

GATE 2024



प्रचण्ड Batch

HMT

MODES OF HEAT TRANSFER

TIME- 4:30PM

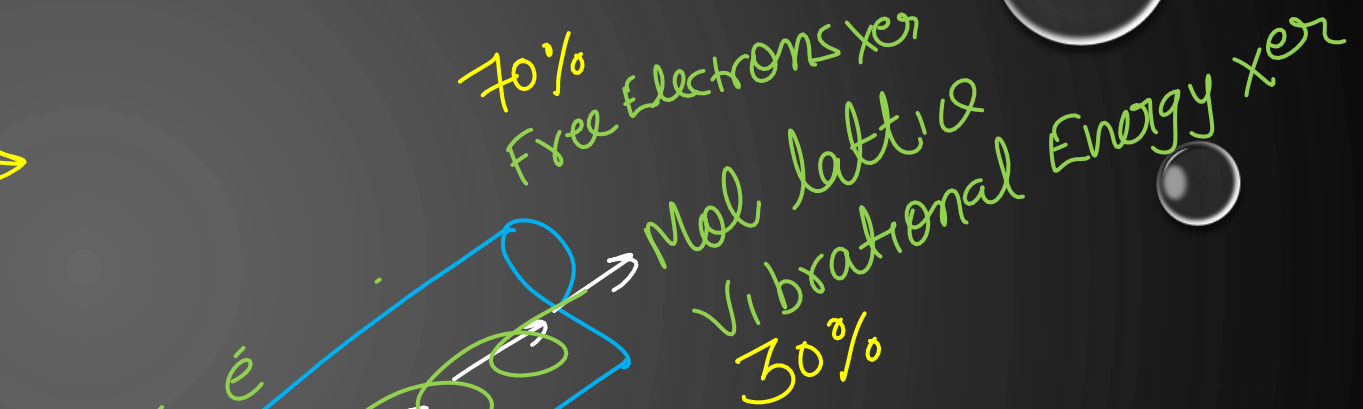
YOGESH SIR



Modes of Heat transfer →

- ① Conduction
- ② Convection
- ③ Radiation

Conduction →



Solid which is good conductor of Electricity well Also a good conductor of Heat

Exception → Diamond

$$k_{\text{Diamond}} = 2300 \frac{\text{W}}{\text{m}\cdot\text{K}}$$

Conduction

30%

Mol lattice Vibrational
Energy xer



Phononic Conduction

70%

Free Electrons
xer

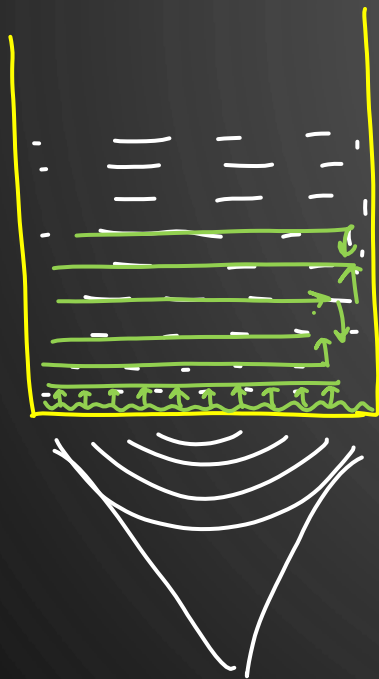


Electronic Conduction



Conduction
is a Micro
scopic
Phenomenon

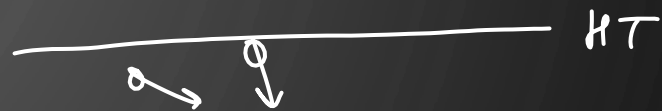
Conduction in Liquids →



Condⁿ Also occurs in liquids
When high velocity high temp
Molecule comes in contact with
low vel, low temp mol

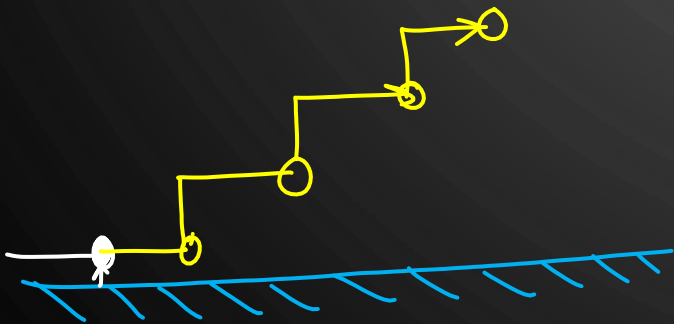
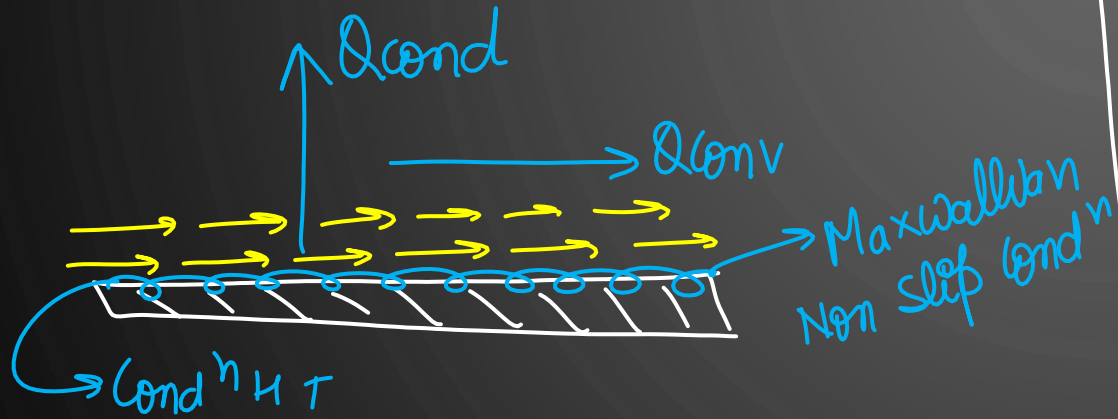
They exchange their heat & this
Phenomenon is known as Condⁿ in
Liquids.

xxx



High vel & High Temp Mol collides
with Low vel Low temp mol
→ Conduction in Gases.

Convection →

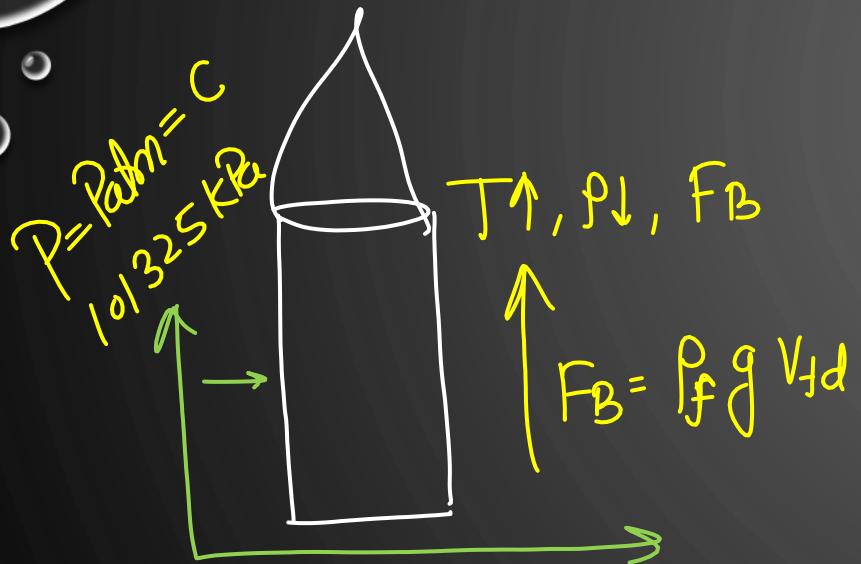


In convection HT, HT by Q_{cond} is transported by fluid (flowing)

* Convection is a Transport Phenomenon.

Convection

- Natural Convection (Free convection)
- Forced Convection



$$PV = nRT$$

$$P = \frac{n}{V} RT$$

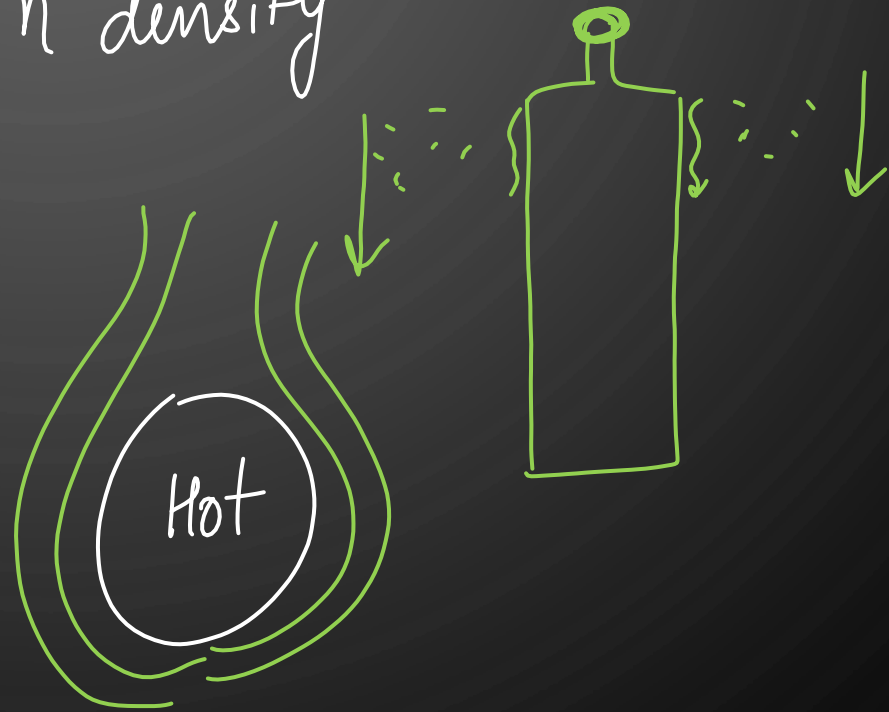
$$P = \rho RT$$

$$\rho \propto \frac{1}{T}$$

$$T \uparrow, \rho \downarrow$$

$$T \downarrow, \rho \uparrow$$

If the Flow takes place Naturally due
 density Density Difference i.e. due to
 Buoyancy Forces arising by change
 in density





When convection $H \cdot T$
Takes place with the help
of some external Agent
i.e. forcefully then it
is known as forced conv'n.

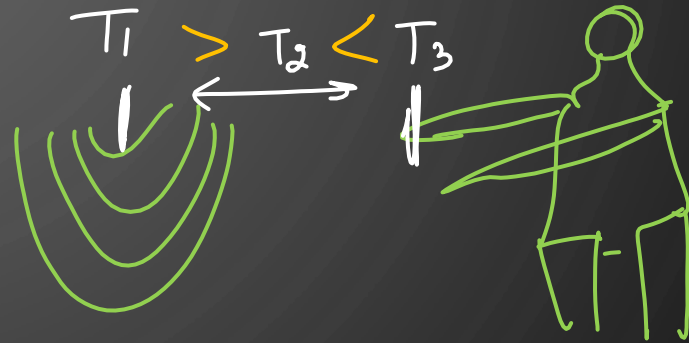


Bulk Displacement of fluids forced
→ Macroscopic phenomenon

Radiation →

Radiation is the Mode of HT which do not require Any Material, and hence Radiation Heat Transfer take place with the help of EMT, wave Propagation, which Travel with the speed of light.

Radiation HT Dominates over Conduction & Convection when temp diff is very high



All bodies at All temperatures emit thermal Radiation except the body is a 0K

at 0K → Mol Become Motionless

Steady State Conduction-1

4:30 PM

