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GENERAL STUDIES (TEST CODE : 1824)

Name of Candidate	NEEPA MANOCHA		
Medium Eng./Hindi	ENGLISH	Registration Number	12500
Center	DELHI	Date	9/3/2022

INDEX TABLE

Q. No.	Maximum Marks	Marks Obtained
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
11	15	
12	15	
13	15	
14	15	
15	15	
16	15	
17	15	
18	15	
19	15	
20	15	

Total Marks Obtained:

Remarks:

INSTRUCTIONS

- Do furnish the appropriate details in the answer sheet (viz. Name, Registration Number and Test Code).
उत्तर पुस्तिका में सूचनाएं भरना आवश्यक है (नाम, प्रश्न-पत्र कोड, विद्यार्थी क्रमांक आदि)।
- There are **TWENTY** questions printed in **ENGLISH & HINDI** इसमें बीस प्रश्न हैं अंग्रेजी और हिन्दी में छपे हैं।
- All questions are compulsory.**
सभी प्रश्न अनिवार्य हैं।
- The number of marks carried by a question/part is indicated against it.
प्रत्येक प्रश्न/भाग के अंक उसके सामने दिए गए हैं।
- Answers must be written in the medium authorized in the Admission Certificate, which must be stated clearly on the cover of this Question-Cum-Answer (QCA) Booklet in the space provided. No marks will be given for answers written in medium other than the authorized one.
प्रश्नों के उत्तर उसी माध्यम में लिखे जाने चाहिए जिसका उल्लेख आपके प्रवेश पत्र में किया गया है और उस माध्यम का स्पष्ट उल्लेख प्रश्न-सह-उत्तर (क्यूसीए) पुस्तिका के मुख्य पृष्ठ पर अंकित निर्दिष्ट स्थान पर किया जाना चाहिए। उल्लिखित माध्यम के अतिरिक्त अन्य किसी माध्यम में लिए गए उत्तर पर कोई अंक नहीं मिलेंगे।
- Word limit in questions, if specified, should be adhered to.
प्रश्नों में शब्द सीमा, जहाँ विनिर्दिष्ट है, का अनुसरण किया जाना चाहिए।
- Any page or portion of the page left blank in the Question-Cum-Answer Booklet must be clearly struck off.
उत्तर पुस्तिका में खाली छोड़ा हुआ पृष्ठ या उसके अंश को स्पष्ट रूप से काटा जाना चाहिए।

16-B, 2nd Floor, Above National Trust Building, Bada Bazar Marg, Old Rajinder Nagar, Delhi-110060

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EVALUATION INDICATORS

1. Contextual Competence
2. Content Competence
3. Language Competence
4. Introduction Competence
5. Structure - Presentation Competence
6. Conclusion Competence

Overall Macro Comments / feedback / suggestions on Answer Booklet:

1.

2.

3.

4.

5.

6.

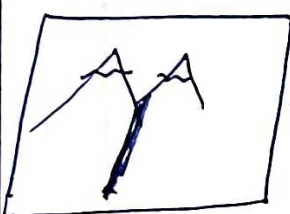
All the Best

1. Explaining the concept of meandering, identify the various landforms associated with flood plains. (150 words) 10

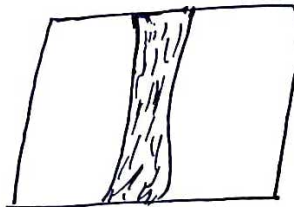
विसर्प की अवधारणा की व्याख्या करते हुए, बाढ़ के मैदानों से जुड़ी विभिन्न भू-आकृतियों को वर्णित कीजिए।

meandering refers to the curving / looping of the river when it reaches the mature stage.

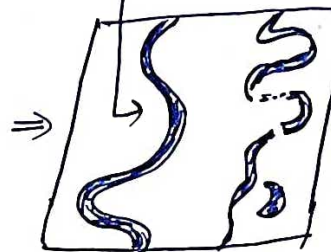
LIFECYCLE of a River



Youth stage
Linear flow
High speed
High Depth



Intermediate
slight tilt
More wide
than deep



Mature stage
curves & loops
slower speed
shallow

River
meanders
due to
deposits

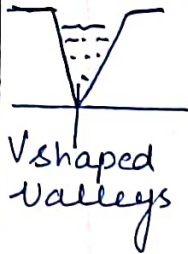
It is observed that the river meanders when the depositional action of the flowing water is stronger than its erosional force.

landforms associated with floodplains are called FLUVIAL LANDFORMS and include

① EROSIONAL LANDFORMS

This happens when the river erodes the path on which it flows. Higher speed

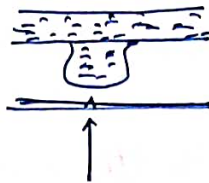
means deeper erosion and is common in nascent stage



V shaped
Valleys



Canyons
and
gorges



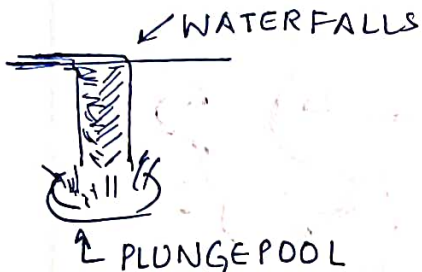
potholes



Peneplain

(undulating
landmass)
formed by ABRASIVE
action of River

It also creates waterfalls and plungepools
when the river falls from a height.



PLUNGEPOOL

② DEPOSITIONAL LANDFORMS

The depositional landforms are prominent when the river deposits the silt, rocks, debris brought with it and is found in mature stage



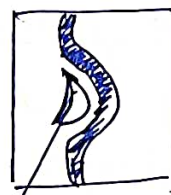
Delta on
Coast



meanders



Oxbow
lakes



point bars

Erosional landforms are biodiversity hotspots and tourist attractions whereas depositional landform provide fertile soil for agricultural activities

2. What is a cloudburst and what are its effects? Why are they more frequent in the Himalayan region? (150 words) 10

बादल फटना क्या है और इसके क्या प्रभाव हैं? हिमालयी क्षेत्र में इनकी आवृत्ति अधिक क्यों है?

cloudburst are occurrences of high amount of rainfall over a small region and over a short period of time.

They are formed due to vertical updraught and high amount of relative humidity.

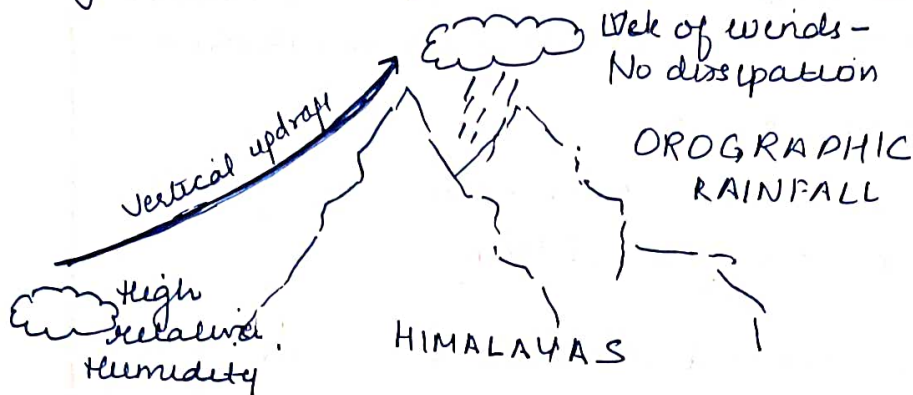
There have been instances of cloudbursts in the states of Uttarakhand, Himachal Pradesh. It has had devastating effects of

- ① Destruction of life and property
- ② Causes Flash Floods
- ③ uprooting of trees
- ④ soil erosion
- ⑤ Landslide and landslips
- ⑥ Habitat Destruction and Biodiversity loss
- ⑦ Downstream deposition of silt & sediments which may choke river beds and cause land elevation
- ⑧ Tourism Loss and impacts the economy

They are more frequent in the Himalayan Region because:-

- ① Himalayas act as a barrier for the rain bearing clouds. This makes the clouds shed their moisture through

Orographic rainfall.



- ② Stable wind conditions in upper atmosphere doesn't let the clouds dissipate
- ③ High relative humidity in the floodplains augment cloud formation.
- ④ Low temperatures in Himalayan region leads to rapid condensation and heavy downpour.

The vulnerability of the Himalayan region has increased due to climate change which has led to warming, thereby changing patterns of evaporation, wind speeds and condensation.

Therefore, there is a need of early warning system and mitigation of destruction caused by cloudburst to maintain climatological balance.

3. Volcanic eruptions are widely considered to be agents of destruction but they also have certain positive impacts on the people and landscape. Discuss.

(150 words) 10

ज्वालामुखी विस्फोटों को व्यापक रूप से विनाश का कारक माना जाता है, लेकिन उनका लोगों और भूदृश्य पर कुछ सकारात्मक प्रभाव भी पड़ता है। चर्चा कीजिए।

Volcanic eruptions are natural disaster in which molten magma, ash, dust, debris and aerosols are spewed by volcanoes.

Volcanoes are considered agents of destruction because :-

- 1) Lava flows lead to death and destruction for biodiversity and human life
- 2) It causes damage to property and national monuments
- 3) The ash dust and aerosols spewed causes air pollution and inhabitable conditions

However they also have certain positive impacts.

① For people

↳ Volcanoes often become tourist destinations. These natural marvels attract people from all around world, thereby providing economic activities to inhabitants in vicinity. Eg:- Mount Etna, Stromboli are tourists sites in Italy.

- ② These eruptions leave fertile sediments which makes the land enriched with nutrients for agricultural activities
- ③ The shaking of ground accompanied by the eruptions rejuvenates the fertility of land by altering the top soil.
- ④ For landscapes
 - ① Aerosols released by volcanic eruption cause cooling of atmosphere
 - ② Magma eruption is a rich source of rare minerals like zinc, gold, copper, nickel and even diamonds.
 - ③ Magma also becomes the potential source of geothermal energy which can be harnessed for production of energy.

Therefore,

There is a need for channelising the positive impacts and mitigating the negative impacts of the volcanoes

4. How does the interaction between oceans and the atmosphere stabilize and regulate the climatic variations over the earth? (150 words) 10

महासागरों और वायुमंडल के बीच परस्पर क्रिया किस प्रकार पृथ्वी पर जलवायुविक भिन्नताओं को स्थिर और नियंत्रित करती है?

The threat of climate change alters the interaction between oceans and atmosphere and creates unprecedented events which alter climatic pattern over earth.

The fine balance of interaction oceans & atmosphere stabilise and regulates the climate variations in following ways:-

- ↳ Wind patterns impacts the wave frequency & intensity
- ↳ Land Breeze & Sea Breeze - Regulates temperature in coastal areas.
- ↳ Impacts Monsoon Patterns
- ↳ Convictional Rainfall gives relief from high temperatures humidity
- ↳ Ocean currents - stabilise the Ocean temperature by taking warm water from equator to poles & vice versa
- ↳ Impact El Nino, ENSO and AMOC - Atlantic Meridional overturning circulation.

↳ Oceans also help in absorbing carbon dioxide and help to reduce global average temperature caused by GHGs.

↳

However this precarious balance is being disturbed by excessive atmosphere warming which is leading to ocean warming, glacial melting, sea level rise, and increasing cyclones.

Hence steps for mitigating climate variability must take a holistic view on ocean-atmosphere interaction.

5. Despite its potential, there are several challenges in the implementation of the Ken-Betwa Link Project. Discuss. (150 words) 10

केन-बेतवा लिंक परियोजना की क्षमता के बावजूद, इसके कार्यान्वयन में अनेक चुनौतियां विद्यमान हैं। चर्चा कीजिए।

The Union Budget 2022 provided for the implementation of Ken Betwa interlinking project at the estimated cost of 45000 crore.

The project has been heralded as the initiation of series of projects for river interlinking which has the following potential:-

- ① Help region overcome paradoxes of floods & droughts
- ② Provide irrigation for 9 lakh hectares of farmland
- ③ Provide drinking water supply to 62 lakh people
- ④ Provide 103 MW of hydropower and 27 MW of solar power.
- ⑤ Pave way for more interlinking projects

However, there have been several challenges in the implementation of the Ken-Betwa Link project:-

① Environment concerns

↳ Submergence of Panna Tiger Reserve :- The project will endanger habitat and prey base (chital & sambhar) for the tigers

↳ Habitat Fragmentation of Gharials in Ken river

↳ Affect the habitat of vultures and jackals

↳ This will also have to be complement with cutting down of 23 lakh trees which would

impact the entire forest ecosystem.

↳ The matter has not been given clearance by Supreme court after a central empowered Committee submitted its report on same

② Interstate Water Dispute - The project will endanger the cooperative federalism because the governments of Uttar Pradesh Madhya Pradesh haven't been able to reach to a water sharing agreement in non monsoonal months.

③ The project has been questioned on the improper and inadequate environmental clearance and inaccurate estimates regarding land to be irrigated which could be done with help of expansion of already existing project

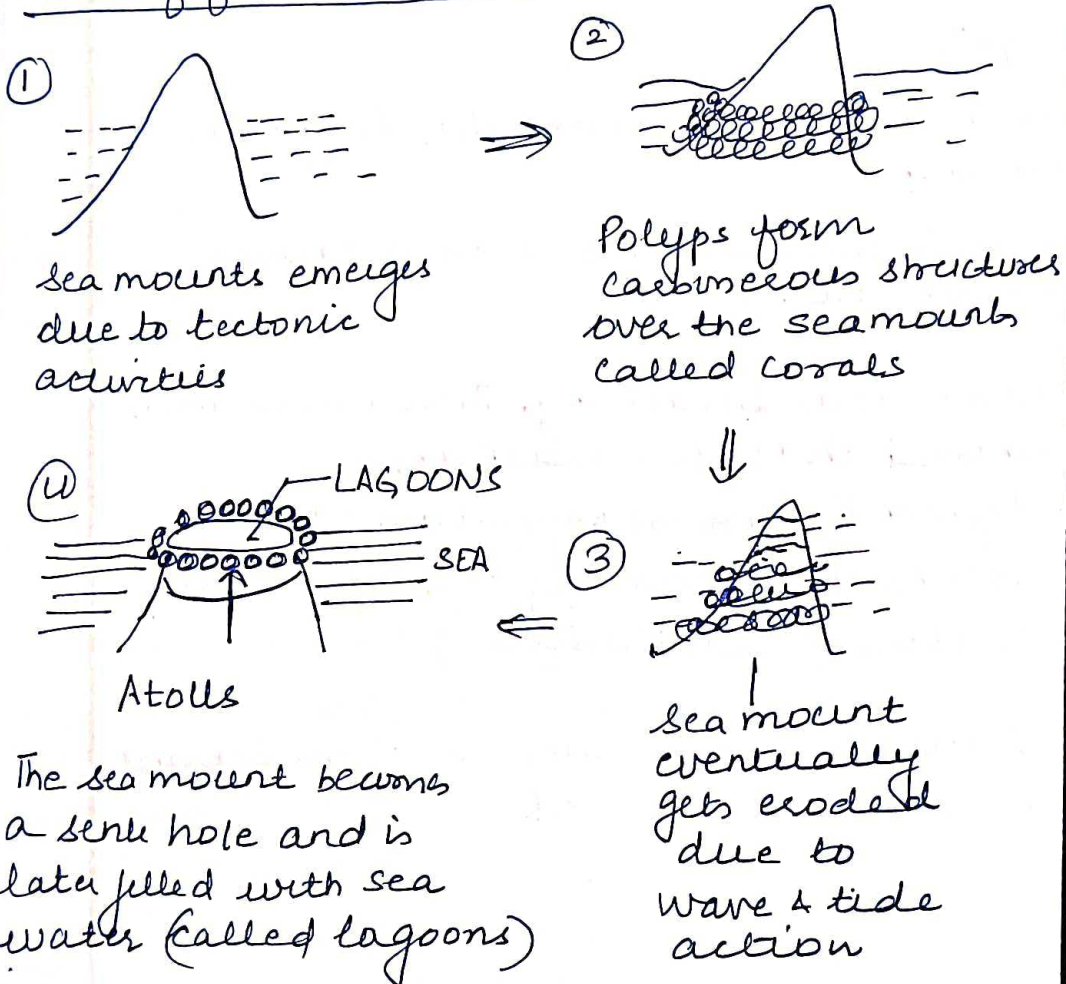
Therefore, these challenges need to be resolved so that the project can balance socio-economic needs of people and environmental conservation.

6. How are atolls formed? Discuss the threats faced by them due to anthropogenic factors. (150 words) 10

एटॉल कैसे निर्मित होते हैं? मानवजनित कारकों के कारण उनके समक्ष विद्यमान खतरों की विवेचना कीजिए।

Atolls are a variant of coral reef that are formed as a natural boundary between a lagoon and sea.

Process of formation of atolls.



The sea mount becomes a sink hole and is later filled with sea water (called lagoons)

Lakshadweep islands in India is an example of atolls.

However, atolls are facing destruction due to anthropogenic factors which include:-

- ① Destruction due to coastal development, dredging, mining, quarrying, shoreline expansion
- ② Pollution due to chemicals that find their way into water (Eg:- Sunscreens which harm corals)
- ③ Excessive use of fertilisers and pesticides causing ocean acidification
- ④ Overfishing
- ⑤ Intensive tourism and Rapid and unsustainable Urbanisation
- ⑥ Oil spills
- ⑦ Rise in sea temperature due to global warming
- ⑧ Human induced climate change causes sea level rise.

This causes coral bleaching. These threats must be countered through sustainable management (coastal Regulation zones) Use of Technology (Bio-rock) and community conservation (coral Nurseries)

Thus, Atolls are tropical rainforest of the sea and must be suitably conserved.

7. Foaming in the beginning of winters in River Yamuna in and around Delhi has been in news. Identify the reasons behind this and discuss its larger impact. (150 words) 10

दिल्ली और उसके आसपास यमुना नदी में शीत ऋतु के प्रारंभ में उत्पन्न झाग सुर्खियों में रहा है। इसके पीछे के कारणों की पहचान करते हुए इसके व्यापक प्रभाव पर चर्चा कीजिए।

Foaming in a river occurs on the decomposition of organic and inorganic matter and constant churning of river water.

Although, foaming is natural phenomena, yet the huge foam mountains floating on River Yamuna in Delhi has become a huge menace and cause of concern.

Reasons for foam:-

- 1) Formed due to dumping of industrial wastes in River Yamuna containing sulphates & nitrates
- 2) Dumping of agricultural, domestic & animal wastes
- 3) Festivities like Chath Purnima
- 4) Winter also witnesses a reduced water flow this impact the self cleansing properties of Yamuna
- 5) Lack of winds in winter lead to accumulation of foam without dissipation
- 6) Increasing number of stems near Yamuna further aggravates the problem

Larger impact of the river

- 1) Foul smell and purity of river compromised

- 2) Health hazards for inhabitants in vicinity
- 3) Destruction of floral and faunal diversity in the river.
- 4) Habitat fragmentation and increased toxicity.
- 5) Disrepute for pollution controlling & river conservation authority.
- 6) Infringement of rights of rivers which are declared as living people.

Thus,

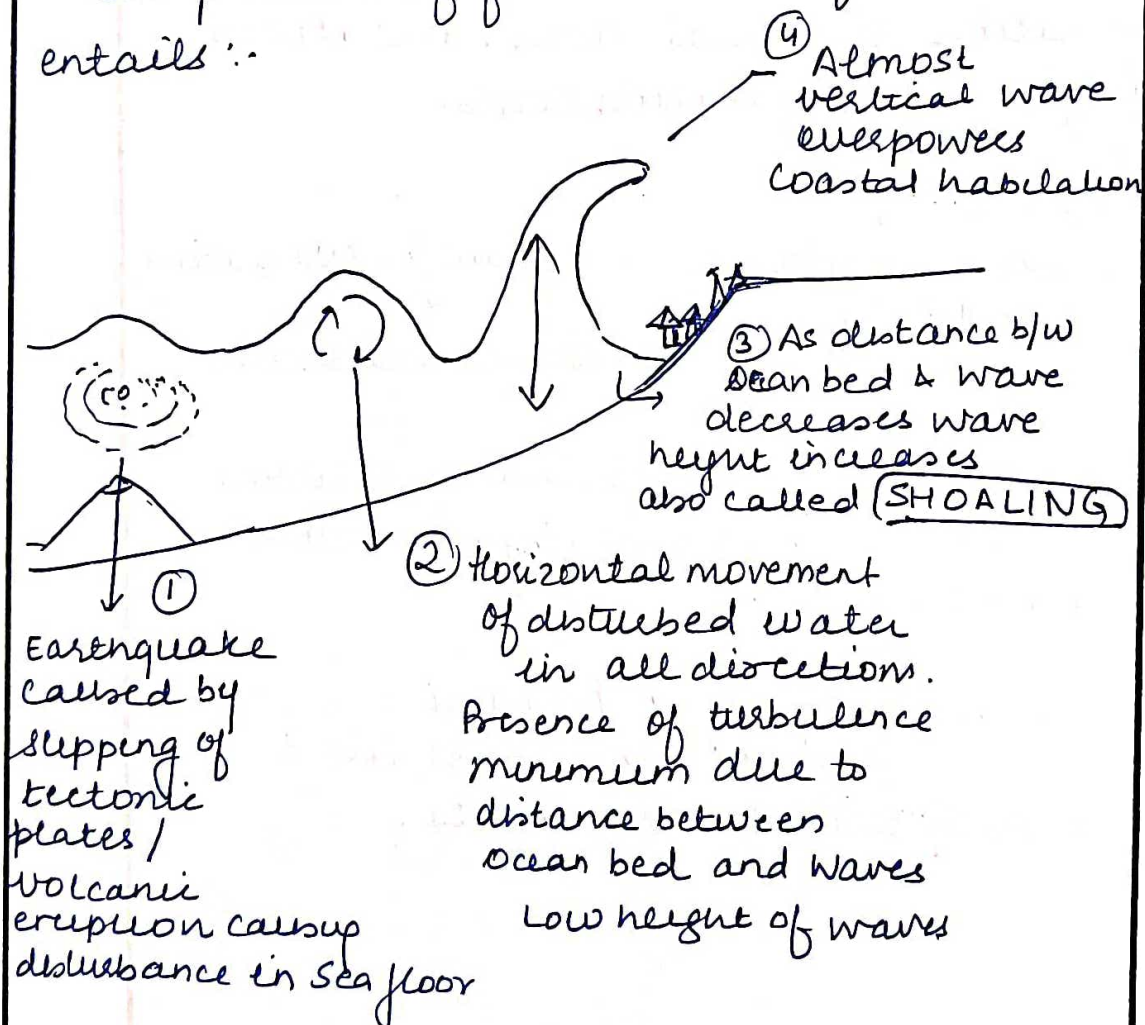
Construction of sewage treatment plants, stricter regulations & penalties for polluting industries and community based conservation plan can go a long way in ridding the river of treacherous foam.

8. Explain the process of formation of a tsunami. Also, mention the tsunami preparedness and mitigation efforts taken by the government. (150 words) 10

सुनामी उत्पन्न होने की प्रक्रिया की व्याख्या कीजिए। साथ ही, सुनामी के विरुद्ध सरकार की तैयारियों और इसके द्वारा किए गए शमन प्रयासों का भी उल्लेख कीजिए।

Tsunami's are a series of long waves caused due to sudden and large displacement of ocean water due to volcanic eruption or earthquakes.

The process of formation of Tsunami entails :-



After the Devastation caused by the Tsunami in 2004, the government has undertaken the following measures

① Preparedness

- ① Tsunami Early warning systems:- Technologies like Sonar, and seismic sensors, communication channels are used so that people can be evacuated in time.
- ② The Indian Tsunami early warning system was established by INCOIS in 2007
- ③ Construction of embankments, seawalls etc
- ④ Regulation of coastal area habitation through Coastal Regulation Zones.

② Mitigation

- ① Dispatching quick response team for evacuation, rescue and relief
- ② Construction of adequate designated shelter areas.
- ③ Use of technology for post disaster recovery
- ④ Capacity building & building back better infrastructure.

Thus a community based Tsunami mitigation & preparedness plan can secure live & livelihoods of coastal communities.

9. Discuss the role of geospatial technologies in developing effective approaches for disaster risk reduction and disaster management.

(150 words) 10

आपदा जोखिम न्यूनीकरण और आपदा प्रबंधन के लिए प्रभावी दृष्टिकोण विकसित करने में भू-स्थानिक प्रौद्योगिकियों की भूमिका की विवेचना कीजिए।

Geospatial technologies provide location based services which can help in surveillance, monitoring, navigating.

Introduction of these technologies in disaster management can be fruitful in overcoming human limitations and expand reach of rescue operations.

ROLE OF GEOSPATIAL TECHNOLOGIES IN DISASTER RISK REDUCTION:-

① Use in Early Warning systems :-

GPS; GIS services provide tools for incident mapping and Hazard Zoning including communication of impending disasters.

② Reporting violations of regulations :- These services help to reduce vulnerability by ensuring adherence to regulations regarding Coastal Zones (Tsunami & cyclones) Overcrowding (Landslides etc)

ROLE OF GEOSPATIAL TECHNOLOGY IN DISASTER MANAGEMENT:-

- ① Augment Search and Rescue Operation
(Eg:- Use of Drones in flood hit areas)
- ② Deployment of Relief forces and
Optimising response efforts
- ③ Provision of food & medical supplies at
unreachable areas
- ④ Use for land use planning in reconstruction
and post recovery phase
- ⑤ Map Based alerts to inhabitants
- ⑥ Tagging construction of post disaster
infrastructure

Therefore, geospatial technologies can complement human efforts and strengthen community preparedness against a disaster.

10. Discuss the key challenges in implementation of school safety measures in India. How does the National Policy on Disaster Management (NPDM), 2009, seek to address these challenges? (150 words) 10

भारत में स्कूल सुरक्षा संबंधी उपायों के कार्यान्वयन में विद्यमान प्रमुख चुनौतियों पर चर्चा कीजिए। राष्ट्रीय आपदा प्रबंधन नीति (NPDM), 2009 द्वारा इन चुनौतियों का समाधान कैसे किया गया है?

Ensuring school safety during a disaster becomes indispensable due to increased vulnerability of children.

However, there are some challenges in implementation of school safety measures :-

- ① Attitudinal inertia to prepare for unknown occurrences
- ② Lack of relevant curriculum creating awareness about disaster management
- ③ Lack of training of teachers and non teaching staff
- ④ Absence of resilient infrastructure
- ⑤ Inefficiency of funds to install disaster tackling equipments like fire - , extinguishers,
- ⑥ Spatial Design of schools inconsistent with Disaster Management plans including lack of multiple exit points etc

The government has formulated the National Policy on Disaster Management, 2009, that seeks to address these challenges through

- ① Mandates setting up of Disaster management fund to finance resilient infrastructure and expenditure of equipments
- ② Adequate teacher Training and Mock Drills for students
- ③ Inclusion of disaster management courses in curriculum
- ④ Inclusion of concept of disaster preparedness in Building construction codes for schools
- ⑤ Regular inspection of equipments, particularly in vulnerable areas
- ⑥ Information, Education & Communication videos, seminars & workshops for schools.

Thus,
The safety of schools need to be ensured for a comprehensive disaster risk reduction strategy.

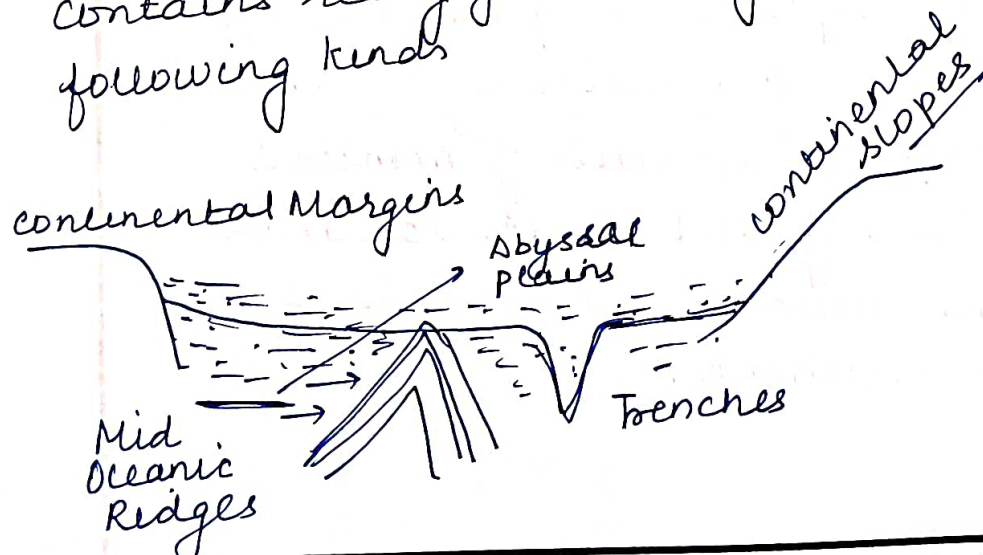
11. Post drift theories based on ocean floor mapping provided new dimensions to the study of distribution of oceans and continents. Elaborate.
(250 words) 15

महासागरीय अधस्तल के मानचित्रण पर आधारित उत्तरवर्ती प्रवाह सिद्धांत ने महासागरों और महाद्वीपों के वितरण के अध्ययन को नए आयाम प्रदान किए हैं। सविस्तार वर्णन कीजिए।

The theories for distribution of oceans & continents given after the Alfred Wegner's continental drift theory are called post drift theories which consisted of Arthur Holmes convection current theory, the ocean floor mapping theory and the Plate Tectonic theory.

The ocean floor mapping was convened post the world war 2 which added to the geological literature :-

- 1) It made an important discovery that ocean floor is not plain but contains relief features of the following kinds



- a) The mid oceanic ridges were interconnected chain of mountain systems formed due to volcanic activity of converging boundaries.
- b) The trenches were formed due to divergent actions of oceanic crust
- c) The abyssal plains were extensive plains between continental margins & mid oceanic ridges. which had deposits of sediments

Thus as opposed to Wegner's theory that suggested breakup of the landmass of Pangea due to continents drifting apart through tidal action, the ocean floor mapping provided conclusive evidence of SEA FLOOR SPREADING.

This went in depth to study ocean relief & claimed that formation of oceanic crust due to activities of mantle & cooling down of underwater volcanoes led to the current distribution of oceans & continents.

This was evidenced by newer deposits on mid oceanic ridge & older at the continental margins.

Further research in seafloor spreading gave way to the theory of plate tectonics which claimed that lithosphere is divided into major & minor plates and these plates have been constantly moving over the globe. It was not the continents that drifted but the plates, which continents were a part of.

Thus, the present distribution of oceans & continents was due to the configuration of these geological plates. and hence post drift theories led to substantiative evidence for the same.

12. Explain the phenomenon of heat waves. Also, enumerate conditions favourable for the development of heat waves in India and their associated health impacts. (250 words) 15

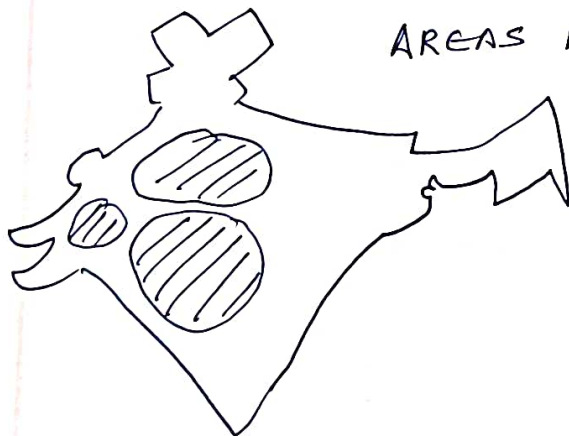
हीट वेव्स की परिघटना की व्याख्या कीजिए। साथ ही, भारत में हीट वेव्स के विकास के लिए अनुकूल परिस्थितियों और उनसे संबद्ध स्वास्थ्य प्रभावों को सूचीबद्ध कीजिए।

Heat waves are defined as prolonged episodes of abnormally high temperature persisting over a considerable amount of area.

IMD (Indian meteorological Department) defines a heatwave as:-

* Maximum temperature exceeding at least 40°C (for plains) and 30°C (for hills) and an increase of $(4-6^{\circ}\text{C})$

The north western, central & south central part of India is particularly vulnerable to the heatwaves. Heat waves typically occur between March and June.

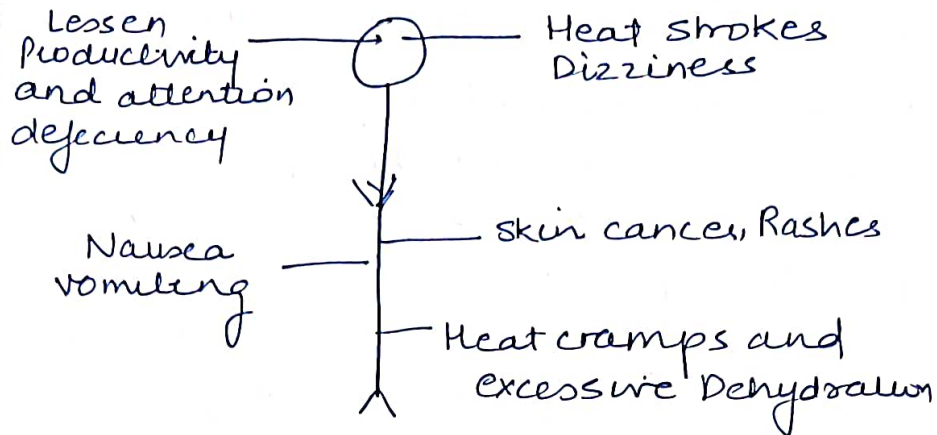


AREAS MOST SEVERELY
IMPACTED
DUE TO
HEAT WAVES

Conditions favourable for development of heat waves in India include:-

- ① Prevalence of hot dry air over India during peak summer months. This has been augmented with lack of moisture in upper atmosphere.
- ② Cloudless sky leading to increased isolation.
- ③ Anticyclonic flow due to high pressure system forcing dry air downwards. This sinking air acts like a DOME and keeps warm air intact.
- ④ Prevalence of Anthropogenic factors including:-
 - 1) Presence of Urban Heat Island effect wherein the temperature of urban areas is high over the surrounding rural areas due to inavailability of open spaces
 - 2) concretisation leading to low albedo effect of Asphalt.
 - 3) Pollution, Dust from construction, deforestation and other global warming inducing industrial activities
 - 4) Changing weather patterns due to climate change vagaries.

ASSOCIATED HEALTH IMPACTS OF HEAT WAVE



Prolonged exposure can also cause illness, death, permanent impairment. Here people with preexisting conditions and senior citizens, children become vulnerable.

Heat strokes not only impact the health of human but also lead to drastic changes in behaviour patterns of biodiversity and leads to habitat fragmentation.

Health impacts lead to greater economic costs due to need for hospitalisation & severe stress on power grids for cooling equipments.

Episodes of heatwaves in India are growing as changes in climate intensifies, therefore, global emission reduction can help to mitigate heatwave occurrences in future.

13. Elaborate various factors that determine the nature of circulation of the oceanic currents. Also, highlight the major oceanic currents along with their unique features. (250 words) 15

महासागरीय धाराओं के संचलन की प्रकृति को निर्धारित करने वाले विभिन्न कारकों का सविस्तार वर्णन कीजिए। साथ ही, प्रमुख महासागरीय धाराओं के साथ-साथ उनकी अनूठी विशेषताओं को भी रेखांकित कीजिए।

Ocean currents are directed, coordinated continuous movement of sea water.

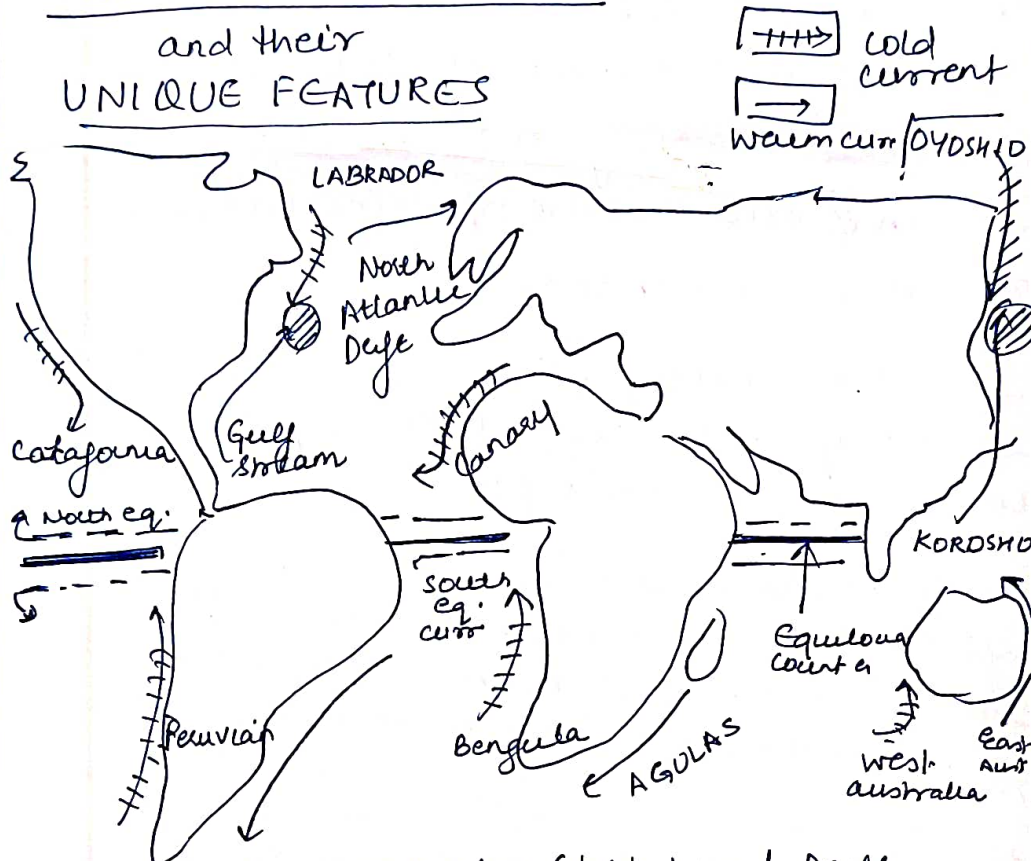
The following are the factors that determine the nature of circulation of oceanic currents :-

- ① Solar Radiation → Equator - water gets heated up - causing it to expand and flow towards poles
- ② Wind :- Wind blowing on ocean surface moves the water, hence often wind direction determines ocean current direction on surface.
- ③ Gravity :- Pressure gradient is created due to downward pull of gravity
- ④ Coriolis force :- Moves water in right in northern hemisphere and left in southern hemisphere
- ⑤ Differences in Water Salinity :- Salinity causes density differences - denser water sinks, this causes upwelling & downwelling

- ⑥ Temperature ∴ Increase in temperature gradient increases the strength of movement of ocean currents

MAJOR OCEANIC CURRENTS

and their UNIQUE FEATURES



Antarctic Circumpolar (West wind Drift)

EQUATORIAL CURRENTS - Flow from east to west
with equatorial counter current
west to east

Antarctic Circumpolar current - keeps antarctic
shielded from warm waters and vice versa

Peruvian current - keeps hot Peru climate cool
also responsible for Atacama desert

Oyashio & Kuroshio - Japanese show form

nutrient rich fishing grounds

Labrador Current & Gulf Stream - Creates fishy grounds in Newfound land region
Labrador current also responsible for cyclones in America

North Atlantic Drift - Warm offshoot of gulf stream keeps the British Islands warm.

Canary current & Benguela current - Desiccating effects of these cold currents & lack of moisture is responsible for formation of Sahara & Kalahari Desert.

Indian monsoon is also impacted by the Northeast monsoon current, Southwest monsoon current and the Somali current -

Therefore, oceanic currents play an important role in determination of climate, topographic, economic activities and precipitation pattern of surrounding areas and hence must be carefully analysed.

14. Despite both being polar regions, the environmental threats faced by the Arctic region are slightly accentuated as compared to Antarctica. Comment. Also, discuss the measures needed to protect the Arctic ecosystem.

(250 words) 15

दोनों ध्रुवीय क्षेत्र होने के बावजूद, अंटार्कटिका क्षेत्र की तुलना में आर्कटिक क्षेत्र द्वारा सामना किए जाने वाले पर्यावरणीय खतरों में वृद्धि हुई है। टिप्पणी कीजिए। साथ ही, आर्कटिक पारिस्थितिकी तंत्र की रक्षा के लिए आवश्यक उपायों की विवेचना कीजिए।

According to the WWF - Arctic programme, the average rise in the temperature of the arctic regions has been double when compared to the global average rise in temperature. This augment with 75% reduction in ice cover over the last 50 years have added to the perils of the arctic region.

COMMONALITY OF THREATS FACED BY POLAR REGIONS:-

According to IPCC Special Report on Oceans and Cryosphere in a changing climate, the polar regions are witnessing threats due to

- ↳ Increased global warming & global ocean heat increase
- ↳ Increasing sea levels due to glacier melting and permafrost thawing
- ↳ Albedo effect weakening
- ↳ Bio diversity loss.
- ↳ Ocean acidification

However, this effect is more pronounced over arctic due to:-

- ↳ ① Higher impact of anthropogenic activities like pollution, over fishing, oil drilling, seismic blasting, oil spills, transportation.
- ↳ ② Conflict over Arctic. Russia, Canada, Norway & Denmark have put overlapping claims for extended continental shelves that has led to danger to sea bed resources.
- ↳ ③ Increased temptations to take first mover advantage:- Eg. Russian - Nuclear submarine fleet, Polar Silk Road of China and possibility of Northern Sea Route.
- ↳ ④ Unlike Antarctica, Arctic is not treated as a global common and has no overarching treaty for its conservation.

With thawing, permafrost, sudden storms, increasing sea levels, the tundra region which is a home to many indigenous groups and biodiversity is under threat and the following measures are needed to protect the Arctic ecosystem:-

↳ Revamping Role of Arctic Council:-

- * Making it more inclusive with countries around world participating in conservation and sustainable development of Arctic.

- * Prioritise action against climate change as done in Paris agreement
- * Funding mechanisms for Arctic to be instituted
- ② Increased Research and Studies on temperature, precipitation and summer ice melt patterns with focus on biodiversity conservation
- ③ Use of mechanisms like UNCLOS to bring cooperation on ice bed resources and imposing penalties on over exploitation through fishing & oil drilling

Hence,

Preservation of the arctic is of utmost importance as ice melting will set in motion a positive feedback loop & endanger the livelihood of 3.8 billion coastal dependant communities due to unprecedented sea level rise

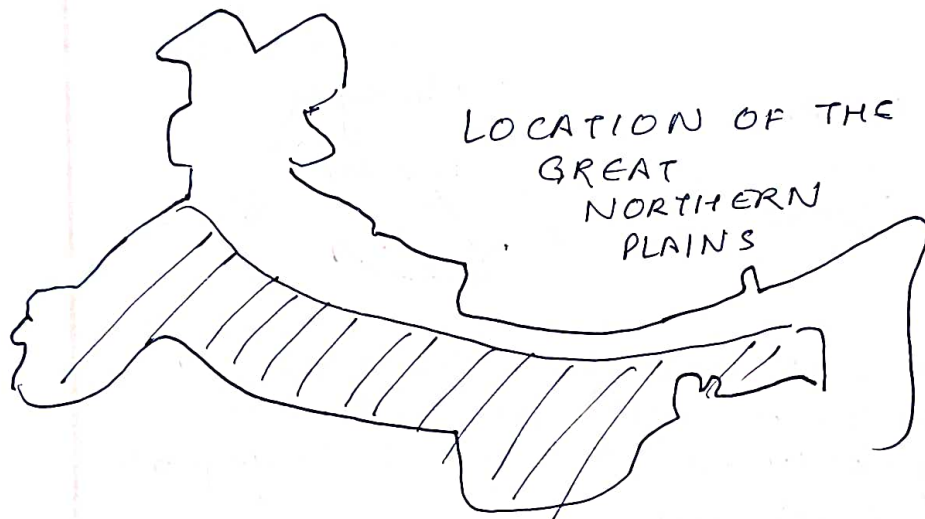
15. Explaining the formation of the Great Northern Plains of India, describe its physiographic divisions and their important characteristics.

(250 words) 15

भारत के विशाल उत्तरी मैदानों के निर्माण की व्याख्या करते हुए, इसके भौगोलिक विभाजन और उनकी महत्वपूर्ण विशेषताओं का वर्णन कीजिए।

The great Northern plains consisting of the fertile soil is the granary and livelihood sustenance system of India.

They are the youngest physiographic feature of the Indian subcontinent



FORMATION OF GREAT NORTHERN PLAINS

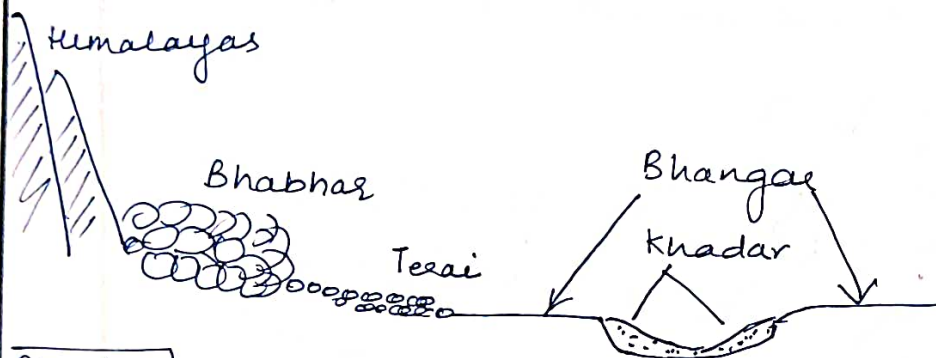
About 50 million years ago, when the Indian plate collided with the Eurasian plate, the Himalayan range and the Tethys sea were uplifted.

This upward movement led to a subsidence of the northern part of the peninsula and a large basin was formed.

This basin was filled with the sediments from the rivers which came from the Himalayan mountains & southern peninsula.

These extensive alluvial deposits led to the formation of the northern plains of India.

THE PHYSIOGRAPHIC DIVISIONS OF NORTHERN PLANE IS AS FOLLOWS :-



Bhabhar

- ① 8-10 km belt running from Indus to teesta
- ① Footthills of Himalayas - coarser sediments
- ① High porosity - dry river courses - huge pebble studded rock beds
- ① Not suitable for cultivations, only for trees with large roots

Terai

- ① Marshy, south of Bhabhar
- ① Reemergence of streams
- ① Earlier dense forest now converted to agricultural land

Bhangar

- ① Older alluvium along river beds
- ① Dark, humus rich -

- ① Clayey with lime nodules - kankar
- ① Found in Doabs
- ① In dry areas, saline efflorescence (Reh, Kallar, Bhur)

Khadas

- ① New alluvium along flood plains
- ① Light coloured, sandy textured
- ① Most fertile soil
- ① Repeated renewal every year through river deposits.

IMPORTANT CHARACTERISTICS :-

- ① Support 40% of total population of countries
- ② Fertile alluvial soil, flat surface, favourable river sources, climate facilitate intense agricultural activity
- ③ Significant navigable routes
- ④ Rich sources of mineral deposits
- ⑤ Also a centre for tourism and industrial development and service based industries

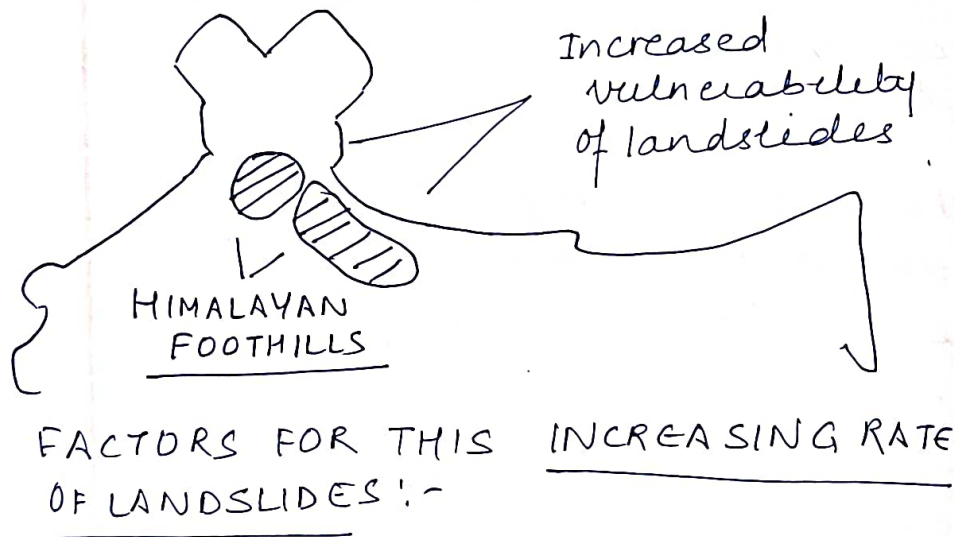
Thus, the great northern plains cater to huge diversity and variety of cultures. It is the cradle of economic progression in India.

16. In recent years, states of Uttarakhand and Himachal Pradesh have witnessed an alarming increase in the rate of landslides. Discuss the reasons for this increase and suggest some remedial measures.

(250 words) 15

हाल के वर्षों में, उत्तराखंड और हिमाचल प्रदेश राज्यों में भूस्खलन की दर में खतरनाक वृद्धि देखी गई है। इस वृद्धि के कारणों की विवेचना कीजिए तथा कुछ उपचारात्मक उपाय सुझाइए।

Landslides are rapid downward movement of rock, earth, debris under the influence of gravity. According to a report released by NCRB, about 300 people died in 2020 in Uttarakhand and Himachal due to increased landslides.



Anthropogenic

Natural Factors.

Natural Factors include:-

- 1) Uttarakhand & Himachal lie on foothills of young-fold unstable ever increasing himalayas which makes the region earthquake prone; threatening the integrity of soil through seismic shocks
- 2) Steeper slopes causing orographic precipitation
- 3) Phenomena like excessive rain, glacial lake outburst, cloudbursts

Anthropogenic causes

① unsustainable Development Activities

- ① Large Hydro Power Projects = (Eg:- Projects like Narmada Shakti or Satley faced projects) Big projects lead to deforestation threatening soils capacity to bind itself and damming of rivers causes induced earthquakes
- ② Road/Highway/Infrastructure Projects :-
Eg - Char Dham projects which causes mountain base erosion
- ③ Shum Cultivation/Shifting agriculture
further degrades soil
- ④ Global warming - causing glacial melting, glacial outburst and forest fires.

However, All is not lost and Remedial measures include :-

Risk Reduction
and Prevention

Mitigation and
Adaption

Risk Reduction techniques include (short term) :-

- ↳ Early Warning System
- ↳ Slope Stabilisation measures
- ↳ Construction of retention walls
- ↳ Use of metal wall compactness
- ↳ Hazard Zonation Mapping
- ↳ Detailed EIA & SIA before undertaking hydropower projects

Mitigation Measures include : (Long term) :-

- ↳ Restriction of unsustainable construction & development of large settlements in valleys
- ↳ Terrace Farming
- ↳ Large scale Afforestation
- ↳ Promotion of Ecotourism

India is one of the worst affected nations by landslides. In order to minimise the economic loss suffered due to hazardous landslides the NDMA guidelines which detail site specific studies, institutional mechanisms for assessment of stability status must be implemented in letter & spirit.

17. Haphazard growth and poor management make the Indian cities the locus of disasters, both large and small. Comment. Also, discuss the current gaps in policies in addressing these challenges. (250 words) 15

अव्यवस्थित विकास तथा निम्न स्तरीय प्रबंधन ने बड़े और छोटे दोनों प्रकार के भारतीय शहरों को आपदाओं का केंद्र बना दिया है। टिप्पणी कीजिए। साथ ही, इन चुनौतियों का समाधान करने में नीतियों में विद्यमान वर्तमान अंतराल पर चर्चा कीजिए।

According to the Global Assessment Report 2019, Disaster vulnerability increases with unplanned urbanisation and overpopulation of areas.

Reasons for increasing disaster vulnerability of cities include:-

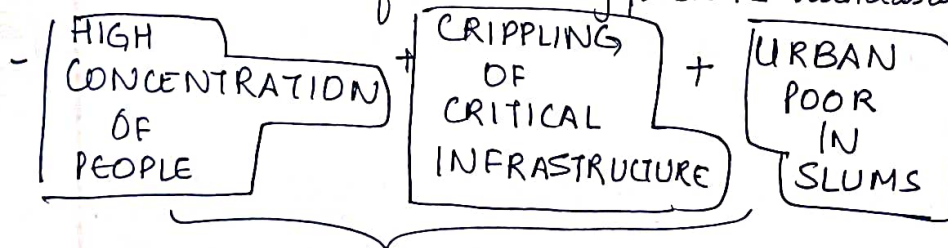
- ① Haphazard growth → Overpopulation, increasing congestion makes the spread of infectious diseases quick and uncontrollable. This was highlighted in the increasing number of COVID cases in congested areas.

Population pressure also exerts burden on land fertility and stability causing earthquakes and destabilises drainage systems.

- ② Poor Management - Through lack of public amenities, non adherence to ^{disaster resilient} building codes and land use guidelines, concretisation

and encroachment of erstwhile wetlands & biodiversity hotspots disturbs the climatic and atmospheric precarious balance which is responsible for :-

- 1) Disasters like Urban Flooding, Mumbai 2005, Chennai, Kerala, etc.
 - 2) Landslides in Uttarakhand, Himachal
 - 3) Earthquakes in seismically sensitive zones
 - 4) Formation of Urban Heat Islands in states like Madhya Pradesh
 - 5) Tsunamis and Cyclones impacting coastal areas which have been left without defences due to non adherence of coastal regulation zones & deforestation of mangrove ecosystem
 - 6) Fire instances in Delhi's coaching institute and food mandi's
- Deforestation, sand mining & flood plain encroachment further aggravate vulnerability



increases the risk profile of urban areas

The current gaps in policies in addressing these gaps include:-

- ① Lack of Bottom up approach and involving local governance in Disaster Management plan formation. This makes plans impractical & delays first response to disaster
- ② One size fit approach with centralised control (As seen during COVID lockdown)
- ③ Lack of Hazard zonation, incident mapping for localised disasters.
- ④ Focus on relief and rehabilitation and ignoring mitigation & adaption
- ⑤ Lack of empirical and databacked decision making without early warning systems
- ⑥ Standard operating procedures (SOP's) in event of emergency not in place
- ⑦ Coordination issues, manpower shortages, funding gaps & lack of community's capability to deal with disaster.

Therefore, disaster risk reduction strategies including adherence to resilient infrastructure construction codes, coastal regulation zones, awareness of disasters is essential to build back a better urban society.

Japan, vispite of facing disasters every year, is a benchmark for sustainable Urbanisation. India should replicate their best practices.

18. What are the reasons behind vulnerability of coastal areas to cyclones in India? In this context, critically discuss India's cyclone management framework. (250 words) 15

भारत में तटीय क्षेत्रों की चक्रवातों के प्रति सुभेद्यता के लिए कौन-से कारण उत्तरदायी हैं? इस संदर्भ में, भारत के चक्रवात प्रबंधन ढांचे की समालोचनात्मक विवेचना कीजिए।

The recent IPCC Report on oceans & cryosphere indicates that warming of oceans will lead to an increased frequency and intensity of cyclones with 3.5 billion to 3.8 billion coastal communities being at risk

India has a long coastline of 7500 km and this increases the vulnerability of coastal areas to cyclones in India.

REASONS FOR INCREASING VULNERABILITY

1) Increased ocean temperatures :- A 0.8°C increase has been witnessed in sea & Ocean temperatures which strengthens cyclone activities and is a direct consequence of GLOBAL WARMING

2) Anthropogenic activities :-

↳ Shoreline development

(Tourism Hubs, Ports, cities - compromising environmental balance for economic development)

↳ Deforestation - Severely impacting mangrove forests

3) Earlier, mostly the eastern coast was impacted but due to warming up of Arabian sea cyclones such as Nisarga have also struck the Western Coast (Mumbai)

4) Overpopulation, encroachment, sand mining, rapid construction of coastal infrastructure without adherence to CRZ (Coastal Regulation Zones) have aggravated the vulnerability.

Cyclones like Amphan, Tauktae, Fani & Yaas have exposed India's cyclone management framework :-

1) Reactive rather than proactive response:-
Lack of preparedness in terms of Early warning systems, hazard zoning, risk assessment.

2) Localised response without centre state coordination due to vulnerability of coastal states, therefore there is excessive reliance on state funds.

3) Non enforcement of NDMA guidelines on creation of DISASTER RESILIENT INFRASTRUCTURE

4) Lack of effective drainage systems to deal with consequent flash floods

However all is not gloomy -

Odisha has set up a DISASTER PREPAREDNESS FRAMEWORK consisting of:-

- 1) Regular cabinet meetings
- 2) Separate financing
- 3) Building cyclone shelters
- 4) Institution of an Early Warning system and Odisha Disaster Rapid Action Force.

However more needs to be done :-

- ↳ Use of Drones, Doppler, cyclone centres for cyclone probing
- ↳ Creation of COASTAL BIODIVERSITY
- ↳ Embankment & all weather road construction
- ↳ Power grids should be underground to save power infrastructure & ensure structural integrity
- ↳ Flood Inundation Management & flood zoning need to be undertaken

India ranked 7th in Global Climate risk index Report in its vulnerability to extreme climate related events. Thus there is an immediate need for effective and stronger cyclone mitigation measures.

19. To build greater disaster resilience amongst communities, it is important to avoid looking at disaster events in isolation and understand the interconnections between global disasters. Elaborate, with examples.

(250 words) 15

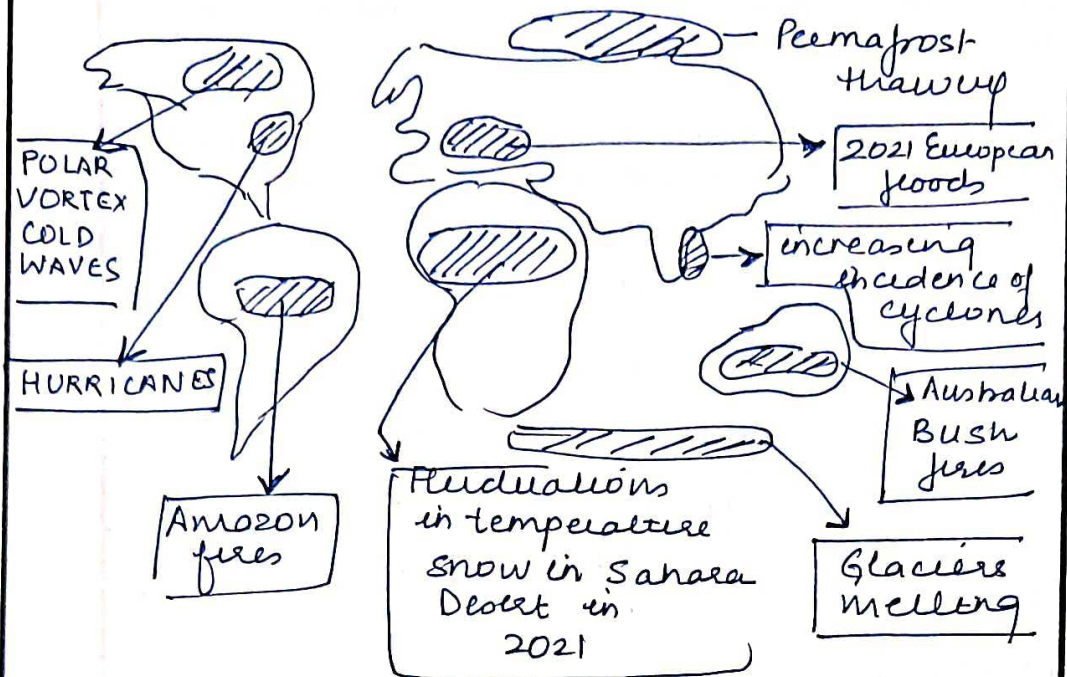
समुदायों में अधिक आपदा प्रत्यास्थता विकसित करने हेतु, आपदा की घटनाओं को अलग-अलग देखने से बचना और वैश्विक आपदाओं के बीच अंतर्संबंधों को समझना महत्वपूर्ण है। उदाहरण सहित सविस्तार वर्णन कीजिए।

With increasing climate change, destruction of global commons and scale of interconnectivity through economic development & globalisation, Disaster events have become PROBLEMS WITHOUT PASSPORTS

The commonality of the sufferings due to disasters can be seen from following examples :-

- ① Virus that once originated in Wuhan, took the world by storm and reached even in remotest corners of Antarctica and has become endemic in many countries now.
- ② The locust attacks witnessed by Africa, Middle east and South Asian countries
- ③ The impacts of global warming has been seen all over the world; as per the latest IPCC Report the world has witnessed the manifestations of increase in average temperature of

planet in form of various disasters :-



④ The most dangerous impact of the glacial snowmelt and thawing of permafrost is the rising ocean temperature which further leads to sea level rise. This endangers livelihoods & lives of 3.5bn coastal communities all over the world.

⑤ Abnormal heating up of earth also disrupts El Nino, La Nina, AMO current oscillation which creates changes in normal precipitation patterns and leads to droughts & floods in various parts of world

Importance of understanding global interconnectedness of disasters :-

① Interclimatic boundaries getting blurred

- ② Spillover effects of Environmental Migration & Refugee crisis
- ③ Prevention of spread of crippling impact of disasters by taking proactive measures (COVID Lockdown)
- ④ Finding a common solution (Eg. COVID vaccine)
- ⑤ Institutionalising mechanisms for repeat events & mutations (eg:- Genome Sequencing)

Hence greater disaster resilience can be built with help of Global cooperation (Eg:- Japan excelled in creating earthquake resistant infrastructure & collaborating through Sendai Framework). The need of the hour is to gauge the impacts of disasters not in isolation but through prism of global community capacity building.

India has paved way through its enlisting of Coalition for Disaster Resilient Infrastructure & other countries should follow suit through protection of global commons.

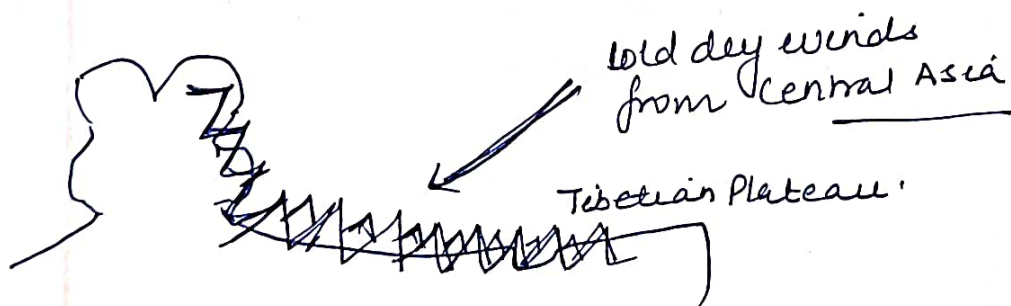
20. How does the Himalayan mountain range shape the climate of the Indian subcontinent? Also, discuss the impact of the warming of the Himalayas on the Indian subcontinent. (250 words) 15

हिमालय पर्वत श्रृंखला भारतीय उपमहाद्वीप की जलवायु को कैसे आकार प्रदान करती है? साथ ही, भारतीय उपमहाद्वीप पर हिमालय के उष्मण के प्रभाव की विवेचना कीजिए।

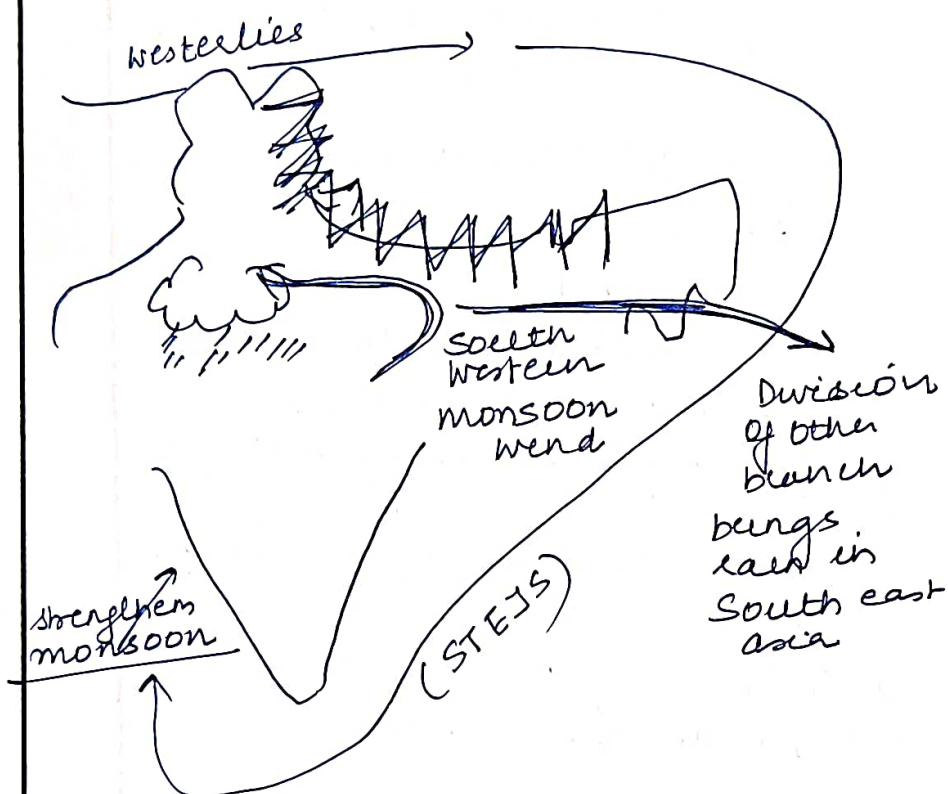
The Himalayas are considered to be the third pole of the world. Due to its unique topography, ecology, and innumerable communities that depend on it, Himalayas are the most important part of our climatic heritage.

The Himalayan mountain range act as the climatic divide. They influence the climate of the Indian subcontinent in the following way:-

- ① Barrier between India and Central Asia :- During winters, the Himalayas protect India from the desiccating impact of cold and dry air mass of Central Asia



- ② Aids in monsoon :- Himalayas act as effective physical barrier for rain bearing south west monsoon winds. Force them to shed their moisture in northern plains & hills through rains & snow.



It also divers the westerly jet stream into Subtropical easterly jet stream which augments and strengthens rain bearing winds from arabian sea

Thus, without the impact of Himalayas, the Indian subcontinent would have been a cold desert like Tibetan Plateau.

The International Centre for Integrated Mountain Development (ICIMOD) has claimed that HKH

Hindukush Himalayan Region has warmed faster than global average. The impact of this warming on Indian Subcontinent include :-

- 1) Melting of glaciers - Extreme flooding of rivers in summers and paradox of droughts - impacting lives of 750 million people dependant on these rivers
- 2) Loss of biodiversity & habitat fragmentation, of marine fauna & flora
- 3) Desertification of land,
- 4) Chemical runoff in rivers due to snow thaw
- 5) Impacting indigenous communities by drying up of spring & creating scarcity of freshwater
- 6) Positive feedback effect on global warming through albedo effect
- 7) Increased incidences of natural disasters (Ultrahand Glacial ; ... outburst)

To counter the above, National Mission for Sustaining Himalayan Ecosystem (NMSHE) has been put in place to ensure time bound action plan to secure the fragile & diverse ecosystem