Answer on question #58109, Physics / Other

Question 16 A 30,000-kg truck travelling at 10.0m/s collides with a 1700-kg car travelling at 25m/s in the opposite direction. If they stick together after the collision, how fast and in what direction will they be moving?
8.1 m/s in the direction of the truck's motion
12.3 m/s in the direction of the car's motion
24.2 m/s in the direction of the car's motion
17.6 m/s in the direction of the truck's motion
17 Sand drops at the rate of 2000 kg/min. from the bottom of a hopper onto a belt conveyor moving horizontally at 250 m/min. Determine the force needed to drive the conveyor, neglecting friction.
500 N
800 N
139 N
152 N

Solution 16. Let us use momentum conservation law:

$$m_1 v_1 - m_2 v_2 = (m_1 + m_2)u$$

where 1 is truck, 2 is car and u is their final velocity. We find that

$$u = \frac{m_1 v_1 - m_2 v_2}{m_1 + m_2} = \frac{30000 \cdot 10 - 1700 \cdot 25}{30000 + 1700} \approx 8.1\, m/s$$

They will move together in the same direction as the truck was moving
17. Let find change of impulse per unit time which is created by sand:

$$\Delta p = \Delta m v = 2000 kg/min \cdot 250 m/min = 500000 kg \cdot m/(min^2) \approx 138.9\, N$$

The force needed is 138.9 N.