40. One approach is to choose a *moving* coordinate system which travels the center of mass of the body, and another is to do a little extra algebra analyzing it in the original coordinate system (in which the speed of the $m = 8.0$ kg mass is $v_0 = 2$ m/s, as given). Our solution is in terms of the latter approach since we are assuming that this is the approach most students would take. Conservation of linear momentum (along the direction of motion) requires

$$\begin{aligned} mv_0 &= m_1v_1 + m_2v_2 \\ (8.0)(2.0) &= (4.0)v_1 + (4.0)v_2 \end{aligned}$$

which leads to

$$v_2 = 4 - v_1$$

in SI units (m/s). We require

$$\begin{aligned} \Delta K &= \left(\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2\right) - \frac{1}{2}mv_0^2 \\ 16 &= \left(\frac{1}{2}(4.0)v_1^2 + \frac{1}{2}(4.0)v_2^2\right) - \frac{1}{2}(8.0)(2.0)^2 \end{aligned}$$

which simplifies to

$$v_2^2 = 16 - v_1^2$$

in SI units. If we substitute for v_2 from above, we find

$$(4 - v_1)^2 = 16 - v_1^2$$

which simplifies to

$$2v_1^2 - 8v_1 = 0$$

and yields either $v_1 = 0$ or $v_1 = 4$ m/s. If $v_1 = 0$ then $v_2 = 4 - v_1 = 4$ m/s, and if $v_1 = 4$ then $v_2 = 0$. Stated more simply, one of the chunks has zero speed and the other has a velocity of 4.0 m/s (along the original direction of motion).