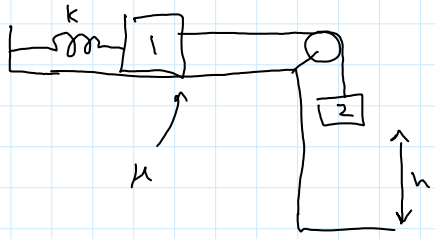
Phy 2A Review 5/19

Friday, May 19, 2017 10:00 AM

Energy conservation Problems:

1)



given: $m_1 = 10$ kg

$m_2 = 20$ kg

$k = 30 \frac{N}{m}$

$h = 2$ m

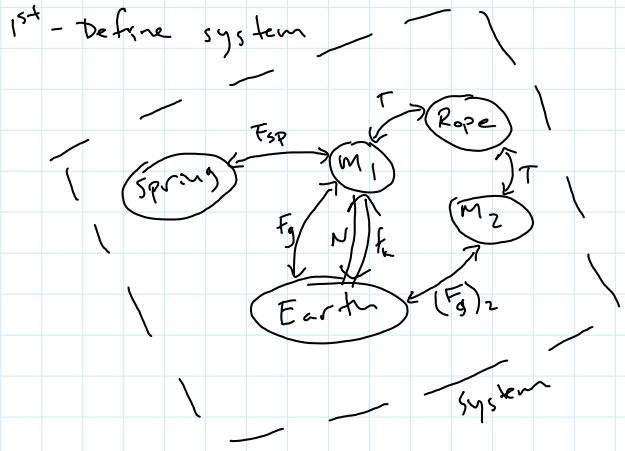
$\mu_k = 0.2$

$V_i = 0$

Spring starts unstretched

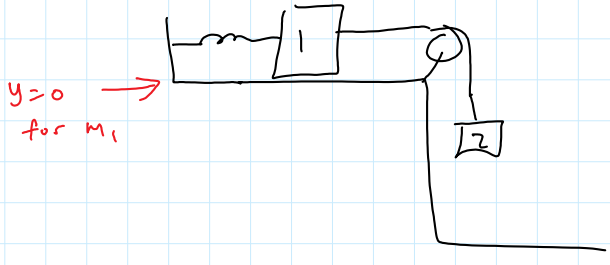
find: V_f (speed of m_2 just before it hits the ground)

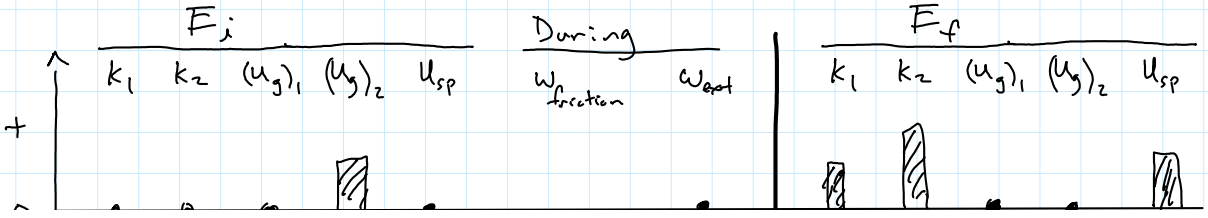
1st - Define system

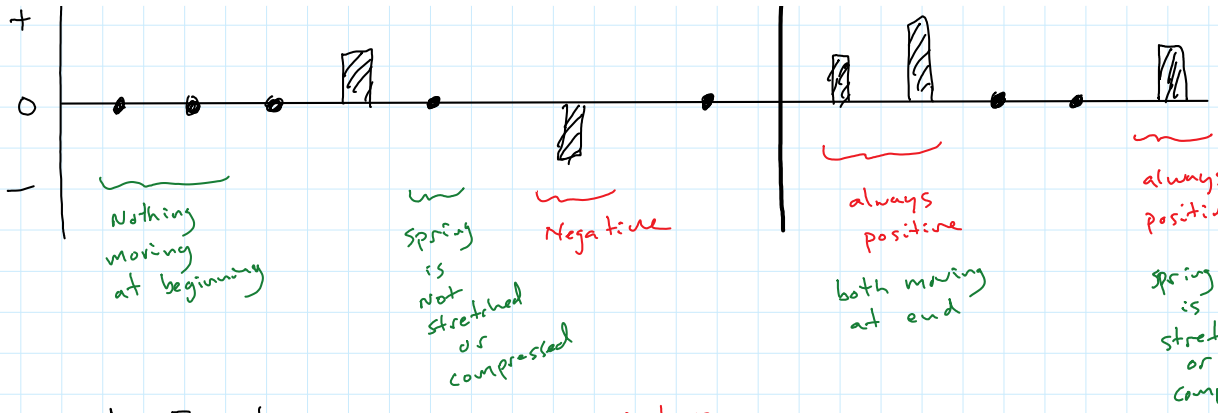


No external forces

2nd - Energy Bar chart: $E_i + W_{friction} + W_{ext} = E_f$







3rd - Equation

N distance

$$m_2 g h - \mu_k (m_1 g) h = \frac{1}{2} m_1 v_f^2 + \frac{1}{2} m_2 v_f^2 + \frac{1}{2} k h^2$$

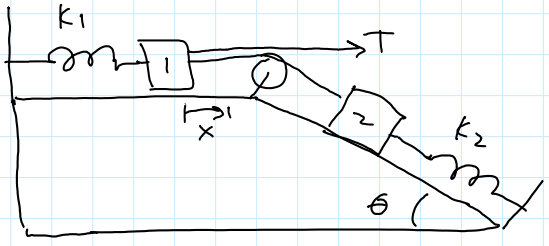
distance spring is stretched is h

$$(20)(9.8)(2) - (0.2)(10)(9.8)(2) = \frac{1}{2}(10) v_f^2 + \frac{1}{2}(20) v_f^2 + \frac{1}{2}(30)(2)^2$$

$$v_f^2 = 19.52$$

$$v_f = 4.42 \ \frac{m}{s}$$

2)



given:

$m_1 = 10$ kg

$m_2 = 50$ kg

$k_1 = 15 \ \frac{N}{m}$

$k_2 = 30 \ \frac{N}{m}$

$\theta = 60°$

both springs are unstretched at start

$T = 40$ N

$\mu_k = 0.2$ for both boxes

$v_i = 0$

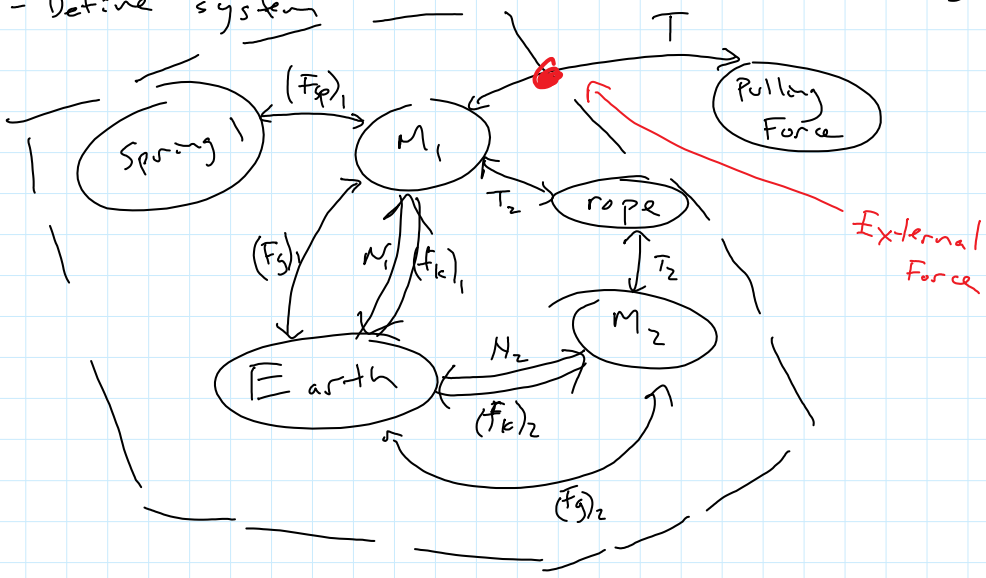
$v_f = 0$

find: x (the distance m_2 slides down the incline before coming to rest)

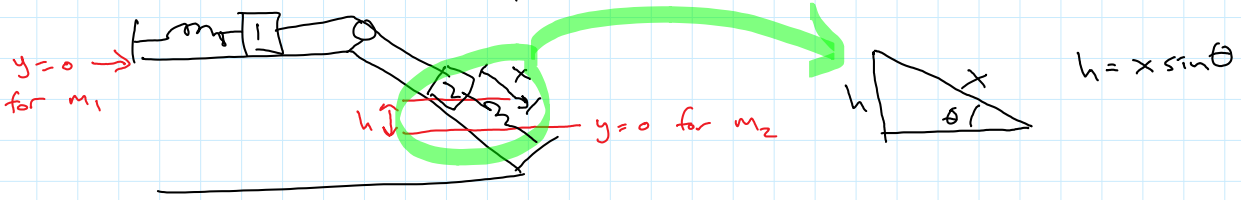
1st - Define system ———) T

coming to rest)

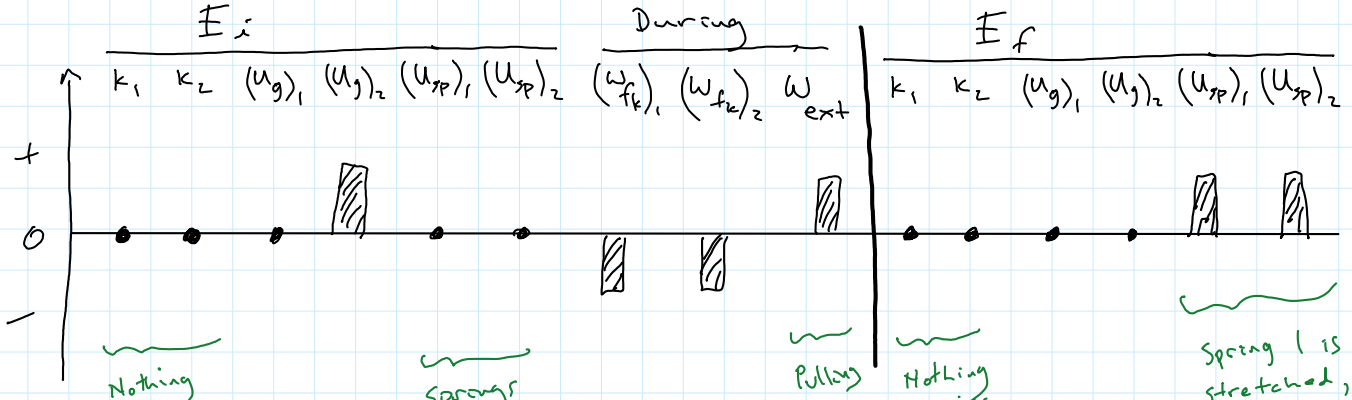
1st - Define system



System



2nd - Energy Bar chart: $E_i + W_{friction} + W_{ext} = E_f$



Nothing moving at start

Springs not stretched or compressed

Pulling Force is doing positive work

Nothing moving at end

Spring 1 is stretched, Spring 2 is compressed, Either way they have positive energy stored in them

$$M_2 g h - \mu_k N_1 X - \mu_k N_2 X + T X = \frac{1}{2} k_1 X^2 + \frac{1}{2} k_2 X^2$$

$$m_2 g x \sin\theta - \mu_k (m_1 g) x - \mu_k (m_2 g \cos\theta) x + T x = \frac{1}{2}(k_1 + k_2) x^2$$

$$(50)(9.8)\sin 60 - (0.2)(10)(9.8) - (0.2)(50)(9.8)\cos 60^\circ + 40 = \frac{1}{2}(15 + 30)x$$

$$424 - 19.6 - 49 + 40 = \frac{45}{2} x$$

$$395.4 = \frac{45}{2} x$$

$$x = 17.6 \text{ m}$$