**Q.1) Consider the following statements:**

1. The weather varies tremendously whereas, the climate is always constant in a region.
2. Generally the climate of temperate latitudes is far more variable than that of tropics.

**Which of the above statements is/are correct?**

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 and 2

**Q.1) Solution (b)**

**Basic Information:**

**WEATHER:**

The vast and invisible atmospheric envelope is energized by solar radiation, stimulated by earthly motions, and affected by contact with Earth's surface. The atmosphere reacts by producing an infinite variety of conditions and phenomena known collectively as weather—**the study of weather is known as meteorology.**

- **The term weather refers to short-run atmospheric conditions that exist for a given time in a specific area.**
- It is the sum of temperature, humidity, cloudiness, precipitation, pressure, winds, storms, and other atmospheric variables for a short period of time.
- Thus, we speak of the weather of the moment, the week, the season, or perhaps even of the year or the decade.

**CLIMATE:**

Weather is in an almost constant state of change, sometimes in seemingly erratic fashion, yet in the long view, it is possible to generalize the variations into a composite pattern that is termed climate.

- **Climate is the aggregate of day-to-day weather conditions over a long period of time.**
- It encompasses not only the average characteristics, but also the variations and extremes of weather.

- To describe the climate of an area requires weather information over an extended period, normally at least three decades.

**Statement Analysis:**

| Statement 1 | Statement 2 |
|---|---|
| **Incorrect** | **Correct** |
| The weather or climate can or cannot change in a region. It is not always constant, it is liable to change.<br><br>Relate to Climate Change too!! | Generally, the climate of **temperate latitudes** is far **more variable** than that of the **tropics**.<br><br>For instance, the climate of the British Isles is so changeable that many people have said that '**Britain has no climate, only weather**'. Conversely, the climate of Egypt is so static that it makes a good deal of sense when people say that '**Egypt has no weather, only climate**'. |

**Q.2) Consider the following statements about the Atmosphere:**

1. In climatic processes, 99.9% of the atmosphere plays no role.
2. Water vapour is a variable gas whose amount decreases from equator towards pole.
3. Carbon dioxide is transparent to short wave but absorbs long wave radiations.

**Which of the above statements are correct?**

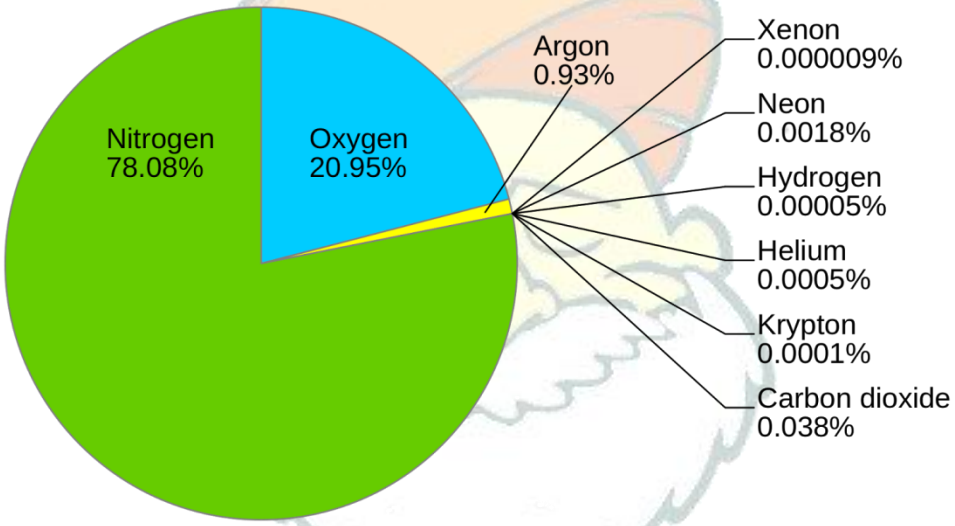
a) 1 and 2 only
b) 2 and 3 only
c) 1 and 3 only
d) 1, 2 and 3

**Q.2) Solution (d)**

**Basic Information:**

**Atmosphere** is a mixture or mechanical aggregate of gases and dust. As a whole atmosphere is very well mixed acting as a single gas and following gas laws.

Atmosphere contains living gases like oxygen for man and animal, and carbon dioxide for plants (important for survival). It protects the earth from the harmful radiation from the sun. It acts as Green house by **allowing short-wave radiation (from Sun) and trapping long-wave terrestrial radiation (from Earth's surface).**




The proportion of the main gases in the atmosphere is shown in the figure above. A unit of **dry air** consists of 78.084% Nitrogen, 20.946% Oxygen, 0.934% Argon, 0.036% Carbon dioxide and the remaining other trace gases.

**Statement Analysis:**

| Statement 1 | Statement 2 | Statement 3 |
|---|---|---|
| **Correct** | **Correct** | **Correct** |
| In climatic processes 99.9% of the atmosphere plays no role since only greenhouse gases play important role as | Water vapour is highly variable and 99.99% is found within 6km.<br><br>Temperature is the primary | Carbon dioxide is a greenhouse gas thus it is transparent to short wave but absorbs long wave |

| | | |
|---|---|---|
| it absorbs heat. | factor that controls presence of water vapour.<br><br>The concentration decreases from equator to pole. | radiations. |

**Q.3) The line above which atmospheric gases are not well-mixed is?**

a) Tropopause
b) Van Allen belt
c) Turbopause
d) Exospehre

**Q.3) Solution (c)**

**Explanation:**

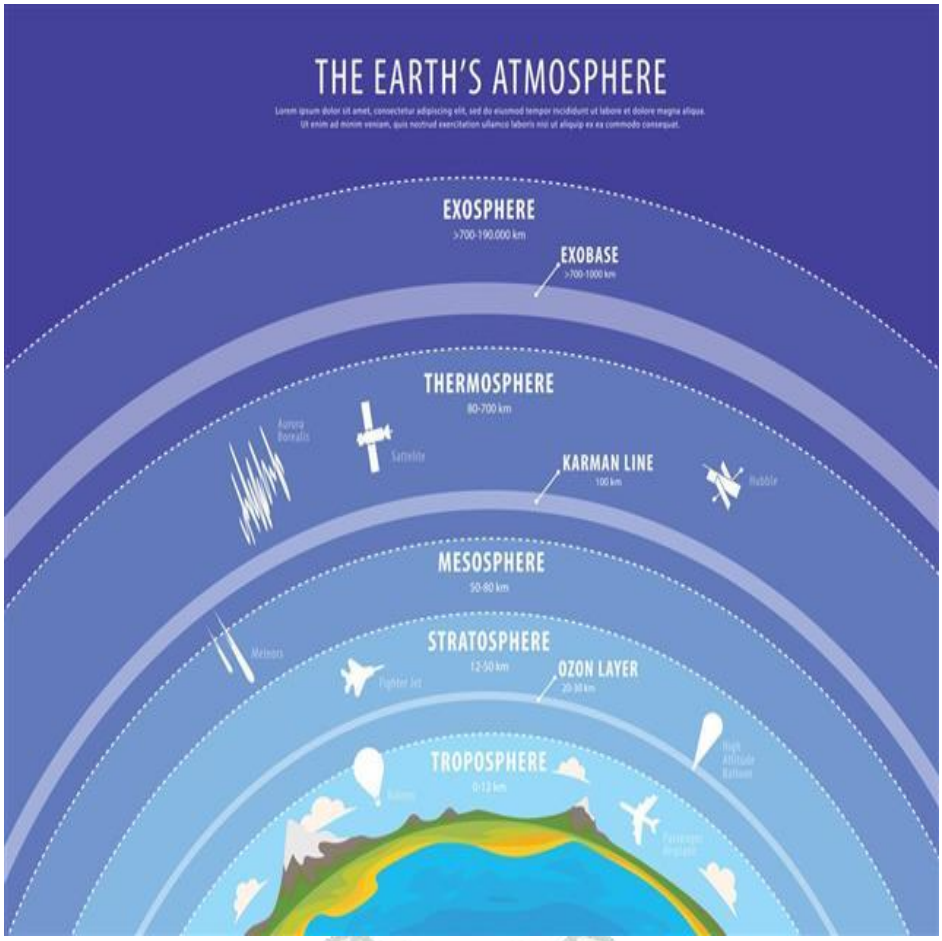
**Karman Line:**

- The Karman line is an attempt to define a boundary between Earth's atmosphere and outer space.
- The line is named after Theodore von Kármán (1881–1963), a Hungarian American engineer and physicist, who was active primarily in aeronautics and astronautics.
- He was the first person to calculate the altitude at which the atmosphere becomes too thin to support aeronautical flight and arrived at 83.6 km (51.9 miles) himself.

**Locating the line:**

- The Fédération Aéronautique Internationale (FAI) defines Karman Line as the altitude of 100 kilometres above Earth's mean sea level.
- However, other organizations do not use this definition. There is no international law defining the edge of space, and therefore the limit of national airspace.
- For instance, the US Air Force and NASA define the limit to be 50 miles (80 km) above sea level.
- The line is approximately at the **turbopause**, above which atmospheric gases are not well-mixed.

**Note:** The turbopause or Karman Line marks the boundary between Homosphere and Heterosphere.




**Q.4) With reference to Coriolis force, consider the following statements:**

1. The Coriolis force acts perpendicular to the pressure gradient force.
2. It has a role in the direction of wind and also affects wind speed.
3. It is maximum at poles.

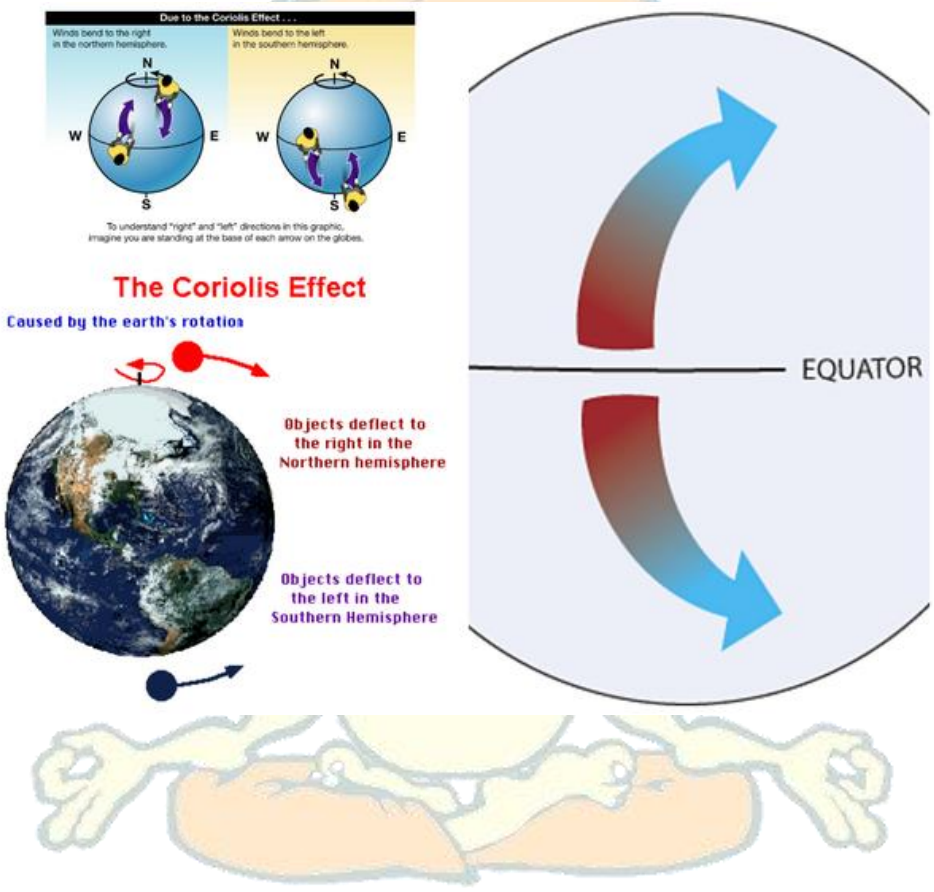
**Which of the above statements is/are correct?**

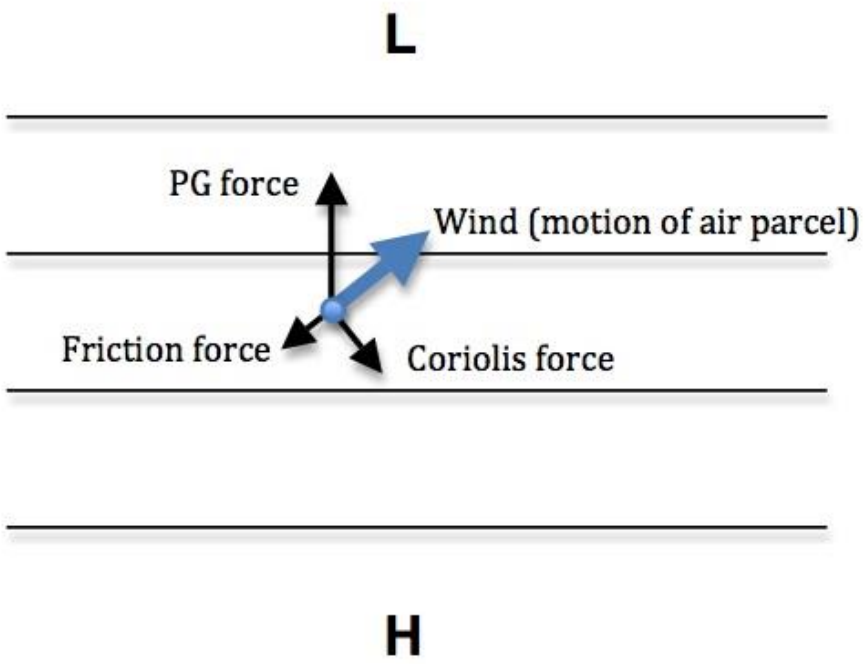
a) 1 and 2 only
b) 2 and 3 only
c) 3 only
d) 1, 2 and 3

**Q.4) Solution (c)**

**Basic Information:**

It is a **pseudo deflecting force** experienced due to rotation of earth. Because of coriolis the air appears to turn towards its right in the northern hemisphere and towards its left in the southern hemisphere. The coriolis always acts in the perpendicular direction of the motion of air. It is zero at the equator and increases towards the poles.






$$F_c = 2 * m(v \; x \; \omega)$$

*v= velocity*
*m= mass*
*ω = angluar velocity*

***Fig:*** Formula of Coriolis force

**Statement Analysis:**

| Statement 1 | Statement 2 | Statement 3 |
|---|---|---|
| **Incorrect** | **Incorrect** | **Correct** |
| The Coriolis force acts **perpendicular** to the **direction of motion of wind** and not pressure gradient | It has a role only in the direction of wind and does not affect wind speed.<br><br>More Coriolis force does not | It is **maximum** at the **poles** and is zero at the equator because it is directly proportional to the **angle of** |

| | | |
|---|---|---|
| force. | mean more wind speed. | **latitude**. |

**Q.5) Doldrums are**

1. Equatorial calms
2. Calm and light winds
3. Roaring forties
4. Variable both in position and in extent

**Select the correct answer using the code given below:**

a) 1, 2 and 4 only
b) 2 and 3 only
c) 1 and 3 only
d) 2, 3 and 4 only

**Q.5) Solution (a)**

**Explanation:**

Known to sailors around the world as the **doldrums**, the **Inter-Tropical Convergence Zone**, (ITCZ pronounced and sometimes referred to as the "itch"), is a belt around the Earth extending approximately **five degrees north and south of the equator**. Here, the prevailing trade winds of the northern hemisphere blow to the southwest and collide with the southern hemisphere's driving northeast trade winds.

Because the air circulates in an **upward direction**, there is often little surface wind in the ITCZ. That is why sailors well know that the area can be calm sailing ships for weeks. And that's why they call it the doldrums.

The doldrums are **variable both in position and extent** usually moving northward and southward with the sun.

**Roaring forties** are strong **Westerly Winds** found in Southern hemisphere generally latitudes of 40 ° and 50 °.

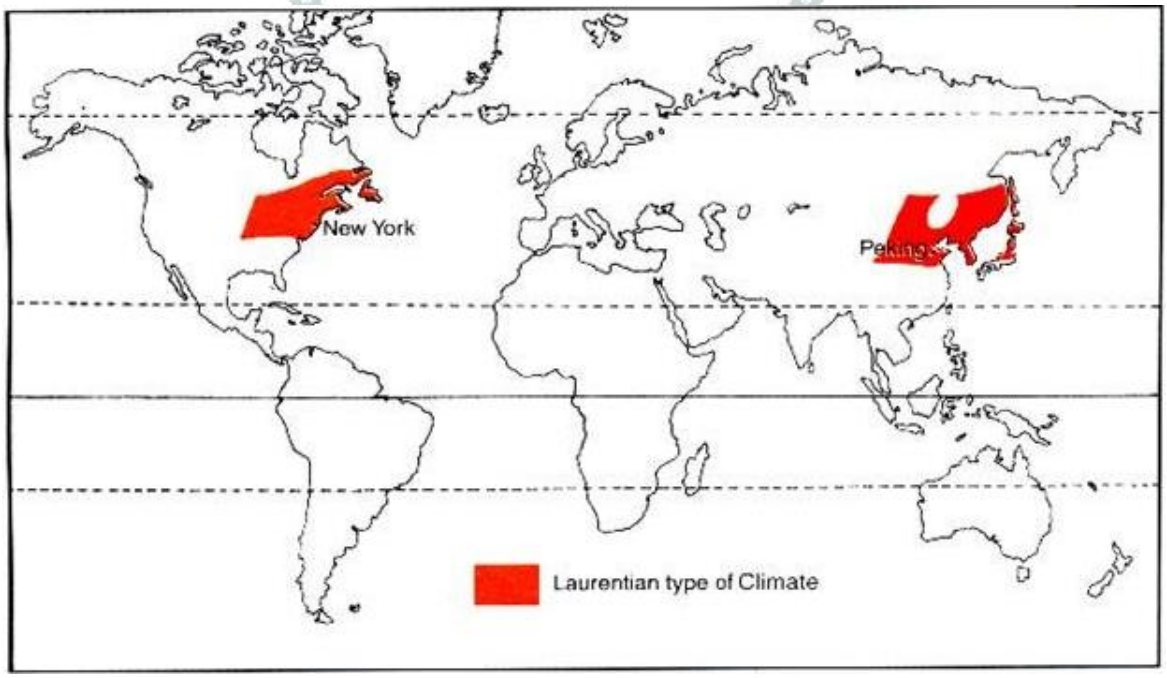
**Q.6) Select the incorrect statement about Laurentian type of climate:**

a) The Laurentian type of climate has cold, dry winters and warm, wet summers.
b) Eastern coast of North America and of China fall in this type of climate.
c) Laurentian climate of the North American region has uniformity in precipitation throughout the year.
d) Laurentian climate of eastern China region has uniformity in precipitation throughout the year.

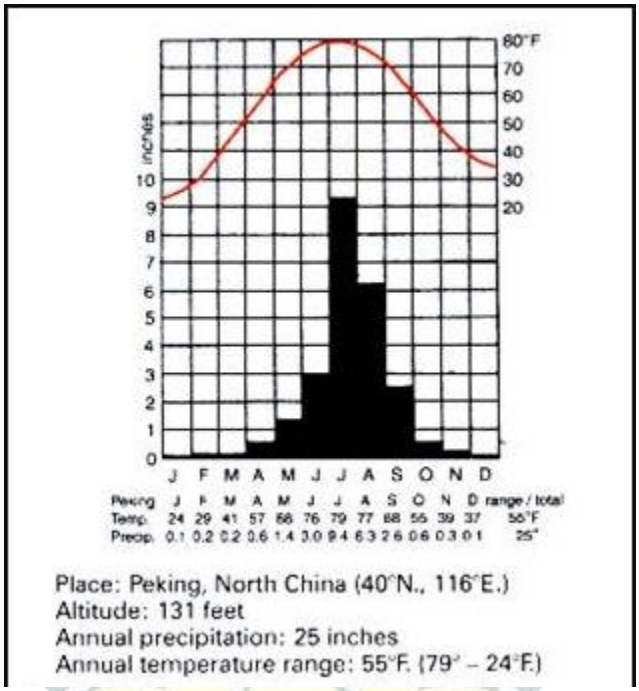
**Q.6) Solution (d)**

**Basic Information:**

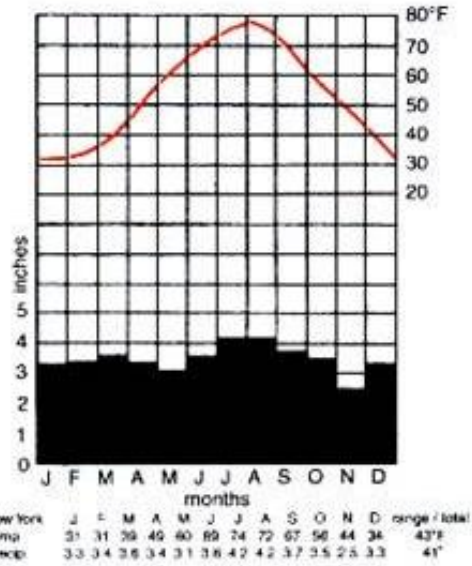
- The Cool Temperate Eastern Margin (Laurentian) Climate is an intermediate type of climate between the British and the Siberian type of climate. It has features of both the maritime and the continental climates.
- The Laurentian type of climate has cold, dry winters and warm, wet summers. The Laurentian type of climate is found only in two regions.
- One is north-eastern North America, including eastern Canada, north-east U.S.A., (i.e. Maritime Provinces and the New England states), and Newfoundland.
- The other region is the eastern coastlands of Asia, including eastern Siberia, North China, Manchuria, Korea and northern Japan.
- In the southern hemisphere, this climatic type is absent because only a small section of the southern continents extends south of the latitude of 40°S.



- The annual precipitation graph of Asiatic region.




- The most remarkable characteristic of the Laurentian climate of the North American region is its uniformity in precipitation (about 3 to 4 inches monthly) with a late summer maximum.
- No month is really dry, and the driest month, November, has 2.5 inches of rain. This uniformity of precipitation is largely due to the Atlantic influence and that of the Great Lakes. The warm Gulf Stream increases the moisture content of easterly winds from the open Atlantic.
- In contrast to the North American region, the **distribution of precipitation is less uniform in the Asiatic region.**
- Winters are very cold and dry while summers are warm and exceptionally wet.
- The rainfall regime resembles the tropical monsoon type in India where the rainfall is concentrated in the three summer months.




Place: New York, U.S.A (41°N., 74°W.)
Altitude: 314 feet
Annual precipitation: 41 inches
Annual temperature range: 43°F. (74° - 31°F.)

**Q.7) With reference to British type of climate, consider the following statements:**

1. This climate is experienced in Southern Chile, Southern Australia, Tasmania and most parts of New Zealand.
2. Rainfall occurs throughout the year with winter maxima.

**Which of the above statements is/are correct?**

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 and 2

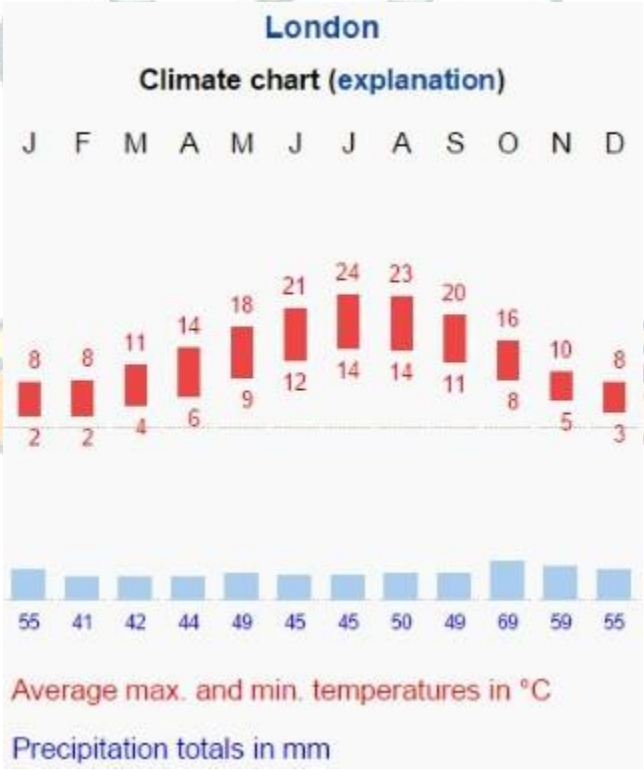
**Q.7) Solution (c)**

**Basic Information:**

- British Type Climate or Cool Temperate Western Margin Climate or North-West European Maritime Climate.

- The cool temperate western margins are under the influence of the Westerlies all-round the year.
- They are the regions of frontal cyclonic activity (Temperate Cyclones).
- This type of climate is typical to Britain, hence the name 'British Type'.
- However this type of climate is also found in southern Chile, Southern Australia, Tasmania and most parts of New Zealand.
- It is called as North-West European Maritime Climate due to greater oceanic influence.

- Rainfall occurs throughout the year with winter maxima.



**Statement Analysis:**

| Statement 1 | Statement 2 |
|---|---|
| **Correct** | **Correct** |
| Though, Britain has most developed 'British' type of climate, it is also found in Southern Chile, Southern Australia, Tasmania and most parts of New Zealand | The increase in precipitation starts from October and stays till whole of winters. |

**Q.8) Consider the following statements about rainfall:**

1. Convectional rainfall is possible above both land and sea.
2. All high mountain ranges cause orographic rainfall.
3. Frontal rainfall is absent in southern hemisphere due to very less land area present beyond 40°S latitude.

**Which of the above statements is/are NOT correct?**

a) 1 only
b) 2 and 3 only
c) 1 and 2 only
d) 2 only

**Q.8) Solution (b)**

**Basic Information:**

There are three main types of rainfall that occur frequently and depend on a variety of factors.

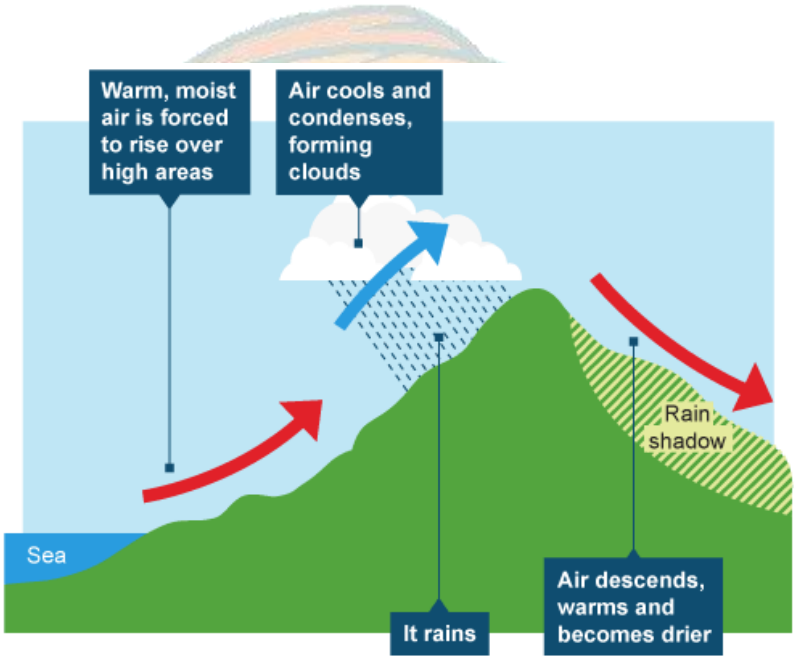
**Relief Rainfall**

This type of rainfall is common in places with mountains and sea. Relief rainfall frequently occurs near mountains beside the sea. The moisture-laden wind blows in from the sea because the wind meets a high mountain and hence it is forced to rise upwards. At the height, it is cooled and then the cloud is formed.

This saturated cloud with water vapor begins to precipitate on the side of the mountain facing the sea. This front side of the mountain is called the windward side.

The cloud mostly precipitates on the windward side of the mountain. Meanwhile, the cloud meets the other side, which is called the leeward side. Since the cloud has already lost most of its moisture so it rains very little there.

This makes leeward side of a mountain receive very little rains. There is a much moister climate on the windward sides of slopes. On the other hand, there is a drier, sheltered climate on the leeward side.

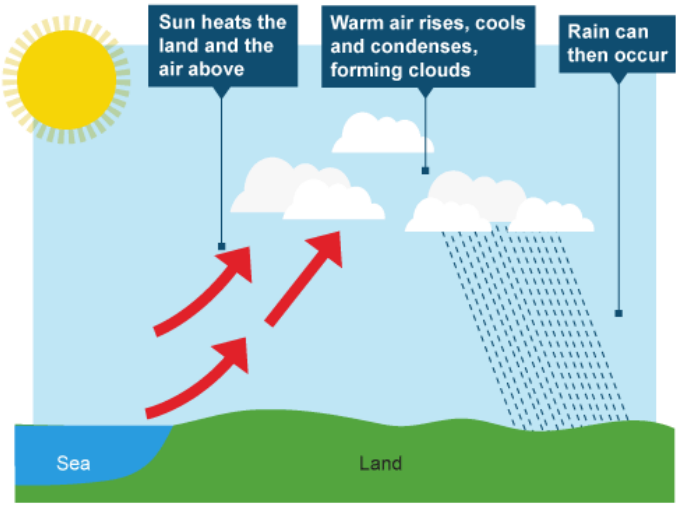



**Convectional Rainfall**

Suppose we are enjoying the rays of sunshine and suddenly, the sky gets darker with the grey cloud. Without any warning the heavens open and it begins to rain, with a thundery feel. This is the convectional rain. It occurs frequently on hot days usually giving cumulus cloud and thundery showers.

The sun heats the ground which causes the air to warm and become very hot. Then the air rises upwards and becomes cool. Then it condenses to form cumulus cloud.

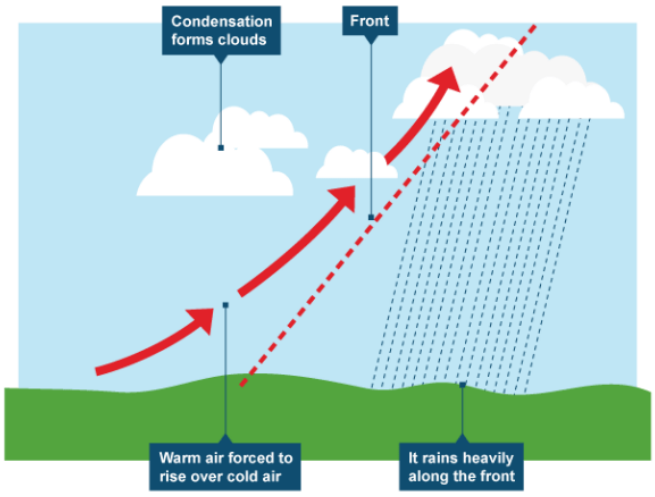
When this cloud is saturated, it begins to precipitate giving heavy and thundery showers. Due to this, we get thundershowers on a hot day, as the Sun warms the air and it rises, cools and begins to rain.




**Frontal Rainfall**

This rainfall occurs when a warm, tropical air mass comes in contact with a cold, polar air mass. It is very common in Britain and Ireland. Because the air is in the warm front, then it rises over the cold front. The air is cooled and so condenses to form a stratus cloud. Thus when the stratus cloud becomes saturated, it begins to precipitate.

Though frontal rainfall is common and more developed in the northern hemisphere, it does occur in the southern hemisphere as well; regions experiencing British type of climate also experience frontal rainfall. **These regions are southern Chile, Southern Australia, Tasmania and most parts of New Zealand.**




**Statement Analysis:**

| Statement 1 | Statement 2 | Statement 3 |
|---|---|---|
| **Correct** | **Incorrect** | **Incorrect** |
| As long as there is moisture in the air, convectional rainfall may happen above both land and sea. | All high mountain ranges may not cause orographic rainfall, as it is necessary for the mountain range to lie perpendicular to the direction of movement of wind. | Although, southern area has less developed frontal rain it does happen in then regions experiencing British type of climate. |

**Q.9) Select the *incorrect* statement about Harmattan Winds:**

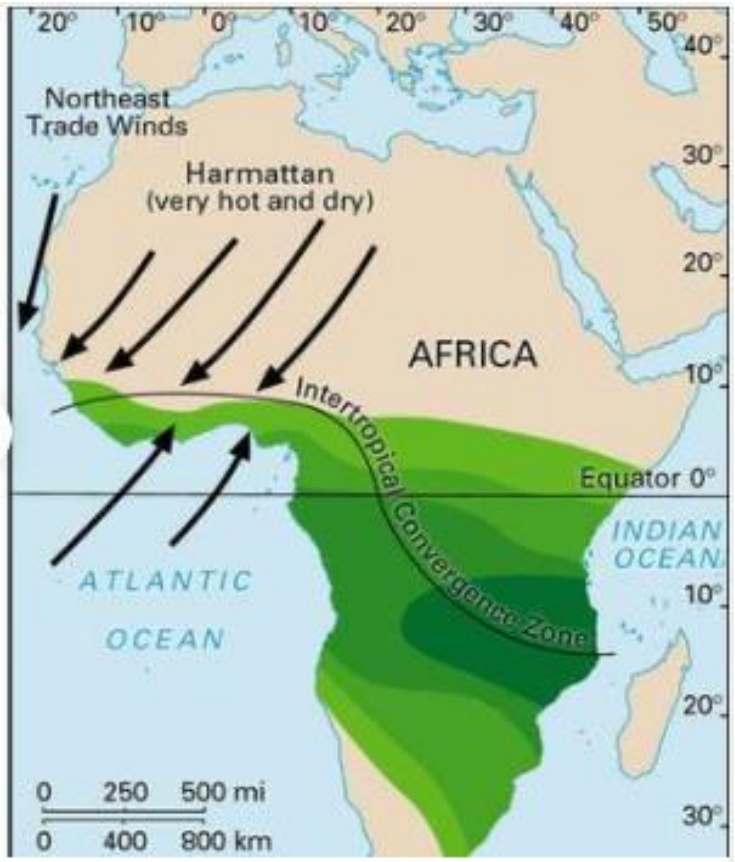
a) It is dry and dusty north-easterly trade wind.
b) It blows from the West Africa towards the Sahara desert.
c) It is seasonal wind blowing between the end of November and the middle of March
d) It is also known as the "doctor wind", because of its invigorating dryness compared with humid tropical air.

**Q.9) Solution (b)**

**Basic information:**

- The Harmattan is a seasonal wind in West Africa, which occurs between the end of November and the middle of March.
- It is characterized by the dry and dusty north-easterly trade wind, of the same name, which blows **from the Sahara Desert over West Africa into the Gulf of Guinea**.
- The name is related to the word 'haramata' in the Twi language. The temperature is cold in most places, but can also be hot in certain places, depending on local circumstances.
- The Harmattan blows during the dry season, which occurs during the months with the lowest sun.
- In this season the subtropical ridge of high pressure stays over the central Sahara Desert and the low-pressure Intertropical Convergence Zone (ITCZ) stays over the Gulf of Guinea. On its passage over the Sahara, the harmattan picks up fine dust and sand particles (between 0.5 and 10 microns).

- It is also known as the **"doctor wind"**, because of its invigorating dryness compared with humid tropical air.




**Q.10) Which of the statements about sub-tropical high pressure belt is/are correct?**

1. It lies in the area where the ascending equatorial air currents descend.
2. Both trade winds and westerlies originate from the sub-tropical high pressure belt.

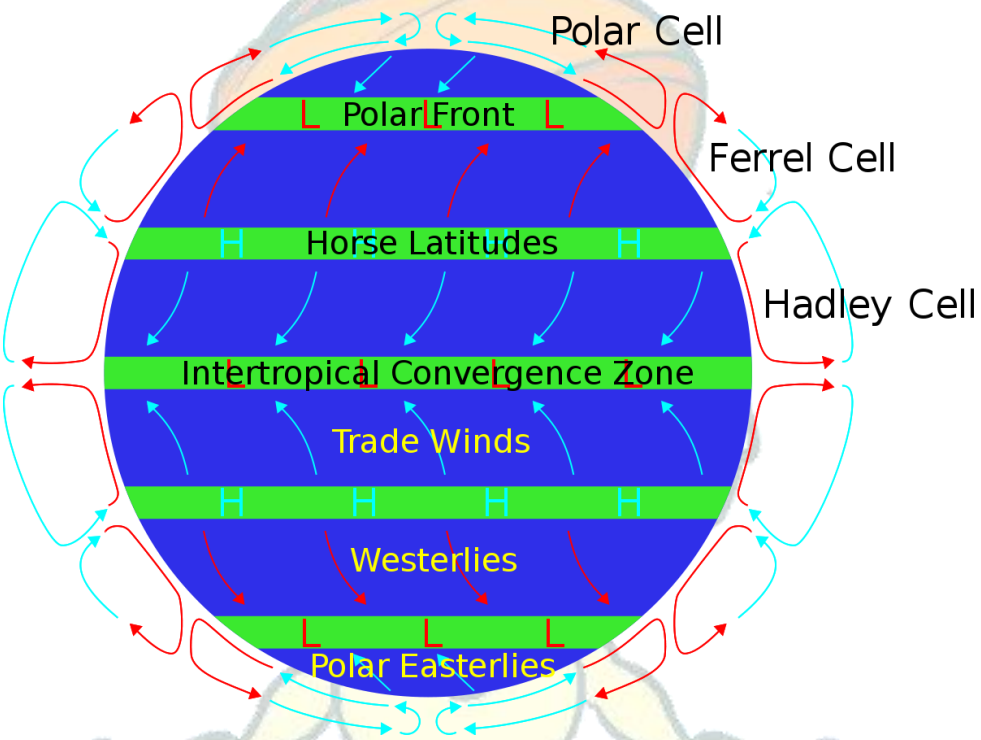
**Select the correct code:**

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

**Q.10) Solution (c)**

**Basic Information:**

- At about 30°North and South of Equator lies the area where the ascending equatorial air currents descend.
- This area is thus an area of high pressure. It is also called as the **Horse latitude**.
- Winds always blow from high pressure to low pressure. So the winds from subtropical region blow towards the Equator as Trade winds and another wind blow towards Sub-Polar Low-Pressure as Westerlies.




**Statement Analysis:**

| Statement 1 | Statement 2 |
|---|---|
| **Correct** | **Correct** |
| Descending air causes high pressure in this zone. | As shown in the diagram. |

**Q.11) With reference to Somali Jet Stream, consider the following statements:**

1. It is a temporary jet stream originating near Madagascar.
2. It flows at low height and obstructs the southwest monsoon wind reaching Indian subcontinent.

**Which of the above statements is/are NOT correct?**

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 and 2

**Q.11) Solution (b)**

**Note:** Incorrect statements are asked in the question.

**Basic Information:**

**Jet Streams:**

Jet streams are high speed winds that occur in narrow bands of upper air westerlies. The width of this air band can be 160 – 480 km wide and 900 – 2150 m thick, with core speed exceeding 300 km/hr. such is their strength that aircraft routes which run counter to jet movements are generally avoided. Jets are coincident with major breaks in the tropopause.

**Types of Jet Streams:**

1. **Permanent:**
   - **Polar Jet Stream:** This is a thermally induced jet stream and it flows parallel to surface fronts. They flow west to east in a sinusoidal fashion. It is strongest at 200-300mb level and swings between $40^{o}$-$60^{o}$ latitude. It is found in both the hemispheres. Its band is non-continuous but flows all-round the year. It can reach up to 160-200 km/hr.
   - **Subtropical jet stream:** They also flow all-round the year. They flow to conserve the angular momentum in upper atmosphere. They are found at the poleward limit of Hadley cell around $30^{o}$N and S latitude. It follows a more fixed pattern than polar jet stream. It is strongest on Indian sub-continent. The maximum speed can reach upto 300km/hr. the subtropical westerly jet does not seem to affect surface weather as much as the polar front's jets do.

**2. Temporary:**

- **Polar Night Jet Stream:** The polar-night jet stream forms mainly during the winter months when the nights are much longer, hence polar nights, in their respective hemispheres at around 60° latitude.
- **Tropical Easterly Jet Stream:** They are seasonal jet streams flowing east to west. These are only found in northern hemisphere and generates only in summer season. These are also thermally induced.
- **Somali/Findlater Jet Stream:** The Somali jet occurs during the summer over northern Madagascar and off the coast of Somalia. The jet is most intense from June to August with average monthly maximum speeds of 18 m/s even though daily speeds can reach the order of 50 m/s. The jet remains relatively steady from June to September before moving southward to the southern Indian Ocean during the winter.


**Statement Analysis:**

| Statement 1 | Statement 2 |
|---|---|
| **Correct** | **Incorrect** |
| The Somali jet occurs during the summer over northern Madagascar and off the coast of Somalia. | It flows at **low height around 1.6-2km** and **helps in aiding** the southwest monsoon wind reaching Indian subcontinent. |

| | |
|---|---|
| It is temporary and most intense from June to August. | |

**Q.12) Consider the following statements regarding "nacreous clouds":**

1. They may contain both liquid and ice crystals.
2. These clouds enhance the breakdown of the Earth's ozone layer.

**Which of the above statements is/are correct?**

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 and 2

**Q.12) Solution (c)**

**Basic Information:**

**Ice polar stratospheric clouds or nacreous clouds:**

- It occurs mainly at high latitudes during the winter when temperatures in the stratosphere fall below the frost point.
- They are most common in Antarctica, but have also been observed in the Arctic, Scotland, Scandinavia, Alaska, Canada and the northern Russian Federation. On rare occasions, they have been reported in other parts of northern Europe.
- Ice polar stratospheric clouds (nacreous clouds) form at temperatures below the ice frost point, typically near −85 °C, which is colder than the average lower stratosphere temperature.
- The characteristic bright iridescent colours, resulting from diffraction and interference of light waves, suggest that the clouds are composed of similarly sized spherical crystals of about 10 µm in diameter.

**Statement Analysis:**

| Statement 1 | Statement 2 |
|---|---|
| **Correct** | **Correct** |
| Nacreous clouds will also only form when the temperature in the stratosphere is below a chilly -78°C, which turns any **moisture in the air** into **super-cooled liquid or ice crystals**. | Nacreous clouds have a darker side too.<br><br>These clouds enhance the breakdown of the Earth's ozone layer, a vital part of our atmosphere that provides protection from the sun's harmful ultraviolet rays.<br><br>The ice crystals in the clouds encourage a chemical reaction between the ozone layer, which is made up of a specific type of molecular oxygen (O3), and gases such as chlorine and bromine. |

**Q.13) Consider the following statements:**

1. Photochemical smog is formed in cool humid climate.

2. Planting trees increases the albedo.

**Which of the above statements is/are correct?**

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 and 2

**Q.13) Solution (d)**

**Basic Information:**

**Photochemical smog:**

- Photochemical smog is a type of smog produced when **ultraviolet light** from the sun reacts with **nitrogen oxides** in the atmosphere. It is visible as a **brown haze**, and is **most prominent** during the **morning** and **afternoon**, especially in densely populated, **warm cities**.
- It is oxidising smog.
- Photochemical smog forms from a complex process, however the source of it is quite apparent. The largest contributor is **automobiles**, while **coal-fired power plants** and some other power plants also produce the necessary pollutants to facilitate its production. Due to its abundance in areas of warmer temperatures, **photochemical smog is most common in the summer**.

**Albedo:**

- Albedo is a non-dimensional, unitless quantity that indicates how well a surface reflects solar energy.
- Albedo varies between 0 and 1.
- Albedo commonly refers to the "whiteness" of a surface, with 0 meaning black and 1 meaning white. A value of 0 means the surface is a "perfect absorber" that absorbs all incoming energy.
- Absorbed solar energy can be used to heat the surface or, when sea ice is present, melt the surface. A value of 1 means the surface is a "perfect reflector" that reflects all incoming energy.

| Surface | Range of Albedo |
|---|---|
| Fresh Snow | 0.80 to 0.90 |
| Old/Melting Snow | 0.40 to 0.80 |
| Desert Sand | 0.40 |
| Grassland | 0.25 |
| Deciduous Trees | 0.15 to 0.18 |
| Coniferous Forest | 0.08 to 0.15 |
| Tundra | 0.2 |
| Ocean | 0.07 to 0.10 |

**Statement Analysis:**

| Statement 1 | Statement 2 |
|---|---|
| **Incorrect** | **Incorrect** |
| **Photochemical smog** is formed in warm, dry and sunny climate.<br><br>**Classical smog** is formed in cool humid climate. | Planting trees **decreases** the albedo.<br><br>The dark leaves of trees can raise temperatures by absorbing sunlight. |

**Q.14) This type of inversion takes place in lower planetary boundary layer where earth is cooled due to long wave radiation at night. Identify the correct answer –**

a) Frontal inversion
b) Advection inversion
c) Tropopause inversion

d) Radiation inversion

**Q.14) Solution (d)**

**Basic Information:**

**Temperature Inversion:**

Usually as we move up in troposphere from the surface, the temperature decreases with increase in altitude. But sometimes due to local conditions, the temperature, instead of decreasing, increases with height. This phenomenon is called temperature inversion. This is also known as **negative lapse rate**.

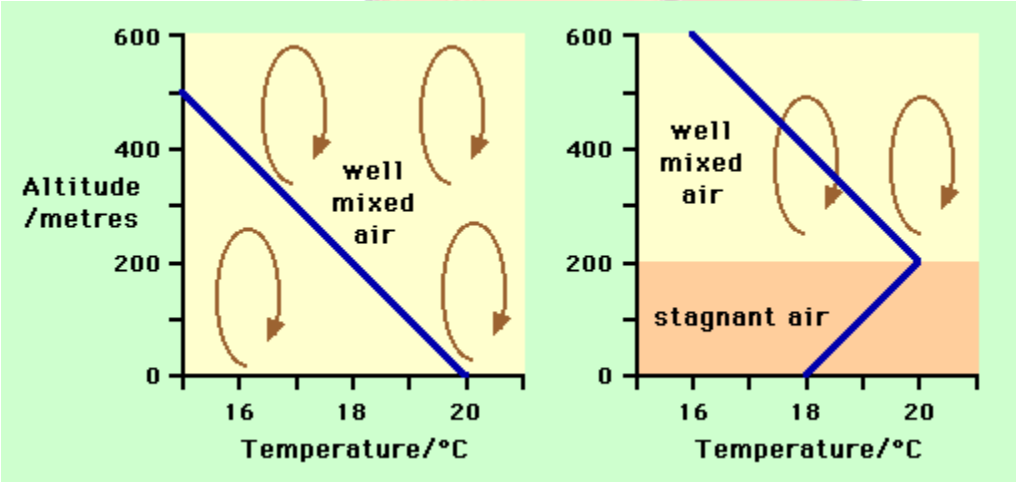


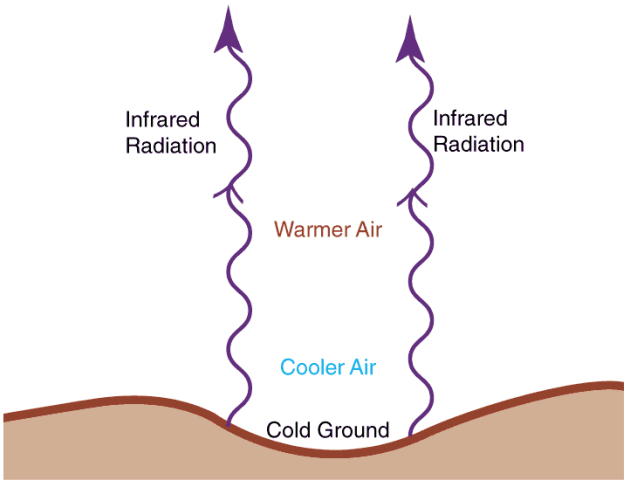

**Fig: graphs comparing normal condition and condition of temperature inversion.**

**The different types of inversions may be classified as:**

**Radiation Inversion:** This is the condition where temperature near the ground increases, rather than decreasing with elevation. This type of inversion occurs generally in tropical and sub-tropical regions during the period of long winter nights. This inversion however, disappears with sunrise. The duration and height of surface inversion increases pole wards. Following conditions are required for ground surface inversion:

- Long winter nights
- Cloudless calm skies
- Dry air and low relative humidity
- Calm atmosphere or slow movement of air

- Snow covered surface




**Upper air inversion:** It occurs when the warm air is transported upwards into the cold air due to eddies. It may be caused due to compression of the descending air as it happens in the case of subtropical high-pressure belts.

**Frontal inversion:** It is caused by horizontal and vertical movement of air. The temperate cyclones are formed by convergence of warm westerlies and cold polar air, and thus the warm air overlies the cold air. The presence of warm air above and cold air below reverses the normal lapse rate and inversion of temperature occurs.

**Advection Inversion:** Here the warm air rises and then advects in the middle of troposphere away from the source region and forms a lid in region of lower elevation.

**Tropopause inversion:** it is a condition of extreme stability which restricts further rise of air globally. Since temperature rises with height in stratosphere there is a condition of inversion.

**Q.15) Consider the following statements:**

1. Blocking highs tend to force areas of low pressure to travel around them.
2. Horse latitude is found in the northern hemisphere only.
3. All Rossby waves are geostrophic wind.

**Which of the above statements is/are correct?**

a) 1 only

b) 2 only
c) 2 and 3 only
d) 1 and 3

**Q.15) Solution (d)**

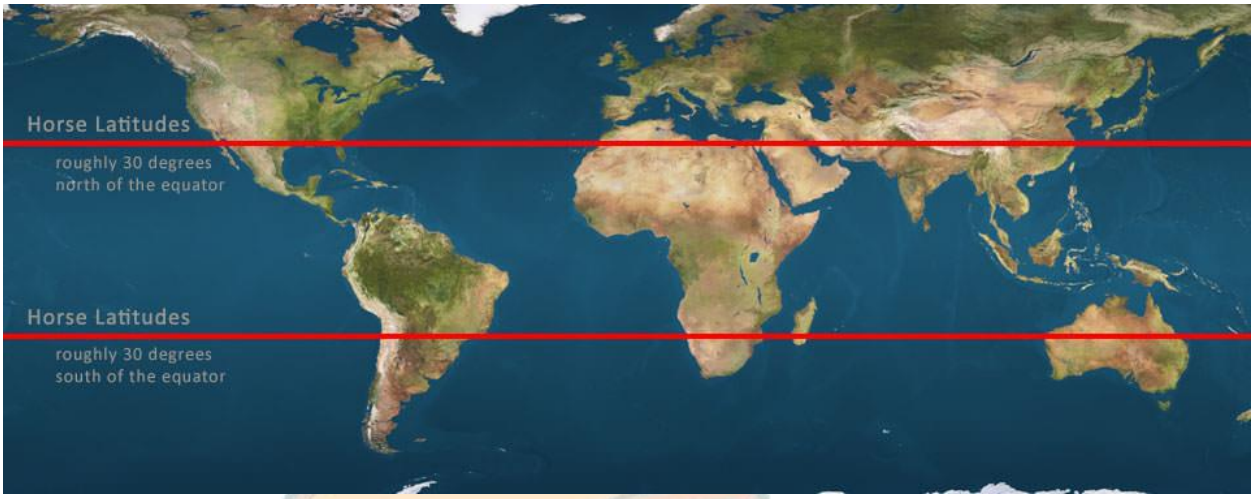
**Basic Information:**

**Blocking highs:**

- Blocks in meteorology are large-scale patterns in the atmospheric pressure field that are nearly stationary, effectively "**blocking**" or **redirecting migratory cyclones**. They are also known as **blocking highs** or **blocking anticyclones**.
- **Areas of high pressure** can sometimes be very slow moving, almost stationary. Such a region of slow moving air can prevent other, faster moving pressure systems from moving into a region. For this reason they are known as blocking highs or blocking anticyclones.

**Horse latitude:**

- The horse latitudes are located at about **30 degrees north and south** of the equator.
- It is common in this region of the **subtropics** for winds to diverge and either flow toward the poles (known as the prevailing westerlies) or toward the equator (known as the trade winds).
- These diverging winds are the result of an **area of high pressure**, which is characterized by **calm winds, sunny skies, and little or no precipitation**.
- According to legend, the term comes from ships sailing to the New World that would often become stalled for days or even weeks when they encountered areas of high pressure and calm winds. Many of these ships carried horses to the Americas as part of their cargo. Unable to sail and resupply due to lack of wind, crews often ran out of drinking water. To conserve scarce water, sailors on these ships would sometimes throw the horses they were transporting overboard. Thus, the phrase 'horse latitudes' was born.




**Statement Analysis:**

| Statement 1 | Statement 2 | Statement 3 |
|---|---|---|
| **Correct** | **Incorrect** | **Correct** |
| Anticyclones produce a **stable atmosphere**.<br><br>Anticyclones, or highs, are also referred to as **blocking highs because they tend to force areas of low pressure to travel around them.**<br><br>For example, a hurricane (tropical cyclone) that encounters an area of high pressure will be deflected around the cyclone. Blocking highs have spared the East Coast of the United States from many hurricane strikes, pushing them out over the Atlantic Ocean. | The horse latitudes are located at about **30 degrees north and south** of the equator. | Rossby waves form outer edge of geostrophic wind generally in polar areas.<br><br>Thus, all Rossby waves are geostrophic wind but all geostrophic winds are not Rossby waves. |

**Q.16) Select the incorrect statement about tropical cyclones:**

a) A tropical cyclone is a non-frontal synoptic scale low-pressure system.
b) Heaviest rain is found at the eye-wall of the storm.
c) Sea-surface temperature must be 26°C spanning through at least 100m depth.
d) A weaker vertical shear makes the storm grow faster vertically into the air.

**Q.16) Solution (c)**

**Basic Information:**

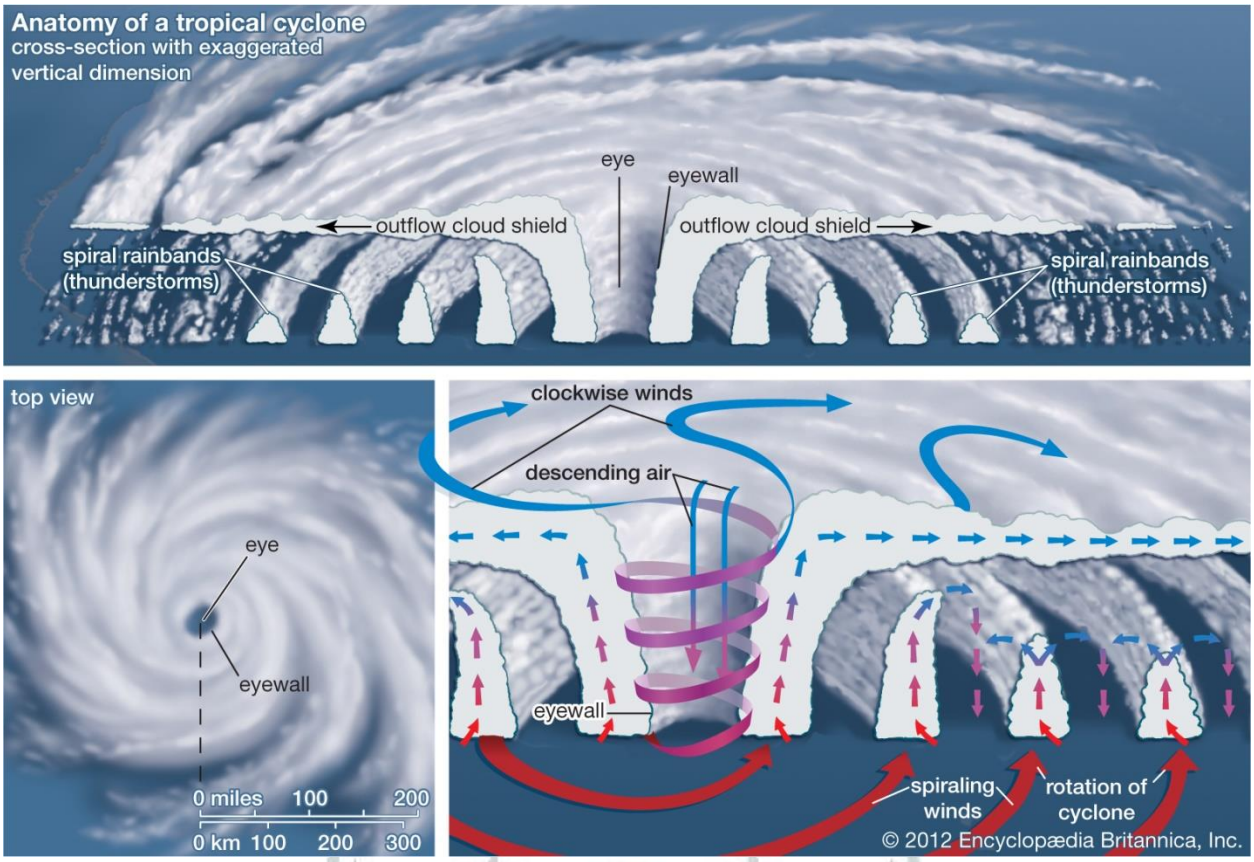
A tropical cyclone is the generic term for a non-frontal synoptic scale low-pressure system over tropical or sub-tropical waters with organized convection (i.e. thunderstorm activity) and definite cyclonic surface wind circulation

A cluster of thunderstorms can develop over warm tropical oceans. If that cluster persists in an area of low pressure, it can start rotating. If the conditions are just right, the cluster of thunderstorms can grow in size and sustain itself and then develop into a tropical cyclone.

**Preconditions for formation of tropical cyclone:**

a) The temperature of the surface layer of ocean water must be 26.5 °C (80 °F) or warmer, and this warm layer must be at least 50 metres (150 feet) deep.
b) A pre-existing atmospheric circulation must be located near the surface warm layer.
c) The atmosphere must cool quickly enough with height to support the formation of deep convective clouds.
d) The middle atmosphere must be relatively humid at a height of about 5,000 metres (16,000 feet) above the surface.
e) The developing system must be at least 500 km (300 miles) away from the Equator.
f) The wind speed must change slowly with height through the troposphere—no more than 10 metres (33 feet) per second between the surface and an altitude of about 10,000 metres (33,000 feet).

**Structure of the cyclone**




The eye is a region of mostly calm weather at the center of tropical cyclones. The eye of a storm is a roughly circular area, typically 30–65 kilometers (19–40 miles) in diameter. It is surrounded by the eyewall, a ring of towering thunderstorms where the most severe weather and highest winds occur.

**Q.17) Consider the following statements:**

1. Increase in temperature and pressure will increase the rate of evaporation in the atmosphere.
2. All the moisture present in the atmosphere is due to evaporation.

**Which of the statements given above is/are correct?**

a) 1 only
b) 2 only
c) Both 1 and 2

d) Neither 1 nor 2

**Q.17) Solution (d)**

**Basic Information:**

- Evaporation happens when a liquid substance becomes a gas. When water is heated, it evaporates. The molecules move and vibrate so quickly that they escape into the atmosphere as molecules of water vapour.
- Evaporation is a very important part of the water cycle. Heat from the sun, or solar energy, powers the evaporation process. It soaks up moisture from soil in a garden, as well as the biggest oceans and lakes. The water level will decrease as it is exposed to the heat of the sun.
- Many factors affect how evaporation happens. If the air is already clogged, or saturated, with other substances, there won't be enough room in the air for liquid to evaporate quickly. When the humidity is 100 percent, the air is saturated with water. No more water can evaporate.
- Air pressure also affects evaporation. If air pressure is high on the surface of a body of water, then the water will not evaporate easily. The pressure pushing down on the water makes it difficult for water to escape into the atmosphere as vapour. Storms are often high-pressure systems that prevent evaporation.
- Temperature, of course, affects how quickly evaporation happens. Boiling-hot water will evaporate quickly as steam.
- Evaporation is the opposite of condensation, the process of water vapour turning into liquid water.
- Evaporation is the process by which water changes from a liquid to a gas or vapour. Evaporation is the primary pathway that water moves from the liquid state back into the water cycle as atmospheric water vapour. Studies have shown that the oceans, seas, lakes, and rivers provide nearly 90 percent of the moisture in the atmosphere via evaporation, with the remaining 10 percent being contributed by plant transpiration.
- A very small amount of water vapour enters the atmosphere through sublimation, the process by which water changes from a solid (ice or snow) to a gas, bypassing the liquid phase. This often happens in the Rocky Mountains as dry and warm Chinook winds blow in from the Pacific in late winter and early spring.

**Statement Analysis:**

| Statement 1 | Statement 2 |
|---|---|

| Incorrect | Incorrect |
|---|---|
| Evaporation increases with increase in temperature.<br><br>Evaporation decreases with increase in pressure. | Moisture enters the atmosphere through evaporation, transpiration and also sublimation. |

**Q.18) Consider the following statements about lapse rate:**

1. If the environmental lapse rate is greater than the adiabatic lapse rate, the atmosphere is then said to be stable.
2. If the environmental lapse rate is less than the adiabatic lapse rate, the atmosphere is said to be unstable.
3. Dry adiabatic lapse rate is always higher than saturated adiabatic lapse rate.

**Which of the statements given above is/are correct?**

a) 1 only
b) 2 only
c) 1, 2 and 3
d) 3 only

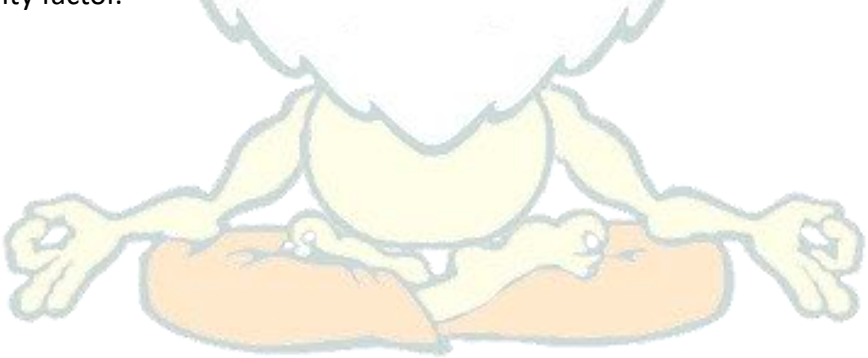
**Q.18) Solution (d)**

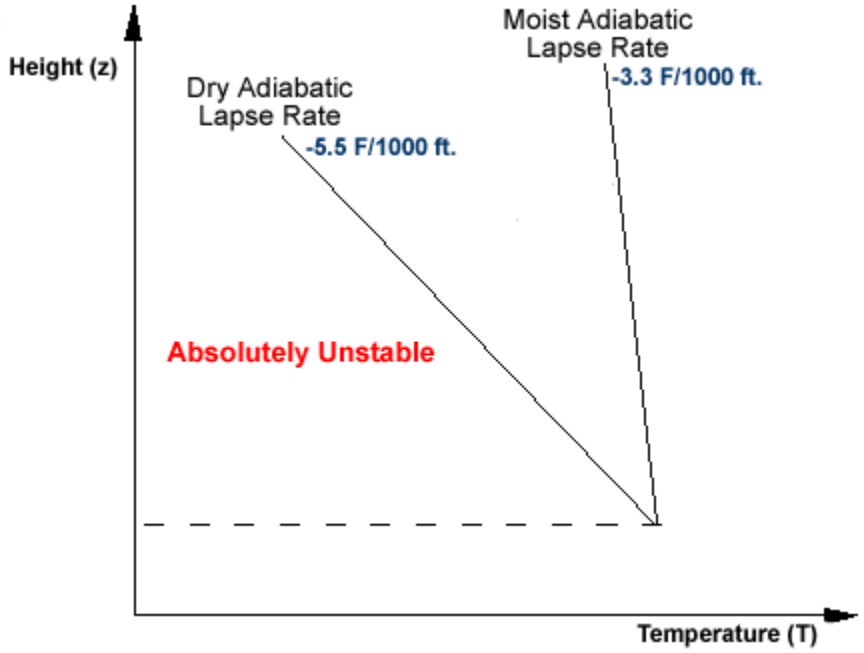
**Basic Information:**

- When air is forced to rise up in the atmosphere, the pressure reduces with height. For a given volume of gas, the pressure divided by the temperature remains constant (Boyle's Law). Therefore, as the air pressure reduces, so does the temperature.
- If no heat is exchanged with the surrounding air during this process, which is called "adiabatic cooling", the rate at which the air cools, the Adiabatic Lapse Rate (ALR) is a constant.
- For unsaturated air, the lapse rate is 3°C per 1000 feet; this is called the Dry Adiabatic Lapse Rate (DALR). However, when the parcel of air reaches the Dew Point and becomes saturated, water vapour condenses, latent heat is released during the condensation process, which warms the air, and the lapse rate reduces. The Saturated Adiabatic Lapse

Rate (SALR) is therefore the rate at which saturated air cools with height and is, at low levels and latitudes, 1.5°C per thousand feet. At higher altitudes and latitudes, where there is generally less water content in the air, and therefore less latent heat to release, the SALR is closer to 3°C per thousand feet.

- The ELR (Environmental Lapse Rate) is the actual rate at which the ambient temperature changes with height.
- Considering the parcel of air as before and utilizing the DALR and SALR for that parcel of air in contrast to the surrounding air:
- If the ELR is greater than the ALR, rising air will be warmer than the surrounding air and therefore keep rising; the atmosphere is then said to be unstable. If ELR is greater than SALR, the air is said to be absolutely unstable, since the air, whether saturated or unsaturated, will always have a higher temperature than it surroundings.
- When the ELR is less than the SALR and greater than the DALR, then the air is considered conditionally unstable: the condition being whether the air is saturated or not.
- If the ELR is less than the ALR, then the rising air will be cooler than the surrounding air and will sink - the atmosphere is said to be stable. If the ELR is less than the DALR, the air is said to be absolutely stable, since the air, whether saturated or unsaturated, will always be cooler than the surrounding air.
- The distinctions between stability and instability as noted above are the foundation of weather analysis, in particular for afternoon airmass thunderstorm development or stable conditions. The most complex situation is when the troposphere is considered conditionally unstable, since a trigger may be needed to enhance either the stability or instability factor.






**Statement Analysis:**

| Statement 1 | Statement 2 | Statement 3 |
|---|---|---|
| **Incorrect** | **Incorrect** | **Correct** |
| If the ELR is greater than the ALR, rising air will be warmer than the surrounding air and therefore keep rising; the atmosphere is then said to be **unstable**. | When the ELR is less than the ALR, the air packet is cooler than the surrounding air and will not rise; a **stable** condition. | Less moisture means less latent heat released due to condensation, therefore, the air packet will cool faster. |

**Q.19) Consider the following statements about the characteristics prevalent during El Nino:**

1. In an El Nino year, air pressure drops over large areas of the central Pacific and along the coast of South America.
2. Peruvian coast gets relatively cooler during El Nino than normal times.
3. El Nino brings drought to the western Pacific and rains to the equatorial coast of South America.

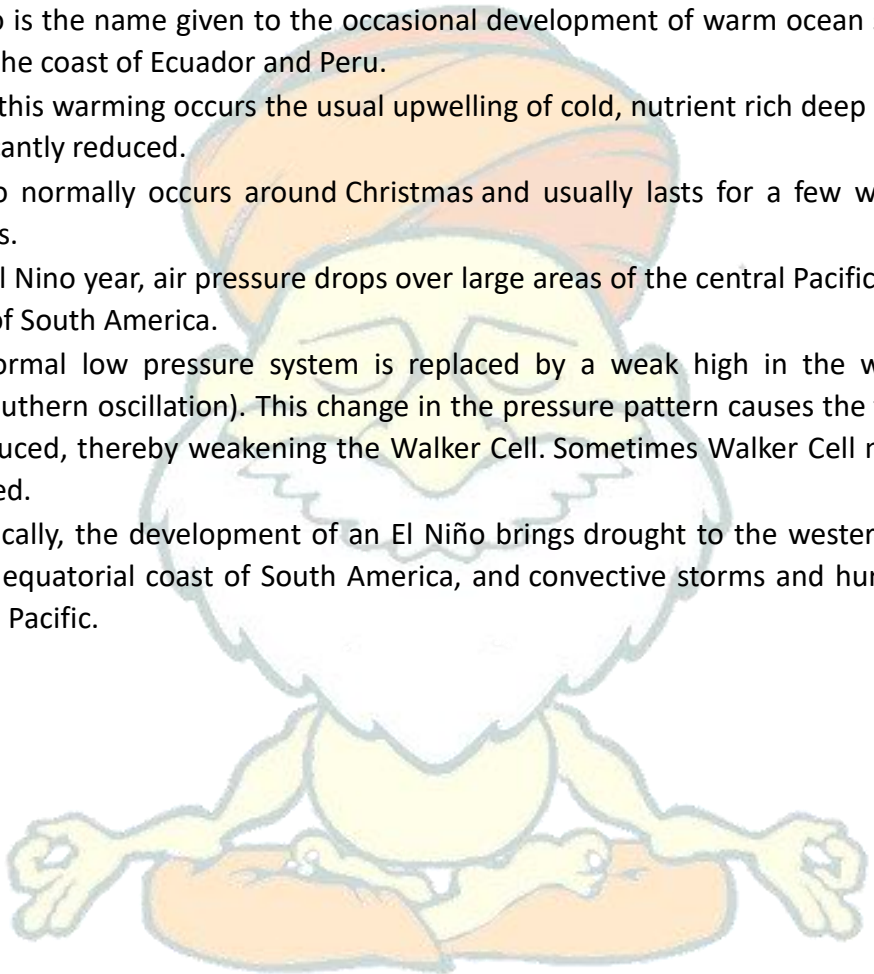
**Which of the above statements is/are correct?**

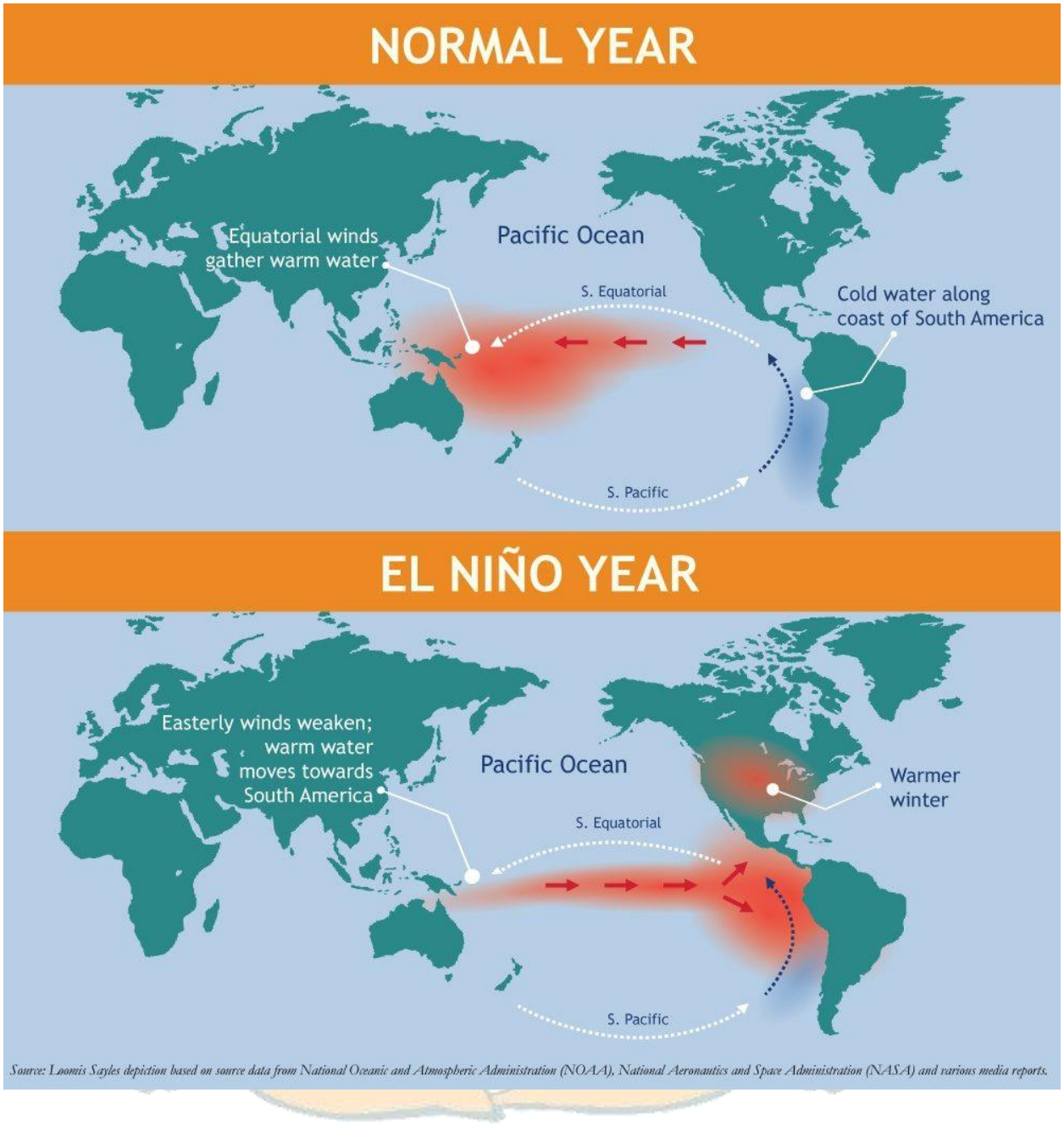
a) 2 and 3 only
b) 1 and 3 only
c) 2 only
d) 1, 2 and 3

**Q.19) Solution (b)**

**Basic Information:**

- El Nino is the name given to the occasional development of warm ocean surface waters along the coast of Ecuador and Peru.
- When this warming occurs the usual upwelling of cold, nutrient rich deep ocean water is significantly reduced.
- El Nino normally occurs around Christmas and usually lasts for a few weeks to a few months.
- In an El Nino year, air pressure drops over large areas of the central Pacific and along the coast of South America.
- The normal low pressure system is replaced by a weak high in the western Pacific (the southern oscillation). This change in the pressure pattern causes the trade winds to be reduced, thereby weakening the Walker Cell. Sometimes Walker Cell might even get reversed.
- Climatically, the development of an El Niño brings drought to the western Pacific, rains to the equatorial coast of South America, and convective storms and hurricanes to the central Pacific.






**Statement Analysis:**

| Statement 1 | Statement 2 | Statement 3 |
|---|---|---|
| Correct | Incorrect | Correct |

| | | |
|---|---|---|
| It is a fact.<br><br>In an El Nino year, air pressure drops over large areas of the central Pacific and along the coast of South America. | The pressure drop and accumulation of warm water along the Peruvian coast keeps it relatively warm (observe the figure above). | El Nino brings drought to the western Pacific, rains to the equatorial coast of South America, and convective storms and hurricanes to the central Pacific. |

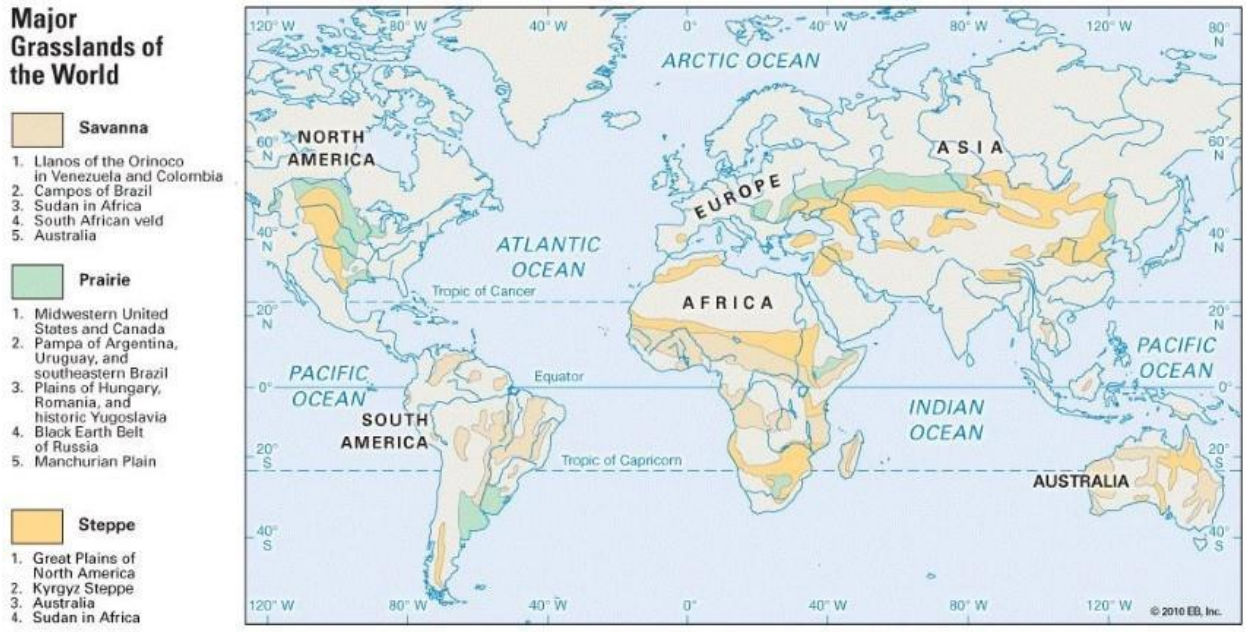
**Q.20) Select the incorrect statements with respect to Steppes type of climate:**

a) Climate is continental with extremes of temperature.
b) Steppes type of climate in the southern hemisphere is more severe.
c) The heaviest rain comes in summer in.
d) Southern hemisphere experiences more rainfall.

**Q.20) Solution (b)**

**Basic information:**

- Climate is continental with extremes of temperature.
- Temperatures vary greatly between summer and winter.
- The summers are hot and the winters are cold.
- Summers are very warm, over 18 – 20° C.
- The steppe type of climate in the southern hemisphere is never severe.
- The average rainfall may be taken as about 45 cm, but this varies according to location from 25 cm to 75 cm.
- The heaviest rain comes in June and July (late spring and early summer).
- Most of the winter months have about 2.5 cm of precipitation, brought by the occasional depressions of the Westerlies and coming in the form of snow.
- The maritime influence in the southern hemisphere causes more rainfall.
- The major grasslands of the world correspond to the Steppes type of climate.




**Q.21) India is a member of which among the following?**

1. Indian Ocean Rim Association
2. Indian Ocean Commission
3. Indian Ocean Naval Symposium

**Select the correct answer using the code given below:**

a) 1 and 3 only
b) 1 only
c) 1 and 2 only
d) 1, 2 and 3

**Q.21) Solution (a)**

**Indian Ocean Rim Association** is a regional forum established in 1997 that seeks to build and expand understanding and mutually beneficial cooperation through a consensus-based, evolutionary and non-intrusive approach.

- IORA has 22 member states, including Australia, Bangladesh, Comoros, **India**, Indonesia, Iran, Kenya, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Oman,

Seychelles, Singapore, Somalia, South Africa, Sri Lanka, Tanzania, Thailand, UAE, and Yemen.

**Indian Ocean Commission** is the inter-governmental organization that coordinates maritime governance in the south-western Indian Ocean. It consists of Madagascar, Comoros, La Réunion (French overseas territory), Mauritius and Seychelles. **India is an observer to IOC.**

**The 'Indian Ocean Naval Symposium' (IONS)** is a voluntary initiative that seeks to increase maritime cooperation among navies of the littoral states of the Indian Ocean Region by providing an open and inclusive forum for discussion of regionally relevant maritime issues.

- There are 36 littoral in the Indian Ocean which has been geographically grouped into the following four sub-regions - South Asian Littorals, West Asian Littorals, East African Littorals and South East Asian and Australian Littorals.
- **India** along with Bangladesh, Maldives, Pakistan, Seychelles and Sri Lanka forms South Asian Littorals group.

**Q.22) Consider the following statements:**

1. Any registered political party can have 40 star campaigners.
2. Expenditure incurred on campaigning by such notified star campaigners is exempt from being added to the election expenditure of a candidate in all circumstances.

**Which of the statements given above is/are correct?**

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

**Q.22) Solution (d)**

| Statement 1 | Statement 2 |
|---|---|
| **Incorrect** | **Incorrect** |
| Star campaigners are nominated by political parties to campaign in a given set of constituencies. List of star campaigners must be communicated to Chief Electoral Officer | **Expenditure incurred on campaigning by such notified star campaigners is exempt from being added to the election expenditure of a candidate. However, this only applies when a** |

| | |
|---|---|
| and ECI within a week from the election notification date as required under section 77(1) of Representation of the People Act (RPA), 1951. **A recognised political party can have 40 Star campaigners and an unrecognized (but registered) political party can have 20.** | **star campaigner limits herself to a general campaign for the political party** she represents. If a candidate or her election agent shares stage with a star campaigner at a rally, then the entire expenditure on that rally, other than the travel expenses of star campaigner, is added to candidate's expenses. |

**Q.23) Sometimes seen in news, the *Apophis* is**

a) An exoplanet in goldilocks zone
b) An asteroid which may hit Earth
c) A newly discovered black hole closer to Earth than any other
d) A new star cluster in our Milky Way galaxy

**Q.23) Solution (b)**

**Asteroid Apophis** may hit the Earth in 2068 due to a phenomenon called Yarkovsky effect. This effect has eventually accelerated the asteroid's flow and also changed its path.

The **Yarkovsky effect** describes a small but significant force that affects the orbital motion of meteoroids and asteroids smaller than 30-40 kilometers in diameter. It is caused by sunlight; when these bodies heat up in the Sun, they eventually re-radiate the energy away as heat, which in turn creates a tiny thrust.

Before the discovery of Yarkovsky effect, the possibility of the collision was impossible. The detection of this effect acting on Apophis means that the 2068 impact scenario is still a possibility.

**Q.24) With reference to INS Vagir, consider the following statements:**

1. It is a Kalvari-class diesel electric attack submarine.
2. It is developed under the *Project 75I* of Indian Navy.

**Which of the statements given above is/are correct?**

a) 1 only
b) 2 only

c) Both 1 and 2
d) Neither 1 nor 2

**Q.24) Solution (a)**

| Statement 1 | Statement 2 |
|---|---|
| **Correct** | **Incorrect** |
| Indian Navy's fifth **Kalvari-class Diesel Electric attack submarine INS Vagir** was launched at Mazgaon Dock in Mumbai. It is the fifth among the six Kalvari-class submarines. The other vessels in the class are INS Kalvari, INS Khanderi, INS Karanj, INS Vela and INS Vagsheer. Of these Kalvari and Khanderi have been commissioned in 2017 and 2019. Vela and Karanj are undergoing sea trials. Vagsheer is under construction. | **Project-75 is a programme by the Indian Navy that entails building six Scorpene Class attack submarines.** The Public shipbuilder Mazagon Dock Ltd (MDL) is manufacturing six Scorpene submarines with technology assistance from Naval Group of France. The Project 75I-class submarine is follow-on of the Project 75 Kalvari-class submarine under which Indian Navy intends to acquire six diesel-electric submarines, which will also feature advanced air-independent propulsion systems. |

**Q.25) Consider the following pairs:**

| *Tiger Reserve* | *State/UT* |
|---|---|
| 1. Manas | Assam |
| 2. Dampha | Tripura |
| 3. Pilibhit | Uttar Pradesh |

**Which of the pairs given above are correctly matched?**

a) 1 and 2 only
b) 3 only
c) 1 and 3 only
d) 1, 2 and 3

**Q.25) Solution (c)**

- **Pilibhit** Tiger Reserve (PTR) in **Uttar Pradesh** won TX2 Award for doubling its population. TX2 is the global award which was set up in 2010 in St. Petersburg, Russia by

international organizations working for tiger conservation like WWF, UNDP, IUCN, Global Tiger Fund (GTF), CATS and The Lion's Share.

- Transboundary Manas Conservation Area straddling the India-Bhutan border has received the TX2 Conservation Excellence Award for 2020. **Manas National Park is in Assam**.
- **Dampha** Tiger Reserve is a tiger reserve of western **Mizoram**.

**Q.26) With respect to Association of Southeast Asian Nations (ASEAN) which of the following statement is *NOT* correct?**

a) India has a Free Trade Agreement with ASEAN spanning goods, services and investment.
b) Bangkok Declaration is the founding document of ASEAN.
c) India's trade deficit with ASEAN has been narrowing in the last decade.
d) India became a Strategic Partner of ASEAN in 2012.

**Q.26) Solution (c)**

Association of Southeast Asian Nations (ASEAN) is a regional grouping that promotes economic, political, and security cooperation. It was established on 8th August 1967 in Bangkok, Thailand with the signing of the ASEAN Declaration (Bangkok Declaration) by the founding fathers of ASEAN, namely Indonesia, Malaysia, Philippines, Singapore and Thailand. The current Ten Members are: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam.

- **India became a Strategic Partner of ASEAN in 2012**, after progressing from its earlier roles of Sectoral Partner (1992), Dialogue Partner (1996) and Summit Level Partner (2002).
- **India has a Free Trade Agreement with ASEAN spanning goods, services and investment.** India-ASEAN trade and investment relations have been growing steadily, with ASEAN being India's fourth largest trading partner.
- **The two-way trade between India and ASEAN is tilted towards ASEAN with the trade gap expanding rapidly**. India's trade deficit with ASEAN rose from less than US$ 8 billion in 2009-10 to about US$ 22 billion in 2018-19.


**Q.27) With reference to Thirty Meter Telescope (TMT) project which of the following statements is/are correct?**

1. It is an international partnership between the USA, Canada, Japan, China, and India.
2. It is being installed at Hanle, Ladakh.

**Which of the statements given above is/are *INCORRECT*?**

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

**Q.27) Solution (b)**

| Statement 1 | Statement 2 |
|---|---|
| **Correct** | **Incorrect** |
| The Thirty-meter telescope (TMT) project is an international partnership between CalTech, Universities of California, Canada, Japan, China, and India; through the Department of Science and | **TMT project being installed at Maunakea in Hawaii**, which can revolutionized the understanding of the universe and the enigmas in it. It will also allow to see deeper into space and observe cosmic objects with unprecedented sensitivity. The Major Atmospheric Cherenkov Experiment Telescope (MACE), ground-based |

| | |
|---|---|
| Technology (DST) and Department of Atomic Energy (DAE). | gamma-ray telescope is placed in Hanle, Ladakh. |

**Q.28) The *Water Risk Filter 2020* report is released by which of the following?**

a) World Economic Forum (WEF)
b) World Health Organisation (WHO)
c) World Wide Fund for Nature (WWF)
d) NITI Aayog of India

**Q.28) Solution (c)**

**WWF Water Risk Filter** is a practical online tool that enables companies and investors to explore, assess value and respond to water risks worldwide. It has been developed by WWF and the German finance institution DEG.

According to the scenarios in the WWF Water Risk Filter, 100 cities in world including 30 Indian cities that are expected to suffer the biggest rise in water risk by 2050 are home to 350 million people.

**Q.29) The World's first nuclear energy partnership centre, Global Centre for Nuclear Energy Partnership (GCNEP) is located in which of the following?**

a) Kazakhstan
b) France
c) Australia
d) India

**Q.29) Solution (d)**

**Global Centre for Nuclear Energy Partnership (GCNEP) is World's first nuclear energy partnership centre at Kheri Jasaur village in Jhajjar district of Haryana**.

- GCNEP will help in capacity building, in association with the interested countries and the IAEA, involving technology, human resource development, education & training and giving a momentum to R&D in Nuclear Energy.

- The centre will house following 5 schools to carry out its objectives – School of Advanced Nuclear Energy System Studies (SANESS), School of Nuclear Security Studies (SNSS), School on Radiological Safety Studies (SRSS), School of Nuclear Material Characterization Studies (SNMCS) and School for Studies on Applications of Radioisotopes and Radiation Technologies (SARRT).

**Q.30) Consider the following statements:**

1. India is the world's largest cultivator of bamboo.
2. India has the world's largest fields of bamboo.
3. The eight North-eastern States grow more than 60 percent of India's bamboo.

**Which of the statements given above is/are correct?**

a) 1 and 2 only
b) 3 only
c) 2 and 3 only
d) 1, 2 and 3

**Q.30) Solution (c)**

The National Bamboo Mission, under the Ministry of Agriculture & Farmers' Welfare, has been initiated to provide a boost to livelihood and environmental acreage.

Recently, 22 bamboo clusters in 9 states were virtually inaugurated by Union Minister for Agriculture and Farmers' Welfare and a logo for the National Bamboo Mission (NBM) has also been released.

| Statement 1 | Statement 2 | Statement 3 |
|---|---|---|
| **Incorrect** | **Correct** | **Correct** |
| **India is the world's second-largest cultivator of bamboo after China**, with 136 species and 23 genera spread over 13.96 million hectares, according to the State of Environment report 2018. | **India has the world's largest fields of bamboo.** It grows on nearly 13% of the country's forest land. | **Northeast** consists 60% of India's reserve of Bamboo. The eight North-eastern States – Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura – **grow 67% of India's bamboo** and have 45% of global bamboo reserves. |

**Q.31) Fresh grapes contain 80% of water and dry grapes contain 20% of water. If the weight of dry grapes were 250 kg. What was its total weight when it was fresh?**

a) 1,000 kg
b) 1,100 kg
c) 1,200 kg
d) 1,150 kg

**Q.31) Solution (a)**

The weight of dry grape is 250 kg, In this weight of water is 20%, i.e. 50 kg of water and remaining 200 kg is the weight of the pulp

The weight of pulp remains same both in fresh grapes and dry grapes.

Fresh grapes contain 80% of water and 20% pulp

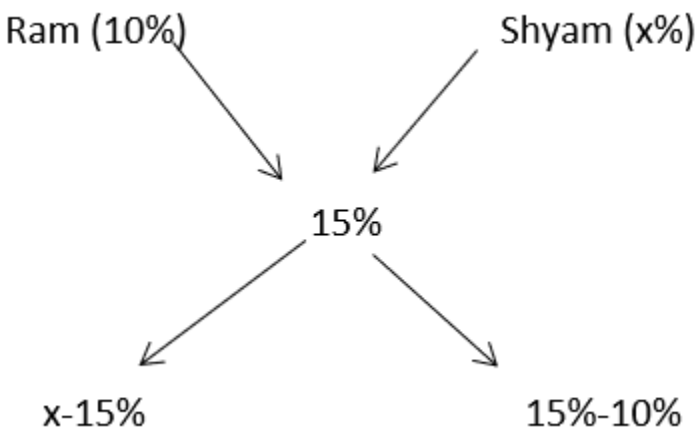
Here 20% of pulp=200 kg and 80% of water which is 200*4=800 kg

Therefore, total weight of fresh grapes is 1,000kg

**Q.32) Weights of two friends Ram and Shyam are in the ratio 4:5. If Ram's weight is increased by 10% and total weight of Ram and Shyam become 82.8 kg, with an increase of 15%. By what percent did the weight of Shyam has to be increased?**

a) 10%
b) 19%
c) 21%
d) 25%

**Q.32) Solution (b)**




Now, given ratio of Ram and Shayam's weight = 4:5

Hence, (x-15)/(15-10) = 4/5

On solving we get, x = 19%

**Q.33) On a test consisting of 80 questions, Anusha answered 90% of the first 40 questions correctly. What percent of the other 40 questions does she need answer correctly for her grade on the entire exam to be 80%?**

a) 50%
b) 60%
c) 70%
d) 80%

**Q.33) Solution (c)**

80% of the entire exam means getting 64 answers correct.

As 90% of the first 40 questions were answered correctly, she already has 36 questions correctly answered. All she needs is to answer another 28 correctly in remaining 40 questions which is nothing but 70%.

**Q.34) In an examination, 34% of the students failed in mathematics and 42% failed in English. If 20% of the students failed in both the subjects, then find the percentage of students who passed in both the subjects.**

a) 40%
b) 42%
c) 44%
d) 46%

**Q.34) Solution (c)**

Failed in mathematics, n (A) = 34

Failed in English, n (B) = 42

$n(A \cup B) = n(A)+n(B)-n(A \cap B)$

$= 34+42-20 = 56$

Failed in either or both subjects are 56

Percentage passed = (100−56) % = 44%

**Directions for the following 1(one) question:**

**Read the following passage and answer the question that follows the passage. Your answer to the question must be based on the passage only.**

North American walnut sphinx moth caterpillars (Amorpha juglandins) look like easy meals for birds, but they have a trick up their sleeves—they produce whistles that sound like bird alarm calls, scaring potential predators away. At first, scientists suspected birds were simply startled by the loud noise. But a new study suggests a more sophisticated mechanism: the caterpillar's whistle appears to mimic a bird alarm call, sending avian predators scrambling for cover. When pecked by a bird, the caterpillars whistle by compressing their bodies like an accordion and forcing air out through specialized holes in their sides. The whistles are impressively loud - they have been measured at over 80 dB from 5 cm away from the caterpillar -considering they are made by a two-inch long insect.

**Q.35) What is the most logical and appropriate summary of the passage?**

a) North American walnut sphinx moth caterpillars will whistle periodically to ward off predator birds - they have a specialized vocal tract that helps them whistle.
b) North American walnut sphinx moth caterpillars can whistle very loudly; the loudness of their whistles is shocking as they are very small insects.

c) North American walnut sphinx moth caterpillars, in a case of acoustic deception, produce whistles that mimic bird alarm calls to defend themselves
d) North American walnut sphinx moth caterpillars, in a case of deception and camouflage, produce whistles that mimic bird alarm calls to defend themselves

**Q.35) Solution (c)**

A new study suggests a more sophisticated mechanism: the caterpillar whistle appears to mimic a bird alarm call, sending avian predators scrambling for cover.

The whistles are impressively loud - they have been measured at over 80 dB.