Problem 4: (25 pts.) You are riding up in a construction elevator at a constant speed of 2.50 m/s when you realize you left a tool on the ground. A friend on the ground tosses the tool up to you. You are 5.00 m above the ground when he tosses the tool, and you catch the tool after 1.80 s.

a. (20 pts.) With what speed did your friend toss the tool? Assume he released the tool from a height of 1.00 m above the ground, and tossed it straight up.

b. (5 pts.) Was the tool on the way up or on the way down when you caught it? Explain your reasoning.

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a. (20 pts.) With what speed did your friend toss the tool? Assume he released the tool from a height of 1.00 m above the ground.

Elevator: $y_e = y_{e0} + v_{e0}t + \frac{1}{2}a_e t^2$

$y_e = 5.00 + 2.50t + 0 = 5.00 + 2.50(1.80) = 9.5\,m$

Tool: $y_T = 1.00 + v_{T0}t - \frac{1}{2}gt^2$

$y_T = 1.00 + v_{T0}(1.80) - \frac{1}{2}(9.8)(1.80)^2$

$y_T = v_{T0}(1.80) - 14.876\,m$

Catch tool: $y_e = y_T$

$9.5\,m = v_{T0}(1.80) - 14.876\,m$

$\boxed{13.5\,m/s = v_{T0}}$

b. (5 pts.) Was the tool on the way up or on the way down when you caught it? Explain your reasoning. Look at v_T:

$v_T = v_{T0} - gt$

$= 13.5\,m/s - (9.8)(1.80) = \boxed{-4.10\,m/s \text{ Downward}}$