NEWTON'S LAWS OF MOTION

1. From third law of motion

$\vec{F}_{AB} = -\vec{F}_{BA}$

$\vec{F}_{AB}$ = Force on A due to B

$\vec{F}_{BA}$ = Force on B due to A

2. From second law of motion

$F_x = \frac{dP_x}{dt} = ma_x$ $\quad F_y = \frac{dP_y}{dt} = ma_y$ $\quad F_z = \frac{dP_z}{dt} = ma_z$

5. WEIGHING MACHINE :

A weighing machine does not measure the weight but measures the force exerted by object on its upper surface.

6. SPRING FORCE $\vec{F} = -k\vec{x}$

x is displacement of the free end from its natural length or deformation of the spring where K = spring constant.

7. SPRING PROPERTY $K \times \ell$ = constant

= Natural length of spring.

8. If spring is cut into two in the ratio m : n then spring constant is given by

$\ell_1 = \frac{m\ell}{m+n}$; $\quad \ell_2 = \frac{n.\ell}{m+n}$ $\quad k\ell = k_1\ell_1 = k_2\ell_2$

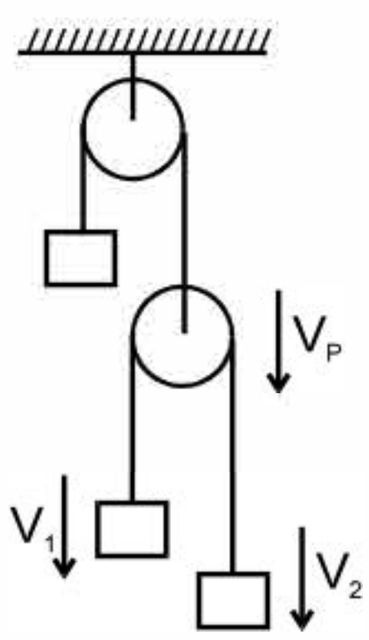
For series combination of springs $\frac{1}{k_{eq}} = \frac{1}{k_1} + \frac{1}{k_2} + ...$

For parallel combination of spring $k_{eq} = k_1 + k_2 + k_3 .....$

9. SPRING BALANCE:

It does not measure the weight. It measures the force exerted by the object at the hook.

Remember :

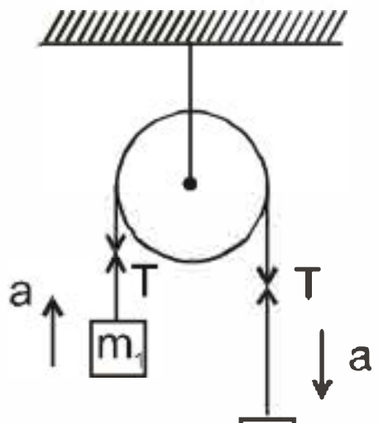


$V_p = \frac{V_1 + V_2}{2}$

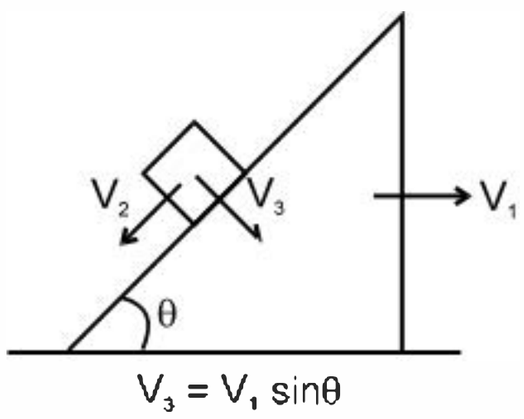
$a_P = \frac{a_1 + a_2}{2}$

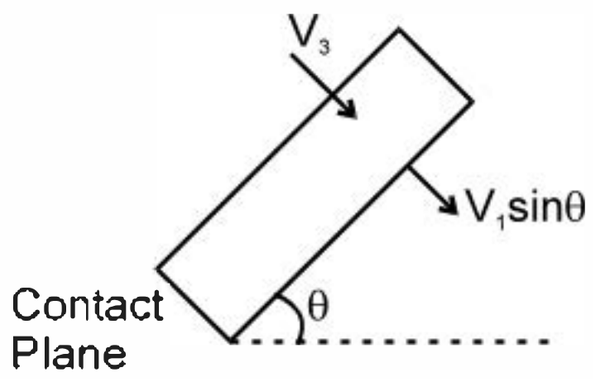
11. $$a = \frac{(m_2 - m_1)g}{m_1 + m_2}$$

$$T = \frac{2m_1m_2g}{m_1 + m_2}$$



12. WEDGE CONSTRAINT:





Components of velocity along perpendicular direction to the contact plane of the two objects is always equal if there is no deformations and they remain in contact.

13. NEWTON'S LAW FOR A SYSTEM

$$\vec{F}_{ext} = m_1\vec{a}_1 + m_2\vec{a}_2 + m_3\vec{a}_3 + ...$$

$\vec{F}_{ext}$ = Net external force on the system.

m_1, m_2, m_3 are the masses of the objects of the system and

$\vec{a}_1, \vec{a}_2, \vec{a}_3$ are the acceleration of the objects respectively.

14. NEWTON'S LAW FOR NON INERTIAL FRAME :

$$\vec{F}_{Real} + \vec{F}_{Pseudo} = m\vec{a}$$

Net sum of real and pseudo force is taken in the resultant force.

$\vec{a}$ = Acceleration of the particle in the non inertial frame

$$\vec{F}_{Pseudo} = -m\,\vec{a}_{Frame}$$

(a) Inertial reference frame: Frame of reference moving with constant velocity.

(b) Non-inertial reference frame: A frame of reference moving with non-zero acceleration.