$$\tfrac{1}{2}mv_f^2 + \tfrac{1}{2}Mv_B^2 = \tfrac{1}{2}mv_2^2 + \tfrac{1}{2}M\left(v_B - \left(\tfrac{m}{M}\right)v_f - \left(\tfrac{m}{M}\right)v_2\right)^2$$

Let $C_1 = \tfrac{1}{2}mv_f^2 + \tfrac{1}{2}Mv_B^2$ we know this $= 2347\ \text{J}$

$C_2 = v_B - \left(\tfrac{m}{M}\right)v_f$ we know this $= 26.06\ \tfrac{\text{m}}{\text{s}}$

$$C_1 = \tfrac{1}{2}mv_2^2 + \tfrac{1}{2}M\left(C_2 - \left(\tfrac{m}{M}\right)v_2\right)^2$$

$$= \tfrac{1}{2}mv_2^2 + \tfrac{1}{2}M\left(C_2^2 - 2\tfrac{m}{M}C_2v_2 + \left(\tfrac{m}{M}\right)^2 v_2^2\right)$$

$$= \tfrac{1}{2}mv_2^2 + \tfrac{1}{2}MC_2^2 - mC_2v_2 + \tfrac{1}{2}\tfrac{m^2}{M}v_2^2$$

$$C_1 = \tfrac{1}{2}\left(m + \tfrac{m^2}{M}\right)v_2^2 - \left(mC_2\right)v_2 + \tfrac{1}{2}MC_2^2$$

$$\rightarrow \quad 0 = \tfrac{1}{2}\left(m + \tfrac{m^2}{M}\right)v_2^2 - \left(mC_2\right)v_2 + \left(\tfrac{1}{2}MC_2^2 - C_1\right)$$

$$v_2 = \frac{+mC_2 \pm \sqrt{m^2C_2^2 - 2\left(m + \frac{m^2}{M}\right)\left(\frac{1}{2}MC_2^2 - C_1\right)}}{\left(m + \frac{m^2}{M}\right)}$$

$$\frac{52.1\ \frac{\text{kg m}}{\text{s}} \pm 79.7\ \frac{\text{kg m}}{\text{s}}}{2.8\ \text{kg}}$$

$$= \begin{cases} +\ 47.1\ \frac{\text{m}}{\text{s}} & \text{corresponds to } \underline{\text{after}} \text{ collision} \\ -\ 9.86\ \frac{\text{m}}{\text{s}} & \text{corresponds to } \underline{\text{before}} \text{ collision} \end{cases}$$