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NET, IAS, State-SET (KSET, WBSET, MPSET, etc.), GATE, CUET, Olympiads etc.: Stability

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Atmospheric Stability & Instability [https://www.youtube.com/watch?v=qArxR0K0FT8]

Stability: When the dry adiabatic lapse rate of ascending dry air is higher than the normal lapse rate and if it is not saturated and does not attain dew point, it becomes colder than surrounding air at certain height with the result it becomes heavier and descends. This process causes stability of atmospheric circulation due to which vertical circulation of air is resisted;

When the ascending parcel of air reaches such height that its temperature equals temperature of surrounding air, its further upward movement is stopped. Such air is said to be in the state of neutral equilibrium.

Mechanical Instability: It is a case of abnormal conditions when the normal lapse rate is exceptionally very high (15 degree C to 35 degree C per 100 m.) . The upper layers are cold and denser than the underlying layers, therefore, cold and denser upper layers automatically descend. Such situation is called mechanical instability and helps in the formation of tornado.

Conditional Instability: When a parcel of air is forced to move upward, it cool at dry adiabatic lapse rate (10 degree C per 1000 m or 5.5 degree F per 1000 feet) , normal lapse rate is 6.5°C per 1000 m. The air is initially forced to move upward but rises automatically due to its own properties after condensation point is reached.

Dew

- The earth receives radiation from the sun during day and reflects in the night.
- When the earth reflects the heat the surface becomes cool and the air around it also becomes cooler.
- Then the water vapour in the air condenses and then is called 'dew' .
- But there are two preconditions: there must be vapour in the air; and the surface must be cool enough to condense that water vapour.
- that's why after rainy season, the water vapour content in the air increases.

- After the rainy season in the winter, the air becomes cool and therefore adequate dews are formed in Oct. Nov.

Fog

- It is a special type of thin cloud consisting of microscopically small water droplets which are kept in suspension in the air near the ground surface and reduces horizontal visibility.
- Fog is generally associated with inversion of temperature and occurs in the morning hours but sometimes also continue till noon.
- When there is a mixture of smoke and fog, it becomes Smog.

Radiation Fog

Indian Monsoon [<https://www.youtube.com/watch?v=7A5flepzZYk>]

- Radiation fog is formed when warm and moist air lies surface. Due to this situation overlying warm and moist air cools and the dew point is reached, with the condensation of water vapour around hygroscopic nuclei (dust particles and smokes) forms numerous tiny water droplet and thus fog is originated.
- When fog is combined with sulphur dioxide it becomes poisonous and causes human deaths. Such fog is called urban smog.

Advectional Radiation Fog

- The fog formed due to mixing of warm moist air and cold air due to arrival of warm and moist air over cold ground surface is called advectional radiation.
- The fogs occurring over sea surfaces are called sea fogs, which are generally formed, near the coastal areas frequented by cold ocean currents.

Steam Fogs

Steam fogs are in fact advectional fogs, which are formed when cold air moves from land over oceanic surface and there is evaporation of large quantity of moisture from water surface to saturate the overlying cold air. They are also called evaporation fogs.

Upslope or Hill Fogs

It originates when continental warm and moist air rises upslope along the hill slopes because the rising air is saturated due to cooling and condensation of moisture around hygroscopic nuclei and forms fogs which cover the lower segments of hill slopes.

Frontal Fogs

Fronts are formed when two contrasting air masses (warm and cold air masses) converge along a line. Warm air is pushed upward by cold air and hence overlying warm air is cooled from below due to underlying warm air is cooled from below due to underlying cold air and fogs originate after condensation.

Frost

- When the temperature falls below freezing point, it forms a frost. Temperature either 0°C or less, than the water droplets take the form of ice cubes.

Rime

- It is a deposit of white opaque ice crystals formed by the freezing of super cooled water droplets on the surface below 0°C .