Finish Reading Chap 6

Next H.W Available (not due until after spring break)

NO clickers today

I will be gone Thursday / Friday

Guest Lecturer on Friday

David Bertsche gone for group
Dave LaMantia no office hrs Thursday

Office hours 9:30-10:30 today

Energy Review

Potential (U) — Gravity: mgh

Spring: $\frac{1}{2}kx^2$ ($F = kx$)

k = spring constant

Kinetic (K) — $\frac{1}{2}mv^2$

$W_{net} = F_{net} d \cos\theta = K_f - K_i$

$W_c = -\Delta U$

conservative forces — work done independent of path taken

non-conservative forces — i.e. friction

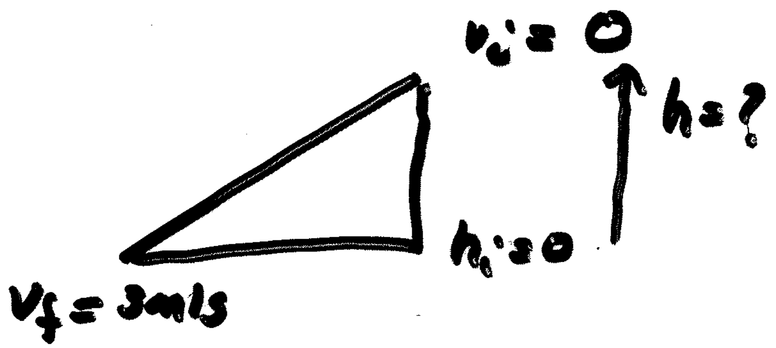
$W_{NC} = \Delta K + \Delta U$

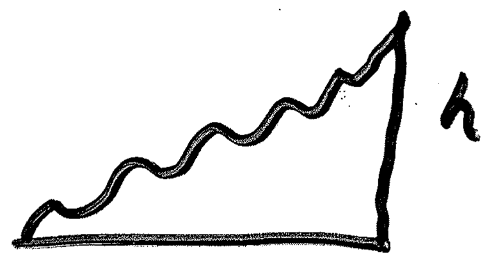
if only conservative forces

$\Delta K + \Delta U = 0$

Energy conserved (mechanical)

ex) A child and sled of mass = 50kg slide down a frictionless hill. If sled starts from rest and has a speed of 3.00 m/s at bottom, how high is the hill?





conserve mechanical Energy

$E_i = E_f$

$E_i = \frac{1}{2}mv_i^2 + u_i$ $\quad$ $v_i = 0$ $\quad$ $u_i = mgh$

$E_f = \frac{1}{2}mv_f^2 + u_f$ $\quad$ $v_f = 3 m/s$ $\quad$ $u_f = 0$

$E_i = 0 + mgh$

$E_f = \frac{1}{2}mv_f^2 + 0$

$E_i = E_f$ $\quad$ $mgh = \frac{1}{2}mv_f^2$

$$h = \frac{v_f^2}{2g} = \frac{(3 m/s)^2}{2\cdot(9.8 m/s^2)} = .46 m$$

$$v_f^2 = v_0^2 + 2a\Delta y \quad (v_0 = 0)$$

$$\Delta y = \frac{v_f^2}{2a} = \frac{v_f^2}{2g}$$

ex) A 0.5 kg block is used to compress a spring with spring constant 80.0 N/m a distance of 0.02 m. When spring released, what is final speed of block?

$$E_i = E_f$$

$$\frac{1}{2}mv_i^2 + u_i = \frac{1}{2}mv_f^2 + u_f$$

$v_i = 0$ $\qquad$ $v_f = ?$

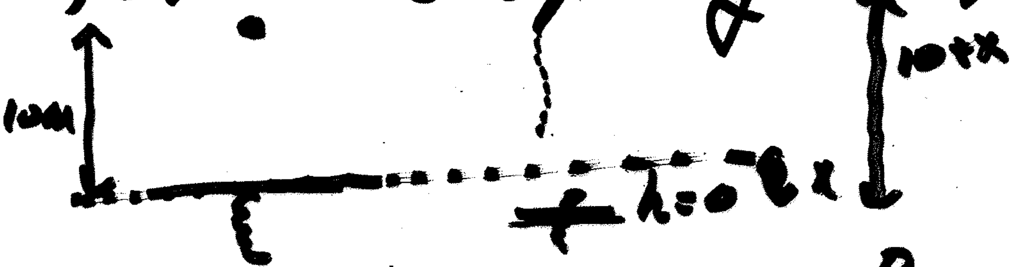
$u_i = \frac{1}{2}kx^2$ $\qquad$ $u_f = 0$

$$\frac{1}{2}mv_i^2 + \frac{1}{2}kx^2 = \frac{1}{2}mv_f^2 + u_f$$

$$v_f = \sqrt{\frac{kx^2}{m}}$$

$$v_f = \sqrt{\frac{(80\,N/m)(.02\,m)^2}{.5\,kg}} = \boxed{.25\,m/s}$$

ex) A 1.2 kg object is dropped from a height of 10.0 m onto a spring with spring constant 500 N/m. How far does spring compress?



$E_i = E_f$

$v_i = 0$

$v_f = 0$

$$\frac{1}{2}mv_i^2 + u_i = \frac{1}{2}mv_f^2 + u_f$$

$$mgh = \frac{1}{2}kx^2$$

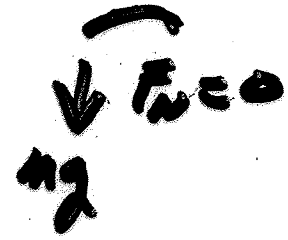
$$x^2 = \frac{2mgh}{k} \quad (10m + x)$$

$$x = \sqrt{\frac{2\cdot(1.2kg)(9.8m/s^2)(10m)}{500N/m}} = \boxed{.68m}$$

* note neglected small change in potential Energy as spring compresses

find minimum "h" to make it around loop

Frictionless



$$mg = m\frac{v^2}{r}$$

$$v^2 = gr$$

$$E_i = E_f$$

$$\frac{1}{2}mv_i^2 + u_i = \frac{1}{2}mv_f^2 + u_f$$

$$mgh = \frac{1}{2}mv_f^2 + mg2r$$

$$gh = \frac{1}{2}gr + g2r$$

$$h = \frac{r}{2} + 2r \Rightarrow \boxed{h = 2.5r}$$