

While riding on an elevator descending with a constant speed of 3.0 m/s , you accidentally drop a book from under your arm.

(1) How long does it take the book to reach the elevator floor?

(2) What is the book's speed relative to you when it hits the floor?

Note: Let 1.2 m be the distance between arm and floor.

(1) solution

$$x_i = 1.2 \text{ m}$$

$$x_f = 0 \text{ m} \quad (\text{relative to you})$$

$$\Delta t = ?$$

$$a = -9.81 \text{ m/s}^2$$

$$v_i = 0 \text{ m/s} \quad (\text{relative to you})$$

you, the book, and elevator are all moving together.

Without windows or bumps in the track, you would not know you are moving.

2

$$x_f = x_i + v_i t + \frac{1}{2} a t^2$$

$$x_f = x_i + \frac{1}{2} a t^2$$

$$t = \sqrt{\frac{x_f - x_i}{\frac{1}{2} a}}$$

$$t = \sqrt{\frac{0\text{m} - 1.2\text{m}}{\frac{1}{2}(-9.81\text{m/s}^2)}}$$

$$= 4.95 \text{E-}1 \text{ s}$$

$$0.495 \text{ s}$$

$$\boxed{0.50 \text{ s}}$$

(2) solution

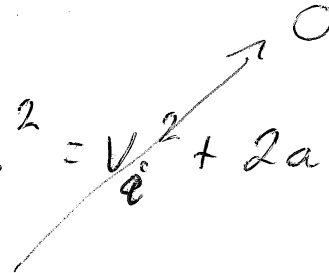
$$V_f = ?$$

$$V_o = 0 \text{ m/s}$$

$$a = -9.81 \text{ m/s}^2$$

$$x_f = 0 \text{ m}$$

$$x_i = 1.2 \text{ m}$$

$$V_f^2 = V_o^2 + 2a \Delta x$$


$$V_f = \sqrt{2a \Delta x}$$

$$V_f = \sqrt{2(-9.81 \text{ m/s}^2)(0 \text{ m} - 1.2 \text{ m})}$$

$$= 4.85 \text{ m/s}$$

4.9 m/s
