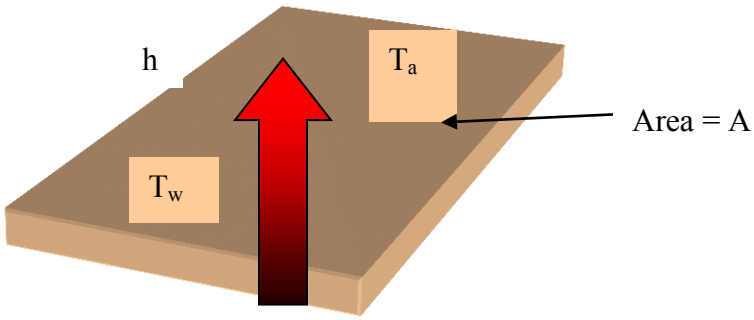
Heat Transfer in Fluids

OBJECTIVES:

1.To study mechanisms of heat transfer in fluids.
2.To determine procedures for calculating heat transfer coefficients in forced and free convection.



q =

Fluid flow on a solid surface can occur as

-- laminar flow
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--direction of flow may be parallel or perpendicular to the solid object.
--there may be influence of the entrance region on the flow.
--properties of the fluid –

--influence the rate of heat transfer.

RATE OF HEAT TRANSFER IN FLUIDS:

$q=hA(T_W-T_a)$

where h = convective heat transfer coefficient, $W/m^2 C$

h = f (

The convective heat transfer coefficient is determined by dimensional analysis.

A series of experiments are conducted to determine relationships between following dimensionless numbers.

Nusselt Number = $N_{Nu} = hD/k$
Prandtl Number = $N_{Pr} = \mu c_p/k$
Reynolds Number = $N_{Re} = \rho vD/\mu$

where

D = characteristic dimension
k = thermal conductivity of fluid
v = velocity of fluid
c_p = specific heat of fluid
ρ = density of fluid
μ = viscosity of fluid