



TEST CODE 7 1 1 2 0 3

Time Allowed : Three Hours
समय : तीन घंटे

ForumIAS

Maximum Marks : 250
अधिकतम अंक : 250

GENERAL STUDIES / सामान्य अध्ययन

Name Of Candidate परीक्षार्थी का नाम	MOHIT GUPTA		
Roll No./अनुक्रमांक	1910125710	Medium/माध्यम	English <input checked="" type="checkbox"/> हिंदी <input type="checkbox"/>
Center Code/परीक्षा केंद्र	1901	Date/दिनांक	

*Center Code : For Online - 1900 / Delhi : Karol bagh - 1901, ORN - 1902, Mukharji Nagar - 1903 / Patna : Boring Rd. - 2001 / Hyderabad : Jawahar Nagar - 2101

INDEX TABLE / अनुक्रमणिका			INSTRUCTION / अनुदेश		
Q. No. प्र.सं.	Max. Marks अधिकतम अंक	Marks Obtained प्राप्तांक	1. Please do furnish Name, Email, Roll No and Mobile in the answer sheet. कृपया उत्तर-पुस्तिका में नाम, ईमेल, रोल नंबर और मोबाइल नंबर भरें।		
1			2. There are TWENTY questions printed in ENGLISH & HINDI, all questions are compulsory. उत्तर पुस्तिका में अंग्रेजी/हिंदी में बीस प्रश्न दिए गए हैं, सभी प्रश्न अनिवार्य हैं।		
2			3. The number of marks carried by a question/part is indicated against it. प्रत्येक प्रश्न/भाग के लिए निर्धारित अंक उसके सामने अंकित किए गए हैं।		
3			4. 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. उत्तर प्रवेश पत्र में अधिकृत माध्यम में लिखे जाने चाहिए, जो कि दिए गए स्थान में इस प्रश्न-सह-उत्तर (क्यूसीए) पुस्तिका के कवर पर स्पष्ट रूप से लिखा जाना चाहिए।		
4			5. Word limit in questions, if 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. प्रश्नों में शब्द सीमा, यदि निर्दिष्ट हो, का पालन किया जाए। प्रश्न-सह-उत्तर पुस्तिका में खाली छोड़े गये किसी भी पृष्ठ या पृष्ठ के भाग को स्पष्ट रूप से काट दें।		
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Examiner's Discretion/मूल्यांकन कर्ता का विवेक :			Start Time/प्रारंभ करने का समय : 8:15:15 PM	End Time/समाप्त करने का समय : 18:50 PM	
Total Marks/कुल अंक :			Mode Of Examination/ परीक्षा की विधि :	Online/ऑनलाइन <input type="checkbox"/>	Offline/ऑफलाइन <input type="checkbox"/>
*Examiner's Discretion is the marks awarded at the discretion of the examiner based on your overall impression, on the basis of (but not limited to) your handwriting, presentation, use of diagrams, flowcharts, facts and figures or absolutely anything that he/she liked in your copy. मूल्यांकन कर्ता का विवेक अंक, आपकी लिखावट, प्रस्तुति, आरेखों के उपयोग, फ्लोचार्ट, तथ्यों और आंकड़ों या समग्र रूप किसी अन्य विषय वस्तु, जो मूल्यांकन कर्ता को आपकी कॉपी में पसंद आयी के आधार पर (लेकिन इन्हीं तक सीमित नहीं) पर दिए गए अंक हैं।			For Office Use Only / केवल कार्यालय प्रयोग हेतु		
			ECN CODE/ ईसीएन कोड :	EG/ईजी : ① ② ③ ④ ⑤	Evaluation Date/ मूल्यांकन तिथि :

Note: Students are expected to incorporate suggestions from the feedback provided in the answers. Discussion classes for the tests are also available online in your portal to aid in your preparation. Further, students are requested to see the good copies of the tests and learn from them. You can also discuss your copy with a Mentor and discover ways and means to improve your answers, or if you have any issues with this test / copy. Ask specific questions, to get specific answers.

EXAMINER'S REMARKS

CRITERIA FOR THE FEEDBACK SECTION AT THE END OF EACH QUESTION

1. **AWIS = Answered What is Asked.** This means whether you have addressed the core demand of the question or not. Addressing the core demand of the question gets you an objectively fair score. It is examiner's perception if you have understood the question and if you know the answer in the first place. Creative answer writing, sometimes missing the core demand, may fetch very high or very low scores, and exposes your answer to the subjectivity of the examiner.
 2. **CD & VA = Content Density & Value Addition.** Examiner will evaluate the quality and quantity of your content in the answer. In the same word limit and space limit have you (a) written what is asked (b) gone beyond what is asked (c) enriched answers through combination of (but not all!) suggestions, ideas, quotes, flowcharts, diagrams, facts and figures, data etc. This affects objective components of assessment.
 3. **S & F = Structure & Flow =** Whether you have structured your answer properly or not. Whether the answer has been broken into parts and sub-parts and each part has been addressed appropriately or not. Whether the flow of the answer is maintained. Affects both subjective and objective components of assessment.
 4. **P & R =** How your answer performs on the criteria of **presentation, ease of read, clarity and apparent effort** in writing the answer. This affects the subjective components of assessment.
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Q.1) Discuss the characteristics of water masses and their role in thermohaline circulation. Why are thermohaline circulations of the Pacific Ocean not as developed as in the Atlantic Ocean? (10 marks, 150 words)

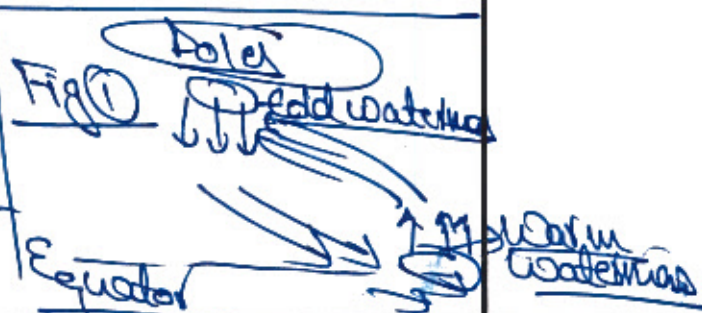
जल राशियों की विशेषताओं और थर्मोहेलिन परिसंचरण में उनकी भूमिका पर चर्चा कीजिए। प्रशांत महासागर के थर्मोहेलिन परिसंचरण अटलांटिक महासागर की तरह विकसित क्यों नहीं हैं? (10 अंक, 150 शब्द)

Ans) Characteristics of water masses

- ① Uniform composition in terms of temperature, salinity etc.
 - ② Large volume & surface area.
 - ③ They impact ocean currents & surrounding water body. They also exchange properties by confluence of another water mass.
- Thus, water masses are huge chunks of water with homogeneous composition.

Role in thermohaline circulation

Fig ① shows thermohaline circulation & role of water mass. Cold water mass sink in poles



Regions & warm watermass rises in equatorial region. This rising & sinking limbs complete oceanic conveyor belt & enable thermohaline circulation.

Pacific Ocean has less developed thermohaline circulation

- ① Absence of polar mass directly above them like Arctic Circle for AMOC.
- ② ~~Absence of~~ ^{weak} subsurface currents as compared to Atlantic Ocean.
- ③ less temperature & salinity differential as compared to Atlantic ocean which has higher gradients owing to long coastlines.
Due to absence of polar body & relatively open waters of Pacific, thermohaline circulations are underdeveloped.

Feedback

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Please put tick marks in the above table.

Here G is Good, A is Average and P is Poor.

TOTAL MARKS	
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Q.2) Describe the various types of delta. Why does India's eastern coast has more deltas than its western coast? (10 marks, 150 words)

डेल्टा के विभिन्न प्रकारों का वर्णन कीजिए। भारत के पूर्वी तट में पश्चिमी तट की तुलना में अधिक डेल्टा क्यों हैं?

(10 अंक, 150 शब्द)

Ans) Deltas are the areal marking confluence of river & ocean ecosystems (Depositional landform)

Various types of deltas are:

- ① Riverine delta : Formed due to sedimentation brought down by rivers. Ex : Bhitarbhanika Delta.
- ② Estuaries : Formed due to smaller streams & sills. Ex : Along West Coast.
- ③ Mangrove Delta : Swampy marshy areas inhabited by mangrove vegetation. Ex : Sundarbans.
- ④ Intertidal delta : due to depositional action of marine tides.

India's eastern coast has more deltas than western coast

① Most rivers originate from Himalayas & western Ghats & flow eastwards to drain in Bay of Bengal. Only Narmada, Tapi etc. are few west flowing rivers.

② These rivers collect sediments along their way which they deposit on river mouth forming delta while west flowing rivers have shorter course, less sediments & thus form estuaries & not delta.

③ Eastern coast is emergent in nature & has wider continental shelf. This aids in coast formation. (Gentler slope)
Due to above reasons, Eastern coast have wide & extensive deltas.

Feedback

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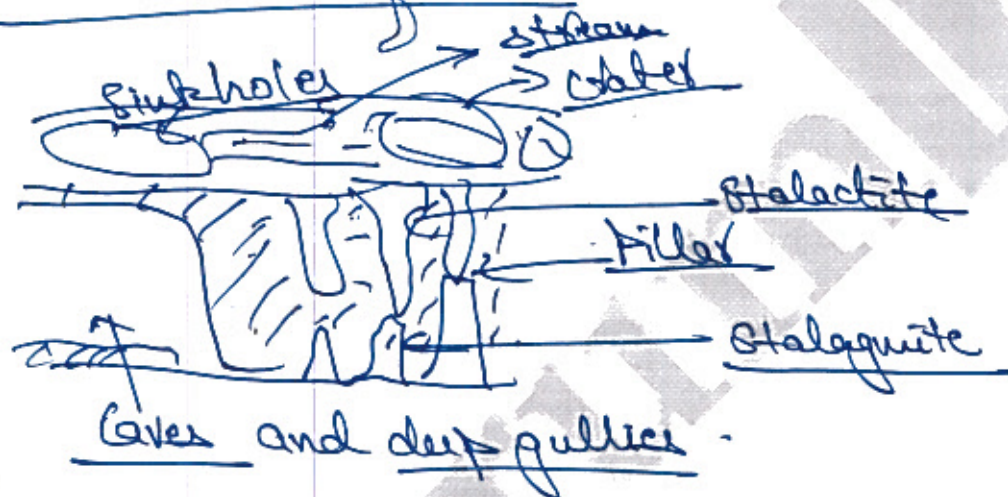
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TOTAL MARKS	
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Q.3) With the help of an annotated diagram, discuss the various landforms of karst region. Why is 'underground scenery' very well developed in karst region? (10 marks, 150 words)

व्याख्यात्मक आरेख की सहायता से कार्स्ट क्षेत्र के विभिन्न स्थलाकृतियों की चर्चा कीजिए। कार्स्ट क्षेत्र में 'भूमिगत दृश्यावली' बहुत अच्छी तरह विकसित क्यों है? (10 अंक, 150 शब्द)

Ans 3) Karst Topography is found in limestone one rich region and is an example of erosional landform



(1) Sinkholes : Formed due to erosion of soil & minerals by agents like wind, water (etc).

(2) Caves & Gullies : Formed due to continuous erosion, deformation & falling off of rocks from wall forming deep cavities.

(3) Stalactites : ~~are~~ Formed due to continuously

dripping water and hang from cave ceilings.

④ Stalagmites ° Depositional feature which is formed due to water dripping from above.

They rise up from ground. Sometimes stalactite & stalagmite join to form pillars.

⑤ Streams & water channels ° irregular in shape & flow

Reason for well developed underground scenery

① Continuous erosion from water as limestone is water soluble.

② Over time it gets deposited underground in various configurations giving it scenic look.

③ Surface topography becomes eroded & like badlands while rich depositional features develop underground.

Despite their scenic nature, karst region are geologically fragile areas.

Feedback

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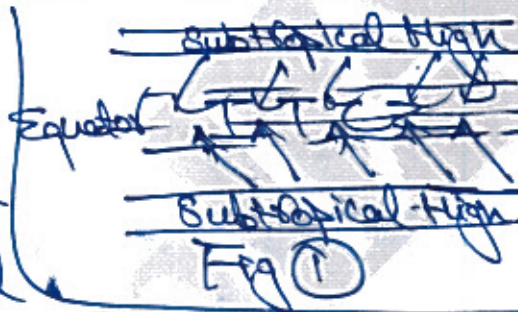
TOTAL MARKS

Q.4) What do you understand by the Inter-tropical convergence zone (ITCZ)? Discuss the climatic impact of its seasonal shift. (10 marks, 150 words)

अंत-उष्णकटिबंधीय अभिसरण क्षेत्र (ITCZ) से आप क्या समझते हैं? इसके मौसमीय स्थानांतरण (Seasonal Shift) से जलवायु प्रभाव पर चर्चा कीजिए। (10 अंक, 150 शब्द)

As shown in Fig. ①, ITCZ predominantly lies in equatorial tropical region.

It is the zone of convergence of easterly trade winds from subtropical



High Pressure Belts of either hemisphere.

The winds converge & form rising limbs of convective cell in equatorial region. This area is called as ITCZ.

Characteristics of ITCZ

- (A) High sunlight incidence → High Temperature
- (B) Intense low Pressure Area
- (C) Shifts with apparent motion of sun.

Climatic Impact of Seasonal Shift

① Between ~~June~~ ^{March} - ~~September~~ ^{June}, Sun is directly

overhead in Northern Hemisphere. This leads to shifting of ITCZ.

② In June & July, ITCZ lies directly over mainland India. As a result, intense low pressure region develops. This attracts Southwest monsoon winds towards Indian Subcontinent & results in rainfall from June-Sep.

③ The wavy nature of ITCZ is also responsible for rainfall over African east coast & western Australia.

④ After September, ITCZ starts retreating southward. This leads to Northwest monsoonal rainfall on Coromandel Coast.

⑤ Complete retreat of ITCZ leads to onset of winter season over India. Thus, shifting of ITCZ is central to Indian Monsoon & global climatic pattern.

Feedback

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Q.5) Explain the process of tide formation and distinguish between tides and waves.

(10 marks, 150 words)

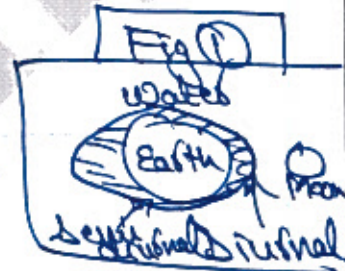
ज्वार-भाटा बनने की प्रक्रिया को समझाइए तथा ज्वार-भाटा और तरंग में अंतर स्पष्ट कीजिए।

(10 अंक, 150 शब्द)

Ans) Tides are upward lift or downward compression of water caused due to interplay of gravitational forces.

Process of tide formation

① Diurnal & Semi-diurnal tides : Formed due to centrifugal force of Earth & gravitational pull of moon.



where the moon is closest, high tide occur, whereas at polar opposite end, high tide occur due to centrifugal force. At 90° angles, low tide occur to maintain balance.

② Spring tide & Neap Tide : Spring Tide occur when sun, moon and earth are ~~at~~ in straight line. Highest tides occur during ~~the~~ spring of conjunction with sun & moon at 0° angle &

High tide with low amplitude in Syzygy of opposition with sun & moon at 180° .

Neap tides are high tides with relatively low amplitude when sun & moon gravitational forces act at 90° to each other.

→ Tides

① Results due to gravitational & centrifugal force.

② Whole ~~mass~~ mass of water body rises or falls

③ Organized & Predictable

④ Huge volume of water

Waves

① Results due to wind shear at surface, submarine disturbance etc.

② Traveling energy form with only specific section having high amplitude at a time.

③ Random & Unpredictable

④ Smaller volume of water

Tides and waves are both disturbances in water bodies, but their mechanisms are different.

Feedback

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TOTAL MARKS	
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Q.6) Define air mass and explain the influence of different types of air masses on weather patterns. (10 marks, 150 words)

वायु राशि को परिभाषित कीजिए और मौसम के पैटर्न पर विभिन्न प्रकार के वायु राशियों के प्रभाव की व्याख्या कीजिए। (10 अंक, 150 शब्द)

Ans) Air mass refers to a homogeneous packet of air with uniform temperature, moisture content & other physical properties.

Air mass travel from one place to another.

They also acquire the characteristics of landforms & water body on the way. Ex) \odot

Air mass over warm water body will acquire moisture.

Influence of different types of Air Masses on weather patterns

① Tropical maritime air mass (mT) is warm and full of moisture - originate in tropical areas and is responsible for raising temperature & causing rainfall.

② Tropical Continental Airmass (Ct) : Warm & devoid of moisture. Responsible for raising temperature & creating dry & arid conditions

Ex : 'loo' as local winds flowing from Thar Desert

③ Polar maritime Airmass (Pm) : Cold & full of moisture. During landfall it leads

to lowering of temperature & causes rainfall or snowfall. Ex : Blizzards in USA & Canada

④ Polar continental Airmass (Cp) : Cold & devoid of moisture. Causes dryness in air

with intense chilly ~~at night~~ conditions. Ex : Trans Siberian winds

Airmass are important factor for regulating local climatic conditions.

Feedback

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TOTAL MARKS

Q.7) The melting of the cryosphere due to climate change is a global threat whose effects will not be restricted to mountains and polar countries. Discuss. (10 marks, 150 words)

जलवायु परिवर्तन के कारण क्रायोस्फीयर का पिघलना एक वैश्विक खतरा है जिसका प्रभाव पहाड़ों और ध्रुवीय देशों तक ही सीमित नहीं होगा। चर्चा कीजिए। (10 अंक, 150 शब्द)

Ans → Cryosphere refers to the frozen landforms on the earth. It consists of glaciers, glacial lakes, snow capped mountains, polar ice masses. According to IPCC 6th Assessment Report, 66% of cryosphere can melt till 2100 at current emission levels.

Global nature of threat due to melting of cryosphere

- ① loss of temperature moderation: Ex: poles moderate the surface temperature of earth by trade winds systems. It will lead to global warming.
- ② lowered Albedo: More heat trapped near earth & greenhouse gases release due to

thawing of permafrost. Both will raise global temperatures.

③ Impact of on global air currents leading to variability in climate & rising extreme weather events.

④ Weakening of ocean currents like AMOC.
This will affect weather pattern for all countries.

⑤ Almost 80% of freshwater is in cryosphere.
Their melting will lead to freshwater scarcity & water crisis.

⑥ Impact on agriculture & human settlement.
This will threaten economic, political & social stability globally.
Cryosphere are global commons & thus responsibility to conserve them is globally shared.

Feedback

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TOTAL MARKS	
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Q.8) Heat waves are a silent natural disaster. Describe the criteria for declaring heat waves and enumerate its humanitarian, environmental and economic impacts. (10 marks, 150 words)

हिट वेव एक मुख्य प्राकृतिक आपदा हैं। हिट वेव की घोषणा करने के मानदंडों का वर्णन कीजिए और इसके मानवीय, पर्यावरणीय और आर्थिक प्रभावों की गणना कीजिए। (10 अंक, 150 शब्द)

Ans 8) Heat waves refer to the abnormally high temperature as compared to mean temperature leading to disaster like conditions.

Criteria for declaring heat waves

① Temperature is 4.5°C or more higher than mean temperature (historical data)

If duration is ~~5 or more~~ 6.4°C or more \rightarrow severe heat wave.

② Temperature at plains $> 40^{\circ}\text{C}$

Temperature at coasts $> 37^{\circ}\text{C}$

Temperature in mountains/hills $> 30^{\circ}\text{C}$

③ The conditions should hold true for 2 or more days to be declared a heat wave.

Humanitarian impacts

① Heat strokes & dehydration leading to

Hospitalisation & fatalities:

- ② Homeless, daily wage labourer etc. i.e. belonging to lower strata are most affected.

Environmental impacts

① High temperatures → ~~to~~ leads to forest fires → drying up of plants & trees.

② In plain areas with less cover, death of animals due to dehydration & lack of shelter.

③ ~~Urban~~ higher use of airconditioners, Urban heat island effect etc. → Global Warming

Economic impacts

① Investments (~~to be~~ ^{Public}) for Heat Action Plan & Emergency services i.e. diversion of resources.

② Loss of manhours at work due to heat wave conditions.

③ Deaths leading to loss of human resources.

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TOTAL MARKS	
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Q.9) What are the locational factors for textile industry? Why have countries like Vietnam and Bangladesh emerged as significant competitors to India in the textile exports?

(10 marks, 150 words)

वस्त्र उद्योग के लिए अवस्थिति कारक क्या हैं? वियतनाम और बांग्लादेश जैसे देश वस्त्र निर्यात में भारत के लिए महत्वपूर्ण प्रतियोगियों के रूप में क्यों उभरे हैं? (10 अंक, 150 शब्द)

Ans) Textile Industry has been central most industry since ancient times, with India being largest global exporter till 1760s.

Locational Factors for Textile Industry

- ① Availability of raw material. Ex :- Jute industries localised in Bengal.
- ② Availability of water for dyeing, weaving processing etc. Ex :- Kanpur Textile Factories at bank of Ganga.
- ③ Availability of cheap skilled & semi-skilled labour. Ex :- UP - Bihar - Bengal belt.
- ④ Transport & logistical connectivity
- ⑤ Proximity to urban markets or export channels
- ⑥ Govt. schemes. Ex :- MITRA scheme for incentives in textile parks.

Countries like Vietnam & Bangladesh as Chief Competitor's reasons

- ① Climatic Conditions : High temperature & high humidity which suits textile processing.
Ex : Cotton industry in hot humid areas
- ② Cheap labour availability as labour laws are often lax & frequently violated.
- ③ Excessive government subsidies. Ex : Free electricity to jute plants in Bangladesh
- ④ Integration with global supply chains especially with China centric supply chain
- ⑤ ~~Easy~~ Easy port connectivity with quicker turnaround time.
India needs to invest in industrial infrastructure and increase integration with global textile value chains to regain export prominence.

Feedback

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Q.10) The Himalayan region has significant mineral resources but realizing their potential has its own set of challenges. Discuss in light of recent finding of lithium reserves in Jammu & Kashmir.

(10 marks, 150 words)

हिमालयी क्षेत्र में महत्वपूर्ण खनिज संसाधन हैं, लेकिन उनकी क्षमता को दोहन करने की अपनी चुनौतियां हैं। जम्मू-कश्मीर में लिथियम भंडार की हाल की खोज के आलोक में चर्चा कीजिए। (10 अंक, 150 शब्द)

Ans 10) Reasi District in Jammu & Kashmir revealed significant potential ^{lithium} reserves in exploration by Geological Survey of India.

Himalayan region has significant mineral resources

- ① Rich in igneous rock based minerals as their base is of solidified igneous rock.
- ② Rich in coal, limestone, zinc, chrome etc.
- ③ Also rich in biodiversity & energy sources.

Realizing potential has own set of challenges

- ① Fragile ecosystem due to weak sedimentary outer layer, tectonic activity etc.
- Ex: Frequent earthquakes in Himalayas.

② Lack of connectivity & infrastructure.
limited potential to develop roads, tunnels
etc. due to limited carrying capacity.

③ Issue of environmental degradation like
river pollution, glacial contamination etc. in
mining process -

④ Hard impermeable igneous & metamorphic
base makes it impossible to mine minerals

Further such high investment extraction
will be uneconomical.

⑤ Issue of protected areas, & disturbing
with life of native communities. (Legal & social
challenges)

Proper EIA Assessment, economic viability
& least disturbance to biodiversity & native life
should be prerequisite of Himalayan Mineral
Extraction

Feedback

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Here G is Good, A is Average and P is Poor.

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Q.11) Describe the structure of a tropical cyclone and the conditions that are suitable for its formation. Also discuss the impact of tropical cyclones on human populations and the natural environment. (15 marks, 250 words)

एक उष्णकटिबंधीय चक्रवात की संरचना और इसके बनने के लिए उपयुक्त दशाओं का वर्णन कीजिए। मानव आबादी और प्राकृतिक पर्यावरण पर उष्णकटिबंधीय चक्रवातों के प्रभाव की भी चर्चा कीजिए। (15 अंक, 250 शब्द)

Q.11 Structure of Tropical Cyclone : (Fig. 1)

① Cyclone walls : Area of intense convectional uprisings due to low pressure systems.



② Rainy bands of cumulonimbus clouds spiral out which are responsible for intense prolonged rainfall.

③ Eye of cyclone : Region which has highest temperature & pressure gradient. It forms only in mature stage.

④ Upper atmosphere is calmer

⑤ Anticlockwise rotation in Northern & clockwise in Southern Hemisphere.

Conditions suitable for tropical cyclone formation

- ① Warmer sea surface temperature (27°C or above)
- ② Absence of Coriolis force.
- ③ Absence of vertical wind shear.
- ④ Upper ~~air~~ ^{atmospheric} divergence
- ⑤ low pressure centre formation
- ⑥ Continuous supply of water vapour
which acts as energy source by supplying latent heat of condensation.

Impact of tropical cyclone on human population

- ① winds as strong as 200 km/hr blows.
This leads to uprooting of houses, offices etc. It can also lead to fatalities.
- ② Torrential rainfall \rightarrow can lead to coastal flooding.

③ Loss of life and livelihood - Millions get displaced from their home.

Ex: - Supercyclone in Odisha in 1989.

④ Tidal surges can result in freshwater contamination & land salinization. Deaths * by diseases caused by vectors like Malaria, Dengue etc. are also common.

Impact on natural environment

① Destruction of green cover and loss of faunal biodiversity due to strong winds, flooding, diseases etc.

② Land degradation & contamination of groundwater.

③ Disturbed ecosystem services & loss of ecological functions.

Tropical cyclone impacts can be mitigated by building community shelters, early warning systems etc.

Feedback

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Q.12) To what extent does the theory of plate tectonics explain the major geological features of the Earth's surface? Discuss with suitable examples. (15 marks, 250 words)

प्लेट टेक्टोनिक्स सिद्धांत किस हद तक पृथ्वी की सतह की प्रमुख भूवैज्ञानिक विशेषताओं की व्याख्या करता है? उपयुक्त उदाहरणों के साथ चर्चा कीजिए। (15 अंक, 250 शब्द)

Ans Theory of Plate Tectonics was proposed in aftermath of Continental Drift Theory & Seafloor spreading theory to explain tectonic processes on earth.

Plate tectonics explaining major geological features

① Mid oceanic Ridges :- These are located at rising limb of convective cell in mantle.

New crust is being created due to oceanic plates divergence. Ex :- Atlantic mid ocean ridge

② Formation of island arcs, accretionary arcs, volcanic islands etc :- due to oceanic-oceanic convergence, which leads to subduction.

Plate Convergence also explains the formation of trenches. Ex^s - Japanese Island etc.

③ Formation of cordilleras & fold mountains.
They result due to ocean-continent convergence.
The wolten basalt rises & sediments are compacted also synclinal & anticlinal folds giving rise to fold mountains. Ex^s - Andes.

④ Explanation of earth's paleomagnetism as new crust is formed & moves apart horizontally.

⑤ Formation of transform faults like San Andreas Fault when two continental plates slip against each other.

⑥ It also explains the occurrence of Deccan trap & Madagascar's volcanism ~~as these are at~~ by hypothesizing about mantle plumes.

⑦ Pacific ring of fire is centre of earth's

cause of volcanic eruptions due to oceanic plate submergence.

⑧ It also explains the similar coastline features across continents as it validates Wegener's Continental Drift Theory.

Limitations of Plate Tectonic Theory

① Cannot explain & predict the formation of ~~mantle plumes~~ mantle plumes & why & how convection cells form.

② Cannot explain submarine landform formation like submarine mountains, guyots etc.

③ Still unclear about evolution of continental landmass & forces explaining their current position.
Plate Tectonic theory still serves as most credible & evidence backed theory explaining earth's geological features.

Feedback

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Here G is Good, A is Average and P is Poor.

TOTAL MARKS

Q.13) Account for the differences in ocean water density across the globe and its diverse implications. (15 marks, 250 words)

विश्व भर में समुद्र के जल के घनत्व में अंतर और इसके विविध प्रभावों के बारे में बताएं।

(15 अंक, 250 शब्द)

Ans 13) Ocean density differences are function of difference in temperature & salinity.
It also gives rise to ocean stratification.

Difference in ocean water density across the globe

① Vertical Profile : ~~Depth~~ Density increases non-linearly with depth. Surface water is less dense compared to subsurface ^{water mass}.

② Horizontal Profile : (i) water at equator is higher in temperature and with more salinity. It is less dense compared to poles where colder water is more denser.

(ii) ~~#~~ Tropical areas receive high amount of freshwater (river influx & rainfall).

leading to lower density than temperate & polar zones.

(ii) Areas such as Baltic Sea receive high freshwater influx and are less dense, while areas like Mediterranean Sea experience high salinity and are more dense.

(iii) Due to more evaporation & salinity, oceans in northern hemisphere are denser than their southern counterpart.

Diverse Implication of different oceanic density

① Drives thermohaline circulation such as Atlantic Meridional Overturning Current leading to subsurface ocean currents.

② It also drives warm & cold surface

currents which regulate local weather conditions temperature redistribution etc.

③ Density difference causes cold upwellings & downwellings. These have direct correlation with nutrient redistribution, biodiversity productivity of warm waters etc

④ Density differences also ~~can~~ impact ocean-atmosphere coupling. Ex: La Nina, El Niño etc. are result of cold or warm upwellings

⑤ Density differences drives ocean currents. Thus enable fishing, navigation, trade etc. Global trade relations depend on ocean currents.

⑥ Nesting zones & predator prey interactions are driven by density differences of water. Density variations are responsible for all oceanic features and thus greatly impact human activities too.

Feedback

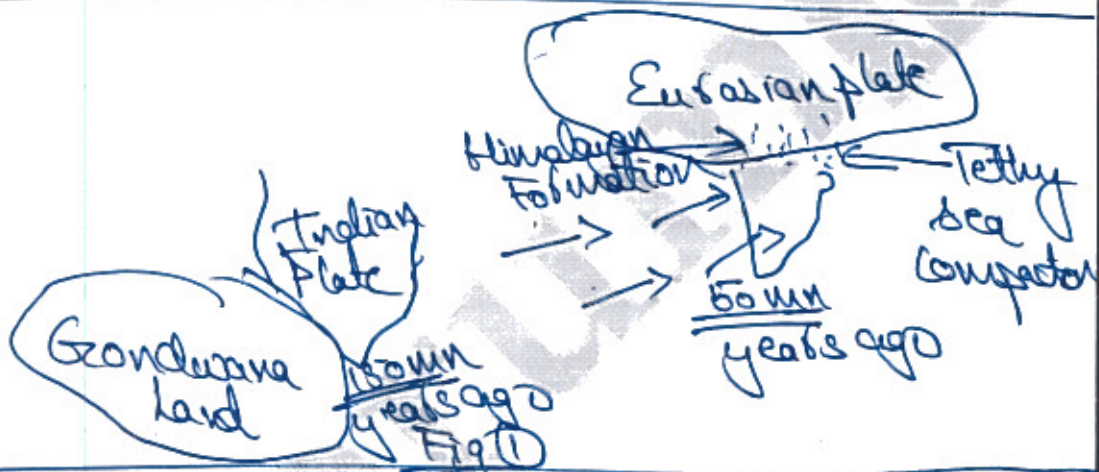
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Q.14) Explain the origin and evolution of the Himalayan Mountain range. What impact do Himalayas have on the climate and geography of the Indian subcontinent? (15 marks, 250 words)

हिमालय पर्वत श्रृंखला की उत्पत्ति और विकास की व्याख्या कीजिए। भारतीय उपमहाद्वीप की जलवायु और भूगोल पर हिमालय का क्या प्रभाव है? (15 अंक, 250 शब्द)

Ans) Himalayas are the youngest folded mountain ranges of the earth & are result of tectonic plate interactions.



Origin & Evolution of Himalayas

As shown in Fig. 1: Step 1: Indian plate separated from Gondwanaland & drifted northeast towards Eurasian Plate.

Step 2: ~~sea~~ Tethys sea subducted. It led to deposition of marine sediments. As oceanic plate

Subducted, it melts & ~~is~~ rises as basaltic lava. This forms the igneous base of Himalayas. Under high temperature & pressure, it turned to metamorphic rock.

Stage (3) :- After complete subduction, Continental-Continental collision occurs. This led to rise & compaction of continental sediments along synclinal & anticlinal folds.

This formed outer covering of Greater Himalayas & formation of Shiwaliks.

Stage (4) :- Himalayan formation occurred in door hinge fashion. Firstly, Hindukush area collided & then it pivoted across it.

The closing end was North-east Himalayas. As a result, Hindukush & ~~the~~ Arabian Yoma are called syntaxial bends.

Stage (5) :- Further landforms like gorges, canyons, valleys etc formed due to erosional action of rivers like Ganga.

Impact on climate & geography

- ① Formation of Don Valley & Northern Indian Plains are result of Himalayan rivers.
- ② Protects ~~re~~ India from cold winds from Siberian region by blocking them.
- ③ High Altitude and lower temperatures leads to snowfall. Permanent snowlines present at higher peaks.
- ④ Himalayas trap the monsoon winds. North-East Himalayas deflect Bay of Bengal Branch towards India, while Himalayas ensure that monsoon winds rains mostly over Indian mainland.
- ⑤ It houses diverse geo-climatic zones ranging from tropical rainforest to alpine type.
Himalayas are central to determining geo-climatic conditions of Indian subcontinent.

Feedback

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Q.15) Describe the factors that influence the monsoon rainfall in India. What do you mean by normal monsoon? Why do some regions suffer drought even in a year of 'normal monsoon'?

(15 marks, 250 words)

भारत में मानसूनी वर्षा को प्रभावित करने वाले कारकों का वर्णन कीजिए। सामान्य मानसून से आपका क्या अभिप्राय है? 'सामान्य मानसून' वाले वर्ष में भी कुछ क्षेत्रों में सूखा क्यों पड़ता है? (15 अंक, 250 शब्द)

Ans (15) Indian Monsoon is characterised by "seasonal reversal of winds". It represents a distinct rainy season with intense rainfall.

Factors influencing monsoon rainfall

- ① Formation of intense low pressure area & shifting of ITCZ.
- ② Northward shift of Subtropical westerly Jet stream.
- ③ Differential heating of land & water.
- ④ Formation of Tibetan High & Tropical Easterly Jet which aids equatorial crossing of monsoon winds.
- ⑤ Formation of Mascarene High in Indian Ocean.
- ⑥ Ocean-atmospheric coupling like El-Nino (weakening) & La-Nina (strengthening)

- ⑦ Positive or negative Indian ocean dipole.
- ⑧ Madden Julian oscillation.
- ⑨ local factors like green cover, altitude etc.

Normal Monsoon % When the rainfall recorded over India lies in the threshold range of average rainfall over years, it is called as Normal Monsoon. Additionally, there should be little variability in onset & withdrawal date of monsoon (1 June - 30th September)

Some regions suffering drought even in normal monsoon year

- ① Differential spatial distribution % Some areas receive more rainfall while others receive less. This keeps average rainfall same but some areas face drought

② High monsoon variability with periods of monsoon breaks & torrential downpour.

This can leads to drought like conditions during monsoon breaks.

③ local factors like urban heat island effect & green lack of vegetation cover, concretization &

encroachment of wetlands can lead to low moisture retentivity in soil. This creates drought like conditions.

④ If local anticyclonic conditions develops, this leads to clear & stable skies.

That results in drought in some regions.

Additionally leeward side of mountains & rainshadow zones experience drought.

Normal monsoon is merely a statistical metric which can deviate from ground reality.

Feedback

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Q.16) Healthy coral reefs are among the most biologically diverse, ecologically vital and economically valuable ecosystems on earth. Elaborate upon the significance of coral reefs. Describe the suitable conditions for their health and the threats faced by them. (15 marks, 250 words)

स्वस्थ प्रवाल भित्तियां पृथ्वी पर सबसे जैविक रूप से विविध, पारिस्थितिक रूप से महत्वपूर्ण और आर्थिक रूप से मूल्यवान पारिस्थितिक तंत्रों में से एक हैं। प्रवाल भित्तियों के महत्व के बारे में विस्तार से बताएं। उनके स्वास्थ्य के लिए उपयुक्त स्थितियों और उनके सामने आने वाले खतरों का वर्णन कीजिए। (15 अंक, 250 शब्द)

Ans) Coral reefs are called as 'Tropical Rain-forests' of ocean owing to their high ecological, economic & biodiversity potential.

Significance of Coral reefs

① Biological Diversity: (a) occupy less than 1% of ocean's area but houses around 40% marine biodiversity.

(b) Provide shelter to various organisms & provide nutrition through biological processes.

② Ecologically vital: (a) Indicate health of marine ecosystems thus used as indicator species.

(b) Protection of coasts by acting as breakwaters.

(C) Regulatory, provisioning & supporting services to marine organisms & coastal communities.

(3) Economically Valuable : (a) Rich sources of calcium carbonate & other deposited minerals.

(b) Indicator of good fishing grounds.

(c) Huge ecosystem services contribution.

Suitable conditions for healthy coral reef

(1) Optimum temperature range (24-27°C).

Higher or lower temperature can cause heat stress & resultant death.

(2) Sediment free water. Excessive sedimentation leads to closing off of nodules.

(3) Found at shallow depths & mostly in tropical & subtropical water.

(4) Absence of chemical contaminants & water pollutants.

(5) Absence of physical stresses like trawling, tourism, etc.

Threats faced by coral reefs

- ① Rising global temperatures leading to breakdown of symbiotic relationship
- ② Rising ocean levels worldwide & rising extreme weather events -
- ③ Contaminated water, due to industrial release, oil spills; coastal activities etc.
- ④ Physical mechanical stresses caused by anthropogenic activities.
- ⑤ Rising sediments in water near coasts caused due to ships, rivers etc -
- ⑥ Rise in ocean acidification leading to dissolution of calcium carbonate shells -
bleaching, relocation etc. along with degradation of marine protected areas needs to be done for coral conservation.

Feedback

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Q.17) The Regional Rapid Transit System (RRTS) is being planned as a reliable, high-speed, and high-frequency transportation service for the National Capital Region (NCR). Discuss the factors driving the need for RRTS and elaborate upon the challenges faced in implementing such systems in India. (15 marks, 250 words)

क्षेत्रीय त्वरित परिवहन प्रणाली (RRTS) को राष्ट्रीय राजधानी क्षेत्र (NCR) के लिए एक विश्वसनीय, उच्च गति और उच्च आवृत्ति परिवहन सेवा के रूप में योजनाबद्ध किया जा रहा है। RRTS की आवश्यकता को प्रेरित करने वाले कारकों पर चर्चा कीजिए और भारत में ऐसी प्रणालियों को लागू करने में आने वाली चुनौतियों पर विस्तार से चर्चा कीजिए।

(15 अंक, 250 शब्द)
RRTS is proposed as a solution to challenges of rapid & unplanned urbanisation, promising low-cost & integrated solutions.

Factors Driving the need for RRTS

① Growing pressure on common infrastructure like roads: Increased vehicular density is resulting in traffic jams, Congestion & delays.

② Rising cost of transportation & need for affordable transit systems.

③ Rising urban air pollution. Also urban heat island effect is compounded.

by reducing vehicular emission.

4) Need for bifurcation in Commercial & non-Commercial roads to prevent congestion.

Transit oriented Development (TOD) is being integrated with RRTS.

5) Lack of connectivity between suburbs & central commercial spaces. RRTS will provide integrated connectivity to all urban outgrowths.

6) Improve inter-city & intra-city connectivity services. This will reduce population pressure in central cities.

Challenges in implementing such systems

1) High economic cost & long gestation periods of infrastructure project. Issue of

Credit & financing.

② Aligning existing infrastructure in modern plan. Using same ~~inf~~ roads can lead to optimisation issues.

③ Haphazard distribution of residential & commercial areas. This makes integrated planning & demarcation of transit lanes difficult.

④ Land Acquisition issues for modernisation of transit systems.

⑤ High suburban outgrowth increases the cost & expense of project.

⑥ Long time duration of project.

⑦ Issues of jurisdiction as NCR is spread over multiple states.

RRTS is an ambitious project to reduce transportation time & population pressure, however challenges require urgent attention.

Feedback

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Q.18) "Water scarcity threatens economic and social gains and is a potent fuel for wars and conflict." What are the political and natural challenges in access to freshwater resources in regions with shared international transboundary rivers? Elaborate upon the impact of access to freshwater for economic development and poverty reduction. (15 marks, 250 words)

"जल की कमी आर्थिक और सामाजिक लाभ के लिए खतरा और युद्ध एवं संघर्ष के लिए एक शक्तिशाली ईंधन है।" साझा अंतरराष्ट्रीय सीमा पार नदियों वाले क्षेत्रों में मीठे जल के संसाधनों तक पहुंच में राजनीतिक और प्राकृतिक चुनौतियां क्या हैं? आर्थिक विकास और गरीबी में कमी के लिए मीठे जल तक पहुंच के प्रभाव के बारे में विस्तार से बताएं।

(15 अंक, 250 शब्द)

Ans 18) Shared international transboundary rivers have often been points of conflict among countries due to huge dependence of population on it as freshwater source.

Natural Challenges in access to freshwater resources in shared-transboundary river region

① Lower riparian states face lower availability of river freshwater.

② Excessive sedimentation & pollutants

Carried ~~due to~~ in lower riparian states -

Ex ① - Ganga in Bangladesh.

③ Drying up of rivers due to variable rainfall pattern, excessive ~~to~~ dam construction etc.

Political Challenges : ① Boundary Issues

as rivers frequently change course. (Ex) :- Brahmaputra near India-China boundary.

② Geopolitical conflict over water sharing arrangements. (Ex) :- Indus water treaty.

③ Lack of river water data sharing to predict freshwater availability.

Impact of access to freshwater for economic development

① Necessary for various industries like textile, semiconductor etc.

② Necessary for irrigation in agriculture.
Production of foodgrains & cash crops.

③ Rivers serve as source of cheaper & cleaner hydropower (Ex) :- Arun III project.

④ Inland waterways : logistics, trade & tourism

- ⑤ Most human settlements & urban centres are located at bank of freshwater sources only. (Ex) → Varanasi, Kolkata etc.
- ⑥ Freshwater is essential for survival & quality of human capital.

Impact on poverty reduction

① Access to freshwater is essential for sanitation & health. This helps in improving socio-economic indicators.

② Decreased prevalence of waterborne disease.

③ Unlocking women economic potential as they will not remain confined to homes (long distance to fetch water).

④ Agricultural income boost, farmer income in rural areas. Freshwater acts as lifeline for human survival.

Feedback

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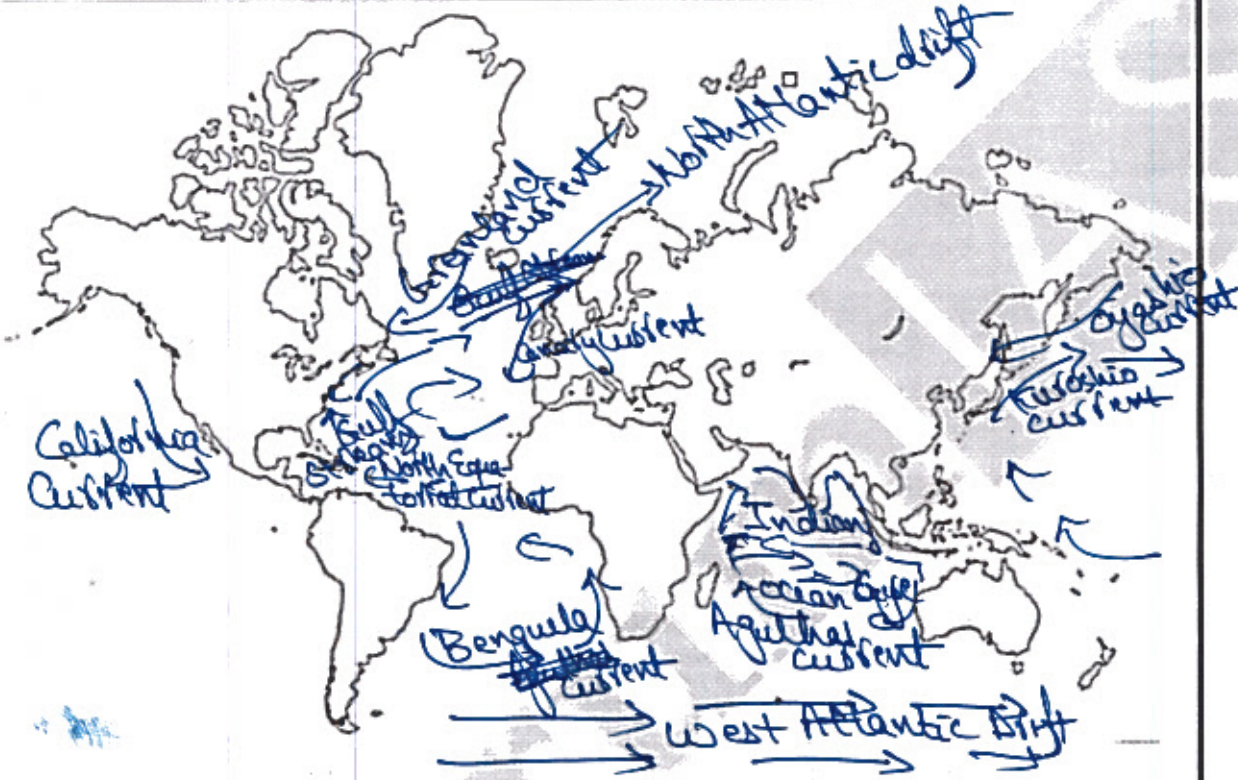
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Q.19) With the help of a map, show major ocean currents of the world. Explaining the factors driving the ocean currents, highlight their effects on human activities. (15 marks, 250 words)

मानचित्र की सहायता से विश्व की प्रमुख महासागरीय धाराओं को दर्शाए। महासागरीय धाराओं को प्रभावित करने वाले कारकों की व्याख्या करते हुए, मानवीय गतिविधियों पर उनके प्रभावों को उजागर कीजिए। (15 अंक, 250 शब्द)



→ Ocean currents are organized movement of water on surface of water bodies -

Factors driving the ocean currents

① Winds: Primary factor driving currents. Friction between trade winds systems & water surface help sustain ocean currents.

② Temperature Differential ° Warm currents move towards the poles while cold currents move towards equator.

③ Thermohaline Circulation like AMOC which is driven by temperature & salinity differences.

④ Coriolis force due to rotation of earth. This helps in ~~leftward~~ ^{rightward} deflection in Northern Hemisphere & leftward in Southern. This aids in formation of gyres.

⑤ Ocean-Atmosphere Coupling ° Ekman ° cell which drive warm ocean currents towards Indian Ocean.

⑥ Orientation of coastline & atmospheric conditions like low & high pressure regions

lead to local variations :

① Upwelling & Downwelling of water mass impact ocean currents.

Effect of ocean currents on Human Activities

① Enable global trade as navigation on high sea is governed by ocean currents.

② Determine climatic conditions of an area.

Ex) Monsoon type over India.

③ Determine topographic properties like soil type of an area. Ex) western margins in subtropical areas are desert like due to cold upwelling of ocean currents

④ Distribution & occurrence of rainfall.

⑤ Moderating conditions for human settlement. Ex) North Atlantic Drift

for British Isles -

⑥ Fishing grounds : Coastal communities' livelihood. Ex : Japanese coast as meeting point of hot & cold currents.

Ocean current determine & impact economic, social & environmental conditions for human settlement.

Feedback

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Q.20) Explain the primary lines of evidence supporting the theory of continental drift. How did it contribute to expanding our understanding of Earth's history. Also discuss the limitations of continental drift theory. (15 marks, 250 words)

महाद्वीपीय विस्थापन सिद्धांत का समर्थन करने वाले साक्ष्य की प्राथमिक स्थिति की व्याख्या कीजिए। इसने पृथ्वी के इतिहास की हमारी समझ का विस्तार करने में कैसे योगदान दिया। महाद्वीपीय विस्थापन सिद्धांत की सीमाओं पर भी चर्चा कीजिए।

(15 अंक, 250 शब्द)

Ans 20) Alfred Wegener proposed Continental Drift Theory (CDT) to explain the geological evolution of earth.

Primary lines of evidence supporting CDT

- ① Jigsaw fit of the continents.
Ex) $\frac{1}{2}$ Africa-South America coast.
- ② Similar ~~glacial~~ glacial fossils found on either coast of Atlantic Sea.
- ③ Similar geological landforms on different continents. Ex) $\frac{1}{2}$ Canadian shields & Scottish high.
- ④ Similar rock composition across multiple continents.
- ⑤ Similar biodiversity in flora & fauna.

⑥ Same tillite deposits found in South America, Africa & Asia.

Contribution to understanding of earth's history

① Initially there was a giant landmass called 'Pangaea' having all continents joint together.

② Due to gravitational, tidal & centrifugal forces, there was breakdown of Pangaea into Laurasia & Gondwanaland. Further separation created present shape of continents.

③ It was revolutionary as it challenged geological staticism present at that time.

④ It laid the foundation for seafloor spreading & plate tectonic theory that

Landmass actually moved over earth.

Limitations of CDT

- ① Scientific Rejection as gravitational & tidal forces were inadequate to explain movement of continents.
- ② It largely relied on jigsaw fit & fossil evidence, which were mere logical conjectures.
- ③ It gave no explanation for volcanism, earthquake etc. There was no explanation of mountain, trench etc. formation.
- ④ It could not explain paleomagnetism & evolution of oceanic crust.
- ⑤ It could not tell the mechanism of seismic activities. Thus, even though CDT was a Revolutionary Conjecture but it totally lacked scientific rigor.

Feedback

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Mentor Feedback Questions

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Test Goal

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Outcomes

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Marking Scheme

Mark	Good	Average	Below average
10 Marker	3.75 - 5.0	3.0 - 3.5	< 3.0
15 Marker	5.75 - 7.0	4.0 - 5.5	< 4.0
20 Marker	7.75 - 10	6 - 7.5	< 6
✓✓	Key / Relevant Point		
✗	Vague / Irrelevant		

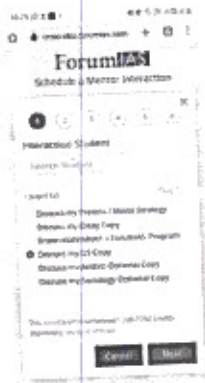
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