2

In Search of the Source of Wind

Prepared by:-

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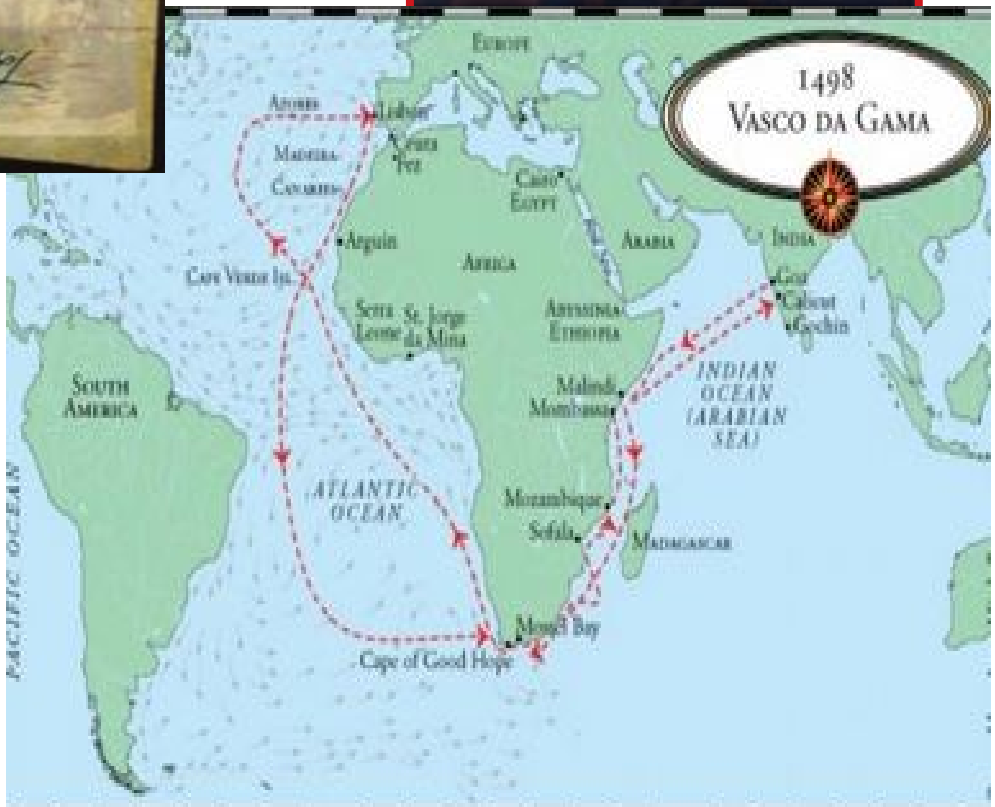
GHSS ALAMPADY
KASARAGOD
9446736276

8 July 1497

Vasco da Gama started his voyage in four ships from the Port of Lisbon with a crew of 170. It was the longest voyage ever attempted in search of a country. They reached the coast of Brazil and from there they travelled to south east. The winds identified by Bartholomeo Dias aided Gama and took him to the southern coast of Africa. However Gama left the place due to disputes with the local government. He sailed past Mombassa and reached Malindi. On sighting Indian merchants there, he sought the help of a local navigator and set sail on 24 April 1498. With the help of the southwest monsoon winds, he reached Kappad near Kozhikode on 20 May after a voyage of 23 days. But Gama struggled a lot when he tried to return during the southwest monsoon season itself neglecting the advice of experts. It took him 132 days to reach Malindi!



~saleemka~

The wind helped
for early sea voyages.
The sailors started
the journey
on the basis
of blowing
direction of winds

The variations in the atmospheric pressure are the basic reason for wind

Atmospheric pressure is the weight of atmospheric air

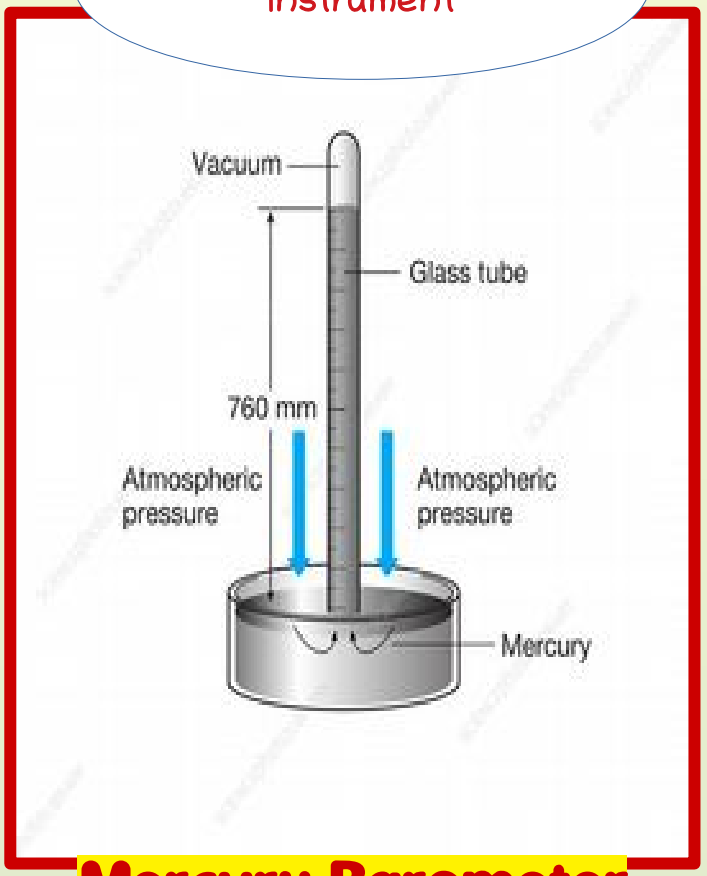
~saleemka~

Variations in atmospheric pressure

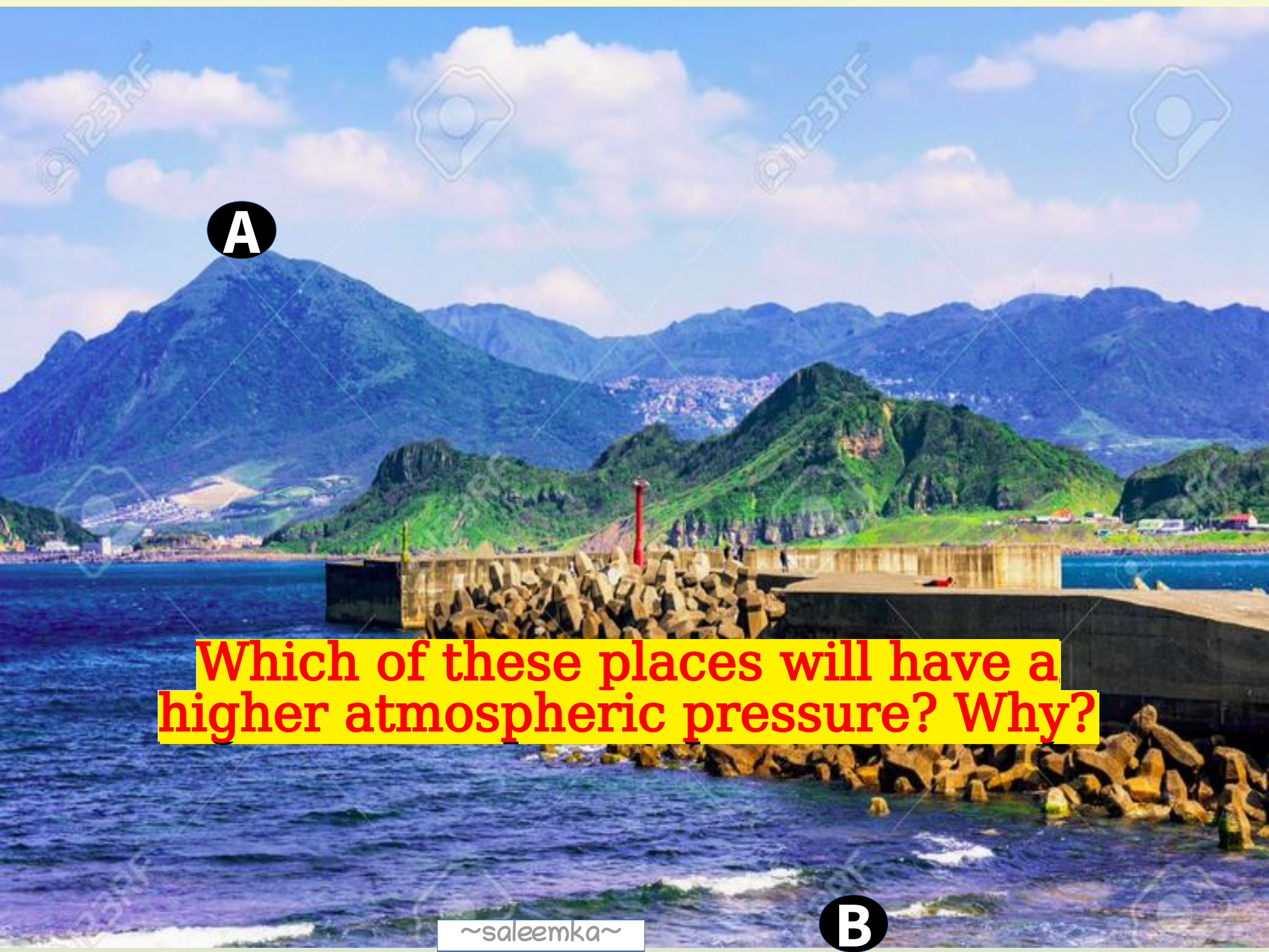
The air exerts an average weight of 1034 mg per cm 2 on the earth's surface

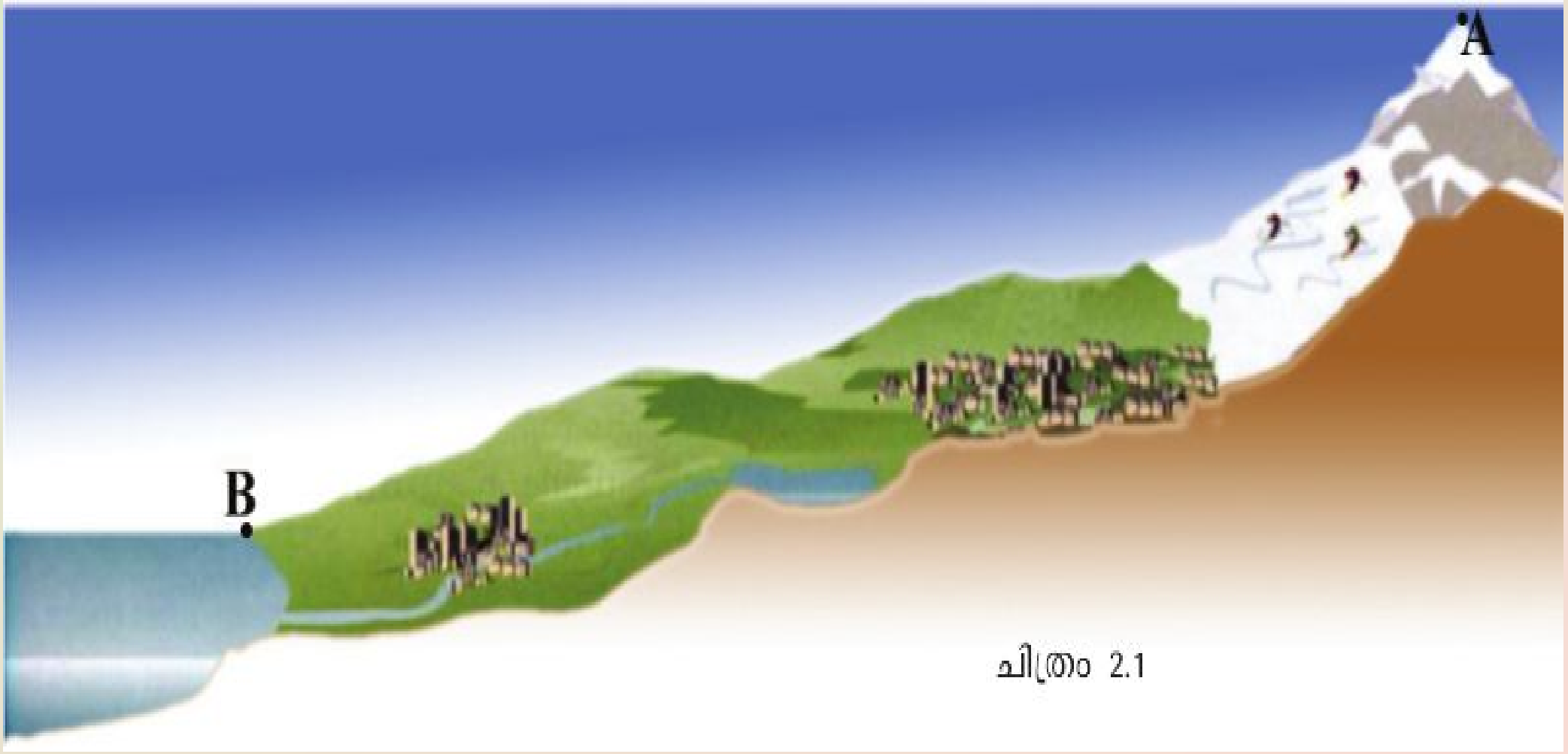
Unit of pressure millibar (mb) and hectopascal (hPa)

Measuring Instrument



Mercury Barometer


A
Which of these places will have a higher atmospheric pressure? Why?
B
~saleemka~



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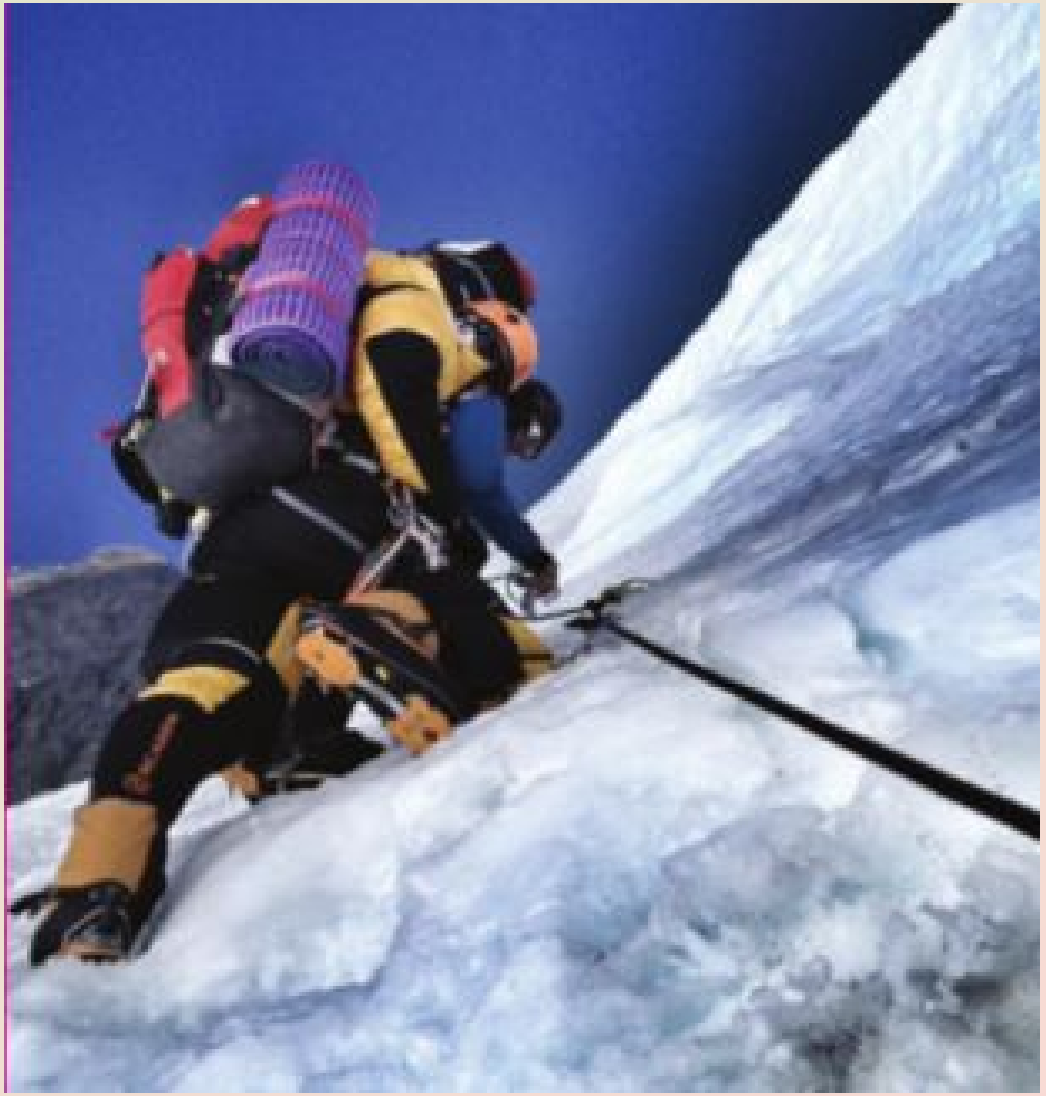
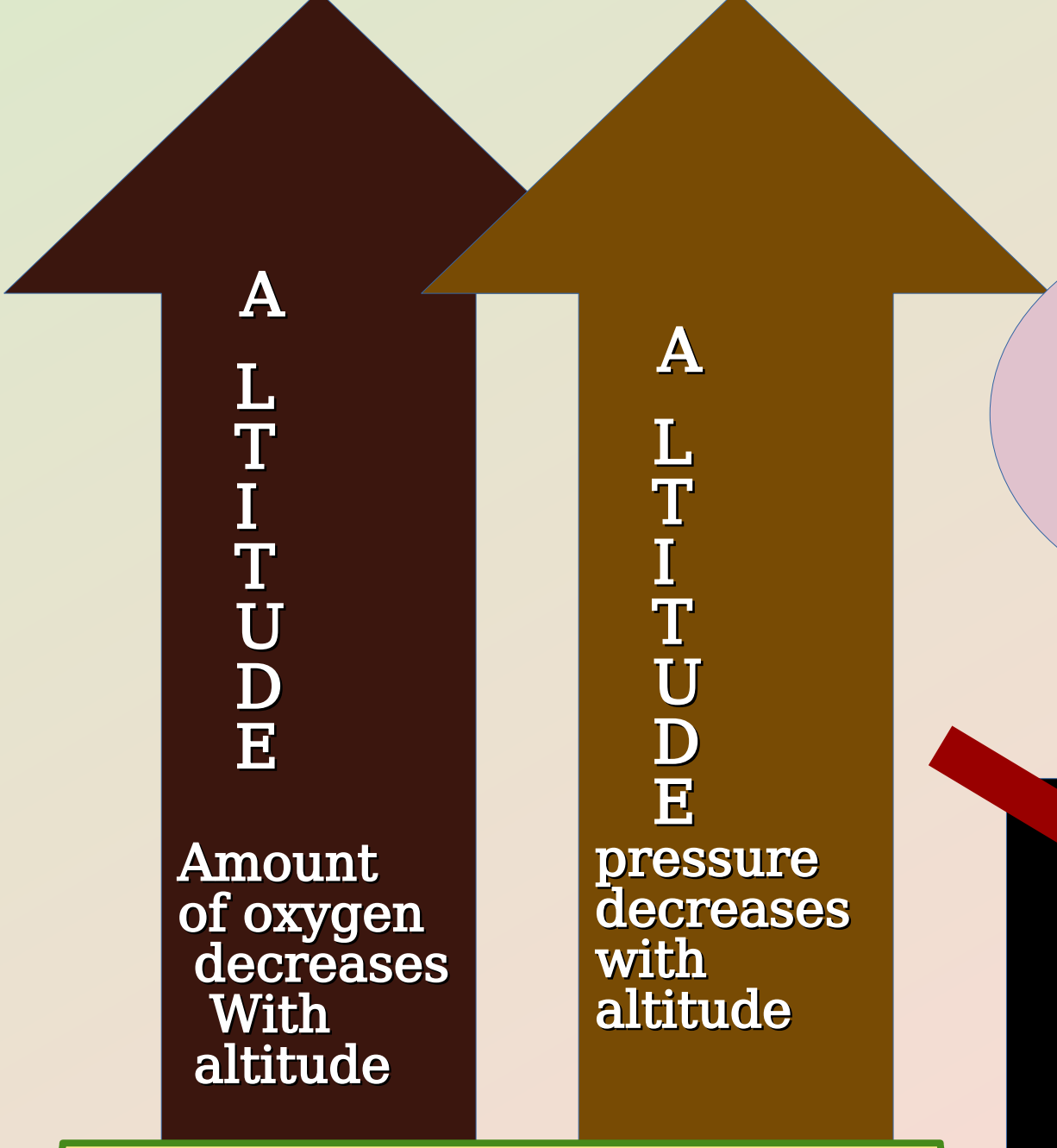
The atmospheric pressure decreases with altitude

Atmospheric pressure and altitude



Why do mountaineers carry Oxygen cylinders?

~saleemka~



The pressure decreases at the rate of 1 millibar (mb) per an altitude of 10 meters

~~The atmospheric pressure and the altitude are inversely proportional~~

Altitude is an important factor influencing the atmospheric pressure

~saleemka~

Why you feel
your ears
clog as you go
to high altitude?

~saleemka~

Temperature and atmospheric pressure

The atmospheric pressure decreases as the temperature increases

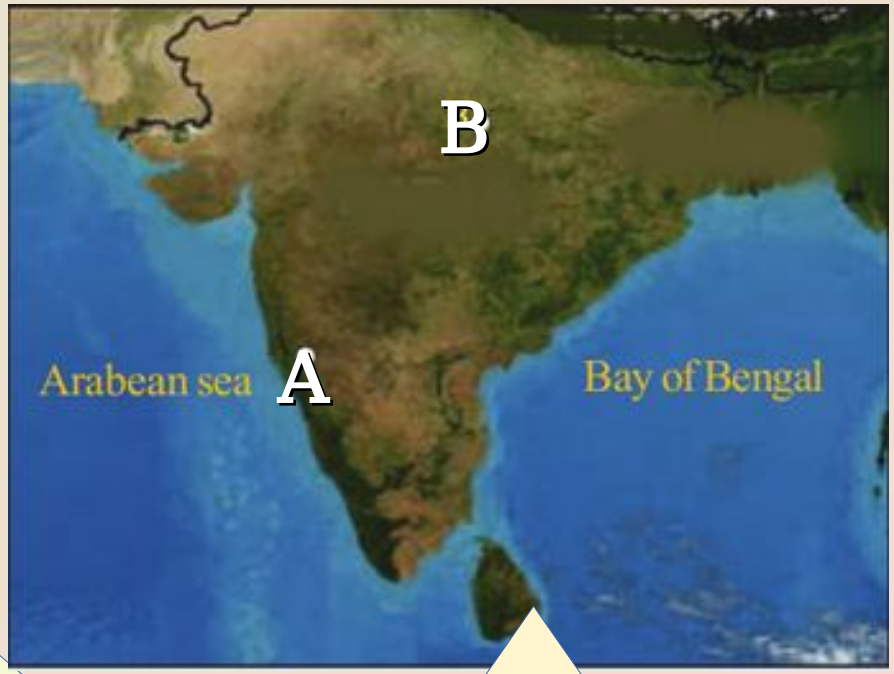
TEMPERATURE

PRESSURE

The atmospheric pressure increases as the temperature decreases

Humidity and atmospheric pressure

The quantity of water present in the atmosphere



HUMIDITY

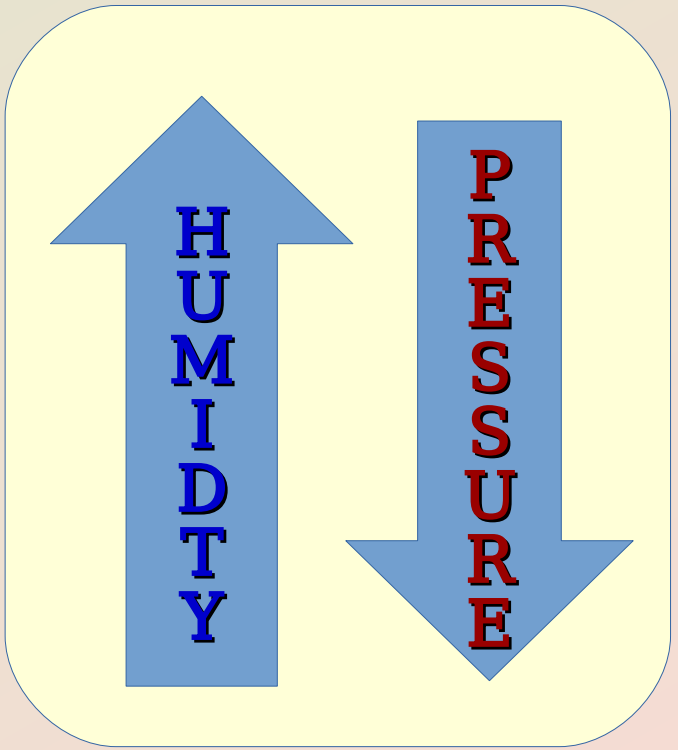
PRESSURE

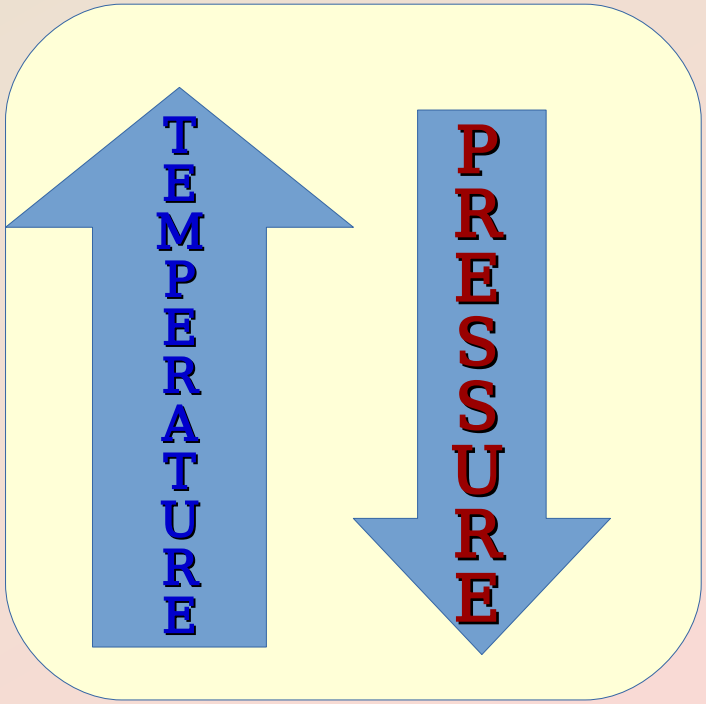
Humidity and atmospheric pressure are inversely proportional
The quantity of water vapour is more in a unit volume of air, then naturally the atmospheric pressure will be less

Which of these has a low atmospheric Pressure A or B ? Why?

~saleemka~

Relation with Pressure

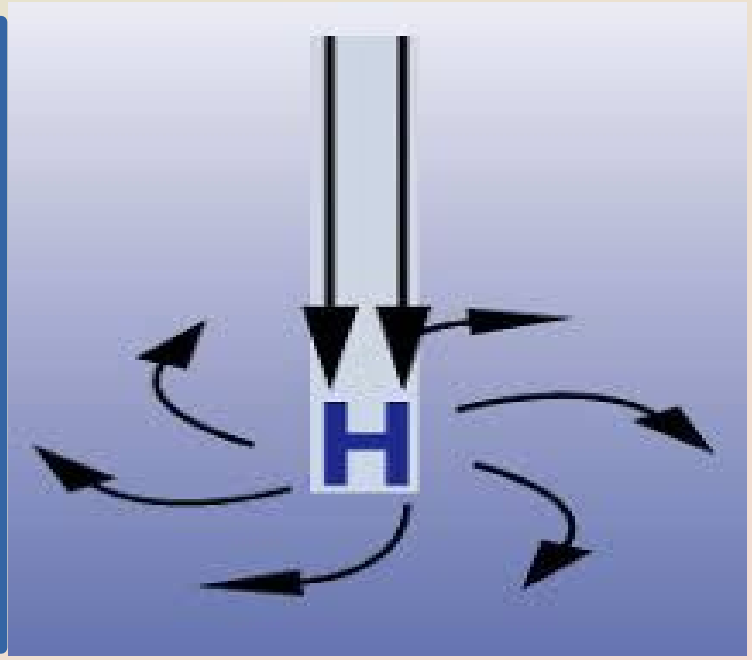


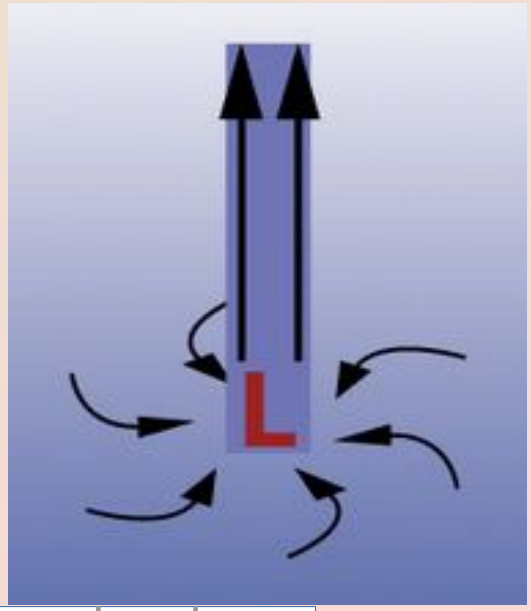


High Pressure (H) Low Pressure (L)

If the atmospheric pressure of an area is higher than that of the surrounding regions

High Pressure



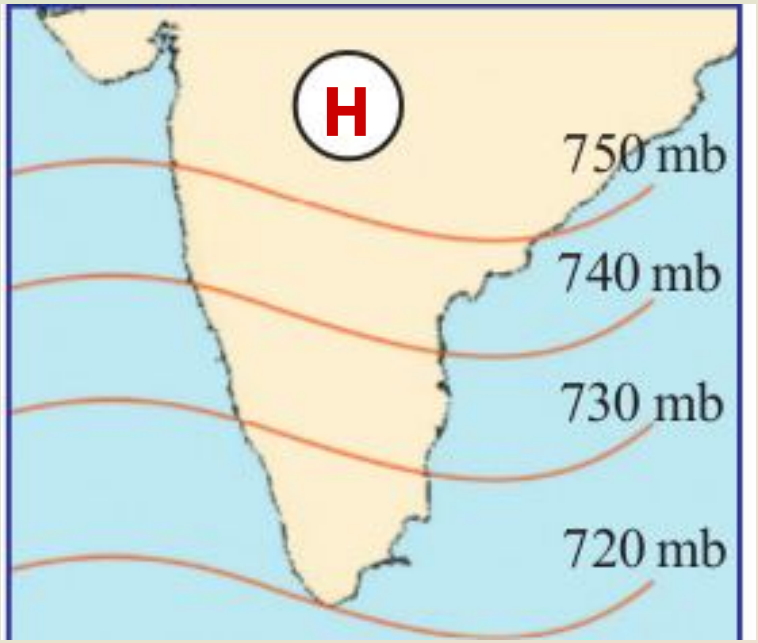


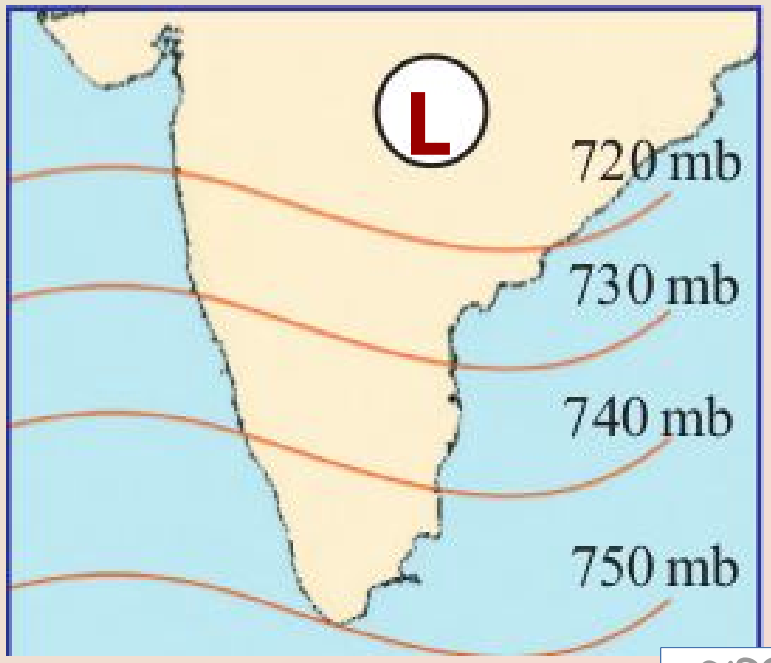
f the atmospheric pressure of an area is higher than that of the surrounding regions

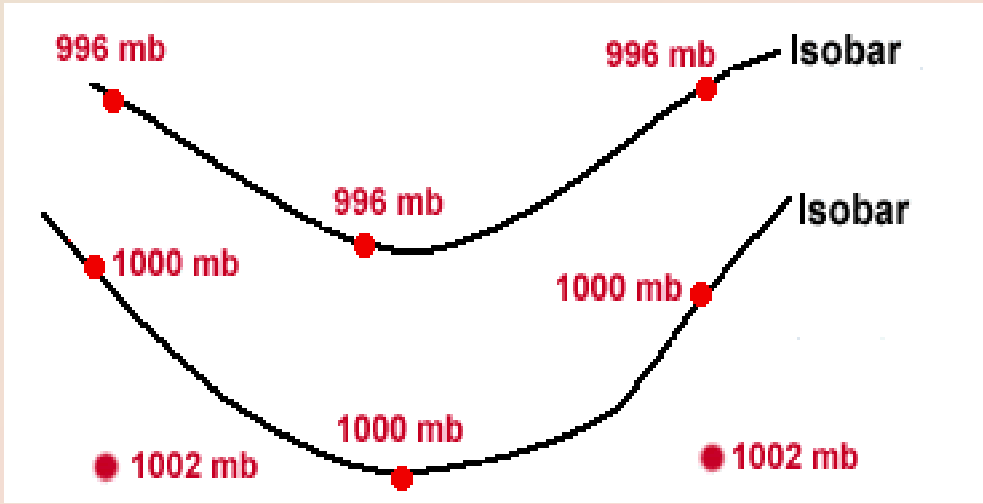
Law Pressure

Isobars

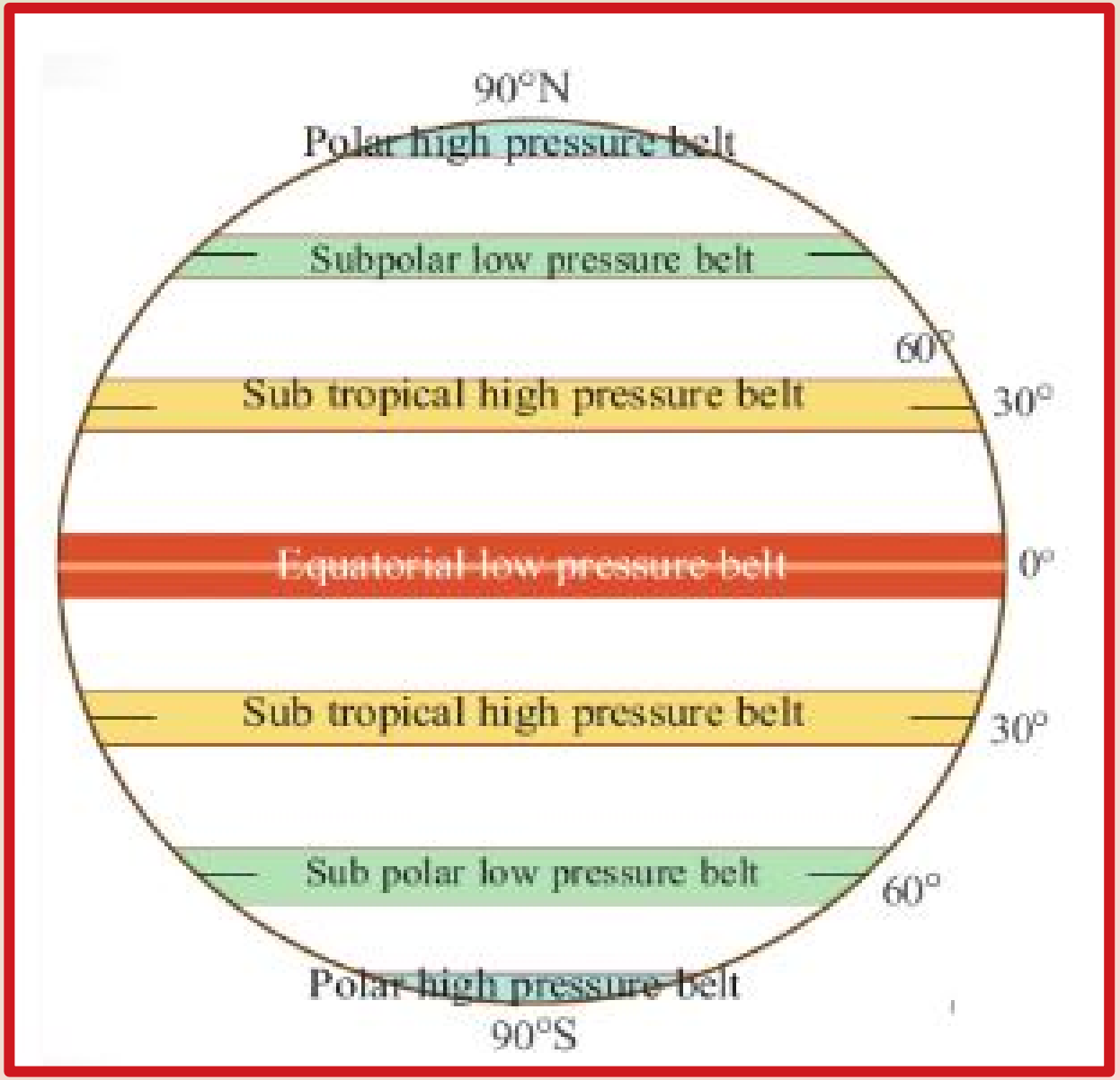
Imaginary lines joining places having the same atmospheric pressure



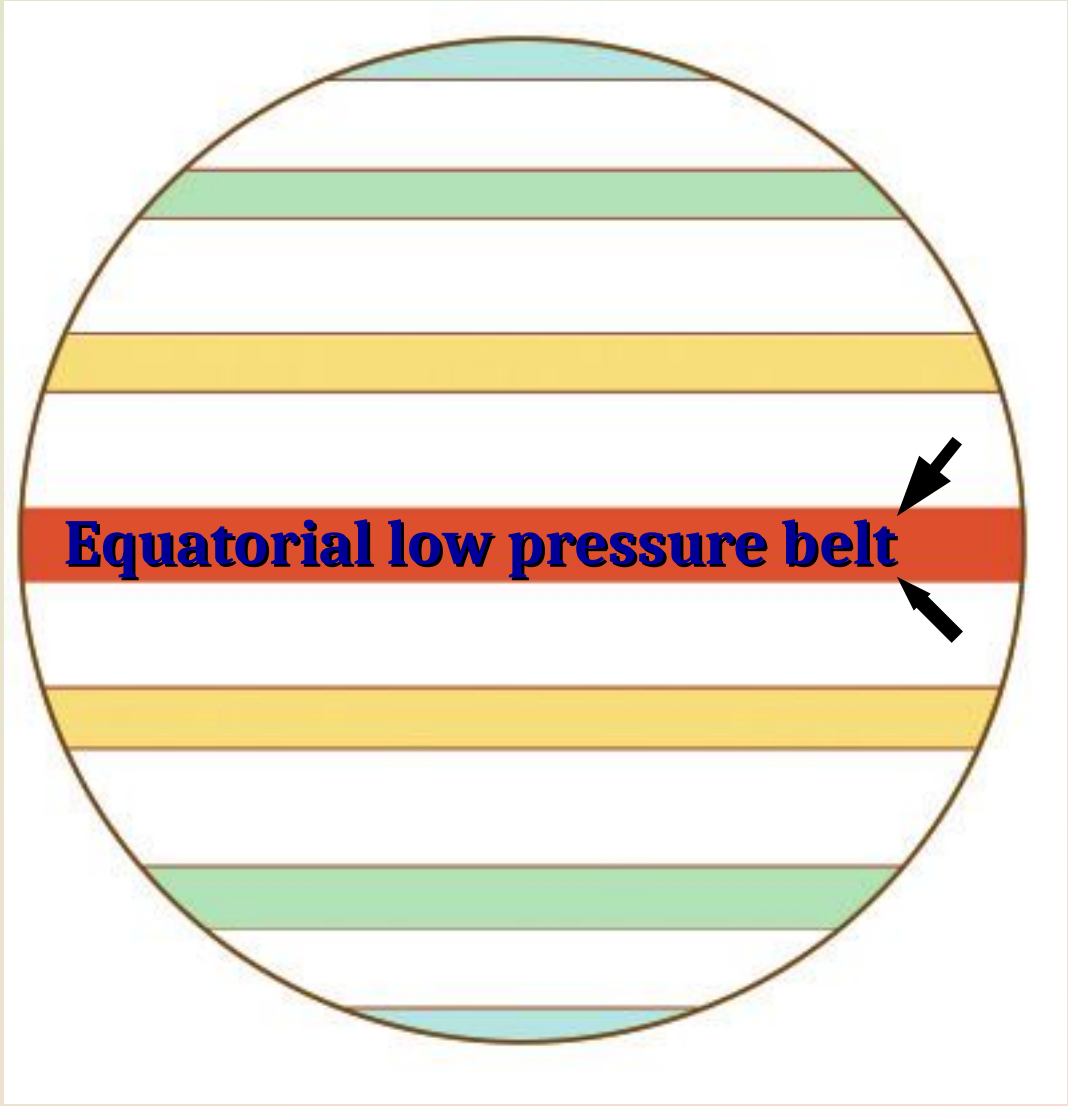




Global pressure belts

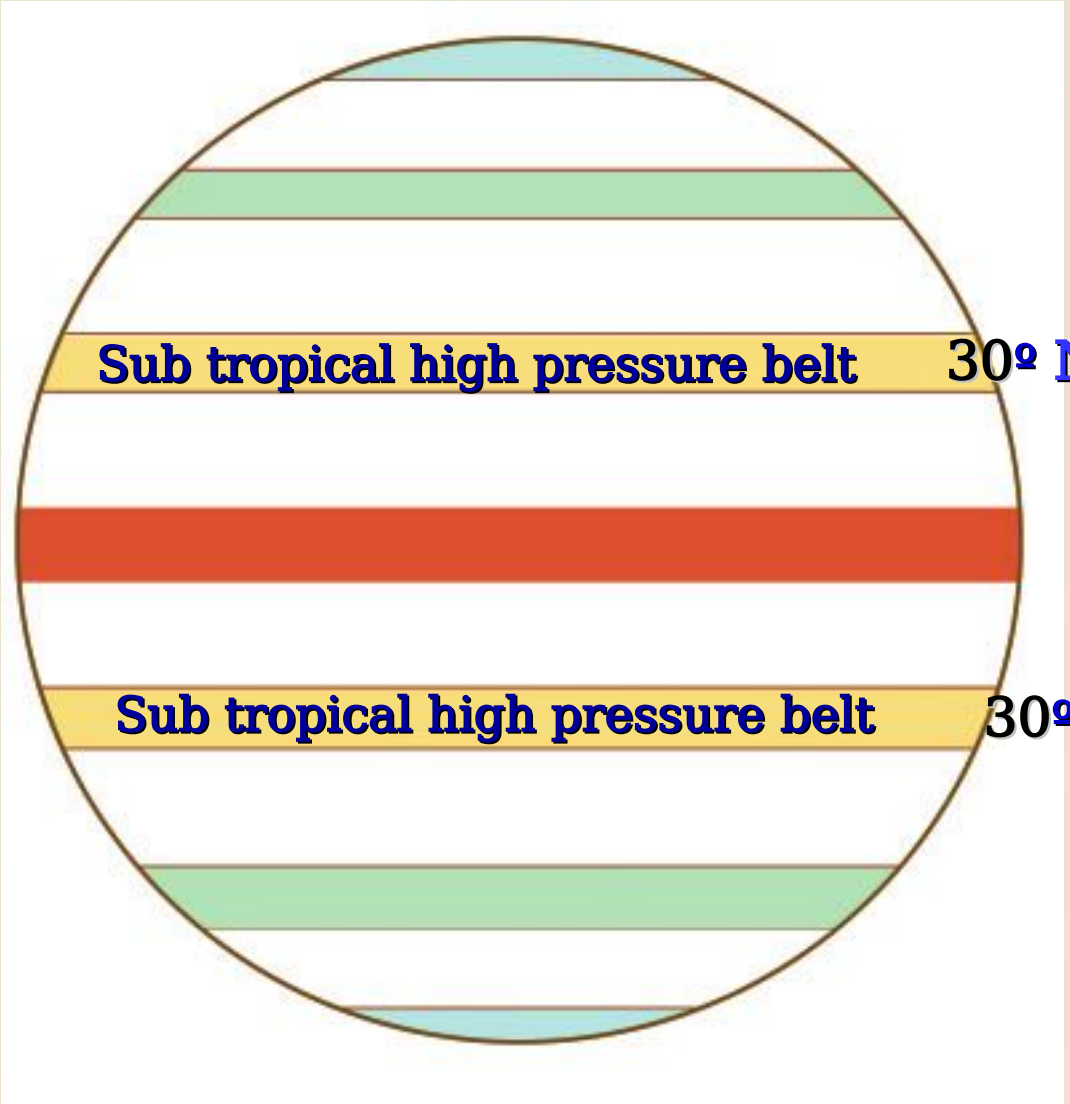


Equatorial low pressure belt

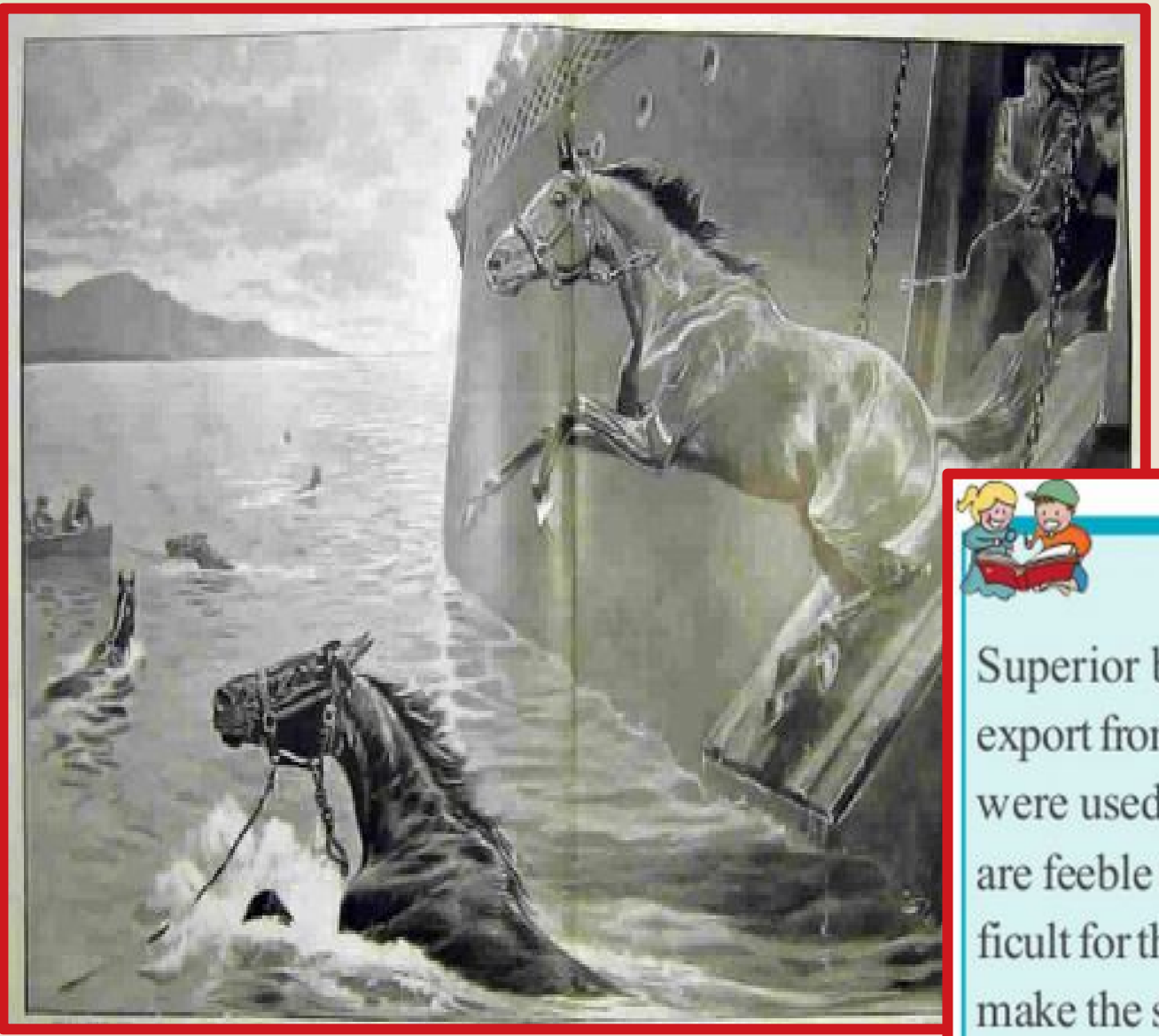


* 5º N&S Latitudes
* Low Pressure zone
* sun's rays fall vertically throughout the year
* High Temperature
* Feeble Winds
* "zone with no winds" (Doldrums)

Sub tropical high pressure belt



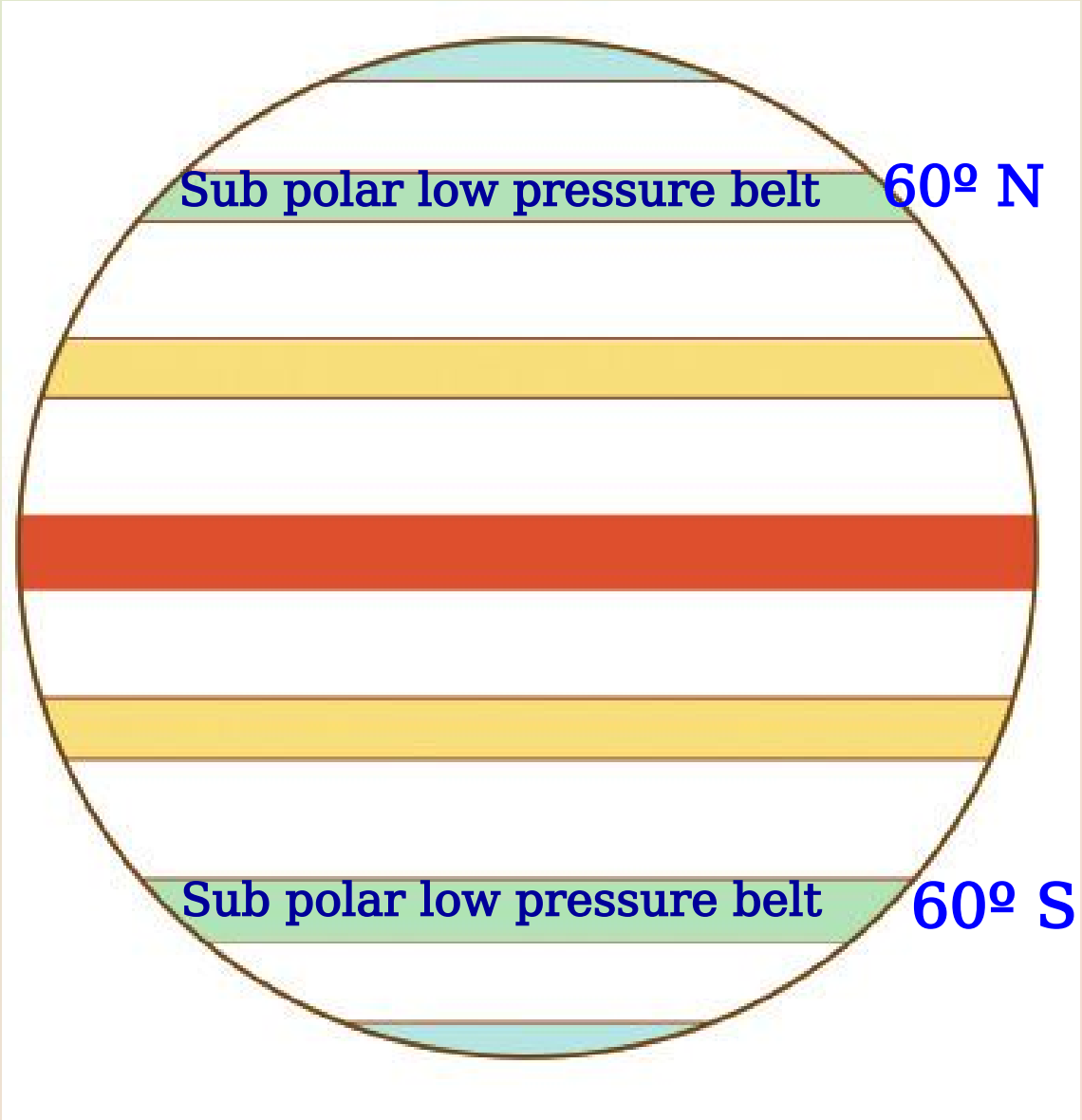
* 30º N&S Latitudes
* High Pressure
* Hot air from Equator Cools here due to Rotation



Horse latitude

Superior breeds of horses were once a major export from Europe to America and Cargo ships were used to carry them across. As the winds are feeble in the subtropical regions, it was difficult for these ships to sail smoothly. In order to make the ship lighter to facilitate easy voyage, they used to throw many of these horses into the sea. Thus the zone acquired the name 'horse latitude'.

Sub polar low pressure belt

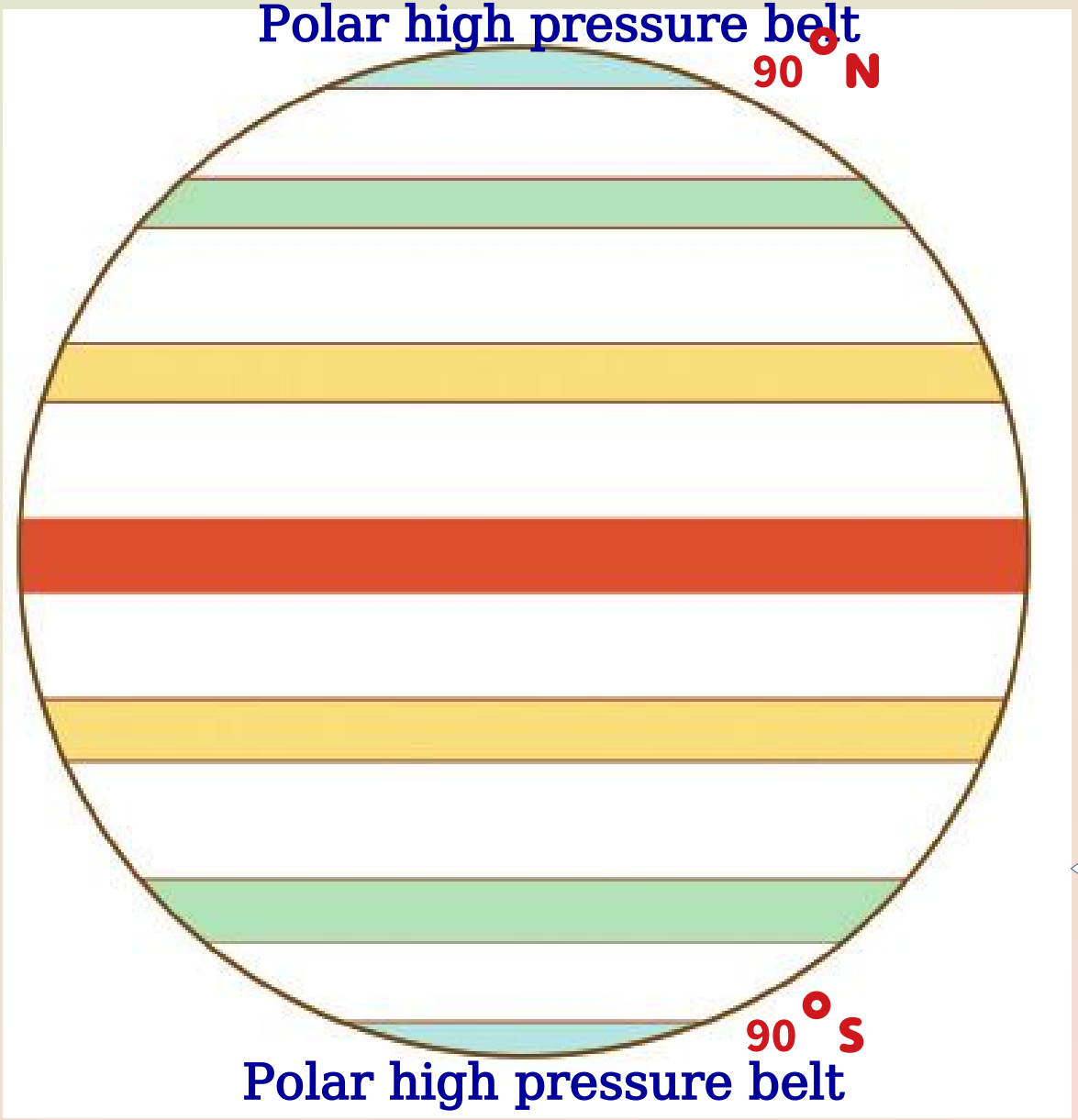


* 60º N&S Latitudes

* Low Pressure

* The cold air remains close to the Earth, the air is thrown away due to the rotation of the earth

Polar high pressure belt



* 90º N&S Latitudes

* High Pressure

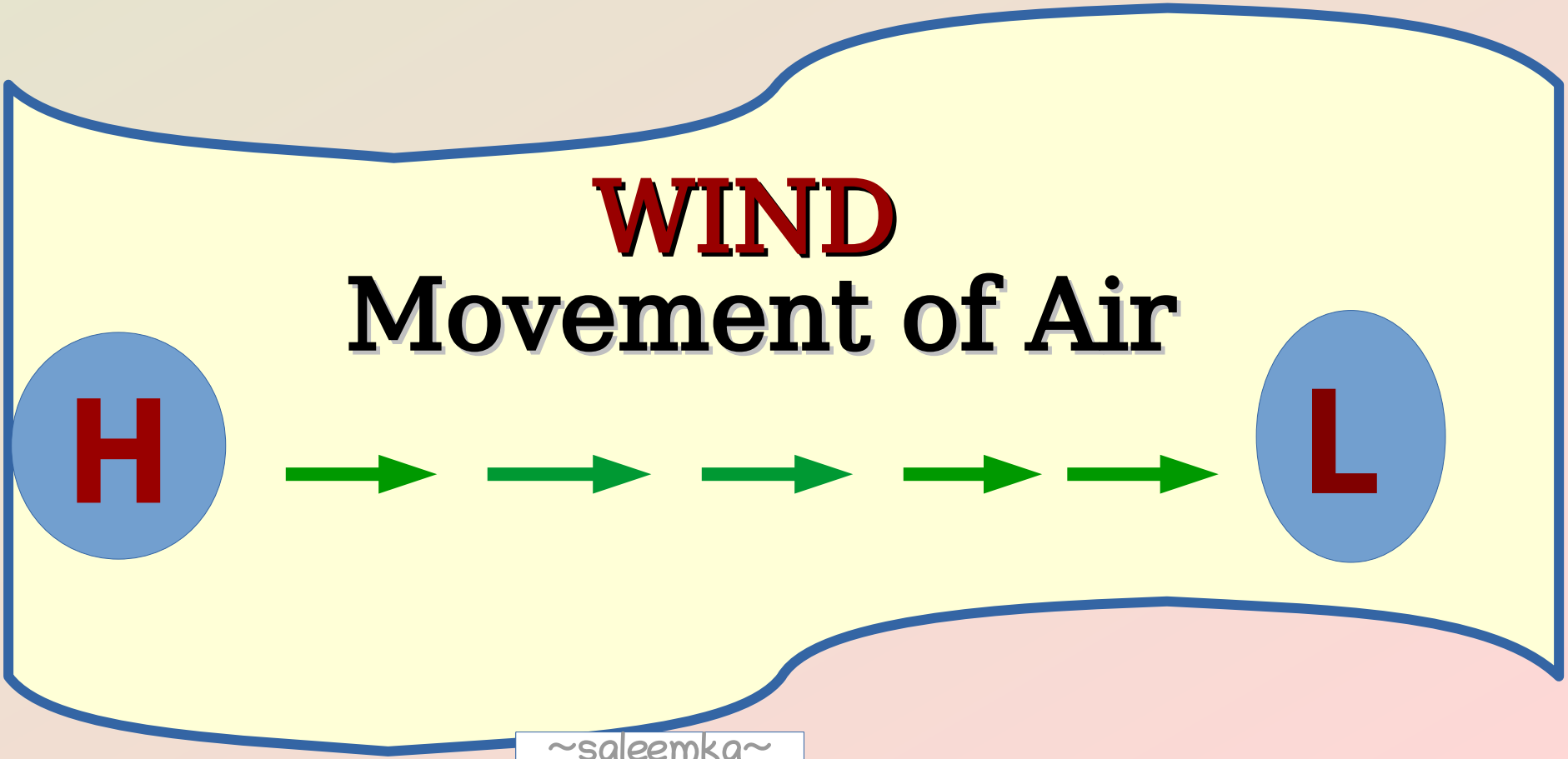
* Severe Cold throughout the Year

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

Atmospheric pressure and 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



How the winds get their name

On the basis of the direction from which they blow

South → South Wind

North → North Wind

Sea → Sea Breeze

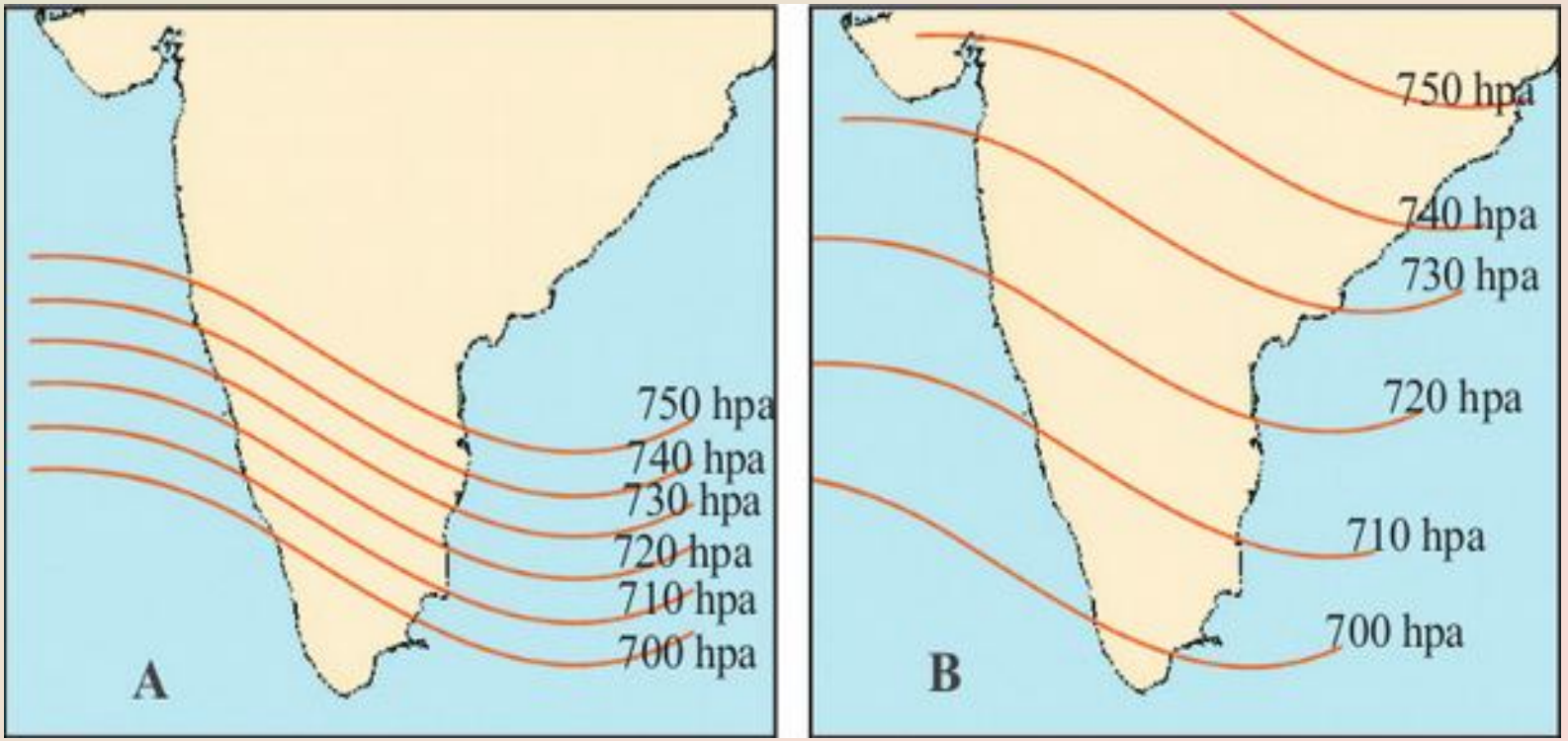
Mountain → Mountain Breeze

The speed and the direction of wind are based on

1. Pressure gradient force

The pressure gradient is said to be steeper when the pressure difference is more

The speed of wind will be higher there

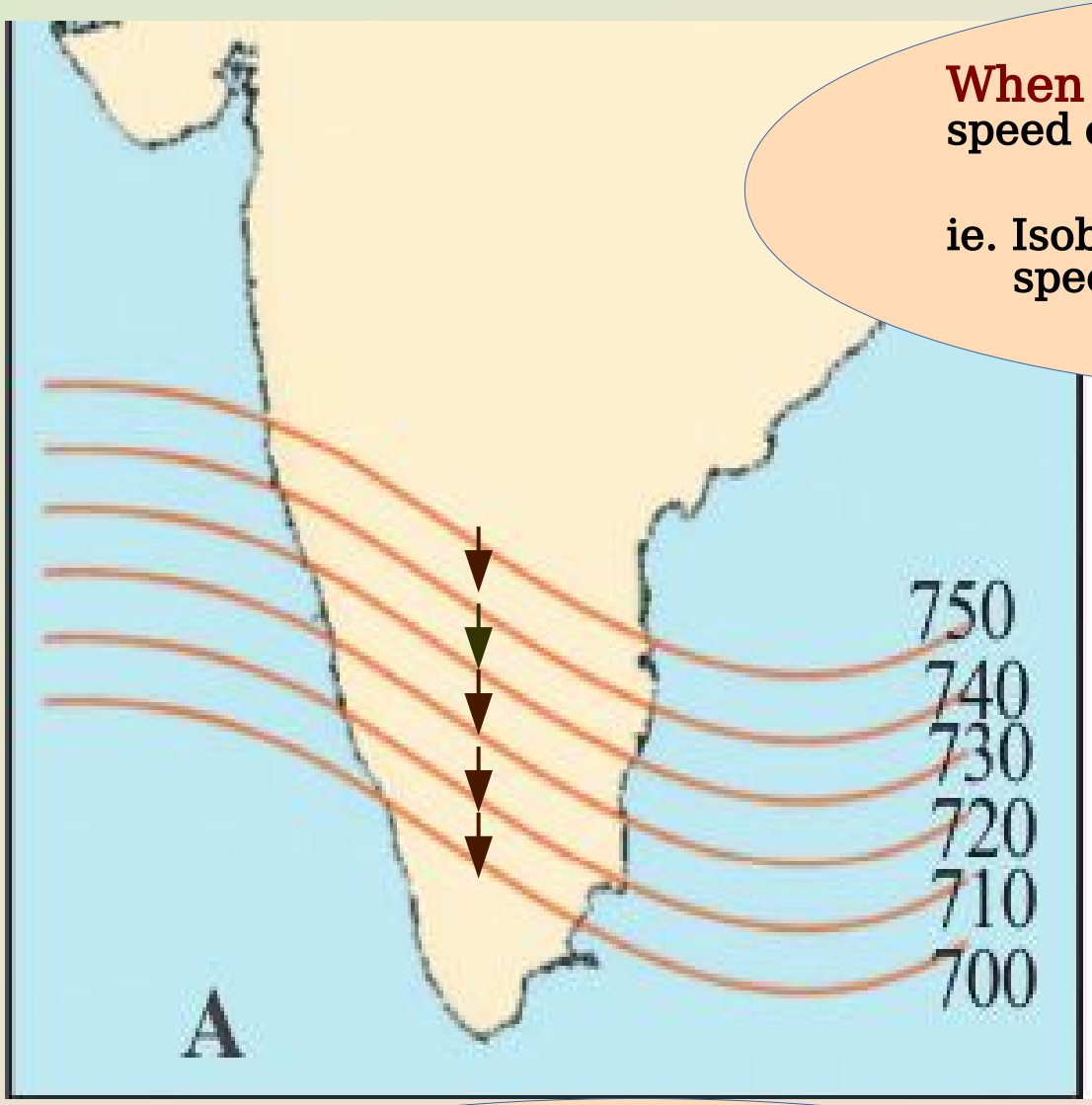


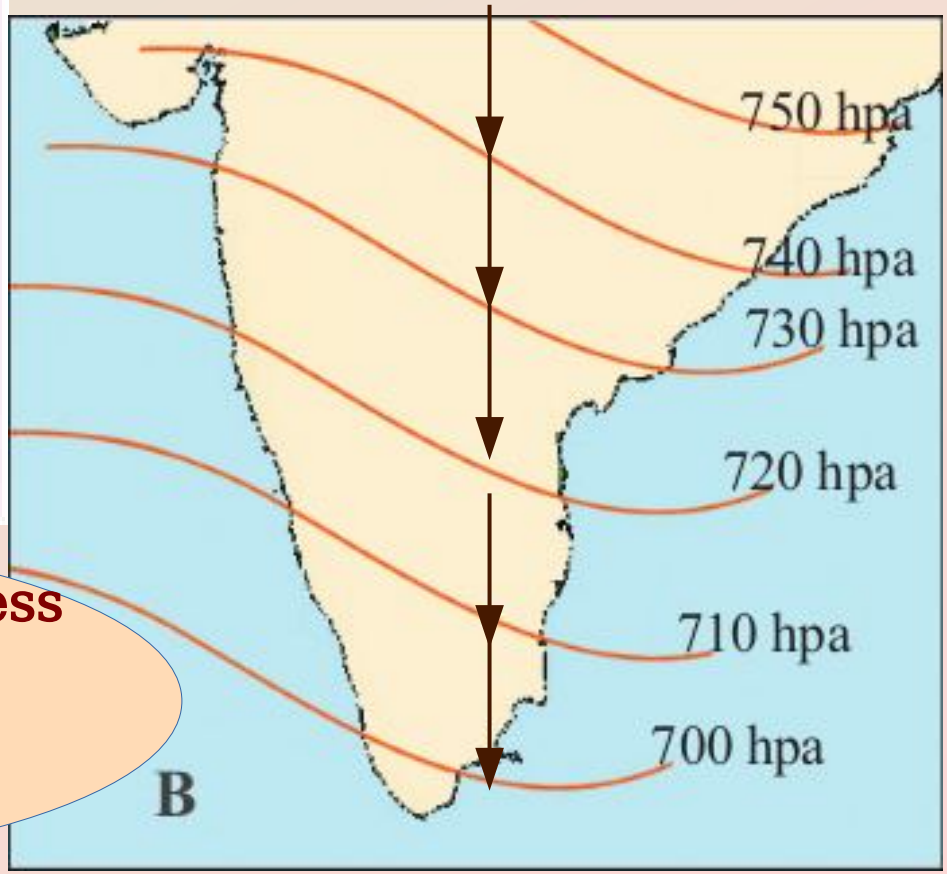
Mark the direction of winds using arrow marks in both the diagrams.

In which of these situations will the speed of the wind be higher? Why?

When the pressure gradient steeper
speed of the wind will be higher

ie. Isobars are shown Closely
speed of the wind will be higher

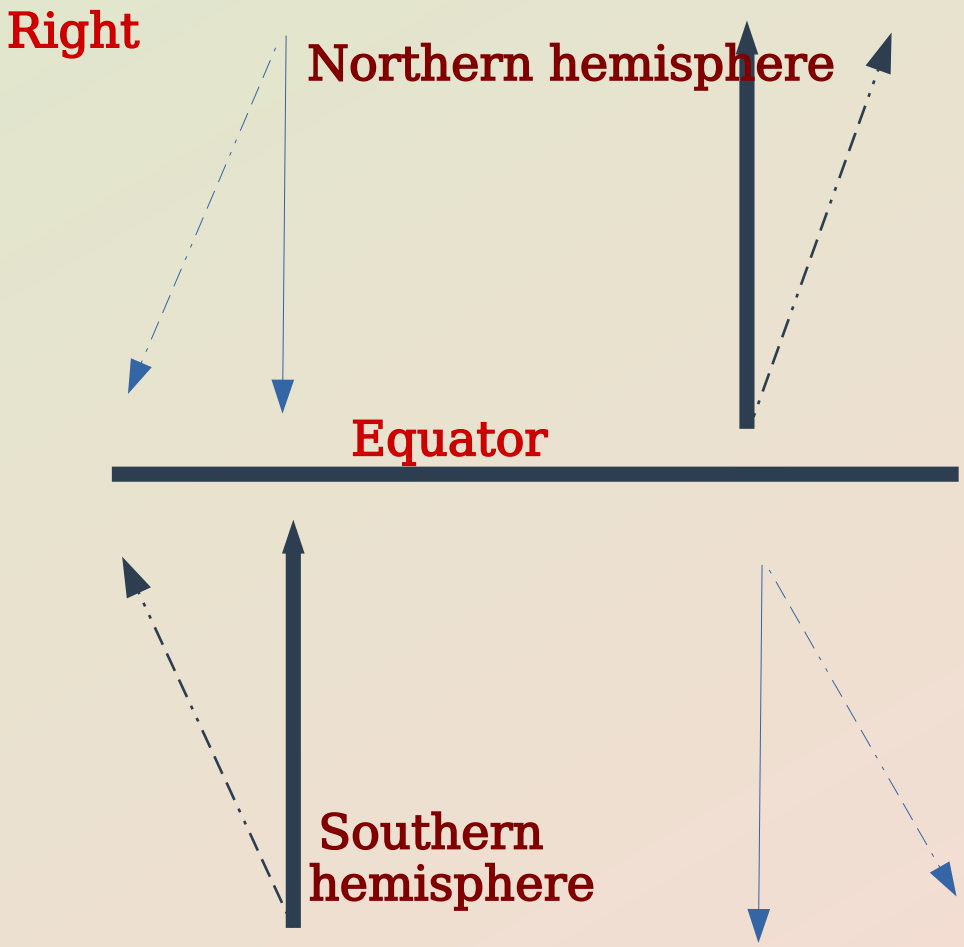




When the pressure gradient is less
speed of the wind will be less

ie. Isobars are shown not Closely
speed of the wind will be less

2. Coriolis force

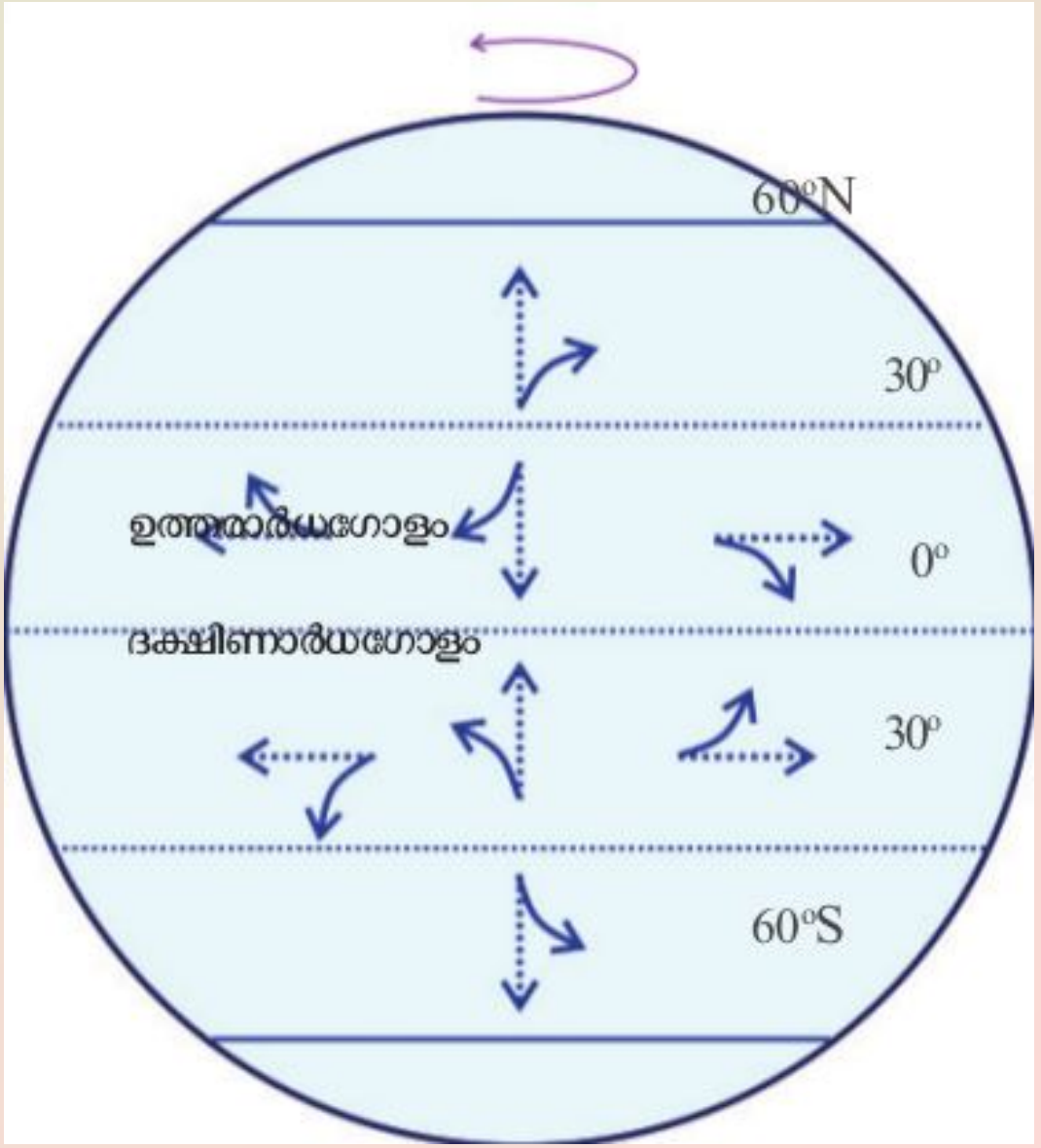


Freely moving bodies get deflected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.
This is due to the force generated as a result of Earth's rotation which is known as the Coriolis force

Movement of winds

Change in direction

Admiral Ferrel



Ferrel's law

3. Friction

Wind

Flat

Less Friction

Speed of wind will be high

Not Flat

High Friction

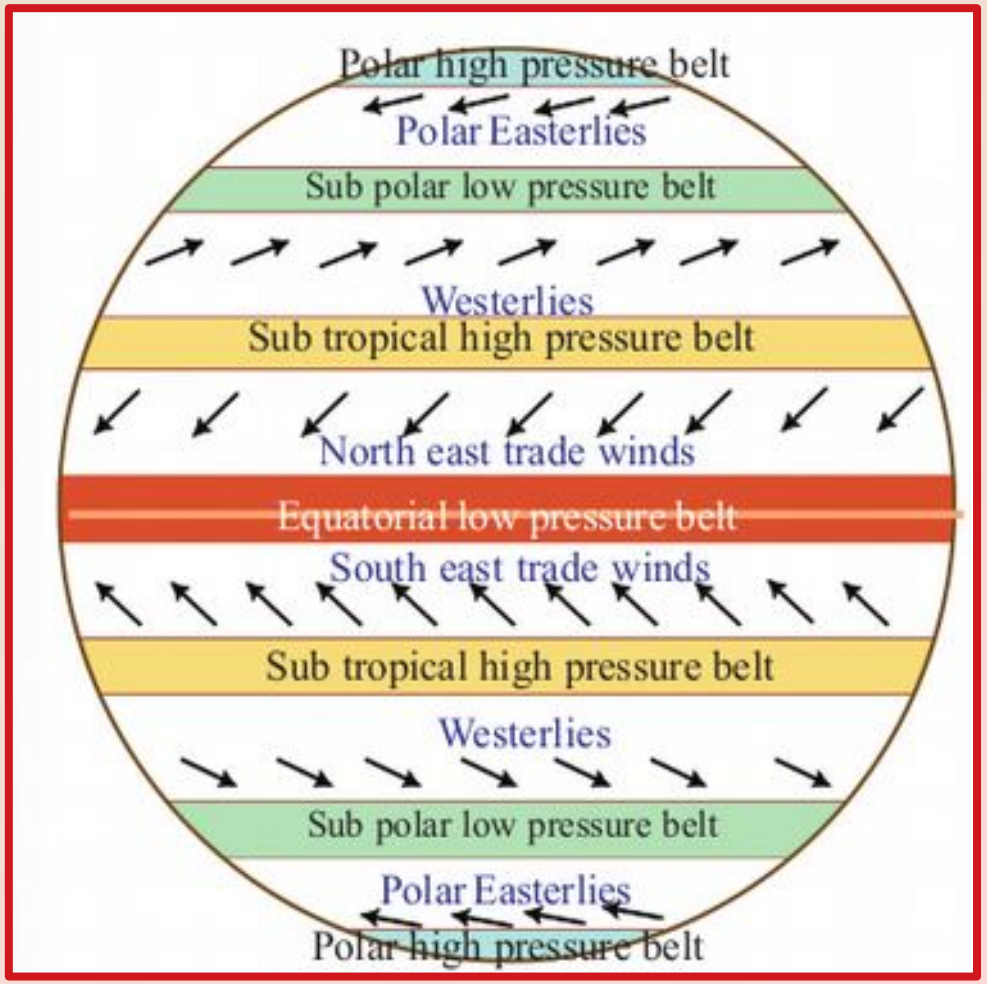
Speed of wind will be less

Pressure belts and winds

Planetary winds

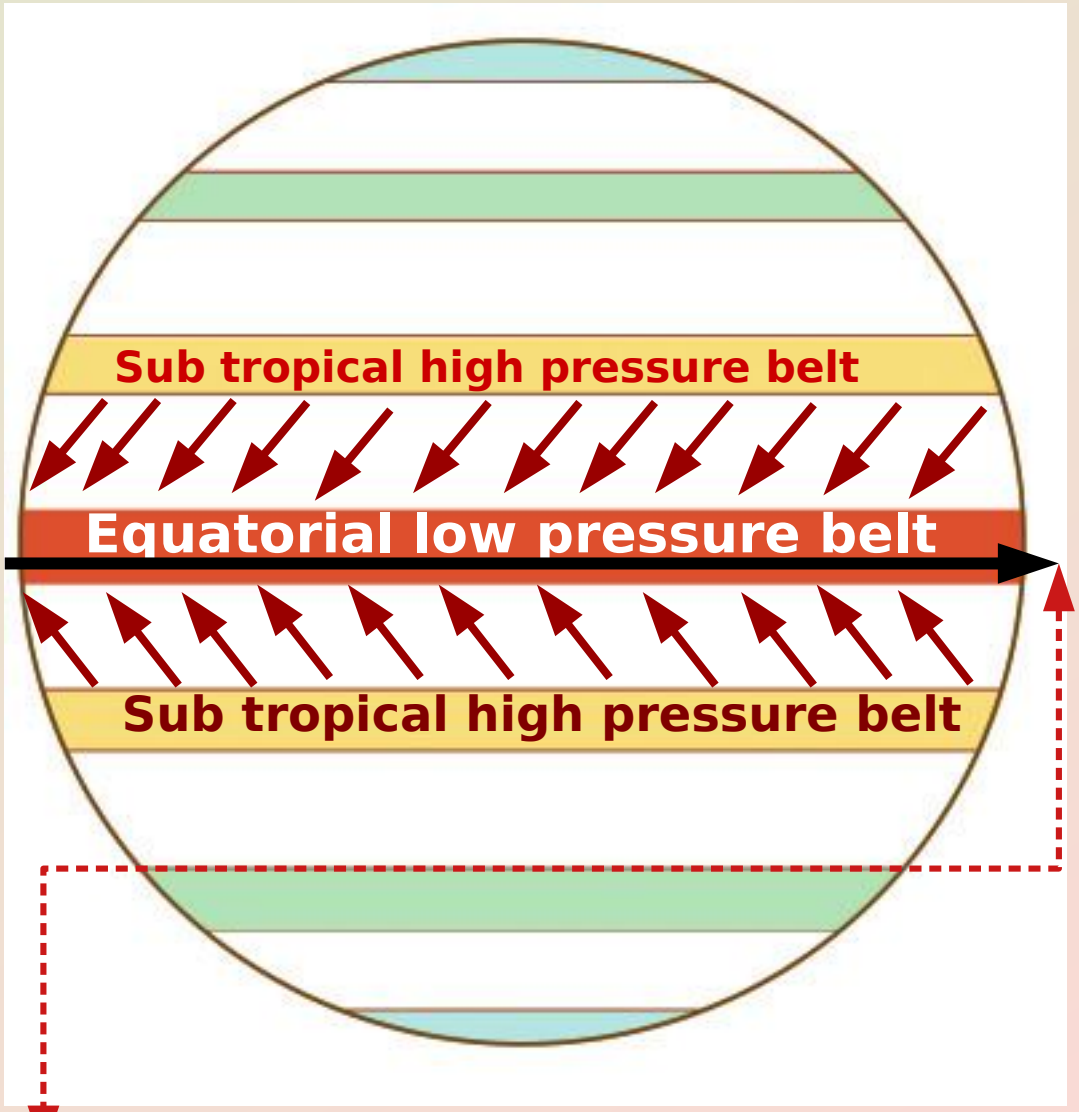
The winds developed between the global pressure belts

1. Trade winds
2. Westerlies
3. Polar easterlies



1.Trade winds

The winds blow continuously towards the equatorial low pressure belt



As these winds blow from the north east in the northern hemisphere, they are known as north east trade winds

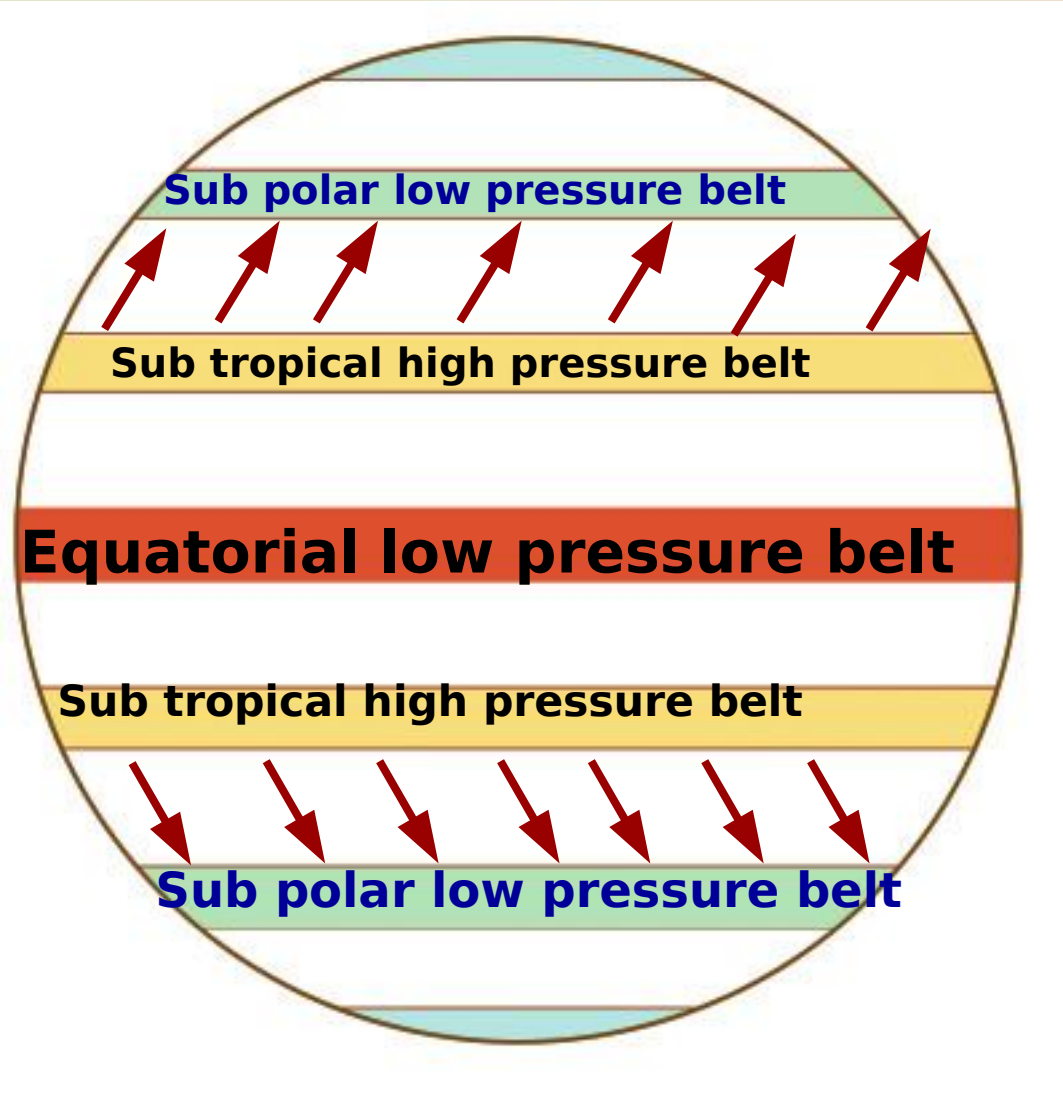
from the south east - South east trade winds

Inter Tropical Convergence Zone (ITCZ) :-

The zone where the trade winds from both the hemispheres converge

2.Westerlies

Blows continuously from the sub polar low pressure belts situated close to the sub tropical high pressure belts in both the hemispheres

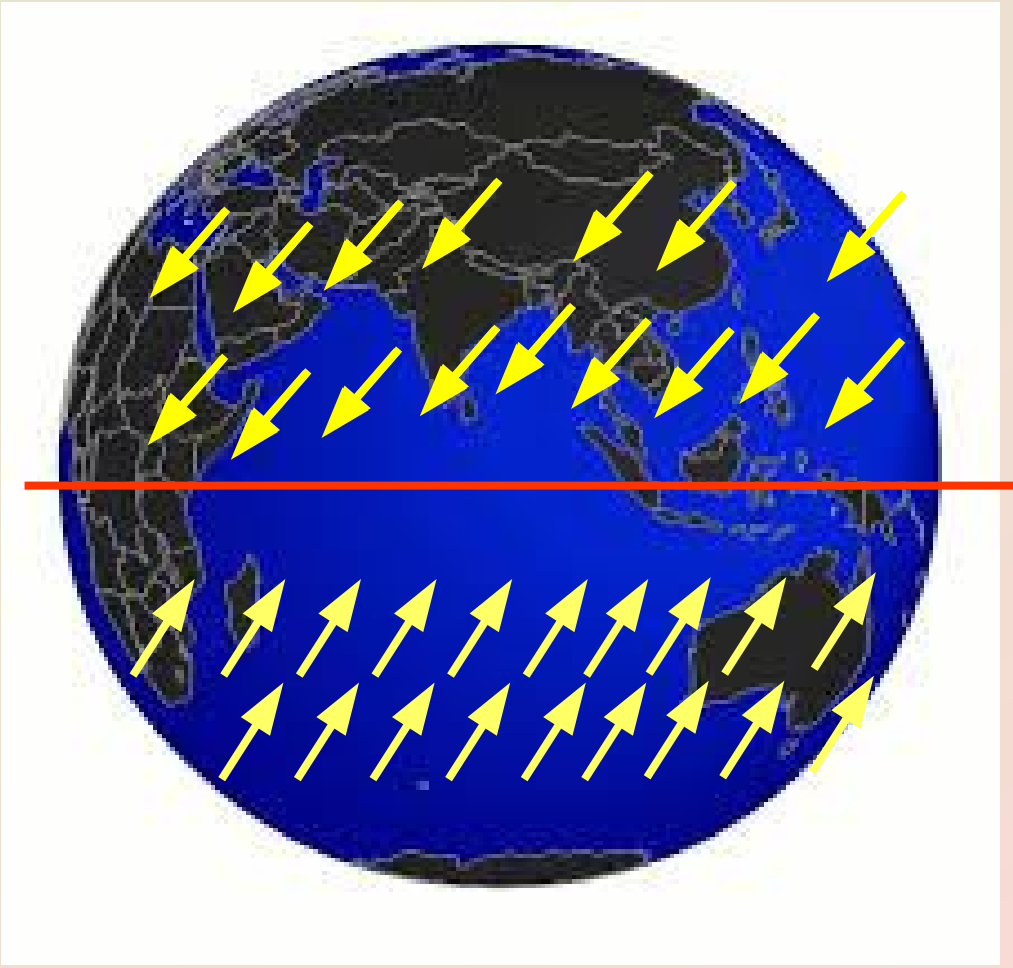


As the direction of these winds are moslty from the west, these are known as the **Westerlies.**

The westerlies are stronger in the southern hemisphere than in the northern hemisphere- Why?

Due to the vast expanse of oceans in the southern hemisphere.

It was the westerlies that helped Gama to reach the South Africa through the south Atlantic Ocean.



"Roaring Forties" along 40° latitudes

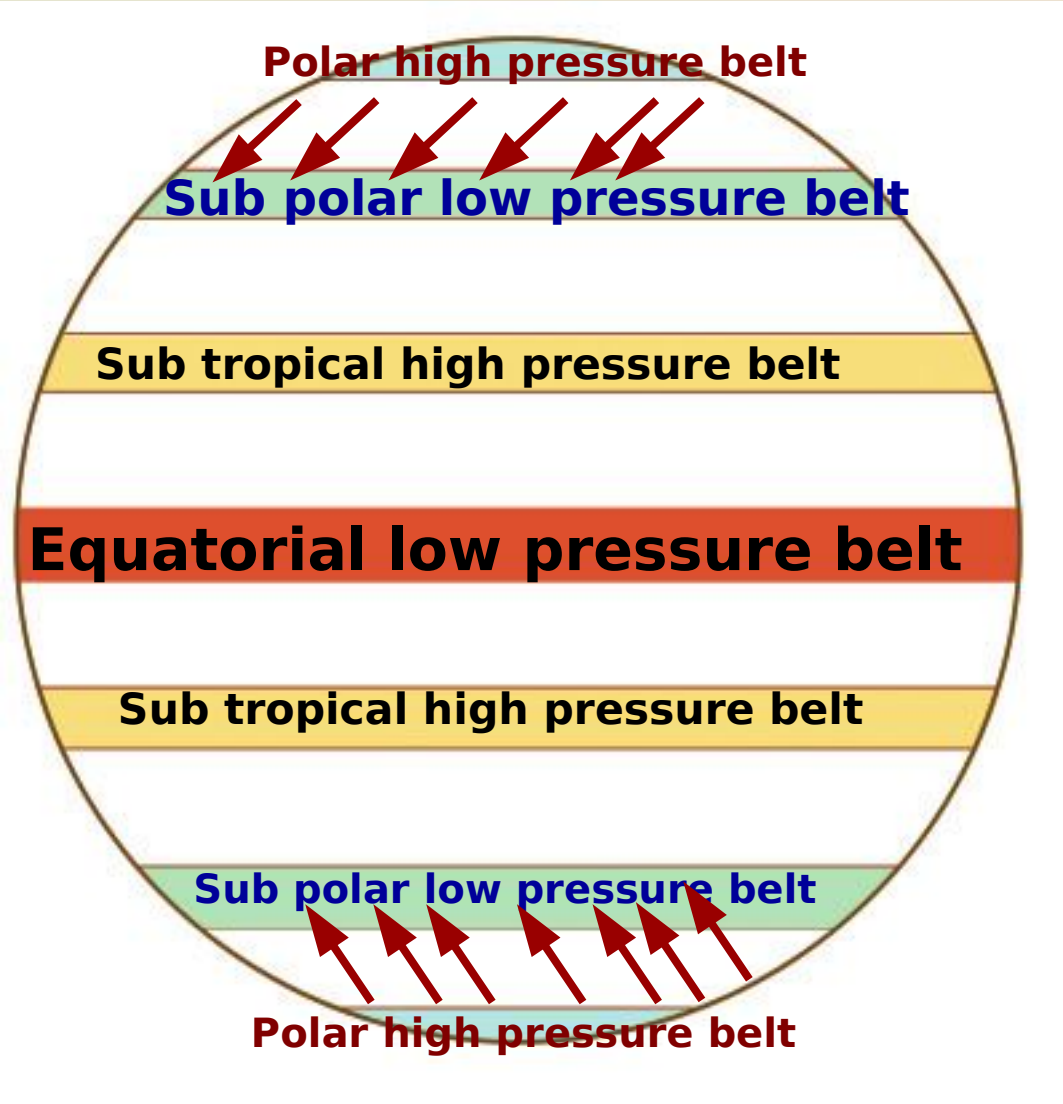
"Furious Fifties " along 50° latitudes

"Shrieking Sixties" along 60° latitudes

} The ancient mariners Called

3.Polar Easterlies

Blows from
these high pressure
areas towards the sub
polar low pressure belts



These winds blow from
the east in both the
hemispheres -
known as

Polar Easterlies

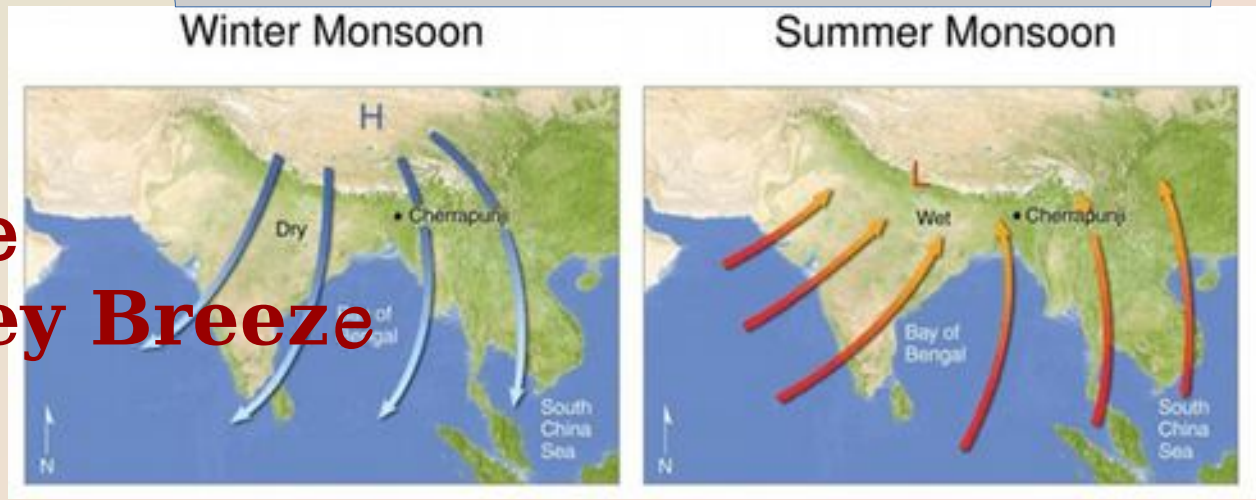
Determining the climate
of North America, the Eastern
European countries, and Russia.

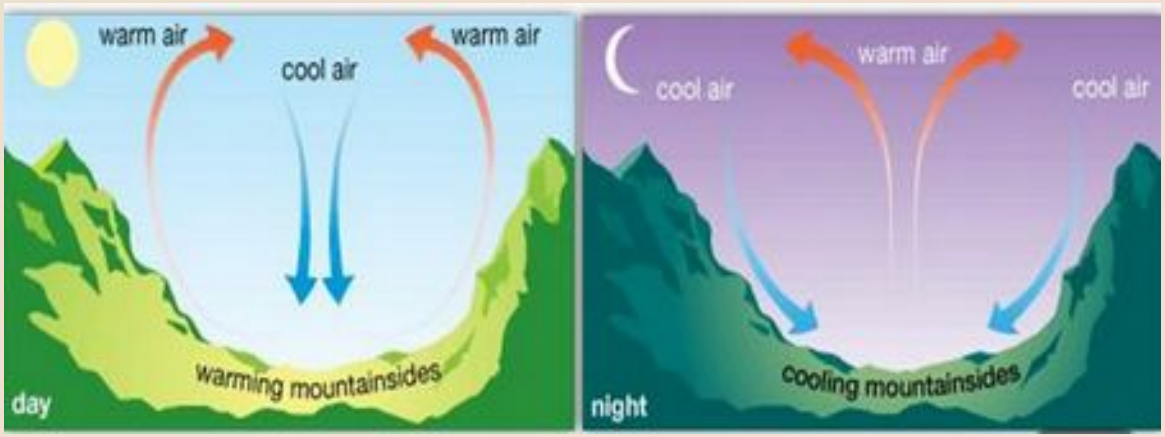
Periodic winds

* For a Short Period
*At Certain Places

Examples

- ♣ Monsoon Winds
- ♣ Land & Sea Breeze
- ♣ Mountain & Valley Breeze





Monsoon Winds

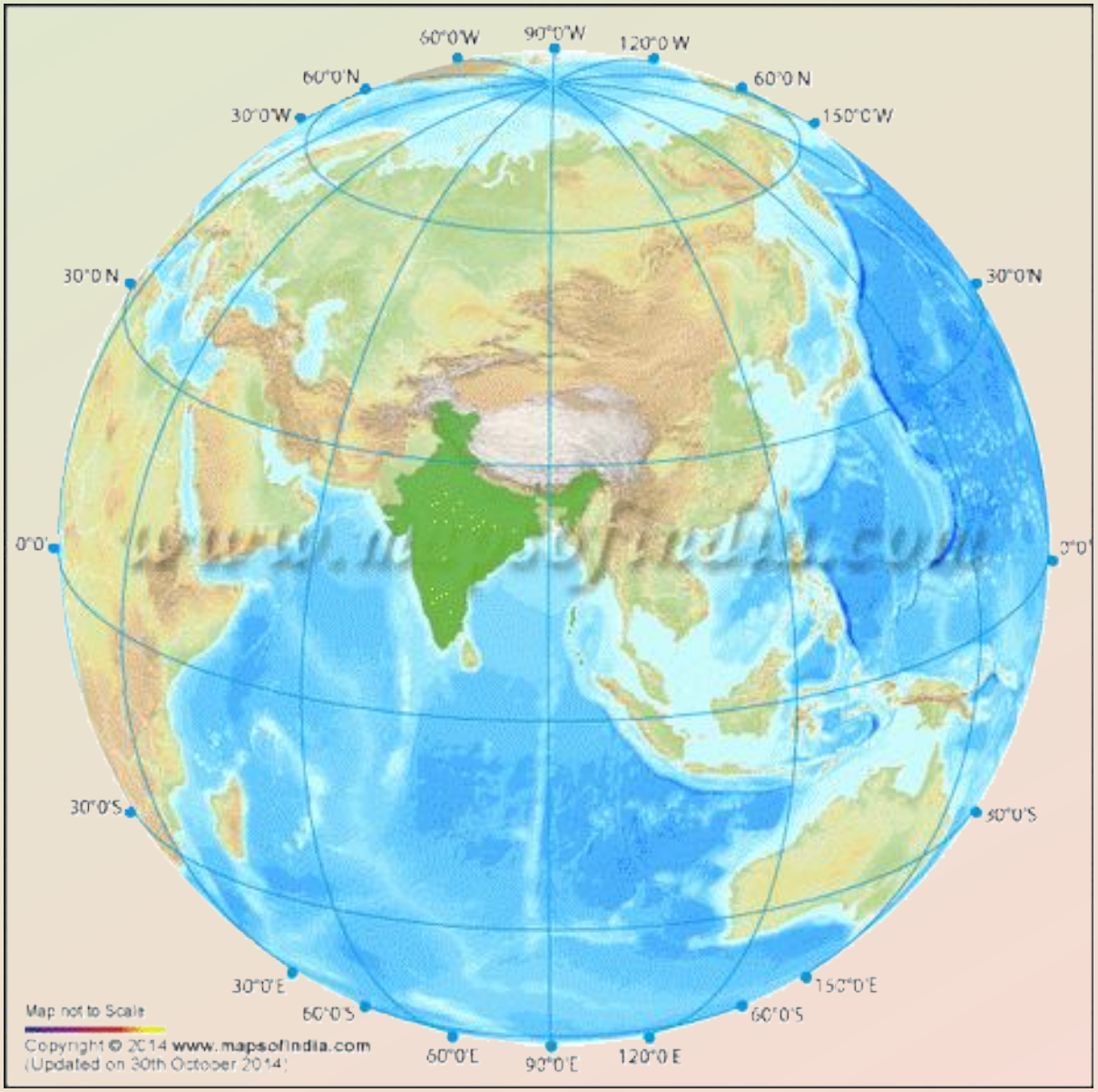
- Arab word 'mousam'
  ('winds that change direction in accordance with season)
- Seasonal reversal of wind in a year
- South West Monsoon Winds
- North East Monsoon Winds

Factors responsible for the formation of the monsoon winds

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

The Arab scholar Hippalus was the first to observe the shift in the direction of monsoon winds.

Hippalus


60°0'W
90°0'W
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60°0 N
30°0'W
150°0'W
30°0 N
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0°0'
30°0'S
30°0'E
60°0'S
60°0'E
90°0'E
120°0 E
150°0'E
60°0'S
Map not to Scale
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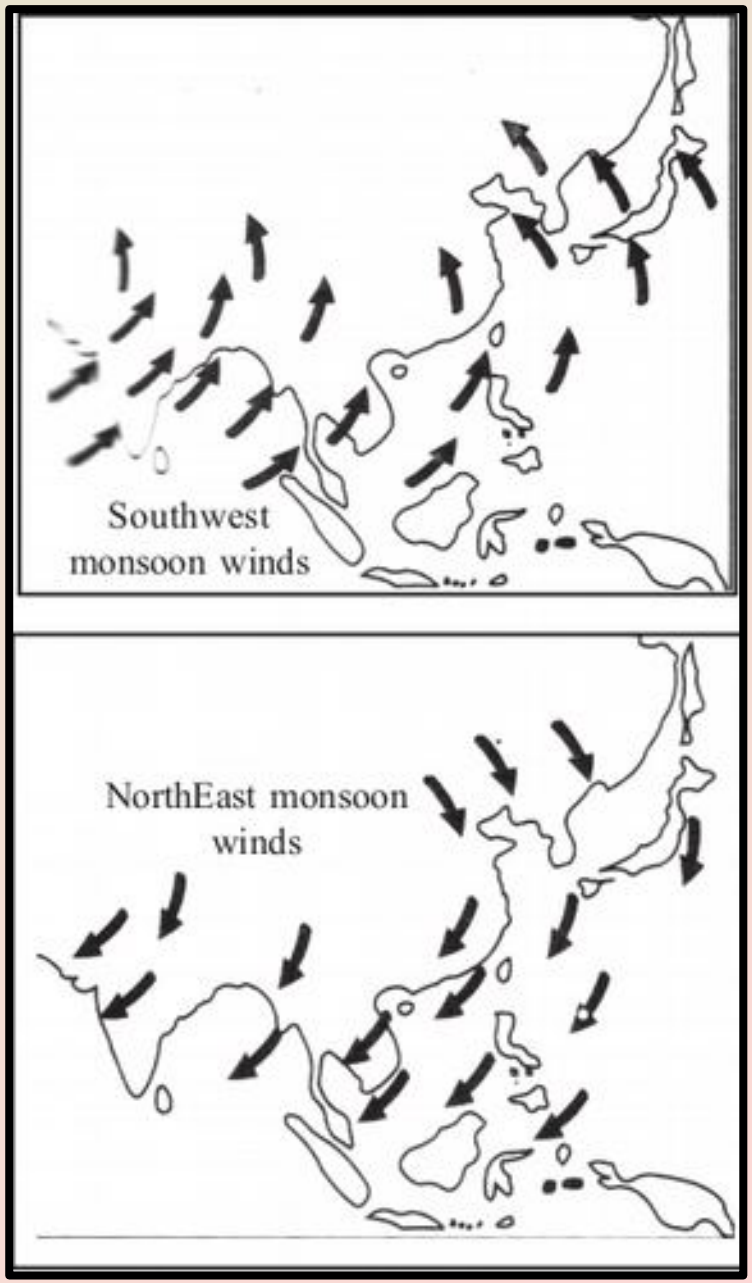
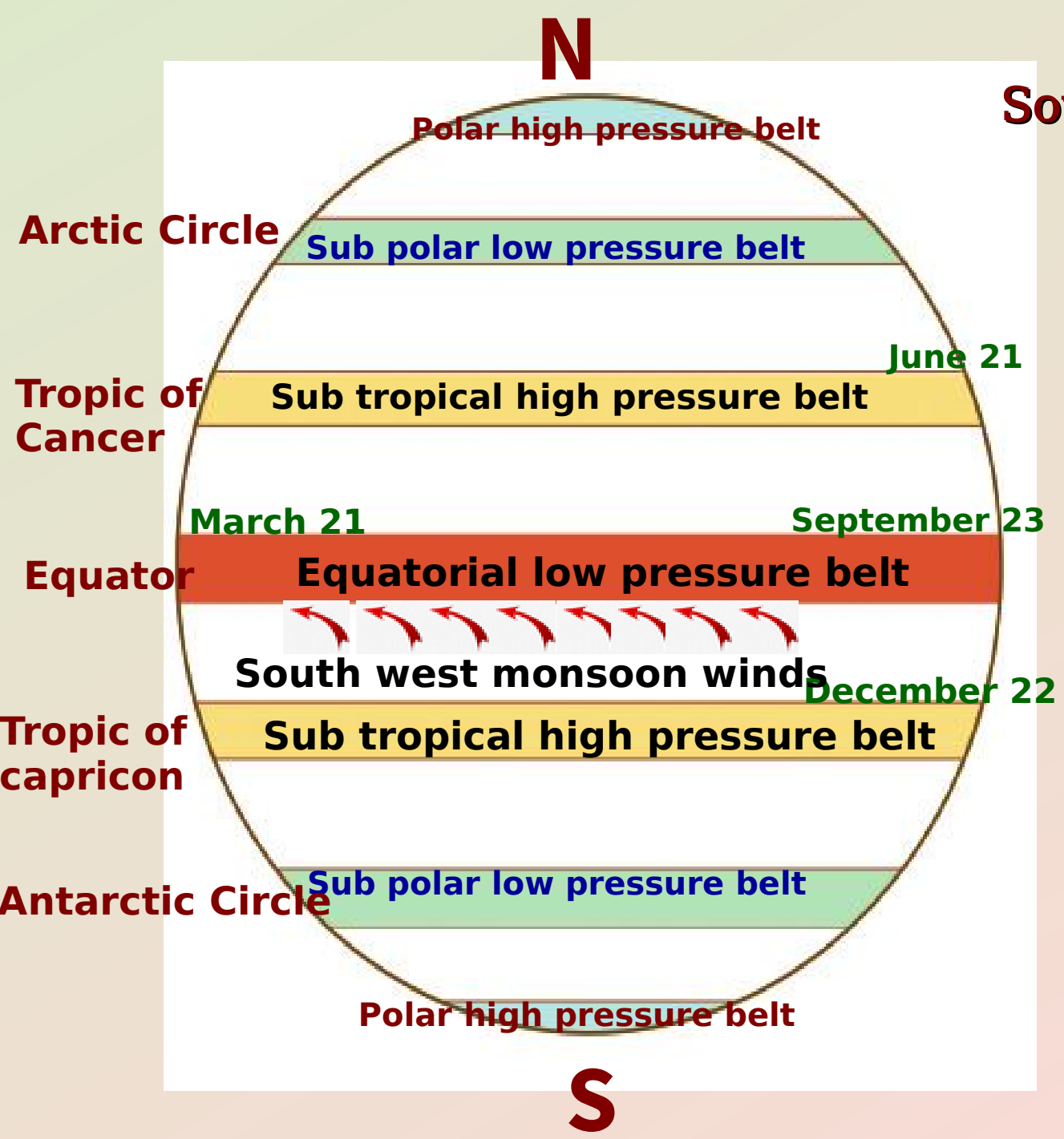
(Updated on 30th October 2014)

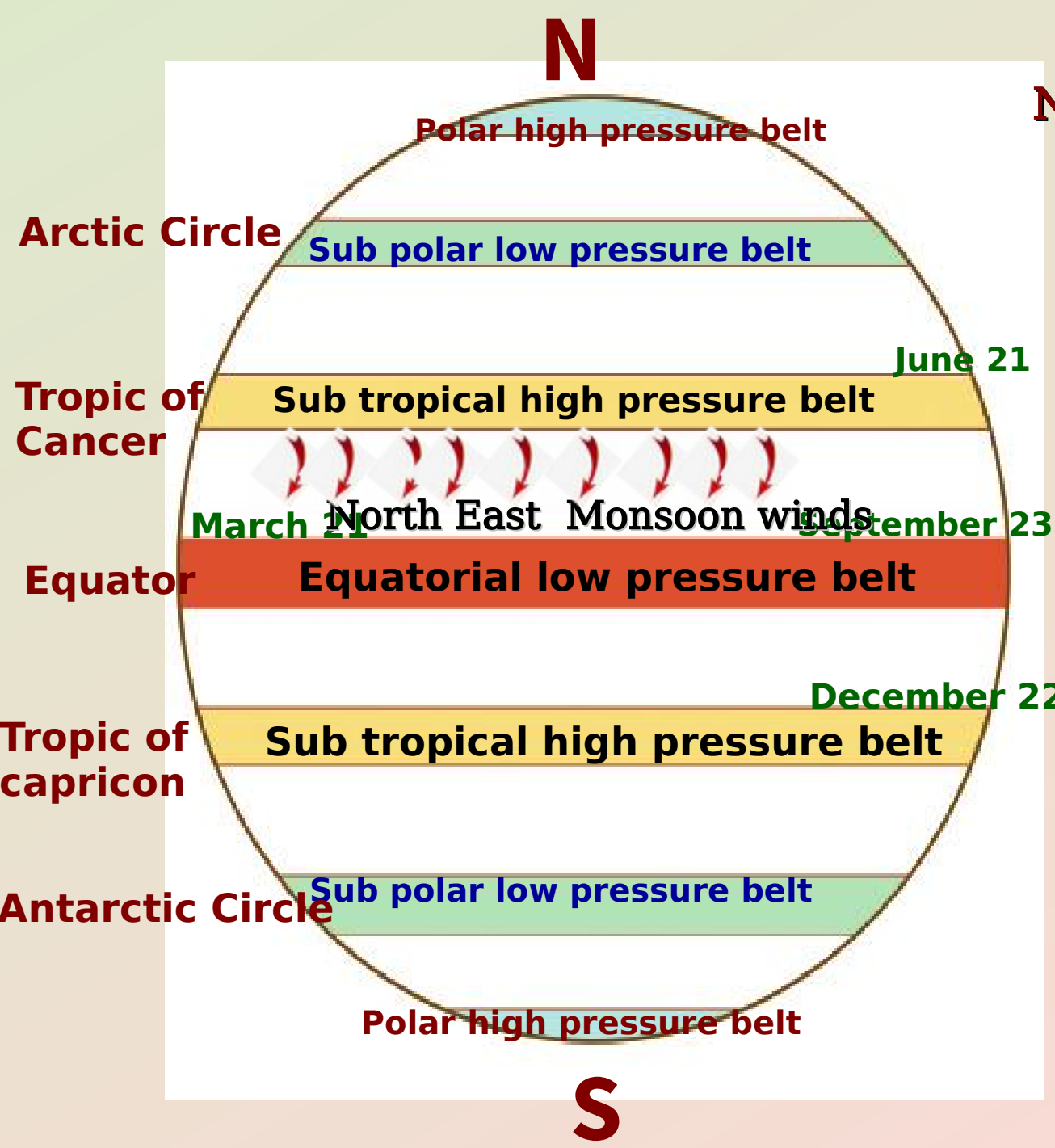

Southwest
monsoon winds
NorthEast monsoon
winds

~saleemka~

South west monsoon winds



- ►Sun- Northern Hemisphere
- ►Pressure Belts Shift to North
- ►Summer in Northern Hemisphere
- ► High temperature
- ►As SE Trade wind cross Equator, deflected (Coriolis Force) and transform into South west Monsoon



North East Monsoon winds

►Winter

►High pressure on Asia landmass & law pressure on Indian Ocean

►Northeast Trade Wind Strengthened & these are

Northeast Monsoon winds

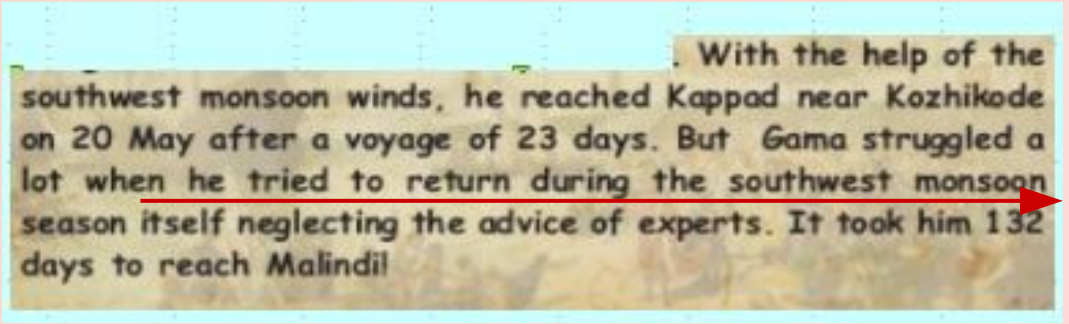
Monsoon doesn't occur in the northern European region. Why?

* **The Planetary Winds In North European Region blow on the Opposite Direction**
* **Winds are not From the Oceans**
* **Temperature difference between Land & Sea is less**

Now try to identify the winds that helped Gama to reach Kerala coast from Malindi.

Why did these winds cause trouble to Gama on his return to Malindi?

* **Reached Kerala with the help of Monsoon Winds**
* **On Return he went against its Direction & it Troubled him**



. With the help of the southwest monsoon winds, he reached Kappad near Kozhikode on 20 May after a voyage of 23 days. But Gama struggled a lot when he tried to return during the southwest monsoon season itself neglecting the advice of experts. It took him 132 days to reach Malindi!

Land and sea breeze

Sea breeze

Land :- heats up and
Cools down quickly

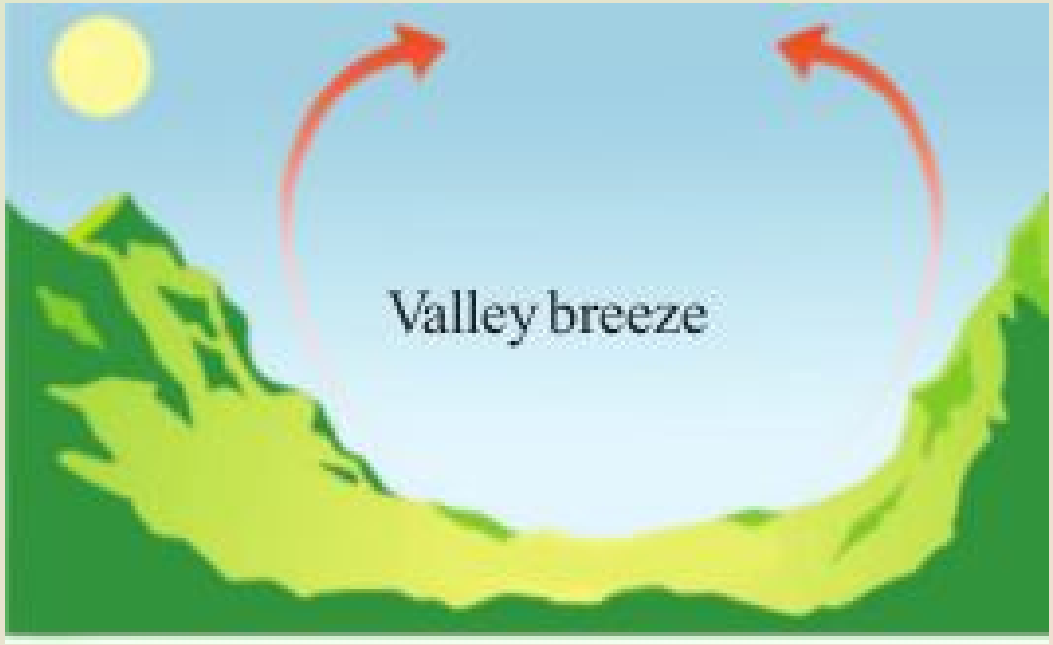
Sea :- heats up and
Cools down slowly

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

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

Mountain and valley breeze



Valley breeze	Mountain breeze
Day	**Night**
* air in the valley gets heated up	Air in the mountainous regions cools due to the intense cold conditions in that region
* the wind Blows up slope from the valley	Cool air is denser, it blows towards the valley.

Local winds

* Effects to a smaller locality
* Result of Local Pressure Difference
* winds are weak

India

Loo
Mango showers
Kalbaisakh

Other parts of the world

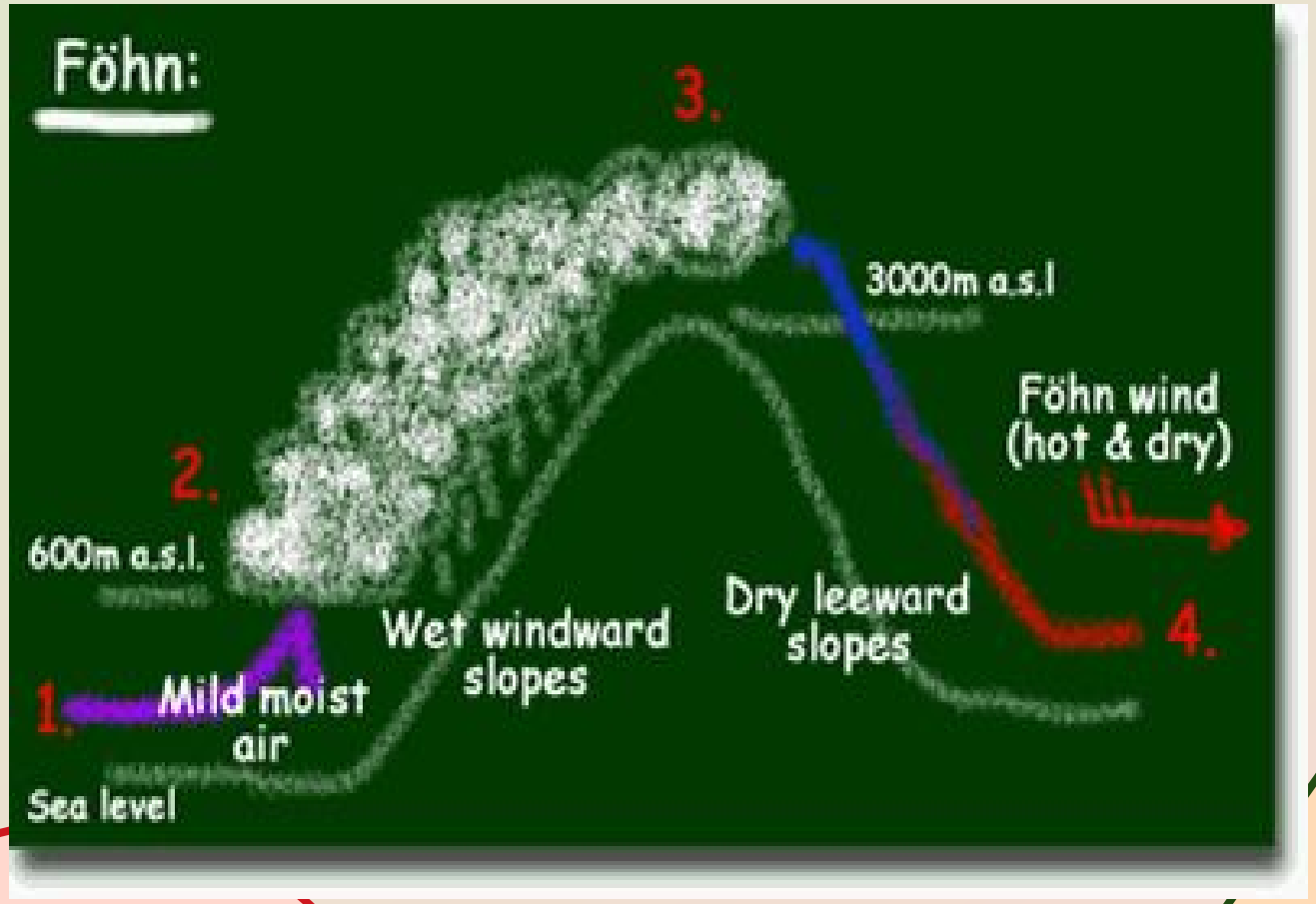
Chinook (North America)
Foehn (Alps mountain)
Harmattan (West Africa)

Chinook (North America)

Eastern slope of the Rockie Mountains in North America

* Melting Snow
* Reduce Severity of Cold
* Wheat Cultivation in Canadian lowlands
* Snow Eater

Foehn (Alps mountain)



Southern Valley of Alps mountain

Reduce severity of Cold

Harmattan (West Africa)

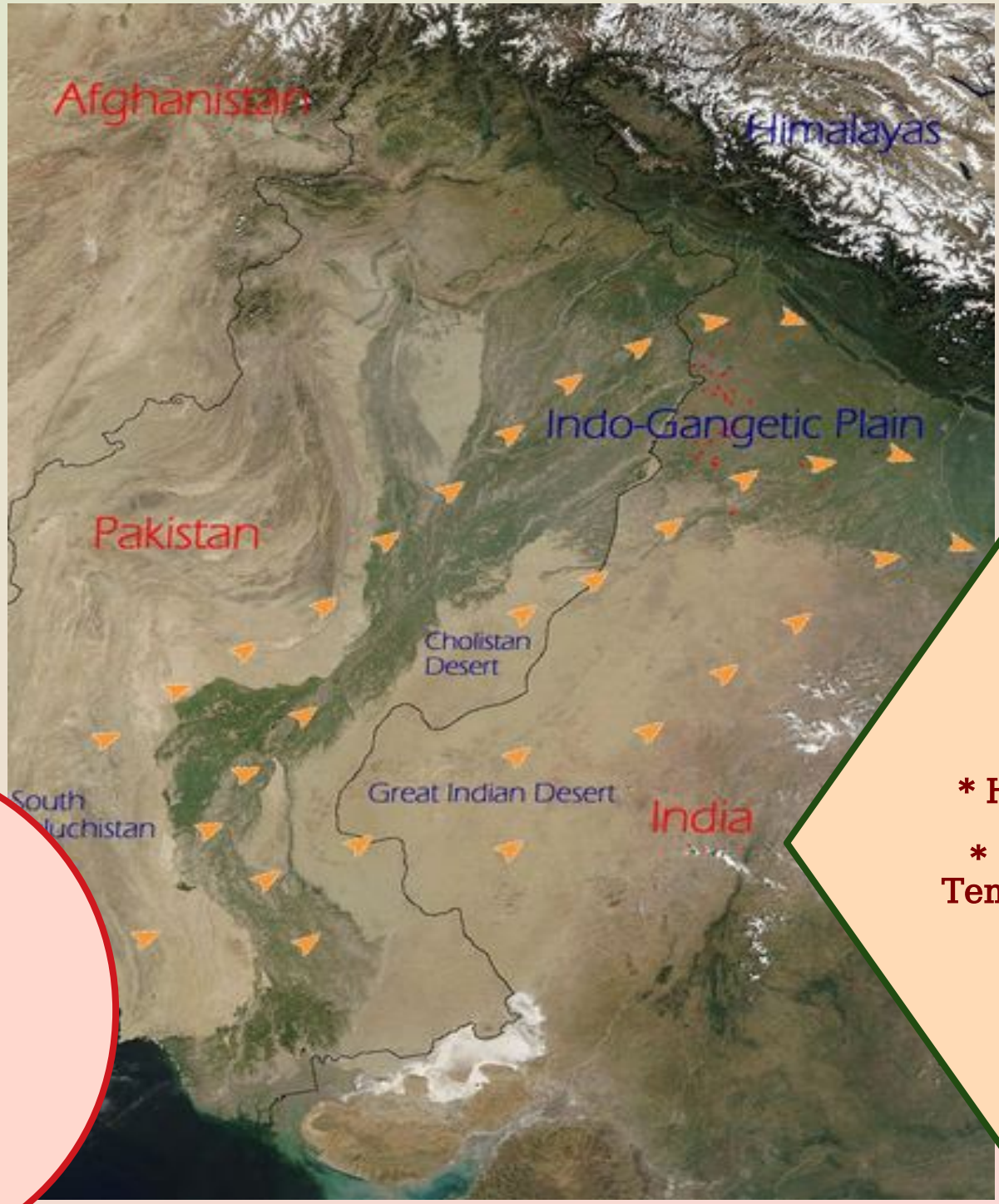
From Sahara desert to West Africa

* Dry Wind

* Humidity & Sultry conditions improved

* Calls – Dr. Harmattan

Loo



From Rajastan to North Indian Plains

* Hot Wind

* Rise in Temperature

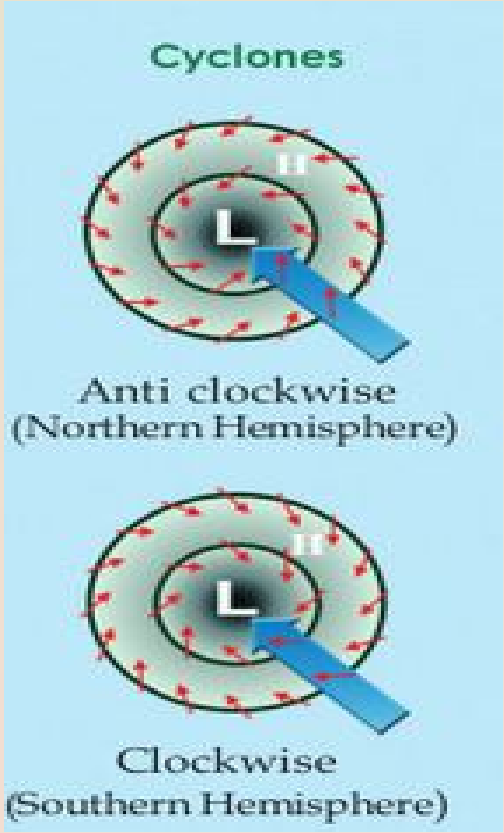
Mango showers

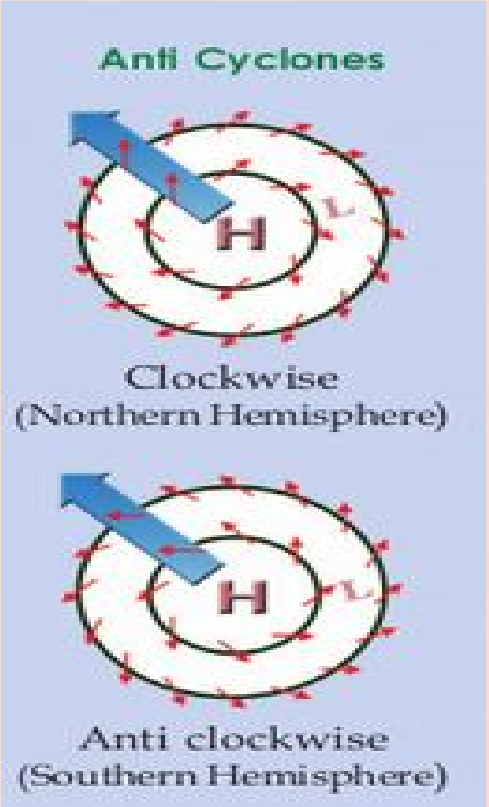
South India

Fall of ripe mangoes

Variable winds

Winds with entirely different characteristics formed during certain atmospheric situations

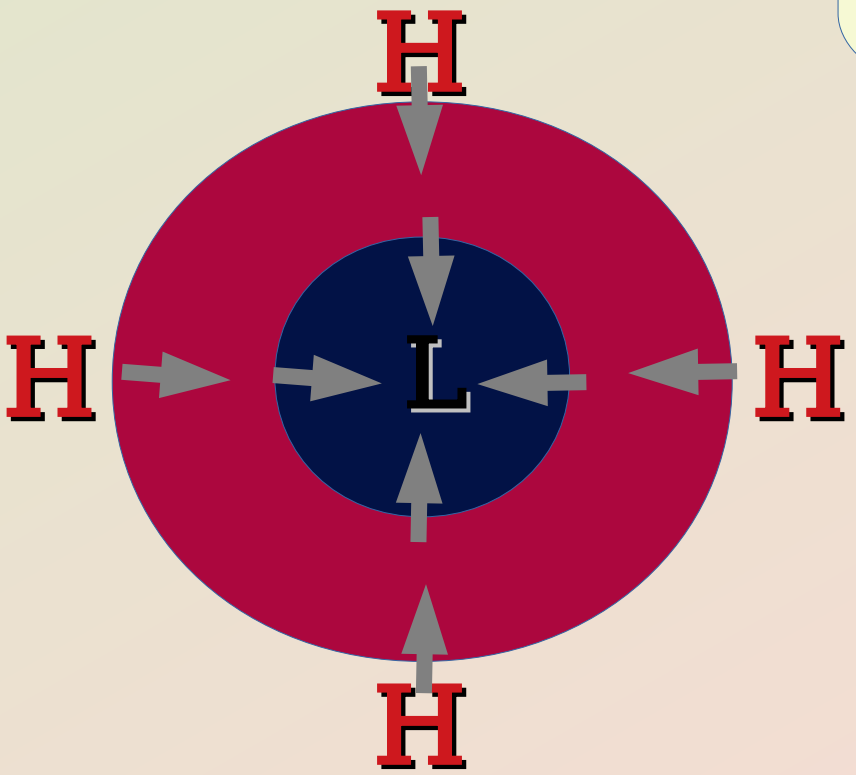




Cyclones

Cause

Low atmospheric pressure at the centre surrounded by high pressure regions



Winds blow towards low pressure centres from the surrounding high pressure

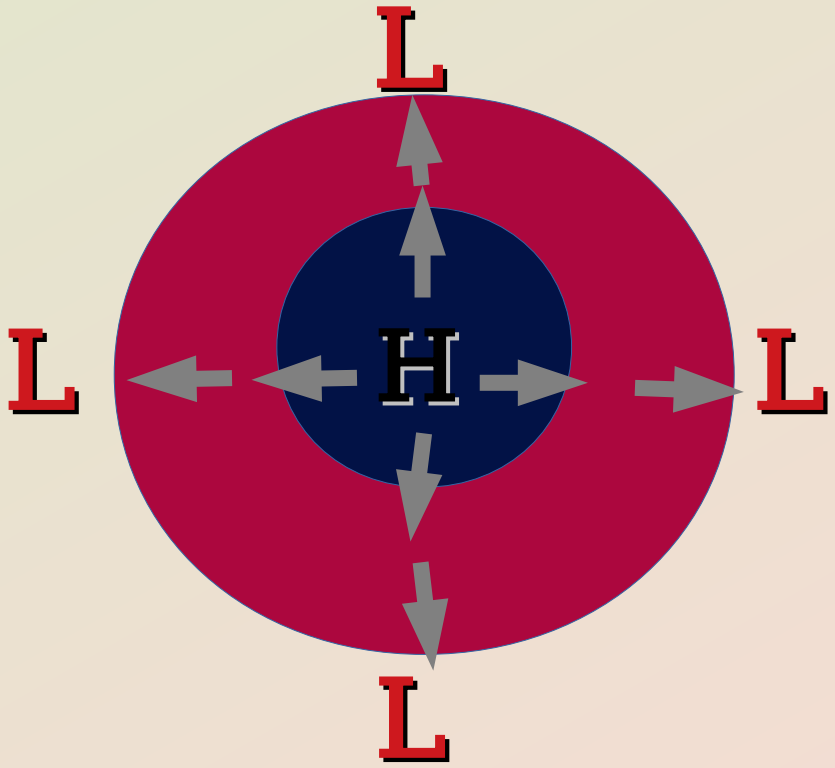
Scenes of
Ockhi - cyloninc
winds that
struck the coastlines
of Kerala and
Lakshdweep during
November *2017*

~saleemka~

Anti Cyclones

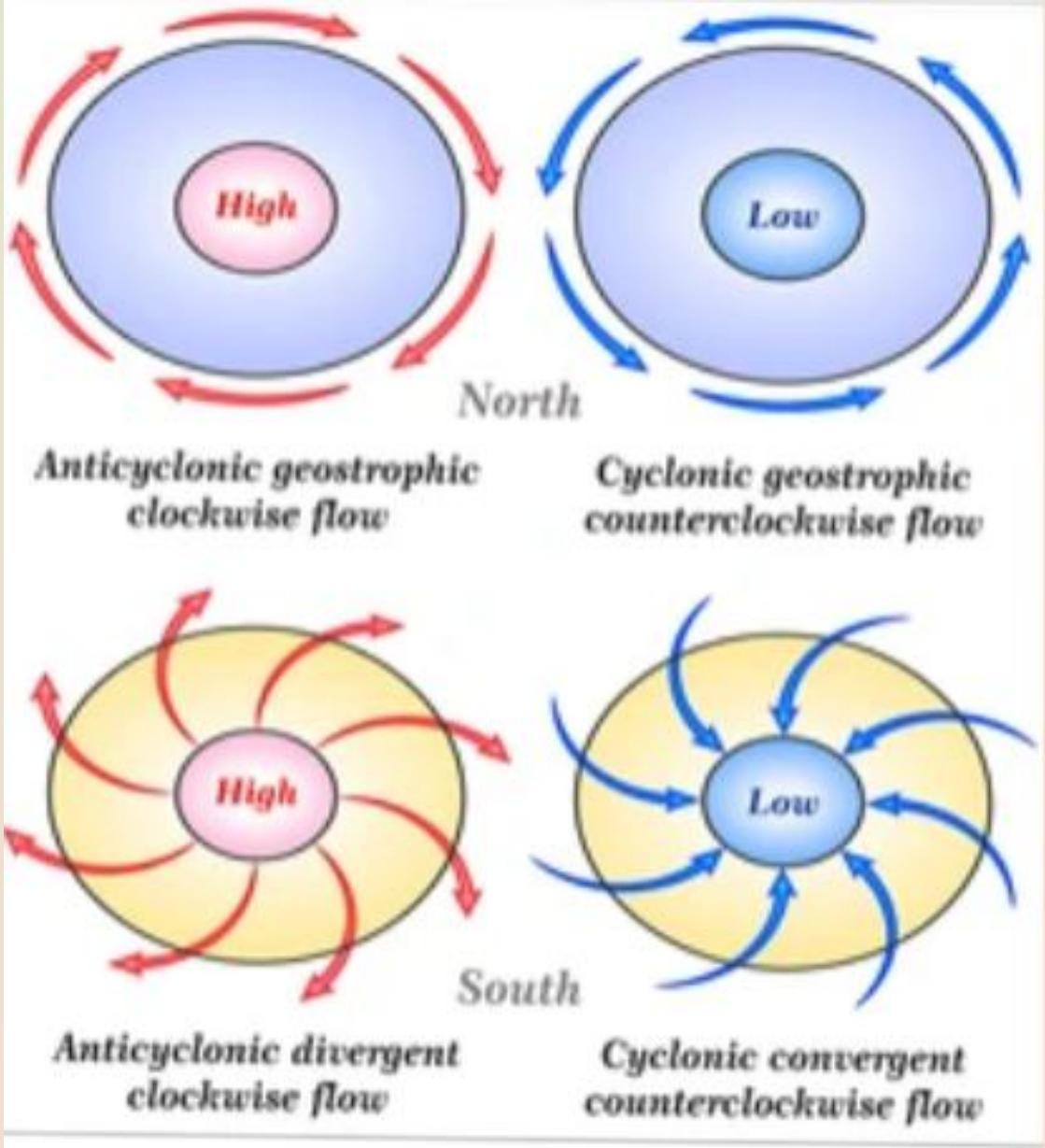
Cause

High atmospheric pressure at the centre surrounded by low pressure regions



Winds blow from the high pressure centres to the surrounding low pressure areas

Due to Coriolis effect the pattern of winds in anti cyclones is clock wise in the Northern Hemisphere and anti clockwise in the Southern Hemisphere



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9446736276

~saleemka~