JEE MAIN

WORK ENERGY POWER FORMULAE

Now that's how you REVISE

-Mohit Goenka, IIT Kharagpur

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WORK ENERGY POWER

Work

F is constant

$\vec{F}.\vec{S}$

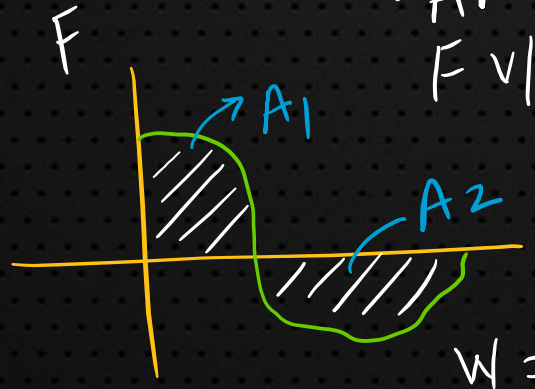
or

$\vec{F}.(\vec{r}_2-\vec{r}_1)$

F(x)

$\int_{x_1}^{x_2} F(x)\,dx$

↳ Area under F v/s x graph



$W = A_1 - A_2$

F(t)

(1) $a(t) = \frac{F(t)}{m}$

↓ INTEGRATE

$v = f(t)$

$\Rightarrow dx = f(t)\,dt$

$W = \int_{t_1}^{t_2} m\,a(t) \times f(t)\,dt$

WORK ENERGY THEOREM

$W_{NET} = \Delta K$

$\hookrightarrow W_{ext} + W_c + W_{NC} = \Delta K$ (In mains level W_p won't be there)

If $W_{NC} = 0$ (no resistive force work done)

$W_{ext} = 0$

$\Rightarrow W_c = \Delta K$ or $\Delta U + \Delta K = 0$

$\Downarrow$

$U_i + K_i = U_f + K_f$

Law of ENERGY cons.

CONSERVATIVE FORCE $\left(F = -\frac{dU}{dx} \right)$

EQUILLIBRIUM $\Rightarrow F = 0$ or $\frac{dU}{dx} = 0$

Stable Eq.

SHM can occur

$\frac{d^2U}{dx^2} > 0$

Unstable Eq

No SHM

$\frac{d^2U}{dx^2} < 0$

Neutral Eq.

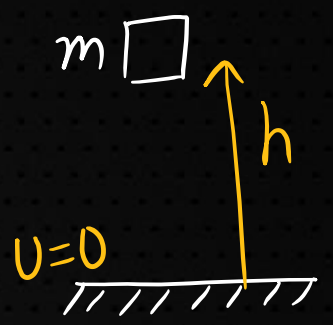
NO SHM

$\frac{d^2U}{dx^2} = 0$

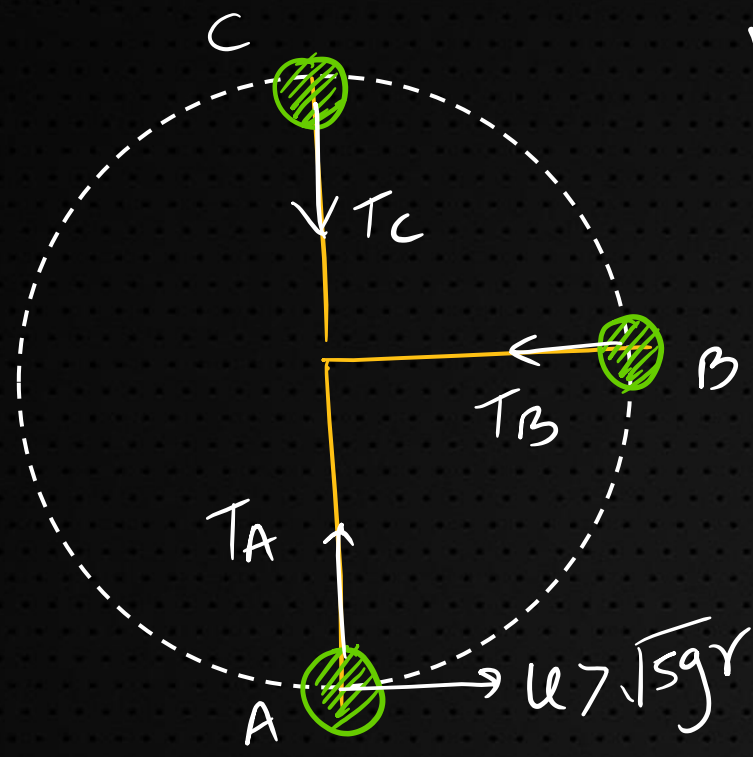
h is height of C.O.M

POTENTIAL ENERGY

- Gravitational
  - $U = mgh$
  - $U = -Gm_1m_2/r$
- SPRING → $U = \frac{1}{2}kx^2$
- Electrostatics
  - $U = Kq_1q_1/r$ (Put q_1 and q_2 with sign)
  - Dipole, $U = -\vec{P}\cdot\vec{E}$
- Magnetism → magnet in B, $U = -\vec{M}\cdot\vec{B}$
- Elastic → $U = \frac{1}{2} \times \text{stress} \times \text{strain} \times \text{Vol.}$



VERTICAL CIRCULAR MOTION



$u \geq \sqrt{5gr}$

① string + bob

② A particle inside a hollow sphere

③ If $u > \sqrt{5gr}$

$T_A - T_B = 3mg$

$T_A - T_C = 6mg$

$u \geq \sqrt{4gr}$

Mass attached to light rod

POWER (unit : Watt)

$$P_{av} = \frac{\Delta W}{\Delta t}$$

$$P_{inst} = \frac{dW}{dt} = \vec{F} \cdot \frac{d\vec{r}}{dt}$$

$$= \vec{F} \cdot \vec{V}$$

$$= FV\cos\theta$$