Question 32301

Let the time for moving upwards until full stop be t_s . If at the moment of stop velocity is zero, then $v=v_0-gt_s=0\Rightarrow t_s=\frac{v_0}{g}$. The maximum height is $h=v_0t_s-\frac{gt_s^2}{2}=\frac{v_0^2}{2g}$. Moving down (from the point of stop – maximum height point) is with no initial velocity, hence the law of motion is $y(t)=h-\frac{gt^2}{2}$, so the time to move down is $t_2=\sqrt{2\frac{h}{g}}$. Plugging $h=\frac{v_0^2}{2g}$ into latter formula gives $t_2=\sqrt{\frac{v_0^2}{g^2}}=\frac{v_0}{g}$. Hence, total time of movement is $t=t_s+t_2=2\frac{v_0}{g}$.

Now, let us find the time needed to move from maximum height point to point of 5 meters above the ground. Distance to travel is $h-5$, hence time is $t=\sqrt{2\frac{(h-5)}{g}}=\sqrt{2\frac{(\frac{v_0^2}{2g}-5)}{g}}$. The velocity at that moment of time is $v=gt=\sqrt{2g(\frac{v_0^2}{2g}-5)}=22.9\frac{m}{s}$.