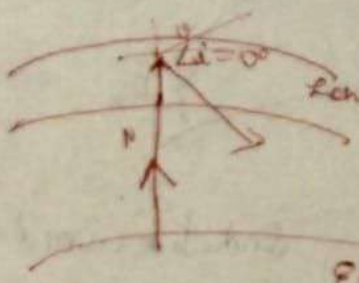
Critical freqn → ⓒ f_c

At vertical incidence, maxm freqn that is reflected by ionosphere and came back to earth is known as critical freqn.



Angle of incidence → the incident wave which make angle with axis of normal is known as angle of incidence

$\angle i = 0$

we know that → $\mu = \sqrt{1 - \frac{81N}{f^2}} = \frac{\sin i}{\sin r} \rightarrow (1)$

at
Since $i = 0°$, $f = f_c$

$\mu = \frac{\sin 0}{\sin r}$

$\mu = 0$

$\sqrt{1 - \frac{81N}{f_c^2}} = 0$

$1 - \frac{81N}{f_c^2} = 0$

$1 = \frac{81N}{f_c^2}$

$f_c = \sqrt{81N}$

$\boxed{f_c = 9\sqrt{N}}$

$f_{max} > f_c$

Maximum usable freqn →

Maxm freqn that comes back to the atmosphere after, reflection at any angle of incidence

$\mu = \frac{\sin i}{\sin r} = \frac{\sin i}{\sin 90°}$ ($r = 90°$)

$\mu = \sin i$

$\sqrt{1 - \frac{81N}{f_{max}^2}} = \sin i$

$1 - \frac{81N}{f_{max}^2} = \sin^2 i$

$1 - \sin^2 i = \frac{81N}{f_{max}^2}$

$\cos^2 i = \frac{81N}{f_{max}^2}$

$\cos i = \frac{9\sqrt{N}}{f_{max}}$

$\boxed{f_{max} = 9\sqrt{N} \sec i}$