The body of mass 126g moving with the velocity of 0.875g and ahead of it is the body of mass 9.66kg moving with the same velocity, the big mass collides perfectly elastically with the wall and on its way back collides elastically with small mass. What is the final velocity of the small mass?

Solution

$$(M-m)V = mV_1 - MV_2. \gg V_2 = \frac{1}{M}(mV_1 - (M-m)V).$$

$$\frac{(m+M)V^2}{2} = \frac{mV^2}{2} + \frac{MV^2}{2} = \frac{mV_1^2}{2} + \frac{MV_2^2}{2}.$$

$$\frac{(m+M)V^2}{2} = \frac{mV_1^2}{2} + \frac{1}{2M}(mV_1 - (M-m)V)^2$$

$$= \frac{mV_1^2}{2} + \frac{m^2}{2M} * V_1^2 - \frac{m(M-m)}{M} * V_1 V + \frac{(M+m)^2}{2M} V^2$$

$$\frac{(0.126+9.66)0.875}{2}$$

$$= \frac{0.126V_1^2}{2} + \frac{0.126^2}{2*9.66} * V_1^2 - \frac{0.126(9.66-0.126)}{9.66} * V_1 0.875$$

$$+ \frac{(9.66+0.126)^2}{2*9.66} 0.875^2.$$

$$0.064V_1^2 - 0.109V_1 - 0.486 = 0$$

$$D = 0{,}109^2 + 0.124 = 0.136$$

$$x_1 = \frac{0.109 + \sqrt{0.136}}{0.128} = 3.733$$

$$x_2 = \frac{0.109 - \sqrt{0.136}}{0.128} = -2.031$$

Answer: $V_1 = 3.733 \frac{m}{s}$.