Question #15829

First, lets use the law of conservation of energy for point where the rock is thrown upwards and the point, where it has zero velocity (reached maximum height):

$$\frac{m v_0^2}{2} = m g h' \Rightarrow h' = \frac{v_0^2}{2g} \quad (1)$$

(h' is the height measured from the building to the maximum height point).

Next, at the point of stop (maximum height): $v_0 = g t'$ (2).

Also, let t note the time for moving from the maximum height point (with zero initial velocity) to the ground. Then, $\frac{g t^2}{2} = h + h'$ (h is the height of the building). One might rewrite this as $h + h' = \frac{g}{2}(t_s - t')^2$, where $t_s = 4\text{s}$ is the summary time. Plugging (1) and (2) into the latter equation gives: $h + \frac{v_0^2}{2\text{g}} = \frac{g}{2}(t_s^2 - 2\frac{t_s v_0}{g} + \frac{v_0^2}{g^2})$, and simplifying, gives:

$$v_0 = \frac{1}{t_s}(\frac{g t_s^2}{2} - h) = 5.65\, m/s \quad .$$

Then, the maximum height is $h_{max} = h + h' = h + \frac{v_0^2}{2\text{g}} \approx 57.43\, m$.