

47. When the temperature changes by ΔT the internal energy of the first gas changes by $n_1 C_1 \Delta T$, the internal energy of the second gas changes by $n_2 C_2 \Delta T$, and the internal energy of the third gas changes by $n_3 C_3 \Delta T$. The change in the internal energy of the composite gas is $\Delta E_{\text{int}} = (n_1 C_1 + n_2 C_2 + n_3 C_3) \Delta T$. This must be $(n_1 + n_2 + n_3) C \Delta T$, where C is the molar specific heat of the mixture. Thus

$$C = \frac{n_1 C_1 + n_2 C_2 + n_3 C_3}{n_1 + n_2 + n_3} .$$