14. We use the constant-acceleration equations of Table 2-1 (with the origin at the traffic light), Eq. 9-5 for x_{com} and Eq. 9-17 for $\vec{v}_{\text{com}}$. At $t = 3.0\,\text{s}$, the location of the automobile (of mass m_1) is $x_1 = \frac{1}{2}at^2 = \frac{1}{2}(4.0\,\text{m/s}^2)(3.0\,\text{s})^2 = 18\,\text{m}$, while that of the truck (of mass m_2) is $x_2 = vt = (8.0\,\text{m/s})(3.0\,\text{s}) = 24\,\text{m}$. The speed of the automobile then is $v_1 = at = \left(4.0\,\text{m/s}^2\right)(3.0\,\text{s}) = 12\,\text{m/s}$, while the speed of the truck remains $v_2 = 8.0\,\text{m/s}$.

(a) The location of their center of mass is

$$x_{\text{com}} = \frac{m_1x_1 + m_2x_2}{m_1 + m_2} = \frac{(1000\,\text{kg})(18\,\text{m}) + (2000\,\text{kg})(24\,\text{m})}{1000\,\text{kg} + 2000\,\text{kg}} = 22\ \text{m}\ .$$

(b) The speed of the center of mass is

$$v_{\text{com}} = \frac{m_1v_1 + m_2v_2}{m_1 + m_2} = \frac{(1000\,\text{kg})(12\,\text{m/s}) + (2000\,\text{kg})(8.0\,\text{m/s})}{1000\,\text{kg} + 2000\,\text{kg}} = 9.3\,\text{m/s}\,.$$