**TDC 1st Year 2nd SEM (Paper Code-2026)**

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**Atmospheric Moisture – Evaporation, Humidity, Condensation, Fog, Precipitation Types, Stability and Instability**

**Evaporation:**

Evaporation is a form of vaporisation that usually happens on the surface of liquids and it involves the transition of the liquid particles into the gaseous phase. Therefore, this process is said to involve a change in the state of matter of liquids. The surrounding gas must not be saturated with the substance which is evaporating. They transfer energy to each other as the molecules of the liquid collide, depending on how they collide with each other. The liquid particles will generally escape and enter the surrounding air as a gas when a molecule near the surface consumes enough energy to overcome the vapour pressure. The energy extracted from the vaporised liquid as evaporation occurs will decrease the temperature of the liquid, resulting in a process known as evaporative cooling.

**Humidity**

Humidity is the amount of water vapour in the air, which makes hot temperatures even more unbearable than they already are. Humidity is actually a broad term, and it can describe different types of humidity in different ways.

Humidity is an important thing which affects weather and climate as well as global climate change. Humidity also affects indoor environments and according to the humidity storing of books, clothing and other important items in our house can be done.

**Condensation**

Condensation is the process through which the physical state of matter changes from the gaseous phase into the liquid phase. For example, condensation occurs when water vapour (gaseous form) in the air changes into liquid water when it comes in contact with a cooler surface. When the water in the air comes in contact with a cold surface, it condenses to form water droplets. The opposite of condensation is evaporation reaction. Again, (i) Condensation is when a gas turns to a liquid. (ii) Condensations have been defined to include those reactions in which two molecules are joined with loss of water. (iii) Condensation is defined as the removal of heat from a system in such a manner that vapour is converted into liquid.

**Fog**

Fog is actually just condensed water vapour close to the ground. To understand fog, we first need to tackle humidity. The air around us can hold a certain amount of water vapours, or water in a gaseous state. As more and more water fills the air, the air feels more humid. The amount of water vapours in the air is known as humidity. When the water vapours completely saturates the air, the water droplets start to condense, or turn from a gas back into a liquid. These droplets of liquid are suspended in the air and appear as a thick haze, known as fog. The types of fog are separated into three main categories, and some of these categories have multiple types.

**Precipitation:**

Different forms of precipitation (dew, fog, rain­fall, frost, snowfall, hailstorm etc.) depend on stability and instability of the atmosphere. The air without vertical movement is called stable air while unstable air undergoes vertical movement (both upward and down­ward). An air mass ascends and becomes unstable when it becomes warmer than the surrounding air mass while descending air mass becomes stable.

The stability and instability depend on the relationships between ‘nor­mal lapse rate’ and ‘adiabatic change of temperature’. Adiabatic rate is always constant whereas normal lapse rate of air temperature changes. When the normal lapse rate is higher than dry adiabatic rate, the air being warmer rises and becomes unstable. On the other hand, when the normal lapse rate of temperature is lower than dry adiabatic rate, the air being cold descends and becomes stable.

Different Types of Precipitation

1. Rain
2. Snow
3. Sleet (Ice Pellets)
4. Freezing Rain
5. Hail
6. Drizzle
7. Sun Shower
8. Snow Grains
9. Diamond Dust

**Stability:**

When dry adiabatic lapse rate of an 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.

For example, at ground surface if the temperature of a parcel of air is 40°C, the dry adiabatic lapse rate and normal (environmental) lapse rate are 10°C per 1000m and 6.5° C per 1000 m respectively, then at the height of one kilometre (or 1000 m) from the ground surface the temperature of the ascending air would be 30°C (40° -10°= 30°C) while the temperature of surround­ing air at that height would be 33.5° C (40°-6.5° = 33.5°C).

Thus, the ascending air being colder than surrounding air would descend and atmospheric stabil­ity is caused. Such air (descending) is called to be in stable equilibrium. Sometimes, the normal lapse rate in a certain layer of the atmosphere is about 4.6° C per 1000 metres. In such conditions if the normal lapse rate is less than wet adiabatic lapse rate even at condensa­tion point, further vertical motion of air is stopped and thus such air is said to be absolutely stable and such atmospheric condition is called absolute stability.

**Instability:**

When normal lapse rate is greater than dry adiabatic lapse rate of ascending parcel of air the rising air continues to rise upward and expand and thus becomes unstable and is in unstable equilibrium. In other words, atmospheric instability is caused when the rate of cooling of rising air (dry adiabatic lapse rate) is lower than the normal lapse rate.

For example, if the temperature of a certain parcel of air at ground surface is 40°C, the dry adiabatic and normal lapse rates are 10°C and 11°C per 1000m respectively, then the tem­perature of ascending air at the height of 1000m (one kilometre) would be 30°C (40°-10° = 30°C) while the temperature of the atmosphere at that height would be 29°C (40°-11°C = 29°C).

Thus, the rising air being warmer (30°C) than the surrounding air (29°C) contin­ues to rise and expand to cause atmospheric instability. If the wet adiabatic lapse rate is also less than normal lapse rate, the rising air further continues to rise up­ward. Such state of continued upward movement of air is called absolute instability.