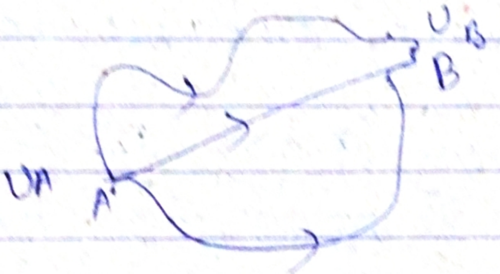
Potensial energey

$$\int_{U_i}^{U_f} dU = -\int dW_c$$

$$\cancel{U_f - U_i} = U_f - U_i = -W.D._c$$

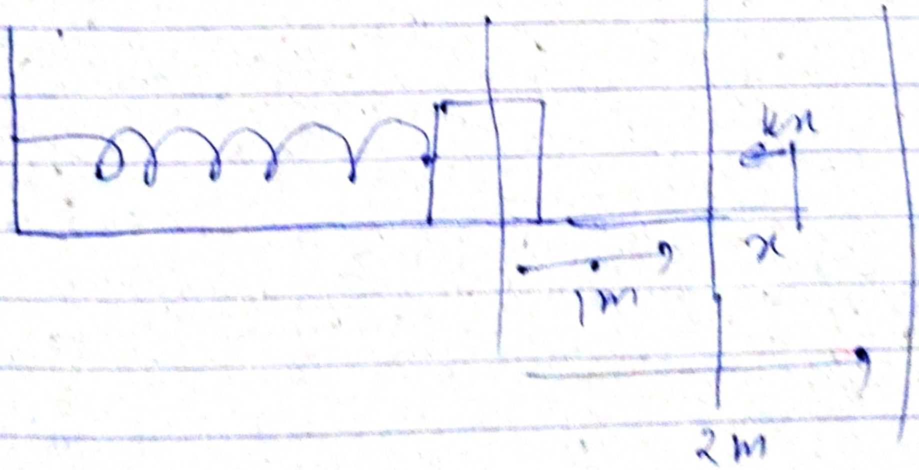
$$\Delta U = -W.D._c$$

$$\boxed{U_i - U_f = WD_c}$$



$U_B - U_A = -WDC$

Potensial energey का concept केवल conservative force के लिए meaningful है।



$$WD_c = -\int kx\,dx$$

$$= -k\left[\frac{x^2}{2}\right]_1^2$$

$$= -k\left(\frac{3}{2}\right)$$

Potensial energey of spring $= \frac{1}{2}kx^2$

$$\frac{1}{2}k(\cancel{1-4}) = -\frac{3}{2}k$$

Potensial energy पहला मुद्दा integration से बचायेगा और सवाल को short करेगा।

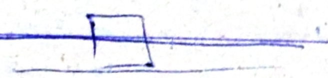
it may be +ve, -ve or zero

unit → joule

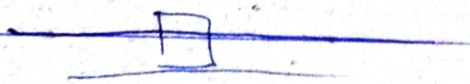
It is only defined for conservative forces. It is because W.D. by conservative force is path independent.

P.E ~~depend~~ at a point depends on refrence but P.E difference does not depend on reference point.

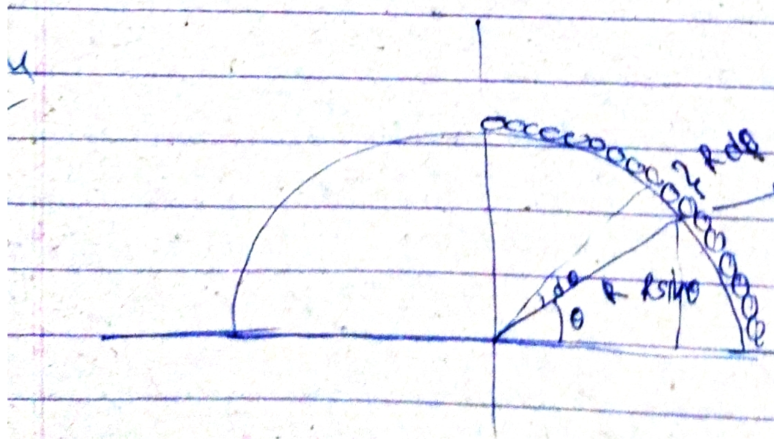
असलियत में हमें समय से पता चलेगा कि P.E का use ~~हमें integration से बचायेगा और साथ ही साथ सवालों को आसान करता है।~~



mgh   when g is assumed constant



0



$dM = \frac{M2}{\pi R} R\,d\theta = \frac{2M}{\pi} d\theta$

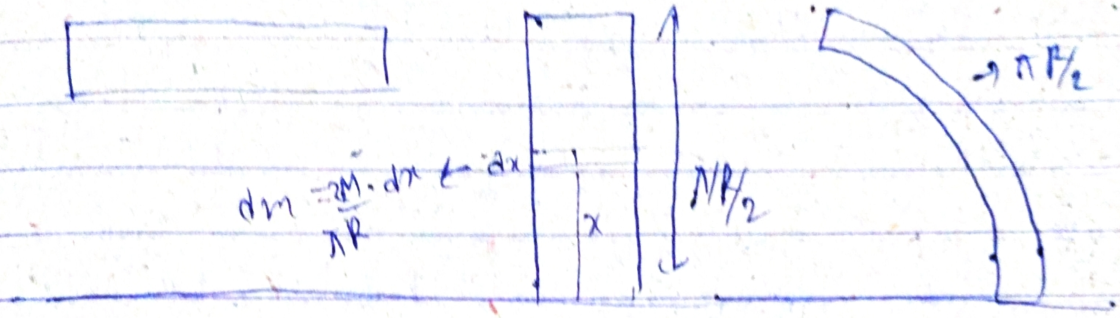
$l = \frac{\pi R}{2}$

R.L = 0

$dPE = dmgh$

$= \int_0^{\pi/2} g \frac{2M}{\pi} R \sin\theta\, d\theta = \frac{2MgR}{\pi}\left[-\cos\theta\right]_0^{\pi/2}$

Ans. किस की P.E. ज्यादा है



$$g\int_0^{\pi R/2} \frac{2M}{\pi R}\, x\, dx$$

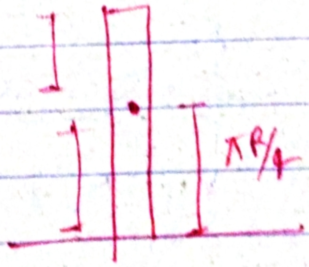
$$\frac{\cancel{2}mg}{\pi \cancel{R}} \cdot \frac{\pi^2 R\cancel{^2}}{4\times\cancel{2}}$$

$$= \frac{mg\,\pi^{\cancel{2}} R}{\cancel{\pi}} = \frac{mg\,\pi R}{4} = mgR\left(\frac{\pi}{4}\right)$$

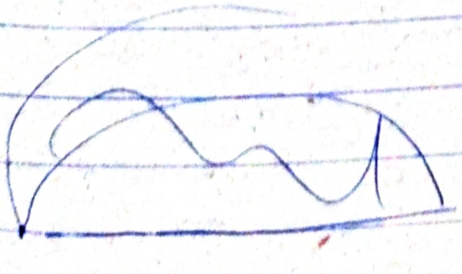
$$P.E = \frac{2mgR}{\pi}$$

2 वाली ~~की~~ 3 से ज्यादा ~~होती~~ है।

अब प्यार सीधा करता

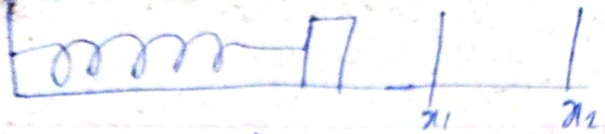


$$\frac{mg\pi R}{4}$$



$$c.om = \frac{2R}{\pi}$$

$$P.E. = \frac{mg\,2R}{\pi}$$



$$WD_c = -\int_{x_1}^{x_2} k\,x\,dx$$

$$= -\frac{1}{2}k\left(x_2^2 - x_1^2\right)$$

$$U_i - U_f = -\frac{1}{2}kx_2^2 + \frac{1}{2}kx_1^2$$

$x = 0$ Assume $U = 0$

$x_i = 0$ $U_i = 0$

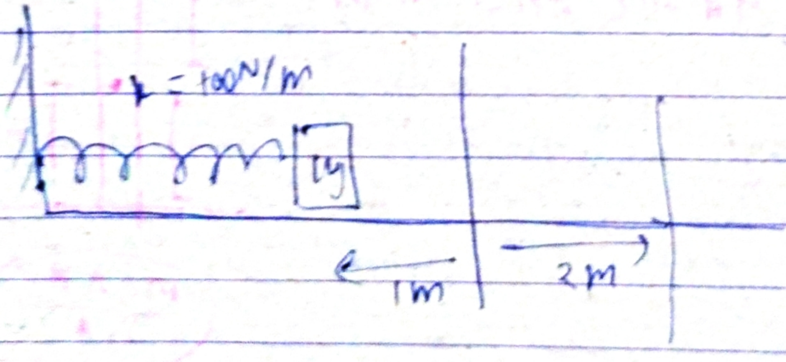
$\boxed{U_f = \frac{1}{2}kx^2}$ → from natural length

→ spring constant

Spring P.E.

when P.E. at natural length is 0

Qn

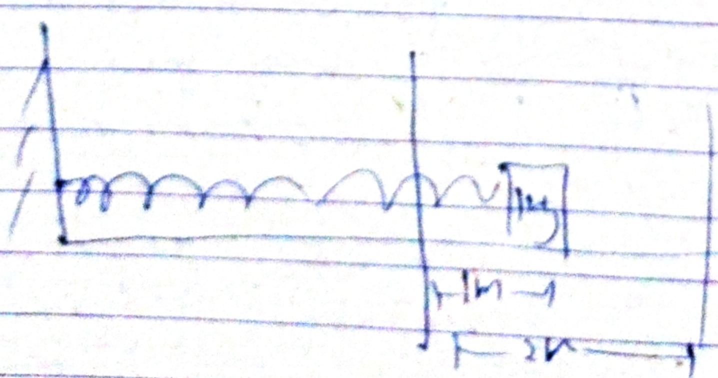


Spring की PE हमेशा +ive होती है अगर हमें natural length में 0 मानी है

$$W.D_{spring} = \frac{1}{2}100\left(1^2 - 2^2\right)$$

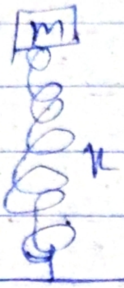
$$= -150$$

Qn



W.D spring $= -150$

Here P.E. = 0
of
gravity



$mg = kx$

$x = \frac{mg}{k}$

write T.P.E of system

$\frac{1}{2}kx^2 - mgx$ where $x = \frac{mg}{k}$

$$\boxed{\vec{F} = -\frac{\partial U}{\partial x}\hat{i} - \frac{\partial U}{dy}\hat{j} - \frac{\partial U}{\partial z}\hat{k}}$$

ctric field $\leftarrow$ $$\boxed{\vec{E} = -\frac{\partial V}{dx}\hat{i} - \frac{\partial V}{dy}\hat{j} - \frac{\partial V}{\partial z}\hat{k}}$$

ex. $\vec{F} =$

if $U = x^2 + 2y + 3z$

then $\vec{F} = -2x\hat{i} - 2\hat{j} - 3\hat{k}$

ex.

if $\vec{F} = x^2\hat{i} + y\hat{j} + 2\hat{k}$

$U_{(1,1)} = 10\,J$

$U_{(2,3)} = ?$

$10 - U = +\left[\frac{x^3}{3}\right]_1^2 + \left[\frac{y^2}{2}\right]_1^3$

$= +\left[\frac{8}{3} - \frac{1}{3}\right] + \left[\frac{9}{2} - \frac{1}{2}\right]$

$10 - U = +\frac{7}{3} + 4 \Rightarrow 10 - 4 - \frac{7}{3} = U$

$U = 6 - \frac{7}{3} = \frac{11}{3}$

$$\boxed{U_i - U_f = \int \vec{F} \cdot d\vec{r}}$$

$$\boxed{V_i - V_f = \int E \cdot d\vec{r}}$$

Ques $\vec{E} = x\hat{i} + 3y^2\hat{j}$

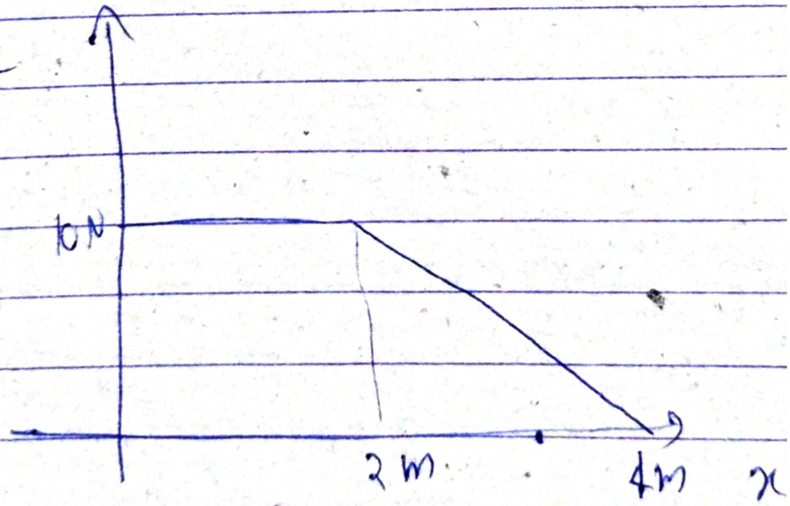
$V = 10V$ $(0,0)$ $\quad$ $V = ?$ $(1,2)$

$$10 - V = \left[\frac{x^2}{2}\right]_0^1 + \left[y^3\right]_0^2$$

$$10 - V = \frac{1}{2} + 8$$

$$\boxed{V = 3/2}$$

Ques



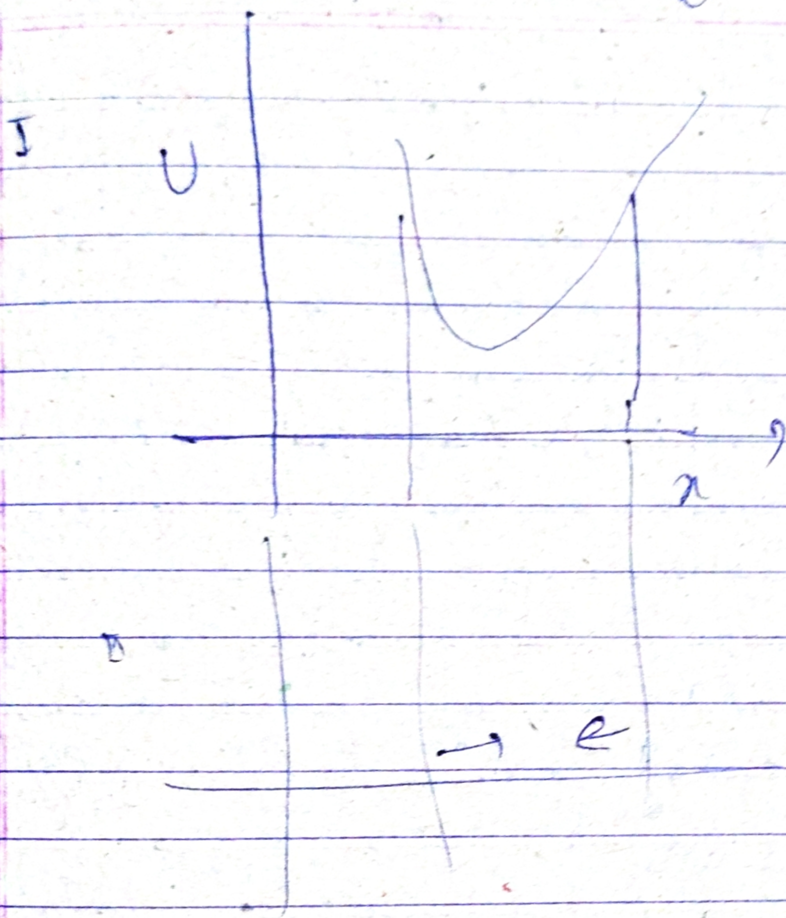
$U_{(0,0)} = 10J$

Find $U_{(4,0)} = ?$

$$10 - U = 30$$

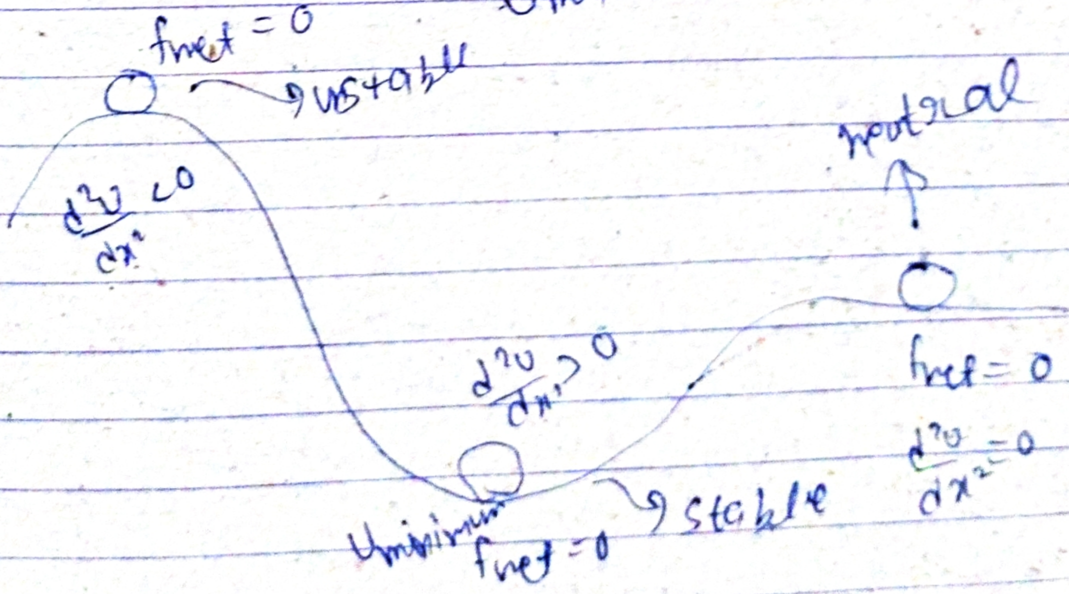
$$\boxed{U = -20J}$$ Ans

Q. I is given find the direction of ~~force~~ at given vertical line.



$$F = -\frac{dU}{dx}$$

Equillibirium ⇒



$$F = 0 = -\frac{dU}{dx}$$

$$\frac{dU}{dx} = 0$$