

Potential Energy & Conservation of Energy

Forces

- non Conservative
Ex: friction

- Conservative

Ex: mg / F_{spring}

properties :-

- 1- Path independent
- 2- $W_{F_{\text{cons}}} = 0$ when around a closed loop
- 3- $W_{F_{\text{cons}}} = -\Delta U$

• Conservative forces

Gravitational Potential Energy

$$U_g = mg \Delta y$$

(when, $y_i = 0$:-

$$U_g = mgy \text{ Joule}$$

Spring Potential energy

$$U_s = \frac{1}{2} k (x_f^2 - x_i^2)$$

when $x_i = 0$

$$U_s = \frac{1}{2} kx^2 \text{ Joule}$$

• Conservation of Mechanical Energy

$$E_{\text{mec}} = K + U \quad (\text{when } F \text{ acting is conservative})$$

$$\hookrightarrow W_{\text{net}} = W_{\text{cons}}$$

$$\hookrightarrow (K + U)_1 = (K + U)_2$$

Haa Etaiwi

Remark Δ :-
 when the system consists of conservative and non-conservative forces :-

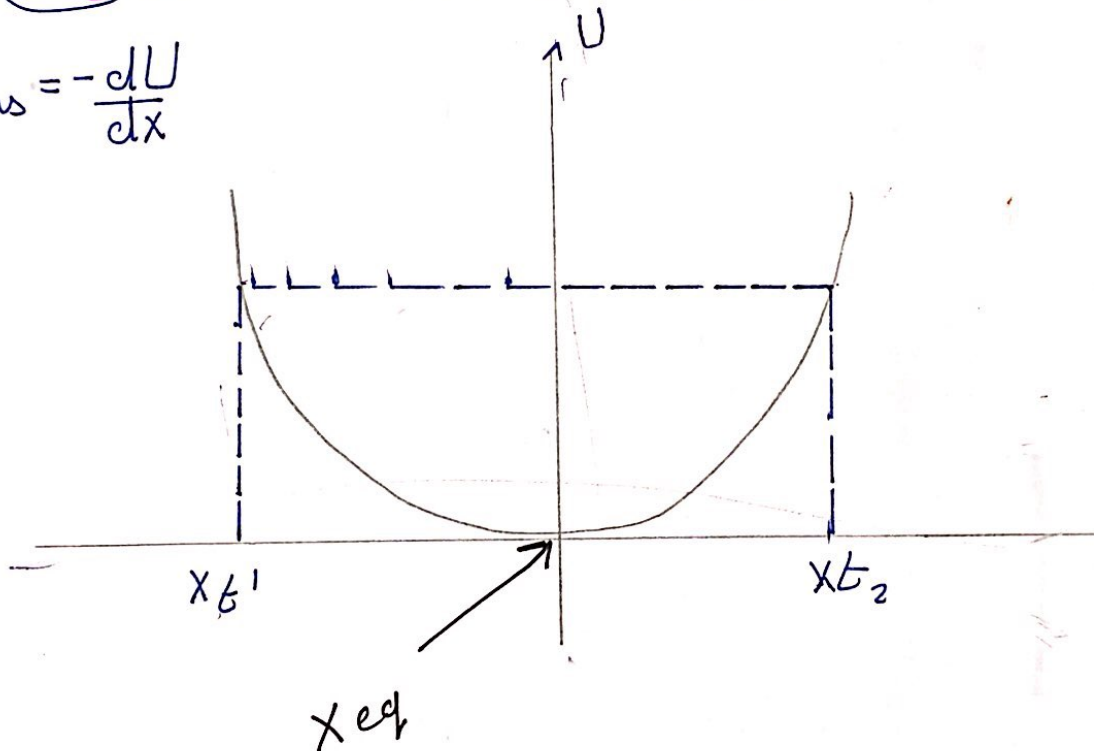
$$W_{\text{cons}} + W_{\text{noncons}} = \Delta K$$

$$-\Delta U + W_{\text{noncons}} = \Delta K$$

$$\boxed{W_{\text{noncons}} = \Delta E} = \Delta U + \Delta K$$

Reading a Potential Energy Curve

$$F_{\text{cons}} = -\frac{dU}{dx}$$



x_{t1}, x_{t2} :- Turning Points $\rightarrow K=0$
 $\rightarrow E=U$

x_{eq} :- equilibrium Point $\rightarrow U=0 \rightarrow E=K$
 $\rightarrow E=0$

Alaa Haini