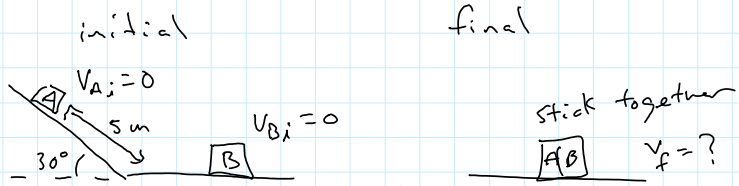
Phy 4A 11/4

Friday, November 4, 2016 10:01 AM

Problems involving both Energy and Momentum

1)

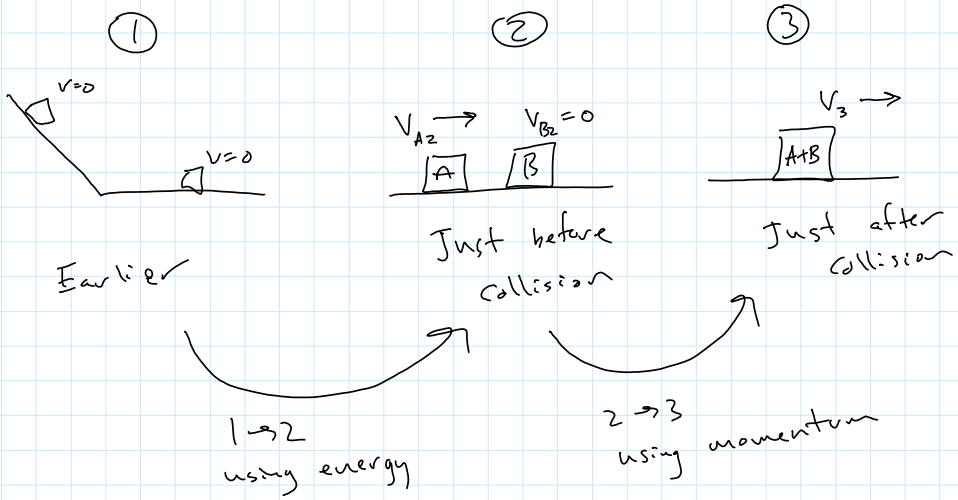


frictionless surfaces

$m_A = 2$ kg

$m_B = 3$ kg

1st make a time line:



$E_1 = E_2$

$m_A g h = \frac{1}{2} m_A V_{A2}^2$

$V_{A2} = \sqrt{2gh}$

$P_2 = P_3 \rightarrow +$

$P_{A2} + P_{B2}^{\,0} = (P_{A+B})_3$

$m_A V_{A2} + m_B(0) = (m_A + m_B) V_3$

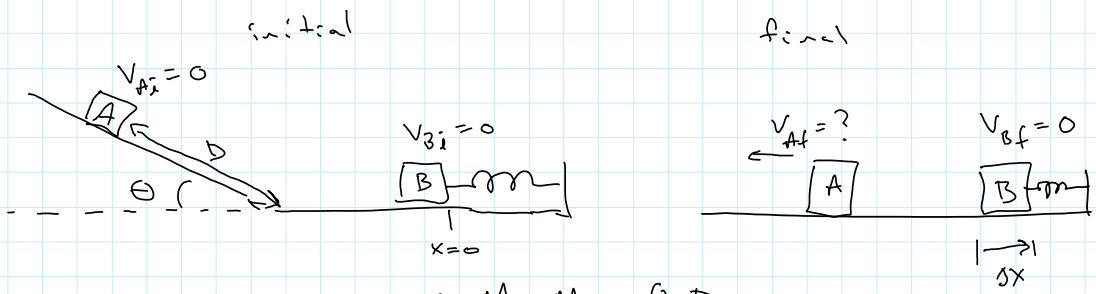
$2\left(\sqrt{2(9.8)\,5\sin 30^\circ}\right) = (2+3)\,V_3$

$V_3 = 2.8 \ \frac{m}{s} \rightarrow$

2) initial final

$V_i = 0$

2)



given: M_A, M_B, θ, D

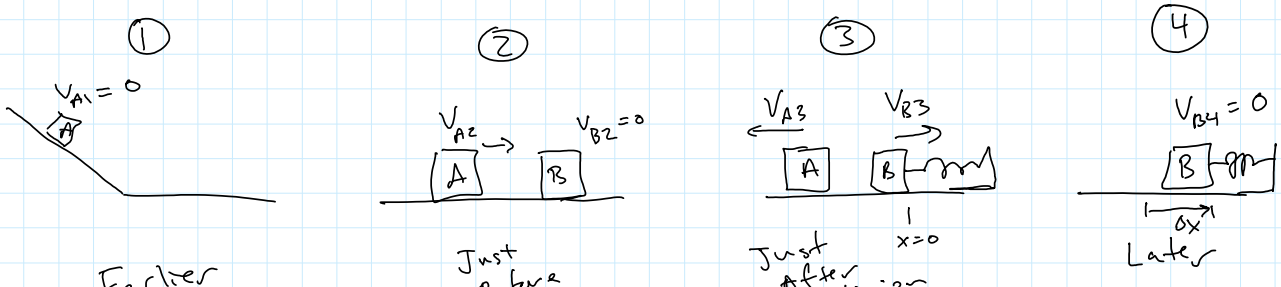
$V_{Ai} = V_{Bi} = 0$

frictionless

$k, \Delta X$

find: V_{Af}

Time Line:



Earlier — Just Before Collision — Just After Collision — Later

1→2 use energy

2→3 use momentum

4→3 use Energy

$E_1 = E_2$

$mgh = \frac{1}{2}mV_{A2}^2$

$V_{A2} = \sqrt{2gh}$

$V_{A2} = \sqrt{2gD\sin\theta}$

$E_4 = E_3$

$\frac{1}{2}k(\Delta x)^2 = \frac{1}{2}M_B V_{B3}^2$

$V_{B3} = \sqrt{\frac{k}{m}}\,\Delta x$

$P_2 = P_3 \rightarrow +$

$P_{A2} + P_{B2} = P_{A3} + P_{B3}$

$M_A V_{A2} + M_B V_{B2}^{\,0} = M_A V_{A3} + M_B V_{B3}$

solving for this

Solve for V_{A3}

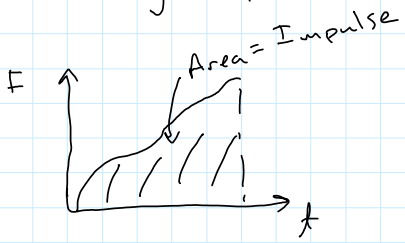
Work

$$W = \int \vec{F} \cdot d\vec{x}$$

$$W = \Delta K$$

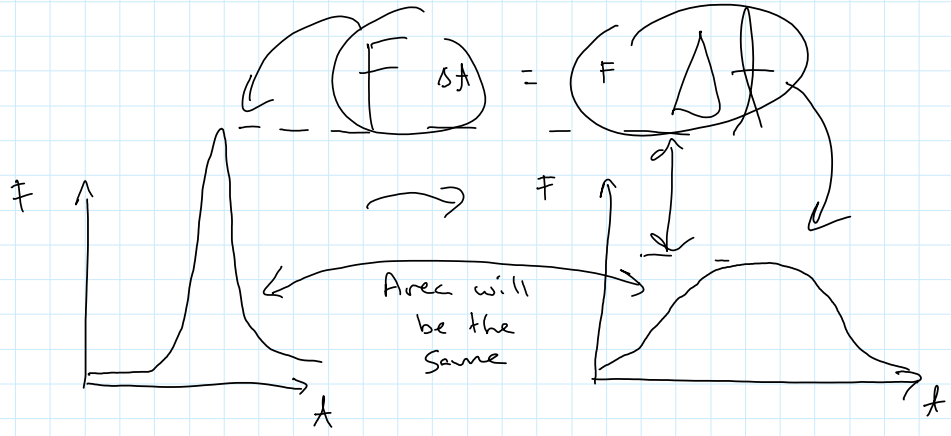
Impulse

$$I = \int F \, dt$$

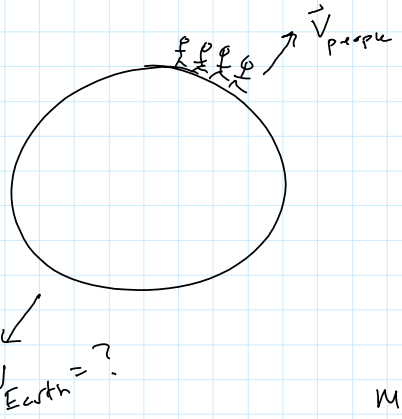


$$\vec{I} = \Delta \vec{p}$$

$$\vec{F}_{Ave} \Delta t = \Delta \vec{p}$$



Every person on Earth stands in the same place and jumps at the same time:



$$|\vec{P}_{people}| = |\vec{P}_{Earth}|$$

$$m_{people} v_{people} = M_{Earth} V_{Earth}$$

$M_{Earth} = 6 \times 10^{24}$ kg

$m_{people} = (100 \text{ kg})(7 \times 10^9)$

$V_{Earth} = ?$

$M_{people} = (100\ kg)(7\times10^9)$

$M_{Earth} = 6\times10^{24}\ kg$

$V_{people} : 1\ m \uparrow$

$E_i = E_f$

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

$v = \sqrt{2gh}$

$v = \sqrt{2g}$

$= \sqrt{20}$

$$V_{Earth} = \frac{100(7\times10^9)\sqrt{20}}{6\times10^{24}} \simeq 10^{-13}\ kg$$