Class → 5

Types of Inversion

that occur near the earth's surface

(A) Surface Inversion

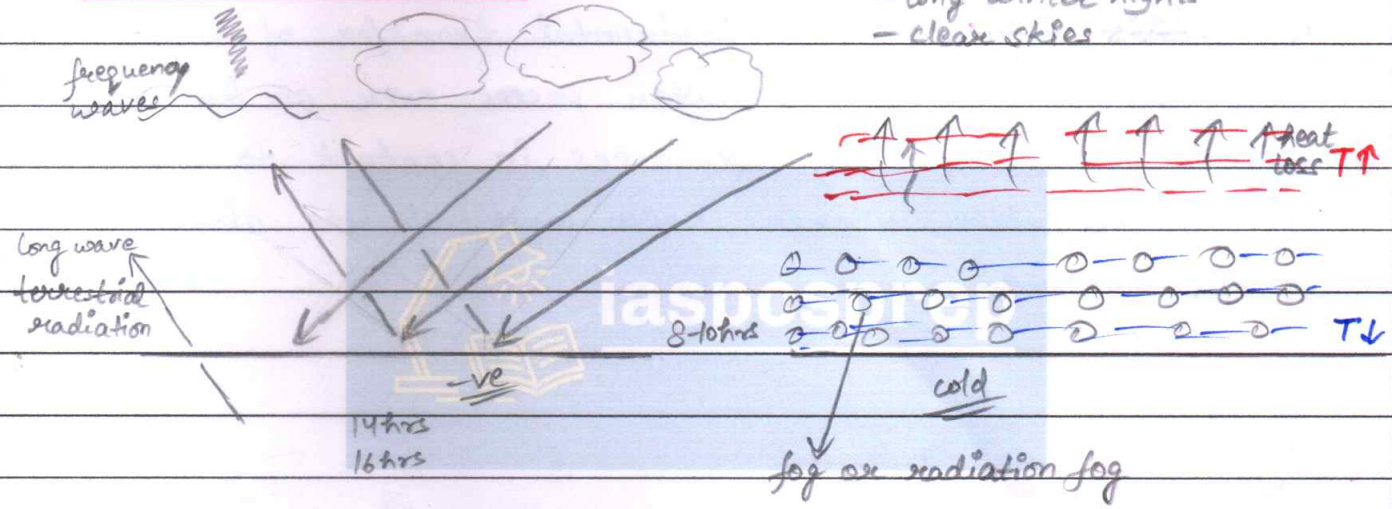
(B) Upper Air Inversion

(1) Radiation Inversion

(2) Advectional Inversion

(3) Valley Inversion

↳ 1) Radiation Inversion :—



Conditions for radiations :

→ (i) Long winter nights

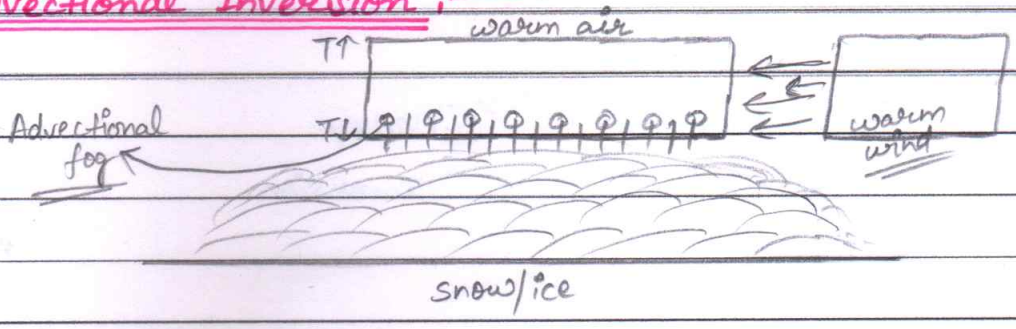
→ (ii) Clear skies

→ (iii) less turbulence in Air

During such conditions heat from the earth surface is lost rapidly as it acts just like a black body (which absorbs and gains heat rapidly). During long winter nights, the radition loss is for longer duration thus the surface gets cooler air in contact to the surface is colder whereas upper layer is warm. It also results in condensation in lower layer of

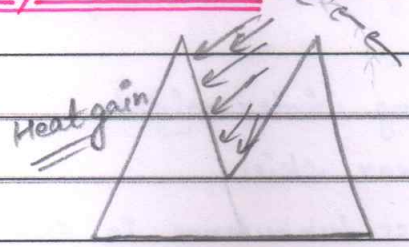
troposphere that forms a dense low floating cloud called as fog or radiation fog. For e.g. :— Fog in Northern Plains of India.

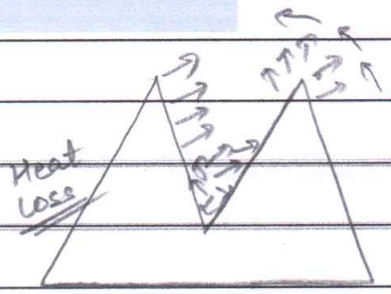
↳ 2.) Advectional Inversion :—

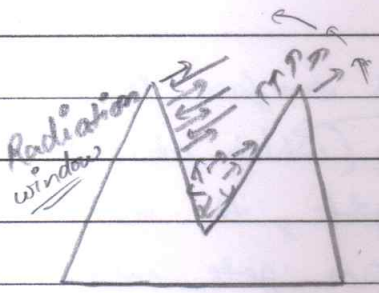


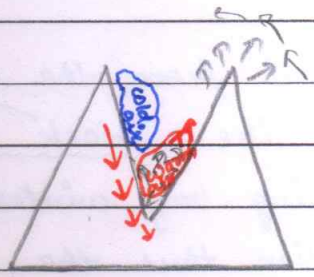
Advectional process involves horizontal transfer of heat. A relatively warmer airmass when passes over an ice-covered surface lower layer of airmasses in contact to the surface get colder whereas upper layer of the airmass remains warmer.

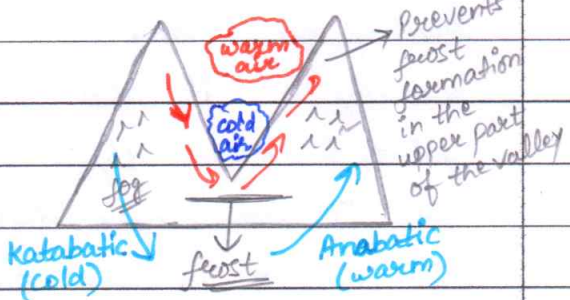
↳ 3.) Valley Inversion :—











Mountain slopes act as radiation windows, receive radiation

during daytime more than the valley base and radiation loss is also higher than the valley base during night. During night, the air in contact to mountain slopes gets denser whereas at the valley base, air is lighter because radiation loss or heat loss is restricted by valley walls or mountain walls. The contrast in temperature and density is very steep or high or maximum in early morning resulting in the subsidence of cold dense air towards the valley base that replaces warm lighter air. The phenomenon results in formation of frost along the base and prevents frost formation along the middle part of the valley.

The sinking cold air is called Katabatic that is cold subsiding air whereas warm air that rises is called as Anabatic.

Effects of Temperature Inversion

↪ 1.) Formation of Fog and its related effects

↪ 2.) It does affect agriculture and therefore human settlements in mountain valleys.

↪ 3.) It leads to clear weather conditions. It is also called as Stable Atmospheric conditions.

Practice Question

Ques. What do you understand by the phenomenon of "temperature inversion" in meteorology? How does it affect the weather and the habitants of the place? (100 Words) (UPSC CSE, 2013)

Humidity and Precipitation

- Types & Factors
- Condensation – Process & Types & Precipitation – Types & Process

* **Humidity** :— It is the invisible water present in air, expressed in 3 types :
  - 1.) Absolute Humidity
  - 2.) Specific Humidity
  - 3.) Relative Humidity

↳ (1.) **Absolute Humidity** :— It is the total amount of water vapours present in air, expressed in grams e.g. 10 grams, 20 grams, 30 grams etc. or in given packet of air.

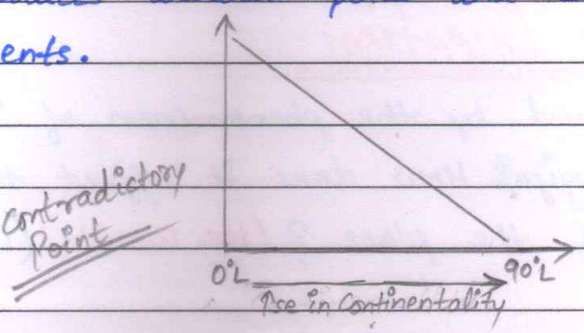
Humidity = Weight of Air – Weight of dry air

In simple terms, it is the humidity that is felt.

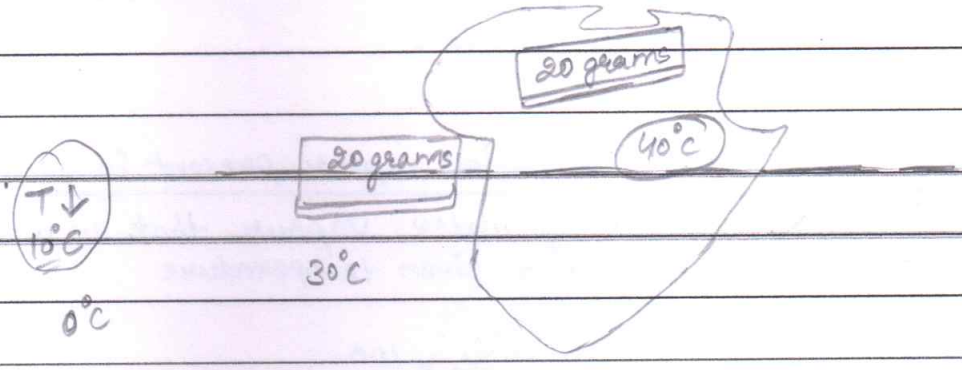
Absolute Humidity is depend on 2 factors :—

- (i) Latitudinally
  - very high in the equatorial areas
  - low in the polar areas
- (ii) Distance from the sea / continentality

Absolute Humidity is proportional to the rate of evaporation. It reduces towards poles and to the interiors of continents.



Absolute Humidity is independent of temperature. If the rate of evaporation is zero, absolute humidity remains the same.



↳(2.) **Specific Humidity** :— It is the ratio of weight of water vapours to the weight of airmass.

$$\text{Specific Humidity} = \frac{\text{Weight of Water Vapour}}{\text{Weight of Airmass}}$$

↳(3.) **Relative Humidity** :— To understant relative humidity, we must understand Humidity Capacity.

Humidity Capacity :— It is the total amount of moisture that an airmass can hold at a given temperature.

↑se in temperature leads to ↓se in Humidity capacity.

$0^\circ C - 4.8\ gm/m^3$
$5^\circ C - 6.2\ gm/m^3$
$10^\circ C - 9.2\ gm/m^3$
$15^\circ C - 12\ gm/m^3$
$30^\circ C - 30.1\ gm/m^3$

} Values are true.

Humidity Capacity $\propto$ Temperature
(proportional to)

Relative Humidity :- It is a percentage ratio of total amount of water vapours present in an airmass to total amount of water vapours that an airmass can hold at a given temperature.

$$\text{Relative Humidity (RH)} = \frac{\text{Total amount of water vapour present in airmass}}{\text{Total amount of water vapour that an airmass can hold at a given temperature}} \times 100$$

$$RH = \frac{\text{Absolute Humidity}}{\text{Humidity Capacity}} \times 100$$

Temperature	Absolute Humidity	Humidity Capacity	Relative Humidity	$T \propto \frac{1}{RH}$
15°C	6gm	12gm	→ 50%	
↓ 10°C	6gm	9gm	→ 67% RH↑	→ Saturation point or Saturated airmass
↓ 5°C	6gm	6gm	→ (100%) RH↑	
↓ 0°C	6gm	4.8gm	→ (100+%) RH↑	→ Super Saturated Airmass causes → Rainfall

Relative Humidity is inversely proportional to temperature because decrease in temperature decreases humidity capacity. As Relative Humidity process super-saturation limit, rainfall occurs or precipitation occurs. Such condition arises with upward movement of airmasses.

Practice Question

Ques. Out of many expressions of Humidity, relative humidity is the most useful for atmospheric analysis. Discuss. (Answer in 150 words)

Class Quiz

Q(1.) What is the primary cause of a radition inversion?

a) Movement of warm air over a cold surface
b) Sinking air in high-pressure systems
c) Clear, calm nights
d) Associated with the movement of air masses

Q(2.) Match the given phenomenon with their effects of temperature inversion :—

List-I	List-II
A. Accumulation of pollutant in valleys	1. Poor air quality
B. Increased rate of evaporation from water bodies	2. Temperature decreases with height
C. Reduced dispersion of air pollutants	3. Fog formation
D. Formation of frost on vegetation	4. Enhanced greenhouse effect

Codes :—

	A	B	C	D
a)	2	3	1	4
b)	1	4	3	2
c)	1	4	2	3
d)	1	3	4	2

Q(3.) During a temperature inversion, what typically happens to visibility ?

a) Visibility improves due to reduced humidity
b) Visibility remains unaffected
c) Visibility worsens due to trapped pollutants
d) Visibility improves due to increased cloud cover

Q(4). Match the types of humidity with their characteristics :—

List-I	List-II
A. Specific Humidity	1. Measures the actual amount of moisture in the air.
B. Relative Humidity	2. The mass of water vapour per unit mass of air.
C. Absolute Humidity	3. The ratio of the amount of water vapour present in the air to the maximum amount that can be held at a given temperature.

Codes :—

	A	B	C
a)	1	2	3
b)	3	2	1
c)	2	1	3
d)	2	3	1

Q(5). Which factor primarily determines the capacity of air to hold water vapour ?

a) Temperature
b) Pressure
c) Wind speed
d) Cloud Cover