Question #54140, Physics / Mechanics | Kinematics | Dynamics |

a body falls freely from the top of the tower.If covers 36% of the total height in last second before striking the ground level,the height of the tower is

**Solution**:

The vertical motion of the object is described by the equation:

$d = v_o t + 1/2\ gt^2$, where d –the distance traveled during the last second, $v_o$ – the velocity of the object travelled 36% of the total height.

At the same time the 36% of height equals:

$0.36h = 1/2\ gt_0^2$, where $t_0$ – the time of flight.

Thus, $t_0^2 = 0.72h/g$,

and

$v_o = gt_0 = g \times (0.72h/g)^{1/2} = (0.72hg)^{1/2}$ .

Then $d = h – 0.36h = 0.64h = (0.72hg)^{1/2}\ t + 1/2\ gt^2$.

Since t = 1 s, $d = 0.64h = (0.72hg)^{1/2} + 1/2\ g$.

Let's $h^{1/2} = x$ and $x > 0$. Then, $0.64x^2 - (0.72g)^{1/2}x – 1/2g = 0$

$D = 0.72g + 4 \times 0.64 \times 0.5g = 7.056 + 12.544 = 19.6$

$D^{1/2} = 4.427$,

$x = [(0.72g)^{1/2} \pm 4.427]/1.28 = ( 2.656 \pm 4.427)/1.28 = 5.53$

Finally $h = x^2 = 30.62$ m

**Answer** : The height of the tower is 30.62 m