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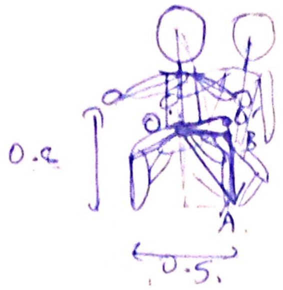
Week 8 Notes

S. Tarun Prasad
MEITB114

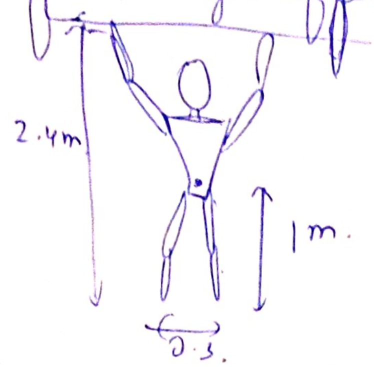


$OA = \sqrt{(0.25)^2 + (0.8)^2}$

$\sin\theta = \dfrac{0.25}{\sqrt{0.25^2 + 0.8^2}}$

$\theta = 17.4°$

For a weightlifter:

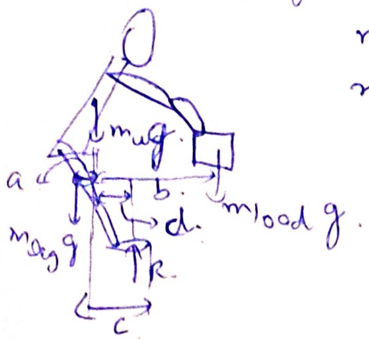


$y_{com} = \dfrac{150(2.4) + 80(1)}{230}$

$= 1.91m$

$\Rightarrow \sin\theta = \dfrac{0.15}{\sqrt{0.15^2 + 1.91^2}} = 4.8°$

Maximum load that can be carried without toppling forward

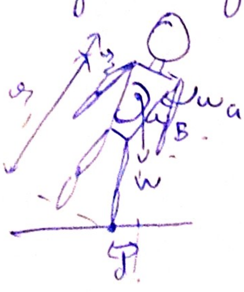


$m_u = 54\,kg$
$m_l = 26\,kg$
$a = 25\,cm$
$b = 35\,cm$
$c = 20\,cm$

'd' is where the Reaction force occurs. When the moment due to load can't even be balanced when the reaction force acts at the tip of the foot, i.e., $c = d$, toppling happens.

$$d = \frac{(m_{load})(b) - (m_{legs})a}{m_{load} + m_u + m_{legs}}$$

Regaining balance:



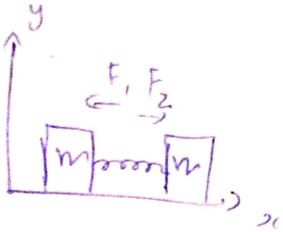
Toppling moment $= Wd$, Avg. Impulse $= \Delta$ ang. mom.

$\int Wd \cdot dt = I\omega_f - I\omega_i$

If we rotate our arms around our shoulder in the direction of toppling:

Angular momentum $= (I_B + m_B r_1^2)\omega_B + m_A(r_1 + r_2)^2\omega_B + I_A\omega_A = \int Wd\,dt$

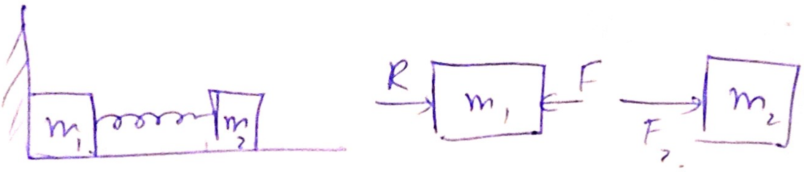
Hence ~~impa~~ angular velocity of body will not increase by much as in earlier case



$\bar{F}_1 = -\bar{F}_2 \Rightarrow F_1 = F_2 \Rightarrow m\frac{\Delta V_1}{\Delta t} + m\frac{\Delta V_2}{\Delta t} = 0.$

If $V_1 = V_2 = 0$ at $t = 0$,

$\Rightarrow m\Delta r_1 + m\Delta r_2 = 0 \rightarrow$ C.O.M doesn't move.



$\vec{R} - F = m_1\frac{\Delta V_1}{\Delta t}$

$F = m_2\frac{\Delta V_2}{\Delta t}$

$\Rightarrow R = m_1\frac{\Delta V_1}{\Delta t} + m_2\frac{\Delta V_2}{\Delta t}$

$\Rightarrow$ C.O.M shifts to the right

Human Gait

Stance phase: leg is on the ground

Swing phase: leg is off the ground.

Gait cycling: Period between the beginning of the swing phase of one leg and swing phase of the same leg.

Double support: When both legs are in contact with the ground.

Single support: Only one leg is in contact with the ground.