The Chemical Floor: The Temperature of Chemistry as a Closed Formula

Martin Scholl — Independent Researcher

It Is All One — Chemistry Notes. July 2026 (working draft)

Abstract. Chemistry has an operating temperature — the few-hundred-kelvin band in which bonds are made and broken — and it is treated as a contingent fact of the terrestrial environment. This note reports that the band is not contingent: it is fixed by three fundamental constants with no chemical input. The Unruh temperature of the electron's own binding curvature in the hydrogen atom is $T = \alpha^3 \cdot m_e c^2 / 2\pi \cdot k_B = 367$ K — the fine-structure constant cubed, the electron rest energy, and Boltzmann's constant, returning the temperature of a warm afternoon. The same constants arrange chemistry's three characteristic energies as a ladder in powers of α: seeing the atom ($\alpha \cdot m_e c^2 = 3.73$ keV, X-rays), operating it ($\frac{1}{2}\alpha^2 \cdot m_e c^2 = 13.6$ eV, the Rydberg), and living in it ($\alpha^3 \cdot m_e c^2 / 2\pi = 32$ meV, the thermal floor). The curvature radius of that binding, and the family-law cell of this series at 300 K, converge independently on the micron — the scale where thermal physics meets molecular machinery. The reaction-rate prefactor every chemist plugs in without derivation, $k_B T/h = 6.3 \times 10^{12}$ s^{-1}, is the same rung read as a clock. None of these is a fitted number; each is an exact identity of standard quantities, re-read through the family law of the It Is All One series as the statement that chemistry runs at the temperature of its own curvature. The factor-of-a-few slack between 367 K and room temperature is stated as a scale match, not a precision claim. The invitation to chemists is explicit: verify each number on a calculator, then decide whether the convergence is coincidence or geometry.

1. One Formula for the Temperature of a Science

Write down three constants of nature: the fine-structure constant $\alpha = 1/137.036$ (the dimensionless strength of electromagnetism), the electron rest energy $m_e c^2 = 511$ keV, and Boltzmann's constant $k_B = 8.617 \times 10^{-5}$ eV/K (the exchange rate between temperature and energy). Combine them the only way that yields a temperature at the electron's third power of α:

$$\mathbf{T = \alpha^3 \cdot m_e c^2 \,/\, (2\pi \cdot k_B) = 367\ K}$$

That is 94 °C — the temperature of a warm kitchen, the band in which every reaction in every living cell and every industrial reactor takes place. No property of any molecule entered. No bond energy, no atomic number, no chemistry at all — only the electron and the strength of its charge. A chemist has spent a career at this temperature without a formula for it; here is the formula, and it contains nothing a chemist would call chemistry.

2. Where the Formula Comes From

The derivation is one line of this series' machinery, walked in the *Metrics of the Living Spaces* note. An electron bound in hydrogen feels its binding as a curvature — an

acceleration $a = c^2/R$ at the binding radius. By the temperature–geometry identity that runs the whole series (Unruh 1976; Gibbons–Hawking 1977; the family law $T \cdot R = \hbar c/2\pi \cdot k_B$), any curvature carries a temperature: $T = \hbar a/2\pi \cdot c \cdot k_B$. Insert the electron's binding acceleration and the result reduces to $\alpha^3 \cdot m_e c^2/2\pi \cdot k_B$. The physical reading, which is the note's contribution and not the arithmetic: **chemistry runs at the temperature of its own curvature.** The bath in which molecules operate is warm to exactly the degree that their binding is curved.

Honesty, at the series' standard: 367 K is not 298 K. The formula fixes the *scale* — it lands the operating temperature of chemistry within a factor of order unity of the constants' prediction, across a family law that spans sixty-one decades of radius from the Hubble horizon to the Planck length and lands every other rung equally close (the electron pair-plasma at 10^9 K, the colour cage at 10^{12} K, the electroweak transition at 10^{14} K). A factor of 1.2 at the chemistry rung is the same quality of landing. The claim is: chemistry's temperature is geometric in origin, not that 367 is 298 to three figures.

3. The α-Ladder: See, Operate, Live

The same three constants arrange chemistry's three characteristic energies as successive powers of α — a staircase whose bottom step is the laboratory:

Floor	Energy	Value	What it does
See	$\alpha \cdot m_e c^2$	3.73 keV	X-rays — the door to resolve the atom; crystallography lives here
Operate	$\frac{1}{2} \cdot \alpha^2 \cdot m_e c^2$	13.6 eV	the Rydberg — ionization; real bonds at 1–5 eV
Live	$\alpha^3 \cdot m_e c^2/2\pi$	32 meV	the thermal floor — 367 K, where bonds breathe

Every chemist knows the middle step (13.6 eV is the first number in the first lecture). Almost none has seen it as the *middle* of a ladder whose rungs are separated by one factor of α each — the electromagnetic gear ratio of the *Metrics* note, expressed once in energy. **Chemistry is the α^3 floor of electromagnetism**: three flights of α below the pair-creation door at $m_e c^2$, two below the atom-seeing door. The science of matter operates on the ground floor of the electron's own building.

4. The Micron, Arrived at Twice

A temperature in this series is also a size — the family-law see-saw. Two independent readings fix the cell of chemistry:

- The curvature radius of hydrogen's binding acceleration: a_0/α^2 = **0.99 µm**.
- The family-law cell at 300 K: 0.3644 mm·K / 300 K = **1.2 µm**.

Two unrelated calculations — one from the atom's geometry, one from the bath's temperature — converge on the micron, the scale at which thermal physics meets the machinery of molecules. Recorded as a curiosity, flagged as such per house rules: the micron is also the size of the smallest free-living cells, and evaluating the family law at body temperature (310 K) gives 1.18 μm — the neighborhood of the mitochondrion. Whether that convergence means anything, or dies in public, the quarantine column exists to hold.

5. The Reaction Clock

Transition-state theory (Eyring 1935) prices every reaction rate with a universal prefactor, k_BT/h, that chemists insert without asking what it is:

$k_BT/h = 6.25\times10^{12}\ s^{-1}$ at 300 K

In this series it is not universal-by-fiat but the **thermal winding rate** — the frequency at which a room's phase closes at temperature T, the family law read as a clock rather than a temperature (the *Radii of the Worlds* note: radius, temperature, door, winding are one number read four ways). Eyring wrote it and called it universal; the geometry says why it is universal — it is the bath's own tick, and every chemical event is timed by it. At the chemical floor of 367 K the clock runs at $7.6\times10^{12}\ s^{-1}$; at body temperature, 6.5×10^{12}.

6. What This Note Claims, and Does Not

Claims. The operating temperature, the characteristic energies, the cell size, and the rate prefactor of chemistry are all fixed by α, m_e, and k_B with no chemical input, and they organize as one geometric structure — the α^3 floor of the electromagnetic rung of the family law.

Does not claim. That any of these is a precision result. Each is an exact identity of *standard* quantities ($\alpha^3 m_e c^2/2\pi k_B$ is not fitted, but neither is it 298 K); the content is the interpretation, not new arithmetic. A sharp chemist will note the factor-of-1.2 slack in Section 1 and the quarantine flags in Section 4, and should. The convergence is offered as a curiosity worth a chemist's afternoon: reproduce the four numbers, then decide.

7. The Invitation

The series' standard is *numbers first, meaning when earned*, and the numbers here need nothing but a calculator: $\alpha^3\cdot(511000\ \text{eV})/(2\pi)$ divided by 8.617×10^{-5} eV/K is 367 K, and it is the temperature of your bench. If that is coincidence, it is a coincidence involving only the electron and its charge, landing on the temperature of life. If it is not, then chemistry has a floor, and the floor is geometry. The Feldtheorie makes no further demand on the chemist than to check the four numbers and hold the question open.

References

W. G. Unruh, Phys. Rev. D 14, 870 (1976); G. W. Gibbons and S. W. Hawking, Phys. Rev. D 15, 2738 (1977); H. Eyring, J. Chem. Phys. 3, 107 (1935); CODATA 2018 values of α, m_e, k_B, a_0; and the notes of this series (the Postulates — the family law; the Metrics of the Living Spaces — the α-ladder and the chemistry rung; the Radii of the Worlds —

radius/temperature/door/winding as one number; Matter Meets Space — the 364 K audit). *(Citations from memory; the literature-verification pass — caveat (ix) of the foundations paper — applies to every one.)*

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