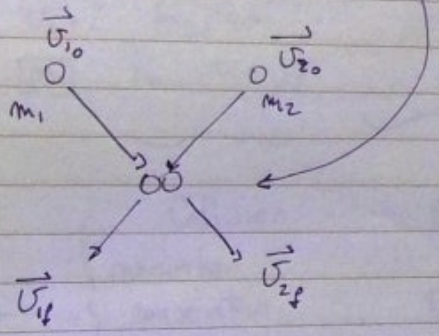
Lecture 16 - Phys 203

Chapter 7 - Momentum $\vec{p}$

$\vec{p} = m\vec{v} \longrightarrow \vec{P} = m_1\vec{v}_1 + m_2\vec{v}_2$

momentum conservation $\Sigma \vec{F}_{ext} = 0$

collision



$\vec{P}_0 = m_1\vec{v}_{1_0} + m_2\vec{v}_{2_0}$

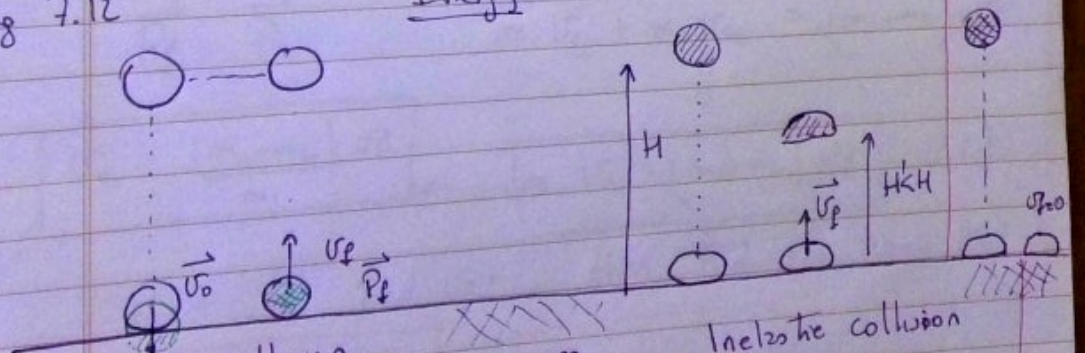
$\uparrow \downarrow$

$\vec{P}_f = m_1\vec{v}_{1_f} + m_2\vec{v}_{2_f}$

Energy

Fig 7.12

Energy



Elastic collision

KE is conserved

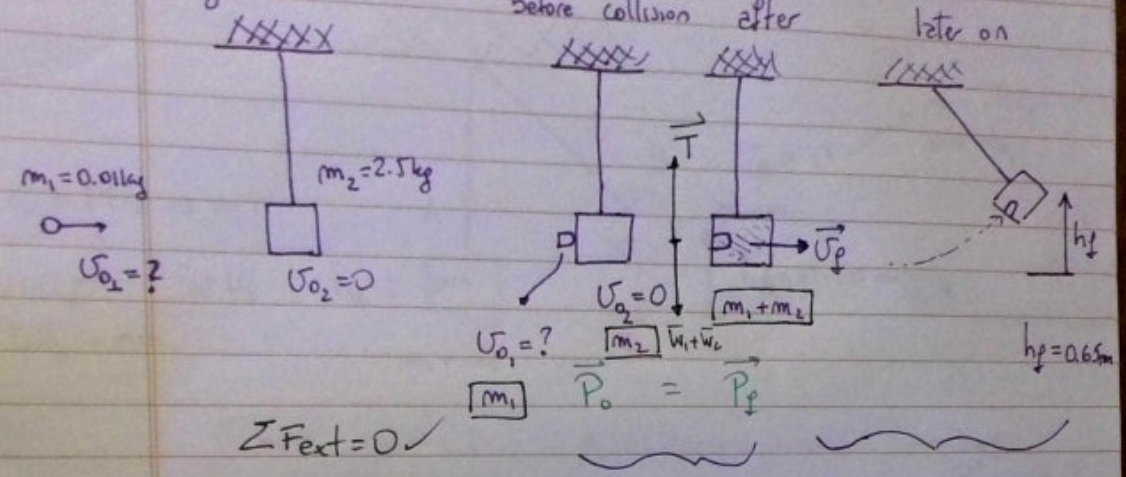
$KE_0 = KE_f$ ←

→ Inelastic collision

KE is not conserved (dissipation of energy)

Complete Inelastic Collision (plastic)

Ex 8 - Ballistic Pendulum



$\Sigma F_{ext} = 0$ ✓

$T - (w_1 + w_2) = 0$

$T = w_1 + w_2$ ✓

Collision
- momentum conservation CH.7
- Energy (mechanical) Energy conservation CH.6

before $\vec{P}_0 = \vec{P}_f$

$\vec{P}_f = \vec{P}_0$

$m_1 v_{0_1} + m_2 v_{0_2} = (m_1 + m_2) \cdot v_f$

$v_0 = 0$

$$m_1 v_{0_1} = (m_1 + m_2) v_f \quad (1)$$

$$v_{0_1} = \frac{(m_1 + m_2)}{m_1} v_f$$

Next → find $v_f = ?$ then find v_{0_1} using Eq(1)

$$v_{0_1} = \left(\frac{m_1 + m_2}{m_1}\right)\sqrt{2gH}$$

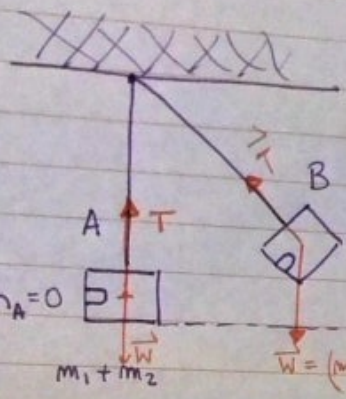
$v_{0_1} = 896 \, m/s$

$v_f = v_A$

→ second part of the problem

collision

After collision



$0 = PE_A$ is min

$v_A = v_f$

KE_A is max

FROM A → B : Is energy conserved? → Yes

why? → bcs $\vec{T} \perp$ motion ⇒

→ Is momentum conserved? $W_f = 0$

Check if $W_{NC} = 0$ → force gravity → conservative

$E = KE + PE$

is there any NC?

↳ YES → Tension

However $W_{Tension} = 0$ ⇒ $W_{NC} = 0$ ⇒ E is conserved

⇒ $E_A = E_B$ → get $v_A = v_f$ → go to E_B (1), get v_0 ✓

Is momentum conserved from A → B?

↳ NO

$$\frac{1}{2}(m_1+m_2)v_A^2 + 0 = 0 + (m_1+m_2)gH$$

(3) ↳ $v_A = \sqrt{2gH} = v_f$