Next IAS ID: MT24GEORA008, GEO001, 16-08-2024 12:19 AM

NEXT IAS

(To be filled by candidate)

Name of Candidate : SAGAR KAUSHIK

Roll No. : GSMACT24A1320 **Contact No.** [redacted]

e-mail: [redacted] **Date of Examination :** 16-08-24

Exam Centre : Old Rajinder Nagar ☐ Online ☑

CSE (MAINS) TEST SERIES-2024

Test-01

Dated : 30-06-2024

GEOGRAPHY OPTIONAL

PAPER - I (SECTIONAL)

Time Allowed : Three Hours

Maximum Marks: 250

QUESTION PAPER SPECIFIC INSTRUCTIONS

(Please read each of the following instructions carefully before attempting questions)

*There are **EIGHT** questions divided in **Two sections** and printed in **ENGLISH**.*

*Candidate has to attempt **FIVE** questions in all.*

***Question No. 1 and 5** are compulsory and out of the remaining, any **THREE** are to be attempted choosing at least **ONE** question from each section.*

The number of marks carried by a question/part is indicated against it.

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 a medium other than the authorized one.

Word limit in questions, wherever specified, should be adhered to.

Attempts of question shall be counted in sequential order, unless struck off. Attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question cum Answer (QCA) booklet must be clearly struck off.

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(For filling by Examiners only)

Q. No.	Page No.	Max. Marks	Marks	Total	Signature
1. (a)	4	10			
1. (b)	6	10			
1. (c)	8	10			
1. (d)	10	10			
1. (e)	12	10			
2. (a)	14	20			
2. (b)	18	15			
2. (c)	21	15			
3. (a)	24	20			
3. (b)	28	15			
3. (c)	31	15			
4. (a)	34	20			
4. (b)	38	15			
4. (c)	41	15			
5. (a)	44	10			
5. (b)	46	10			
5. (c)	48	10			
5. (d)	50	10			
5. (e)	52	10			
6. (a)	54	20			
6. (b)	58	15			
6. (c)	61	15			
7. (a)	64	20			
7. (b)	68	15			
7. (c)	71	15			
8. (a)	74	20			
8. (b)	78	15			
8. (c)	81	15			
Grand Total					

Remarks

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Observations:

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SECTION-A

Write notes on the following in about 150 words each: **(10 × 5 = 50)**

Q.1 (a) Describe the geomorphic and ecological importance of weathering.

Weathering is a geomorphic process of loosening and disintegration of material (debris) from the rocks. Main driving force of weathering may be physical (temp. & pressure), chemical (solution formation) or biological.

1. Geomorphic importance of weathering

a.) In important exogenic force which facilitates erosion and leads to formation of landforms of second order. (Eg.) Drumlins.

b.) Cause enrichment of a particular mineral in rocks leading to ore formation. (Eg.) Bauxite ore formation.

c.) Primary reason for geomorphical disasters like landslides, avalanche etc.

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d.) A factor determining the type of landform & landscape devt.

2. Ecological importance

a.) Weathering of parent rock is the basis for formation of soil.

b.) Weathering determines the type of soil formed and inturn the type of vegetation supported.

c.) It also determines the type of biodiversity of a particular niche.

Eg. Shola forest over Nilgiri hills.

Thus, weathering as an imp. geomorphic process plays an important role in evolution of geomorphology & ecology.

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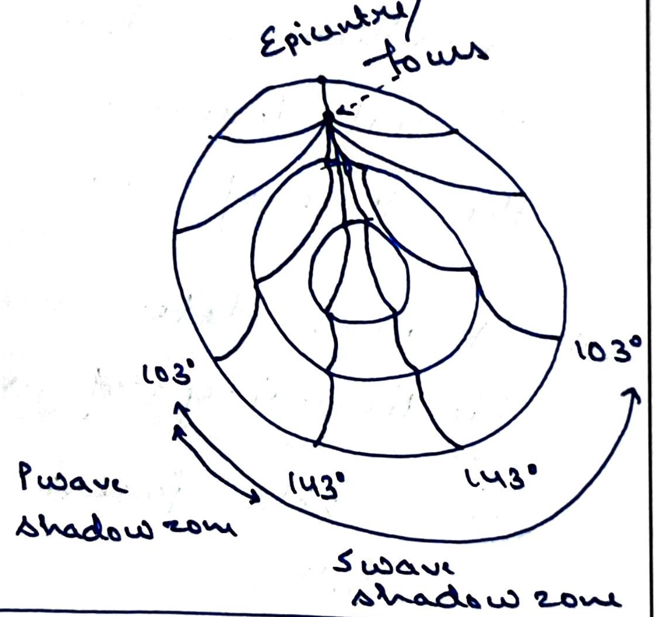
Q.1 (b) Define earthquake and discuss its geographical distribution.

Earthquake is the oscillation of surface of earth caused by a transient disturbance of the gravitational equilibrium of the rocks beneath the surface at focus.

Causes

a.) Vulcanicity

b.) Elastic Rebound theory of H.F. Reid.



c.) Hydro-static pressure & Anthropogenic causes.

d.) Convergent, Divergent & transform plate boundaries.

Distribution of Earthquake

a.) Around 70% of earthquake occurs in circum pacific belt overlapping

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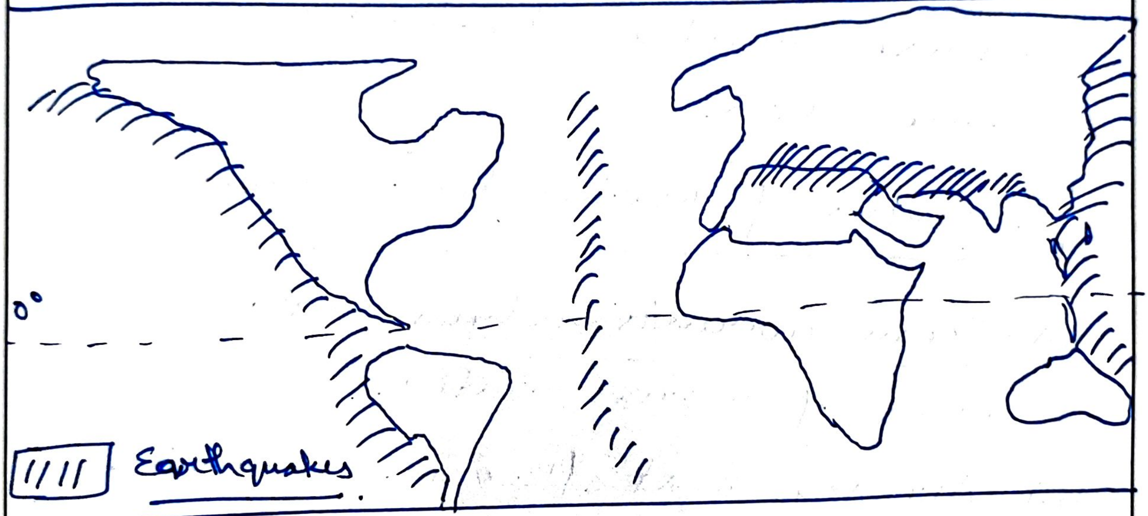
the volcanic hotspots.

b.) 20% are found/ observed in Mediterranean - Himalayan belt including Asia Minor, Himalayas & parts of NW China.



c.) At divergent boundary of Mid Atlantic Oceanic ridge.

d.) Rest in interiors of plates and on spreading ridges centre.

Earthquake is a catastropic endogenetic force which is an important factor of landform development

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Q.1 (c) What do you understand by Marine heat waves? Discuss how it impacts the marine ecosystem.

Marine heatwaves are prolonged periods of anamalously high Sea Surface temperature. for eg. Northern Bay of Bengal experienced intense marine heatwave in June 2023.

Drivers of marine heat waves

a.) Ocean currents which build up areas of warm water.

b.) Air-sea heat flux ie. warming through the ocean surface from the atmosphere.

c.) Climate modes like El Nino.

Impact on Marine Ecosystem

a.) Effects ecosystem structure by supporting certain species and suppressing others.

b.) Mass mortality of marine invertebrates.

c.) Coral bleaching, sea grass

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destruction, loss of kelp forests etc.

d.) Adverse impact on fishes.

e.) Change habitat range of certain species

f.) Loss of bio diversity.

g.) Destruction of coastal ecosystem.

h.) Increase in stressors such as ocean acidification, deoxygenation etc.

Thus, marine heat waves impacts marine ecosystem adversely.

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Q.1 (d) Write explanatory note on principle of denudation chronology.

Denudation chronology is the reconstruction of geomorphic history of a region in terms of no. of cycles of erosion. It reveals the evolution of present landscape.

On basis of concepts such as:

i.) Evidences of past landscapes are still apparent in existing topography.

ii.) Palimpsest topography.

iii.) Sequential changes in landform over time.

iv.) Cyclic Nature of Earth's history (James Hutton).

v.) Davisian Geographical cycle of erosion.

vi.) Principles of uniformitarianism (Hutton).

Processes involved

① Identification of erosional surfaces.

by morphometric techniques such as:

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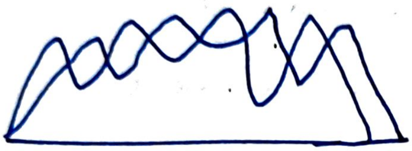
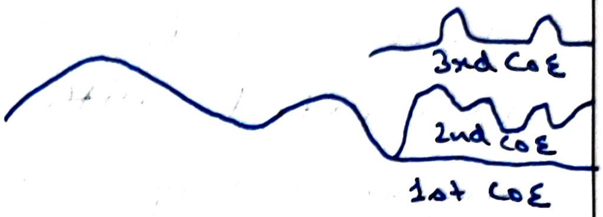
a.) Altimetric frequency histogram & curves.

b.) Field check

c.) Superimposed profile diagram



Superimposed profile



Palimpsest topography.

② Dating of Erosional surface by:

a.) Correlation technique.

b.) Radiometric dating

c.) Geological unconformity

d.) Sequence of sedimentation.

Issues in this technique

a.) Subjectivity: Degree of accuracy depends upon deductive power of chronologist.

b.) Highly deductive.

c.) Difficult to recover original form of landform because of modification by subsequent processes.

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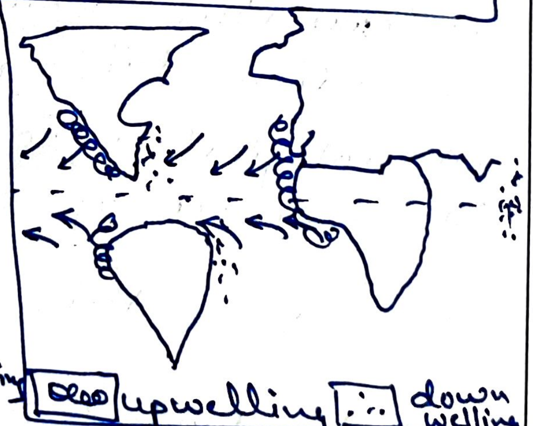
Q.1 (e) Describe different types of oceanographic conditions that produce up-welling and down-welling.

Upwelling and down welling are the positive and negative changes in sea level for a temporary time period. They are mainly associated with exchange of ~~enger~~ energy between water molecules.

Oceanographic conditions producing upwelling & down welling

1. Oceanic currents



- Oceanic current going away from coasts cause up-welling & downwelling at coast where they meet land.
- Mainly under influence of trade winds.

  (Eg.) Western coasts in tropical regions are zone of upwelling & eastern coasts are of down-welling.

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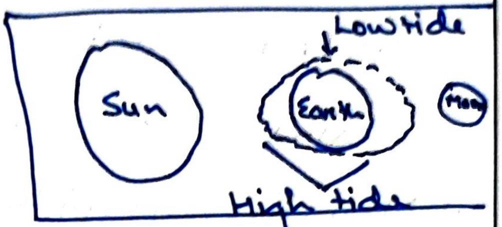
2. Tides

- Tides cause rise or fall of sea level under the impact of gravitational force of sun & moon.



- High tide is the zone of upwelling and low tide is the zone of downwelling.

3. Waves

- It is the generation of trough & ridges along the water.
- It may be due to air- water interaction, earthquake & volcanism under water etc.

Significance

a.) Zone of fishing as the up-welling brings nutrient rich water to surface.

b.) Role in spatial distribution of heat.

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Q.2 (a) Discuss the concept of isostasy and explain the global isostatic adjustment.

[20 Marks]

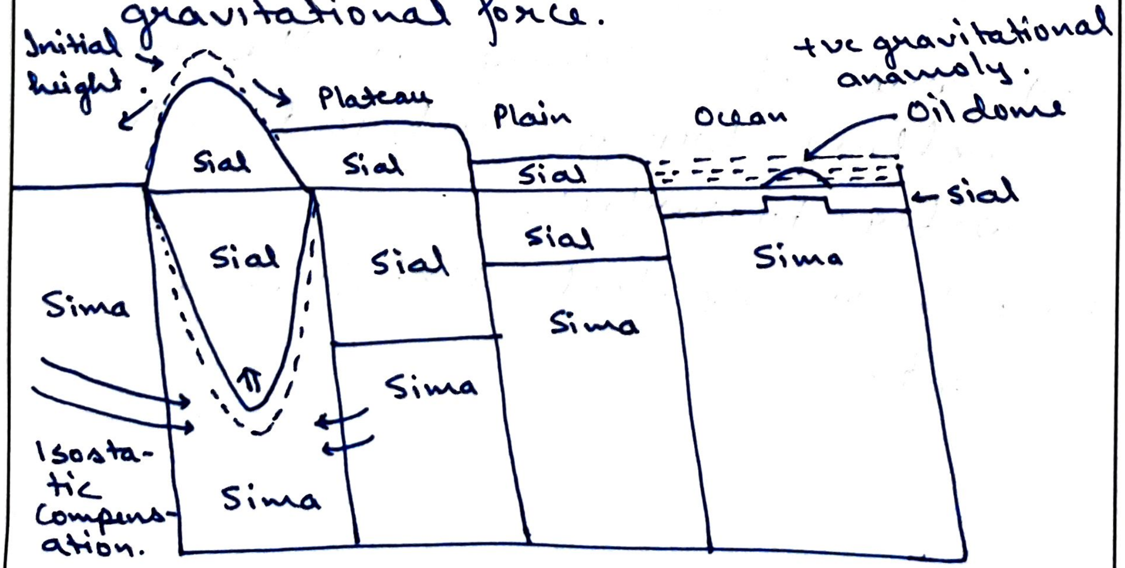
Isostacy is the state of gravitational equilibrium existing on earth's surface (between continents, ocean basins, mountains, plateaus, plains etc).

a.) Negative gravitational anamoly

① On earth crustal columns like Mts, plateaus (made up of Sial) floats over SiMa (underlying mantle).

② Taller the crustal column, more the weight leading to more deeper Sialic roots. It led to more displacement of denser SiMa, due to which column has overall low weight.

③ Low weight results in low gravitational force.



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b.) Positive gravitational anamoly in case of oceanic crust (having anti roots) leads to finding of oil.

Isostatic compensation

a.) Over a period of time, due to weathering and erosion of Mts, the height decreases.

b.) It leads to removal of load, resulting in less weight experiencing more buoyancy.

c.) Due to buoyancy exceeding viscosity upliftment takes place, which is known as isostatic compensation.

Isostatic adjustment

a.) The sediments removed from Mts. gets deposited on the adjoining landform (esp. oceans).

b.) It led to increase in weight of ocean bed resulting in displacement of underlying SiMa.

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c.) Underlying SiMa flows to Mts column in underlying mantle, which results into upliftment of Mts.

d.) This upliftment of Mts and flow of Sima (magma) is termed as Isostatic adjustment.

for e.g. Upliftment of Himalayas is a consequence of isostatic adjustment due to collision between Indian & Eurasian plate.

e.) When a tectonic plate undergoes subduction, the descending plate's denser material displaces mantle material, causing isostatic rebound and influencing plate movement.

Eg. Andes Mts (Nazca plate beneath South American plate).

Various theories explaining Isostacy

a.) George Airy's view

- Based on law of floatation.
- Density of different columns

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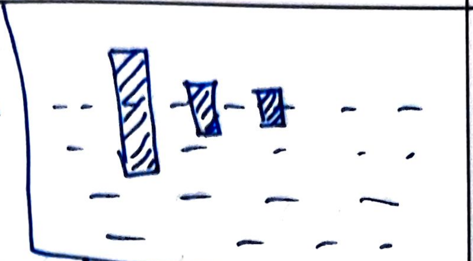
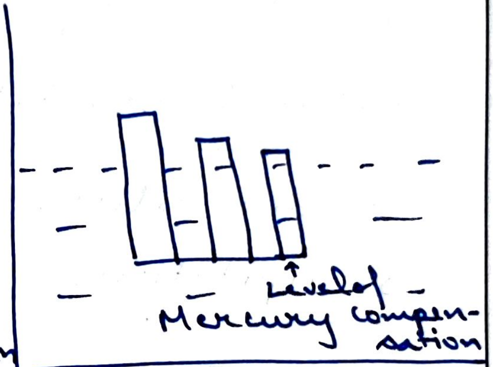
remain same, but depth in substratum varies.

- Depth is $\propto$ height of Column above substratum



Law of crustal rotation.

b.) Pratt's view



- Based on law of uniform depth with varying density.
- Inverse relation between height & density above level of compensation.
- But below level of compensation density is uniform.

c.) Current acceptance

- Truth lies in a compromise between Airy & Pratt view, Airy claiming wider acceptance.

(Eg.) Glacial adjustment of scandenavian countries

Thus theory of Isostacy describe about gravitational anamoly & increased understanding about Plate Tectonic theory.

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Q.2 (b) Examine critically the drawbacks of Koppen's classification of climates. Explain how Thornthwaite attempted to overcome Koppen's limitations. **[15 Marks]**

Koppen was the pioneer in the field of climatic classification. He classified climatic regions on the basis of natural vegetations and average mean values of temperature and precipitation.

Drawbacks of Koppen's classification

① It was primarily an empirical classification & doesn't take into account the causative factors.

② Not capable of climatic predictions.

③ He established association between climate & vegetation through reverse engineering, not through research.

④ He has taken discreet values of temp. & precipitation which are highly variable with space & time.

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⑤ Highly generalised and doesn't take into account the local variations.

⑥ Didn't considered humidity factor.

⑦ Never took into account meteorological phenomenon such as cyclones

⑧ Highland region is not emphasised.

⑨ He stated that As is absent, but in reality Tamilnadu experience it.

~~Thorn~~

Thornthwaite classification (1948)

He classified climates on the basis of

a.) Potential evapotranspiration:

It represents the amount of moisture that would be transferred to the ~~va~~ atmosphere from soil & vegetation by evaporation & transpiration.

b.) Determined 4 indices to determine boundaries of climatic regions:

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① Moisture index
② Thermal efficiency index
③ Aridity & humidity index.
④ Concentration of thermal efficiency.

Overcoming Koppen's

a.) Concept of soil water balance.
(causative or genetic factor)

b.) Reliance on evapotranspiration, unlike evaporation of koppen.

c.) Special & well researched classification.

d.) Used Quantification and laboratory analysis.

e.) At microlevel analysis, this classification holds better than Koppen's.

Hence, both climatologists contribute a lot to the understanding of different climatic regions of world in a Structured manner.

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Q.2 (c) Bring out the relevance of Seismic study in determining the structure of the interior of the earth. **[15 Marks]**

Seismic waves are the oscillations originated from the focus during earthquake.

Seismic study is an important source to know about physical conditions of earth's interior indirectly.

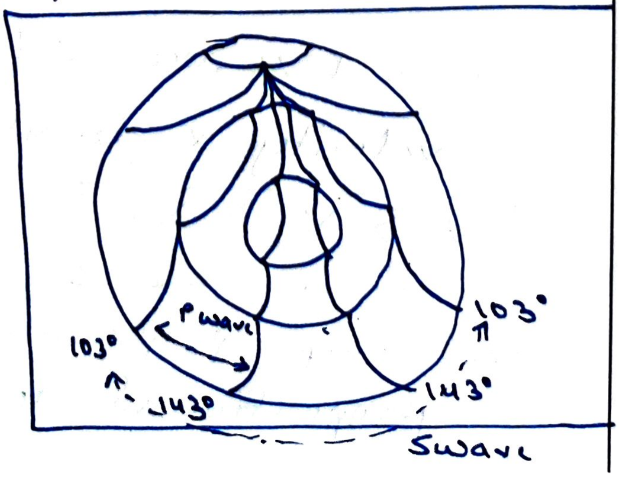
Relevance in determining structure of earth's interior.

① Different types of seismic waves interact differently with materials inside earth.

② This interaction depends on physical conditions such as temperature, density, pressure, rigidity, incompressibility etc.

③ Shadow zone of P waves & S waves tells about the state of matter in crust, mantle & core.

P wave : 103° - 143°
S wave : 103° - 103°.



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④ 2 important aspect of P waves & S waves, which tell about earth's interior:

1. Travel path : They follow curved path which shows refraction due to heterogeneity of earth's interior.

2. Velocity : It changes with density & state of matter.

- Velocity of p wave = $\sqrt{\frac{K+\frac{4}{3}\mu}{d}}$
- velocity of s wave = $\sqrt{\frac{\mu}{d}}$

$\mu = 0$ for liquid & gas

where, K = bulk modulus
μ = rigidity
d = density.

∴ velocity ∝ rigidity &
∝ K (incompresibility)

as K & μ are ∝ $(\text{density})^n$

∴ velocity ∝ density.

$\boxed{V_s > V_l > V_g}$

and temp. & pressure are inversely proportional to velocity.

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This helps in determining the discontinuities between two zones.

⑤ It also give insights into the earth geomagnetism as it describes outer core as molten.

Thus, Seismic study is an important source to know about ~~th~~ earth's physical condition inside below 200 km especially.

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Q.3 (a) Discuss the distribution and mechanism of extra-tropical cyclone [20 Marks]

Cyclones are low pressure centres. surrounded by closed isobars. which involves a closed circulation about low pressure circle. They are result of Gradient winds.

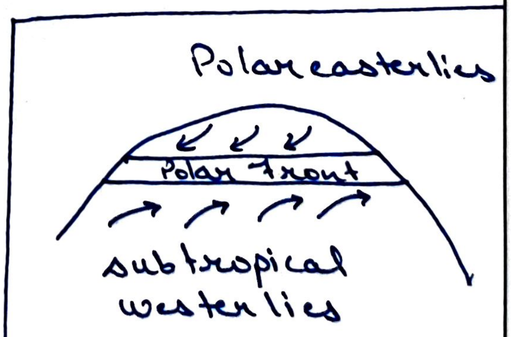
Mechanism of extra-tropical cyclone

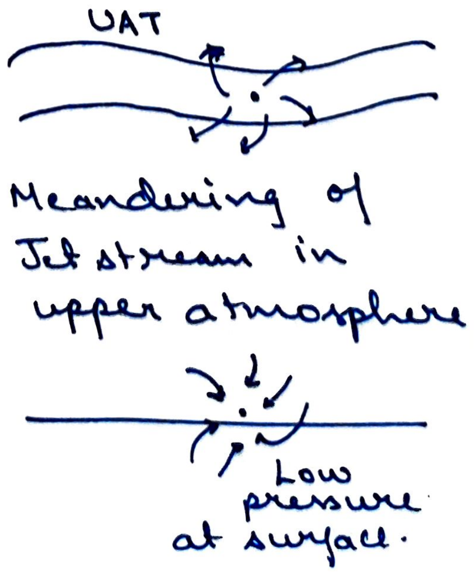
It can be explained through "Polar front Theory" put forwarded by V. Bjerknes & J. Bjerknes in 1980.

4 stages of form^n

1. Initial stage.

a.) Development of Polar front (stationary by opposite and parallel flowing easterlies & westerlies.





2. Incipient Stage

a.) Ahead of Upper Air Trough of

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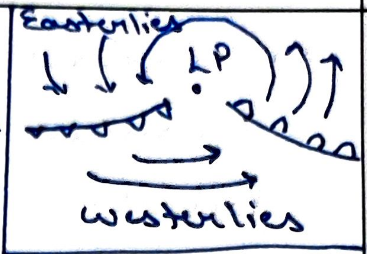
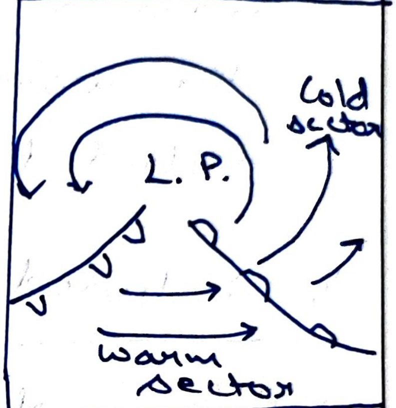
Rossby wave, there will be low pressure at surface which cause wave shaped discontinuity on polar front.



Stage II

b.) Easterlies & westerlies converge towards each other, around the low pressure centre. This is termed as cyclo genesis.



Mature stage

c.) formation of warm front (warm westerlies over riding cold polar easterlies) & cold front (cold polar easteries over riding warm westerlies)

d.) Due to divergence (ahead of UAT) in upper atm., this wave shaped discontinuity intensifies.

3. Mature stage

a.) Cyclone gets fully developed.

b.) Marked increase in curvature of cyclone.

c.) Marked demaricated cold & warm sector.

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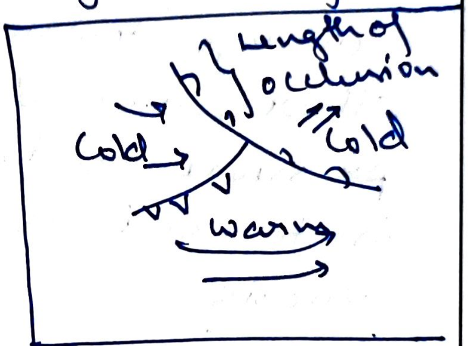
d.) Surface position of cold front advances faster than warm front. ⇒ reduce of warm sector ⇒ upliftment of entire warm air mass ⇒ cold front will overtake the warm front ⇒ formn of occluded front.



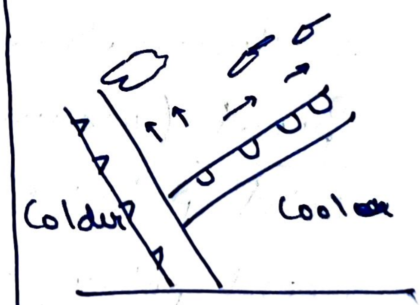
4. Occluded stage

a.) Process of occlusion takes place from apex and come down to all parts.

b.) of two types:

① Cold front occlusion:

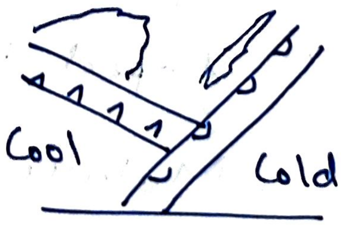
Cold air behind the cold front is colder.



Cold front occlusion

② Warm front occlusion:

Cold air behind the cold front is warmer.



Warm front occlusion

Distribution of extra tropical cyclone

a.) Mainly formed between 35°c to 65° (depends on apparent movement

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of sun)

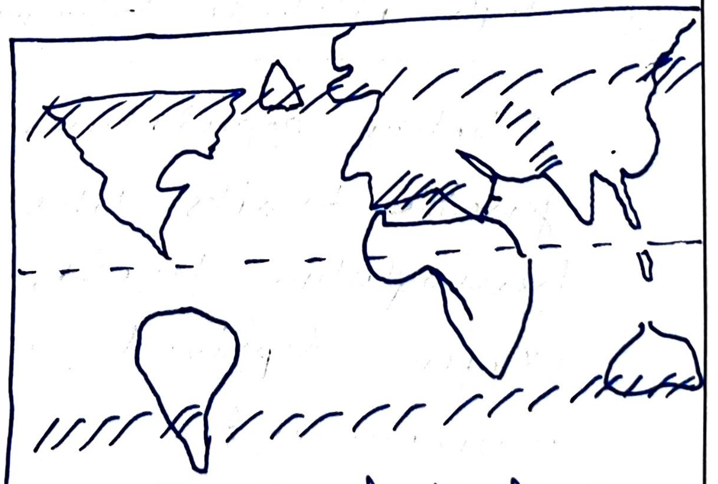
b.) Move along west to east under influence of westerlies.

c.) Can cover area upto 1.6 million sq. km

d.) Densly concentrated around icelandic low & Aleutian low.

e.) Cause rainfall along mid-latitude zone (40°- 50°) especially on western & middle part of continents.

f.) In winter they also cause rainfall till western India & Pakistan.



Temperate cyclones.

Thus, they are an important secondary circulation which helps in spatial distribution of heat.

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Q.3 (b) "What are human ecological adaptations, and how do they enable societies to thrive in specific ecological niches. **[15 Marks]**

Human ecological adaptations are the ways in which humans adjust to and interact with their natural, social and built environments.

Human Ecological adaptations

① Cultural adaptations : A population process where individuals use intelligence to discover locally adaptive information.

② High altitude tolerance : Eg. Tibetan populations have developed genetic traits like increased hemoglobin levels, to thrive in oxygen-deprived high altitude environment.

③ Heat tolerance : Indigenous population in hot climates may exhibit increased sweating efficiency and heat resistance.

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④ Cold climate adaptations: Inhabitants of polar regions may have developed adaptations like increased body fat to withstand extreme cold.

⑤ Dietary Adaptations: People of north west India are more lactose tolerant.

⑥ Skin Pigmentation due to adaptation to different levels of UV radiation.

⑦ Tradional Ecological knowledge: Allows sustainable resource use and minimizing environmental impact.

These are the human ecological adaptations, which enable societies to live in different niches.

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Q.3 (c) Describe the ideal conditions for coral reef formation and discuss the glacial theory of coral reef formation. [15 Marks]

Coral reefs are structure of limestones and dolomite secreted by Polyps. They contribute to 1% of earth's ~~cont~~ area but contribute to 25% of earth's biodiversity (Tropical rainforests of ocean).

1. Ideal conditions for coral reef formation

a.) Temperature around 20°C, ∴ found mainly in 25° N to 25° S.

b.) Upto 200-250 feet depth.

c.) Sediment free water as sediments cloggs the mouth of coral org.

d.) Highly saline water is not conducive as it lacks carbonate of lime (27% to 40% salinity).

e.) Fresh water is also harmful.

Eg. Great Barrier Reef is broken at places where river

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pours fresh water.

f.) waves & currents bring food and O_2 to polyps.

g.) Existence of submarine bench or platform within 50 fathoms.

2. Glacial Control theory by Daly in 1915

① Revolves around the central idea of changes in sea level during pleistocene period & coral reefs are formed after pleistocene ice age.

② During glacial period due to decrease in sea level & temp., chilling and killing of coral reefs occured.

③ New sea level led to formation of platform.

④ At end of ice age, sea level rised, leading to submerging of platform.

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⑤ It led to formation of new reefs on these platforms:

a.) Fringing reefs on narrow platform
b.) Barrier " " broader " .

⑥ Criticism of theory

a.) No evidence of death of corals during glacial period.
b.) For barrier reefs broad platform is not required.
c.) Sea level can't change upto such extent i.e. 300 m.
d.) Platform can't be uniformly cut to justify uniform depth of lagoon.

Coral reefs are home to biodiversity and due to climate change they are bleaching. It is need of the hour to check this through tech. like Cryomesh technologies.

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SECTION-B

Write notes on the following in about 150 words each: **(10 × 5 = 50)**

Q.5 (a) Explain the processes of heating and cooling of the atmosphere.

Earth's atmosphere is an envelop of gases and aerosols along with dust particles which tries to maintain average temp. of around 16°C. This maintenance of temp. occurs through spatial balance of heat. via cooling & heating.

Processes of heating & cooling

1. Diabatic process

- Continous exchange of heat of air parcel with surrounding.
- Operates only on stationary or horizontally moving air over surface.
- Heating or cooling take process through convection from surface below.
- It led to formation of dew, fog, frost etc.
- Releases or absorbs latent heat of condensation or vaporisation resp.

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2. Adiabatic processes

- No exchange of heat between an ascending air parcel & environment.
- Heat content remains unchanged.

a.) Cooling

Rising air parcel ⇒ Less atm. pressure ⇒ expansion ⇒ decrease in temp. ⇒ High Relative humidity ⇒ Condensation (unstability).

b.) Heating

Descending air parcel ⇒ High atm. pressure ⇒ contraction ⇒ Increase in temp. ⇒ Low relative humidity. ⇒ Stability.

Factors leading to temp. change

- Frontogenesis
- Tropical cyclones form"
- Temperature inversion.
- Moving of air masses.
- Atmospheric circulation.

Thus, processes of heating & cooling helps in sustainance of biosphere.

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Q.5 (b) Write short note on Desert Ecosystem.

Desert ecosystems are maily characterised by excessive evapotranspiration as compared to precipitation.

1. Climatic condition

a.) Areas of low precipitation & extreme temperature.

b.) Cloudiness is almost absent.

c.) wind are dry Eg "Loos" in summer of India, Harmatten in Sahara desert.

2. Flora

a.) Has Xeric habitat.

b.) Has modification to avoid water loss. Eg Leaves are absent & transformed into thorns.

c.) Low level of biodiversity.

d.) Species present are: Cactus, Babool, bel etc.

e.) Tropical deciduous forest,

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grass lands are present. on margins.

3. Fauna

a.) Mainly active towards night to avoid water loss & heat.

b.) Surface dwelling animals.

c.) Low biodiversity.

d.) Species are Camels, rats, squirrels etc.

4. Landscape

a.) Desert can appear as barren landscapes covered in dry sands, rocks or sand dunes.

b.) Landform features: Seif, Barchans, shifting sand dunes etc.

The desert ecosystem is a terrestrial ecosystem that covers around 17% of earth's surface and is found on almost every continent.

Q.5 (c) Why volcanic eruptions are environmental hazards?

Volcanic eruption is a process that propels the magma as well as solid fragmental pyroclastic material with violent gases from beneath the earth onto the earth surface.

Volcanic eruptions as environmental hazards

a.) Impact on climate

- Release GHG such as CO_2, water vapour etc which contribute to global warming.
- Cause of acid rain: SO_2 released reacts with water to form H_2SO_4 & cause acid rain.

b.) Cause of earthquakes

c.) Pyroclastic flow cause destruction by incinerating everything in their path.

d.) Volcanic ash affect air quality & also covers building & human settlement causing

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devastating impact.

e.) CO_2 and fluorine gas can pollute the regional environment making it difficult for humans & animals to breathe.

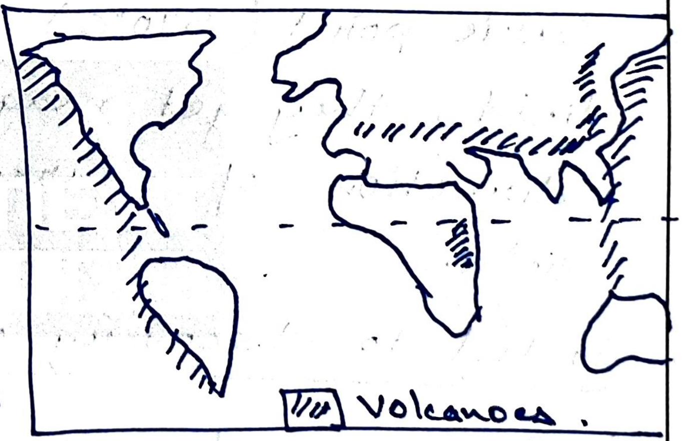
Distribution of volcanoes

- found in 3 well defined belts:

a.) Circum-Pacific belt (Pacific Ring of fire.)

b.) Mid World Mountain belt

c.) African rift valley.



Hence volcanic eruption are environmental hazards which needs proper mitigation & disaster management strategies.

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Q.5 (d) Write the short note on paleomagnetism and geomagnetism.

a.) Paleomagnetism

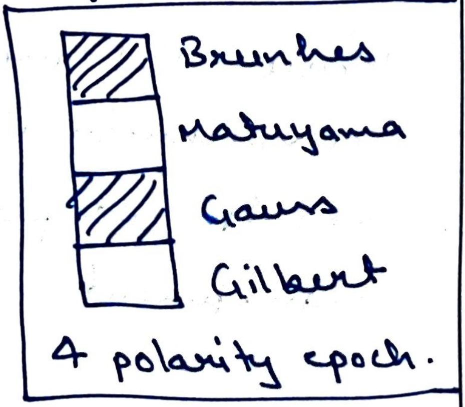
It can be described as preservation of magnetic properties in the older rocks.

The principle involved is Thermo-remanent Magnetisation i.e. when magnetizable materials cools below Curie point (570°C) in a magnetic field, they get magnetised in the direction of surrounding magnetic field.

It led to discovery of

i.) Polar wandering & moving lithosphere (basis of plate tectonic theory).

ii.) Reversal of Earth's magnetic field after every 0.5 mya.



4 polarity epoch.

iii.) Sea floor as magnetic tape recorder validating Sea floor spreading theory of Harry Hess.

b.) Geomagnetism

- Earth's geomagnetism can be described by a model of parmanent bar magnet at centre, inclined 11° from geographic axis.

- Origin

i.) High temp. of core (~ 6000°C) shows impossible permanent magnetization, ∴ magnetic fields are continously produced & maintained.

ii.) Outer core having high thermal & electrical conductivity works as a dynamo.

iii.) It creates magnetic fields as thermal convection currents works as rotating coil.

Significance
- Creates an envelop of magnetic field around earth.
- Protects earths from solar flares, solar geo-magnetic storms etc.

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Q.5 (e) Compare and contrast the terms exogenic process and endogenic process.

The various landforms of earth surface are the outcome of complex interaction between the endogenic & exogenic processes.

Endogenic process	Exogenic process
• By forces eminating from inside the earth. i.e. epirogenic forces & orogenic forces.	• By forces eminating from above the earth's surface (water, wind etc.).
• Led to formation of landforms of first order.	Led to formation of landforms of second order.
• Constructive forces forming initial landforms. Eg. Mountains due to compressional forces.	Destructive forces leading to disintegration & movement of rocks, soils, minerals etc. Eg. Peneplain form.
• May be catastropic Eg. Earthquake	Mainly slow forces. Eg. weathering.
• Types of forces are radial & tangential.	• Types of forces are gravity, molecular stress etc.

Similarity between both processes

a.) Both are the factors which controls landform development.

b.) Both depends on structure, stage and time.

c.) Both can act slow, imperceptibly and inexhorably. (Eg.) Weathering and compressional forces.

Hence, both plays an important role in evolution of earth's biosphere & contination of bio-geo-chemical cycles.

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Q.6 (a) Explain frontal depressions and its associated impacts on weather conditions. **[20 Marks]**

A frontal depression is a low pressure area formed at the boundary between two different air masses. (Eg.) Polar front between cold easterlies and warm westerlies.

Characteristics

a.) Marked by abrupt change in weather elements like temperature, pressure, humidity etc.

b.) Has vertical extent upto tropopause and horizontal upto 1000 km.

c.) Temperature contrast is directly proportional to width of frontal zone.

d.) Abrupt wind shift occurs at front.

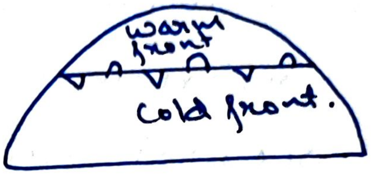
e.) Once formed, they are mobile & displaced by planetary winds.

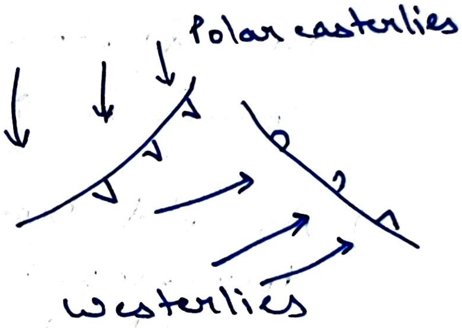
f.) Associated with cloudiness & precipitation.

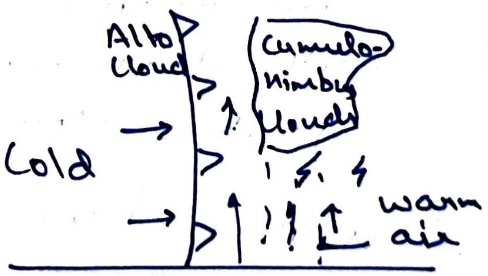
g.) Type of clouds & precipitation depends upon slope of front and amount of moisture in ascending air mass.

Types of frontal depressions and associated weather conditions

1. Cold front







① Created when cold air is active and forces warm air to uplift. around low pressure region. (Eg.) Ahead of upper air trough.

② It has steep slope, sloping backward because of friction. It results in no forecast of approaching cold front.

③ Weather associated

a.) Vertical upliftment of warm air & its adiabatic cooling results

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in formation of cumulonimbus clouds along with thunder & lightening.

b.) Cumulonimbus clouds cause heavy rainfall in short duration over a small area.

c.) In warm sector, temp. is high, pressure is low and due to occasional rise of air, stratus or stratonimbus clouds get formed. ⇒ Light rainfall.

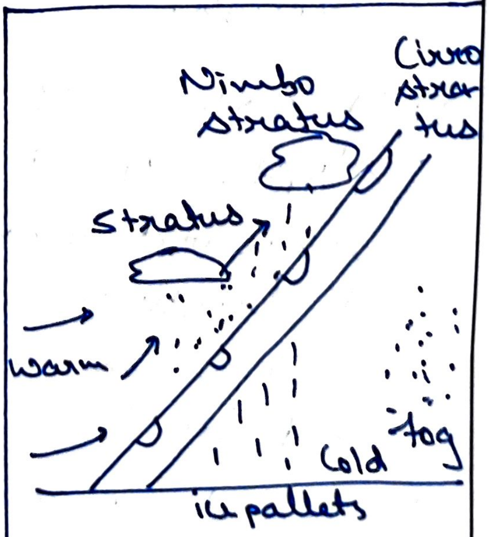
d.) As cold front approaches, visibility decreases.

e.) In cold airmass, atm. is stable ⇒ low temp., high pressure along with clear sky and cirrus & stratus cloud.

2. Warm front

① Formed when warm air is active and overrides over cold air.

② Slow rate of upward movement of air leading to gradual cooling & condensation.



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③ Weather associated.

a.) Due to gradual cooling, clouds with horizontal extent gets formed.

b.) These clouds cause moderate rainfall over large area through nimbo-stratus clouds.

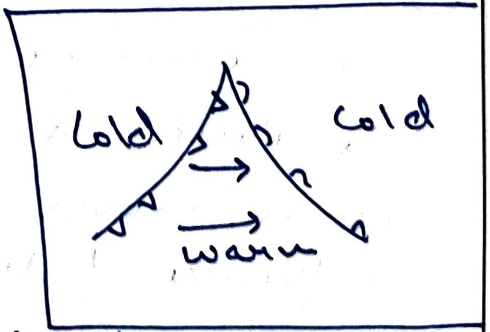
c.) When water droplets pass through cold airmass they freeze in form of ice pellets.

d.) Warm & moist air will be cooled from below leading to Advection fog.

e.) In cold airmass: low temp, high pressure stable weather, clear sky with cirrus cloud.

f.) In warm air mass: high temp., low pressure. clear sky but occasional lifting of air.

3. Occluded front



① As surface position of cold front is more it will overtake warm front & cause uplifting of warm air ⇒ Occluded front

②. formed when cold air from behind meets cold air ahead.

Thus, frontal depressions play a significant role in impacting local weather condⁿ.

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Q.6 (b) Discuss the importance of the ITCZ as a climatic control throughout the tropical regions. **[15 Marks]**

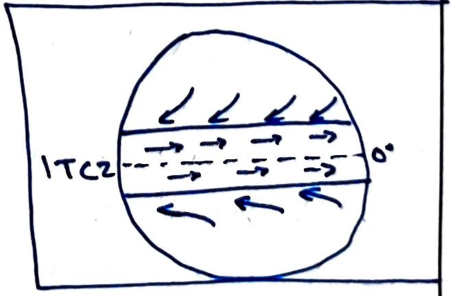
Inter Tropical Convergence Zone (ITCZ) is a zone of low pressure, characterised by slowly moving doldrums from west to east.

It is a zone of convergence of trade winds from subtropical high pressure belt.

It mainly formed around 10° N to 10° S, but moves along the apparent movement of sun.

Importance of ITCZ as climate control

① Spatial distribution of heat as counter equitorial currents in Pacific & Atlantic ocean moves under influence of doldrums



② Plays important role in formation of dynamic component of monsoon.

③ Sometimes North Equatorial current

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of Pacific gets intensed & replaces peru current causing phenomenon of El nino.

④ Plays an important part in teleo-meterological communication across world.

⑤ Shifting of ITCZ brings several areas under monsoon. Eg. East Asian monsoon.

⑥ It's shifting decides the date of onset of monsoon in Indian and its intensity determines the amount of rainfall.

⑦ In ITCZ, due to humid atm. the temp. range remains very less.

⑧ Regulation of heat through increased cloud cover in tropical areas.

⑨ Acts as incubator where tropical cyclones originates.

Thus, ITCZ plays an important role in determining the climatic

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condition throughout the tropical regions.

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Q.6 (c) Highlight major causes of soil degradation and methods of soil conservation.

[15 Marks]

As per UNCCD, 30% of land is undergoing degradation.

Soil degradation is the process of removal of fertile upper layer of soil, leaving it unfit for cultivation or vegetation growth.

1. Major causes of soil degradation

a.) Soil erosion : loosening and detachment of soil particles from soil mass & transportation to down slope.

Types

① Water erosion
- Raindrop erosion
- Sheet erosion
- Rill erosion
- Streambank erosion

② Wind erosion
- By Siltation
- By suspension
- By surface creep.

Anthropogenic activities accelerating soil erosion!

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① Deforestation

② farming practices

- Tilling or ploughing
- Continous cropping
- Cultivation on mountain slopes
- Over grazing.

③ Mining

④ Developmental work, human settlement & transport.

b.) Anthropogenic causes of soil degradatio

① Use of agrochemical (chemical fertilisers & pesticides) causing soil pollution.

② Excessive irrigation causing soil salinization.

③ Increase pressure on soil.

2. Methods of Soil conservation

a.) Increase vegetation cover to protect soil surface from direct impact of raindrop.

b.) Reduce the volume & velocity of overland flow and enhance infiltration through tree planting.

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c.) Measures of crop management in plain areas:

① Early sowing of crops i.e. before monsoon.

② Inter cropping / Mixed cropping ensuring one standing crop at all time.

③ Stubble mulching.

④ Increasing organic content by organic fertilizers.

d.) Mechanical protection devices in hilly areas:

① Contour farming

② Tied ridging.

③ Terrace farming

④ Contour bunding

⑤ criss-cross ploughing

e.) Awareness campaigns like "Save Soil" movement by Isha foundation

Thus it is need of hour to conserve soil to ensure sustainability of biosphere.