1.	**Light Pollution - PPP 100 - PRELIMS 2024 - 15** **What is Light Pollution?** • It is the modification of natural light at night, caused by unwanted, inappropriate, or excessive anthropogenic artificial light sources. It's a consequence of industrial civilisation and urbanization. • Building exterior and interior illumination, advertising, outdoor area lighting (such as car parks), offices, industries, street lights, and illuminated stadiums are some of its sources. • Moonlight and starlight serve as important cues for marine organisms and their glow can easily be washed out by artificial light. • **Components** of light pollution include: o **Glare:** Excessive brightness that causes visual discomfort o **Skyglow:** Brightening of the night sky over inhabited areas o **Light trespass:** Light falling where it is not intended or needed o **Clutter:** Bright, confusing and excessive groupings of light sources. **Marine Light Pollution** • When this **artificial light is used excessively or poorly**, it becomes light pollution and disrupts the natural patterns of wildlife, contributing to the **increase in carbon dioxide (CO_2)** in the atmosphere. o The scientists found that 1.9 million km2 of the ocean experience biologically significant amounts of artificial light pollution to a depth of 1 metre. ▪ This represents about 3% of the world's Exclusive Economic Zones (EEZs). o Significant areas of the ocean are seeing **light exposures to depths of 10 metres, 20 metres, or more.**

- In areas with very clear water, the light at night can reach depths of more than 40 metres.

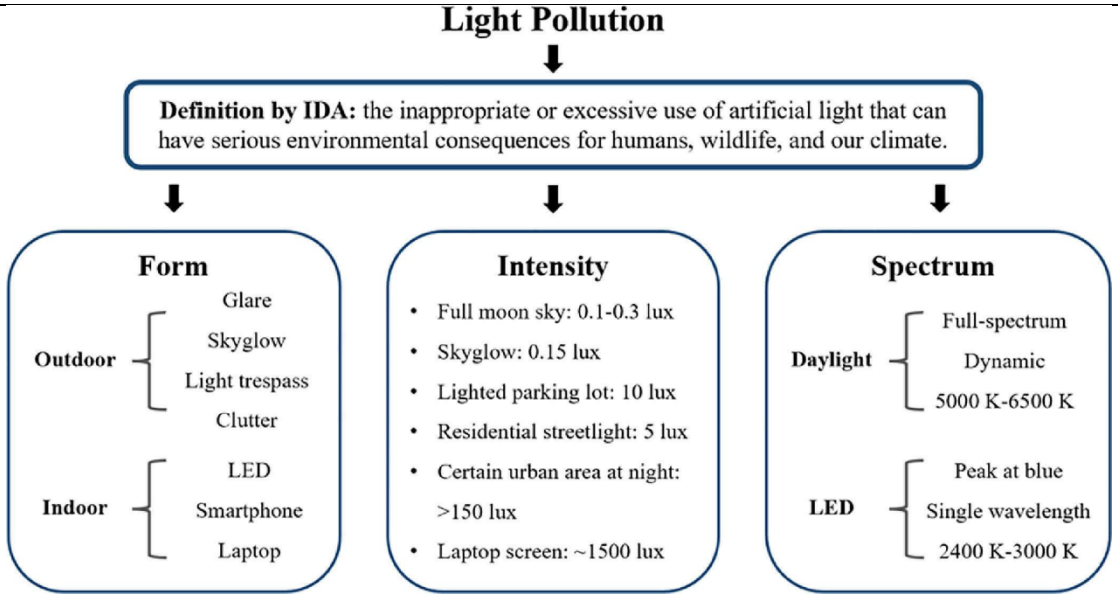
- **Sources:**
  - **Coastal development**(e.g., buildings, streetlights, billboards, ports, piers, docks and, light house).
  - **Vessels**(e.g., fishing and merchant marine vessels), harbours and offshore infrastructure such as oil rigs.
  - Some of the common types of artificial lights in the marine environment are **LED, fluorescent, metal halide, and plasma lamps.**

- **White LEDs produce broad spectrum light that is sensed by a wide range of organisms**and have a peak at short wavelengths (blue and green light) to which many marine organisms are particularly sensitive.

Note:

- The **Earth is getting artificially brighter, at a rate of 2.2% per year.** As a result of these brighter nights, the impacts of **artificial light at night (ALAN)** have become an increasing focus in terrestrial ecology.
  - As per studies, non-natural light increased the brightness of Skyglow, by 9.2-10% every year between 2011 and 2022

- Research has shown that **ALAN is a major form of anthropogenic pollution**that can affect a wide range of biotic processes, including physiology, behaviour, animal movements, species interactions, community structure and reproduction.



Artificial Lightning Affect the Marine Ecosystem

- **Disruption of Normal Cycles:**As per the study, it already took marine organisms an **evolution of over millions of years to adapt to natural light** and now the threat of ever-increasing anthropogenic light pollution has been posing several threats to them.
    - Artificial light can easily **wash out the glow of moonlight and starlight consequently disrupting their hormonal cycles, inter-species behaviour, and reproduction cycles.**
- **Illustration:**For instance, to lay their eggs, female sea turtles try to find a quiet, dark spot and avoid light. However, due to artificial lightning, they may end up not coming ashore at all.
    - Moreover, their hatchlings head toward inland lights instead of moonlight on the water and then die of dehydration or starvation.
- **LEDs Worsening the Impact:**The ever-growing usage of LED lighting is also altering the very nature of artificial light.
- **Suggestion:**
    - Encouraging land-based **Lights Out efforts**(local, state, and regional campaigns to darken skies) to help migrating birds that

are drawn to light at night. It will also benefit marine systems near coastal cities.

- **Increasing the usage of red light in coastal areas**as much as possible and **putting up barriers to shield the coastline from artificial light.**
  - Red light, having the longest wavelength in the visible spectrum, doesn't penetrate as far into the water.

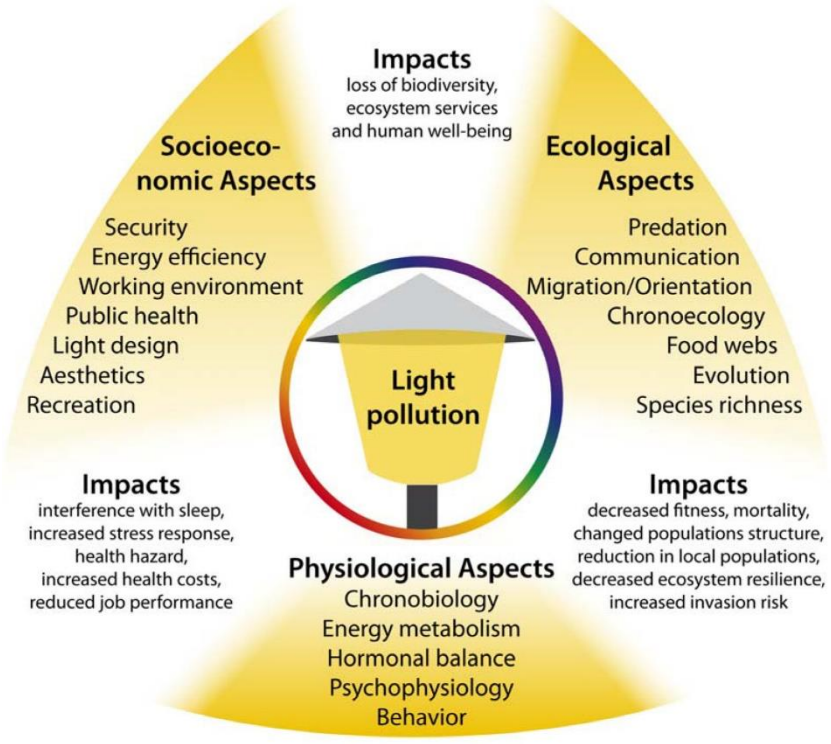
- **Impact of Light Pollution**
- Plants are affected by three characteristics of light: Quantity, quality and duration. Quantity of light refers to the total concentration or intensity of the light. Light quality indicates the wavelength of the light and duration refers to the total period for which light is present. Light pollution has the potential to alter one or more of these characteristics. Broadly speaking, light pollution affects plants by interfering with photoperiodism. Based on their sensitivity to light, plants are classified as long-day plants, short-day plants and day-neutral plants. The presence of artificial light, beyond natural light hours, can disturb the photoperiods of these plants. Several biological activities in plants, such as pigment formation, leave shedding and the onset and breaking of bud dormancy are determined by the photoperiod. The presence of artificial night lighting alters the natural photoperiod and, therefore, upsets the plant's development. Many plant species (such as night-blooming cacti, for example, Queen of the Night *Epiphyllum Oxypetalum*) bloom only at night and depend on nocturnal pollinators for pollination. Increasing lighting can prevent flowering and pollination in such plants and hamper reproduction.

- Similarly, animals are also affected by light pollution. Crepuscular (active only at dusk and dawn) and nocturnal (active only during the night) animals depend on the duration of day (light) length to start / stop their daily activities. Exposure to artificial light interferes with these activities, decreases their chances of finding food and mates and exposes them to predators. While light pollution can potentially affect

any organism, its effects are particularly pronounced on insects, amphibians, sea turtles and migratory birds.

- Artificial light at night is one of the prominent causes of global decline of insects. Amphibians are sensitive to ambient light and can detect light intensity at far below human limits. Amphibians perform their mating calls at night. Long exposure to artificial light can interfere with this process and affect their reproductive success.
- Sea turtles lay their eggs on beaches. When the eggs hatch, the hatchlings find their way to the sea by detecting the bright horizon over the ocean. However, artificial lights on the coasts draw them away from the ocean and in the wrong direction. This process exposes them to several dangers.
- Light pollution also affects endangered leatherback and loggerhead sea turtles. On Canada's Atlantic coast, baby turtles on beaches look for moonlight reflecting from the water. This helps them find their way to the ocean. But light pollution can lead them to cities instead. Because of this, fewer sea turtles reach maturity and breed. This puts the survival of the species at even more risk.
- Nocturnal birds use moonlight and starlight for navigation and hunting and thus, become disoriented by a large amount of artificial light. The collision of birds with brightly lit high-rise buildings, lighthouses, wind turbines and sea-based drilling platforms results in the death of numerous birds and is a common phenomenon in many cities.
- Light pollution makes migration difficult for many birds. The Prothonotary warbler depends on stars to find its way from Ontario to the Gulf of Mexico. But light from tall buildings and outdoor advertisements hides its view of the night sky. This means fewer birds survive to reach the areas where they breed or find food during the winter.

- Artificial light causes major sleep disturbances in humans. The circadian clock, which is a 24-hour day / night cycle, affects physiologic processes in practically all organisms. Brain wave patterns, hormone generation, cell regulation and other biologic functions are examples of these processes. In human beings, disruption of circadian clock has been associated with a variety of medical issues, including depression, sleeplessness, cardiovascular disease and cancer.



- Photoreceptors are light-sensitive cells in the retina. The retina is found at the back of your eye. Photoreceptors are responsible for converting light into signals. Our brain interprets these signals as images of the world around us. There are three types of photoreceptors - rods, cones and intrinsically photosensitive retinal ganglion cells or ipRGCs. **Rods help us see light and dark**. They are very sensitive to light. **Cones help us to see colours. Glare can hurt your eyes because it can damage or kill rods and cones.** This can lead to vision loss or impairment. Scientists think ipRGCs help rods respond to light at many different brightness levels. They

may also help regulate circadian rhythms. Circadian rhythms are like an internal clock that our bodies follow every day. Many circadian rhythms are controlled by the light signals around us. So light pollution can disrupt our circadian rhythms.

- The photoperiodism is a phenomenon of plants in response to the length of light and dark period in a day. The changes in the light period and dark period duration are considered as photoperiods. In plants photoperiodism involves in the maintaining the flowering process. On the basis of the response towards photoperiodism the plants are classified into short day plants and long day plants.

Short day plants	Long day plants
The short day plants are those plants that bloom flower in day length shorter than the critical point.	The long day plants are those that bloom when they are exposed to days longer than the critical point.
The short day plants need continuous dark periods.	The long day plants need light periods and it is critical for these plants.
The short day plants do not bloom if the dark period is interrupted by a flash of light.	The long day plants bloom more effectively if the dark period is interrupted by a flash of light.
The gibberellic acid in short day plants does not induce flowering process except in balsam.	The gibberellic acid induces the flowering process in long day plants.
The short day plants are also considered as long night plants.	The long day plants are also considered as short night plants.
The short day plants bloom normally in early autumn or spring.	The long day plants bloom in spring and early summer.
Green grams, marijuana, cotton, soyabean, jowar and rice are examples of short day plants.	Wheat, henbane, carnation, lettuce, barley and oats are the example of long day plants.

- Some of the plants like; rice, cucumber, and corn are considered as day-neutral plants because their blooming process is regardless of the length of the light period like the long day and short day plants.

- **Reduction of Light Pollution**
- Reducing light pollution implies many things, such as **reducing sky glow, reducing glare, reducing light trespass, and reducing clutter.**
- The method for best reducing light pollution, therefore, depends on exactly what the problem is in any given instance. **Possible solutions include:**
    - Utilizing light sources of minimum intensity necessary to accomplish the light's purpose.
    - Turning lights off using a timer or occupancy sensor or manually when not needed.
    - Improving lighting fixtures, so that they direct their light more accurately towards where it is needed, and with less side effects.
    - Adjusting the type of lights used, so that the light waves emitted are those that are less likely to cause severe light pollution problems.
    - Evaluating existing lighting plans, and re-designing some or all of the plans depending on whether existing light is actually needed.
- **Initiatives taken**
- **International Dark-Sky Association (IDA):** Global organization protecting the night sky and reducing light pollution through guidelines and dark sky preserves.
- **Globe at Night:** Citizen science campaign reporting light pollution levels to raise awareness and support reduction efforts.
- **International Year of Light (IYL):** UN initiative promoting sustainable lighting practices and addressing light pollution.
- **The Dark Sky Scotland Project:** Promotes dark skies in Scotland through collaboration and implementation of effective lighting solutions.

2. Why Andaman and Nicobar Islands are key to Indo-Pacific security?

- The Andaman and Nicobar Islands, historically significant due to their use as a penal colony by the British following the **1857 War of Independence**, have evolved into a strategic asset for India. Their geographical location and the historical context of near loss to foreign powers underscore their importance. The liberation of these islands during **World War II by the INA** and subsequent developments highlights their strategic significance.
- **Issues**
- *Historical Context and Strategic Neglect*: Initially, after the 1857 War of Independence, the British established a penal colony in the A&N islands, which later became known as **Kalapani**. Post-independence, the islands suffered from benign neglect by New Delhi until a Chinese submarine was reportedly sighted in 1962, prompting the establishment of a naval garrison.
- *Japanese Occupation and INA's Role*: During World War II, the islands were occupied by the Japanese and were symbolically liberated by **Netaji Subhas Chandra Bose and the Indian National Army (INA) in 1943**. However, the British reoccupied the islands after the Japanese surrender in 1945.
- *Post-Independence Security Concerns*: Post-independence, there were moments when the sovereignty over the islands was questioned or threatened, notably during the **1965 India-Pakistan** hostilities and the post-Kargil War period. These instances underscored the islands' strategic vulnerability.
- *Establishment of **Andaman Nicobar Command** (ANC)*: In response to security reviews and the strategic importance of the islands, the ANC was established in 2001 as India's first joint/unified operational comman Despite its success, the model has not been widely replicated in the Indian military.
- *Geographical Significance and Threats*: The unique geography of the A&N islands, located near critical maritime routes and neighboring countries, presents both strategic opportunities and vulnerabilities. The

possibility of surreptitious occupation by neighboring states and the frequent transits of Chinese naval vessels highlight the need for robust security measures.

- *Security Infrastructure and Maritime Domain Awareness*: The ANC must maintain comprehensive maritime domain awareness and be equipped with adequate defensive and offensive capabilities to deter intrusions and manage threats, including from state and non-state actors.
- *Strategic Importance in the Indo-Pacific Region*: The A&N islands are crucial for monitoring and controlling the flow of maritime traffic through the **Strait of Malacca**, a critical choke point for global trade and oil shipments. This strategic position offers India the potential to project power and foster cooperation with like-minded partners in the Indo-Pacific region.
- *Future Strategy and Regional Cooperation*: The reported security infrastructure upgrades are part of a broader strategy to transform the A&N islands into a maritime bastion. This strategy aims not only to enhance India's defensive capabilities but also to enable it to play a more significant role in regional maritime cooperation, including disaster relief, anti-piracy efforts, and ensuring peace and tranquility in the Indo-Pacific.

Road ahead

- *Strengthening the Andaman Nicobar Command (ANC)*: The ANC should be further strengthened with advanced defensive and offensive capabilities, including anti-submarine warfare assets to counter the presence of Chinese naval forces. This includes deploying additional surface ships, submarines, and maritime patrol aircraft with modern sensors and weapons. Rapid-reaction forces should be enhanced with amphibious and airlift capabilities to ensure swift deployment and mobility across the archipelago.
- *Networked Maritime Domain Awareness*: Implement a comprehensive maritime domain awareness system by integrating radars, satellites, unmanned vehicles, and aircraft to monitor and secure the vast maritime zone around the A&N Islands.

- *Diplomatic Engagement and Regional Cooperation*: India should actively engage with like-minded countries to foster cooperation and ensure maritime security in the Indo-Pacific. This includes conducting joint naval exercises, sharing intelligence, and collaborating on marine surveillance.
- *Port Blair as a Regional Hub*: Transform Port Blair into a regional hub for navies, focusing on interoperability in disaster relief, medical aid, anti-piracy operations, and search and rescue missions. This initiative would not only enhance regional maritime security but also build goodwill among neighboring countries.
- *Strategic Infrastructure Upgradation*: Accelerate the development of **strategic infrastructure on the A&N Islands**, including upgrading naval bases, airfields, and surveillance facilities. This would enhance India's ability to project power and monitor strategic sea lanes.
- *Addressing the "Malacca Dilemma"*: The **Great Nicobar Island's** strategic location should be utilized to monitor and, if necessary, control the western entrance/exit of the **Malacca Strait**. This positioning should be leveraged to ensure the security of one of the world's busiest sea lanes, addressing concerns about the **"Malacca Dilemma."**

- Recent efforts to upgrade security infrastructure in the Andaman and Nicobar Islands are crucial for enhancing India's strategic posture in the Indo-Pacific region. These islands not only serve as a vital point for monitoring key maritime routes but also offer opportunities for India to project power and foster regional cooperation. The focus on these islands aligns with broader strategic objectives to ensure peace and stability in the region.

3. Climate and its characteristics

Climate is the long-term accumulation of the atmospheric components (and their changes) that, in the short term, consist of weather at a specified place.

World climates are classified as hot-wet equatorial climates, savanna climates, tropical monsoon climates, desert climates, steppe climates, Mediterranean climates, Warm Temperate Eastern Margin Climates, British type climates, taiga climates, Laurentian climates, and polar climates.

World Climate:

1. **Hot, Wet Equatorial**

- **DISTRIBUTION**
- 50N – 100S from the equator
- The absence of trade winds will result in a monsoon-like climate if you move away from this.
- Basically, a hot, damp environment, however, there are some cool places, such as Cameron Highlands in Malaysia, due to their high altitude.
- Examples are Ecuador, Colombia, Brazil, Peru, Nigeria, Liberia, Myanmar, Thailand, Cambodia, Malaysia, Java
- **CLIMATE**
- There is great uniformity of temperature throughout the year.
- The average monthly temperature is consistently between 24 and 27°C, with very little variance.
- There is no winter.
- The diurnal and annual range of temperature is small.
- Between 6 and 10 inches of heavy, evenly spaced-out precipitation fall each year.
- Its defining attribute is the two-fold rainfall peaks that occur around the equinoxes.
- **NATURAL VEGETATION**
- Supports a luxuriant type of vegetation – the tropical rainforest.
- Amazon tropical rain forest is known as Selvas.
- Numerous evergreen trees that produce tropical hardwoods including mahogany, ebony, greenheart, and cabinet wood are found there. Also dyewoods.
- Lianas, epiphytic and parasitic plants are also found.
- In such vegetation, trees of a single species are rare.

2. **Savanna or Sudan Climate (or Tropical Wet and Dry Climate)**

- Between equatorial woods and trade wind-heated deserts, the savanna or Sudan climate can be found.
- It is restricted to the tropics (Tropics of Cancer and Capricorn) and is most developed in Sudan, where dry and wet climates are most distinct, therefore the name Sudan climate.
- It covers much of Africa (Keya, Nigeria, Gambia) as well as large areas of Australia, South America (Brazilian highlands), and India.
- The Savana Climate features a distinct dry season in the winter compared to other world climates. The region's rainfall is concentrated throughout the summer. Much vegetation dies during the lengthy dry season, and waterways dry up, causing animals to migrate.

DISTRIBUTION

- It is located on either side of the equator in tropical latitudes. It is well developed in Sudan, where there are distinct rainy and dry seasons, hence the name.
- Africa (African Sudan, East Africa) and South America have this climate in the northern hemisphere (Llanos grasslands of Orinoco river basin).
- This climate is prevalent in Australia, South America (Campos grasslands of the Brazilian Highlands), and the southern hemisphere (in Northern Australia – south of its monsoon strip).

TEMPERATURE

- For lowlands, monthly temperatures in this area might vary from 20 to 32 degrees Celsius, but the range widens as one gets farther from the equator.
- The annual average temperature is around 18 degrees centigrade
- The greatest temperature is in April in the northern hemisphere and October in the southern hemisphere, right before the start of the rainy season. The summer solstice falls in the northern hemisphere in June, but it is not the hottest month.

- A cloudy sky causes temperatures to fall during the rainy season. Midday temperatures frequently exceed 37 degrees Celsius in the summer.
- Temperatures dip below 10 degrees centigrade even in the hot season due to rapid radiation loss at night caused by clear skies. A frequent occurrence during this season is night frost.
- Thus, a typical characteristic feature of the Savanna climate is the extreme diurnal range of temperature.

PRECIPITATION

- The region is characterized by a hot, rainy season and a cool, dry season.
- The hot and humid season lasts from May until September in the northern hemisphere (e.g., Kano, in Nigeria). The remainder of the year is chilly and dry. Over 80 centimetres of rain occur annually in Kano, which is more than 1500 metres above mean sea level, with the majority of it falling during the summer.
- In the southern hemisphere, the rainy season begins in October and ends in March.
- As one proceeds away from the equator and towards the desert borders, the length of the rainy season and total annual rainfall both decrease significantly.

WINDS

- The prevailing winds of the region that deliver rainfall to the coastal areas are known as trade winds. Easterly breezes blow from east to west, so rainfall is most on the east coasts.
- In the summer, when the ITCZ is located over a scorching desert, they are at their strongest. They move over the coastal regions, expelling all the moisture, and by the time they get to the interiors of the continent, they are comparatively dry.
- The easterly trade winds in West Africa blow offshore, bringing dry, dusty winds from the Sahara to the coast of Guinea. This hot, dry, dusty breeze is referred to locally as "the doctor" or "Harmattan."

- Although Harmattan has a terrible impact on the crops, it also has a cooling effect. By speeding up evaporation, it offers some relief from Guinea's humid air.
- Trade winds are to blame for the region's distinct, alternating dry and wet seasons. Rainfall is brought on by onshore trade winds during the summer. Off-shore winds keep the weather dry during the winter.

VEGETATION

- Tall grass and little trees make up much of the local vegetation. 'Parkland' or 'bush-veld' are other terms for grassland.
- Along with the river banks, tree cover is maximum towards the equator and declines in density and height further from it.
- The trees are deciduous, which means they lose their leaves in the cool, dry months to reduce transpiration losses. Acacia is a classic representative of this kind.
- Other tree varieties include those with wide trunks that function as water reservoirs to assist them to endure dry spells or droughts. For instance, bottle trees, baobabs, etc.
- They are hardwood trees, sometimes thorny, which exude gum like the 'gum Arabic.
- This region's grass is unusually tall and coarse, reaching heights of 6-12 feet. **Elephant grass**, the highest type of grass, may reach heights of 15 feet.
- The grass is dense, with lengthy roots that stretch down for water. The grass appears dormant throughout the dry season and blooms during the rainy season.
- As one approaches the desert, the grasses give way to prickly shrubs.

WILDLIFE

- The savanna is home to some of the world's largest terrestrial species.

- The two main groups of animals include – herbivores and carnivores.
- Zebra, giraffe, elephant, antelope, and other savanna herbivores are well-known. Herbivores are either blessed with exceptional speed to flee or have camouflage abilities to avoid carnivores.
- This region's carnivores include lions, hyenas, leopards, panthers, pumas, and jaguars, among others. For attacking other animals, they have powerful jaws and teeth.
- Aside from rhinos and hippos, reptiles such as crocodiles, monitor lizards, and giant lizards can be found in rivers and marshy areas.

3.World Climate: Tropical Monsoon Climate

- The area between the Tropics of Cancer and Capricorn is home to the monsoon climate, commonly referred to as the tropical monsoon climate.
- The inter-tropical convergence zone (ITCZ), which moves through the area, influences its world climate, which is hot and muggy throughout the year.
- Monsoons are seasonal breezes that blow over land from the oceans and vice versa.
- They are distinguished by a seasonal reversal in wind direction, which causes temperature and precipitation changes.
- Summer, winter, and rainy seasons are the three prominent and distinct seasons of this climatic region.

DISTRIBUTION

- They are confined within 5 – 30 degrees latitudes on either side of the equator.
- Thailand, India, and Indo-China (Laos, Vietnam, and Cambodia). This world climate can be found in southern China and northern Australia.

WINDS

- Seasonal wind reversal is caused by the differential pace of heating and cooling of continental landmasses and seawaters.

- During the summer, as the sun passes overhead the Tropic of Cancer, a low-pressure zone forms over Central Asia. As a result, the Asian continent warms quicker than the surrounding oceans, which remain at a higher pressure in the northern hemisphere.
- In the southern hemisphere, winter conditions prevail, leading to a high-pressure zone over northern Australia.
- Winds blow out from the Australian landmass towards Java (Indonesia) and are drawn to the low-pressure region over the Indian subcontinent after crossing the equator due to the Coriolis force. These are the South-West monsoon winds.
- During winters, a reversal in the wind direction occurs.

TEMPERATURE

- Summers are warm to hot due to the region's proximity to the tropics.
- The average monthly temperature is over 18 degrees Celsius, however, in the summer, the maximum temperature can reach 45 degrees Celsius.
- The average temperature in the summer is around 30 degrees centigrade, with an overall temperature range of 30 to 45 degrees centigrade.
- Winter temperatures range from 15 to 30 degrees Celsius. In the winter, the average temperature is around 25 degrees Celsius.

PRECIPITATION

- The region receives a lot of rain in a short period of time.
- The annual average rainfall is roughly 200-250 cm. However, some areas have a very high average of around 350 cm.
- Maysynram and Cherrapunji in the Khasi Hills (Meghalaya) receive over 1000cm of rain per year. They are positioned on the hills' windward side, resulting in significant orographic rains (caused by a lift of the monsoon winds). These areas receive a lot of rain because of their placement between mountains, which generates a

concentration of rain-bearing clouds, also known as the funnelling effect.

SEASONS

- Unlike the tropical world climate, which has no distinct seasons, the monsoon climate has significant seasonal changes in meteorological conditions.

THE HOT DRY SEASON

- This lasts from March to mid – June.
- The sun is in a northward shift to the Tropic of Cancer. This causes the temperatures to rise sharply.
- In Central India, average daytime temperatures exceed 35 degrees Celsius. Temperatures in Sindh and south India can reach 44 degrees Celsius.
- Temperatures are lower at the seaside due to the influence of sea breezes.
- Except for the occasional thunderstorms, there is little rainfall during this season.

THE RAINY SEASON

- This lasts from mid – June to September
- The rains begin with a monsoon 'burst' over the subcontinent. It causes torrential rains over the country.
- During this season, the country receives more than 70% of its annual rainfall.
- This is a typical aspect of the monsoon type of climate, with concentrated heavy rainfall throughout the summer months.

THE COLD DRY SEASON

- This season begins in October and lasts until February.
- Also known as the receding monsoon season. The southwest monsoon begins to withdraw southwards when the sun begins its southward journey, eventually leaving the Indian landmass entirely.
- As the land mass's temperatures start to drop, the Indian subcontinent experiences a higher pressure than the nearby seas.

This makes the winds blow away from the continent and toward the sea.

- In the months of November and December, winds from the northeast start to blow over the Bay of Bengal, bringing some rain to India's southeast coastline area.
- The Western Disturbances bring some rain and snow to the north, but overall the area is dry. Winter crops require frontal (cyclonic) rains brought on by the western disturbances in order to survive.

MONSOON FORESTS

- Also known as the Tropical Monsoon Forests.
- The majority of these are deciduous trees, which have a specific season for leaf loss. To reduce transpiration losses during the dry/drought season, they shed their leaves.
- They are classified as moist deciduous when the annual rainfall exceeds 150cm and dry deciduous when the annual rainfall is less than 150cm.
- Similar to equatorial rainforests, they consist of broad-leaf hardwood trees. However, the forests are less dense, more open, and have a smaller variety of species (flora as well as fauna).
- Evergreen rainforests of the tropical kind can be found anywhere there is a rainfall of more than 200–250 cm. These are prevalent in India's Andaman and Nicobar islands, forests in the northeast, and the southern Western Ghats. Southeast Asian islands also include them.
- Savanna-like grasslands with sporadic trees are present anywhere there is little rainfall.
- As a result, monsoon vegetation ranges from thick forests to thorny scrublands (savanna).

4.World Climate: Desert Climate

- Desert regions are distinguished by little rainfall and sparse vegetation. The growing season is restricted to a brief rainy season.

- Due to a lack of moisture and food, the region's landscape is devoid of plants and animals.
- They can be of two types:
- **hot deserts**– like the Saharan desert
- **mid-latitude deserts**– like the Gobi desert.

HOT DESERTS – DISTRIBUTION

- The world's most important hot deserts are located on the western margins of continents between latitudes 15 to 30 degrees north and south.
- The Sahara desert, which has an extent of 3.5 million square miles, is the largest of the hot deserts. The Great Australian Desert, Arabian Desert, Kalahari Desert, Thar Desert, and others are notable examples of hot deserts.
- America also contains hot deserts. They are referred to in North America as the Mohave, Sonoran, Californian, and Mexican deserts. They run from the United States to Mexico. The Atacama or Peruvian deserts are found in South America.

HOT DESERTS – TEMPERATURE

- These deserts have some of the highest temperatures on earth and experience scorching weather all year round.
- They do not have a distinct cold weather season.
- Summertime averages are consistently above 30 degrees Celsius.
- Libya had the highest recorded temperature in 1922. The temperature increased to a maximum of 57 degrees Celsius.
- Such high temperatures are caused by clear skies, intense insolation, dry air, and a quick rate of evaporation.
- However, because of the regulating effect of the seas, the coastline regions of these deserts enjoy a comparatively temperate climate. The cooling influence of cold currents also lowers the region's typical temperatures.
- The interior regions experience extreme temperatures – hot summers and cold winters.

- The temperature varies greatly throughout the day. The temperature rises with the sun during the day due to strong solar radiation, dry air, and clear skies.
- However, as soon as the sun sets, the mercury falls below the mean temperature because of the constant radiation-driven heat loss and the lack of cloud cover that would normally trap the heat.
- The average diurnal range of temperatures is around 14 to 25 degrees centigrade.
- During winter nights, frost is a common occurrence.

HOT DESERTS – PRECIPITATION

- The average annual precipitation in these regions is not more than 25 cm.
- These deserts are situated in the Sub-Tropical High-Pressure Belts, often referred to as the Horse Latitudes, where the air masses are descending, making it difficult for clouds that could produce precipitation to form.
- The Trade Winds, which blow offshore and prevent any moisture-laden winds from the sea from blowing over these regions, are the dominant winds in these areas.
- On-shore westerlies do not pass over desert areas, which lowers the likelihood of any precipitation.
- The relative humidity of the winds that travel over deserts is reduced since they originate in cooler climates. This lessens the likelihood of water vapour condensation and consequent precipitation.
- From 60% in the coastal regions to less than 30% in the interior, relative humidity falls. This makes these desert regions permanently dry by increasing the rate of evaporation and decreasing the likelihood of precipitation.
- Desiccating these deserts is the result of the cold currents that travel over the west coasts of the continents. Only drier winds blow

over the deserts because any sea-borne winds carrying moisture condense into mist or fog over the cold currents.

- However, convectional rainfall occurs in these areas for shorter periods of time in the form of intense thunderstorms. Landslides are a common and disastrous result of these abrupt downpours.
- With less than 2 cm of annual precipitation, the Atacama Desert is the driest place on earth.

MID-LATITUDE DESERTS – DISTRIBUTION

- These deserts are frequently found on plateaus and are found in continental interiors.
- They include the Gobi desert, Turkestan desert, Patagonian desert, etc.
- In India, the Ladakh desert falls under this category.

MID-LATITUDE DESERTS – CLIMATE

- The world climate conditions of these deserts are comparable to those of hot deserts in many aspects.
- Because these deserts are located far from the shore or are surrounded by high mountains, they are shut off from the moisture-laden breezes blowing from the seas.
- Average annual precipitation does not exceed 25 cm.
- However, depressions may infrequently enter these Asian deserts, bringing wintertime little precipitation. Convectional precipitation is a possibility in the summer.
- These areas see a wider range of yearly temperatures than hot deserts. Continentality, a phenomenon linked to landmasses located far from the coast, is the cause of these severe temperatures.
- These areas have extremely cold winters with subfreezing temperatures. In rare cases, summertime ice thawing results in widespread flooding.

DESERT VEGETATION

- All deserts have some form of vegetation such as grass, scrub, weeds, etc.
- Although they may not always appear green, they are dormant and waiting for unpredictable rainfall.
- The xerophytic or drought-resistant scrub is the most prevalent plant type in both hot and mid-latitude deserts.
- Bulbous cactus, long-rooted wiry grasses, thorny bushes, and dwarf acacia are some significant species of this kind.
- Clusters of date palms can be found in a few places with plenty of groundwater, particularly in hot deserts.
- These areas support a unique species of vegetation that has evolved to withstand extreme aridity.
- Due to the lack of moisture, which decreases the pace at which organic matter decomposes, soils are lacking in humus.
- These desert shrubs have a sophisticated network of extended roots that expand in quest of moisture. To reduce water loss through transpiration, they have few or no leaves and foliage that is hairy, waxy, or needle-shaped.
- These plants' seeds, which have thick, hard exterior surfaces, have unique defences to keep them safe while they're dormant. They begin to sprout as soon as the rain moistens them.

LIFE IN THE DESERTS

- Despite their inhospitable conditions, different types of human settlements have come up in these deserts
- Primitive hunters and gatherers: These are tribes that do not domesticate any animals or grow any crops. They include the Bindibu, the Australian Aborigines, and the Bushmen of the Kalahari Desert.
- Nomadic herdsmen: They survive off of their herds and travel through the deserts in quest of water and lush pastures. They consist of the Mongols of the Gobi Desert, Tuaregs of the Sahara, and Arabian Bedouins.

- Settled cultivators: They have survived close to rivers such as the Nile in Egypt, Indus in Pakistan, Colorado in the USA, and Tigris-Euphrates in Iraq. They cultivate crops like wheat, barley, sugarcane, fruits, and vegetables
- Mining settlers: Prominent among these include the gold mines in Australia, Diamond mines in Kalahari, Copper mines in Chile, Silver mines in Mexico, and Oil in the Persian Gulf countries.

5.World Climate: Steppe Climate

- The term steppe refers to a region that is a semi-desert with grassland or shrub vegetation.
- Steppes are intermediate regions, not receive enough rainfall to support a forest but are also not as dry as a desert.
- The Steppe Climatic region is also known as Temperate Grasslands.
- These grasslands are some of the most developed agricultural fields and are termed grain baskets.
- Livestock ranching is another major activity carried out in these areas due to the availability of natural grasses.

DISTRIBUTION

- Steppes are found in the continental interiors.
- They are usually found in temperate latitudes and hence come under the influence of Westerly winds.
- Steppes are characterized by vast grasslands which are, by and large, devoid of trees.
- Steppes typically refer to the vast temperate grasslands of Eurasia, which stretch between the Black Sea coast on the east to the Altai mountains in the west, covering a length of over 2000 miles.
- Steppes are known by their regional names in different parts of the world. They include,
- Prairies – North America
- Pustaz – Hungary
- Pampas – Argentina and Uruguay

- Velds (High Veld) – South Africa
- Downs – Australia
- Canterbury – New Zealand

PRECIPITATION

- The average annual rainfall over the steppes varies from 25 to 75 cm, depending upon the region.
- The highest rainfall occurs in the spring season, or just prior to the onset of summer. In the northern hemisphere, it occurs in the months of June and July.
- During the winters, Westerlies bring in occasional depressions which often cause snowfall over these regions. However, the overall precipitation in the winter is low, at an average of 25 cm.
- In the southern hemisphere, due to a larger influence of maritime weather, higher rainfall occurs over these regions as compared to their counterparts in the northern hemisphere.

TEMPERATURE

- These regions are under the effect of continentality and hence experience extremities in temperature.
- Summers are warm with the average temperature in the range of 18-20 degrees centigrade.
- Winters are usually cold with occasional snowfall.
- The steppes in the northern hemisphere have a very high annual range of temperatures.
- In contrast, the steppes in the southern hemisphere, due to maritime influence, have a moderate climate throughout the year.

WINDS

- The prevailing winds of these regions are the Westerlies, which are responsible for precipitation during the winters.
- Apart from these, there are many local winds that blow over these regions and have a significant impact on the local weather.

- They are known by various names such as Mistral (France), which is cold dry wind; Loo (Gangetic plains), Sirocco (Sahara), Foehn (Alps), etc. are warm, dry winds.
- Over the North American Prairies, the Chinook is a hot, dry local wind. Flowing from the southwest, it is a katabatic wind that is descending from the Rocky Mountains.
- It is a scorching breeze, and in only 20 minutes it elevates the temperature in the area by more than 5 degrees centigrade.
- Because it melts the snow covering the pastures so the animals may graze there, it is helpful for local agriculture.

VEGETATION

- In contrast to tropical savanna grasslands, which are interspersed with trees, temperate grasslands are nearly treeless. Furthermore, the grass in these grasslands is substantially shorter than in the savanna.
- Unlike the coarse grass found in savannas, the grass here is fresh and healthy. This is primarily true for North American prairies, as well as the Chernozem grasses of Ukraine. The prairie soils are also rich in nutrients.
- The grass is lean, thin, and scattered.
- This makes them suitable for ranching, or large-scale cattle husbandry.
- The grass growing season lasts all year, despite seasonal fluctuations in temperature and precipitation.
- Conifers can be found in a transitional zone of woods near the poleward spread of prairies.
- Trees are placed around croplands in steppe farmlands to protect them from severe winds.

6.Mediterranean Climate (Western Margin Climate)

- The Mediterranean climate or warm temperate western margin climate is found between 30o and 45o North and South of the Equator.

- This climate is found in relatively few regions of the planet and is nearly entirely restricted to the western borders of continental landmasses.
- The basic cause of this climate is the seasonal shift of the wind belts.

DISTRIBUTION

- Central Chile,
- California (around San Francisco),
- The south-western tip of Africa (around Cape Town),
- Southern Australia (in southern Victoria and
- Around Adelaide bordering St, Vincent, and Spencer Gulfs), and south-west Australia.

CLIMATE

- The Mediterranean climate is distinguished by its dry, warm summers and rainy, chilly winters, as well as local winds.

DRY, WARM SUMMERS WITH OFF-SHORE TRADE WINDS

- During the summer, the sun is directly overhead the Tropics of Cancer and Capricorn.
- The Westerlies' influence belt has drifted poleward, and rain-bearing tradewinds are expected to be off-shore.
- Thus, the areas basically experience no summertime rain, remaining dry.
- The heat is intense and the days are excessively warm.
- Durable droughts are frequent in the interior. There is typically little relative humidity.
- Summer temperatures are relatively high, with the highest recorded temperatures occurring away from the shore in the continental interiors of the Balkan peninsula, the Anatolian plateau, and the Mediterranean Middle East.

WET, COLD WINTERS WITH ON-SHORE WESTERLIES

- During the winter months, the Westerlies belt swings equatorward, bringing on-shore Westerlies to the Mediterranean.

- Hence, these lands receive almost all of their precipitation during the winter months.
- In September and October in Mediterranean Europe, the rain falls in torrential downpours and causes flooding.

LOCAL WINDS

- Because of the topography of the region, which includes the Alps in the north, the Sahara desert in the south, continental interiors in the east, and the open Atlantic in the west, the Mediterranean climatic region in Europe experience several local winds. Temperature, pressure, and precipitation all vary greatly as a result. The two most important local winds are:

SIROCCO

- This is a hot, dry, and dusty wind.
- It originates in the Sahara desert and can happen at any time of the year, but it's most common in the springtime.
- Normally it lasts only for a few days.
- It blows into the Mediterranean Sea from the interior Saharan desert and is typically connected to Atlantic Ocean depressions.
- Although it is significantly cooled after crossing the Sea due to the absorption of water vapour, the heat causes the local vegetation and crops to wither.
- Hence it is also called "Blood Rain" because it is carrying the red dust of the Sahara desert.

MISTRAL

- Mistral is a cold wind from the north.
- It rushes down the Rhone valley, accelerating due to the valley's funnelling action between the Central Massif and the Alps [Plateau in France].
- In very severe situations, the wind's velocity can be so strong that trains and trees can be uprooted.
- In winter, if the Mistral is frequent the temperatures could go below the freezing point.

OTHER LOCAL WINDS

- Bora: Cold north-easterly wind along the Adriatic coast.
- Tramontana and Gregale: cold winds in the Mediterranean Sea.

NATURAL VEGETATION

- The vegetation of the region is not luxuriant.
- Trees with small broad leaves are widely spaced.
- This climate's distinctive lack of shade and the growth that occurs nearly exclusively in the fall and spring are other peculiarities.
- Heat, dry air, high evaporation, and protracted droughts are continuous targets of plants.
- Hence they are generally xerophytic or drought resistant in nature.

TYPES OF MEDITERRANEAN VEGETATION:

- The vegetation consists of Evergreen forests, evergreen coniferous forests, grass, bushes and shrubs.

EVERGREEN FORESTS

- They are open forests with evergreen oaks, only found in climatically favourable areas with annual precipitation of over 25 inches.
- The cork oaks are used for making wine-bottle corks.
- In Australia, the eucalyptus forests replace the evergreen oak.
- The giant sequoia or redwood is typical of Californian trees.

EVERGREEN CONIFEROUS FORESTS

- They include various kinds of pines, firs, cedars, and cypresses.
- Where there are fewer severe droughts and higher temperatures, they are more common.

BUSHES AND SHRUBS

- This is the most prominent type of Mediterranean vegetation.
- The low bushes grow in scattered clumps and are often thorny.

GRASS

- Because most of the rain falls during the cool season, when development is slow, the conditions in this region are unsuitable for grass.
- They are generally wiry and bunchy and are not suitable for animal farming.
- Thus cattle rearing is not an important occupation in the Mediterranean

7.Warm Temperate Eastern Margin Climate

- It is located near the eastern edges of the continents between 20 and 35 N and S latitude.
- The region has a monsoonal climate, with rain in the summer and dry weather in the winter.

VARIATIONS OF WARM TEMPERATE EASTERN MARGIN CLIMATE

- **China Type**: Temperate monsoon or China type is found in most parts of China and is a modified form of monsoonal climate.
- **Gulf Type:** Though less pronounced, the overall climate resembles the China Type. It is found in the southeastern parts of the USA bordering the Gulf of Mexico. The continental heating during summers induces an inflow of air from the cooler Atlantic Ocean.
- **Natal Type**: In Southern Hemisphere, this climate is witnessed in New South Wales, Natal, and Parana-Paraguay-Uruguay basin. This is often referred to as the Natal Type of climate and is influenced by the on-shore Trade winds all around the year.

CLIMATE

- It is typified by a warm moist summer and a cool, dry winter.
- Occasionally, the penetration of cold air from the continental interiors may bring down the temperature to the freezing point.
- The relative humidity is a little high in mid-summer but most of the time, the climate is pleasantly warm.
- Rainfall is more than moderate and ranges between 60 cm to 150 cm and there is a uniform distribution of temperature throughout the year.

- Rain comes either from convectional sources or as orographic rain in summer, or from depressions in prolonged showers in winter.
- Local storms also occur. Examples: typhoons, and hurricanes.
- The rainfall is adequate for all agricultural purposes and hence the areas are densely populated.

CHINA TYPE

- It is the most typical of the warm temperate eastern margin climate.
- In summer due to intense heating of the continental interiors of the heart of Asia including Tibet, a low-pressure system is set in which attracts the tropical Pacific air stream.
- This is witnessed as the South-East monsoon in the region.
- In winter, there is intense high pressure over Siberia and the continental polar air stream flows outwards as the North-West Monsoon, bitterly cold and very dry.
- There is little rain but there is considerable snow.
- The region also experiences intense tropical cyclones called typhoons that originate in the Pacific Ocean and are most frequent in the late summer.

THE GULF TYPE

- The Gulf-Atlantic regions of the USA experience this type of climate similar to the China type but with less monsoonal characteristics.
- The warm Gulf Stream and the on-shore Trade winds help bring down the range of temperatures and there is a heavy annual rainfall of around 59 inches.
- The amount of rain is increased by thunderstorms in summer and by hurricanes in September and October.
- Due to intense local heating, the region also experiences violent tornadoes leading to heavy destruction.

NATAL TYPE

- The narrowness of the continents and the dominance of maritime influence eliminate the monsoonal elements.

- The South-East Trade winds bring about a more even distribution of rainfall throughout the year.
- The annual range of temperature is low and rain comes in prolonged showers.

NATURAL VEGETATION

- Due to heavier rainfall, the region supports luxurious vegetation.
- There is perennial plant growth and the conditions are well-suited to a rich variety of plant life.
- The lowlands carry both evergreen broad-leaved forests and deciduous trees, similar to the tropical monsoon forests.
- In the highlands, are various species of conifers such as pines and cypresses which are important softwoods.
- Eastern Australia – Eucalyptus
- South-Eastern Brazil, eastern Paraguay, north-eastern Argentina – Parana pine, the quebracho, wild yerba mate trees.
- Natal: palm trees

8.World Climate: British Type Climate

- British-type climatic regions are under the permanent influence of the Westerlies all around the year.
- These are also regions of high cyclonic activity., typical of Britain and thus said to experience the British climate.
- This climate is also referred to as the cool temperate western margin climate or the North-west European Maritime Climate.

DISTRIBUTION

- There are exists of the northern hemisphere and southern hemisphere distributions.

NORTHERN HEMISPHERE

- The climatic belt stretches from Britain into North-West Europe, including northern and western France, Belgium, the Netherlands, Denmark, western Norway, and also north-western Iberia.

- It primarily affects the coastlands of British Columbia in North America. The North American Rockies prohibit on-shore Westerlies from penetrating far inland.

SOUTHERN HEMISPHERE

- The majority of New Zealand, especially the South Island, Tasmania, southern Chile, and southern Australia all enjoy this climate.
- The surrounding wide stretches of water have made these areas' climates more marine.

CLIMATE

- Mild winters and moderately warm summers. Temperature extremes are unlikely.
- Adequate rainfall throughout the year.

TEMPERATURE

- The mean annual temperature is usually in the range of 5 C – 15 C.
- This range is comparatively small for such high latitudes.
- Winters are unusually mild with no station recording temperatures below freezing, while summers are seldom particularly warm.
- The North Atlantic Drift's warming influence and the South-Westerlies' predominance are to blame for this.
- Hence, they are some of the most advanced regions of the world.

PRECIPITATION

- Adequate rainfall throughout the year.
- From cyclonic sources, there is a propensity for a tepid winter or autumn maximum.
- The western edges have the most rainfall because the rain-bearing winds originate in the west.
- Moving eastward from the sea, the amount of rainfall diminishes.

SEASONS

- There are four distinct seasons.

- The long, sunny summers are followed by the roar of the wind-filled autumn.
- Winter is a season marked by overcast skies, foggy mornings, and numerous days with rain brought on by cyclonic depressions.
- The driest and most pleasant season after the gloomy winter is spring, and then the cycle repeats itself.

NATURAL VEGETATION

- The natural vegetation of this climatic type is the deciduous forest.
- In the winter, trees lose their foliage. This modification serves as a defence against winter snow and ice.
- Autumnal or fall-related shedding starts and is dispersed by the winds.
- Some of the common species of temperate hardwood include oak, elm, ash, birch, beech, hornbeam, and poplar.
- In the wetter areas grow willows, alder, and aspen.
- The deciduous trees grow in pristine stands and have significant logging value from a business standpoint.
- The sparse undergrowth is useful in logging operations.
- The deciduous hardwoods are great for industrial and fuel uses.
- The conifers, which can endure a higher altitude, a lower temperature, and poorer soils, typically replace the deciduous trees further up the mountains in the Scandinavian highlands, the Rockies, the southern Andes, and the Southern Alps of New Zealand.

9.World Climate: Taiga Climate (Coniferous Forests & Lumbering)

- Taiga Climate is sometimes referred to as the Cool Temperate Continental Climate and is also known as Siberian Climate and Boreal Climate.
- Due to the Southern Hemisphere's little populated landmass, this sort of climate is primarily seen in the Northern Hemisphere.
- Koppen has defined the Taiga Climatic region as D type in his climatic classification.

- According to Koppen's classification, the winter temperature can drop below 3 degrees C while the summer months can be pleasant with temperatures over 10 degrees C.

DISTRIBUTION

- It spans central Canada, the majority of central and southern Russia, and certain areas of Scandinavia from 50 to 70 N along a continuous strip.
- Around the Arctic Circle, it combines with the Arctic tundra of Canada and Eurasia to the north or poleward. The "Subarctic climate" is another name for this environment.
- In the south, the climate becomes less severe and merges into the temperate Steppe climate.
- Due to the narrowness of the continents at high latitudes, the Siberian climate is absent in the Southern Hemisphere.
- The Southern Hemisphere's considerable maritime influence lessens the severity of the winter.

CLIMATE

- In the Taiga climate region, the summers can be moderate or cool, while the winters can be quite cold because of the polar and Arctic air masses' strong winds and snowstorms.

TEMPERATURE

- These areas have exceptionally cold winters that last for a very long time and have temperatures between – 30 C and – 40 C.
- The summers are cool and brief. Spring and autumn are very brief and transitional periods.
- The annual range of temperature is very high, almost 50 C to 60 C.
- The coolest place on earth, Verkhoyansk is situated in this climatic region.
- In this location, significant snowfall and frosts are frequent due to the year-round extremely low temperatures.
- Rivers and lakes are frozen, while arctic winds to the north, like the Buran and Blizzards of Eurasia, blow ferociously.

- Siberian climate zones have extremely scarce populations due to the harsh conditions.

PRECIPITATION

- The interiors have almost no maritime influences, which results in low annual precipitation, often between 38 and 63 cm.
- It falls evenly throughout the year, with a summer peak from convectional rain as the continental interiors heat up.
- In winter, the precipitation is in the form of snow.

NATURAL VEGETATION

- The predominant vegetation of this region is evergreen coniferous forests.
- Conifers are highly adapted to this environment and can resist such harsh conditions.
- The greatest single band of the coniferous forest is the taiga in Siberia.
- The region's coniferous forests mostly consist of pine, fir, spruce, and larch trees.
- The richest sources of softwood are the coniferous forest belts in North America and Eurasia.
- **Coniferous forests are of huge commercial value due to the following reasons:**
- They occur in pure stands and there exist only a few species.
- Coniferous woods occur at consistent heights, grow straight and tall, and are of moderate density, in contrast to the dense and challenging-to-exploit equatorial rain forests.
- Almost all conifers are evergreen. There is no annual replacement of new leaves as in deciduous trees.
- Evergreens greatly benefit from the low yearly temperatures, with more than half of the year being below the growing-point temperature.
- Conifers have a conical shape, which allows them to live in the subarctic climate.

- The sloping branches discourage snow build-up and provide weak wind support.
- Leaves are small, thick, leathery, and needle-shaped to check excessive transpiration.
- Poorly podzolized soils in the area cause undergrowth because they are highly acidic and leached.
- Evergreen forests don't have falling leaves, thus there is limited humus development and the leathery needles take a long time to decompose because of the cold temperatures.
- Other obstacles to sparse vegetation include the lack of direct sunshine and the brief summer season.
- Coniferous forests are also found in areas with high altitudes and low temperatures in addition to the continental interiors of high latitudes. In the Himalayas, for instance.

10.World Climate: Laurentian Climate

- The Cool Temperate Eastern Margin climate is also known as the Laurentian climate.
- It is the intermediate between the British and Siberian types of climates.

DISTRIBUTION

- It is found only in two regions and only in the northern hemisphere.
- The climate combines elements of the coastal and continental climates.
- **North American region:** One region is north-eastern North America including eastern Canada, north-east USA, and Newfoundland.
- **Asiatic region:** The other region is the eastern coastlands of Asia, including North China, eastern Siberia, Manchuria, Korea, and northern Japan.
- Due to the little amount of continental landmass that extends south of latitude 40 S, the climate is completely missing in the southern hemisphere.

- The only possible regions are in eastern Patagonia.
- However, the Southern Andes obstruct the westerlies, making the area arid rather than continental.
- Only 10 inches of precipitation fall there annually due to its rain-shadow status.

TEMPERATURE

- The climate of this type has cold, dry winters and warm, wet summers.
- Winter temperatures can be well below freezing, and snowfall can reach quite a depth.
- The off-shore cold currents from the Arctic helped to temper down the summers, which are as warm as those in the tropics.

PRECIPITATION

- Rain falls throughout the year.
- The easterly winds from the oceans do, however, bring rain, thus there is a noticeable summer maximum.
- Two-thirds of the annual precipitation is in summer.
- Dry, chilly winds from the interiors of the continent blow during the winter.

NATURAL VEGETATION

- The predominant vegetation in this climate is cool temperate forests.
- Trees thrive best in regions with high rainfall, mild summers, and damp air from fogs.
- Forest tends to be coniferous north of the 50 N latitude.
- South of this latitude, deciduous forests is seen.

11.World Climate: Polar Climate (Tundra & Ice Caps)

- The polar climate has cold climatic conditions all through the year.
- In his climatic classification, Koppen (World climate classification) categorised Polar Climate as E type.

- Koppen (World climate classification) claims that the area's summer temperature is less than 10 degrees. Polar Tundra and Polar Ice Caps were his additional divisions of the polar climate.

DISTRIBUTION

- There are exists of the northern hemisphere and southern hemisphere distributions.

NORTHERN HEMISPHERE

- In the northern hemisphere, the polar climate is mostly found north of the Arctic Circle.
- The ice caps are only found in Greenland and highlands at high latitudes where the ground is always covered in snow.
- The lowlands which are ice-free for a few months have tundra vegetation.
- This comprises the Arctic seaboard of Eurasia, the Greenlandic coastal strip, and the desolate regions of northern Canada and Alaska.

SOUTHERN HEMISPHERE

- The largest single ice cap where the layers of permanent ice are visible in the southern hemisphere is found in Antarctica, an uninhabited continent.

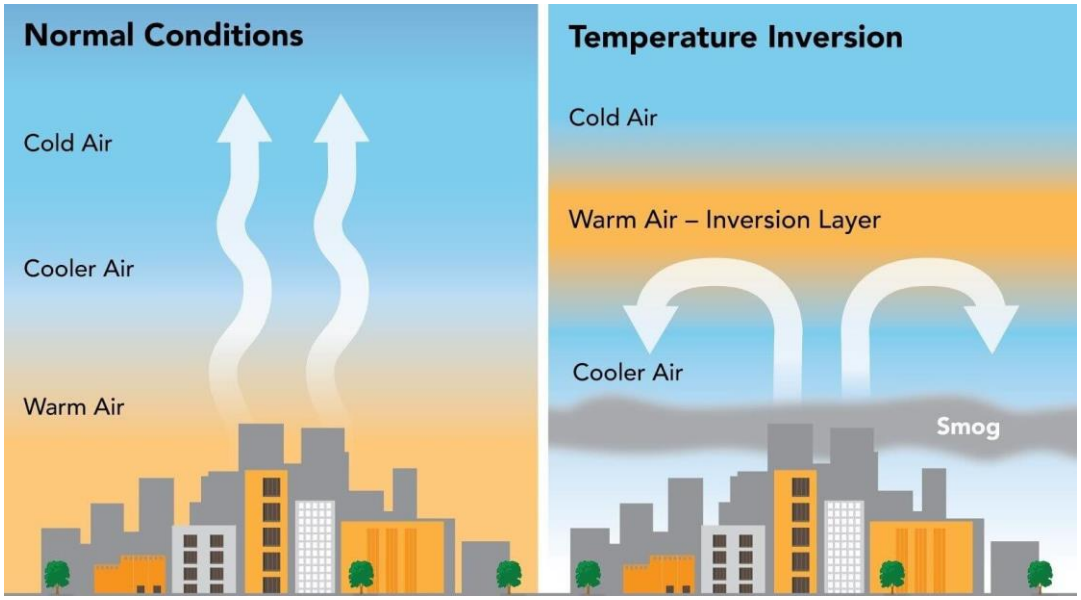
TEMPERATURE

- A very low mean annual temperature characterizes the tundra or polar temperature.
- There are just four months with temperatures above freezing. With the exception of four months, the ground is always frozen.
- Interiors are much colder than in the coastal regions.
- Winters are long and very severe, and summers are cool and brief.
- There are weeks of nonstop darkness outside the Arctic and Antarctic circles.
- Frosts and blizzards that occur are very hazardous to the polar inhabitants.

PRECIPITATION

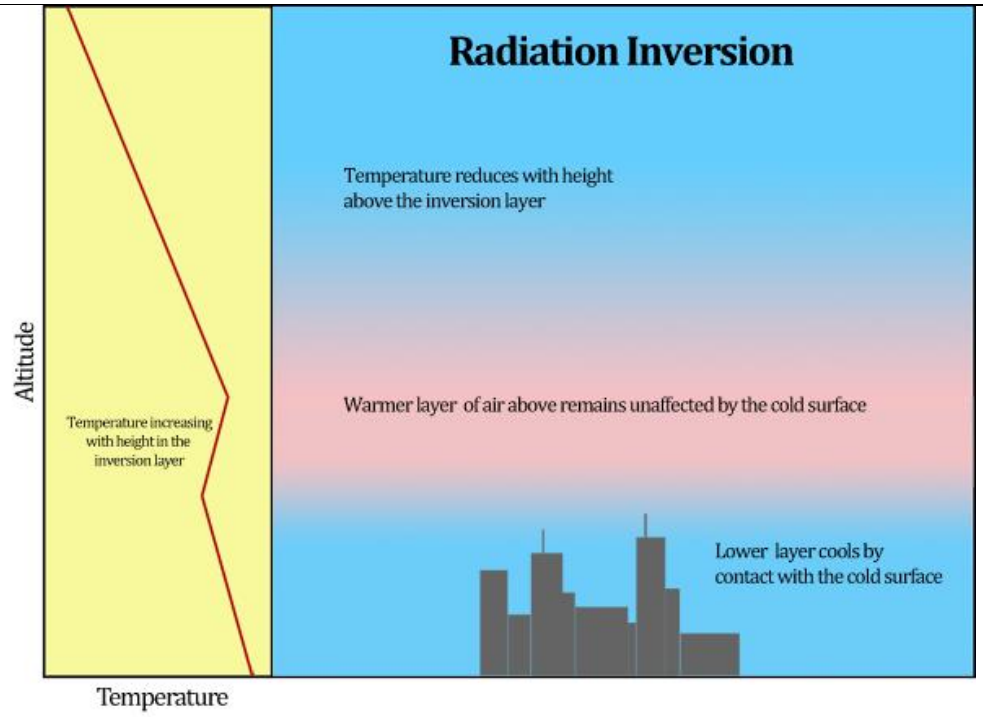
	• In the winter, precipitation primarily takes the form of snow, which is drifting by blizzards. • Convectional rainfall is generally absent because of the low rate of evaporation and the lack of moisture in the cold polar air. • In summer, there is a maximum and the precipitation is in the form of rain or sleet. • Cyclones are felt in the coastal areas and there is a tendency towards a winter maximum. **NATURAL VEGETATION** • In severe environments like that of Tundra, few plants survive. • The greatest inhibiting factor is the lack of heat and energy. • The growing season is for less than three months and there are no trees in the tundra. • Hence only the lowest forms of vegetation are supported like mosses, lichens, and sedges. • In the more sheltered spots, stunted birches, dwarf willows, and undersized alders struggle to survive. • In the brief summers when snow melts and the days are warmer and longer, berry bushes and Arctic flowers bloom. • They are short-lived but they brighten the monotonous polar landscape into Arctic prairies. • The most widely used classification of world climate is the empirical world climate classification scheme developed by Wladimir Koppen.
4.	**Temperature Inversion** • Under normal conditions, temperature usually decreases with increase in altitude in the troposphere at a rate of 1 degree for every 165 metres. This is called **normal lapse rate.** • But on some occasions, the situations get reversed and temperature starts increasing with height rather than decreasing. This is called **temperature inversion.**

- **Temperature inversion:** It is a reversal of the normal behavior of temperature in the troposphere. Under this meteorological phenomenon a layer of warm air lies over the cold air layer. It is caused in stac atmospheric conditions while some times, it occurs due to **horizontal or vertical movement of air.**
- Temperature inversion is usually of short duration but quite common nonetheless.



- Favourable Conditions for Temperature Inversion
- **Long winter nights:**Loss of heat by terrestrial radiation from the ground surface during night may exceed the amount of incoming solar radiation.
- **Cloudless and clear sky**: Loss of heat through terrestrial radiation proceeds more rapidly without any obstruction.
- **Dry air near the ground surface:**It limits the absorption of the radiated heat from the Earth's surface.
- **Slow movement of air:**It results in no transfer or mixing of heat in the lower layers of the atmosphere.
- **Snow covered ground surface:**It results in maximum loss of heat through reflection of incoming solar radiation.

- Types of Temperature Inversion
- Temperature inversion occurs in several conditions ranging from ground surface to great heights. Thus there are several kinds of temperature inversions.
- The following are classified on the basis of relative heights from the earth's surface at which it occurs and the type of air circulation:
- **Non-Advectional**
    - **Radiation Inversion (Surface Temperature Inversion)**
        - Surface temperature inversion develops when air is cooled by contact with a colder surface until it becomes cooler than the overlying atmosphere; this occurs most often on clear nights, when the ground cools off rapidly by radiation. If the temperature of surface air drops below its dew point, fog may result.
        - It is very common in the higher latitudes. In lower and middle latitudes, it occurs during cold nights and gets destroyed during day time.

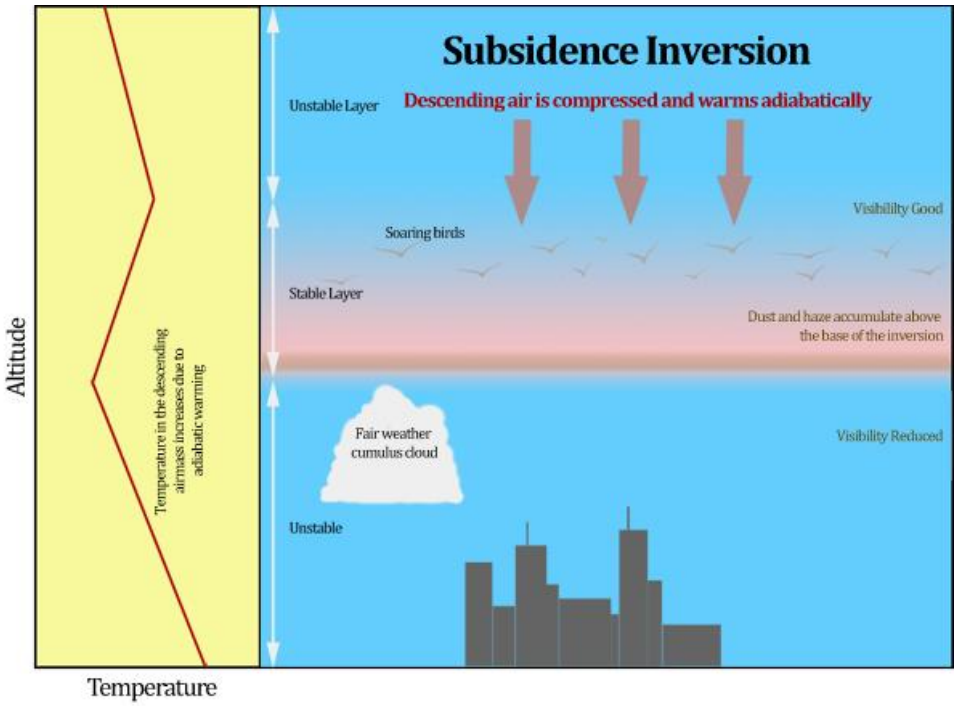


- Ground or surface inversion, also called as radiation inversion, occurs near the earth"s surface due to radiation mechanism. This is also called as non-advectional inversion because it occurs in stable atmospheric condition characterized by almost no movement of horizontal or vertical air.
-
    - **Subsidence Inversion (Upper Surface Temperature Inversion)**

        - When a widespread layer of air descends, it is compressed and heated by the resulting increase in atmospheric pressure, and as a result the lapse rate of temperature is reduced.
        - The air at higher altitudes becomes warmer than at lower altitudes, producing a temperature inversion. This type of temperature inversion is called subsidence inversion.
        - It is very common over the northern continents in winter (dry atmosphere) and over the subtropical oceans; these

regions generally have subsiding air because they are located under large high-pressure centers.

- It is also called upper surface temperature inversion because it takes place in the upper parts of the atmosphere.

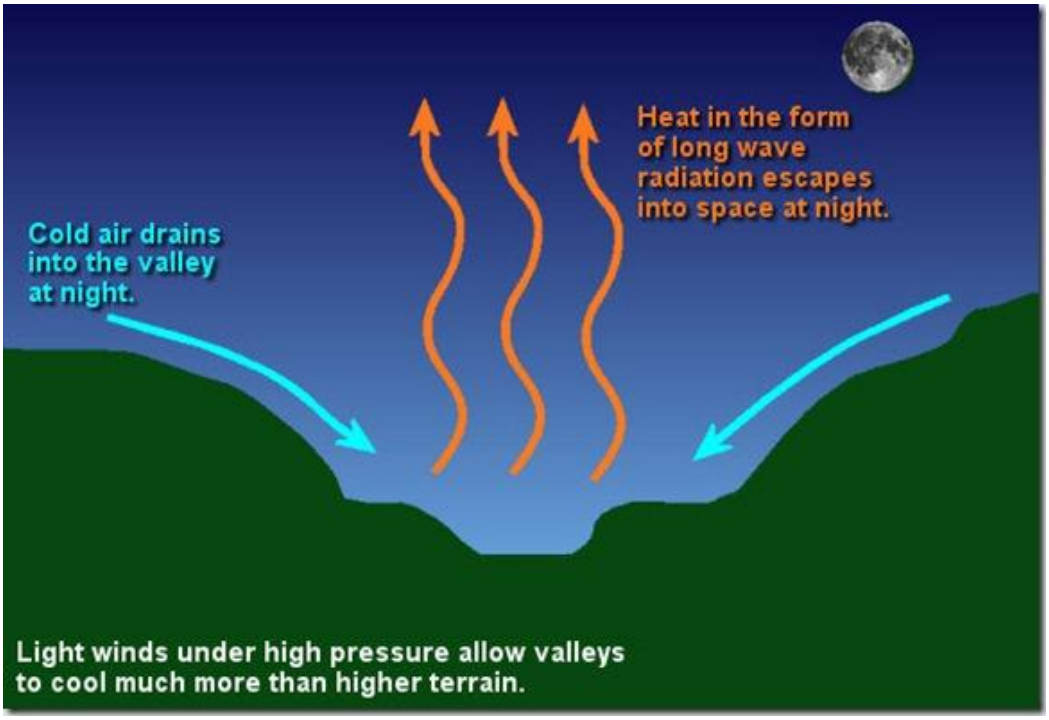


Advectional

- Advection Inversions: They develop when there is a horizontal inflow of cold air into an area. This is common to cool maritime air blowing into a coastal locale. Advection inversions are usually short-lived (typically overnight) and shallow. They can happen at any time of year, depending on the location of the relatively cold surface and the direction of the wind.
    - **Valley inversion in intermontane valley**
        - In high mountains or deep valleys, sometimes, the temperature of the lower layers of air increases

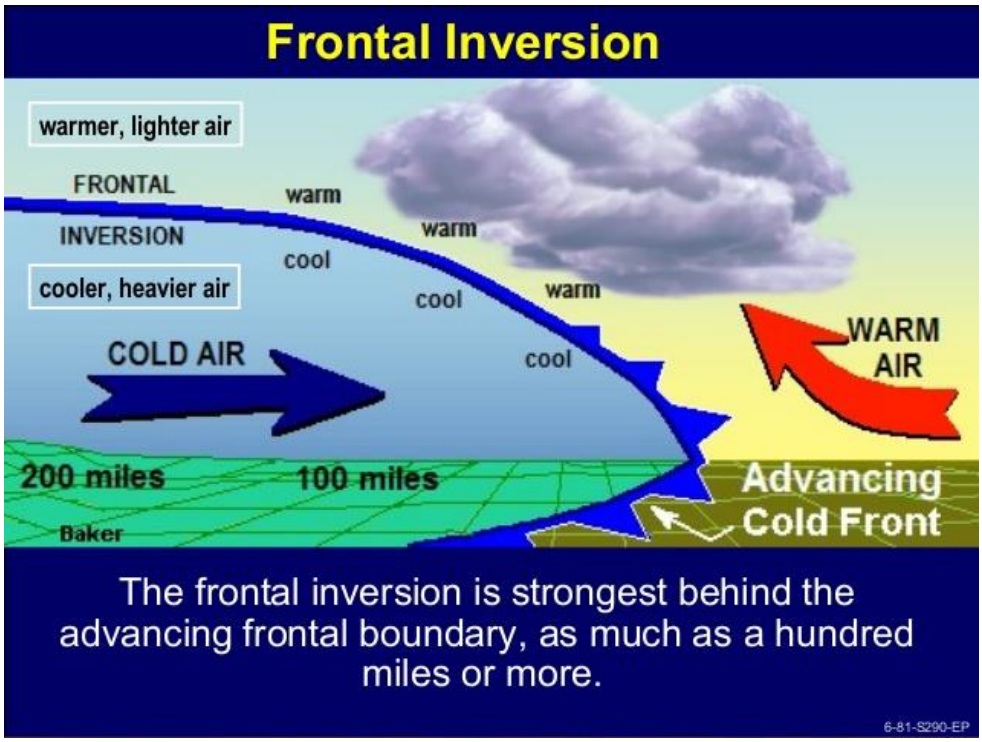
instead of decreasing with elevation along a sloping surface.

- Here, the surface radiates heat back to space rapidly and cools down at a faster rate than the upper layers. As a result the lower cold layers get condensed and become heavy.
- The sloping surface underneath makes them move towards the bottom where the cold layer settles down as a zone of low temperature while the upper layers are relatively warmer.
- This condition, opposite to normal vertical distribution of temperature, is known as Temperature Inversion.



- **Frontal or Cyclonic inversion**

- When the warm and cold fronts meet, then the warm front rises up and being heavier the cold front sinks down. It results in formation of Frontal Inversion.
- It has considerable slope, whereas other inversions are nearly horizontal. It often takes place in the temperate zone and causes cyclonic conditions which result in the precipitation in different forms.
- A frontal inversion is unstable and is destroyed as the weather changes.



Effect

- Temperature inversion determines the precipitation, forms of clouds, and also causes frost due to condensation of warm air due to its cooling.
- **Dust particles hanging in the air:**Due to inversion of temperature, air pollutants such as dust particles and smoke do not disperse on the surface.
- **Stops the movement of air:**It causes the stability of the atmosphere that stops the downward and upward movement of air.

	▪ **Less rainfall:**Convection clouds can not move high upwards so there is less rainfall and no showers. So, it causes a problem for agricultural productivity. ▪ **Lower visibility:**Fog is formed due to the situation of warm air above and cold air below, and hence visibility is reduced which causes disturbance in transportation. ▪ **Thunderstorms and tornadoes:**Intense thunderstorms and tornadoes are also associated with inversion of temperature because of the intense energy that is released after an inversion blocks an area's normal convention patterns. Diurnal variations in temperature tend to be very small.
5.	**Types of Rainfall** Rain is not only essential for plant growth but it is equally important for better survival of life. Formation of rainfall occurs when saturated air is heated and rises either by a frontal action or by a mountain. With the rising process saturated air or water vapour cools down and further they attach themselves to tiny particles of dust salt, seeds or smoke in the atmosphere. These attached particles are also known as condensed nuclei. When so many condensed nuclei join together then there occurs a process of condensation. This condensation process is necessary for formation of rain drop. Further raindrop leads to the formation of clouds. On the basis of origin rainfall is classified into three types: ▪ **Conventional rainfall** ▪ **Orographic rainfall or relief rainfall** ▪ **Cyclonic rainfall or frontal rainfall** ▪ **Convectional Rainfall:**

- The formation of convectional rainfall occurs when air is on the surface of the earth or a few metre above the surface of the earth it is heated by the sun. Once the air is heated it becomes lighter and further this lighter air rises up and cools down and condenses on the condensation nuclei which are present in the atmosphere. This is because of the fact that only a small surface of area is covered by converging air. As soon as air converges it gets condense to form a thick cumulus cloud. as the cloud Rises up they become unstable and because of this instability cloud drops on the ground in the form of raindrops or rainfall.

- **Characteristic Features of Conventional Rainfall:**
- Once the air gets heated they become light and rise in a convection current.
- With the rise of air they expand and the temperature drops down and by this condensation process takes place and forms clouds.
- Convectional rainfall is usually in the summer or the hotter part of the day.
- Sach rainfall is mainly associated with hail and graupel.
- The equatorial region and internal part of the continents mainly in the Northern hemisphere receive conventional rainfall.

- **Orographic or Relief Rainfall:**
- When wind forces moist air landwards towards the mountain's terrain then the mountain further lifts the moist air in an upward direction that is into the atmosphere. Once the air reaches the atmosphere it cools down and undergoes a precipitation process.

- With rising in winter water vapour they started becoming unstable and heavy and because of this they develop around conventional nuclei and form thick clouds. Further, this cloud moves up and becomes an

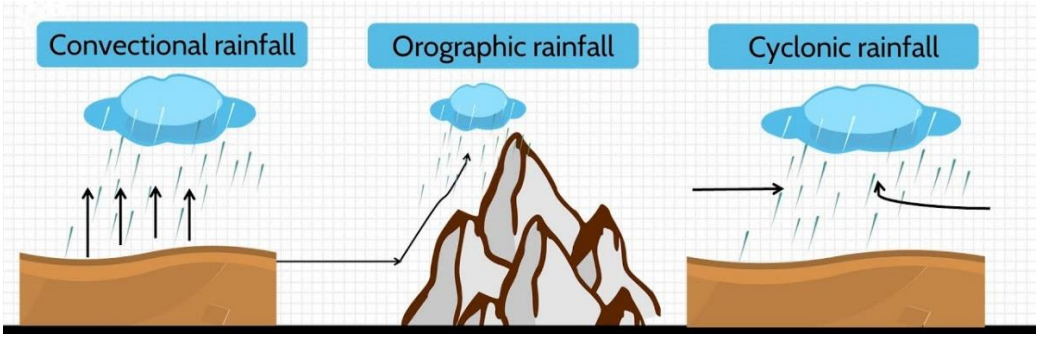
unstable water droplet. And after this, they fall on the ground as raindrops.

- Inversion of rainfall is associated with orographic rainfall. This occurs due to the ascent of the air forced by the mountain barrier that is across the wind direction so that the moist air is forced in obstruction to move upwards and get cooled. The amount of rainfall increases with increasing height of the barrier such as mountain but this is only up to a certain limit. After that limit, there is a marked decrease due to lesser moisture content of the air and this phenomenon is called Inversion of rainfall.

- **Characteristic Features of Orographic or Relief Rainfall:**
- The principal characteristic behind this type of rainfall is that the windward slope gets heavy rainfall.
- The reason located on the leeward side opposite side is known to be rain-shadow area.
- This rainfall is seen in mountainous areas and along hills.
- Mountains act as an obstacle that force vapour to rise which leads to orographic rainfall.

- **Cyclonic or Frontal Rainfall:**
- It is the last type of rainfall and occurs when two air masses that have different characteristics combine together. For example when a warm Maritime air mass combines with a cold heavier air mass then in that case the warm air mass is undercut by cold air mass. And because of this warm air mass is forced to move up because of its lightweightness. And warm water vapour cools down as it rises up which leads to the condensation process and a cloud is formed and the condensation nuclei in the atmosphere. With rise in clouds they become unstable as more water droplets are accumulated in the cloud and they fall on the ground in the form of cyclonic rainfall.

- **Characteristic Features of Cyclonic or Frontal Rainfall:**
- The Tropic and Temperate Zones receive such rainfall.
- The layer which separates two masses of air is known as the front.
- The type of rainfall is mainly for a few hours to a few days.



6. Geography & Politics of Siachen Glacier

- The Siachen Glacier is located in the eastern Karakoram range of the Himalayas, in the disputed territory of Jammu and Kashmir between India and Pakistan.
- It is one of the longest glaciers outside the polar regions after Fedchenko Glacier in Tajikistan and is known as the world's highest battleground.
- It originates at the base of the Indira Col West, a col (low point) on the Indira Ridge, at an altitude of 6,115 meters, and it descends to an altitude of 3,570 meters.
- The Siachen Glacier is situated at an altitude of approximately 5,400 meters (17,700 feet) above sea level and stretches for about 76 kilometers (47 miles) in length.
- It is surrounded by some of the world's highest peaks, including **Saltoro Kangri**and **Sia Kangri** and the **Nubra River** originates from it.

- Leading Indian geologist V. K. Raina oversaw the first Geological Survey of India mission to the Siachen glacier in June 1958.
- This incident is significant historically and strategically because it dispels the misconception that Pakistan has been in charge of the glacier from the beginning.
- During the time, both India and Pakistan were abiding by the terms of the Karachi ceasefire agreement of 1949 under which they had delimited the entire cease-fire line right up to the glaciers and agreed to mutually demarcate it.

- **The strategic importance of Siachen**
- The area around the Siachen Glacier has been the subject of a long-standing territorial dispute between India and Pakistan.

	▪ Both countries have deployed military personnel in the region since the 1980s. ▪ The extreme weather conditions, with temperatures dropping as low as -50 degrees Celsius (-58 degrees Fahrenheit), make the Siachen Glacier an incredibly challenging and inhospitable environment for the soldiers stationed there. ▪ Due to the harsh climate and treacherous terrain, the Siachen Glacier is often referred to as the "White Desert." ▪ The soldiers stationed there face numerous hardships, including altitude sickness, frostbite, and avalanches. ▪ Both India and Pakistan have made efforts to improve the living conditions for their troops, constructing permanent military bases and establishing supply routes for essential resources. ▪ The conflict over the Siachen Glacier has resulted in the loss of many lives on both sides over the years. ▪ However, there have been attempts by India and Pakistan to find a peaceful resolution to the dispute. ▪ In 2003, both countries agreed to a ceasefire along the Actual Ground Position Line (AGPL) in the region, but the issue of territorial control remains unresolved. ▪ However, until a final resolution is reached between India and Pakistan regarding the territorial dispute, the Siachen Glacier will continue to be a contentious and heavily militarized region. ▪ **Siachen conflict** ▪ The Siachen War, also known as the Siachen Glacier Fight or the Siachen War, involved India and Pakistan in a military engagement over the disputed Siachen Glacier region in Kashmir.

- India's effective seizure of the Siachen Glacier as part of **Operation Meghdoot** in 1984 marked the beginning of the conflict, which was maintained in 1987 by Operation Rajiv.
- The dispute over Siachen primarily stems from the conflicting interpretations of the Line of Control (LoC) in the region.
- The LoC is the de facto border that separates the Indian-administered territory of Jammu and Kashmir from the Pakistan-administered territory.
- The line continues northwards from the last demarcated point to the glaciers, but the precise demarcation was never agreed upon by both countries.
- **Ecological importance of Siachen Glacier**
- The Siachen Glacier is also of significant ecological importance. Its melting waters feed several rivers in the region, including the Indus River, which is a lifeline for millions of people in Pakistan and India.
- The fragile ecosystem of the area has been adversely affected by the military presence and the associated waste and pollution.
- Efforts have been made by various organizations to raise awareness about the environmental impact of the conflict and promote the idea of turning the Siachen Glacier into a peace park or a zone of cooperation.
- Despite the harsh conditions, the Siachen Glacier region supports a diverse range of flora and fauna.
- The surrounding areas are home to several species of high-altitude plants, including rare and endemic ones.
- The Siachen region serves as a habitat for a variety of wildlife, including snow leopards, ibex, brown bears, and migratory birds.

- These animals rely on the ecosystem's resources for their survival. Protecting the glacier and its surroundings is crucial for the long-term conservation of these species.
- Glaciers, including Siachen, play a role in regulating local and regional climates.
- They act as reservoirs of freshwater, releasing it gradually as they melt, thereby maintaining a steady flow in rivers.
- The meltwater from the Siachen Glacier contributes to the stability of downstream ecosystems and supports agricultural activities.
- The Siachen Glacier region presents a unique opportunity for scientific research and study of glacial processes, climate change, and their impact on the ecosystem.
- Researchers and scientists can gain insights into the effects of global warming on glaciers, water resources, and biodiversity in high-altitude environments.
- Glaciers like Siachen help control erosion in mountainous regions. As they slowly move and melt, they transport sediments and debris, preventing excessive soil erosion and maintaining the stability of slopes and riverbanks.

Way forward

- It is important to note that the ecological significance of the Siachen Glacier has been impacted by the military presence and associated activities.
- Efforts to reduce the ecological footprint of the conflict and promote environmental conservation in the region are essential for preserving this unique ecosystem for future generations.

	▪ In recent years, there have been calls from various quarters to demilitarize the Siachen Glacier and convert it into a zone of peace or a scientific research center. ▪ Such proposals aim to reduce the human and economic costs associated with the conflict and promote regional stability. ▪ However, any progress toward resolving the conflict remains dependent on the willingness of both India and Pakistan to reach a mutually acceptable solution.
7.	**Planets in Solar System** • Planets in solar system consist of **eight primary planets that orbit the Sun.** These planets **include Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.** • All Planets in the solar system have its **unique characteristics, sizes, and orbits, contributing to the diverse nature** of our cosmic neighborhood. Studying these planets provides valuable insights into the formation and evolution of celestial bodies in the universe. • Celestial bodies that **follow elliptical orbits around a star** are termed "planets." • **Classification:** In our solar system, these planets can be **classified into two distinct groups** based on their characteristics and positions. **Type of Planets in solar System** ***1. Terrestrial Planets*** • They are also known as Inner planets. • These planets lie between the Sun and the asteroid belt. • They are generally made up of rocks and metal and have relatively high densities. • These include – Mercury, Venus, Earth and Mars. 2. Jovian Planets

- Jovian planets are also known as Outer planets or Gas Giant planets.
- These planets lie beyond the asteroid belt.
- They are larger than terrestrial planets and have a thick atmosphere consisting of hydrogen and helium.
- They have numerous satellites of their own, for instance, Jupiter and Saturn have 79 and 82 moons respectively (as of 2019).
- All Jovian planets have rings.
- For example, Jupiter has 1 ring, Saturn has 7 rings, Uranus has 13 rings and Neptune has 6 rings.
- Jovian planets include – Jupiter, Saturn, Uranus and Neptune.

The Differences between the Terrestrial and Jovian planets

- Distance with respect to the Sun: The terrestrial planets were formed in close vicinity of the Sun as compared to the Jovian planets.
- Thus, it was too warm for gasses to condense to solid particles.
- Effect of solar winds: The solar winds were most intense nearer the sun, it blew away lots of dust and gasses from the terrestrial planets.
- Whereas, the solar winds were not that intense to remove gasses from the Jovian planets.
- Gravity: Terrestrial planets are small compared to the Jovian, their lower density could not back the escaping gasses.

Classification Criteria for Planets in Solar System:

- The International Astronomical Union **(IAU)** categories include characteristics such as **their size, location, and composition.**
- Also **being in orbit around the Sun**, having sufficient **mass for self-gravity** to form a nearly round shape.
- In **2006,** the International Astronomical Union (IAU) introduced **the term "dwarf planet" to classify celestial objects** that share some

characteristics with planets but do not meet all the criteria for a full-fledged planet.

- **Pluto** is one such object that was reclassified as a dwarf planet.

International Astronomical Union:

- It was founded in **1919, headquartered in Paris, France.**
- Its **mission is to promote and safeguard the science of astronomy** in all its aspects, including research, communication, education and development, through international cooperation.
- It is the **global authority for naming planetary features** in the solar system.

- **The Goldilocks Zone: The Habitable Region for Life in the Universe**
- It is a **habitable zone** around the star, within which the planet supports the conditions for habitat. In this zone, water can exist in liquid form.
- **Moon: Exploring Earth's Mysterious Satellite and Its Origins**
- **About:** The Moon, **Earth's natural satellite,** is a celestial body that orbits our planet.
  - It is the **brightest and most prominent object in Earth's night sky.**
  - It has **no atmosphere** of its own.
- **Distance from Earth**
  - The moon is **approximately 384,400 kilometers** away from the Earth.
- **Orbital Period**
  - It **revolves** around the Earth in **about 27 days.**
- **Tidal Locking**
  - Due to tidal locking, **only one side of the moon is visible from Earth.**
  - Tidal locking means the Moon rotates about its axis in about the same time it takes to orbit Earth.

- **Apogee and Perigee**
  - The moon's distance from Earth varies during its orbit.
  - Apogee is **the greatest distance** between the Earth and the moon.
  - Perigee is **the nearest point** at which the moon revolves around the Earth.
- **Origin of the Moon: Exploring Formation Theories and Their Implications**
  - **Giant Impact Theory (Big Splat Theory):** The moon's formation is believed to result from a giant impact shortly after the Earth's formation around **4.4 billion years ago.**
  - An object, **three times the size of Mars, collided with Earth**, causing a significant part of Earth to be blasted into space, eventually forming the moon.
  - **Fission Hypothesis:** Another theory suggests that the moon separated from Earth early in the history of the solar system.
  - The Pacific Ocean basin is considered the possible site from which the moon originated.
- **Note:**
- **Tidal lock** is the situation when **an object's orbital period matches its rotational period**. The moon has the same rotation and revolution time period of about 27 days.
- Thus due to the tidal lock effect only one face of the moon is visible from the surface.
  - **Exploring the Cosmic Divisions: Asteroid belt between Mars and Jupiter**
  - Asteroid belt is a **torus shaped circumstellar disc located roughly between the orbits of Mars and Jupiter.**

- It **consists of numerous irregular shaped bodies known as asteroids**, and also differentiates asteroids from other asteroid populations in the Solar system.
- Planets are differentiated into two groups based on their position with respect to the Asteroid belt and the nature of planets.
- The zone beyond Neptune, from 33-50 AU, is known as the **Kuiper Belt.** The celestial objects in this zone are known as **Trans Neptunian Objects (TNO)** or **Kuiper Belt Objects (KBO)**.
- The zone beyond Kuiper Belt is termed as **Termination Shock**, followed by Heliopause till 100AU.
- **Heliopause** is a zone which lies outside the physical influence of the Sun.

Comparative Overview of Terrestrial Planets in Solar System

Parameter	Mercury	Venus	Earth	Mars
Distance from Sun	Closest planet to Sun	Average distance	Average distance	Average distance of about 227.9 million kilometers
Atmospheric Composition	Weak atmosphere	Rich in CO2 and sulphuric acid clouds	Rich in N2 and O2	Rich in CO2 and N2
Magnetic Field	No magnetic field	No magnetic field	Yes	A Very weak magnetic field
Appearance from Earth	No moon and no ring	Appears bright due to high albedo	Appears blue due to abundant water	The "Red Planet" due to its reddish appearance
Rotation Direction	West to East	**East to West**	West to East	West to East

	Rotation Period (days)	58.6	243	1	1.025 days
	Revolution Period (days)	88	224.7	365	687 days
	Shape	Spherical-harmonic shape	Oblate spheroid (flattened at poles,bulging at equator)	Geoid (flattened at poles,bulging at equator)	Spherical
	Number of Moons	No	No	**1(Moon)**	Two small moons, **Phobos and Deimos**.
	Average Temperature	–	Very hot	Around 14 Degrees	Around -80 degrees Fahrenheit (-62 degrees Celsius).
	Speed of Rotation (Poleward)	–	Decreases poleward	Decreases poleward	Near its poles is slower

8. India's stakes in Iran-Israel conflict — and why it does not want tensions to escalate.

Iran-Israel Relations: Historical Background

- Iran was one of the first countries in the region to recognise Israel after its formation in **1948**. It was only after 1979 that their diplomatic ties ended.
- **Pre-1979 Iran Israel Ties**: In 1948, the opposition of Arab states to Israel led to the **first Arab-Israeli war**. Iran was **not** a part of that conflict, and after Israel won, it established ties with the Jewish state. **It was the second Muslim-majority country to do so after Turkey**.

- **The Pahlavi Dynasty**: The dynasty under the **Shah Mohammad Reza Pahlavi**, ruled Iran then. It had **US support**, as did Israel, and the two countries maintained ties with each other, with Iran also selling oil to Israel amid its economic boycott by Arab states.
- **The 1979 Revolution**: A religious state was established in Iran after the Shah was overthrown in the **1979 Islamic Revolution**. The regime's view of Israel changed, and it was seen as an occupier of Palestinian land.
- Iran also sought to grow its presence in the region, challenging the two major powers **Saudi Arabia and Israel** – both of whom were US allies.
- Israel's Iranian Supreme Leader termed Israel *"Little Satan"* and the United States the *"Great Satan"*, seeing the two as parties interfering in the region.
- **Iran's Relations with Egypt**: Egypt's leader Nasser had long championed the idea of "pan-Arabism" in the region, for the cultural commonalities between the Arab states to be translated into larger solidarity and unity. This put Iran, a non-Arab country, at odds with it.
- However, with the death of Nasser in 1970, Iran's relations with countries such as Egypt warmed.
- **Iran-Iraq Accord, 1975**: Iran ceased support for **Kurdish-Iraqi separatists**, reduced hostilities and affected Israel's strategic value to Iran.
- **Post 1979**: While Israel and Iran have never engaged in direct military confrontation, both have attempted to inflict damage on the other through proxies and limited strategic attacks.
- Israel has attacked Iranian nuclear facilities from time to time. In the early 2010s, it targeted several facilities and nuclear scientists in a bid to prevent it from developing nuclear weapons.
- **Stuxnet Cyberattack, 2010**: The US and Israel are believed to have developed Stuxnet, a malicious computer virus that disrupted Iran's **Natanz nuclear facility**, marking a significant moment in cyber warfare.

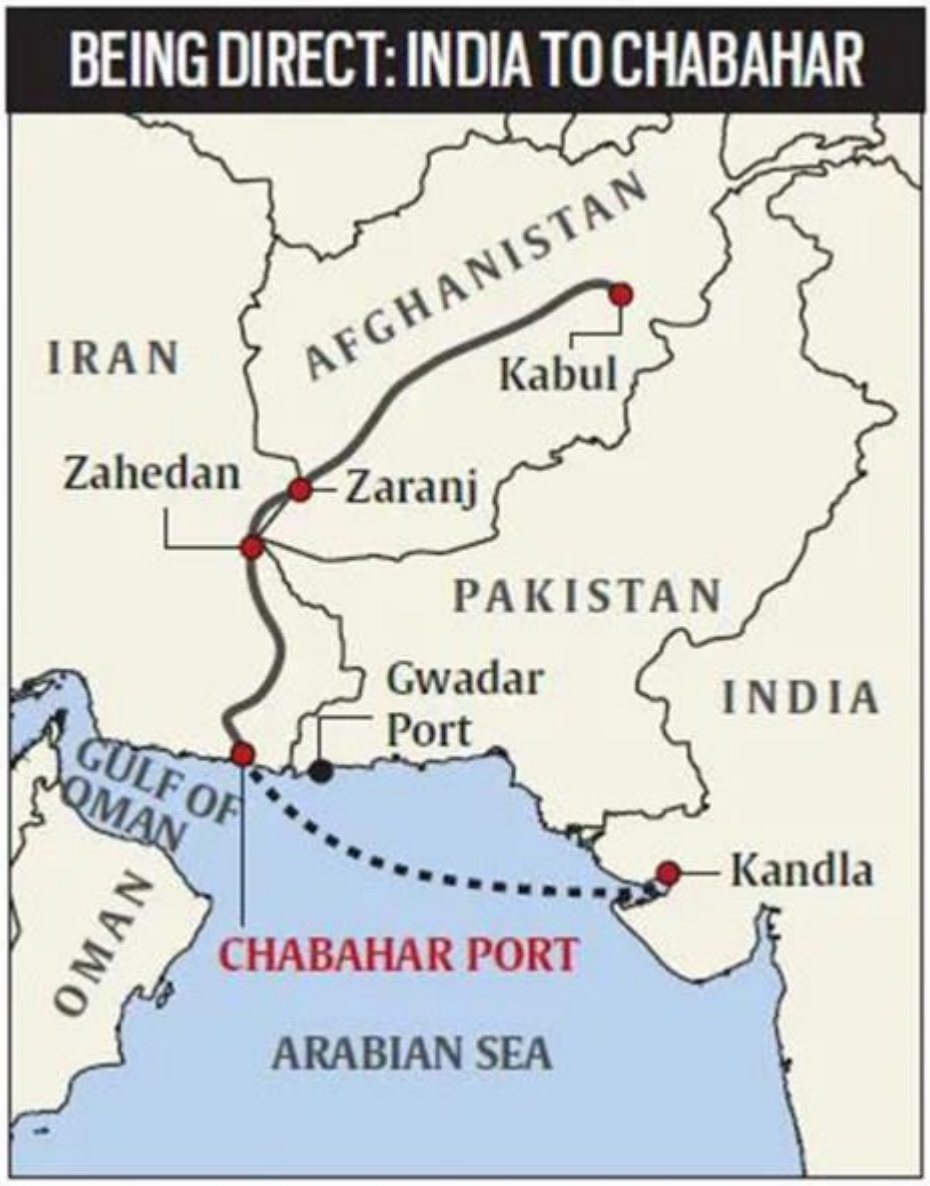
- It was the **"first publicly known cyberattack on industrial machinery".**
- **Iran's Proxy Support**: Iran is seen as responsible for funding and supporting several militant groups in the region that are anti-Israel and anti-US, such as Hezbollah in Lebanon and Hamas in the Gaza Strip.Regional groups supported by Iran
- **Nuclear Issues**:One of the greatest points of contention has been Iran's nuclear program. Israel perceives a **nuclear-armed Iran as an existential threat** and has repeatedly stated its position that it will take any necessary action, including military strikes, to prevent Iran from developing a nuclear weapon.
- Accusations and international sanctions have further complicated relations, with Israel being a vocal advocate for tough sanctions against Iran in international forums.

- *Regional groups supported by Iran:*
- **Hamas**- It originated during the **first Intifada in 1987** to establish a **Palestinian** state, it has governed the Gaza Strip since 2007.
- **Palestine Islamic Jihad**, 1979- It is the second-largest militant group in the Gaza Strip and the West Bank, it receives financial assistance and training from Iran.
- **Hezbollah**- It means "Party of God" set up by **Iran's Revolutionary Guards in 1982** to fight Israeli forces that had invaded **Lebanon** that year.
- **Houthis**- They have been engaged in **Yemen's civil war** for over a decade, they attacked ships in the Red Sea during Israel Hamas conflict disrupting a major shipping route between Europe and Asia it is supported by Iran.
- **Popular mobilisation Forces**- It is Iraq's state sanctioned coalition of paramilitary groups they maintain close ties with Iran's Revolutionary Guards.

India's Relations with Iran & Israel

- Important Ally: India has very difficult choices at the moment as both Iran Israel are important to India for its national interests.
- Iran Israel Conflict India's Position: It wants there should be "immediate de-escalation" and "step back from violence" and "return to the path of diplomacy" is, therefore, crucial to its national interest.
- *India Iran Relations:*
- **Historical Relation**: India-Iran Relations back to the ancient times **of Indus Valley civilization** and trade between the coast of southern Iran and India through the Persian Gulf and the Arabian Sea.
- **Political Dimension**: Signed a friendship treaty on 15 March 1950. The ***Tehran Declaration*** was signed that shared a vision for an "equitable, pluralistic and co-operative international order.
- **Geo-Strategic Location**: Iran's unique geographical position provides India access to Central Asia, Afghanistan, and Eurasia markets.
- **Energy Security**: Iran ranks **2nd globally in terms of gas reserves**, presenting an opportunity for fuel diversification, decarbonization and share of gas in India's energy mix until 2030.
- **Economic Ties**: Bilateral trade was **US$2.5 bn in 2022**, reflecting an increase of **48% from 2021**.
- **Indian Exports**: Sugar, man-made staple fibers, electrical machinery and artificial jewelry.
- **Indian Imports**: Dry fruits, chemicals and glassware.
- Iran included India in the list of countries whose citizens will not require a visa to travel.
- **People-to-people and Cultural Ties**: The Indian Cultural Centre was established in 2013 and renamed **the Swami Vivekananda Cultural Centre (SVCC)** in 2018 and India recently decided to include **Farsi** as one of the nine classical languages under the New Education Policy.
- *Significance of Iran for India:*

- **A Traditional Partner**: Being a traditional partner, Iran has assumed increased importance in recent times, which will continue to remain valid even in the future.
- This relationship therefore needs to be nurtured and sustained.
- **Oil Supplier**: Iran has been one of the major suppliers of crude — which has suffered setbacks due to US sanctions.
- **Shared Common Concern of Terrorism**: Besides, both countries have shared concerns on terrorism emanating from Pakistan and Afghanistan.
- **Chabahar Port**: Iran has gained strategic importance for India wherein India is operationalising Iran's Chabahar Port as part of a Tripartite agreement between Iran, Afghanistan, and India.
- It acts as a gateway to Afghanistan and Central Asia — since Pakistan denies land transit to Indian goods.



India Israel Relations:

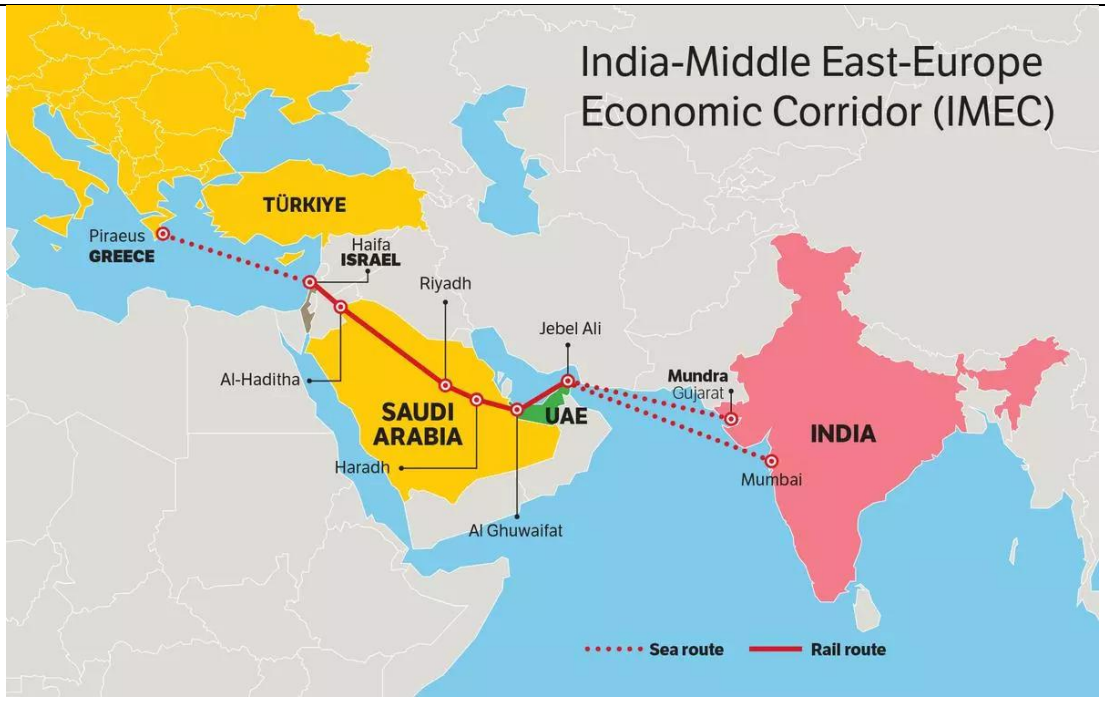
- **Strengthening of Relations**: The India Israel relationship has appreciably strengthened in recent years. Mr. Modi became **the first Indian Prime Minister to visit Israel** and Mr. Netanyahu has twice traveled the other way.
- However, when Israel was indeed established, India duly extended recognition, but kept relations at consular level for more than four

decades and in **1992 relations were upgraded to Ambassadorial level**.

- **Victims of Militancy**: Both India and Israel share similar enemies in Islamist extremists, and both enduring terrorist attacks from self-declared holy warriors.
- **Enhancement of Cooperation**: Security and intelligence co-operation began to grow between India and Israel. Gradually, political and diplomatic relations became deeper.
- Israel became a vital source of defense equipment and intelligence co-operation for India.
- **India's Stand during Hamas Attack**: In this attack, India stands in solidarity with Israel.

India's Strategic Decisions on Grouping

- **Association with Abraham Accords**: India associated itself with the reorientation of the geopolitics of the Middle East following the **Abraham Accords-** These are a series of agreements signed in 2020 between Israel and several Arab states, marking a historic shift in diplomatic relations in the Middle East.
- **I2U2**: Joined the "I2U2" (India, Israel, the United Arab Emirates and the United States).
- **IMEC**: Recently, India announced IMEC **(India-Middle East-Europe-Economic Corridor).**
- An India-Middle Eastern Economic Co-operation initiative whose trade route would go from India through Saudi Arabia to the Israeli **port of Haifa**.



Recently taken Actions:

- **Freedom of Navigation**: India and Israel discussed the freedom of navigation for ships going through the **Bab-el-Mandeb strait**, which faced a threat **from Yemen's Houthi rebels.**
- The Bab-el-Mandeb Strait connects the Mediterranean Sea and the Indian Ocean and is an important link for India's trade with the Middle East, Africa and Europe.
- **Operation Prosperity Guardian**: It is a multinational security initiative launched by the US to counter the growing number of attacks against Israel-bound international traffic.
- Coalition includes the U.K., Bahrain, Canada, France, Italy, the Netherlands, Norway, Spain, and Seychelles, apart from the U.S.
- *Significance of Israel for India:*
- **Strategic Importance**: India has a very deep strategic relationship with Israel, especially in the context of defence and security partnership.

- The two sides have strong concerns about extremism and terrorism, as both have suffered during the 26/11 Mumbai terror attacks.
- Israel supported India during times of crisis, including the **Kargil war in 1999**.
- **Defence Importance**: India shares one of the best relationships with Israel in the current times which is operative in multiple domains with a special focus on provision of high-technology equipment to the defence forces.
- Israel has also emerged as a major defence supplier, along with the US, France and Russia.
- Israel constituted an important ally for provision of the **defence equipment**, especially till the time India achieves self-reliance through indigenous means in the defence domain.
- It is therefore essential that Israel does not get involved in an intense war with Iran as it is already battling Hamas and Hezbollah.

- *Challenges for India amid the Iran Israel Conflict:*
- **Remain Unaffected**: India has strategic ties with both Iran and Israel and for decades, it has been able to balance between the two sides. But if the conflict widens, it would be difficult for it to maintain an **ambivalent position**.
- **Concerning Consequences**: An escalation between the two countries has direct and tangible consequences for India, mainly on three accounts: its people, its economic interests and strategic needs.
- **Impact on People**: There are about **18,000 Indians in Israel** and about **5,000-10,000 Indians in Iran**, about **90 lakh** people are living and working in the Gulf and West Asia region. Any conflict that expands will end up posing a risk to the Indian community that is based in the region.
- **Example: India asked its citizens not to travel to Israel and Iran.**
- **Impact on Strategic Needs**: India has invested in a strategic relationship with major Arab countries, Iran, and Israel. India has been working in this region to push for the **India-Middle-East-Europe Economic corridor**, which has strategic as well as economic benefits for India.
- An escalating conflict could adversely impact the consensus that has been built.
- **Impact on Economic Interests**: Though imports from Russia have increased, **Arab states account for two-thirds of India's oil needs**. Higher oil prices will push up inflation and delay any interest rate cuts critical to boost GDP growth. Merchandise exports, already slow, will drop further.
- **Sensex and Nifty fell** due to escalating Iran Israel conflict, making investors risk-averse.

Road ahead

- **Clarification of India's Position**- India has already called for the **'immediate de-escalation'** and '**stepping back from violence**' and '**return to the path of diplomacy**'.
- **Balance engagements with other key actors in the Middle East**- India must try to forever balance its engagement with key regional actors- Egypt, Iran, Israel, Qatar, Turkey, Saudi Arabia, and the United Arab Emirates– whose orientation and interests are often different in the middle eastern conflicts.
- **Pursue non-ideological engagements**- India must pursue non-ideological engagement in the middle east region to complement India's expanding interests in the Middle East.
- **A Dialogue-based Diplomatic Solution**: India had always adopted this approach. India needs to engage with Israel more as Iranian actions have been initiated as a consequence of the Israeli attack on an Iranian complex in Damascus, Syria.
- **Proactive Engagement**: It is now the responsibility of Israel to absorb the initial drone attacks launched by Iran and show restraint until Iran escalates it further. India must proactively engage with the USA, Iran, Russia, and Israel to ensure that this conflict is contained.
- **India has to make all-out efforts so that Iran does not get involved in a sustained conflict with Israel as it will mean a conflict with the USA which has already started emerging in this region of the world.**
- **Consideration of Future Challenges**: A dialogue with the USA is required as it is involved in the **Russia-Ukraine War**, **Israel-Hamas War**, **Houthis interference in the Red Sea**, and the **potential Iran Israel conflict**.
- Hence, it will become difficult for the USA to meet its responsibilities if China escalates conflict in the South China Sea for integration of Taiwan or other such claims.
- **Focus on Development**:

	• India has to discuss with Israel to *establish defence manufacturing facilities in India* which will meet the needs of India, Israel and also other friendly countries. It will provide Israel a more secure place to develop its defence industry. • India must fast-track the completion of the Chabahar Port in Iran which has been already delayed. Once this is completed, operationalised and put to use, it will give additional leverage with Iran to shape Iran's opinion on its regional and world matters. • **Complete Process Fixation**: India has to come up with its 'process fixation' in totality to promote its indigenisation drive and to counter the threat from China and Pakistan in addition to its emerging obligations in the new world order.
9.	**PET Enzyme, Corals, Pangolin, Pink Bollworm - PPP 100 - PRELIMS 2024 - 16** **1, Coral Reefs** • These are large underwater structures primarily composed of living organisms known as coral polyps. These polyps secrete calcium carbonate to form hard, rock-like structures. Over time, these structures accumulate and create the complex reef systems that we associate with coral reefs. • Coral reefs are often referred to as "rainforests of the sea" due to their incredible biodiversity. They provide a habitat to a wide variety of marine species, including fish, mollusks, crustaceans, and other invertebrates. • These reefs are of immense economic importance as they support fisheries, tourism and other recreational activities, providing livelihoods to millions of people around the world.

- They also act as natural barriers that protect coastlines from the damaging effects of storms, hurricanes, and erosion. They absorb wave energy, reducing the impact on the shore.
- Coral reefs are mostly found in tropical and subtropical waters around the world, particularly in the Pacific, Indian, and Atlantic Oceans. Some of the most famous coral reefs are the Great Barrier Reef in Australia, the Mesoamerican Barrier Reef in the Caribbean, and the Coral Triangle in Southeast Asia.

Growth Conditions for Coral Reefs

- The temperature of the water should not be below 20°C. The most favourable temperature for the growth of the coral reefs is between 23°C to 25°C. The temperature should not exceed 35°C.
- Corals can survive only under saline conditions with an average salinity between 27% to 40%.
- Coral reefs grow better in shallow water having a depth less than 50 m. The depth of the water should not exceed 200m.
- Types of Coral Reefs
- Coral Reefs are differentiated into three categories based on their shape, nature and mode of occurrence.
- Fringing Reef: The coral reefs that are found very close to the land and forms a shallow lagoon known as Boat Channel are called Fringing Coral Reefs. The Fringing Reefs develop along the islands and the continental margins. They grow from the deep bottom of the sea and have their seaward side sloping steeply into the deep sea. Fringing Reefs are the most commonly found coral reefs among the three. For example Sakau Island in New Hebrides, South Florida Reef.
- Barrier Reef: Barrier Reefs are considered as the largest, highest and widest reefs among the three coral reefs. They develop off the coast and parallel to the shore as a broken and irregular ring. Being the largest

reef among the all, they run for 100kms and is several kilometres wide. One example of Barrier Reef is the Great Barrier Reef of Australia which is 1200 mile long.

- Atolls: An atoll can be defined as a reef that is roughly circular and surrounds a large central lagoon. This lagoon is mostly deep having a depth of 80-150 metres. The atolls are situated away from the deep sea platforms and are found around an island or on a submarine platform in an elliptical form. For example Fiji Atolls, Suvadivo in Maldives and Funafoothis Atoll of Ellice.

Importance of Coral Reefs

- They protect coastlines from the damaging effects of wave action and tropical storms.
- They provide habitats and shelter for many marine organisms.
- They are the source of nitrogen and other essential nutrients for marine food chains.
- They assist in carbon and nitrogen-fixing.
- They help with nutrient recycling.
- The study of coral reefs is essential for scientifically testable records of climatic events over the past million years.
- The fishing industry depends also on coral reefs. Many fish spawn there, and juvenile fish spend time there before making their way to the open sea. The Great Barrier Reef generates more than 1.5 billion dollars annually for the Australian economy from fishing and tourism.
- Coral reefs are also key indicators of global ecosystem health. They serve as an early warning sign of what may happen to other less sensitive systems, such as river deltas if climate change is not urgently addressed.

Snowflake Coral – A Threat to Biodiversity

- Carijoa Riisei also known as snowflake coral is an invasive species discovered recently by the scientists off the coast of

Thiruvananthapuram and Kanyakumari. These fast-growing species were found at a depth of 10m off Kovalam in Thiruvananthapuram and at a depth of 18m off Enayam in Kanyakumari.

- The snowflake coral is known to cause a serious threat to the marine ecosystem due to the following reasons:
- According to a survey conducted on Maui Black Coral Bed in 2001, it was found that the snowflake corals killed 60% of the black coral trees which was found between 80 metres to 150 metres depth.
- They consume large quantities of the zooplanktons which can have a high ecological impact.
- They threaten the biodiversity by displacing the native species and by monopolizing food resources.
- It has the capacity to invade space and as a result, it can crowd out marine species like corals, algae and sponges that play a major role in maintaining the marine biodiversity.

Coral Reefs in India

- India has its coastline extending over 7500 kilometres. It is due to the subtropical climatic conditions, there are a very few coral reefs in India. The major coral reefs in India includes the Palk Bay, the Gulf of Mannar, the Gulf of Kutch, the Andaman and Nicobar Islands and Lakshadweep Islands. Among all these coral reefs, the Lakshadweep reef is an example of atoll while the rest are all fringing reefs.
- Palk Bay - Situated in the south-east coast of India, Palk Bay is separated from the Gulf of Mannar by the Mandapam Peninsula and the Rameshwaram Island and is centred on 9 °17′N and 79° 15′. The one fringing reef in the Palk Bay is 25-30km long, and less than 200m wide lies in the east-west direction of the Pamban channel. This reef has a maximum depth of around 3 m.

- The Gulf of Mannar - Situated around a chain of 21 islands, the Gulf of Mannar lies between Tuticorin and Rameswaram at a stretch of 140 km. These 21 islands fall between latitude 8°47′ N and 9° 15′ N and longitude 78° 12′ E and 79° 14'E and form a part of the Mannar Barrier Reef which is 140 km long and 25 km wide.
- Andaman and Nicobar Islands - The Andaman and Nicobar Islands fall between 6°-14° N lat and 91 °-94° E longitude. They are situated at the south-eastern part of the Bay of Bengal and consist of 350 islands, of which only 38 are inhabited. These islands extend southward from the Irrawaddy Delta of Burma to the Arakan Yoma Range. All the islands of the Andaman and Nicobar groups are almost fringing reefs.
- The Gulf of Kutch - The Gulf of Kutch is situated in the northern part of Saurashtra Peninsula and is located between 22°15′-23°40′ N Latitude and 68°20′-70°40′ East Longitude having an area of about 7350 sq km. These reefs are of a fringing type and are about 170 km long and 75 km wide at the mouth which narrows down at a longitude of 72° 20′. Due to the mud deposits on various coral reefs, these coral reefs are in a highly degraded condition.
- Lakshadweep Islands - Located between 8°N – 12°3'N latitude and 71 °E- 74°E longitude, the Lakshadweep Islands which lies scattered in the Arabian Sea are situated at about 225 km to 450 km from the Kerala Coast. The islands covering an area of 32 km2 consist of 36 tiny islands, 12 atolls, 3 reefs and 5 submerged banks, with lagoons occupying about 4200 km^2. Due to the warm humid climate of these islands, the temperature of the water varies between 28-31 °C with salinity ranging from 34% – 37%.
- <u>Coral Bleaching</u>
- The coral and the zooxanthellae share a symbiotic relationship and 90% of the nutrients that are produced by the algae are transferred to the coral hosts. But this relationship gets affected under severe

environmental stress which causes the loss of symbiotic algae (zooxanthellae). As a result, the white calcium-carbonate exoskeleton is visible through its transparent tissue leading to a condition known as Coral Bleaching. The corals become vulnerable in the absence of the algae and begin to die if the temperature of the sea remains high for weeks.

- Challenges in front of Coral Reefs ecosystem are:
- Climate Change: Rising sea temperatures can lead to coral bleaching, where corals expel the symbiotic algae that provide them with essential nutrients, causing them to lose their colour and vitality. Repeated bleaching events can result in coral death.
- Ocean Acidification: Increased levels of carbon dioxide (CO2) in the atmosphere lead to ocean acidification, where CO2 is absorbed by the oceans. This makes it more difficult for corals to build their calcium carbonate skeletons, weakening the reef structure and its ability to support marine life.
- Overfishing and Destructive Fishing Practices: Overfishing, as well as the use of destructive fishing practices like blast fishing, can deplete fish populations on coral reefs. This disrupts the delicate balance of the ecosystem as some species play key roles in reef health.
- Pollution: Runoff from land-based activities introduces pollutants, such as sediment, agricultural chemicals, and sewage, into coastal waters. These pollutants can reduce water quality, all of which can harm coral reefs.
- Tourism and Recreational Activities: Uncontrolled tourism and recreational activities, such as snorkeling and diving can lead to physical damage to corals.
- Invasive Species: Invasive species, such as crown-of-thorns starfish, can prey on and destroy corals, disrupting the reef ecosystem.

	Coral Reef Breakthrough (CRB) • Basically, the CRB is a science-based initiative with clear goals for the state and non-state actors (like NGOs) to collectively conserve, protect, and restore coral reefs. • With investments of at least USD 12 billion, the CRB intends to safeguard the future of at least 125,000 km2 of shallow-water tropical coral reefs by 2030, thereby supporting the resilience of more than half a billion people worldwide. • Achieving the targets of CRB will help in achieving the Sustainable Development Goals (SDGs), particularly SDG14- Life Below Water. • CRB is based on four action points:

- To eliminate local factors that pose danger to coral reefs such asland-based sources of pollution, unplanned coastal development, overfishing etc.
- To double the area of coral reefs under effective protection and to promote resilience-based coral reef conservation efforts by aligning with global coastal protection targets including 30 by 30. This 30 by 30 is a global initiative to protect at least 30% of the Earth''s land and ocean area by 2030. This initiative was proposed during the UNCCD Conference of Parties (COP15).
- To assist in the development and implementation of creative solutions at large scale and to promote climate-smart designs

that support coral adaptation to impact 30% of degraded reefs by 2030.

- To get investment of at least USD 12 billion by 2030 from public and private sources to conserve and restore the coral ecosystems.

Way Forward

- Efforts to address the above challenges include the establishment of marine protected areas, sustainable fishing practices, pollution control measures, coral restoration initiatives, and global action to reduce greenhouse gas emissions.
- Coral reef conservation requires collaboration among governments, communities, scientists, and conservation organizations to ensure the long-term survival of these valuable ecosystems.

International Coral Reef Initiative (ICRI)

- ICRI is a partnership of governments, international organizations, and the non-governmental organizations dedicated to the preservation and sustainable management of coral reefs and related ecosystems around the world.
- It was established in 1994 in response to growing concerns about the degradation and decline of coral reefs due to various environmental threats, including climate change, overfishing, pollution, and coastal development.
- Presently, ICRI has 101 members, including 45 countries (India is one of them).

Global Fund for Coral Reefs (GFCR)

- GFCR is a finance instrument to integrate action and resources to protect and restore the coral reef ecosystems.

- Many UN Agencies, states, philanthropies, private investors and organisations have joined it.

High-Level Climate Champions (HLCC)

HLCCs are appointed by the UN to increase the engagement of non-state actors such as businesses, cities, regions, and investors in supporting the goals of the Paris Agreement.

2, PET 46

- The discovery of PET46 has been made from deep-sea organisms belonging to the archaea domain.
- Archaea is a domain of single-celled microbes lacking cell nuclei and are therefore prokaryotes.
- It has the ability to degrade both very long-chain PET molecules (polymers) and short-chain PET molecules (oligomers), which means that degradation can be continuous.
- It uses a completely different mechanism for substrate binding than previously known PET-degrading enzymes.
- A "lid" of 45 amino acids above the enzyme''s active center is crucial for binding, whereas in other PET enzymes, aromatic amino acids close to the active site are typical.

Application of PET46:

- PET46 is similar molecularly to another enzyme- ferulic acid esterase.
- PET46 degrades the natural polymer lignin in plant cell walls by breaking down lignin polymers to release sugars from woody plant parts.
- The lignin and PET have many structural similarities, so the PET-degrading enzymes found in nature may be important for composting wood in forest soils.

- The biochemical properties of PET46 may be useful both for marine and terrestrial plastics and for biotechnology.
- The PET46 is more efficient at 70° Celsius than best-characterized PET-degrading enzymes from bacteria and composting plants at their respective optimum temperatures.

Polyethylene terephthalate (PET) plastic

- Polyethylene terephthalate is one of the most common plastics used in a variety of items from water bottles and product packaging to baby wipes, clothing, bedding and mattresses.
- PET doesn't readily break down, contributing to plastic pollution.
- Plastics like PET can break down into tiny pieces called microplastics, which are prevalent in our oceans, bays, lakes, and even drinking water.
- Plastics break down into tiny pieces, but they never go away, as petroleum-derived plastic is not biodegradable.
- Microplastics are often consumed by aquatic life, both large and small and eventually leading to accumulation in humans.

3. Manis Mysteria

- Adding to the eight known species of pangolins, scientists recently discovered a ninth variety, tentatively named "Manis mysteria".
- It is a newly discovered Pangolin species.
- The newly identified pangolin species emerged from a detailed study of scales seized in China's Yunnan province in 2015 and 2019.
- This new species is believed to have diverged from its Philippine and Malayan relatives approximately five million years ago.
- Pangolins

- They are mammals known for their distinctive appearance and protective scales.
- They are often referred to as "scaly anteaters" due to their characteristic scales and their diet, which primarily consists of ants and termites.
- Pangolins are found in parts of Africa and Asia and are known for their elusive nature and status as the most trafficked mammals in the world.
- Features
- They are easily recognizable by their armor-like scales, which cover their bodies. These scales are made of keratin, the same protein found in human hair and nails. They are the only known mammals with this feature.
- When threatened, pangolins can curl into a tight ball, with their scales forming a protective barrier.
- Their diet consists mainly of ants and termites, which they capture using their long tongues (A pangolin's tongue is longer than its body).
- Pangolins have no teeth; they chew with gravel and and keratinous spines inside the stomach.
- They are most active at night and are solitary creatures.
- Threat
- All pangolin species are listed on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species.
- The Indian pangolin, also called thick-tailed pangolin, is classified as Endangered under the IUCN Red List.

4. Pink Bollworm

- It is one of the most destructive pests of cotton.
- Scientific name: Pectinophora gossypiella

- Distribution: Originally native to India, it is now recorded in nearly all the cotton-growing countries of the world.
- The adults are small moths about 3/8 inch long and are dark brown with markings on the fore wing.
- The larval stage is the destructive and identifiable stage.
- The larvae have distinctive pink bands and can reach a length of ½ inches right before they pupate.
- Ecological Threat
- Pink bollworms are major pests of cotton.
- Adults only last for 2 weeks, but females will lay 200 or more eggs.
- Adults lay eggs on cotton bolls; once hatched, the larvae eat the seeds and damage the fibers of the cotton, reducing the yield and quality
- When the larvae mature, they cut out the boll and drop to the ground and cocoon near the soil surface.
- It has also been observed to attack hibiscus, okra, and hollyhock plants.

Cotton

Growing Conditions	Cotton is a Kharif crop that requires 6 to 8 months to mature. **Temperature:** Between 21-30°C (Requires a hot, sunny climate with a long frost-free period) **Rainfall:** Around 50-100 cm (Most productive in warm and humid conditions). **Soil Requirements:** Cotton can be planted in a wide range of soils, from **medium to heavy, but**

		black cotton soil is the most ideal for cotton cultivation. It can tolerate a **pH range of 5.5 to 8.5** but is sensitive to waterlogging.
	Major Cotton Growing States	Northern Zone: Punjab, Haryana, Rajasthan. Central Zone: Gujarat, Maharashtra, Madhya Pradesh. Southern Zone: Telangana, Andhra Pradesh, Karnataka, Tamil Nadu.
	Significance	Primary source for the textile industry, commanding two-thirds of India"s total textile fibre consumption. **Cottonseed oil** and cake/meal are used for cooking and as feed for livestock and poultry. Cottonseed oil is India's third-largest domestically-produced vegetable oil. Cotton is one of India's most important commercial crops, accounting for approximately **25% of global cotton production.** It is often referred to as "**White-Gold**" due to its economic significance.
	Initiatives	Kasturi cotton Minimum Support Price (MSP)

Cotton Corporation of India (CCI)

National Food Security Mission-Commercial Crops (NFSM-CC)

Prelims - Previous Year Questions (PYQs)

1. "Biorock technology" is talked about in which one of the following situations?

(a) Restoration of damaged coral reefs

(b) Development of building materials using plant residue

(c) Identification of areas for exploration/extraction of shale gas

(d) Providing salt licks for wild animals in forests/protected areas

Ans: (a)

2. Consider the following statements: (2018)

1. Most of the world's coral reefs are in tropical waters.

2. More than one-third of the world's coral reefs are located in the territories of Australia, Indonesia and Philippines.

3. Coral reefs host far more number of animal phyla than those hosted by tropical rainforests.

Which of the statements given above is/are correct?

(a) 1 and 2 only

(b) 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

Ans: (d)

3. Which of the following have coral reefs? (2014)

(1) Andaman and Nicobar Islands

(2) Gulf of Kachchh

(3) Gulf of Mannar

(4) Sunderbans

Select the correct answer using the code given below:

(a) 1, 2 and 3 only

(b) 2 and 4 only

(c) 1 and 3 only

(d) 1, 2, 3 and 4

Ans: (a)

4. The black cotton soil of India has been formed due to the weathering of (2021)

(a) brown forest soil

(b) fissure volcanic rock

(c) granite and schist

(d) shale and limestone

Ans: (b)

5. A state in India has the following characteristics: (2011)

1. Its northern part is arid and semi-arid.

2. Its central part produces cotton.

3. Cultivation of cash crops is predominant over food crops.

Which one of the following states has all of the above characteristics?

(a) Andhra Pradesh

(b) Gujarat

(c) Karnataka

(d) Tamil Nadu

Ans: (b)

6. Consider the following animals (2021):

1. Hedgehog

2. Marmot

3. Pangolin

To reduce the chance of being captured by predators which of the above organisms rolls up/roll up and protects/ protects its/their vulnerable parts?

(a) 1 and 2

(b) 2 only

(c) 3 only

(d) 1 and 3

Ans: (d)

7. Why is there a great concern about the 'microbeads' that are released into environment? (2019)

(a) They are considered harmful to marine ecosystems.

(b) They are considered to cause skin cancer in children.

(c) They are small enough to be absorbed by crop plants in irrigated fields.

(d) They are often found to be used as food adulterants.

Ans: (a)

8. In India, 'extend producer responsibility' was introduced as an important feature in which of the following? (2019)

(a) The Bio-medical Waste (Management and Handling) Rules, 1998

(b) The Recycled Plastic (Manufacturing and Usage) Rules, 1999

(c) The E-Waste (Management and Handling) Rules, 2011

(d) The Food Safety and Standard Regulations, 2011

Ans: (c)

10. Mahaveer Jayanti

Recently, the Vice-President of India greeted the people on the occasion of 'Mahavir Jayanti' (April 21st, 2024)

Mahavir Jayanti:

- **Festival of Jainism**: Mahavir Jayanti, also known as **Mahavir Janma Kalyanak** is one of the most significant festivals in Jainism, celebrating

the birth anniversary of Lord Mahavir, the **24th and last Thirthankara** of Jainism.

- **Celebrations**: Celebrated by Jains around the world, Mahavir Jayanti is observed through religious processions, prayers, chants, and sermons. The day is marked by celebration, reflection, and a renewed commitment to the teachings of Lord Mahavir.
- **Commitments**: On this day when Jains pledge and vow to practise compassion towards all living beings.
- Mahavir Jayanti promotes the values of tolerance, compassion, and non-violence towards all and serves as a reminder for people to think about their actions and aim to live a life of righteous nature and morality.
- Donations are also made in order to contribute towards saving animals from slaughter.

Historical Background:

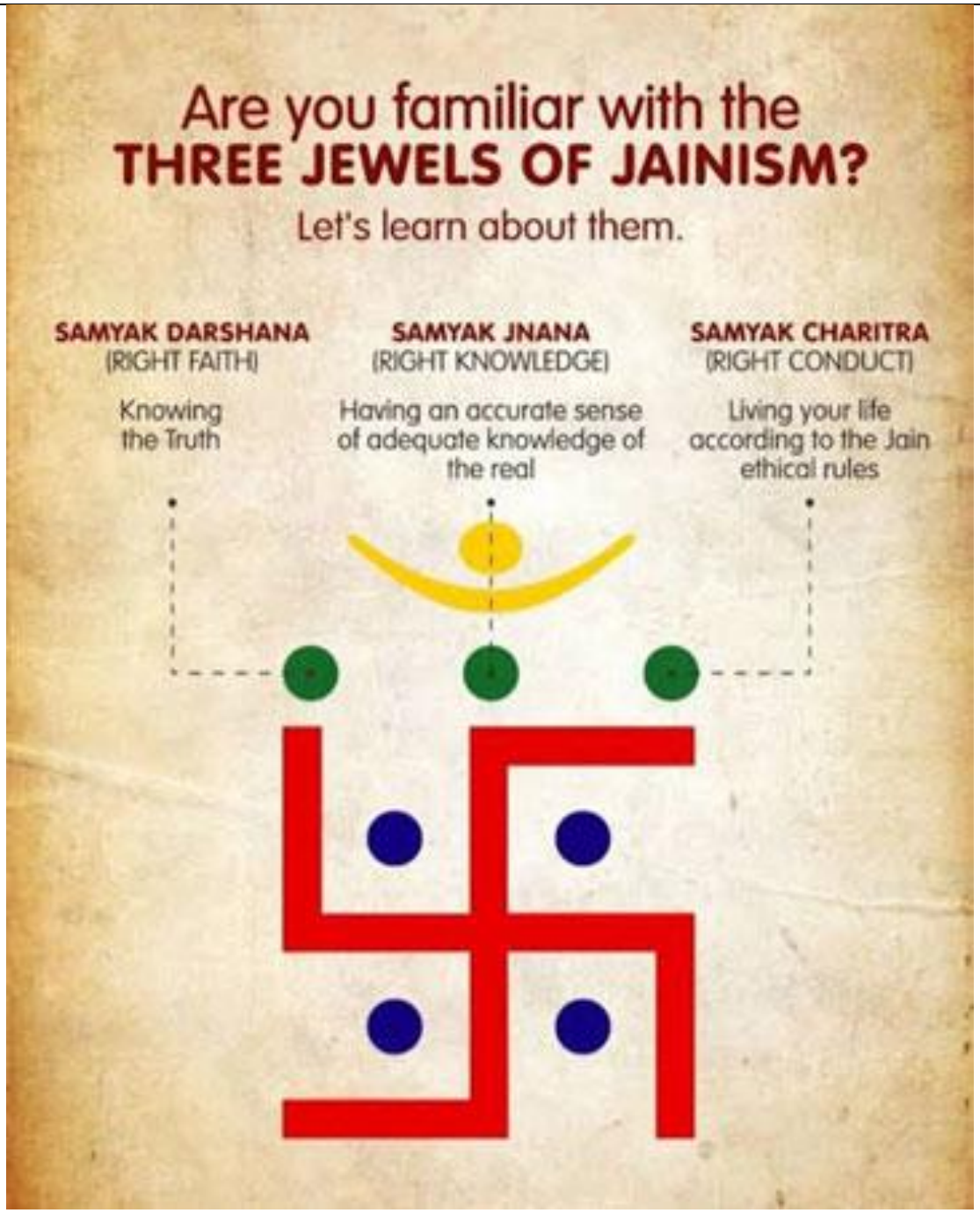
- **Birth**: He was born as **Vardhamana** into the royal family, to **King Siddhartha** and **Queen Trishala**, in the early part of the **6th century BCE** in **Kundagrama**, which is in modern-day Bihar, India.
- He was born on the **Trayodashi (13th)** date of **Shukla Paksha** (the bright half) of the Hindu month of **Chaitra**, which falls in late March or early April as per the Gregorian calendar.
- His birth date, however, is sometimes debatable, the Swetambar Jains believe that he was born in **599 BC**, while the Digambar Jains believe he took birth in **615 BC.**
- Spiritual Awakening: Mahavir, or the 'great hero,' renounced his royal status and familial ties at the age of 30 to seek spiritual awakening.
- After 12 years of intense meditation and ascetic life, Mahavira **attained Kevala Jnana** (omniscience or supreme knowledge) hence, was also called Sage **Vardhamana** and preached non-violence (ahimsa) and spent the next 30 years travelling around India to teach his philosophy.
- He delivered his first sermon at **Pava.**

- Symbol: A symbol was associated with every Tirthankara and Mahavira's symbol was a **lion**.
- Enlightenment: He got his name for his exceptional control over his senses. Seeking truth and spiritual freedom, he attained enlightenment (Nirvana) at the age of 72 in **468 B.C.** at the **Pavapuri in Bihar**.
- **Contribution**: Mahavir, renowned as a teacher who propagated Dharma in Jainism.
- He is known for his teachings of non-violence, compassion, and the importance of leading a simple and austere life.
- His core teachings included **Ahimsa (non-violence), Satya (truth), Asteya (non-stealing), Brahmacharya (chastity), and Aparigraha (non-attachment),** which later became the fundamental principles of Jainism.
- *Important Disciple*: **Indrabhuti Gautama** was the main disciple of Mahavira, who wrote his master's teachings for the benefit of the world.

Jainism:

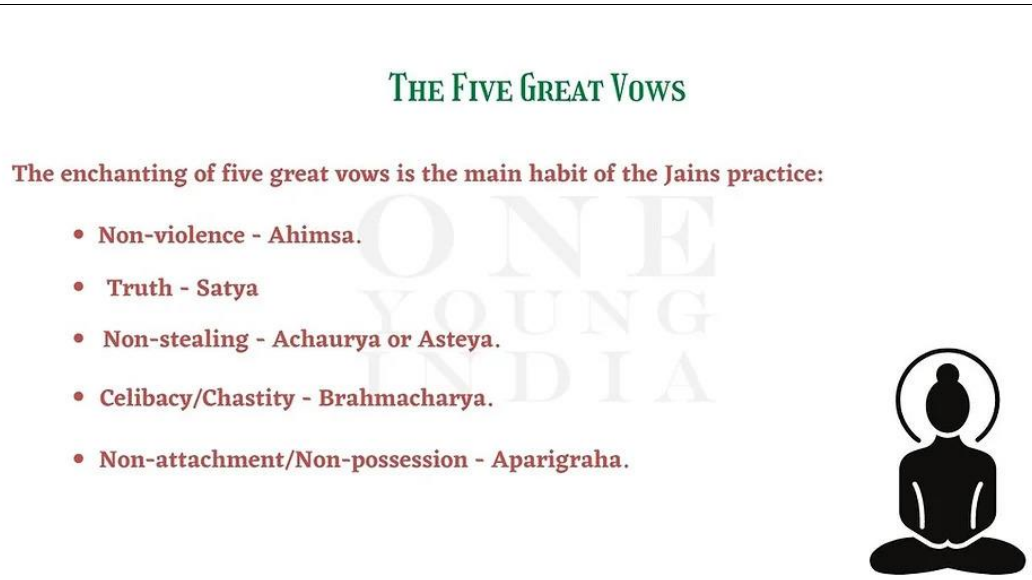
- Origin: Jainism came to prominence in the 6th century B.C. when Lord Mahavir propagated the religion.
- The word 'Jain' is derived from **jina or jaina** which means the **'Conqueror'.**
- The doctrine of Jaina is **older** than the Buddhist doctrine.
- *Cause of Origin:*
- **Rigidity of Hinduism**: Hinduism had become rigid and orthodox with complex rituals and dominance of Brahmins and Kshatriyas reacted against the domination of the Brahmanas.
- **Use of Iron**: Spread of the new agricultural economy in north-eastern India due to the use of iron tools.
- **Tirthankaras**: Tirthankaras are people who had attained all knowledge **(Moksha)** while living and preached it to the people and there were 24 Tirthankaras.
- The **first** Tirthankara was **Rishabnatha** and the last – 24th Tirthankara was Vardhaman Mahavir.

	• **Belief:** Jains believe that Jainism is an **eternal (sanatan) religion (dharma)** with the tirthankaras guiding every cycle of the Jain cosmology. • **Parasparopagraho Jīvānām** (the function of souls is to help one another) is the **motto** of Jainism. • **The Concept of God**: Jainism **believes in God** but does not believe in God as a creator, survivor, and destroyer of the universe. • However, for Jainism God is lower than **Jina (Lord Mahavir).** • Tenets: Jainism mainly aims at the attainment of liberation, for which **no ritual** is required. It can be attained through three principles called **Three Jewels or Triratna** as follows: **Right Faith (Samyak Darshan)** **Right Knowledge (Samyak Jnana)** **Right Action (Samyak Charitra)**



Doctrines:

- **Ahimsa: Non-injury to living being**
- **Satya: Do not speak a lie**
- **Asteya: Do not steal**
- **Aparigraha: Do not acquire property**
- **Brahmacharya: Observe continence**



- *Spread*: Jainism spread through Sangha, it consists of **both women and men.**
- Patronage: Under the patronage of **Chandragupta Maurya, Kharavela of Kalinga** and the royal dynasties of South India such as the **Ganges, the Kadambas, the Chalukyas and the Rashtrakutas.**

Sects/Schools of Jainism:

- **Major Sects**: Jain order has been divided into two major sects: *Digambara and Shwetambara.*
- *Digambaras:*
- Monks of this sect believe in **complete renounce of clothes.**
- Male monks **do not wear clothes** while female monks wear unstitched plain white sarees.
- They follow all **five vows** i.e., Satya, Ahimsa, Asteya, Aparigraha and Brahmacharya.
- They believe that women **cannot** achieve liberation.
- Exponent: **Bhadrabahu** was an exponent of this sect.
- Major Sub-Sects: **Mula Sangh, Bisapantha, Terapantha, Taranpantha or Samaiyapantha.**

- Minor Sub-Sets: **Gumanapantha, Totapantha.**
- *Shwetambara:*
- Monks of this sect **wear white clothes**.
- They follow only **4 vows (except brahmacharya).**
- They believe that women **can achieve** liberation.
- Exponent: **Sthulabhadra** was an exponent of this sect.
- Major Sub-Sects: **Murtipujaka, Sthanakvasi, Terapanthi**
- *Important Terms Related to Jainism:*
- **Asrav**: Inflow of karmas to the soul that occurs at every second in life.
- **Samvara**: Stoppage of the influx of the material karmas into the soul consciousness.
- **Nirjara**: Shedding or removal of accumulated karmas from the atma (soul), essential for breaking free from samsara, the cycle of birth-death and rebirth, by achieving moksha, liberation. It is one of the important principles or **tattva** in Jain philosophy.
- **Sallekhana**: It is the religious practice of voluntarily fasting to death by gradually reducing the intake of food and liquids. It is also known as Santhara.
- **Kaivalya**: It is also known as Kevala Jnana, means omniscience in Jainism and is roughly translated as complete understanding or supreme wisdom.
- **Anekantavada**: It emphasises that the ultimate truth and reality is complex, and has multiple-aspects i.e., **"theory of plurality".**
- It refers to the simultaneous acceptance of multiple, diverse, even contradictory viewpoints.
- **Syadvada**: Syadavada literally means the method of examining different probabilities. Here, all judgments are conditional, holding good only in certain conditions, circumstances, or senses.
- It believes in Seven modes of prediction **(Saptabhangi Nayavada).**
- Difference between Anekantavada and Syadvada: **Anekantavada** is the knowledge of all differing but opposite attributes whereas Syadvada is a

process of the **relative description** of a particular attribute of an object or an event.

- *Historical Jain Councils:*
- **First Jain Council**: It was held at **Patliputra** in **3rd Century B.C.** and was presided by **Sthulbhadra.**
- **Second Jain Council**: It was held at **Vallabhi** in **512 A.D.** and was presided by **Devardhi Kshmasramana**.
- *Difference of Jainism from Buddhism:*
- **God Existence**: Jainism recognised the existence of god while Buddhism did not.
- **Varna System**: Jainism **does not condemn** the **varna system** while Buddhism does.
- **Belief System**: Jainism believed in **transmigration of soul** i.e., reincarnation while Buddhism does not.
- **Path Followed**: Buddha prescribed the middle path while Jainism advocates the extreme path, even completely discarding the clothes i.e. life of austerity.
- *Contribution of Jainism :*
- **Language & Literature**: They helped in growth of **Prakrit and Kannada language**.
- **Vardhaman Mahavir** preached in **'Ardha-Magadhi' language**, the language of the common man.
- **Kalpasutra** was written by **Bhadrabahu** and contains biographies of **Tirthankaras.**
- Jain literature is mainly written in Prakrit language.
- Teachings of tirthankara before Mahavira were known **as Purva.**
- Jain literature is called **Jain Agamas (canonical text based on Mahavira's teachings).**
- *Classification of Jain Literature:*
- ***Agam or Canonical Literature (Agam Sutras)***: It consists of many texts, which are the sacred books of the Jain religion.

- They are written in the Ardha-magadhi, a form of Prakrit language.
- These agamas are further divided into **Angas, Mulasutra, Upangas, Prakirnaka Sutra, Chedasutra and Ulikasutras.**
- The canonical Jain literature is claimed to have started from **Adinath**, also known as Rishabhnath.
- ***Non-Agam Literature***: It consists of commentary and explanation of Agam literature, and independent works, compiled by ascetics and scholars.
- They are written in many languages such as **Prakrit, Sanskrit, Apabhramsa, Old Marathi, Rajasthani, Gujarati, Hindi, Kannad, Tamil, German, and English.**
- ***Philosophy***: They introduced a new philosophy – **syadvada**.
- **Art & Architecture**: Statue of **Gomateshwara (Shramanbdlogola),** temples of **Khajuraho** and **Abu and Tiger cave of Udayagiri** and **Indra Sabha of Ellora** are significant contributions of Jainism.
- **Manasthambha**: It is found in the front side of the temple, having religious importance with an ornamental pillar structure carrying the image of Tirthankar on top and on all four cardinal directions.
- **Basadis**: Jain monastic establishment or temples in Karnataka.
- **Economy**: Jainism contributed to the growth of the trading community.

Significant Architectural Figures of Jainism:

- **Layana/Gumphas (Caves)**:
- Ellora Caves (Cave No. 30-35)- Maharashtra
- Mangi Tungi Cave– Maharashtra
- Gajpantha Cave– Maharashtra
- Udayagiri-Khandagiri Caves– Odisha
- Hathi-gumpha Cave– Odisha

- Sittanavasal Cave– Tamil Nadu
- **Statues**:
- Gomateshwara/Bahubali Statue– Shravanabelagola, Karnataka
- Statue of Ahimsa (Rishabnatha)– Mangi-Tungi hills, Maharashtra
- Jinalaya (Temple):
- Dilwara Temple: Mount Abu, Rajasthan
- Girnar and Palitana Temple: Gujarat
- Muktagiri Temple: Maharashtra

Contemporary Relevance of Jainism:

- **Ahimsa (non-violence):** Jainism preached non-violence toward all living beings. This value is significant in today's nuclear world to attain long lasting peace in the society.
- It can also help to counter growing violence and terrorism.
- Non-violence is about treating all living beings **as equal**. The concept of equality is the core of the theory of non-violence.
- Killing of the **plant kingdom** also comes under the ambit of **Himsa.** As the world marches on towards creating a sustainably developed world, the world must keep our forests intact.
- The Philosophy that lies behind the creation of UNESCO resembles the thought of Jainism, which declares that, **"Since wars begin in the minds of men. It is in the minds of the men that the defense of peace must be constructed."**
- Jainism believes that all living beings have an equal right to lead a peaceful life.
- **Aparigraha (non-possession)**: Aparigraha holds the answer to the problems emanating from rampant consumerism, i.e., the depletion of

	natural resources, climate change, and biodiversity loss, among others. Curtailing the consumption of unnecessary goods directly addresses this issue. • This value can help in reducing the issue of global warming by doing away with unwanted luxuries, which produce carbon emissions. • Today, newspapers are filled with concerning incidents such as murders, rapes, and fraudulent activities. The main reason for these crimes is the want for more. These activities not only disrupt the social balance but also degrade the societal values of those individuals. • By inculcating this value, these issues can help in combating such serious crimes. • **Anekantavada**: It highlights the spirit of intellectual and social tolerance. • Religious tolerance is required, particularly in India, where hundreds of religions and ideas coexist. Blasphemy, mob lynching, and religious rioting can be reduced if everyone understands and adheres to this doctrine. • **The doctrine of Triratna**: It is relevant to liberate humans from the subjugation to liberty and freedom. *Conclusion:* • Jainism holds an important position and has been rightly called an ethical religion, which is applicable and relevant today as it was thousand of years ago. The Jain ethos comprehends all aspects of human life and leads to social development, individual happiness, economic advancement and political harmony.
11.	**UNFF, NECP, Organics - PPP 100 - PRELIMS 2024 - 17** **1.United Nations Forum on Forests** • The Ministry of Environment, Forest and Climate Change is organising a Country-Led Initiative (CLI) event as part of the United

Nations Forum on Forests (UNFF) from 26-28 October, 2023 at the Forest Research Institute (FRI), Dehradun, Uttarakhand.

- **United Nations Forum on Forests**
- It promotes the **management, conservation, and sustainable development** of all types of forests.
- It was **established in 2000** by the UN Economic and Social Council of the United Nations **(ECOSOC).**
- The Forum meets annually at the UN Headquarters in New York, bringing together representatives of all member states and forest-related agencies for **high-level dialogue on technical matters in odd years and policy matters in even years.**
- The forum **has universal membership**, and is composed of **all Member States of the United Nations and specialized agencies**.
- **India** is a founding member of UNFF.
- **Country-Led Initiative (CLI)**
- Its primary goal is to contribute to the discussions of UNFF regarding the implementation of **Sustainable Forest Management** and **the UN Strategic Plan for Forests.**
- It also aims to facilitate the sharing of best practises among UNFF member States for the implementation of SFM and UNSPF.
- This year, CLI will discuss thematic areas involving forest fires and forest certification.

2. National Cooperative Organics Limited

- The NCOL is a multipurpose initiative that aims to provide a platform to all the **farmers** doing **natural farming** across the country and to make arrangements for **marketing** of their **products**.
- It has been established under the **Multi State Cooperative Societies Act, 2002** in **2023**.
- It is headquartered at **Anand, Gujarat**.

- It will sell the **organic products** in India and later will market in other countries.
- About **50**% of **profits** from sale of **organic products** through NCOL will be **transferred** directly to member farmers.
- It is being promoted by National Dairy Development Board.
- It covers the entire supply chain of organic products via activities ranging from aggregation, certification, production, testing, procurement, storage, processing, branding, packaging, labeling, marketing, etc for the ultimate benefit of farmer members.
- It is one of the **three** new cooperatives the government has set up, the other two cooperatives work in the field of **certified seeds** and **exports**.
- ***Organic agriculture***
- Organic farming is a method of agriculture that relies on natural inputs and processes to produce crops without the use of synthetic chemicals, genetically modified organisms, hormones or antibiotics. Organic farming aims to enhance soil health, biodiversity, animal welfare and ecological balance, while minimizing environmental pollution and health risks.
- In 2002, the government launched the National Programme for Organic Production (NPOP), which aims to promote organic farming and increase the area under organic cultivation. As a result of these efforts, the area under organic cultivation in India has been increasing steadily. In 2019, the area under organic cultivation was 2.3 million hectares.
- **Benefits of organic farming in India**
    - **Prevention of soil and water pollution** due to elimination of use of chemicals that can leach into groundwater and surface water and contaminate the food chain.
- **Conservation of disease-free and healthy biodiversity** by maintaining a variety of crops, animals and microorganisms that can resist pests and diseases naturally, and provide ecosystem services such as pollination, nutrient cycling and pest control.

- **Cost effectiveness** due to the use of natural products such as animal manures, composts, biofertilizers, biopesticides and crop residues that are locally available and cheaper than synthetic inputs.
    - It also reduces the dependence on external inputs and markets and increases the bargaining power of farmers.
- **Maximisation of resource utilisation,** thus high efficiency of this type of farming. Organic farming optimizes land, water, energy & labour with practices like crop rotation, intercropping, mulching, rainwater harvesting, vermicomposting & agroforestry, enhancing soil fertility, water retention, carbon sequestration & biomass production.
- **Increased nutritional content of food** by producing crops that have higher levels of antioxidants, vitamins, minerals and phytochemicals than conventionally grown foods.
    - Organic foods also have lower levels of pesticide residues, nitrates, heavy metals, hormones and antibiotics that can cause adverse health effects.
- **Maintenance of soil fertility** by improving the physical, chemical and biological properties of soil through organic matter addition, microbial activity, humus formation and soil structure improvement.
    - Organic farming also prevents soil erosion, salinization and acidification that can degrade soil quality and productivity.
- **Toxin-free food reduces health issues** earlier caused by the absorption of toxins by crops. This improves the immunity, vitality and well-being of consumers who prefer organic foods for their safety and quality.
- **Cheaper inputs, higher and more stable prices,** and organization in farmer cooperatives. Organic farming reduces the input costs for farmers who can save on expensive chemicals and seeds.
- **Helps in meeting twin challenges of food security** and job creation, and poverty reduction. Organic farming can increase food production by

improving crop yields and diversifying food sources. It can also create more employment opportunities for rural people by involving more labour-intensive activities such as weeding, composting and harvesting.

Challenges of organic farming in India

- **Lack of awareness:** Many farmers in India are not aware of the benefits of organic farming or how to transition to this method of production. This lack of awareness can make it difficult for farmers to adopt organic farming practices.

- **High cost:** The upfront costs of transitioning to organic farming can be high, as farmers may need to purchase new seeds, fertilizers, and pesticides. Additionally, organic farming may require more labour than conventional farming, which can also increase costs.
- **Low yields:** Organic farming typically produces lower yields than conventional farming, which can make it difficult for farmers to make a profit. This is because organic farming relies on natural processes to control pests and diseases, which can lead to crop losses.
- **Market access:** There is a limited market for organic produce in India, which can make it difficult for farmers to sell their products. This is because consumers are often not aware of the benefits of organic food or are willing to pay a premium for it.
- **Government support:** Though the government provides support for organic farming, which may not be adequate for adopting organic farming.
    - It encounters a difficulty in certification, accreditation, labelling and marketing of organic products due to the lack of uniform standards, regulations and infrastructure.
- **High transition period:** It requires a transition period of at least three years to convert a conventional farm to an organic farm, during which the yield may decline.
- **Lack of inputs availability:** It suffers from a shortage of quality organic seeds, planting materials, bio-fertilizers, bio-pesticides and other organic inputs.

- It also faces a high risk of pest and disease outbreaks due to the absence of synthetic pesticides.

- **Hard to compete with conventional farming:** It competes with the conventional farming system, which is heavily subsidized and supported by the government policies and programs.

Measures to promote Organic farming

- **Implementing organic farming policies** in a staggered manner, with clear targets, incentives and regulations for organic production, certification and marketing.

- **Strengthening soil health** and guaranteeing water conservation system by using organic manures, bio-fertilizers, crop rotation, mulching, green manuring, composting and other techniques.
- **Promoting organic farming** and its benefits to the consumers through awareness programmes, labeling schemes, quality standards, price premiums, subsidies and market linkages.
- **Supporting organic farmers** through cluster-based approach, farmer producer organisations (FPOs), capacity building, post-harvest infrastructure, value chain development and export facilitation.
- **Providing financial assistance** for organic inputs, certification, mechanised compost production units and other components under various government schemes such as Paramparagat Krishi Vikas Yojana (PKVY), Mission Organic Value Chain Development for North Eastern Region (MOVCDNER), Capital Investment Subsidy Scheme (CISS) under Soil Health Management Scheme and National Food Security Mission (NFSM).
- **Indian Scenario Regarding Organic Farming**
  - **Sikkim** became the first State in the **world** to become **fully organic in 2016.**
  - **North East India** has traditionally been organic and the consumption of chemicals is far less than the rest of the country.

- Similarly the tribal and island territories have been traditionally practicing organic farming.
- The major organic exports from India have been **flax seeds, sesame, soybean, tea, medicinal plants, rice and pulses.**
- There was an increase of nearly 50% in organic exports in 2018-19, touching Rs. 5151 crore.
- Commencement of exports from Assam, Mizoram, Manipur and Nagaland to UK, USA, Eswatini and Italy have proved the potential by increasing volumes and expanding to new destinations as the demand for **health foods** increases.

- **Government Initiatives to Promote Organic Farming**
  - **Mission Organic Value Chain Development for North East Region (MOVCD)**
    - Mission Organic Value Chain Development for North East Region (MOVCD-NER) is a **Central Sector Scheme,** a sub-mission under **National Mission for Sustainable Agriculture (NMSA)**
    - It was launched by the Ministry of Agriculture and Farmers Welfare in 2015 for implementation in the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura.
    - The scheme aims to develop certified organic production in a value chain mode to link growers with consumers and to support the development of the entire value chain.
  - **Paramparagat Krishi Vikas Yojana (PKVY)**
    - Paramparagat Krishi Vikas Yojana, launched in 2015 is an elaborated component of **Soil Health Management (SHM)** of major project **National Mission of Sustainable Agriculture (NMSA).**

- Under PKVY, Organic farming is promoted through adoption of organic villages by cluster approach and Participatory Guarantee System (PGS) certification.

- **Certification Schemes**
  - **Food Safety and Standards Authority of India (FSSAI)** is the food regulator in the country and is also responsible for regulating organic food in the domestic market and imports.
  - **Participatory Guarantee System (PGS):** PGS is a process of **certifying organic products**, which ensures that their production takes place in accordance with laid-down quality standards. **PGS Green** is given to chemical free produce under transition to 'organic' which takes 3 years. It is mainly for **domestic purpose.**
  - **National Program for Organic Production (NPOP):** NPOP grants organic farming certification through a process of third party certification for **export purposes.**
  - **Soil Health Card Scheme** has led to a **decline of 8-10% in the use of chemical fertilizers** and also raised productivity by 5-6%.
- **Agri-export Policy 2018**
  - **Focus on clusters** and **Marketing and promotion of "Produce of India"** have positively impacted the organic farming in India
- **One District - One Product (ODOP)**
  - The programme aims to encourage more **visibility and sale of indigenous and specialized products/crafts of Uttar Pradesh**, generating employment at the district level.

- The presence of aggregators is imperative to bring about economies of scale for the small and marginal farmers.

- **PM Formalization of Micro Food Processing Enterprises (PM FME)**
  - The **Ministry of Food Processing Industries (MoFPI)** launched the **PM FME scheme** as a part of **'Atmanirbhar Bharat Abhiyan'.**
  - It aims to bring in new technology, apart from affordable credit to help small entrepreneurs penetrate new markets.

- **Zero Budget Natural Farming**
  - **Zero budget natural farming** is a method of chemical-free agriculture drawing from traditional Indian practices.

- Organic farming is a sustainable and profitable alternative to conventional farming that can benefit the environment, the farmers and the consumers. However, organic farming also faces many challenges that need to be addressed by the government and other stakeholders. By providing adequate support and incentives, the government can promote organic farming in India and make it a viable and feasible option for the future of agriculture.

3. National Efficient Cooking Programme

- Recently, the Energy Efficiency Services Limited (EESL) launched its groundbreaking National Efficient Cooking Programme (NECP) and Energy Efficient Fans Programme (EEFP).
- It is a subset of the **Clean Cooking Scheme.**
- It focuses on **Non-Solar/Electricity-based Induction Cookstoves**, aligning with the Go- electric initiative by the Ministry of Power.
- This programme introduces induction-based cookstoves.
- **Target:** To deploy **20 Lakh Induction cook-stoves** across India.

- EESL seeks to reduce the environmental impact of cooking methods, ensuring cleaner air and improved health for citizens.
- EESL has also partnered with Modern Energy Cooking Services (MECS) for the large-scale deployment of induction cooktops.
- The deployment is expected to accelerate the acceptance and large-scale adoption of modern electric cooking devices in Indian kitchens.
- **Benefit:** It offers a cost advantage **of 25-30% over traditional cooking methods**, promising both energy savings and cost-effective cooking solutions.
- **Key Facts about Energy Efficiency Services Limited**
- It is **promoted by the Ministry of Power**, Government of India, as a Joint Venture of four reputed public-sector undertakings NTPC Limited, Power Finance Corporation Limited, REC Limited and POWERGRID Corporation of India Limited.
- It is registered **under the Companies Act, 1956** on 10th December 2009.
- It was formed to create and sustain market access to energy efficient technologies, particularly in public facilities like municipalities, buildings, agriculture, industry etc. and to implement several schemes of the Bureau of Energy Efficiency, Ministry of Power and Ministry of New & Renewable Energy, Government of India.
- It is also leading the market-related activities **of the National Mission for Enhanced Energy Efficiency (NMEEE).**

PYQs

1. In the context of India, which of the following is/are considered to be practice(s) of eco-friendly agriculture? [2020]

1. Crop diversification

2. Legume intensification

3. Tensiometer use

4. Vertical farming

Select the correct answer using the code given below:

a) 1, 2 and 3 only

b) 3 only

c) 4 only

d) 1, 2, 3 and 4

2. With references to organic farming in India, consider the following statements: [2018]

1. 'The National Programme for Organic Production"(NPOP) is operated under the guidelines and directions of the Union Ministry Of the Rural Development.

2. 'The Agricultural and Processed and Products Export Development Authority"(APEDA) functions as the Secretariat for the implementation of NPOP.

3. Sikkim has become India's first fully organic State.

Which of the following given above is/are correct?

a) 1 and 2 only

b) 2 and 3 only

c) 3 only

d) 1, 2 and 3

3. Which one of the following agricultural practices is eco-friendly? [1999]

a) Organic farming

b) Shifting cultivation

c) Cultivation of high-yielding varieties

d) Growing plants in glass-houses

12. India's Pulse puzzle

India's pulses import almost doubled in 2023-24, it may rise further this year.

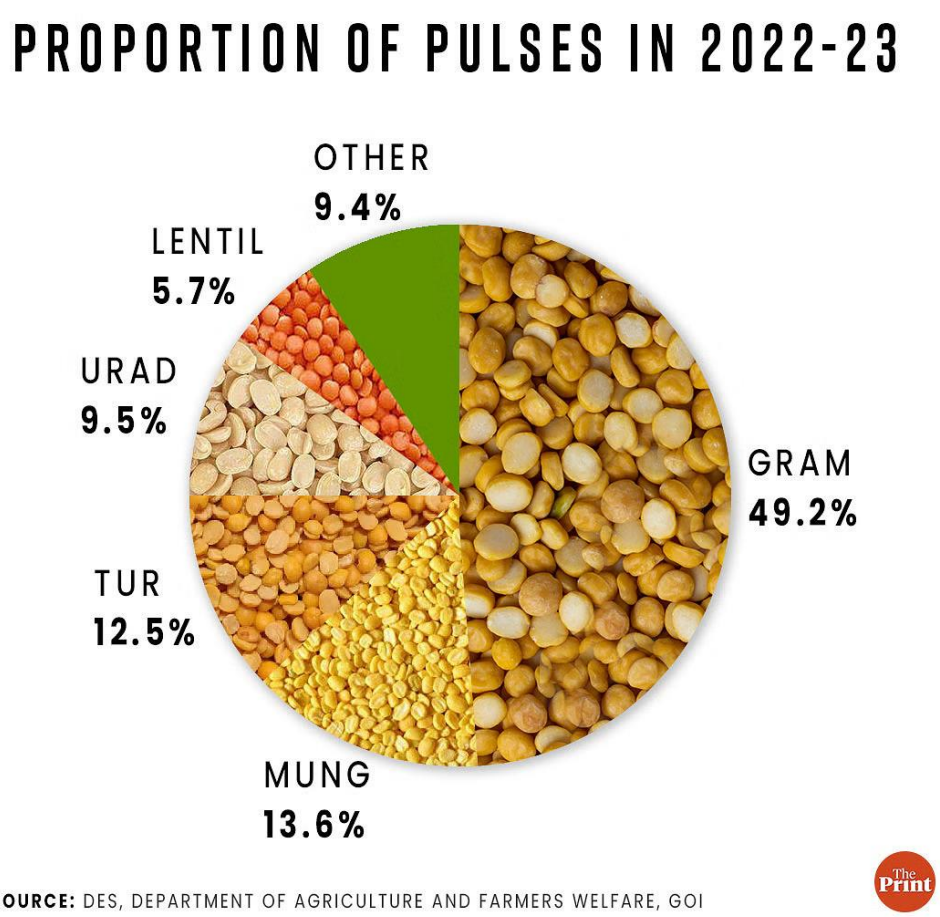
Overview of Pulses Imports:

- India"s pulses imports in fiscal 2024 surged by a staggering **84%** compared to the previous year.
- Total imports reached **4.65 million metric tons**, marking the highest volume since **fiscal year 2018**.
- Import value also saw a significant increase, rising by **93% to $3.75 billion**.

Reasons behind Surge in Imports:

- **Production Decline**:
- Lower domestic production of pulses compelled India to boost imports to meet demand.
- The Ministry of Agriculture estimates pulses production in 2023-24 to be **234 lakh tonnes**, which is lower than the previous year"s production of **261 lakh tonnes**.
- The pulses sowing area has **decreased by 16% from 2021-22 to 2023-24.**
- **Policy Adjustments**:
- The Indian government allowed **duty-free imports** of specific pulses such as **red lentils and yellow peas** further fueled the surge in imports.
- Import taxes were removed as a strategy to reduce market prices ahead of upcoming elections
- ***Pulses inflation stood at 17%*** in March 2024.
- *Key Import Trends:*

- Red lentil imports, particularly from **Canada**, more than doubled, surpassing 1.2 million tons.
- **Yellow peas** imports from **Russia and Turkey** witnessed a notable increase after duty-free imports were permitted.
- **Black gram** imports also saw a surge during the period.



Impact on Global Market:

- India''s increased imports have supported global pulses prices.
- Exporting countries such **as Canada, Australia, and Myanmar** have benefited from reduced stocks due to India''s higher demand.
- Mitigating Production Shortfalls:

- To compensate for production shortfalls, India also imported **pigeon peas and chickpeas** from various countries.
- *Historical Import Partners:*
- Traditionally, India imports pulses from countries like **Canada, Myanmar, Australia, Mozambique, Brazil, Tanzania**, etc.
- *India's Status with respect to Pulses:*
- India is the **world"s biggest importer, producer and consumer** of protein-rich pulses.
- India accounts for **35% of the global acreage** and **25% of the world"s production**.
- The country also consumes **27% of the world"s pulses** and **imports 14%.**
- **Rajasthan, Madhya Pradesh, Maharashtra, Uttar Pradesh, and Karnataka** are the top five states in India for producing pulses.
- Why does India import pulses?
- **High Domestic Demand**: India is the largest consumer of pulses in the world.
- Pulses are a staple part of the Indian diet, serving as a primary source of protein, especially in vegetarian diets.
- **Insufficient Production**: Despite being one of the largest producers of pulses, India"s production does not meet its domestic demand.
- **Price Stability**: Importing pulses helps stabilize prices in the domestic market.
- During years of low yield due to poor weather conditions or other agricultural problems, prices of pulses can skyrocket.
- **Variety and Quality**: Imports also provide access to different varieties of pulses that may not be domestically produced in India.

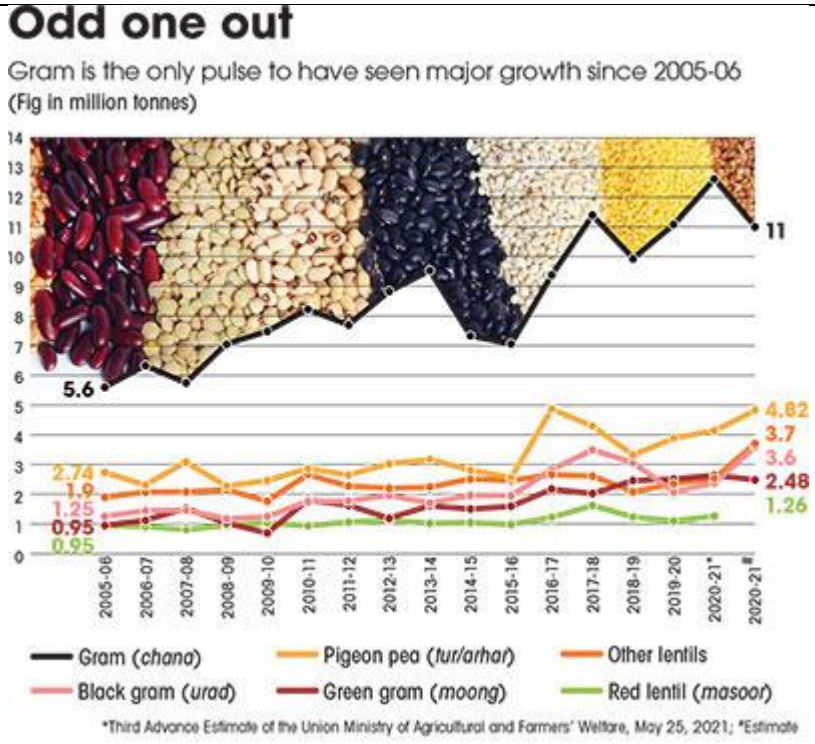
IMPORTS OF MAJOR PULSES (in thousand tonnes)

	Peas (Matar)	Chickpea (Chana)	Lentil (Masoor)	Pigeonpea (Tur/Arhar)	Urad & Moong
2014-15	1951.97	418.88	816.47	575.22	622.89
2015-16	2245.39	1031.49	1260.19	462.71	581.6
2016-17	3172.76	1080.63	829.44	703.54	574.52
2017-18	2877.03	981.32	796.62	412.95	346.97
2018-19	851.41	185.95	248.97	530.67	574.24
2019-20	666.7	370.67	854.46	449.78	381.52
2020-21	46.33	294.53	1116.17	442.62	416.63
2021-22	0.85	202.1	667.43	840.46	807.17
2022-23	0.86	62.92	858.44	894.42	556.71

Source: Department of Commerce

Pulses:

- Pulses are the ***dry seeds of leguminous plants***, like lentils, chickpeas, dry peas, and beans.
- They are a vital source of protein and amino acids for people around the world.
- Pulses are grown in India during the **Kharif, Rabi, and Zaid** seasons of the agricultural year.
- **Kharif**: Pigeon peas and other pulses are grown during this season.
- **Rabi**: Chickpeas, lentils, lathyrus, field peas, and kidney beans are grown during this season.
- Rabi pulses account for **more than 60% of the total production.**
- **Zaid**: Cow peas are grown during this season.
- The nitrogen-fixing properties of **pulses enhance soil fertility**, leading to increased productivity of farmland.



- *Initiatives taken to promote Pulses:*
- **National Food Security Mission (NFSM)**: It aims to increase pulse production through productivity enhancement and area expansion.
- This program also includes restoring soil fertility, creating employment opportunities, and improving farm economy.
- **Rashtirya Krishi Vikas Yojana (RKVY)**: States can promote pulses with approval from the **State Level Sanctioning Committee (SLSC).**
- **Pradhan Mantri Annadata Aay Sanrakshan Abhiyan (PMAASHA) Scheme**: It aims to ensure MSP for farmers.
- It includes procurement of Pulses and Copra under the Price Support Scheme.

13. Space Economy

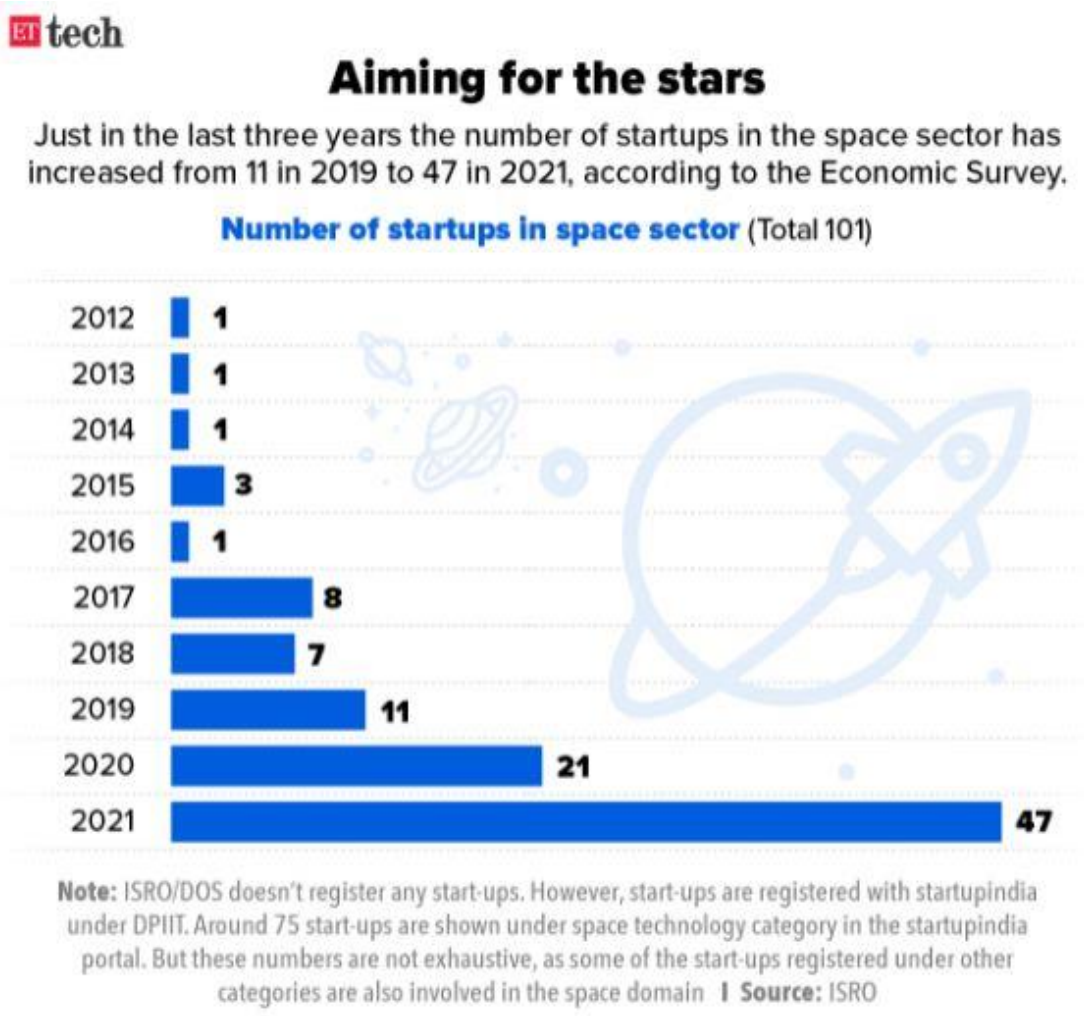
World Economic Forum and McKinsey & Co report: 'Space: The $1.8 Trillion Opportunity for Global Economic Growth'

Space Economy:

- The Space Economy is defined by the OECD as the **full range of activities** and the **use of resources that create value and benefits** for human beings in the course of **exploring, researching, understanding, managing, and utilizing space.**
- **The term 'space economy' covers the goods and services produced in space for use in space.**
- Current Trends in the Space Economy:
- **Economic Growth in Space Sector: The Space Report 2022 estimates that the space economy was worth $469 billion in 2021 – a 9% increase from a year earlier.**
- Global space market is **projected to reach $1 trillion by 2040.**
- **Rise in State-Backed Investment:** According to the Space Foundation report, there has been an increase in state-backed investment in space projects around the world.
- There was a **19% jump in overall government** spending on military and civilian space programmes in 2021.

- *Drivers of Space Economy:*
- **Decrease in Launch Cost:** Rapid and large drop in launch costs of satellites and rockets, which has fallen **10-fold over the past 20 years.**
- **Price of Data and Connectivity:** It is also expected to **drop by at least 10 percent** as demand **increases by 60 percent by 2035.**
- **Commercial Innovations:** Example, **improvement in resolution of Earth-observation technology,** which in turn drives down the price to access the said technologies.
- **Diversification of Technologies:** There is a **rapid diversification of space-based technologies** and activities such as **space tourism.**
- **Cultural Awareness:** Cultural awareness and general enthusiasm for space in recent days is also a major driver of interest in space for future generations.

- **Catalysts of Expansion:**
- Various industries are both **drivers and beneficiaries of growth and diversification**by improving three key aspects of space technology:
  - **Harmonisation**
  - **Increasing ease of usability and accessibility, and**
  - **Education and awareness of growing technology.**
- **New Space Entrepreneurship** has emerged in India with many start-ups which seek value in exploring end-to-end services in the Business-to-Business and Business-to-Consumer segments using New Space.



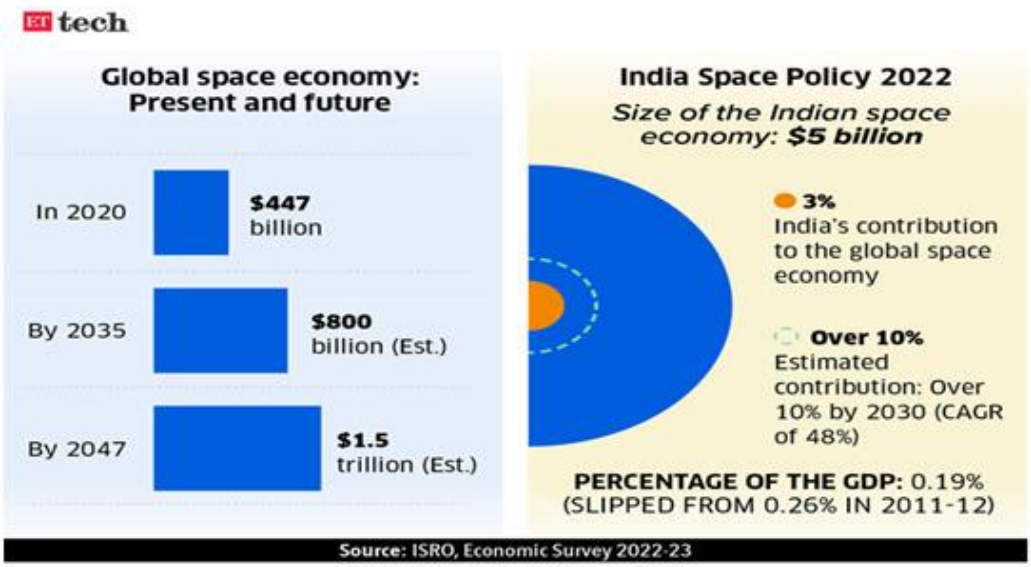
Space Economy in India:

- **Share in Global Space Economy:** At current, the space sector in India accounts for around **two percent of the global space economy.**

- India's space economy has the **potential to reach $44 billion by 2033**with about **8 per cent of the global share.**
- **Size of the Indian Space Economy:** It is estimated around 8.4 Billion USD. Of this, the **downstream services market**, primarily of **communication and data applications**, accounts for close to **80% of the total space economy**, wherein the private sector is a major contributor.
- The**upstream market**e. **satellite and launch operations**, is primarily contributed by the Government, with the private sector in a vendor oriented role towards manufacturing and delivering subsystems/components.
- **Compound Annual Growth Rate (CAGR):** As per the various market surveys, the space economy has grown with an average CAGR of 8%.
- **Rise in Number of Space Start-Ups:** As per DPIIT Start-Up India Portal, the number of Space Start-Ups have increased from just **1 in 2014 to 189 in 2023**.
- The investment in Indian Space Start-Ups has increased to **$ 124.7 Million in 2023.**
- **Increasing Role of Private Sector:** Private companies are exploring satellite-based communication solutions, Satellite integration and testing facilities.
- The local manufacturing of the satellite subsystems and Ground systems are being taken up by the private sector.
- Ex- SpaceX, Virgin Galactic, Blue Origin and Arianespace offer launch services and space tourism.
- **Rise in Satellite Launches:** There is an increase in the number of launches accomplished by the ISRO.Out of the 424 foreign satellites launched by Isro since 1990s, 389 (more than 90%) were launched in the last nine years.
- India earned **$174 million from launching of foreign satellites.**
- *Steps taken to boost space economy in India:*

- **Indian Space Policy, 2023:** It enables **end-to-end participation of Non-Governmental Entities (NGEs)** in all domains of space activities.
- **FDI Norm under Automatic Route:** The policy allows up to **100 percent investment under automatic route**for the **manufacturing of components, systems and subsystems for satellites, ground segments** and user segments.
    - For **manufacturing and operating an entire satellite**, up to **74 percent investment will be allowed** under the automatic route.
- **FDI Norm under Government Approval Route:**Anything **beyond the limit will have to go through a government approval process**.
    - Under the**current policy**, any foreign investment in manufacturing and operating satellites is allowed only with government approval.
- **ASAT Capability:** On 27 March 2019, India tested an **anti-satellite weapon** during an operation code named **'Mission Shakti'**.
- **The test put India on an equal footing to US, Russia and China**, the countries with such capability in the world till date.
- **IndSpaceX:** First table-top space warfare exercise – IndSpaceX, demonstrated **integrated satellite communications and reconnaissance** for enhanced intelligence and firepower.
- **Defense Space Agency (DSA):** In 2019, India established the DSA and the Defense Space Research Organisation (DSRO).
- The DSRO, resembling a U.S. fighter command, **coordinates space assets across military branches.**
- The DSA, a research organisation, integrates civilian space technology for military applications.
- **Chandrayaan-3:** launch the Chandrayaan 3 spacecraft to achieve a **soft landing of a robotic lander on the moon's surface.**
- **Aditya L1 mission:** The Indian Space Research Organisation (ISRO) launched Aditya L-1, its **first space-based mission to study the Sun.**

- **Bharatiya Antariksha Station:** India plans to set up Bhartiya Antariksha Station' (Indian space station) by **2035 and take the first Indian to the Moon by 2040.**



Opportunities Offered by the Space Economy:

- **Advancing Scientific Knowledge:** A space station enables India to **conduct cutting-edge research** in various fields—such as astronomy, biology, physics, medicine and engineering.
- It will provide a unique platform for studying the**effects of microgravity** and the **space environment on various phenomena and processes**.
- A space station will also facilitate the **development and testing of new technologies**and **applications for space exploration and utilization.**
- **Enhancing the Nation's Prestige:** It will showcase India's achievements and capabilities in space and demonstrate its commitment and leadership in advancing humanity's frontiers.
- It will **inspire and motivate the next generation of scientists**, engineers and explorers. A space station will also **foster a sense of national identity and pride among Indians.**
- **Promoting Global Cooperation & Peace:** It will offer **opportunities for collaboration and exchange with other countries and organizations in space.**

- This will thereby foster a**spirit of cooperation and mutual understanding** among the participants and contribute to the peaceful use of outer space.
- This will also support the **global goals of sustainable development and social welfare.**
- **Space Mining:** Asteroids are rich in **precious resources crucial for industries**. They offer an alternative with abundant reserves, avoiding environmental concerns tied to wildlife harm during extraction.
- Space mining is driven by **demand for critical metals essential in electronics, solar panels, wind power, and electric car components.**
- *Space Legislation in India:*
- **Satcom Policy:** It aimed to develop a healthy and thriving communications satellite and ground equipment industry as well as satellite communications service industry in India.
- **Remote Sensing Data Policy (RSDP) 2011:** It governs the acquisition and distribution of satellite remote sensing data by non-government users, which may be acquired either through an Indian satellite or a foreign satellite.
- **Regulatory Framework for Space Activities in India:**
- India's space programme is headed by the **Office of the Prime Minister**, governing all operations and **exercising control over India's space programme** through the **Space Commission and the DOS.**
- The Space Commission is in charge of **framing India's space policy.**
- **Responsibility for the implementation** of this policy lies with the DOS.
- **Research and development in the space sector** is primarily realised through ISRO.
- **Space Debris:** According to NASA, there are **more than 100 million pieces of space debris** at a size of one millimetre or larger orbiting the Earth.

- This debris can include**non-functional spacecraft, abandoned equipment, and mission-related debris** travelling at speeds up to 17,500 miles per hour (28,160 kilometres per hour).
- Even a tiny piece of debris can damage a satellite or spacecraft.
- **Lack of Regulatory Ecosystem for Startups:**
- The start-ups in India are yet to take off in the absence of regulatory clarity.
- Hence, they need an**enabling ecosystem, a culture of accelerators, incubators, venture capitalists**, and mentors that exist in cities like Bengaluru which is where most New Space start-ups have flourished.
- India has to **transform these start-ups into full-fledged industries** to accelerate India's dominance in space.
- **Cyber Attacks:** The draft **National Cyber Security Strategy lacks a focus on space security**, despite concerns raised **by the Data Security Council of India** about **potential attacks on critical infrastructure, including space agencies**.
- **Minimal Share in Global Economy:** India's share is estimated at just 2% of the global market.
- **Over a third of transponders used for Indian services are leased from foreign satellites**and this proportion will rise as the demand grows.
    - Thus, India needs to collaborate with partners to increase its share in the global space market.
- **Unidentified Anomalous Phenomena (UAP):** The Indo-Tibetan Border Police (ITBP), have consistently reported UAP sightings. India is lagging significantly behind other nations in addressing the UAP issue.
- UAPs denote flying objects linked to non-human (alien) intelligences.

- **Human Spaceflight Expertise:** India lacks experience in human spaceflight, which is essential for building and operating a space station.
- **Hazards to Astronaut Health:** The space environment can be lethal **without the correct protection equipment and precautions.**
- The greatest threats are a **lack of oxygen and pressure in closed environments**; expansion of the cerebral ventricles, **altered gravity fields; radiation and the psychological effects of isolation and confinement.**
- *Overcoming challenges:*
- **Integrating space into the National Cyber Security Strategy:** There is a need to **integrate critical cybersecurity safeguards into India's national space policy,** aligning it with the National Cyber Security Strategy and National Security Strategy.
    - India needs to implement a **Purple Revolution**, incorporating **cybersecurity red and blue teaming exercises** under the Ministry of Defence and Home Affairs to **enhance offensive and defensive capabilities.**
    - ISRO defends against more than 100 cyberattacks each day.
    - India needs to emulate the US and prepare satellite hacking sandboxes that can be experimented with to find system vulnerabilities.
- **Increasing Space Budget:** The space budget allocation must be **increased from 0.04 percent to at least 0.5 percent of GDP** to boost research centres and space standards.
- **Indian Space Resilience Agency:** India must **enhance space supply-chain resilience and security** within QUAD's space cooperation, establishing a central Indian space resilience agency for joint monitoring and incident response exercises.

- **Permanent Body for UAP:** India must establish a permanent body for UAP research under the Defence Ministry like the US and UK or under ISRO, on the French model.
  - India must introduce **protocols for military and civilian reports** while synchronizing the land, sea and space surveillance capabilities.
  - Given India's ancient civilization, and the long history of UAP sightings, there is a possibility of UAP-related artifacts lying within its soil and waters.
- **Incentivising Startups:** India must strategically incentivise startups for **innovative space logistics solutions, aligning with the success of its satellite launch program.**
  - Like the US and Luxembourg, an **easy regulatory and tax regime** will greatly incentivise the growth of the space industry.
- **Protection from Space Debris:** Presently, India relies on data compiled by NASA to ascertain threats to its orbital assets. Thus, protection from space debris needs to **track potentially threatening debris and change the course of the functional hardware.**
  - Future solutions can include **more accurate tracking of debris and measures to lower their orbit for eventual burn out** in the atmosphere.
  - **Closer association with Inter Agency Space Debris Coordination Committee (IADC)** and **developing satellite bodies** which can withstand minor impacts are some of the other steps which can be taken.
- **Advancing Space Capabilities:** This can be done by **developing sophisticated space-based weaponry including hard kill guided missile systems, jamming devices, directed energy weapons, and electromagnetic pulse systems for space-to-space operations**.

	▪ **Both soft and hard kill systems**, such as jammers and directed energy weapons, are crucial components for **Outer Space Warfare**. ▪ **Creation of Space Force:** India may create a Space Force, mirroring the U.S., to strengthen satellite network defence and take **assertive actions against adversary networks in the evolving space security landscape.** ▪ **Training Astronauts for Space Flights Program:** India will have to train a team of astronauts and ensure their safety and well-being in space. ▪ India will also have to develop **reliable launch vehicles and spacecraft** that can transport crew and cargo to and from the space station.
14.	**Lord Macaulay's Minute (1835)** • **On February 2, 1835,** British historian and politician **Thomas Babington Macaulay** delivered his "**Minute on Indian Education,**" which sought to establish the need for Indian "natives" to receive an English education. Lord Macaulay"s Minute of 1835 marked a pivotal moment in India"s colonial history, advocating for the promotion of English education and shaping the trajectory of the country"s educational landscape. • Lord Macaulay wished to cultivate a group of Indians who could support and uphold British interests. This group would be "Indian by blood and colour, but English by likes, beliefs, morality, and intellect." He believed that "**Indian learning was inferior to European learning,**" which was correct in terms of physical and social sciences at the time. • **Macaulay's Minute - Historical Background**

- British education policy in colonial India was almost non-existent at first because their sole goal was to make a profit through trade and other means.
- Gradually, the value of education was recognized, and the company began to construct a few institutes of higher learning.
- These learning centers provided instruction in Indian subjects in languages such as Sanskrit, Arabic, and Persian. Persian was also the court language.
- The **Charter Act of 1813** was the country"s first concrete step toward modern education. This act allotted an annual sum of Rs.1 lakh for the purpose of educating the subjects."
- By the time **missionaries were already present in the country** and were involved in this field. However, they primarily provided religious education, with the primary goal of Christianizing the "heathen" natives.
- Following the Charter Act, there was a schism (division) among the British over the mode of education to be provided to Indians betwwen Anglicists & Orientalists.
- Lord Macaulay arrived in India as President of the General Committee of Public Instruction in June 1834. (GCPI).
- **Orientalists** believed that **Indians should be educated in their native languages** and taught their own scriptures and texts, Anglicists believed that English education was the best type to be given.
- The famous **Lord Macaulay"s Minute** settled the dispute in favor of **Anglicists**—the limited government resources were to be devoted solely to the teaching of Western sciences and literature in English.
- **Macaulay's Minute - Features**

- Lord Macaulay arrived in India on **June 10, 1834**, as a law member of the Governor General"s Executive Council and was appointed President of the Committee of Public Instruction.
- In 1835, he was tasked with settling a **dispute between orientalists and Anglicists**.
- He **presented his famous minutes to the council** in February 1835, which **Lord Bentik approved**, and a resolution was passed in March 1835.
- The following points were **emphasized** by him:
    - The main goal of the British government should be to promote European literature and science among Indians, and that "all funds appropriated for the purpose of education would be best spent on English education alone."
    - All existing professors and students at all institutions under the committee"s supervision shall continue to receive stipends, but no stipend shall be given to any students who may subsequently enter any of these institutions.
    - No funds from the government were to be spent on the printing of oriental works.
    - All funds available to the government would be spent in the future on imparting knowledge of English literature and science to Indians.
- **Macaulay's Minute - Objectives**
- **Spending Only on Western Education:** Macaulay wanted the government to spend money only on western education, not oriental education.
- **Closure of Colleges:** He advocated for the closure of all colleges that taught only eastern philosophy and subjects.

- **Downward Filtration Theory:** He also advocated for the government to educate only a few Indians, who would then educate the rest of the population. This is referred to as the downward filtration" policy.
- **Indian by Blood & British by Taste:** He wished to create a pool of Indians capable of serving British interests and remaining loyal to them. This group would be "Indian by blood and color, but English by tastes, opinions, morals, and intellect."
- **Lord Macaulay**
- Thomas Babington Macaulay (25 October 1800 – 28 December 1859) was a Whig politician and historian from the United Kingdom. He is widely regarded as the primary architect of India"s transition to a **Western-style education system**.
- As an essayist, on contemporary and historical socio-political subjects, and as a reviewer, Macaulay wrote extensively.
- The History of England was a seminal and paradigmatic example of Whig history, and its literary style has remained a source of praise since its publication, even after widespread condemnation of its historical contentions became popular in the twentieth century.
- Throughout his political and scholarly career, Macaulay consistently emphasized Western culture"s supposed superiority.
- Macaulay wrote in his February 1835 Minute on Indian Education that "a single shelf of a good European library was worth the whole native literature of India and Arabia when we pass from works of imagination to works in which facts are recorded, and general principles investigated, the superiority of the Europeans becomes absolutely immeasurable."
- Macaulay was devoted to the concept of progress, particularly in terms of liberal liberties. He was an outspoken opponent of radicalism while idealizing historical European culture and traditions.

- **Downward Filtration Theory**
- Downward Filtration Theory is a theory **proposed by Lord Macaulay** in his famous Macaulay''s Minutes of 1835, which were submitted to the then Governor General of British India.
- According to the theory, the British thought to educate a few upper-class Indians (**to educate a small group of people who would then disseminate the knowledge to the general public**). These Indians would then disseminate education to the general populace. It was thought that education would trickle down through this system.
- **Macaulay's Minute- Merits**
- **Role of English in India's Freedom Struggle:** The first advantage of Macaulay''s Minutes for Indians was that it contributed to the expansion of the English language in India. It cannot be denied that English later played a significant influence in India''s freedom movements.
- **Foundation for Modern Education in India:** The second advantage that Macaulay''s Minutes provided to Indians was that it helped create the groundwork for modern education in that country.
- It represented a transition from the traditional indigenous educational system to a structured contemporary educational system.
- **Doorway to World Literature:** The fact that Macaulay''s Minutes opened a gateway to international literature was another benefit it provided. New literary genres and writing styles were created as a result.
- **Served as a Model for Indians:** Additionally, it served as a model for Indians to research the country''s current educational system and write reports to raise the standard of education there.
- **Macaulay's Minute- Demerits**
- **Instead of resolving the issue** known as "The Oriental-Occidental Controversy," Macaulay''s Minutes was **instead fueling the flames.**

- Macaulay **did not listen to any of the orientalists'' arguments.** He aggressively insulted them in addition to rejecting their pleas.
- Although his claim that English was the key to modern knowledge was true, it was **not practical to educate Indians at all levels in English** at the time because it was the beginning of modern education in India.
- Macaulay''s claim that **English only is used as a medium of instruction** is unjustifiable. **Other Indian languages** have also been **overlooked**.
- The **native people were further insulted** by his comment that "a single shelf of a fine European library was worth the whole native literature of India and Arabia."
- The controversial "**Downward Filtration Theory**" presented by Macaulay''s Minutes was responsible for **dividing society into two groups: the educated and the uneducated.** For Indians, his downward filtration theory proved to be a **failure.**
- The **higher class never assisted the lower class in getting better education** and raising the standard of living in their lives. It simply led to the development of individuals like **Mohan Lal,** who degraded even their wives due to their lack of knowledge.
- It is also incorrect to believe that Macaulay was responsible for the implementation of a new educational policy in India.
- **Difference Between Anglicists And Orientalists**
- **Orientalist:**
- Orientalists were the group of people who wanted to give education to Indian people in the Indian language. The emphasis was on the knowledge of the East. They wanted Indians to learn about Indian philosophy, science, and literature. In the Initial stage, company officials favored oriental learning.

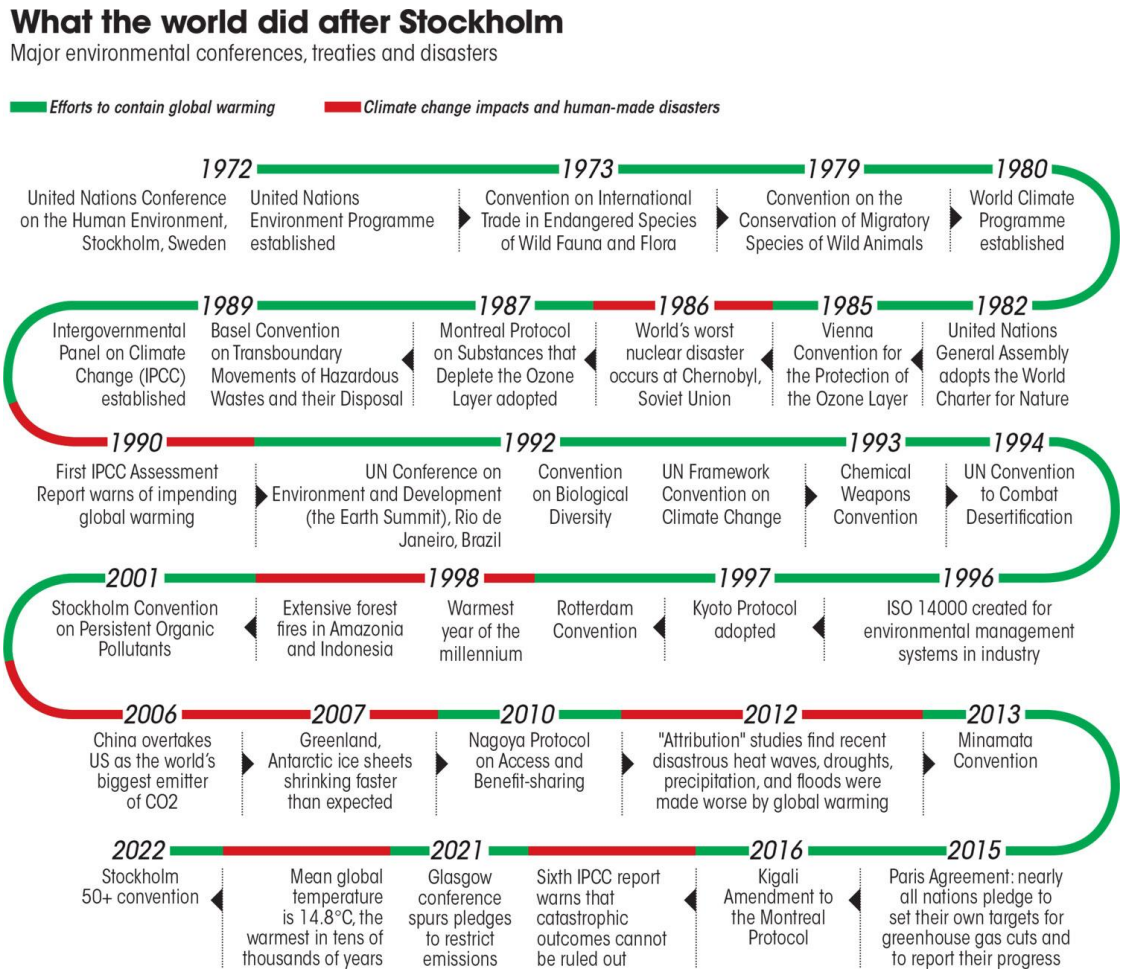
- Orientalists were led by William Jones who was a junior judge of the supreme court and linguist. He had a deep interest in Indian philosophy, religion, law, and politics. Henry Thomas Colebrooke and Nathanial Halhed were other officials who supported the orientalist approach, they had an interest in the Indian glory, cultural decline, and future development.
- The interest of these British officials led to the formation of the Asiatic Society of Bengal on January 15, 1784, by Sir William Jones. They started a journal called Asiatic Researches. Other important establishments regarding orientalists were Calcutta Madrasa by Warren Hastings in 1781, and The Banaras Sanskrit college by Jonathan Duncan in 1791.
- Aims of the Orientalist
- They wanted to become guardians of Indian culture and hoped to win the hearts of the native people so that it becomes easy to rule them by appearing as protectors of their culture.
- They believed that to bring the glory back and rule properly they need to learn Indian culture and literature which led to a detailed study and translation of the ancient text.
- Most of the orientalists were linguists and their personal interest in learning about India's rich culture and history favored oriental learning.
- **Anglicist:**
- Anglicists were those people who supported the teaching of modern western education to Indian people in the English language. People who favored Anglicists were Thomas Babington, Macaulay, James's mill, Charles wood, Charles Trevelyan, and Elphinstone. The Anglicists were supported by the most advanced Indians like Raja Ram Mohan Roy.
- Aims of the Anglicists

- Anglicists didn't want to comprise grafting western education on oriental learning.
- They were firm and wanted to utilize the educational grant for spreading western thought and education with practical and scientific knowledge.
- Macaulay was prejudiced, he used to believe that a single shelf of a good European library was worth the whole native library of India.
- They wanted to develop low paid clerk class in India and they would help Britishers by acting as interpreters between the masses and the British.
- They wanted to create a class of persons who are Indian in blood and color but English in taste, opinion, morals, and intellect.
- The period of 1813-1858 was considered the 2nd phase of British economic policy, known as Industrial capitalism, the market was filled with British goods and to increase demand, Britishers need to inculcate western taste in Indians by introducing western education and western superiority.
- Lord William Bentinck, became governor-general in 1833. In 1835, to address the controversy he formed a General Committee of Public Instruction under the chairmanship of Lord Macaulay. Lord Macaulay through his famous Macaulay's minute settled the debate in the favor of Anglicists.
- One of the major impact of Macaulay's Minute was promotion of English as the language of administration and of higher law courts. This led eventually to English becoming one of the languages of India, rather than simply the native tongue of its foreign rulers. Modern ideas, if not education, did reach the masses, albeit not in the form desired by the rulers, but rather through political parties, the press, pamphlets, public platforms, and so on. Modern education only aided this process by making basic literature on physical and social sciences available to

nationalists, thereby stimulating their capacity to make social analyses; otherwise, the content, structure, and curricula of modern education served colonial interests.

15. COP28 - PPP 100 - PRELIMS 2024 - 17

- The 2023 United Nations Climate Change Conference or Conference of the Parties of the UNFCCC, more commonly known as COP28, was held from 30 November until 12 December at Expo City, Dubai, United Arab Emirates.
- The COP28 meet has delivered some important outcomes. However, like all previous COPs, it still remained an underachiever, unable to measure up to the expectations.



COP Climate Summit

- In 1992, at the Rio Earth Summit, 154 countries signed a multilateral treaty called the United Nations Framework Convention on Climate Change (UNFCCC).
- It aimed to stabilise greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system."
- The treaty came into force two years later, and since then, countries which are part of the UNFCCC, meet every year at different venues.
- Today, there are 198 'parties' or signatories of the Convention.
- Between 30 Nov to 12 Dec 2023, the Government of the United Arab Emirates hosted the 28th Conference of the Parties to the UNFCCC (COP-28).

United Nations Framework Convention on Climate Change (UNFCCC):

Origin: Signed in 1992, at the United Nations Conference on Environment and Development also known as the Earth Summit the UNFCCC) is the foundational treaty that has provided a basis for international climate negotiations

Key Principle: Common but Differentiated Responsibilities and Respective Capabilities (CBDR–RC)

It is a principle that acknowledges the different capabilities and differing responsibilities of individual countries in addressing climate change.

Secretariat: Bonn, Germany.

The Convention has near universal membership (197 Parties) and is the **parent treaty of the 2015 Paris Agreement.**

Institutional Structure:

Their role is to facilitate the work of the COP and promote agreements among Parties.

Conference of the Parties (COP): It is the supreme body to regularly reviews, devise, agrees and implements climate policy.

COP President and Bureau: The office of the COP President normally rotates among the five United Nations regional groups. The President is usually the environment minister of his or her home country.

Subsidiary Bodies (SBs): They provide scientific and technological advice and assess how well the Convention is being implemented.

- **Key Outcome of the COP28**
- Overall, there is not enough in the final agreement to accelerate climate action in the short term.
- Fossil Fuel phase-out:
  - The role of fossil fuels in causing global warming had never been even acknowledged in any earlier COP decision, but this was getting increasingly untenable.
  - After much deliberations, the final agreement called upon countries to contribute towards "transitioning away" from fossil fuels, "so as to achieve net zero by 2050".
  - There were no time schedules and no targets. Some countries were extremely disappointed that the term "fossil fuel phase-out" had not been used.
- Tripling of renewable energy:
  - This was an expected outcome, and the only one that contributes to additional emission reductions between now and 2030.
  - The COP28 agreement calls upon countries to contribute to tripling of global installed capacity of renewable energy, and doubling of annual improvements in energy efficiency.
  - Together, these two measures have the potential to avoid emissions of about 7 billion tonnes of carbon dioxide equivalent between now and 2030.

- Tripling is a global target, and it is not incumbent on every country to individually triple its current installed capacity.
- It is thus not clear how this tripling would be ensured.

- Phase-down of coal:
  - Despite being a fossil fuel, just like oil or natural gas, coal has received a separate mention in the agreement.
  - This is because coal was already singled out for phase-down in the Glasgow conference (COP26) in 2021.
  - There was a move to stipulate that no new coal fired power plants could be opened without an in-built carbon capture and storage facility, but this was strongly resisted by India, China, South Africa and other countries.
  - It was dropped, and finally the Glasgow language was reiterated.
  - There is nothing about how this phase-down is to be measured, or from what baseline.
- Methane Emission cuts:
  - Methane is the most widespread greenhouse gas apart from CO2, accounting for nearly 25 per cent of all emissions.
  - It is also about 80 times more potent than CO2 in causing global warming.
  - Methane emission reductions can therefore bring substantial benefits.
  - However, several countries, including India, are extremely opposed to any mandate to cut methane emissions, mainly because one of the major sources happens to be agriculture and livestock.
  - Cutting methane emissions could involve tweaking agricultural patterns which could be extremely sensitive in a country like India.

- Possibly in deference to the concerns of such countries, the agreement does not mention any targets for methane emission cuts for the year 2030.

- Loss & Damage fund:
  - For the poor and vulnerable countries, this was the most important outcome.
  - A decision to set up a Loss and Damage Fund had been taken last year in COP27 but it had not been created, and no money had been promised.
  - COP28 operationalised this fund on the opening day of the conference, and several countries, including hosts UAE, made funding commitments.
  - By the end of the conference, commitments worth about US$ 800 million had been made.
  - The money is meant to provide financial help to countries trying to recover from climate-induced disasters.
- Global Goal on Adaptation:
  - This was another important step developing countries had been waiting for.
  - Historically, adaptation hasn't received enough attention, or resources, as compared with mitigation activities, mainly because adaptation is largely a local endeavor. Its benefits also are mostly local.
  - Developing countries had been arguing that a global framework for adaptation was necessary to bring more attention to it.
  - COP28 adopted the framework, but much more needs to be done on this front, particularly in identifying the indicators to measure progress on each of the global goals.

- The adaptation agreement currently lacks financial provisions, and countries would need to continue working on it to strengthen it in the coming years.

- **Major Engagements of India in COP 28**
- *Green Credit Initiative: Promoting Pro-Planet Actions*
- In response to the pressing challenge of climate change, the Green Credit Initiative emerges as a visionary mechanism. This initiative aims to incentivize voluntary pro-planet actions by issuing Green Credits for plantations on waste/degraded lands and river catchment areas. The ultimate goal is to rejuvenate and revive natural ecosystems through collective efforts.
- *Phase II of the Leadership Group for Industry Transition (LeadIT 2.0): Toward Inclusive Industry Transition*
- In its second phase, the Leadership Group for Industry Transition (LeadIT 2.0) is set to address the imperative of an inclusive and just industry transition.
- The focus lies on the co-development and transfer of low-carbon technology, along with financial support to emerging economies for a smooth industry transition.
- This phase aims to foster sustainability and equitable development on a global scale.
- *Global River Cities Alliance (GRCA): India"s Commitment to Sustainable River-Centric Development*
- Launched at COP 28, the Global River Cities Alliance (GRCA) is spearheaded by the National Mission for Clean Ganga (NMCG) under the Ministry of Jal Shakti, Government of India.
- This alliance underscores India"s pivotal role in sustainable river-centric development and climate resilience.
- By facilitating knowledge exchange, river-city twinning, and disseminating best practices, GRCA seeks to drive positive change in managing river ecosystems.

- *Quad Climate Working Group (QCWG) on Localised Climate Action: Empowering Local Communities*
- The Quad Climate Working Group (QCWG) recently convened to amplify the role of local communities and regional governments in supporting sustainable lifestyles.
- This event recognized the significance of localized climate action and sought to empower communities to contribute actively to climate resilience.
- By fostering collaboration and understanding, QCWG aims to drive meaningful change at the grassroots level.
- **Challenges India facing at the COP28 Climate Summit**
- **Cooling Pledge:** India is reportedly hesitant to sign a global pledge to reduce cooling-related emissions at the COP28 climate summit, citing the need for affordable cooling in the world's most populous country.

The Global Cooling Pledge, led by COP28 climate summit host the United Arab Emirates, is designed to make things like air conditioners, deep freezers and heat-dissipating homes more affordable, especially in developing countries, while reining in planet-warming emissions from the sprawling cooling sector.

- **Luxury emissions:** India has been called to **reduce "luxury emissions,"** encompassing emissions from sectors like oil and gas and waste, contributing to Methane Emissions.
  - This demand requires a nuanced approach considering the impact on various sectors and India's broader developmental goals.
- **Loss and Damage Finance:** A new **CSE-Down to Earth** assessment revealed that India witnessed an extreme weather event almost every other day in the first nine months of this year. Therefore, India's emphasis would be on "loss and damage finance".

- **Coal dependence and fossil fuel phase-out:** India's reliance on coal for power production remains a contentious issue. Immediate shutdown proposals for coal-fired power plants clash with India's emphasis on energy security.
  - **For Example,** about 73 percent of electricity consumed in India is produced using coal.
- **India's Stance on Emission Reduction:** India will not agree to any proposal that asks to reduce its emissions. As India's climate actions are framed in terms of emissions intensity, or emissions per unit of GDP, and not on emissions directly.
  - India also rejects any suggestions to define a peak, or a peak year, for its emissions.
- **Agricultural Emission Cuts and Food Security:** The agriculture sector, along with animal husbandry, accounts for close to 15% of India's annual emissions.
  - Agreeing to emission cuts from agriculture could mean changes in cropping patterns and **have huge implications for India's food security.**
  - Therefore, **cutting down on methane emissions for India could be a point of contention** at the COP28 climate summit.
- **Financial support for renewable energy:** While India transitions towards cleaner energy sources, securing financial support for green energy corridors and grid infrastructure development is imperative.
  - The financial assistance needed aligns with the **G20 New Delhi Leaders Declaration,** emphasizing the requirement for significant funds
- COPs are crucial in the battle against climate change but the road ahead is both challenging and promising. Its success requires collective determination, unwavering commitment, and a recognition that the stakes are high. By embracing determined contributions and

forging genuine partnerships, the global community can build a sustainable and resilient future.

PYQs

1. **Consider the following statements: [2023]**

Statement-I: Carbon markets are likely to be one of the most widespread tools in the fight against climate change.

Statement-II: Carbon market transfer resources from private sector to the State.

Which of the following is correct in respect of the above statements?

a) Both Statement-I and Statement-II are correct and Statement-II is the correct explanation for Statement-I.

b) Both Statement-I and Statement-II are correct and Statement-II is not the correct explanation for Statement-I.

c) Statement-I is correct but Statement-II is incorrect.

d) Statement-I is incorrect but Statement-II is correct.

2.The Partnership for Action Green Economy (PAGE), a UN mechanism to assist countries transition towards greener and more inclusive economies, emerged at: [2018]

a) The Earth Summit on Sustainable Development 2002, Johannesburg

b) The United Nations Conference on Sustainable Development 2012, Rio De Janeiro

c) The United Nations Framework Convention on Climate Change 2015, Paris

d) The World Sustainable Development Summit 2016, New Delhi

3.With reference to 'Agenda 21', sometimes seen in the news, consider the following statements: [2016]

It is a global action plan for sustainable development

It originated in the World Summit on Sustainable Development held in Johannesburg in 2002.

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

4.With reference to the Agreement at the UNFCCC Meeting in Paris in 2015, which of the following statements is/are correct? [2016]

The Agreement was signed by all the member countries of the UN and it will go into effect in 2017.

The Agreement aims to limit the greenhouse gas emissions so that the rise in average global temperature by the end of this century does not exceed 2^0C or even 1.5^0C above pre-industrial levels.

Developed countries acknowledged their historical responsibility in global warming and committed to donate $ 1000 billion a year from 2020 to help developing countries to cope with climate change.

Select the correct answer using the code given below.

a) 1 and 3 only

b) 2 only

c) 2 and 3 only

d) 1, 2 and 3

5.Regarding 'carbon credits" , which one of the following statements is not correct ? [2011]

a) The carbon credit system was ratified in conjunction with the Kyoto protocol.

b) Carbon credits are awarded to countries or groups that have reduced greenhouse gases below their emission quota.

c) The goal of the carbon credit system is to limit the increase of carbon dioxide emission.

. d) Carbon credits are traded at a price fixed from time to time by the United Nations environment programs.