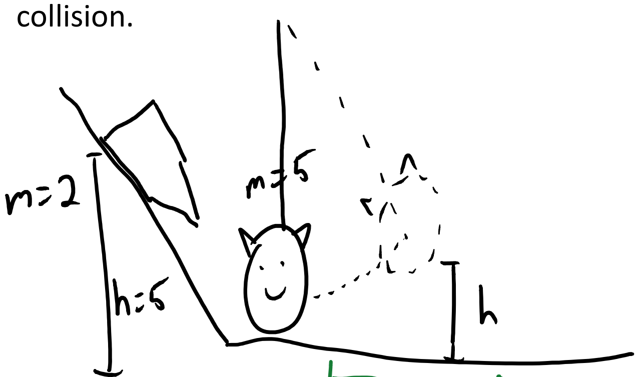
The Ballistic Pendulum (collisions)

Thursday, December 09, 2010 3:41 PM

During collisions many forms of energy are created which we cannot calculate (sound, elastic energy in deformation of objects) as a result you cannot conserve energy during collisions. Rather you must conserve momentum in order to find the final velocity of mass after a collision.
Energy may be conserved before and after a collision to find velocities and heights but not DURING the collision.

How high does the cat head go?



Conservation of Energy V @ bottom

Conservation of momentum to find V of cat/bullet combo.

Conservation of Energy. Final h.

1) $E_{po} + E_{ko} = E_{pf} + E_{kf}$ ~~$+Q$~~

$(9.8)(5) + 0 = 0 + \frac{v_f^2}{2}$

$V_f = 9.9\,m/s$

2) $P_{bullet} + P_{cat\ head} = P_{Both}$

$2(9.9) + 0 = (5+2)V_f$

$V_f = 2.83\,m/s$

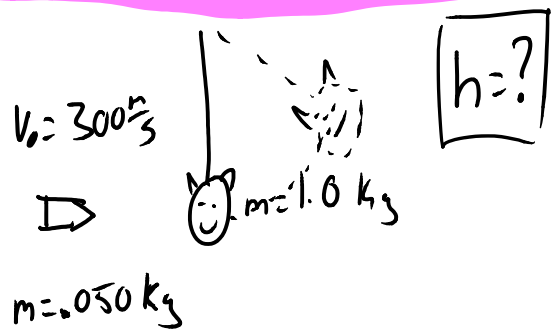
blue

3) $E_{po} + E_{ko} = E_{pf} + E_{kf}$ ~~$+Q$~~

green

$0 + \frac{(2.83)^2}{2} = 9.8h + 0$] green

$h = .41m$



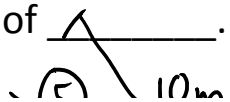
1) We know V_0
2) Conservation of momentum
3) Conservation of Energy.

$h = 10.4m.$

The INELASTIC collision: large scale collisions we see every day. HERE kinetic energy is not conserved. You MUST conserve momentum from before collision to afterward.

Most collisions involve molecular gases. These are assumed to be 100% efficient and kinetic energy is conserved. These are called ELASTIC collisions (perfectly elastic collisions).

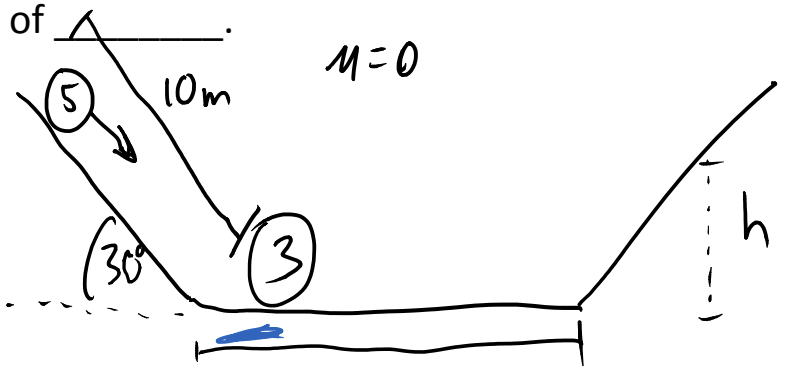
A mass of 5.0 kg is at rest on the frictionless slope below, it slides down, collides with a 3.0 kg mass initially at rest, they couple together and slide up the other slope to a height of _____.



$\mu = 0$

1) V @ impact

height of _____.



1) V @ impact → C of E

2) V of mass combo C of M

3) C of E to find h.

$E_{p_0} + E_{k_0} = E_{pf} + E_{kf}$

$(98)10\sin 30 + 0 = 0 + \frac{v_f^2}{2}$

$v_f = 9.9\ m/s$

$P_1 + P_2 = P_{1+2}$

$5(9.9) + 0 = (5+3)v_f$

$v_f = 6.19\ m/s$

$E_{p_0} + E_{k_0} = E_{pf} + E_{kf}$

$0 + \frac{(6.19)^2}{2} = 9.8h + 0$

$h = 1.95\ m$

$E_{ff} = ?$ hint it's $\frac{\text{useful out}}{\text{total in}} \times 100\%$

$\frac{mgh}{mgh} = \frac{(8)9.8(1.95)}{(5)9.8(10)(\sin 30)}$

$= 62.4\%$