

Geography Foundation

1/10/24

Climateology

12:00 - 2:15 Lec 2

◦ Atmosphere, its importance & structure ✓

Atmospheric Layering

- 1] Based on Density stratification
- 2] Based on Relative mixing of Gases
- 3] Layering based on Temperature Patterns

◦ Atmosphere receives much of heat from Insolation however insolation does not heat the atmosphere directly (Incoming solar Radiation = Insolation)

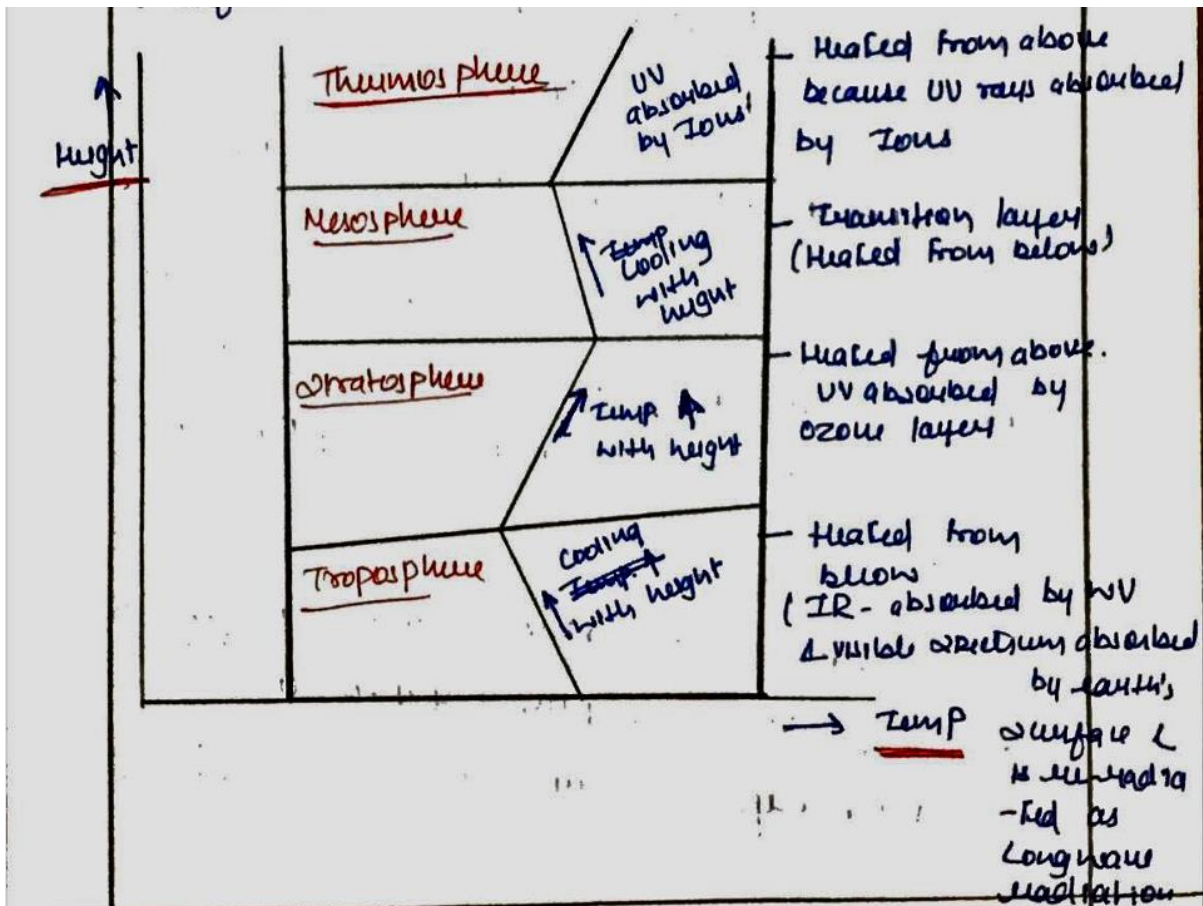
o The insolation that enters Earth's atmosphere (1800 km)  
is UV, visible spectrum (0.4  $\mu$  - 0.7  $\mu$ ) &  
Infrared rays. UV rays are largely absorbed

by ozone layer (stratosphere). Visible spectrum  
& do not get absorbed by atmosphere & ∴  
called as Atmospheric window of Insolation.

∴ Infrared - partly absorbed by water vapour  
in lower atmosphere but much of it hit the earth's surface & earth  
surface absorb it.

- o visible spectrum - 40-42%
- o Infrared rays - 48-50%

} % of  
Energy entering  
the atmosphere



## 1] Troposphere

- Heated from below
- IR absorbed by  $H_2O$  in lower layers & lower layers are also heated by the outgoing terrestrial radiation which are low energy & long waves & which are absorbed by  $CH_4$ -dust particles, pollutants,  $CO_2$  etc
- There is a linear rate of cooling with height -  $6.4^\circ C/km$  -  $6.5^\circ C/km$  called as normal



## Lapse Rate (NLR)

(Hypothetical - for ideal steady state atmosphere (balance of atmosphere) - but fact is atm is always trying to balance & is not actually in balance)

o The actual rate of cooling of atmosphere with height is called as ELR (Environmental Lapse Rate). - This is variable (unlike NLR) all to season, nature of surface, day or night time

◦ Lapse Rate  $\begin{cases} \rightarrow \text{NLR (Constant \& Hypothetical)} \\ \rightarrow \text{ELR (Variable)} \end{cases}$

◦ All Atmospheric Processes are because of ELR  
 $\& \text{ not NLR}$

◦ The Lapse Rate of the Troposphere is the reason why we have Weather Phenomenon  
Lapse Rate makes possible rising air

◦ Lapse Rate of the Troposphere  $\& \text{ consequence}$   
in terms of rising air makes the Troposphere  
the Turbulent layer - with mixing of air  $\&$   
all the atmospheric phenomena we see

◦ The upper boundary of Troposphere is a  
layer called as Tropopause (Transition -  
layer)  
where fall of temp. is stopped  $\&$  layer  
maintains same temperature  $\therefore$  it is called  
as Isothermal Layer. The Isothermal layer  
acts like a lid  $\&$  won't allow for air to rise  $\&$   
escape into stratosphere.  $\therefore$  All weather phenom  
remains within Troposphere  
C: Troposphere - Weather Layer

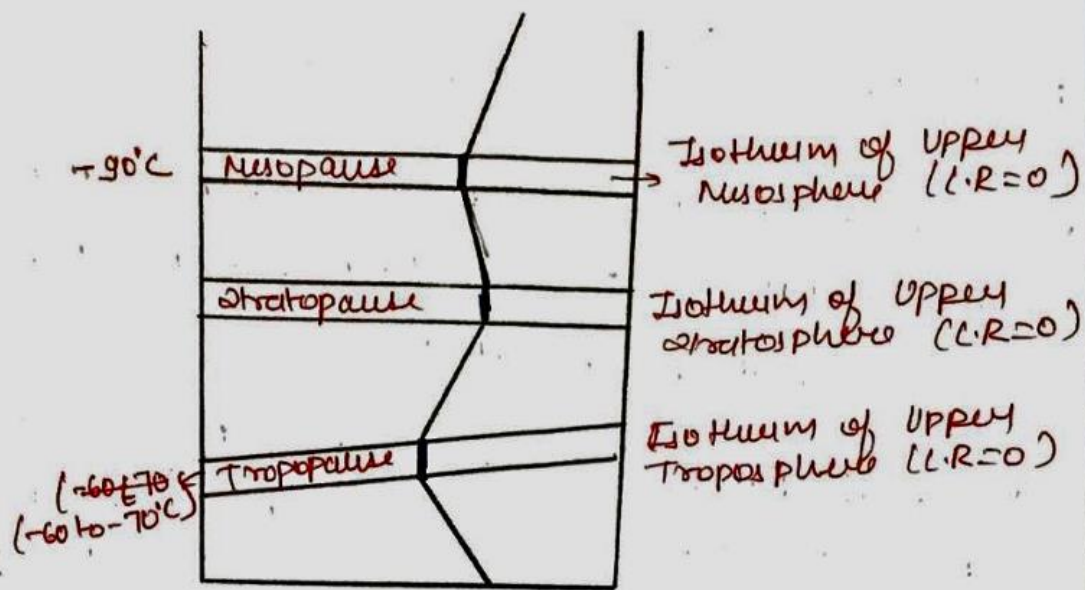


Fig - Isothermal Layers

## 2] Stratosphere -

- It has large scale inversion ∴ called as High Inversion Layer of atmosphere
- Stratosphere is heated from above
- It is heated because of UV absorption of Ozone layer
- Ozone is present from about 15km above



surface to about 40-50 km above surface but  
it is maximum 14-25 km above surface

• The stratosphere does not have much mixing  
of air, however it has very strong winds  
called as stratospheric winds

• The stratosphere has some amount of moisture  
which can form clouds but those clouds  
do not form cause rainfall called as Deard/  
Nacreous clouds. & they are very bright &  
hence also called as Mother of Pearl clouds

◦ Stratosphere has continuous formation & destruction of the ozone, part of process called as Chapman cycle.

### 3] Mesosphere

◦ A Transition zone

◦ Neither has ion, nor the ozone  $\therefore$  is heated by below by warm layers of upper

stratosphere

◦ Mesosphere can also have some water vapour

↳ Clouds = noctilucent clouds (do not cause rain & shine at night time)



◦ Mesopause } layers of Temp. inversion  
Tropopause  
& Stratopause

◦ Mesopause - is one of coldest layer of Atmosphere at temp. of about  $-90^{\circ}\text{C}$  to  $-100^{\circ}\text{C}$   
[Tropopause - Temp of around  $-60$  to  $-70^{\circ}\text{C}$

4] Thermosphere -

◦ It has ions  $\therefore$  synonym with Ionosphere  
of atmosphere.

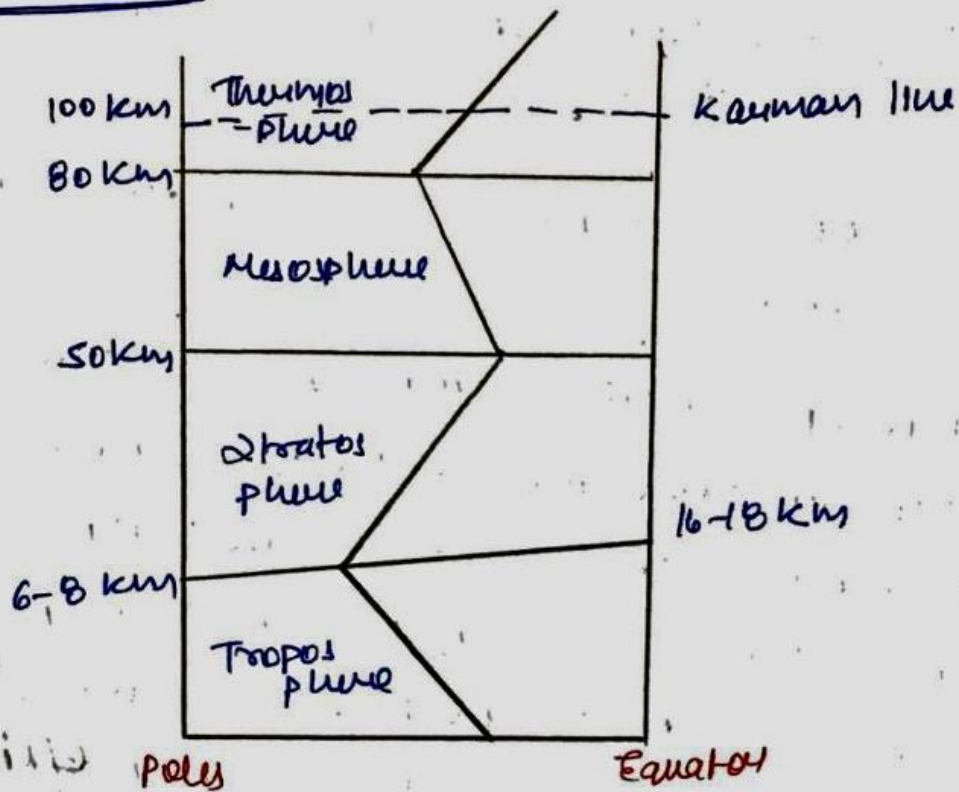
◦ While Thermosphere can have very high temp. it has negligible heat  
[Temp = measurement of relative hotness or coldness

◦ Thermosphere is extremely ionized, it has very less molecules & hence mass of thermosphere is very less. Hence thermosphere has very less amount of heat energy

◦ At Ionosphere, we have diff. layers-

G		= Appleton layer
F		= short wave of Radio waves (Reflect)
E <sub>2</sub>		= called as Kennelly Heaviside layer reflect medium wave of <u>Radio communication</u>
E <sub>1</sub>		
D		= present in day time = Disappear in night time
,		= used for long wave radio communication

## Relative Height of - Atmosphere



◦ Troposphere - lesser height at poles & higher height at equator, because at equator, there is convection which pushes Troposphere at higher heights



