NDA-CDS 2 2024

GS

LIVE

PHYSICS

CLASS 8

NAVJYOTI SIR

SSBCrack EXAMS

09 July 2024 Live Classes Schedule

8:00AM	09 JULY 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	09 JULY 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

SSB INTERVIEW LIVE CLASSES

9:00AM	OVERVIEW OF PIQ FORM & PI	ANURADHA MA'AM

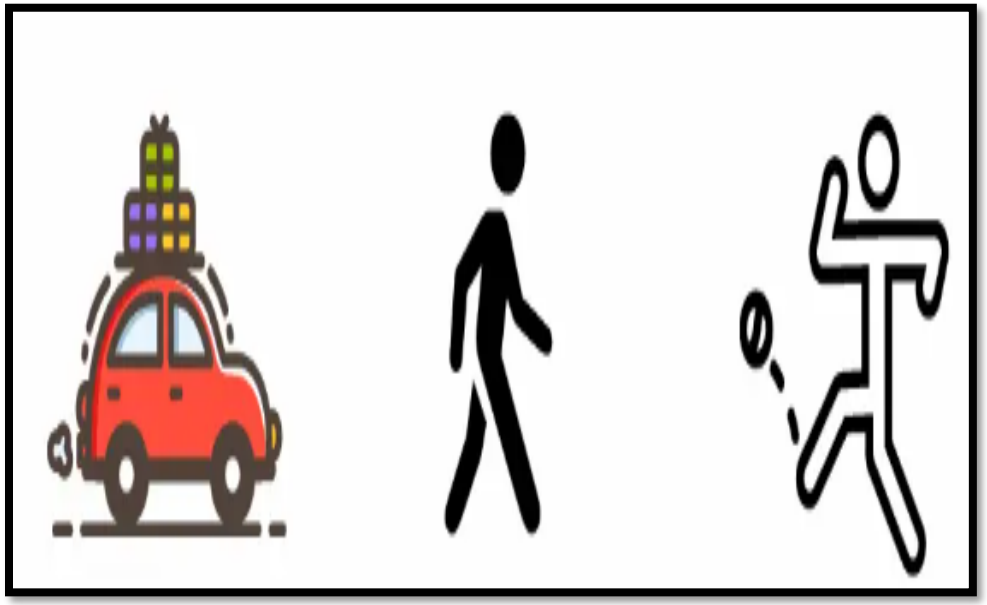
NDA 2 2024 LIVE CLASSES

1:00PM	GS - PHYSICS - CLASS 8	NAVJYOTI SIR
4:00PM	MATHS - STATISTICS - CLASS 2	NAVJYOTI SIR
5:30PM	ENGLISH - USAGE OF PAIRED WORDS - CLASS 1	ANURADHA MA'AM

CDS 2 2024 LIVE CLASSES

1:00PM	GS - PHYSICS - CLASS 8	NAVJYOTI SIR
5:30PM	ENGLISH - USAGE OF PAIRED WORDS - CLASS 1	ANURADHA MA'AM

WORK AND ENERGY



WHAT WILL WE STUDY ?

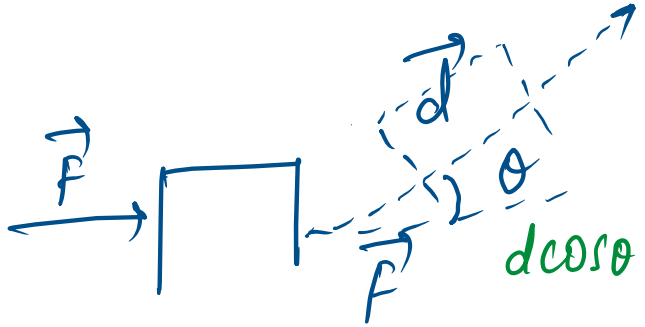
- Concept of Work
- Energy
- Kinetic and Potential Energy
- Conservation of Energy
- Power
- Collisions

CONCEPT OF WORK

- **Work done by the force is equal to the product of the force and the displacement of the object in the direction of force.**

(dot product of $\vec{F}$ and $\vec{s}$)

$$W = \mathbf{F} \cdot \mathbf{s} = Fs \cos\theta$$



$W = F \cdot d\cos\theta$

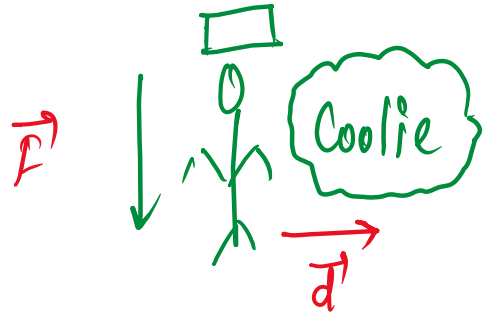
- **It is a Scalar Quantity. Its SI unit is Nm or Joules.**

Work done by a force is zero, if

(a) body is not displaced actually, *i.e.* $\mathbf{s} = 0$. ✓

(b) body is displaced perpendicular to the direction of force, *i.e.* $\theta = 90°$.

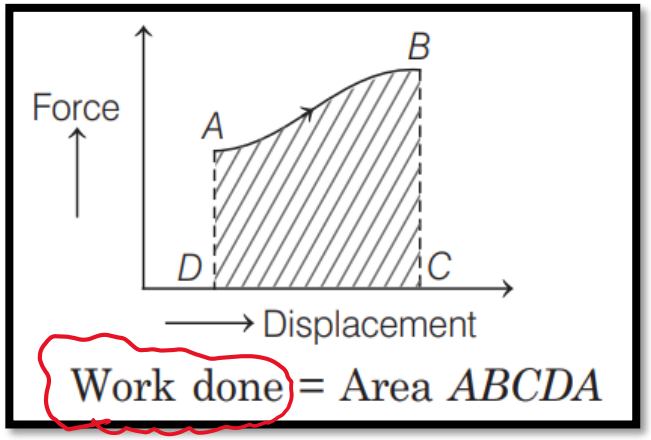
$\cos 90° = 0$



angle b/w $\vec{F}$ & $\vec{d} = 90°$ $W = 0$

WORK DONE

- **Work done by a variable force F = Area under Force – Displacement graph**



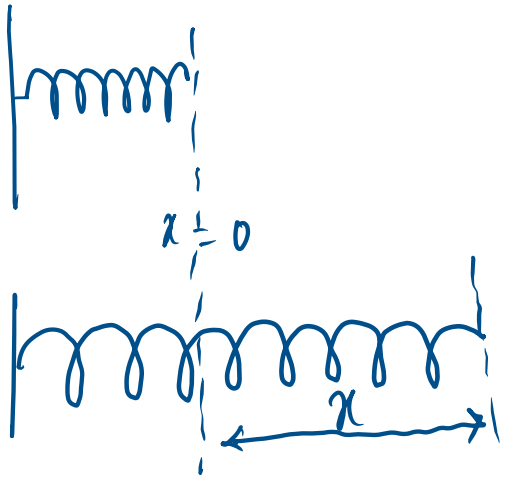
- **Work done in displacing any body under the action of a number of forces is equal to the work done by the resultant force. In equilibrium (static or dynamic), the resultant force is zero, therefore resultant work done is zero.**

WORK DONE

- **If work done by a force during a round trip of a system is zero, then the force is conservative otherwise it is called non-conservative force.**
- **All the central forces such as Gravitational and Electrostatic Forces are conservative forces.**
- **Frictional force, viscous force etc are non-conservative forces.**

WORK DONE

- Work done by the force of gravity on a particle of mass m is given by $W = mgh$ where, g is acceleration due to gravity and h is height through which the particle is displaced.
- Work done in compressing or stretching a spring is given by $W = -\frac{1}{2}kx^2$ where, k is spring constant and x is displacement from mean position.



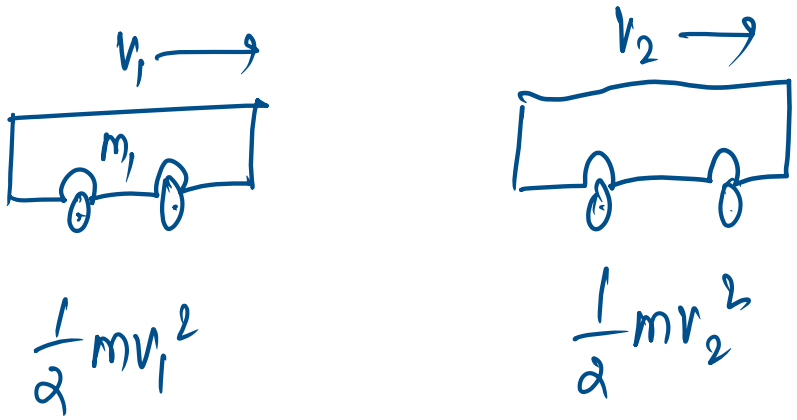
ENERGY

- **Energy of a body is its capacity of doing work.**
- **It is a scalar quantity. Its SI unit is Joule.**
- **There are several types of energies, such as kinetic energy , potential energy, chemical energy, light energy, heat energy, sound energy, nuclear energy and electric energy etc.**

WORK – ENERGY THEOREM

- **Work done by a force in displacing a body is equal to change in its kinetic energy.**

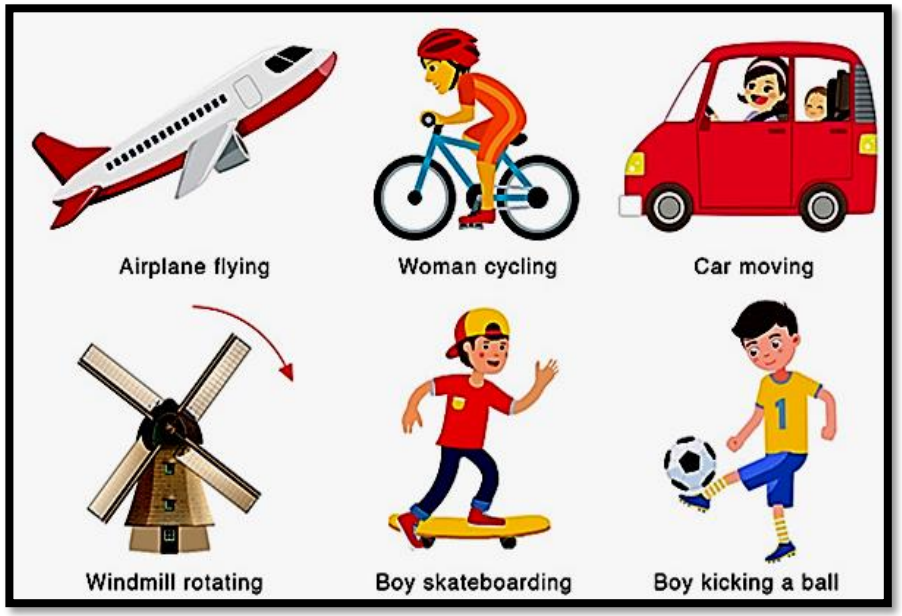
$$W = \int_{v_1}^{v_2} F \cdot ds = \frac{1}{2} m v_2^2 - \frac{1}{2} m v_1^2 = K_f - K_i = \Delta \mathrm{KE}$$



$$W = \frac{1}{2} m v_2^2 - \frac{1}{2} m v_1^2$$

KINETIC ENERGY

- **The energy possessed by any object by virtue of its motion.**



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

where m = mass of the object , v is its velocity and

p = mv is momentum.

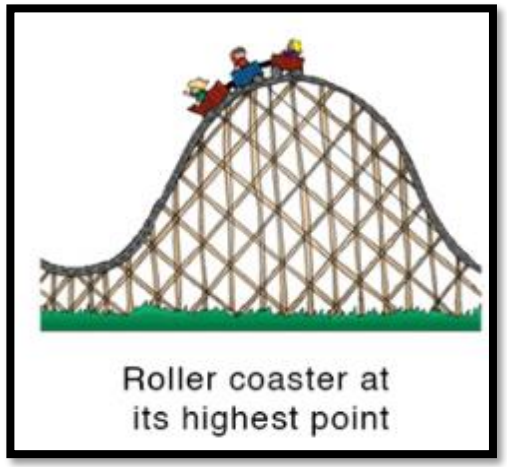
$$KE = \frac{1}{2} mv^2$$

$$mKE = \frac{1}{2} m^2v^2 = \frac{1}{2}(p)^2$$

$$p^2 = 2mKE$$

POTENTIAL ENERGY

- **The energy possessed by any object by virtue of its position or configuration.**


Roller coaster at its highest point


Apples on a tree


A slingshot being pulled

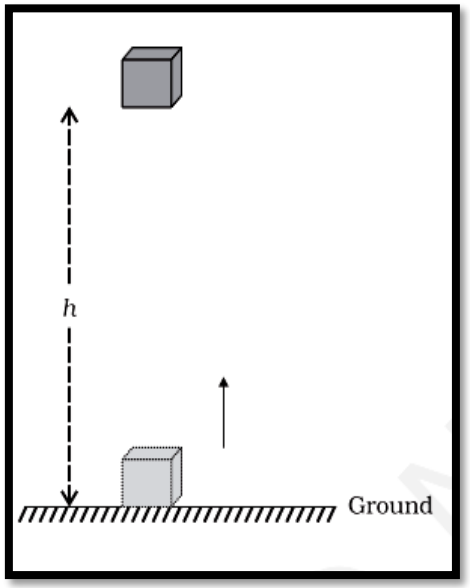
- **Potential energy is defined only for conservative forces.**

TYPES OF POTENTIAL ENERGY

1. Gravitational Potential Energy :

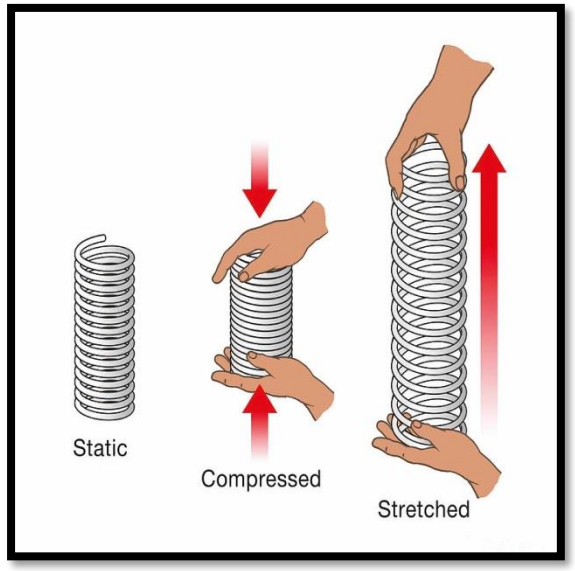
work done, W = force × displacement
$= mg \times h$
$= mgh$

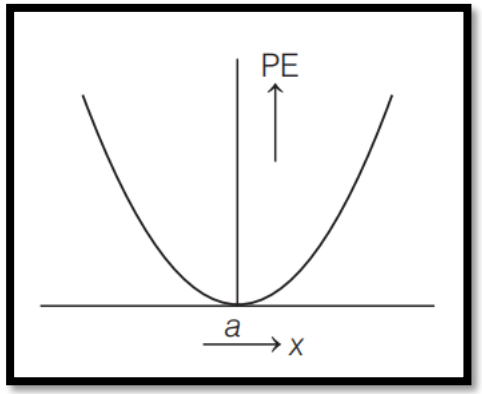
weight height



TYPES OF POTENTIAL ENERGY

2. Elastic Potential Energy :





If a spring of spring constant k is stretched through a distance x,

then elastic potential energy of the spring $= \frac{1}{2} kx^2$

EQUILIBRIUM

- **If the forces acting on an object are conservative , and the net external force on the object is zero , the object is said to be in equilibrium.**

net force = 0

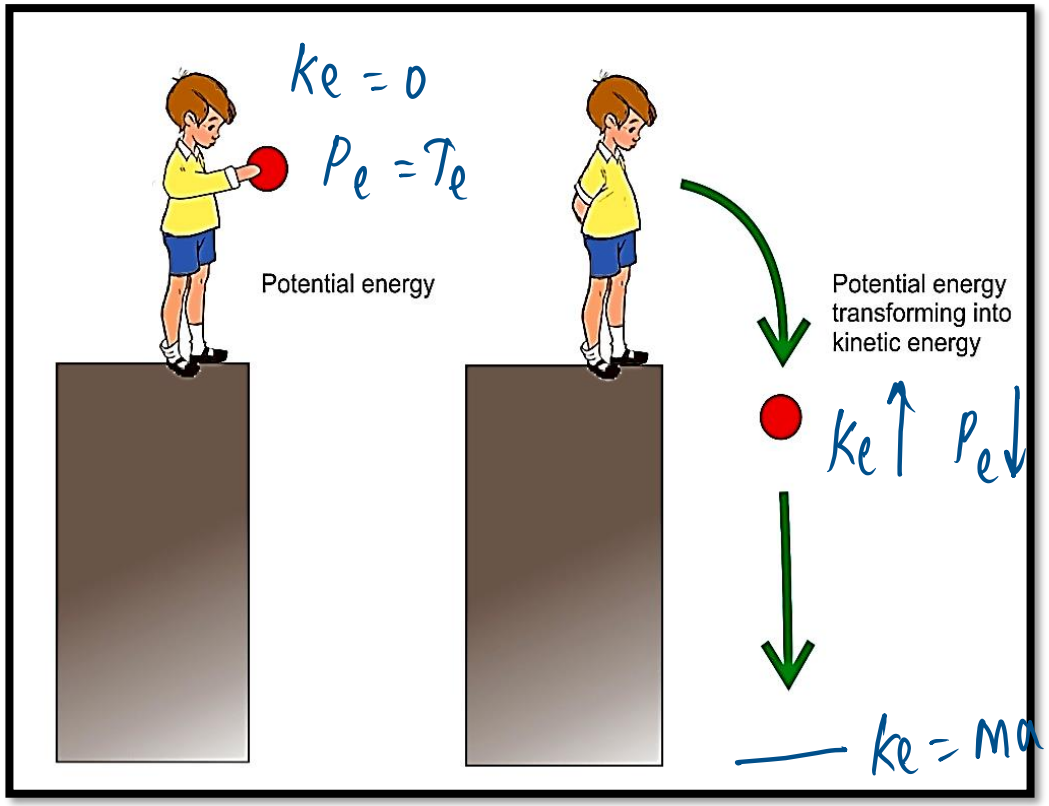
Work done = 0

OTHER FORMS OF ENERGY

1. **Heat Energy :** A body possess heat energy due to the disorderly motion of its molecules.
2. **Chemical Energy :** Chemical energy is stored in the chemical bonds of atoms and molecules.
3. **Electrical Energy :** It is the energy which is associated with the flow of electric current.
4. **Nuclear Energy :** It is the binding energy of the nucleus of an atom.

PRINCIPLE OF CONSERVATION OF ENERGY

- **Energy can neither be created nor be destroyed, it can only be transferred from one form to another form.**
- **For conservative forces, the total <u>mechanical energy (sum of kinetic and potential energies)</u> of any object remains constant.**



POWER

- **The rate at which work is done by a body or energy is transferred.**

$$\text{Power} = \text{Rate of doing work} = \frac{\text{Work done}}{\text{Time taken}}$$

- **Power is a scalar quantity. Its SI unit is watt.**
- **Its other units are kilowatt and horse power.**
- **1 kilowatt = 1000 watt**
- **1 horse power = 746 watt**

If under a constant force $\mathbf{F}$ a body is displaced through a distance $\mathbf{s}$ in time t, then the power $P = \frac{W}{t} = \frac{\mathbf{F} \cdot \mathbf{s}}{t}$

But $\frac{\mathbf{s}}{t} = \mathbf{v}$, uniform velocity with which body is displaced.

$\therefore$ $$P = \mathbf{F} \cdot \mathbf{v} = F\, v \cos\theta$$

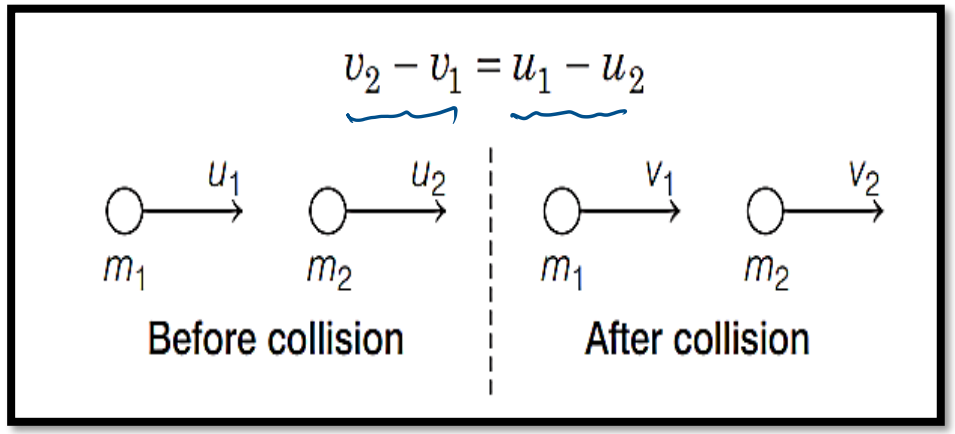
where, θ is the smaller angle between $\mathbf{F}$ and $\mathbf{v}$.

COLLISION

- Collision between two or more particles is the interaction for a short interval of time in which they apply relatively strong forces on each other.
- There are two types of collision : Elastic and Inelastic

ELASTIC COLLISION

- **The collision in which both the momentum and the kinetic energy of the system remains conserved.**
- **In an elastic collision, all the involved forces are conservative forces and total energy remains conserved.**



$$v_2 - v_1 = -(u_2 - u_1)$$

P
Ke
Te
Conserved

INELASTIC COLLISION

- **The collision in which only the momentum remains conserved but kinetic energy does not remain conserved are called inelastic collisions.**
- **In an inelastic collision, some or all the involved forces are non-conservative forces.**
- **Total energy of the system remains conserved.**

$\left.\begin{matrix} p \\ T_e \end{matrix}\right\}$ — conserved (Law of conservation of p ; " " " T_e)

Coefficient of Restitution or Resilience (e)

- The ratio of relative velocity of separation after collision to the relative velocity of approach before collision. difference of velocities,
- It is represented by e and it depends upon the material of the colliding bodies.
- For a perfectly elastic collision, e = 1
- For a perfectly inelastic collision (If after the collision two bodies stick to each other), e = 0
- For all other collisions, 0 < e < 1.

SUMMARY

- Concept of Work
- Energy
- Kinetic and Potential Energy
- Work Energy Theorem
- Conservation of Energy
- Power
- Collisions

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1. The SI unit of Power is

A. Js

B. J/s

C. s/J

D. J/s^2

NDA & CDS 2 2024 LIVE PHYSICS - CLASS 8

1. The SI unit of Power is

A. Js

B. J/s

C. s/J

D. J/s^2

J/s or watt

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

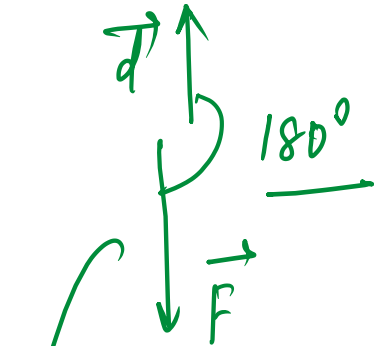
D. 540 J

$(g = 10\ m/s^2)$

Work done $= mgh$

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

$= -450\ J$



$\theta = 180°$

$\cos 180° = -1$

(negative work)

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

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3. 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.

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

(d) conservation of energy, momentum and charge.

Answer: D

conservation of charge
momentum
Energy

4. 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

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A. 10 W

B. 100 W

C. 1000 W

D. 500 W

5. A pair of bullocks exerts a force of 140 N on a plough. The field being ploughed is 15 m long. Find the work done ?

A. 210 J

B. 2100 J

C. 21000 J

D. 210000 J

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A. 210 J

B. 2100 J

C. 21000 J

D. 210000 J

6. 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

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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

7. 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

7. 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

8. 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

8. 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

9. 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

9. 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

10. 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. $p^2/2m$

10. 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 ?

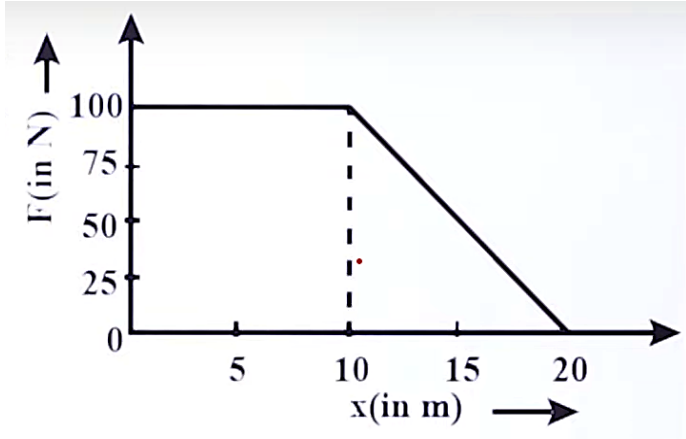
A. $p/2m$

B. $v/2m$

C. $v^2/2m$

D. $p^2/2m$

11. 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 :



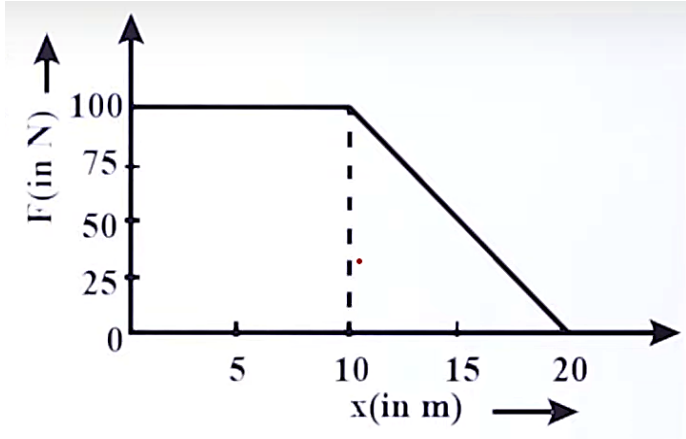
A. 500 J

B. 1000 J

C. 1500 J

D. 2000 J

11. 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

12. 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

12. 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

13. 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

13. 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

14. 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

14. 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

15. 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

15. 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

16. 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

16. 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

17. 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

17. 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

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18. 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

$$100 = \frac{1}{2} m v^2$$

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

$$v^2 = 100$$

$$v = 10$$

18. 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

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

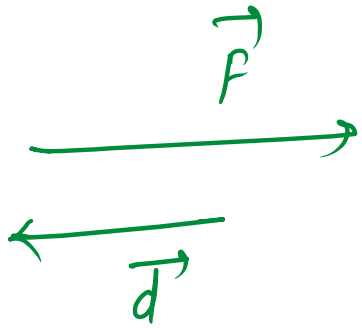
(a) perpendicular to each other.

(b) parallel to each other.

(c) anti-parallel to each other.

(d) equal in magnitude.

opposite



$\theta = 180^\circ$

$\cos\theta = -1$

$W = Fd\cos\theta$

$= Fd(-1) = -Fd$

negative work

19. 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

20. 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

20. 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

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21. 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

NDA & CDS 2 2024 LIVE PHYSICS - CLASS 8

21. 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

Answer : B

NDA & CDS 2 2024 LIVE PHYSICS - CLASS 8

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

(a) Frictional force

(b) Electric force

(c) Gravitational force

(d) Mechanical force

22. 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

NDA-CDS 2 2024

GS

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CLASS 9

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