule is maximum.
Attraction will be maximum at that point where the positive slope is maximum because
$F = -\frac{dU}{dx}$

(32) A block of mass $1\ kg$ slides down on a rough inclined plane of inclination $60°$ starting from its top. If the coefficient of kinetic friction is 0.5 and length of the plane is $1\ m$, then work done against friction is ..... J

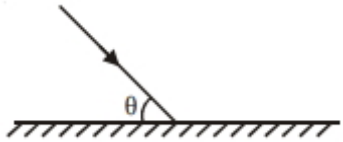
(A) 9.82 (B) 4.94

(C) 2.45 (D) 1.96

Solution:(Correct Answer:C)

(c)$W = \mu mg \cos\theta\, S = 0.5 \times 1 \times 9.8 \times \frac{1}{2} \times 1 = 2.45\ J$

(33) A ball of mass m moving with speed u collides with a smooth horizontal surface at angle θ with it as shown in figure. The magnitude of impulse imparted to surface by ball is [Coefficient of restitution of collision is e]



(A) $mu(1+e)\cos\theta$ (B) $mu(1-e)\sin\theta$

(C) $mu(1-e)\cos\theta$ **(D)** $mu(1+e)\sin\theta$

Solution:(Correct Answer:D)

(d)
$u_y = -u\sin\theta\hat{j}$
$\vec{v}_y = +eu\sin\theta\hat{j}$
$\vec{I} = m(\vec{v}_y - \vec{u}_y)$
$= mu(e+1)\sin\theta$

(34) A bullet is fired from a gun. If the gun recoils freely, the kinetic energy of the gun will be

(A) Less than that of bullet

(B) Equal to that of bullet

(C) Greater than that of bullet

(D) Zero

Solution:(Correct Answer:A)

In recoil of gun, law of conservation of momentum holds good. Kinetic energy of bullet is $p^2/2m$ and KE of gun is $p^2/2M$, where p is momentum. Since p is same, KE of gun $< KE$ of bullet

(35) Which of the following is not an example of perfectly inelastic collision

(A) A bullet fired into a block if bullet gets embedded into block

(B) Capture of electrons by an atom

(C) A man jumping on to a moving boat

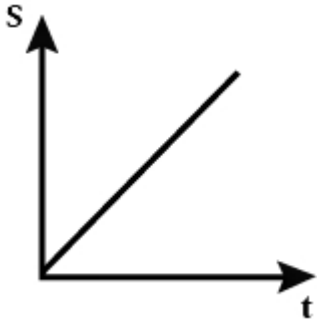
(D) A ball bearing striking another ball bearing

Solution:(Correct Answer:D)

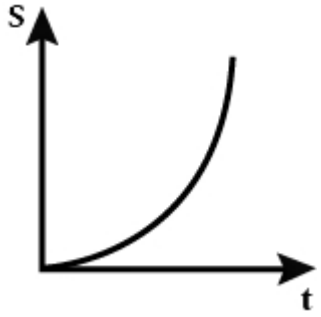
(d)In case of perfectly inelastic collision, the bodies stick together after impact.

(36) A body starts moving unidirectionally under the influence of a sourceof constant power. Which one of the graph correctly shows the variation of displacement (s) with time (t)?

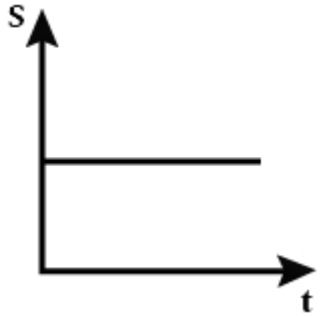
(A)



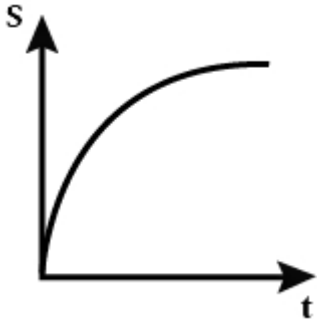
(B)



(C)



(D)



Solution:(Correct Answer:B)

Here, $P = \left[ML^2T^{-3}\right] = \text{constant}$

$\frac{L^2}{T^3} = constant$

$L \propto T^{3/2}$

displacement $d \propto t^{3/2}$

(37) Two springs of spring constants $1500\,N/m$ and $3000\,N/m$ respectively are stretched with the same force. They will have potential energy in the ratio

(A) $4:1$ (B) $1:4$

(C) $2:1$ (D) $1:2$

Solution:(Correct Answer:C)

(c)$U = \frac{F^2}{2k}$

==> $\frac{U_1}{U_2} = \frac{k_2}{k_1}$ (if force are same)

$\frac{U_1}{U_2} = \frac{3000}{1500} = \frac{2}{1}$

(38) An engine pumps up $100kg$ of water through a height of $10m$ in $5s$. Given that the efficiency of the engine is 60% . If $g = 10ms^{-2}$, the power of the engine is ..... kW

(A) 3.3 (B) 0.33

(C) 0.033 (D) 33

Solution:(Correct Answer:A)

(a)Work output of engine $= mgh = 100 \times 10 \times 10 = 10^4 J$

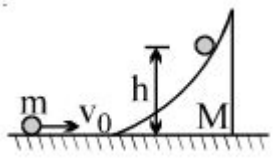
Efficiency (η) = $\frac{\text{output}}{\text{input}}$

Input energy = $\frac{\text{outupt}}{\eta}$

$= \frac{10^4}{60} \times 100 = \frac{10^5}{6} J$

Power = $\frac{\text{inputenergy}}{\text{time}} = \frac{10^5/6}{5} = \frac{10^5}{30} = 3.3\ kW$

(39) A particle of mass m moving horizontally with v_0 strikes a smooth wedge of mass M, as shown in figure. After collision, the ball starts moving up the inclined face of the wedge and rises to a height h. When the particle has risen to a height h on the wedge, then choose the correct alternative (s)



(A) The particle is stationary with respect to ground

(B) Both are stationary with respect to the centre of mass

(C) The kinetic energy with respect to centre of mass is converted into potential energy

(D) Both (B) and (C)

Solution:(Correct Answer:D)

(40) Two bodies of masses m and $2m$ have same momentum. Their respective kinetic energies E_1 and E_2 are in the ratio

(A) $1:2$ **(B)** $2:1$

(C) $1:\sqrt{2}$ (D) $1:4$

Solution:(Correct Answer:B)

(b)$E = \frac{P^2}{2m}$. If momentum are same then $E \propto \frac{1}{m}$

$\frac{E_1}{E_2} = \frac{m_2}{m_1} = \frac{2m}{m} = \frac{2}{1}$