

## VAJIRAM &amp; RAVI

SURESHOT MAINS TEST SERIES 2025

<b>GENERAL STUDIES</b> Subjective Assessment Physical Geography   Test - 4	Evaluator Code: Date of Assignment: CQ:
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NAME: 

Time allowed: 90 Minutes

ADMIN. NO.: Email: MOBILE NO.: Submission Date: **QUESTION PAPER SPECIFIC INSTRUCTIONS**

Please read each of the following instructions carefully before attempting questions:

There are **TEN** questions printed in **ENGLISH**. All the questions are compulsory.

The number of marks carried by a question/ part is indicated against it. Word limit in questions, wherever specified, should be adhered to. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.

Q No.	Marks	Q No.	Marks
Q1	/10	Q6	/15
Q2	/10	Q7	/15
Q3	/10	Q8	/15
Q4	/10	Q9	/15
Q5	/10	Q10	/15
<b>Subtotal</b>	<b>/50</b>	<b>Subtotal</b>	<b>/75</b>
<b>Penalty</b>			
<b>Total marks</b>			<b>/125</b>

Follow these steps to avail the facility of mentoring –

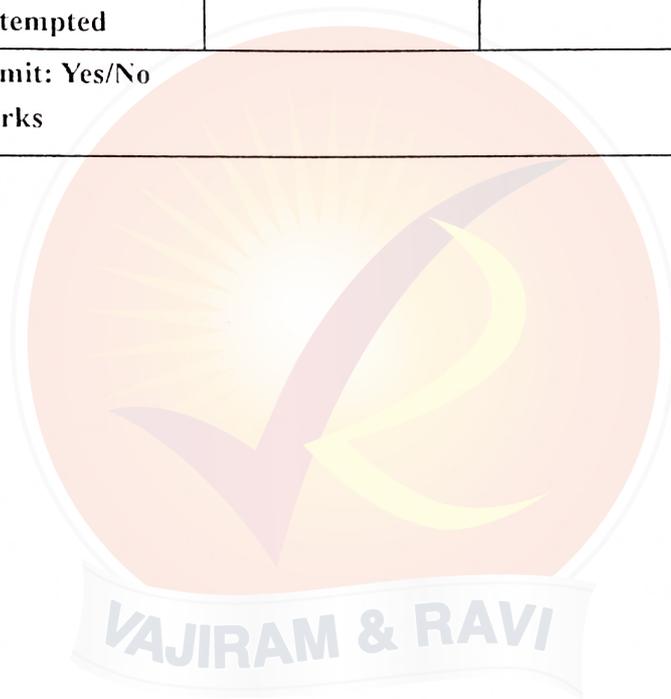
- Go through the soft copy of your evaluated answer sheet and analyse all the comments and suggestions given.
- Call 9717565805 between 11:00 am to 5:00 pm to fix your mentoring slot.
- Please follow the mentoring appointment timings properly.

**For Student Only**

Start Time -	End Time -
Mode of Examination	Online <input checked="" type="checkbox"/> Offline <input type="checkbox"/>

Receiving date - Dispatch date -

Parameters		Good	Average	Needs Improvement
Conceptual Understanding				
Contextual Clarity				
Structure	Introduction			
	Body			
	Conclusion			
Meeting the Demand of the Questions				
Value Addition- Use of examples, case studies, Current Affairs Linkage, data etc.				
Presentation-Illustrations, flowcharts, diagrams, etc.				
Language Competency and Flow				
No. of Questions Attempted				
<ul style="list-style-type: none"> <li>Adherence to Word Limit: Yes/No</li> <li>Subject-Specific Remarks</li> </ul>				



## Evaluator/Reviewer Suggestions



All the Best

(Answer questions in NOT MORE than the word limit specified for each in the parenthesis. Content of the answer is more important than its length.)

1. Discuss the concept of jet stream and explain its effects on Indian monsoon.

(10 marks, 150 words)

Jet streams are relatively narrow bands of winds blowing in the upper layers of atmosphere from west to east. They are strongest in the Northern and Southern Hemisphere winters.

## Types of Jet Streams

### Polar Jet streams

- polar regions
- influences storm tracks & temperature gradients

### Subtropical Jet Streams

- subtropical regions
- formation and movement of hurricanes and tropical storms

### Tropical easterly Jet streams

- over Asia (south of subtropical ridge)
- affect onset and intensity of monsoon (South Asia and West Africa)

## Effect of Jet Stream on Indian Monsoon -

• Influence on onset and progression -

northward shift of subtropical jet stream - onset on monsoon.

southerly positioned jet stream - delay in onset and thus, drought conditions.

• Impact on Monsoon withdrawal

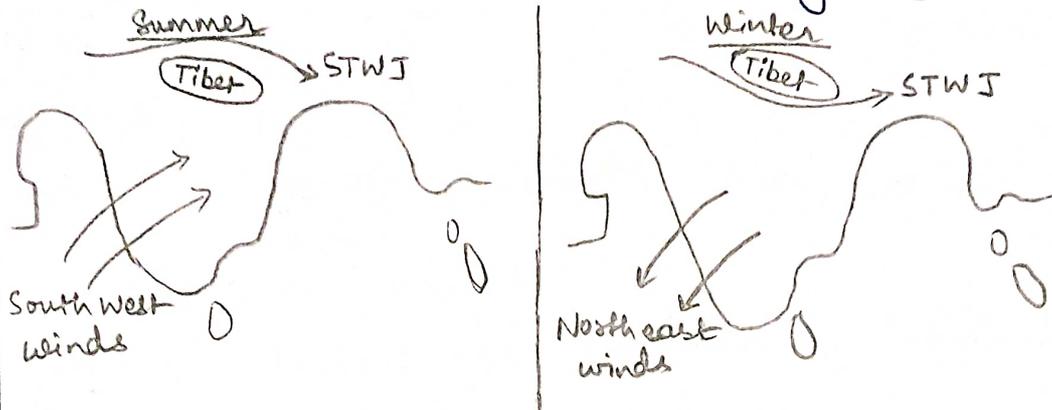
southward retreat of jet stream - around September - withdrawal of monsoon.

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northward persistence of jet stream indicates delay in withdrawal, thus flooding regions.



STWJ - Sub-Tropical Westerly Jet Stream

- Role in North east monsoon westerly Jet stream creates high pressure over NW India which causes movement of dry wind towards Bay of Bengal transforming into North east monsoon.
- Somali Jet Stream high pressure near Madagascar intensifying South southwest monsoon towards India.

Jet streams influence weather and precipitation patterns along with seasonal variability, thus making it crucial for weather forecasting and mitigation of monsoon impacts in India.

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2. Enumerate the conditions needed for formation of tropical cyclones. Give reasons for more cyclones in the Bay of Bengal compared to in Arabian Sea. (10 marks, 150 words)

Tropical cyclones are large rotating systems of clouds and thunderstorms over warm water in tropical latitudes - Eg, Cyclone Michaung 2023.

Conditions needed for formation of Tropical cyclone -

- warm ocean water, temperature above 27°C
- High humidity and moisture content.
- Low wind shear
- Coriolis force helps cyclones develop their characteristic rotation.
- Vertical wind speed
- Pre-existing weak low pressure area is usually the starting point for cyclone development.

Reasons for more cyclones in Bay of Bengal compared to Arabian Sea -

- Warmer water with greater depths in Bay of Bengal
- Larger expanse of shallow water and the shape and orientation of Bay of Bengal funnel cyclones.

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- Trade winds - favourable conditions for westward movement of cyclones in South China Sea into Bay of Bengal.
- Bay of Bengal experiences lower wind shear compared to Arabian Sea.
- Higher frequency of pre-existing disturbances such as tropical waves or cluster of thunderstorms in Bay of Bengal.

Way Forward -

- However, climate change and global warming has led to increase in cyclones in the Arabian Sea as well.
- need for a proper mitigation and adaptation strategy.

The preparedness for disasters along with an early warning systems and community awareness in coastal regions can help in minimising loss of life and property due to tropical cyclones.

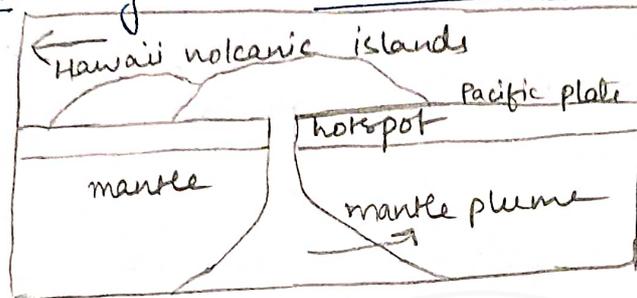
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3. Describe the characteristics of hot spot volcanism with examples.

(10 marks, 150 words)

A hot spot is a region deep within the earth's mantle from which heat rises through convection process as a thermal plume. Eg. The Hawaiian Islands.



Characteristics of hot spot volcanism -

- Location of hotspots - not at boundaries of earth's tectonic plates, instead at hot centres (mantle plumes).
- Geochemical features distinct - eg. The Galápagos island lava contains helium isotopes, lead, thorium - indicated deep mantle source.
- Seamounts and Guyots are formed, like the Emperor Seamount over Hawaiian hot spot.
- Hotspot volcanoes often occur in linear chains of volcanic islands or seamounts.

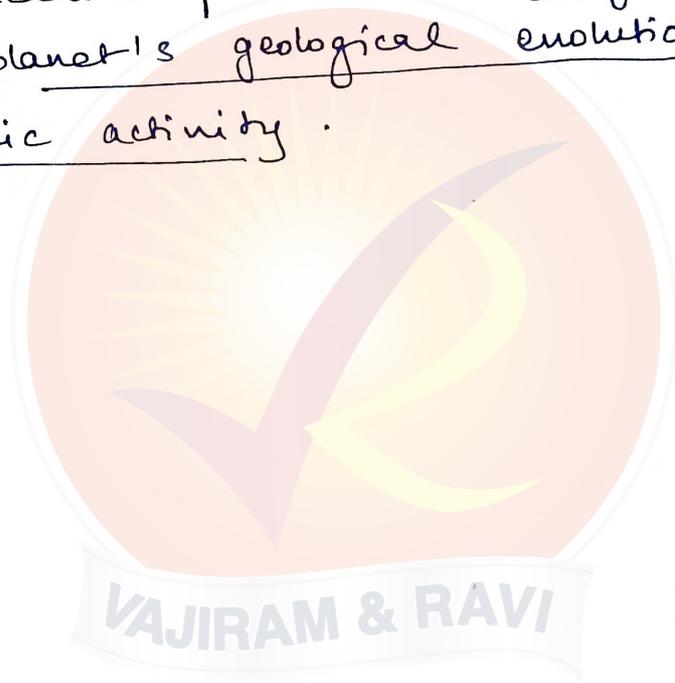
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- Lava plateau can be formed due to hotspot volcanic activities. eg. the Deccan plateau.
- Prolonged volcanic activity in case of hotspot volcanoes. eg. Yellowstone, home to a supervolcano, is active for millions of years - geysers, hot springs.

Hot spot volcanoes provide an insight into the planet's geological evolution and tectonic activity.



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4. 'Invasive alien species have become one of the most potent threats to local biodiversity in various regions.' Discuss with examples. (10 marks, 150 words)

As per the IPEBS Invasive Alien species Assessment, invasive species are <sup>one of</sup> the major drivers for biodiversity loss - 60% of global plant and animal extinction and cost humanity \$400 billion a year.

Invasive alien species as potent threat to local biodiversity -

- Competition for resources - Zebra mussels compete with native mussels leading to the decline of latter.
- Ecological disruption - In western ghats, Lantana decimating traditional trees.
- Spread of diseases - caused through amphibian trade (Chytrid fungus affects native amphibian species).
- Threat to crop production - Cotton mealybug cause yield loss in cotton crops - Deccan region.
- Disruption of mutualistic relationships between invasive and native species.

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Suggestions to prevent biodiversity loss -

- monitoring and surveillance systems
- Research to understand the invasive species scientifically.  
eg. Canada's CAISN
- International cooperation like CBD and IUCN initiatives for invasive species management.
- Technologies like drones, remote sensing, GIS mapping as adopted by Australia for biosecurity.

In order to achieve Target 4 of India's National Biodiversity Action Plan, the need is to be committed to the goal of 50% reduction in invasive species by 2030 under Kunming-Montreal Global Biodiversity Framework.

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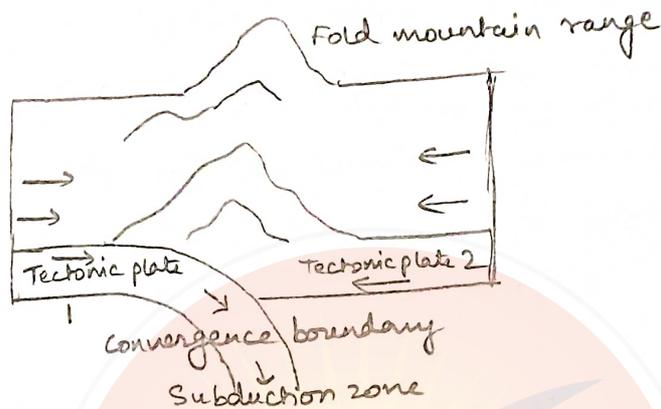
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5. Give a reasoned account on the geographical distribution of fold mountains on earth's surface. (10 marks, 150 words)

Fold mountains are large mountain ranges formed by the folding of rock layers due to compressing tectonic forces.



Geographical distribution account -  
(influenced by plate tectonics)

- Continent - Continent collision when two continents collide it causes the crustal rocks to fold and uplift.  
eg. The Himalayas, Asia - collision between Indian and Eurasian plate.
- Continent - Ocean collision - At the convergent plate boundary where continental and oceanic plates collide. The oceanic plate is subducted beneath continental plate.

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eg. The Rockies, North America - collision of North American and the Pacific plate.

- Plate movements in geological past - Relict Fold Mountains are typically older and eroded.

eg. The Urals, Russia were formed during collision of Siberian and Baltic plates.

Similarly - Caledonian Mountains formed during Caledonian orogeny by collision of Laurentian and Baltica plates.

Understanding the distribution of fold mountains provides us vital information on the geological past of the earth.

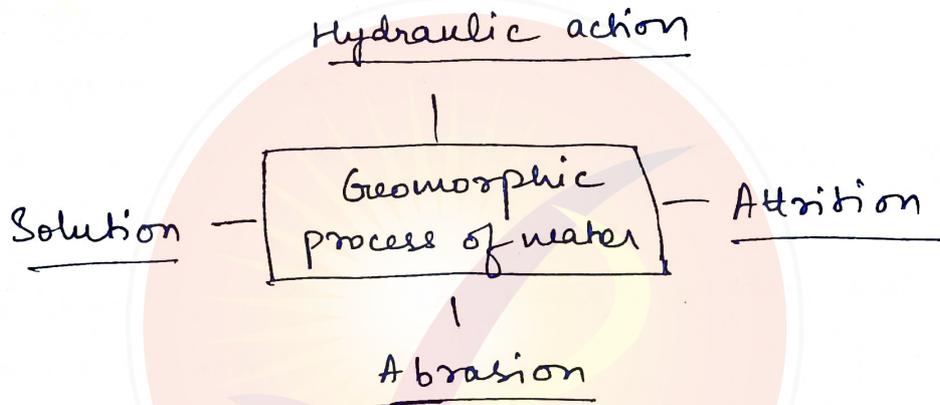
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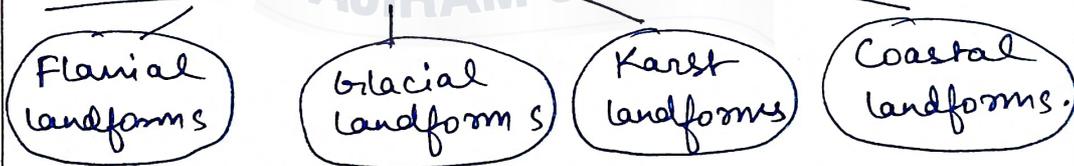
6. Discuss the importance of water as the chief architect of the earth surface.

(15 marks, 250 words)

About 97% of the Earth's water is in the ocean, and more freshwater in glaciers or underground aquifers. Water shapes the topography through its erosional and depositional processes along with providing habitat for different living organisms.



Through these mentioned processes, water plays a pivotal role in shaping four diverse landforms



### FLUVIAL LANDFORMS -

- Potholes - circular depressions from erosive action of water and sediments.
- Waterfalls - differential erosion of rock layers  
eg. Victoria Falls.

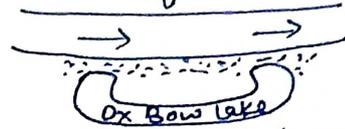
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- **River Delta** - accumulation of sediments.  
Eg. Ganges-Brahmaputra delta.
- **Oxbow Lakes** - meander cut off from main channel - U shaped bodies of water.

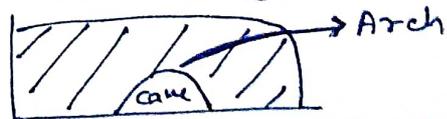
## GLACIAL LANDFORMS



- **U-shaped valleys** - erosive action of glaciers.
- **Arêtes and Horns** - ridges and pointed mountain peaks. Eg. Matterhorn, Swiss Alps.
- **Moraine** - sediments (hill) deposited by glaciers.
- **Eskers** - ridges of gravel within or beneath glaciers.

## COASTAL LANDFORMS

- **Wave cut platform** - eg. Seven sisters chalk cliffs in England.
- **Barrier Islands** - long, narrow islands parallel to coastline.
- **Tombolos** - ridges of sand connecting island to mainland.
- **Sea caves** - by abrasion and hydraulic action of waves.



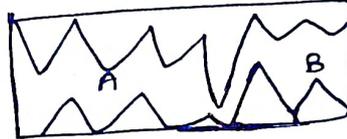
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## KARST LANDFORMS

- Stalactites and Stalagmites - deposition of minerals  
dripping from cave ceiling (A) accumulating on cave floor (B)



- Sinkholes - dissolution of soluble bedrock beneath the surface.
- Dolines - circular or oval depressions.

Understanding these landforms becomes imperative as they provide valuable insight into the complex processes that shape the earth.

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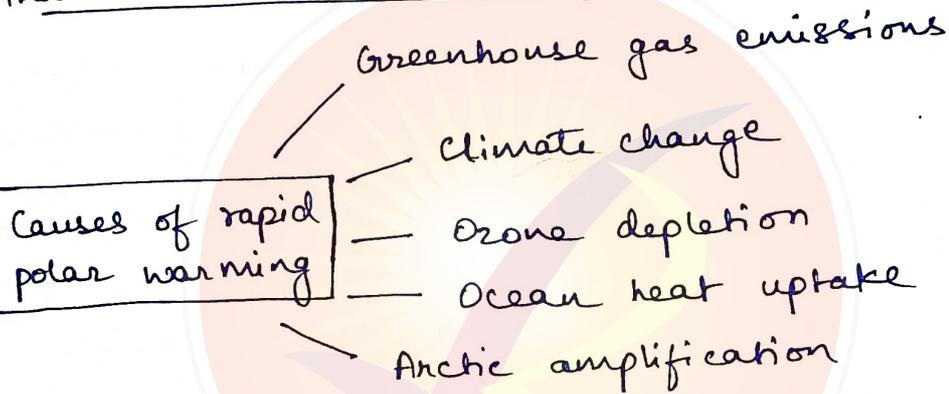
Introduction
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Suggestions:

7. "Rapid polar warming will create large-scale climate refugees." In the light of the statement, discuss the hazard vulnerability of coastal regions.

(15 marks, 250 words)

Rapid polar warming is the accelerated increase in temperature in the polar regions, Arctic and Antarctic mainly due to human induced climate change. World Bank projections indicate that due to rapid polar warming by 2050 over 216 million individuals will be compelled to relocate.



The hazard vulnerability of coastal regions due to rapid polar warming are -

- Sea-level rise - complete submergence threat to small island states like Maldives.
- coastal erosion threatening the coastal infrastructure and communities. Coastline inundations in Mumbai, Chennai, Kolkata.
- Thawing permafrost can lead to rise of viruses and bacteria - 2016 Anthrax outbreak NW Serbia.

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- Loss of biodiversity and ecosystems due to ocean acidification, coastal bleaching as in Andaman and Nicobar islands and habitat destruction.
- increase in extreme weather patterns. The number of cyclones in Arabian sea have increased over the years. 2023 Cyclone Biparjoy.

Steps needed to reduce the impact of polar warming on coastal regions -

- Relocation as mitigation technique. Eg. Jakarta, capital of Indonesia, is being moved to Borneo.
- Innovation in architecture and infrastructure like building sea wall, drainage systems.
- Climate resilient agriculture and livelihood following Kerala model.
- Promotion of renewable energy. Eg. India's National Solar Mission and wind Energy Programme.
- ICZM Project in Gujarat to strengthen coastal governance.

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A comprehensive mitigation and adaptation strategies to build resilience and safeguard coastal community in the face of polar warming and climate changes.



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8. Why are earthquakes zonal in distribution? Discuss the seismic vulnerability of India. (15 marks, 250 words)

An earthquake is a sudden shaking of the earth's crust due to movement of tectonic plates, volcanic eruptions, etc. These earthquakes are present at certain specific locations of the earth's crust. Bhuj 2001 earthquake was due to tectonic plate movement.

Key reasons for earthquake zonal distribution -

Most earthquakes occur at plate boundaries where tectonic plates interact.

• Convergent boundaries - plates move towards each other leading to subduction or collision. Eg - Pacific Ring of Fire.

• Divergent boundaries - plates move away from each other, creating new crust. Eg, Mid-Atlantic Ridge.

• Transform Boundaries, when plates slide past each other horizontally creating frictional resistance. Eg, San Andreas Fault.

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## Seismic Vulnerability of India

NDMA report indicates that a total of 59% of India is prone to earthquakes.

— collision of Indian and Eurasian plate. Eg. Nepal earthquake 2015.

Reason for India's seismic vulnerability

— intra-plate seismic activity  
Eg. Lahur earthquake 1993.

Weak construction practices.

high population density increases vulnerability

- Zone 5 - MSK IX, 11% of the country, Andaman and Nicobar islands, Kashmir, western and central Himalayas - highest risk.
- Zone 4 - MSK VIII, 18% area of country, Delhi, Patan Nagar Maharashtra - high damage risk zone.
- Zone 3 - MSK VII, 30% of the country, Chennai, Mumbai, Pune, Kolkata, Kerala - moderate damage risk zone.
- Zone 2 - MSK VI or lower, 41% in zone 2, Bengaluru, Hyderabad, Nagpur, Raipur - low damage risk zone.

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## Way Forward

- seismic zoning - building codes by BIS.
- early warning systems like BHOOKAMP alert app in Uttarakhand.
- public awareness campaigns.
- NIDM conducts training workshops on earthquake risk reduction. Similar other training programs needed.

A comprehensive and collaborative effort is needed to build a more resilient nation as mentioned in Sendai Framework for Disaster Risk Reduction.

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Suggestions:

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9. Explain the reasons for geographical concentration of ozone holes. What are the remedial measures to ozone depletion? (15 marks, 250 words)

The ozone hole is defined as an area for which ozone column values amount to 220 DU or less, primarily over Antarctica.

Impact of Depletion of Ozone layer -

- Increased UV radiation - increase in diseases like skin cancer, cataract, etc.
- Climate change like glacier melting and sea level rise due to global warming.
- Impact on marine life - increased W-B radiation inhibit phytoplankton.
- Degradation of materials increased economic costs for repairs.

Reasons for Geographical concentration of Ozone Hole -

- [ Horizontal distribution - Antarctica has a larger ozone hole ]
- extremely low temperature in the Antarctic stratosphere, Polar Stratospheric Clouds (PSC) persist longer.

- Stronger and more stable polar vortex in Antarctica.

- Meteorological conditions - temperature variations, wind patterns, aerosols due to volcanic eruptions, etc.

[Vertical distribution - lower stratosphere]

- Temperature inversion helps PSC formation.

- concentration of chlorine and bromine in the lower stratosphere.

- Stratospheric dynamics - polar vortex most effective in lower stratosphere due to low temperature.

Remedial measures to ozone depletion -

- International agreements like 2016 Kigali Amendment to Montreal Protocol.

- India phased out CFC by 2010.

- Alternatives like HFCs but they also need controlled use.

- New Technology - energy-efficient air conditioners, EESL program, ICAP 2019, Ozone Cell, MoEFCC low GWP refrigerants.

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- Public awareness for Ozone depleting substance use reduction.

A healthier and more sustainable planet for all requires innovation in the environment-friendly direction with increased global community vigilance.



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Suggestions:

10. 'Tropical rainforests of the ocean are under serious threat of existence.' Discuss. Also, suggest measures to rejuvenate these critical ecosystems.

(15 marks, 250 words)

Coral reefs are the tropical rainforests of the ocean, supporting 25% of all marine organism species while occupying less than 1% of ocean floor.

Tropical rainforests of ocean are under serious threat of existence due to -

- Coral bleaching - expel the symbiotic algae living in their tissues leading to coral death.
- Global warming - rise in sea temperature leading to bleaching.
- Ocean Acidification - increased CO<sub>2</sub> level lower ocean pH weakening coral skeletons. eg. Florida Keys
- Sea-level rise - reduce sunlight reaching shallow corals affecting their growth.
- Pollution - eg. In Caribbean, agriculture run off led to overgrowth of algae that smothers corals. Pesticides harm coral health.

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- Tourism - as in case of Hawaii, physical damage to corals due to anchors and tourist contact.
- Coral diseases like black band and white band disease.

Case study - threat to coral reefs:

Wilkinson Report on Great Barrier Reefs

- mass coral bleaching of the Great Barrier Reefs in 2016, 2017.
- ocean acidification impede coral carbonate skeleton building.
- It was predicted that world's coral reefs would be at risk of severe degradation, if current trends continue, by 2050.

Measures to rejuvenate these critical ecosystems -

- Marine protected area where fishing and tourism are regulated.
- Restoration projects like Florida's Coral Restoration foundation.
- Policy change - eg, Belize banning oil drilling

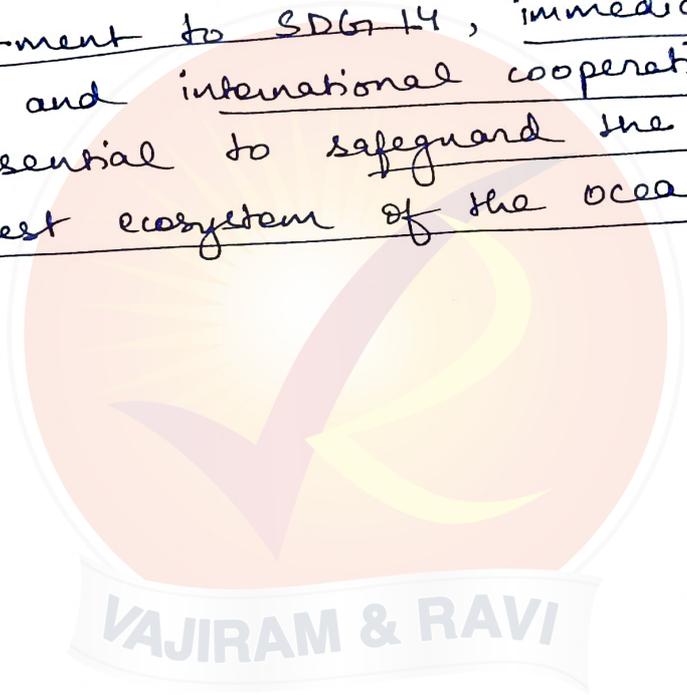
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- Public Awareness - educating communities on reef conservation.
- Technological innovations like Biorock technology which supports coral growth and helps restore damaged reefs.

Commitment to SDG 14, immediate action and international cooperation are essential to safeguard the tropical rainforest ecosystem of the ocean.



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