4. Air Pressure

Let's recall.

Have you tried the activity that shows 'Air has weight' given on page 16 of your Science textbook?

Geographical explanation

During the activity, you saw that the balance tipped on the side of the full blown balloon. This shows that the air has weight.

Anything that has weight, exerts pressure on the thing that lies below it. Thus, the air in the atmosphere exerts pressure on the surface of the earth. Due to this air pressure, various phenomena like storms, precipitation, etc. occur in the atmosphere. There are variations in air pressure.

- Air pressure is not uniform on all places on the earth's surface.
- Air pressure keeps on changing from time to time.
- The altitude of a region, temperature of the air, and amount of water vapour in the air are some factors influencing air pressure.

Altitude of the region and air pressure:

The proportion of dust in the air, water vapour, heavy gases, etc. is higher in the air closer to the surface of the earth. This proportion decreases with increasing altitude. As one moves higher and higher from the surface of the earth, the air becomes thinner and thinner. As a result, the air pressure decreases with increasing altitude.

Air temperature and air pressure:

Try this.

- Take a flying lantern.
- Tie an approximately 5m long thread to the flying lantern so that you can bring the lantern down whenever required.
- After carefully reading the instructions given on the package of the lantern, open it and light the candle placed in it. Observe what happens.
- After some time, bring the lantern down with the help of the thread and put off the candle.

(Instructions for teachers/ parents: This activity is to be performed under your supervision and presence with utmost care.

The teacher should arrange a discussion after completing the activity given above. Use following questions to initiate the discussion.)

Figure 4.1 : The experiment of the flying lantern

- Did the flying lantern start ascending immediately after the candle was lit?
- What would have happened to the flying lantern had the candle got extinguished after the lantern had gone up in the air?

Geographical explanation

The air in the flying lantern gets heated once the candle is lit. The hot air expands, becomes lighter and starts moving up. Therefore, the lantern is also lifted up towards the sky. In nature too, a similar phenomenon occurs.

Temperature and air pressure are closely related. Wherever the temperature is high, the air pressure is low. As the temperature rises the air gets heated, expands, and becomes lighter. This lighter air in the vicinity of the earth's surface starts moving up towards the sky. As a result, the air pressure in such areas decreases.

Think about it.

What will be the effect on air pressure if the temperature drops? Why?

Temperature zones and pressure belts are interrelated to each other but the latitudinal extent of the temperature zones is much larger while pressure belts are narrower. See fig. 4.2a and 4.2b. For example, the Temperate zone extends from 23° 30' to 66° 30'. Compared to this, the air pressure belt has limited extent. It is generally up to 10° parallel.

The uneven distribution of temperature influences the distribution of air pressure too. This leads to the formation of low and high pressure belts horizontally between the equator and the poles. See fig. 4.2b.

Observe fig. 4.2 a and b and answer the following questions:

- Which pressure belt is mainly found in the Tropics?
- With which pressure belt are the polar winds associated? In which temperature zone are they observed?
- What could be the reason behind a low pressure belt in the Tropics?
- With which pressure belts are the winds in the Temperate zone associated?
- Write the latitudinal extent of the low pressure belts.

Can you tell?

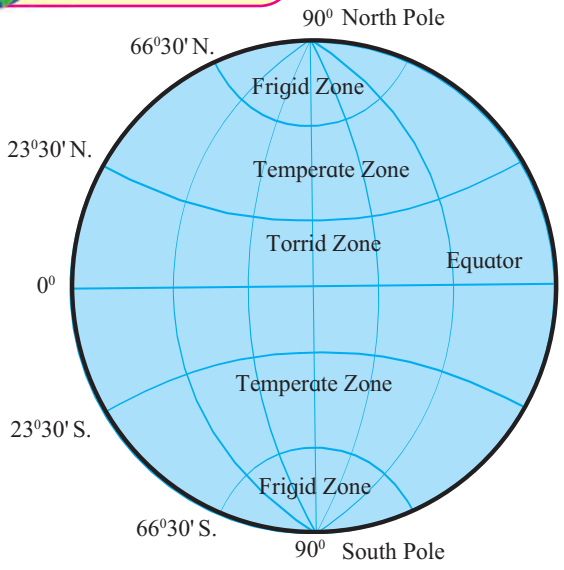


Figure 4.2 a : Temperature zones

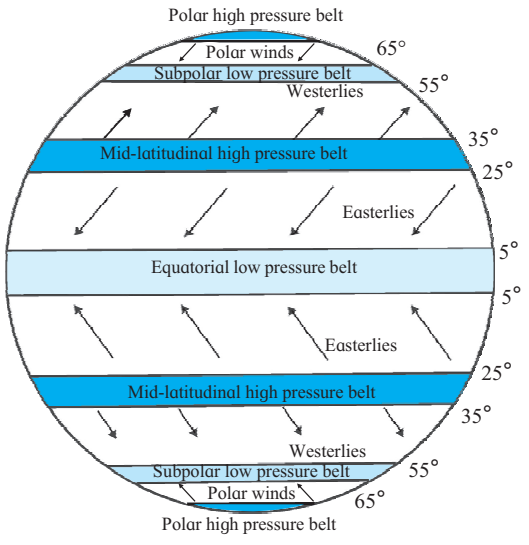


Figure 4.2 b : Pressure belts and planetary winds

Pressure belts on the earth's surface:

The heat received from the sun is uneven in different regions. Hence the distribution of the temperature is uneven from the equator to the poles. As a result, the temperature zones are created. We have studied this in the previous class.

Equatorial low pressure belt:

The sunrays can be perpendicular between the Tropic of Cancer and the Tropic of Capricorn. So the temperature is higher in this region. Hence air in this region gets heated, expands, becomes lighter and moves towards the sky. As this process operates continuously a low pressure belt gets formed in the central part of this region between the parallels 5° north and 5° south.

Mid-latitudinal high pressure belts:

The heated air becomes lighter, starts ascending and after reaching higher altitudes, moves towards the polar region, i.e., towards the North and the South Pole. Due to low temperatures at the higher altitudes, the air cools down and becomes heavier. This heavier air descends down in both the hemispheres in the region between 25° to 35° parallels. This leads to the formation of high pressures belts in these parallels of latitudes in both the hemispheres. This air is dry, hence the region does not get rainfall. Consequently, most of the hot deserts on the earth are found in these regions. (See fig. 4.2b.)

Sub-polar low pressure belts:

Due to earth's curvature, the area between two parallels gets reduced as we move towards the poles. This results in lesser friction of the air with the earth's surface. Air in this region is thrown out because of this reduced friction and also because of the earth's rotational motion. This leads to the development of a low pressure belt. This condition is observed in the area between 55° and 65° parallels in both the hemispheres.

Polar high pressure belts:

In both the polar regions, the temperature is below 0°C throughout the year. Hence, here the air is cold. As a result, high pressure belts get formed. These are called polar high pressure belts. They generally occupy the area between 80° and 90° parallels in both the hemispheres.

The duration and the intensity of sunrays varies during particular periods of the year in both the hemispheres. As a result, the locations of the temperature zones and the pressure belts dependent on the sun's heat also vary. This change is of the order of 5° to 7° towards north in Uttarayan, and 5° to 7° south in Dakshinayan. This is called the oscillation of pressure belts.

Always remember –

The major difference between the temperature zones and pressure belts is that the temperature zones are continuous and are spread from the equator to the poles from Torrid to Frigid. Pressure belts are not continuous and areas of high and low pressure are found in different regions from the equator to the poles.

Effects :

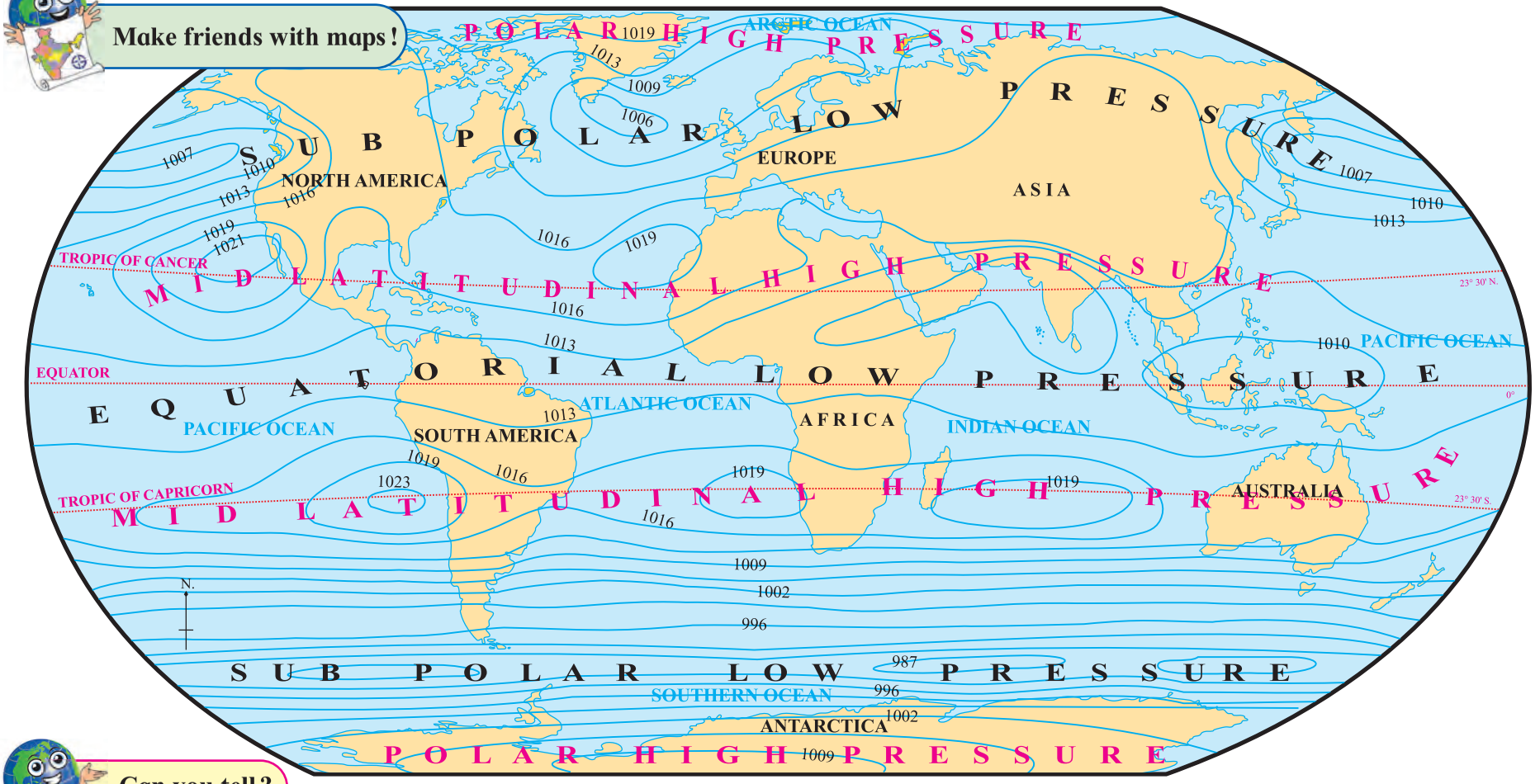
Air pressure has the following effects.

- Origin of winds.
- Generation of storms.
- Convectional type of rain.
- Air pressure affects the breathing activity too.

Isobars:

The line that joins the places of equal pressure on the map is called an isobar.

Make friends with maps !



Can you tell ?

Figure 4.3 : Distribution of Annual Average Pressure in the World (Value of Air Pressure in Millibars)

Observe the map given above and study the distribution of air pressure. Consider the following points:

- The nature of the isobars.
- High and low pressure belts and their latitudinal position.
- The direction of the isobars and the distance between successive isobars over oceans and continents.
- Comparison of the isobars in the northern and the southern hemispheres.

Do you know ?

The air pressure at sea-level is 1013.2 millibars.

Use your brain power!

☞ If there is low pressure at the equator, what will be the condition of air pressure in the Arctic Zone?

Always remember –

Air pressure is measured in units of millibars. For this an instrument called barometer is used. The air pressure at the earth's surface is measured with this instrument.

Figure 4.3 : Barometer

Give it a try.

Study the temperature distribution map given in your Std VI textbook and the pressure distribution map in this lesson to find the correlation between air temperature and air pressure.

Do you know?

All things in and on the earth stay earthbound because of the earth's gravity. This includes air which is in the gaseous form. Due to the earth's gravity, air is pulled to the earth's surface. That is why, air pressure is maximum at sea-level. Note that air exerts pressure on everything and everyone including us. It is believed that the weight of the air column on any one person's head amounts to 1000 kg.

Look for me elsewhere!

☞ Class Three- Environmental Studies.

☞ Class Seven- Science.

4LH2H5

Exercises

Q. 1. Give reasons:

(1) Air pressure decreases with increasing altitude.

(2) Pressure belts oscillate.

Q. 2. Give short answers to the following questions.

(1) What effect does temperature have on air pressure?

(2) Why is the subpolar low pressure belt formed?

Q. 3. Write notes on:

(1) Mid-latitudinal high pressure belts

(2) Horizontal distribution of air pressure.

Q. 4. Fill in the gaps with the appropriate option.

(1) At higher altitudes air becomes .....
(thicker, thinner, hotter, more humid)

(2) Air pressure is expressed in ..... .
(millibars, millimetres, millilitres, milligrams)

(3) On the earth, air pressure is ..... .
(uniform, uneven, high, low)

(4) The ..... pressure belt spreads between 5° North and 5°South parallel.
(Equatorial low, Polar high, Subpolar low, Mid-latitudinal high)

Q. 5. How does a high pressure belt get formed near 30° parallel? Why does this region have hot deserts?

Q. 6. Draw a neat diagram showing pressure belts. Label the diagram.

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