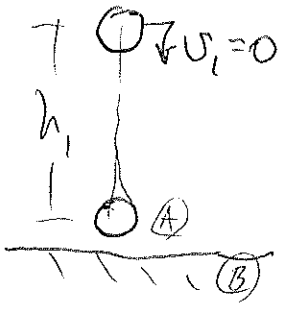
PROB. 13-163

$h_1 = 100'' = 8.333\ ft$, $53 \le h_2 \le 58''$ OR $4.417 \le h_2 \le 4.833\ ft$

FIND e



DROP THE BALL: $T_1 + V_1 = T_2 + V_2$

$T_1 = 0$, $V_1 = Wh_1$, $T_2 = \frac{1}{2}\frac{W}{g}v_2^2$, $V_2 = 0$

$0 + Wh_1 = \frac{1}{2}\frac{W}{g}v_2^2 + 0$

$$v_2 = \sqrt{2gh_1} = \sqrt{2\left(32.2\ \frac{ft}{s^2}\right)(8.333\ ft)} = -23.16\ \frac{ft}{s}$$

IMPACT WITH GROUND: RESTITUTION

$$e = \frac{(v_B' - v_A')}{(v_A - v_B)} \qquad v_B' = v_B = 0 \text{ (GROUND)}$$

$$e = \frac{-v_A'}{v_A} = -\frac{v_3}{v_2}$$

REBOUND: $T_3 + V_3 = T_4 + V_4$

$T_3 = \frac{1}{2}\frac{W}{g}\cdot v_3^2$, $V_3 = 0$, $T_4 = 0$, $V_4 = Wh_2$

$\frac{1}{2}\frac{W}{g}\cdot v_3^2 + 0 = 0 + Wh_2$

$$v_3 = \sqrt{2gh_2} \Rightarrow e = -\frac{\sqrt{2gh_2}}{v_2}$$

FOR $h_2 = 4.417\ ft$,

$$e = -\frac{\sqrt{2\left(32.2\ \frac{ft}{s^2}\right)(4.417\ ft)}}{\left(-23.16\ \frac{ft}{s}\right)} = 0.7282$$

FOR $h_2 = 4.833\ ft$,

$$e = -\frac{\sqrt{2(32.2)(4.833)}}{(-23.16)} = 0.7617$$

$$\boxed{0.7282 \le e \le 0.7617}$$