ENLITE IAS
Enlightening minds. Lightening journeys

MAINS TEST SERIES

GEOGRAPHY

Question Paper Specific Instructions

1. *There are **TWENTY** questions printed in ENGLISH.*
2. *All the questions are **compulsory.***
3. *The number of marks carried by each question (or part) is indicated against it.*
4. *Word limit in questions wherever specified should be adhered to.*
5. *Any page or portion of the page left blank in the Answer booklet must be clearly struck off.*

Qn No.	Marks Obtained	Qn No.	Marks Obtained	Qn No.	
1	3	8	4	15	7
2	1½	9	5	16	7½
3	4½	10	4½	17	7½
4	—	11	7½	18	7½
5 (ET)	4	12	7½	19 (ET)	6
6 (ET)	4	13 (ET)	6½	20 (ET)	7
7	3½	14	6½		
TOTAL					

ET: Extra Time (7 3/4)

Name	LAKSHMIPRIYA · P	**Roll no**	
Subject	Geography	**Date**	
Questions Attempted	15 .		

Contact us :enliteias@gmail.com, 799 405 8393

EXAMINER REMARKS

GRADE / PARAMETERS	BELOW AVERAGE	AVERAGE	GOOD	BETTER	OUTSTANDING
Understanding of question					
Conceptual clarity					
Structure					
Content					
Presentation & legibility					

Any other remarks:

1. What specific scientific, technological, and societal reasons underlie our enduring interest in the exploration of the Red Planet? (10 Marks)

The Mangalyaan 2.0 project is garnering international attention post India's remarkable feat of Mangalyaan - 1 : the 1st country in the world to successfully orbit the Mars in the very first attempt

Exploration of Mars has key reasons

A) Scientific:

1) • Expanding the scope of understanding of the universe - through search for life, water

2) • Paradigm shift forcing mankind to explore anhabitable spaces outside Earth - Elon Musk's statements.

3) • Extraction of materials - Indirect evidence about origin of Earth

B) Technological

1) • Development of technology to sustain spaceinssions

Do not write anything on the margin

Comparison w. the earth - similarity

potential resources

of longer duration. ~~eg ~3 times the time~~

a) Development of technology transcending Earth's biases
eg Ingenuity helicopter - 1st flight on Mars

Societal

1) National pride and achievement of mankind in its spirit of enquiry.

2) Geo strategic significance: due to the growing space weaponization, militarization etc.

@ diplomatic
- INDIA → Bangladesh
- launch other satellite
(amid...

SSLV → turnaround time
→ cost less
• Light weight
• LEO
• Smallsat launch
• ISRO-Myspace, Antrix - revenue generation
• Launch vehicles → economies of scale
•

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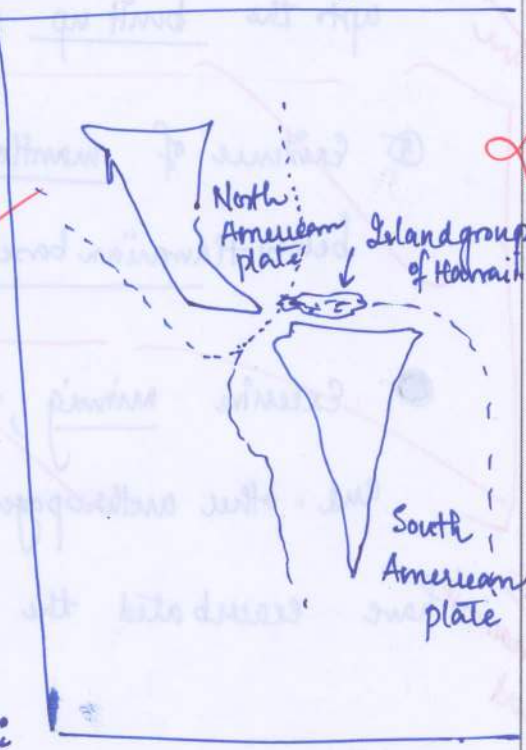
2. Discuss the geographical factors that contribute to the unusually high frequency of earthquakes and volcanism in the Hawaiian Islands. (10 Marks)

The Islands of Hawaii experience high no of earthquakes and volcanism.

eg: 2022 volcanic eruption whose Sulphur smoke reached upto Africa and Asia



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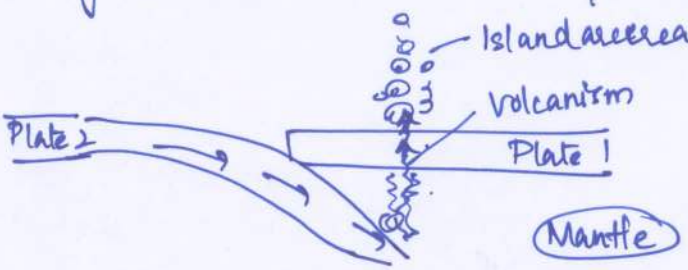
Geographical factors that contribute

① The existence of plate boundaries: the North American and South American convergent boundary creates earthquakes due to collision.

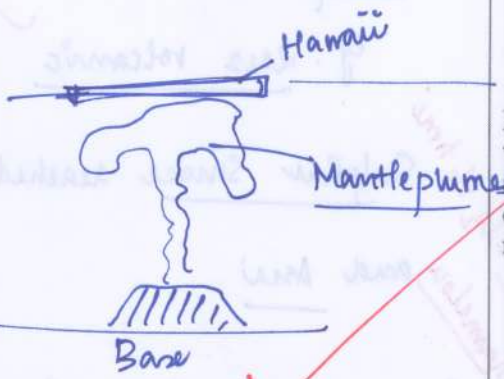
② The subduction of the oceanic part of the plates creates an island arc marked by volcanism and earthquakes.



③ Fault zones: of built up stress - released during earthquakes.

④ Proximity to the Pacific ring of fire. - with continuous explosions volcanoes and earthquakes - which adds upto the built up stress in Hawaii

⑤ Existence of mantle plumes below Hawaiian basement



● Excessive mining, deforestation and other anthropogenic factors have exacerbated the situation in the recent times.

This was the main part of answer

Oceanic crust is the thin reason it has come out

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3. What are the contributing factors that lead to the formation of a heat dome phenomenon? Discuss its impact on the region. (10 Marks)

Heat dome phenomenon has been witnessed in USA, Europe in 2022-23 garnering attention to the direct impacts of climate change.

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Factors that leads to the formation of heat dome

Heat domes are concentrated subsidence of heated air that increases the local surface temperature creating heatwaves and associated consequences like heatstroke. It is caused by:

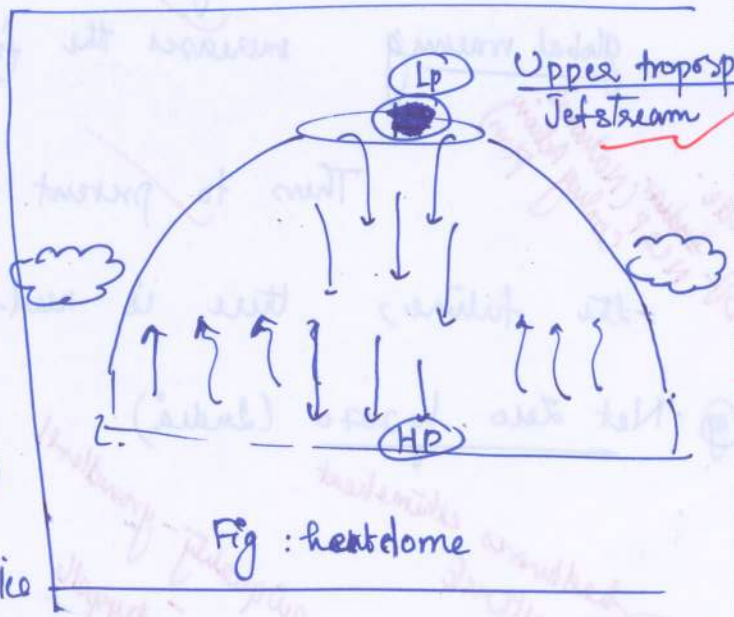

Fig : heat dome

1) Creation of Low pressure in upper troposphere & high pressure near Earth's surface resulting in forced

subduction of air (~~physically~~) (dynamically induced)

② The heat thereby gets trapped between the jetstreams of the ~~hot~~ atmosphere and air.

③. The airmass fronts dissolves due to subduction and resists the formation of cyclonic fronts

④ ~~This leads to~~ Rising ~~climate~~ climate change & global warming increases the frequency of the event.

Thus to prevent such extreme events in the future, there is need for climate action– NAPCC

④ ·Net Zero by 2070 (India)

Urban structures – building code. USAID / ~~Indore~~ NCAP (National Cooling Action Plan)

Impact – heatwaves extreme heat – health risk

1) Social – ~~water~~ air quality – groundlevel ~~[illegible]~~
Env – wildfire – water supply – dry spells
2) Agri – stress crops, ↓food security
3) Econ – need in humanrts – healthrisks – energy demand – tourism impact

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4. In the context of climate change, discuss the concept of climate feedback loops. Substantiate with examples. (10 Marks)

Climate feedback loops are mechanisms that helps the identification of exacerbating climate change, thereby aiding the mitigation of temperature rise. (maintaining within 1.5°C of pre industrial rate).

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Climate feedback loops are essential for:

① Bringing concerted attention to the subject — global awareness.

② Mitigation of direct impact on people,

③ Reduction of climate related mortality

eg ~1500 deaths in India in 2021 due to heatwave and associated incidents.

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5. "The relationship between the winds and the ocean currents is best seen in the Indian Ocean." Justify. (10 Marks)

One of the key factors for the formation of ocean current is the direction of prevailing winds.

eg. The equatorial currents are pushed by the trade winds from East to West.

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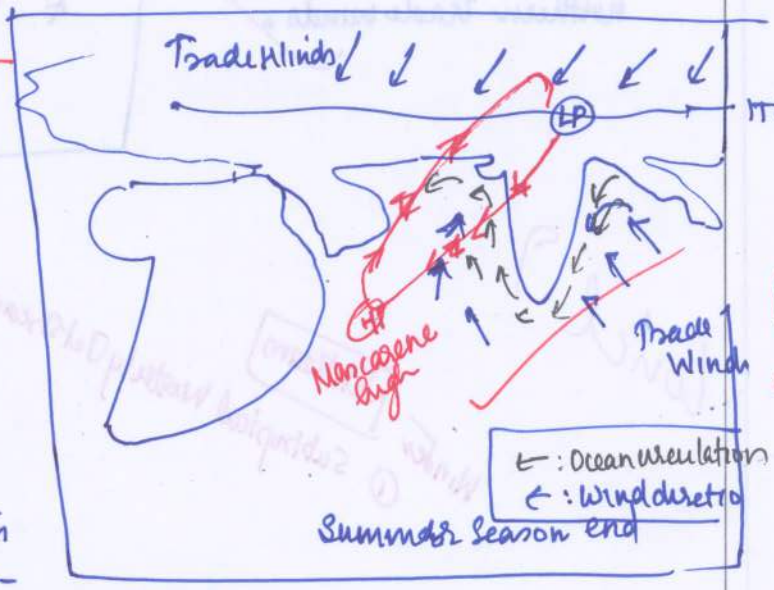
This correlation is directly seen in Indian Ocean

Season 1 → wind direct → Ocean

Season 2 → _____

During ~~Indian~~ Summer, and winter seasons the apparent shift in the ITCZ towards the north and south results in a change in direction of winds over Indian subcontinent. This translated into a change in direction of ocean currents as well.



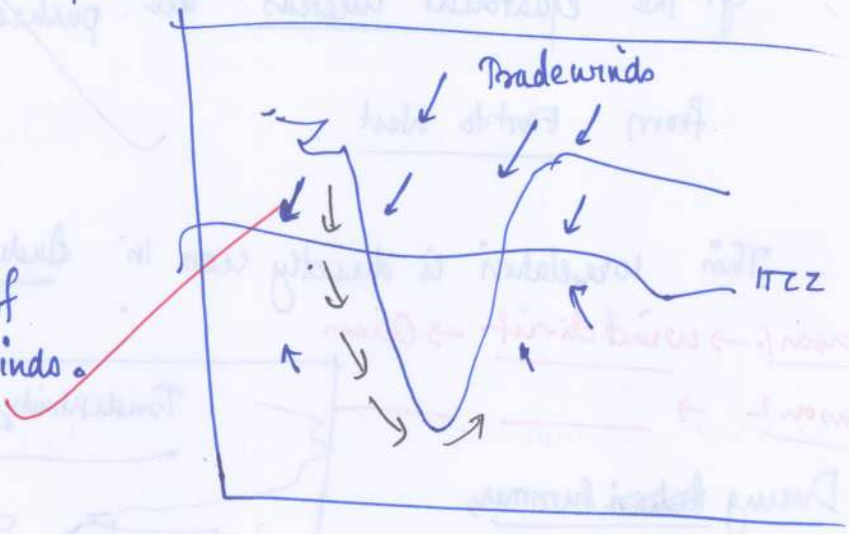
Good attempt

Case 1: During Summer, under the influence of trade winds (southern half), the winds are from East → West

and the ocean currents in Indian Ocean follow same direction.

Case 2:

During the winters, when the ITCZ shifts southwards the direction of oceanic circulation changes due to the influence of northern trade winds.



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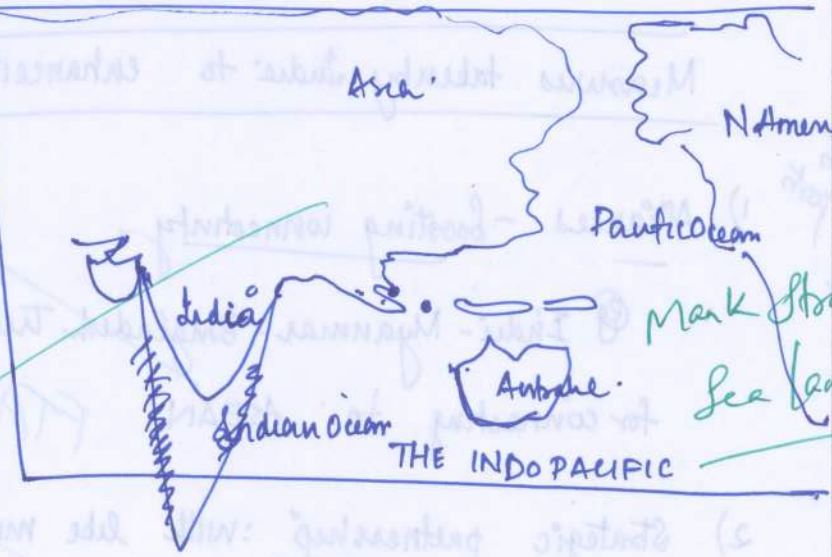
Winter Jetstreams
① Subtropical Westerly Jetstream – Western Australian

6. Explain the significance of the Indo-Pacific region for India's international trade endeavors. Additionally, explore the measures undertaken by India to enhance its geopolitical standing in the Indo-Pacific region. (10 Marks)

The Indo Pacific region is of strategic significance - due to the combination of 2 large ~~water~~ oceans and also due to the presence of world leaders on either side



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Significance of Indopacific for international trade

1) Geoeconomic: Majority of the vessels of India pass through the ~~Malacca Strait~~ - ~~Hence~~ Indo-Pacific region.

2) Connectivity and accessibility: of US coasts (trade surplus)

3) Opens up the doors to larger trade groups

(eg) Presence of blocks like ASEAN - with considerable importance.

4) Geostrategic: ~~Indo~~ China's rising presence and influence and the need to counter.

Measures taken by India to enhance its geopolitical standing

22 major ports
200 minor ports
Sagarmala

1) Alliances - boosting connectivity -
   - eg India - Myanmar - Bangladesh Trilateral highway for connecting to ASEAN FTA

2) Strategic partnership : with like minded countries
   - eg QUAD's stated goals of trade booster

3) Establishment of tricommand at Andaman & Nicobar in close proximity to Malacca Strait to counter ~~iss~~ China's influence and potential threats.

4) growing military alliances with US.
   - eg: LEMOA : to utilize each other's logistics facilities

Act East
Sagar.

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7. What is carbon capture and storage (CCS) technology? Discuss its feasibility as a means to mitigate carbon emissions in India. (10 Marks)

Carbon capture and storage (CCS) technology refers to the techniques, tools and processes that enable reduction of carbon stock in the environment through their capture and storage.

3 stages

India has pledged reduction of emission intensity by 50% and 500 bn in absolute emissions in its NDC. CCS technology can help this mitigation:-

① Capturing the carbon stocks from the environment before emission stage

explain CCS

eg Biochar formation and preservation

② Increasing the potential of environment to capture emissions - through afforestation drives.

③ Widening the scope of carbon ~~capture~~ Stock management - through carbon exchanges, carbon credit mechanisms etc

Do not write anything on the margin

However the feasibility is limited by:

① Lack of potential to real time assessment of carbon stocks.

② ~~Long term and~~ Infrastructure ~~aided~~ by lack of investment

③ Poor research and development ecosystem in India.

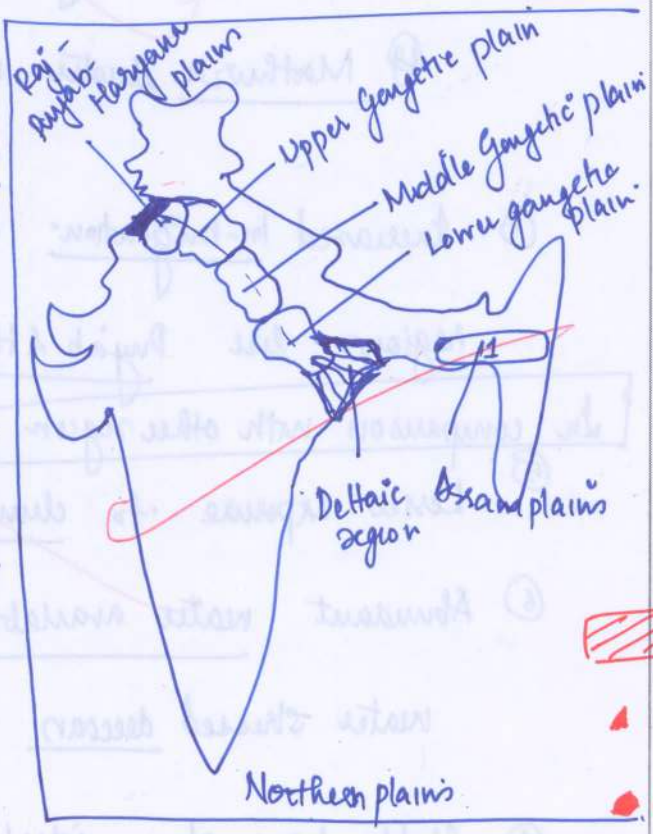
④ IPR hurdles - hampering technological progress

India's ~~pte~~ is the only G20 nation that is on track to achieve its NDC goals. This ~~grid~~ model should be ~~xplicated~~ by all ~~nations~~ ~~to emulate~~ ~~and~~ through following LiFe- Lifestyle for Environment.

Do not write anything on the margin

8. What geographic characteristics contribute to the notably higher population density in the Northern plains of India compared to other regions of the country? (10 Marks)

The Northern plains of India are a result of the alluvial deposits of ~~Indus~~, Ganga, Brahmaputra rivers and tributaries of Indus - Ravi, Beas and Sutlej. This area has the highest population density (eg) Bihar, West Bengal.



Reasons:

① Deposition of fertile alluvium which aids the agricultural economy.
(eg) lower gangetic plains - Bihar, West Bengal etc.

② Success of The Green Revolution in Agriculture - high productivity and high income - which aids population growth
(eg) Punjab - Haryana plains.

Do not write anything on the margin

③ Presence of important industrial centres associated with river bank economy — increased livelihood opportunity

eg Mathura cluster near Middle gangetic plains

④ Increased in-migration of labourers into the agri surplus regions like Punjab & Haryana

In comparison with other region

⑤ Lesser exposure to climate disasters — eg coastal plains

⑥ Abundant water availability — as opposed to water stressed deccan

⑦ Stable topography ideal for settlement — as opposed to landslide affected Himalayan regions.

eg Assam plains v/s Nagahills.

~~These factors about the popul~~
~~In addition~~ ~~The lesser success~~

Populations are attracted by pull factors and discouraged by push factors

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9. Discuss various stages in the value chain of the petroleum and natural gas industry. Also, identify the distribution of natural gas resources in India. (10 Marks)

Petroleum and natural gas value chain disruptions during Russia Ukraine war upset the world economy.

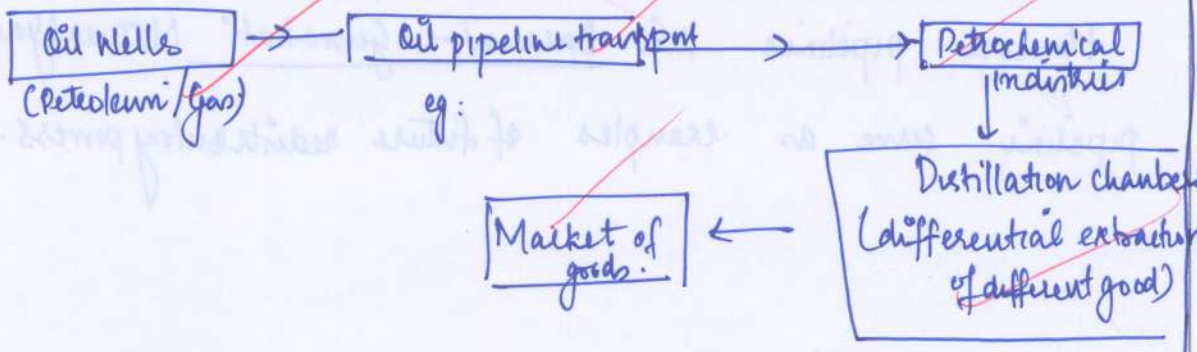

Fig: Value chain of Petroleum and Natural Gas Industry

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Natural gas and petroleum value chain's and seamless supply is essential to sustain a world that is still dependent on these as primary energy sources for vehicular transport etc.

Distribution of Natural Gas Resources

India has Natural gas reserves but suffers from:-

1) Technology for exploration

2. investment in infrastructure

3. regulatory cholesterol

4. storage, transportation and logistics challenges.

However pipelines like Barauni – Guwahati Natural Gas pipeline serve as examples of future redistributory powers.

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10. Assess the growing importance of air transport in India and examine its role in the regional development of the country. (10 Marks)

Air transport is gaining increased attention in national priorities.

Growing importance can be seen in:-

① Increased number of passengers availing the air transport : ~40% increase in 2years.

② Construction of airports in previously unserved areas eg North East

③ Reduction in the airfares by governmental interventions to make air transport affordable.

eg PM- UDAAN Scheme

④ Rising middle class demanding faster service delivery

eg Air cargo transport

However, a large majority of the country has not availed the service due to its higher cost, lesser expansion etc -

Do not write anything on the margin

~~Role in reg~~ Role of air transport in regional development

1) Establishment of connectivity : in regions inaccessible by other modes of transport (eg) Increased focused for North Eastern under DONER department.

2) Establishment of ~~geostrategic advantage~~ livelihood opportunities: ~~mitigating~~ improving ease of living standards

3) The generation of employment opportunities by bringing development to direct footsteps of man. eg tourism

4) Geostrategic : reducing the conflicts and better management of border areas and strategic areas.
(eg) Andaman & Nicobar (near Malacca Strait).

The PM's vision of 'Hawai Pehnon Walom ko Hawai Jahaz mein lena' reflects India's vision of airport led development.

Do not write anything on the margin

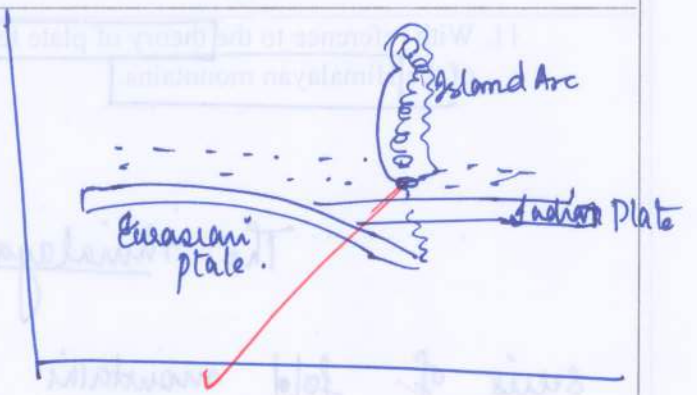
11. With reference to the theory of plate tectonics, describe the formation and evolution of the Himalayan mountains. (15 Marks)

The Himalayan mountains ~~formatio~~ are a series of fold mountains on the Indian subcontinent. ~~form~~ & its formation can be explained by theory of plate tectonics

Do not write anything on the margin

The Indian plate and Eurasian plates were once separated with the Tethys Sea in between. ~~Educating for~~ ie, India was part of Gondwanaland and Eurasia part of Laurentian landmass.

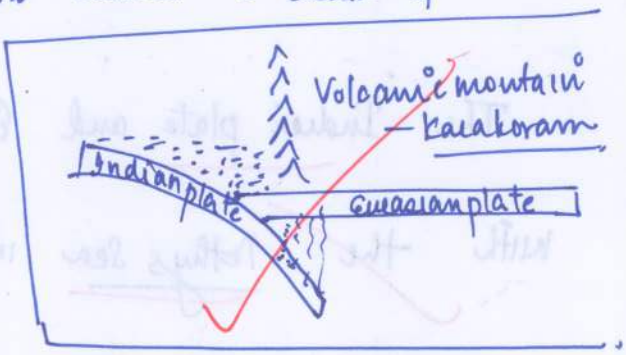
The movement of the Indian plate to the North resulted in the collision of oceanic path of both plates. This ocean-ocean collisions created a series of Island ares -



After the complete subduction of oceanic part of Eurasia, the continent of Eurasia collided with oceanic part of Indian plate.

Good.

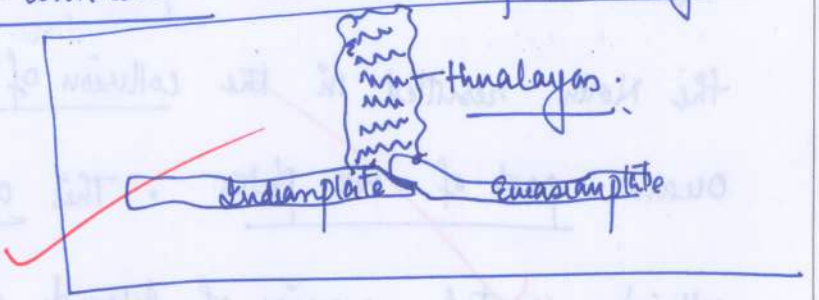
This continent - ocean collision created a chain of volanic mountain -



the present Karakoram ranges

Post the subduction of oceanic crust of Indian plate the continent portions of both the region resulted in a continent - continent collision creating Himalayas

Could mention about the sedimentary basin or geosyncline.



The other end of the landmass collided with the right end border of Eurasia

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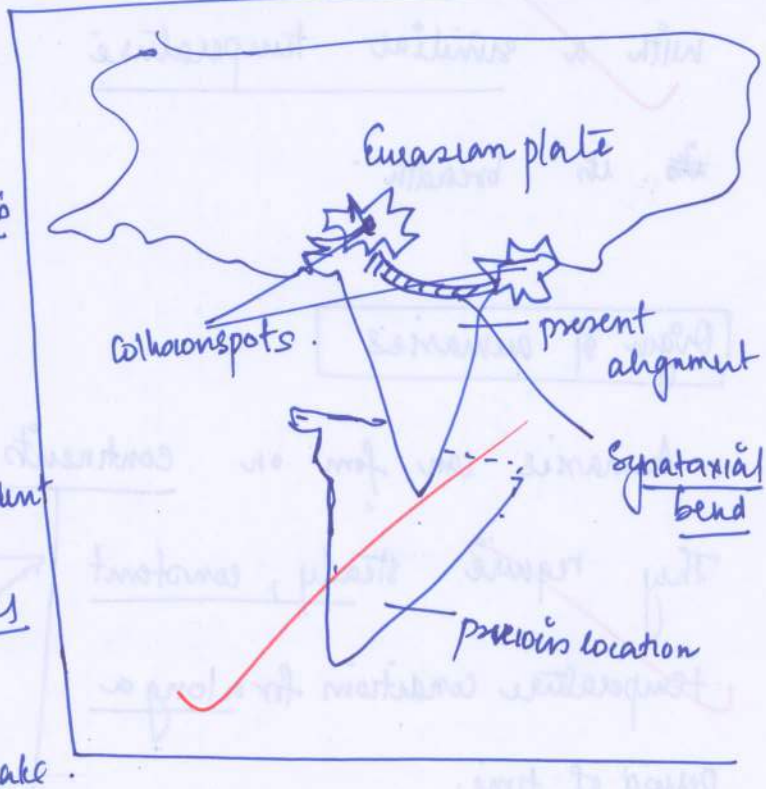
This impactful collision of the 2 continents has resulted in a syntaxial bend in the alignment of the Himalayas



The landscape of Himalayas ~~have been~~ is continuously being modified due to tectonic activity as evident in the frequent earthquakes in the region

eg: 2020 Nepal earthquake.

The face of the Himalayas has been further updated by the cutting through of antecedent river channels (eg: Brahmaputra) and by anthropological activities

Value addition

→ can mention geological timelines in one or two places.

Do not write anything on the margin

V. good

12. Discuss the origin, movements and characteristics of air masses and explain their role in influencing world climates. (15 Marks)

Air masses are large volumes of air with a similar temperature and pressure throughout its breadth.

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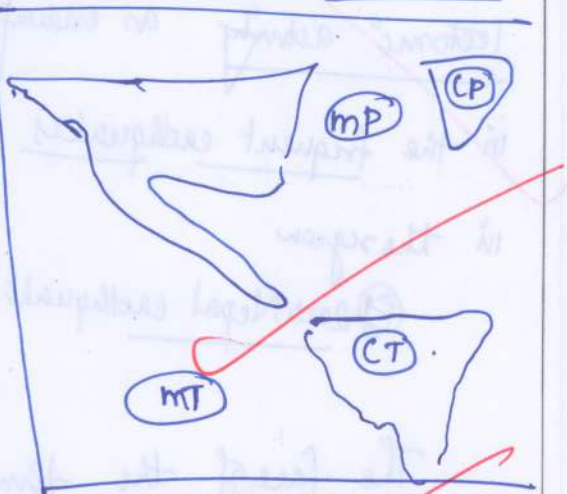
Origin of airmasses

Airmasses can form on continents as well as waterbodies.

They require steady, constant temperature conditions for a long a period of time.

They acquire the characteristics of their source regions and can be classified into maritime, continental airmasses. Some examples →



mP: maritime Polar.
cP: continental Polar
mT: maritime tropical
cT: continental Tropical

Movements of airmasses

Airmasses are formed in Temperate regions. Hence

* Could mention the type of airmasses & show in the diagram.

they come under the influence of Westerlies planetary winds. and hence moves from West to East.

Characteristics of Air massie :-

1) ~~[redacted]~~ ~~[redacted]~~ Air masses of different temperatures come in close proximity it result in the formation of fronts - extend thousands of kilometers.

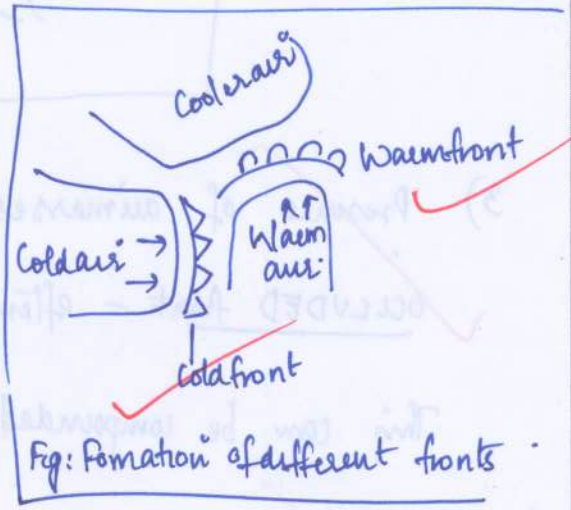


Fig: Formation of different fronts.

2) They possess uniform temperature conditions.
3) Moves from West → East
4) They contribute to the formation of temperate cyclonic circulation

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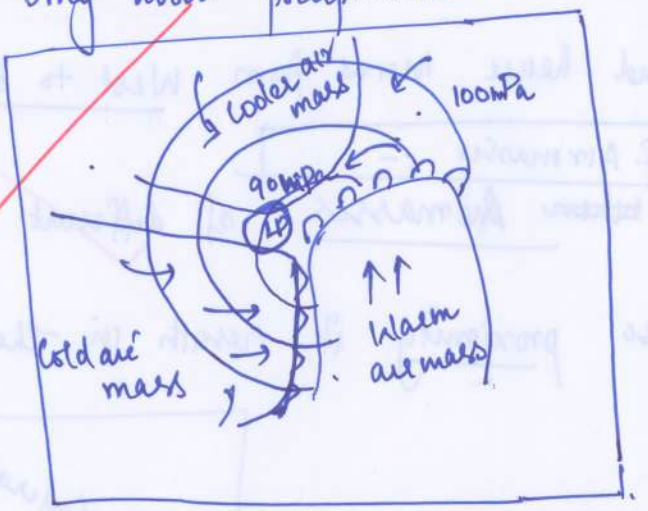
Role in influencing world climate

1) Influence the local temperature of a region.
2) Formation of temperate cyclones:
   due to the circulation of air masses and subsequent upliftment of hot air masses creating cumulonimbus clouds

which bring about precipitation.



3) Presence of airmasses of different temperatures creates OCCLUDED fronts - often resulting in FOGS, mists etc

This can be compounded with dust to form SMOG.

4) The Frontolysis or dissipation of the fronts creates stable weather conditions in the locality.

This predictability of airmasses aid the weatherprediction processes of temperate regions.

13. What is thermohaline circulation? What role does it play in regulating Earth's climate and how does the change in the circulation pattern influence global climate?

(15 Marks)

Thermohaline circulation refers to the international circulation of water of all oceans balancing the thermal and saline differences.

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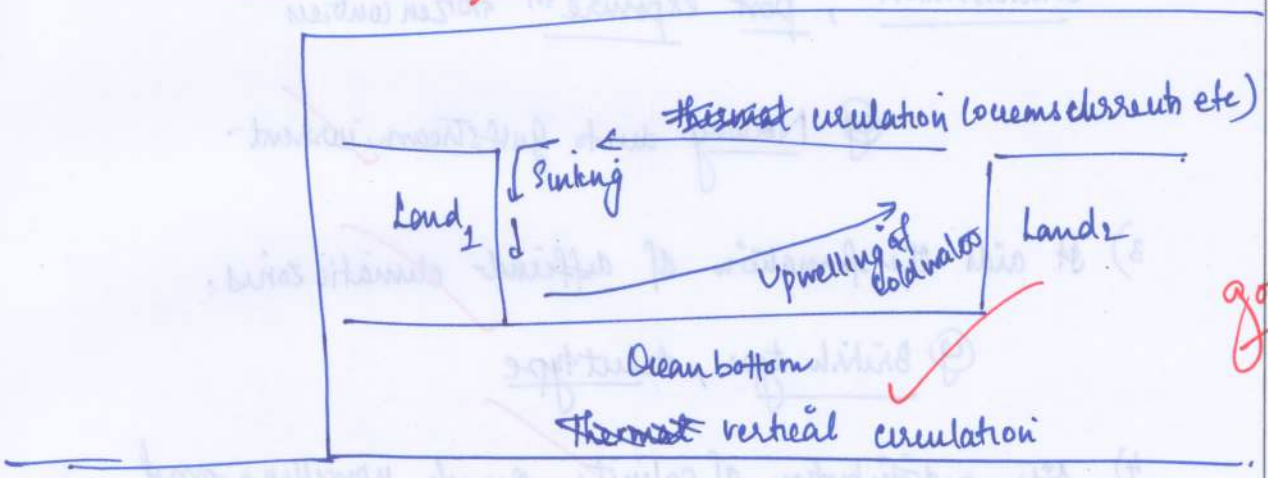

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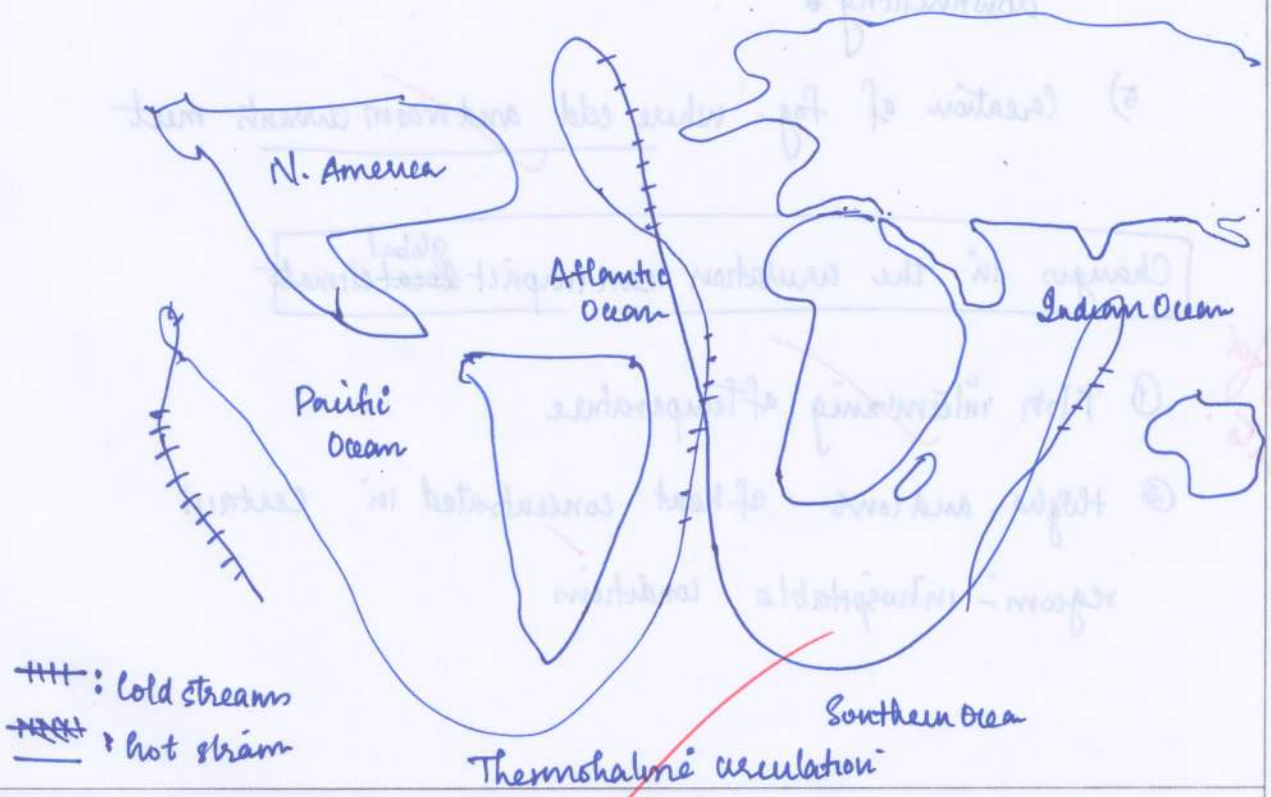


Thermohaline circulation

Role in Earth's climate

1) Aids maintaing the temperature balance of the Earth's Ocean.

2) The regions with hot stream flow aids in 'frost condensation', 'post exposure in frozen contries'

eg Norway due to Gulfstream current

3) It aids the formation of different climatic zones.

eg British type, desert type

4) Aids redistribution of salinity through upwelling and downwelling.

5) Creation of fog. where cold and warm currents meet

Changes in the circulation can impact ~~local~~ global climate

Refer key for more points.

① Non uniformity of temperature

② Highs and lows of heat concentrated in certain regions - inhospitable conditions

Do not write anythin on the margin

③ Affect biodiversity – fishing stocks etc.

④ May ~~bring~~ exacerbate climate disasters

eg cyclones..

Do not write anything on the margin

14. Distinguish between the West and East coast of India in terms of their evolution, present topography and drainage pattern. (15 Marks)

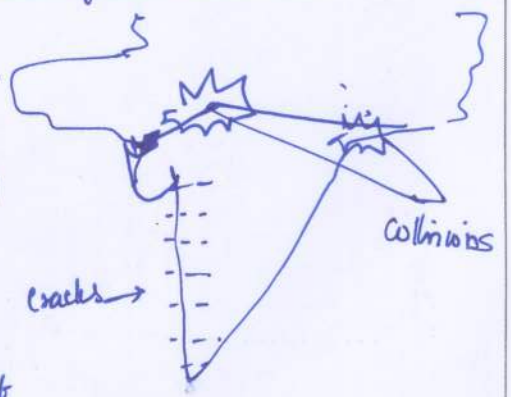
The Western and Eastern coastal margins are different due to their unique evolution pattern

Evolution .

1) The Western and Eastern parts of Indian subcontinent was once part of the large Gondwanaland.

2) The northward movement of the landmass over hotspot areas near present Reunion Islands resulted in the formation of Deccan Traps of igneous rock foundation

3) The collision impact of Indian plate with Eurasian plate resulted in the formation of cracks along the Western border



4) The subsequent submergence of the western margin ~~created~~ the created the submergent coast of the west

5) The eastern coast is an emergent coast

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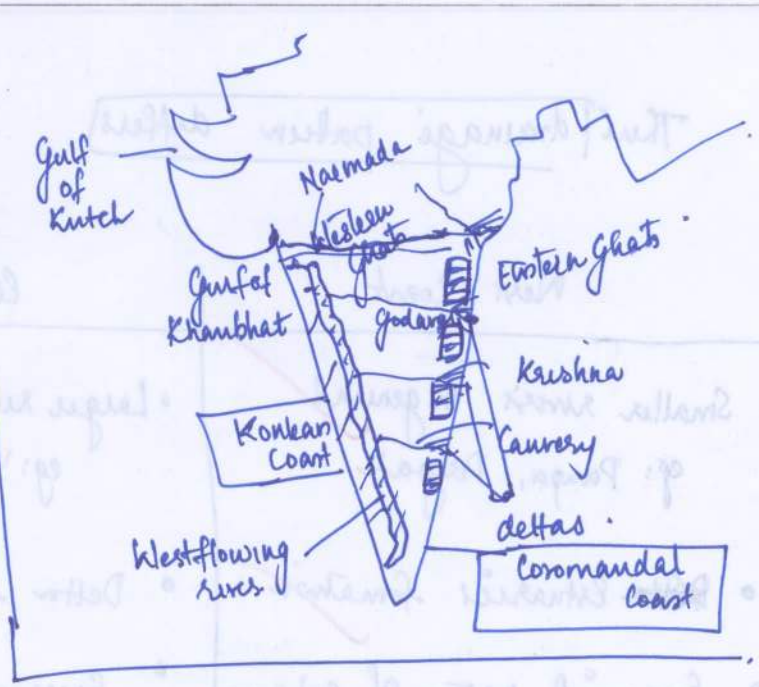
Topography.



The Konkan coast in the West

* Submergent coast
  (exceptions - near Malabar coast)
* Maged by small beaches
* Smaller estuaries formed by the westflowing rivers from Westeern Ghats
* Continental shelf - very narrow. → ∴ Continental shelf wider in western coast.
* Natural ports

The coromandal coast in the East

* Emergent coast - wide beaches @g Chennai Marina beach
* ~~formation of large estuaries~~
* Alignment of subcontinent in W → E direction aids the formation of large deltas by the rivers Godavari, Krishna, Caurery
* Beaches of high quality and tourism potential - continuously growing
* Wider continental shelf : with higher potential for fishing industry.

Do not write anything on the margin

Thus drainage pattern differs

West Coast	East Coast
• Smaller rivers in general eg: Pampa, Periyar	• Larger rivers eg: Godavari, Krishna
• ~~Delta~~ Estuaries formation	• Delta formation
• Erosional nature of submergent coast carries away sediment deposition	• Emergent coast ⇒ growing deltas.
• Less polluted rivers	• Highly polluted eg Kovvum, TN
Parallel drainage pattern	Dendritic drainage pattern.

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15. Explain the challenges and potential opportunities of dryland agriculture in India. With examples, emphasize the strategies and schemes aimed at its promotion across various regions. (15 Marks)

Dryland agriculture refers to cultivation in drylands without access to adequate irrigation facilities. It mandates detailed analysis of landscape, resistant crop selection and agricultural practices

Do not write anything on the margin

Challenges to dryland agriculture

① ~~Unpredictability~~ lesser yield: irrigation increases yield by 40% of crop (ICRISAT data)

② Need for land reclamation, for adequate returns.

③ Lack of adequate technology to bring economies of scale

④ Crops of dryland farming, ~~are~~ are less remunerative, discouraging farmers

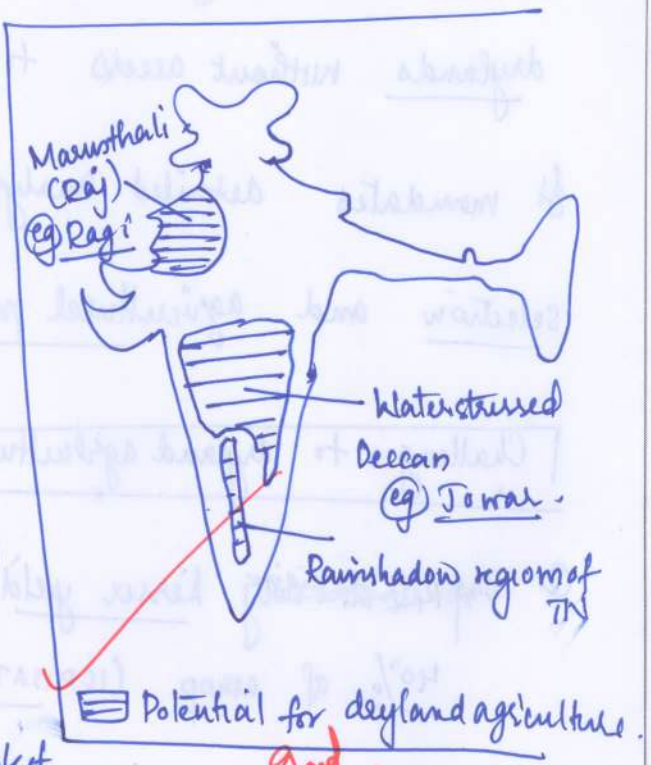
Opportunities of dryland agriculture

1) Need of the times for food security - as entire rainfall

in the country is limited to 4 months.

2) Existence of dryland in ~40% of geographical area.

3) Need to ~~[illegible]~~ practising water conservative agriculture (presently, a net water exporter, in water stress)



4) Availability of traditional practices aligned with dryland
(eg) Jowar in Karnataka

5) Diversification of India's food basket

6) Aim of increasing farmer's income.

The Indian government has introduced several schemes for its promotion:

① Crop diversification under National Millet Mission:
to increase the share of these in adequate location

2) PDS annoncement of dryland crops - mainly millets to boost product

3) Speial focus under National Mission on Sustainable Agriculture (part of NAPCC).

4) International collaporation on water usage effiency eg Israel.

Refer key for more points

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16. Emphasize the possible advantages of deep-sea mining for developing nations, with a specific focus on India. Also, discuss the challenges and environmental concerns in deep sea exploration. (15 Marks)

India has received permission for deepsea mining of polymetallic nodules from Indian Ocean basin from UNCLOS.

Deep sea mining has many advantages for developing nations

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① Exploration aids resource collection - needed for economic advancement of developing nation

eg: India's ~~successful~~ polymetallic nodule exploration is aimed at extracting Manganese, Ferric, Zircon amongothers

good.

② Development of industrial sector : the key generator of employment opportunities for any developing country. India particularly needs this due to its stagnant industrial sector since 1990s. (~15% to GDP).

③ · Livelihood enhancement, income boost — to bring out

population from poverty.

④ ~~In India~~ Abundance of currently rare elements — will give developing countries a chance to create a niche for themselves

However deep sea mining pose Several challenges

① Lack of technological knowhow to deal with the pressure and temperature conditions of deep seas.

② International clashes over deep sea bed sovereignty

eg China's claims over '9-dash line' territories

③ Lack of ~~accessible~~ ~~access~~ available research materials on the potentials of deep sea beds. 'Deep Ocean Bathymetry' still in pilot stages across the world.

④ Potential impacts on neighbouring countries -

eg Small Island Developing states.

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Environmental concerns

1) Will involve disruption of biodiversity in the exploration area (eg drilling, dredging activities)

2) May result in large no of oil spills due to increased usage of vessels in and around

3) Direct impact on health of coral reefs - the rainforests of ocean world - can lead to extinction of many existing species

4) Increased deposition of exploration related waste materials on ocean floors → ~~some~~ entering food chain through bioaccumulation, biomagnification etc.

5) Lack of international alignment on environmental concerns of global commons can lead to a blackhole of environmental degradation.

Thus while exploration is beneficial, ecocentrism should be the key for sustainability

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17. Analyze the location, distributional pattern and problems of cotton textile industries in India. (15 Marks)

India has known cotton textile making since Indus Valley civilization. This indigenous technology faces several opportunities and challenges.

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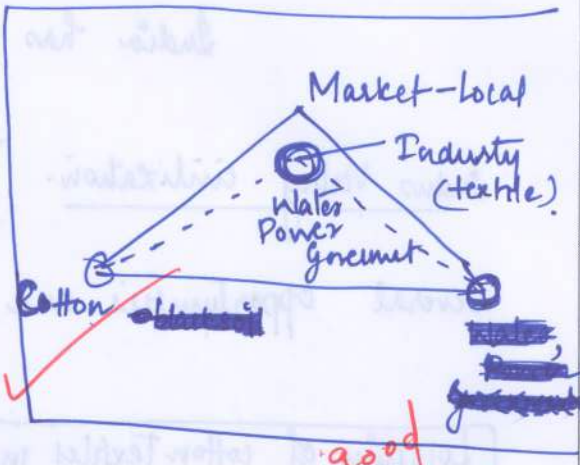
Location of cotton Textiles industry and Distributional pattern

* Cotton grows best in Blacksoil. Thus the earlier industries were centred around the production areas → Maharashtra
* However being a weight ~~losing~~ gaining industry it later reshifted to region closer to market.
  - eg Almost all capital region of state has textile centres.
* In addition the mill strikes in Gujarat etc has forced the reshuffling of textile sector to region of favourable trade policies eg Maharashtra, Tamil Nadu.

Cotton industry in India

good.

The distributional pattern of ~~off~~ in addition affected by market consideration



> Local markets:
  - eg Delhi - Lajpat Nagar shopping area

> International export potential
  - eg near ports - Mumbai, ~~Surat~~ Chennai.

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good

Cotton industry face several challenges ~~like~~:

Recently India became a net importer of cotton for a brief span. This highlights the issues with the sector:

1) Stiff competition in international markets due to globalization
2) Non profitable cultivation - ~~despite introduction of~~ BT
3) Poor price realization.
4) Climatic barriers - unpredictable showers due to climate change impact.

This part of answer can improve

5) Changing preferences – 'jeans culture' vis 'mindu/dhothi'

To overcome the above ~~issues~~ issue, the Ministry of Textiles came up with the MITRA scheme for segmentation of markets for Indian textiles. PLI benefits were introduced and credit facilities were institutionalised. The introduction of BT-Cotton was also to boost the yield of Indian cotton.

In addition, handholding of the sector for adequate international price realization. ~~and~~ can help the sector to sustain its competence

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18. "India's blue economy if properly harnessed could open up a sea of opportunities". Comment. Also, examine how far the climatic changes can inhibit the blue economy's expansion in India. (15 Marks)

Blue economy refers to the economic exploration of the potential of ocean resources. With a 7500 km coastline, India is strategically placed to utilize this sector.

Opportunities

① Exploitation of the possibilities of remunerative fishing
↳ eg Tamil Nadu coast - near Gulf of Mannar.

② Uplifting livelihoods of coastal communities - ~~through resource utilization~~
eg Tourism industry - Goa

③ Extraction of valuable natural resources

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eg Petroleum from Bombay High aiding petrochemical sector in India.

④. Conservation of unique ecosystems and its species

eg coral reefs of Lakshadweep.

⑤. Energy resource exploitation

eg Tidal energy from ~~Kan~~ Gulf of Kutch

⑥ Improving resilience of the nation to disasters.

eg Mangrove belt

⑦ Contribution to GDP by establishing sealines of trade & commerce.

However, climate change can inhibit this expansion by:

① Sea level rise - inundating the coastal ~~en~~ life and livelihood opportunities

② Increased frequency of climate disasters.

eg. Impacting ~~the cyclones of~~ Odisha, Bengal coasts

③ Climate extremities reduce the tourist occurance - impacting livelihoods directly

④ Temperature changes in ocean water will impact coral reefs.

⑤ Fishing potential will reduce due to migration to cooler places of ideal settlements etc.

Thus to exercise the above, there must be global alliances to mitigate. The mandates of COP27 along the lines of Paris Climate deal can be envisaged. Creation of a pro-planet lifestyle through Mission Life will aid this

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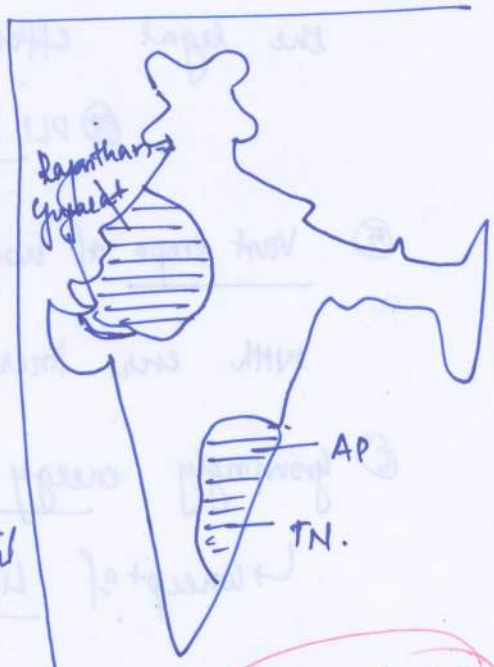
19. Elucidate India's solar energy potential. Examine the factors that are driving the sector's growth and the major challenges faced by the sector. (15 Marks)

India has set out a target of achieving 500GW solar energy production by 2030.

India has sufficient solar energy potential due to:

- Unique location as a tropical country
- ~~[illegible]~~



Regions of Solar potential

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potential & factors are not same

Factors driving the growth of solar sector:

1. Locational advantage: tropical with abundant insolation
2. Topographical: large desert areas (Rajasthan) to extract the energy.
3. Governmental push: through formation of international Solar Alliance, setting up of RE targets etc.

④ Investment push in the sunrise industry due to the legal efforts in this direction
(eg) PLI Incentives, credit etc.

⑤ Vast scope of usage : large population base with ever increasing energy requirements.

⑥ growingly energy conscious society -
↳ concept of Life: pro planet people.

However challenges affecting the sector :—

1) Lack of availability of solar photovoltaics : excessive dependence on China for supply chain

2) Intermittent nature of solar energy creating hurdles to 100% solarization of electricity

3) Inability to storage without leakages .

4) Poor research & development infrastructure & inefficient linkages between industry and academia.

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5) Difficulties in land acquisition in already land stressed nation of high population.

6) Lack of connectivity to national grid supply

~~7) Higher Insola~~

However the governmental steps have hugely changed the scenario in favour of solar sector. There is a

- growing awareness due to National Solar Mission,
- practical usage through Rooftop Solar Project,
- ~~Communication attempts etc~~. National Green Grid initiative for interconnection etc.

This will help reduce India's reliance on coal based electricity generation thereby reducing the nation's emission intensity and achieving NDC targets. (Net Zero, 2070)

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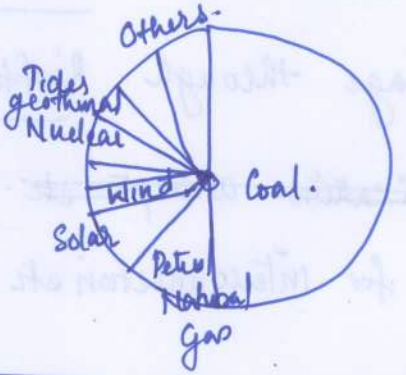
20. Examine India's energy mix and analyze the factors that have influenced its composition. Propose modifications to the energy mix that align with the Sustainable Development Goals (SDGs) to ensure sustainable development in India. (15 Marks)

The energy mix of India is heavily skewed

→ towards coal (~50%), petroleum and natural gas, etc.

→ However there is a recent push towards renewable energy (solar, wind) which is visible in the mix.



Factors that influenced composition:

1) Historical: reliance on coal based thermal plants for energy generation.

2) Economical ~~Fact~~: Presence of abundant coal reserves
(eg) Gondwana coal

3) ~~Accessibility and~~

3) Growing needs of the increasing population
(eg) Reliance on petroleum and natural gas vehicles transport sector

4) Growing consciousness of Lifestyle for Environment : increasing renewable energy mix.

5) Governmental steps :-
   - eg Compulsory procurement of RE by DISCOMS

However to align with SDGs, modifications are necessary :-

1) Minimize the coal share : 'phase down' rather than 'phase out' as enshrined in COP27 Summit.

2) Increase the share of Renewable energy in the energy mix : to ensure sustainability.

3) Development of energy city planning with SDG energy goals in mind - less polluting intervention
   - eg BS-VI norms - minimize diesil

4) Include Biotechnology, Nanotechnology into ideal energy mix design
   - eg Scope for biofuels.

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