Atmospheric Pressure and Winds

Exercises

I. Short Answer Questions.

Question 1.
Define the following terms :

(a) Pressure Gradient
(b) Winds
(c) Coriolis force.
(d) Altitude
(e) Monsoons.

Answer:

(a) Pressure Gradient — It is the rate of change of atmospheric pressure between two points on the earth's surface.
(b) Winds — Horizontal movements of the air from high pressure to low pressure areas are called winds.
(c) Coriolis force — This force is created by the rotation of the earth as the winds in different belts deflect towards right in Northern hemisphere and to the left in Southern hemisphere.
(d) Altitude — The pressure also decrease with increasing altitude at the rate of 100 millibars in every 1000 metres of height gained.
(e) Monsoons — are the periodic seasonal winds blowing in the regions of South East Asia and Northern Australia. The word monsoon is derived from the Arabic word 'Mausim' meaning 'Season', on account of deeply affecting the seasons of the particular region.

Question 2.
Name the four main pressure belts of the earth.
Answer:

- Equatorial low pressure belt
- Sub-tropical high pressure belt
- Circum-polar low pressure belt
- Polar high pressure areas.

Question 3.
What is Circum-polar Low Pressure Belt ?
Answer:
It is the belt of low pressure belt between 60°N – 70°N and 60° S – 70° S.

Question 4.
How does Coriolis Force vary latitudinally ?
Answer:
In the northern hemisphere the winds deflect towards right and in Southern hemisphere deflect towards left due to the effect of the rotation of the earth, e.g. the trade winds take the Southwest direction in place of southern direction in northern tropical belt and in southern tropical belt these winds take northwest direction in place of northern direction.

Question 5.
Name the three chief types of wind.
Answer:
Three chief types of winds are Trade winds, Westerlies, and Polar winds.

Question 6.
What are periodic winds ?
Answer:
Periodic winds blow at regular intervals or in regular cycles. They are winds that result from localised differences in pressure and temperature. For example, land and sea breezes and the seasonal winds.

Question 7.
What are local winds ? Name any two local winds.
Answer:
The local winds blow in certain places and these are warm and cold according to the area from which they blow, e.g. Foehn winds blow descending on the slopes of the Alps and makes the temperature ideal for grapes due to its warm effect. In the same way Chinook winds blowing and coming down from the Rockies mountains in North America helps to increase the temperature and are beneficial to keep grasslands ice free and warms the ranches, so good for animal rearing.

Question 8.
Name two types of variable winds ? Why are they so called ?
Answer:
Variable winds change their direction and force from place to place due to changing the pressure system. These blow for a short time or for a few days. These are cyclones and anticyclones. These are the circular winds with low pressure and high pressure in the centre respectively.

Question 9.
Why are cyclones frequent in summer in the tropical region ?
Answer:
In summer in the tropical region due to die shifting of Doldrums, the low pressure region is strongly originate between 8° and 20° N and S. They mainly originate in China sea and surrounding area. In Bangla Desh, these are known as 'KalBaisakhi' rneaning 'Time of Death' and cause heavy calamities and destruction. These are known as 'hurricanes' in North America, 'Typhoons' in China,'willywillies' in Australia.

Question 10.
Mention any two differences between Tropical Cyclones and Temperature Cyclones.
Answer:
Tropical Cyclones :

1. Tropical cyclones are produced mainly over the sea.
2. They generally originate in the tropical region between 8° and 20°N and S.

Temperature Cyclones :

1. Temperate cyclones are produced both on land and on sea.
2. They originate in the mid latitudinal region between 35° latitude and 65° latitude.

Question 11.
How are cyclones named differently in different parts of the world ?
Answer:
The name of the cyclones is different in different parts of the world on the basis of the local languages e.g. hurricanes in America, typhoons in China and Japan, meaning the destructive horrible cyclonic winds.

Question 12.
What are two chief characteristics of anticyclones ?
Answer:
Two chief characteristics are that these provide clear weather and the winds blowing from the centre towards outside in clockwise direction.

Question 13.
Why are the summer monsoons known as South-West Monsoons in the Indian subcontinent ?
Answer:
Due to the low pressure created in the Northern Indian subcontinent and high pressure centre located in the Indian ocean, the Monsoons start to blow from the ocean to the Indian landmass taking a direction from southwest to northeast in summer seasons.

Question 14.
Name the two types of instruments used for measuring pressure. State one point of difference between them.
Answer:
Two types of barometers are used for measuring pressure, e.g. Fortin's Barometer and Aneroid Barometer. The main difference is that Fortin's Barometer is filled with mercury, while Aneroid Barometer is without any liquid. Fortin's Barometer consists of a long narrow tube filled with mercury, while Aneroid is in the round shape like a watch.

Question 15.
Briefly state the variations in the vertical distribution of pressure.
Answer:
Many factors like slope of land, presence of winds and the temperature affect the pressure of air vertically. The rate of decrease is 100 millibars per 1000 metres of height gained. There is a thin air cover at high altitudes, so the percentage and amount of oxygen is also less.

Question 16.
Why are the months of January and July used to describe the world distribution of pressure ?
Answer:
Due to the lowest and highest temperatures recorded in January and July respectively the pressure areas are also affected, so it is preferred to display the distribution of pressure distinctly in January and July.

II. Give reasons for each of the following

Question 1.
The Westerlies in the Southern Hemisphere blow with greater force than those in the Northern Hemisphere.
Answer:
In the Southern Hemisphere there is open ocean for free movement along the belt of Westerlies. These blow with roaring sound and great speed along 40°S. and are known as 'Roaring Forties'.

Question 2.
There is a seasonal shifting in pressure belts.
Answer:
Due to the earth's changing aspect with respect to the sun, the pressure belts shift northwards by 5° in summer and southwards in winter resulting in particular seasonal changes, e,g. The cold waves blow in India in winter due to the sub¬tropical belt shifting along 30°N touching the Himalayas. On the other hand in summer the trade winds become powerful in India and push the monsoon winds from east to west in Northern Plain of India.

Question 3.
As we go higher, the atmospheric pressure decreases.
Answer:
As the air become thinner with increasing height, so, the air pressure also decreased. The rate of decrease is 100 millibars per 1000 metres of height gained. So mountain hikers take oxygen cylinder with them to compensate the air inhaled.

Question 4.
The winds are directed to the right of their flow in the Northern Hemisphere.
Answer:
Due to the rotation of the earth from west to east, the winds are deflected to the right e.g. the trade winds blowing from north, to south take north easterly direction.

PQ. Mediterranean lands receive most of the rainfall in winter season.
Answer:
Mediterranean lands come along the belt of Westerlies along 30°S in place of 40°N in winter. So, the Mediterranean countries along 30°N get ample rainfall. Similarly in the Southern Hemisphere the Westerlies blow along 30°S, in winter, so, the southern Mediterranean countries get winter rainfall.

Question 5.
Temperature and pressure are inversely related to one another.
Answer:
When the temperature increases and the air start to rise upwards. creating a low pressure area, but when the temperature decreases, the air start to sink downwards creating a high pressure area on land surface. So, the temperature and pressure are inversely related to one another.

Question 6.
Humid air is lighter than dry air.
Answer:
In tropical region the air is greatly humid due to excess of evaporation creating a low pressure conditions, while the cold regions with less humidity are high pressure areas. So, the humid air is lighter than dry air.

Question 7.
Doldrums is a low pressure belt.
Answer:
Doldrums is a low pressure belt along the equator from 5°N to 5°S. In this belt due to high amount of evaporation, the atmosphere is very calm and quiet due to no circulation of winds and continuous rising air mass creating a hollow like condition in this belt. Inspite of air pushed towards the equator, it is immediately deflected to right and left, creating a vacuum like condition resulting in a belt of calm named as 'Doldrums'

III. Distinguish between the following

PQ. Isobars and Isotherms
Answer:
Isobars :

1. These are the lines joining the places of same air pressure.
2. The closeness of these lines indicate the intensity of pressure.

Isotherms :

1. These are the lines joining the place of same air temperature.
2. The closeness of these lines indicate the intensity of temperature.

Question 1.
Cyclones and Anticyclones.
Answer:
Cyclones :

1. These are the circular winds with low pressure in the centre.
2. The winds blow anticlockwise from outside to the centre in Northern Hemisphere.
3. These bring rainfall, clouds thunder lightening.

Anticyclones :

1. These are circular winds with high pressure in the centre.
2. The winds blow clockwise from the centre towards all sides in Northern Hemisphere.
3. These bring clear weather and cold winds.

PQ. Vertical and Horizontal Temperature variation.
Answer:
Vertical Variation :

1. The Temperature decreases as the height increases
2. The rate is 1°C for every 166 metres of height.

Horizontal Variation :

1. The temperature decreases as the latitude increases.
2. Highest temperatures are found along Equatorial and tropical regions, while least temperature is recorded in polar areas.

Question 2.
Permanent and Periodic Winds.
Answer:
Permanent winds :

1. These blow throughout the year.
2. These are named Trade winds, Westerlies and Polar winds.

Periodic winds :

1. These blow in particular area and seasons.
2. These are named monsoon winds, Chinook, Foehn, Mistrel winds etc.

Question 3.
Summer and Winter Monsoons.
Answer:
Summer Monsoon :

1. These blow in summer season from July to September.
2. These bring heavy rainfall with thunder lightening

Winter Monsoon :

1. These blow in winter mainly in December and January.
2. These bring dry cold weather and cold waves.

IV. Long Answer Questions.

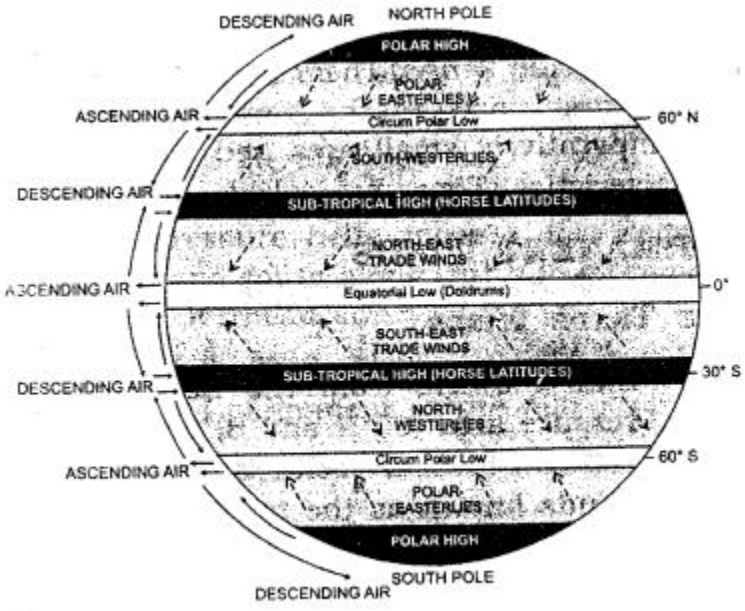
Question 1.
What is meant by the term 'Atmospheric Pressure' ? Explain briefly the factors that affect Atmospheric Pressure.
Answer:
Atmospheric Pressure refers to the force per unit area exerted against a surface by the weight of the air above that surface. Pressure is expressed in millibars (mb) and measured with a mercury barometer. The average atmospheric pressure at sea level is 1013.25 mb or 760 mm (the) height of the column of mercury in a barometer at sea level). Atmospheric Pressure decreases with height.
Factors affecting Atmospheric Pressure are as below :

- **Altitude :** The atmospheric pressure decreases with height or altitude. The decrease in pressure is about 1 cm of mercury for every 110 m of ascent. The atmospheric pressure is highest at sea level. This is because at higher altitudes the air is thinner or less dense than the air at the sea level. The maximum air density is at the earth's surface ; air density decreases with height because the

pull of the earth's gravity is less. The fewer number of gas molecules at higher altitudes means fewer molecular collisions and a decrease in air pressure.

- **Temperature :** Atmospheric pressure decreases with increase in temperature. This is because when the temperature rises, air expands. The molecules of air move far apart (become less dense) and hence exert less pressure. On the contrary, with decrease in temperature the air gets compressed and the space between molecules decreases (becomes more dense) and exerts more pressure on the region.
- **Water Vapour :** Water vapour concentration affects atmospheric pressure because the molecular weight of water (18 g/mol) is less than the average molecular weight of air (about 29 g/mol). When water evaporates and enters the atmosphere as a gas, the water vapour molecules take the place of other gas molecules in the air. So, a volume of wet (or humid) air weighs less than an equal volume of dry air. Therefore, humid air is less dense and exerts less pressure than dry air.
- **Rotation of the Earth :** Due to the rotation of the earth, bulk of the air at the Poles is thrown away towards the Equator. Since the Equatorial region receives great amount of heat throughout the year, the air becomes warm and light and therefore, it rises and creates low pressure. At the Poles, the cold heavy air sinks down and creates high pressure. In fact, temperature and rotation of the earth together contribute to the formation of world pressure belts.

Question 2.
Explain the swinging of the pressure belts.
Answer:
In summer the pressure belts are pushed northwards and in winter southwards.



Pressure Belts

This shifting takes place upto 5° distance. In summer, it results in remarkable change in weather and climate, e.g. summer monsoon with thunderstorms, lightening and rainfall

etc. while, in winter, the Mediterranean climatic regions get rainfall due to Westerlies coming from sea towards land.

Question 3.
Briefly explain the three chief types of winds.
Answer:
The three chief types of winds are Trade winds, Westerlies and polar winds.
Trade winds : blow along the tropical belt from sub-tropical High to equatorial low pressure belts. The name trade is given due to the past time, when trade ships were sailed according to the direction of these winds.
Westerlies : are the winds blowing from western direction. These are south-westerly in northern and north-westerly in the southern hemispheres.
The Polar : winds are icy cool winds blowing from poles towards Circum polar low pressure belts, which are also known as Blizzards.

Question 4.
Describe some of the important types of local winds.
Answer:
Chinook in North America blowing eastwards from the Rockies slopes make the climate of Central Plains ideal for animal rearing and agriculture.
Foehn : winds descending down from the Alps makes the agriculture successful in PO basin and
Mistral : from the Alps along France towards the Mediterranean sea brings the temperature suddenly down instead of bright sunshine.

Question 5.
Explain the weather conditions associated with tropical and temperate cyclones.
Answer:
Tropical cyclones : These are associated with turbulent weather conditions and cause heavy damage to property and human life, e.g. Tornado in North America, Hurricanes in Carribean region, typhons in China and Japan. These blow from south to north.
Temperate cyclones : These are active along mid-latitude region from west to east direction and cover a long region. These are pushed with Westerlies and also called the western Disturbances. These affect from Mediterranean to Pacific ocean covering South European countries, Middle East, Iran, Iraq etc., Pakistan, India, China from west to east. These are associated with rainfall, snowfall, hailstones etc, followed by a clear weather due to coming back anticyclones.

Question 6.
What are the Jet Streams ? What is the significance of Jet Streams ?
Answer:
Jet streams are the concentrated bands of rapid air movement found in troposphere and stratosphere. The meeting front of warm and cold winds along sub-tropical zone near 30° latitude and polar front along 60° latitude. Jet streams transport moisture and help in formation of cyclonic winds. Jet streams are used to forecast the weather specially for

air travel, so that the flying should be done according to the jet-streams. Mostly, these jet-streams blow from west to east with the Westerlies.

Question 7.
Describe the world distribution of pressure.
Answer:
The distribution of atmospheric pressure across the latitudes is termed as global horizontal distribution of pressure and represented as pressure belts, e.g. Equatorial low, Sub-Tropical High, Circum-polar low and Polar High pressure belts. It is correlated with the rising up and descending down of the air along low and high pressure belts respectively. Due to the spherical shape of the earth the higher latitudes receive less insolation than the lower latitudes and this difference in temperature different pressure belts are created. Due to extreme low pressure equatorial 'Doldrums' (still air) are created.