Newton Mechanics:-

① if the speed of interacting bodies are very large (speed of light) we must apply Emishies Special theory of relativity.

② if the interacting bodies are on the atomic structure (e, p, n ——) we must apply Quantum mechanic.

Newton mechanics are special case of mechanics. between these two case

Force: $\vec{F}$

Newton or dyne

Newton: is the force acclerate 1 kg by 1 m/s²

$\vec{F}_{net} = \sum F_i = F_1 + F_2 + F_3 + F_4$

There must be some force to change the

CLEAR

Velocity of a body every acceleration is due to the action of net force

*Newton First Law :-

The body remains at rest if it is initially at rest of moving in a Straight line at Constant Speed. if it is in motion, if no net Force act on it.

① if no net force act on the body ($F_{net}=0$) the body's Velocity can not change then cannot accelerate.

② if the body in motion at cons. Vel. will continue to move

V = cons. $a=0$ $V_1=V_2$ no change $\therefore F=0$

CLEAR

Law of Inertia:- The resistance of body to change in motion is called Inertia

Newton's Second Law:- the Second Law states that the acceleration of an object and the mass of the object.

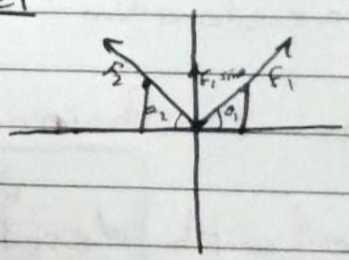
Newton's Second Law of motion pertains to the behavior of objects for which all existing forces are not balanced.

$$F \propto a$$

$$\vec{F} = m\vec{a} \Rightarrow m = \frac{\vec{F}_{net}}{\vec{a}}$$

$$\vec{F}_{net} = m\vec{a}$$

$$\vec{F}_{net} = \sqrt{F_x^2 + F_y^2}$$



$$\Sigma F_y = F_1 \sin\theta_1 + F_2 \sin\theta_2 \Rightarrow F_y = \Sigma m a_y$$

$$\Sigma F_x = F_1 \cos\theta + F_2 \cos\theta_2 \Rightarrow F_x = \Sigma m a_x$$

CLEAR

الموضوع : التاريخ / / ٢٠١

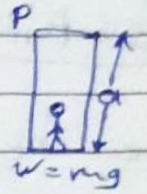
Newton's third law

① The force is along the line joining bodies

② The action and reaction forces which always accure in pairs act at different bodies.

Motion of Elevator:

apparent weight P الوزن الظاهر



a = (+) acceleration upward motion ↑

a = (−) acceleration downward motion ↓

(+ve) acceleration means that elevator either move upward with increasing speed or moving downward with decelerating Speed.

السرعة تقل

(-ve) acc^{n} means that the elevator either moves upward with decelerating Speed or downward

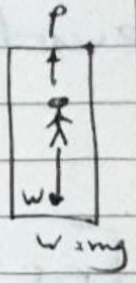
with increasing Speed.

For moving of elevator upward with acc^{n}. $\vec{a}$

$$\{F_y = m a_y$$

$$\left(F=ma \rightarrow F=w \quad ; \quad w=mg \Rightarrow m=\frac{w}{g} \right)$$

$$\boxed{P-w=\frac{wa}{g}}$$ this means $P>w$



② elevator downward $\longrightarrow \vec{a}$

$$\{F_y = -ma$$

$$P-w=-ma \Rightarrow P-w=-\frac{w}{g}a \qquad P<w$$

③ The elevator Cable break

$$a=-g$$

$$P-w=\frac{-w}{g}g \Longrightarrow P=w-w=0$$

④ $V=$ cons. $\Rightarrow a=0$, $a=\frac{du}{dt}=0$

$$P-w=0 \Rightarrow P=w$$

CLEAR

$$\boxed{\Sigma F = ma}$$

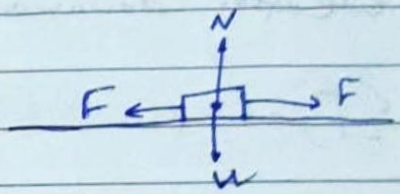
descending هابط a — acceleration +a

ascending صاعد +a — deceration -a

downward -a

upward +a

Friction:-



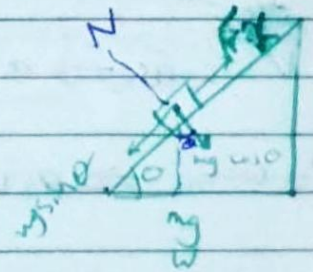
$F_s \propto N \Rightarrow F_s = \mu_s N$

① The $F_{s\,max} = \mu_s N$

$F_k = \mu_k N$ The body begin to slide then along the surface

$\Sigma F = ma$

$F_k - mg\sin\theta = -ma$ —— ①



$\Sigma F_y = ma \Rightarrow N - mg\cos\theta = a \Rightarrow N = mg\cos\theta$ —— ②

$\mu_k = \frac{F_k}{N} \Rightarrow F_k = \mu_k N$

$F_k = \mu_k (mg\cos\theta) \rightarrow (2)$ subs. (2) in (1)

$\mu_k (mg\cos\theta) - mg\sin\theta = -ma$

$a = g\sin\theta - \mu_k g\cos\theta$ if $\theta = 30°$; $\mu_k = 0.3$ $\vec{a}$ = ?

$a = 2.35\ m/s^2$

Work and energy

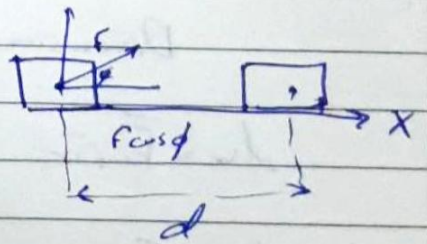
$\vec{F} = ma$

$a = \frac{F}{m}$ if F and r cons. $a \Rightarrow$ cons.

$V = V_0 + at$, $X = V_0 t + \frac{1}{2} a t^2$

$W = \vec{F} \cdot \vec{d}$ Scalar $\vec{F} \rightarrow$ in direction

$W = Fd\cos\theta$



when $\phi = 0$

$W = Fd$

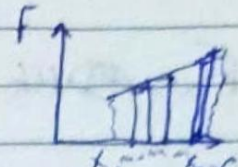
if $\phi = 90$ $W = 0$

هذا موجود بالمنزل

CLEAR

Work done by variable force - one Dimension (case)

$\Delta W = F \Delta x$



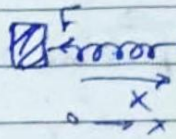
$W_{12} = \sum_{x_1}^{x_2} F \Delta x$

$W_{12} = \lim_{\Delta x \to 0} \sum_{x_1}^{x_2} F \Delta x$

$W_{12} = \int_{x_1}^{x_2} F\,dx \Rightarrow \boxed{W_{12} = \int_{x_1}^{x_2} F(x)\,dx}$ as ex: spring

$F \propto x \Rightarrow F = -kx$

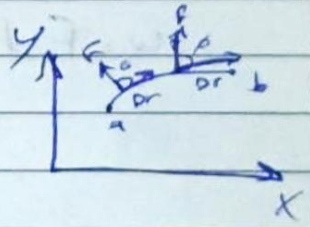
$F' = kx \Rightarrow k = \frac{F'}{x}$ $\frac{N}{m}$



$W = \int_0^x F'(x)\,dx$

$W = \int_0^x kx\,dx \Rightarrow \boxed{W = \frac{1}{2} kx^2}$

Work Done by Variable Force - Two Dimension (case)



$dW = \vec{F} \cdot d\vec{r}$

$dW = F \cos\phi\, dr$

on line a → b on limit $dr \to 0$

CLEAR

$$W_{ab} = \int_a^b F \cdot dr = \int_a^b F \cos\phi \, dr$$

$$\boxed{\vec{F} \cdot \vec{dr} = F_x dx + F_y dy}$$

$$\therefore W = \int_a^b (F_x dx + F_y dy)$$

Kinetic Energy and work-energy theorem

$$\sum F \neq 0$$

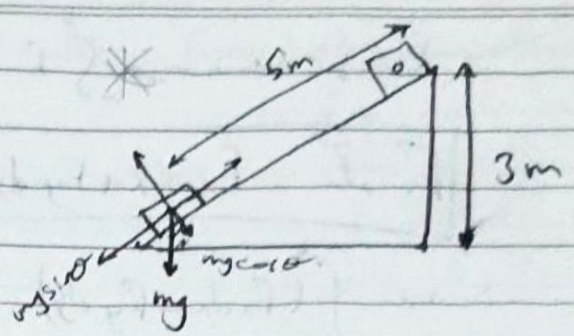
$$a = \frac{V - V_0}{t} \quad , X = \frac{(V+V_0)t}{2}$$

$$W = FX = maX$$

$$= m\left(\frac{V-V_0}{t}\right)\left(\frac{V+V_0}{2}\right)(t) = \underbrace{\frac{1}{2}mV^2}_{k} - \underbrace{\frac{1}{2}mV_0^2}_{k_0}$$

$$W = \Delta k = k - k_0$$

Ex1/



$\sum F_x = 0$ $m = 10\,kg$

$P - mg\sin\theta = 0$ — ma

$P = mg\sin\theta$

$P = 10(9.8)\frac{3}{5} = 58.8\,N$

$W = P.d = (58.8)(5) = 294\,J$

Power $P = \frac{dw}{dt}$ $W = F.x$

$P = \frac{d(F.x)}{dt}$ $F = const$

$P = F\left(\frac{dx}{dt}\right)$

$\therefore P = F.V$

The End of Mechanic

CLEAR