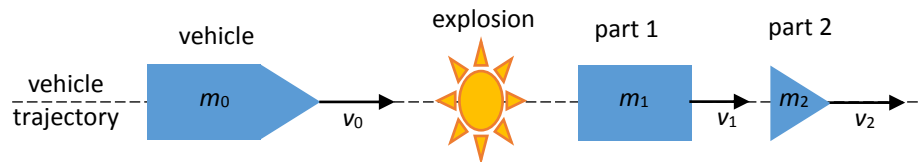


### Question # 74440

A space vehicle travelling at a velocity of  $1206\text{ms}^{-1}$  separates by a controlled explosion into two sections of mass  $952\text{ kg}$  and  $332\text{ kg}$ . The two parts carry on in the same direction with the lighter front section moving  $145\text{ ms}^{-1}$  faster than the heavier rear section. Determine the final velocity of each section. Ensure you include a labelled diagram.

#### Answer:

Here we have an inelastic collision problem (see the figure below).



The momentum conservation equation before and after the explosion is given by:

$$m_0 v_0 = m_1 v_1 + m_2 v_2, \quad (1)$$

where  $m_1 = 952\text{ kg}$  and  $m_2 = 332\text{ kg}$  – masses of two parts of the vehicle after the explosion;

$v_1$  and  $v_2$  – velocities of two parts of the vehicle after the explosion;

$m_0 = m_1 + m_2$  – mass of the vehicle before the explosion;

$v_0 = 1206\text{ m}\cdot\text{s}^{-1}$  – velocity of the vehicle before the explosion;

Since

$$v_2 = v_1 + 145\text{ m}\cdot\text{s}^{-1}, \quad (2)$$

equation (1) gives us the following:

$$(m_1 + m_2)v_0 = m_1 v_1 + m_2(v_1 + 145),$$
$$v_1 = \frac{(m_1 + m_2)v_0 - 145m_2}{m_1 + m_2} = \frac{(952 + 332) \cdot 1206 - 145 \cdot 332}{952 + 332} = 1168.5\text{ m}\cdot\text{s}^{-1},$$
$$v_2 = 1168.5 + 145 = 1313.5\text{ m}\cdot\text{s}^{-1}.$$

Answer provided by <https://www.AssignmentExpert.com>