HYDROGEN –THE SUBSTANCE OF SPACE ORIGIN IS NOT GOVERNED BY THE EARTH LAWS OF MOLECULAR-KINETIC THEORY OF AN IDEAL GAS

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1. INTRODUCTION

The works of ancient chemists of 16th and 17th centuries very often mentioned extraction of a fuel gas when acids reacted with metals. G.Cavendish in 1766 managed to collect and investigate that gas, naming it "hot air". Its modern name (hydrogen from the Greek hýdör, meaning –water and gennáö – meaning giving birth) appeared as the result of analysis and synthesis of water), the complicated properties of which were proved by A.Lavoisier (1783). In 1787 he determined "hot air" as a new chemical element. Under normal conditions hydrogen is a gas, having no colour, odour, or taste.

Distribution of hydrogen in nature is well investigated, though its own nature has not been revealed by modern science yet. Hydrogen comprises water, the most common and yet the most mysterious substance on the Earth, it also comprises such substances as coals, oil, natural gases and living organisms and plants (i.e., proteins, carbohydrates, fats, nucleic acids etc.).

Hydrogen is extremely rarely met in free state. Still it comprises the internal ("proton") radius in the near-earth space, in the form of protons' flow. Hydrogen is the most widespread element in the outer space. In the form of plasma it comprises nearly half of the mass of the Sun and most of the stars and the bulk of interstellar media and planetary nebulae. Hydrogen is present in atmospheres of various planets and comets in the form of free H_2, methane CH_4, radicals of CH, NH, OH, SiH, PH types etc. In the form of proton stream hydrogen is present in corpuscular radiation of the Sun and space rays [1].

It would be worthwhile to add here that an extremely simple electron-nuclear model of hydrogen's atom is the base for construction of constantly changing models of atoms of the other chemical elements, in accordance with the Periodic law of D.I. Mendeleev.

1. IMPERFECTION OF THE CONCEPTS OF MOLECULAR-KINETIC THEORY OF AN IDEAL GAS

Gas phase is considered to be the simplest of the known three aggregate states of matter. "Gas laws" begin to seem complicated only at high temperature, or high pressure. Regularities of different gases vary substantially, still it is believed that [2], "regularities are simplified and differences on behavior of gases lessen at relatively low pressure and not very high or low temperatures".

Dependence of gas volume on gas pressure was established by Boyle (1669) and Marriott (1676) and since then the product of the values of gas pressure *p* and gas *mass*   More detailed investigations proved fluctuations from this law (fig.1).

The data presented in logarithmic scale on X axis (fig.1*b*) show that the law *pV* = const. appears to be correct at gas presser being 2 orders lower than singular. Besides, on this scale there will be equidistant points, showing pressure values, being bigger or smaller in the same number of times, rather than in the same value, as for the ordinary scale *a*).

For a particular pressure value $p = 0{,}01at$, at the lesser values Boyle-Marriott law being correct we shall introduce a new notion of a *scaled number* $/sn/\ j_p^{-2}$, a completely new notion in physical theory of dimension and the system of units of measuring and physical units, possessing pressure dimensionality. So, in general, we offer to express in simple numbers and order $10^{\pm n}$ modified by $j^{\pm n}$ symbol numerical values of physical values comprising the equation of gaseous state. This new designation was introduced not only to simplify the writing of mathematical equations, but also to eliminate imperfection of the theory of dimensionality [4] and the units of measurement of physical values [5].

Here in $sn\ j_p^{-2}$ expression a low index is specified, corresponding to dimensionality of
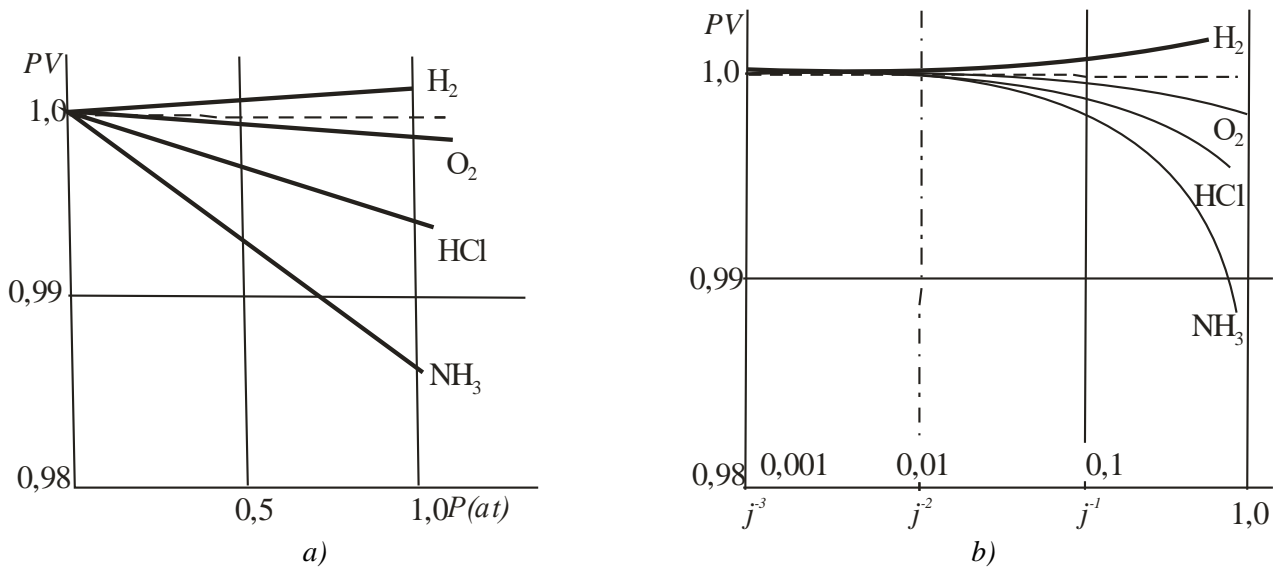
Figure 1. Fluctuations from Boyle-Mariott law according to the data, obtained in [2]. The results of the pv=f(p); a) – in ordinary and b) – logarithmic alongside X, (scale) system of coordinates.

pressure (e.g temperature in ºC) and square brackets [ºC] are used. Thus we'll write down the formula, expressing the law of Boyle-Marriott with a correction, according to which the numerical values, measured in atmospheres are decreased by 2 orders, i.e.

$$p \cdot j_p^{-2} \cdot V = \text{const} \qquad (1)$$

The analysis of the curves motion alongside with the increase in pressure $p > j_p^{-2}$ shows that intensity of negative fluctuations is individual for each particular gas. Only hydrogen's curve differs from the rest, because at pressure increase its results of multiplying the pressure value by volume increases.

It was experimentally proved that gas media pressure and temperature increases, when compressed. According to the notions of molecular-kinetic theory temperature increment in this case is explained by increase in number of elastic collisions of material particles of the ideal gas.

Then negative fluctuations from Boyle-Marriott law could be explained by the fact that kinetic energy inputs of the entire material particles, used for increasing of the integral level of heat energy grow more intense than the growth of specific power characteristic of media, i.e. pressure per area unit of the walls of a solid body, restricting the volume.

Judging by the notions, regarding different velocities of increase in parameters of a closed system of moving particles, due to transition of power from one kind into another it is impossible to explain principally different shape of hydrogen

curve. It appears that kinetic power is not used for increase of temperature of gaseous hydrogen? However it can be explained by two reasons: *a)* either collisions are present at $p < j_p^{-2}$ and are missing in principle at $p > j_p^{-2}$; *b)* or we have wrong notions, regarding causal motion of gas medium.

The first hypothesis is evidently inept, hence the second one remains. *m*-Symbol in kinetic energy formula $W_к = \frac{1}{2} mv^2$ is present in equations, describing bodies' motion of an arbitrary mass. Still there is no arbitrary mass in nature, the more so, because we speak about the substance filling the space of the Universe and also the substance, without which the Sun's <u>arbitrary *mass* (?)</u> seems to be impossible. The simplest atomic structure of hydrogen being proved it is evident that science is unaware of the main fact- there is mass [6,7], so, what is its nature and origin?

The production of the symbols $pV = \text{const}$, means the permanency of internal energy of gases in closed volume at constant temperature. As it was said in the textbook on molecular physics [2] Dimensionality of production

$$pV = \left[\frac{f}{S}\right][V] = \frac{[f]}{L^2}L^3 = [f]L \text{ is dimensionality of}$$

the production of force by length i.e. dimensionality of work or energy. Such listing is obviously outdated, still its sense has not practically been changed with perfection of the theory of dimensionality and units of measuring of physical values [4,5]. At the times when molecular-kinetic theory was being developed two units were applied

«*a) technical atmosphere* $1at = 1k\Gamma/1cm^2$ and *б)physical 1atm – 760 мм of mercury column* [2].

It appears that the proposed correction for the law of Boyle-Marriott can be realized more easily if force $1kg_f$ is divided by the area not $1\ cm^2$, but one hundred times bigger, by $1\ dm^2 = 100\ cm^2$, or s*n* $j^2_{[cm]^2}$. Still the practice is to measure gas mass, enclosed in volume in units, three orders smaller as compared to the mass unit equal to $1kg$, i.e. $1g = j^{-3}_{[kg]}$. Hence, the unit of are$1dm^2$ should be decreased by three orders accordingly i.e. $1dm^{2/3} = j^{2/3}_{[cm]^2}$. Because the dimensions of the vessel (area of the walls), are in no way related to gas mass that filled the vessel and is taken arbitrarily for investigation.

The proposed correction means that permanency of the production of pV symbols is ensured only in the case, when for measuring of three-dimensional volume and two-dimensional area of energy space homogeneous linear units of length are used. Transition to other units of mass measuring must be taken into consideration in the appropriate way by altering the order of the measured value:

$$p\,j^{-2}_p \cdot V = \textbf{const}\ ;\ \frac{kg_f}{dm^2} \times dm^3 = kg_f \cdot dm =$$

$$\frac{g_f}{dm^{2/3}} \times dm^{1/3} = \frac{g_f}{dm^2} \qquad (2)$$

From the equation above and its corresponding dimensionality of physical values it is obvious that if we use for the unit of mass of the first kg we'll receive that the production $1kg_f \cdot dm$ shows gas work, produced in closed volume. The similar transformation of dimensionality, but using – $1g_f$ as the unit of mass measuring will point out at permanency of specific force characteristic of gas *mass* i.e. its pressure upon the unit of surface $1dm^2$.

For description of natural processes of power exchange, by means of equation of mathematical physics an obligatory formulation of initial and limiting conditions is required. It seems to be extremely strange that such conditions have not been created yet by classical physics for the substance without which life on an inhabited planet is impossible.

The analysis of experimental data, regarding experimental fluctuations in Boyle-Marriott law testify that:

1. *Correction for Boyle-Marriott law* j^{-2}_p *eliminates imperfection of the theory of dimensionality as wells as the units of mass measuring and power space, one of which is the Earth atmosphere. This physical value is the initial condition, necessary and sufficient for the beginning of discreet transition of the Earth substance from liquid phase into gaseous phase*

2. *Fluctuations in the law of Boyle-Marriott at pressure* $p > j^{-2}_p$ *have a strict individual character, explained by differences in physical properties and also peculiarities of atomic structure of separate gases and their chemical compounds.*

3. *Fluctuations in the law of Boyle-Marriott for gaseous hydrogen (at the same conditions) seem to be of the character, different, that can't be explained by classical molecular-kinetic theory of an ideal gas.*

1.2. The dependence of gas volume and pressure upon its temperature was investigated by Gai-Lussac (1802). He discovered that all gases behave quite similarly, namely, they enlarge in volume (expand) being heated by every single degree Cº by a small share of the volume $\beta \approx 1/267 = 0,00375$, which they had at 0º C [2].

In the classical doctrine about heat (thermal dynamics) the notion about temperature is one of the most complicated notions [8,9,10], despite the fact that ways of its measuring are well known, for example they are based on thermal expansion of liquid (mercury, spirit etc.). Placing temperature in proportion with pressure of an ideal gas $p = KT$, where K – a coefficient of proportionality, the notion of unit of temperature measuring originated, as it is well known, from the following judgment The difference between temperature of ice melting and water boiling at pressure equal to 1 atmosphere was adopted to be one hundred units of temperature difference, i.e., . $T_{boiling} - T_{melting} = 100ºC$. It follows from this definition that $K = \dfrac{p_2 - p_1}{100}$, where p_1 – is the pressure of an ideal gas at the temperature of ice melting T_1, p_2 – is the pressure of an ideal gas at the temperature of water boiling T_2.

Taking into account these considerations, coefficient $\alpha = \dfrac{K}{p_1} = \dfrac{p_2 - p_1}{100 p_1}$ was evaluated by means of experimental data.

Some of these results [2] are summarized in table 1 Fig 2 shows the results in fluctuations from the law of a uniform expansion of gases, though "the experimental law of Gai-Lussac was corrected in two directions: firstly, gas behavior seems to be similar at very slow pressure (it is considered to be approximation to ideal values); and secondly, the fracture 1/267 was substituted by /273,15 [2].

Table 1.

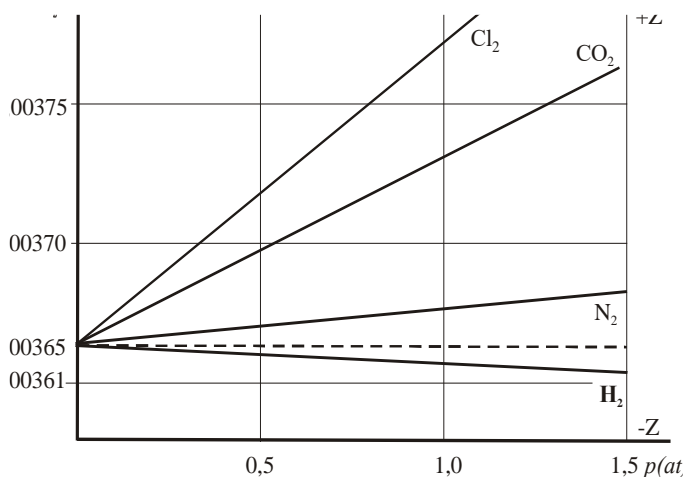| №	α	0ºC	Author	Year
1	0,0036618	273,09	Berteloo	1903
2	0,0036607	273,17	Bukichet	1907
3	0,0036617	273,10	Kamerling-Onnes	1910
4	0,0036581	273,37	Hawkstone	1919
5	0,0036600	273,20	Henning and Heise	1921
6	0,0036604	273,20	Heise	1926

Figure 2. Dependence if thermal coefficient of expansion at constant volume for some gases [2].

As can be seen, experimental and calculated values of α, indicated in the table were substituted by coefficient $\beta \approx 0,003660$, which was given the name of thermal coefficient of expansion. Still, it follows from the analysis of functional dependence of coefficient $\beta = f(p)$, represented graphically:

- that each of simple and complicated gases is characterized by strictly individual slope angle of graphic's line in relation with –abscissa axis, calculated in a counterclockwise direction;

- linear function of $\beta_H = f(p)$ possess principally different character.

1.3. Let us mention here a quoting from a textbook, written by L.A. Sena [3]. «Experimental law of Boyle-Marriott and the law of equal expansion of gases (Gai-Lussac's law) were unified in a single law by D.I. Mendeleev and В.Э.Clapeyron, the law that expresses dependence of gas volume on temperature. Considering that the production of the volume of a given mass by its pressure is a linear characteristic of temperature it would be possible to present a combined law by $pV = C(1+\beta T)$ formulas and depict it graphically with one line (see fig. 3).

This line, crossing the ordinate axis is extrapolated until it touches the abscissa axis was taken for the point of "absolute temperature". As far as the scale of measuring of this temperature it can be quite arbitrary. It was taken so that the interval between the points of ice melting and water boiling could be divided by 100 parts-degrees. For such scale the point of crossing of the straight line with the abscissa axis on fig.3 happens to be 273 degrees away from the point of ice melting. It is known that such point was termed as the "*absolute zero*".
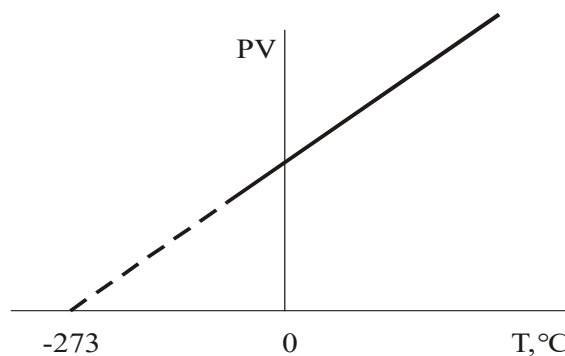

Figure 3. Graphical interpretation of the law of Mendeleev-Clapeyron.

Thus, the mistake of the combined law $pV = C(1+\beta T)$ is that in the left part of the equation the initial condition j_p^{-2}, is missing, resulting in overstated by 2 orders evaluation of potential energy of gas, having an arbitrary volume V, and in the right part of the equation coefficient of proportionality β lowers the role of the temperature factor also for evaluation of potential gas energy at heating..

2. THE ESSENCE OF THE UNIQUE PHYSICAL PROPERTY OF HYDROGEN

2.1. It is believed that the notions of numbers have not been altered since the time when f I. Newton, defined them in his" Universal arithmetic" " As a number we understand an abstract relation of a certain value to another value <u>of the same kind (!)</u>,

considered to be a unit, rather than the multitude of units". Still in the international system of units (SI system) an extremely important definition of the nits of measurement of homogeneous physical value is missing. Thus, taking into account the unit's definition, made by I. Newton, we received absolutely precise and universal constant β, showing how many times the unit of measurement 1 degree Centigrade is smaller than Kelvin's absolute zero(0,K= -273,15 ℃).

$$\beta = \frac{-1^{\circ},C}{-273,15,^{\circ}C} = \frac{1}{273,15} = 0,003660 \vdash$$

$$0,3660 \cdot j_p^{-2} \qquad (3)$$

Here an unusual writing of f.(3), where the arithmetic equality symbol (=) between a simple and a decimal fractures is substituted by the symbol of physical equality ($\vdash$), showing that the small value of the decimal fracture is explained by the alternation for the law of Boyle-Marriott f.(1), regarding the unit of pressure measurement. It appears that length of the temperature scale 0, … +100℃ $\vdash$ sn $j^2_{[^\circ C]}$ is unjustifiably extended towards the sphere of low temperatures (fig.3), just for the sake of convenient graphical interpretation of the wrong formula $pV = C(1+ \beta T)$.

If this unusual substantiation of principally new physical sense of the *absolute thermal coefficient of expansion* does not seem reasonable enough, then we'll bring an undisputable proof. Normal pressure of 1 *at* is balanced by mercury column 760 *mm* high, while 1 degree on a common medical mercury thermometer is equal to 8,333 *mm* length of mercury column. It appears that the atmospheric pressure, which is two orders smaller than sn j_p^{-2} corresponds to 7,6 *mm* of mercury column, while +1℃ = 8,33 *mm*. If we evaluate the parameters of gaseous medium with regard to physical properties of the same compound (liquid mercury), than direct and reciprocal relation of +1℃ unit to correction due to imperfection of pressure measuring units and unclear physical definition, gas mass is equal to

$$\left(\frac{+1^{\circ}C}{j_p^{-2}}\right)^{\pm 1} = \left(\frac{8,33мм}{7,6мм}\right)^{\pm 1} =$$

$$(1,0964; 0,9120) \approx 1,1…1,0. \qquad (4)$$

where 1,0964 – is the result of evaluation of the direct and , a 0,9120 – of the reciprocal relation of homogeneous units of measuring temperature and pressure . From theoretical point of view this is

original, natural relativity of the basic parameters, which are of vital importance for the Earth's biosphere, existing in gaseous, aggregate state.

We are going to explain the necessity to reconsider the fundamentals of molecular-kinetic theory of gases with application of dimensioned calculation by showing the definition of K – coefficient in variants, equal from the point of view of arithmetic в вариантах,

$$K = \frac{p_2 - p_1}{100} = \frac{p_2 - p_1}{j^2} = (p_2 - p_1) \times j^{-2}.$$

If we open the brackets in the last equation it will appear that $p_1 j^{-2}$, i.e. pressure of an ideal gas at temperature of ice melting, diminished by two orders is written correctly, while, $p_2 j^{-2}$ – cannot be considered as being correct at *Tboil*, as the level of potential energy of liquid medium at the phases interface, resulting from heating is evaluated by temperature difference T$_{Tboil}$ − T$_{Tmel}$ = 100℃ (sn $j^2_{[^\circ C]}$), i.e. by 2 orders bigger than at 0℃. The estimated length of the column of medical thermometer will be equal to 830 *mm*, while at the temperature of ice melting = 0, and pressure $p = j_p^{-2}$ = 7,6 mm of mercury column – is physically precise unit of measuring of atmospheric pressure, it is also the initial condition for transition of substance into gaseous aggregate state, not depending upon temperature.

So, we see that the formula for evaluation of α appears to be incorrect, as 0,00366 decimal fracture was received as the result of subtraction of p_1 symbol in the numerator and its increase by two orders in the denominator.

It should be noted that that the absolute relation of zero values and the temperature, determined by expansion of bodies (mercury thermometer), equal to 36.6℃, is considered normal for a live human organism. It presents the coefficient β, increased by four orders, and with regard to sn j_p^{-2} (having no relation to characteristics of the level of internal energy of bodies) - just by 2 .

$$T = 36,6℃ = sn\, j^4 \times \beta. \qquad (5)$$

The evaluated temperature 37,5 ℃ = sn $j^4 \times \frac{1}{267}$, proves to be a high temperature if we take into account the coefficient of thermal expansion , the data provided by Gai-Lussac.

Hence, it is clear that global climatic changes of the planet, evaluated in temperature ±1℃, could

mean serious fluctuations of thermal equilibrium of the inhabitant planet, tantamount to natural disaster. This example has to demonstrate that revelation of temperature's nature means provision of absolute precise methods of its evaluation, with application *of natural, dimensional calculation-* independent object of an physical mathematics.

2.2. It is obvious that generalization of experimental laws of Boyle-Marriott and Gai-Lussac's laws, represented on fig.3 was made in the incorrect way. The segment of abscissa axis in the area of low temperatures was groundlessly stretched by two orders, this was caused by neglecting I. Newton's definition of relativity of homogeneous units of measurements for gaseous media temperature. The ordinates axis, on which numerical values of pV productions, are determined, on the contrary seems to have been compressed by 2 orders, due to imperfection of the theory of dimensionality and the units of pressure measuring, i.e. s$n\, j_p^{-2}$.

It goes without saying that such dimensional characteristics of integral, power level of elastic gaseous media, evaluated by temperature difference as the local force characteristics –pressure upon the vessel's walls are not taken into account by the altered formula : $pV = \dfrac{m}{M} RT$. Moreover, a relation of m,-symbol, denoting normally mass of an arbitrary body to M-symbol, denoting *molar mass* is introduced. And just because this equation also includes Avogadro's law (Avogadro's constant N_A = 6, 0221367(36) · 10^{23} mole^{-1}) it is usually treated as determination of temperature as the value, proportional to the product of division of pressure by one volume of one mole f gas.

Finally, it was said in the reference book [3] that it was said that "development of kinetic theory of ideal gases made it possible to derive an equation $pV = C(1+ \beta T)$, with the series of simplifying assumptions and under assumption, regarding proportionality of the temperature of the average kinetic energy of forward motion of molecules, to be determined by Bolzman's formula $w = \dfrac{mv^2}{2} =$ kT, where k – is the universal constant (irrespective of gas). This equation is generally written like $w =$ $\dfrac{mv^2}{2} = \dfrac{3}{2} k_Б\, T$.»

With regard to the notions of the new natural theory we can hardly agree with conclusion of the authors of the reference book [3], that the aforementioned "*equation allows to bring certain*

physical sense for temperature, as the value, proportional to the average kinetic power of forward motion of molecules".

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