Answer on Question#53380 - Physics - Mechanics - Kinematics - Dynamics

On a vehicle crash simulation, a car of mass $m = 1200\ \text{kg}$ is travelling at a velocity of $v_m = 40\ \text{mph}$ in the easterly direction when it is hit by a truck of mass $M = 3300\ \text{kg}$ travelling at a velocity of $v_M = 25\ \text{mph}$ from the westerly direction. Assuming that the two vehicles become entangled calculate in m/s their combined velocity after the crash.

Take 1.61 km/hr = 1 mph

Solution:

Let's choose the east direction as the positive one. According to the law of conservation of momentum we obtain the resultant momentum of entangled vehicles

$$(M + m) \cdot v = M \cdot v_M - m \cdot v_m,$$

where v – is the speed of the vehicles after collision. Therefore

$$v = \frac{M \cdot v_M - m \cdot v_m}{(M + m)} = \frac{3300\ \text{kg} \cdot 25\ \text{mph} - 1200\ \text{kg} \cdot 40\ \text{mph}}{3300\ \text{kg} + 1200\ \text{kg}} = 7.67\ \text{mph} = 3.43 \frac{\text{m}}{\text{s}}$$

Answer: $3.43 \frac{\text{m}}{\text{s}}$ in the easterly direction.