49. Argon is a monatomic gas, so $f = 3$ in Eq. 20-51, which provides

$$C_V = \left(\frac{3}{2}\right) R = \left(\frac{3}{2}\right) \left(8.31 \frac{\text{J}}{\text{mol} \cdot \text{K}}\right) \left(\frac{1\,\text{cal}}{4.186\,\text{J}}\right) = 2.98 \frac{\text{cal}}{\text{mol} \cdot \text{C}^\circ}$$

where we have converted Joules to calories (Eq. 19-12), and taken advantage of the fact that a Celsius degree is equivalent to a unit change on the Kelvin scale. Since (for a given substance) M is effectively a conversion factor between grams and moles, we see that c_V (see units specified in the problem statement) is related to C_V by

$$C_V = c_V M \qquad \text{where} \quad M = mN_\text{A}$$

where m is the mass of a single atom (see Eq. 20-4).

(a) From the above discussion, we obtain

$$m = \frac{M}{N_\text{A}} = \frac{C_V/c_V}{N_\text{A}} = \frac{2.98/0.075}{6.02 \times 10^{23}} = 6.6 \times 10^{-23}\ \text{g} .$$

(b) The molar mass is found to be $M = C_V/c_V = 2.98/0.075 = 39.7$ g/mol which should be rounded to 40 since the given value of c_V is specified to only two significant figures.