5) Monatomic gas $V = 1.0\,m^3$ $T = 3.00 \times 10^2\,K$

Gas in a chamber of fixed volume heated to $T = 4.00 \times 10^2\,K$

Process requires 10.0 J. How many gas molecules are in chamber?

$\Delta U = n C_v \Delta T \qquad C_v = \frac{3}{2} R$ (monatomic gas)

$$n = \frac{\Delta U}{C_v \Delta T} = \frac{10.0\,J}{\frac{3}{2} \times 8.315 \frac{J/K}{mol} \times 100\,K} = 8.02 \times 10^{-3}\,mol$$

$$N = n N_A = 8.02 \times 10^{-3}\,mol \times 6.022 \times 10^{23}\,mol^{-1}$$

$$= 4.8 \times 10^{21} \quad (E)$$