Phys 2110-3 10/11/10

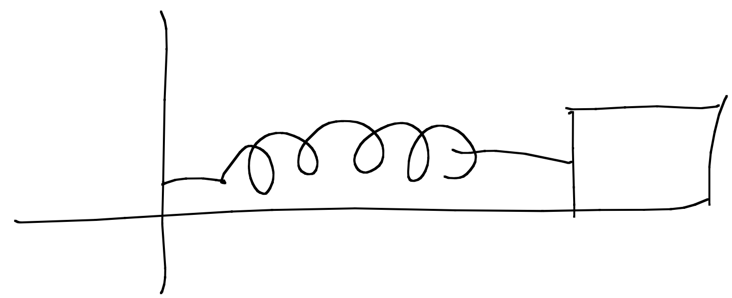
Note Title 10/11/2010

Chap 7

Conservation of Energy

$$W_{spr} = -\frac{k}{2}(\Delta x^2)$$

$$= -k/2\,(x_2^2 - x_1^2)$$

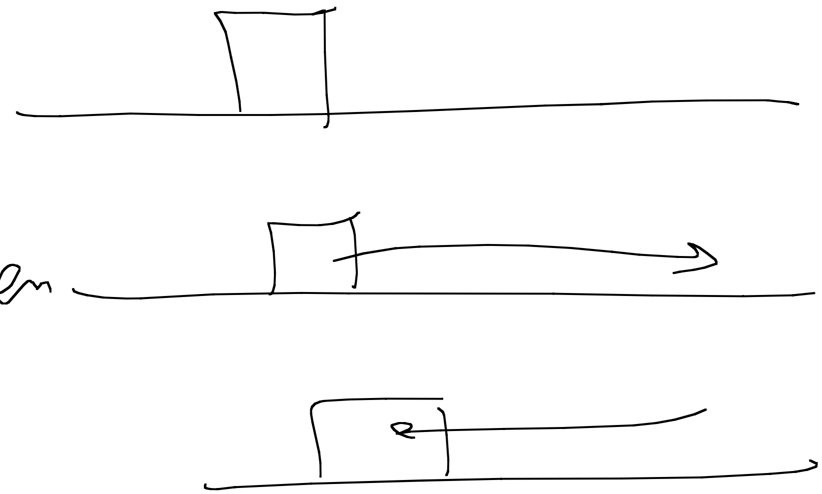


$$W_{grav} = \Delta(-mgy)$$

$$= \Delta(-mg(y_2 - y_1))$$

$$W = \int_{x_1}^{x_2} F\,dx$$

Work done by friction depends on "path" between x_1 & x_2



Useful: Define $U(x)$ potential energy

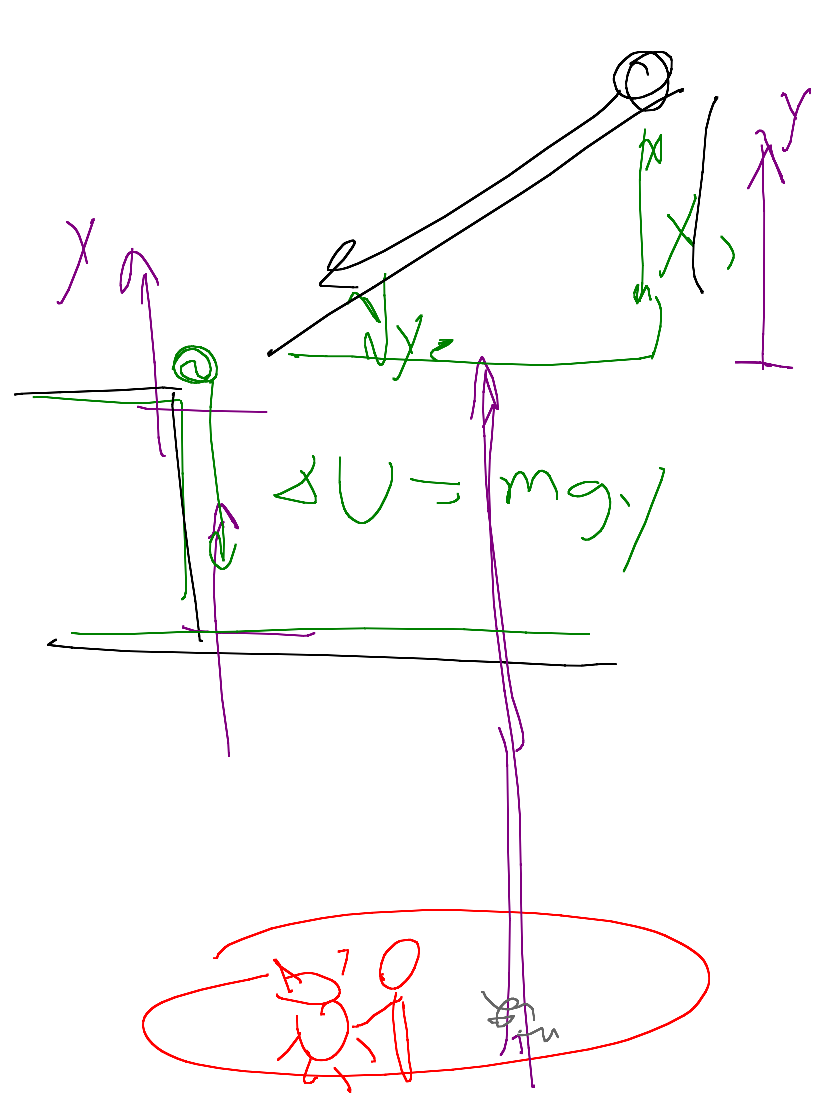
$$W = \Delta(-U) = -\Delta U$$

$$U_{spr}(x) = \frac{1}{2}kx^2 \qquad U_{grav} = mgy$$

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

$$\Delta U_{grav} = mg\Delta y$$

Formula only has Δy in it



W-E Theorem

$$\Delta K = W_{net} = \int_A^B \vec{F}_{net} \cdot d\vec{r}$$

sum of forces

$$\Delta K = \underbrace{W_{grav} + W_{spring}}_{\text{change to } -\Delta U} + \underbrace{W_{fric}}_{\text{can't make this into } -\Delta U(x)} + \ldots$$

Conservative forces

Non-conservative forces

$$\Delta K = -\Delta U_1 - \Delta U_2 + \ldots W_{fric}$$

$$\underbrace{\Delta U_1 + \Delta U_2 + \dots}_{} + \Delta K = W_{fric}$$

$$\Delta U_{Tot} + \Delta K = W_{fric}$$

Total mechanical energy

$$K + U \equiv E$$

$$\Delta K + \Delta U = \Delta E$$

$$\Delta E = W_{non\text{-}cons}$$

Special case:

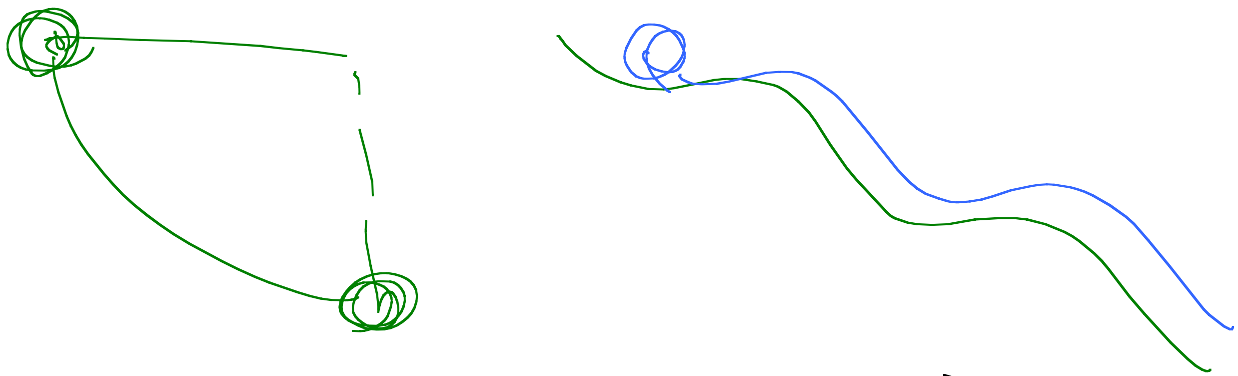
No non-conserv forces

(No friction no other misc. forces...)

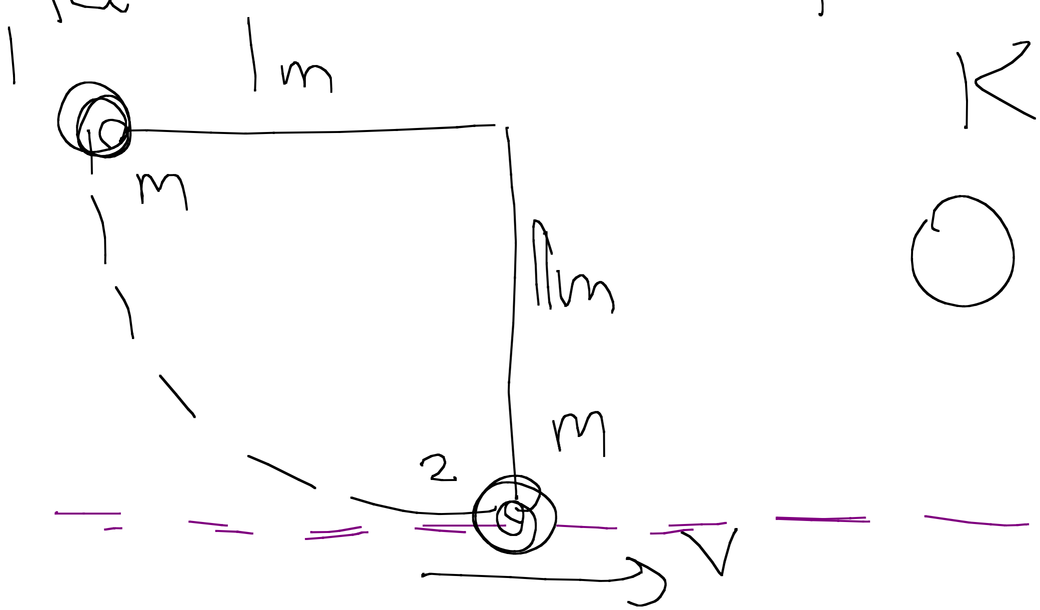
$$\Rightarrow \Delta E = 0$$

$$E_2 = E_1 \qquad K_1 + U_1 = K_2 + U_2$$

Conservation of Energy



Principle is good for finding Release speed, position.



$$K_1 + U_1 = K_2 + U_2$$

$$0 + mg(1\,m) = \frac{1}{2}mv^2 + 0$$

$$\cancel{m}g(1.0m) = \frac{1}{2}\cancel{m}v^2$$

$$v = \sqrt{2g(1.0m)}$$

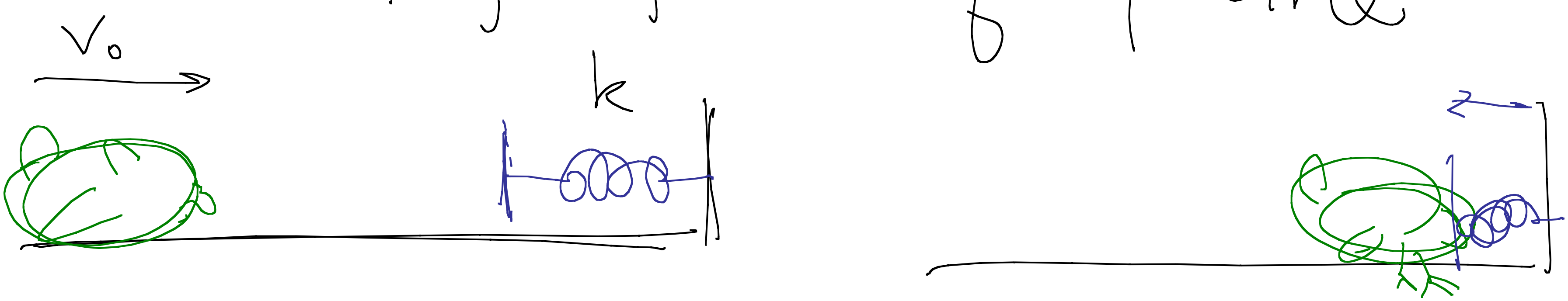
$$= \sqrt{2(9.8\tfrac{m}{s^2})(1.0m)}$$

$$= 4.\text{something } \frac{m}{s}$$

$$= 4.4\frac{m}{s}$$

7.21 Navy jet mass 10,000 kg lands on carrier snags cable - - - spring 40,000 N/m.

Spring stretches by 25 m to stop plane. What was landing speed of plane



Energy is conserved

$$\cancel{\tfrac{1}{2}} m v_0^2 = 0 + \cancel{\tfrac{1}{2}} k x^2$$

KE U=0 KE

Solve for v_0

$$v_0^2 = \frac{kx^2}{m} \rightarrow \boxed{50\,\frac{m}{s}}$$