# Heat Transfer

## Convection - Dimensional Analysis

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# Introduction

# Forced Convection

$$h = f(D, v, \rho, \mu, k, C_P)$$

These 7 variables with totally 4 basic dimensions of $M, L, t, T$ shall be written as 3 dimensionless groups.

| Variable | Symbol | Unit | Dimensions |
|---|---|---|---|
| heat transfer coefficient | $h$ | $W/(m^2.K)$ | $Mt^{-3}T^{-1}$ |
| thermal conductivity | $k$ | $W/(m.K)$ | $MLt^{-3}T^{-1}$ |
| specific heat | $C_P$ | $J/(kg.K)$ | $L^2t^{-2}T^{-1}$ |
| diameter | $D$ | m | $L$ |
| velocity | $v$ | m/s | $Lt^{-1}$ |
| density | $\rho$ | $kg/m^3$ | $ML^{-3}$ |
| viscosity | $\mu$ | kg/(m.s) | $ML^{-1}t^{-1}$ |