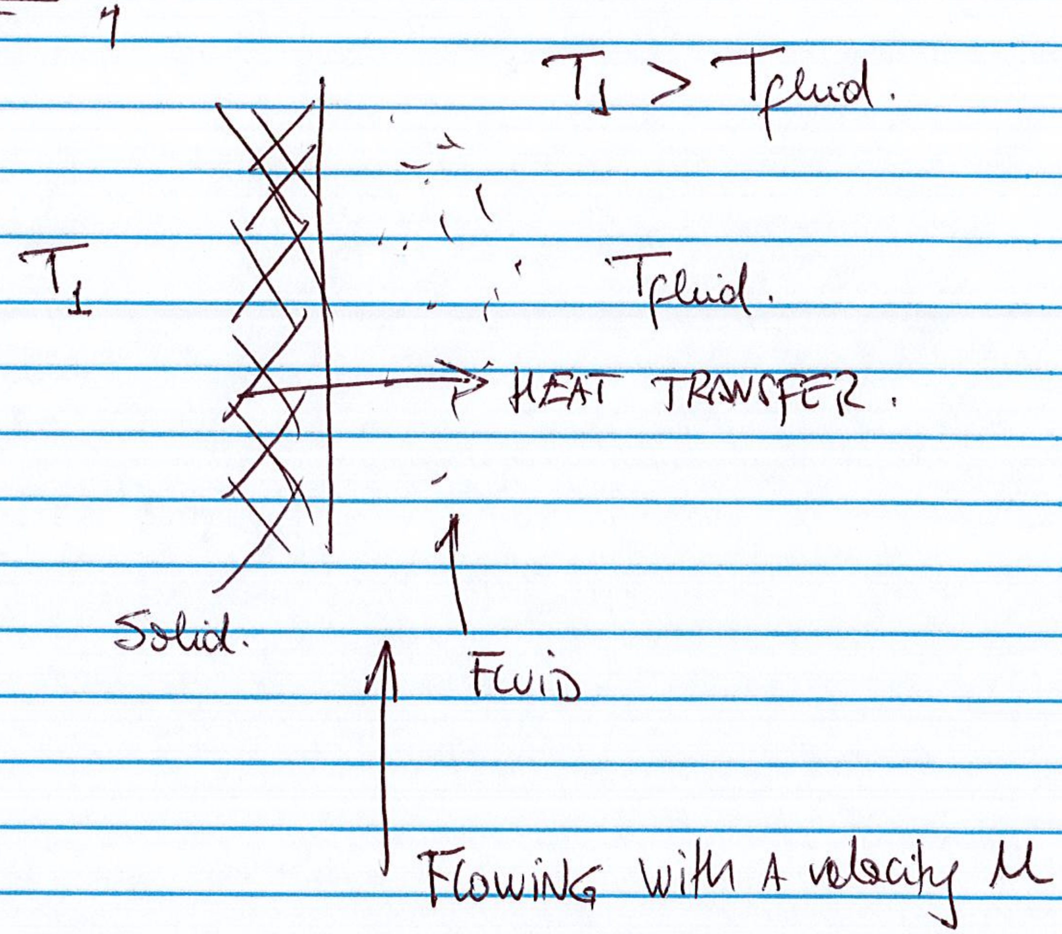
LECTURE 1-18-2018

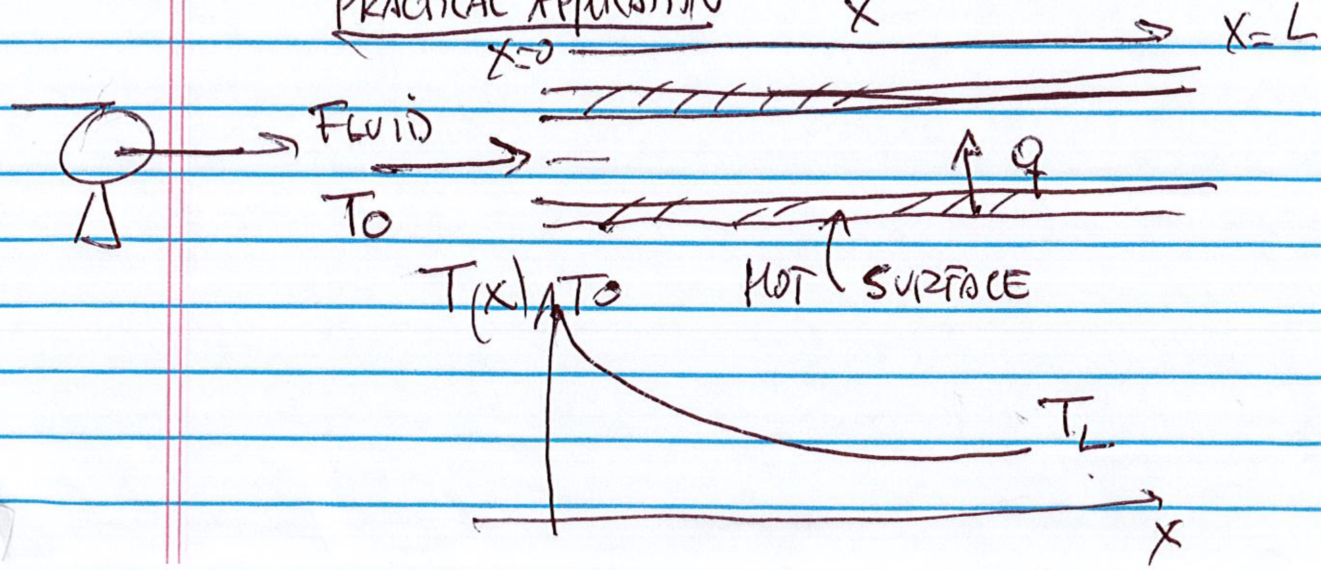
DIFFERENCE BETWEEN CONVECTION AND RADIATION

CONVECTION

$T_1 > T_{fluid}$.

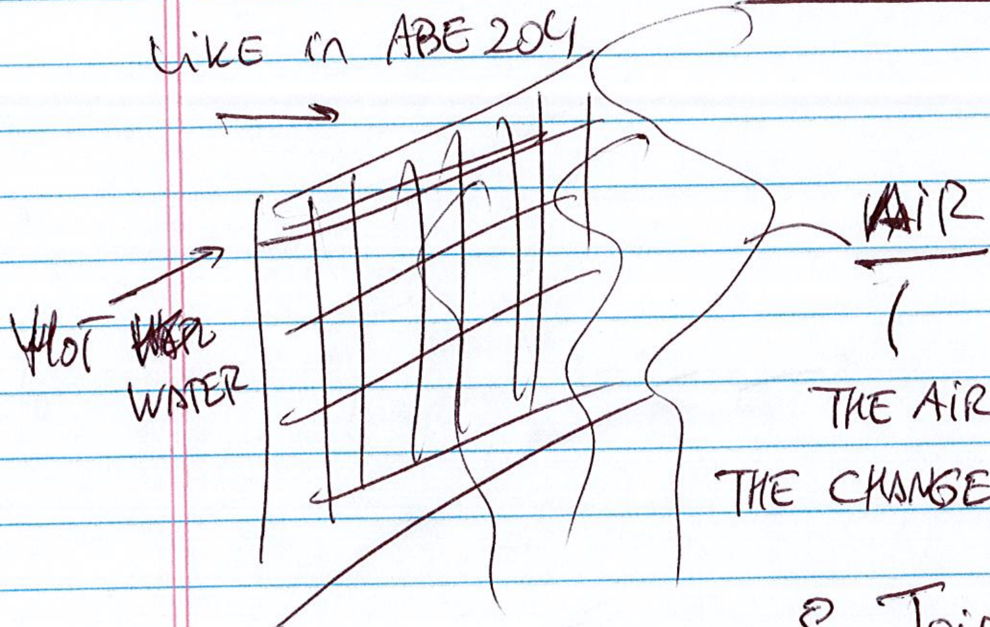


PRACTICAL APPLICATION

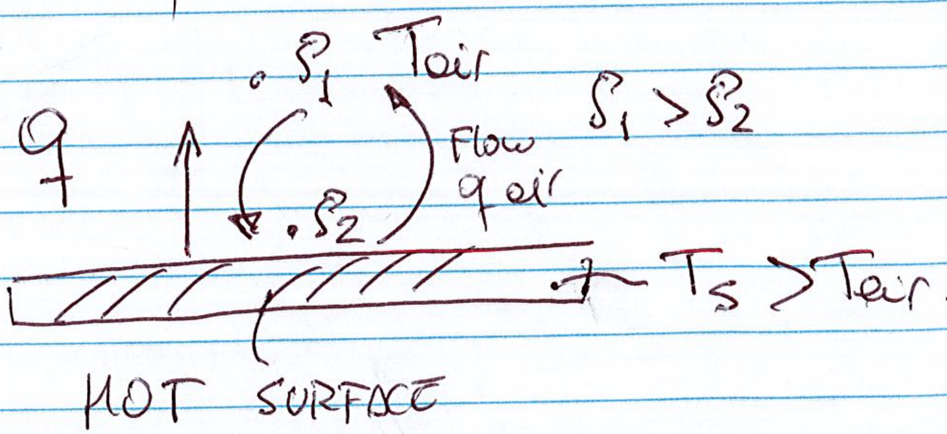


= TO HAVE CONVECTION WE NEED A FLUID MOVING

- We can move the fluid by a pump, fan, etc. FORCED CONVECTION



THE AIR IS MOVED BY THE CHANGE IN DENSITY



NATURAL CONVECTION

$$q = hA[T_s - T_{air}]$$ NEWTON EQUATION

h ← heat convection coefficient.

HEAT TRANSFER

- CONDUCTION $q = -kA\frac{dT}{dx}$ FOURIER LAW

THERMAL CONDUCTIVITY

- CONVECTION

$$q = hA[T_s - T_{fluid}]$$

Newton Equation

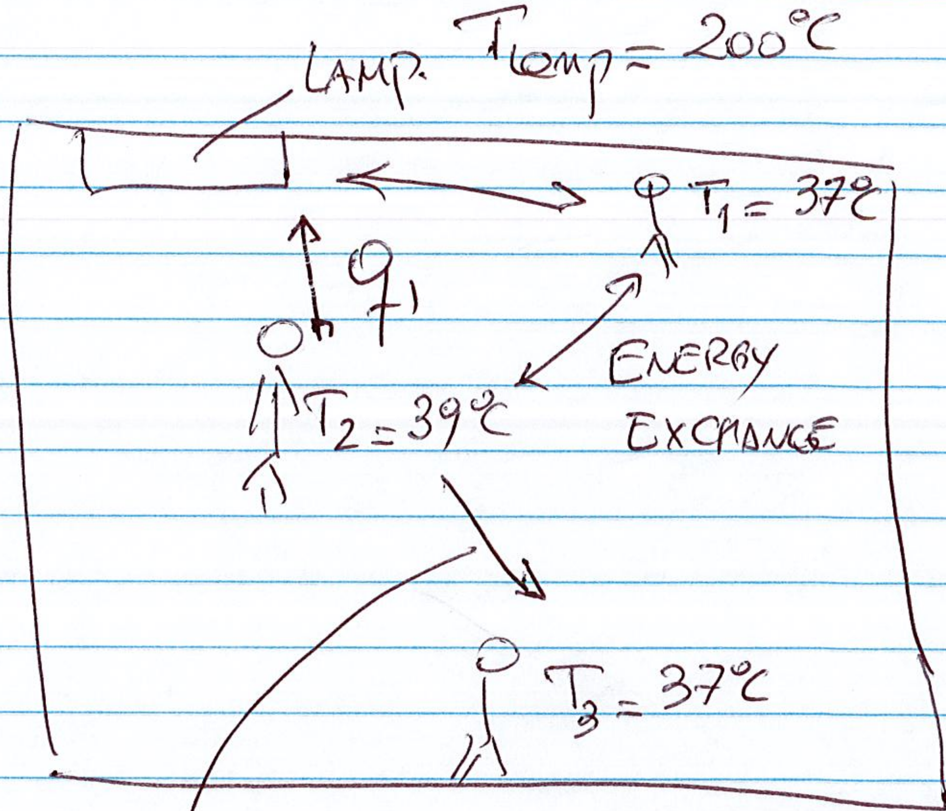
h is not unique, it will depend on the system

if u_{fluid} is large $\Longrightarrow$ h is large.

- By now we will use values of h given

- LATER ON WE will learn how to calculate h

RADIATION



IF AIR IS NOT MOVING WE ARE GOING TO HAVE AN ENERGY THAT IS RADIATION, WE DON'T A MEDIUM TO TRANSFER THE ENERGY

→ stefan Boltzman

$$q_{1\to 2} = \sigma A_2 \left[T_{lamp}^4 - T_2^4 \right]$$

Area of person 2

(5)

AS LONG WE HAVE A "BODY" WITH A TEMPERATURE LARGER THANT 0K THE BODY will EMITE RADIATION WITH A POWER OF σT^4

Myself will emite radiation with a power of $5,67\times10^{-8}\,\frac{W}{m^2K^4}\times(37+273)^4$

$$\boxed{\text{SUN}\quad 5,67\times10^{-8}\,\frac{W}{m^2K}\,(5,600\,K)^4}$$

$$q_{12} = \sigma A_1 \underbrace{(T_1^4 - T_2^4)}$$

$$(T_1^2 - T_2^2)(T_1^2 + T_2^2)$$

$$(T_1 - T_2)(T_1 + T_2) \quad h_{eff}.$$

$$q_{12} = \overbrace{\sigma A_1 (T_1 + T_2)(T_1^2 + T_2^2)}(T_1 - T_2)$$

(6)

$$q_{12} = h_{eff} [T_1 - T_2]$$

$$h_{eff} = \sigma A_1 (T_1 + T_2)(T_1^2 + T_2^2)$$

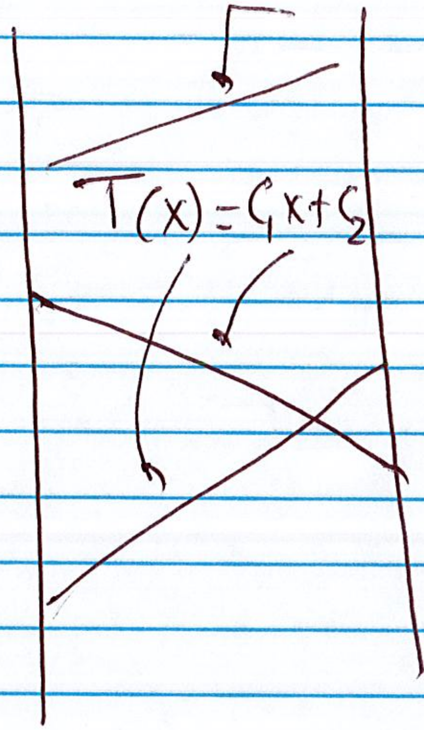
T in Kelvins

$$\frac{K}{\rho C} \frac{d^2T}{dx^2} = 0$$

$$\frac{d^2T}{dx^2} = 0$$

By integration $\frac{dT}{dx} = C_1$

By integration $T(x) = C_1 x + C_2$



we have ∞ straight lines that satisfy the equation

$$T(x) = C_1 x + C_2$$

how do you know what is the right one?

WE NEED TO KNOW BC

$$\begin{cases} \dfrac{d^2T}{dx^2} = 0 \\ x = 0 \quad T = T_1 \\ x = L \quad T = T_2 \end{cases}$$

$$\frac{d^2T}{dx^2} = 0 \Longrightarrow T(x) = C_1 x + C_2$$

at $x=0$ $\quad T(x=0) = T_1 = C_2$

$$T(x) = C_1 x + T_2$$

at $x=L$ $\quad T(x=L) = T_1 = C_1 L + T_2$

$$C_1 = \frac{T_1 - T_2}{L}$$

$$\boxed{T(x) = \frac{T_1 - T_2}{L} x + T_2} \qquad (8)$$