THE GROWTH OF MOUNT EVEREST: PAPER - I

Mount Everest, the tallest mountain in the world, stands as a symbol of nature’s grandeur, rising to a towering height of approximately 8,848 meters (29,029 feet) above sea level. Despite its perceived immovability, this natural wonder continues to grow due to a variety of geological processes that have been shaping it for millions of years.

THE GEOGRAPHICAL PHENOMENON BEHIND EVEREST'S GROWTH

The growth of Mount Everest and the surrounding Himalayas is primarily the result of the collision between the Indian and Eurasian tectonic plates. This ongoing tectonic activity began around 50 million years ago, when the Indian plate, moving northward, collided with the Eurasian plate, pushing up land between them and giving rise to the vast Himalayan range.

In addition to tectonic movement, scientists have discovered that a process known as "isostatic rebound" also contributes to Everest’s growth. Isostatic rebound occurs when the Earth's crust rises in response to the removal of heavy material, such as rock or ice. In Everest's case, this process is driven by the increased erosion caused by changes in nearby rivers, particularly the

merging of the Kosi and Arun rivers around 89,000 years ago. This merger increased the rate of erosion, which removed significant amounts of soil and rock from the region, reducing the weight on the Earth's crust and allowing it to rise. As a result, Mount Everest has grown by approximately 15-50 meters (49-164 feet), and continues to rise at a rate of 0.2-0.5 millimeters per year.

GEOGRAPHICAL FACTORS CONTRIBUTING TO EVEREST'S GROWTH

The growth of Mount Everest is influenced by several key geographical factors:

1. **Tectonic Plate Movements**: The Indian and Eurasian plates continue to converge, applying pressure on the land and forcing it upward. This is the primary driver behind the rise of the Himalayas and Everest.
2. **Isostatic Rebound**: This process is crucial in areas where erosion or melting ice sheets remove significant weight from the Earth's surface. In Everest’s case, erosion caused by the merging of the Kosi and Arun rivers has played a key role in lightening the crust, allowing it to rebound and rise.
3. **Glacial Melting**: Like other mountain ranges affected by glaciation, the melting of glaciers in the Himalayas contributes to isostatic rebound. As the glaciers recede, the weight pressing down on the Earth's crust is reduced, allowing it to rise over time.
4. **Erosion**: Rivers and other natural forces continuously erode the rock and soil surrounding Mount Everest, facilitating its uplift. The Kosi and Arun river systems play a particularly important role in this process.

IMPORTANCE OF EVEREST’S GROWTH

The continued growth of Mount Everest holds significant importance from both a geological and cultural perspective. Geologically, Everest serves as a prime example of Earth’s dynamic nature, where even its highest peaks are subject to ongoing change. Scientists study Everest to better understand tectonic processes, erosion, and the effects of climate change, particularly as glaciers in the region continue to melt.

Culturally, Everest remains a symbol of endurance, adventure, and human achievement. Known as Sagarmatha in Nepal and Chomolungma in Tibet, the mountain holds deep spiritual significance for local Sherpa and Tibetan communities. To them, Everest is not only a geographic feature but a sacred site that embodies the power of the natural world.

Furthermore, Everest plays a crucial role in Nepal and the surrounding region's economy. As one of the most sought-after destinations for mountaineers and trekkers from around the world, the mountain supports a thriving adventure tourism industry. Every year, thousands of climbers attempt to reach the summit, bringing economic benefits to local communities and the broader region.

THE IMPACT ON INDIA

India is geographically, economically, and environmentally tied to the Himalayas, including Mount Everest. As the Indian plate continues to collide with the Eurasian plate, the growth of the Himalayas directly affects India in several ways:

1. **Seismic Activity**: The tectonic forces that drive the uplift of Everest and the Himalayas are also responsible for the region’s high seismic activity. Northern India, particularly states like Uttarakhand, Himachal Pradesh, and parts of Jammu and Kashmir, is prone to earthquakes due to these ongoing tectonic movements.
2. **Glacial Melting and Water Security**: The Himalayas are often referred to as the "Water Tower of Asia" because they provide freshwater to millions of people through rivers like the Ganges, Yamuna, and Brahmaputra. Glacial melting in the Himalayas, including around Everest, poses a serious risk to water security in India. Accelerated melting could lead to flooding in the short term, followed by water shortages as glaciers shrink over time.
3. **Tourism and Economy**: While Mount Everest itself is located on the Nepal-China border, India benefits from the broader Himalayan tourism industry. Adventure tourism in the Indian Himalayas, such as trekking and mountaineering in states like Uttarakhand and Sikkim, is closely linked to the allure of the region’s towering peaks, including Everest.

GOVERNMENT MEASURES AND CONSERVATION EFFORTS

Given the importance of Mount Everest and the Himalayas, both Nepal and India have implemented measures to protect the environment and ensure the sustainability of the region.

1. **Regulating Tourism**: Nepal has introduced stricter regulations for climbers attempting to summit Everest, including requirements to bring back waste generated during expeditions. This effort is aimed at reducing the environmental impact of tourism, which has led to litter and pollution on the mountain.
2. **Environmental Protection**: Both Nepal and India have established conservation programs aimed at protecting the fragile ecosystems of the Himalayas. India has implemented various projects under the National Mission for Sustaining the Himalayan Ecosystem (NMSHE), which focuses on conserving biodiversity, managing water resources, and studying the impacts of climate change.
3. **Seismic Monitoring**: In response to the region's high seismic activity, India has strengthened its seismic monitoring capabilities in collaboration with Nepal and other countries. This includes the installation of GPS systems to track the movement of tectonic plates and the uplift of the Himalayas. These systems help monitor Everest's growth and predict potential earthquakes in the region.
4. **Climate Change Mitigation**: Recognizing the risks posed by climate change, India and Nepal have both committed to reducing carbon emissions and promoting sustainable development. India has launched initiatives like the International Solar Alliance and the National Action Plan on Climate Change to combat the effects of global warming, which are particularly pronounced in the Himalayan region.

CONCLUSION

Mount Everest's ongoing growth is a powerful reminder of Earth's dynamic nature. While it stands as a towering symbol of human achievement, it is also shaped by complex geological processes that have been unfolding for millions of years. The convergence of tectonic plates, isostatic rebound, erosion, and climate change all contribute to Everest's rise, making it an ever-changing feature of our planet.

For India, Everest and the broader Himalayan range play a vital role in the country's economy, water security, and environmental health. The continued growth of Everest highlights the need for responsible tourism, environmental conservation, and preparedness for natural disasters like earthquakes. Government measures in both India and Nepal, including efforts to regulate tourism, protect ecosystems, and mitigate climate change, are essential to ensuring that Everest remains both a natural wonder and a sustainable resource for future generations.

In a world that often feels static, Everest reminds us that change is constant, even in places where it seems least likely.

PRELIMS PRACTICE QUESTIONS

Question 1:

Consider the following statements:

1. Mount Everest continues to grow due to the ongoing collision between the Indian and Eurasian tectonic plates.
2. Isostatic rebound contributes to the growth of Mount Everest by reducing the weight of eroded rock on the Earth's crust.
3. Erosion caused by river systems like the Kosi and Arun plays no significant role in the rise of Mount Everest.

Choose the correct answer using the codes below:

a) 1 and 2 only
b) 2 and 3 only
c) 1 and 3 only
d) 1, 2, and 3

Question 2:

Consider the following statements:

1. Mount Everest is culturally significant to both the Sherpa and Tibetan communities.
2. The melting of glaciers around Everest poses no long-term threat to water security in the region.
3. The Himalayan region is a major source of freshwater for rivers like the Ganges and Yamuna.

Choose the correct answer using the codes below:

a) 1 and 3 only
b) 1 and 2 only
c) 2 and 3 only
d) 1, 2, and 3

Question 3:

Consider the following statements:

1. Isostatic rebound is a process where the Earth's crust rises after the removal of heavy materials like ice or rock.
2. The growth of Mount Everest has been halted due to the melting of glaciers in the Himalayas.
3. The Arun and Kosi rivers played a key role in causing increased erosion, which contributed to Everest's growth.

Choose the correct answer using the codes below:

a) 1 and 2 only
b) 1 and 3 only
c) 2 and 3 only
d) 1, 2, and 3

Question 4:

Consider the following statements:

1. The Indian government has implemented the National Mission for Sustaining the Himalayan Ecosystem to protect the region’s biodiversity and water resources.

2. Nepal has introduced stricter regulations for climbers on Mount Everest to reduce waste and environmental impact.
3. The growth of Mount Everest has been unaffected by human activities such as tourism and mountaineering.

Choose the correct answer using the codes below:

a) 1 and 2 only
b) 1 and 3 only
c) 2 and 3 only
d) 1, 2, and 3

Question 5:

Consider the following statements:

1. Mount Everest grows at a rate of 0.2-0.5 millimeters per year due to tectonic activity and isostatic rebound.
2. The Himalayas are rising due to the ongoing convergence of the Indian and Eurasian plates.
3. Seismic activity in northern India is unrelated to the tectonic processes that cause the Himalayas to rise.

Choose the correct answer using the codes below:

a) 1 and 2 only
b) 2 and 3 only
c) 1 and 3 only
d) 1, 2, and 3

Answers & Explanation

Question 1:

Answer: a) 1 and 2 only

Explanation:

- **Statement 1** is correct because Mount Everest continues to grow due to the tectonic collision between the Indian and Eurasian plates.
- **Statement 2** is correct as isostatic rebound occurs when the Earth's crust rises after the removal of weight, such as eroded rock, which contributes to the growth of Everest.
- **Statement 3** is incorrect because erosion from the Kosi and Arun rivers has played a significant role in the rise of Mount Everest by removing material, which allows the land to rise.

Question 2:

Answer: a) 1 and 3 only

Explanation:

- **Statement 1** is correct because Mount Everest holds cultural and spiritual significance for both the Sherpa and Tibetan communities.
- **Statement 2** is incorrect because the melting of glaciers poses a serious long-term threat to water security in the region. Melting glaciers contribute to river systems, and their depletion can eventually cause water shortages.
- **Statement 3** is correct because the Himalayan region is a critical source of freshwater for major rivers like the Ganges and Yamuna, which supply water to millions of people.

Question 3:

Answer: b) 1 and 3 only

Explanation:

- **Statement 1** is correct because isostatic rebound occurs when the Earth's crust rises after heavy materials (like eroded rock or glaciers) are removed, reducing pressure on the crust.
- **Statement 2** is incorrect because the growth of Everest has not been halted by glacial melting. Instead, it continues to grow due to tectonic activity and erosion.
- **Statement 3** is correct because the erosion caused by the Arun and Kosi rivers has lightened the Earth's surface, allowing the crust to rise, which has contributed to Everest's growth.

Question 4:

Answer: a) 1 and 2 only

Explanation:

- **Statement 1** is correct because the Indian government has implemented the National Mission for Sustaining the Himalayan Ecosystem (NMSHE) to conserve biodiversity, manage water resources, and address climate change impacts in the Himalayas.
- **Statement 2** is correct because Nepal has introduced stricter regulations to reduce environmental degradation, including the requirement for climbers to bring back waste from their expeditions on Mount Everest.
- **Statement 3** is incorrect because human activities like tourism and mountaineering have impacted the environment of Everest, including pollution and waste accumulation, even though these activities do not directly affect the mountain's geological growth.

Question 5:

Answer: a) 1 and 2 only

Explanation:

- **Statement 1** is correct because Mount Everest is growing at a rate of 0.2-0.5 millimeters per year due to the combination of tectonic plate movements and isostatic rebound.
- **Statement 2** is correct because the continued convergence of the Indian and Eurasian plates is the primary reason for the uplift of the Himalayas.
- **Statement 3** is incorrect because seismic activity in northern India is directly related to the same tectonic processes that cause the Himalayas to rise, as the convergence of the plates causes earthquakes in the region.

MAIN PRACTICE QUESTION

Discuss the geological processes that contribute to the growth of Mount Everest and explain the significance of these processes for the surrounding region. How do human activities and climate change interact with these natural processes, and what are the potential impacts on countries like India?

ANSWER GUIDELINES:

A well-structured answer should include the following key points:

1. **Introduction to Everest's Growth:**
    - Mention the ongoing tectonic activity between the Indian and Eurasian plates, which has been pushing the Himalayas, including Mount Everest, upwards for millions of years.
    - Highlight the process of isostatic rebound, where the Earth's crust rises due to the removal of heavy materials like eroded rock.
2. **Geological Processes:**

- Discuss the role of tectonic plate collision as the primary force driving the uplift of the Himalayas.
- Explain how isostatic rebound is influenced by erosion, particularly the role of river systems like the Kosi and Arun, which increase erosion and cause the land to rise.

3. **Significance of These Processes:**
    - Emphasize the geological and ecological significance of Everest's growth in shaping the region's landscape and ecosystems.
    - Explain the importance of the Himalayan region as a major source of freshwater for rivers that support millions of people in South Asia.
4. **Interaction with Human Activities and Climate Change:**
    - Briefly mention how human activities like tourism, mountaineering, and pollution affect the environment of Mount Everest.
    - Discuss the impact of climate change, particularly the melting glaciers, which influence water availability and contribute to isostatic rebound.
5. **Impact on India:**
    - Summarize the potential impacts on India, such as increased seismic activity, glacial melting affecting water security, and the need for disaster preparedness.