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Ch-14 Atmospheric Pressure and Winds

Atmospheric Pressure

Atmospheric Pressure -
It refers to the force per unit area exerted against a surface by the weight of the air above that surface.

Measurement of Atmospheric Pressure -

1. The unit of measurement of atmospheric pressure is millibar (mb).
2. It is measured by an instrument called barometer.
3. Atmospheric pressure decreases with height.
4. The average air pressure at sea level is 1013 mb or 760 mm of mercury.

Pressure gradient - It is defined as the decrease in pressure per unit distance in the direction in which the pressure decreases most rapidly.

Isobar -
Lines joining places having the same atmospheric pressure.
These are imaginary lines drawn on a weather map indicating atmospheric pressure. Close spacing of the isobars indicate that pressure is changing rapidly while wide spacing suggests a weak gradient.

Factors affecting atmospheric pressure -

1. Altitude -
(i) The atmospheric pressure decreases with increase in altitude or height at the rate of 1cm of mercury for every 110m of ascent.
(ii) It is highest at the sea level since the air is more dense at the sea.
(iii) Since the atmosphere is highly compressible, the overlying layers exert pressure on the ~~low~~ underlying layers.

2. Temperature -
(i) Temperature and Pressures are inversely related i.e. high temperature results in low pressure. It is because when temperature rises the molecules of air move apart and air becomes less dense exerting less pressure.
(ii) On the other hand when temperature decreases, air gets compressed (inter molecular space decrease) and air exerts less pressure.
(iii) This is why equator has low pressure while the poles have a higher pressure.

3. Water vapour -
(i) The molecular weight of water vapour is less than that of air molecules. Since in a humid air water vapour displaces the

heavier gas molecules, humid air exerts less pressure than dry air.

4. Rotation of the earth-

(i) Due to the centrifugal force generated by earth's rotation, the bulk of air is thrown away towards the equator. As a matter of fact temperature and rotation together contribute to the formation of pressure belts.

World Pressure Belts-

As per the global horizontal distribution of pressure the earth has seven pressure belts.

1. Equatorial Low Pressure (1).
2. Subtropical High Pressure (2).
3. Subpolar / Circumpolar Low Pressure Belt (2).
4. Polar High Pressure Belt (2).

1. Equatorial Low Pressure Belt-

(i) It extends from 0°-5° North and South of the equator.

(ii) Intense heating due to vertical suns rays cause an area of low pressure. It is because hot air expands and rises as convection currents.

(iii) It is also called doldrums since it is a zone of total calm without any breeze.

2. Subtropical High [redacted] Pressure –
(i) These pressure belts extends between 30°-35° North and South of the equator.
(ii) It has a high pressure since the air ascending from the equator and the sub polar region descend here.
(iii) It is also called horse latitude.

3. Circumpolar low Pressure Belts–
(i) These [redacted] belts are located 60°-70° in each hemisphere.
(ii) Centrifugal forces operating in this region thrown the bulk of air from this region creating [redacted] a low pressure which otherwise would have been a high pressure due to lower [redacted] te Imperatures.

4. Polar High Pressure [redacted] Belts –
(i) These pressure belts exist at 80°-90° North and South.
(ii) The cold descending air gives rise to high pressure also known as polar highs.

Shifting of Pressure Belts–
(i) Due to earth's inclined axis and revolution around [redacted] the sun, the sun rays migrate from their original positions to the north [redacted] and South of the equator.
(ii) Since the pressure belts are affected by

the sun rays [redacted] they also follow this annual migration of sun rays by 5°-10°.
(iii) The seasonal shifting of the pressure belts affects the climatic conditions specially between 30° and 40° latitudes in both the hemisphere. (Mediterranean region) receives winter rainfall. It is due to the shifting of pressure belts. During summer this region comes under the influence of offshore trade winds whereas during winters they are influenced by ~~on~~ on-shore [redacted] westerly winds.

Winds–
The [redacted] horizontal [redacted] movement of air from high pressure areas to low pressure areas is called winds.

Air current–
The vertical [redacted] movement of air upward as well as downward which results in the formation of [redacted] low pressure and high pressure areas respectively.

Factors affecting direction and velocity of winds [redacted]:–

1. Direction of wind is influenced by coriolis force or [redacted] effect.

Coriolis force is the force of deflection of winds from their original path due to earth's rotation.
The winds are deflected towards their right in the northern and towards their left in the southern hemisphere. This is known as ~~ferrel~~ ferrel's law.

2. The velocity of wind is affected by pressure gradient.
Pressure gradient is the rate of change of atmospheric pressure between two points on the earth's surface. The greater the difference in pressure between 2 points, the steeper is the pressure gradient and higher the speed of winds.

3. The deflection of winds is least at the equator and maximum at the poles. It is due to maximum speed of equation at the equator and minimum at the poles. The winds deflect towards its right in the northern hemisphere and towards its left in the southern hemisphere. This is known as Ferrel's Law.

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Types of Winds

- Permanent / Planetary / Prevailing
  - Trade
  - Westery
  - Polar
- Periodic
  - Land & sea Breeze
  - Monsoon Winds
- Local
  - Warm
  - Cold
- Variable
  - Cyclones
  - Anti-cyclones

1. Permanent winds –
The winds that blow throughout the year from high pressure belts to low pressure belts in a definite direction.

	Trade Winds	Westery Winds	Polar Winds
1.	These winds blow from subtropical high pressure to equatorial low pressure belt between 0° & 30° North and South of the equator.	These winds blow from subtropical high pressure belt to subpolar low pressure belt between 30° & 60° North and South of the equator.	These winds blow from polar high pressure belt to subpolar low pressure belt between 60° & 90° North and south of the equator.
2.	They are known as northeast trade winds in the northern and southeast	They are called south westerlies in the northern and north ~~were~~ westerlies in the	They are called northeast polar winds in the ~~north~~ northern and

Trade winds in the southern hemisphere.	southern [redacted] hemisphere.	and southern polar winds in the southern hemisphere.
3. They are strong and steady and bring rains to the eastern margin of the continents in the tropical zone.	These winds bring rain to the western margin of the continents in the temperate zone.	They are of tremedy cold winds and become warm only when they blow [redacted] over the oceans

Q. Westerlies wind in the southern hemisphere blow with great speed.

Ans. It is because of the absence of land masses in the southern hemisphere ~~between~~ ~~to~~ between these ~~latitudes~~. latitudes.

2. Periodic Winds –

(i) The winds that blow in a particular period only in a definite direction are called periodic winds.

(ii) These winds reverse the direction of flow according to periods or seasons.

(iii) The two periodic winds are –
1) The land and sea breezes.
2) The monsoon winds.

(iv) These winds are caused mainly due to unequal heating of land and water masses.

Difference between –

I.

	Land and Sea Breezes	Monsoon Winds
(i)	They blow daily.	They occur seasonaly.
(ii)	They affect smaller areas mainly the coastal areas.	They affect larger areas the ocean and the continent.

II.

	Land Breezes	Sea Breezes
(i)	They blow during the night.	They blow during the day time.
(ii)	They blow from high pressure over the land to low pressure over the sea.	They blow from high pressure over the sea to low pressure over the land.
(iii)	They are cold and dry.	They are cool and moist cold may bring rainfall.

Phenomenon of Sea and Land Breezes –

(i) They are caused due to unequal heating of land and sea.

(ii) During the day the land gets heated faster, the air above the land rises creating a low pressure.

(iii) Due to high heat capacity, the sea is still

comparatively cooler having a high pressure.

(iv) The winds blow from high pressure over the sea to low pressure over the land causing (sea breezes).

(v) At night land cools faster developing a high pressure where as the sea has become warm and air above the sea rises creating a low pressure.

(vi) Now the winds blow from high pressure over the land to low pressure over the sea known as (land breezes).

[Winds get their names from the direction where they blow.]

Difference between—

	Summer monsoon	Winter monsoon
(i)	The summer monsoon [redacted] winds blow from south-west therefore they are called south-west summer monsoon.	They blow from north-east thus they are called north-east winter monsoons.
(ii)	As they blow from sea to land they bring heavy rainfall to south-east asia.	As these wind blow from land to sea, they bring cold and dry weather generally.
(iii)	They are caused during summer when the interior of continent become hot having a low pressure whereas the surrounding water bodies have a higher pressure.	They are caused in winter when high pressure occurs over the land with a comparative lower pressure over the sea.

[Diagram of [redacted] Warm Land Breeze, Cool Sea Breeze ; Fig. 14.8. (a), (b)]

3. Variable Winds—

(i) Variable winds are related to pressure systems and blow in small areas. Their speed depends upon the intensity of depression.

(ii) The variable winds are called so because they vary in both speed as well as direction.

(iii) There are two types of variable winds- Cyclones and Anti-cyclones.

	Cyclones	Anti-cyclones
(i)	They are low pressure system [redacted] with surrounding high pressure.	They are high pressure system in which the pressures decreases [redacted] outwardly.
(ii)	The winds blow towards the interior in an anti-clock wise direction in the northern and clock wise direction in the	The winds blow outwardly from the high pressure centre in a clock wise direction in the northern and anti-clock

	southern hemisphere.	anti-clock wise direction in the southern hemisphere.
(iii)	They are associated with violent winds, dense cloud and heavy rains and may cause damage to property and loss of human life.	They bring calm weather condition with some amount of rainfall.

	Tropical Cyclones	Temperate Cyclones
(i)	Tropical cyclones are produced mainly over the sea between 5° and 20° N and S.	Temperate cyclones are produced both on land and on sea between 35° latitude and 65° latitude.
(ii)	They are limited to a small area and travel from east to west.	They occupy areas measuring thousands of kilometers and travel from west to east.
(iii)	They are associated with violent winds great speed, dense cloud and heavy rain during summer.	The winds speed is low and the rainfall is light which continues for many days during winter.

Q. Cyclones are frequent in summer in the tropical regions.
It is because of the equatorial low pressure belt shifting to the north of equator during summer.

Names given to cyclones in different parts of the world—

Cyclone name	Country
Cyclones	Indian Ocean
Hurricanes	Caribbean region
Typhoons	China
Willy-Willy	Australia

Tornado—
(i) Tornado is a tropical cyclone which occurs over land and its diameter is hardly 300-400 meters.
(ii) It looks like a dark, funnel shaped cloud extending downwards from the base of the thunderstorm.

Jet Streams—
Jet streams refer to the concentrated bands of rapid air movement found at the tropopause and the

Importance of Jet Streams—
(i) The position and strength of jet streams helps the meteorologists forecast future weather events.

(ii) By flying commercial aircraft within the jet streams, the flight time gets reduced which further decreases the flight time and fuel consumption.

Altitude –
The height of a thing above sea level.

Monsoon –
The word monsoon is derived from an Arabic word 'mausam' which means seasons thus monsoon winds are seasonal winds which develop due to unequal heating of land and water.

4. Local winds
Local winds are restricted to certain place they blow over a small area for a short period of time. They may be warm or cold depending upon the area from which they blow.

Local winds

	Name	Type	Area
1.	Loo	Warm and dry.	Plains of northern India. It may cause heat stroke to people.
2.	Foehn	Strong warm winds.	Southern slopes of Alps. It hastens the ripening

	chinook chinook ↑		of grapes.
3.	Chinook	Warm Winds.	Western slopes of Rocky mountain (America). They melt the snow. (Chinook means snow heaters.)
4.	Mistral	Cold Winds	Flows from Alps over France and brings down the temperature below freezing point.

[Diagram of Pressure Belts; Fig. 14.4]