

Topic 04. Thermal Physics

1. How much energy is required to change a 40-g ice cube from ice at -10°C to steam at 110°C ?
2. A student drops two metallic objects into a 120-g steel container holding 150 g of water at 25°C . One object is a 200-g cube of copper that is initially at 85°C , and the other is a chunk of aluminum that is initially at 5.0°C . To the surprise of the student, the water reaches a final temperature of 25°C , precisely where it started. What is the mass of the aluminum chunk?
3. Oxygen gas having a volume of 1000 cm^3 at 40.0°C and $1.01 \times 10^5\text{ Pa}$ expands until its volume is 1500 cm^3 and its pressure is $1.06 \times 10^5\text{ Pa}$. Find (a) the number of moles of oxygen present and (b) the final temperature of the sample.
4. The best laboratory vacuum has a pressure of about $1.00 \times 10^{-18}\text{ atm}$, or $1.01 \times 10^{-13}\text{ Pa}$. How many gas molecules are there per cubic centimeter in such a vacuum at 293 K ?
5. An ideal monatomic gas initially has a temperature of 330 K and a pressure of 6.00 atm . It is to expand from volume 500 cm^3 to volume 1500 cm^3 . If the expansion is isothermal, what are (a) the final pressure and (b) the work done by the gas? If, instead, the expansion is adiabatic, what are (c) the final pressure and (d) the work done by the gas?
6. An ideal gas absorbs $5.00 \times 10^3\text{ J}$ of energy while doing $2.00 \times 10^3\text{ J}$ of work on the environment during a constant pressure process. (a) Compute the change in the internal energy of the gas. (b) If the internal energy now drops by $4.50 \times 10^3\text{ J}$ and $7.50 \times 10^3\text{ J}$ is expelled from the system, find the change in volume, assuming a constant pressure process at $1.01 \times 10^5\text{ Pa}$.