A space vehicle travelling at a velocity of 1200m/s separates by a controlled explosion into two sections of mass 855 kg and 240 kg. The two parts carry on in the same direction with the heavier rear section moving 120 m/s slower than the lighter front section. Determine the velocity of each section after separation.

Solution:

$V = 1200\frac{m}{s} - \text{initial speed of the space vehicle;}$

$m_1 = 855kg - \text{mass of the first section;}$

$m_2 = 240kg - \text{mass of the second section;}$

$V_1 - \text{speed of the heavier section;}$

$V_2 - \text{speed of the lighter section;}$

$\Delta V = 120\frac{m}{s} - \text{speed difference between the sections;}$

The law of conservation of momentum along the X-axis:

$x: (m_1 + m_2)V = m_1V_1 + m_2(V_1 + \Delta V)$

$m_1V_1 + m_2V_1 = (m_1 + m_2)V - m_2\Delta V$

$$V_1 = \frac{(m_1 + m_2)V - m_2\Delta V}{m_1 + m_2} = V - \frac{m_2\Delta V}{m_1 + m_2} =$$

$$= 1200\frac{m}{s} - \frac{240kg \cdot 120\frac{m}{s}}{855kg + 240kg} = 1174\frac{m}{s}$$

$$V_2 = V_1 + \Delta V = 1174\frac{m}{s} + 120\frac{m}{s} = 1294\frac{m}{s}$$

Answer: speed of the heavier (855kg) section: $1174\frac{m}{s}$

Speed of the lighter (240kg) section: $1294\frac{m}{s}$.