CHAPTER 17 EXAMPLES:

• A gas consists of $10^{27}$ atoms at a pressure of $10^6$ J/m$^3$ and a temperature of 300 K. It’s in a container. What’s the volume of the container?
Answer: $4.14 \text{ m}^3$ or 4140 liters.

• A certain substance melts at 100 K and has heat capacity $20 \text{ J}/(\text{kg-K})$. If $L_f$ is 50 J/kg and there are 10 kg of the substance, initially at 50 K, how much heat must be added to liquify it completely?
Answer: $1.05 \times 10^4 \text{ J}$.

• A material has $\beta = 10^{-5}/\text{K}$ and is initially at a density of 1000 kg/m$^3$. If its temperature changes by $\Delta T = 100 \text{ K}$, how does its density change?
Answer: $\Delta \rho = -1 \text{ kg/m}^3$, a change of 0.1%.

• A gas consists of molecules with a mass of $5.3 \times 10^{-26}$ kg, at a pressure of $1 \times 10^5$ J/m$^3$, at a temperature of 300 K. What is its density?
Answer: $1.28 \text{ kg/m}^3$. (The typical density of air, which is mainly O$_2$ and N$_2$, is $1.2 \text{ kg/m}^3$ at sea level and $15^\circ \text{ C}$.)