52. (a) Using $M = 32.0$ g/mol from Table 20-1 and Eq. 20-3, we obtain

$$n = \frac{M_{\text{sam}}}{M} = \frac{12.0\,\text{g}}{32.0\,\text{g/mol}} = 0.375 \text{ mol} .$$

(b) This is a constant pressure process with a diatomic gas, so we use Eq. 20-46 and Table 20-3. We note that a change of Kelvin temperature is numerically the same as a change of Celsius degrees.

$$\begin{aligned} Q &= nC_p\Delta T = n\left(\frac{7}{2}R\right)\Delta T \\ &= (0.375\,\text{mol})\left(\frac{7}{2}\right)\left(8.31\,\frac{\text{J}}{\text{mol}\cdot\text{K}}\right)(100\,\text{K}) \\ &= 1.09 \times 10^3 \text{ J} . \end{aligned}$$

(c) We could compute a value of ΔE_{int} from Eq. 20-45 and divide by the result from part (b), or perform this manipulation algebraically to show the generality of this answer (that is, many factors will be seen to cancel). We illustrate the latter approach:

$$\frac{\Delta E_{\text{int}}}{Q} = \frac{n\left(\frac{5}{2}R\right)\Delta T}{n\left(\frac{7}{2}R\right)\Delta T} = \frac{5}{7} \approx 0.714 .$$