

This is a 1-D problem involving free-fall acceleration.

A mischievous student drops an egg from the window of his dorm room. The egg falls straight down onto the hood of a car parked below. A few floors below, someone is recording a video on their webcam, which is facing the window. The egg is recorded falling past the window. The person recording the video is a physics student, and she sees an opportunity to solve an interesting physics problem while also determining the height, and consequently the room, that the egg was dropped from. She analyzes the video, and determines that it took the egg 0.14 seconds to fall from the top of the window to the bottom. She then measures the height of the window to be 1.30 meters. From what height, measured from the top of the window, was the egg dropped?

Solution: Assumption: - air resistance is negligible

Use the Kinematic equation: $d = v_i t + \frac{1}{2} g t^2$

$v_i = ?$ (egg speed at top of window)

$g = 9.8 \text{ m/s}^2$

↓ t (sign convention)

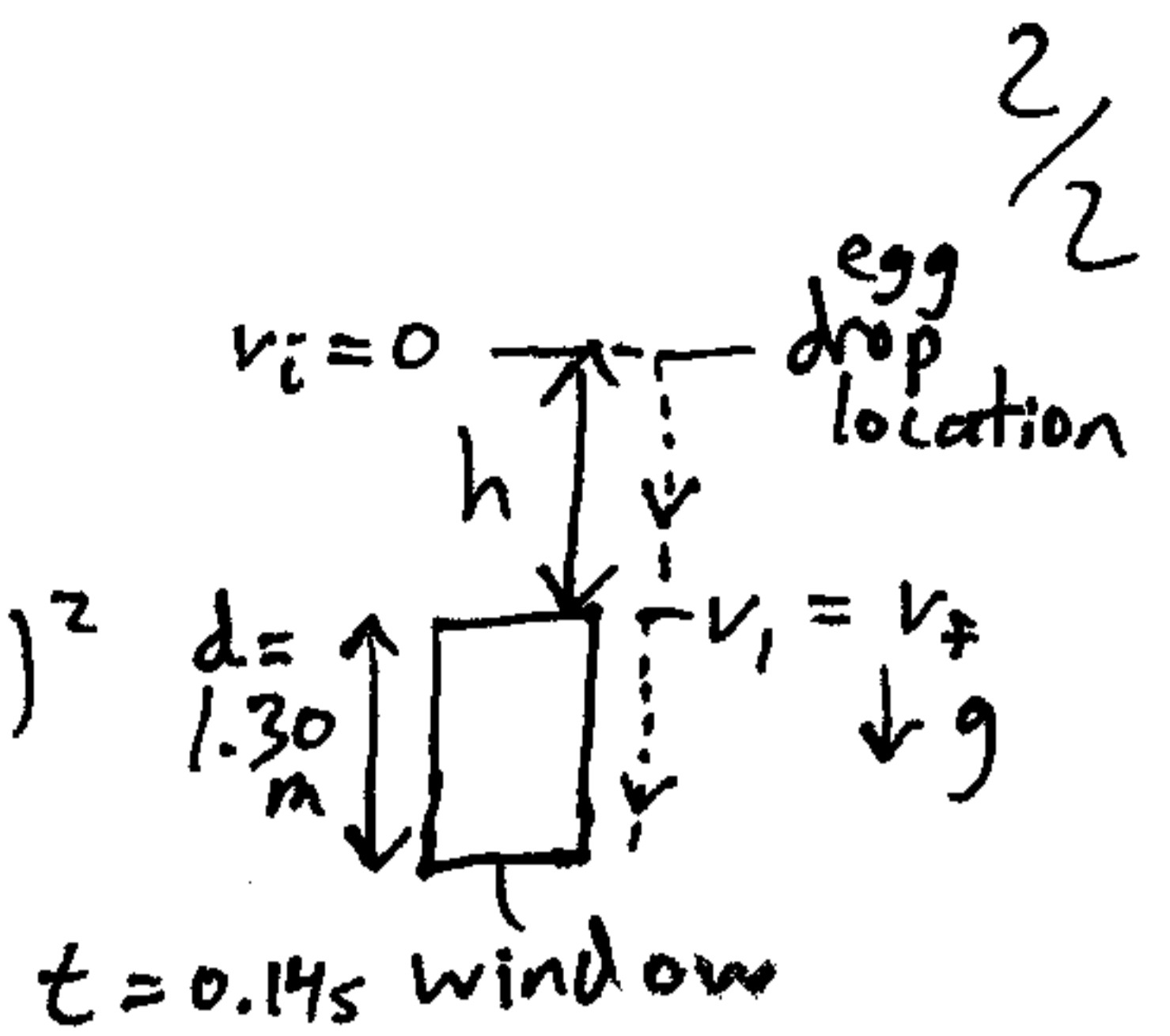
$d = 1.30 \text{ m}$ (window height - egg displacement)

$t = 0.14 \text{ s}$ (falling time from top of window to bottom)

Substitute:

$$1.30 = v_i (0.14) + \frac{1}{2} (9.8) (0.14)^2$$

$$v_i = 8.6 \text{ m/s}$$



Next, use the kinematic equation: $v_f^2 = v_i^2 + 2gh$

$$v_f = v_i = 8.6 \text{ m/s}$$

$$v_i = 0 \text{ (egg is dropped from rest)}$$

$$g = 9.8 \text{ m/s}^2$$

$$h = ? \text{ (Falling height } \overset{\text{measured}}{V} \text{ from the top of the window)}$$

Substitute:

$$(8.6)^2 = (0)^2 + 2(9.8)h$$

$$h = 3.77 \text{ m (answer)}$$

Using this information, the floor that the egg was dropped from, and the room (which is directly above), can be identified!