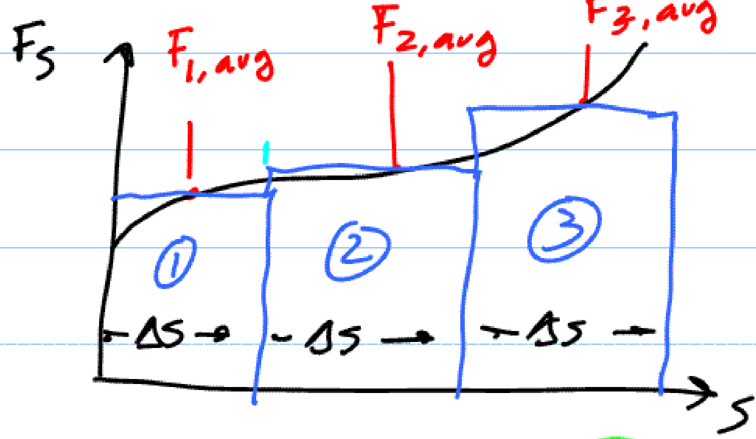
Class 11 - October 19/05

Almost § 11.2



F_s on mass m

$F_{1,avg} = m\,a_{1,avg}$ (Newton)

Δs small $\quad a_1 \sim$ constant

Kinematics $\quad a_{1,avg} = \dfrac{v_{f1} - v_{i1}}{\Delta t_1}$

$\Delta s = v_{avg1}\,\Delta t_1$

$v_{avg,1} = \dfrac{v_{f1} + v_{i1}}{2}$

$F_{1,avg}\,\Delta s$

$$F_{1,avg} \Delta s = \frac{1}{2} m v_{f1}^2 - \frac{1}{2} m v_{i1}^2$$

$$F_{2\,avg} \Delta s = \frac{1}{2} m v_{f2}^2 - \frac{1}{2} m v_{i2}^2$$

$$(F_{1,avg} + F_{2,avg}) \Delta s$$

$$\frac{1}{2} m v_{f2}^2 - \frac{1}{2} m v_{i1}^2$$

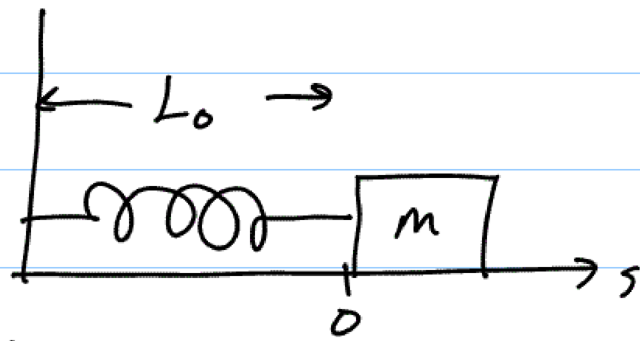
$$\lim_{\Delta s \to 0} \quad \int_{s_1}^{s_2} F_s \, ds = \frac{1}{2} m v_{sf}^2 - \frac{1}{2} m v_{si}^2 = \Delta K$$

↳ Work W done on mass m

$$J_s = \int F_s \, dt = \Delta p_s$$

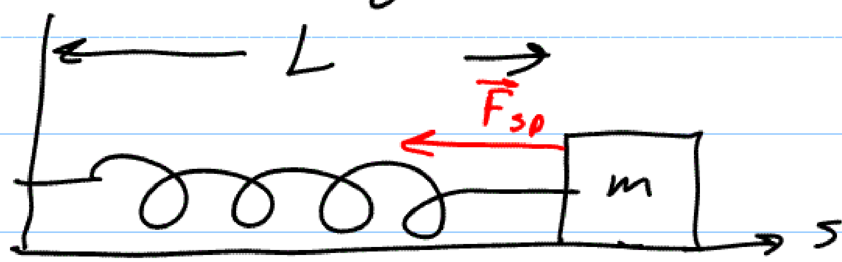
§10.4 - Hooke's Law

Springs



equilibrium

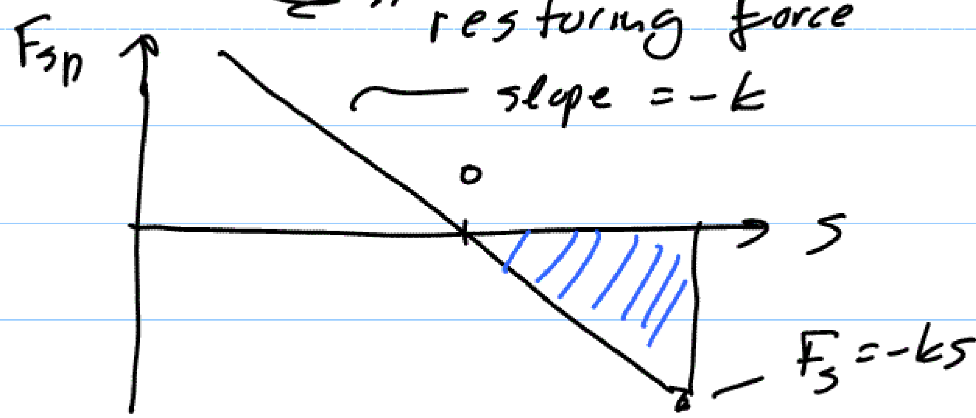
$F_{on\ m} = 0$



Exptly! $F_{sp} = -k\,(L - L_0) = -k\,\Delta s$

Hooke's Law

"restoring force"



magnitude area $\frac{1}{2}$ base × height

$$\frac{1}{2} s \times ks = \frac{1}{2} ks^2$$

"Elastic Potential Energy"

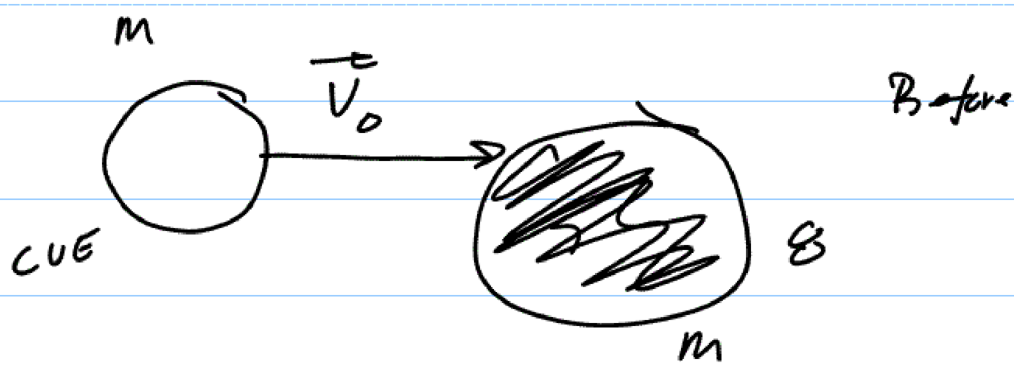
U_s

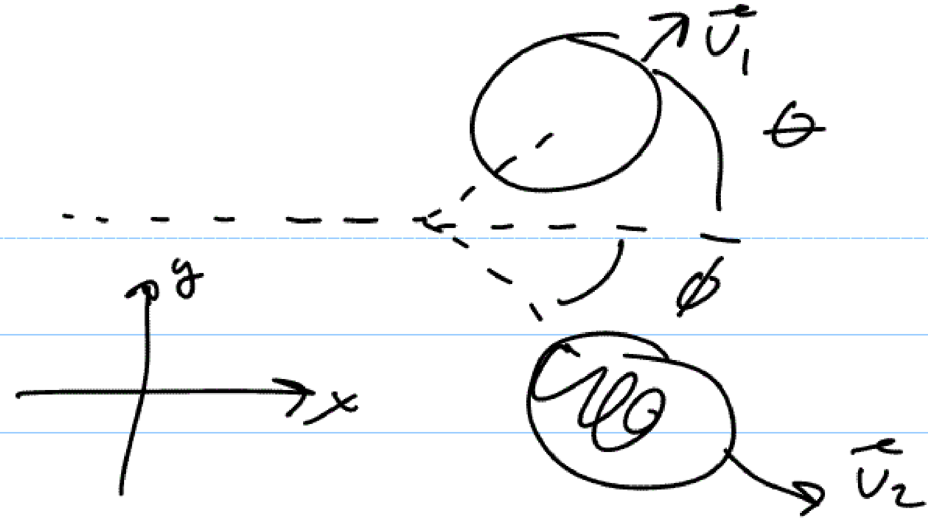
$$U_s + K = \text{constant}$$

§10.6 - Elastic Collisions

2 - dimensions

Billiard Balls - not spinning



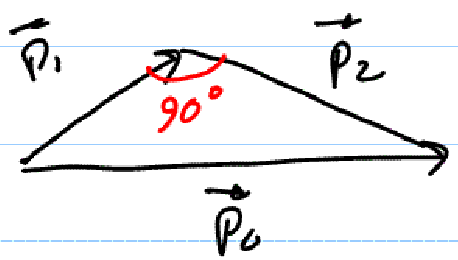


$\vec{P}_{tot}$ = constant

$m v_0 = m v_1 \cos\theta + m v_2 \cos\phi$

$m v_1 \sin\theta = m v_2 \sin\phi$

$\vec{P}_{tot} = \vec{P}_0 = \vec{P}_1 + \vec{P}_2$



Elastic:

K = const

$$K = \frac{1}{2} m v^2 = \frac{1}{2} \frac{p^2}{m}$$

$$K_0 = \frac{1}{2} m v_0^2 = \frac{P_0^2}{2m}$$

$$= K_f = \frac{P_1^2}{2m} + \frac{P_2^2}{2m}$$

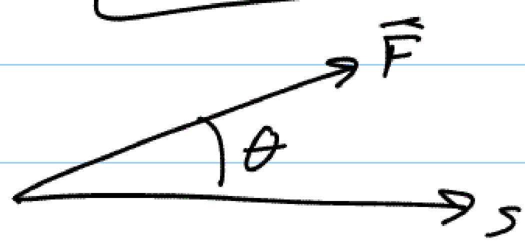
$$\Big\} \quad P_0^2 = P_1^2 + P_2^2$$

§10.7 - NTA

CHAPT. 11
WORK

Work $W = \int_{s_1}^{s_2} F_s \, ds$

$$W = \Delta K$$



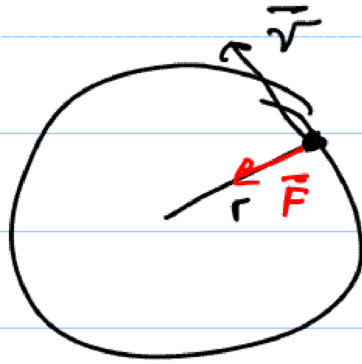
$F_s = F \cos\theta$

Dot Product $\vec{A} \cdot \vec{B} \equiv AB\cos\theta$

$W = \int_{s_1}^{s_2} \vec{F} \cdot d\vec{s}$ $\quad \vec{F} = \text{const}$

$= \vec{F} \cdot \vec{\Delta s}$

Uniform ⊙ Motion



$d\vec{s} = \vec{v}\,dt$

$d\vec{s} \perp \vec{F}$

§11.5 - F, W, U

W_{grav} independent of path.

Depends only on initial and final posns

$W = \Delta K = -\Delta U_g$

U potential for work to be done

2 kinds of forces

① Conservative.

W ind of path

Define U

$E_{mech} = K + U$ = conserved

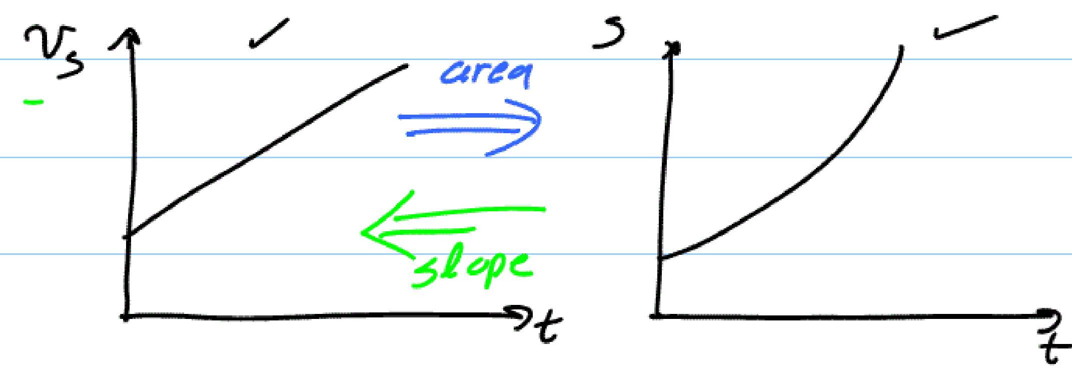
② Non-conservative

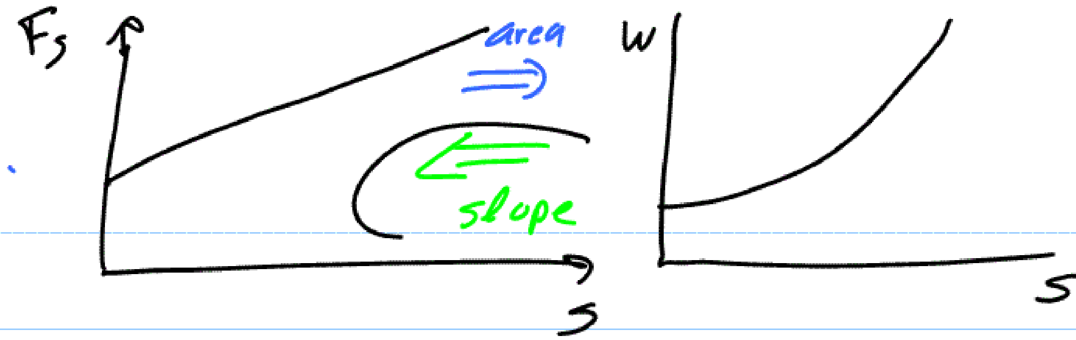
W depends on path

U can not be define

E_{mech} not conserved

§11.6 – F, U





$$F_s = \frac{dW}{ds} \qquad W = -\Delta U$$

$$F_s = -\frac{dU}{ds}$$