13. Atmospheric Pressure and Winds

EXERCISE

A. Answer the following questions briefly :

1. What do you mean by the term 'Atmospheric Pressure'?

Ans. Air pressure therefore can be defined as the force exerted against the surface by continuous collision of the gas molecules.

2. Name the instrument used to measure atmospheric pressure.

Ans. Mercury barometer.

3. How is the atmospheric pressure caused?

Ans. The atmospheric pressure is caused by:

- The amount of pressure exerted by air at a particular point is determined by two factors, viz., temperature and density.
- A change in either temperature or density will cause a corresponding change in the pressure.
- An increase in either density or temperature will cause an increase in pressure provided the other variable (density or temperature) remains constant.

4. Name the factors, which affects the atmospheric pressure of a place.

Ans. Factors affecting air pressure are:

- Influence of Altitude on Pressure.
- Influence of Temperature on Pressure.
- Influence of Rotation of Earth on Pressure.

5. Name the world's pressure belts.

Ans. The world's pressure belts are:

- Equatorial Low Pressure Belts.
- Subtropical High Pressure Belts.
- Sub-polar Low Pressure Belts.
- Polar High Pressure Belts.

6. What is Ferrel's Law?

Ans. Ferrell's law – "Any object or fluid moving in the Northern Hemisphere tends to be deflected to the right of its path of motion. In the Southern Hemisphere, a similar reflection is towards the

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left of the path of motion".

7. What are Doldrums? Why are they called so?

Ans. Doldrums is the equatorial belt of low atmospheric pressure where the NE and SE trade winds converge on and meet each other, producing calm and light surface winds and a strong upward movement of air.

- The word 'doldrums' has come to be associated with a gloomy, listless mood, perhaps reflecting the sultry air and variable breeze found there.

8. What are Trade Winds? How are they caused?

Ans. Trade Winds are the surface winds which move from the Horse Latitudes to the Doldrums. They are caused by Primary circulation.

9. What are Westerlies?

Ans. The Westerly Winds which blow with great frequency and regularity in regions lying on the pole ward sides of the subtropical high pressure areas or Horse Latitudes are known as the Anti-Trade Winds or Westerly.

10. What are Roaring Forties and Furious Fifties? Why are they called so?

Ans. Westerly blow with great strength and regularity throughout the year between 40° and 50° S and have been given the name roaring forties and furious fifties because they face almost no obstruction.

11. Name the Planetary Winds.

Ans. The planetary winds are:

- Trade winds.
- Westerly.
- Polar winds/Polar Easterlies.

12. What does Pressure Gradient mean?

Ans. The pressure gradient means:

- The spacing of isobars indicates the pressure gradient.
- The closer the isobars, the steeper the gradient of the pressure and the weather is stormy.
- When isobars are far apart from each other there is a little difference in atmospheric pressure.

13. What are causes and consequences of shifting of pressure belts?

Ans. The causes and consequences of shifting of pressure belts are:

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- **Causes :**
  - ➢ All air movements have their roots in pressure differentials in the atmosphere, called pressure gradients.
  - ➢ Wind belts depend on temperature, so temperature changes can move the belts and also change wind patterns.
- **Consequences:**
  - ➢ The shifting of the pressure belts cause seasonal changes in the climate, especially between latitudes 30° and 40° in both hemispheres.
  - ➢ In this region the Mediterranean type of climate is experienced because of shifting of permanent belts southwards and northwards with the overhead position of the sun.

14. What is Coriolis Force? What is its result?

Ans. Earth's rotation produces the Coriolis force which tends to turn the flow of air.

- The direction of action of the Coriolis Force is stated in Ferrell's Law-Any object or fluid moving in the Northern Hemisphere tends to be deflected to the right of its path of motion. In the Southern Hemisphere, a similar reflection is towards the left of the path of motion.

15. What are Local Winds? Give examples.

Ans. The winds which blow in particular area are called local winds. Local winds are of two types. Hot local winds and cold local winds.

Hot local winds : Harmattan, Khamsin, Loo, Sirocco and Zonda.

Cold local winds : Blizzard, Bora, Buran, Friagem(Surazo), Gregale, Levanter.

16. What are Land and Sea breezes?

Ans.
- The Land Breeze is a diurnal wind blowing from the land out to sea. It is caused by the differential cooling of land and sea.
- The Sea Breeze develops along sea coasts or large inland water bodies(lakes) in summer when the land heats much faster than the water on a clear day and a low pressure develops over the land.

17. Explain a sea breeze with the help of a diagram.

Ans. Sea breeze:

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- The Sea Breeze develops along sea coasts or large inland water bodies(lakes) in summer when the land heats much faster than the water on a clear day and a low pressure develops over the land.
- In the day, the air blows from the sea to the land as there is high pressure on the sea and low pressure over the land.
- The air movement from the sea to land reaches the greatest intensity during the afternoon.

18. What are Monsoon Winds? How are they caused?

Ans.
- The monsoon, which is essentially the seasonal reversal in wind direction, causes most of the rainfall received in India and some other parts of the world.
- The primary cause of monsoons is the difference between annual temperature trends over land and sea.

19. In what way does the land and sea breeze affect the temperature of a place?

Ans. The land and sea breeze affect the temperature of a place:
- In addition to seasonal changes, the temperature of the surface of the sea and land also experience diurnal changes during a day. However, since the scale is smaller it will influence only the coastal areas.
- In areas close to the shore, in daytime the land is warmer than the sea. Therefore the air pressure of the land is lower than the sea. As a result, wind usually blows from the sea to the land. Such type of wind is called a "sea breeze". After nightfall, the situation is reversed, wind blows from land to sea and is called a "land breeze".

20. What is a Cyclone? How is it caused?

Ans. Cyclone is a dynamically or thermally caused low pressure area of converging and ascending air flows.

Causes:
- During the months of October-November, there is a low pressure of a depression created over the Bay of Bengal.
- Winds blow at a great speed towards the centre which is the eye of the storm.
- Cyclones have the centres of low pressure which may last for a few days to a few hours.
- They are affected by the Coriolis force.
- The winds blow in an anti-clockwise direction in the Northern

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Hemisphere and in the clockwise in the Southern Hemisphere

- These winds bring heavy rain and cause great damage to places over which they pass.

21. Describe the weather conditions associated with the cyclones.

Ans. The weather conditions associated with the cyclones are:

- **Tropical cyclones:**
  - ➢ They are generally associated with high temperature and high humidity.
  - ➢ They are mostly circular with low pressure in centre.
  - ➢ They cause heavy damage to lives and property owing to the strong winds.
  - ➢ The rainfall is torrential. They move from East to West.
- **Temperate cyclones:**
  - ➢ They are accompanied with alternating anticyclones.
  - ➢ These cyclones do not cause much damage to life and property but bring sudden changes in weather.

22. What are Anticyclones? How are they caused?

Ans.

- Anti-cyclone is a dynamically or thermally caused area of high atmospheric pressure with descending and divergence in air flow.
- In the Northern Hemisphere winds blow in a clockwise spiral away from the centre , while in the Southern Hemisphere they blow in an anti- clockwise spiral.

23. What are Tropical and Temperate Cyclones?

Ans. **Tropical Cyclones:**

They start within 8◦ and 15◦-20◦ North and South of the Equator where surface-sea temperature reaches 27◦C.

Temperate Cyclones:

They are common near the Sub polar Low Pressure Belts, i.e., between 25◦ to 65◦ North and South.

24. What are Variable Winds?

Ans. Wind direction which varies by 60 degrees or more during the period of time the wind direction is being determined is called Variable Winds

25. Name two special types of tropical cyclones and for each name the specific region where it is experienced.

Ans. Two types of Tropical Cyclones are:

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- **Typhoons :** South China sea.
- **Hurricanes :** Caribbean Sea

26. Name an area where typhoons are experienced.

Ans. South China Sea

27. What are Isobars?

Ans. Isobars are imaginary lines drawn on a map to join places having same or equal mean atmospheric pressure reduced to sea level.

28. Name the factors affecting air pressure.

Ans. The factors affecting air pressure are:

- Altitude, temperature and Earth rotation.

29. How are Weather Maps important for us?

Ans. Weather Maps are important for us:

- To know the weather condition of any place
- help as account of information with us while we are on tour.

30. List the main causes for development of local winds.

Ans. The main causes of the development of local winds are:

- Unequal heating of land and sea.
- Heating and cooling of the mountain slopes.
- Convectional Local Winds are caused by steep pressure gradients and steep variations in local temperatures.

31. What are Jet Streams?

Ans. Jet streams are fast flowing narrow air currents-found in the upper atmosphere or in troposphere of some planets including earth. The main jet streams are located near the altitude of the Tropopause.

32. What is wind? How does it originate?

Ans. The horizontal movement of air relative to Earth's surface, produced essentially by air pressure differences from place to place, also influenced by the Coriolis force and surface friction.

33. Name the important pressure belts of the Earth.

Ans. The important pressure belts of the Earth are:

- Equatorial Low Pressure Belt
- Subtropical High Pressure Belts
- Sub-Polar Low Pressure Belts
- Polar High Pressure Belts.

34. What is meant by permanent winds? How do they derive their name?

Ans. Permanent winds are also known as prevailing and periodic winds. They blow in a particular direction in a particular period

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of time. They change their direction periodically.

Depending on the direction in which it blows, they are named as North-East Trades or South-East Trades etc.

35. What are Trade Winds called in the Northern Hemisphere?

Ans. North East Trade Winds

36. What are Trade Winds called in the Southern Hemisphere?

Ans. South East Trade Winds

37. What are periodic winds? How are they caused?

Ans. Permanent winds are also known as prevailing and periodic winds. They blow in a particular direction in a particular period of time. They change their direction periodically

They are caused by the general arrangement of pressure belts.

38. Name any two local winds.

Ans. Two local winds are:

- Katabatic and Anabatic winds.

39. Name the two wind systems of Monsoons. Where are they experienced?

Ans. The two wind systems of Monsoon are:

- Summer Monsoon and Winter Monsoon.
- These winds can be best noticed in South West Asia and northern Australia.

B. Define the following terms :

1. Winds

Ans. **Winds:** Same as 32nd answer.

2. Atmospheric Pressure

Ans. **Atmospheric pressure:** Same as 1st answer.

3. Cyclones

Ans. **Cyclones:** same as 20th answer

4. El Nino

Ans. **El Nino:** It is the name given to the occasional development of a warm ocean current along the coast of Peru as a temporary replacement of the Cold Peru Current.

5. Isobars

Ans. **Isobars:** Same as 27 th answer.

6. Coriolis Effect

Ans. **Coriolis Effect:** The effect produced by a coriolis force, namely,

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the tendency of all particles of mater in motion on the earth's surface to be defected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere

C. Distinguish between the following pairs :

1. Summer and Winter Monsoons

Ans. Summer and Winter Monsoon

Summer Monsoon	**Winter Monsoon**
They are associated with heavy rainfall.	They are offshore winds and bring less rainfall.
it usually happens between April and September.	it usually happens between November and January.
They are called as South-West Monsoons	They are called as North-East Monsoons

2. Cyclone and Anticyclone

Cyclone	**Anti-Cyclone**
It is an area of low pressure surrounded by high pressure.	It is an area of high pressure surrounded by low pressure.
Winds converge at the eye (central low pressure) of the cyclone, wind moves in a spiral motion.	Winds diverge from the central high pressure to the surrounding low pressure.
Stormy conditions prevail.	Light cool winds blow.
Winds blow in an anti-clockwise direction in the Northern hemisphere and vice-versa in the Southern hemisphere.	Winds blow in a clockwise direction in the Northern hemisphere and vice-versa in the Southern hemisphere.

3. Tropical and Temperate Cyclones

Tropical Cyclone	**Temperate Cyclone**
It is a summer phenomena	It is a winter phenomena
it occupies a small area	it occupies a larger area
it moves from east to west	it moves from west to east.

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4. Trade and Anti-Trade Winds

Trade winds	Anti-Trade winds
The trade winds are the prevailing pattern of easterly surface winds found in the tropics, within the lower portion of the Earth's atmosphere, in the lower section of the troposphere near the Earth's equator.	The Westerly Winds which blow with great frequency and regularity in regions lying on the pole ward sides of the subtropical high pressure areas or Horse Latitudes are known as the Anti-Trade Winds or Westerly.
They are North-East Trades in the Northern Hemisphere and South-East trades Southern Hemisphere	They are South-West in the Northern Hemisphere and in the Southern Hemisphere from the North-West

5. Permanent and Seasonal Winds

Permanent winds	Seasonal winds
They blow in a certain direction permanently all around the year.	They blow for a certain period in a particular direction.
They do not change direction	They change direction
Eg. Trade winds and Westerly.	Eg. Land and Sea breeze

6. Mountain Breeze and Valley Breeze

Mountain Breeze	Valley Breeze
It occurs during night time. It occurs during day time. In the night, it is a lot cooler as the sun goes to sleep. So the air at the upper slope of the mountain cools off very quickly and becomes dense. A high pressure is created. At this time, the air at the valley floor is a lot warmer (low pressure) and is forced to give way to colder air moving down the slope towards the valley floor. This is called mountain breeze.	During the day, the air over the mountain slope heats up more than the air at the foot of the mountain. The warm air over the slope reduces in density. A low pressure is created at the top of the mountain and high pressure from the cool air below forces a cool breeze to move upward. This condition generates a breeze which we call Valley breeze.

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7. Land and Sea Breeze.

Land breeze	Sea breeze
• Late at night, the loss of heat source causes land to quickly cool down which causes the heat to be released towards the surrounding air. • As compared to land, water retains heat longer which causes the air above it to have lesser density and rise. • Low pressure is formed above the water while high pressure is formed above the land. • The denser air above the land moves to the space over the water. • As winds typically blow from high to low pressure areas, the cooler breeze then comes from the shore and is now called as "land breeze".	• During day time, the sun often quickly heats up land. • The air above the land gets warmer than the air above water. • As the air above land is warmer, it gets less dense and it begins to rise. • Low pressure is formed. • The denser air above the water moves to the space above the land. This cooler air is now what is termed as a "sea breeze".

D. Give reasons for the following :

1. As we go higher upwards, the atmospheric pressure decreases.

Ans. As we go higher, the atmospheric pressure decreases:

- Due to increase in the altitude of the atmosphere, atmospheric pressure decreases as we go higher up above the earth's surface.
- Atmospheric pressure is the pressure applied at a point due to the weight of the air above that point.
- As we go up, the altitude increases and the amount and the density of air above it decreases. So the pressure due to it decreases.

2. The Tropical Belt of Calms is also known as the Horse Latitude.

Ans. The Tropical Belt of Calms is also known as the Horse Latitude:

- In olden days because of the absence of surface winds ships had to unload the cargo to make them lighter.

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- At times the cargo used to be horses.

3. The winds are deflected to the right in the Northern Hemisphere.

Ans. The winds are deflected towards right in the Northern Hemisphere:

- The Coriolis Effect causes a deflection in global wind patterns.
- The anticlockwise rotation of the Earth deflects winds to the right in the northern hemisphere and to the left in the southern hemisphere.

4. The Roaring Forties and Furious Fifties are found in the Southern Hemisphere.

Ans. The Roaring Forties and Furious fifties are found in the Southern Hemisphere:

- The Roaring Forties in the Northern Hemisphere don't have the same impact that they do in the Southern Hemisphere.
- While the Roaring Forties may be fierce, 10 degrees south are even stronger gale-force winds called the Furious Fifties.

5. There is seasonal shifting in pressure belts.

Ans. There is a seasonal shifting in pressure belts:

- The shifting of the pressure belts cause seasonal changes in the climate, especially between latitudes 30° and 40° in both hemispheres.
- In this region the Mediterranean type of climate is experienced because of shifting of permanent belts southwards and northwards with the overhead position of the sun.

6. Cyclones cause heavy damage to life and property.

Ans. Cyclones cause heavy damage to life and property.

- Very strong winds may damage installations, dwellings, communication systems, trees. etc. resulting in loss of life and property.
- Heavy and prolonged rains due to cyclones may cause river floods and submergence of low lying areas by rain causing loss of life and property.

7. High pressure prevails over landmasses during winter.

Ans. High pressure prevails over landmasses during winter.

- During winter seasons the weather conditions are just the reverse of summer.

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- A high pressure zone develops over the interior of the continent as there is a sudden drop in temperature, the land cools and the high pressure is formed in Central Asia.
- Cold winds from the interior of the continent blow towards the sea.
- These winds are offshore winds and bring less rain. They are also called the North-East Monsoon because they blow from the North-East.

8. Cyclones mostly occur in summer in tropical regions.

Ans. Cyclones require a sea surface temperature of about 26°C to develop and maintain their strength. During this time the tropical regions have high relative humidity.

9. Chinooks are called snow eater.

Ans. Chinook is a warm and dry local wind which can melt the snow when it blows over the grasslands.

10. Equatorial region has low pressure belt.

Ans. This region receives the maximum insolation of sun rays, high temperature leads to the formation of low pressure in this region.

E. Diagrams :

1. Draw a diagram to show the planetary wind system showing the direction of winds.

2. Draw a diagram showing the formation of land and sea breeze.

3. Draw a labelled diagram of cyclone in both the Hemispheres.

4. Draw a labelled diagram of an anticyclone in the Northern Hemisphere.

5. Draw a labelled diagram to show the Major Pressure Belts of the World.

Ans. Students to do it themselves.

F. Choose the correct option.

1. Air pressure decreases with

(a) Decreasing temperature

(b) increasing temperature & altitude

(c) Decreasing altitude

(d) None of these

2. _____ are the imaginary lines drawn on the weather map to

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join the places having same or equal mean atmospheric pressure reduced to sea level.

(a) Isotherms (b) Isobars
(c) Isohume (d) Isohyets

3. Which of the following force is responsible for deflecting the winds from their original position?

(a) Gravitational force (b) Centrifugal force
(c) Coriolis force (d) Centripetal force

4. Which of the following pressure belt lie between 550-600 North & South latitude?

(a) Subtropical High pressure belt
(b) Polar High pressure belt
(c) Sub polar low pressure belt
(d) Equatorial low pressure belt

5. Which of the following permanent wind is blowing from sub tropical high pressure belt to equatorial low pressure belt in Northern Hemisphere?

(a) South east trade winds (b) North east trade winds
(c) Westerly winds (d) North east polar easterlies

6. Which of the following statement is not correct?

(a) Land breeze & sea breeze are the phenomena of interior parts of the country.
(b) Land breeze blows during the night & sea breeze during the day.
(c) Both are periodic winds
(d) They form due to the differential heating & cooling of land & water.

7. In which of the following area the tropical cyclone is known as Willy Willies?

(a) USA (b) Australia
(c) The Caribbean Sea (d) South China Sea

8. Which of the following difference between the cyclone & anti cyclone is correct?

(a) Cyclone is a high pressure centre with surrounding low pressure whereas the anti cyclone is low pressure centre with surrounding high pressure.

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(b) Cyclone blows clockwise whereas anti cyclone blows anti clockwise in the Northern Hemisphere.
(c) Anticyclone causes great damage to the life and property whereas cyclone brings stable weather.
(d) Cyclone is associated with cloudy skies & very heavy rainfall but anticyclone is associated with clear skies & Dry conditions.

9. Which of the following is not a local wind?
(a) Mistral (b) Bora
(c) Trade wind (d) Foehn

10. El Nino occurs at the coast of
(a) Brazil (b) Costa Rica
(c) Peru (d) Guinea

11. Summer monsoon blows from which direction?
(a) South west (b) North east
(c) South east (d) North west

12. Which of the following wind is extremely important for the aviation process?
(a) Westerlies (b) Trade
(c) Jet stream (d) Cyclone

Answers

1. b	2. b	3. c	4. c	5. b	6. a	7. b	8. d
9. c	10. c	11. a	12. c				

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