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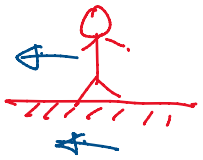
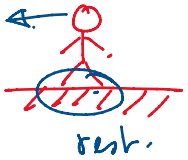
Physics Motion

Newton's 1st law

Inertia.

Every object continues in its state of rest or of uniform motion (constant speed.) unless compelled by an external force to act otherwise





rest.

INERTIA OF MOTION.

Tendency.

Newton's 2nd law

The rate (w.r.t time.) of change of momentum of a body is directly proportional to the applied force and the change takes place in the direction of the force.

If a force acts on a body then its momentum might change

Momentum = mass × velocity = mv

Initial Momentum = $m_i v_i$

final Momentum = $m_f v_f$.

Change in " = $m_f v_f - m_i v_i$

rate of " " " = $\frac{m_f v_f - m_i v_i}{t}$.

$$\frac{m_f v_f - m_i v_i}{t} \propto F$$

$$\frac{m_f v_f - m_i v_i}{t} = kF.$$

mass is constant.

$m_f = m_i = m$ (say)

$\frac{m[(v_f - v_i)]}{t} = kF.$

Change in vel / time = acceleration = a.

$ma = kF$

∴ 1 Newton Force = force which acts on 1kg to produce

mass is variable.

$F = \frac{m_f v_f - m_i v_i}{t}$.

Rocket / Aeroplane

1 Newton Force = force which acts on 1kg to produce an acceleration of $1 m/s^2$

$\therefore K = 1$ $\quad F = ma$

CGS Units SI → mass = kg. Length = m Time = Sec

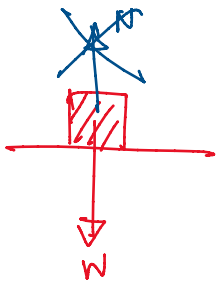
mass = gm
length = cm.
time = sec. Force = dyne = $\frac{gm\,cm}{s^2}$.

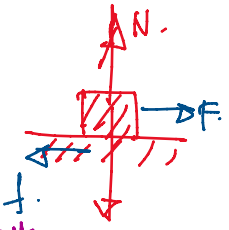
$a = m/s^2$.

$F = m \times a = kg \times m/s^2 = \frac{kg\,m}{s^2}$ → Newton.

Newton's 3rd Law

Every action has an equal and opposite reaction.





friction coefficient

$f = \mu N = \mu W = \mu mg$

W = weight

f → friction force

μ → variable

Equations of motion (linear motion)

v = velocity = rate of change of displacement. = $\frac{\Delta d}{\Delta t}$.

$v_t = \frac{d_2 - d_1}{t} = \frac{D}{t}$. $\quad a$ = rate of change of vel = $\frac{v_2 - v_1}{t}$.

If a = constant

$t = 0 \rightarrow t = t$

$v(0) = u \quad v(t) = v$.

$v_2 - v_1 = at$

$v_2 = v_1 + at$

$v(t) = u + at$ $\quad -(1)$

$v(0)$.

$v = u + at$

$D = \left(\frac{v+u}{2}\right) t = \frac{u+v}{2} t$.

$$D = \frac{1}{2}t(u+v) = \frac{1}{2}t(u+u+at) = \frac{1}{2}t(2u+at)$$

$$\boxed{D = ut + \frac{1}{2}at^2} \quad -(2)$$

(1) $v = u + at$

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

$\boxed{a \; u \; v}$ s?

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

$$s = t\left[u + \frac{1}{2}at\right] = \left(\frac{v-u}{a}\right)\left[u + \frac{1}{2}a\frac{(v-u)}{a}\right]$$

$$s = \frac{v-u}{a}\left[\frac{2u+v-u}{2}\right] = \frac{(v-u)(v+u)}{2a}$$

$$v^2 - u^2 = 2as.$$

$\boxed{v^2 = u^2 + 2as}$ ← when t is not given