

Cause      effect

(2)

$$\sum \vec{F} = m\vec{a}$$

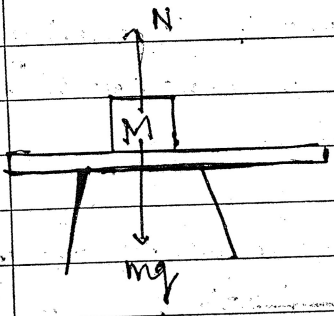
↑  
force on the system

In FVD, only causes are shown

- R  
i  
- A

### NEWTON'S THIRD Law

To every action, there is an equal and opposite reaction



Reaction force of  $N =$  <sup>reaction</sup> force of block on table  
 Reaction force of  $mg =$  force of block on earth  
 (In FVD only force acting on block are shown)

Action and reaction always act on different bodies and they must have same nature (gravitational/electromagnetic)

Reaction of 'force of A on B' is 'force of B on A'

### COMMON TYPES OF FORCE

#### Gravitational force

- It always acts towards the centre of earth
- For small height near the surface of earth, this force remains constant for an object. Its value is given by  $F = \frac{GMm}{r^2}$

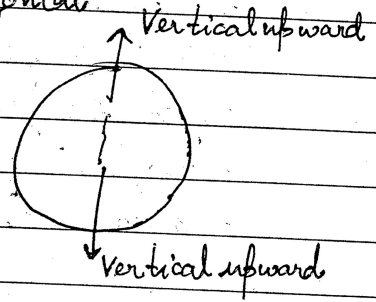
(near the surface of earth)

- $G$ : gravitational constant
- $R$ : radius of earth
- $M$ : mass of earth
- $m$ : mass of object

$\frac{GM}{R^2} = \text{constant}$  has magnitude  $9.8 \text{ ms}^{-2}$

$$F = mg$$

- Radius outward is vertical <sup>up</sup> outward and radius inward is called vertical inward (defined wrt earth)
- Any plane perpendicular to radius is called horizontal

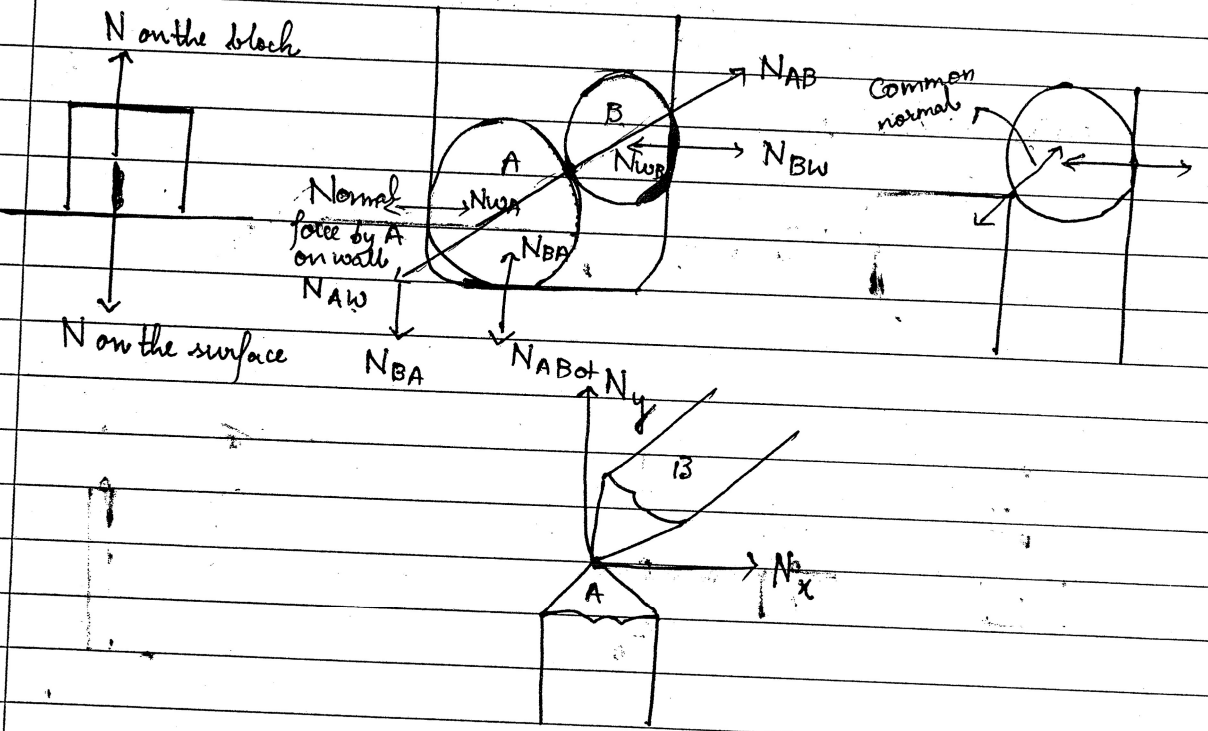


in table on earth are shown)

### NORMAL CONTACT FORCE

- It is an electromagnetic type of force
- It acts on the body due to contact and it is component of contact force along the common normal
- It always acts towards the body/system
- It is "push kind of force"

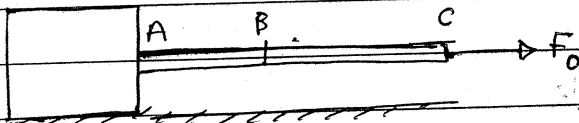
It have



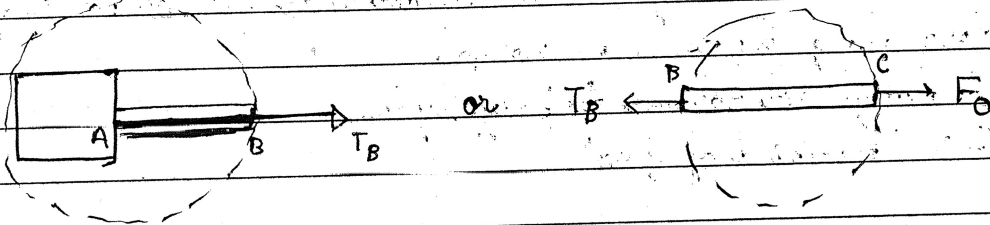
since

TENSION FORCE

- It is an electromagnetic type of force
- It is full kind of force
- Tension in a string is the force applied by the string on an object or force applied by one part of string on remaining part of string
- It always acts along the string and away from the system

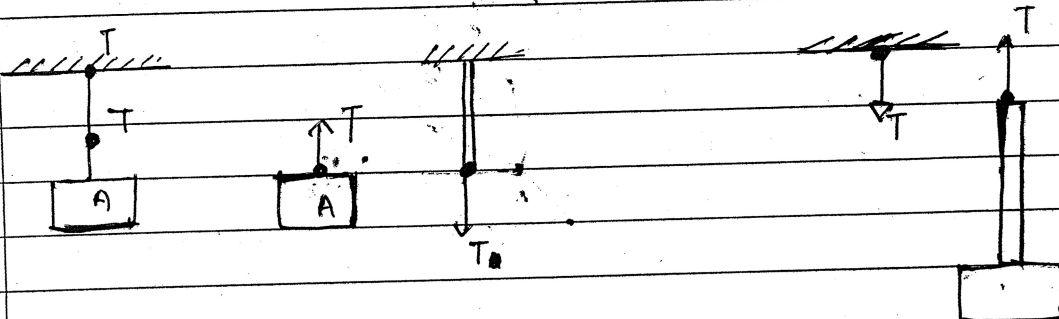
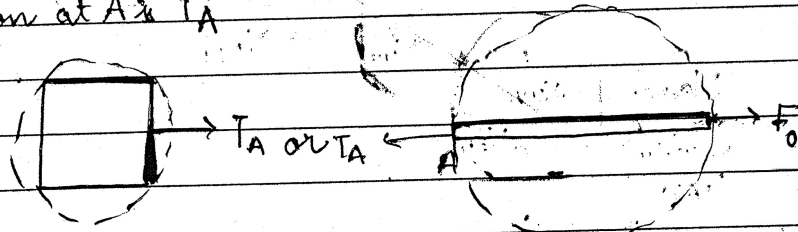


Tension at point B is  $T_B$  means



They are action-reaction pair

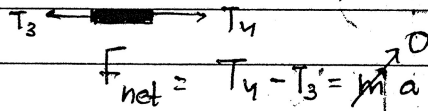
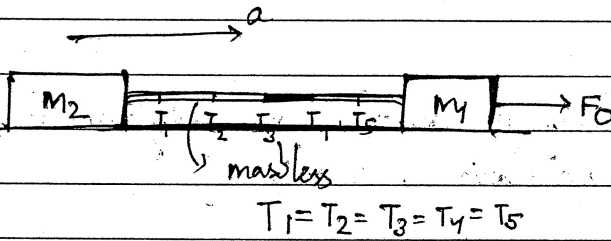
Tension at A is  $T_A$



Action reaction pair

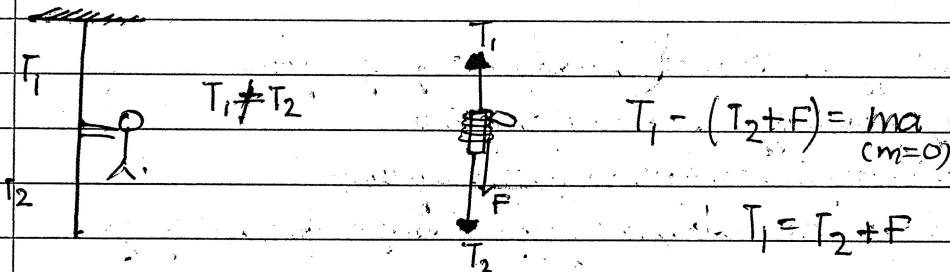
Tension at any point means force applied by one side of the system on another point on the system through that point/section

Tension in a massless string is uniform throughout the string if no tangential force acting on the string



$T_3 = T_4$  similarly at all points, tension is same

\* Tangential force: External force along the string is called tangential force



If tangential force is applied, tension is not same on both sides