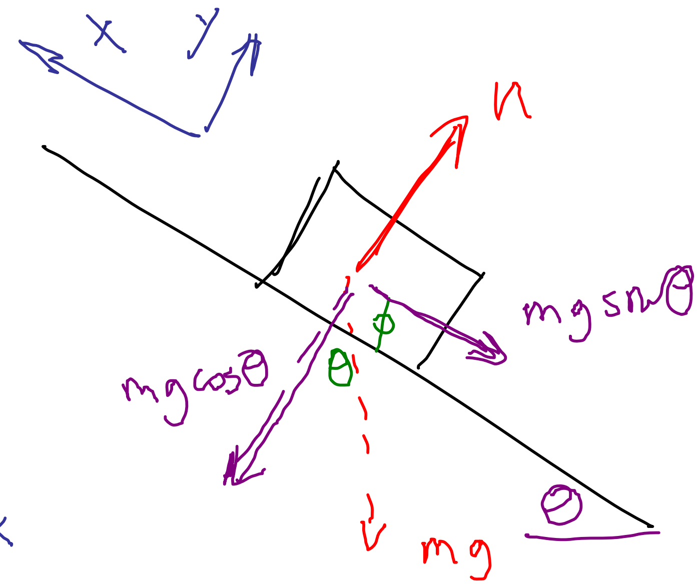
Phys 2110-4 2/18/13

Note Title 2/18/2013

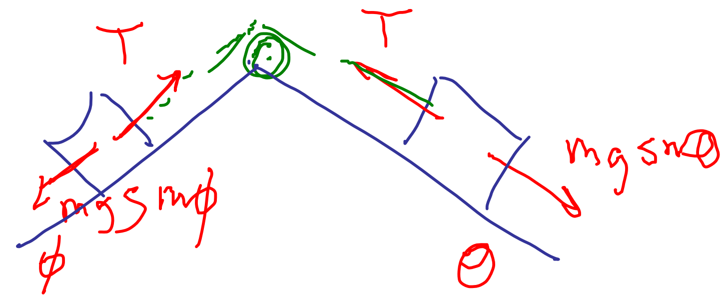
Frictionless incl. plane



$$n = mg\cos\theta$$

$$F_x = -mg\sin\theta = ma_x$$

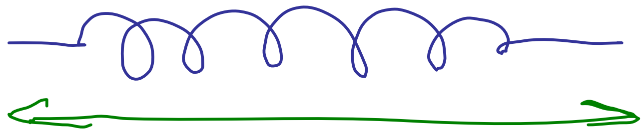
$$a_x = -g\sin\theta$$



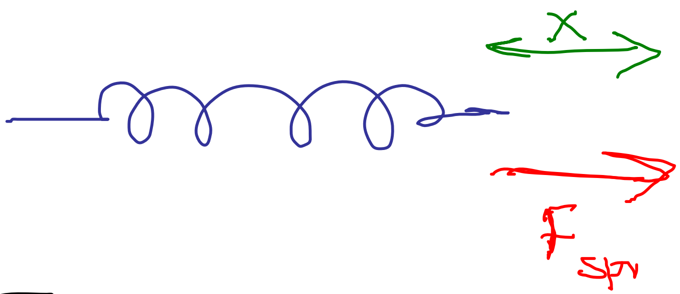
Springs

Ideal, massless springs

Pull or push depending on whether compress or extend spring



Natural length ℓ



Squash by x

k spring constant (force)

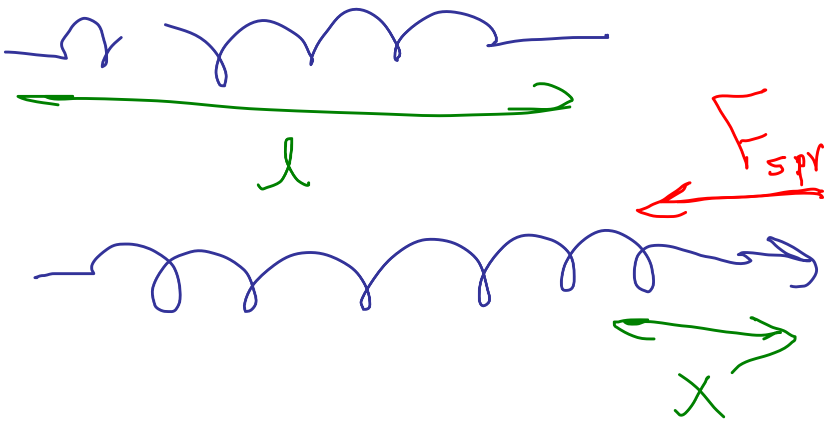
F_{spr} is prop to squish

$$|F_{spr}| = \underbrace{k}\, x$$

Units $\quad N = [k]\, m$

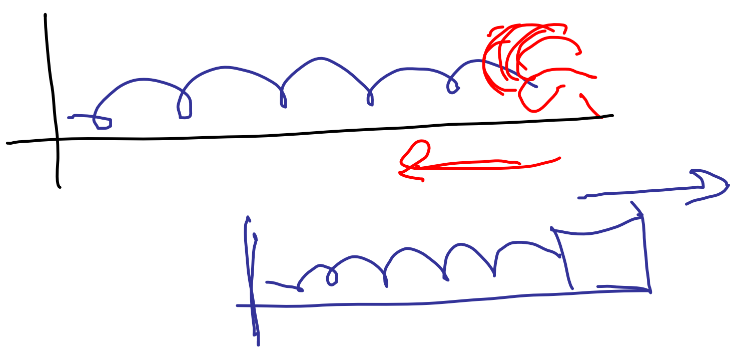
$$[k] = N/m = kg/s^2$$

Also, stretch

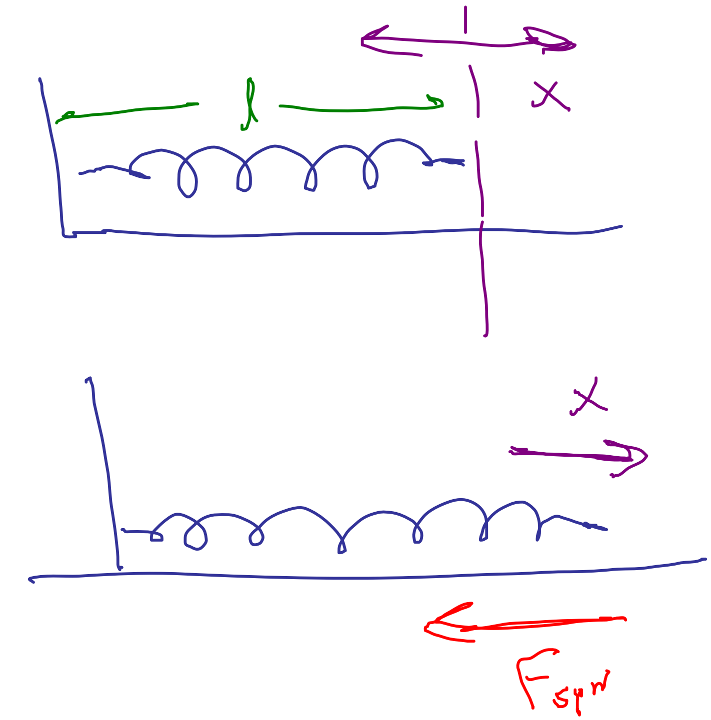


$$|F_{spr}| = kx$$

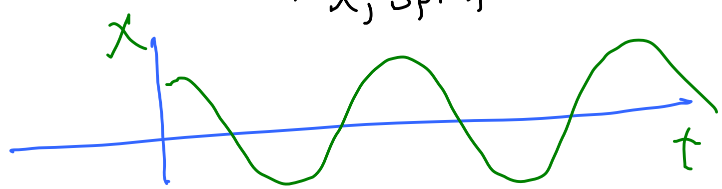
<u>same k</u>



Mathematical

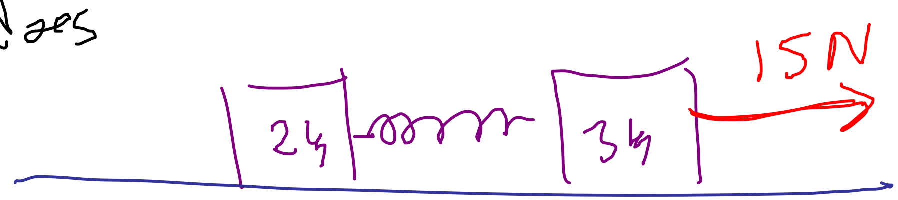


$$F_{x,\,spring} = -kx$$

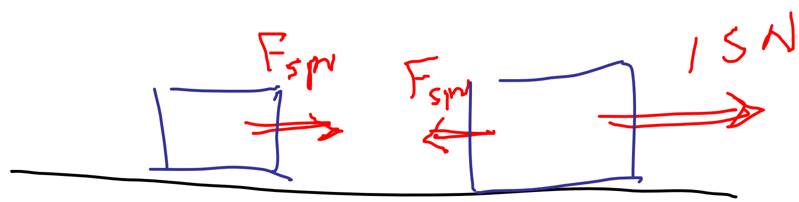


4.50 2.0 kg & 3.0 kg mass are on horiz. fric. surface connected by spr, $k = 140\,\frac{N}{m}$

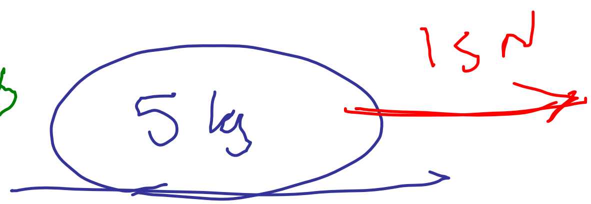
A 15 N force is applied to larger mass. By how much does spring stretch from equil. length?



Both block have same motion.

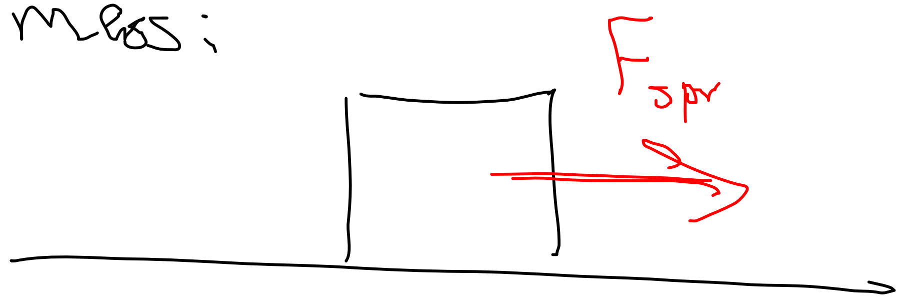


Legal: considering blocks as one mass.



$\longrightarrow \quad a = 3.0\,\frac{m}{s^2}$

Second mass:

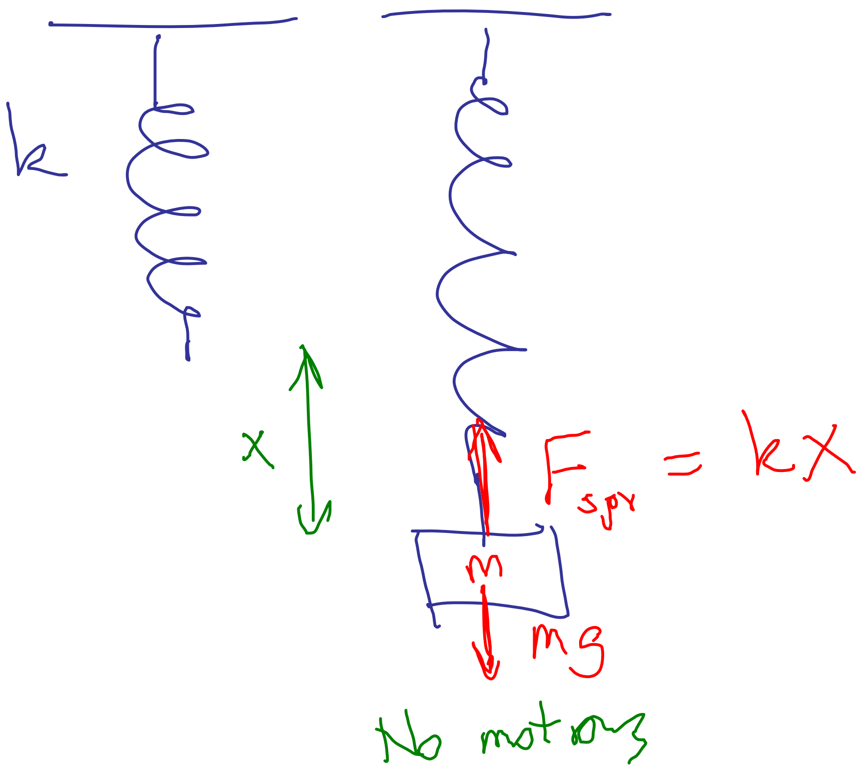


$$a = 3.0\ \frac{m}{s^2}$$

$$F_{spr} = ma = (2.0\ kg)(3.0\ \tfrac{m}{s^2}) = 6.0\ N$$

$$= |kx| = (140\ \tfrac{N}{m})\,x$$

$$x = 0.043\ m = \underline{\underline{4.3\ cm}}$$

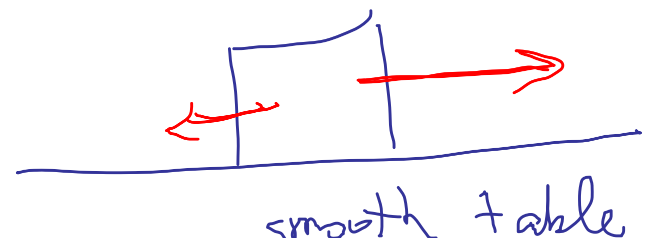


$$kx = mg$$

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

Spring scale..

Ch. 5 Friction
Circular

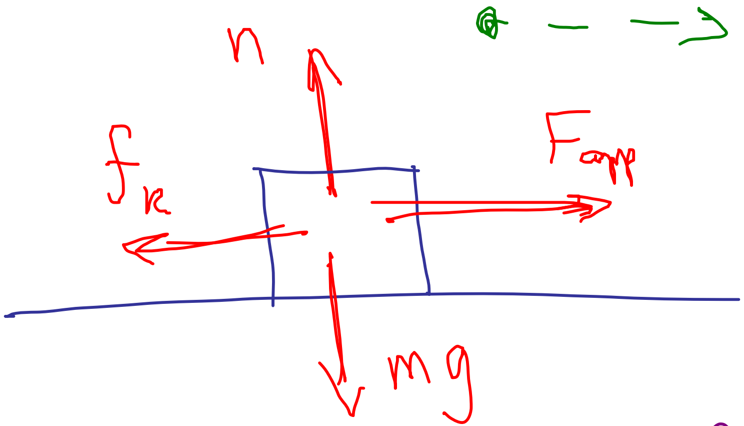


Friction!

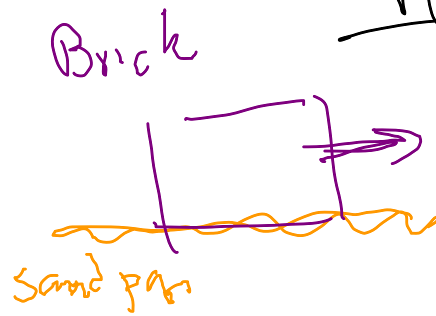
There is now f_k

(force of kinetic friction)

Opposes motion.



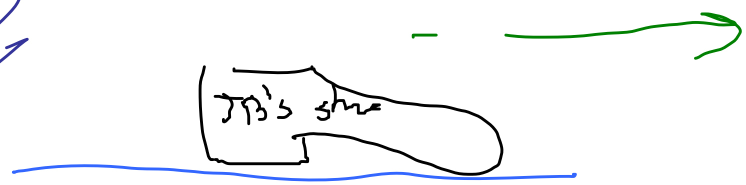
Depends on:



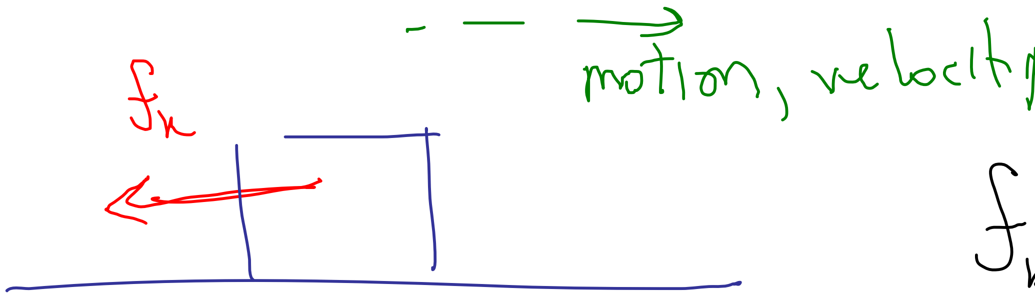
Materials

Normal force?

Speed of object?



Empirical. Sliding friction, mat'ls normal force.



$\propto n$

$$f_k = \mu_k n$$

p.75

μ_k coefficient of kinetic friction.

μ_k is unitless

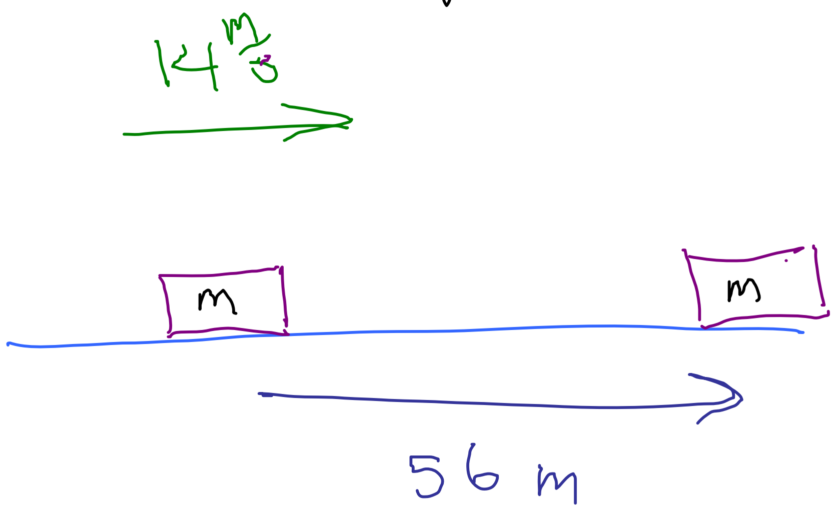
$$[N] = \mu_k [N]$$

e.g. Wooden block on table

$\mu_k \approx 0.2$

Tires on concrete $\mu_k \approx 0.8$

5.29 A hockey puck is given an initial speed of $14 \frac{m}{s}$. If it comes to rest in 56 m, what's coefficient of kinetic friction?

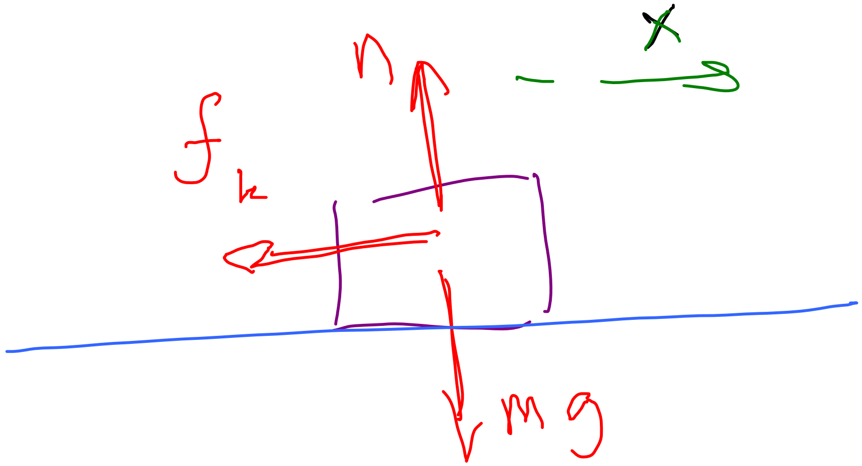


Acceleration

$$v^2 = v_0^2 + 2aX$$

$$\underbrace{v^2}_{0} = \underbrace{v_0^2}_{(14 \frac{m}{s})} + 2a\underbrace{X}_{56}$$

$$a = -1.75 \frac{m}{s^2}$$



$$f_k = \mu_k n = \mu_k m g$$

$$F_x = m a_x$$

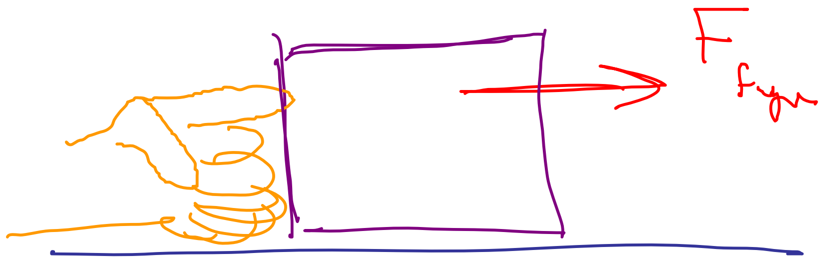
$$\underline{n = mg}$$

$$\cancel{-}\mu_k \cancel{m} g = \cancel{m}\left(\cancel{-}1.75 \frac{m}{s^2}\right)$$

Mass cancels out.

$$\mu_k = \frac{1.75 \frac{m}{s^2}}{g} = \boxed{0.179}$$

$9.8 \frac{m}{s^2}$



There is a value of F_{app} so that it starts $\longrightarrow$ f_s

Until then,

$f_s = F_{fingr}$ $\longrightarrow$ $f_s^{(max)}$