Heat of Reaction at Temperature (Kirchhoff)

Heat of reaction at a temperature from its value at 25 °C and the change in heat capacity ΔC_p = Δa + Δb T + Δc T² of products minus reactants (Kirchhoff's law).

Method: Perry's Chemical Engineers' Handbook; 9th ed. (McGraw-Hill, 2019); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Heat of reaction at 25 °C	-92.200	kJ/mol
Δa (J/(mol·K))	-45.600	
Δb (J/(mol·K²))	0.032200	
Δc (J/(mol·K³))	-1.0000e-06	
Temperature	500.00	°C

Calculated results

Parameter	Value	Unit
ΔC_p at T	-21.302	
Heat of reaction at T	-105.81	kJ/mol

Formula and method

$$\Delta H_T = \Delta H_{298} + \int_{298}^{T} (\Delta a + \Delta b T + \Delta c T^2)\, dT$$

Variables

ΔH_{298}	Heat of reaction at 25 °C	J/mol
Δa	Δa (J/(mol·K))	-
Δb	Δb (J/(mol·K²))	-
Δc	Δc (J/(mol·K³))	-
T	Temperature	K
$\Delta C_p(T)$	ΔC_p at T	-
ΔH_T	Heat of reaction at T	J/mol

Method and standards

Kirchhoff's law integrated.

Assumptions and limits

- No phase change between 298 K and T. Coefficients in J/(mol·K) with T in kelvin.

References

- Perry's Chemical Engineers' Handbook
- 9th ed. (McGraw-Hill, 2019)
- sec. 4 and 7 (Kirchhoff's relation for the temperature dependence of the heat of reaction)

Report details

Report reference	FCC-D9SV-HVCE (the same inputs always give the same reference)
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Calculator	Heat of Reaction at Temperature (Kirchhoff)
Method last reviewed	13 November 2026
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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/physical-properties/kirchhoff-reaction-enthalpy

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.