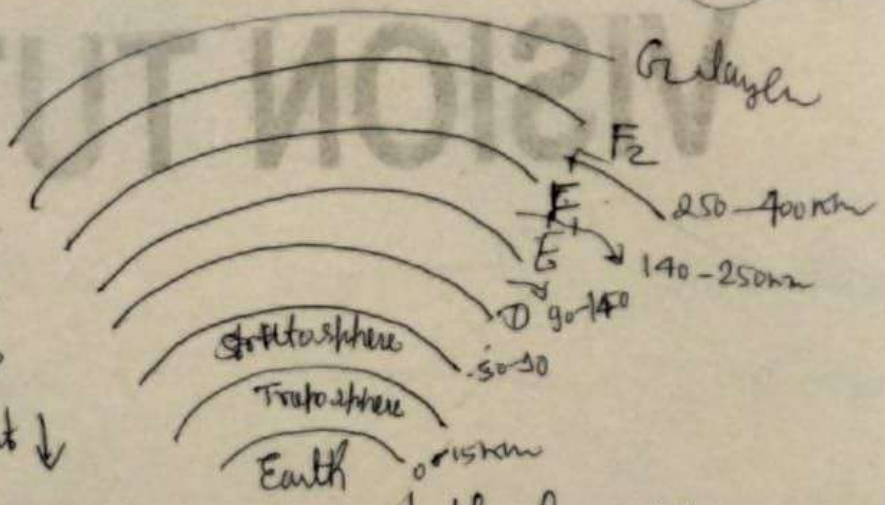
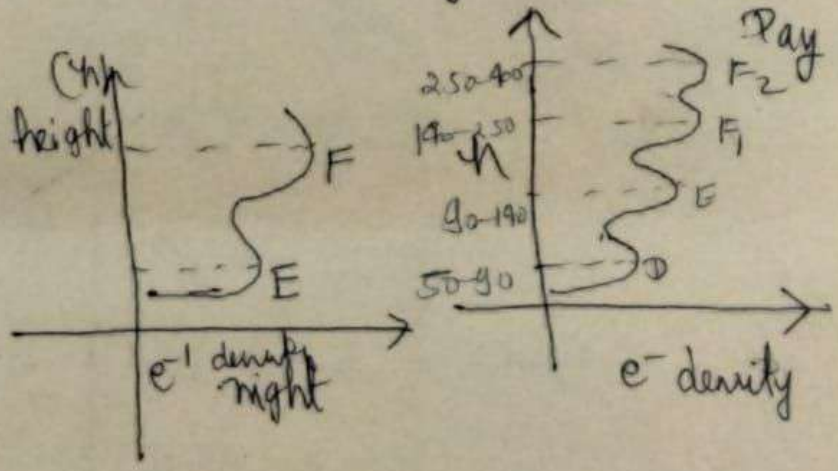
Structure of Ionosphere →



Troposphere → × With increase in height temp ↓
× water vapour component ↓
→ suitable for VLF, HF, VHF

Ionosphere →
- D → Ionised by photoionisation of oxygen molecule.
- E → Due to X-ray ionisation.
- F_1 → 300 km
- F_2 → 400 km

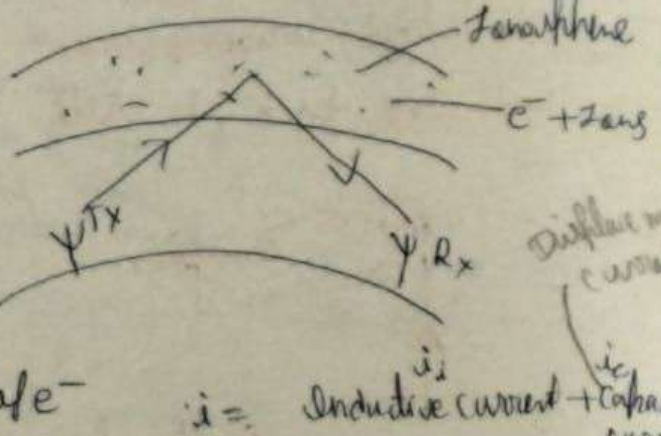


Critical freq^n → (i) if $f > f_c$ then wave will penetrate ionosphere no reflec

(ii) if $f \leq f_c$ then then wave wi reflect back by ionosphe

Sky wave propagation →

Refractive Index of Ionosphere →



Ions + e^{-1} are responsible for reflection.

mass of ions >> mass of e^{-1}

velocity of ions << velocity of e^{-}

i = Induction current + Capacitive current

Let Electric field →

$E = E_m \sin\omega t$

$F = eE$ — (force exerted by electric fel

$ma = eE$

$m\frac{dv}{dt} = eE$

$dv = \frac{eE}{m}\,dt$

$dx = \frac{eE}{m}x$

$dv = \frac{e}{m} \times E_m \sin\omega t\, dt$

$$\boxed{v = \frac{-e}{m} E_m \times \frac{\cos\omega t}{\omega}}$$

$i_i = Nev$ (No. of e^{-1}/m^3)

$i_i = -Ne \times \frac{e}{m\omega}\cos\omega t\, E_m$

$i_i = \frac{-Ne^2}{m\omega} E_m \cos\omega t$

$i_c = \varepsilon_0 \frac{\partial D}{\partial t}$ (Electric field density), $D = \varepsilon_0 E$

$i_c = \varepsilon_0 \frac{\partial E}{\partial t}$

$i_c = \varepsilon_0 \times E \cos\omega t\, \omega$

$i = i_i + i_c$

$i = \frac{-Ne^2}{m\omega} E_m \cos\omega t + \varepsilon_0 E \omega \cos\omega t$

$i = E_m \cos\omega t\, \omega \left[\varepsilon_0 - \frac{Ne^2}{m\omega^2}\right]$

Let $\epsilon = \varepsilon_0 - \frac{Ne^2}{m\omega^2}$

we know that $\mu = \sqrt{\frac{\epsilon}{\varepsilon_0}}$

$\mu = \sqrt{\frac{\varepsilon_0 - \frac{Ne^2}{m\omega^2}}{\varepsilon_0}}$

$\mu = \sqrt{1 - \frac{Ne^2}{m\omega^2\varepsilon_0}}$

$$\boxed{\mu = \sqrt{1 - \frac{81N}{f^2}}}$$

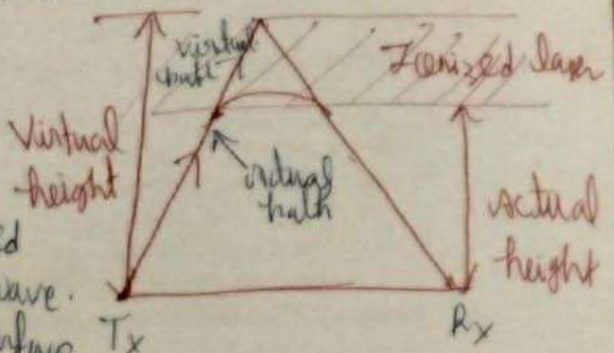
$\varepsilon_0 = 8.85 \times 10^{-12}$ F/m

$m = 9.1 \times 10^{-31}$ kg

not true height

Virtual height →

It is defined as "the effective height by which the radio waves are reflected from the ionosphere around the earth curvature.



* The actual path of the wave in the ionized layer is a curve due to refraction of wave.
* The height from this curve to the ground surface is known as actual height.

$$h = \frac{CT}{2}$$

Distance = Time × velocity

$$2h = C \times T$$

$$h = \frac{CT}{2}$$

Where T is time measure to take one round trip

Skip distance → It is the shortest distance from a transmitter measured along the surface of the earth at which a sky wave of fixed freqⁿ will be returned to the earth.