NDA-CDS 1 2025

GS

LIVE

PHYSICS

WORK ENERGY POWER

CLASS 2

NAVJYOTI SIR

SSBCrack EXAMS

18 Dec 2024 Live Classes Schedule

8:00AM	18 DEC 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	18 DEC 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

SSB INTERVIEW LIVE CLASSES

9:30AM	COMPLETE PSYCH TESTS	ANURADHA MA'AM

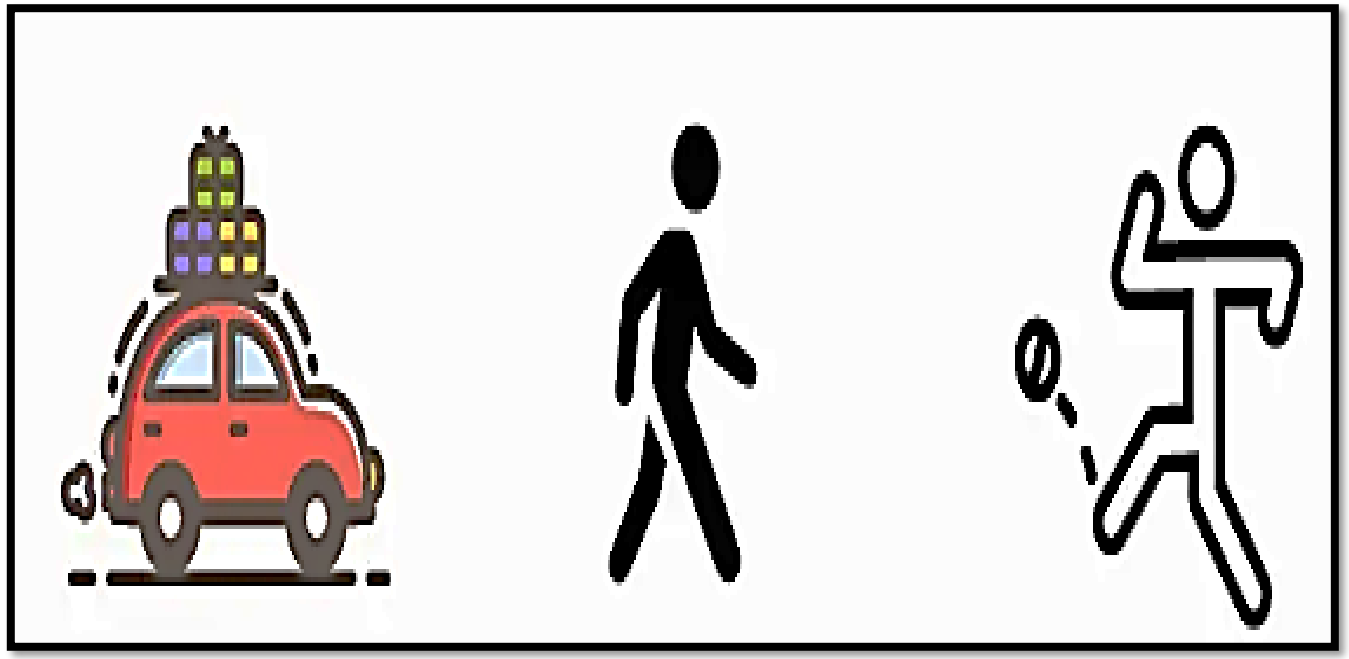
NDA 1 2025 LIVE CLASSES

1:00PM	PHYSICS - WORK ENERGY POWER - CLASS 2	NAVJYOTI SIR
4:30PM	ENGLISH - CORRELATING SENTENCES - CLASS 1	ANURADHA MA'AM
5:30PM	MATHS - INTEGRATION - CLASS 2	NAVJYOTI SIR

CDS 1 2025 LIVE CLASSES

1:00PM	PHYSICS - WORK ENERGY POWER - CLASS 2	NAVJYOTI SIR
4:30PM	ENGLISH - CORRELATING SENTENCES - CLASS 1	ANURADHA MA'AM
7:00PM	MATHS - LOGARITHMS	NAVJYOTI SIR

WORK, ENERGY AND POWER - MCQs



The SI unit of Power is

A. Js

B. J/s

C. s/J

D. J/s^2

$$\text{Power} = \frac{\text{Work done / Energy}}{\text{Time}}$$

J

s

Js^{-1} or watt

The SI unit of Power is

A. Js

B. J/s

C. s/J

D. J/s^2

What is the work done in lifting a body of mass 5 kg vertically through

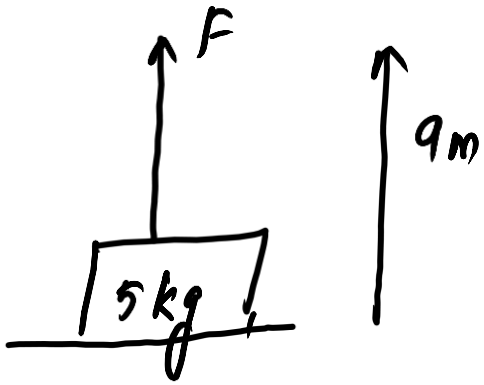
9 m ?

A. - 450 J

B. 450 J

C. 45 J

D. 540 J



$$W = (mg)h$$

$$= (5 \times 10) \times 9$$

$$= 450\ J$$

What is the work done in lifting a body of mass 5 kg vertically through

9 m ?

A. - 450 J

B. 450 J

C. 45 J

D. 540 J

Fundamental laws of physics require

(a) conservation of energy and non-conservation of charge.

(b) conservation of charge and non-conservation of linear momentum.

(c) conservation of charge and non-conservation of energy.

(d) conservation of energy, momentum and charge.

Fundamental laws of physics require

(a) conservation of energy and non-conservation of charge.

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(c) conservation of charge and non-conservation of energy.

(d) conservation of energy, momentum and charge.

Answer: D

A lamp consumes 1000 J of electrical energy in 10 s. What is its power ?

A. 10 W

B. 100 W

C. 1000 W

D. 500 W

$$\frac{1000\ J}{10\ s} = 100\ Js^{-1} \text{ or } 100\ W$$

A lamp consumes 1000 J of electrical energy in 10 s. What is its power ?

A. 10 W

B. 100 W

C. 1000 W

D. 500 W

A weightlifter lifts a weight off the ground and holds it up then :

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

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

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

D. No work is done in lifting the weight but work is done in holding it up

displacement = 0

Work done = 0

A weightlifter lifts a weight off the ground and holds it up then :

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

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

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

D. No work is done in lifting the weight but work is done in holding it up

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

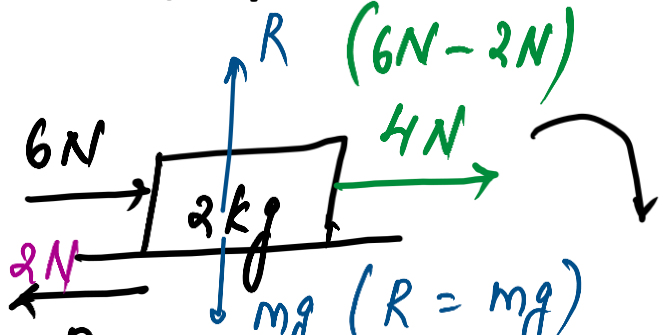
(Take g = 10 m/s²)

A. 200 J

B. - 200 J

C. 600 J

D. - 600 J



Force of friction = μR

$= 0.1\,(2)(10)$

$= 2\,N$

$a = \frac{F_{effective}}{mass}$

$= \frac{4}{2\,kg} = 2\,m/s^2$

$W = F \times s$

$= 6 \times 100 = 600\,J$

$s = ut + \frac{1}{2}at^2$

$s = 0 + \frac{1}{2}(2)(10)^2$

$s = 100\,m$

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

(Take g = 10 m/s^2)

A. 200 J

B. - 200 J

C. 600 J

D. - 600 J

The work done by a body against friction always results in

A. Loss of Kinetic Energy ✓

B. Loss of potential Energy

C. Gain of Kinetic Energy

D. Gain of Potential Energy

will reduce speed ; $K = \frac{1}{2}mv^2$

$K \downarrow$ if $v \downarrow$

The work done by a body against friction always results in

A. **Loss of Kinetic Energy**

B. Loss of potential Energy

C. Gain of Kinetic Energy

D. Gain of Potential Energy

Which of the following is an incorrect statement

A. Kinetic Energy may be zero , positive or negative ✗

B. Power , Energy and Work are all scalars

C. Potential Energy may be zero , positive or negative ✓

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

$\frac{1}{2}mv^2 < 0$

$v^2 < 0$ (not possible)

Which of the following is an incorrect statement

A. **Kinetic Energy may be zero , positive or negative**

B. Power , Energy and Work are all scalars

C. Potential Energy may be zero , positive or negative

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

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

A. $p/2m$

B. $v/2m$

C. $v^2/2m$

D. $p^2/2m$ ✓

$$K = \frac{p^2}{2m}$$

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

A. $p/2m$

B. $v/2m$

C. $v^2/2m$

D. $p^2/2m$

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

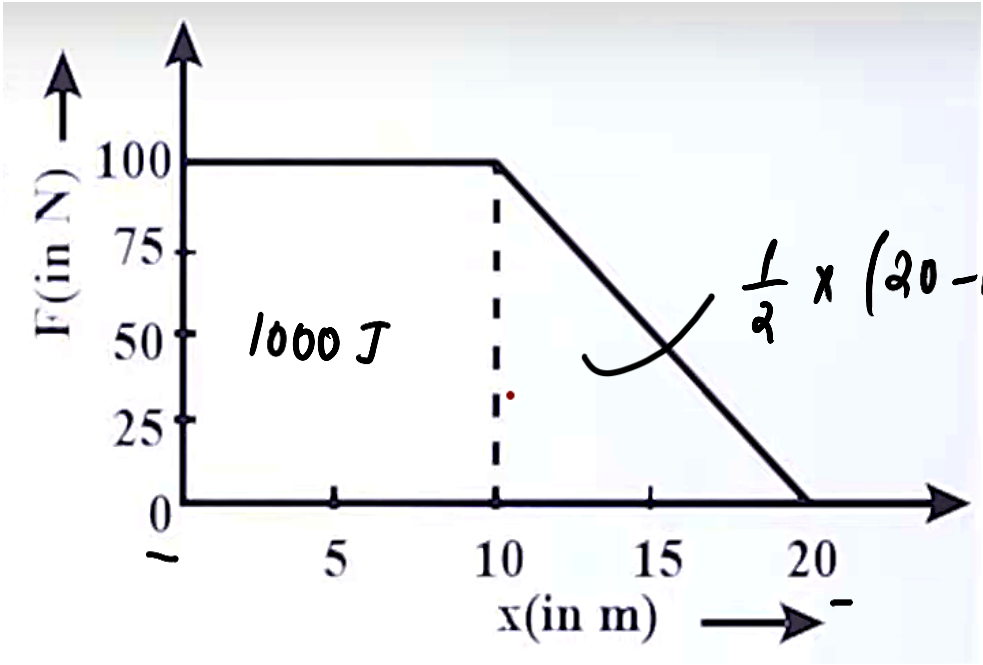
The work done by the force in moving the object from x = 0 to x = 20 m is :

A. 500 J

B. 1000 J

C. 1500 J

D. 2000 J



Work done = Area under force-displacement graph,

$\frac{1}{2} \times (20-10) \times 100 = 500\ J$

Total area = 1000 J + 500 J = 1500 J

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

The work done by the force in moving the object from x = 0 to x = 20 m is :

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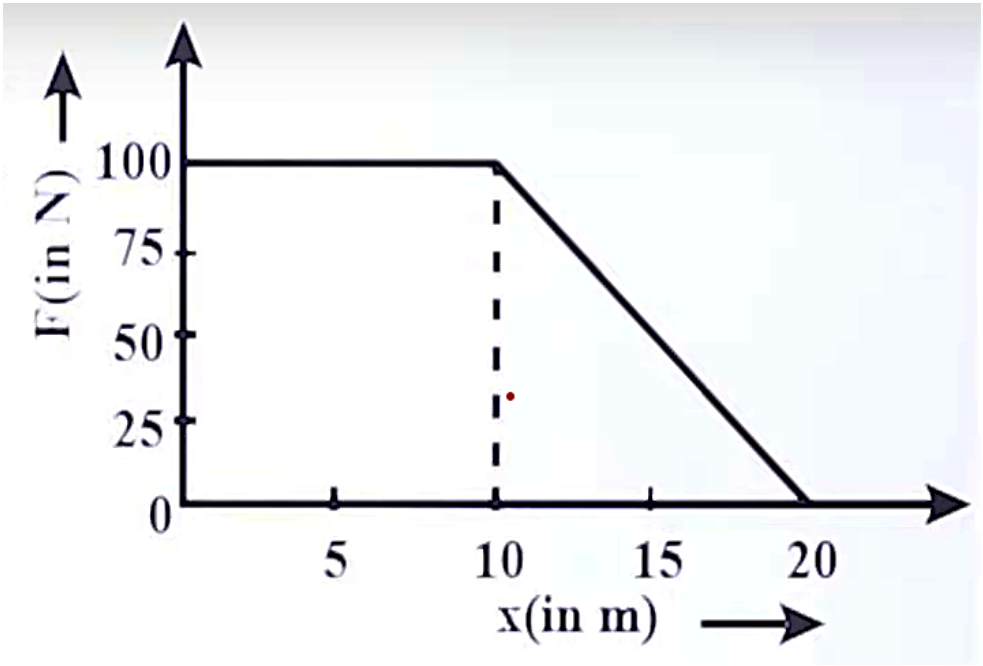
C. 1500 J

D. 2000 J



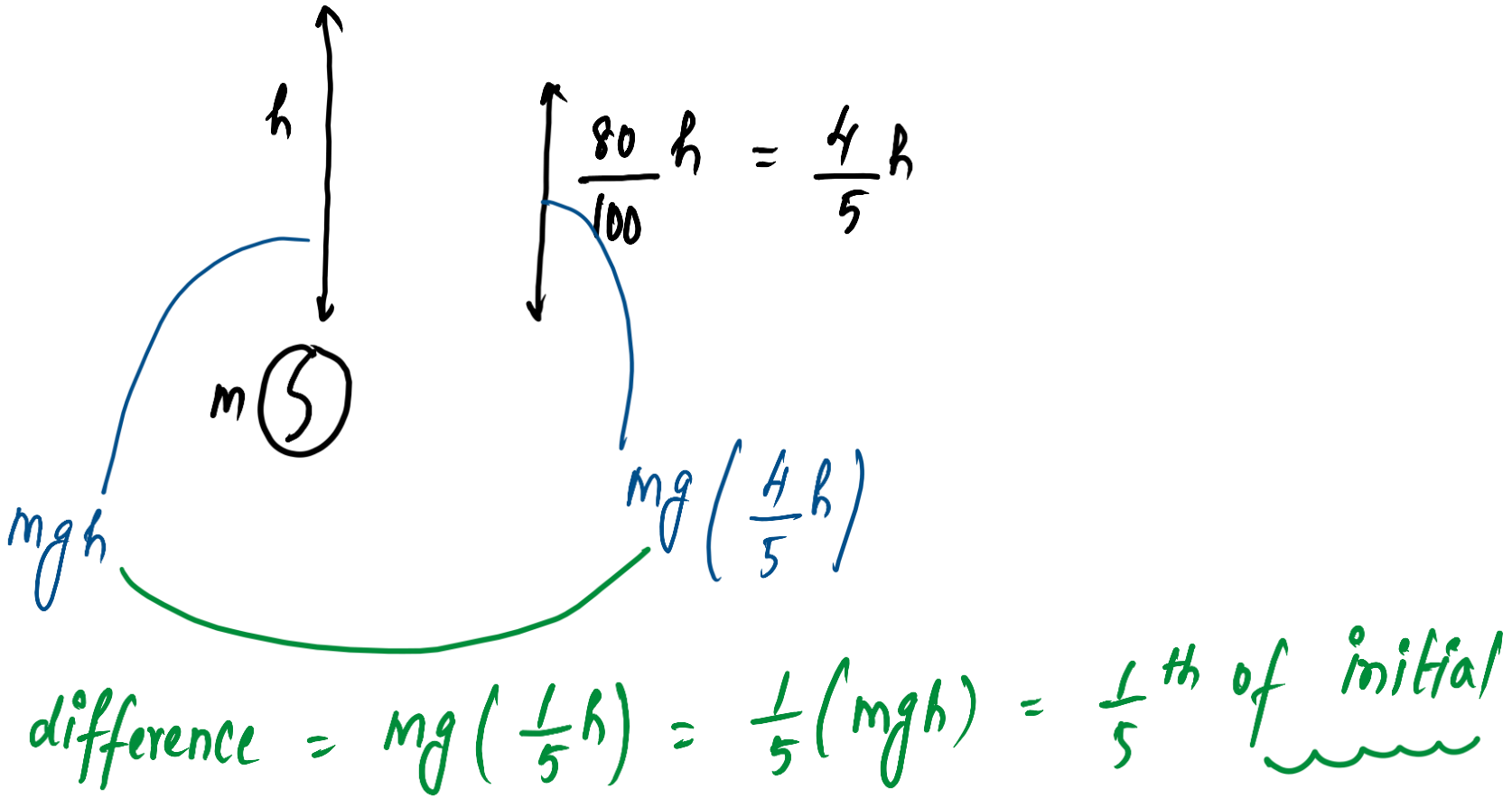
A ball bounces to 80% of its original height. What fraction of its potential energy is lost in each bounce ?

A. 2/5

B. 4/5

C. 1/5 ✓

D. None of the above



A ball bounces to 80% of its original height. What fraction of its potential energy is lost in each bounce ?

A. 2/5

B. 4/5

C. 1/5

D. None of the above

An object of mass 40 kg is raised to a height of 5 m above the ground.

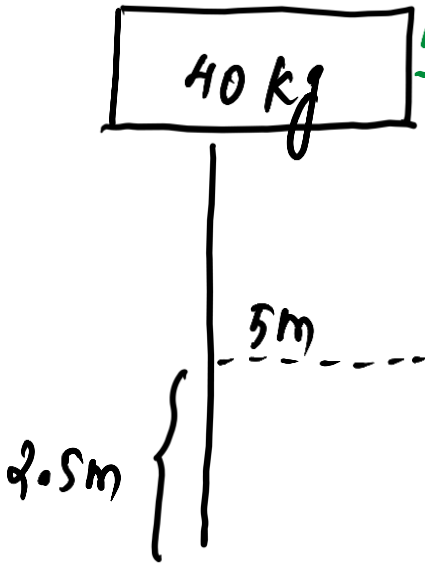
If the object is allowed to fall , find its Kinetic Energy midway.

A. 2000 J

B. 4000 J

C. 1000 J

D. 1500 J



Kinetic energy (KE) $= \frac{1}{2}mv^2 = \frac{1}{2}m(0) = 0$

Potential energy $= mgh = 40 \times 10 \times 5 = 2000\,J$

Total energy $= 2000\,J$

$PE = mg\left(\frac{h}{2}\right) = \frac{1}{2}(mgh) = 1000\,J$

$KE = \text{Total} - PE$

$= 2000\,J - 1000\,J$

$= 1000\,J$

Law of conservation of energy.

An object of mass 40 kg is raised to a height of 5 m above the ground.

If the object is allowed to fall , find its Kinetic Energy midway.

A. 2000 J

B. 4000 J

C. 1000 J

D. 1500 J

A simple pendulum of length 1 m has a wooden bob of mass 1 kg. It is struck by a bullet of mass 0.01 kg moving with a speed of 200 m/s. The height to which the bob rises before swinging back is (Take g = 10 m/s^2)

A. 0.2 m

B. 0.6 m

C. 8 m

D. 1 m

When a long spring is stretched by 2 cm , its potential energy is U. If the spring is stretched by 10 cm , then the potential energy now becomes

A. 10 U

B. 5 U

C. U / 5

D. 25 U ✓

Potential energy $= \frac{1}{2} k x^2$ where k is spring constant, x is displacement

$U = \frac{1}{2} k (2)^2$

$U = 2k$

$U' = \frac{1}{2} k (10)^2$

$= 50k$

$= 25 (2k)$

$= 25U$

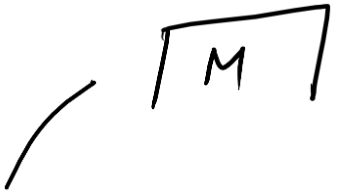
When a long spring is stretched by 2 cm , its potential energy is U. If the spring is stretched by 10 cm , then the potential energy now becomes

A. 10 U

B. 5 U

C. U / 5

D. 25 U



One man takes 1 minute to raise a box of height of 3 m while another man takes 1/2 minute to do so. The energy gained by box in both cases is

A. Same ✓

B. Different

C. Energy for first is more

D. Energy for second is more

potential energy

Mgh Mgh

does not depends on time

One man takes 1 minute to raise a box of height of 3 m while another man takes 1/2 minute to do so. The energy gained by box in both cases is

A. **Same**
B. Different
C. Energy for first is more
D. Energy for second is more

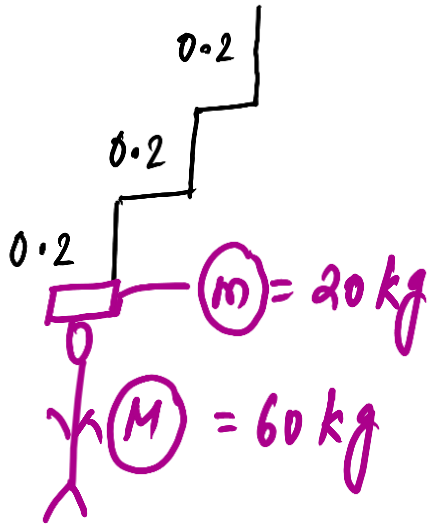
A man weighing 60 kg climbs up a staircase carrying a load of 20 kg on his head. The staircase has 20 steps each of height 0.2 m. If he takes 10 s to climb , find his power.

A. 320 W

B. 120 W

C. 80 W

D. 160 W



$h = 0.2 \times 20\ m = 4\ m$

$(Mg + mg) = (M+m)g$

$$\text{Power} = \frac{\text{Work done}}{\text{Time}} = \frac{(60+20) \times 10 \times 4}{10} = 320\ W$$

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

A. **320 W**

B. 120 W

C. 80 W

D. 160 W

An object of mass 2000 g possesses 100 J kinetic energy. The object must be moving with a speed of

(a) 10·0 m/s

(b) 11·1 m/s

(c) 11·2 m/s

(d) 12·1 m/s

$$100\,J = \frac{1}{2}(2\,kg)\,v^2$$

$$v^2 = 100$$

$$v = 10\ m/s = 10.0\ m/s$$

An object of mass 2000 g possesses 100 J kinetic energy. The object must be moving with a speed of

(a) 10·0 m/s

(b) 11·1 m/s

(c) 11·2 m/s

(d) 12·1 m/s

Answer: A

A negative work is done when an applied force **F** and the corresponding displacement **S** are

(a) perpendicular to each other.

(b) parallel to each other.

(c) anti-parallel to each other.

(d) equal in magnitude.

$W = Fs\cos\theta$

For negative work,

$W = -Fs = Fs(-1)$

$\cos\theta = -1$

$\theta = 180^\circ$

(force and displacement are anti-parallel)

A negative work is done when an applied force **F** and the corresponding displacement **S** are

(a) perpendicular to each other.

(b) parallel to each other.

(c) anti-parallel to each other.

(d) equal in magnitude.

Answer: C

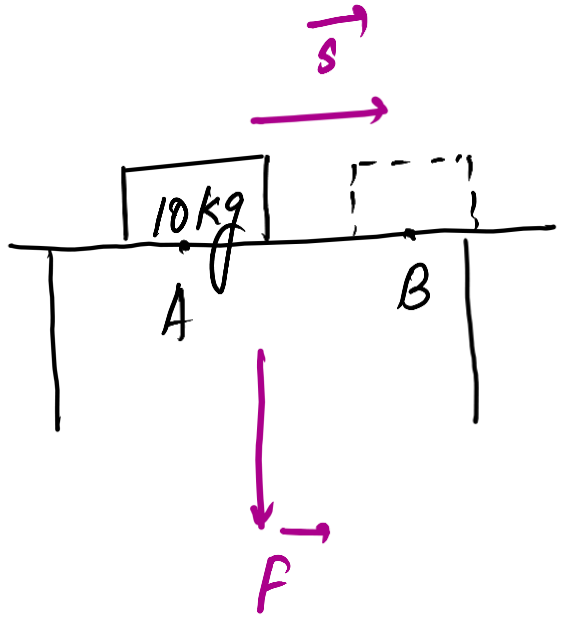
A mass of 10 kg is at a point A on table. It is moved to a point B horizontally , what is the work done on the object by the Gravitational force ?

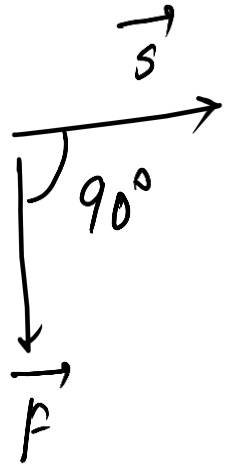
A. 0 J

B. 10 J

C. 100 J

D. 1000 J





$\cos 90^\circ = 0$

Work done = 0 J

A mass of 10 kg is at a point A on table. It is moved to a point B horizontally , what is the work done on the object by the Gravitational force ?

A. 0 J

B. 10 J

C. 100 J

D. 1000 J

The energy possessed by a body due to its change in position or shape is called

(a) thermal energy

(b) potential energy

(c) kinetic energy

(d) electric energy

The energy possessed by a body due to its change in position or shape is called

(a) thermal energy

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(c) kinetic energy

(d) electric energy

Answer : B

Which one of the following forces is non-central and non-conservative ?

(a) Frictional force ✓

(b) Electric force

(c) Gravitational force

(d) Mechanical force

→ resistive forces like friction, viscous forces.

Which one of the following forces is non-central and non-conservative ?

(a) Frictional force

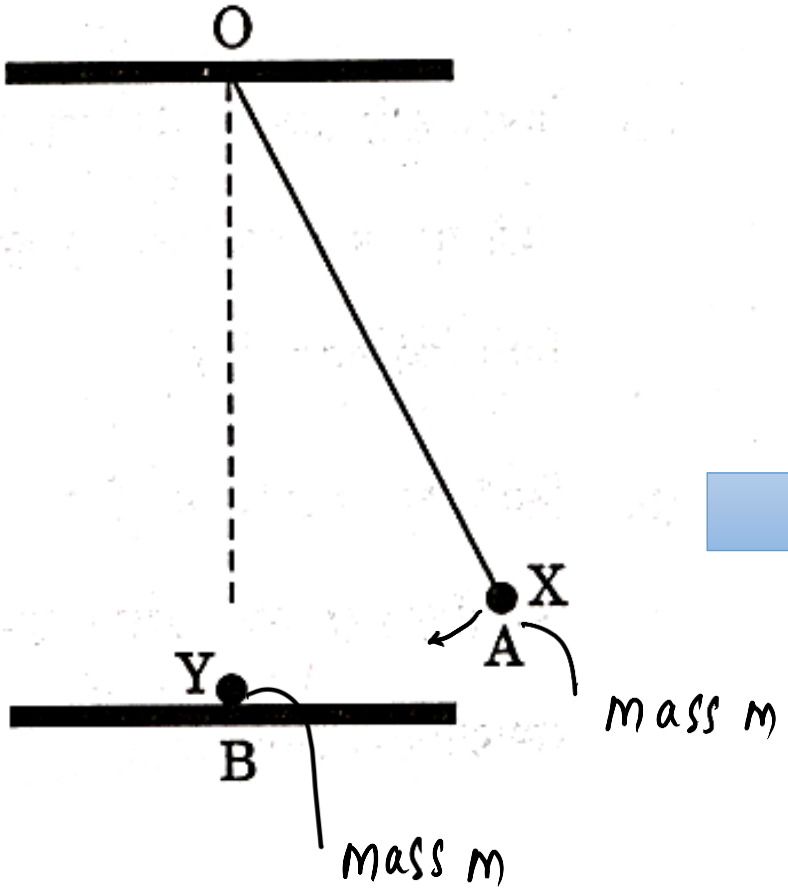
(b) Electric force

(c) Gravitational force

(d) Mechanical force

Answer : A

A metallic bob X of mass m is released from position A. It collides elastically with another identical bob Y placed at rest at position B on a horizontal frictionless table. The angle AOB is 30°.



How high does the bob X rise immediately after the collision ?

(a) To the same height as that of position A on the other side in the same trajectory

(b) To half the height as that of position A on the other side along the same trajectory

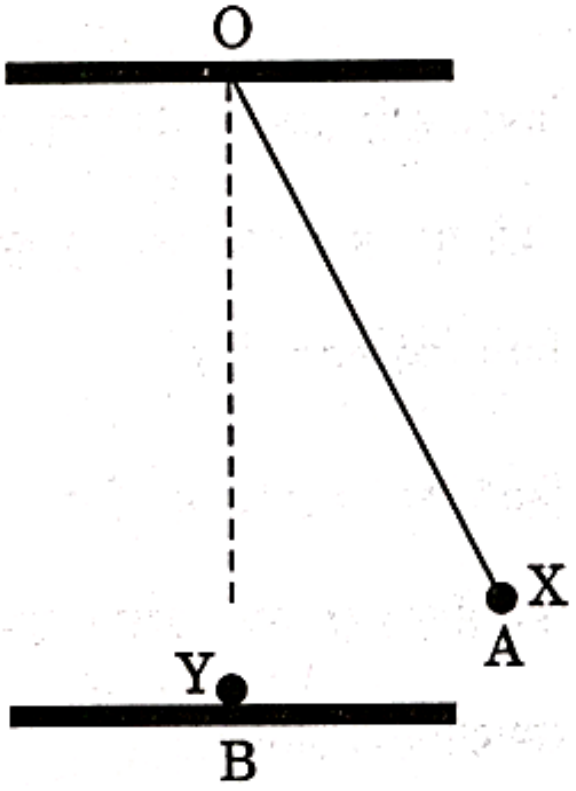
(c) The same height at position A

(d) It stops at position B

PYQ – 2024 - I

When masses are equal, and elastic collision is there, velocities get interchanged.

A metallic bob X of mass m is released from position A. It collides elastically with another identical bob Y placed at rest at position B on a horizontal frictionless table. The angle AOB is 30°.



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(c) The same height at position A

(d) It stops at position B

PYQ – 2024 - I

$$v_{1f} = \frac{(m_1 - m_2)}{m_1 + m_2} v_{1i}$$

$$v_{2f} = \frac{2m_1 v_{1i}}{m_1 + m_2}$$

if $m_1 = m_2$,
$v_{1f} = 0$
$v_{2f} = v_{1i}$

Answer : D

PYQ – 2024 - I

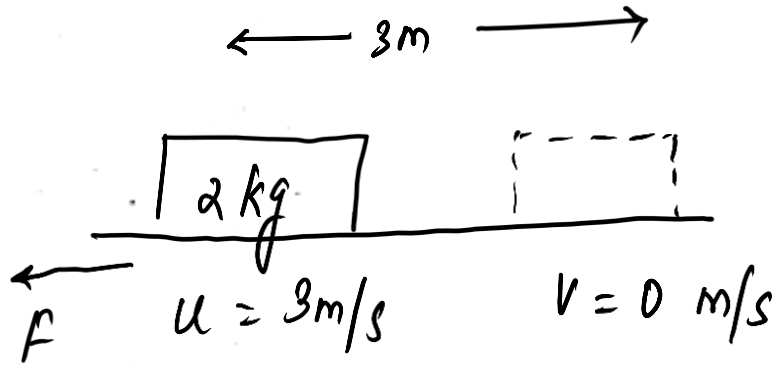
A block of mass 2 kg, moving with the initial speed of 3 m/s comes to rest on a rough horizontal surface after travelling a distance of 3 m. The magnitude of the frictional force is :

(a) 9 N

(b) 3 N

(c) 18 N

(d) 1 N



$$-(F \times 3) = (KE)_f - (KE)_i$$

$$= \frac{1}{2}(2)(0)^2 - \frac{1}{2} \times 2(3)^2$$

$$-3F = 0 - 9$$

$$F = 3N$$

Work done by frictional force = change in kinetic energy

(Work Energy Theorem)

PYQ – 2024 - I

A block of mass 2 kg, moving with the initial speed of 3 m/s comes to rest on a rough horizontal surface after travelling a distance of 3 m. The magnitude of the frictional force is :

(a) 9 N

(b) 3 N

(c) 18 N

(d) 1 N

ANS : B

PYQ – 2024 - I

There is a ball of mass 320 g. It has 625 J potential energy when released freely from a height. The speed with which it will hit the ground is

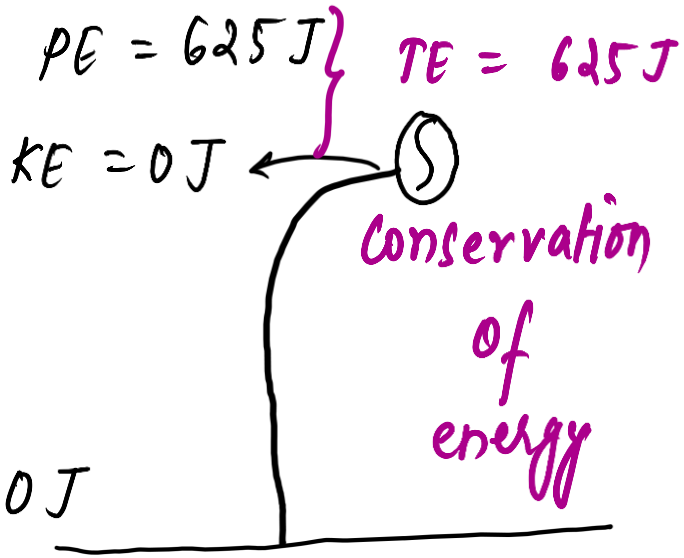
(a) 62·5 m/s

(b) 2·0 m/s

(c) 50 m/s

(d) 40 m/s

625 J = Total energy



$$625\,J = \frac{1}{2}mv^2$$

$$625 = \frac{1}{2} \times 0.32\,kg \times v^2$$

$$v^2 = \frac{625 \times 2 \times 100}{32} = \frac{625 \times 100}{16}$$

$$v = \frac{25 \times 10}{4} = \frac{125}{2} = 62.5\ m/s$$

PYQ – 2024 - I

There is a ball of mass 320 g. It has 625 J potential energy when released freely from a height. The speed with which it will hit the ground is

(a) 62·5 m/s

(b) 2·0 m/s

(c) 50 m/s

(d) 40 m/s

ANS : A

Conservation of momentum in a collision between particles can be understood on the basis of

(a) Newton's first law of motion
(b) Newton's second law of motion
(c) Both Newton's second law of motion and Newton's third law of motion ✓
(d) conservation of energy

Conservation of momentum in a collision between particles can be understood on the basis of

(a) Newton's first law of motion
(b) Newton's second law of motion
(c) Both Newton's second law of motion and Newton's third law of motion
(d) conservation of energy

ANS : C

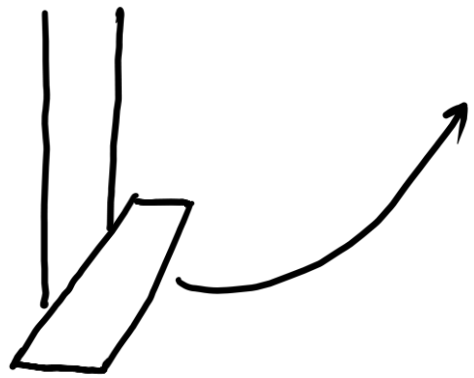
Which one among the following happens when a swing rises to a certain height from its rest position?

(a) Its potential energy decreases while kinetic energy increases

(b) its kinetic energy decreases while potential energy increases ✓

(c) Both potential and kinetic energy decreases

(d) Both potential and kinetic energy increases



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(a) Its potential energy decreases while kinetic energy increases
(b) its kinetic energy decreases while potential energy increases
(c) Both potential and kinetic energy decreases
(d) Both potential and kinetic energy increases

ANS : B

A particle is moving freely. Then, its

(a) kinetic energy is always greater than zero

(b) potential energy is greater than zero and kinetic energy is less than zero

(c) potential energy is less than zero and kinetic energy is greater than zero

(d) potential energy is zero and kinetic energy is less than zero

As particle is moving

⇓

v is there

⇓

kinetic energy > 0

A particle is moving freely. Then, its

(a) kinetic energy is always greater than zero

(b) potential energy is greater than zero and kinetic energy is less than zero

(c) potential energy is less than zero and kinetic energy is greater than zero

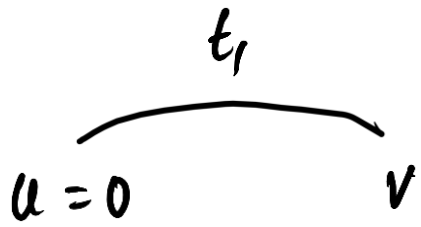
(d) potential energy is zero and kinetic energy is less than zero

ANS : A

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

(a) $\frac{Mvt^2}{2t_1}$ (b) $\frac{Mvt^2}{t_1}$

(c) ✓ $\frac{Mv^2t^2}{2t_1^2}$ (d) $\frac{Mv^2t_1^2}{2t^2}$



$$a = \frac{v-u}{t_1} = \frac{v}{t_1}$$

$$s = ut + \frac{1}{2}at^2$$

$$s = 0 + \frac{1}{2}\left(\frac{v}{t_1}\right)(t^2)$$

$$s = \frac{1}{2}\left(\frac{vt^2}{t_1}\right) = \frac{vt^2}{2t_1}$$

$$W = F \times s$$

$$= M\left(\frac{v}{t_1}\right) \times \left(\frac{vt^2}{2t_1}\right)$$

$$= \frac{Mv^2t^2}{2t_1^2}$$

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

(a) $\frac{mvt^2}{2t_1}$

(b) $\frac{mvt^2}{t_1}$

(c) $\frac{mv^2t^2}{2t_1^2}$

(d) $\frac{mv^2t_1^2}{2t^2}$

ANS : C

A 4 kg mass and a 1 kg mass are moving with equal kinetic energies. The ratio of their momenta is

(a) 3 : 1 (b) 1 : 1
(c) 4 : 1 (d) 2 : 1

momenta → plural of momentum

$$\frac{K_1}{K_2} = \frac{\frac{p_1^2}{2m_1}}{\frac{p_2^2}{2m_2}} \Rightarrow 1 = \frac{p_1^2}{p_2^2} \times \frac{m_2}{m_1}$$

$$\frac{p_1^2}{p_2^2} = \frac{m_1}{m_2} = \left(\frac{1}{4}\right) \Rightarrow \frac{p_1}{p_2} = 1:2 \text{ or } 2:1$$

A 4 kg mass and a 1 kg mass are moving with equal kinetic energies. The ratio of their momenta is

(a) 3 : 1 (b) 1 : 1

(c) 4 : 1 (d) 2 : 1

ANS : D

Mass of B is four times that of A. B moves with a velocity half that of A. Then, B has

(a) kinetic energy equal to that of A ✓

(b) half the kinetic energy of A

(c) twice the kinetic energy of A

(d) kinetic energy one-fourth of A

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

$$K_B = \frac{1}{2}(4m)\left(\frac{v}{2}\right)^2 = \frac{1}{2} \times 4m \times \frac{v^2}{4} = \frac{1}{2}mv^2 = K_A$$

$$K_B = K_A$$

Mass of B is four times that of A. B moves with a velocity half that of A. Then, B has

(a) kinetic energy equal to that of A

(b) half the kinetic energy of A

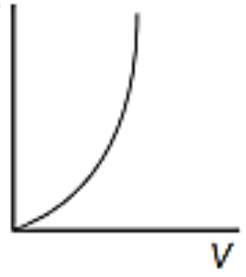
(c) twice the kinetic energy of A

(d) kinetic energy one-fourth of A

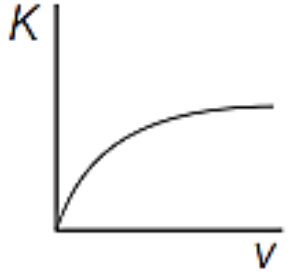
ANS : A

Which one of the following diagrams illustrates the relation between kinetic energy (K) and the velocity (v) of a body?

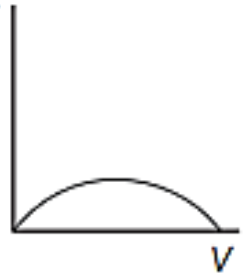
(a)



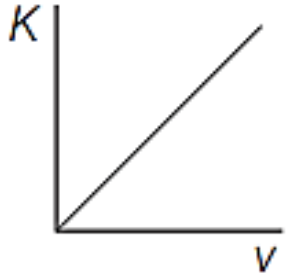
(b)



(c)



(d)



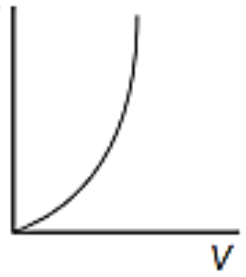
$K = \frac{1}{2}mv^2$

$K \propto v^2$ (parabolic graph)

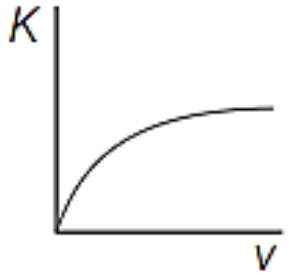
(just like projectile motion)

Which one of the following diagrams illustrates the relation between kinetic energy (K) and the velocity (v) of a body?

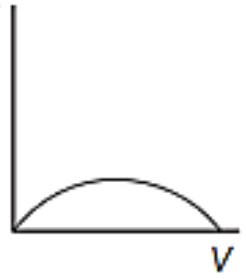
(a)



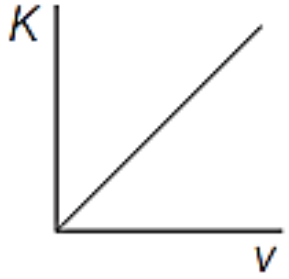
(b)



(c)



(d)



ANS : A

For a perfectly elastic collision, the coefficient of restitution (e) is

(a) 1 (b) –1

(c) 0 (d) infinity

$e = 1$ (perfectly elastic)

$e = 0$ (perfectly inelastic)

all

$0 < e < 1$ (other collisions)

generally ones we see in real life,

For a perfectly elastic collision, the coefficient of restitution (e) is

(a) 1 (b) –1

(c) 0 (d) infinity

ANS : A

Which of the following are the characteristics of an inelastic collision?

I. Momentum is conserved.

II. Total energy is conserved.

III. Kinetic energy is conserved.

IV. All the forces must be of conservative nature.

Choose the correct answer from the codes given below

(a) Both III and IV (b) Both I and II

(c) I, II and IV (d) Both II and IV

Which of the following are the characteristics of an inelastic collision?

I. Momentum is conserved.
II. Total energy is conserved.
III. Kinetic energy is conserved.
IV. All the forces must be of conservative nature.

conservation laws,

Choose the correct answer from the codes given below

(a) Both III and IV (b) Both I and II
(c) I, II and IV (d) Both II and IV

ANS : B

Choose the wrong statement

(a) Work done is a scalar quantity ✓

(b) Work done by a body does not depend on the time taken to complete the work ✓

(c) Work done can never be zero

(d) SI unit of work is joule

W = force × displacement

$\vec{F} = 0$ or $\vec{S} = 0$

or $\theta = 90^\circ$

angle between $\vec{F}$ and $\vec{S}$

Choose the wrong statement

(a) Work done is a scalar quantity

(b) Work done by a body does not depend on the time taken to complete the work

(c) Work done can never be zero

(d) SI unit of work is joule

ANS : C

The linear momentum (p) and kinetic energy (E) for a body of mass m are related as

(a) $p = \sqrt{2mE}$ (b) $p = \sqrt{\frac{2m}{E}}$

(c) $p = \sqrt{\frac{E}{2m}}$ (d) $p = 2\ mE$

$$E = \frac{p^2}{2m}$$

$$p^2 = 2mE$$

$$p = \sqrt{2mE}$$

The linear momentum (p) and kinetic energy (E) for a body of mass m are related as

(a) $p = \sqrt{2mE}$ (b) $p = \sqrt{\frac{2m}{E}}$

(c) $p = \sqrt{\frac{E}{2m}}$ (d) $p = 2\ mE$

ANS : A

The energy associated with state of compression or expansion of an elastic spring is called its

(a) rational kinetic energy

(b) elastic potential energy

(c) total energy (d) magnetic energy

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ANS : B

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