Geog
VISION IAS
(1403)

U.P.S.C.

प्रश्न संख्या (Question No.)

इस भाग में कुछ न लिखें (Don't write anything in this part)

Geo

(1). Explain how the theory of plate tectonics helps in understanding the mechanism of volcanism.

(A) The theory of plate tectonics postulated by Alfred Wegener is used to explain the mechanism behind various geomorphic processes of the world.

Arthur Holmes

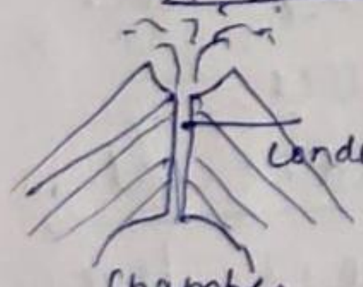
← PLATE TECTONIC THEORY



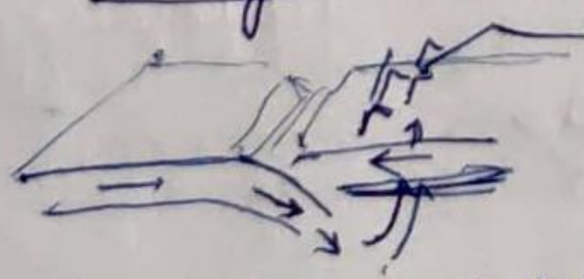
→ Under this the surface or crust of Earth, ~~the upper~~ is divided into a ~~few~~ seven major and various minor tectonic plates - which are constantly moving.

→ Movement is responsible for creation of continents, mountains, expansion of ocean floor etc.

VOLCANISM - refers to the upwelling of molten lava from beneath the earth's surface, emerging from a vent through a conduit linked to the ~~atmosphere~~ magma chamber below.



(A) Convergent plate boundary



→ When 2 plates move towards each other, one is subducted below the other, leading to melting due to compression and heat under pressure.

→ The molten material often comes up as explosive volcanoes and mountains

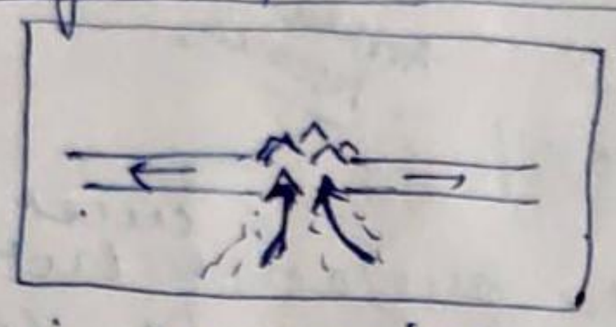
Eg: Ring of Fire in Pacific Ocean →

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due to convergence of Pacific and Eurasian plate and Pacific & North American plate.

Aleutian Islands (Pacific subducted under N American plate)

(A) Divergent plate boundary



• This is associated with expansion of sea floor, rift and volcanoes at the middle of the ocean.

Eg Mid Atlantic Ridge - divergence of North American and Eurasian plates.

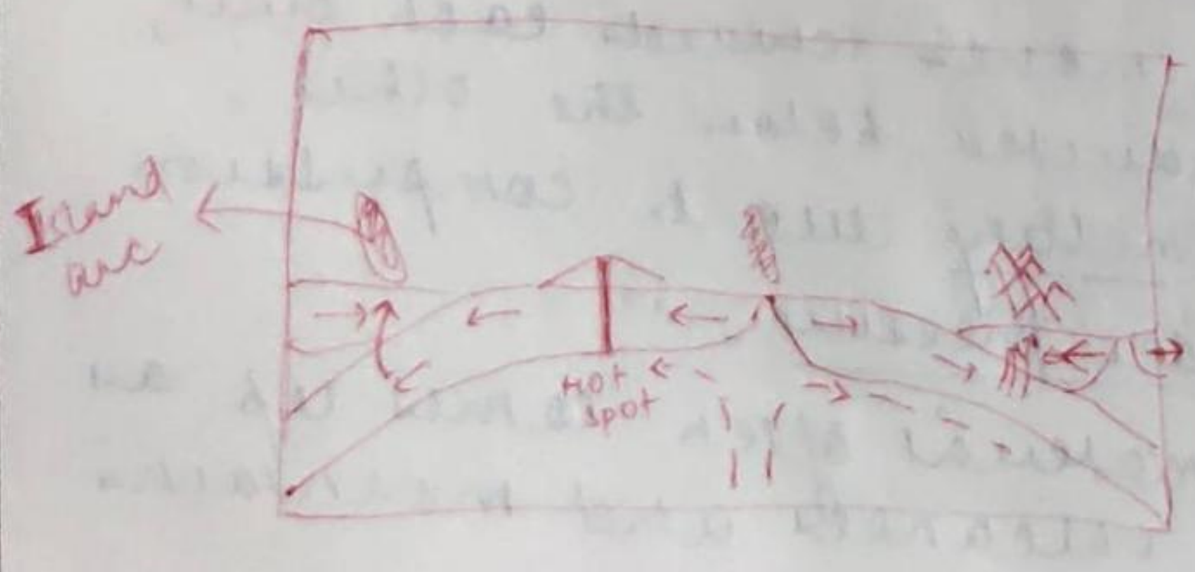
• The East African rift valley also experiences volcanoes.

→ divergent boundary on land. Mt Kilimanjaro (Kenya) Nyiragongo (DRC)

This while plate tectonics determine the location and nature of volcanoes, various other factors like rock material, geographical topography etc affect their explosivity, shape or formation etc.

→ Some criterion of plate (internal plate deformation, mantle plumes)

• High intensity - Indonesia



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Dis. — Spate of disasters in recent past → Disasters → Manmade / Natural

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(2) Discuss how technology can help India cope with disasters.

(A) The Global Climate Risk Index ranks India as the 5th most vulnerable country to climate change. even as we see the intensity and frequency of natural and manmade disasters rising over the years in India.

2024 (7M)

Since the nature of threat is changing, NEW PROBLEMS NEED NEW SOLUTIONS

ROLE OF TECHNOLOGY

(I) CAPACITY BUILDING

(A) PREVENTION → Hazard mapping - eg use of ISRO Landdegradation map. for identifying areas prone for disasters

- GPS, GIS Remote sensing - multi layer geo-referenced info

- Use of drones for aerial mapping.
- Red Atlas Initiative - mapping areas. for floods in Chennai

- Seismic zoning
- Google + CWC → Patna - urban floods (AI) based model - estimate flood level 5 hrs
- path of cyclone (Ensemble Pred. Sys).

(B) MITIGATION & REDUCTION OF RISK → Effective warning systems

- Odisha - Early warning Dissemin. Sys (EWDS) - dig. mobile radio remotely op. siren systems
- eg GEMINI - GAgan enabled early warning system for fishermen to ~~slo~~ ~~pas~~ reduce cyclone related deaths

- Better engineering for seismic resistance - Japan
- IMD - Ensemble Prediction System

- Use of e-governance Involvement of panchayats through e-conferencing.
- warning through apps - CFLOWS, MFLOWS - floods in Chennai & Mumbai

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(II) RECOVERY

(A) RESPONSE & REHABILITATION → use of drones for precision landing of essential stuff.

• Infrared cameras, Advanced listening systems — survivors from rubble/ fire

• aerial robotic (↳ live streaming / night footage)

Establishment of specialised communication systems in case of disruption in internet & phone services.

Phone based / online counselling services for dealing with trauma.

EWDS
Drissa - digital mobile radio remotely operated such systems

(B) BUILD BACK BETTER - in line with Sendai framework to reduce future vulnerability

Space tech → planning

* Big Data Analytics.

+ ↳ cloud tech. Kerala - 'Certificate adalat' record lost certificates in floods.

↳ Use of data analysis systems, artificial intelligence to identify disaster prone locations and building design models.

↳ Investment in further research to develop ~~be~~ newer ~~e~~ fire proof / water proof material to be used in buildings.

Amphan technology ↳ Sendai ↳ NDMA

Moreover it is important to realise that technology is only an enabler and not a replacement for effective and coordinated decision making and long term disaster planning as can be seen in the successful response of Orissa towards Cyclone Amphan.

NDMA Act 2005

NDMRI

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(3) Bring out importance of community based disaster Mgmt in India.

(A) UN Conference of disaster Risk Reduction has claimed that a country stands to lose 4% of its GDP in case it doesn't invest in disaster resilient infrastructure.

However mere spending is not enough → Involvement of the community is crucial.

IMPORTANCE OF COMMUNITY MANAGEMENT

- Ⓐ A top down centralised approach remains unaware of day to day practical challenges. It uses a 'one size fits all' approach.
  - ↳ to understand culture & behaviour
  - ↳ better designed preparedness.
- Ⓐ Utilisation of local traditional knowledge. Can prove useful eg indigenous tribes have unique early warning systems to predict future storms and cyclones. eg ~~IOD~~ ALN → tsunami
  - Resource inventory & analyse local res.
  - Sacred groves → prevent impact of cyclone
- Ⓐ Manage to bring in greater balance with the environment.
  - eg: indiscriminate development in Uttarakhand could have been avoided
    - systems of water harnessing, flood mitigation — creation of natural tanks. dong bundh system etc.
- Ⓐ Decentralisation of decision making allows greater social accountability → quick response
  better allocation of limited funds.
  - Multi stakeholder participation
- Ⓐ SUCCESSFUL EXAMPLES

1st to experience & most imp link in disaster response

Investment in capacity ↓ Hazard x Vulnerability / capacity

✓✓

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(A) ~~Odi~~ Kerala - Involvement of Kudumbashree - local women organisations - ensure greater involvement and passion for working for the community

→ can ensure better response - due to informal links with the people.

→ Miyawaki model of reforestation being implemented with local help.

(B) Odisha → Role of large women SHG network ~~is~~ is of great help.

→ Decentralised ~~dec~~ and granular decision making approach led to quick and effective response in evacuation efforts in Cyclone Fani, Amphan etc.

Thus the successful model of these 2 states should be encouraged, involving a multi-stakeholder approach for a multi pronged response to the multiple range of disasters threatening the country.

mentioned in NDMP Sendai -

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Cryosphere
Cinarral thermometer
4 earth

(4) What is ice albedo feedback, how it rel. to climate Δ?

(A) The snowcover across the world, besides fulfilling aesthetic and cooling purposes is also known to have one of the highest albedos i.e. ability to reflect sunlight falling on it. Ice albedo feedback refers to this function of ice - which ensures stability in the heat balance of the earth.

Arctic heating up twice as fast as RO
↳ due to ice albedo feedback mechanism

Arctic - earth's air conditioner.

RELATION TO CLIMATE CHANGE

(*) climate change is a function of the shift in the heat balance

diagram ↗ in albedo snowcover sunlight exposed ↘ ocean

Relation
- help in cooling of earth
- Influences surface energy, greenhouse gases, water fluxes eg Δ in Arctic sea ice — affect mid latitude atmosphere circulation
- Polar region — carbon sink

Recent changes

- Growth in amount of black carbon and brown carbon - soot particles is decreasing the albedo of snow.
- Industrialisation, blowing of westerly winds towards the Himalayas etc is causing heating and melting of snow.

change in precipitation patterns

Affect on hydrological cycle → increases ocean ↳ lower albedo

IMPACT

⇒ Heating of ice bergs and snow cover at the poles esp Antarctica is leading to sea level rise

⇒ With 10% of world's population living within 100 km of the coast — great threat of submergence of nations like Indonesia, Bangladesh

⇒ Greater absorption of heat due to reduced albedo → increase in global warming

Methane release (due to warming) ? permafrost

Warming ↓ Melt ↓ Ocean

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→ Himalayan rivers - are dependent on Hindu kush mountains - where snow cover is declining → impact on societies dependent on rivers

→ changing of temperatures, flora and fauna, entire ecosystem - may lead to extinction of entire species.

→ All the above changes in vegetation and flora, alongwith latent heat released during ~~the~~ ice melting

↳ further warming

↳ climate change

↳ further ice melting.

WAY FORWARD

Tackling climate change is not a one step solution and needs multiple sector and multi stakeholder analysis.

- Reduction of generation of black & brown carbon can be one of the steps, as the cryosphere is an important determinant of climate change.

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प्रश्न संख्या (Question No.) (1)

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Why ↑ in frequency of glacial lake outburst floods across the world? Highlight measures. - to tackle floods =

The IPCC special report on the Ocean & Cryosphere, has recently highlighted the precarious position of glaciers and ice based landforms in the world. — due to increasing global warming and pollution threats

RISE IN GLACIAL LAKE OUTBURSTS ?

Human → Rise in population → Rise in CO_2 → Heating
→ Consumerism → breeding industrialisation - Increasing debris cover
→ Overuse of thermal energy - black carbon.
→ Increasing tourism in mount. regions
→ Aerial pollution.
→ Overexploitation of limited resources and unsustainable construction

Natural → Rise in global warming
→ Stresses in earth's crust
→ Increased permafrost & glacier temp.

MEASURES TO TACKLE → Disaster = Hazard x Vulnerab / capacity

∴ Need to reduce vulnerability and enhance capacity.

① PREVENTION → Avoiding developmental work in hilly and ecologically sensitive regions
→ Shift towards sustainable living - minimalism and sustainable energy - to avoid thermal pollution.
• Reducing volume of water
• Inventories of glaciers and glacial lakes using GIS, GPS
• afforestation
• check dams
outlet Control Structure
GLOF → Hazard zoning

② MITIGATION AND RESPONSE → Use of quick warning systems for speedy evacuation
→ Use of ICT
→ Stores for delivery of essential items
→ Dev of apps like CFOWS & MFLOWS

EIA

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OAC → EWS - GLOF system for Sikkim govt

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(3) RECOVERY, REHABILITATION & RECONSTRUCTION → Ace to Sendai Framework 'Build Back Better'

- Use of traditional techniques to build sustainable and environment friendly housing, not near the lake.
- Development of 'eco-tourism' models.
- Giving stakes ~~and~~ to local community, encouraging decentralised community disaster management and knowledge-

WAY FORWARD

Besides practical role of community and NDMA, research and development on the lower threat of glacial lake outbursts should be comprehensively undertaken at the National Disaster Mgmt Research Institute

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(2) Cyclonic activity → Arabian region – ↑ frequency.

CHANGES

- ↑ in no.
- more intense.
- timing
  - closer to coast
  - originally ~~further~~ closer from equator, also more time to gain speed

WHY?

- global warming – warming of ocean.
- El Nino – La Nina ..
- Indian Ocean dipole
- Favourable wind condition
- Indonesian throughflow
- El Nino Modoki

Can't control occurence — must be well prepared

~~4 principles of Sendai~~ GEMIN

- weakening of wind shear

IMD → Arabian Sea 400% more cyclones in 2019

– 5/8 cyclones in 2019 — AS

NASA → 17 mm ~~pt~~ Indians living below HTL

8% of land area, 1/3rd of popn → vulnerable ~~cyclones~~

NA

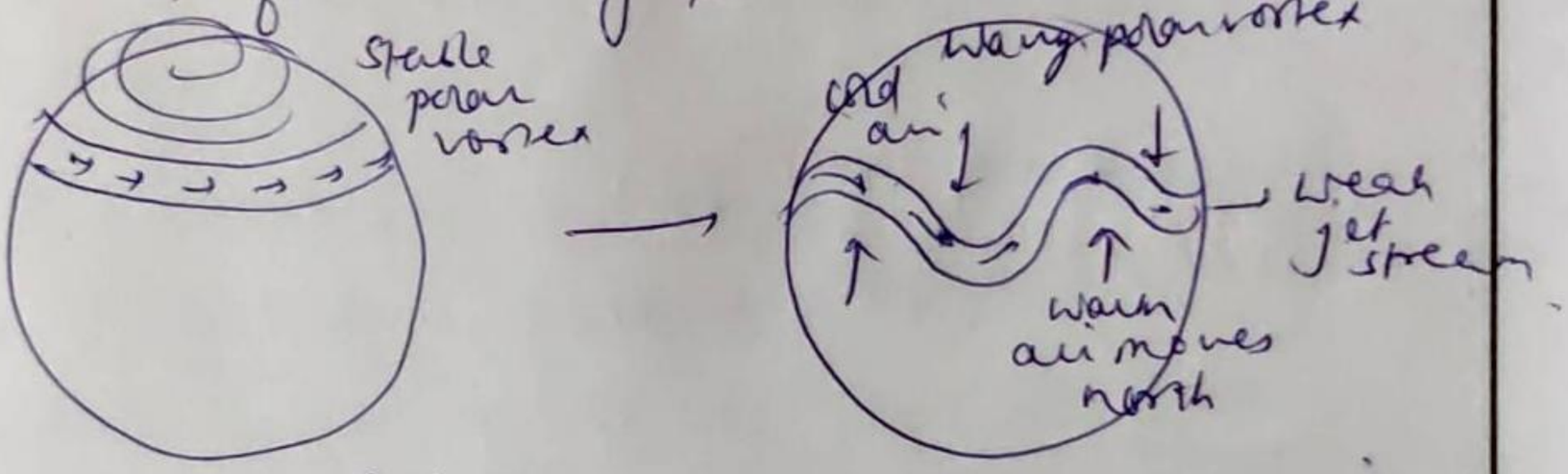
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Explain phenomenon of sudden stratospheric warming witnessed in recent years. How does it affect the ozone hole formation over Antarctica?

- Usually in Northern Hem. (chilly 3rd yr) — sudden ↑ of 50°C within few days
  - ② Altitude of <10km.
  - ③ planetary scale waves form, propagate upward into stratosphere → where they dissipate

NOW in Southern Hemis

Winter → strong stratospheric westerly winds circulate around both pole
↳ formation of polar vortex



Tilt of Sun → warming of stratosphere above South Pole. → weakening of polar vortex → reversing westerly winds

Effect on ozone hole formation

sudden stratospheric warming

↙ Restriction of formation of stratospheric clouds.
↓
limiting ozone depletion

~~Mixing~~ Mixing of air btw mid latitudes & polar region →

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(8) Explain concept of volcanic winter giving examples.

Sulphur aerosols → reflect incoming solar radiation

eg
- Mt. Pinatubo (Philippines) — 1991 — Sulawesi islands.
  - ↳ 0.5°C ↓ global temp
- Krakatoa eruption
- Mt Tambora
- Yellowstone super volcano (USA) could plunge 'deep freeze' — ↓ 15°C global temp

Effects

→ Ash cloud. - thicker cloud formation - blocking sunlight
- air traffic

→ Disruption of weather patterns. - cooler temp, crop failures.

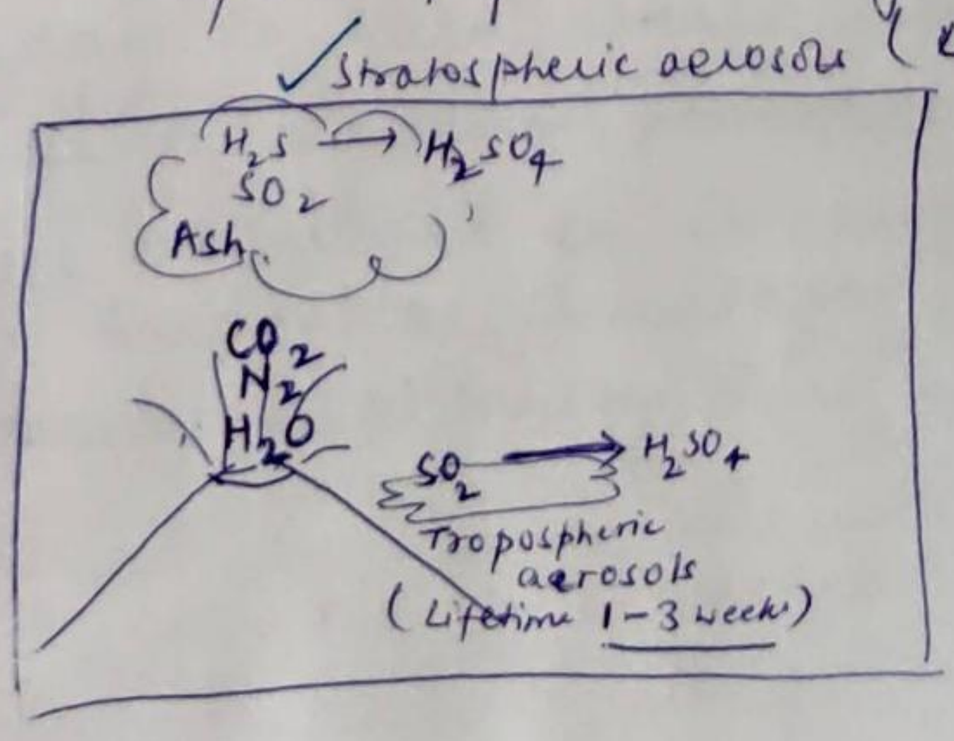
→ Stratospheric warming - affecting air circulation

→ Ozone depletion - Release of chlorine, bromine, aerosols.

→ Acid rain - poisoning soils, stripping vegetation

→ Marine biology → ↓ sea temp, ↓ deep water upwelling — hampers nutrient flow.

→ Polar bottleneck.
↳ Sharp decrease in species pop → ↓ gene pool.



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प्रश्न संख्या (Question No.)

U.P.S.C.

Harry Hess

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(9) Evidences in support of sea floor.

- age. - similarities in pdg formation, chemical comp magnetic properties
- palaeomagnetic, magnetic anomalies - symmetrically arranged on both sides of axis creating bands
- Heat flow
  - high values @ mid oceanic ridges
- Marine sediments - only go upto Jurassic against theory of permanency of ocean basins
- Low seismic wave velocities @ ridge crests attributed to thermal expansion & micro fracturing associated upwelling magma.



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