Answer on Question #47750, Physics, Mechanics — Kinematics — Dynamics

A man steps and falls freely from rest from a tower to the ground. If he falls half the total height of the tower in last 1 second of his motion. Find height h of the tower?

Solution

Let us relate velocity that he had exactly before 1 s of falling and height h of the tower. We have

$$h/2 = v_b \cdot 1\,s + g(1\,s)^2/2$$

But from other hand, this velocity was obtained in first t_b seconds, hence

$$v_b = gt_b$$

and during t_b he passed also $h/2$:

$$h/2 = gt_b^2/2$$

So we have

$$t_b = \sqrt{\frac{h}{g}}$$

$$v_b = g\sqrt{\frac{h}{g}} = \sqrt{hg}$$

And combining with first equation:

$$h = \sqrt{hg}/2 \cdot (1\,s) + 9.8 \cdot \cdot (1\,s)^2/2$$

$$h^2 = hg/4 + (9.8/2)^2$$

Solving this equation with respect to h will yield:

$$h \approx 6.3\,m$$