22. (a) The specific heat is given by $c = Q/m(T_f - T_i)$, where Q is the heat added, m is the mass of the sample, T_i is the initial temperature, and T_f is the final temperature. Thus, recalling that a change in Celsius degrees is equal to the corresponding change on the Kelvin scale,

$$c = \frac{314\,\text{J}}{\left(30.0\times10^{-3}\,\text{kg}\right)\left(45.0°\text{C} - 25.0°\text{C}\right)} = 523\,\text{J/kg}\cdot\text{K}.$$

(b) The molar specific heat is given by

$$c_m = \frac{Q}{N\left(T_f - T_i\right)} = \frac{314\,\text{J}}{\left(0.600\,\text{mol}\right)\left(45.0°\text{C} - 25.0°\text{C}\right)} = 26.2\,\text{J/mol}\cdot\text{K}.$$

(c) If N is the number of moles of the substance and M is the mass per mole, then $m = NM$, so

$$N = \frac{m}{M} = \frac{30.0\times10^{-3}\,\text{kg}}{50\times10^{-3}\,\text{kg/mol}} = 0.600\,\text{mol}.$$