

Radial Heat Conduction Cheat Sheet

Conduction through cylinders and the lab method

ENGINEERING
CHEAT SHEET

Key equations

Quantity	Equation	Notes
Fourier's law (radial)	$Q = -k (2\pi r L) dT/dr$	Heat flow constant with r in steady state
Temperature drop (cylinder)	$Q = 2\pi k L (T_1 - T_2) / \ln(r_2/r_1)$	T_1 at r_1 , T_2 at r_2
Temperature profile	$T(r) = T_1 - (T_1 - T_2) \ln(r/r_1) / \ln(r_2/r_1)$	Logarithmic, not linear
Thermal resistance	$R = \ln(r_2/r_1) / (2\pi k L)$	Adds in series for layered pipes
Critical radius	$r_{cr} = k / h$	Outer radius where insulation stops helping

Key takeaways

- This sheet uses standard textbook relations for radial conduction. The article is a lab write-up whose equations are images, so confirm details against it.
- In a cylinder the flux falls with radius (area grows), so the temperature profile is logarithmic.
- Steady state means Q is the same through every radius.
- Typical lab approach: heated cylinder, thermocouples at several radii, plot T against $\ln r$, and extract k from the slope.