Answer on Question #74492, Physics / Molecular Physics | Thermodynamics

Question. 1) How fast should you throw an apple straight down from $40\ m$ up so that its impact speed would be the same as a mango's dropped from $60\ m$?

2) A car accelerates uniformly at $1.5\ m/s^2$ from rest to $22\ m/s$. Then the brakes are applied and it stops $2.5\ s$ later. Find the total distance travelled.

Given. $h_1 = 40\ m; h_2 = 60\ m; a = 1.5\ m/s^2; v = 22\ m/s; t = 2.5\ s.$

Find. $1)\ u-?\quad and\quad 2)\ s-?$

Solution.

1) For an apple

$$2h_1 g = v^2 - u^2$$

For a mango

$$2h_2 g = v^2$$

We have

$$2h_2 g - 2h_1 g = v^2 - v^2 + u^2 \quad \rightarrow \quad 2g(h_2 - h_1) = u^2 \quad \rightarrow$$

$$u = \sqrt{2g(h_2 - h_1)} = \sqrt{2 \cdot 9.8 \cdot (60 - 40)} = 19.8\ m/s$$

Answer. $u = 19.8\ m/s.$

2) The total distance travelled

$$s = s_1 + s_2$$

For s_1

$$s_1 = \frac{v^2 - v_0^2}{2a} = \frac{v^2}{2a} = \frac{22^2}{2 \cdot 1.5} = 161.3\ m.$$

For s_2

$$s_2 = v_0 t - \frac{at^2}{2}$$

$$v = v_0 - at \quad \rightarrow \quad v_0 = at \quad \rightarrow \quad a = \frac{v_0}{t} = \frac{22}{2.5} = 8.8\ m/s^2$$

So,

$$s_2 = v_0 t - \frac{at^2}{2} = 22 \cdot 2.5 - \frac{8.8 \cdot 2.5^2}{2} = 27.5\ m$$

$$s = s_1 + s_2 = 161.3 + 27.5 = 188.8\ m$$

Answer. $s = 188.8\ m.$