Class 9th Social Science

Chapter : 2

Atmosphere: Structure,Air Pressure and Wind System

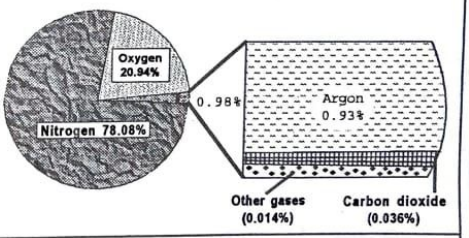
GEOGRAPHY

Give very short answer :

Q.1: What is atmosphere ? Write in brief with data its structure.

Ans: Atmosphere is the veil of odourless,tasteless and colourless gases,dust particles and water vapour surrounding the earth which forms a protective boundary between the outer space and the biosphere. It is composed of different gases in different volumes. Nitrogen and Oxygen together constitute about 99 percent of the total volume of atmosphere gases. The remaining 1 percent is occupied by argon,carbon dioxide and various other gases. The composition of the atmosphere in the light of its gaseous mixture is shown in the chart below: Atmosphere gaseous composition and volume.

Name of gases and their chemical symbol/formula	Per cent (By Volume)
• Nitrogen (N_2)	78.08
• Oxygen (O_2)	20.94
• Argon (Ar)	0.93
• Carbon dioxide (CO_2)	0.036
• Other Gases :	
* Neon (Ne)	
* Helium (He) * Hydrogen (H_2)	0.014
* Methane (CH_4) * Xenon (Xe)	
* Krypton (Kr) * Ozone (O_3)	
Total	**100**



Gaseous Composition of the Atmosphere

Q.2: What are the main layers of the atmosphere based on chemical composition of the gases ? Write briefly about the characteristics of these layers.

Ans: The main layers of the atmosphere based on chemical composition of the gases are homosphere and heterosphere.
The characteristics of these layers are :

[I] Homosphere :

(i) The lower zone of the atmosphere.

(ii) Extends upto an attitude of 80 km from the earth's surface.

(iii) 99% of the atmosphere elements is confined to within 32 km of the homosphere.

(iv) There is uniformity in the composition of various gases throughout the homosphere.

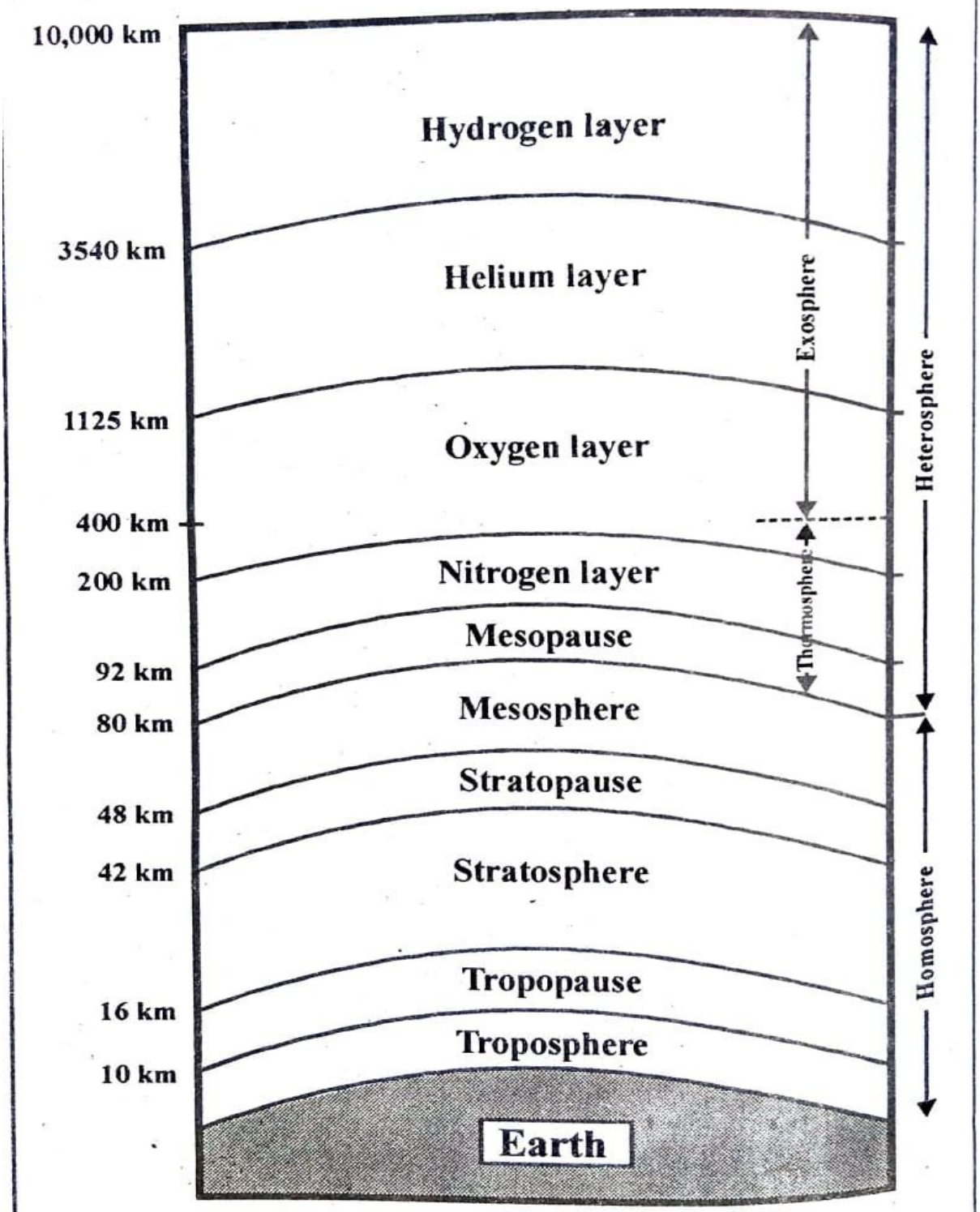
(v) Based on attitude,the layer is further divided into troposphere, stratosphere and mesosphere.

[II] Heterosphere:

(i) The upper zone of the atmosphere.

(ii) Extends beyond 80km to about 10,000km.

(iii) Density of air is negligible low in this region whereas there is spectacular rise in temperature.



Layers of atmosphere and chemical structure

(iv) Based on the variation in the atomic masses of the gases,certain gases remain unevenly concentrated in this layer and form different sub-layers,which fall under the thermosphere and exosphere. There sub-layers are:

(a) Nitrogen layer(from 80km to 200km)

(b) Oxygen layer (from 200km to 1125km).

(c) Helium layer(from 1125km to 3540km).

(d) Hydrogen layer (beyond 3540km to the extreme boundary of the atmosphere at about 10,000km)

Q.3: Write with diagram about the layers of the atmosphere based on the variations in altitude and temperature and write the characteristics of each layer in brief.

Ans: Based on the variations in altitude and temperature,the layers of the atmosphere are divided into troposphere, stratosphere,mesosphere, thermosphere and exosphere.
The characteristics of these layers are:

[I] Troposphere :

(i) Bottom-most layer of the atmosphere that remains close on the earth's surface.

(ii) Upper limit of this layer is called tropopause where the temperature remains constant.

(iii) Average height of the layer is 12km which extends to a maximum height of 16km at the equator and 8km at the poles.

(iv) Temperature tends to decrease with increas in altitude. The rate of decrease in temperature is 6.5°C per kilometre. At the tropopause is reduced to -60° C.

(v) Contains three-fourth of total atmospheric gases and abundant water vapour and dust particles which leads to formation of clouds along with rains,storms,cyclones,etc. So all weather phenomena occur in this layer.

[II] Stratosphere :

(i) Atmospheric layer above the troposphere and below the mesosphere.

(ii) Upper limit of the layer is called stratopause respectively.

(iii) Extends up to 50km from the earth's surface and its thickness beyond the tropopause is 40km on an average.

(iv) Temperature increases with increase in elevation in this layer due to the presence of molecules of ozone gas which absorb the sun's radition. The minimum

temperature of this layer is -60°(at the tropopause) and the maximum temperature is 0°C (at the stratopause).

(v) Ozone layer present in this layer shields the earth from harmful ultra-violet rays of the sun.

(vi) Aeroplanes and jet aircrafts fly in this layer due to horizontal wind movement and absence of clouds.

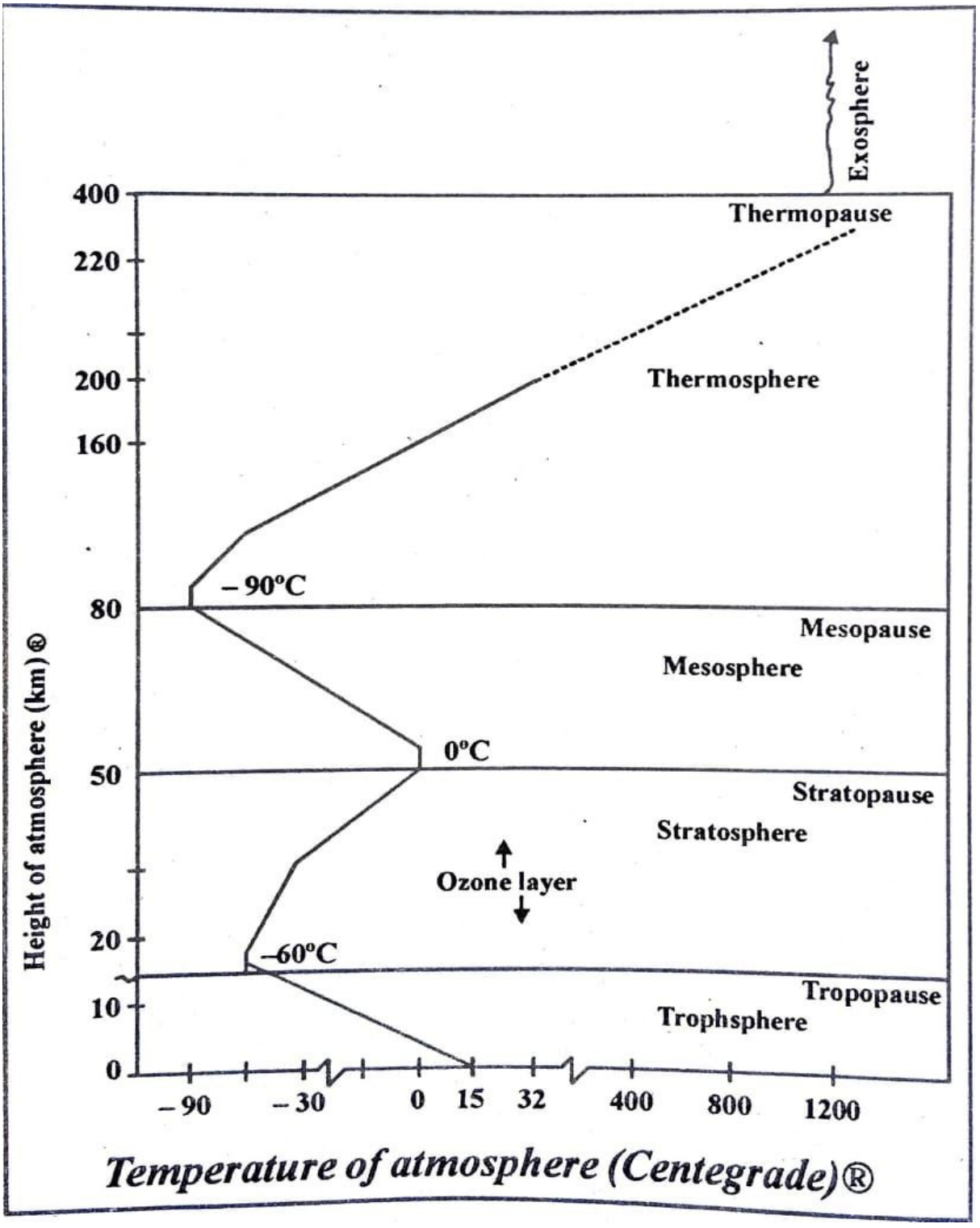
[III] Mesosphere :

(i) Atmospheric layer that above the stratosphere and below the thermosphere.

(ii) Lower and upper limits of this layer are called stratopause and mesopause respectively.

(iii) Extends upto 80km from the earth's surface and its average thickness is 30km.

(iv) Temperature falls with altitude . At the bottom layer,the temperature is around 0°C which falls to -100°C at the upper level of this layer.



[IV] Thermosphere:

(i) Atmospheric layer that exists above the mesosphere and below the exosphere.

(ii) Extends from 80km at the mesopause to about 400km from the earth's surface.

(iii) It is the hottest layer of the atmosphere and the density of air goes down to zero.

(iv) The temperature increases with increase in height and reaches around 1650°C

(v) This layer is also called ionosphere at it contains electrically charged ions.

(vi) The layer reflects radio waves sent from the earth's surface.

[V] Exosphere:

(i) Topmost and the last layer of the atmosphere that lies above the thermosphere.

(ii) Extends from 400km upto a height of 10000km from the earth's surface.

(iii) Air is thin due to the presence of only hydrogen and helium gases in this layer.

(iv) Temperature rises to about 5550℃.

Q.4: Discuss with the factors responsible for variation in atmospheric pressure.

Ans: The factors responsible for variation in atmosphere pressure are :

[I] Air temperature: Temperature is one of the most important factors affecting atmospheric pressure.Temperature varies greatly in different parts of the earth's surface,thus making a place-cold,warm, temperature,etc. Pressure varies inversely to temperature.

(i) High temperature-low pressure:

(a) Due to high temperature,the air near the earth's surface gets heated and expends. This expanded hot air has low density and exerts low pressure.

(b) Warm air absorbs more amount of water vapour. The air laden with moisture and water vapour becomes wet and has a low atmospheric pressure.
e.g. the hot equatorial region has low pressure.

(ii) Low temperature - high pressure:
In the colder regions,where temperature is low,the air remains,cold,heavy and dense. Absence of water vapour in this region makes the air comparatively dry, which creates high atmospheric pressure over the entire region. e.g. the cold polar regions have high pressure.

[II] Height or altitude from the earth's surface:

(i) High altitude -low pressure:

Pressure various inversely to altitude. As we go up from the sea level,the amount of gases present in the atmosphere reduces due to which the mass of air becomes less and it exerts a low pressure. Thus,there exists low atmospheric pressure over the places of high elevation e.g. Darjeeling,Shillong,etc. have low pressure.

(ii) Low altitude - high pressure:
As the mass of air is higher near the earth's surface,high pressure prevails near the places at lower elevation. The rate of decrease in atmospheric pressure is 1inch(34 milibar) per 900ft height. e.g. high pressure prevails in the plains.

Q.5: With the help of diagram discuss the characteristics of the major pressure belts of the world.

Ans: The major pressure belts of the world are:

[I] Equatorial low pressure belt:

(i) Extends on both sides of the equator from 0℃ to 10° N and S latitudes.

(ii) The vertical sun-rays falling in this zone keep the air warm and hot throughout the year which rises upward,thus creating low pressure in this region.

(iii) As there is abundance of water area compared to land area in this region, maximum amount of water

vapour gets absorbed in the air,thus making the air wet,which creates low atmospheric pressure over the region.

(iv) This region remains calm and is also known as equatorial doldrums,as there is absence of horizontally blowing wind over this region.

[II] Sub-tropical high pressure belts :

(i) Extend in both the hemispheres between 25° and 35°N and S latitudes,i.e. the regions around the Tropic of Cancer and the Tropic of Capricorn.

(ii) The warm air rising upward at the equator gradually cools down and descends towards this region,which results in high pressure over this belt.

(iii) Due to the axial rotation of the earth,the cold air from the sub-polar high pressure belts moves gradually to this area and gets accumulated with the air from the equatorial belt. Thus,dense and cool air results in high pressure over the entire area.

(iv) Wind moves downward here and hence there is no perception of blowing wind.

(v) Also known as the 'Horse Latitudes'.

[III] Sub-polar low pressure belts:

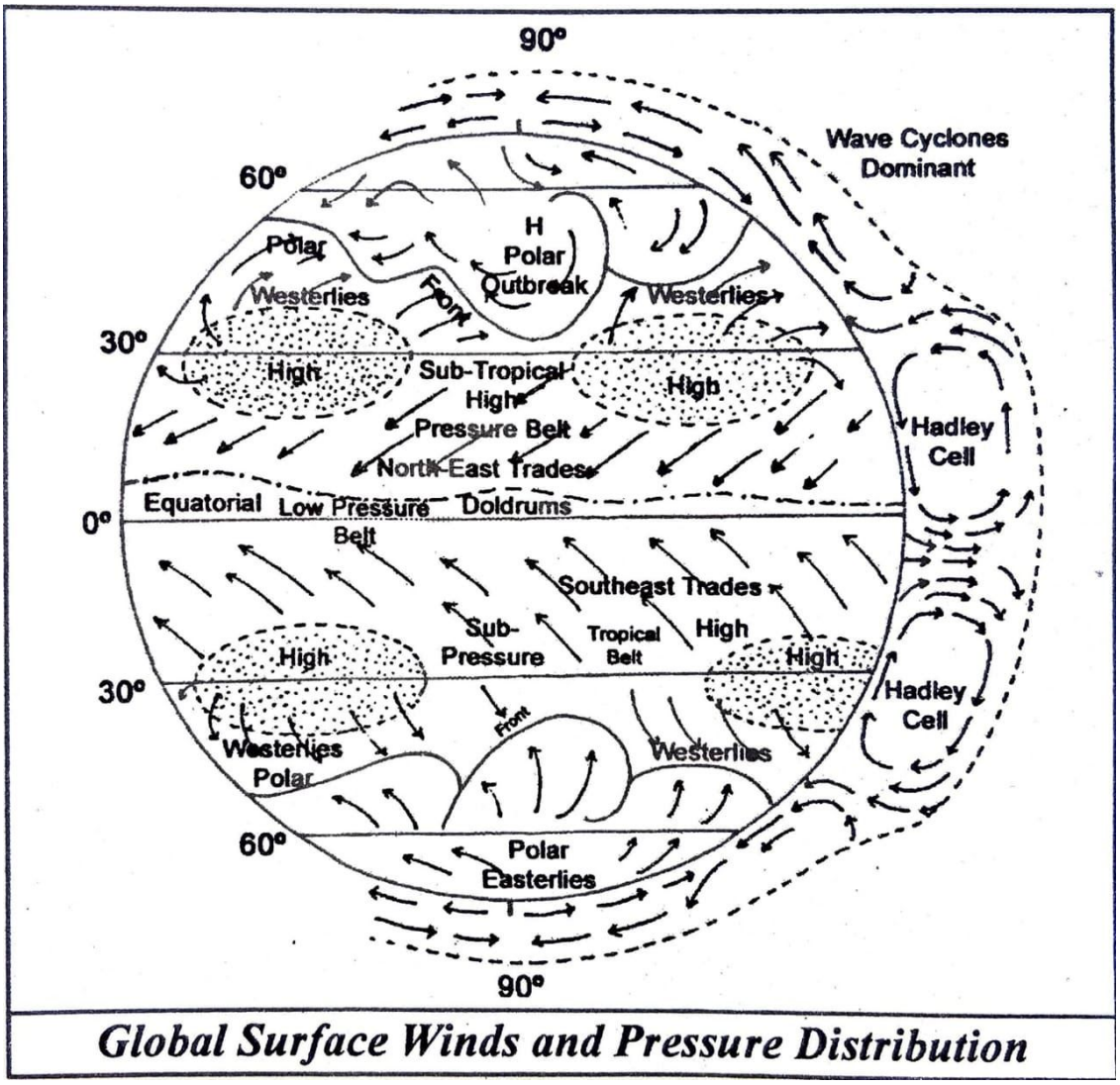
(i) Extend in both the hemispheres between 60° and 70°N and S latitudes.

(ii) Air in this region is reduced as it gets deflected towards the sub-tropical high pressure belt due to high rotational movement of the earth in these sub-polar belts which results in low pressure over this region.

(iii) There is variations in these low pressure belts towards north and south latitudes during different seasons.

[IV] polar high pressure belts:

(i) Extend over the North and South Poles (90°N and 90° S latitudes).

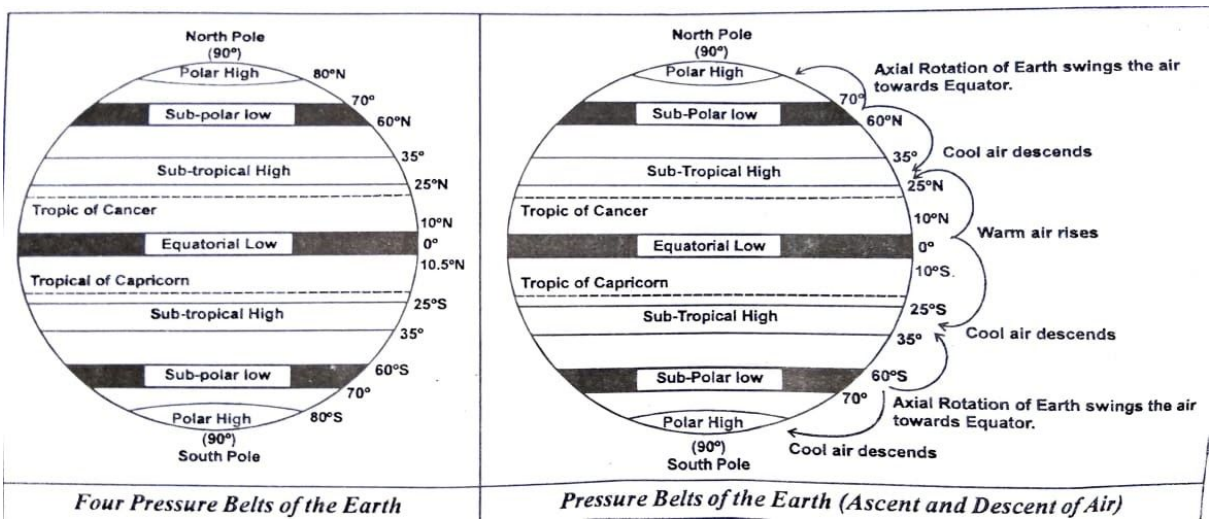


Global Surface Winds and Pressure Distribution

(ii) Region is snow-covered and extremely cold.

(iii) The water is all in the form of ice.

(iv) Permanent high pressure belt prevails over the polar region as the air over both the polar regions contains no water vapour.



Q.6: Write the importance of atmosphere towards creation of a favourable physical environment on the earth.

Ans: The importance of the atmosphere in creating a favourable physical environment on the earth are:

(i) Supplies important gases: The gases that living beings including plants,animals and human beings use in their daily life are provided by the atmosphere.Oxygen,the most active gas without which living beings cannot survive on earth is provided by the atmosphere. Similarly,carbon dioxide given out by animals and human beings is essential for the process of photosynthesis in plants. Nitrogen,the most inactive gas is absorbed by the microorganisms which are then absorbed by the plants as nitrogen compounds. Argon,a chemically inactive gas is used in making electric bulbs,welding works,etc.

(ii) Protects the earth: Carbon dioxide,water vapour and other molecules present in the air prevent the terrestrial

heat from escaping back into space. This is known as greenhouse effect. Similarly,the ozone layer found in the upper limits of the stratosphere prevents the harmful ultraviolet rays from reaching the earth.

(iii) Provides rain and water: Without atmosphere we would not have rain or water.These weather phenomena take place in the troposphere as a result of variations in atmospheric pressure and temperature.

(iv) Protects the earth from extreme heat and cold: Atmosphere acts as an umbrella by protecting the earth from extreme heat or cold.

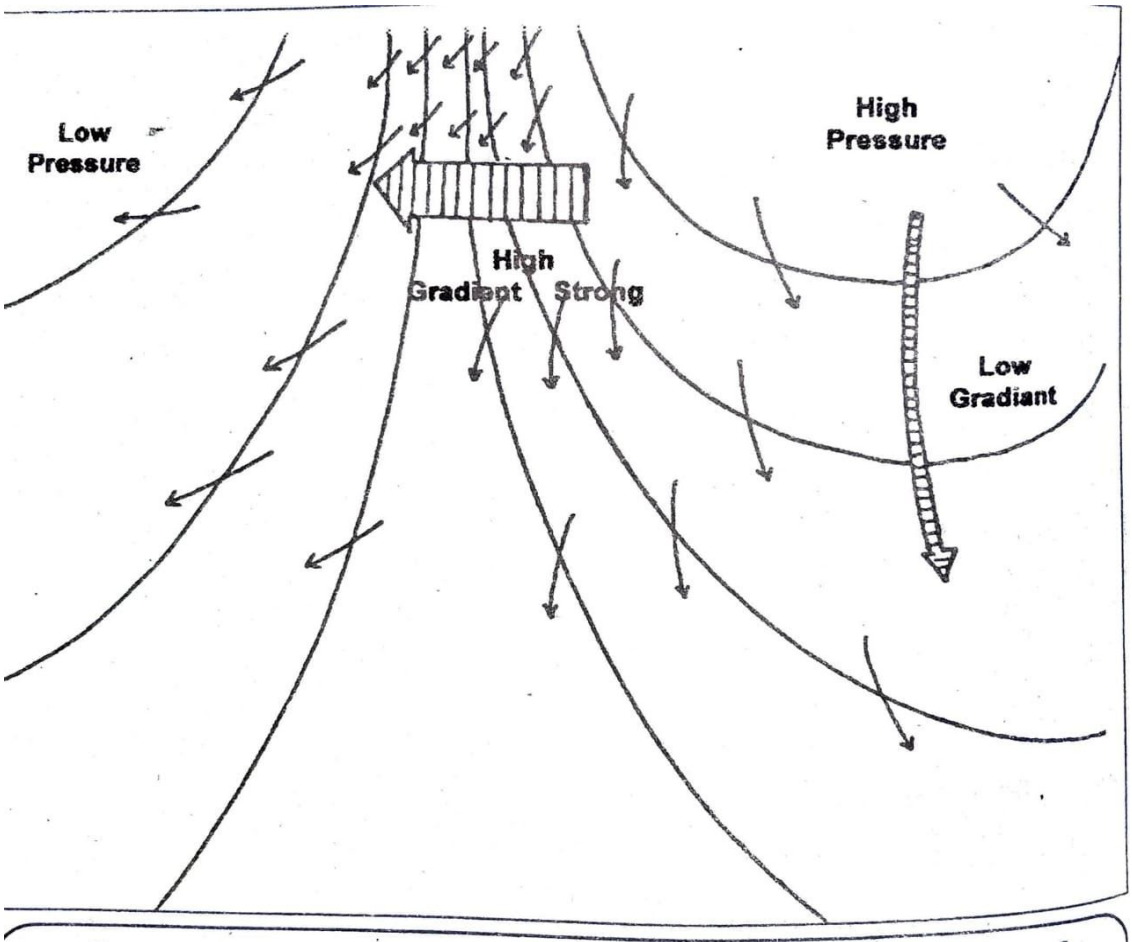
Q.7: What is wind ? Discuss the factors of origin of wind.

Ans: The horizontal movement of air over the surface of the earth is known as wind. In other words,wind is the movement of air that results due to variations in atmospheric pressure caused by temperature differences. Generally,this movement takes place from areas of high pressure to areas of low pressure.
Factors affecting the region of wind are :

(i) Temperature variations.

(ii) Pressure differences.The earth's surface is not heated equally at all places. The equatorial region gets maximum heat due to perpendicular rays of the sun,while the temperature decrease towards the poles because of inclination of sunrays. When the temperature

increase,air becomes light and rises up creating an area of low pressure in the process. The vacuum created by the rising air is soon taken over by the air from the high pressure area which rushes in to fill the vacuum. This brings about movement of air known as wind.Therefore,wind is mainly caused by pressure gradient resulting from pressure differences which,in turn,is caused by variations in temperature.

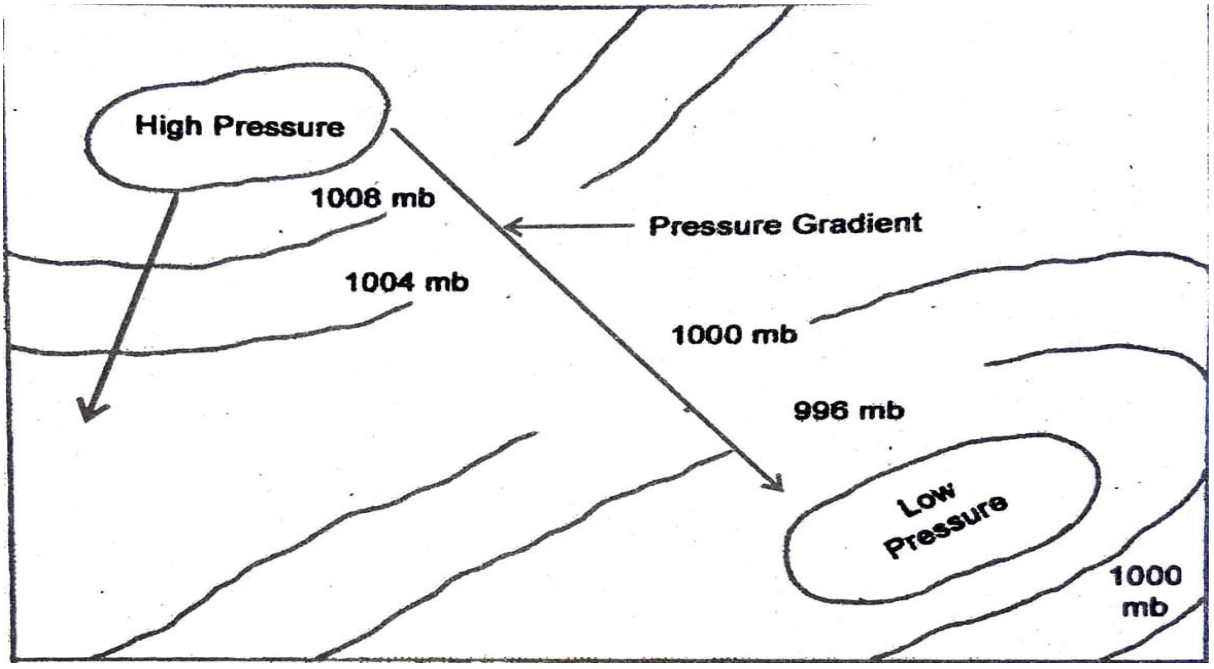


Pressure Gradient and Direction and Velocity of Wind

Q.8: What is the most important reason for the origin of wind ? Briefly discuss the factors determining the velocity and direction of wind.

Ans: The most important reason for the orgin of wind is pressure gradient arising from pressure differences caused by variations in temperature.

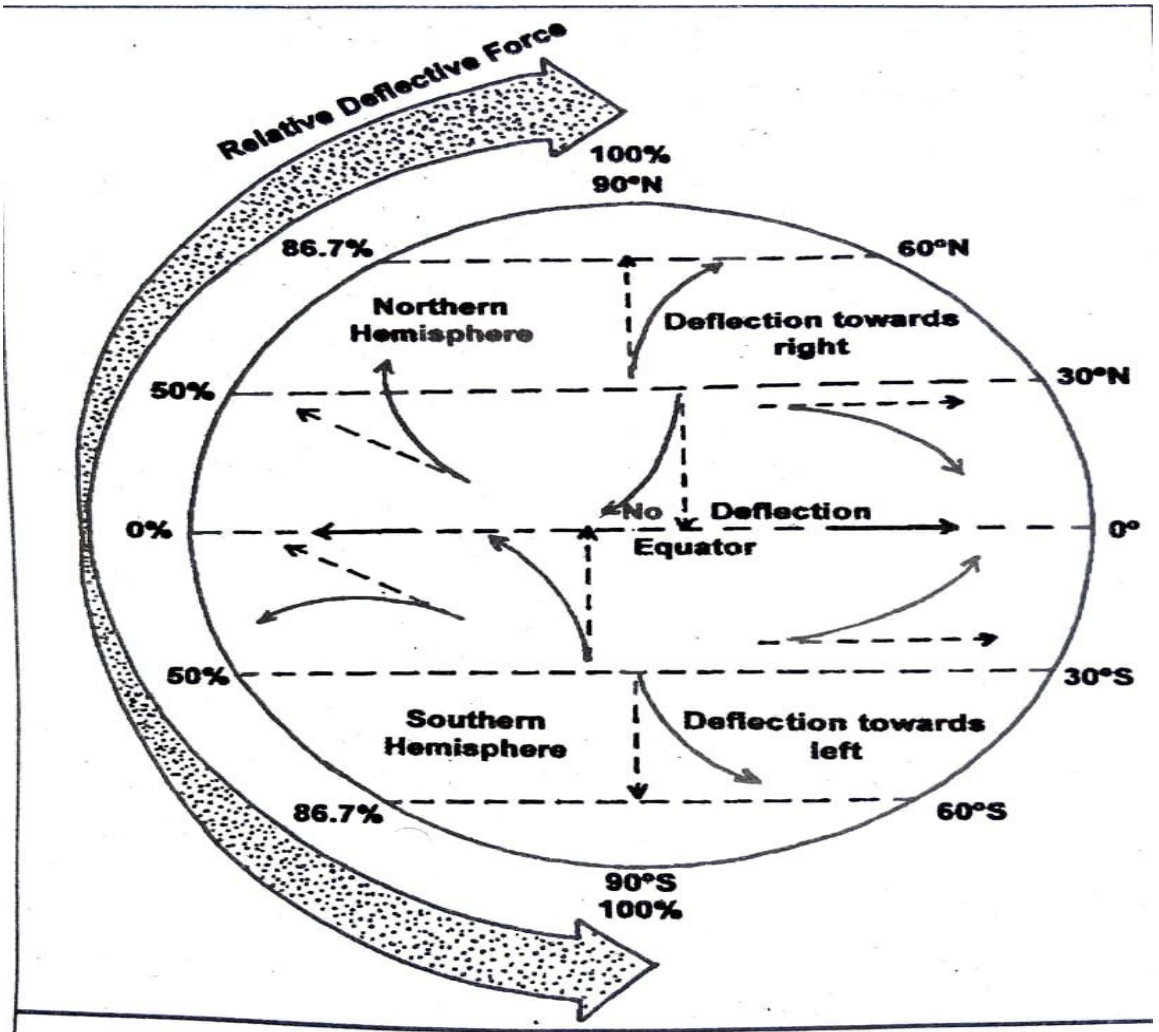
(i) Pressure gradient force: The rate of atmospheric pressure differences between two places is called pressure gradient. The force generated from the atmospheric pressure differences on the earth's surface is known as pressure gradient force. The amount of force produced due to pressure gradient depends on the pressure differences between the two places and the distance between them. The velocity of wind would be higher,if the pressure gradient is high or steep and vice versa. Again,the direction in which pressure decreases determines the direction of wind. An increase in pressure gradient increases the velocity of wind and makes the climate conditions of a place unstable and violent and vice versa,e.g. effect of pressure difference from diurnal range of temperature is low while that from latitudinal differences of temperature is high.



(ii) Gravitational force: Air pressure decrease with increasing altitude,i.e.the gravitational pull over the air decrease with increasing altitude. The air which is close to the earth's surface exerts a higher pressure than that of the air over high altitudes. This creates high pressure over the valleys and low pressure over the mountain areas,resulting in a vertical movement of air from high pressure to low pressure region.Besides the movement of air from one place to another becomes curved rather than a straight line due to gravitational force.

(iii) Centrifugal force: The force generated from the centre of the earth as a result of rotation of the earth on its axis is known as centrifugal force. The wind direction is slightly deflected by this centrifugal force. This force is known as'Coriolis Force',as this phenomenon was first discovered by a French mathematician,Gasperd de Coriolis. As a result of Coriolis force,wind gets deflected towards right in clockwise direction in the northern

hemisphere and towards left in anticlockwise direction in the southern hemisphere. This phenomenon is known as Ferrell's law. The Coriolis force is zero over the equator and gradually increase towards the poles. The Coriolis force is the highest at the poles.



Deflection of Wind due to Coriolis Force

(iv) Frictional force: Frictional force negatively affects wind velocity. Rugged terrain such as mountains,valleys,thick forest,high-rise buildings,etc.block the movement of wind,thereby reducing its velocity. Similarly,the frictional force is much less,when the wind blows over water or snow-covered

land. However,the frictional force not only affects the velocity but also affects the wind direction.
With the decrease in the velocity of the wind,the impact of Coriolis force leading to deflection of wind also becomes less and so its impact on the wind direction is also minimum.

Q.9: What do you mean by'coriolis force's With the help of diagram briefly describe its contribution in determining the direction of wind.

Ans: Refer to answer of question no. 8 (iii) [textual questions and answers]

Q.10: What is meant by 'pressure gradient force' ? What is its contribution in air movement.

Ans: Refer to answer of question no.8 (i) [textual questions and answers]

Q.11: Briefly discuss the contribution of the earth's gravitational force in air movement.

Ans: Refer to answer of question no.8 (ii) [textual questions and answers]

Q.12: What do you mean by naming of wind ? How is the wind blowing over a place named ?

Ans: Giving a name to a particular movement of air over a place or region is known as naming of wind. Naming

of wind depends on wind direction,i.e. the direction from which wind comes is known as 'windward' and the direction to which it blows is called ' leeward'.e.g. if is called westerly wind,etc.

Q.13: How is the velocity of wind determined ? What are the units of wind velocity ?

Ans: The velocity of wind is determined with the help of an instrument named anemometer.
Nowadays,anemograph,a type of anemometer is used to measure and record the direction and wind velocity automatically.The velocity of wind is expressed in terms of knot. The wind velocity of one knot means one nautical mile per hour which would mean 1.854 kilometer per hour or 30.9 metres per minute.
i.e. 1knot = 1nautical mile per hour
Or 1.854 kilometer per hour Or 30.9 metre per minute

Q.14: How is the classification of wind done ? Briefly discuss with examples.

Ans: On the basis of extent of circulation,the different types of wind are :

(i) Primary wind circulation: The regular and permanent wind that originates as a result of permanent pressure belts over the earth's surface and which affects the whole earth is known as primary circulation. It is also called permanent or planetary wind. The main primary or planetary winds are:

(a) Trade winds (b) westerlies

(c) Polar winds

(ii) Secondary wind circulation: The wind that originates in certain areas of the earth as a result of the variations in landforms, distribution of land and water bodies,regional and seasonal variations,variations in temperature-pressure conditions,etc. is known as secondary wind circulation or secondary wind. These winds bring about immense change in the weather of an area and create unstable atmospheric conditions. They are also known as periodic winds. The main winds of secondary circulation are:

(a) Air mass (b) Cyclones

(c) Front (d) Anticyclones

(e) Monsoon wind

(iii) Tertiary wind circulation or local wind: The winds that originates as a result of certain local conditions such as topographic variation,altitude changes,distinct landforms,presence of water, altitude variations,etc. are known as tertiary wind circulation or local winds. These winds blow in a limited area but change the weather of an area significantly.
It is also known as temporary air movement. The main local winds are:

(a) Sea breeze (b) Land breeze

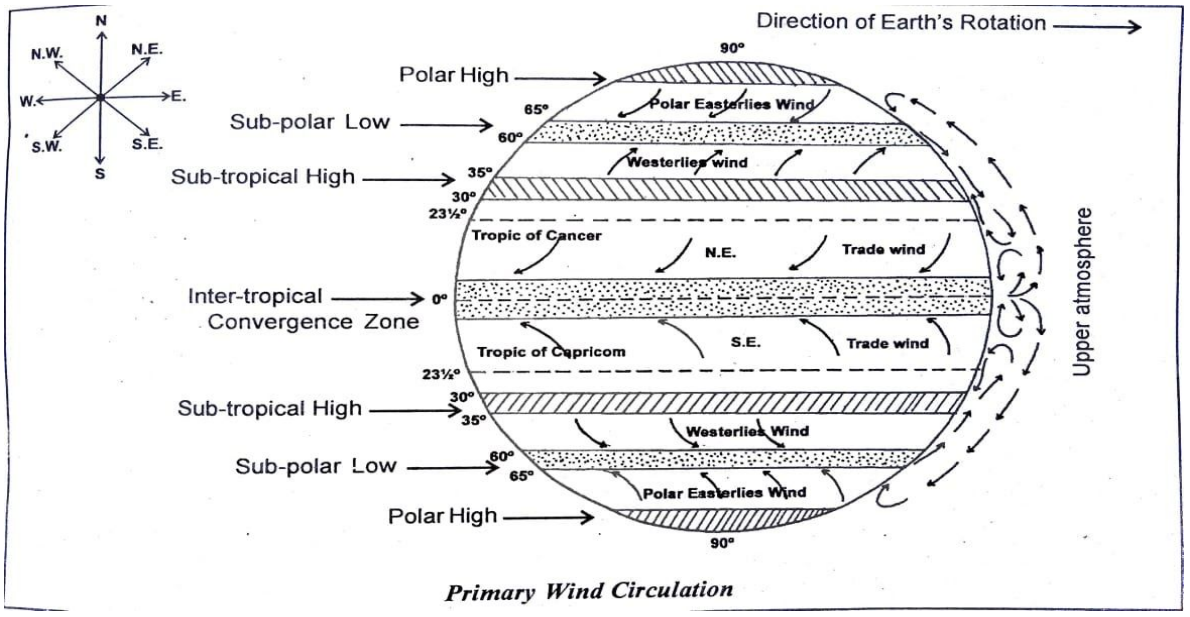
(c) Mountain wind (d) Valley wind

(e) Other local winds

Q.15: What do you mean by primary circulation of wind ? Show distribution of primary circulations in a diagram. Mention its important characteristics.

Ans: Do Your Self.

Distribution of primary wind circulation



Primary Wind Circulation

The main characteristics of the primary circulation wind are :

(i) Trade wind: The wind that blows from the sub-tropical high pressure belts situation on both sides of the equator towards the equatorial low pressure belt from

30°N and 30°S to 0° is known as trade wind. There are two types of trade winds :

(a) North-east trade wind: The trade wind that blows from the north- east direction to south-west direction in the northern hemisphere due to the Coriolis force is called south-east trade wind.

(b) South-east trade wind: The trade wind that blows from the south-east direction to north-west direction in the southern hemisphere due to the Coriolis force is called south-east trade wind.
Since the trade wind comes from both hemispheres towards the equator,a division is formed after meeting each other in the equatorial region. This division is known as inter-tropical convergence zone. The main feature of this area is that the movement of the wind is hardly perceived here as the Coriolis force is almost zero here. Because of the calm nature of the wind here,this area is known as 'calm zone'or 'doldrums'.

(ii) Westerlies: The permanent wind that blows from the high pressure sub-tropical belts towards the high latitude sub-polar low pressure belts are known as westerlies. Since,this wind blows in the opposite direction of the trade wind and is more intense,it is also called anti-trade wind. The main westerlies are:

(a) South-west westerlies: The wind that blows from the south-west to east and north-east in the northern

hemisphere due to the Coriolis force is known as south west westerlies.

(b) North-west westerlies: The wind that blows from the north-west to east and south-east in the southern hemisphere due to the Coriolis force is known as north-west westerlies.The trade winds and westerlies create a calm zone of wind circulation,known as horse latitude in the sub-tropical high pressure belt. This zone lies within 30°-35°N and S latitudes.
But the westerlies are very intense in the southern hemisphere between (40°S-50°S latitude), furious fifties(50°S-60°S latitude) and screaming sixties(60°S-50°S latitude).

(iii) Polar winds: The wind that blows from the polar high pressure belts to low pressure sub- polar regions in both hemisphere is known as polar wind. These winds are also called polar easterlies as these winds blow from the east in both the hemispheres. The polar wind and westerlies meet each other leading to the formation of polar front and moderate cyclonic storm due to their contrasting nature.

Q.16: What is secondary circulation of wind ? Discuss its contribution in determining the climate of a place with examples.

Ans: Do Your Self.

(ii)The contribution of secondary circulation of wind determining the climate of a place are :

(i) Air mass: Refer to answer of question no.19.

(ii) Front: Refer to answer of question no.20.

(iii) Cyclones: Refer to answer of question no.18.

(iv) Anticyclones: Refer to answer of question no.24 (i).

(v) Monsoon winds: Refer to answer of question no.21.

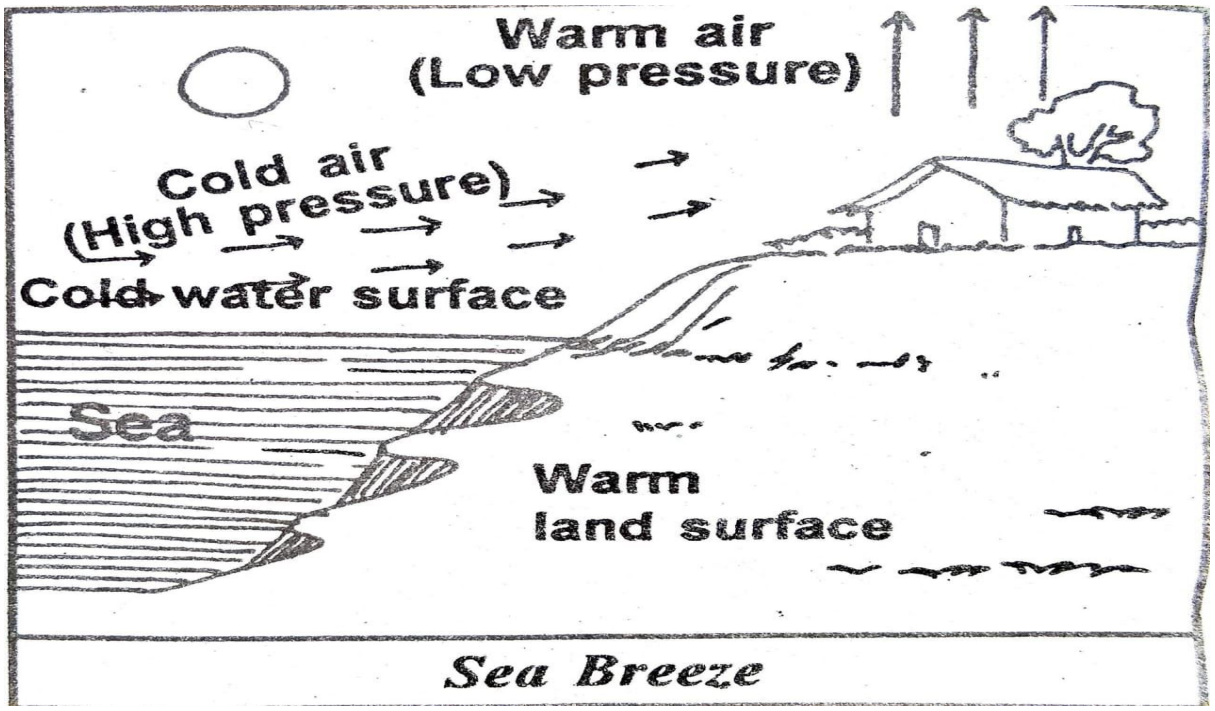
Q.17: What is local wind ? Briefly discuss with examples how local wind determines the weather condition of a place.

Ans:Do Your Self.

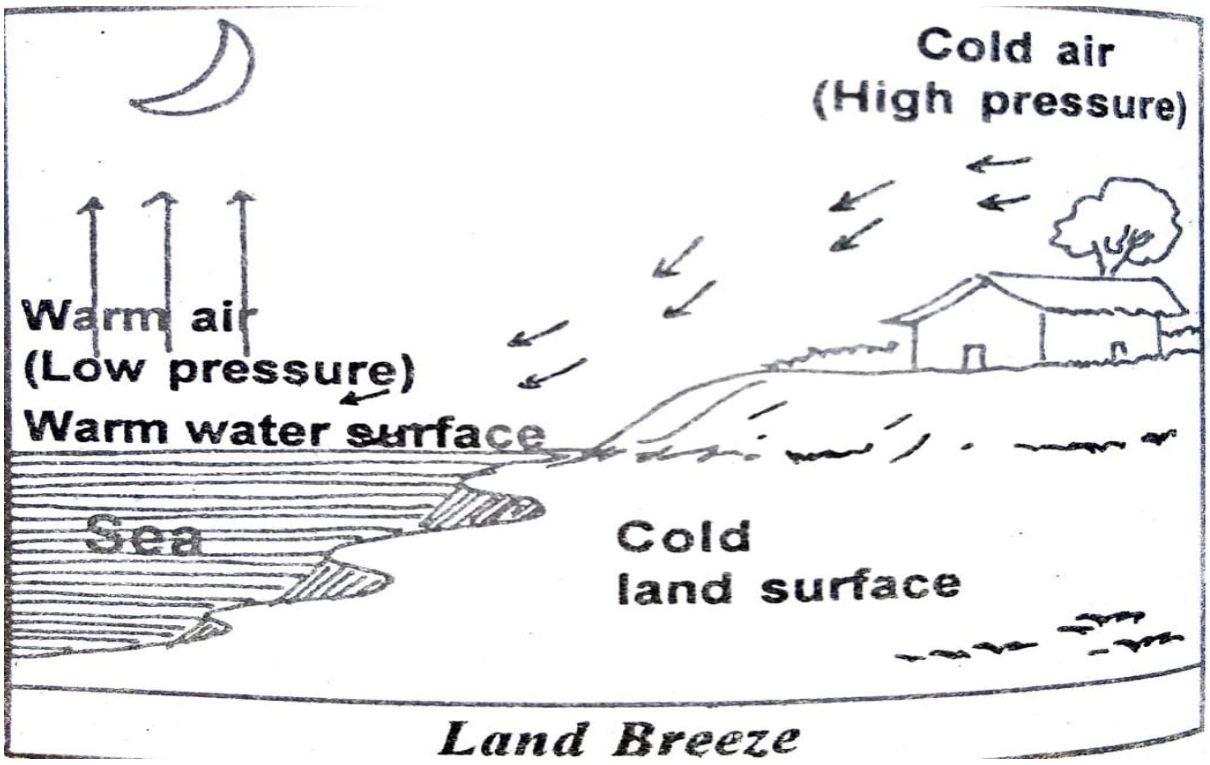
(iii) The role of local wind in determining the weather conditions of a place are :

(i) Sea breeze : The wind that blows during the day from the sea towards the land having low pressure is known as sea breeze. During the day,the land gets heated faster than sea water and as a result there exists low pressure over the land and high pressure over the sea which gets heated much slower. Since this wind comes from the sea,it is cool and full of moisture. The coastal regions of countries are greatly influenced by this wind

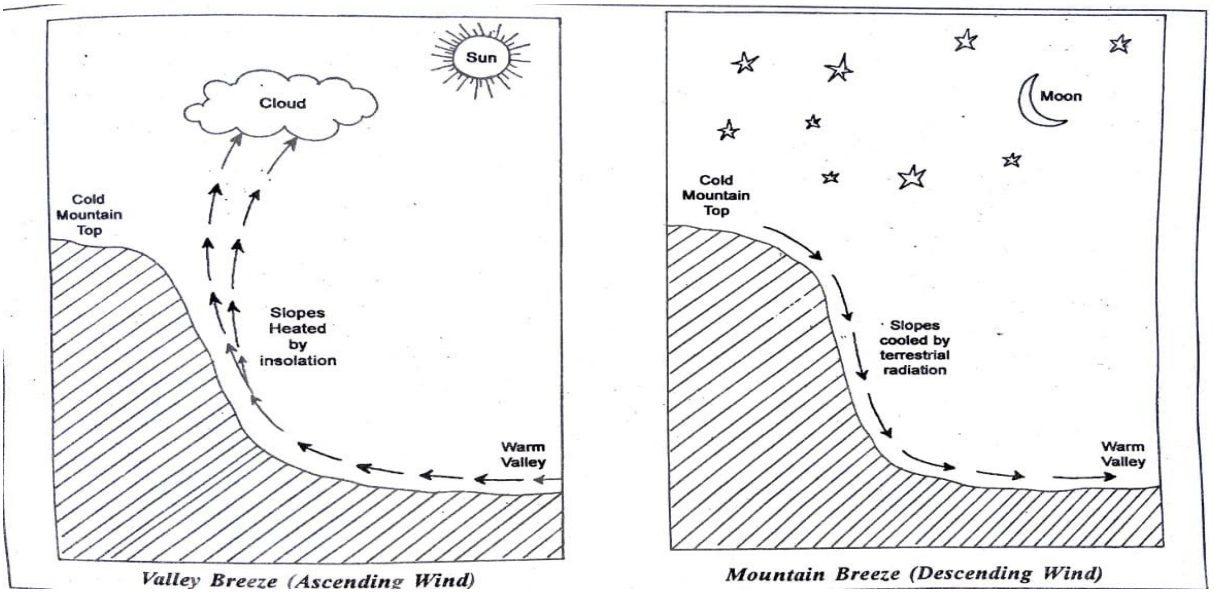
making such regions ideal for habitation as well as for tourism.



(ii) Land breeze : The wind that blows during the night from the land towards the sea as there exists low pressure over the sea is known as land breeze. During the night,the land masses cool off faster than water bodies and so there exists high pressure over the land and low pressure over the sea as water bodies release the heat absorbed during the day more slowly than land. Therefore,wind blows from the land towards the sea. Since such wind comes from land,they are dry and cold.



(iii) Mountain wind and valley wind : During the day,the dense air of the valleys absorbs heat more quickly than the air over the mountains. As a result,the air over the valleys gets heated up forcing it to rise up along mountain slopes. This wind is known as valley wind. During the night,mountain tops and slopes become cold compared to that of the valleys and as a result,wind blows from the mountains tops towards the valleys,known as mountain wind. These do not allow formation of fog even during winter in the foothill areas of mountains.



(iv) Other local winds: Many local wind originates due to certain local temperature variations. They are known by different names in different countries. The common local winds are Chinook,Foehn,Siroco,Mistral, Loo,etc. Chinook is mostly found in the rocky mountainous region of the U.S.A.while Feohn is noticed in the Alpine regions of Europe .Mistral is a dense and cold local wind of Europe which blows from the southern slopes of the Alps towards the coastal region of the Mediterranean Sea in winter. Sirocco is a warm and dry local wind of North African Sahara region while Loo is a dry local wind of North-western India. Such winds bring about great changes in local weather conditions.

Q.18: What is a cyclone ? What are its types ? Mention briefly how it influences the climate of a place.

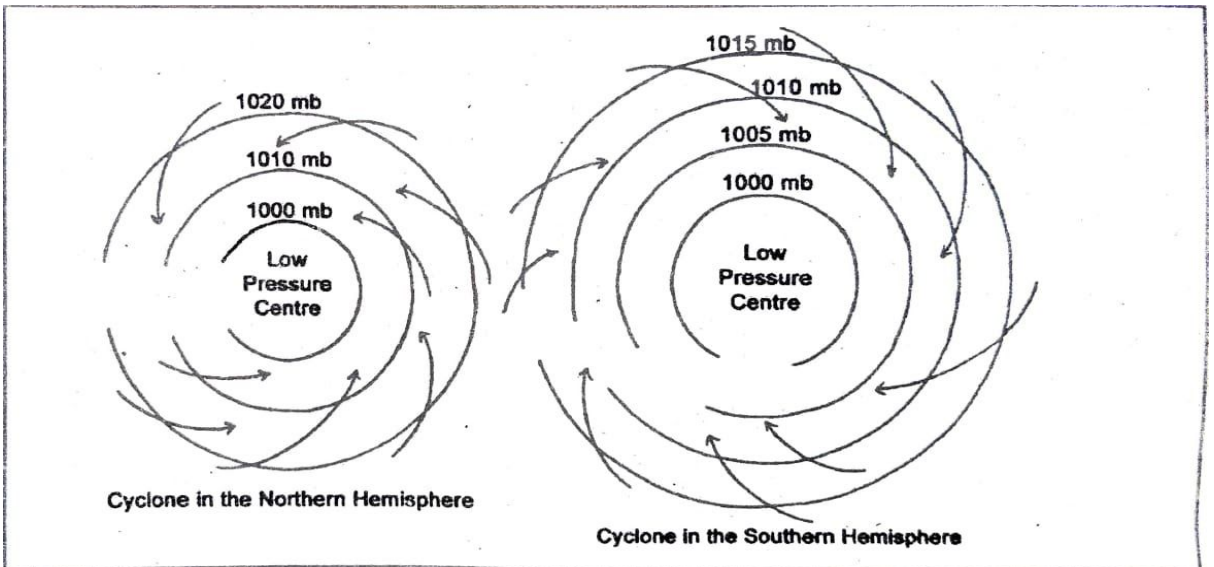
Ans: Cyclone is the state of atmospheric circulation in which high velocity wind assumes a cyclic path around a low pressure centre. The most noticeable feature of

cyclone is the movement of the wind from the centre to the outer periphery marked by violent cyclical movement of the air often causing terrible havoc.
The types of cyclones and the way it influences the climate of a place are:

(i) Tropical cyclones: Tropical cyclone occurs when high velocity wind from a high pressure region take a cyclic path of violent nature all around a low pressure centre in the tropical region.Due to earth's rotation,these cyclones move in an anticlockwise direction in the northern hemisphere and in a clockwise direction in the southern hemisphere. Generally,the wind velocity of tropical cyclones ranges from 120km to 280km per hour and its diameter ranges from few kilometer to thousands of kilometer. During summer,these cyclones mostly begin in the sea and then move over to the land surface causing great havoc and destruction. These tropical cyclones cause extensive damage in South-eastern part of North America,eastern part of Japan and east coastal regions of India. They are known as Typhoon in the coastal areas of the Pacific in the east,Hurricane in the West Indies region,Cyclone in the Indian Ocean,Bardoisila in Assam and Willy-Willy in North-eastern coast of Australia.

(ii) mid-latitude/extra-tropical cyclones/temperate cyclones/wave cyclones: Extra-tropical cyclones are found in regions between 30° and 65° latitude in both the hemispheres,i.e. the temperate and high latitude regions. These type of cyclones are mostly formed as a

result of meeting of diverse types of wind. Extra-tropical cyclone is the polar front formed with unstable atmospheric conditions due to which temperate regions often witness weather change. The atmospheric pressure difference between the centre and outer part of the cyclone ranges from 10 to 35 milibar. Though cyclones have a circular and elliptical shape,sometimes extra-tropical cyclones are V-shaped. Most of the temerate cyclones have a diameter ranging from 300km to 1500km and one of these cyclones covers nearly 1.6 milion sq km area. Generally,the cyclones of the temperate region move from the south-west to north-east region. This type of cyclone is associated with dense clouds,heavy rainfall,hail and thunder storm. But due to mild air movement,the weather soon becomes clear.



Cyclones and Cyclonic Wind in the Northern and Southern Hemispheres

Q.19: What is an mass ? How is it classified ? What is its contribution in determining the climate of a place ?

Ans: Air mass means a huge mass of air having homogeneous temperature and humidity. Generally,it extends over a wide area and is responsible for climate and weather conditions that prevail over that area.
On the basis of the characteristics and source of region of the air mass,it can be categorised into the following four groups:

(i) Tropical continental air mass(cT)

(ii) Tropical maritime air mass (mT)

(iii) Polar continental air mass (cP)

(iv) Polar martime air mass (mP) Air mass greatly influences the climate conditions of the place over which it passes. When air mass passes through an area,it influences the air of that area. One of the features of air mass is that its characteristics are passed on to the surrounding air or the air over which it passes over. Vertical circulation of temperature and pressure is a notable feature of air over air mass. Cold air mass generally influences the air below, making it cold while hot air mass makes the bottom air hot too. It not only transfers heat to the surrounding layers of air but also passes on humidity,density, pressure conditions,etc. Thus,air mass,plays a major role in the distribution of heat in the atmosphere. Because of the dynamic movement of air mass,the heat from warm region moves to cold region in the atmosphere and thereby an equilibrium in atmospheric temperature is maintained.

Therefore,air mass greatly influences the climate and weather conditions of a place.

Q.20: What do you mean by 'front' ? How is it formed ? Briefly discuss the relationship between climate and front.

Ans: When two different air masses with sharp contrast in temperature, pressure,etc.come closer from opposite directions,they do not mix easily and form a line of discontinuity. This line of discontinuity of air mass is known as front. Front is a type of secondary wind circulation or periodic wind. On the basis of nature and characteristics,fronts are divided into the following four types:

(i) Cold front: A warm air mass is shifted by a cold air mass.

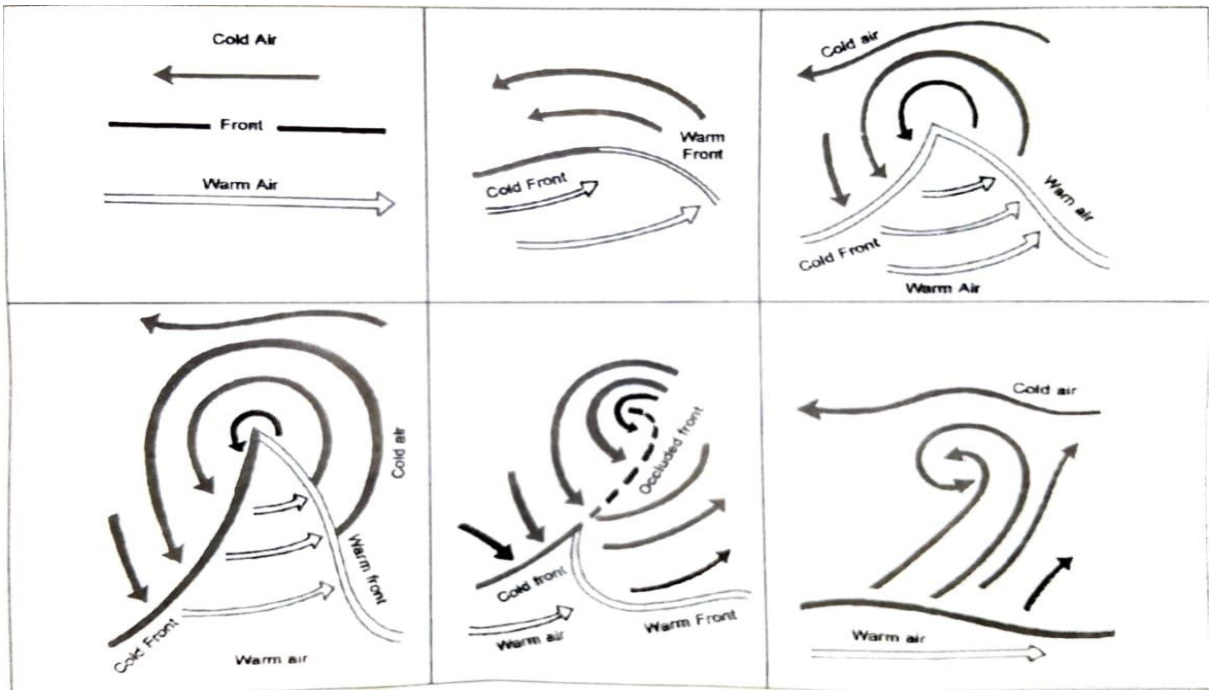
(ii) Warm front: A cold air mass is shifted by a warm air mass which moves over the cold air mass.

(iii) Stationary front: Remains in static condition and does not help in shifting of air mass.

(iv) Occluded front: Formed as a result of intermixing of both cold and warm fronts and has mixed characteristics.
Formation of front:The following two conditions are essential for the formation of a front:

(i) There should be two air masses of which one should be colder and heavier than the other.

(ii) Air movement should be convergent so that the two air masses from opposite directions move closer to one another.



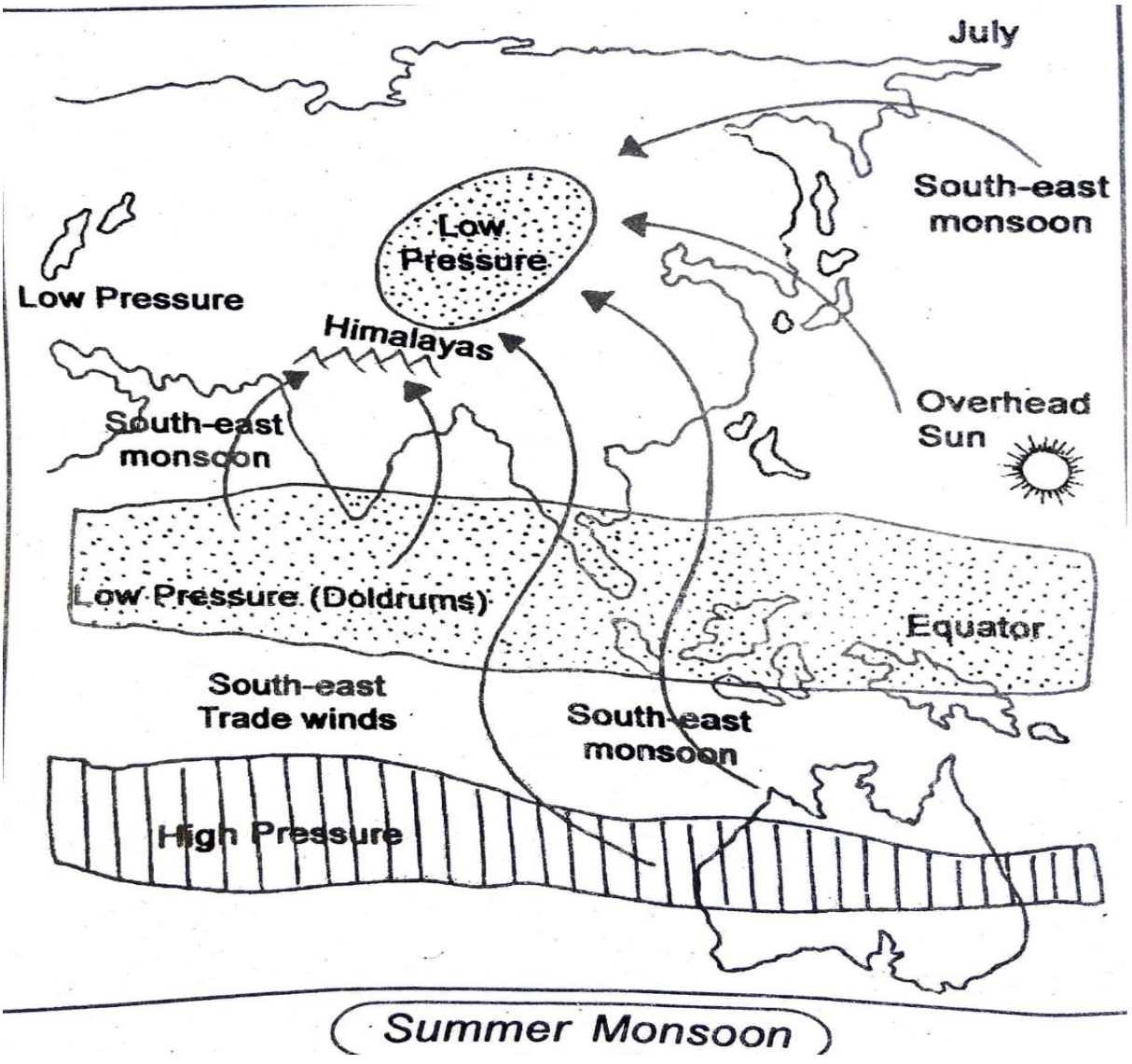
Relationship between climate and front:
The coming closer of two airmasses with contrasting characteristics,brings about a change in the climate in the frontal region. The warm front moves over the cold front and maintains equilibrium of air temperature. The mixing of both types of front due to reversal of pressure gradient direction helps transfer of temperature,diffusion of humidity, pressure and other physical characteristics of the atmosphere. The progress of the front also brings about climate changes in the surrounding regions.

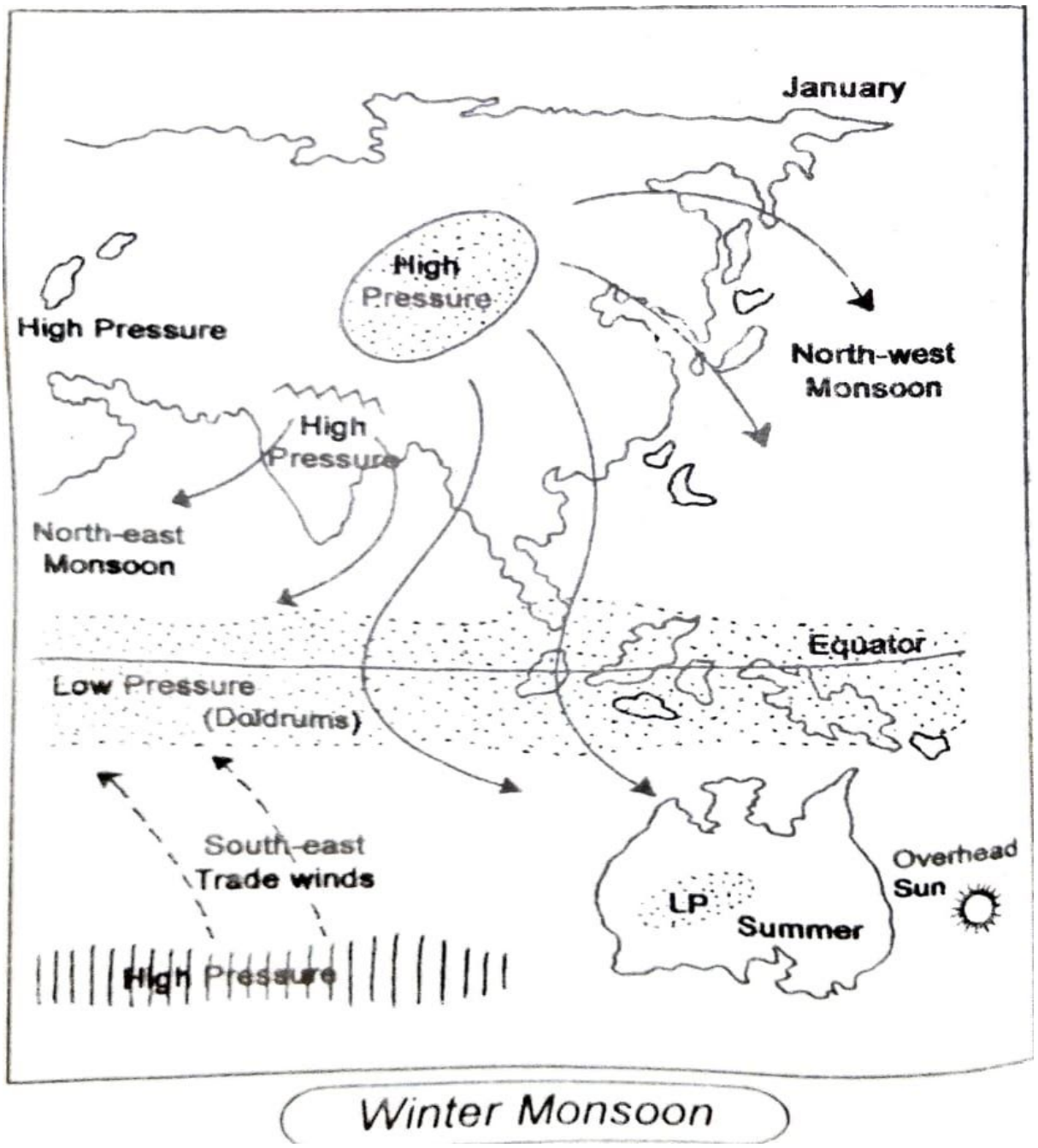
Q.21: What do you mean by 'monsoon wind' ? How is it formed ? In which areas of the earth its impact is quite distinct ?

Ans: The word 'monsoon' has been derived from the Arabic word 'mausim' and the Malayan word 'monsin' which means 'seasons'. Thus,monsoon wind is a type of wind which reverses its direction with change of seasons. In summer,it blows from sea to land,and during winter it blows from land to sea. It blows at places situated near the sea within the tropical and sub-tropical regions,where the differences of temperature between summer and winter is high.
Formation of monsoon wind:

(i) Summer monsoon : During summer in the northern hemisphere,the sun's rays fall vertically in the areas situated near the Tropic of Cancer,due to which a powerful low pressure area develops in these regions. On the other hand,high pressure appears over the sea situation close to the south and soth-east of these regions,and as a result wind blows from sea to land. As this wind blows from sea to land,it is moist and brings a lot of rain to the areas over which it blows. It is due to this reason that the south-west and south-east monsoon wind which blow from the Arabian sea and the Bay of Bengal bring a lot of rain in the foothills regions of Assam southern part of Meghalaya and western slopes of the westernghats.

(ii) Winter monsoon: In winter,the direction of the wind is changed. Because of the existence of high temperature over the water bodies,there exists low pressure over the water and high pressure over the land. Therefore,dry wind blows from the land to the water and high pressure over the land. Therefore,dry wind blows from the land to the sea. However,when this wind passes over the water bodies in their southward journey,





Winter Monsoon

It absorbs certain amount of moisture bringing rain to the lands over which it blows in its later journey. That is why,coastal regions of Tamil And get winter rain from north-east monsoon winds that come from the Bay of Bengal.The main areas of monsoon wind are South-Asia,Africa,South-east and South-west coasts of the U.S.A.,Gulf region of Mexico,North-east Australia,etc. However,the greatest impact of monsoon

is seen in Asia particularly in South-Asia and South-east Asia.

Q.22: Write with reasons :

(a) Why do all weather phenomena occur mainly in troposphere ?

Ans: Why weather activities occur primarily in the troposphere because troposphere contains water vapour,dust particles and other elements. The presence of these elements is responsible for the formation of clouds,rain,thunder, temperature difference, pressure difference,etc. That is why, troposphere is called the weather-making layer.

(b) What would be the consequences of the increase in the amount of carbon dioxide ?

Ans: An increase in the amount of carbon dioxide gas in the atmosphere can lead to serious consequences. Carbon dioxide has the ability to absorb heat from the sun. Therefore, increase in this gas will make the earth much warmer and hence there will be global warming with its negative repercussions.
Secondary,over-abundance of carbon dioxide will push up the ozone layer leading to its further depletion,which in turn,will allow the harmful ultraviolet rays to reach the earth.

(c) What is the reason behind the prevalence of high pressure of dry air than moist air ?

Ans: The wet air has lots of water vapour which reduces the density of air leading to low pressure. On the other hand,dry air contains low or minimal amount of water vapour as it has the ability to absorb less water vapour. Low amount of water vapour leads to high density of air leading to high atmospheric pressure. Therefore,dry air has more pressure than moist air.

(d) How does the ozone layer help the living beings ?

Ans: Ozone layer present in the stratosphere at an altitude of about 40-50 km is a vary useful layer for the living world. The ozone molecules present in the ozone layer have the ability to absorb the harmful ultraviolet rays of the sun. Ultraviolet rays cause skin cancer and many other diseases. In this manner,ozone layer provides protection to the living world.

(e) Why is the air pressure highest at the sea level ?

Ans: Atmospheric pressure is highest at sea level because air over sea is dry since all the water vapour gets evaporated to higher levels due to heat of the sun. Dry air generally has high density which results in high atmospheric pressure. Less amount of water vapour brings about greater density of air which leads to higher atmospheric pressure.

(f) What is the reason behind variation in vertical extent of the troposphere in the polar region and equatorial region ?

Ans: The earth is spherical in shape. The maximum vertical height of troposphere in the equatorial region is about 16km while it is 10km in the polar region, because of inclined position of the earth towards the poles.

(g) Why is horizontal movement of wind parallel to the earth's surface not felt in the equatorial low pressure belt ?
Ans: No wind movement blowing parallel to the earth's surface in the equatorial low pressure belt is felt because no horizontal movement of wind is visible in this region. Due to the heat of the sun,the air over the equatorial region gets heated up and rises up in an upward direction rather than in a parallel direction. Since the movement of air is upwards,the usual noise and disturbance of wind is absent. Therefore,one does not feel any movement of wind over this region.

Q.23: Give very short answer to the following questions :

(a) What is the vertical extent of the atmosphere ?

Ans: 10,000km. (approximately).

(b) Up to what altitude from the earth's surface does chemical composition of gases remain almost same ?

Ans: Upto an altitude of 80 km.

(c) What is the name of the boundary line between homosphere and heterosphere ?

Ans: Menopause.

(d) What is Ferell's Law ?

Ans: Ferell's law states that the poleward moving wind the northern hemisphere moves relatively towards north-east and the poleward moving wind in the southern hemisphere moves relatively to the south-east. Thus,the force generated due to the earth's rotation deflects the wind towards right in clockwise direction in the northern hemisphere and towards left in the anticlockwise direction in the southern hemisphere.

(e) What is Beaufort scale ? Write briefly about the utility of this scale with example.

Ans: A British scientist named Sir Francis Beaufort developed a 0-12 number scale of wind velocity in 1805 which helps to understand the various types of wind velocity,nature of the wind and its impact. This scale is known as Beaufort scale.
The utility of this scale is given in the chart below :

BEAUFORT SCALE

Beaufort Number	Velocity of wind (in knot)	Nature of wind	Impact of wind
0	< 1	Calm	Vertical rising up of smoke takes place.
1	1 – 3	Light air	Drifting of smoke determines direction of wind and not by wind vane.
2	4 – 6	Light breeze	Movement of wind is felt on face.
3	7 – 10	Gentle breeze	Leaves and small twigs moves slightly.
4	11 – 16	Moderate breeze	Dust and sand particles are blown away and small branches also shake.
5	17 – 21	Fresh breeze	Small waves form in pond waters and small trees also begin to sway.
6	22 – 27	Strong breeze	Telephone wires start whistling and big branches start shaking, umbrella used with difficulty.
7	28 – 33	Moderate Gale	Walking becomes difficult and trees start shaking.
8	34 – 40	Fresh Gale	Walking is impeded and twigs start breaking.
9	41 – 47	Strong Gale	Thatched roofs are blown away, structural damage slightly takes place.
10	48 – 55	Whole Gale	Fences are blown off, trees are uprooted and structural damage also takes place.
11	56 – 63	Storm	Causes extensive damage, occurs very rarely.
12	> 64	Hurricane	Causes huge destruction of life and property characterised by violent storm, mostly occurs in tropical region.

(f) Write in brief about lapse rate

Ans: Lapse rate is the rate, i.e. 6.5°C per kilometer in which temperature decrease while going vertically up through the troposphere from the earth's surface.

Q.24:Write short note :

(a) Homosphere.

Ans:Do Your Self.

(b) Heterosphere.

Ans: Do Your Self.

(c) Air temperature,earth's surface height and air pressure relationship.

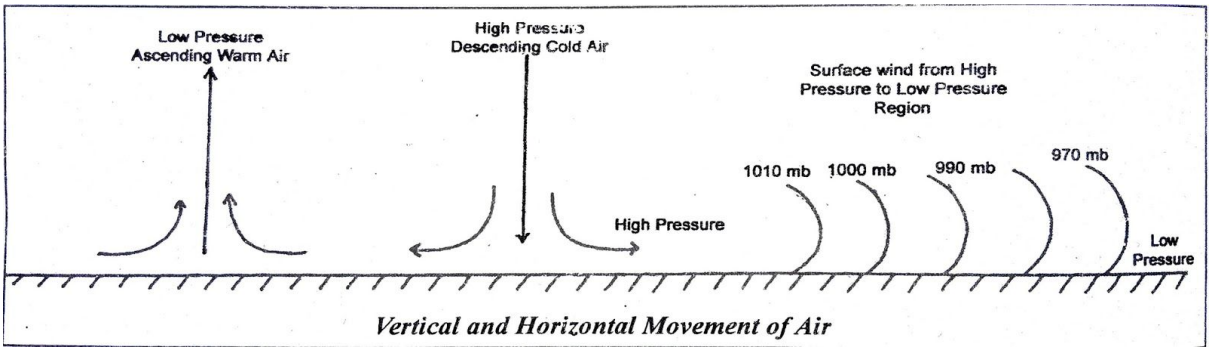
Ans: There is a close relation among atmospheric pressure, temperature and elevation of the earth. All these are interlinked and closely related. The two vital factors that control and influence the atmospheric pressure of a place are temperature and elevation of the place. When the temperature is high,the air expands and becomes light leading to lower density,which brings about low pressure. Therefore,high temperature causes low pressure while low temperature brings about high pressure. That is why,polar regions have high pressure. Atmospheric pressure is also affected by the elevation of the place. Atmospheric pressure decrease with height. In fact,the atmospheric pressure decrease at the rate of 1 inch or 34 millibar per 900 ft. in height. Therefore,places of height elevation have low pressure while places of lower elevation have high pressure. Thus,all the three factors are closely interlinked and interrelated.

(d) Polar high pressure belt.

Ans:Do Your Self.

(e) Wind system.

Ans: Wind is the horizontal movement of air on the surface of the earth resulting from pressure differences caused by variations of temperature. Wind has two movements,viz.horizontal and vertical. The horizontal movement is more significant as the quantum of air involved in horizantal movement is many times more than that of vertical movement. However,there is a constant movement of air vertically as well known as current. Wind is an important agency of the atmosphere that enables the atmosphere to maintain equilibrium of heat,water,energy,etc. It helps transfer to heat,moisture and various other physical characteristics of the atmosphere from one region to another both vertically and horizontally. Thus,wind is not a simple phenomenon but it involves several processes and affects many factors in our physical environment. Hence,it is called wind system.



Vertical and Horizontal Movement of Air

(f) Pressure gradient.

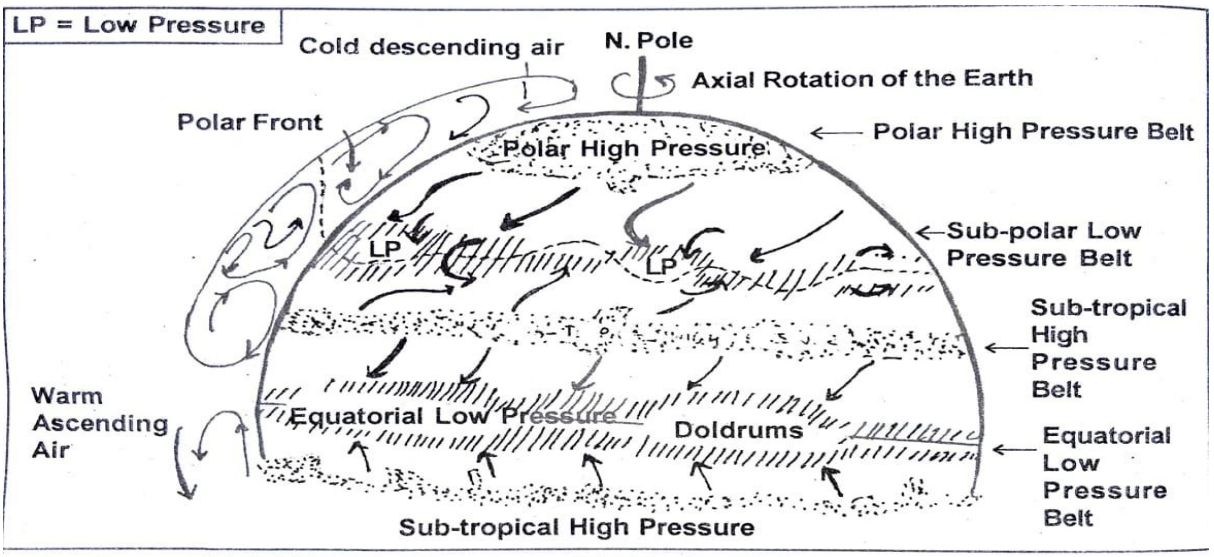
Ans:Do Youe Self.

(g) Trade wind.

Ans: Refer to answer of question no 15 [Textual questions and answers]

(h) Horse latitude.

Ans: A region of the sub-tropical high pressure belt is characterised by a calm zone of wind circulation. Through there are external signs of wind,yet the central part of this zone remains almost motionless and stable. This calm zone is known as Horse Latitudes. During the medieval period,the sailors who used to travel in this area of the sea often threw off horses from the ship to lighten their ship and thus improve its speed. Therefore,this area came to be known as horse latitude.



Impact of Axial Rotational Movement of the Earth on Sub-tropical High Pressure Belt

(i) Roaring forties.

Ans: Westerlies blow from the sub- tropical high pressure belts to the sub-polar low pressure belts in both the hemispheres. In the southern hemisphere,due

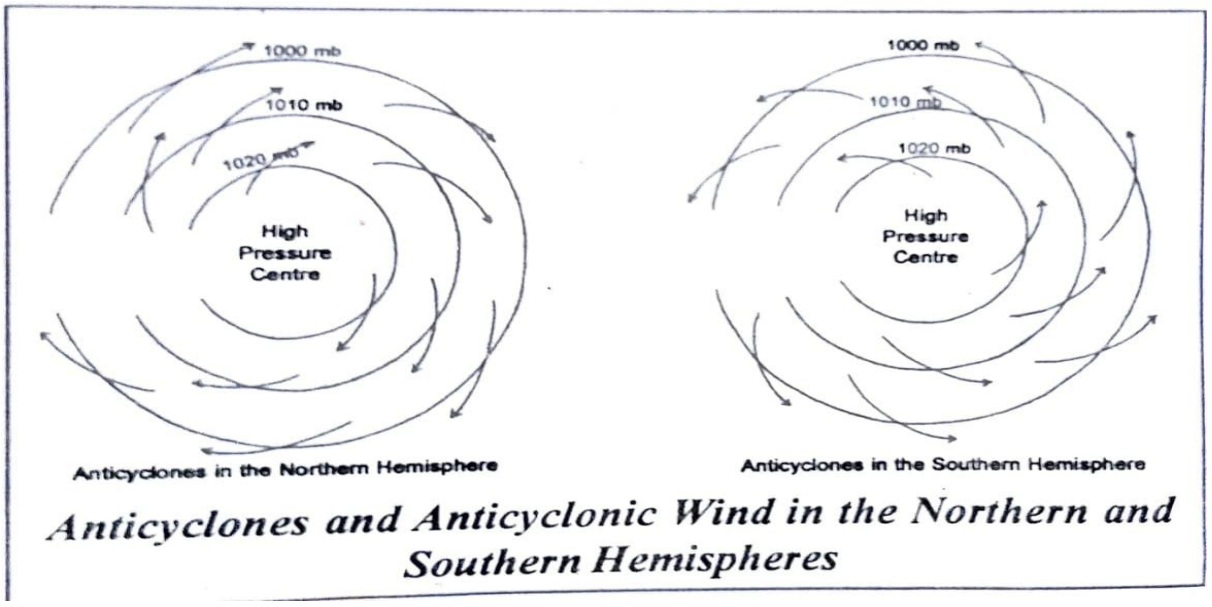
to the predominance of oceans,the westerly wind is more vigorous and noticeable. Unchecked by any landforms at 40° south latitudes,it blows with a terrific speed and roaring sound over the ocean waters. Hence,this area is called 'roaring forties'.

(j) Anticyclone.

Ans: The term 'anticyclone' was first used by Meteorologist Sir Francis Galton in 1861. The movement of air from a high pressure centre towards the low pressure surrounding is known as anticyclone. It is an atmospheric condition completely opposite to that of cyclone and its contribution to weather conditions unlike cyclone is not very significant. The centre is also known as High pressure Centre because pressure is highest at the centre. When this high pressure cell becomes elongated,it is known as ridge. These are formed in the sub-tropical and high latitude regions of both the hemispheres of the earth. Due to rotation of the earth, anticyclones move around the high pressure centre in a clockwise direction in the northern hemisphere and in an anticlockwise direction in the southern hemisphere. There are two types of anticyclones :

(i) Sub- tropical warm core anticyclones : The warm-core anticyclones originate in the sub-tropical regions and move from west to east.

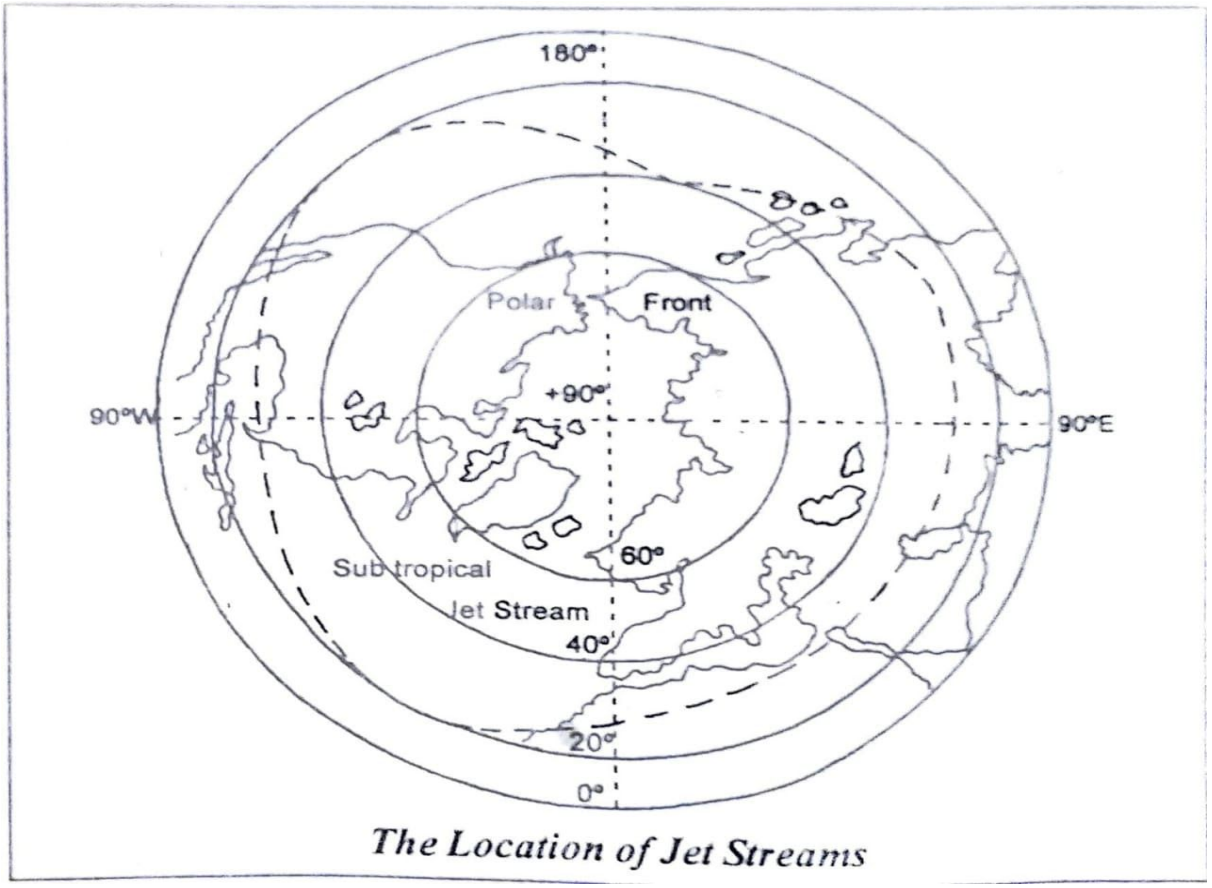
(ii) High-latitude cold core anticyclones : The cold-core anticyclones originate in the sub-tropical regions and move towards south.The wind velocity remains low, which leads to low rainfall due to low pressure differences between the high pressure centre and the outer parts of the anticyclones. Anticyclones are associated with fair weather conditions. Sometimes, anticyclones cause cold wave or blizzards in certain parts of the American continent and Europe.



Anticyclones and Anticyclonic Wind in the Northern and Southern Hemispheres

(k) Jet stream.

Ans: Jet stream is very high velocity wind (640 km per hour) blowing towards east in the tropical high altitude regions, i.e. in the tropopause. They bring about immense changes in the weather and climate of a place. Westerlies are also a type of jet stream.



The Location of Jet Streams

(l) Isobar

Ans: A line joining places having same barometric pressure is called an isobar.

(m) Tropical cyclone.

Ans:Do Your Self.

Q.25 : Write the differences :

(a) Horizontal wind and vertical wind .

Ans: The differences between horizontal wind and vertical wind are :

Sl. No.	Basis of difference	Horizontal wind	Vertical wind
(i)	**Meaning**	Movement of air parallel to the earth's surface.	Movement of air vertically up.
(ii)	**Significance**	Very significant movement of air.	Not very significant movement of air.
(iii)	**Volume of air**	Volume of air involved is much more than that in vertical movement.	Volume of air involved is less than in horizontal wind.

(b) Wind and sir mass.

Ans: The differences between wind and sir mass are :

Sl. No.	Basis of difference	Wind	Air mass
(i)	**Meaning**	The horizontal movement of air over the surface of the earth.	A huge mass of air having homogeneous temperature and humidity.
(ii)	**Types**	(a) primary wind circulation or planetary wind or permanent wind. (b) Secondary wind circulation or secondary or periodic wind. (c) Tertiary wind circulation or local wind.	(a) Tropical continental air mass (cT). (b) Tropical maritime air mass (mT). (c) Polar continental air mass (cP). (d) Polar maritime air mass (mP).
(iii)	**Phenomena**	A wider phenomena and involves many processes.	A smaller phenomena and is one of the forms of secondary circulation of wind.

(c) Tropical cyclone and extra-tropical cyclone.

Ans: The differences between tropical cyclone and extra-tropical cyclone are :

Sl. No.	Basis of difference	Tropical cyclone	Extra-tropical cyclone
(i)	**Meaning**	Cyclic path taken by high velocity wind from high pressure region to a low pressure centre in the tropical region.	Formation of cyclones in the temperate and high-latitude region.
(ii)	**Region**	Takes place in the tropical region.	Takes place in the temperate region.
(iii)	**Diameter**	Varies from 120 km to 280 km per hour.	Varies between 300 km to 1500 km.

Sl. No.	Basis of difference	Tropical cyclone	Extra-tropical cyclone
(iv)	Effect	These cyclones are quite violent, harmful and destructive in nature.	These cyclones do not cause such havoc and are milder than tropical cyclones.
(v)	Time of formation	Formed during the summer season under the influence of oceanic environment.	Formed at any time during the year.
(vi)	Name	Typhoon, Hurricane, Cyclone, Bardoisila, Willy-Willy, etc.	Wave cyclones or temperate cyclones.

(d) Sea breeze and breeze.

Ans: The differences between sea breeze and land breeze are :

Sl. No.	Basis of difference	Sea breeze	Land breeze
(i)	Meaning	Wind that blows during the day from the sea towards the land which has low pressure because of the heat.	Wind that blows during the night from the land towards the sea as there exists low pressure over the sea.
(ii)	Nature	Cool and pleasant.	Dry and cold.

(e) Mountain wind and valley wind.

Ans: The differences between mountain wind and valley wind are :

Sl. No.	Basis of difference	Mountain wind	Valley wind
(i)	Meaning and cause	During the night, mountain tops become cold compared to that of the valley and as a result wind blows from the mountain tops towards the valleys.	During the day, the dense air of the valley absorbs heat more quickly than the air over the mountains. Therefore, wind blows from the valleys and move upward along the mountain slopes.
(ii)	Nature	Normally cold.	Generally warm.

(f) Cyclone and anticyclone

Ans: The differences between cyclone and anticyclone are :

Sl. No.	Basis of difference	Cyclone	Anticyclone
(i)	Meaning	State of atmospheric circulation of of air in which high velocity wind takes a converging cyclic path around a low pressure centre.	State of atmospheric circulation of air in which air moves in a diverging cyclic path around a high pressure centre.
(ii)	Affect	Causes a great deal of damage, since the velocity of cyclonic wind is very high.	Does not cause such havoc.
(iii)	Types	(a) Tropical cyclone. (b) Extra-tropical cyclone.	(a) Sub-tropical warm core anticyclone (b) High-latitude cold core anticyclone.
(iv)	Influence on climate	Make the climate of a place unsteady and violent.	Fair weather conditions are associated with anticyclones.

(g) Cold front and warm front

Ans: The differences between cold front and warm front are :

Sl. No.	Basis of difference	Cold front	Warm front
(i)	Meaning	Front in which a warm air mass is shifted by a cold air mass.	Front in which an advancing warm air mass moves over the cold air mass and shifts its position.
(ii)	Identification	Identified by a line marked with triangular spikes pointing in the direction of frontal movement.	Identified by a line marked with semi-circles facing the direction of frontal movement.

(h) Cold wave and hot wave.

Ans: The differences between cold wave and hot wave are :

Sl. No.	Basis of difference	Cold wave	Hot wave
(i)	Meaning	When an air mass characterised by extreme cold movement over a place brings about cold conditions in that area.	The movement of hot air mass over an area, making the region extremely hot and dry.
(ii)	Region	Temperate regions.	Tropical as well as semi-desert regions.
(iii)	Caused by	High-latitude cold anticyclones.	Sub-tropical warm anticyclones.
(iv)	Example	Parts of North America.	Central and south eastern USA.

(i) Troposphere and stratosphere.

Ans: The differences between troposphere and stratosphere are :

Sl. No.	Basis of difference	Troposphere	Stratosphere
(i)	Meaning	Layer of the atmosphere that lies closest to the earth's surface up to an average height of 10 km.	Second layer of the atmosphere lying above troposphere at a height above 10 km. upto 50 km.
(ii)	Temperature	Temperature decreases with height at the rate of 6.5°C per kilometre reaching – 60°C at the tropopause.	Temperature tends to rise from the tropopause through the stratopause reaching 0°C.
(iii)	Weather phenomena	Most of the climatic and weather phenomena such as clouds, rain, thunder, etc. takes place here.	Free from such weather disturbances.
(iv)	Upper limit	Known as tropopause.	Termed as stratopause.
(v)	Importance	Home of biosphere, i.e. all forms of life such as human beings, plants, animals, etc. are found in this level.	Has the ozone layer that prevents the harmful ultra-violet rays from reaching the earth. Aeroplanes fly in this layer.

Q.26: Find out the correct answer:

(a) Where is ozone layer located ?

(i) Troposphere (ii) Stratosphere

(iii) Mesosphere (iv) Thermosphere

Ans: (ii) Stratosphere

(b) What is amount of oxygen in the atmosphere in terms of volume ?

(i) 20.94% (ii) 29.01%

(iii) 32.47% (iv) 78.08%

Ans: (i) 20.94%

(c) The most important reason for air movement is __.

(i) Humidity difference (ii) pressure difference

(iii) Gravitational force

(iv) Centrifugal force

Ans: (ii) Pressure difference

(d) The instrument used for determination of wind velocity is ___.

(i) Wind vane (ii) Anemometer

(iii) Beaufort scale (iv) Hydrometer

Ans: (ii) Anemometer

(e) The unit of wind velocity is __.

(i) Knot (ii) Milibar

(iii) Percentage (iv) Degree

Ans: (i) Knot

(f) Monsoon wind belongs to which of the following class ?
(i) Local winds (ii) Primary circulation

(iii) Secondary circulation

(iv) Permanent wind

Ans: (iii) Secondary circulation

(g) The name of the cyclone formed in the coastal region of the Pacific Ocean in the east is ___.

(i) Cyclone (ii) Hurricane

(iii) Willy-Willy (iv) Typhoon

Ans: (iv) Typhoon.