

Heat Transfer Basics Cheat Sheet

Conduction, convection and radiation

ENGINEERING
CHEAT SHEET

Key equations

Quantity	Equation	Notes
Fourier's law (conduction)	$q'' = -k \, dT/dx$	Heat flows from hot to cold
Plane wall	$Q = k \, A \, (T_1 - T_2) / L$	$R = L / (k \, A)$
Newton's law of cooling	$Q = h \, A \, (T_s - T_\infty)$	h depends on fluid, flow and geometry
Overall coefficient	$Q = U \, A \, \Delta T, \, 1/U = \Sigma R''$	Resistances in series add
Nusselt number	$Nu = h \, L / k$	Convective vs conductive transfer
Convection correlation	$Nu = C \, Re^n \, Pr^m$	C, n, m depend on geometry and regime
Stefan-Boltzman	$q = \epsilon \, \sigma \, A \, (T_s^4 - T_{sur}^4)$	Kelvin; blackbody $\epsilon = 1$
Radiation coefficient	$h_r = \epsilon \, \sigma \, (T_s + T_{sur})(T_s^2 + T_{sur}^2)$	Linearized so it adds to h

Key takeaways

- Three modes: conduction (through solids and still fluids), convection (solid to moving fluid), radiation (electromagnetic, needs no medium).
- Convection is split into natural (buoyancy-driven) and forced (fan or pump).
- Typical h (W/m²·K): gases forced 10–1,000; liquids forced 50–10,000; liquid metals 5,000–40,000 (values from the related forced-convection article).
- Heat transfer sizes heat exchangers, cooling of electronics and engines, building insulation and furnaces.
- The article's equations are shown as images; the forms here are standard textbook equivalents.