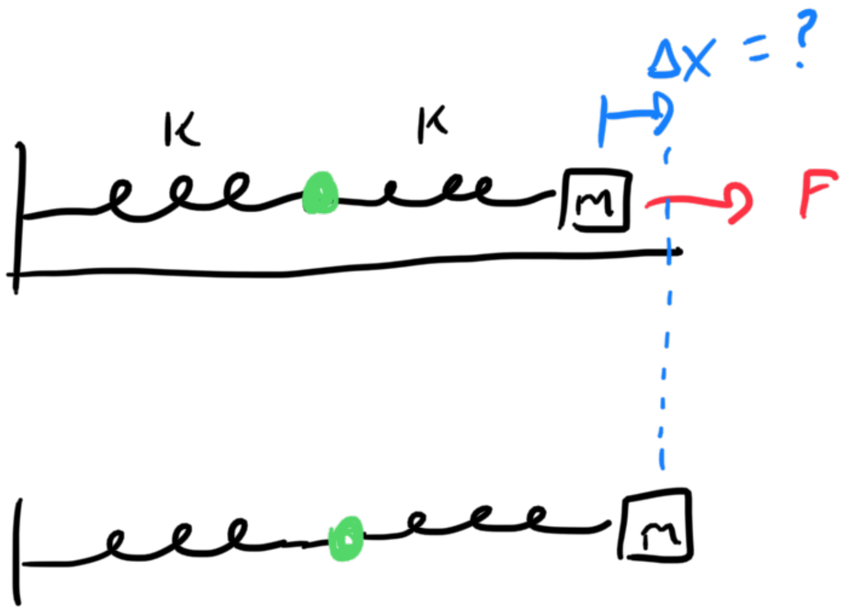
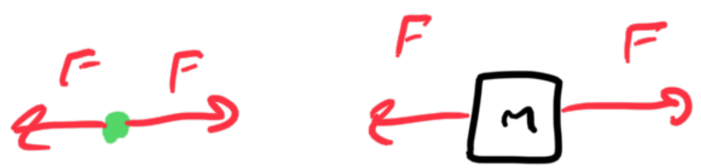




otherwise springs would accelerate.

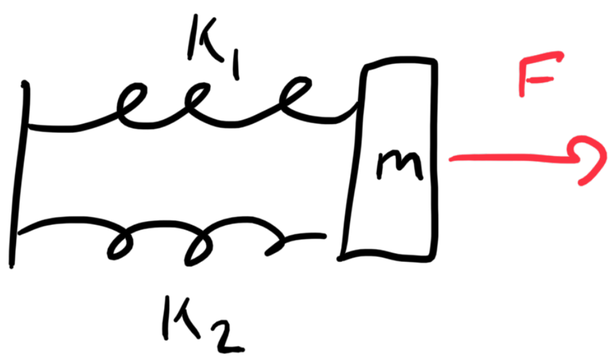
$\Delta x_1 = F/K$

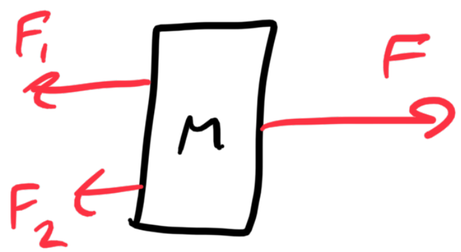
by same logic $\Delta x_2 = F/K$

$\Delta x_{tot} = 2F/K.$

$K_{series} = \dfrac{F}{\Delta x_{tot}} = \dfrac{K}{2}$

Exercise $K_1 \neq K_2$ Hint: equilibrium condition is the same.





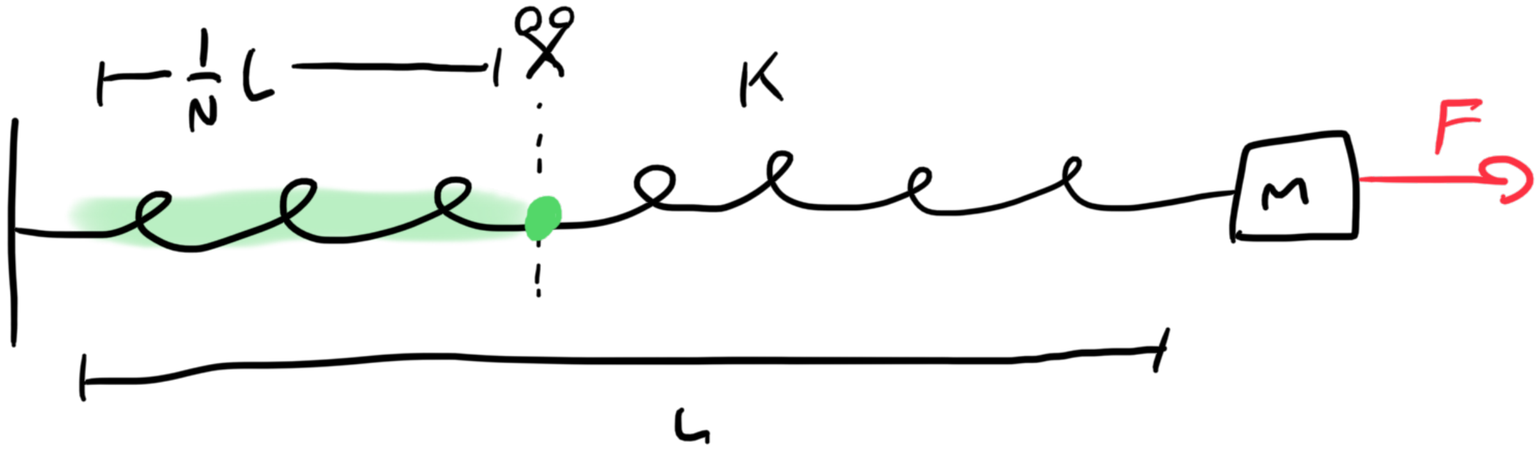
$$X = \frac{F_1}{K_1} = \frac{F_2}{K_2}$$

$$F = F_1 + F_2$$

$$F = K_1 X + K_2 X$$

$$X = \frac{F}{(K_1 + K_2)}$$

$$K_{parallel} = K_1 + K_2$$



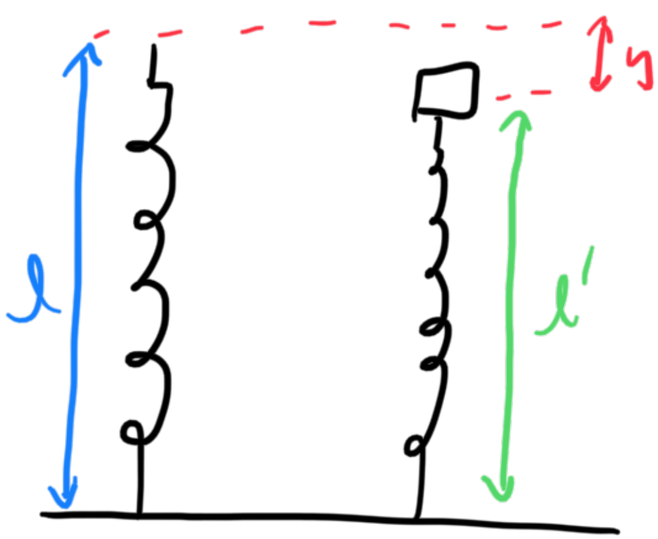
$K_c = ?$

$K \equiv F/x$

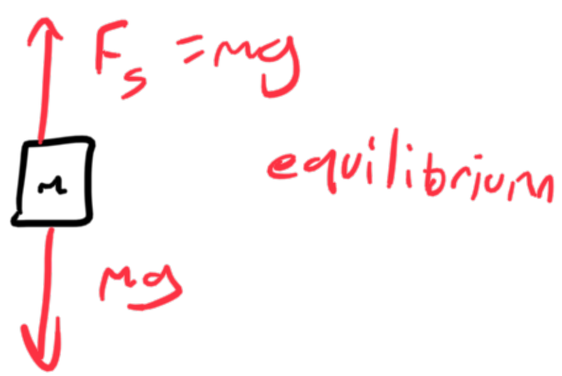
Whole spring extends x, green segment extends x/N

$x_c = x/N$

$$K_c = \frac{F}{\frac{x}{N}} = \frac{NF}{x} = NK$$



$l' = ?$



$$mg = ky \Rightarrow y = \frac{mg}{k}$$

$$l' = l - \frac{mg}{k}$$

$\omega = ?$

$F_{spring} = -kx$

x = displacement from equilibrium.

$F = -kx$

$ma = -kx$

$m\ddot{x} = -kx \ldots$

$\omega = \sqrt{k/m}$.

F=ma Physics

Topic 3

$E(d) \stackrel{?}{=} \frac{1}{2}kd^2$ after changing equilibrium?

$$\Delta E = \frac{1}{2}k(y+d)^2 - \frac{1}{2}ky^2 = \frac{1}{2}kd^2 + kyd$$

additional compression

$$kyd \stackrel{?}{=} -mgd$$

$$F = -ky$$

$$-kyd = Fd = mgd$$

2015 #23

$$\Delta E_s = \frac{1}{2}k(h+x)^2 - \frac{1}{2}kh^2 = \frac{1}{2}kx^2 + khx$$

original compression h:

$$F_s - m_2 g = 0 \Rightarrow \quad h = \frac{-m_2 g}{k} = -0.83\ m$$

$$V_1: \quad mgy = \frac{mv^2}{2} \Rightarrow v = \sqrt{2gy} = 10\ m/s$$

$$V_2 = \frac{m_1 v_1}{m_1 + m_2} = 2.5\ m/s$$ immediately after collision.

$$E_1 = E_{k_1} + E_{s_1} + E_{g_1}$$

$$= \frac{1}{2}(m_1+m_2)v_2^2 + \frac{1}{2}kh^2 + 0$$

$$E_2 = E_{k_2} + E_{s_2} + E_{g_2}$$

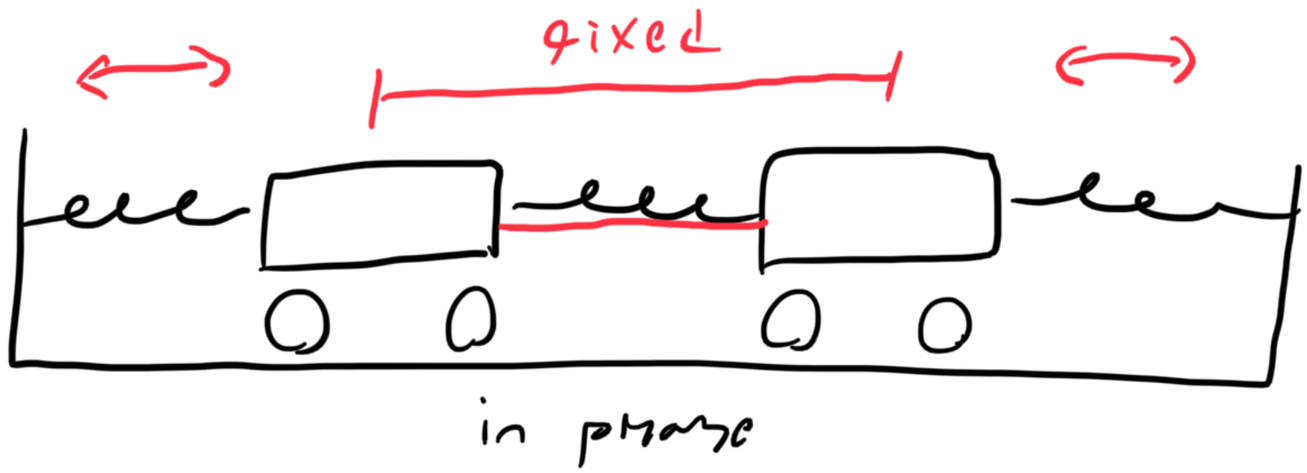
$$= 0 + \frac{1}{2}k(h+x)^2 - (m_1+m_2)gx$$

$$\frac{1}{2}(m_1+m_2)v_2^2 = \frac{1}{2}kx^2 + m_1 g x$$

$$x = -1.16\ m$$

(B)

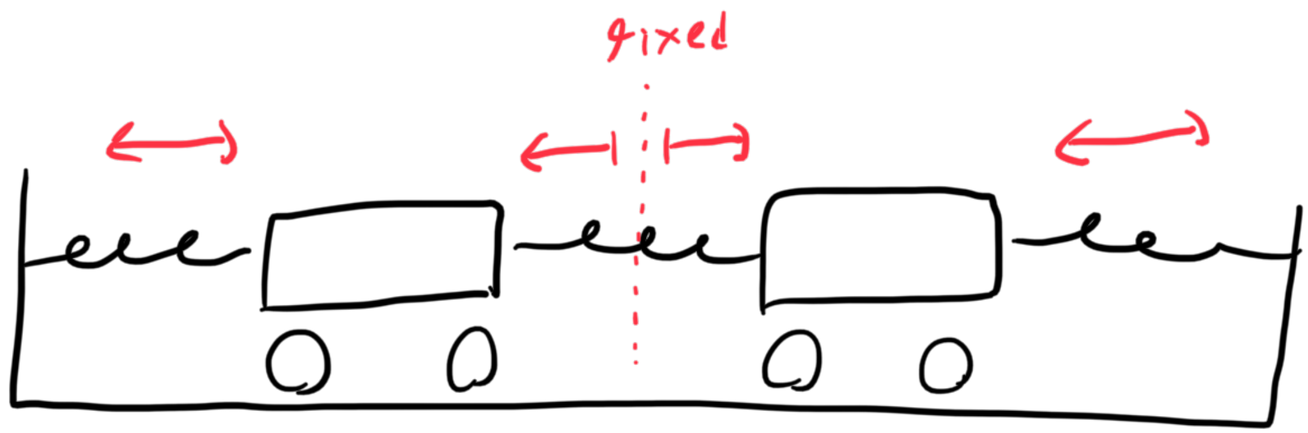
2015 #25



in phase

$$\omega_1 = \sqrt{\frac{2K}{2M}} = \sqrt{K/M}$$

$$\frac{\omega_2}{\omega_1} = \sqrt{3} \quad (A)$$



out of phase

$$\omega_2 = \sqrt{\frac{K_{eff}}{M}} = \sqrt{\frac{3K}{M}}$$

$$K_{eff} = K + K_{eff\ in\ mat} = K + 2K$$

2015 # 19

Topic 3

$$T = 2\pi\sqrt{\frac{m}{k}}$$

if $F = -Kx$

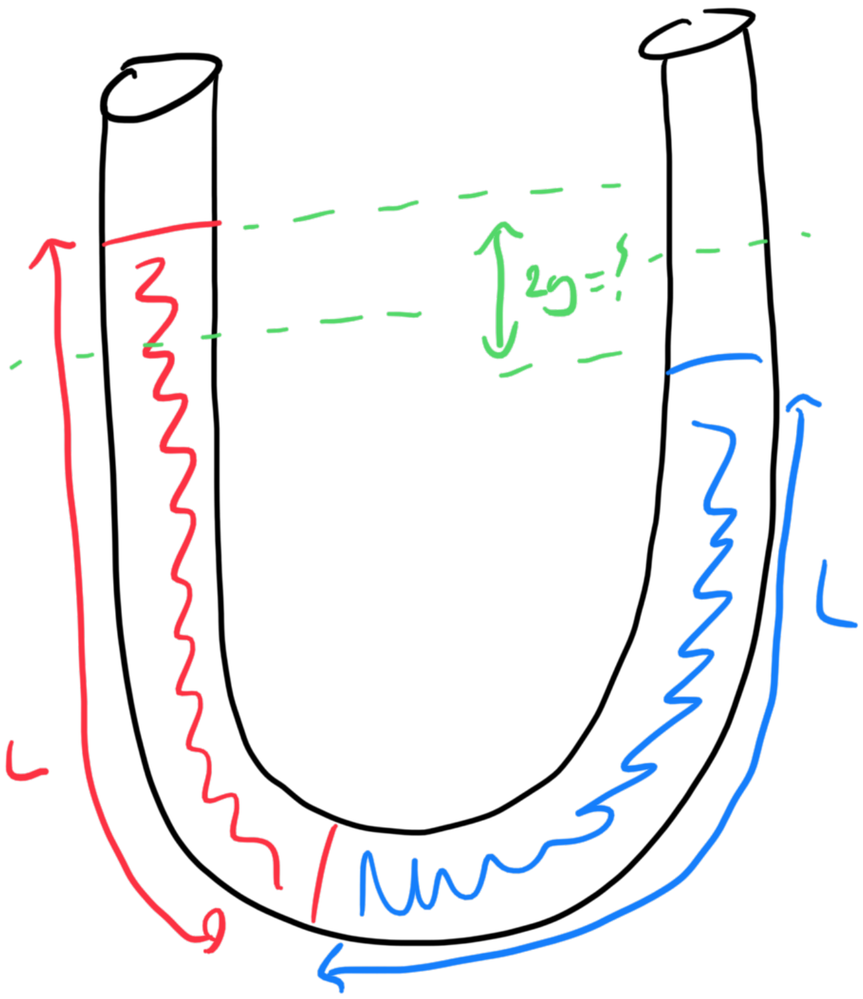
$$m = \rho V = \rho L A$$

$$k = \frac{F}{x} = \frac{2\rho x A g}{x} = 2\rho A g$$

$$T = 2\pi\sqrt{\frac{L}{2g}} \Rightarrow g = \frac{1}{2\pi}\sqrt{\frac{2g}{L}}$$

(A)

2015 #20



$$\rho_w g L + \rho_o g y = \rho_w g (L - y)$$

$$y = \frac{\rho_w - \rho_o}{2\rho_w} L = \frac{L}{4}$$

$$2y = \frac{L}{2}$$ **B**