The Law of Nature or Chance

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In this paper, the distance between neighboring atoms of an ideal gas is calculated. It turns out that the numerical value of the inverse of this distance is approximately equal to the numerical value of the speed of light in a vacuum 299 792 458.

Let us turn to the concept of the molar volume of an ideal gas and other concepts associated with it. On the website NIST.gov (http://physics.nist.gov/constants) we find the following information.

Table

Quantity	Symbol	Value	Unit
speed of light in vacuum	c, c_0	299 792 458	$\mathrm{m\ s^{-1}}$
Avogadro constant	N_A, L	$6.022\ 140\ 857(74) \times 10^{23}$	$\mathrm{mol^{-1}}$
molar gas constant R	R	8.314 4598(48)	$\mathrm{J\ mol^{-1}\ K^{-1}}$
molar volume of ideal gas RT/p T = 273.15 K, p = 100 kPa	V_m	$22.710\ 947(13) \times 10^{-3}$	$\mathrm{m^3\ mol^{-1}}$
Loschmidt constant N_A/V_m	n_0	$2.651\ 6467(15) \times 10^{25}$	$\mathrm{m^{-3}}$
molar volume of ideal gas RT/p T = 273.15 K, p = 101.325 kPa	V_m	$22.413\ 962(13) \times 10^{-3}$	$\mathrm{m^3\ mol^{-1}}$
Loschmidt constant N_A/V_m	n_0	$2.686\ 7811(15) \times 10^{25}$	$\mathrm{m^{-3}}$

Note that the inverse of the numerical value of the speed of light in a vacuum is:

$\{c^{-1}\} = \mathbf{3,335\,640\,9520 \times 10^{-9}}$.

We take the first value of the Loschmidt constant (line 5 of the table).

Let us calculate the number of atoms of an ideal gas on a linear distance of 1 m:

$n_a = \sqrt[3]{n_0} = 298\,198\,339\ \text{m}^{-1}$.

Calculate the distance between the neighboring atoms of an ideal gas:

$d_0 = \frac{1}{\sqrt[3]{n_0}} = \frac{1}{\sqrt[3]{2.651\,6467 \times 10^{25}}} = \mathbf{3,353\,472\,7396 \times 10^{-9}}$ m.

We take the second value of the Loschmidt constant (line 7 of the table).

Let us calculate the number of atoms of an ideal gas on a linear l distance of 1 m:

$n_a = \sqrt[3]{n_0} = 299\,509\,610\ \text{m}^{-1}$.

Calculate the distance between the neighboring atoms of an ideal gas:

$d_0 = \frac{1}{\sqrt[3]{n_0}} = \frac{1}{\sqrt[3]{2.651\,6467 \times 10^{25}}} = \mathbf{3,338\,791\,0331 \times 10^{-9}}$ m.

There is such a question: "Are such coincidences of the numerical values of the inverse of the speed of light in a vacuum and the distance between two neighboring atoms of an ideal gas chance or are there some objective laws in this? If this law of nature is how to explain it, what is the secret behind it lies?"

$\{\boldsymbol{c^{-1}}\} = \{\boldsymbol{d_0}\},\ \{\boldsymbol{c}\} = \{\boldsymbol{d_0^{-1}}\}$ – chance or objective laws?!

This question arose with the author during walks with his grandson Maksim, for which he is declared grateful.