UPSC Mains 2023

4 am Batch Test

(DAY-22 - Answers)

1) Explain the different process involved at convergent plate boundaries.

UPSC Mains Syllabus topic	**Important Geophysical Phenomena such as earthquakes, Tsunami, Volcanic activity**
Why was this question asked?	• **Why are the world's fold mountain systems located along the margins of continents? Bring out the association between the global distribution of fold mountains and the earthquakes and volcanoes.**
Introduction	**The Earth's lithospheric plates interact at plate boundaries, where various processes shape the Earth's surface. Among these boundaries, convergent plate boundaries involve the collision or subduction of plates.**
Body	**Types of Convergent Plate Boundaries:** Convergent plate boundaries are categorized based on the types of lithospheric plates involved. 1. **Oceanic-Oceanic Convergence:** When two oceanic plates collide, one plate subducts beneath the other, forming an oceanic trench and a subduction zone. This collision results in the formation of volcanic island arcs, characterized by active volcanoes and frequent seismic activities. 2. **Oceanic-Continental Convergence:** In this scenario, an oceanic plate collides with a continental plate. The denser oceanic plate subducts beneath the lighter continental plate, forming a continental volcanic arc. This convergence gives

	rise to volcanic activity, earthquakes, and the development of deep-sea trenches. 3. **Continental-Continental Convergence:** When two continental plates collide, neither subducts due to their low density. Instead, the collision leads to the compression and uplift of crustal materials, resulting in the formation of large fold-thrust mountain belts. The Himalayas and the Tibetan Plateau are prominent examples of such convergent boundaries. **Processes Involved in Convergent Plate Boundaries:** Convergent plate boundaries exhibit several geological processes due to the interaction of plates. • **Subduction and Consuming of Plates:** At convergent plate boundaries, the denser plate subducts beneath the less dense plate. The subducting plate descends into the mantle, eventually being consumed or destroyed. This process contributes to the recycling of Earth's crustal materials. • **Formation of Island Arcs and Volcanic Arcs:** Oceanic-oceanic convergence results in the formation of volcanic island arcs, characterized by active volcanoes and seismic activity. Oceanic-continental convergence gives rise to continental volcanic arcs, where the subduction of oceanic plates beneath continental plates leads to volcanic activity. • **Fore-Arc and Trenches:** The region between an oceanic trench and the associated volcanic arc is known as the fore-arc. Fore-arcs are found at convergent margins and often experience intense tectonic stresses, leading to thrust earthquakes. Trenches, on the subducting side of the island arc, are deep and narrow features that form due to the flexing of oceanic lithosphere. They are associated with subduction zones and are the deepest features of ocean basins. • **Marginal Basins:** Marginal basins develop between the continental margin and the island arc on the concave side of the arc. They are elongated and narrow basins formed by tensional tectonics resulting from the rifting of an existing island arc.
Conclusion	**Convergent plate boundaries play a significant role in shaping the Earth's surface. The collision or subduction of lithospheric plates at these boundaries leads to diverse**

	geological processes such as subduction, formation of island arcs, volcanic arcs, fore-arcs, trenches, and marginal basins. Understanding these processes helps us understand the formation of mountains, volcanic activity, and seismic events associated with convergent plate boundaries.

2) Give an account of secondary minerals and their significance.

UPSC Mains Syllabus topic	**Salient features of World's Physical Geography.**
Why was this question asked?	• **Describe the characteristics and types of primary rocks. (Answer in 150 words) 10 (2022)**
Introduction	**Secondary minerals are formed at the Earth's surface through the weathering of pre-existing primary minerals. They result from the alteration or decomposition of primary minerals under varying temperature and pressure conditions, facilitated by water and atmospheric CO2.**
Body	**Secondary minerals play a crucial role in Earth's processes and have significant significance in various aspects.** 1. **Soil Formation:** Secondary minerals contribute to soil formation by weathering primary minerals present in rocks. Through chemical reactions, primary minerals are transformed into secondary minerals, such as clay minerals, iron oxides, and aluminum oxides. These secondary minerals provide essential nutrients, improve soil structure, and enhance soil fertility. 2. **Nutrient Cycling:** Secondary minerals play a vital role in nutrient cycling within ecosystems. They act as reservoirs of essential elements like potassium, calcium, magnesium, and phosphorus. These minerals release nutrients slowly over time, providing a continuous supply for plant uptake and supporting the growth of vegetation. 3. **Soil pH and Acidity:** Secondary minerals influence soil pH levels. Some secondary minerals, like clay minerals, have a negative charge on their surfaces, which can attract and hold cations. This cation exchange capacity affects soil acidity or alkalinity, as the exchange of cations influences the concentration of hydrogen ions in the soil solution.

	4. **Water and Nutrient Retention:** Secondary minerals, particularly clay minerals, contribute to the soil's water-holding capacity. The small particle size and surface properties of clay minerals allow them to hold water and nutrients, preventing leaching and providing a reservoir for plant roots. 5. **Environmental Remediation:** Secondary minerals have applications in environmental remediation. Certain secondary minerals, such as iron and aluminum oxides, have the ability to adsorb and immobilize pollutants and heavy metals, reducing their mobility and potential negative impact on ecosystems. 6. **Geological Indicators:** The presence of specific secondary minerals can indicate the history and processes occurring in geological formations. For example, the identification of specific clay minerals can provide insights into past climatic conditions, depositional environments, and geological events.
Conclusion	**Understanding the formation and significance of secondary minerals is crucial for various fields, including agriculture, environmental science, and geology.**

3) Discuss the pattern and nature of landslide occurrences in the southern part of Western Ghats region. Examine the factors contributing to landslide vulnerability in those regions and suggest mitigatory measures.

UPSC Mains Syllabus topic	**Important Geophysical Phenomena such as earthquakes, Tsunami, Volcanic activity**
Why was this question asked?	• **Differentiate the causes of landslides in the Himalayan region and Western Ghats. (2021)**
Introduction	**The Kerala part of the Western Ghats and its eastern flank in Tamil Nadu experience frequent landslides, primarily during monsoons. This pattern is influenced by various factors such as heavy rainfall, improper land use practices, and developmental activities.**
Body	**Pattern and Nature of Landslide Occurrences:** 1. **Seasonal Triggering Mechanism:** Landslides predominantly occur during the monsoons in the western flank of the Western Ghats and during cyclonic events in the

eastern flank. Heavy rainfall causes over-saturation of the overburden, leading to slope failures.

2. **Relationship with Rainfall Intensity:** There is a correlation between the intensity of rainfall and slope failures, suggesting that higher rainfall leads to increased landslide occurrences.
3. **Impact on Overburden:** Most catastrophic mass movements are confined to the overburden without significantly affecting the underlying bedrock.

Factors Contributing to Vulnerability:

1. **Improper Land Use Practices:** Heavy tilling, agricultural practices, and settlement patterns contribute to creep and withdrawal of toe support, making slopes vulnerable to landslides.
2. **Deforestation and Land Modification:** Deforestation, cultivation of seasonal crops, and increased settlements have disturbed the natural balance, making slopes more prone to landslides.
3. **Developmental Activities:** Construction, road cutting, embankments, and cut-and-fill structures modify natural slopes, block surface drainage, load critical slopes, and reduce toe support, increasing slope vulnerability.

Mitigative Measures:

1. **Drainage Correction:** Proper maintenance of natural drainage channels is essential to reduce infiltration and allow excess water to move down without hindrance. Micro and macro drainage channels need to be maintained.
2. **Proper Land Use Measures:** Controlling the universal use of contour bounding and considering slope characteristics, overburden thickness, texture, and drainage set-up while implementing land use measures can mitigate landslide vulnerability.
3. **Reforestation:** Afforestation measures should be implemented in highly unstable zones occupied by degraded vegetation. Suitable plant species should be selected to withstand the stress conditions and prevent further slope modification.
4. **Awareness and Government Intervention:** Creating awareness among the local population about landslide risks

	and promoting responsible land use practices is crucial. Governmental agencies should play a significant role in implementing effective mitigation strategies.
Conclusion	**By addressing factors such as drainage correction, proper land use practices, reforestation, and raising awareness, the vulnerability to landslides can be significantly reduced. Government agencies should actively contribute to these efforts to ensure the safety of the affected regions.**

4) "Unselfishness is the foundation of morality."

What does the above statement mean to you?

The statement "Unselfishness is the foundation of morality" suggests that selflessness forms the basis of ethical conduct and behavior.

Case Study 1:

- In India, the concept of "Seva" or selfless service, exemplified by organizations like Akshaya Patra providing free meals to children, showcases the importance of unselfishness in promoting the welfare of others.

Case Study 2:

- Globally, the work of humanitarian organizations such as Doctors Without Borders, where medical professionals volunteer their skills to provide care in crisis-stricken areas, exemplifies the significance of selflessness in prioritizing the well-being of others.

List of ethical traits implied in the above case studies:

- **Altruism:** Unselfishness is grounded in acts of selflessness and concern for the welfare of others.
- **Empathy:** Understanding and sharing the feelings of others is essential for cultivating unselfishness.
- **Social Responsibility:** Embracing unselfishness entails recognizing the obligation to contribute to the betterment of society.
- **Sacrifice:** Unselfishness often requires individuals to forego personal interests or comforts for the greater good.
- **Ethical Awareness:** Emphasizing unselfishness encourages individuals to reflect on their actions and consider the ethical implications of their choices.

Integrating moral actions rooted in unselfishness is essential for creating a just and compassionate society. By prioritizing the welfare of others and embracing selflessness, individuals can contribute to the well-being and harmony of the world.

5) Optional Self-Practice Questions:

ANTHROPOLOGY:

- **Critically discuss the mendelian principles and their application to human populations.**

HISTORY:

- **Amuktamalayada dwells much upon the relationship of fort, Brahmanas and dispersed tribal groups. Comment.**

PUBLIC ADMINISTRATION:

- **The principle of delegated legislation, is I think right, but I must emphasise that it is well for parliament to keep a watchful and even zealous eye on it at all stages" (Herbart Morrison). Analyse**

GEOGRAPHY:

- **Give a brief account on different approaches to Regionalisation.**

SOCIOLOGY:

- **Illustrate with examples the role of pressure groups in the formulation of social policies.**