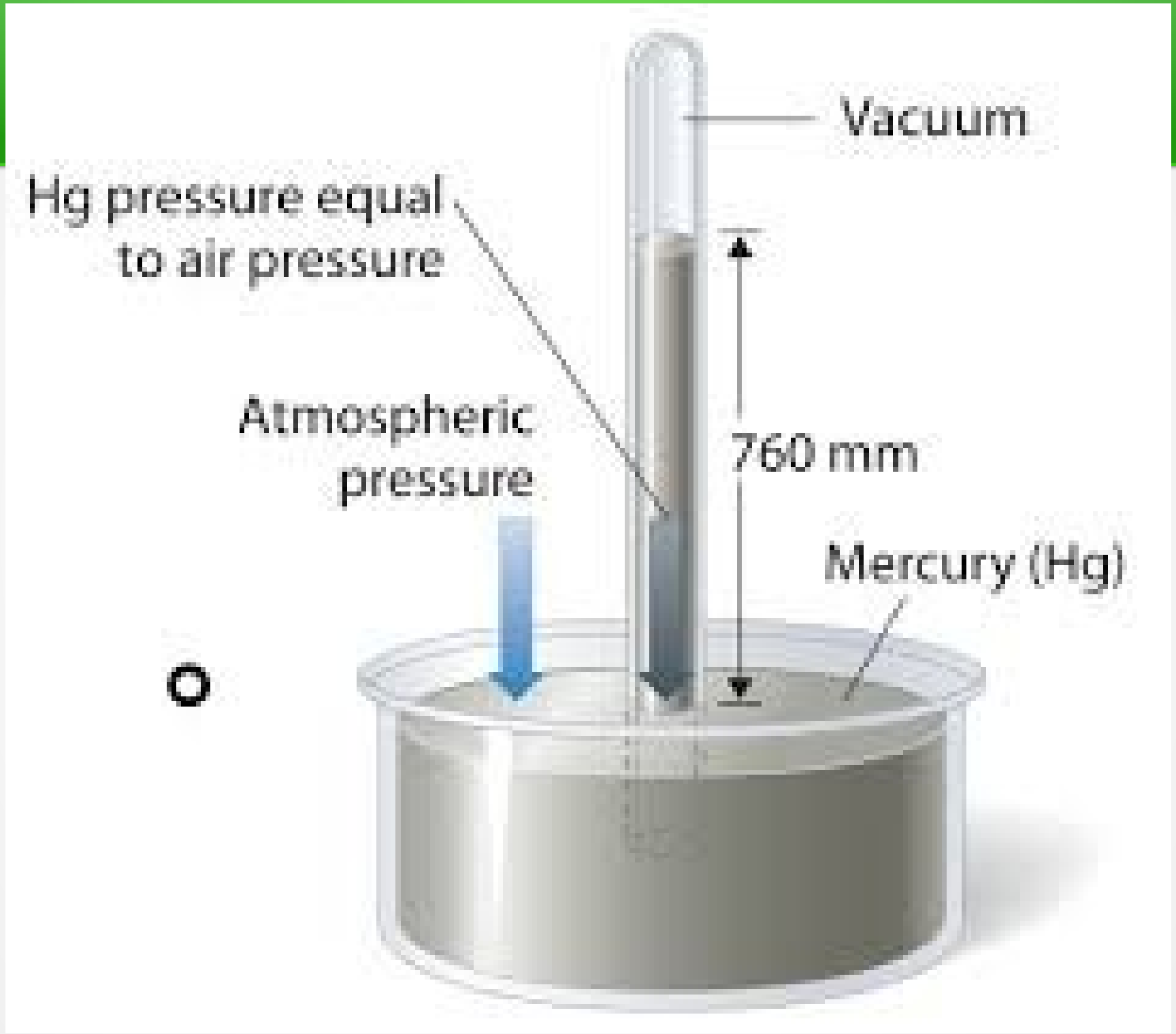
In search of the source of wind

Class 10
Chapter – 2
GHSS PUTHOOR

Atmospheric Pressure

Atmospheric Pressure is the weight of atmospheric air

- The air exerts an average weight of 1034 mg per cm 2 on the earth's surface.
- The atmospheric pressure is measured using an instrument called Mercury Barometer.
- It is recorded in units like millibar (mb) and hectopascal (hPa).
- The level of mercury at normal atmospheric pressure will be 76 cm.
- The atmospheric pressure at that point will be 1013.2 mb or hPa.


Vacuum
Hg pressure equal to air pressure
Atmospheric pressure
760 mm
Mercury (Hg)

Wind

- A 'wind' is the flow of a huge amount of air, usually from a high pressure-area to a low-pressure area.
- variations in the atmospheric pressure are the basic cause for wind.

FACTORS INFLUENCING ATMOSPHERIC PRESSURE

- ALTITUDE
- TEMPERATURE
- Humidity

Atmospheric pressure and altitude

- The atmospheric pressure and the altitude are inversely proportional.
- The atmospheric pressure decreases with altitude.
- The pressure decreases at the rate of 1 millibar (mb) per an altitude of 10 meters.
- The rarification of air with altitude is the reason for this decrease in atmospheric pressure.


A
B

Temperature and atmospheric pressure

When the atmospheric temperature increases, the air expands and loses density and similarly when the temperature decreases the air becomes denser and naturally atmospheric pressure increases.

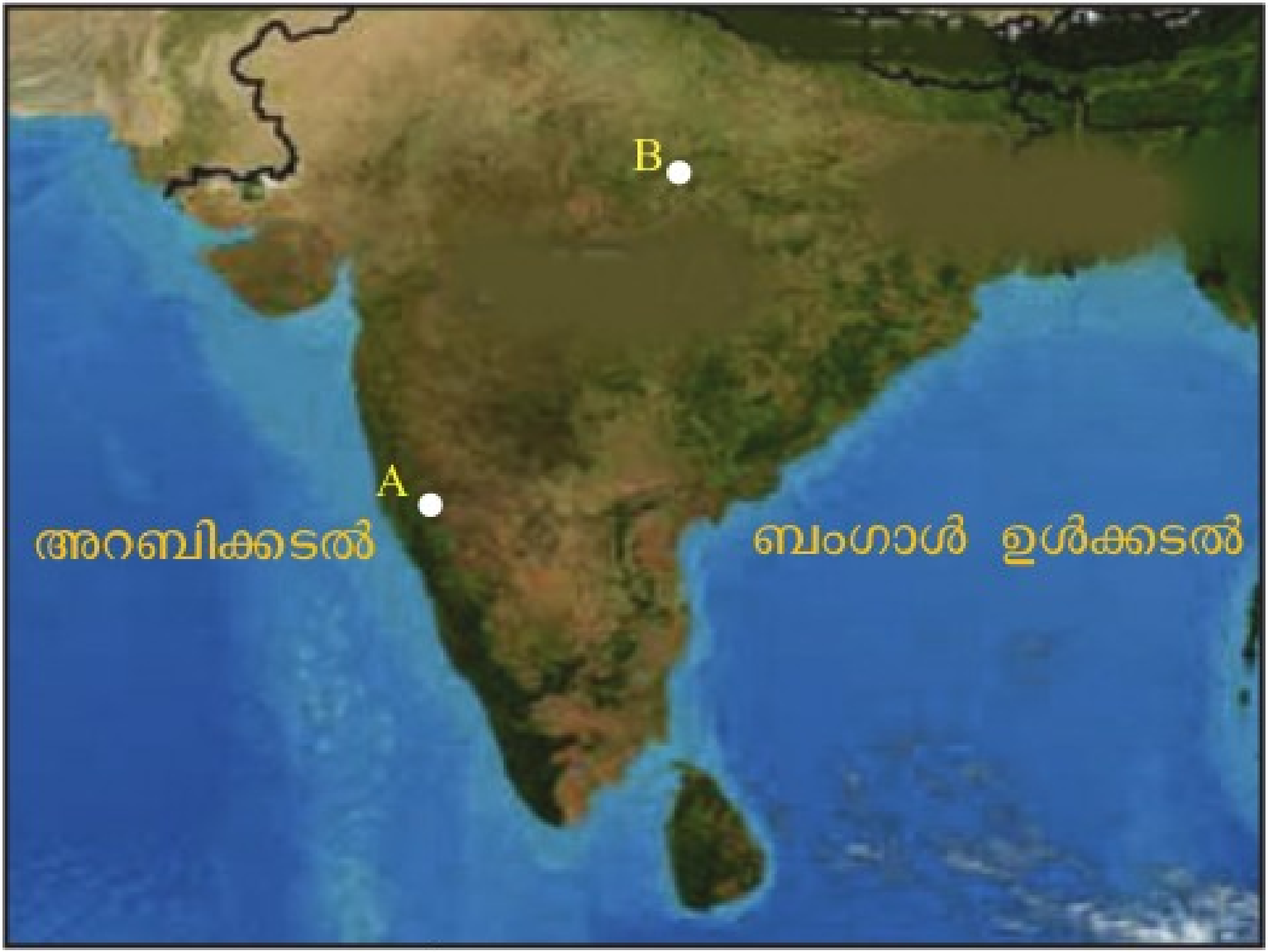
Humidity and atmospheric pressure

Humidity refers to the quantity of water present in the atmosphere.

Water vapour is lighter than air and hence it ascends.

If the quantity of water vapour is more in a unit volume of air, then naturally the atmospheric pressure will be less.

Humidity and atmospheric pressure are inversely proportional.


B
A
അറബിക്കടൽ
ബംഗാൾ ഉൾക്കടൽ

‘High Pressure’

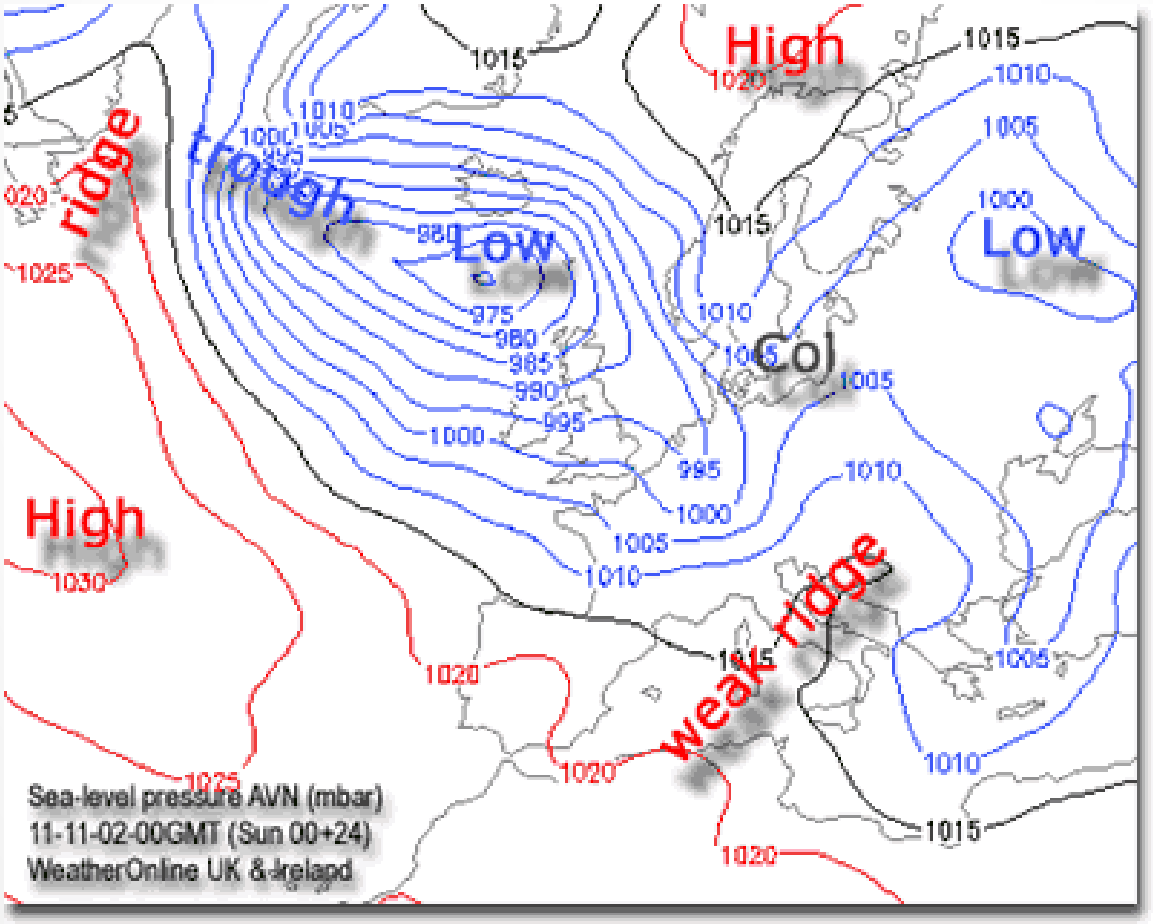
If the atmospheric pressure of an area is higher than that of the surrounding regions it can be named as ‘high pressure’

‘Low Pressure’

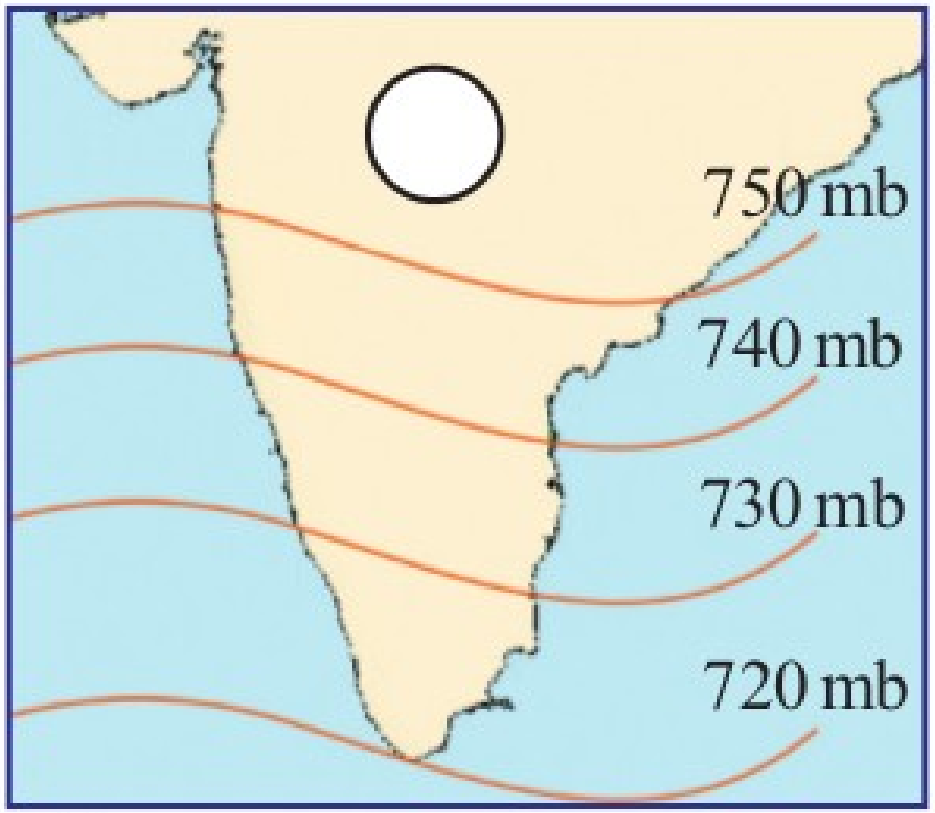
If the atmospheric pressure of an area is lower than that of the surrounding regions it can be named as ‘Low pressure

Isobars

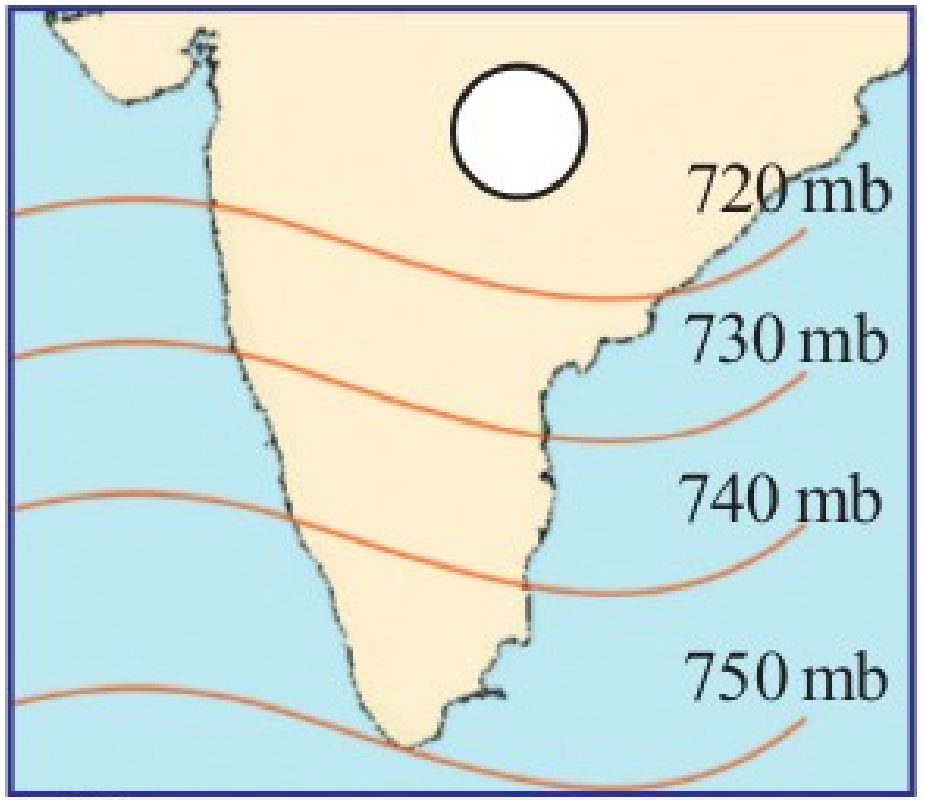
Isobars are imaginary lines joining places having the same atmospheric pressure



Observe the distribution of isobars in the given figure and mark H and L at places experiencing high pressure and low pressure respectively.



A



B

Fig 2.4

Global pressure belts

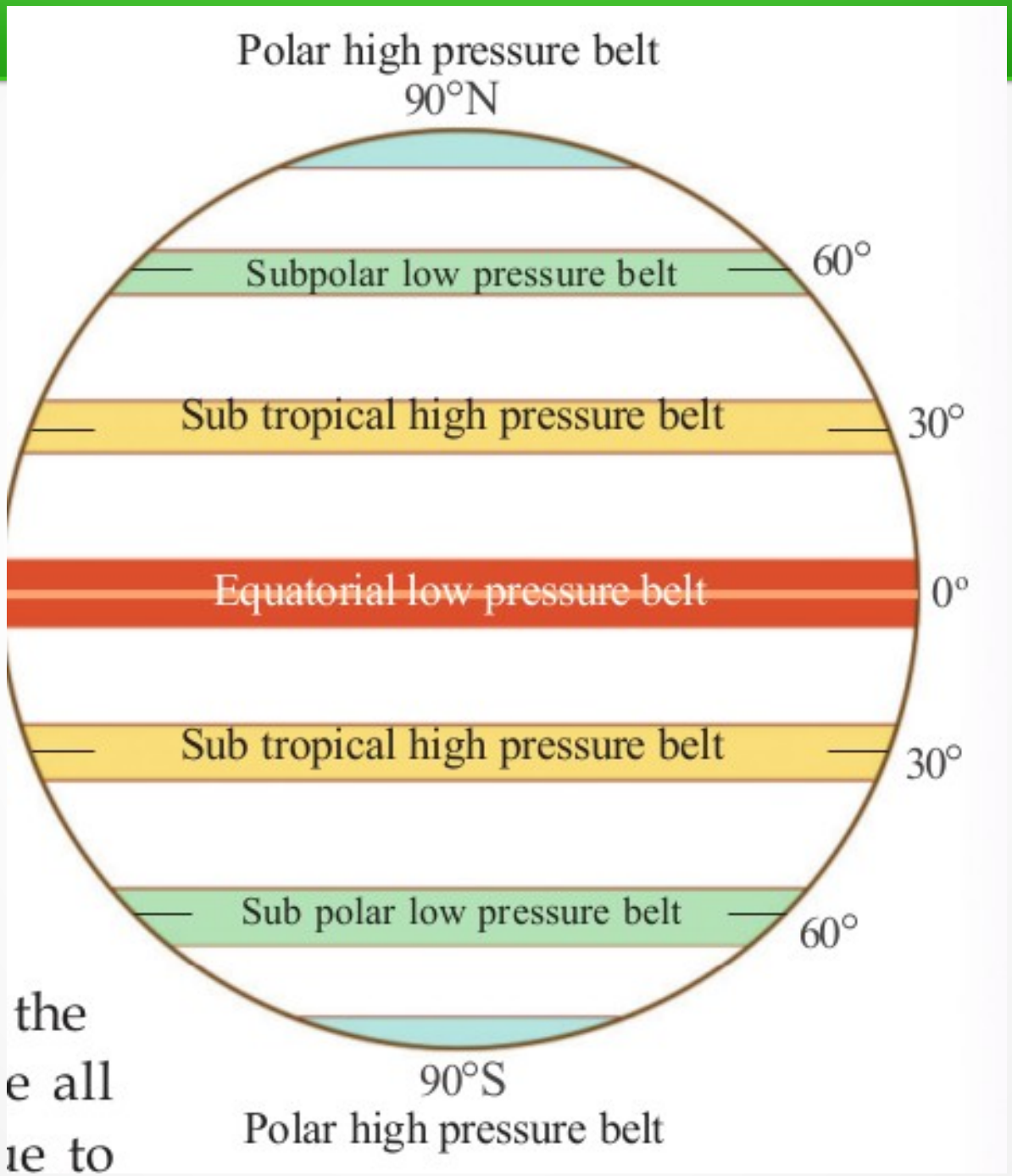
The atmospheric pressure is uniform between certain latitudes. Based on that, the earth's surface is divided into different pressure belts.

- Equatorial low pressure belt
- Sub tropical high pressure belt
- Subpolar low pressure belt
- Polar high pressure belt

Parallelism of the earth's axis

* The axis of the earth is tilted at an angle of 66½° from the orbital plane.
* If measured from the vertical plane this would be 23½°.
* The earth maintains this tilt throughout its revolution.

This is known as the parallelism of the earth's axis



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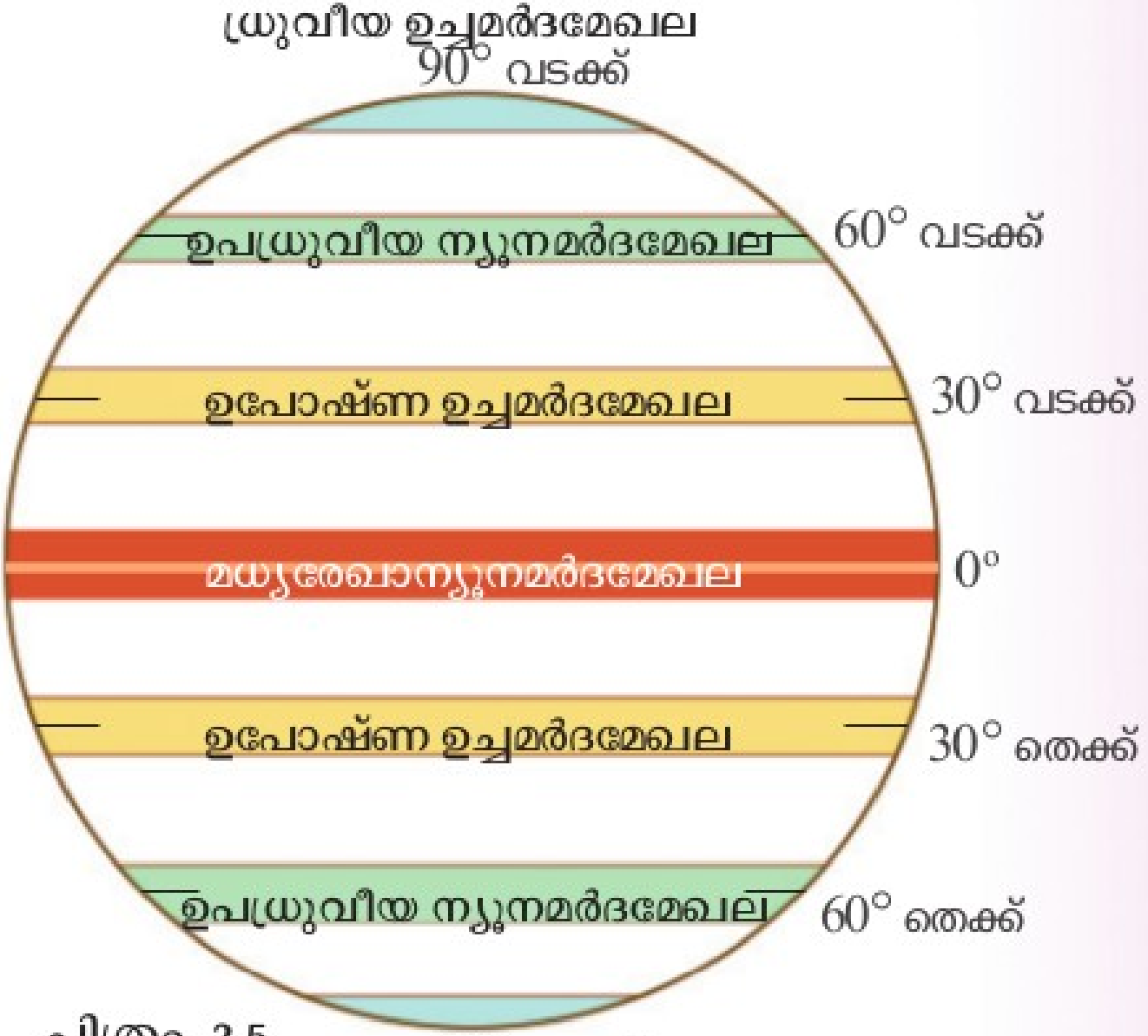

ധ്രുവീയ ഉച്ചമർദമേഖല
90° വടക്ക്
ഉപധ്രുവീയ ന്യൂനമർദമേഖല
60° വടക്ക്
ഉപോഷ്ണ ഉച്ചമർദമേഖല
30° വടക്ക്
മധ്യരേഖാന്യൂനമർദമേഖല
0°
ഉപോഷ്ണ ഉച്ചമർദമേഖല
30° തെക്ക്
ഉപധ്രുവീയ ന്യൂനമർദമേഖല
60° തെക്ക്
90° തെക്ക്
ധ്രുവീയ ഉച്ചമർദമേഖല

ചിത്രം 2.5

Equatorial low pressure belt

- This is the zone where the sun's rays fall vertically throughout the year.
- Hence the temperature will be high in this zone all through the year.
- The air expands due to sun's heat and rises up on a massive scale. This is the reason for the low pressure experienced throughout this zone.
- The equatorial low pressure belt is situated between 5° North and South latitudes.
- As the air in this zone ascends on a large scale, winds are very feeble here.
- This pressure belt is also known as 'doldrum', meaning 'the zone with no winds'. The region was a nightmare for the ancient mariners.

Sub tropical high pressure belt

The hot air ascending from equatorial low pressure belt cools gradually and subsides at the sub tropical zone due to the rotation of the earth.

Sub polar low pressure belt

- As this zone is close to the Pole, the air is colder here.
- Though the cold air remains close to a the earth, the air is thrown up due to the rotation of the earth. As a result, low pressure is experienced all along the sub polar region.

Polar high pressure belt

- This zone experiences severe cold throughout the year.
- As a result, the air remains chilled under the extreme cold that prevails over the Poles, and this contributes to the steady high pressure experienced here.

pressure belts and their latitudinal extent.

Pressure belt	Latitudinal extent
• Equatorial low pressure belt	05 ° north and south
• Sub tropical high pressure belt	30 °
• Subpolar low pressure belt	60 °
• Polar high pressure belt	90 °

Formation of the pressure belts

Variations in the amount of solar energy received and the rotation of the earth contributes to the formation of different pressure belts.

Shifting of pressure belts

- The pressure belts shift according to the apparent movement of the sun.
- The pressure belts shift northward during the period of sun's northward progression and towards the south during the period of its southward progression.

Formation of winds

- Global variations in the atmospheric pressure lead to the formation of winds.
- The horizontal movement of air from a high pressure zone to a low pressure zone is called wind.
- There are different types of winds on the earth's surface, ranging from light breeze to cyclones.

Name of Wind

- Winds are named on the basis of the direction from which they blow.
- For example the south wind is the wind blowing from the south.

Nature of the Wind

- The peculiarities of the source regions influence the nature of the wind.
- Winds blowing from the sea will be saturated with moisture whereas, the moisture content will be less in winds blowing from drier regions.

The speed and direction of wind

The speed and the direction of wind are based on

- Pressure gradient force
- Coriolis force
- Friction

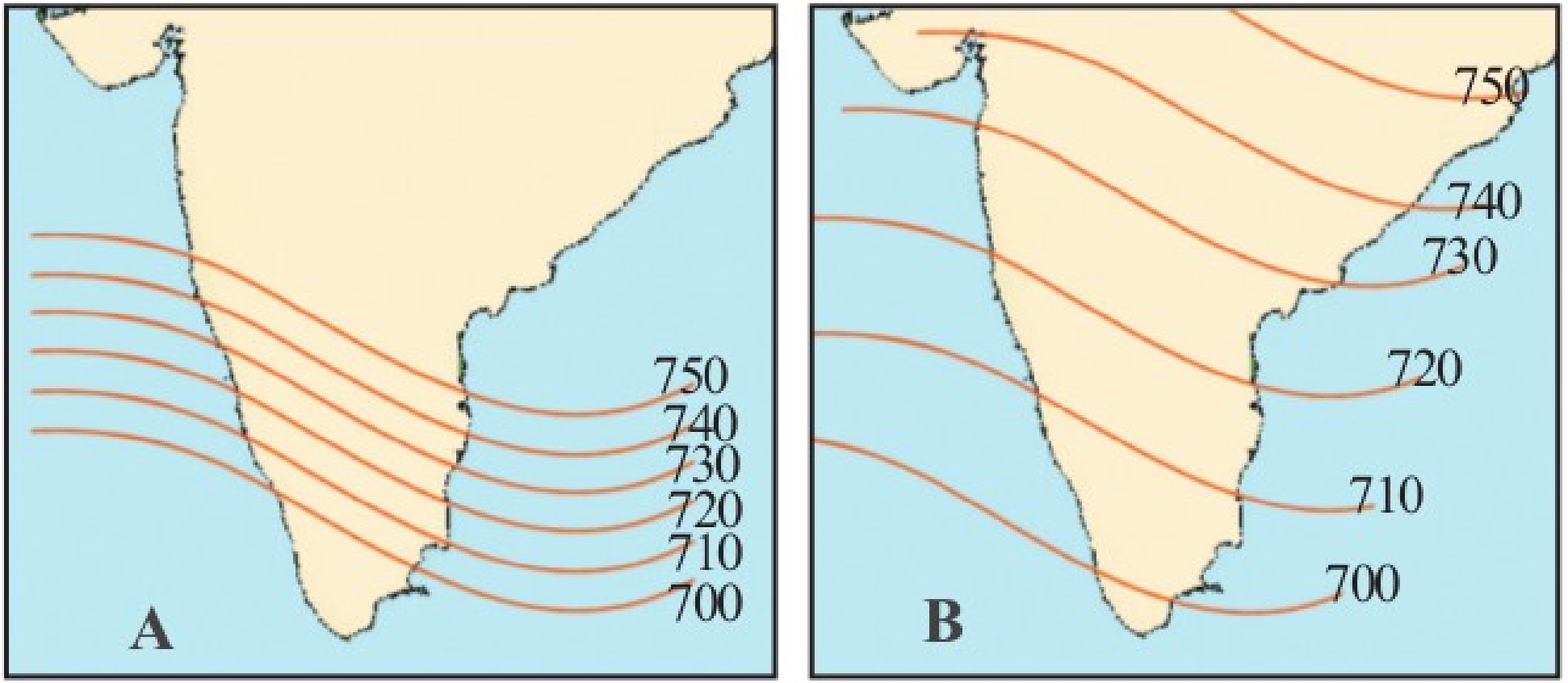
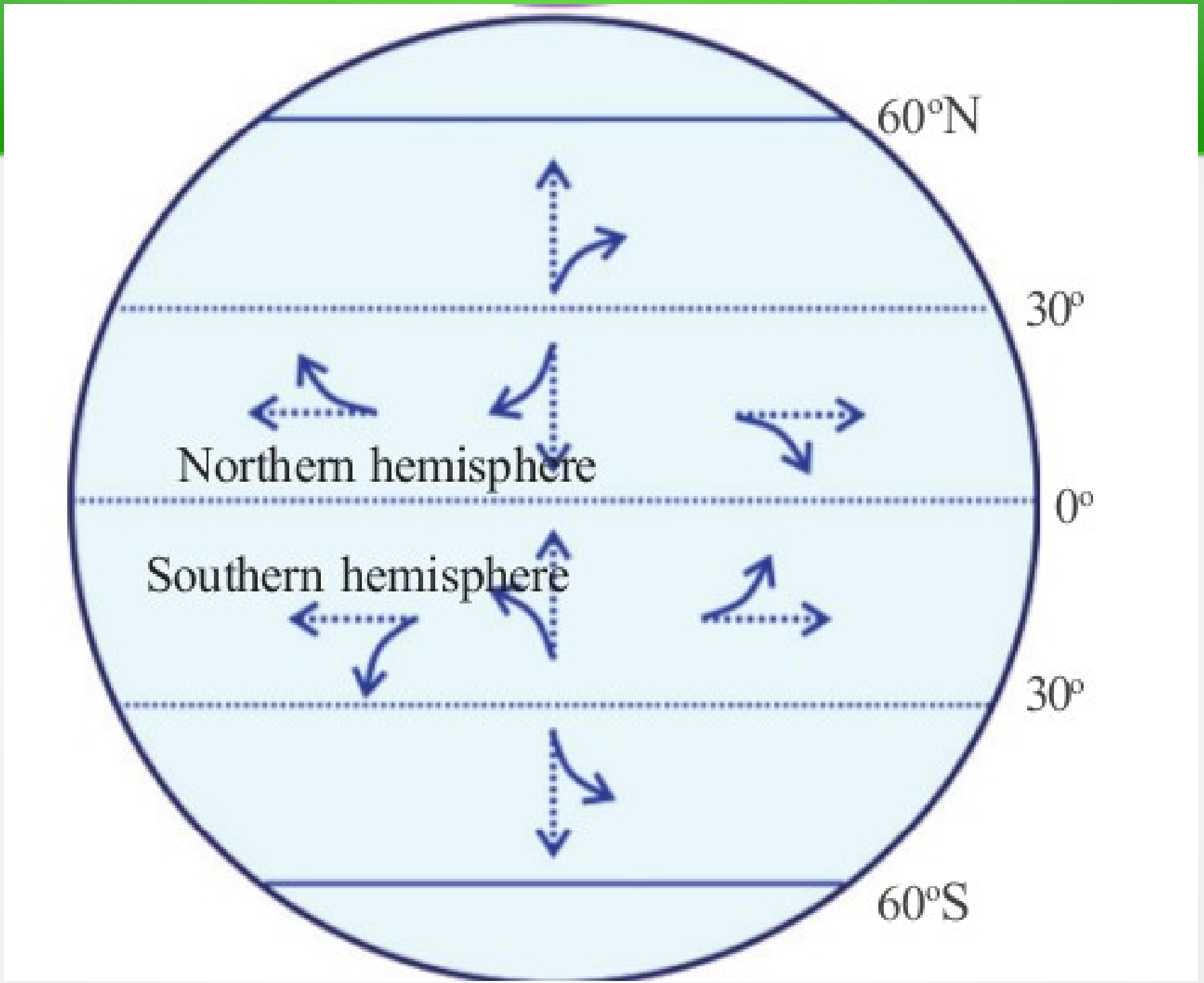


Fig 2.6


60°N
30°
Northern hemisphere
0°
Southern hemisphere
30°
60°S

Coriolis Force

- Freely moving bodies get deflected to the right in the northern hemisphere and to the left in the southern hemisphere due to a force generated as a result of earth's rotation. This is known as the Coriolis force.
- This force increases as it moves towards the Poles from the Equator.

Ferrel's law.

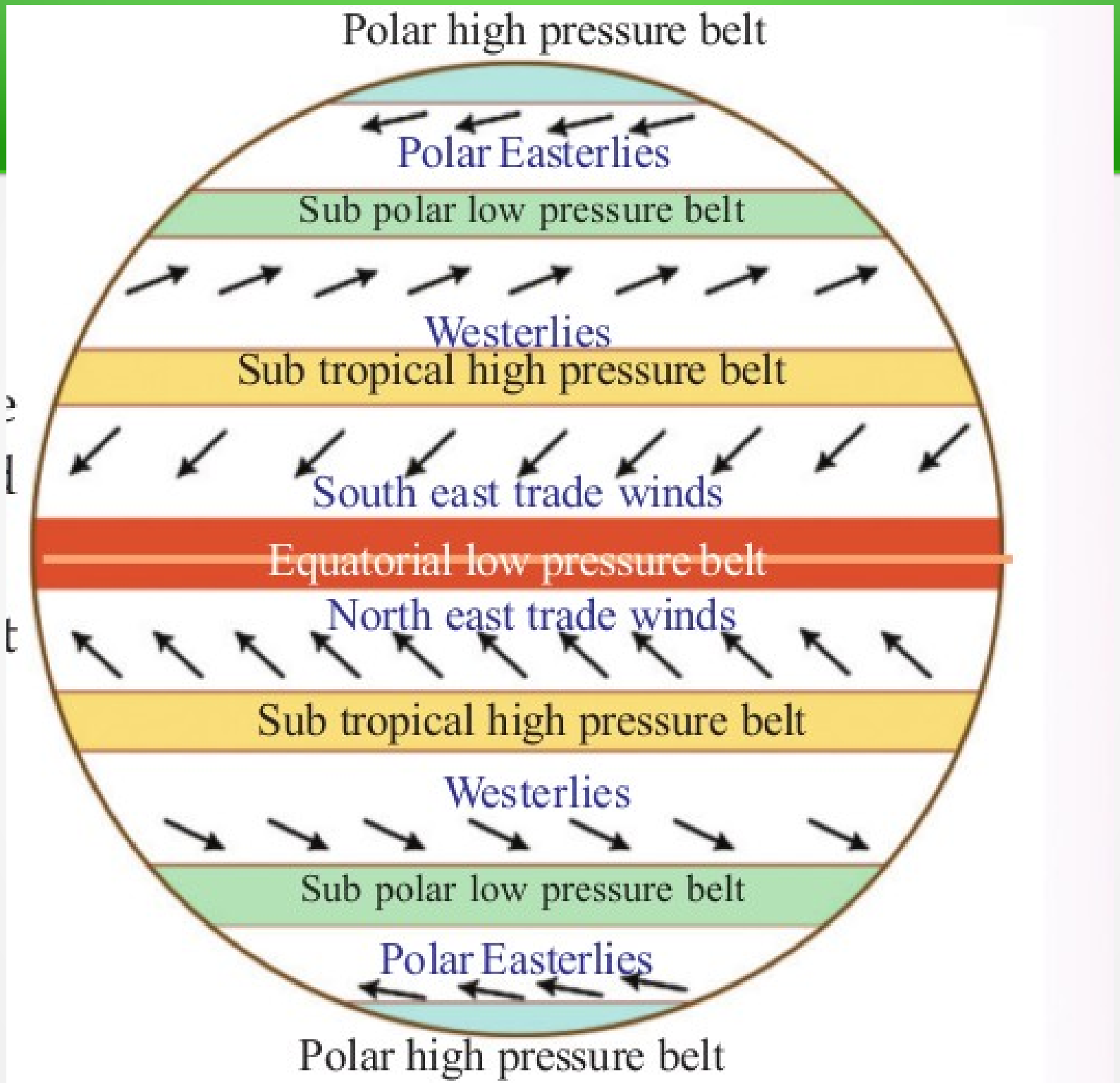
- Admiral Ferrel found out that the winds in the northern hemisphere deflect towards their right and those in the southern hemisphere deflect towards their left due to the Coriolis effect.
- The law put forward by him on the basis of this is known as Ferrel's law.

Speed of wind and Friction

- The speed of wind will be high over ocean surfaces and level lands as the friction is less.
- On the other hand, the friction being more along difficult terrains and places with dense forest cover, the speed of wind will be less in those places.

Planetary winds

- The winds developed between the global pressure belts can be generally called as planetary winds.
- The different planetary winds are
- Trade winds
- Westerlies
- Polar easterlies


Polar high pressure belt
Polar Easterlies
Sub polar low pressure belt
Westerlies
Sub tropical high pressure belt
South east trade winds
Equatorial low pressure belt
North east trade winds
Sub tropical high pressure belt
Westerlies
Sub polar low pressure belt
Polar Easterlies
Polar high pressure belt

Trade Winds

- The winds blow continuously from sub tropical high pressure belt towards the equatorial low pressure belt. These are known as trade winds.
- As these,the winds blow from the northeast in the northern hemisphere they are known as northeast trade winds and the winds blow from the south east in the southern hemisphere they are known as south east trade winds.
- The zone where the trade winds from both the hemispheres converge is known as the Inter Tropical Convergence Zone (ITCZ).

Westerlies

- Winds blow continuously from sub tropical high pressure belts to sub polar low pressure belts.
- As the direction of these winds are mostly from the west, these are known as the westerlies.
- The westerlies are stronger in the southern hemisphere than in the northern hemisphere. This is due to the vast expanse of oceans in the southern hemisphere.
- Westerlies that helped Gama to reach the South Africa through the south Atlantic Ocean.
- The ancient mariners had given different names to the rough westerlies in the southern hemisphere, such as 'Roaring Forties' (along 40° latitudes), 'Furious Fifties' (along 50° latitudes) and 'Shrieking Sixties' (60° latitudes).

Polar Easterlies

- Polar regions are centres of high pressure.
- The polar winds are the cold winds that blow from these high pressure areas towards the sub polar low pressure belts.
- These winds blow from the east in both the hemispheres due to the Coriolis force. Hence these are known as polar easterlies.
- These winds play a significant role in determining the climate of North America, the eastern European countries, and Russia.

Periodic winds

- Periodic winds blow in a constant direction throughout the year.
- But some winds are confined to a small locality. Hence these are known as local winds.
- These are of two types - local periodic winds and other local winds.
- Monsoon winds are example of periodic winds.

Monsoon

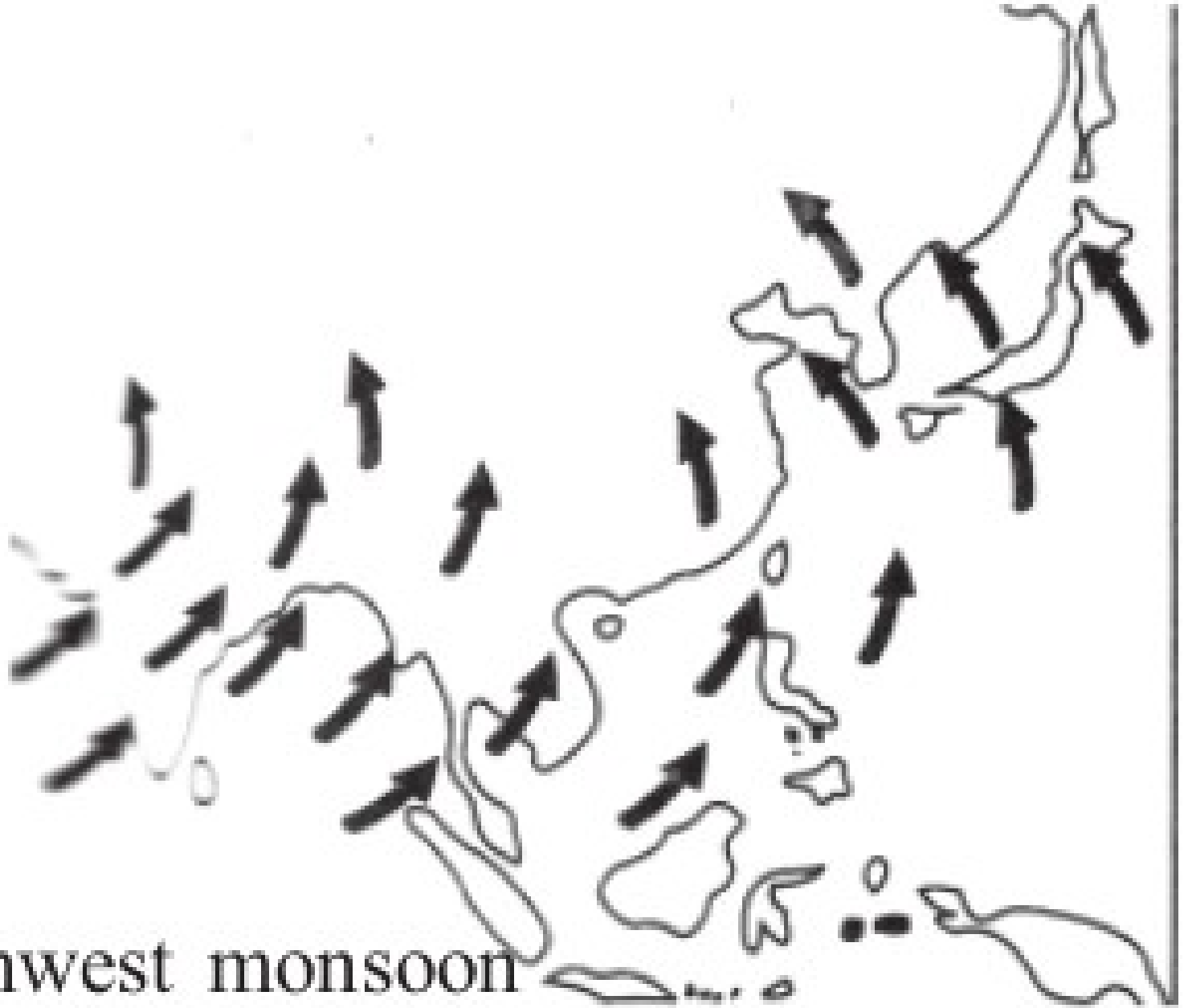
- The term 'monsoon' is derived from the Arab word 'mousam'.
- It means 'winds that change direction in accordance with season'.
- Monsoon is the seasonal reversal of wind in a year.

Factors responsible for the formation of the monsoon winds

- The apparent movement of the sun
- Coriolis force
- Differences in heating

South West Monsoon Winds.

- Sun's rays fall vertically to the north of the Equator during certain months due to the tilt of the earth's axis.
- This leads to an increase in temperature along the region through which Tropic of Cancer passes.
- The pressure belts also shift slightly northwards in accordance with this.
- The south east trade winds also cross the equator and moves towards the north as the Inter Tropical Convergence Zone (ITCZ) moves northwards during the summer in the northern hemisphere.
- As the trade winds cross the Equator they get deflected and transform into south west monsoon winds under the influence of the Coriolis effect.
- The low pressure formed over the land due to the intense day temperature attracts these sea winds and further contributes to the formation of the south west monsoon winds.



Southwest monsoon winds

North East Monsoon Winds

- As a result of the formation of high pressure zones over the Asian landmass during winter and low pressure zones over the Indian Ocean, the north east trade winds get strengthened.
- These are the northeast monsoon winds.

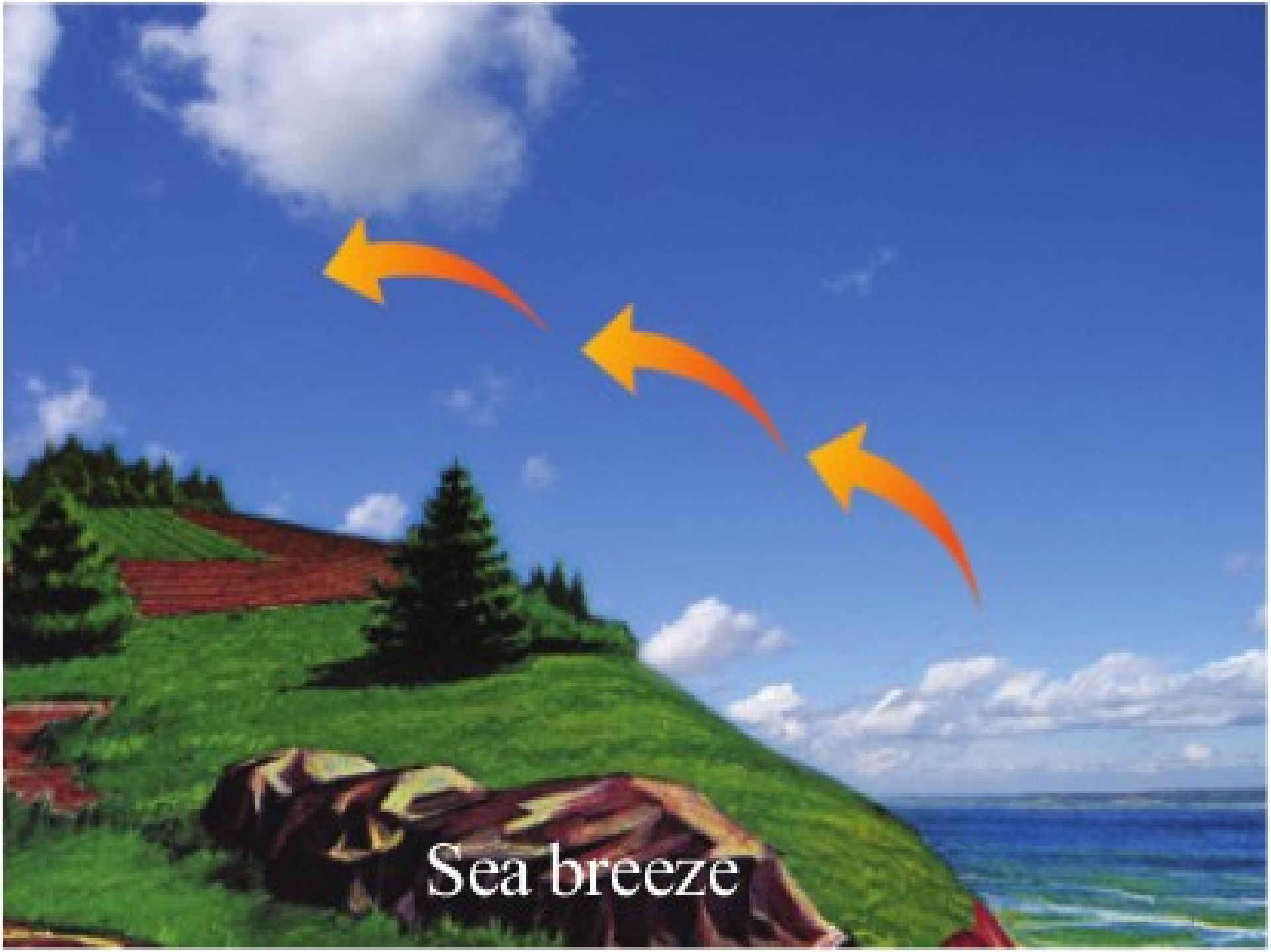

NorthEast
monsoon winds

Reasons of Land and sea breeze

- The reaction of land and sea to Sun's heat is not uniform.
- The land heats up and cools down quickly, whereas the sea gets heated up slowly and can retain the heat for a longer period of time

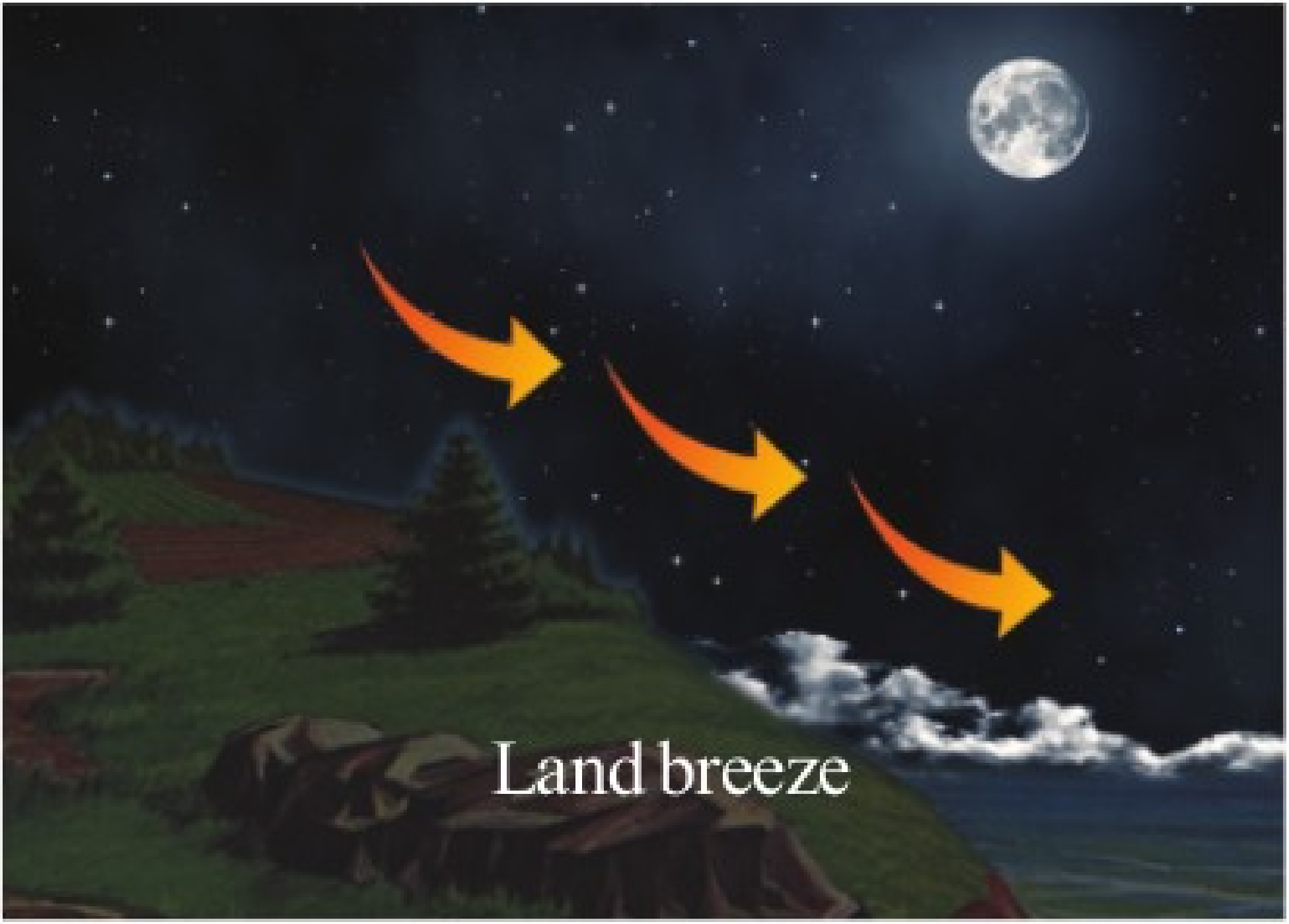
Sea Breeze

- The air in contact with the land also gets heated up and ascends as the land heats up quickly during the day time.
- This leads to the formation of low pressure over the land which causes the comparatively cooler air to blow from the sea.
- This is known as sea breeze.


Sea breeze

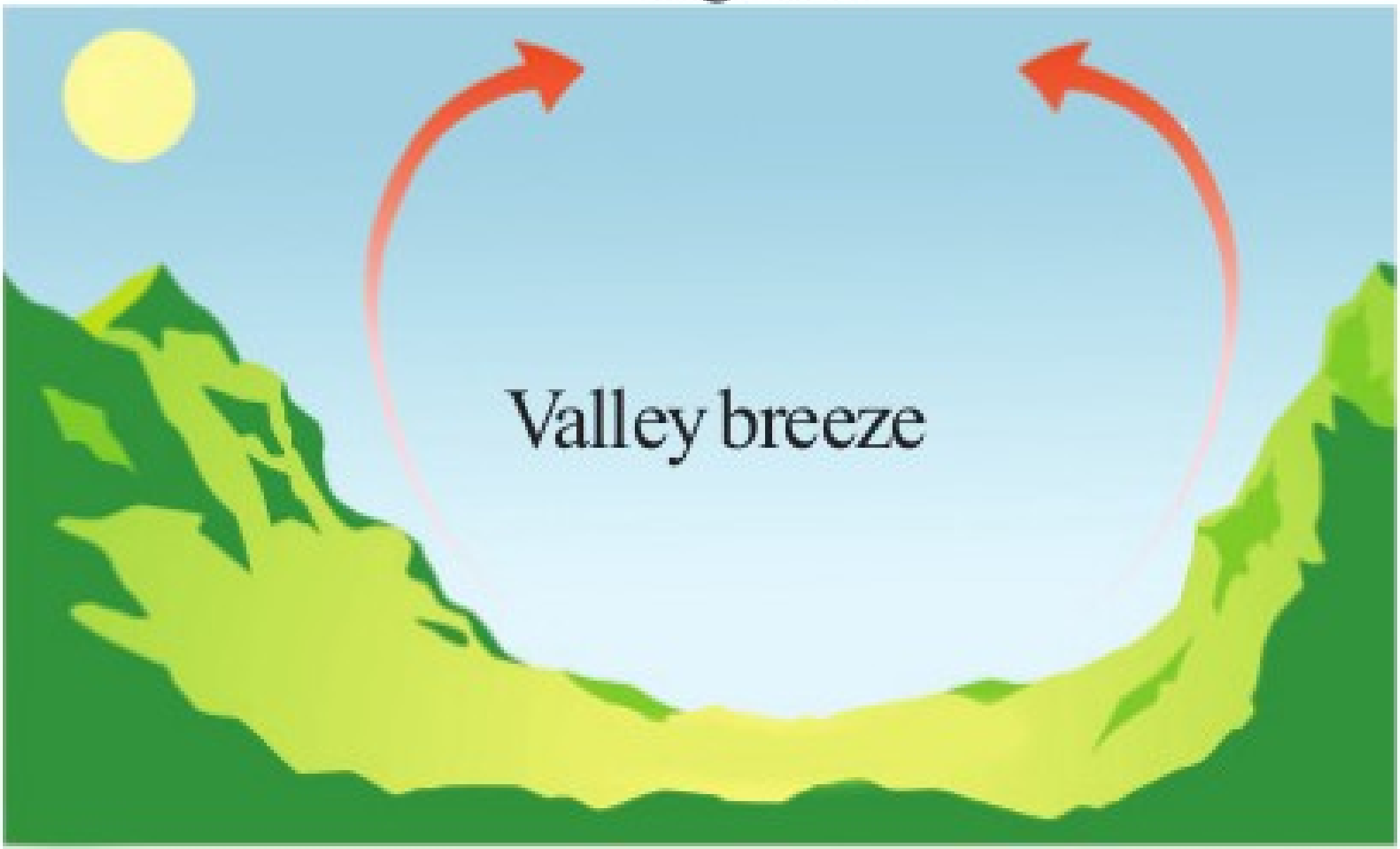
Land breeze

- As the land cools faster than the sea during the night, it would be high pressure over the land and low pressure over the sea.
- This results in the movement of air from the land to sea. This is the land breeze.
- The land breeze which starts blowing at night becomes active in the early morning and ceases by sunrise.


Land breeze

Valley Breeze.

- During the day time the air in the valley gets heated up more than the air on the mountain tops.
- As a result, the wind blows upslope from the valley. This is known as valley breeze.


Valley breeze

Mountain Breeze

- During night the air in the mountainous regions cools due to the intense cold conditions in that region.
- As cool air is denser, it blows towards the valley. This is known as mountain breeze

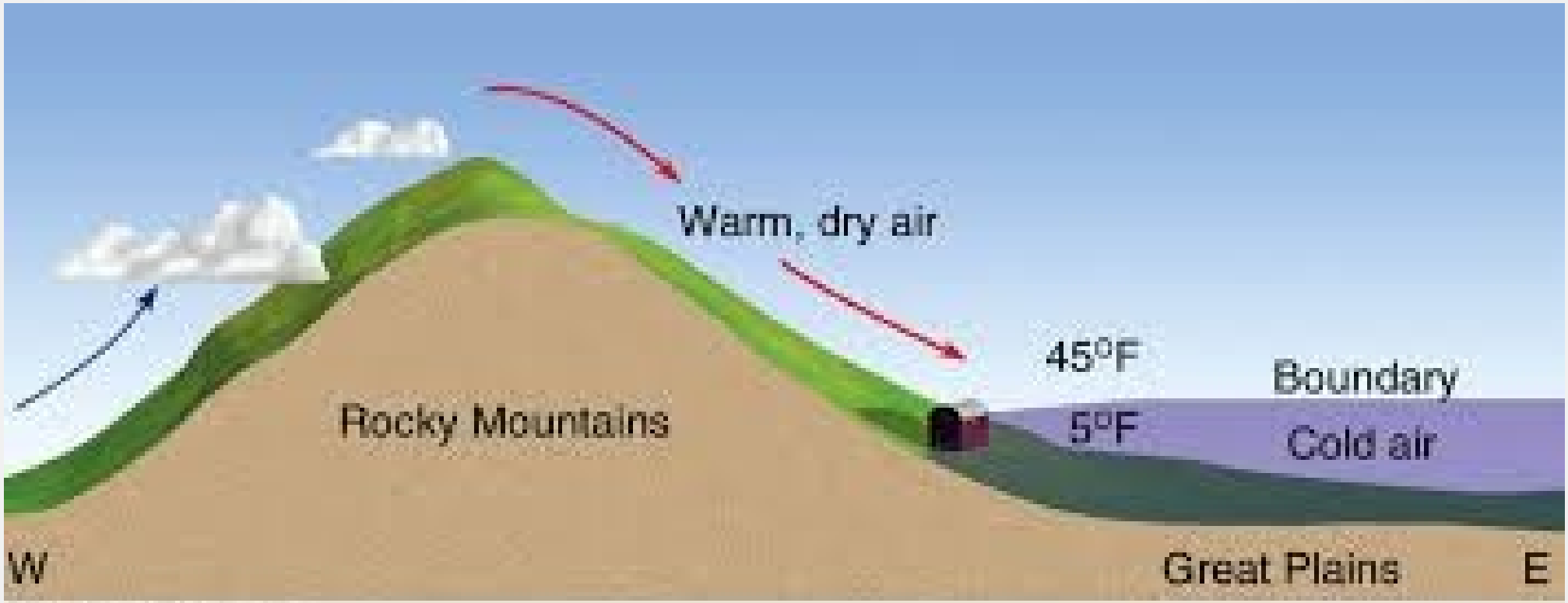

Mountain breeze

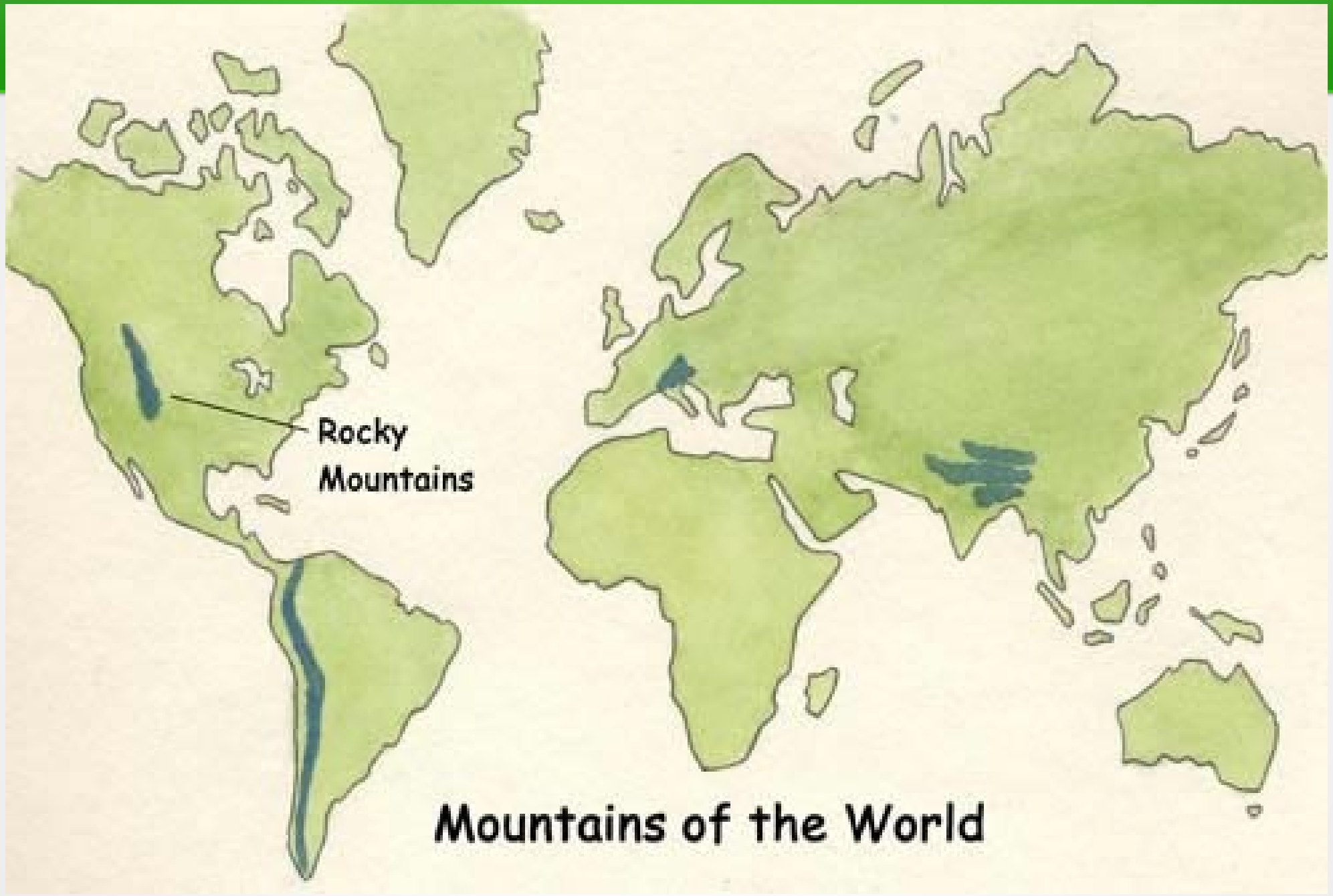
Local winds

- Local winds are winds whose effects are limited to a comparatively smaller locality.
- Formed as a result of local pressure differences, these winds are weak.
- Loo, Mangoshowers, and Kalbaisakhi are the local winds experienced in India.
- Chinook, Harmattan and Foehn are some of the local winds in other parts of the world.

Chinook

- Chinook is a local wind that blows down the eastern slope of the Rockie mountains in North America.
- As a result of these winds, the snow along the eastern slopes of the Rockies melts away.
- The term Chinook means 'snow eater' a term that suits to its peculiarity.
- Since this wind reduces the severity of the cold, it is helpful for the wheat cultivation in the Canadian lowlands.




Rocky
Mountains
Mountains of the World

Foehn

- Foehn is the wind that blows towards the southern valleys of the Alps.
- As the air heats up due to pressure from the descend, it helps in reducing the severity of cold in that region.

Harmattan

- Harmattan is a dry wind which blows from the Sahara desert towards the West Africa.
- On the arrival of these winds, the humid and sultry conditions of West Africa is improved significantly.
- Hence, people call these winds as doctor Harmattan.


North Sea
United Kingdom
Ireland
Danmark
Denmark
Беларусь
Belarus
Polska
Poland
Deutschland
Germany
Bora
Mistral
Österreich
Austria
Україна
Ukraine
France
Bay of Biscay
România
Romania
Italia
Italy
España
Spain
Portugal
Ελλάς
Greece
Türkiye
Turkey
Mediterranean Sea
Syria
Tunisia
Iraq
Morocco
Sirocco
Algeria
Libya
مصر
Egypt
Saudi Arabia
Western Sahara
Harmattan
Mauritania
Mali
Niger
Chad
Sudan
Burkina Faso
Guinea
Ghana
Nigeria
Ethiopia
Gulf of Guinea
Somali
Kenya
Gabon
DR Congo
Tanzania
Angola
Zambia
Mozambique
Namibia
Zimbabwe
Botswana
Madaga

Loo

- Loo is another hot wind blowing in the north Indian plain.
- These winds blowing from the Rajasthan desert cause a rise in the summer temperature of the north Indian plains.
- The winds that blow in south India during this season are called Mangoshowers.
- It acquires its name owing to the fall of ripe mangoes on its arrival.