56. The height reached by the player is $y = 0.76$ m (where we have taken the origin of the $y$ axis at the floor and $+y$ to be upward).

(a) The initial velocity $v_0$ of the player is

$$v_0 = \sqrt{2gy} = \sqrt{2(9.8)(0.76)} = 3.86 \text{ m/s}.$$

This is a consequence of Eq. 2-16 where velocity $v$ vanishes. As the player reaches $y_1 = 0.76 - 0.15 = 0.61$ m, his speed $v_1$ satisfies $v_0^2 - v_1^2 = 2gy_1$, which yields

$$v_1 = \sqrt{v_0^2 - 2gy_1} = \sqrt{(3.86)^2 - 2(9.80)(0.61)} = 1.71 \text{ m/s}.$$

The time $t_1$ that the player spends *ascending* in the top $\Delta y_1 = 0.15$ m of the jump can now be found from Eq. 2-17:

$$\Delta y_1 = \frac{1}{2}(v_1 + v)t_1 \implies t_1 = \frac{2(0.15)}{1.71 + 0} = 0.175 \text{ s}$$

which means that the total time spent in that top 15 cm (both ascending and descending) is 2(0.17) = 0.35 s = 350 ms.

(b) The time $t_2$ when the player reaches a height of 0.15 m is found from Eq. 2-15:

$$0.15 = v_0 t_2 - \frac{1}{2} g t_2^2 = (3.86)t_2 - \frac{9.8}{2} t_2^2,$$

which yields (using the quadratic formula, taking the smaller of the two positive roots) $t_2 = 0.041$ s = 41 ms, which implies that the total time spent in that bottom 15 cm (both ascending and descending) is 2(41) = 82 ms.