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# MAINS ANSWER WRITING APPROACH ANSWERS

Topic- GEOGRAPHY

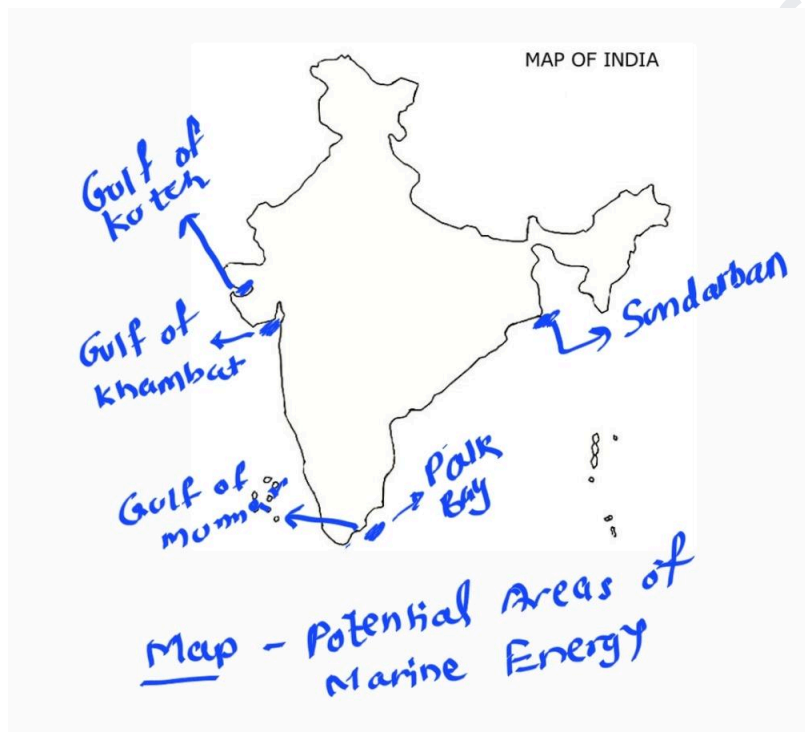


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**Q.1) India has immense potential for marine energy resources. Enumerate the advantages and problems in harnessing these resources. (10 marks) (150 words)**

The total length of the coastline of the mainland, Lakshadweep Islands and Andaman & Nicobar Islands is **7,516.6 km**. India is estimated to have a potential of **about 54 gigawatts (GW)** of ocean energy including about **12.4 GW of tidal power**. The potential areas are in the Gulf of Khambhat, Gulf of Kutch & southern regions in Gujarat, Palk Bay- Mannar Channel in Tamil Nadu, and Hoogly river, South Haldia & Sunderbans in West Bengal.



These energy sources tapped from various sources and their harvestability, include:

- **Wave energy**
- **Tidal energy**
- **Ocean thermal energy conversion (OTEC)**
- **Non-renewable - petroleum and natural gas, Methane Hydrates**

**Advantages of marine energy sources**

- Most of these sources are **renewable** in nature and thus offers an **alternative to the limited non-renewable fossil-fuel based energy resources**.
- Conversions of the stored energy in the marine dynamic processes to electric energy involves **no/very low level of Greenhouse gas emission**.
- These power plants also create **very low waste products** in the process of generation.

- This **eliminates the cost of handling and management cost** of the waste products, unlike in the conventional **nuclear and thermal power plants**.
- Help in **diversifying the energy mix**.
- Very **low input cost** for power generation. This is on account of **low/no cost for fuel**, as the energy source is from ocean dynamism. The **cost of operation is also low** in comparison to conventional power plants.

### Problems in harnessing

- **Continuity of the power supplied:** For example, using **tidal energy** would be able to provide power supply on an average for about 10 hours, **depending on the pattern of tides and currents**.
- **Huge initial investments required**
- **Nascent technology:** in most of these fields, even after years of development, has also **limited the efficiency** of these energy plants.
- **Constant monitoring and maintenance:** which is required for these **devices as they suffer corrosion under the saline waters** and other **pollutants such as in oil spills**.
- **Increasing Storm surges and Tsunamis:** along the coastal locations also become reasons for these equipment to be **damaged**, the cost of repair in turn makes the projects **unviable**.
- **Predictability of power:** The recent **climate change induced weather** and atmospheric-hydrological telecommunications, including **El Nino and La Nina phenomenon**, has brought about **changes in the regular circulation patterns**.
- **Environmental Concerns** Eg. The risk of blades striking marine wildlife and fish.
- Till date only a handful of commercial ocean energy projects from other sources have been delivered, reflecting the current immaturity and high costs of these technologies, as well as the challenging market environment in which they operate.

Although marine energy exploration is in its nascent stage with many challenges, need is to invest more in research and development, international collaboration to utilize these resources in a sustainable way.

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**Q.2) Discuss the distribution of coal in India and examine the causes for the country's overdependence on coal for power generation. (15 marks) (250 words)**

### India's coal distribution

- India is the **world's second-largest coal producer** and user. In India, coal accounts for **40% of electricity**. Approximately **30% of coal is imported**.
- **Jharkhand** has the **highest reserves and production** of coal. **Auranga, Bokaro, Dhanbad, Jharia, Giridih, Karanpur, Ramgarh, and Hutar** are the state's major coal mining centres.

- **Odisha** has the country's **second-largest coal deposit**. In **Sambalpur, Dhenkanal, and Sundargarh districts**, coal resources are most abundant.
- **Chhattisgarh** - **Korba coalfield, Hasdo-Arand, Chirmir, Jhimli, Johilla.**
- **West Bengal** - Deposits are located in **Bardhaman, Darjeeling, Bankura, Jalpaiguri, and Purulia.**



#### Causes for over dependence on coal as a fuel in the country

- It costs less than nuclear, gas, or oil.
- Hydro is generally **cheaper**. However, challenges with hydro include **public indignation over river basin closures** and concerns about peak demand.
- Coal **generates many jobs**. Unlike other energy sources (nuclear, gas, oil, and hydroelectric), coal mining, transportation, burning, and disposal produces a considerable number of jobs.
- Alternative energy sources including solar, nuclear, hydro, and others are **still insufficient and expensive** to replace coal.

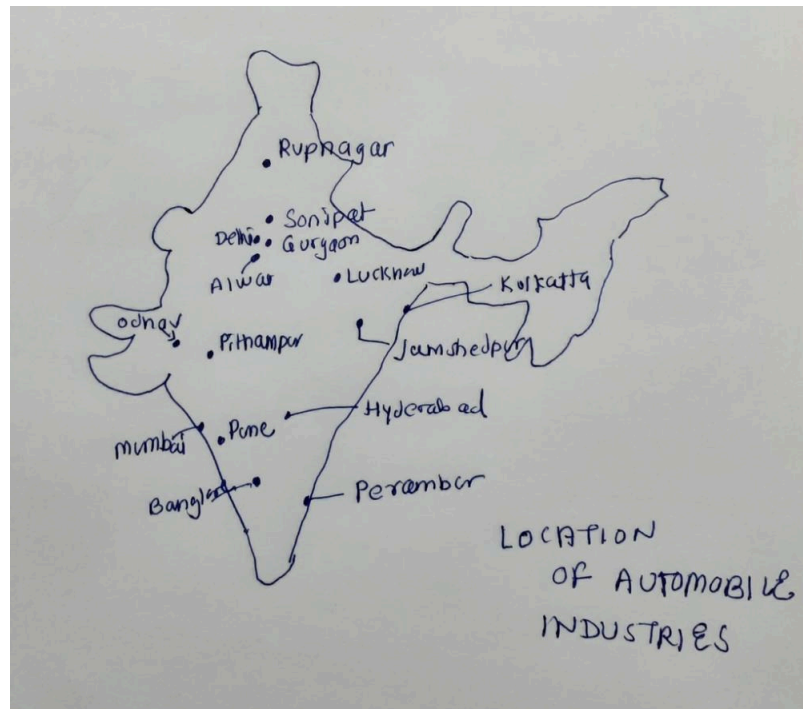
Climate change mitigation requires a reduction in coal consumption. **Encouraging more renewable energy production** and use would help alleviate environmental problems.

**Q.3) Discuss briefly the factors affecting the location of the automobile industry in India. (10 mark) (150 words)**

Automobiles provide **49% of India's manufacturing GDP**, with forward and backward links to steel, electricity, banking, petroleum, and other industries.

### Major cluster

- **NCR (including Gurugram and Manesar), Chennai cluster, Chakan cluster in Pune, Sanand cluster in Gujarat, and Pithampur in Madhya Pradesh** are the five major industrial clusters in India.



### Factors which influence the location of automobile industry are -

- The availability of **raw materials (including heavy steel)** and **manufactured cars** in destination markets is a critical consideration in the placement of automobile industries. In this regard, the **NCR cluster's** well-connected nature with national highways and trains.
- **Market** facilitates the **speedy disposal of manufactured units** and creates a conducive environment for unit after-sale services. The **NCR cluster**, which caters to dense **North-Indian markets**, is an excellent example of automobile industry market-based location.
- **Strong policy support, taxation-related measures, faster credit, and incentives** all play an important role in industrial location. The **Tamil Nadu** government, which has been proactive in promoting the ease of doing business in the region, strongly supports the **Chennai-cluster**.

- For the establishment of manufacturing units, industry requires **enormous areas of land**. Because it necessitates a **significant financial investment**, land title certainty is critical. The **Nandigram dispute and the relocation of Tata Nano factory from West Bengal to Gujarat** is the most notorious example.
- **Exports** account for more than **30%** of sub-component manufacturing output. As a result, **faster exports and a lower cost structure** have a significant impact on the location. **Three ports in Chennai and one in Tuticorin** support the **Chennai cluster's exports**. The presence of **JNPT near Chakan** has an impact on the location of industry there.
- **Money** has an impact on both **the supply and demand sides**. The **ease of credit** boosts demand for automobiles in regions, while capital seeks security in investment. Both have an impact on the location. However, because finance is so **fluid**, determining its net impact on location is difficult.
- The use of **robotics and new transportation technology**, as well as **3D printing**, may have a significant impact on the location of industry.

India is expected to be the **world's third-largest automotive market** in terms of volume by 2026. There is a need for affirmative steps for further development of this industry.

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**Q.4) What is the significance of Industrial Corridors in India, and why are they important? Identify industrial corridors and explain their main characteristics. (15 mark) (250 words)**

Industrial Corridors are stretches of land across the country intended to boost industrial development. It aspires to build a manufacturing cluster and smart, sustainable cities by leveraging a high-speed, high-connectivity transportation infrastructure.

**Significance and importance of Industrial Corridors in India:**

- Industrial corridors recognise the interdependence of diverse economic sectors and integrate industry and infrastructure for economic and social development. Industrial corridors provide high-speed infrastructure.
- Establishing NMIZs along the industrial corridor across the state would reduce distress migration and create local work possibilities.
- It will prevent industries from concentrating in one region, which degraded the environment.
- Export surpluses create jobs and boost per capita earnings.
- People would find jobs close to home and not have to migrate, protecting the family unit. This will boost social integration.

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- Industrial corridors have several socioeconomic implications, including the creation of industrial townships, schools, roads, railways, airports, and hospitals that produce jobs and increase living standards.
  - Improved transportation and agglomeration would lower production costs, making Indian goods competitive domestically and internationally.
  - Provide logistics infrastructure to achieve economies of scale, allowing enterprises to focus on core competencies.
  - People would find jobs close to home, reducing migration to cities and relieving urban stress.
  - Preventing industry concentration would avoid environmental exploitation and maintain balanced development.

#### India's industrial corridor:

- The **Delhi–Mumbai Industrial Corridor Project (DMICDC)** is a planned industrial development project between Delhi and Mumbai. One of the world's largest infrastructures spans six states.
- **Chennai-Bengaluru Industrial corridor** is projected to increase business between south India and East Asia by allowing faster transportation of commodities to Chennai and Ennore ports.
- The **East Coast Economic Corridor (ECEC)**, which runs from Kolkata to Kanyakumari, is a multimodal, regional maritime corridor that may unify India's enormous domestic market and integrate it with Southeast and East worldwide value chains.
- **Amritsar kolkata industrial Corridor (AKIC)**: To enhance industrial growth in Northern and Eastern India's densely populated states. AKIC will also use the Inland Water System via National Waterway-1 from Allahabad to Haldia.
- **North East Myanmar Industrial Corridor**: It was started by the Tokyo Declaration for India-Japan Special Strategic and Global Partnership to boost connectivity and development in the Northeast, catalysing economic growth and prosperity in the region.

An industrial corridor is infrastructure spending targeted to a specific area to boost industrial development. Creating ICs involves examining demand, viability, transport choices for commodities and people, land values, and economic incentives for enterprises. Attracting potential investors to set up manufacturing units in National Investment and Manufacturing Zones will assure ICs' economic and financial feasibility (NMIZs). India will also need foreign innovation. ICs should improve industrial and urban infrastructure.

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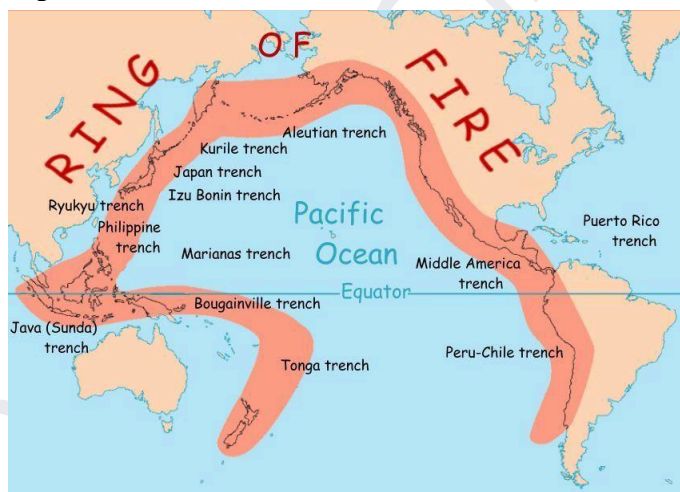
**Q.5) Volcanoes are located in major belts and regions around the world. Give an account of how volcanoes are distributed around the world. (10 mark) (150 words)**

Volcanoes are fissures or openings in the crust of the earth through which molten magma from beneath the earth's crust is released onto the surface. They are found in some major belts and regions around the world.

### Distribution of volcanoes

- **Ring of fire belt**

- It is present around continental boundaries that touch the **Pacific Ocean (the Pacific plate)**, and it extends in a continuous pattern across **Japan, the Philippines, the Aleutian Islands, Peru, Chile, New Zealand, and other countries.**
- The region represents the **subducting Pacific plate** beneath the boundaries of the adjacent continental plates. It causes severe stress and fracturing, allowing hot magma to escape. Famous volcanoes in this belt include **Mount Fuji in Japan, Mount Cotopaxi in Ecuador, and Mount Pinatubo in the Philippines.**



- The **East African Rift**, which separates the **Somali Plate from the African Plate**, is another location for active volcanoes. The **Dabbahu volcano in Ethiopia** erupted in **2005** and is known for its visible fissures on the ground.
- The **Alps and Mediterranean region** contain some of the **most active and dangerous volcanoes**, such as **Mount Etna and Mount Vesuvius**. The African plate is subducted beneath the massive Eurasian plate.
- The **Mid Atlantic ridges** are the **world's longest continuous chains of active volcanism**. On one side, they represent the diverging boundaries of the North American and South American plates, while on the other, they represent the diverging boundaries of the Eurasian and African plates. The magma from within the earth continues to pour out on both sides, forming new crust.



- **Pacific Ocean islands**, such as the **Hawaiian Islands and the Deccan traps**, are an **anomaly** in an otherwise explainable correlation of volcanoes with plate boundaries. **Hotspots** explains this. These are fixed-in-space regions of the earth's mantle. As a result, a series of volcanic eruptions are observed as the tectonic plate moves over the **hotspots**. The **Deccan traps** were formed today when the Indian plate moved over a hotspot near Reunion Island.

Thus, volcanoes exhibit a distinct pattern in their distribution. A combination of **plate tectonics, hot spots, and mid-oceanic ridges** can explain their distribution pattern. Their physical uniqueness, as well as their role in shaping the world around them, must be recognized.

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**Q.6) Account for the change in the spatial pattern of the Iron and Steel industry in the world. (15 mark) (250 words)**

Technological, demand, and transportation changes have altered the iron and steel industry's spatial pattern.

- **From 18th to 19th centuries** : Early iron and steel production was near **raw material like iron ore and coal**. Because transportation was expensive, it was cheaper to deliver finished goods than raw resources.
- **Transition to coastal areas (20th century)** : Iron and steel moved to coastal areas as transportation costs fell and technology improved. This was because coastal areas had deepwater ports, making global raw material imports cheaper and easier. Additionally, coastal areas were near significant steel markets.
- **Developing Country Rise (Late 20th-21st century)**: The iron and steel industry moved to developing nations in the late 20th century. Many developing countries have cheaper labor and greater natural resources than developed nations. Developing nations also offered steel producers subsidies and other incentives.
- **Present Trends**: Today, China, India, and Japan dominate the iron and steel sector. Their steel plants are among the world's largest and most advanced.

### Causes of Change

Several causes have changed the iron and steel industry's spatial arrangement. Some factors are:

- **Technology changes**: Electric arc furnaces make steel production more efficient and environmentally friendly. Steelmakers can now place their factories farther from raw material suppliers.
- **Demand shifts**: Developing nations now demand steel. Rapid economic growth in developing countries has increased demand for infrastructure and consumer products.

- **Cost of transportation changes:** Raw materials and final products are cheaper to transport due to falling transportation costs. Steelmakers can now put their operations farther from their markets.

Future iron and steel industry spatial patterns may change. Technological advances, market shifts, and raw material availability will drive this.

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**Q.7) Explain how extra tropical cyclones benefit the middle latitudinal regions. Also, discuss how they have been affected by climate change. (10 mark) (150 words)**

Extra-tropical cyclones are also called **wave cyclones or mid-latitude cyclones**. They are a type of storm system formed in the middle or high latitudes, in regions of large horizontal temperature variations called the **frontal zones**.

#### **Benefits to the middle latitudinal regions**

- Extra-tropical cyclones are crucial to the **mid-latitude region** from the point of view of **weather and agriculture**.
- Rains due to extra-tropical cyclones **bring great relief to a region**.
- The rainfall brought by these cyclones is highly beneficial to the region. This rainfall in the mid-latitude region gives required moisture to **agriculture and plantation of the region**.
- While regions like **Iran and northern India** also face rainfall due to these cyclones. These extra cyclones are quite useful for the **Rabi crops and plantations like apples and orchards**.
- Further, these cyclones move from west to east. Also, these cyclones have vast area coverage as the diameter of these cyclones is vast. Due to this reason, the passage of a cyclone causes **abrupt changes in weather conditions**.
- These cyclones also **bring relief to the region affected by cold waves** as these cyclones bring rainfall and snowfall.

#### **The impact of recent climate change on these extra-tropical cyclones:**

- Due to change in climate, **the pattern of these cyclones have changed over time**.
- The **frequency of these cyclones has increased**. Intense change in weather over a shorter period of time is quite prevalent.
- Further, climate change and pollution have created a **new pattern of cloud formation and rainfall**.

The extra-tropical cyclones are beneficial for the climate in some regions. The effect of climate change is hampering the growth and development of these regions by interfering with the natural

benefits provided to them like the monsoon rainfall, etc. Thus, steps must be taken to control climate change and utilise the benefits provided naturally to us.

**Q.8) The country's water resources are worsening in terms of both quality and quantity. Discuss the reasons for this and propose a long term solutions for water sustainability. (15 mark) (250 words)**

As India grows and urbanizes, its water resources are worsening. It's estimated that around **70% of surface water in India is unfit for consumption**. Every day, almost 40 million litres of wastewater enters rivers and other water bodies with only a tiny fraction adequately treated.

**Reasons for worsening quality and quantity of water resources:**

- Increased demand for water for domestic, industrial and agricultural needs and limited surface water resources lead to **the over-exploitation of groundwater resources** and thus percolation of polluted water to aquifers.
- The **Green Revolution** allowed water-intensive crops to be grown in drought-prone/water-stressed areas, resulting in groundwater over-extraction. On one hand, it reduced the quantity while on the other side the use of fertilizers polluted the water.
- Subsidies on electricity and high MSP for water-intensive crops are also leading reasons for depletion. This increased the unmindful pumping of groundwater.
- Water contamination, such as that caused by **landfills, septic tanks, leaking underground gas tanks, and the overuse of fertilizers and pesticides**, damages and depletes groundwater resources.
- Inadequate groundwater law enforcement encourages the **depletion of groundwater resources** with no consequences. Even the private sector and construction companies exploited the water resources without responsibility.
- **Deforestation, unscientific agricultural methods, chemical effluents from industries, and a lack of sanitation** all contribute to groundwater pollution, rendering it unusable.

**Solution to the current scenario of water crisis:**

- Given the current situation, a paradigm shift is required. We urgently need to shift away from this "supply-and-supply-more" water provision and toward measures that improve water use efficiency, reduce leakages, recharge/restore local water bodies, and apply for higher tariffs and ownership by various stakeholders.
- Encouraging farmers to **adopt micro-irrigation techniques** such as **drip irrigation and micro-sprinklers**. Government programs- **DRIP programme, More drop per crop, Krishi Sinchai Yojana**

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- **Empowering the local community** to become active participants in groundwater management.
  - Restrictions on groundwater access in areas designated as "critical" and "dark zones," where the groundwater is **overused or very low**.

The most effective response to the freshwater crisis is to integrate conservation and development activities - from water extraction to water management at the local level; thus, educating and involving communities is essential for success.

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**Q.9) Glaciers are one of the most powerful agents of geomorphic change, and they have shaped the Earth's landscape for millions of years. Discuss the major types of glaciers, their characteristics, and their significance for human societies. (10 mark) (150 words)**

Gravity moves enormous ice glaciers over land. They are one of the most potent geomorphic change agents, shaping Earth's landscape over millions of years.

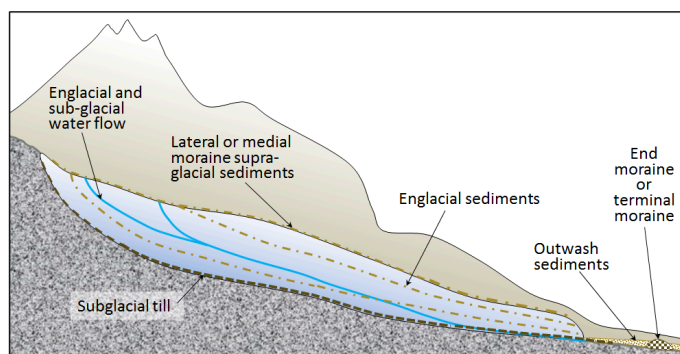
### **Glacier Types**

Alpine and continental glaciers exist.

- **Continental glaciers** are the largest and most widespread. They can cover thousands of acres and be thousands of feet thick. **Antarctic and Greenland** are the largest continental glaciers.
- Despite being smaller than continental glaciers, **Alpine glaciers** are powerful. High mountains and valleys are their habitat.

Glaciers are characterized by their movement, their erosion, and their deposition.

- **Movement:** Glaciers move slowly, only inches or feet per year. They are strong and can move boulders and rocks.
- **Erosion:** Glaciers degrade their paths. This involves plucking and abrasion. Plucking occurs when glaciers freeze and remove rocks. When glaciers scrape rocks, abrasion occurs.
- **Deposition:** As they flow, glaciers deposit material. Their moraines include this material. Glaciers deposit rock and debris into moraines.



### Glacier Importance for Human Societies

- Glaciers benefit humans in many ways. They supply drinking and agricultural water. They back tourism and recreation. Glaciers also regulate climate.
- Glaciers are also dangerous. These can produce avalanches and floods. They also melt, raising sea levels.

One of Earth's most powerful features is glaciers. They have shaped Earth's landforms for millions of years and are still crucial to human societies. Glaciers are dangerous, thus we must be mindful of them.

**Q.10) Climate change is one of the most pressing environmental challenges facing human societies today. Discuss the causes and consequences of climate change, and the ways in which human societies can mitigate its impact and adapt to its effects. (15 mark) (250 words)**

Global warming, or climate change, is the long-term shifts in temperatures and weather patterns since the pre-industrial period. Human actions, especially burning fossil fuels, put greenhouse gases into the atmosphere, causing these changes. Greenhouse gases including carbon dioxide, methane, and nitrous oxide capture solar heat, warming the globe.

### Causes of Climate Change

- Climate change is caused by using fossil fuels like coal, oil, and natural gas. Burning fossil fuels releases greenhouse gases such carbon dioxide, methane, and nitrous oxide. These gases trap solar heat, warming the globe.
- **Other human actions that cause climate change:**
  - **Deforestation:** Cutting down trees releases carbon dioxide into the sky.
  - **Agriculture:** Agriculture emits methane and nitrous oxide.
  - **Industrial processes** emit greenhouse gases such carbon dioxide, methane, and nitrous oxide.

### Climate Change Effects

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Climate change is already affecting the world. Such effects include:

- **Increasing sea levels:** Glaciers and ice sheets melt, raising sea levels. This endangers coastal habitats.
- **Greater weather extremes:** Heat waves, droughts, floods, and wildfires are increasing due to climate change.
- **Pattern changes in precipitation:** Changes in precipitation patterns due to climate change might cause water shortages and desertification.
- **Ecosystem impacts:** Global ecosystems are suffering from climate change. Reefs are bleaching and dying owing to rising ocean temperatures.
- **Human health risks:** Human health is threatened by climate change. Heat-related diseases and respiratory issues are rising.

### Climate mitigation

- **Renewable energy sources** like solar and wind power do not emit greenhouse gasses.
- **Energy efficiency** can be improved by making houses and businesses more energy efficient.
- **Reduce deforestation:** Forest protection and tree planting minimize deforestation.
- We may reduce fertilizer and pesticide use by adopting **sustainable agricultural techniques**.
- **Technology development for carbon capture and storage:** Carbon capture and storage can store power plant and industrial CO<sub>2</sub> underground.
- We can create **climate-resistant infrastructure** like seawalls and flood-resistant structures.
- **Developing extreme weather early warning systems:** We can prepare for and respond to extreme weather disasters via early warning systems.
- **Adopting drought-resistant crops and farming practices** can help us cope with water shortages.
- **Protecting ecosystems that aid climate change adaptation:** We can conserve forests and wetlands that regulate water flow and protect us from floods to adapt to climate change.

Climate change is severe, but action is still possible. We must act now to adapt to and minimize climate change. Collaboration can create a more sustainable and resilient future for all.

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