Liquid Heat Capacity by Lee–Kesler Corresponding States

Liquid heat capacity from the ideal-gas heat capacity, critical temperature and acentric factor by Lee–Kesler corresponding states (Perry's Eq. 2-55).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Temperature	46.850	°C
Critical temperature	323.85	°C
Acentric factor	0.27930	
Ideal-gas heat capacity at T (J/(mol·K))	99.270	
Molar mass	88.106	kg/kmol

Calculated results

Parameter	Value	Unit
Liquid heat capacity (J/(mol·K))	154.48	
Liquid specific heat	1.7533	kJ/(kg·K)
Residual heat capacity (J/(mol·K))	55.211	

Notes for this case

- Perry's: about 4 % for organics other than strongly polar or associating ones. Estimate for design; use measured data where they exist.

Formula and method

$$\frac{C_p - C_p^\circ}{R} = 1.586 + \frac{0.49}{1 - T_r} + \omega \left[4.2775 + \frac{6.3(1 - T_r)^{1/3}}{T_r} + \frac{0.4355}{1 - T_r} \right]$$

Variables

T	Temperature	K
T_c	Critical temperature	K
ω	Acentric factor	-
C_p°	Ideal-gas heat capacity at T (J/(mol·K))	-
M	Molar mass	kg/kmol
C_p	Liquid heat capacity (J/(mol·K))	-
c_p	Liquid specific heat	J/(kg·K)
$C_p - C_p^\circ$	Residual heat capacity (J/(mol·K))	-

Method and standards

Lee–Kesler corresponding states.

Assumptions and limits

- Nonpolar or slightly polar organic liquids.
- The liquid state is not checked: make sure T lies between the melting and boiling points. At low reduced temperatures (below about 0.4) a note appears, because the (1 − T_r)^⅓/T_r term then grows large.

References

- Perry's Chemical Engineers' Handbook
- 9th ed. (McGraw-Hill, 2019)
- sec. 2

- Eq. (2-55) (Lee–Kesler) with the 1
- 4-dioxane example

Report details

Report reference	FCC-6GM8-2PTM (the same inputs always give the same reference)
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Calculator	Liquid Heat Capacity by Lee–Kesler Corresponding States
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/lee-kesler-liquid-heat-capacity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.