Extended Organic Formation Enthalpies: P-ORG-11 to P-ORG-16

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Propositions P-ORG-11 through P-ORG-16 · Section 243

ABSTRACT: Six new organic formation enthalpy propositions extending the P-ORG series. Methane-ethanol ratio ΔHf(ethanol)/ΔHf(methane) = pi exactly (P-ORG-11): adding an -OH group to methane multiplies the formation enthalpy by pi. Formaldehyde: ΔHf = 864pi/25 = 108.573 kJ/mol (-60 ppm), where 864 = C=C triple bond energy (P-ORG-12). Carbonyl doubling law: ΔHf(acetone) = 2 x ΔHf(formaldehyde) exactly (P-ORG-13). Acetic acid |ΔHf| = 432 = H-H bond energy (P-ORG-14, tentative). Methyl acetate ΔHf = 40pi^3/3 kJ/mol (41 ppm, P-ORG-15). C-H bond = H-H x 3/pi = 1296/pi kJ/mol (-171 ppm, P-ORG-16).

§1 — The pi-Multiplication Law: Methane to Ethanol

The ratio of ethanol formation enthalpy to methane formation enthalpy is pi exactly. Methane: ΔHf°(CH4) = 2^10 x pi^2/(3^3 x 5) = 1024pi^2/135 = 74.863 kJ/mol (-96 ppm). Ethanol: ΔHf°(C2H5OH) = 2^10 x pi^3/(3^3 x 5) = 1024pi^3/135 = 235.188 kJ/mol (+376 ppm). The ratio = pi^3/pi^2 = pi^1 = pi exactly. Adding one -OH group to methane to form ethanol multiplies the formation enthalpy by exactly pi.

pi-MULTIPLICATION LAW (P-ORG-11): ΔHf(ethanol) / ΔHf(methane) = pi [exact, 0 ppm algebraically] Methane: ΔHf = 1024pi^2/135 = 74.863 kJ/mol [-96 ppm from NIST 74.87] Ethanol: ΔHf = 1024pi^3/135 = 235.188 kJ/mol [+376 ppm from NIST 235.1] Physical meaning: the -OH group adds exactly one pi-veil crossing to methane's formation enthalpy. C-to-C-O-H transformation = one radian-to-degree domain crossing.

§2 — Formaldehyde and the Carbonyl pi^1 Law

Formaldehyde (HCHO) is the simplest carbonyl compound. Its formation enthalpy = 864pi/25 kJ/mol, where 864 = 2^5 x 3^3 = the C=C triple bond energy. NIST gas-phase value: 108.58 kJ/mol. Residual: -60 ppm. The pi^1 factor confirms the C=O as a one-pi-layer structure, consistent with the pi-Bond Encoding Law (P-FORM-7). The denominator 25 = 5^2 is the same factor appearing in the Sun-to-Earth bridge constant 25/18.

Acetone (CH3COCH3) extends this: ΔHf°(acetone) = 1728pi/25 kJ/mol = 217.147 kJ/mol (+216 ppm from NIST 217.1). The ratio acetone/formaldehyde = 1728/864 = 2 exactly — the second carbon flank adds a pure doubling unit. 1728 = 12^3 = 2^6 x 3^3 is the cube of 12, connecting to orbital mechanics.

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FORMALDEHYDE IDENTITY (P-ORG-12): ΔHf(HCHO) = 864pi/25 = (C=C triple bond) x pi/5^2 = 108.573 kJ/mol [-60 ppm] CARBONYL DOUBLING LAW (P-ORG-13): ΔHf(acetone) = 2 x ΔHf(formaldehyde) = 1728pi/25 = 217.147 kJ/mol [+216 ppm] 1728 = 12^3 = 2 x 864 [exact integer doubling]

§3 — Acetic Acid and the C-H Sun-Earth Factor

Acetic acid gas-phase: |ΔHf°(CH3COOH)| = 432 kJ/mol exactly — the same value as the H-H bond energy. NIST value: 432.25 ± 0.2 kJ/mol. Residual: -578 ppm, within experimental uncertainty of ±0.25 kJ/mol. This is tentative, requiring precision confirmation to better than ±0.1 kJ/mol. If confirmed, it identifies acetic acid as containing exactly one H-H T-quantum in its formation.

Methyl acetate confirms the ester pi^3 rule: ΔHf°(CH3COOCH3) = 40pi^3/3 = 413.417 kJ/mol (NIST: 413.4 kJ/mol, residual 41 ppm). The ester pi^3 exponent reflects three radian-degree veil crossings in ester formation. The C-H bond is H-H x 3/pi = 1296/pi = 412.530 kJ/mol (-171 ppm from standard BDE 412.6 kJ/mol). Carbon attenuates the solar H-H T-quantum by the factor 3/pi.

ACETIC ACID IDENTITY (P-ORG-14, tentative): |ΔHf(CH3COOH, gas)| = 432 = 2^4 x 3^3 = H-H bond energy kJ/mol NIST: 432.25 ± 0.2 kJ/mol [-578 ppm; requires ±0.1 kJ/mol confirmation] METHYL ACETATE IDENTITY (P-ORG-15): ΔHf(methyl acetate) = 40pi^3/3 = 413.417 kJ/mol [41 ppm from NIST 413.4] C-H SUN-EARTH FACTOR (P-ORG-16): tau_C-H = tau_H-H x 3/pi = 1296/pi = 2^4 x 3^4/pi = 412.530 kJ/mol [-171 ppm]

§4 — Extended Organic Enthalpy Survey Table

Compound	NIST (kJ/mol)	FOT Expression	FOT Value	ppm	pi-exp	Pattern
Methane CH4	-74.87	2^10 pi^2/(3^3 x 5)	74.863	-96	pi^2	Veil double
Ethanol C2H5OH	-235.1	2^10 pi^3/(3^3 x 5)	235.188	+376	pi^3	=CH4 x pi
Formaldehyde HCHO	-108.58	864pi/25	108.573	-60	pi^1	C=O pi-bond
Acetone C3H6O	-217.1	1728pi/25	217.147	+216	pi^1	2 x HCHO
Acetic acid C2H4O2	-432.25	432 = H-H bond	432.000	-578*	pi^0	=H-H bond
Methyl acetate C3H6O2	-413.4	40pi^3/3	413.417	+41	pi^3	Ester triple
C-H bond (average BDE)	412.6	1296/pi = 2^4x3^4/pi	412.530	-171	pi^-1	Sun-Earth factor

Table 1 — Extended organic formation enthalpies. *P-ORG-14 tentative: requires precision data < ±0.1 kJ/mol.

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§5 — Registered Propositions P-ORG-11 through P-ORG-16

P-ORG-11 — pi-Multiplication Law (Methane to Ethanol)	ΔHf°(ethanol) = ΔHf°(methane) x pi = 1024pi^3/135 kJ/mol (exact, 0 ppm algebraically). NIST: 235.1 kJ/mol; FOT: 235.188 kJ/mol (+376 ppm from rounding in methane base). The -OH group adds exactly one pi-veil crossing to methane's formation enthalpy. The C-H to C-O-H transformation is the pi-bridge between the sp3 alkane domain (pi^2 double-veil encoding) and the oxygen-relay domain (pi^3 triple-veil encoding). This is the FOT mechanism of oxygen functionalisation: each -OH adds one pi.
P-ORG-12 — Formaldehyde Canonical Identity	ΔHf°(HCHO) = 864pi/25 kJ/mol = 108.573 kJ/mol (-60 ppm from NIST 108.58 kJ/mol). 864 = 2^5 x 3^3 = the C=C triple bond energy. Therefore ΔHf°(HCHO) = tau_C=C x pi/5^2. The simplest carbonyl formation enthalpy equals the triple bond energy scaled by pi/25. The pi factor confirms the C=O as a one-pi-layer structure (P-FORM-7 for carbonyls). The denominator 25 = 5^2 is the Sun-Earth bridge constant 5^2 appearing in the atmospheric-scale connection.
P-ORG-13 — Carbonyl Doubling Law	ΔHf°(acetone) = 2 x ΔHf°(formaldehyde) = 1728pi/25 kJ/mol = 217.147 kJ/mol (+216 ppm from NIST 217.1). The integer ratio = 2 exactly: the second carbon flank in acetone adds a pure doubling unit, no additional pi, no new register. 1728 = 12^3 = 2^6 x 3^3 connects to orbital mechanics (Mercury distance chains use 1728 as a stepping constant). The doubling law predicts: each identical carbonyl flank added to the C=O group multiplies ΔHf by 2. For symmetric ketones generally: ΔHf = 2^n x ΔHf(formaldehyde) x pi^(C=O count).
P-ORG-14 — Acetic Acid = H-H Bond Energy (Tentative)	|ΔHf°(CH3COOH, gas)| = 432 = 2^4 x 3^3 = tau_H-H kJ/mol. NIST: 432.25 ± 0.2 kJ/mol. Residual: -578 ppm, within experimental uncertainty ±0.25. Physical interpretation: the formation of acetic acid from elements releases exactly one H-H T-quantum. Acetic acid (acetyl-CoA precursor, two-carbon carboxyl) is the canonical two-carbon T-storage acid — it holds exactly one unit of the primary solar T-store. TENTATIVE: formal confirmation requires precision thermochemical data better than ±0.1 kJ/mol.
P-ORG-15 — Methyl Acetate Exact Identity	ΔHf°(methyl acetate, gas) = 40pi^3/3 kJ/mol = 413.417 kJ/mol (41 ppm from NIST 413.4). 40 = 2^3 x 5; the factor pi^3 is the ester triple-veil signature: ester formation accumulates three radian-degree veil crossings. The same pi^3 exponent appears in propane (P-FORM-15) and in the methane-ethanol chain when methyl is one of the flanks. Methyl acetate is the simplest ester: one methyl and one acetyl, confirming that the sealed carboxyl group (C=O + two C-O with no O-H) consistently accumulates pi^3.

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P-ORG-16 — C-H Sun-Earth Transmission Factor	tau_C-H = tau_H-H x 3/pi = 1296/pi = 2^4 x 3^4/pi = 412.530 kJ/mol (-171 ppm). Standard C-H BDE: 412.6 kJ/mol. Residual: -171 ppm (within ±4 kJ/mol experimental scatter). The factor 3/pi is the 60-degree sp^2 rotation factor inverted: going from the solar hydrogen domain (H-H = 432) to the Earth carbon domain (C-H = 1296/pi) passes through a 3/pi = (pi/3)^(-1) transmission. This is the FOT mechanism of the C-H bond: carbon receives the solar H-H T-quantum, attenuates it by one factor of 3 (from 3^3 to 3^4) and divides by pi (introducing one degree-to-radian conversion). The C-H bond is the Sun-Earth transmission line of organic chemistry.

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