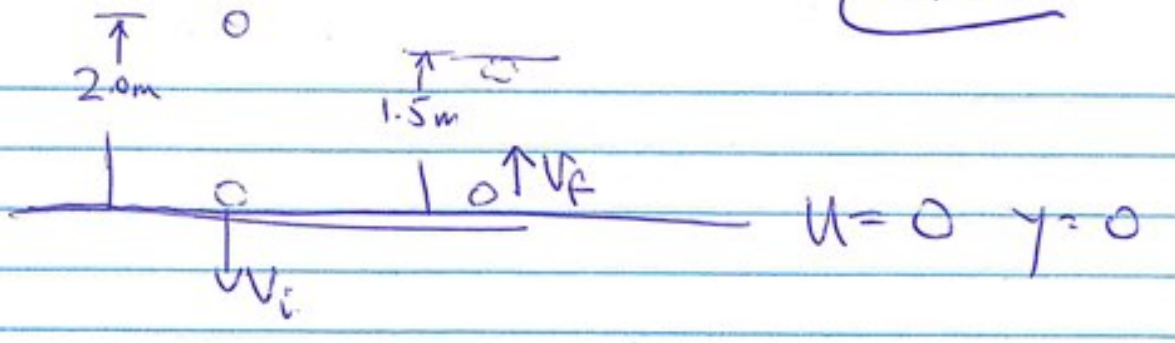
Lecture 25

Ball



Phase 1: $\frac{1}{2}mv_i^2 = mgh_1$ $\quad h_1 = 2.0\ m.$

$v_i^2 = 2gh_1$

$\therefore v_i = -6.3\ \frac{m}{s}$

Phase 2: $\frac{1}{2}mv_f^2 = mgh_2$ $\quad h_2 = 1.5\ m$

$\therefore v_f^2 = 2gh_2$

$\therefore v_f = 5.4\ \frac{m}{s}$

$J = \Delta p = mv_f - mv_i$

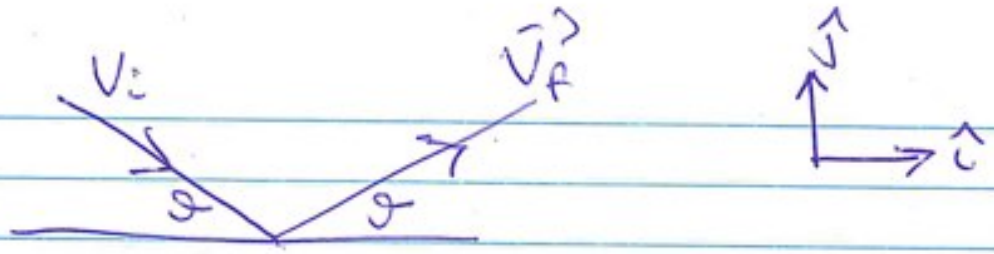
$= m(v_f - v_i) = 0.1\ kg \times \left(5.4\ \frac{m}{s} - (-6.3\ \frac{m}{s})\right)$

$= 0.1\ kg \times 11.7\ \frac{m}{s}$

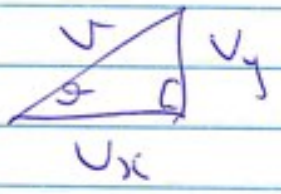
$= 1.2\ kg \cdot \frac{m}{s}$

Mechanical energy: $\frac{E_f}{E_i} = \frac{h_2}{h_1} = 0.75$ i.e. 25% lost.

9.38



$$\vec{v}_i = v_x \hat{i} + v_y \hat{j}$$
$$= (v\cos\theta)\hat{i} - (v\sin\theta)\hat{j}$$
$$\vec{v}_f = (v\cos\theta)\hat{i} + (v\sin\theta)\hat{j}$$



$$\vec{J} = \Delta\vec{p} = m\vec{v}_f - m\vec{v}_i$$
$$= m(\vec{v}_f - \vec{v}_i) = m\Delta\vec{v}$$
$$= 2m\underbrace{v\sin\theta}_{v_y}\hat{j}$$
$$= 2\times(0.3\,kg)\left(6.0\,\frac{m}{s}\right)(0.5)\,\hat{j}$$
$$= \left(1.8\,kg\cdot\frac{m}{s}\right)\hat{j}$$

(b) $$\vec{F}_{avg} = \frac{\vec{J}}{\Delta t} = \frac{1.8\,kg\cdot m/s}{0.01\,s}\,\hat{j} = 180\,N\,\hat{j}$$

$$\Rightarrow \vec{a}_{avg} = \frac{\vec{F}_{avg}}{m} = 600\,\frac{m}{s^2}$$