Date:- 9/12/24

TENDER HEART HIGH SCHOOL, SEC-33B, CHD

CLASS-IX ; Ch-2 -[WORK, Energy and Power]

Subject:- PHYSICS

Work:- Work is said to be done only if applied force displaces a body. Or applied force makes the body move (ie there is a displacement of the body)

For Example:- a man pushing a car, a horse while pulling a cart; A boy going upstairs, A coolie lifting a load.

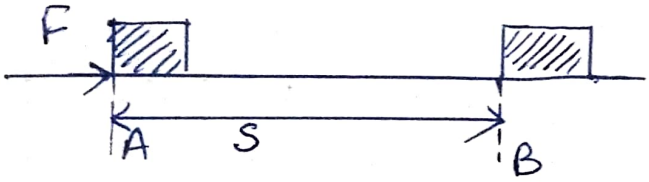
* pushing the wall, no work is being done (∵ displacement is zero)
* A coolie standing with a heavy load on his head does no work ∵ displacement of load is zero

⇒ Mathematically;

Work done = Force × displacement in the direction of force.

$$W = F \times S$$

⇒ Suppose a constant force, F displaces a body from position A to position B, along the direction of force. The displacement produced in a body is S



So Work done;

$$W = F \times S$$

* Work is a Scalar quantity.

Basic formula for work done is;

$$W = FS\cos\theta$$

θ is the angle between the direction of force and displacement.

Special Cases: →

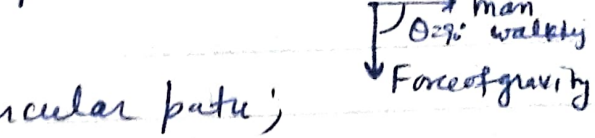
(i) **Zero work done:** → Work done is zero when displacement is perpendicular or normal to the direction of force i.e $\theta = 90^\circ$

So $W = FS\cos\theta = FS\cos 90^\circ = 0$ $(\because \cos 90^\circ = 0)$

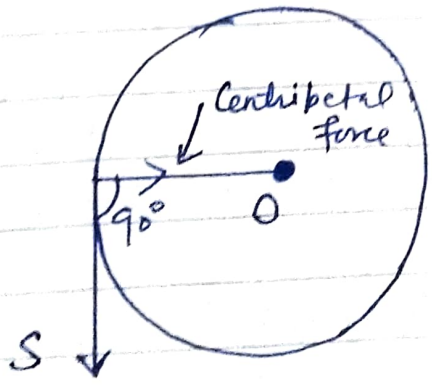
$$\boxed{W = 0}$$

Examples: → (1) A Coolie Walking on a ground Carrying load (work done = 0)

∵ Force of gravity and displacement are normal to each other.



(2) When a body moves in a circular path; work done is zero ∵ Centripetal force and displacement are perpendicular to each other



* Work done is also zero when (i) Applied force is zero
(ii) No displacement

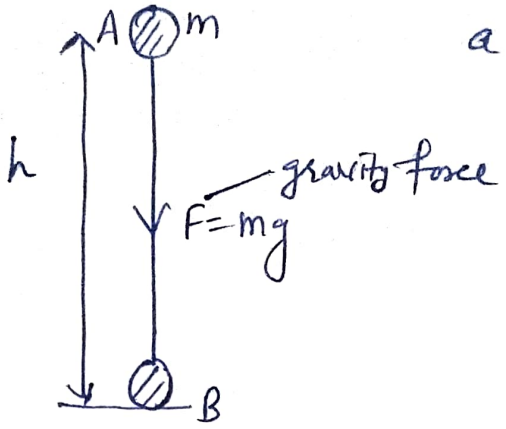
(ii) **Positive Work done:** → Work done is positive when displacement is in the direction of force (F) i.e $\theta = 0^\circ$

So, $W = FS\cos\theta = FS\cos 0^\circ = FS(1)$ $[\cos 0^\circ = 1]$

$$\boxed{W = FS}$$

Teacher's Signature .....

Examples:→ (a) A Body falling freely (under gravity effect) means when a body falls from a height h under gravity effect.



$W = FS = (mgh)$

$(\because F = mg$
$S = h)$

(b) Work done by the coolie in raising the load.

As coolie raises the load against gravity force, $F = mg$ and let it raises the load by height h (in the upward direction)

So $W = Fs = mgh$ (as direction of force and displacement are same)

(iii) **Negative Work done:→** Work done is negative when displacement and force are in opposite direction

i.e $\theta = 180^\circ$

So $W = FS\cos 180^\circ = Fs(-1)$ $[\cos 180^\circ = -1]$

So $\boxed{\text{work done} = -Fs}$

Examples:→

(1) The work done on a body by a force of friction is negative. As the force of friction between the body and surface is in opposite directions ($\theta = 180^\circ$)

(2) Work done on body: When a body is thrown vertically upwards. Here F and s are in opposite directions As the force is gravity and it is vertically downwards & displacement is upwards. $\boxed{W = -mgh}$