Answer on Question #44616-Physics-Mechanics-Kinematics-Dynamics

A diesel locomotive of mass $m_1 = 30\ tonne = 30 \cdot 10^3 kg$ is travelling at $v = 1.8\frac{m}{s}$ when it couples with a series of coaches of total mass $m_2 = 350\ tonne = 350 \cdot 10^3 kg$, whilst the coaches are stationary. Ignoring the effect of energy lost in the buffers and couplings, what is the speed immediately after impact of the whole train?

Solution

According to the conservation of momentum law

$$m_1 v_1 = (m_1 + m_2)u.$$

The speed immediately after impact of the whole train is

$$u = \frac{m_1}{(m_1 + m_2)}\ v_1 = \frac{30 \cdot 10^3 kg}{(30 \cdot 10^3 kg + 350 \cdot 10^3 kg)} \cdot\ 1.8\frac{m}{s} = 0.14\frac{m}{s}.$$

Answer: $\mathbf{0.14}\frac{\boldsymbol{m}}{\boldsymbol{s}}$.