Question 1.

A body moves a distance of 10 *m* along a straight line under the action of a force of 5 *N*. If the work done is 25 *joules*, the angle which the force makes with the direction of motion of the body is

(1) 0°

(2) 30°

(3) 60°

(4) 90°

Question 2.

A particle of mass m at rest is acted upon by a force *F* for a time *t*. Its Kinetic energy after an interval *t* is

(1) $\frac{F^2t^2}{m}$

(2) $\frac{F^2t^2}{2m}$

(3) $\frac{F^2t^2}{3m}$

(4) $\frac{Ft}{2m}$

Question 3.

A man pushes a wall and fails to displace it. He does

(1) Negative work

(2) Positive but not maximum work

(3) No work at all

(4) Maximum work

Question 4.

Which of the following is not a unit of energy?

(1) watt-hour

(2) joule

(3) eV

(4) N/m

Question 5.

A constant force is applied on a body of mass 2 kg to give it a displacement s = $\frac{1}{2}t^2$. Work done by agent applying the force up to time t = 3 s is

(1) 3 J

(2) 9 J

(3) 18 J

(4) 2 J

Question 6.

The work done in pulling up a block of wood weighing 2 *kN* for a length of 10*m* on a smooth plane inclined at an angle of 15° with the horizontal is (given: sin15°=0.2588):

(1) 4.36 *kJ*

(2) 5.17 *kJ*

(3) 8.91 *kJ*

(4) 9.82 *kJ*

Question 7.

A person-1 stands on an elevator moving with an initial velocity v & upward acceleration a. Another person-2 of the same mass m as person-1 is standing on the same elevator. The net work done on the person-1 as observed by person-2 in time t is-

1. $m(g + a)\left(vt + \frac{1}{2}at^2\right)$

2. $-mg\left(vt + \frac{1}{2}at^2\right)$

3. 0

4. $ma\left(vt + \frac{1}{2}at^2\right)$

Question 8.

The kinetic energy of a body is increased by 21%. The percentage increase in the magnitude of linear momentum of the body is:

(1) 10%

(2) 20%

(3) Zero

(4) 11.5%

Question 9.

Work done in time t on a body of mass m, when it is accelerated from rest with constant acceleration to a speed v in time t_1, as a function of time t is given by:

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

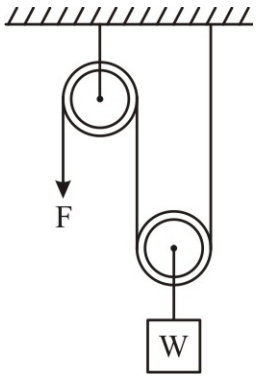
2. $m\frac{v}{t_1}t^2$

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

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

Question 10.

In the diagram shown, force F acts on the free end of the string. If the weight W moves up slowly by distance h, then work done on the weight by the string holding it is: (Pulley and string are ideal)



1. Fh

2. 2Fh

3. $\frac{Fh}{2}$

4. 4Fh

Question 11.

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?

1. 8 J

2. 11 J

3. 5 J

4. 2 J

Question 12.

A chord is used to vertically lower a block of mass m by a distance d at a constant downward acceleration of $\frac{'g'}{4}$. The work done by the chord on the block is

(1) $\frac{3}{4}$mgd

(2) $-\frac{3}{4}$mgd

(3) $\frac{1}{4}$mgd

(4) $-\frac{1}{4}$mgd

Question 13.

The energy required to accelerate a car from rest to 30 m/s is E. The energy required to accelerate the car from 30 m/s to 60 m/s is

1. E
2. 2E
3. 3E
4. 4E

Question 14.

Forces acting on a particle have magnitudes of 14, 7, and 7 N and act in the direction of vectors $6\hat{i} + 2\hat{j} + 3\hat{k}$, $3\hat{i} - 2\hat{j} + 6\hat{k}$, $2\hat{i} - 3\hat{j} - 6\hat{k}$ respectively. The forces remain constant while the particle is displaced from point A: (2, –1, –3) to B: (5, –1, 1). Find the work done. The coordinates are specified in meters.

1. 75 J
2. 55 J
3. 85 J
4. 65 J

Question 15.

A lorry and a car moving with the same K.E. are brought to rest by applying the same retarding force, then

(1) Lorry will come to rest in a shorter distance

(2) Car will come to rest in a shorter distance

(3) Both come to rest in a same distance

(4) None of the above

Question 16.

The position of a particle (x) varies with time (t) as $x = (t - 2)^2$, where x is in meters and t is in seconds. Calculate the work done during t = 0 to t = 4 s if the mass of the particle is 100 g.

(1) 0.4 J

(2) 0.2 J

(3) 0.8 J

(4) Zero

Question 17.

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

(1) Its velocity is constant

(2) Its acceleration is constant

(3) Its kinetic energy is constant

(4) It moves in a straight line

Question 18.

Q. 4 A bicyclist comes to a skidding stop in 10 m. During this process, the force on the bicycle due to the road is 200N is directly opposed to the motion. The work done by the cycle on the road is

(1) + 2000J

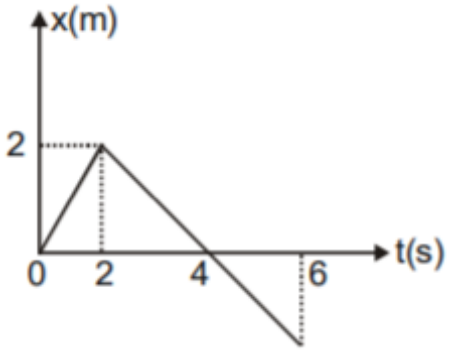
(2) - 200J

(3) zero

(4) -20,000J

Question 19.

The position-time graph of a particle of mass 2 kg is shown in the figure. Total work done on the particle from t = 0 to t = 4s is:



1. 8 J
2. 4 J
3. 0 J
4. Can't be determined

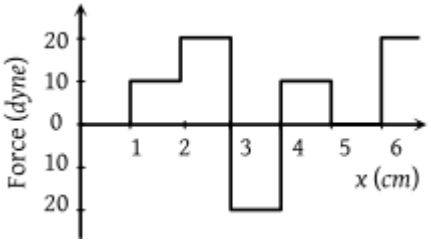
Question 20.

A block of mass m is placed in an elevator moving down with an acceleration $\frac{g}{3}$. The work done by the normal reaction on the block as the elevator moves down through a height h is

1. $\frac{-2mgh}{3}$
2. $\frac{-mgh}{3}$
3. $\frac{2mgh}{3}$
4. $\frac{mgh}{3}$

Question 21.

The relationship between force and position is shown in the figure given (in one dimensional case). The work done by the force in displacing a body from x = 1 *cm* to x = 5 *cm* is -



(1) 20 *ergs*

(2) 60 *ergs*

(3) 70 *ergs*

(4) 700 *ergs*

Question 22.

A position-dependent force F = 6 + 8x - $3x^2$ N acts on a small body of mass 3 kg displacing it from x = 0 to x = 2 m. The work done in joule is:

(1) 20 J

(2) 40 J

(3) 10 J

(4) 12 J

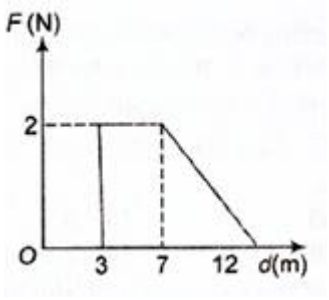
Question 23.

A position dependent force $F = 7 - 2x + 3x^2$ *N* acts on a small body of mass 2 kg and displaces it from x = 0 to x = 5m. The work done in joule is -

1. 70
2. 270
3. 35
4. 135

Question 24.

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



1. 21 J
2. 26 J
3. 13 J
4. 18 J

Question 25.

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

(1) 475 J

(2) 450 J

(3) 275 J

(4) 250 J

Question 26.

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

1. 20 J
2. 30 J
3. 5 J
4. 25 J

Question 27.

A force $\boldsymbol{F} = -K(y\boldsymbol{i} + x\boldsymbol{j})$ (where K is a positive constant) acts on a particle moving in the xy-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 F on the particles is

(1) $-2Ka^2$

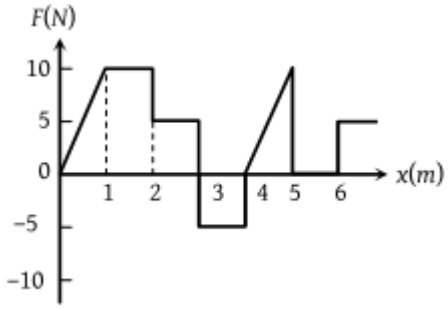
(2) $2Ka^2$

(3) $-Ka^2$

(4) Ka^2

Question 28.

The relationship between the force F and position x of a body is as shown in figure. The work done in displacing the body from $x = 1\ m$ to $x = 5\ m$ will be



(1) 30 J

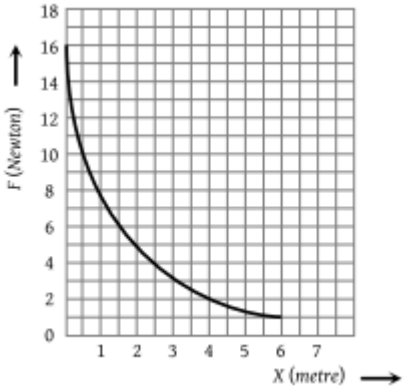
(2) 15 J

(3) 25 J

(4) 20 J

Question 29.

The relation between the displacement X of an object produced by the application of the variable force F is represented by a graph shown in the figure. If the object undergoes a displacement from $X = 0.5\ m$ to $X = 2.5\ m$ the work done will be approximately equal to



(1) 16 J

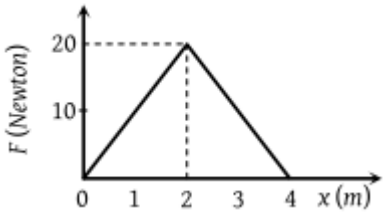
(2) 32 J

(3) 1.6 J

(4) 8 J

Question 30.

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



(1) 50 J

(2) 40 J

(3) 20 J

(4) 10 J

Question 31.

A force of 5 N making an angle θ with the horizontal acting on an object displaces it by 0.4 m along the horizontal direction. If the object gains kinetic energy of 1 J , the horizontal component of the force is -

1. 1.5 N

2. 2.5 N

3. 3.5 N

4. 4.5 N

Question 32.

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

(1) 20 J

(2) 30 J

(3) 40 J

(4) 10 J

Question 33.

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

1. 20 J

2. 30 J

3. 40 J

4. 10 J

Question 34.

A body is moving at the speed of 20 m/s on a rough surface. If the coefficient of friction is 0.5, then the distance after which velocity becomes zero is:

1. 10 m
2. 20 m
3. 40 m
4. 80 m

Question 35.

The work-energy theorem is mathematically written as $W = \frac{1}{2}m\left(v^2 - u^2\right)$. Here the work W is done by

(1) conservative forces only.

(2) non-conservative forces only.

(3) internal forces only.

(4) All the forces

Question 36.

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-

(1) x^2

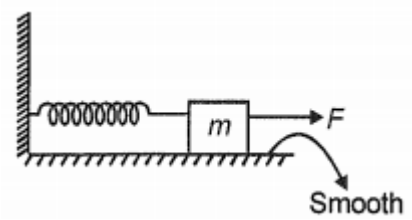
(2) e^x

(3) x

(4) $\log_e x$

Question 37.

A block of mass m is connected to a spring of force constant K. Initially, the block is at rest and the spring is relaxed. A constant force F is applied horizontally towards the right. The maximum speed of the block will be



1. $\frac{F}{\sqrt{2mK}}$
2. $\frac{\sqrt{2}F}{\sqrt{mK}}$
3. $\frac{F}{\sqrt{mK}}$
4. $\frac{2F}{\sqrt{2mK}}$

Question 38.

When an object is shot from the bottom of a long smooth inclined plane kept at an angle of 60° with horizontal, it can travel a distance x_1 along the plane. But when the inclination is decreased to 30° and the same object is shot with the same velocity, it can travel x_2 distance. Then x_1: x_2 will be:

1. $1:2\sqrt{3}$
2. $1:\sqrt{2}$
3. $\sqrt{2}:1$
4. $1:\sqrt{3}$

Question 39.

A body of mass m dropped from a height h reaches the ground with a speed of $1.4\sqrt{gh}$.

The work done by air drag is-

1. –0.2 mgh
2. –0.02 mgh
3. –0.04 mgh
4. mgh

Question 40.

A block of mass M is attached to the lower end of a vertical spring. The spring is hung from a ceiling and has force constant value k. The mass is released from rest with the spring initially unstretched. The maximum extension produced in the length of the spring will be

(1) Mg/k

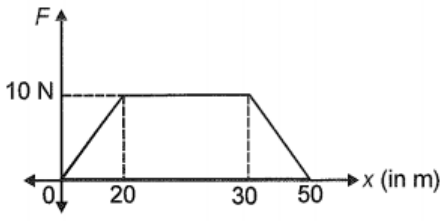
(2) 2Mg/k

(3) 4 Mg/k

(4) Mg/2k

Question 41.

An object of mass m = 1.5 kg is acted upon by the force as shown in the figure that varies with the position of the object as shown. If the object starts from rest at a point x = 0. What is its speed at x = 50 m?



1. 20 m/s
2. 25 m/s
3. 15 m/s
4. 17 m/s

Question 42.

A bullet fired towards a wall reduces its half kinetic energy after the penetration of 6 cm. The further penetration of the bullet in the wall is-

1. 2 cm
2. 1 cm
3. 6 cm
4. 3 cm

Question 43.

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

1. $mg\left(h+d\right)+\frac{1}{2}kd^2$
2. $mg\left(h+d\right)-\frac{1}{2}kd^2$
3. $mg\left(h-d\right)-\frac{1}{2}kd^2$
4. $mg\left(h-d\right)+\frac{1}{2}kd^2$

Question 44.

According to the work-energy theorem, the change in kinetic energy of a body is equal to work done by:

(1) Non-conservative force on the particle

(2) Conservative force on the particle

(3) External force on the particle

(4) All the forces on the particle

Question 45.

A block is carried slowly up an inclined plane. If W_f is work done by the friction, W_N is work done by the reaction force, W_g is work done by the gravitational force and W_{ex} is the work done by an external force, then choose the correct relation/s:

(1) $W_N + W_f + W_g + W_{ex} = 0$

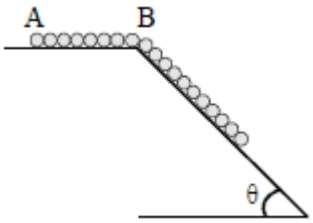
(2) $W_N = 0$

(3) $W_{ex} + W_f = -W_g$

(4) All of these

Question 46.

A chain of length L and mass m is placed upon a smooth surface. The length of BA is (L–b). Calculate the velocity of the chain when its end reaches B.



1. $\sqrt{\frac{2g\ \sin\theta}{L}\left(L^2 - b^2\right)}$

2. $\sqrt{\frac{g\ \sin\theta}{2L}\left(L^2 - b^2\right)}$

3. $\sqrt{\frac{g\ \sin\theta}{L}\left(L^2 - b^2\right)}$

4. None of these

Question 47.

The principle of conservation of energy implies that:

(1) the total mechanical energy is conserved.

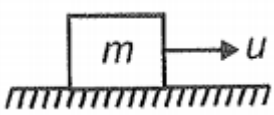
(2) the total kinetic energy is conserved.

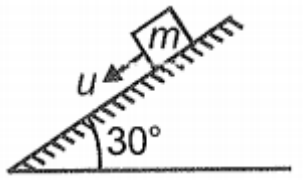
(3) the total potential energy is conserved.

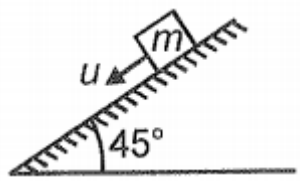
(4) the sum of all types of energies is conserved.

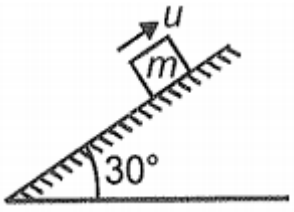
Question 48.

Four situations are shown in following options. In each situation, planes are equally rough and block begins with the same speed and slides until the kinetic frictional force has stopped it. In which of the following cases increase in thermal energy due to sliding is least?

1. 

2. 

3. 

4. 

Question 49.

Three different objects of masses m_1, m_2 and m_3 are allowed to fall from rest and from the same point '*O*' along three different frictionless paths. The speeds of the three objects, on reaching the ground, will be in the ratio of

(1) $m_1 : m_2 : m_3$

(2) $m_1 : 2m_2 : 3m_3$

(3) 1 : 1 : 1

(4) $\frac{1}{m_1} : \frac{1}{m_2} : \frac{1}{m_3}$

Question 50.

If a stone is projected vertically upward from the ground with a speed of 10 m/s, then it's: ($g = 10\ m/s^2$)

1. Potential energy will be maximum after 0.5 s
2. Kinetic energy will be maximum again after 1 s
3. Kinetic energy = potential energy at a height of 2.5 m from the ground
4. Potential energy will be minimum after 1 s

Question 51.

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, the work required to pull the hanging part on to the table is

(1) *MgL*

(2) *MgL*/3

(3) *MgL*/9

(4) *MgL*/18

Question 52.

A ball is thrown vertically downwards from a height of 20m with an initial velocity v_o . It collides with the ground, loses 50% of its energy in collision and rebounds to the same height. The initial velocity v_o is (Take, g = 10 ms^{-2})

(1) 14 ms^{-1}

(2) 20ms^{-1}

(3) 28ms^{-1}

(4) 10ms^{-1}

Question 53.

A spherical ball of mass 20 *kg* is stationary at the top of a hill of height 100 *m*. It slides down a smooth surface to the ground, then climbs up another hill of height 30 *m* and finally slides down to a horizontal base at a height of 20 *m* above the ground. The velocity attained by the ball is

(1) 10 *m/s*

(2) $10\sqrt{30}$ *m/s*

(3) 40 *m/s*

(4) 20 *m/s*

Question 54.

A particle of mass m is projected at an angle α with the horizontal with an initial velocity u. The work done by gravity during the time it reaches its highest point is:

1. $u^2\sin^2 a$
2. $\frac{mu^2\cos^2\alpha}{2}$
3. $\frac{mu^2\sin^2\alpha}{2}$
4. $-\frac{mu^2\sin^2\alpha}{2}$

Question 55.

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

(1) *mg*

(2) $mg\left(1-\frac{h}{d}\right)$

(3) $mg\left(1+\frac{h}{d}\right)$

(4) $mg\left(1+\frac{h}{d}\right)^2$

Question 56.

A cord is used to lower vertically a block of mass M by a distance d with constant downward acceleration $\frac{g}{4}$. Work done by the cord on the block is

(1) $Mg\frac{d}{4}$

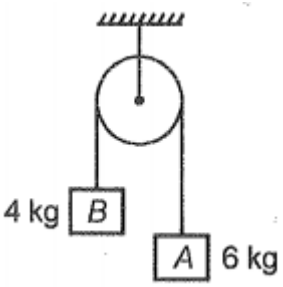
(2) $3Mg\frac{d}{4}$

(3) $-3Mg\frac{d}{4}$

(4) Mgd

Question 57.

What is the work done by gravity on block A in 2 seconds after the blocks are released? (Pulley is light)



(1) 240 J

(2) 200 J

(3) 120 j

(4) 24 J

Question 58.

The work done by a person in carrying a box of mass 10 kg through a vertical height of 10 m is 4900 J. The mass of the person is:

(1) 40 kg

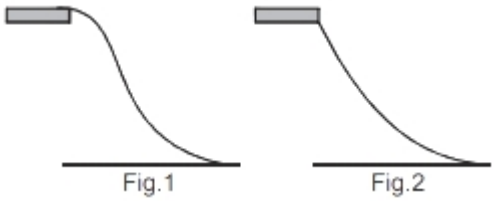
(2) 60 kg

(3) 50 kg

(4) 55 kg

Question 59.

A flexible smooth track is fixed in two alternate arrangements, as shown in figure-1 and 2. The length of the track used is the same in each case, and the height through which it falls from the bench to the floor is the same. A toy car is released at rest and slides down the track. Air resistance can be ignored.



1. The speed at the bottom as well as time taken in both the tracks are the same.

2. The speed at the bottom as well as time taken in both the tracks are different.

3. The speed at the bottom is different but the time taken in both the tracks are the same.

4. The speed at the bottom is same but the time taken in both the tracks are different.

Question 60.

Two identical cylindrical vessels with their bases at the same level each contain a liquid of density; ρ. The height of the liquid in one vessel is h_1 and that in the other vessel is h_2 $\left(h_1 > h_2\right)$.The area of either base is A. The work done by gravity in equalizing the levels when the two vessels are connected is :

(1) $\left(h_1 - h_2\right)g\rho$

(2) $\left(h_1 - h_2\right)gA\rho$

(3) $\frac{1}{2}\left(h_1 - h_2\right)^2gA\rho$

(4) $\frac{1}{4}\left(h_1 - h_2\right)^2gA\rho$

Question 61.

Select incorrect statement about potential energy.

1. Change in potential energy is equal to work done against the internal conservative force.

2. Change in potential energy is independent of the reference point.

3. Change in potential energy depends on the reference frame.

4. The potential energy at a point is not unique.

Question 62.

A body is thrown vertically up with certain initial velocity, the potential and kinetic energies of the body are equal at a point P in its path. If the same body is thrown with double the velocity upwards, the ratio of potential and kinetic energies of the body when it crosses the same point, is

1. 1:1

2. 1:4

3. 1:7

4. 1:8

Question 63.

A ball is dropped from a height of 5 m, if it rebound upto height of 1.8 m, then the ratio of velocities of the ball after and before rebound is :

1. $\frac{3}{5}$

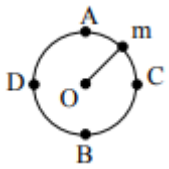
2. $\frac{2}{5}$

3. $\frac{1}{5}$

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

Question 64.

A mass is performing vertical circular motion (see figure). If The average velocity of the particle is increased, then at which point the string will break :



1. A

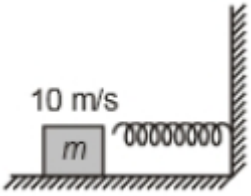
2. B

3. C

4. D

Question 65.

A block of mass 2 kg moving with velocity of 10 m/s on a smooth surface hits a spring of force constant 80×10^3 N/m as shown. The maximum compression in the spring is



1. 5 cm

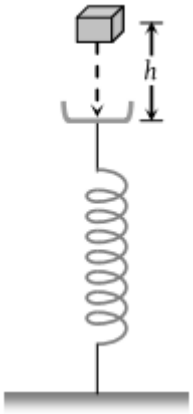
2. 10 cm

3. 15 cm

4. 20 cm

Question 66.

A block of mass *m* initially at rest is dropped from a height *h* on to a spring of force constant *k*. the maximum compression in the spring is *x* then **[BCECE 2005]**



(1) $mgh = \frac{1}{2}kx^2$

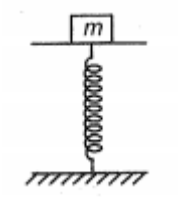
(2) $mg\left(h + x\right) = \frac{1}{2}kx^2$

(3) $mgh = \frac{1}{2}k(x + h)^2$

(4) $mg\left(h + x\right) = \frac{1}{2}k(x + h)^2$

Question 67.

A mass of 1 kg is put on a pan and the spring is stretched from its equilibrium position by 10 cm. When the pan is released, the block just gets detached for a moment. What should be the minimum value of the spring constant for which this can happen? $\left[Take\ g = 10\ ms^{-2}\right]$



1. 10 N/m
2. 100 N/m
3. 1000 N/m
4. 1 N/m

Question 68.

A spring 40 mm long is stretched by the application of a force. If 10 N force required to stretch the spring through 1 mm, then work done in stretching the spring through 40 mm is

(1) 84J

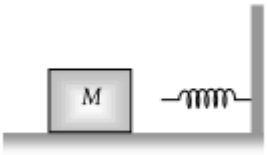
(2) 68J

(3) 23J

(4) 8J

Question 69.

The block of mass *M* moving on the frictionless horizontal surface collides with the spring of spring constant *K* and compresses it by length *L*. The maximum momentum of the block after collision is



(1) Zero

(2) $\frac{ML^2}{K}$

(3) $\sqrt{MK}\,L$

(4) $\frac{KL^2}{2M}$

Question 70.

Two springs of spring constants k and 3k are stretched separately by the same force. The ratio of potential energy stored in them respectively will be:

1. 3: 1
2. 9: 1
3. 1: 3
4. 1: 9

Question 71.

A weight mg is suspended from a spring. If the energy stored in the spring is U. The elongation in the spring is:

1. $\frac{2U}{mg}$
2. $\frac{U}{mg}$
3. $\frac{\sqrt{2}U}{mg}$
4. $\frac{U}{\sqrt{2}mg}$

Question 72.

Work done in increasing the length of a massless spring from natural length 15 cm to 15.1 cm is 20 J. Work done in increasing the length from 15.1 cm to 15.2 cm is

(1) 20 J

(2) 40 J

(3) 60 J

(4) 80 J

Question 73.

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

(1) U/5

(2) 5U

(3) 10U

(4) 25U

Question 74.

Work done in increasing the length of massless spring by 1 cm from natural length is 10 J. Work done in increasing the length further by 1 cm, is

(1) 10 J

(2) 30 J

(3) 50

(4) 80 J

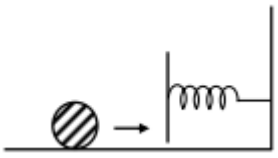
Question 75.

When spring is subjected to 4N force its length is a metre and if 5N is applied length is b metre. If 9N is applied its length is :

1. 4b – 3a
2. 5b – a
3. 5b – 4a
4. 5b – 2a

Question 76.

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



(1) 0.12 m

(2) 1.5 m

(3) 0.5 m

(4) 0.15 m

Question 77.

Two springs A and B $\left(K_A = 2K_B\right)$ are stretched by the same suspended weights, then the ratio of work done in stretching is:

1. 1 : 2
2. 2 : 1
3. 1 : 1
4. 1 : 4

Question 78.

The potential energy U of a system is given by $U = A - Bx^2$ (where x is the position of its particle and A, B are constants). The magnitude of the force acting on the particle is:

1. Constant
2. Proportional to x
3. Proportional to x^2
4. Proportional to $\left(\frac{1}{x}\right)$

Question 79.

Potential energy of a particle at position x is given by $U = (-x^2 + 2x)$ J. Force on the particle at x = 1 m is:

(1) $-\hat{i}$N

(2) $-2\hat{i}$ N

(3) $2\hat{i}$ N

(4) Zero

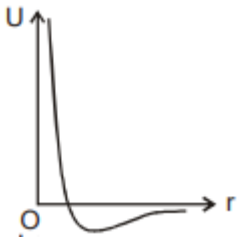
Question 80.

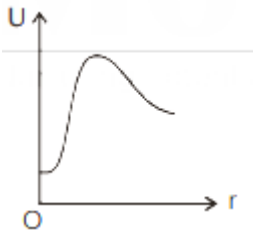
The potential energy of a particle in a force field is $U = \frac{A}{r^2} - \frac{B}{r}$ where A and B are positive constants and r is the distance of the particle from the center of the field. For stable equilibrium, the distance of the particle is:

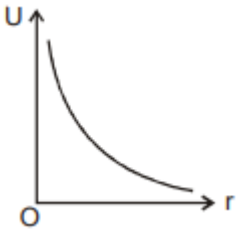
1. B/A
2. B/2A
3. 2A/B
4. A/B

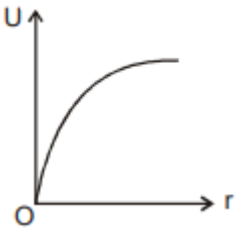
Question 81.

The diagrams represent the potential energy U of a function of the inter-atomic distance r. Which diagram corresponds to stable molecules found in nature.

1. 

2. 

3. 

4. 

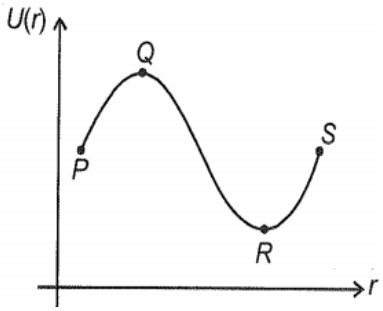
Question 82.

Potential energy (U) related to coordinates is given by U = 3(x + y). Work was done when the particle is going from (0, 0), (2, 3) is:

1. 15 J
2. -15 J
3. 12 J
4. 10 J

Question 83.

The potential energy of a particle varies with distance r as shown in the graph. The force acting on the particle is zero at:



(1) P

(2) S

(3) Q and R

(4) Both P and S

Question 84.

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

1. $\frac{K}{2r}$
2. $-\frac{K}{2r}$
3. $-\frac{K}{r}$
4. $\frac{K}{r}$

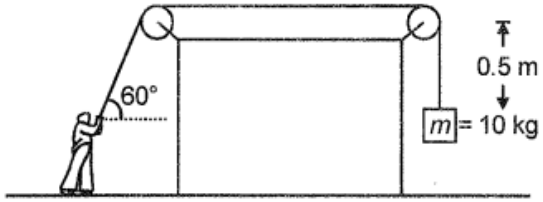
Question 85.

The potential energy of a particle of mass 1 kg free to move along the X-axis is given by $U(x) = \left(3x^2 - 4x + 6\right)$ J. Force acting on the particle at x = 0 is:

1. $2\hat{i}$ N
2. $-4\hat{i}$ N
3. $5\hat{i}$ N
4. $4\hat{i}$ N

Question 86.

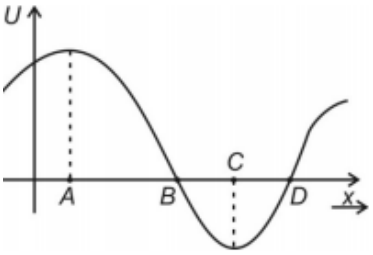
In the given figure, a man pulls the mass m with the help of a rope. Work done by the man against the gravity when mass is lifted by 0.5 m is ($g = 10\ m/s^2$)



1. 50 J
2. 100 J
3. 25 J
4. Zero

Question 87.

The given diagram represents the potential energy curve of a particle in a field. The particle will be in equilibrium at position:



1. at B and D
2. at A and C
3. A, B, and C
4. at A, B, C, and D

Question 88.

The potential energy of a system increases if work is done

(1) by the system against a conservative force

(2) by the system against a nonconservative force

(3) upon the system by a conservative force

(4) upon the system by a nonconservative force

Question 89.

A particle is moving such that potential energy U varies with position in metre as U = ($4x^2$ - 2x + 50) J. The particle will be in equilibrium at:

(1) x = 25 cm

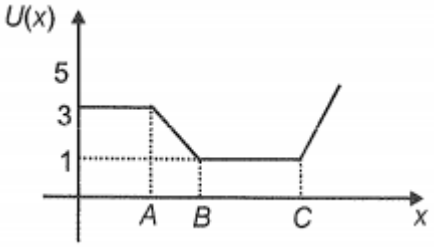
(2) x = 2.5 cm

(3) x = 25 m

(4) x = 2.5 m

Question 90.

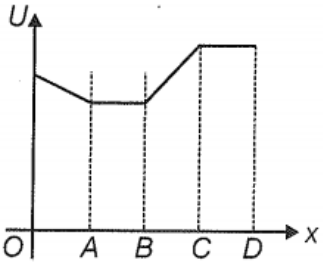
The figure shows the potential energy function U(x) for a system in which a particle is in one-dimensional motion. What is the direction of the force when the particle is in region AB? (symbols have their usual meanings)



1. The positive direction of x
2. The negative direction of X
3. Force is zero, so direction not defined
4. The negative direction of y

Question 91.

The figure shows the potential energy function U of a system in which a particle is in one-dimensional motion. In which region the magnitude of the force on the particle is greatest? (x: position)



(1) OA

(2) CD

(3) AB

(4) BC

Question 92.

An engine pumps liquid of density d continuously through a pipe of cross-sectional area A. If the speed with which liquid passes through the pipe is v, then the rate at which kinetic energy is being imparted to the liquid by the pump is:

1. Adv^2
2. $\frac{1}{2}Adv^2$
3. $\frac{1}{2}Adv^3$
4. $\frac{1}{2}Adv$

Question 93.

A particle moves with velocity $\left(5\hat{i} - 3\hat{j} + 6\hat{k}\right)$m/s under the influence of a constant force $\vec{F} = \left(10\hat{i} + 10\hat{j} + 20\hat{k}\right)$ N. The instantaneous power applied to the particle is:

1. 200 J/sec
2. 40 J/sec
3. 140 J/sec
4. 170 J/sec

Question 94.

An automobile of mass m accelerates from rest, while the engine supplies constant power P. The speed of the automobile as a function of time is given by:

1. $v = \left(\frac{2Pt}{m}\right)^{1/2}$
2. $v = (2Ptm)^{1/3}$
3. $v = \left(\frac{8}{9}\frac{P}{m}t^3\right)^{1/2}$
4. $v = \left(2Pt^3m\right)^{1/2}$

Question 95.

A pump ejects 12,000 kg of water at a speed of 4 m/s in 40 s. Find the average rate at which the pump is working.

1. 0.24 kW
2. 2.4 W
3. 2.4 kW
4. 24 W

Question 96.

A truck of mass M accelerates from rest while the engine supplies a constant power P. The velocity attained after time t is proportional to

1. $t^{1/2}$
2. $t^{5/2}$
3. $t^{-1/2}$
4. t^2

Question 97.

A body is moving along a straight line by a machine delivering constant power. The distance moved by the body in time *t* is proportional to

(1) $t^{1/2}$

(2) $t^{3/4}$

(3) $t^{3/2}$

(4) t^2

Question 98.

A weight lifter lifts 300 *kg* from the ground to a height of 2 *meter* in 3 *second*. The average power generated by him is

(1) 5880 *watt*

(2) 4410 *watt*

(3) 2205 *watt*

(4) 1960 *watt*

Question 99.

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

1. t_2P_0
2. $t^{1/2}$
3. $t^{-1/2}$
4. $t / \sqrt{m}$

Question 100.

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

1. $\frac{1}{2}mv^3$
2. mv^3
3. $\frac{1}{2}mv^2$
4. $\frac{1}{2}m^2v^2$

Question 101.

A truck of mass 30,000 kg moves up an inclined plane of slope 1 in 100 at a speed of 30 km/h. The power of the truck is (given g=10 ms^{-2}):

1. 25 kW
2. 10 kW
3. 5 kW
4. 2.5 kW

Question 102.

A water pump rated 400 W has an efficiency of 75%. If it is employed to raise water through a height of 40 m, then the volume of water drawn in 10 min is:-

1. 10.9 m^3
2. 0.45 m^3
3. 1.8 m^3
4. 0.25 m^3

Question 103.

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

1. 1 m/s
2. 4 m/s
3. 2 m/s
4. $2\sqrt{2}$ m/s

Question 104.

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? (g = 10 m/s^2)

1. 8.1 kW
2. 10.2 kW
3. 12.3 kW
4. 7.0 kW

Question 105.

A particle of mass m is moving in a circular path with speed v = kt, where k is constant and t is time. The instantaneous power delivered to the particle is

(1) Zero
(2) mkt
(3) mk^2t
(4) mk^2t^2

Question 106.

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

1. $\sqrt{\frac{mk}{2}}t^{\frac{-1}{2}}$
2. $\sqrt{mkt}^{\frac{-1}{2}}$
3. $\sqrt{2mkt}^{\frac{-1}{2}}$
4. $\frac{1}{2}\sqrt{mkt}^{\frac{-1}{2}}$

Question 107.

A motor pulls a block by giving a force of 50 N at a speed of 36 km/h. The power supplied by the motor to the block is:

1. 500 watt
2. 1800 watt
3. 250 watt
4. 200 watt

Question 108.

A body starts moving from rest in straight line under a constant power source. Its displacement in time t is proportional to

(1) $t^{1/2}$

(2) t

(3) $t^{3/2}$

(4) t^2

Question 109.

A quarter horse power motor runs at a speed of 600 *r.p.m*. Assuming 40% efficiency, the work done by the motor in one rotation will be

(1) 7.46 *J*

(2) 7400 *J*

(3) 7.46 *ergs*

(4) 74.6 *J*

Question 110.

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

(1) $\frac{Mv^2}{T}$

(2) $\frac{1}{2}\frac{Mv^2}{T^2}$

(3) $\frac{Mv^2}{T^2}$

(4) $\frac{1}{2}\frac{Mv^2}{T}$

Question 111.

The speed of a particle moving in a circular path is decreasing with time. The instantaneous power due to the force acting on it will be:

(1) Positive

(2) Negative

(3) Zero

(4) Maybe positive or negative

Question 112.

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

(1) $\frac{mv_1t}{t_1}$

(2) $\frac{mv_1^2t}{t_1}$

(3) $\frac{mv_1t^2}{t_1}$

(4) $\frac{mv_1^2t}{t_1^2}$

Question 113.

A force F acting on a body depends on its displacement x as $F \propto x^n$. The power delivered by F will be independent of x if n is–

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

2. $-\frac{1}{3}$

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

4. $-\frac{1}{2}$

Question 114.

A 40 kg boy is swinging on a swing. The power delivered by gravity force, when the swing is making an angle of 30° with the horizontal and the boy moving with a velocity of 8 m/s upwards, is: ($g = 10\ m/s^2$)

(1) - 1000 W

(2) - 500 W

(3) - 1600 W

(4) $-1600\sqrt{3}$ W

Question 115.

A body is projected obliquely from the horizontal ground. The magnitude of power delivered by gravity during its motion from the ground to the topmost point is:

1. Constant

2. Increases continuously

3. Decreases continuously

4. May increase or decrease depending on the angle of projection

Question 116.

A rope is used to lower vertically a block of mass M with a constant downward acceleration of $\frac{g}{3}$. Then power delivered by the rope at any time t

1. $\frac{Mg^2}{9}t$

2. $\frac{-Mg^2}{9}t$

3. $\frac{-2}{3}Mg^2t$

4. $\frac{-2}{9}Mg^2t$

Question 117.

A 50 kg mass is swinging in a vertical plane on a string, from rest. Then the power delivered when mass is moving with a velocity of 2 m/sec upwards in a direction making an angle 60° with the vertical is- ($g = 9.8\ m/s^2$)

1. 980 W

2. 490 W

3. $490\sqrt{3}\ W$

4. 245 W

Question 118.

If $\vec{F} = \left(60\hat{i} + 15\hat{j} - 3\hat{k}\right) N$ and $\vec{V} = \left(2\hat{i} - 4\hat{j} + 5\hat{k}\right) m/s$, then instantaneous power is:

1. 195 watt
2. 45 watt
3. 75 watt
4. 100 watt

Question 119.

A body of mass 2 kg moving with a velocity $\left(\hat{i} + 2\hat{j} - 3\hat{k}\right) ms^{-1}$ collides with another body of mass 3 kg moving with a velocity $\left(2\hat{i} + \hat{j} + \hat{k}\right) ms^{-1}$. If they stick together, the velocity in ms^{-1} of the composite body is :

1. $\frac{1}{5}\left(8\hat{i} + 7\hat{j} - 3\hat{k}\right)$
2. $\frac{1}{5}\left(-4\hat{i} + \hat{j} - 3\hat{k}\right)$
3. $\frac{1}{5}\left(8\hat{i} + \hat{j} - \hat{k}\right)$
4. $\frac{1}{5}\left(-4\hat{i} + 7\hat{j} - 3\hat{k}\right)$

Question 120.

Two equal masses m_1 and m_2 moving along the same straight line with velocities +3 *m/s* and –5 *m/s* respectively collide elastically. Their velocities after the collision will be respectively

(1) +4 *m/s* for both

(2) –3 *m/s* and +5 *m/s*

(3) –4 *m/s* and +4 *m/s*

(4) –5 *m/s* and +3 *m/s*

Question 121.

A smooth sphere of mass M moving with velocity u directly collides elastically with another sphere of mass m at rest. After the collision, their final velocities are V and v respectively. The value of v is:

1. $\frac{2um}{m}$
2. $\frac{2um}{M}$
3. $\frac{2u}{1 + \frac{m}{M}}$
4. $\frac{2u}{1 + \frac{M}{m}}$

Question 122.

Which of the following remains unchanged (for the system) during an inelastic collision?

1. Mechanical energy
2. Kinetic energy
3. Momentum
4. All of the above.

Question 123.

A body of mass 2 kg moving with a velocity of 3 m/s collides with a body of mass of 1 kg moving with a velocity of 4 m/s in opposite direction. If the collision is head-on and completely inelastic, then the wrong statement is:

1. Both bodies move together with velocity (2/3) m/s.
2. The momentum of the system is 2 kg-m/s throughout.
3. The momentum of the system is 10 kg-m/s.
4. The loss of KE of the system is (49/3) J.

Question 124.

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 v/3. The second block's speed after the collision is

(1)2√2/3v

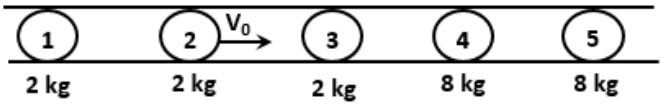
(2)3/4v

(3)3/√2v

(4)√3/2v

Question 125.

Five balls are placed one after another along a straight line as shown in the figure. Initially, all the balls are at rest. Then the second ball has been projected with speed V_0 towards the third ball. Mark the correct statement. (Assume all collisions to be head-on and elastic):



1. The total number of collisions in the process is 5

2. The velocity of separation between the first and fifth ball after the last possible collision is V_0

3. Finally three balls remain stationary

4. All of the above are correct

Question 126.

A car of mass 100 kg and traveling at 20 m/s collides with a truck of mass 1 ton traveling at 9 km/h in the same direction. The car bounces back at a speed of 5 m/s. The speed of the truck after the impact is:

1. 11.5 m/s

2. 5 m/s

3. 18 m/s

4. 12 m/s

Question 127.

A body of mass m moving with speed v collides head-on elastically with another identical body at rest. The percentage loss in kinetic energy of the first body will be:

(1) 0%

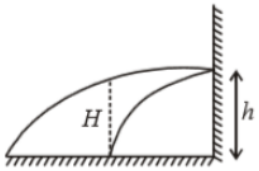
(2) 25%

(3) 50%

(4) 100%

Question 128.

A stone is projected from a horizontal plane. It attains maximum height 'H' & strikes a stationary smooth wall & falls on the ground vertically below the maximum height. Assume the collision to be elastic, the height of the point on the wall where ball will strike is:



(1) $\frac{H}{2}$

(2) $\frac{H}{4}$

(3) $\frac{3H}{4}$

(4) None of these

Question 129.

A body of mass m moving with a certain speed suffers a perfectly inelastic collision with a body of mass M at rest. The ratio of the final kinetic energy of the system to the initial kinetic energy is:

1. $\frac{m}{m + M}$

2. $\frac{M}{m + M}$

3. $\frac{m + M}{m}$

4. $\frac{m + M}{M}$

Question 130.

A body having initial kinetic energy 2 J collides with the identical body at rest. The maximum loss of kinetic energy in the collision is-

(1) 2 J

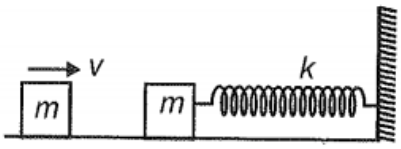
(2) Zero

(3) 1 J

(4) 1.5 J

Question 131.

A block of mass m is moving with speed v towards a spring block system. If the collision is perfectly inelastic, then maximum compression in the spring will be:



1. $v\sqrt{\frac{m}{k}}$

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

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

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

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