Metric Time and Non-Metric Time: The Speed of Light
Conversion Factor 1.157407407 for Translating CODATA
Fundamental Constants to a Metric System

Charles William Johnson

Extract

In order to convert the CODATA physical and chemical fundamental constants from the non-metric, conventional time system of 24h-60m-60s, to a metric time system, one may employ a conversion factor of fractal 1.157407407 and multiples thereof. Selected conversions are presented in this essay as well as a discussion about the fundamental constants regarding the use of mixed systems of measurement [metric and non-metric] as in the speed of light value, $299792.458$ kms/sec. This reflects a mixed expression inasmuch as [kilo]meters is a metric expression and a second of time is non-metric. The question is discussed regarding how can fundamental constants be considered to be exact when they are based on mixed measurement systems [non-metric and metric]. The metric expression for the speed of light in a vacuum is $259020.6837$ kms/metric-second. The 1.157407407 conversion factor derives from the speed of light numerical values of both the metric and the non-metric systems.

There exists an essential contradiction among many of the physical and chemical fundamental constants as registered by the CODATA. In many of the constants, as in the numerical value for the speed of light in a vacuum, the numerical expressions are the result of mixing metric [mass, distance] and non-metric [time] measurement systems. One must question how can exact numerical expressions of constants be derived from combining two
different measurement systems. It would be like multiplying oranges times apples.

Many of the CODATA numerical values are derived theoretically and not from actual measurement systems. Yet, where measurements are effected at times it would appear that the definition of the time-factor [i.e., the second of time] as in the speed of light is not fully comprehended. The possibility exists that by employing a metric system of measurement for both aspects [space and time], then different numerical values will derive and there may exist a more relational aspect to the physical and chemical constants than what has been discerned to date. When I speak of space and time separately, I am considering how mass and distance/meter [space] are measured as distinct from seconds [time].

By their admission, scientists point out the deficiency in having a non-metric time system of measurement, while employing the metric system for mass and distance. When one employs the 299792.458 numerical CODATA value for the speed of light in a vacuum, it does represent a given velocity of light for a specified time [conventional second]. So, the numerical value coming out of the constants have meaning, but one wonders whether by employing a metric system of time along with the metric system of space might produce numerical values of a more comprehensible and relational structure amongst the constants themselves.

The conventional 24-hour | 60-minute | 60-second time system employed today causes the speed of light to register a value of 299792.458 kilometers per second in the metric system for measuring distance. The 86400 seconds in which one rotational period of the Earth is divided by this 24-60-60 time system is essentially an arbitrary number, whose explanation is readily available as we compare the conventional time system to the theoretical metric time system.

The theoretical metric time system is generally proposed as consisting of 10-hours | 100-minutes | 100-seconds. There are variations, as I have discussed in a previous essay [www.earthmatrix.com]. By way of the 24-60-60 time system we know that during the time it takes the Earth to rotate on its axis in a 24-hour period [one Earth day], light has traveled 25902068370.0 kilometers. This is confirmed by the basic computation of multiplying the numbers of seconds in one day [86400] times the speed of light expressed in that time system [299792.458 kms/second].
86400 x 299792.458 = 25902068371.2

Now, given the fact that the rotation of the Earth is not exactly 24 hours, but rather 23-hours 56-minutes 4.1-seconds or, 0.99726968 of that amount, the actual distance would register as: **25831347440.0** give or take. One cannot help but notice that this value suggests the number of years often given for the Earth’s precession of ca. **25800** years. Understandably one is relational to the other, i.e., the rotational period of the Earth is relational to its precession; obviously. For now, I shall work with the theoretically posited value of 259020.6837 kilometers for the metric-second.

The 299792.458, then, represents an arbitrary amount assigned to the speed of light. Naturally, that is its speed, light does travel 299792.458 kilometers in that one second of time as of the 24-60-60 time system/clock. But, one could derive other values by employing a distinct time system/clock, as say with the metric time system/clock. Within the metric time-keeping system the speed of light would be 259020.6837 kilometers per metric-second. This obtains because based on the 10-100-100 time system/clock, the rotational period of the Earth is divided into 100000 sectors [divisions or seconds]. Each one of those sectors, then translates into 259020.6837 kilometers for the speed of light.

In this sense, then, the speed of light registered on the 24-60-60 time system/clock is actually representing that light travels 299792.458 kilometers per a 24-60-60 time system/clock, or 1.157407407 times greater than the 259020.6837 metric second value. On a metric time system, then, the unit one [1.0] is defined as of the rotational period of the Earth. Whereas with the 24-60-60 time system a rotational period of the Earth of 1.157407407 is taken as the baseline. This particular baseline makes little sense from the point of view of unit 1.0 analyses. Rather it is the concept of one second as defined by the conventional system [its 24-60-60 relationship] that is defining the second and hence the distance used in the measurement.

The choice of defining the speed of light as of the 1.157407407th rotational period of Earth has no scientific basis as such. Its basis is the historical arbitrariness of the 24-60-60 system; meaning having divided the Earth’s rotation into 86400 random-like sectors [seconds].
The scientific baseline for computing spacetime/motion in terms of distance and time with regard to the Earth’s rotational period can only be achieved by doing so as of its rotational period being set as the baseline 1.0, as unit 1.0 so it were. Now, why would anyone choose the rotational period of Earth as a baseline for measuring the speed of light requires further discussion, just as all of the physical and chemical constants require such a clarification.

We line on planet Earth, and to choose Earth’s time system for telling time and measuring time is acceptable for that simple reason: it is the reality that we have been confronted with for the life of our existence on the planet. In the beginning we had no other choice but to create our time-keeping system as of the Earth itself, and then the relationship of the Earth with other planetary bodies, the solar system and beyond.

Today, scientists are attempting to break out of this historically determined shell and are employing the vibrations/pulses of a Cesium-133 atom to define the second of time (at 9,192,631,770 pulses). For now, however, I will leave aside any comments on this attempt to create a time-system outside of the rotational period of the Earth. I am interested at present with the arbitrary time system based on 86400 seconds for one rotational period of the Earth and the theoretically designed 100000 seconds for the metric system/clock.

The rotational period of the Earth may divided into as many sectors [divisions, seconds] as one may choose. Here are some selected examples of possible divisions plus the conventional and the metric time systems.

<table>
<thead>
<tr>
<th>Number of Divisions (seconds) in the Rotational Period of Earth</th>
<th>Kilometers/rotational period of Earth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.590206837 E10 kms/rotation</td>
</tr>
<tr>
<td>2</td>
<td>1.2951034 E10</td>
</tr>
<tr>
<td>3</td>
<td>8634022790.0</td>
</tr>
<tr>
<td>4</td>
<td>1475517093.0</td>
</tr>
<tr>
<td>…</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>2590206837.0</td>
</tr>
<tr>
<td>…</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>259020683.7</td>
</tr>
<tr>
<td>…</td>
<td></td>
</tr>
</tbody>
</table>
From the number of sectors assigned to one rotation of the Earth upon its axis, one could assign any number of theoretical combinations of hours/minutes/seconds in order to achieve those total numbers. Consider some of the more obvious examples that have been forwarded today and some that I am proposing. The proposals are not for these systems to be adopted, but rather to be proposed for the analysis.

**Theoretical Time Systems and the Speed of Light**

**Listed Decrementally for Each Particular Clock**

<table>
<thead>
<tr>
<th>Time</th>
<th>Speed of Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>25902068.37</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>10000</td>
<td>2590206.837</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>43200</td>
<td>599584.916</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>72000</td>
<td>359750.9496</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>86400</td>
<td>299792.458 conventional 24-60-60</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>100000</td>
<td>259020.6837 metric 10-100-100</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>103680</td>
<td>249827.0483</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>200000</td>
<td>129510.3419</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>etc. infinitely so…</td>
<td></td>
</tr>
</tbody>
</table>

* A **20-60-60** clock: **359750.9496** kilometers per second
  
  \[20 \times 60 \times 60 = 72000\] seconds/day

* A **24-60-60** clock: **299,792.458** kilometers per second
  
  \[24 \times 60 \times 60 = 86400\] seconds/day
The two time systems that are most significant for this analysis concern the 24-60-60 and the 10-100-100 time systems. Correspondingly, one may view the relational speed of light as of each one of the proposed systems. The speed of light changes in value because the second of time itself increases/decreases with each different system. If the Earth’s rotational period is divided into more sectors [seconds], then the speed of light will decrease; and vice versa, if the length of the second is shortened, then the apparent speed of light will have a higher numerical value.

Nonetheless, the speed of light is the same for all of these time-systems, only the definition of the second of time has been modified according to the number of divisions or sectors [seconds] into which the Earth rotational period have been divided. In other words, all of the cited values for the speed of light are correct and exact; it is merely a question of knowing which second of time is being employed for each one.

Obviously, there can be two or more alternative expressions for the same total number of sectors/divisions [seconds] in one particular time system. 24-hours 60-minutes 60-seconds yields 86400 seconds in one rotational period of Earth. Likewise, one could divide the Earth’s rotational period into other relationships, such as 6-hours/120-minutes/120-seconds. The speed of light for the 24-60-60 time system would be the same as that for the 6-120-120 time system/clock. In fact, the second of time would be exactly the same, as the Earth’s rotational period is divided up effectively in both cases into 86400 divisions/sectors/seconds.
In a sense a 12-60-60 time system is the that we employ; twelve hours of day and twelve of night, from mid-day to mid-night. Marine time attempts to emphasize the 24-hour time system/clock, with one through 24 hours marked on the clock and stated as such.

As one understands the nature of the time system/clock in terms of the number of divisions within the Earth’s rotational period, then the particular design of a specific clock becomes of secondary importance. In my mind, what is significant is to query why scientists employ a 24-60-60 time system/clock for the physical and chemical constants. The immediate answer will be that that particular time system has been inherited by us through the 60-base system, and that there is pretty much nothing we can do about it now.

Many scholars propose changing from the 24-hour clock to a metric time based system, and even to a decimal clock for telling time. Such proposals have met with derision at times for being unrealistic. The best that scientists have been able to do is abandon the concept of a time-system determined by the Earth’s rotational period for one related to the pulses in a Cesium-133 atom; the so-called atomic clock.

All that aside, what are the implications for the values of the physical and chemical constants when we realize that the speed of light is not relational as unit 1.0 to those constants in which its numerical value participates in the computations of those values. But, rather the speed of light in a vacuum as measured by the 24-60-60 time system reflects an arbitrary numerical value of 2.99792458 or, rather 1.157407407 above the baseline [259020.6837].

One can only wonder why would an arbitrary number relate to the physical and chemical constants as given by the CODATA recommended values of the fundamental physical constants. Some of the values are the result of measurements and some are theoretical in nature.

The very first one on the CODATA list is that of the speed of light in a vacuum, numerical value m s\(^{-1}\) as unit and relative standard of uncertainty is given as *exact*. And, it so it is that light travels at 299792.458 kilometers per second when that second refers to the 24-60-60 time system/clock as enunciated in relation to the Earth’s axial rotational period. The trick is
knowing what the concept “second of time” means. Anyone coming from another planet who were to examine these data would have to search for the definitions regarding [kilo]meter and second [of time] in order to understand how they are defined.

The second of time in all of the physical and chemical constants is evidently taken for granted, with everyone knowing that the second of time refers to the second as defined by the 24-60-60 division of Earth’s axial rotation period, meaning 86400 such divisions [seconds]. Now, change the time system/clock employed and all of the numerical values for the speed of light in a vacuum will change as well. As shown earlier, consider the different theoretical time systems/clocks as follows:

* A 48-30-30 clock: 599,584.916 kilometers per 48-30-30-second
* A 20-60-60 clock: 359,750.9496 kilometers per 20-60-60-second
* A **24-60-60** clock: **299,792.458** kilometers per conventional second
* A **10-100-100** clock: **259,020.6837** kilometers per metric-10 second
* A 20-72-72 clock: 249,827.0483 kilometers per 20-72-72-second
* A 20-100-100 clock: 129,510.3419 kilometers per metric-20 second

For each of the distinct time systems/clocks cited, the *numerical* value of the speed of light in a vacuum changes. The actual speed of light in a vacuum for all cases is exactly the same.

Now, think about it. For all of the physical and chemical constants a metric system of measurement for distance, weight/mass, etc., is employed. Yet the numerical values resulting from that metric system are combined with a supposedly 60-base system [non-metric] system in terms of time measurement. The physical and chemical constants then combine two distinct forms of measurement: a metric one for *space* [distance, weight/mass, etc.], and a non-metric [24-60-60] one for *time*. And, in spite of this apparent inconsistency, we are told that the numerical values of the constants resulting from these combinations of computations are correct to the point of being exact.
One could imagine employing numerical values for the speed of light from any one of the other alternative non-metric time systems shown above [48-30-30; 20-60-60; 20-72-72] in relation to the physical and chemical constants and understandably distinct results in the computations and values of the constant would obtain.

Likewise, were one to employ the numerical values for the speed of light pertaining to the metric system of time measurement as shown [259020.6837], then distinct numerical values would result for the different physical and chemical constants whose terms include computations based on the speed of light.

Consider some of the CODATA physical and chemical constants whose terms involve the speed of light in a vacuum (c).

Newtonian constant of gravitation $G = \frac{G}{\hbar c} \approx \frac{6.70881 (67) \times 10^{-39}}{J\text{s}}$

Planck mass $(\hbar G/c)^{1/2}$ energy equivalent in GeV $m_p c^2 \approx 1.220892(61) \times 10^{19}$

Planck length $\left(\frac{\hbar G}{c^3}\right)^{1/2}$ $l_p \approx 1.616252(81) \times 10^{-44} \text{s}$

Planck time $t_p = \left(\frac{\hbar G}{c^5}\right)^{1/2} \approx 5.39124(27) \times 10^{-44} \text{s}$

Bohr magneton $\frac{\hbar e}{2m_e}$ in eV T$^{-1}$ $\mu_B/\hbar c \approx 46.6864515(12) \text m^{-1} \text{T}^{-1}$

Ryderberg constant $\alpha^2m_e c/2\hbar^2 = \frac{R\infty c}{c} \approx 3.289841960361(22) \times 10^{15} \text{Hz}$

Ryderberg constant $\alpha^2m_e c/2\hbar = \frac{R\infty \hbar c}{c} \approx 2.17987197(11) \times 10^{-18} \text{J}$

R$\infty \hbar c$ in eV $\approx 13.60569193(34) \text{eV}$

Fermi coupling constant $\frac{G_F}{\hbar c^3} \approx 1.16637(1) \times 10^{-5} \text{GeV}^{-2}$

Electron mass energy equivalent $m_e c^2 \approx 8.18710438(41) \times 10^{-5} \text{J}$

[As with the electron, at this juncture one would list the mass energy equivalencies for the other particles: muon, tao, proton, neutron, deuteron, triton, helion, and alpha as offered in the CODATA. However, for the sake of brevity in the analysis, I mention them without offering their specific numerical values. The purpose is not modify the values at this point, but simply to draw attention to them in relationship to the fact that they contain...
computations involving the speed of light in a vacuum similar to the electron mass as shown. Now, back to the CODATA list of constants as they appear in the CRC Handbook.

Boltzmann constant \( R/N_A \quad k/hc \quad 69.50356(12) \text{ m}^{-1} \text{K}^{-1} \)

First radiation constant \( 2\pi hc^2 \quad c_1 \quad 3.74177118(19) \times 10^{-16} \text{ Wm}^2 \)

First radiation constant for spectral radiance \( 2hc^2 c_{1L} \quad 1.191042759(59) \times 10^{-16} \text{ Wm}^2 \text{s} \)

Second radiation constant \( hc/k \quad c_2 \quad 1.4387752(25) \times 10^{-2} \text{ m K} \)

It is quite understandable that if one were to employ a metric time system in the previous computations for the physical and chemical constants, whereby the numerical value of the speed of light in a vacuum (c) were to be 259020.6837 instead of the conventional 299792.458, then the resulting numerical values of the constants would necessarily be different from the ones listed above.

One would then have to make the observation that the numerical values of the constants change because the 259020.6837 value reflects a shorter second of time compared to the 299792.458 measurement. Understandably, the numerical values will be different, but obviously correct; merely reflecting different spacetime coordinates in the measurements, i.e., a shorter second of time.

Below are the computations as reflected in the different formulae given for the fundamental constants by CODATA that involve time measurement implied by the speed of light, as in [kilo]meters/second. As may be observed from the metric values for the constants given, the metric values will take on different relationships with respect to one another.

In the following list of numerical values for the selected constants, one understands that the values reflect a metric measurement of space together with a metric measurement of time. Constants that relate only to space, without a term in its formula related to time, are evidently not treated on this list.
On the list following list, first are listed the computations for deriving the conventional CODATA numerical value of the fundamental constant. The next set of computations then pertains to those where the 2.99792458 value for the speed of light has been changed for the 2.590206837 metric value of the speed of light, immediately listing therein the metric numerical value of that particular constant.

**Selected Conversions of the CODATA Fundamental Physical and Chemical Constants Involving the Speed of Light in a Vacuum**

**CODATA**

Newtonian constant of gravitation $G = \frac{\hbar}{c}$

$G/\hbar c = 6.70881$

*Computations not given.*

**Metric**

$6.70881 / 1.157407407 = 5.796411842$ fractal

**CODATA**

Planck mass $(\hbar c/ G)^{1/2}$

$m_p c^2 = 2.17644(11) \times 10^{19}$

$\left( \frac{\hbar G}{c} \right)^{1/2} = \left( \frac{1.054571628 \times 299792.458 / 6.67428}{3.161526205 / 6.67428} \right)^{1/2} \approx 2.176437408$

**Metric**

$\left( \frac{\hbar G}{c} \right)^{1/2} = \left( \frac{1.054571628 \times 259020.6837 / 6.67428}{2.731558641 / 6.67428} \right)^{1/2} \approx 2.0230334$

**CODATA**

Fine structure constant $\frac{e^2}{4 \pi \varepsilon_0 hc}$

$a = 7.2973525376(50) \times 10^{-3}$

$\frac{e^2}{4 \pi \varepsilon_0 hc} = 1.602176487^2 \times 3.141592654 \times 8.854187817 \times 1.054571628 \times 299792.458 =$
2.566969495 / 12.56637061 x 9.337375253 x 299792.458 =

2.566969495 / 3.517672305 = 7.297352546

**Metric**

1.602176487^2 / 4 x 3.141592654 x 8.854187817 x 1.054571628 x 259020.6837 =

2.566969495 / 12.56637061 x 9.337375253 x 259020.6837 =

2.566969495 / 3.039268871 = 8.446009892

8.446009892 halves down to 1.64961131 [Sothic cycle number, 1.649457812]. Could it be that the ancient Sothic calendar encoded the fine structure constant.

---

Inverse fine structure constant in metric measure: 118.3991036
The doubling of the metric inverse fine structure constant yields 236.7982072, which is within the 1.36, 2.36 series of constant values.

137.035999679 / 118.3991036 yields the 1.157407407 conversion factor.

---

**CODATA**

Planck length \( \frac{\hbar}{p c} = \left( \frac{\hbar G}{c^3} \right)^{1/2} l_p \) 1.616252(81) x 10^{-44} s

\( \left( \frac{\hbar G}{c^3} \right)^{1/2} \) (1.054571628 x 6.67428 / 299792.458^3) \( 1/2 \) =

(1.054571628 x 6.67428 / 2.694400242) \( 1/2 \) =
(7.038506325 / 2.694400242 = 2.612272006) \( 1/2 \) = 1.616252457

**Metric**

\( \left( \frac{\hbar G}{c^3} \right)^{1/2} \) (1.054571628 x 6.67428 / 259020.6837^3) \( 1/2 \) =
(7.038506325 / 1.737814178 \( 1/2 \) = 4.05020653

---

**CODATA**

Planck time \( l_p c = \left( \frac{\hbar G}{c^5} \right)^{1/2} t_p \) 5.39124(27) x 10^{-44} s

\( \left( \frac{\hbar G}{c^5} \right)^{1/2} \) (1.054571628 x 6.67428 / 299792.458^5) \( 1/2 \) =

(7.038506325 / 2.421606171) \( 1/2 \) =
(2.90654459) \( \frac{1}{2} \) = 5.39123789

**Metric**

\( \left( \frac{hG}{c^5} \right) \frac{1}{2} \) = \( \frac{1.054571628 \times 6.67428}{259020.68275} \) \( \frac{1}{2} \) =

\( \frac{7.038506325}{1.165929328} \) \( \frac{1}{2} \) =

\( \frac{6.03682072}{1.165929328} \) \( \frac{1}{2} \) = 7.76969801

---

**CODATA**

Rydberg constant \( \alpha \frac{2mec}{2h} \)

\( R \approx c \) 3.289841960361(22) \( \times 10^{15} \) Hz

\( \alpha \frac{2mec}{2h} \)

Given that alpha (\( \alpha \)) already is the result of computations with the speed of light in a vacuum, then the computation in this case becomes more involved. One would first have to adjust the fine structure constant (alpha) according to the metric second and then proceed to adjust the Rydberg constant. Given that alpha (\( \alpha \)) equals \( \frac{e^2}{4 \pi \varepsilon_0 \hbar c} \) the formula is actually:

\( \alpha \frac{2mec}{2h} \)

7.2973525376\(^2\) \times 9.10938215 \times 299792.458 \div 2 \times 6.62606896 =

53.25135406 \times 2.730924066 \div 13.25213792 =

145.4254043 \div 145.4254043 = 10.97373158

**Metric**

\( \alpha \frac{2mec}{2h} \) = 8.446009892 (alpha, fine structure constant)

\( e^2/4 \pi \varepsilon_0 \hbar c \) (\( m_e c/2h \))

8.446009892\(^2\) \times 9.10938215 \times 259020.6837 \div 2 \times 6.62606896 =

71.3350831 \times 2.359518393 \div 13.25213792 =

168.3164406 \div 13.25213792 = 12.70107825 **metric Rydberg constant**

**Note:** 12.70107825 / 10.97373158 = 1.15740741 conversion factor

---

**CODATA**
Rydberg constant $\alpha^2 m_e c^2 / 2h$

$R \propto h c$

$2.17987197(11) \times 10^{-18} \text{ J}$

$R \propto h c$

$10973731.568527 \times 6.62606896 \times 299792.458 = 2.17987197$

**Metric**

$R \propto h c$

$10973731.568527 \times 6.62606896 \times 259020.6837 = 1.883409382$

---

$R \propto h c$ in eV

$R \propto h c/e$

$13.60569193(34) \text{ eV}$

$R \propto h c/e$

$2.17987197 / 1.602176487 = 13.60569193$

**Metric**

$R \propto h c/e$

$1.883409382 / 1.602176487 = 1.175531783 \text{ fractal}$

---

**CODATA**

Electron mass energy equivalent

$m_e c^2$

$8.18710438(41) \times 10^{-5} \text{ J}$

$m_e c^2$

$9.10938215 \times 299792.458^2 =$

$9.10938215 \times 89875517870.0 = 8.187104382 \text{ conventional time}$

**Metric**

$m_e c^2$

$9.10938215 \times 259020.6837^2 =$

$9.10938215 \times 67091714580.0 = 6.111640672 \text{ in metric time}$

[As with the electron, at this juncture one would place the mass energy equivalencies for the other particles: muon, tao, proton, neutron, deuteron, triton, helion, and alpha as offered in the CODATA. However, for the sake of brevity in the analysis, I will give their metric numerical values without offering their particular numerical computations. The purpose at this point is to draw attention to them as they contain computations involving the speed of light in a vacuum similar to the electron mass as shown here.]
Boltzmann constant $R/N_A$  \hspace{2cm} k/hc  \hspace{2cm} 69.50356(12) \text{ m}^{-1} \text{ K}^{-1}

$k/\text{hc}$  \hspace{2cm} \frac{1.3806504}{6.62606896} \times 299792.458 = \hspace{2cm} \frac{1.3806504}{1.9864455} = 6.950356301

\textbf{Metric}

$k/\text{hc}$  \hspace{2cm} \frac{1.3806504}{6.62606896} \times 259020.6837 = \hspace{2cm} \frac{1.3806504}{1716288.912} = 8.044393867 \text{ fractal}

\hline

\textbf{CODATA}

First radiation constant $2\pi c/\hbar c$  \hspace{2cm} c_1  \hspace{2cm} 3.74177118(19) \times 10^{-16} \text{ Wm}^2

The computations of the original constant:

$2\pi c/\hbar c$  \hspace{2cm} 2 \times 3.141592654 \times 6.62606896 \times 299792.458^2 = \hspace{2cm} \frac{2 \times 3.141592654 \times 6.62606896 \times 89875517870.0}{3.7417711810} = 3.7417711810

\textbf{Metric}

$2\pi c/\hbar c$  \hspace{2cm} 2 \times 3.141592654 \times 6.62606896 \times 259020.6837^2 = \hspace{2cm} \frac{2 \times 3.141592654 \times 6.62606896 \times 67091714580.0}{2.7932172190} = 2.7932172190 \text{ fractal}

\hline

\textbf{CODATA}

First radiation constant for spectral radiance $2\hbar c/\hbar c$  \hspace{2cm} c_{1L}  \hspace{2cm} 1.191042759(59) \times 10^{-16} \text{ Wm}^2\text{s}

$2\hbar c/\hbar c$  \hspace{2cm} 2 \times 6.62606896 \times 299792.458^2 = \hspace{2cm} 2 \times 6.62606896 \times 89875517870.0 = 1.191042748 \text{ fractal}

\textbf{Metric}

$2\hbar c/\hbar c$  \hspace{2cm} 2 \times 6.62606896 \times 259020.6837^2 = \hspace{2cm}
2 x 6.62606896 x 67091714580.0 = \textbf{8.891086549} \textit{fractal}

\textbf{CODATA}

\begin{tabular}{lrr}
\hline
Second radiation constant $hc/k$ & $c_2$ & $1.4387752(25) \times 10^{-2}$ m K \\
\hline
$hc/k$ & $6.62606896 \times 299792.458 / 1.3806504 = 1.43877516$ \\
\hline
\end{tabular}

\textbf{Metric}

\begin{tabular}{lrr}
\hline
$hc/k$ & $6.62606896 \times 259020.6837 / 1.3806504 = 1.243101738$ \\
\hline
\end{tabular}

\textit{Note}.- $1.43877516 / 1.243101738 = \textbf{1.157407407} \textit{conversion factor for conventional \mid metric time}$

As illustrated above, by comparing the computations for each of the fundamental constants that involve the numerical value of the speed of light in a vacuum, and replacing the non-metric value[s], 299792.458, with the metric value[s], 259020.6837, numerical expressions derive in \textbf{metric seconds}. A summary table of the selected fundamental constants with their corresponding metric numerical values follows below.

The metric time values are also presented in their \textbf{fractal} expressions without concern for the specific \textit{spatial/temporal units} of measurement. Basically, the numerical expressions are similar to the scientific notation decimal placement, but without the units of measurements in order to concentrate on the numerical values themselves. There are no data regarding the \textit{relative standard of uncertainty} as appear in the CODATA numerical values ---pocket calculators can do just so much.
Summary List of Selected Fundamental Constants
Expressed in the Metric Time System

<table>
<thead>
<tr>
<th>Constant</th>
<th>Expression</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newtonian constant of gravitation G</td>
<td>( \frac{G}{\hbar c} )</td>
<td>5.796411842 fractal</td>
</tr>
<tr>
<td>Planck mass ((\hbar G)^{1/2})</td>
<td>(m_p c^2)</td>
<td>2.0230334 fractal</td>
</tr>
<tr>
<td>Energy equivalent in GeV</td>
<td>(\frac{\alpha}{4\pi\varepsilon_0\hbar c})</td>
<td>8.446009892 fractal</td>
</tr>
<tr>
<td>Inverse fine structure constant</td>
<td></td>
<td>118.3991036 fractal</td>
</tr>
<tr>
<td>Planck length (\frac{\hbar}{p c})</td>
<td>(l_p)</td>
<td>4.05020653 fractal</td>
</tr>
<tr>
<td>Planck time (\frac{\hbar G}{c^5})</td>
<td>(t_p)</td>
<td>7.76969801 fractal</td>
</tr>
<tr>
<td>Rydberg constant (\frac{\alpha^2 m_e c}{2\hbar})</td>
<td>(R_{\infty c})</td>
<td>12.70107825 fractal</td>
</tr>
<tr>
<td>Rydberg constant (\frac{\alpha^2 m_e c}{2\hbar})</td>
<td>(R_{\infty hc})</td>
<td>1.883409382 fractal</td>
</tr>
<tr>
<td>Rydberg constant (\frac{R_{\infty hc}}{e})</td>
<td>(1.175531783) fractal</td>
<td></td>
</tr>
<tr>
<td>Electron mass energy equivalent</td>
<td>(m_e c^2)</td>
<td>6.111640672 fractal</td>
</tr>
<tr>
<td>Boltzmann constant (\frac{R}{N_A})</td>
<td>(k/\hbar c)</td>
<td>8.044393867 fractal</td>
</tr>
<tr>
<td>First radiation constant (2\pi\hbar c^2)</td>
<td>(c_1)</td>
<td>2.7932172190 fractal</td>
</tr>
<tr>
<td>First radiation constant for spectral radiance (2\hbar c^2)</td>
<td>(c_{1L})</td>
<td>8.891086549 fractal</td>
</tr>
<tr>
<td>Second radiation constant (\frac{\hbar c}{k})</td>
<td>(c_2)</td>
<td>1.243101738 fractal</td>
</tr>
</tbody>
</table>

When the formulae given have as one of their terms the speed of light in a vacuum value, 299792.458 \(\text{m/s}^2\), then divide the following numerical values of the selected constants by a factor of \(1.339591907\) \[1.157407407 \text{m/s}^2\] in order to convert them to metric time constants. The reason for this is that the original formula precisely contains the speed of light \(\text{m/s}^2\), so one would have to square the metric speed of light.
conversion factor [1.157407407] and then divide that into the CODATA numerical value in order to obtain the corresponding metric time value.

With this procedure it is possible to derive the metric numerical values for the constants that were named earlier, but whose computations or data sets were not given. In order to complete the metric picture of atomic particles, the electron mass energy is included on the list, although its data sets/computations were offered above. The order of presentation of the particles follows that of the CODATA list published by the CRC handbook. The values given, again, are fractal expressions, not scientific notation as such, because the units of their spatial/temporal coordinates are not provided on the list.

<table>
<thead>
<tr>
<th>Constant</th>
<th>CODATA</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>fractal values</td>
<td>fractal values</td>
</tr>
<tr>
<td><strong>Electron</strong> mass energy equivalent</td>
<td>8.18710438</td>
<td>6.111640672</td>
</tr>
<tr>
<td><strong>Muon</strong> mass energy equivalent</td>
<td>1.692833510(95)</td>
<td>1.263693444</td>
</tr>
<tr>
<td><strong>Tau</strong> mass energy equivalent</td>
<td>2.84705</td>
<td>2.125311436</td>
</tr>
<tr>
<td><strong>Proton</strong> mass energy equivalent</td>
<td>1.503277359</td>
<td>1.122190535</td>
</tr>
<tr>
<td><strong>Neutron</strong> mass energy equivalent</td>
<td>1.505349505</td>
<td>1.123737384</td>
</tr>
<tr>
<td><strong>Deuteron</strong> mass energy equivalent</td>
<td>3.00506272</td>
<td>2.2432673</td>
</tr>
<tr>
<td><strong>Triton</strong> mass energy equivalent</td>
<td>4.50038703</td>
<td>3.359520916</td>
</tr>
<tr>
<td><strong>Helion</strong> mass energy equivalent</td>
<td>4.49953864</td>
<td>3.358887596</td>
</tr>
<tr>
<td><strong>Alpha</strong> particle mass</td>
<td>5.97191917</td>
<td>4.458013772</td>
</tr>
</tbody>
</table>

**Additional Comments**

In order to convert selected CODATA fundamental physical and chemical constants from the non-metric, conventional time system of 24h-60m-60s, to a metric time system, a conversion factor of 1.157407407 fractal and multiples thereof [1.339591907].

Selected conversions have been presented in this essay as well as a discussion about the fundamental constants regarding the use of mixed systems of spatial/temporal measurement, including metric and non-metric systems as with regard to the speed of light value, 299792.458 kms/sec. The
[kilo]meter/second expression in the non-metric time system reflects a mixed expression. For [kilo]meters reflects a metric expression and the second of time expressed there is non-metric. I have discussed how fundamental constants may be exact even when they are based on mixed spatial/temporal measurement systems [non-metric and metric]. Even though the 299792.458 kms/sec expression reflects a mixed measurement system, the numerical expression does reflect an actual velocity of light for that given temporal unit. The question, as illustrated in this essay, is to comprehend the nature of the time unit [24h-60m-60s] with regard to a metric temporal unit [10-100-100]. Both time systems of measurement reflect specific distances that light travels in a given temporal framework in relation to the rotational period of the Earth on its axis.

The metric expression for the speed of light in a vacuum is 259020.6837 kms/metric-second. The 1.157407407 conversion factor derives from the speed of light numerical values of both the metric and the non-metric systems.

\[
\frac{299792.458}{259020.6837} = 1.157407407 \text{ conversion factor for non-metric and metric time systems of measurement}
\]

In order to convert the conventional 24-60-60 time system/clock to the metric 10-100-100 time system/clock, for certain constants, one would divide the CODATA numerical value of the physical and chemical constants by a factor of 1.157407407 or 1.339591908, depending upon whether the constant in the formula is squared or not.

The next step in our research would be relating the time-determined fundamental constants to the other fundamental physical and chemical constants that are spatial-determined without an apparent temporal aspect in their units of measurement.

*  
©12 February 2009 Copyrighted by Charles William Johnson. All rights reserved. Reproduction prohibited.

Earth/matriX: Science in Ancient Artwork and Science Today  
P.O. Box 231126, New Orleans, Louisiana 70183-1126

www.earthmatrix.com    www.theschemata.com    www.paleoanimation.us    johnson@earthmatrix.com