37. Our notation is as follows: the mass of the original body is $M = 20.0$ kg; its initial velocity is $\vec{v}_0 = 200\hat{\text{i}}$ in SI units (m/s); the mass of one fragment is $m_1 = 10.0$ kg; ; its velocity is $\vec{v}_1 = 100\hat{\text{j}}$ in SI units; the mass of the second fragment is $m_2 = 4.0$ kg; ; its velocity is $\vec{v}_2 = -500\hat{\text{i}}$ in SI units; and, the mass of the third fragment is $m_3 = 6.00$ kg.

(a) Conservation of linear momentum requires

$$M\vec{v}_0 = m_1\vec{v}_1 + m_2\vec{v}_2 + m_3\vec{v}_3$$

which (using the above information) leads to

$$\vec{v}_3 = 1000\,\hat{\text{i}} - 167\,\hat{\text{j}}$$

in SI units. The magnitude of $\vec{v}_3$ is $v_3 = \sqrt{1000^2 + (-167)^2} = 1.01 \times 10^3$ m/s. It points at $\tan^{-1}(-167/1000) = -9.48°$ (that is, at $9.5°$ measured clockwise from the $+x$ axis).

(b) We are asked to calculate ΔK or

$$\left(\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 + \frac{1}{2}m_3v_3^2\right) - \frac{1}{2}Mv_0^2 = 3.23 \times 10^6 \text{ J} .$$