

Important slides for Exam

Source of atmospheric ionization

1 Galactic cosmic rays :

- They are main source of ionization over sea surface and 1-2 kilometres above land surface.
- Ionization rate between 1.5 to 2 ion-pairs/cm

2. Ground radioactivity:

- Ionization due to α , β , and γ radiations from earth surface.
- Ionization due to radioactive gases and their daughter products.
- Ionization rate vary up to 1-2 order.

Ohms law

- $i = E \lambda$
- E – Electric field
- λ - air conductivity
- I - air earth current

Effect of fog on Atmospheric electric field

- Atmospheric electric parameters show significant variations, few hours before the formation of fog becomes visible. The same is true for the dissipation of fog.
- Observations show increase in electric field and decrease in air conductivity during widespread fog.

Electrical structure of thunderclouds

- Tripole charge structure.
- Positive charge above, Negative charge below, Positive charge pocket in the base.

Charging Mechanisms

1. Convective
2. Inductive
3. Non inductive

Types of Lightning

- i) Intra-cloud discharges
- ii) Cloud-to-ground discharges
- iii) Cloud-to-ionosphere discharges
(sprites, elves, blue jets)

Lightning Initiation

- Maximum electric field measured in thunderstorms are 100 to 200 x kV/m.
- Required breakdown field of the order of 1000 kV/m.
- Presence of hydrometers can reduce breakdown voltage to 250 to 950 kV/m.

1. Conventional breakdown theory

According to this hypothesis lightning is initiated via emission of positive corona from the surface of precipitation particles highly deformed by strong electric field coupled with some mechanism whereby the electric field is locally enhanced.

2. Runaway breakdown theory

The runaway breakdown requires the presence of initial electron with energy exceeding 0.1 to 1 mev. Such energetic electrons are produced in thunderclouds via collision of very high energy (10^{15} eV to 10^{16} eV or greater) cosmic ray particles with atmospheric nuclei.

Gross features of discharges

- ❑ **Currents flowing in a discharge 20,000 to 200,000 amp.**
- ❑ **Charge destroyed in a single discharge ~ 20 C.**
- ❑ **Electrical moment destroyed in a single discharge ~ 100 C km.**
- ❑ **Energy of a flash - $10^9 - 10^{10}$ J.**