HW #2 | II.1

The physicist is, of course, RIGHT.
The total energy of an ideal gas

$$E = N c_v T$$

(c_v: heat capacity per particle)

Since $P = \text{const}$ and $V = \text{const}$, we have

$$PV = NT = \text{const}$$

The average energy of each molecule, however, does increase and that is what defines the temperature and the comfort level. At the same time, the total number of molecules in the room decreases.

This problem was first discussed in a respectable science magazine "Nature" volume 141, page 908, in 1938

If we measure information in bits (ΔI) the change in entropy is going to be

$$\Delta S = -\frac{k_B}{\log_2 e}\Delta I$$

A usual coding of Latin characters requires 5 bits (2^5 different characters)

Thus, a 400 page book with 50 lines of 70 characters per page contains

$$\Delta I = 5\times 70\times 50\times 400 = 7\cdot 10^6 \text{ bits}$$

Thus $\underline{\Delta S_{brain} \sim 10^{-16}\ J/K}$

An electric bulb (100w) at room temperature is going to cause

$$\Delta S_{bulb} \sim \frac{\text{Power}\cdot\text{time [in sec]}}{T} \sim 0.3\cdot t\ \frac{J}{K}$$

Thus $$\frac{\Delta S_{brain}}{\Delta S_{bulb}} \sim \frac{10^{-19}}{t^*}$$

t^* in hours.

So the entropy is always going up!