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News: Dense fog, cold wave grip swathes of north, northwest India

- Entire north India, including the National Capital Region and the neighbouring plains shivered under a ‘severe’ cold on Monday and large swathes of them battled very dense fog as the Met department predicted the conditions to persist over the next few days.
- Fog, Mist, Haze and Smog are different forms of condensation.

Condensation

- The transformation of water vapour into water is called condensation.
- Condensation is caused by the loss of heat (latent heat of condensation, opposite of latent heat of vaporization).
- When moist **air is cooled, it may reach a level when its capacity to hold water vapour ceases** (Saturation Point = 100% Relative Humidity = Dew Point reached).
- Then, the **excess water vapour condenses into liquid form**. If it directly condenses into solid form, it is known as sublimation.
- In free air, **condensation results from cooling around very small particles termed as hygroscopic condensation nuclei**.

- Particles of dust, smoke, pollen and salt from the ocean are particularly good nuclei because they absorb water.
- Condensation also takes place when the moist air comes in contact with some colder object and it may also take place when the temperature is close to the dew point.
- Condensation, therefore, depends upon the amount of cooling and the relative humidity of the air.

Condensation takes place

- When the **temperature of the air is reduced to dew point** with its volume remaining constant (adiabatically),
- When **both the volume and the temperature are reduced**,
- When **moisture is added to the air** through evaporation,
- After **condensation the water vapour or the moisture in the atmosphere takes one of the following forms — dew, frost, fog and clouds.**
- Condensation takes place when the **dew point is lower than the freezing point as well as higher than the freezing point.**

Forms of Condensation

- The forms of condensation can be classified on the basis of temperature at which the dew point is reached.
- Condensation can take place when the dew point is lower than the freezing point and sometimes higher than the freezing point.
- White frost, snow and some clouds (cirrus clouds) are produced when the temperature is lower than the freezing point.
- Dew, fog and clouds result even when the temperature is higher than the freezing point.
- Forms of condensation may also be classified on the basis of their location, i.e. at or near the earth's surface and in free air.
- Dew, white frost, fog and mist come in the first category, whereas clouds are in the second category.

Dew

- When the moisture is deposited in the form of water droplets on cooler surfaces of solid objects (rather than nuclei in air above the surface) such as stones, grass blades and plant leaves, it is known as dew.
- The ideal conditions for its formation are clear sky, calm air, high relative humidity, and cold and long nights.

- For the formation of dew, it is necessary that the dew point is above the freezing point.

White Frost

- Frost forms on cold surfaces when condensation takes place below freezing point (0°C), i.e. the dew point is at or below the freezing point.
- The excess moisture is deposited in the form of minute ice crystals instead of water droplets.
- The ideal conditions for the formation of white frost are the same as those for the formation of dew, except that the air temperature must be at or below the freezing point.

Fog

- When the temperature of an air mass containing a large quantity of water vapour falls all of a sudden, condensation takes place within itself on fine dust particles.
- So, the fog is a cloud with its base at or very near to the ground. Because of the fog and mist, the visibility becomes poor to zero.

- In urban and industrial centers smoke provides plenty of nuclei which help the formation of fog and mist. Such a condition when fog is mixed with smoke, it is described as smog.
- Radiation fog results from radiation, cooling of the ground and adjacent air. These fogs are not very thick. Usual in winters.
- Fogs formed by condensation of warm air when it moves horizontally over a cold surface, are known as advectional fog. These fogs are thick and persistent. Occurs over warm and cold water mixing zones in oceans.
- Frontal or precipitation fog is produced due to convergence of warm and cold air masses where warm air mass is pushed under by the heavier cold air mass.
- Precipitation in the warm air mass condenses to produce fog at the boundary of the two air masses. These are called frontal or precipitation fog.

Mist

- The difference between the mist and fog is that mist contains more moisture than fog.
- In mist each nuclei contains a thicker layer of moisture.
- Mists are frequent over mountains as the rising warm air up the slopes meets a cold surface.

- Mist is also formed by water droplets, but with less merging or coalescing. This means mist is less dense and quicker to dissipate.
- Fogs are drier than mist and they are prevalent where warm currents of air come in contact with cold currents.
- In mist visibility is more than one kilometer but less than two kilometres.

Haze

- Haze is traditionally an atmospheric phenomenon where dust, smoke and other dry particles obscure the clarity of the sky (No condensation. Smog is similar to haze but there is condensation in smog).
- Sources for haze particles include farming (ploughing in dry weather), traffic, industry, and wildfires.

Smog

- Smog = smoke + fog (smoky fog) caused by the burning of large amounts of coal, vehicular emission and industrial fumes (Primary pollutants).

Clouds

- Cloud is a mass of minute water droplets or tiny crystals of ice formed by the condensation of the water vapour in free air at considerable elevations.

- Clouds are **caused mainly by the adiabatic cooling of air below its dew point.**
- As the clouds are formed at some height over the surface of the earth, they take various shapes.
- According to their height, expanse, density and transparency or opaqueness clouds are grouped under four types: (i) cirrus; (ii) cumulus; (iii) stratus; (iv) nimbus.