KGP

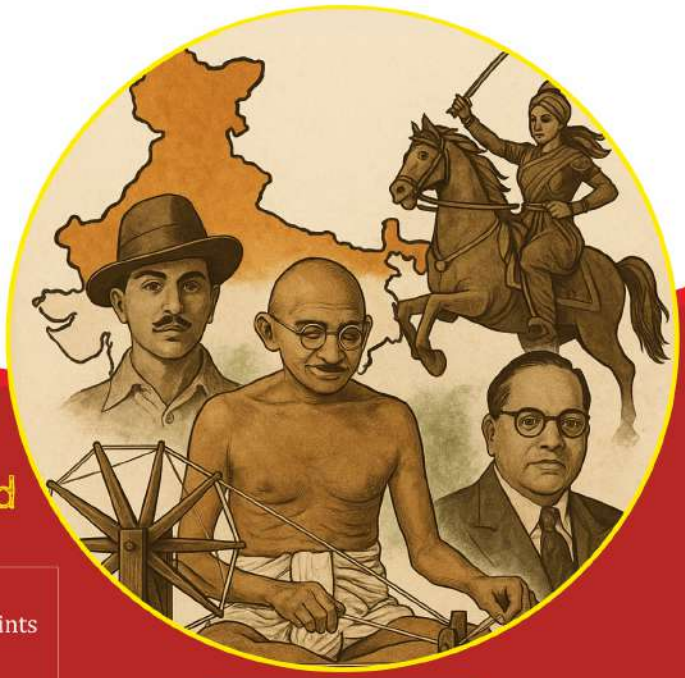
KALAM ACADEMY IAS

Re-Defining UPSC Preparation

Kalam Golden Pages

CSE Mains | General Studies-I

MODERN HISTORY



KGPs' Marks Improvement Grid

STATIC CONCEPT Revisable static concept note	MARKS MAXIMIZER Maximizer Answer Sheet Points not to be missed
PYQS List of all PYQs from the syllabus topics	MIB Marks Improvement Booklet (MIB) to update current affairs

कलाम ACADEMY

FOREWORD

*It is a pleasure to introduce **KALAM GOLDEN PAGES (KGP)** – Static of Dynamic- for Mains. Thematic coverage of Mains syllabus in specified **40 pages** per Theme makes this book an indispensable resource for aspirants.*

*Mains topics like History, Geography, Polity, Economy, Ethics AND Society, World history, Governance, S&T, IR, Security, Agriculture remains as bulky and unstructured material by established institutions. These topics are peculiar in a sense **STATIC** base is required to answer dynamic questions. Implying strategic insights and structured **revision notes** for concrete solutions, and diverse perspectives, for effective score.*

This invaluable notebook by Team Kalam, who were flooded with request of concise and handy Mains specific revision note on line of Marks Improvement Booklet (MIBs) will empower UPSC aspirants to refine their writing skills, build confidence, and excel in the CSE (Main) examination.

***Best wishes**,*

Team Kalam

KGP

(Kalam Golden Pages)

EXPLAINER: How to use this hand out effectively!

CONCEPT Revision of static concept in 40 pages	**Mains Marks Maximizer** Some maximizer points you don't want to miss in your answer
PYQs List of PYQs from the topics	**DIY** Marks Improvement Booklet (MIB) for you to update KGP

Contents

1 TRANSITION TO THE 18th CENTURY

Advent of Europeans in India

The arrival of European in India marked a pivotal moment in the country's history, as it brought about significant cultural, economic, and political changes.

Why Europeans went on Quest for and Discovery of Sea Route to India?

- Ottomans controlling land routes forced Europeans to find sea route to India for cheaper goods.
- Fifteen century Europe was gripped by the spirit of renaissance with its call for exploration.
- European nations were driven by economic competition and religious motives to explore new routes.
- Advances in navigation made long sea voyages possible.
- A direct route allowed them to bypass middlemen, lowering cost and boosting profit.

European Power	Arrivals in India	Key Events/Locations	Impact
Portuguese	***1498***	• Vasco da Gama landed at Calicut (Kozhikode). The Hindu ruler of Calicut Zamorin welcomed him. • Established control over Goa, Daman, Diu.	• Controlled spice trade and established Goa as the capital of their Asian empire. • Other impact: Cultural exchange, conflict with local rulers and reshaping indian society.
Dutch (Netherlands)	***1605***	• Set up trading posts in Masulipatnam, Pullicat, Surat, Chinsurah.	• Focused on spices and textiles trade; influence declined by the 18th cent.
British	***1600 (E.I.C)***	• Permanent factory at Surat (1613), gained territories through treaties and battles (e.g -battle of Plassey etc)	• Became dominant power leading to British colonial rule. Economic exploitation, cultural influence, and political culture shaped India's future.
French	***1664***	• Bases in Pondicherry, Mahe, Karaikal, Yanam. Competed with British: defeated in Carnatic wars (1746-1763).	• Attempted control but eventually lost to British. Left cultural influences especially in Pondicherry.
Danish	***1620***	• Established factory in Tranquebar (Tanjore) in 1620 and Serampore (Bengal) in 1676.	• Limited influences compared to other European power; minimal long-term impact
Other European nations	***Various (Swedes, etc)***	• Limited and short-lived trade attempts	• Minimal impact did not establish lasting control or influences in India

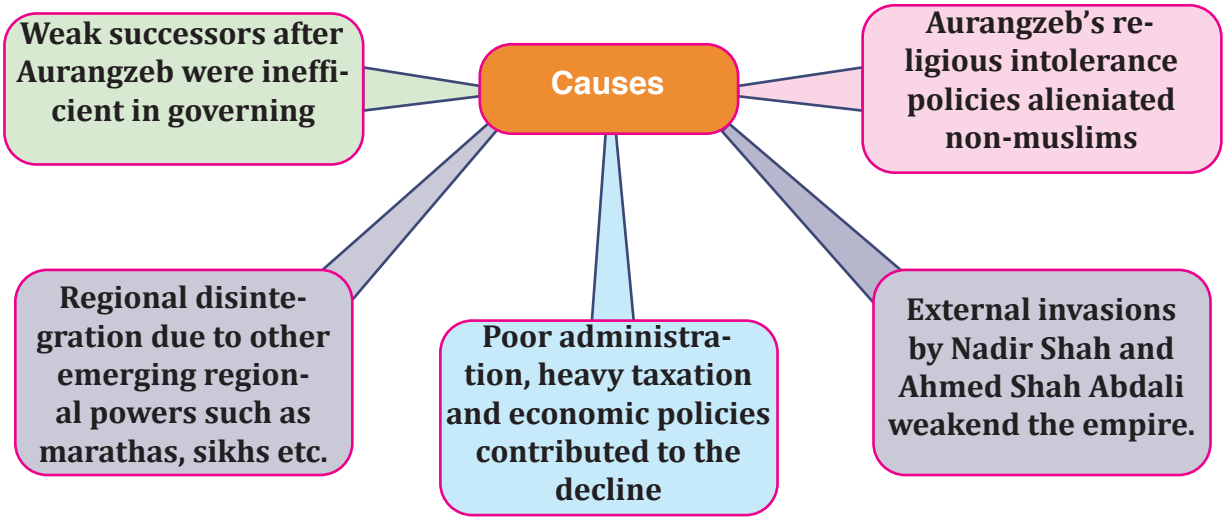
British Dominance Over Other Powers in India

- The English East India company had more dynamic structure; elected directors influenced by shareholders ensured better decision making.
- The Royal Navy of Britain was not only the largest of its time but the most advanced.
- England was at the forefront of the industrial revolution, benefiting from inventions and advancement in textiles, metallurgy and agriculture.

- Well trained and administered British soldier, coupled with technological advancement were hard to defeat.
- Britain lesser zeal for spreading Christianity and religion made its rule more acceptable to the subject than that of other colonial powers.
- Britain enjoyed stable government compared to other European nations.
- The decline of Mughals empire and conflicts among regional rulers created an opportunity.
- Britain successfully utilised the debt markets to fund its wars, particularly through the establishment of bank of England.
- The British cleverly used diplomatic tactics like doctrine of lapse (Lord Dalhousie) and subsidiary alliance (Lord Wellesley) to expand their control over India.

The Decline of Mughal Empire

The decline of Mughal empire marked a significant period in Indian history, characterized by political instability, economic challenges, and social upheaval. The Mughal empire decline began in 18th century, leading to its eventual collapse in mid-19th century paving way for British rule and various regional powers to prosper all over India.

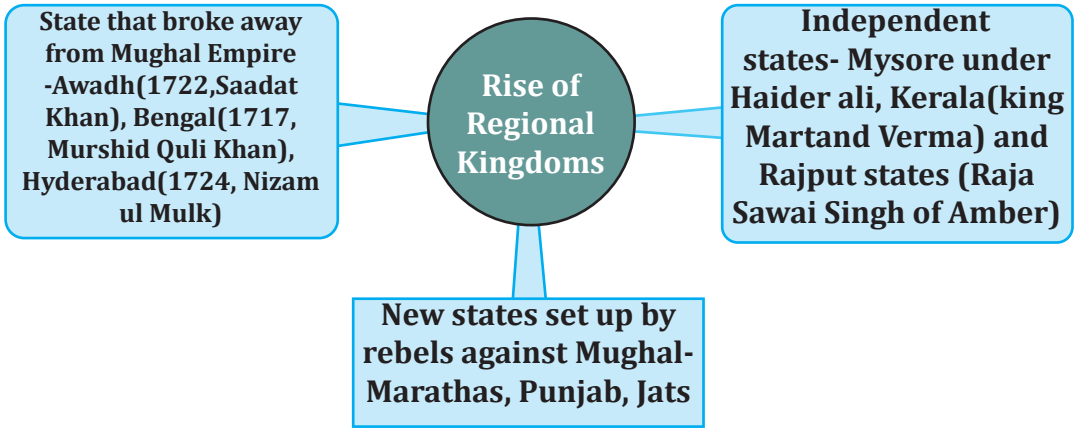


Rise of Regional States

The decline of Mughal empire in 18th century created a power vacuum in India, paving a way for several regional states to rise.

- **Military strength:** Most states incorporated Mughal-style gunpowder weaponry and fortress into their military strategies relying heavily on cavalry. However, some like the Marathas, with their guerilla tactics and adaptability.
- **Leadership and Administration:** several states rose to prominence under the guidance of charismatic leaders like Shivaji of the Marathas, Haider Ali and Tipu sultan of Mysore and Raja Raja Martand Verma of Travancore.
- **Social and religious landscape:** while some states like Mysore under Haider Ali were known for religious tolerance. Others like maharaja Ranjit Singh of Sikh kingdom had a more specific religious identity. Some ruler like Tipu Sultan attempted social reform to address issues like sati and female infanticide.
- **Economic policies:** most state focused on maximising revenue collection through land taxation and control of trade routes.
- **Political systems:** most states were monarchies, with hereditary rule by kings or nawabs. However, legitimacy often relied on military strength and administrative efficiency rather than solely on lineage.

Rise of Regional Kingdoms



Socio-Economic Conditions in India

- **Agriculture**
  - Stagnant and technologically backward agriculture compensated by very hard labour of peasants.
  - Peasants paid revenues to the state, zamindar, Jagirdars and revenue farmers.
  - Major produce/crops: rice, wheat, sugar, pepper, spices, cotton etc.
- **Trade and industry**
  - Trade flourished. Cotton textiles, raw silk, silk fabrics, hardware, indigo, saltpetre, opium, rice, precious stones, drugs etc were exported.
  - Gold musk, woollen cloths, copper, iron, lead, paper, porcelain, pearls, dates, dried fruits, coffee, tea, ivory etc.
  - The textile industry was famous for its produce. The ship building industry flourished. The metal industry was also well developed.
- **Education**
  - Elementary education imparted through Pathshalas and Maktabs.
  - Chatuspathis or Tols among Hindus and Madarasahs among Muslims were the institutes of higher learning.
  - Absence of the study of science and technology and geography was general feature.
- **Society**
  - Apart from the four varnas, Hindus were divided into many sub-castes which were different in their ideology from place to place.
  - Muslims were also divided into caste, race, tribe and status, even though their religion propagated equality.
- **Art, Architecture and Culture**
  - Nawab Asaf-ud-Daulah in 1784, built Bara Imam-Bara at Lucknow
  - Sawai jai Singh built pink city of Jaipur and five astronomical observatories (Delhi, Jaipur, Mathura, Varanasi, Ujjain)
  - Painting school of Kangra and Rajputana came into prominence.
  - Growth of Urdu poetry and language took place in northern India and Sittar poetry enriched Tamil language also developed.

Panipat as Empire Shaking Battlefield

Panipat became a favored battlefield for empire-shaking battles due to several key factors:

Strategic Location: Located in northern India, close to Delhi, Panipat sat at the crossroads of major trade and military routes connecting northwestern India to the heart of the subcontinent.

1. **Flat Terrain**: The open, flat landscape was ideal for large-scale battles, allowing armies, especially cavalry, to maneuver effectively.
2. **Proximity to Delhi**: Control over Delhi was vital for ruling northern India. Panipat's location made it a natural site for battles over Delhi's throne.
3. **Historical Significance**: With a history of decisive battles—such as the Mughal victories at the First and Second Battles (1526 and 1556) and the Maratha defeat in the Third Battle (1761)—Panipat became symbolic of empire-building and power struggles.
4. **Water Sources**: The Yamuna River and nearby water sources provided essential resources for armies, especially in large-scale engagements.

The 3 Empire Shaking Battles at Panipat are:

1. **First battle of Panipat (1526)-**Babur defeated Ibrahim Lodhi laying the foundation of Mughal empire.
2. **Second battle of Panipat (1556)-** the Mughal forces under Akbar's regent bairam khan, defeated Hemu to re-establish Mughal control over India.
3. **Third battle of Panipat (1761)-** Ahmad shah Abdali defeated Marathas, which weakend Marathas allowing British to eventually dominate India.

Expansion of British Rule in India

The expansion of British rule in India started from 1757-1857 with the battle of Plassey, marked a period of gradual but significant British dominance. Through military victories, alliances, and administrative reforms, the British east India company established control over various regions leading to the eventual establishment of direct British control.

1. The Battle of Plassey and the Rise of British Power (1757).

- The Battle of Plassey (1757) was a pivotal moment in British history in India. The British East India Company, led by **Robert Clive**, defeated **Siraj-ud-Daula**, the Nawab of Bengal, in a battle that was more political than military.
- Clive's forces were significantly outnumbered, but he secured the support of key figures in the Nawab's army, including **Mir Jafar**, who betrayed **Siraj-ud-Daula**. After the defeat, Mir Jafar was installed as the puppet Nawab of Bengal, giving the British East India Company significant control over the wealth of Bengal, one of India's richest provinces.

Consequences of Plassey

- Following the Battle of Plassey, the East India Company gained enormous revenues from Bengal, which funded its expansion in India.
- The victory also provided the Company with significant political power, as the British began to interfere more directly in Indian politics, replacing regional rulers with those who were favorable to British interests.

2. Expansion in Bengal and Northern India (1757–1765)

Battle of Buxar (1764)

- The British secured further dominance after the **Battle of Buxar** (1764), where they defeated a coalition of **Mughal forces**, the **Nawab of Oudh**, and the **Nawab of Bengal**.
- This victory was crucial because it led to the **Treaty of Allahabad (1765)**, in which the Mughal Emperor granted the **East India Company** the **diwani** (right to collect taxes) in Bengal, Bihar, and Orissa.
- The Company gained immense control over the wealth of the region, further cementing its dominance.

Subjugation of Other Rulers

- The British continued to expand their power by using a combination of military force & diplomacy to subdue other regional powers in India, including the Marathas, the Mysore Sultanate, and the Sikhs in Punjab.

3. Expansion in Southern and Western India (1770s–1800s).

Mysore Wars (1767–1799)

The British fought a series of wars against the **Kingdom of Mysore**, ruled by **Tipu Sultan**. Tipu Sultan was a fierce opponent of British expansion in southern India.

- The **Anglo-Mysore Wars** (1767–1799) ended with the defeat and death of Tipu Sultan in the **Fourth Anglo-Mysore War** (1799). Mysore was subsequently brought under British control, and the Company took over the administration of the region.

Anglo-Mysore War: Treaty Signed

- 1st AMW (1767-69): Treaty of Mysore.
- 2nd AWM (1779-84): Treaty of Mangalore
- 3rd AWM (1790-92): Treaty of Seringapatam
- 4th AWM (1799): Mysore conquered

Maratha Confederacy

The **Marathas**, who had been one of the most powerful forces in India, were defeated in a series of wars known as the **Anglo-Maratha Wars** (1775–1818).

- After the defeat of the Marathas in 1818, the British effectively controlled most of India, with the exception of a few independent kingdoms.

Anglo-Maratha War & Treaties

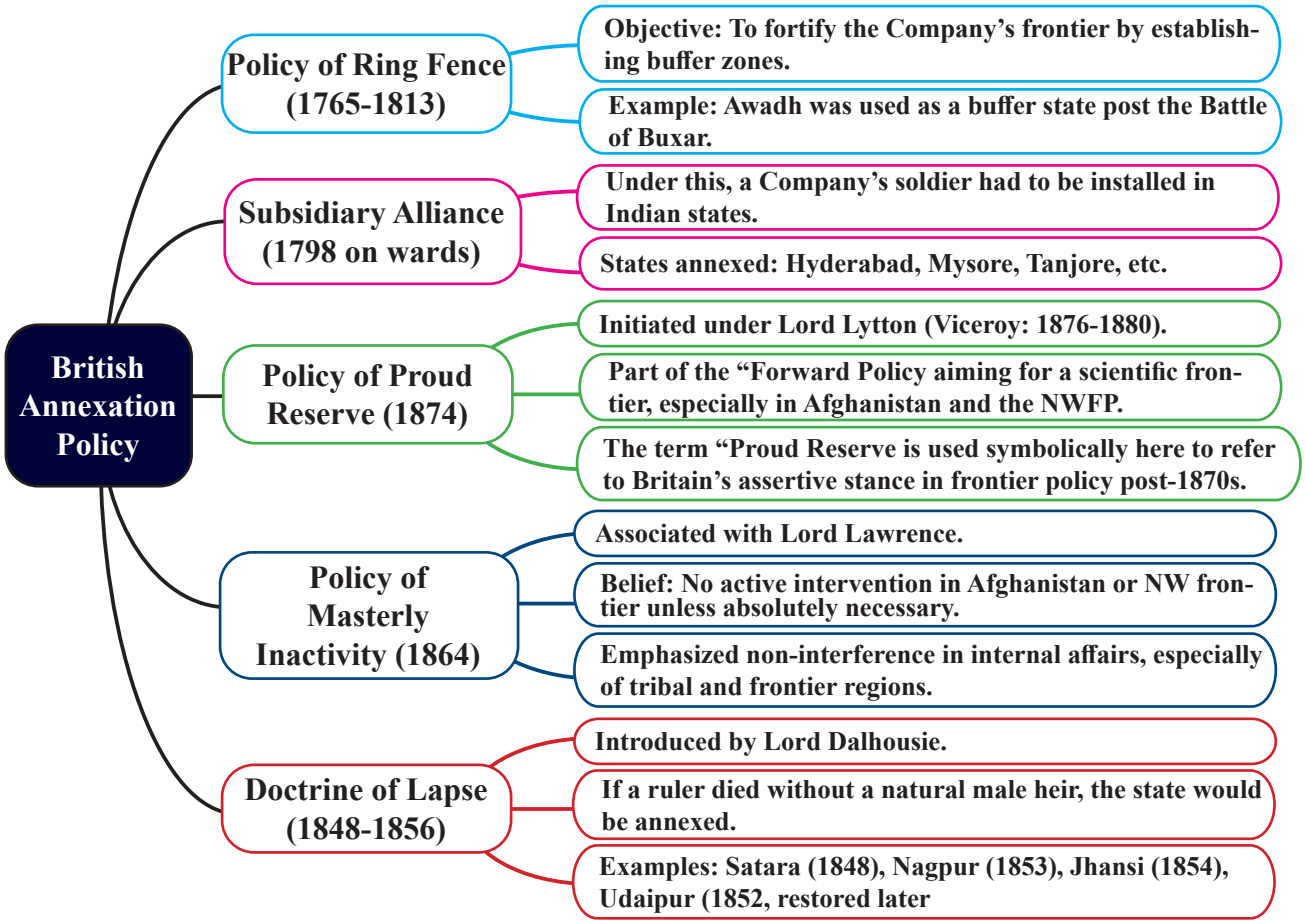
- **1st war (1775-82**); Treaty of Surat (1775), Treaty of Purandar (1776), Treaty of Salbai (1782).
- **2nd war (1803-05**); Treaty of Bassein (1802)
- **3rd war (1817-19**); Marathas conquered.

4. The Sikh Empire and the British Conquest of Punjab (1845–1849)

- The **Sikh Empire**, led by **Ranjit Singh**, had been a powerful kingdom in the northwest, but after Ranjit Singh's death in 1839, the empire weakened.
- The **Sikh Wars** (1845–1849) were fought between the British East India Company and the Sikhs. After a series of defeats, the British annexed the **Punjab region** in 1849, bringing the last major independent kingdom in India under British control.

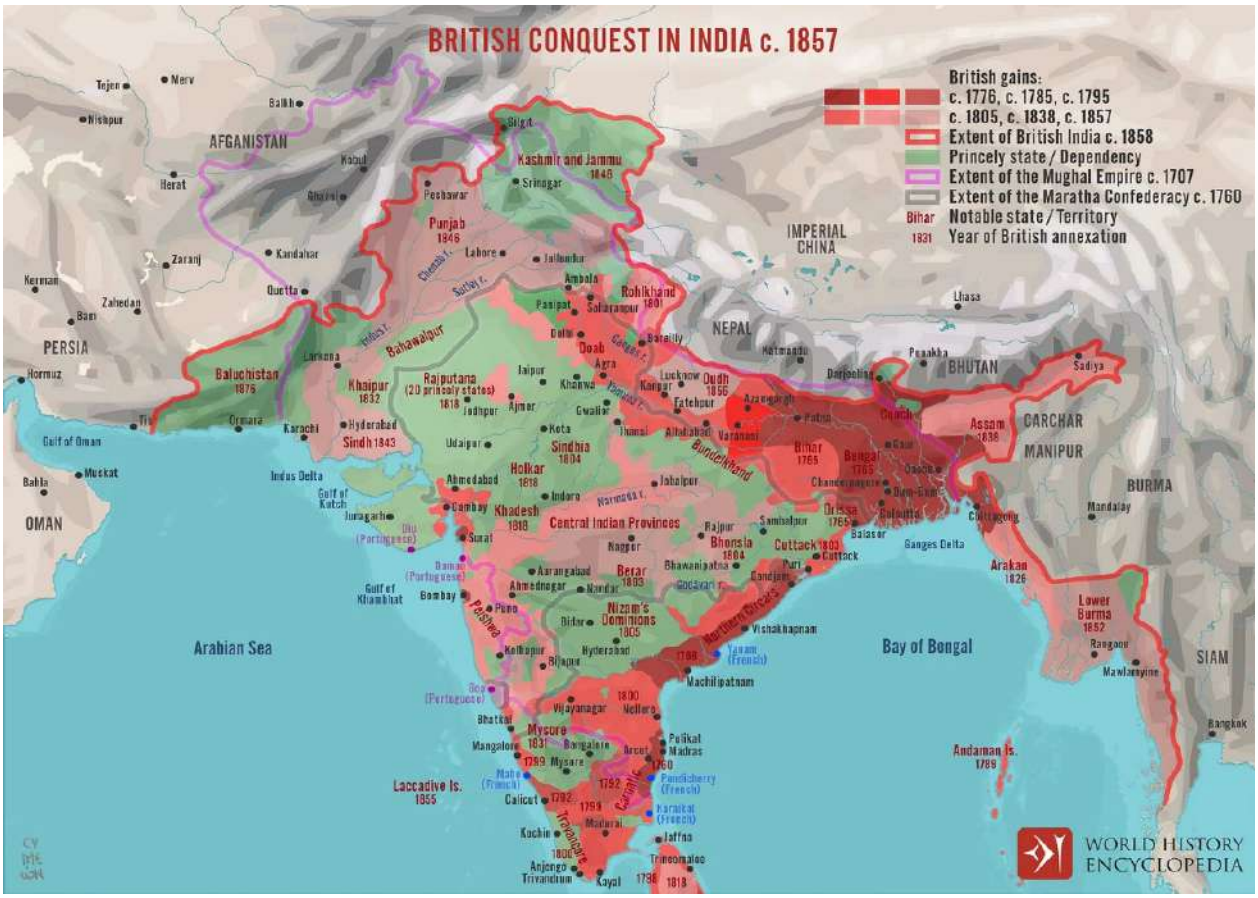
5. Consolidation and Administrative Changes (1818–1857).

Various annexation policies were used to annex states rather than involving in battles.



Railways, Telegraph, and Infrastructure

- British control was further consolidated with the development of infrastructure. The British introduced railways, telegraphs, roads, and canals, which facilitated military control and communication across the vast territory.
- These developments, while aiding British governance, also contributed to the economic exploitation of India, as raw materials were extracted for British industry, and India's economy was reoriented to serve British interests.



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INDIAN ECONOMY

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कलाम ACADEMY

Contents

1 General State of Indian Economy

Topics asked in Mains

➔ GDP (Calculation, Potential GDP & Growth Rate), Foreign Direct Investment and Impacts on Indian Economy, Policy of Protectionism, Inflation

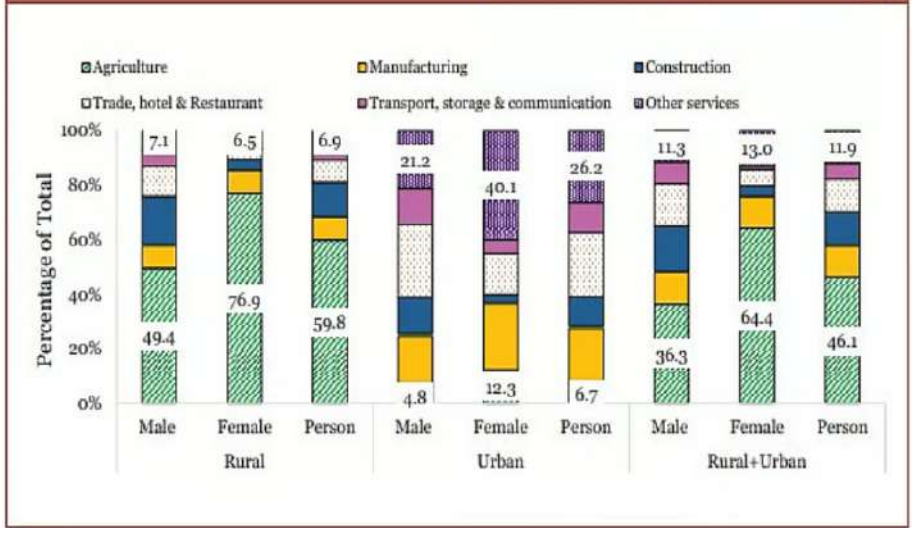
Economy of India

Mixed Economy - Both public and private sector engage in business

- **Large Agriculture sector** - According to PLFS 2023-24, agriculture remains the top employment sector, with its workforce share rising from 44.1% in 2017-18 to 46.1% in 2023-24.
- **The agriculture and allied activities** sector contributes approximately **16% to India's GDP** in FY24.
- **Female participation in agriculture** has surged, rising from 57.0% in 2017–18 to **64.4% in 2023–24**, highlighting the sector's role in rural employment.
- **Servicification of Indian economy** - 55% of GDP is service sector
- **LPG Reforms (1991)**: Marked a shift towards Liberalisation, Privatisation, and Globalisation—reducing state control, encouraging private sector, and opening the economy to global markets, boosting investment and growth.
- **Unequal Wealth Distribution**: The top 10% of the Indian population holds 77% of the total national wealth – Oxfam Report
- **Gender Pay Gap**: Oxfam International report titled "Survival of the Richest: The India Story" Indian women earn only 63 paise for every ₹1 earned by men.

Marks Maximizer Facts	
Size of GDP	$3.9 Trillion
GDP Rank (Nominal)	5th
GDP Rank (PPP)	3rd
GDP Growth rate (FY 23-24)	8.2%
Agriculture	1.4%
Service	7.6%
Industry (Secondary)	9.7%
Inflation Rate	5.4%
Imports as % of GDP	27%
Exports as % of GDP	23%
Gross Fixed Capital Formation	29% of GDP

Chart XII.8 (a) Distribution of workers by broad industry division in 2023-24



- **Vicious Circle of Poverty**: 11% people are extremely poor in India – World Bank
- **Planned Economy**: Five Year Plans and now Niti Aayog plays the role of creating vision documents.

Economy of India in last 20 years

Economic Boom (2003-2008)
- Current Account Surplus
- 8% growth rate
- Dividend of LPGv

→

Global FInancial Crisis (2008-14)
- External shocks
- Crude oil prices increased
- Age of policy Paralysis

→

Revival of Economy (2014-2017)
- Consumption led revival of economy
- Financial incusion with JAM trinity
- Economic Reforms

→

Slowdown & Reccession (2018-onwards)
- Demonetization and GST
- COVID Crisis
- Russia-Ukaraine war and Israel-Hamas war

Gross Domestic Product

Gross Domestic Product means market value of final goods and services produced within a territory in a given period. As per the reports by **International Monetary Fund (IMF)**, India is among the top 10 countries in the world based on the nominal GDP in 2023.

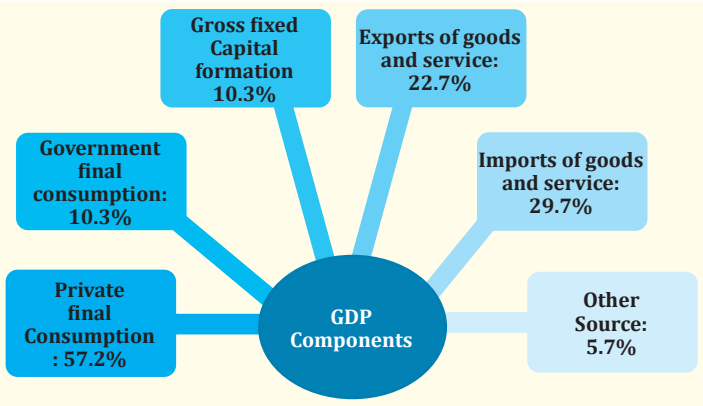
GDP by expenditure method has 4 components:

1. Private Final Consumption Expenditure
2. Government Final Consumption Expenditure
3. Gross Fixed Capital Formation
4. Net Exports = Exports - Imports

Marks Maximizer Facts – Sector Wise Contribution

Sector	Share in GVA	Share in Employment
Agriculture	17.7%	46%
Industry	27.6%	25%
Services	54.7%	29%

Importance of GDP



- **Economic Indicator:** Reflects the size and growth of an economy, providing insights into its overall health and performance.
- **Measure of Living Standards:** GDP per capita is often used as an indicator of the average standard of living in a country.
- **Policy Tool:** GDP data assists policymakers in formulating and evaluating economic policies.
- **International Comparisons**: Enables comparisons between countries.
- **Investment Decision-Making:** Investors rely on GDP data to assess market conditions and business potential.
- **Budget Planning**: Governments use GDP estimates to plan budgets, allocate resources, and prioritize public expenditure on various sectors, such as healthcare, education, infrastructure, and social welfare programs.
- **Business Performance Assessment**: GDP data helps businesses evaluate the market size and demand trends to make decisions regarding production, pricing, and expansion strategies.
- **Economic Forecasting:** GDP forecasts provide valuable insights into future economic trends.

Types of GDP

- **GDP @ Factor Cost** = GDP – Indirect Taxes +Subsidy

  - **Market Price = Factor Cost + Net Indirect Taxes**
  - **Net Indirect Taxes = Indirect Taxes – Subsidies**

  Therefore, **Factor Cost = Market Price - Indirect Taxes + Subsidies**

NDP (Net Domestic Product) = GDP – Depreciation

GDP Calculation

The Central Statistics Office (CSO) uses the income approach to calculate GDP. CSO works under Ministry of Statistics and Program Implementation (MoSPI)

Real GDP = Nominal GDP – Inflation

Changes in GDP Calculation

	Pre 2015	Post 2015
Base Year	2005-05	2011-12
GDP Metric	GDP at Factor Cost	GDP at market prices
Estimation of manufacturing sector	Use data from IIP and Annual Survey of Industries	Use MCA-21 form filled by about 3 lakh companies
Agriculture sector	Considered only value added in farm produce	Now it includes value addition in livestock also
Labour-intensive industries	Equal weightage to all labour activities	Different weightage to different labour types

Limitations of GDP

- **Unpaid Work**: Like household care, is not included in GDP. Unpaid work constitutes 3.1% of GDP
- **Black Market** underground economy constitute 14% of GDP
- Leisure time has negative impact on GDP, but required for quality of life
- **Environmental cost**: Not considered while computing GDP. India ranked 176 out of 180 countries in the 2024 Environmental Performance Index (EPI), showing GDP growth at the cost of sustainability.
- **Income and Wealth inequality**: GDP fails to capture inequality in society
- **Human development** Is not computed in GDP
- **Political Freedom and Social justice** E.g. Colonization increased GDP of UK but curtailed political freedom of colonized

Alternatives to GDP

- **Human Development Index (UNDP)** - Created by the United Nations, HDI is now the most used progress indicator for developing economies. It is a geometric mean of indices across three dimensions:
  - Decent Standard of Living
  - Long and Healthy Life
  - Access to Knowledge
- **Green GDP** – To calculate economic growth with the environmental consequences of that growth factored into a country → Loss of natural resources, Expenses on env protection:
- **Gross National Happiness** - Bhutan's measure for people's quality of life, GNH index combines:-
  - Environmental conservation
  - Cultural preservation
  - Good Governance
  - Sustainable socio-economic development

Dr. Kirit Parikh Committee
• Environmental account should also be maintained under National Accounting Matrix

- **Inclusive Wealth Index (IWI)** → Developed by the UN, IWI measures the wealth of nations using a comprehensive analysis of a country's productive base, including manufactured, human and natural capital. It could help drive climate change policies by assessing changes in natural capital.
- **Genuine Progress Indicator (GPI)** → GPI attempts to adjust GDP by incorporating environmental, social, and financial factors that are not well reflected in GDP. It has been used as a progress indicator in the US state of Maryland since 2015 and in Atlantic Canada.

Potential GDP

Potential GDP → maximum output an economy can produce when operating at full capacity, without triggering inflationary pressures.

Factors Inhibiting India from Realizing Its Potential GDP

- **Infrastructural Bottlenecks:** Inadequate infrastructure in areas such as roads, ports, and electricity can limit the productive capacity of the economy.
- **Low Investment:** India's low savings rate and investment levels (29%) have hindered the growth of the capital stock.
- **Poor Education and Health Outcomes**: India's low education and health outcomes, compared to peers, limit its labour force productivity.
  - **Education: ASER 2023** (Annual Status of Education Report) found that nearly **25% of Class 8 students** cannot read a Class 2 level text in rural India.
  - **Health**: In health, **India's public health expenditure is just 2.1% of GDP (NHA, 2023)**, far below the global average of 6%.
- **Poor Skills:** 51% of graduates are employable: India skills report
- **Agricultural Growth**: Slow agricultural growth (1.4%) in India has limited the overall growth of the economy.

Factors Contributing to Growth Potential

- **Saving Rate** → Provide funds for investment, stability and future reserves.
- **Gross Capital Formation** → Investment in long term assets and infrastructure
- **Human Capital** → Health, education and skills can increase productivity of labour
- **Infrastructure** → Roads, rails and ports reduce transition time and cost
- **Foreign Direct Investment** → FDI provide extra capital and new technology of global standards
- **Policy Support** → PLI Scheme, UDAN, Mudra Bank, etc
- **Technology and Innovation** → Improve competitiveness – India's rank improved from 43 to 40th in GCI
- **Environment Sustainability** → Ensures long-term growth, resilience, and compliance with SDGs & Paris Agreement; India targets **Net Zero by 2070**, **50% renewable capacity by 2030** (NDCs); enabled by **ISA, PM-KUSUM, Green Hydrogen Mission**.

CHALLENGES OF THE INDIAN ECONOMY

- **Global Integration and Technology**
  - **Impact of Global Integration**: Increased fragmentation and slowdown in hyper-globalization.
  - **Threat of Artificial Intelligence** (AI): Automation risks nearly 40% of global jobs.
- **Macroeconomic Concerns**
  - **Russia-Ukraine Conflict**: Escalated conflict led to rising commodity prices and inflation – 6.7% in FY23.
  - **Synchronized Monetary Tightening**: Central banks' inflation control measures caused capital flight to the US, currency depreciation, and inflation.
  - **Slowdown in Chinese Economic Activity**: China's zero-COVID policy and real estate contraction impacted global trade.
  - **Currency Depreciation**: Rupee depreciated by 11% in 2022 against the US dollar.
  - **Slowing Economic Growth:** Global growth projected to decelerate in FY23 and FY24 due to various economic pressures.
- **Structural Challenges**
  - **Overdependence on Agriculture:** Contributes 18.2% of GDP, employs nearly 46% of the workforce (Economic Survey 2023-24).
  - **Population Pressure:** World's most populous country, 1.4 billion people, stressing resources and jobs.
  - **Unemployment:** Slow growth and rapid population increase; underemployment and disguised unemployment prevalent.
  - **Low Rate of Capital Formation**: Gross Fixed Capital Formation at 30% of GDP compared to 41% of China.

- **Underdeveloped Infrastructure**: Massive infrastructure financing gap, $1 billion/day as per World Bank.
- **Low Level of Productivity**: Limited technological adoption and primitive methods hinder productivity.

- **Climate Change**
  - **Vulnerability to Climate Change:** High vulnerability; prone to droughts and earthquakes.
  - **Economic Impact of Climate Change**: Extreme weather costs $9-10 billion annually.
  - **Water Scarcity**: Over 6 crore Indians face shortages; major cities at risk of groundwater depletion by 2025.

DRIVERS OF INDIA'S GROWTH IN THE LAST DECADE

Simplification of Regulatory Frameworks

- Real Estate Act, 2016: Transparent transactions, reduced black money.
- Introduced GST, lowered corporate/income taxes, and removed Dividend Distribution Tax.
- Expanded tax base, reduced compliances, formalized economy.

Ease of Doing Business and MSME Reforms

- Decriminalized minor economic offenses under Companies Act.
- Eliminated 25,000 unnecessary compliances, repealed 1,400 laws.
- Introduced Emergency Credit Line, redefined MSMEs, extended non-tax benefits.

Public Spending on Infrastructure (Since 2014)

- Capital expenditure rose from 2.8% to 4.5% of GDP.
- Implemented Bharatmala, Sagarmala, UDAN for infrastructure improvement.

Inclusive Growth Policies

- Provided 10.11 crore women with free gas connections.
- Built 11.72 crore toilets for the poor.
- Opened 51.6 crore Jan Dhan accounts.
- Facilitated 6.27 crore hospital admissions via Ayushman Bharat.
- Constructed 2.6 crore pucca houses for the poor.

Financial Sector Reforms

- Addressed financial crisis
  - Bank Recapitalization – ₹ 3.31 Lakh Crore infused since FY17
  - PSB mergers, SARFAESI amendments.
- Implemented Insolvency and Bankruptcy Code (IBC) for balance sheet cleanup → value of Rs 13.9 Lakh Crore have been disposed off in 8 years

Private Sector Engagement and Disinvestment

- Revived disinvestment policy; minimized government presence in PSEs.
- Boosted manufacturing, exports, and introduced Production Linked Incentives (PLI).

Making Indian Economy Resilient

- **Strategic Public Spending**: Increase health budget to 2.5% of GDP by 2025 from current 1.8%.
- **Human Resource Development**: Skill 40 crore people as targeted under Skill India Mission.
- **Employment Diversification**: Aim to increase manufacturing sector's GDP share to 25% by 2025 from 17%.
- **Land Reforms**: Digitize land records for all 6.6 lakh villages under SVAMITVA scheme by 2024.
- **Sustainable Development**: Install 500 GW non-fossil energy capacity by 2030, up from 179 GW in 2022.
- **Export Promotion**: Reach $2 trillion export target by 2030, up from $770 billion in FY23.
- **Financial Inclusion**: Open 500 million Jan Dhan accounts by 2025, up from 440 million in 2022.
- **Innovation Ecosystem**: Increase R&D spending to 2% of GDP by 2025 from current 0.7%.

Care Economy and Monetized Economy

- Care Economy refers to unpaid caregiving activities performed without any monetary returns.
- Monetized economy whereas includes all those goods and services which are bought and sold in the market.

Aspect	Care Economy	Monetized Economy
Nature of Work	Involves unpaid tasks like childcare, eldercare, and household chores, essential but not compensated.	Involves producing goods and services for money, including sectors like manufacturing and services.
Recognition	Not accounted for in GDP, making its contributions invisible.	Directly contributes to GDP and is recognized in economic reports.
Gender Participation	Predominantly involves women, with a disproportionate caregiving and housework responsibility.	More balanced gender distribution across various sectors and roles.
Skill Level	Requires emotional labor, patience, and multitasking, often without formal certification.	Requires specialized skills and qualifications, recognized through formal education and certification.
Benefits	Offers emotional and social benefits, but no financial compensation.	Provides financial benefits like salaries, bonuses, and wealth accumulation opportunities.
Economic Value	Unmonetized and invisible, leading to a lack of policy focus and investment.	Tangibly measured, making it easier to assess, manage, and invest in.
Taxation	Not subject to taxation as no formal income is generated.	Subject to various forms of taxation, contributing to public finances.
Stability	Long-term and consistent tasks, such as caring for a child or elderly parent.	Jobs can be temporary, seasonal, or contractual, often lacking long-term stability.
Hours	Operates on a flexible but demanding schedule, requiring unpredictable, around-the-clock attention.	Operates within defined hours, with opportunities for overtime and additional compensation.
Regulation	Largely unregulated, leaving caregivers without safety nets or formal protections.	Subject to various regulations, including labor laws and safety standards, providing worker protections.

Integrating the Care Economy into the Monetized Economy: Strategies and Initiatives

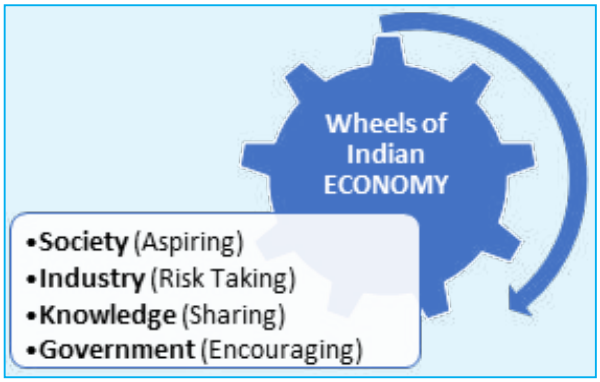
- **Valuing Unpaid Work:** Recognize economic value of unpaid care. UN includes it in satellite accounts.
- **Wage Equality**: Equal pay for equal work. Indian Equal Remuneration Act mandates this.
- **Social Protection**: Implement supportive policies. Sweden's extensive parental leave promotes work-life balance.
- **Women's Workforce Participation**: Provide formal employment opportunities. India's Skill India Mission upskills women.
- **Women's Entrepreneurship:** Support women-led businesses → Stand-Up India offers loans to women entrepreneurs.
- **Community Income Generation**: Promote self-help groups. National Rural Livelihoods Mission supports women's micro-enterprises.

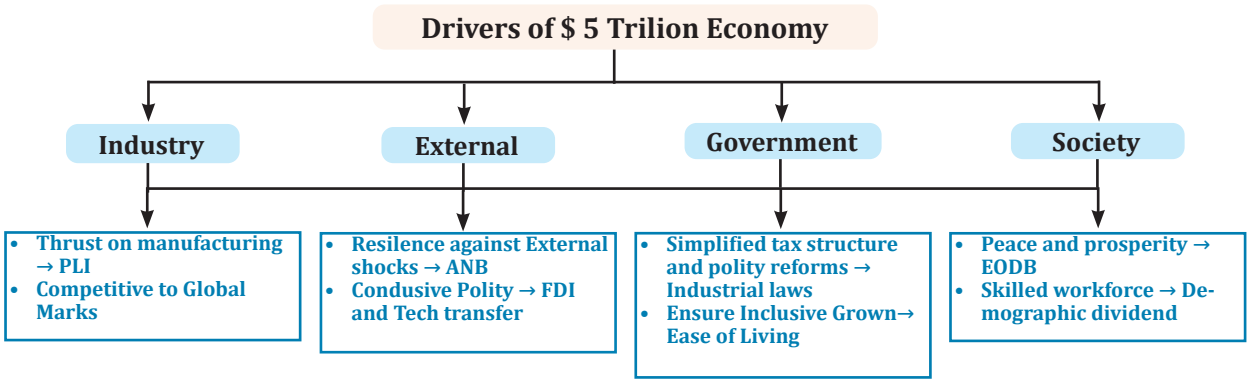
- **Healthcare Employment:** Create healthcare jobs. India's National Health Mission employs women as ASHAs.
- **Childcare Services:** Establish affordable childcare. Singapore's Anchor Operator Scheme subsidizes centers.
- **Cultural Transformation:** Challenge stereotypes. Iceland's campaigns encourage fathers to take parental leave.
- **Technology Integration:** Use tech in care work. Japan's "Society 5.0" applies AI to eldercare.
- **Care Professionalization**: Formalize care work. Philippines' Domestic Workers Act protects domestic workers.

Gender-Responsive Budgeting: Consider gender in budgeting. India's Gender Budget Statement addresses disparities.

Marks Maximiser Keywords

- **5Ds of Indian Economy** → *Democracy, Demography, Demand, Decisiveness and Deregulation*
- **Reforms (4L) in Indian Economy** → *Land, Labour, Liquidity and Law*
- **5 I's of Rapid Transformation** → *Investment, Intent, Inclusion, Innovation and Infrastructure*
- ***Transforming Indian Economy from Fragile Five to Top Five.***
- New India → New Opportunity → New Prosperity





Previous Years Questions	
• Distinguish between 'care economy' and 'monetized economy'. How can care economy be brought into monetized economy through women empowerment?	2023
• Explain the difference between computing methodology of India's gross domestic product (GDP) before the year 2015 and after the year 2015.	2021
• Define potential GDP and explain its determinants. What are the factors that have been inhibiting India from realizing its potential GDP?	2020
• Do you agree with the view that steady GDP growth and low inflation have left the Indian economy in good shape? Give reasons in support of your arguments.	2019
• Among several factors for India's potential growth, savings rate is the most effective one. Do you agree? What are the other factors available for growth potential?	2017

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ART & CULTURE

KGPs' Marks Improvement Grid

STATIC CONCEPT Revisable static concept note	**MARKS MAXIMIZER** Maximizer Answer Sheet Points not to be missed
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कलाम ACADEMY

CHAPTER

01

ARCHITECTURE

The evolution of Indian art and architecture is truly captivating. From the ancient Indus Valley Civilization to the era of British rule, each structure and sculpture carries its own unique narrative. The development of Indian architecture and art mirrors the rise and decline of powerful empires, the arrival of foreign invaders who eventually integrated into local culture, and the blending of diverse influences and styles over time.

Evolution of Indian Architecture

INDUS VALLEY CIVILIZATION (2500BC-1500BC) → ROCK CUT ARCHITECTURE → TEMPLE ARCHITECTURE → INDO-ISLAMIC ARCHITECTURE → COLONIAL ARCHITECTURE

Rock Cut Architecture

- Rock-cut architecture involves creating structures, buildings, and sculptures by carving directly into solid rock. It was mainly used for temples, tombs, and cave dwellings. The oldest example is the Barabar Caves in Bihar, dating back to the 3rd century BC.

Evolution of Rock Cut Architecture

- **Early Phase (2nd CE):** The earliest rock-cut caves date back to the reign of Ashoka and his grandson Dasaratha. Early Buddhist architecture, spanning from the 2nd century BC to the 2nd century AD, mainly consisted **of Chaityas and Viharas,** which were primarily constructed from wood. Notable examples of this architecture can still be seen at sites such as **Karla, Kanheri, Nasik, Bhaja, Bedsa, and Ajanta.**
- **Second Phase (5th CE – 9th CE):** This phase is marked by the removal of timber and the introduction of Buddha images as key features in design. During this period, **Viharas** evolved to house Buddha statues in their inner cells, alongside the monks.
- **Dravidian Influence:** Emergence of the characteristic Mandapa (open pavilion with columns and cells) and the Ratha (monolithic shrine) signals a move toward structural temple architecture.

Pallavas' Contribution (6th–9th CE)

The Pallavas of Southern India pioneered the evolution of Dravidian temple architecture from cave temples to fully-fledged structural temples.

- **Key Features at Mahabalipuram:**
  - **Cave-like Shrines:** Pillared verandahs with carved lion pillars.
  - **Intricate Panels:** Depicting Hindu mythology and sculpted deities.
- **Dedicated Mandapas:**
  - **Varaha Mandapa:** Stunning carvings of Lord Vishnu's boar avatar.
  - **Mahishamardini Mandapa:** Honoring Goddess Durga.
  - **Trimurti Mandapa:** Representing Brahma, Vishnu, and Shiva.
  - **Krishna Mandapa:** Featuring the famous Govardhanadhari panel of Krishna lifting Govardhana hill.
- **Significance:** Rock-cut caves reflect the **transition from aniconic Buddhist art to the anthropomorphic portrayal of Hindu deities**, showcasing **simultaneous evolution in religious thought and architectural form**."

Temple Architecture (Post 5th–6th CE)

- Temple architecture in India has evolved over centuries, adapting to the changing dynasties and regions. Between 600 and 750 A.D., the architecture solidified into two distinct styles: the Nagara in the north and the Dravida in the south. As these styles mingled in the

Deccan region, they gave rise to the Vesara style in the post-750 A.D. period. Despite regional variations in design, all Hindu temples share common core elements: the garbhagriha (sanctum), mandapa, shikhara etc each playing a vital role in the temple's structure and spiritual significance.

Nagara Style of Temple Architecture

- Developed around 5th CE, predominantly in Northern India, followed by other regions including western, central and eastern India.
- **Key Features of Nagara Style Temple Architecture**
- **Built on High Plinth (Jagati):** Temples are elevated on a raised platform, often with steps and decorative base mouldings.
- **Panchayatana Layout** Main shrine (Garbhagriha) surrounded by four subsidiary shrines in a cross-axis formation.
- **Towering Shikhara:** Three main types-
  - **Latina (Rekha-Prasad)** – curvilinear and vertical tower.
  - **Phamsana** – pyramid-like with horizontal tiers.
  - **Valabhi** – barrel-vaulted roof resembling a wagon vault.
- Shikhara crowned with a ribbed stone disc (**Amalaka**) and topped with a finial pot (**Kalasha**).
- **Mandapa in Front:** Assembly Hall (Mandapa) attached to the sanctum, often elaborately pillared.
- **Covered Pradakshina Patha:** Circumambulatory passage (when present) is roofed and enclosed (Sandhara plan).
- **No Water Tanks:** Unlike Dravidian temples, Nagara temples **lack tanks or reservoirs** within premises.
- **Iconography of Ganga and Yamuna:** Images of river goddesses often placed at the temple entrance as doorkeepers of the divine.
- **Absence of Boundary Walls:** No grand Gopurams or walled enclosures; the temple stands open.
- **Decorative Exteriors:** Outer walls richly sculpted with deities, motifs, and narrative friezes; interiors are simpler.

Stages of Temple Architecture	
First stage	♦ **Flat roof** and **square in shape** ♦ Built on low platform ♦ Portico, supported by shallow pillars Ex.- Vishnu Temple, Tigawa (MP)
Second stage	♦ Platforms were higher or upraised ♦ Covered Pradakshina path developed ♦ Double-storeyed temples. ♦ Ex.- Parvati Temple, Nachna (MP)
Third stage	♦ **Shikharas** replaced flat roof. ♦ Introduced **Panchayatana** style. ♦ **Crucified shape** came into prominence ♦ **Subsidiary shrines** appearance Ex.- Dashavatara Temple, Deogarh (UP)
Fourth stage	♦ **Rectangular sanctum** with **apsidal (semi-circular) back** ♦ Barrel-vaulted roof Ex.- Kapoteswara Temple, Chejarla (AP
Fifth stage	♦ Idea of circular temple was introduced with rectangular projection. ♦ Ex.-**Maniyar Math**, Rajgir

Sub-School of Nagara School

ODISHA SCHOOL

- Developed under **Kalinga rulers** (7th–13th century CE).
- **Rekha-Deul** (Shikhara) with vertical curves; **Jagamohana** (mandapa) with a pyramidal roof.
- Temples enclosed by boundary walls; often aligned with cardinal directions.
- Exteriors richly decorated; interiors mostly plain.
- Use of **iron girders** – early engineering adaptation.
- **Cultural Insight**: Iconography often draws from **regional mythological themes** and tribal motifs
- **Examples**: Lingaraja Temple (Bhubaneswar), Sun Temple (Konark), Mukteshvara Temple.

Khajuraho (Chandela) School

- Flourished under **Chandela rulers** (10th–12th century CE, MP).
- Temples on high platforms, east/north-facing.
- Lavishly sculpted **interior and exterior walls**, including **erotic figures**.
- Sandstone was primarily used
- The **subsidiary shrines had Rekha-Prasad type of shikhara** impersonating mountain (Urushringa).
- **Cultural Insight**: Reflects synthesis of **Bhakti, Shaiva, Vaishnava, and Tantric cults**.
- **Example**- Kandariya Mahadev, Lakshmana Temple (MP)

Solanki (Maru-Gurjara) School

- Developed in **Gujarat and Rajasthan** under the Solanki dynasty (11th–13th CE).
- Ornate **Toranas (gateways)** and **step-tanks (Surya-kunds)** near temples.
- Sandstone and soft marble used with intricate carvings
- of temple.
- **Sun-oriented temples: sun-rays fall directly on shrine** during equinox
- Sandstone, Black Basalt, **Soft Marble** were used as material.
- **Cultural Insight**: Integration of temple and water architecture; **sacredness of water** emphasized.
- **Example- Modhera Sun Temple, Rani ki Vav (stepwell temple).**

These sub-schools reflect how **regional ecology, patronage, belief systems**, and **artisanal traditions** shaped **architectural diversity** within the broader Nagara framework.

Stage/Group	Key Features
Mahendra Group (Mahendravarman I)	• Rock-cut cave temples (Mandapas) Earliest examples at Mandagapattu, Mamandur, Dalavanur
Narasimha Group (Narasimhavarman I - Mamalla)	• Sculptural and monolithic architecture • Transition from Mandapas to Rathas (e.g., Pancha Pandvas Rathas, Mahabalipuram) • Draupadi Ratha :is the smallest ratha, like a small bracket.it is designed as hindu temple. • Dharmaraj Ratha : is one of the best example of ratha designed like Vihara. It is biggest among all the rathas • Bhim Ratha and Ganesh rath : are the best examples of the ratha built in the shape of chaitya. • Other two ratha temple: Arjun Rath & Nakula- Sahdeva Ratha • Narrative reliefs (e.g., Descent of Ganges)
Rajasimha Group (Narasimhavarman II)	• Emergence of structural stone temples Developed Vimana and Gopura architecture • Temples: Kailasanatha (Kanchipuram), Shore Temple (Mahabalipuram)
Nandivarman Group (8th–9th Century CE)	• Compact temples with regional influences • Vesara and early Nayaka features • Vaikunta Perumal Temple (Kanchipuram). This temple built by Parmeshwarverman II. This temple dedicated to Bhagwat religion

Dravidian Style of Temple Architecture

- The Dravidian style of temple architecture originated in Tamil Nadu and the southern Deccan during the early Pallava period in the 6th CE. Rooted in earlier traditions of rock-cut architecture, it gradually evolved into elaborate and massive structural temples. The style reached architectural and artistic maturity under successive dynasties such as the Cholas, Pandyas.

Features of Dravidian Style

- **Vimana**: Stepped, pyramidal tower over the **Garbhagriha** (sanctum); unlike curvilinear **Shikhara** of Nagara style.
- **Gopuram**: Monumental entrance gateways; grew larger than the Vimana in later periods (e.g., Nayaka temples).
- **Mandapa**: Pillared hall used for congregation and rituals.
- **Antarala**: Vestibule connecting Garbhagriha and Mandapa.
- **Amman shrine**: Separate shrine for goddess, especially in Shakta traditions.
- **Enclosure walls**: Temples often surrounded by **high concentric walls**.
- **Temple tanks**: Water reservoirs within the complex, reflecting ritualistic significance.
- **Dwarapalas**: Fierce guardian sculptures at entrances.

Cultural and Religious Significance

- Reflected **Bhakti movement** influence—personal devotion to deities, especially Shaiva and Vaishnava traditions.
- Temples served as **economic centres**, **patronized guilds**, and supported **education, arts, and music**.
- It is also used as tools of political legitimacy and dynastic identity.

Some Other Schools of Temple Architecture

Major Temple Architecture Schools in South India & Deccan (Chronological Order)

School & Period	Key Features
Chalukya Style *(6th–8th century CE, Karnataka – Badami, Aihole, Pattadakal)*	• Represented early **experimentation in rock-cut and structural forms**. • **Combined Nagara and Dravida elements**, serving as a **transitional phase**. • Temples feature **flat or slightly stepped shikharas**, and **intricately carved pillars**. • Important precursor to **Vesara style**. **Examples**: *Virupaksha Temple (Pattadakal), Mahakuta Temples (Badami).*
Vesara School *(7th–9th century CE, Deccan – Karnataka & Maharashtra)*	• Developed under **Early Chalukyas** and refined by **Rashtrakutas** and **Hoysalas**. • A **synthesis of Nagara (shikhara)** and **Dravida (vimana, mandapa)** traditions. • Characterized by **stepped towers**, **open ambulatory paths**, and **highly ornate doorframes and ceilings**. • Notable for **intricate sculptural panels**. **Example**: *Ladkhan Temple, Aihole.*
Chola School *(9th–13th century CE, Tamil Nadu)*	• Evolved from **Pallava Dravida tradition**, attaining **maturity under the Cholas**. • Emphasis on **tall vimanas** (e.g. **200 ft** at Brihadeeswara) and **axial, symmetrical layout**. • Gopurams present but **less prominent** than in later styles. • Flourishing of the **bronze sculpture tradition**, especially **Nataraja**. **Examples**: *Brihadeeswara (Thanjavur), Gangaikondacholapuram, Airavateshwara (Darasuram).*
Hoysala School *(11th–14th century CE, Karnataka – Belur, Halebid, Somanathapura)*	• Known for **stellate (star-shaped) ground plan** and **zigzag wall patterns**. • Temples built on raised **Jagati (platforms)**. • Use of **soapstone (chlorite schist)** allowed **fine and dense carving**. • **Lathe-turned pillars**, **Trikuta shrines**, and **ornate ceilings** are hallmarks. • Sculptural detailing resembles **jewellery-like intricacy**. **Examples**: *Chennakesava Temple (Belur), Hoysaleswara Temple (Halebid), Keshava Temple (Somanathapura).*
Vijayanagara School *(14th–16th century CE, Hampi – Karnataka)*	• **Blended Chola, Hoysala, Pandya, Chalukya styles**. • Introduction of **Raya Gopurams – massive, highly ornate entrance towers**. • Addition of **Kalyana Mandapas**, **Amman shrines**, and **Pushkarnis** (temple tanks). • Famous for **musical pillars** (e.g., in *Vittalaswami Temple*). • Temples enclosed within **multiple concentric prakara walls**. **Examples**: *Virupaksha Temple, Vittalaswami Temple, Hazara Rama Temple (Hampi).*
Nayaka School *(16th–18th century CE, Tamil Nadu – Madurai, Srirangam)*	• Continued **Vijayanagara architectural traditions** with enhanced **scale and ornamentation**. • Known for **massive Prakarams** (corridors) and **multi-pillared halls**. • Introduction of the **tallest Gopurams in the Indian subcontinent**. • Integration of **Indo-Islamic decorative motifs** (arches, domes, niches). • Temple complexes often became **self-contained sacred cities**. **Example**: *Meenakshi-Sundareswarar Temple, Madurai* – home to the **world's tallest gopuram**.

Chalukya Style	Hoysala Style	Chola Style	Vijayanagara
			

UNESCO World Heritage Sites in India

- India has **43 UNESCO World Heritage Sites**: 35 Cultural, 7 Natural, and 1 Mixed.
- Notable sites: Ajanta & Ellora Caves, Taj Mahal, Qutb Minar, Sundarbans.

Latest Additions

- **2023**: Sacred Ensembles of the Hoysala Temples (Belur, Halebid, Somanathapura)
- **2024**: **Moidams of the Ahom Dynasty** – First **cultural site** from **Northeast India**.

Sanskriti se Vikas Tak – Heritage as an Engine of Development:

Economic Growth through Tourism	• **UNESCO tag** integrates heritage into **global tourism circuits**, attracting both domestic and international visitors. • **Heritage tourism** boosts **local economies**, **employment generation**, and supports **handicrafts**, **hospitality**, and **micro-industries**. • **Eco-tourism** enables **low-impact, conservation-based livelihoods**. • **Example**: **Kaziranga National Park** – community-based eco-tourism linked to **rhino conservation**.
Cultural Identity & Soft Power:	• Heritage preservation nurtures **national pride**, cultural memory, and **civilizational continuity**. • Projects India as a **global cultural leader**, enhancing its **soft power** and diplomatic influence. • Supports **spiritual tourism circuits** like the **Buddhist Heritage Belt** and **Ramayana Circuit**. • ***Example**: Sarnath and Bodh Gaya attract global pilgrims and scholars alike.*
Institutional & Legal Ecosystem	• **World Heritage Convention (1972)** – integrates heritage into **national planning frameworks**. • **Ancient Monuments and Archaeological Sites and Remains Act (AMASR), 1958** – provides **legal protection**, though sometimes criticized for **centralized control**. • Key institutions: **Archaeological Survey of India (ASI)**, **Indian National Trust for Art and Cultural Heritage (INTACH)**, **National Culture Fund (NCF)**. • **Example**: **Mahabalipuram's monuments** protected via **regulatory buffer zones**.
Community Empowerment	• Involving local communities ensures **sustainable management** and creates a sense of **ownership** and pride. • Helps bridge **socio-economic gaps** by integrating heritage in local development plans. • Revives **traditional skills**, artisan work, and oral histories. • Examples: • Mera Gaon Meri Dharohar (MGMD): Village-level cultural mapping initiative. • Rani ki Vav: Motifs revived in Patola sarees, sustaining local crafts.
Technological Integration	• **Digital Documentation:** 3D scanning of Ellora's Kailasa Temple • **Virtual Tourism:** Darjeeling and Nilgiri Railways offer VR tours to reduce footfall

Challenges in Heritage-Led Development

- **Urban pressure**: Congestion, industrialization, and pollution affect heritage integrity (e.g., **Agra Fort**).
- **Inadequate funding**: Less than **0.1% of GDP** allocated to heritage conservation.
- **Climate change**: Rising sea levels, salinity, and natural disasters threaten ecologically sensitive sites (e.g., **Sundarbans**).
- **Exclusion of local stakeholders**: Communities often sidelined in planning and management (e.g., near **Hampi**).
- **Over-commercialization of sacred sites**: Impacts spiritual experience and sanctity (e.g., **Bodh Gaya**).

Government Initiatives for UNESCO Sites

- HRIDAY (Heritage City Development and Augmentation Yojana): Integrates **urban infrastructure development** with **heritage conservation**. **Example**: Ghat redevelopment and façade restoration in **Varanasi**.
- National Mission on Monuments and Antiquities (NMMA): Offers **financial and technical assistance** for monument restoration. **Example**: Restoration of **Sanchi Stupa**, documentation of over 3 lakh antiquities.
- Incredible India Campaign: Markets Indian **heritage tourism** globally. **Example**: Showcased **Hampi** and **Khajuraho** as global heritage circuits.
- Digital Documentation Initiatives: 3D scanning and digitization of monuments for **preservation and accessibility**. **Examples**: **Ellora**, **Konark** temples.
- Global Branding of UNESCO Sites: Collaborations with international platforms.
- **Example**: Partnership with **Google Arts & Culture** – virtual promotion of **Mahabalipuram**.

- Strengthening of Heritage Laws: Tighter AMASR norms, including bans on construction near protected monuments.
- **Example**: Ban on new buildings near **Mahabalipuram** monuments.
- Infrastructure Development around Sites: Improved **roads**, **sanitation**, **visitor facilities**, while maintaining heritage integrity. **Example**: **Modhera Sun Temple** developed as India's first **solar-powered heritage town**.
- Cultural Festivals and Events: Promote **awareness and pride** through traditional arts.
- **Example**: **Konark Dance Festival** at the Sun Temple, Odisha.

Way Forward

- **Public-Private Partnerships (PPP)**: Red Fort's sound and light show supported by corporate sponsorship
- **Heritage Education Integration**: NCERT content includes WHS like Bhimbetka, Nalanda, Konark to instill pride from early schooling
- **Global Best Practices**: E.g., Chandigarh by Le Corbusier – showcases India's openness to international architecture and planning norms
- **Decentralised Management**: Empower local panchayats, temple trusts, and artisans as **custodians of heritage**

Conclusion

UNESCO recognition is not an endpoint, but a beginning. India's World Heritage Sites are not just symbols of ancient glory—they are strategic assets for **cultural diplomacy**, **economic development**, and **inclusive growth**. Realizing the vision of **Sanskriti se Vikas** requires integration of **culture with commerce**, **tradition with technology**, and **policy with participation**.

PREVIOUS YEAR QUESTIONS		
Year	**Question**	**Marks**
2024	Estimate the contribution of Pallavas of Kanchi for the development of art and literature of South India.	**10**
2024	"Though the great Cholas are no more, yet their name is still remembered with great pride because of their highest achievements in the domain of art and architecture." Comment.	**15**
2022	How will you explain that medieval Indian temple sculptures represent the social life of those days?	**10**
2022	Discuss the main contribution of Gupta period and Chola period to Indian heritage and culture.	**15**
2020	The rock-cut architecture represents one of the most important sources of our knowledge of early Indian art and history. Discuss.	10
2015	Mesolithic rock architecture of India not only reflects the cultural life of the times but also a fine aesthetic sense comparable to modern painting. Critically evaluate this comment.	12.5
2013	Chola architecture represents a high watermark in the evolution of temple architecture. Discuss.	5

S1 – UPSC PYQS ON TEMPLE ARCHITECTURE		
Year	**Question (Verbatim)**	**Marks**
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CSE Mains | General Studies-I

GEOGRAPHY

KGPs' Marks Improvement Grid

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कलाम ACADEMY

Contents

Syllabus

- Salient Features of World's Physical Geography
- Distribution of key natural resources across the world (including South Asia and the Indian sub-continent); factors responsible for the location of primary, secondary, and tertiary sector industries in various parts of the world (including India)
- Important Geophysical phenomena such as earthquakes, Tsunami, Volcanic activity, cyclones. etc., geographical features and their location-changes in critical geographical features (including water-bodies and ice-caps) and in flora and fauna and the effects of such changes

Topic Asked in Mains

- **Geomorphology**
  - → Continental Drift Theory, Types of Rocks, Characteristics of Circum-Pacific Belt, Earthquakes, Volcano & Landslides
- **Climatology**
  - → El Nino and La Nina, Cyclones, Cloudbursts, Temperature Inversion,
- **Oceanography**
  - → Coastal Ecology, Oceanic Currents, Global Warming & its impact on Oceans, Dead Zones & Marine Ecosystem
- **Indian Climate**
  - → Term associated with local winds,
- **Population Dynamics**
  - → Demographic Winter, Relation between Poverty and Population Growth, Population Education, Role of Women in Population control.
- **Human Settlement and Associated Issues**
  - → Urbanisation, Problems of IT hubs in Urban Centres
- **Land Pattern Usages and Trends**
  - → Effective management of land resources, carrying capacity
- **Location of Primary, Secondary and Tertiary Industries**
  - → Agro-processing industries, Green revolution, sugar mills and regional variations, cotton and textile industries
- **Minerals and Energy Resources**
  - → Atomic Energy or Nuclear Energy, Wind Energy, Solar Energy and associated issues.
- **Water Resources and Management**
  - → Water Harvesting System, Water Stress, Fresh water Resources
- **Transport and Communication**
  - → Problems of Inland Transport, Urban Mass Transport

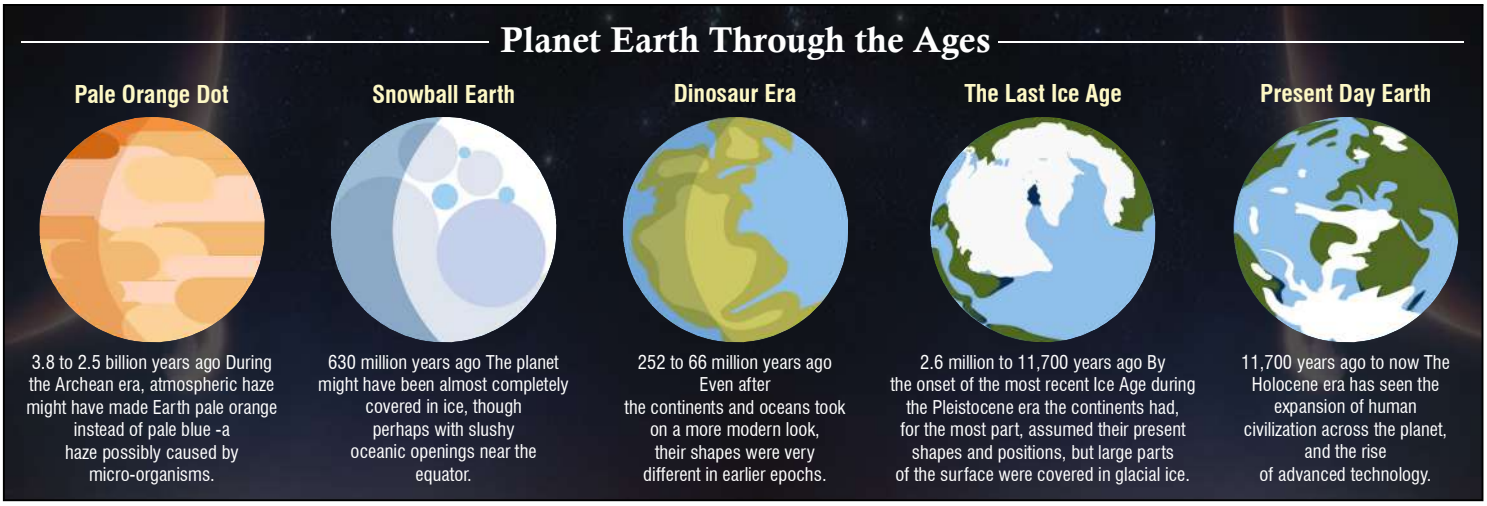
1 Geomorphology

Geomorphology is the scientific study of landforms and the processes that shape them. It explores the origin, development, and distribution of landforms on Earth and other planets. It combines elements of geology, geography, physics, and environmental science to understand the dynamics of the Earth's surface, focusing on processes like erosion, sedimentation, tectonics, and weathering.

1.1. Origin and Evolution of Earth

Earth is a part of a vast and dynamic solar system, and to understand its origins, we must explore the formation of the solar system as a whole. Theories relating to the origin of the Earth;

Theory	Proposed by	Details
Nebular Hypothesis	Kant and Laplace	• It proposes that the solar system originated from a large, rotating cloud of gas and dust called a solar nebula. Over time, this nebula collapsed under its own gravity, flattened into a disk, and eventually formed the Sun and planets. • Modern astronomical observations, such as those from the Hubble Space Telescope, have directly imaged protoplanetary disks around young stars, providing strong support for the Modern Nebular Theory, a refined version of the original Kant-Laplace hypothesis.
Planetesimal Hypothesis	Chamberlain and Moulton	• Planets in our solar system formed from small bodies (planetesimals) in the rotating solar nebula. Planetesimals grew through accretion, with the largest forming planets. The rest were ejected or became moons.
Process of Accretion	Carl Weizascar & Otto Schimidt	• Accretion is the process by which small particles of matter, such as dust and gas, gradually accumulate to form larger bodies. This process is responsible for the formation of planets, stars, and galaxies. • The Core Accretion Model, an updated version of the accretion and planetesimal hypotheses, is now the leading explanation for the formation of planets in our solar system.
Big Bang Theory	Georges Lemaître (1927) & Edwin Hubble	• The Big Bang Theory was first proposed by Georges Lemaître. Edwin Hubble's observations of the expanding universe provided crucial evidence supporting this theory. • It explains the origin and evolution of the universe from a hot, dense state about 13.8 billion years ago. As the universe expanded and cooled, subatomic particles combined to form atoms, leading to the creation of stars and galaxies. Supported by observations like the expansion of the universe and the cosmic microwave background radiation, the Big Bang Theory is the leading cosmological model for the universe's history.



Origin and Evolution of Life on Earth in Eight Stages:

- → **Inhospitable Conditions:** Earth's early atmosphere was not suitable for life, consisting of gases like methane, ammonia, carbon dioxide, and hydrogen, with no oxygen.
- → **Formation of Life's Molecules:** As Earth cooled, water vapor condensed into liquid water, allowing life's basic molecules to form in these water bodies.
- → **Evolution of Bacteria:** Bacteria, the earliest life forms, evolved from these molecules. Fossils of bacteria have been found in rocks dating back 3-5 billion years.
  - Recent studies indicate that oxygen-utilizing bacteria may have evolved much earlier than previously thought, suggesting a more complex and dynamic early biosphere.
- → **Photosynthetic Bacteria:** Some bacteria developed the ability to photosynthesize, using carbon dioxide and water to produce oxygen, which slowly began accumulating in the atmosphere.
- → **Transformation of Atmosphere:** Oxygen levels increased, transforming the atmosphere from reducing to oxidizing, eventually reaching 21% oxygen.
- → **Biological Evolution:** Rise in oxygen triggered further biological evolution, leading to the emergence of life on land.
- → Progression of Life Forms: Life evolved from bacteria to protists, followed by more complex multicellular organisms such as fungi, plants, and animals.
- → **Five Kingdoms of Life:** Life is now classified into five kingdoms: Monera, Protista, Fungi, Plantae, and Animalia.

Asteroid

- An **asteroid** is a small rocky object that orbits the Sun, mostly found in a region between Mars and Jupiter called the **asteroid belt**. Unlike planets, asteroids are much smaller and irregularly shaped. They range in size from tiny pebbles to objects that are hundreds of kilometres across.
- Recent space missions (such as OSIRIS-REx and Hayabusa2) have provided direct samples from asteroids, revealing new details about their composition and structure.
- Asteroids are composed of various materials, including rock, metal, and sometimes organic compounds. There are three main types of asteroids:
  1. **C-type (carbonaceous):** Rich in carbon and the most common type, these are dark and found mostly in the outer regions of the asteroid belt.
  2. **S-type (silicaceous):** Made of silicate materials and nickel-iron, these are found in the inner asteroid belt.
  3. **M-type (metallic):** Composed mostly of metals like iron and nickel.

Meteor	Meteoroid	Meteorite
The object while it's still in space.	The bright streak in the sky as it burns up in the atmosphere.	The remaining fragment that hits the Earth's surface.

- Most meteoroids burn up in Earth's mesosphere; only a small fraction survive to reach the ground as meteorites.
- On average, about 48.5 tons of meteoritic material falls to Earth daily, but most is vaporized in the atmosphere.

1.2.Solar Flares and Sunspots

Solar Flares	• Solar flares are sudden, intense bursts of radiation and energy from the Sun's surface. They occur when magnetic energy stored in the Sun's atmosphere is released, often in areas near sunspots. • Classified by strength: A, B, C, M, and X-class (X being the most powerful, with each letter representing a tenfold increase in intensity). • **Effects:** These powerful bursts emit X-rays, ultraviolet light, and energetic particles that can reach Earth, causing effects like: o Disruption of satellite communications and GPS systems. o Radio signal blackouts. o Enhanced auroras (Northern & Southern Lights). o Potential harm to astronauts & space equipment.

Sunspots	• Sunspots are cooler, darker areas on the Sun's surface (photosphere) that appear due to intense magnetic activity. They are temporary and typically occur in groups. • **Connection to Solar Flares:** Sunspots are often associated with solar flares. Regions with complex magnetic fields near sunspots are prone to flare activity, making sunspots indicators of potential solar flares. • The frequency of sunspots and solar flares varies with the solar cycle, which lasts about 11 years and has periods of maximum and minimum activity

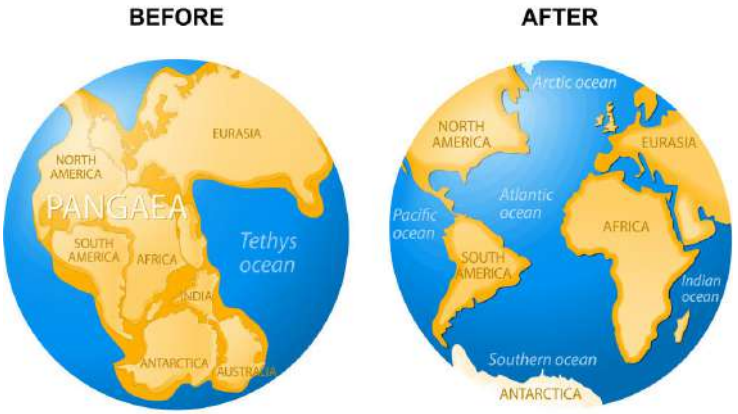
Impact of Solar Flares and Sunspots

- **Space Weather:** Solar flares and the solar wind (charged particles from the Sun) can create geomagnetic storms on Earth, potentially disrupting power grids and communication networks.
- Coronal mass ejections (CMEs), large expulsions of plasma and magnetic field from the Sun's corona, are the main cause of the most intense geomagnetic storms on Earth, which can disrupt power grids and satellite operations.
- **Climate:** While the Sun's overall output varies slightly due to the solar cycle, sunspot activity doesn't significantly affect Earth's long-term climate, though prolonged periods of low sunspot activity (like the Maunder Minimum) have been linked to historical cool periods.

Sunspots are visible indicators of magnetic activity on the Sun, while solar flares are sudden explosions of energy associated with that activity. Both are interconnected and play key roles in influencing space weather.

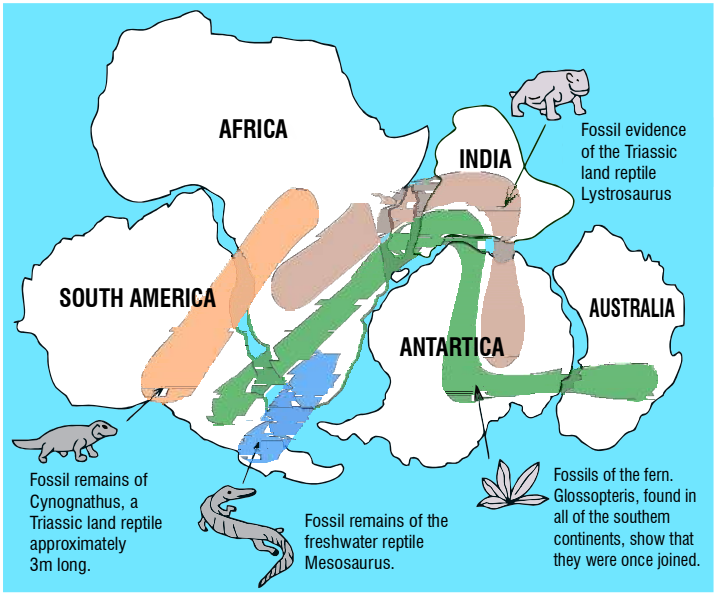
1.3.Continental Drift Theory

It was proposed by **Alfred Wegener in 1912**, suggests that the continents were once connected in a single landmass called Pangea. Pangea began to break up about 200 million years ago. The continents have continued to move ever since. It suggests that the Earth's continents were once joined together in a single supercontinent called Pangaea. The mega-ocean was called Panthalassa, meaning all water.



<u>Wegener's theory was based on several observations</u>

- **Pangaea:** Wegener hypothesized that all continents were once connected as one landmass, known as Pangaea, which eventually split into smaller continents that drifted to their current positions.
- **Fossil Evidence:** Similar fossils of plants and animals (e.g., Mesosaurus, Glossopteris) have been found on continents that are now widely separated, suggesting they were once joined.
- **Geological Evidence:** Mountain ranges and rock formations of similar age and structure, such as the Appalachian Mountains in North America and the Caledonian Mountains in Scotland, indicate that these landmasses were once connected.
- **Climate Evidence:** Evidence of past climates, such as glacial deposits found in now tropical regions, supports the idea that continents have moved from their original locations.
- **Fit of the Continents (Jig Saw Fit):** The shapes of continents, particularly South America and Africa, appear to fit together like puzzle pieces, further suggesting they were once part of a single landmass.



Criticism of Continental Drift Theory

- **Lack of Mechanism:** Wegener could not explain how continents moved, leading critics to question the plausibility of the theory.
- **Inconsistent Geological Evidence:** Some geological formations and fossil distributions did not align well with the idea of drifting continents.
- **Misinterpretation of Fossils:** Critics argued that fossil correlations could be explained by land bridges or similar evolutionary paths rather than continental connections.
- **Incomplete Understanding of Earth's Structure:** The limited knowledge of the Earth's interior made it difficult to understand how large landmasses could move.

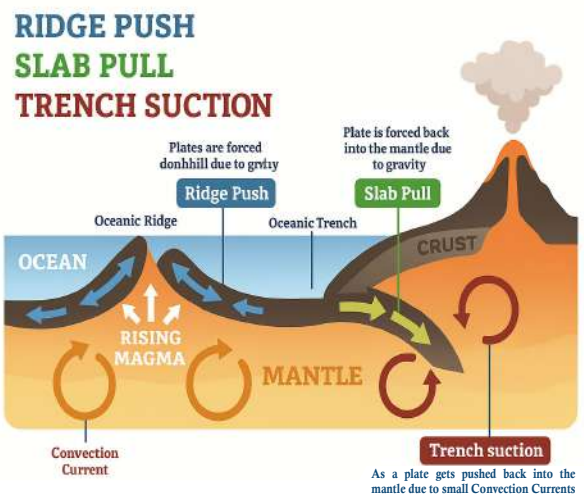
Significance: The continental drift theory has revolutionized our understanding of the Earth's history and evolution. It has also had a major impact on our understanding of climate change, as it explains how the Earth's climate has changed over time due to the movement of the continents.

1.4.Seafloor Spreading Theory

It was proposed by **Harry Hess in 1960s**, which elucidates the intricate processes that shape and reshape the ocean floor. This theory revolutionized our understanding of the Earth's dynamic nature.

Key Principles of the Seafloor Spreading

- **Perpetual Movement:** The seafloor is constantly in motion, driven by forces deep within the Earth.
- **Birth of New Ocean Floor:** New oceanic crust is continually generated at mid-ocean ridges, where tectonic plates diverge. Magma rises from the mantle, solidifies, and forms new seafloor.
- **Demise of Old Ocean Floor:** Old oceanic crust meets its demise at subduction zones, where it sinks beneath other plates and is reabsorbed into the Earth's interior.
- **Mantle Convection Currents:** Movement of ocean floor is ultimately driven by convection currents within Earth's mantle. These currents, caused by temperature differences, transfer heat from planet's interior to surface.
- Plate movement is primarily driven by slab pull at subduction zones and ridge push at mid-ocean ridges, in addition to mantle convection currents.



- **Spreading rates vary globally:** Fast ridges (East Pacific Rise) >90 mm/year; slow ridges (Mid-Atlantic Ridge) <40 mm/year. Spreading rates have slowed by about 35% in the last 19 million years.

Evidence Supporting the Seafloor Spreading Theory

- **Earthquake and Volcanic Activity:** The distribution of earthquakes and volcanoes closely follows the boundaries of tectonic plates, particularly at mid-ocean ridges and subduction zones.
  - o 90% of all earthquakes occur along plate boundaries. The "Ring of Fire" around the Pacific demonstrates subduction zone volcanism
- **Age of the Ocean Floor:** The age of the ocean floor can be determined by measuring the thickness of sediment layers. The ocean floor is generally younger at mid-ocean ridges and older near continents.
- **Magnetic Stripes:** Ocean floor is adorned with alternating stripes of contrasting magnetic polarity. These magnetic stripes are created as new ocean floor forms & retains magnetic field orientation of Earth at times of its formation.

Implications of the Seafloor Spreading Theory

- **Earth's Ever-Changing Nature:** The theory underscores the dynamic nature of the Earth, revealing that the planet's surface is constantly evolving.
- **Continental Drift:** The seafloor spreading theory provides a mechanism for continental drift, explaining how continents have moved over time to their current positions.

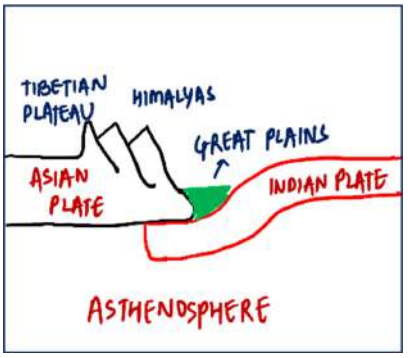
- **Mineral Resources:** The process of seafloor spreading creates valuable mineral deposits, such as hydrothermal vents and seafloor massive sulfide deposits, which are rich in metals like copper, gold, and zinc.
- **Hydrothermal vents** at mid-ocean ridges support unique life forms and are sites for valuable mineral deposits. Seafloor spreading also impacts the carbon cycle by releasing greenhouse gases.

the present day, the seafloor spreading theory stands as a cornerstone of modern geology. It has transformed our understanding of the Earth's processes and continues to guide scientific research and exploration of the ocean floor.

1.5.Plate Tectonics

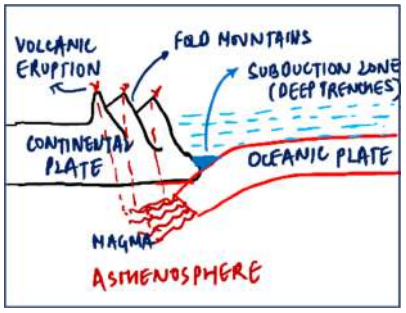
Continent-Continent Convergence

- Occur due to convergence between Continental plates.
- The plate which may have comparatively denser or have more velocity slides beneath the lighter plate, lifting it upwards.
- Unlike oceanic-continental convergence where subduction occurs, both plates in this scenario have similar densities and buoyancy, leading to unique geological consequences.
- In this region, there is doubling of earth's crust and hence volcanoes are absent, but they have high mountains and earthquakes.
  Eg. Indian Plate subducts in Asian plate
- **Significance:** Young Fold Mountains are present → Himalayas.



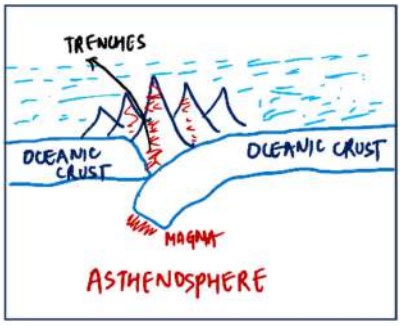
Ocean-Continent Convergence

- Occur due to convergence of Oceanic Plate and Continental Plate.
- The collision of these two plates causes formation of sediments.
- Over the period of time, these sediments are folded or unwrapped to give rise to the high mountains known as fold mountains.
- Generally, continental-ocean convergence gives rise to Cordillera system (long mountain chains parallel to each other).
  Eg. Rockies (Pacific and Juan De Fuca Plate), Andes (Nasca Plate and South American Plate), Alps (Asian and Eurasian Plate).



Ocean-Ocean Convergence

- As both the plates are oceanic plates, they have similar density. In case of collision, a plate of greater density or greater velocity may subduct.
- The sediments of both the plates are folded to form submarine mountains, due to subduction.
- Due to subduction, there is a constant vulcanism → Layers of lava buildup and are projected above the water level, forming chain of islands known as Island Arcs and Festoons.
  Eg. Caribean Island Arc, Japanese Island Arc, Indonesian Island Arc.

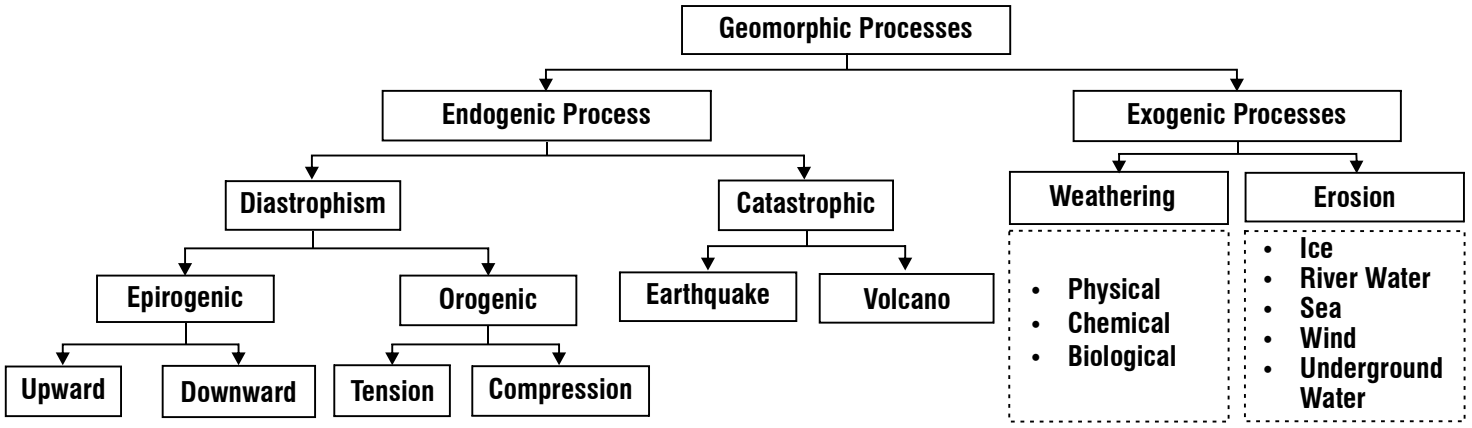


1.6.Interior of the Earth

The configuration of the surface of the earth is largely a product of the Exogenic as well as Endogenic processes operating in the interior of the earth

Why it is important to know about Interior of the Earth?

- **Predicting Natural Hazards:** It helps in understanding earthquakes, volcanic eruptions, and tsunamis, aiding disaster preparedness.
- **Plate Tectonics:** Explains how tectonic plates move, causing mountains, earthquakes, and volcanoes.
- **Resource Exploration:** Guides the search for minerals, fossil fuels, and geothermal energy.
- **Magnetic Field:** Earth's core generates the magnetic field, protecting life from harmful solar radiation.
- **Earth's Evolution:** Provides insights into Earth's formation, structure, and geological history.
- **Seismic Studies:** Seismology helps map the Earth's interior using earthquake-generated waves.
- **Climate Impact:** Volcanic activity affects global climate and the carbon cycle.
- **Planetary Science:** Helps understand other planets by comparing Earth's structure.
- **Infrastructure:** Essential for safe construction projects like tunnels and dams.



	Endogenic Processes	Exogenic Processes
Definition	Originate from within the Earth and are primarily driven by the heat and energy from the Earth's interior (such as radioactive decay and heat from the Earth's core).	Originate from forces and energy outside the Earth's interior, mainly driven by solar energy, gravity, and atmospheric forces.
Landforms	Builds up the Earth's surface (e.g., mountain formation, volcanic activity).	Wears down the Earth's surface (e.g., erosion, weathering).

Endogenic Processes → Diastrophism

Processes that deform the Earth's crust, leading to the formation of various landforms. It includes all the movements of the Earth's crust caused by tectonic forces, resulting in the bending, breaking, and uplifting of the Earth's surface. Diastrophism is primarily driven by internal forces such as heat, pressure, and the movement of tectonic plates.

Epeirogenic Processes → involve slow, vertical movements of the Earth's crust, either uplifting or sinking large regions without significant deformation. They affect broad areas like continents and occur over long periods.

Key Points:

- **Uplift:** Land rises, often due to melting glaciers or erosion (e.g., post-glacial rebound).
- **Subsidence:** Land sinks due to sediment accumulation or other factors (e.g., Mississippi River Delta).
- **Effects:** Create plateaus, alter coastlines, and change river systems.

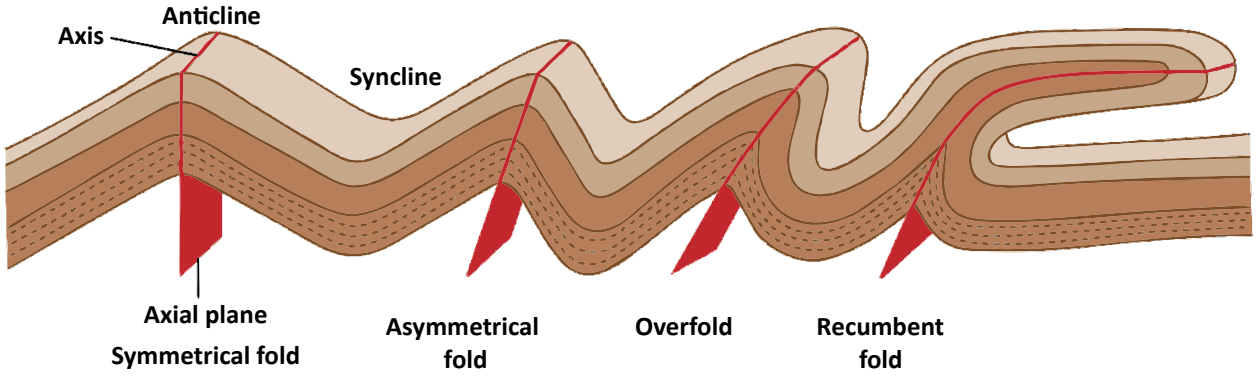
Unlike orogenic (mountain-building) processes, Epeirogenic movements affect broad continental areas and occur over millions of years, shaping landscapes in subtle but profound ways.

Orogenic Forces → Orogenic forces refer to the tectonic processes that lead to the formation of mountains, these forces are primarily driven by the movement and interaction of Earth's tectonic plates and involve intense deformation of the Earth's crust.

Folding

- It occurs when landform in unwrapped due to intensive compressive forces that operates within the earth.
- Folding occurs in relatively more elastic rocks, as even after the compressive forces they are not broken.
- Folding results in the formation of Anticline (anticlinal mountains) and Syncline (Synclinal valleys)
- **Types of Folds**

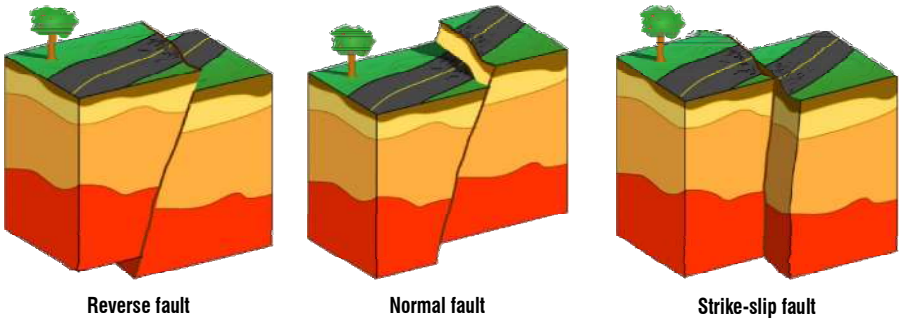
Symmetrical	Both the folds are inclined equally or at equal angles.
Asymmetrical	If one limb is inclined at steeper angle or both are inclines at different angles.
Monoclinal	If one limb is steeply inclined, while other limb is gentle Himalayan Mountain Range
Isoclinal	If the compressive forces from both the sides are strong, both limbs become steep and more or less parallel to each other.
Recumbent	Both the limbs become parallel to each other and they are parallel to the ground surface. It is seen in complex fold mountain range.
Overthrust	When the compressive forces are very strong, the recumbent fold may be broken at the central point and hence both limbs of the fold may join forming overthrust fold.



Faulting

- A geological process where the Earth's crust breaks and moves, is primarily caused by tectonic forces acting upon the Earth's lithosphere. The movement of tectonic plates can be in three main directions:
  - **Tensional Forces:** Pull rocks apart, creating normal faults (e.g., Basin and Range Province, USA).
  - **Compressive Forces:** Push rocks together, forming reverse/thrust faults (e.g., Himalayas).
  - **Shear Forces:** Cause horizontal movement, leading to strike-slip faults (e.g., San Andreas Fault).
- Faulting represents a crack in the rocks along the lines or zone of weakness (joints).
- **Types of Faults**

Normal Fault	It is caused due to tensional forces, pulling apart the rocks. The displacement of rocks give rise to Horst and Graben.
Reverse Fault	It is formed due to compressive forces; it results in crustal shortening. E.g. Vindhyas and Satpura.
Stripe-Slip Fault	In a strike-slip fault, the movement of the rocks is **horizontal**, along the fault line. The blocks of rock move sideways past each other rather than up or down.
Lateral Fault	In this type of fault, movements of rocks occurs horizontally either to the left or the right. Leftward movement is known as Dextral Fault and Rightward movement is known as Sinistral Fault → In such types of faults, there are long narrow rift valleys. E.g. African Rift Valley.



Endogenic Processes → Catamorphic Processes

A catastrophic process refers to an event or series of events that lead to severe, often irreversible damage or disruption. These processes can occur in various contexts, including natural disasters, industrial failures, biological phenomena, or technological systems.

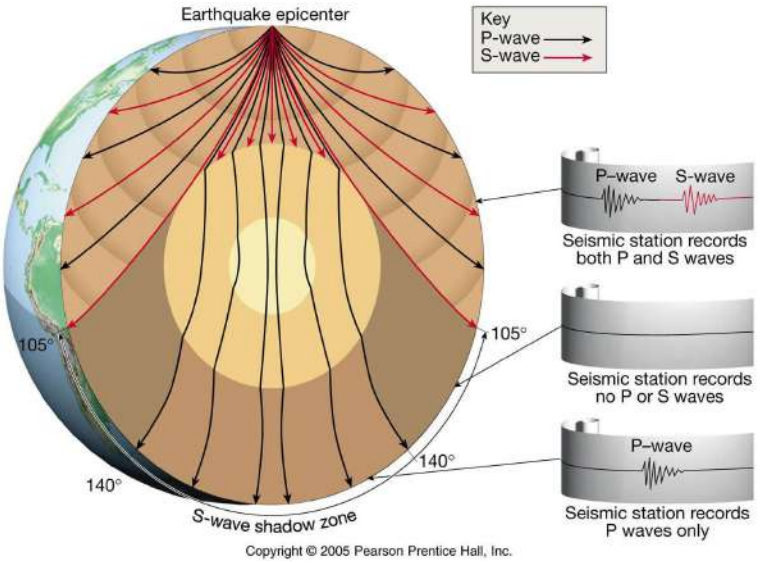
1.7.Earthquakes

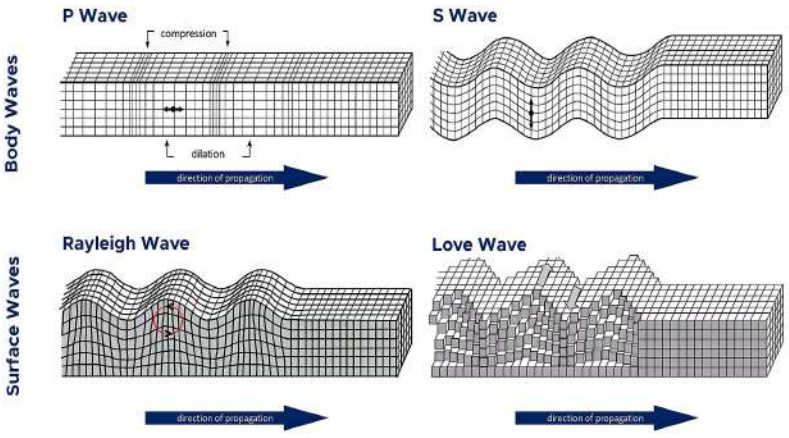
An earthquake is the shaking of the Earth's surface caused by the sudden release of energy in the crust, often due to fault movements. This energy travels as seismic waves, causing ground shaking that can vary in intensity and may be followed by aftershocks.

Earthquake Waves

Earthquake waves, also known as **seismic waves,** are the energy waves produced by an earthquake. They are classified into two main types:

1. **Body Waves:** These travel through the Earth's interior.
   - **P-waves (Primary waves):** The fastest type, compressing and expanding the ground like sound waves. It travels through Solid, Liquid and Gaseous materials.
   - **S-waves (Secondary waves):** Slower than P-waves, moving the ground up and down or side to side. It travels only through Solid materials.
2. **Surface Waves:** These travel along the Earth's surface and are slower but cause more damage.
   - **Love waves** produce horizontal shearing motions that are especially hazardous to building foundations as they move the ground from side to side.
   - **Rayleigh waves** create an elliptical, rolling motion similar to ocean waves, combining both vertical and horizontal displacements that can severely damage infrastructure.

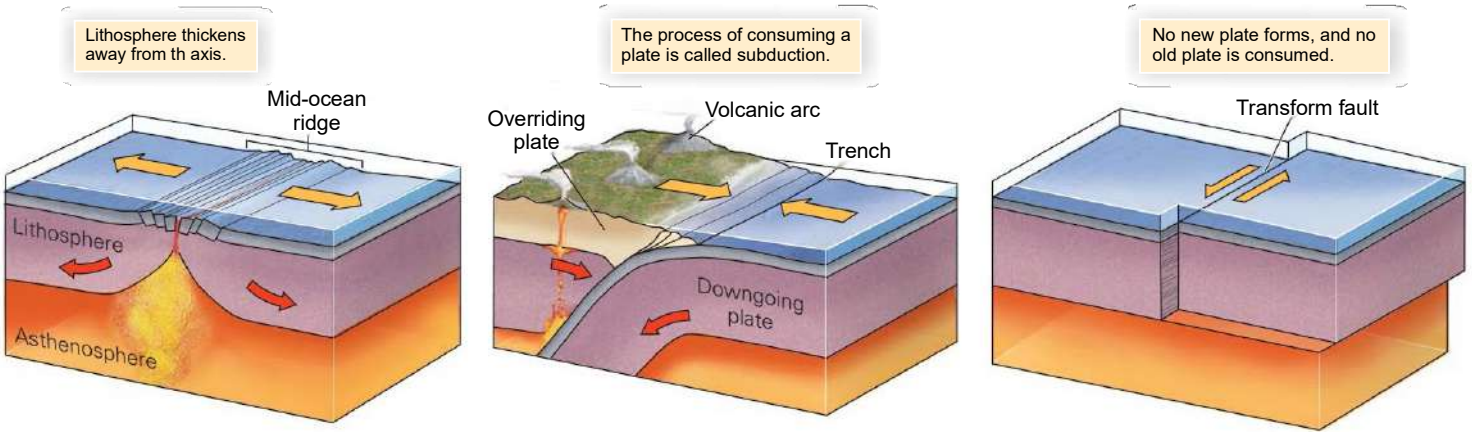




Distribution of Earthquakes

Earthquakes are primarily distributed along tectonic plate boundaries where the Earth's plates interact. There are three main types of plate boundaries where earthquakes commonly occur:

1. **Convergent Boundaries:** Where plates collide, such as in subduction zones (e.g., Pacific "Ring of Fire"), leading to strong earthquakes.
2. **Divergent Boundaries:** Where plates move apart, such as mid-ocean ridges, causing less frequent and smaller earthquakes.
3. **Transform Boundaries:** Where plates slide past each other, such as the San Andreas Fault, generating frequent and sometimes severe earthquakes.

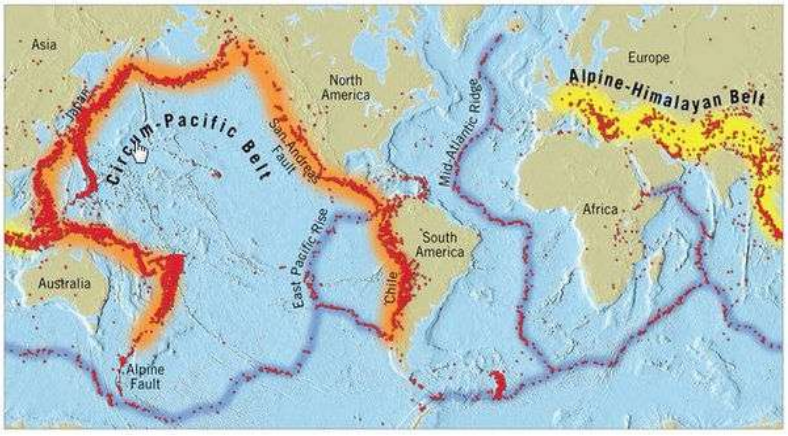


(a) At a divergent boundary, two plates move away from the axis of a mid-ocean ridge. New oceanic lithosphere forms.

(b) At a convergent boundary, two plates move toward each other; the downgoing plate sinks beneath the overrding plate.

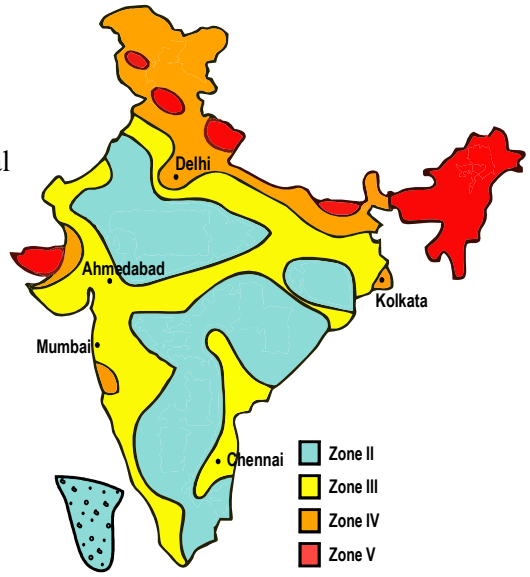
(c) At a transform boundary, two plates slide past each other on a vertical fault surface.

Three Major Belts of Earthquakes



- **Circum-Pacific Belt (Ring of Fire):** Most active earthquake zone, located around edges of the Pacific Ocean, including countries like Japan, Chile, Indonesia, and the west coasts of North and South America.
- **Alpide Belt:** Stretches from the Mediterranean region through southern Europe, Middle East, and into the Himalayas, affecting areas like Turkey, Iran, and northern India.
- **Mid-Atlantic Ridge:** A mostly underwater seismic zone where tectonic plates are diverging, causing frequent but usually less intense earthquakes. It runs along the Atlantic Ocean floor.

Distribution of Earthquakes in India



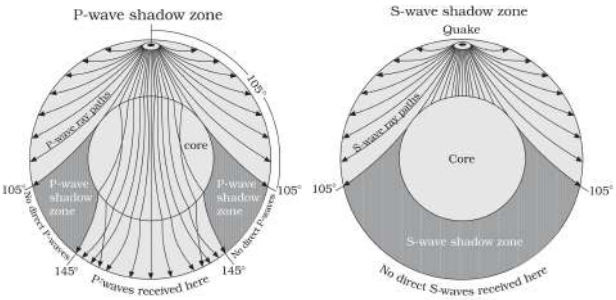
- **Himalayan Region:** Northern states like Jammu and Kashmir, Himachal Pradesh, and Uttarakhand.
- **Northeastern India:** States like Assam, Arunachal Pradesh, and Sikkim.
- **Ganges-Brahmaputra Basin:** Northern West Bengal and parts of Bihar.
- **Indus-Ganga Plain:** Western Uttar Pradesh and parts of Punjab.
- **Western India:** Gujarat, especially around Kutch.
- **Southern India:** Parts of Andhra Pradesh and Karnataka, though less active.

Key Terminology

- **Focus (Hypocentre):** Location within the Earth where an earthquake begins.
- **Epicentre:** Point on the Earth's surface situated directly above the focus.
- **Foreshocks:** Smaller tremors that occur before the main earthquake event.
- **Aftershocks:** Smaller tremors that follow the primary earthquake.
- **Swarms:** A series of numerous minor earthquakes concentrated in a specific area over a short period.
- **Magnitude:** The measurement of the energy released by an earthquake.
- **Seismic Waves:** Energy waves that travel through the Earth's layers during an earthquake.
- **Richter Scale:** A logarithmic scale used to measure the magnitude of an earthquake.

Shadow Zone of Earthquakes

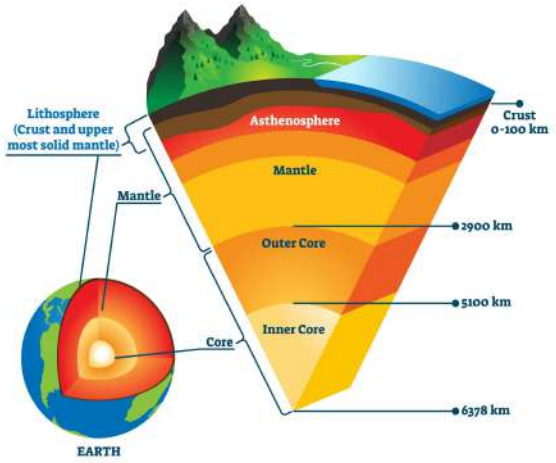
- Seismographs situated at great distances from the epicentre can record earthquake waves, but there are specific regions where these waves are not detected, known as the "shadow zone."
- Seismographs within 105° of the epicentre capture both P and S-waves, while those beyond 145° only detect P-waves.



1.8.Structure of the Earth

The Earth is composed of several layers, each with distinct characteristics. These layers can be broadly divided into the crust, mantle, outer core, and inner core.

- **Crust:** Earth's outermost layer, which is solid and relatively thin compared to other layers.
  - **Thickness:** Varies from about 5 km (beneath oceans) to 70 km (under continents).
  - **Composition:** Primarily composed of silicate rocks like basalt (in the oceanic crust) and granite (in the continental crust).
  - **Temperature:** Ranges from about 200°C to 400°C near the mantle.
  - The mean density of material in oceanic crust (3 g/cm3) is higher than the continental crust (2.7 g/cm3).
  - **Subdivisions:**
    - **Oceanic crust:** Denser and thinner, primarily basaltic.
    - **Continental crust:** Thicker and less dense, primarily granitic.
- **Mantle:** Layer beneath the crust, extending to about 2,900 km deep.
  - **Composition:** Made of silicate minerals rich in iron and magnesium.
  - **Thickness:** Approximately 2,885 km.
  - **Temperature:** Ranges from about 500°C near crust to 4,000°C near the core.
  - The immense heat within the mantle primarily comes from two sources:
    - Residual heat from the Earth's formation.
    - Radioactive decay of isotopes within the mantle, such as uranium, thorium, and potassium.



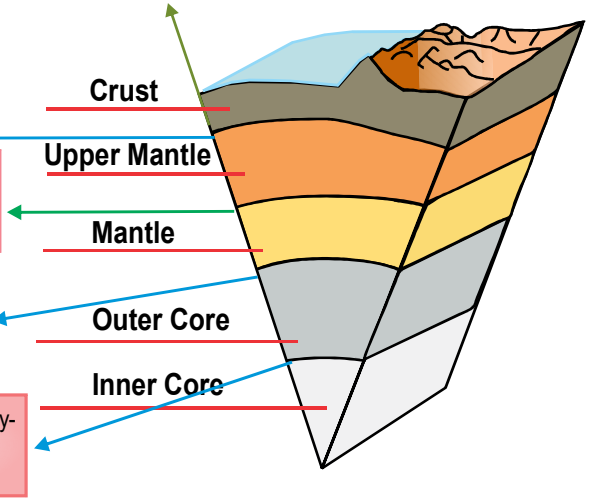
Conorod discontinuity - between upper & lower crust

Mohorovicc discontinuity- between lower crust & upper mantle

Repiti discontinuity- between upper & lower mantle

Guttenberg discontinuity- between lower Mantle & outer Core

Lehmannn discontinuity- - between outer & inner core



- **Characteristics:** Mantle behaves like a very viscous fluid on geological timescales, meaning it can slowly flow.
- **Subdivisions:**
  - **Upper Mantle:** Includes the asthenosphere, a semi-fluid layer that allows tectonic plates to move.
  - **Lower Mantle:** More rigid due to higher pressure, though it can still flow.

- **Core:** It consists of two zones: Outer Core and Inner Core

Outer Core	Inner Core
• **Description:** The outer part of Earth's core, composed mainly of liquid iron and nickel. • **Thickness:** About 2,200 km. • **Temperature:** Estimated between 4,000°C and 6,000°C. • **State:** Liquid, responsible for generating Earth's magnetic field due to the motion of conductive materials (a phenomenon called the geodynamo).	• **Description:** The innermost layer, composed mostly of solid iron and nickel. • **Radius:** About 1,220 km. • **Temperature:** Estimated to be as high as 5,000°C to 6,000°C, close to the temperature of the Sun's surface. • **State:** Solid, despite the high temperatures, due to the immense pressure at the center of the Earth

Mantle Plume

A **mantle plume** is an upwelling of hot rock from deep within Earth's mantle. When it reaches the lithosphere, it causes volcanic activity and can form volcanic islands, like Hawaii.

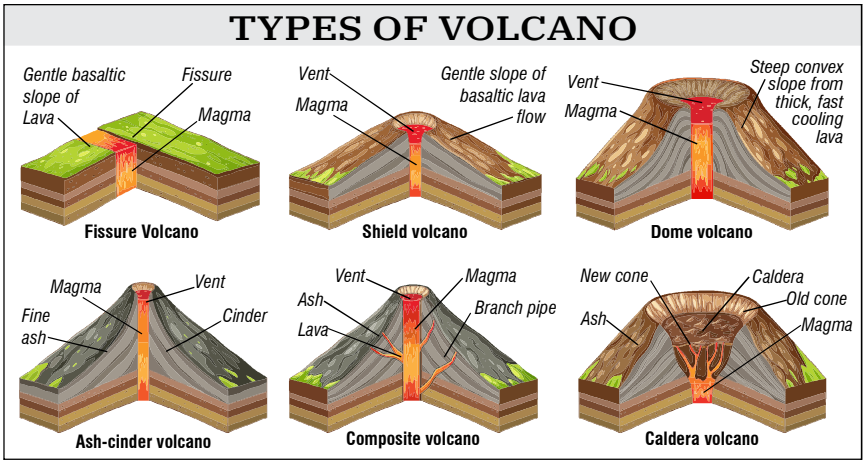
Role in Plate Tectonics:

- **Hotspot Volcanism:** Mantle plumes create hotspots, causing volcanic chains as tectonic plates move over them.
- **Plate Movement:** Plumes add forces that influence plate dynamics through localized uplift.
- **Rifting:** Mantle plumes can weaken crusts, leading to the splitting of continents and new tectonic boundaries.
- **Large Igneous Provinces:** Plumes can cause massive volcanic eruptions, forming large volcanic regions.

Mantle plumes drive volcanic activity and contribute to tectonic processes.

1.9. Volcanoes

- Volcano is a vent or crack on the crust from which magma comes out as lava.
- When the radioactive elements decays below the earth crust, energy gets released. This energy generates more heat and increases the temperature of the magma. This heated magma now starts upwelling through the magma chamber and results in the outpour of lava. This is the process of volcanism which constitutes from the formation of magma till the outpour of lava



Causes of Vulcanism

- The main cause for the volcanism is the convection current in the mantle. It is Majorly found on the convergent and divergent plate boundary.
- Hence, mostly volcanoes are found on the margins of the plate. These plate margins can be destructive plate margins or constructive plate margins.

Types of Volcanos

Shield Volcano	Largest volcanoes, primarily composed of basalt, a highly fluid type of lava, typically have low explosivity. However, they can become explosive if water enters the vent. Eg. Hawaiian volcanoes.
Composite Volcano	These volcanoes are known for eruptions involving cooler, more viscous lavas compared to basalt, often leading to explosive eruptions. Eg. Mount Fuji in Japan.

Caldera	These volcanoes are the most explosive on Earth and typically collapse inward rather than forming tall structures resulting depressions are known as calderas. Their high explosiveness suggests that the magma chamber supplying the lava is both large and close to surface. Eg. Yellowstone Caldera in the USA.
Flood Basalt Province	These volcanoes outpour highly fluid lava that flows for long distances. Ex: Deccan Traps of India, covering most of the Maharashtra plateau.
Mid Oceanic Ridges	It occurs in oceanic areas. There is a system of mid-ocean ridges through all the ocean basins. Central portion of this ridge experiences frequent eruptions. Ex: Aden Ridge (B/w Somalia & Arabian Peninsula).

Factors Triggering Volcanoes

- **Magma Chamber Pressure:** Increased pressure from rising magma can cause an eruption if it exceeds the strength of the surrounding rock.
- **Magma Composition:** The viscosity and gas content of the magma influence explosiveness. More viscous, gas-rich magma tends to be more explosive. All magma contain dissolved gases, primarily Water vapor (H_2O), Carbon dioxide (CO_2), and Sulphur dioxide (SO_2).
- **Tectonic Plate Movements:** The movement of tectonic plates can create fractures and pathways for magma to reach the surface, leading to eruptions.
- **Volcanic Gas Pressure:** The buildup of volcanic gases (e.g., water vapor, carbon dioxide, sulfur dioxide) can increase pressure within the magma chamber, triggering an eruption.

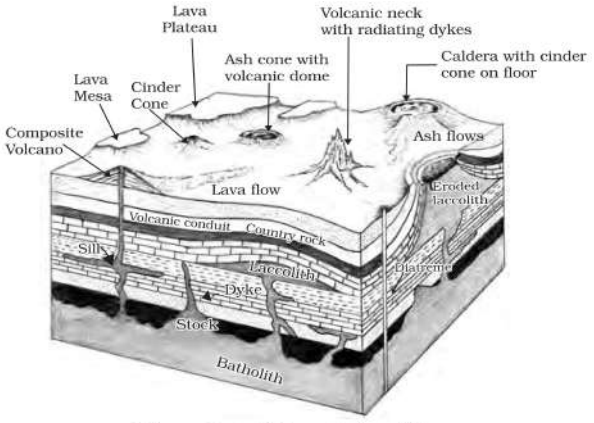


Figure 3.4 : Volcanic Landforms

- **Hydrothermal Activity:** Interaction of magma with groundwater or surface water can cause steam explosions, contributing to volcanic activity.
- **Geological Instabilities:** Weaknesses or fractures in the Earth's crust, such as faults or previous volcanic structures, can facilitate magma ascent and eruption.
- **External Triggers:** Events such as earthquakes or landslides can destabilize volcanic systems and initiate eruptions.

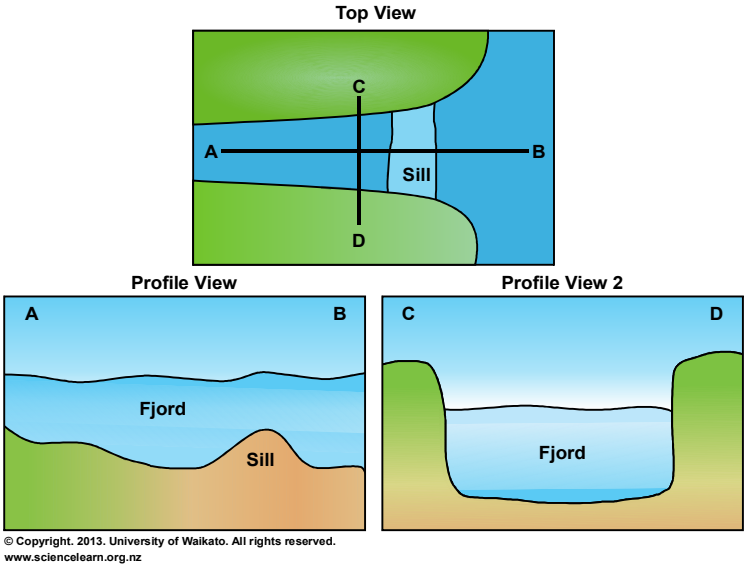
Impacts of Volcanic Eruption

Environmental	• **Cooling:** Ash and gases can reflect sunlight, causing temporary cooling (e.g., Mount Pinatubo in 1991). • **Destruction:** Lava flows, ashfall, and pyroclastic flows can destroy ecosystems and infrastructure. • **Acid Rain:** Released gases lead to acid rain, damaging crops and forests.
Social	• **Loss of Life:** Eruptions can be deadly, displacing populations and causing injuries. • **Health Issues:** Respiratory problems arise from ash and gas exposure. • **Psychological Effects:** PTSD and anxiety often affect survivors.
Economic	• **Infrastructure Damage:** Eruptions destroy homes, roads, and agriculture. • **Tourism & Travel:** Ash clouds disrupt air travel, and tourism can suffer.
Climate	• Eruptions can temporarily cool the planet due to sulfur dioxide emissions, though large releases of CO_2 have potential long-term warming effects. • The 2022 Hunga Tonga eruption injected record amounts of water vapor into the stratosphere, which may temporarily warm the planet—contrasting with the usual cooling effect of large eruptions which usually involve large amounts of Sulfur dioxide that reflect sunlight.

1.10. Fjords

- Fjords are long, narrow inlets of the sea surrounded by steep cliffs. They are formed when glaciers carve out valleys in the landscape. When the glaciers retreat, the valleys are flooded by the sea, creating fjords.

- Fjords are typically found in high-latitude regions. They are formed when glaciers flow down mountains and into the sea. The glaciers carve out deep valleys, which are then flooded by the sea when the glaciers retreat.
- **Canada:** British Columbia coast (e.g., inside passage).
- **Greenland:** Extensive fjord systems.
- **Iceland:** Eastern and Western Fjords.
- **Norway:** The Nærøyfjord and Geirangerfjord, are UNESCO World Heritage Sites and exemplify classic fjord landscapes..
- **New Zealand:** Southwest South Island (Fiordland National Park).
- **Scotland:** Western Isles (often called "sea lochs," which are essentially fjords).
- **Sweden:** Parts of its western coast.



Why do fjords constitute some of the most picturesque areas of the world?

Fjords are often considered to be some of the most picturesque areas in the world. This is due to their unique combination of natural features, including:

- Steep cliffs and mountains
- Deep, clear water
- Lush vegetation
- Glaciers and waterfalls

Fjords are also home to a variety of wildlife, including whales, seals, and birds. This makes them a popular destination for tourists and nature lovers. Recent research highlights fjords as important carbon sinks, playing a role in global climate regulation.

1.11. Rock System

Rocks are composed of one or more minerals bound together by chemical bonds. Feldspar and quartz are the most frequently occurring minerals in rocks. There are three main types of rocks, classified by their formation process: Igneous, Sedimentary and Metamorphic.

Igneous	• Igneous rocks form from the solidification of molten material called magma or lava. They are classified into two main types based on where they solidify:
	  • **Intrusive:** Form beneath the Earth's surface, cooling slowly to create large crystals (e.g., granite).
	  • **Extrusive:** Form on the surface, cooling quickly with smaller crystals or a glassy texture (e.g., basalt, pumice).
	• These rocks typically have interlocking crystals, with textures ranging from fine to coarse, depending on the cooling rate.

Sedimentary	• Sedimentary rocks form from the accumulation and compaction of mineral and organic particles, called sediments, which are transported and deposited by wind, water, or ice. There are three main types:
	  • **Clastic:** Made from fragments of other rocks, like sandstone and shale.
	  • **Chemical:** Formed from mineral precipitation, such as limestone.
	  • **Organic:** Created from plant or animal debris, like coal and certain types of limestone.
	• These rocks often feature layers and may contain fossils, offering insights into Earth's history.

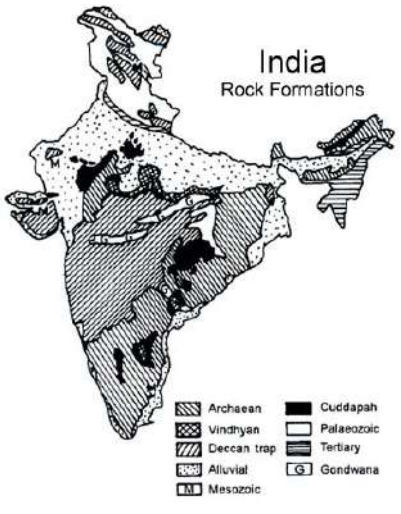
Metamorphic	• Metamorphic rocks form when existing rocks are transformed by heat, pressure, or fluids without melting. This process changes their mineral composition and structure. There are two types:
	  • **Foliated:** Have a layered appearance, like schist and gneiss.
	  • **Non-foliated:** Lack layers, with examples like marble and quartzite.
	• Metamorphic rocks often exhibit greater density and hardness compared to their original forms and may display new minerals that developed under high temperatures and pressures.

Distribution of Rocks in the World

Igneous	o **Oceanic Crust:** Basalt dominates, forming at mid-ocean ridges. o **Subduction Zones:** Andesite and rhyolite are found in volcanic arcs. o **Continental Rifts:** Basalt and phonolite form in rift zones. o **Hotspots:** Basalt and pumice found at hotspots like Hawaii and Yellowstone.
Sedimentary	o **Coastal Areas:** Sandstones, shales, and limestones dominate. o **River Basins:** Large rivers like Ganga and Mississippi contribute to formation. o **Continental Shelves:** Accumulation of sediment forms sandstones and mudstones. o **Deep Ocean Basins:** Fine-grained sediments create mudstones and siltstones.
Metamorphic	o **Mountain Belts:** Found in ranges like the Alps and Himalayas. o **Subduction Zones:** High-pressure, low-temperature conditions create blueschist and eclogite.

Distribution of Rocks in India

Igneous	o **Deccan Traps:** Massive volcanic formations in Maharashtra, Gujarat, MP and neighbouring states, formed 66 MYA. o **Himalayan Region:** Features granite and basalt due to active mountain-building processes.
Sedimentary	o **Gondwana Basins:** Sandstones, shales, and coal deposits in the Damodar Valley, Son Valley, and Satpura-Godavari Basin. o **Coastal Plains:** Sandstones, clays, and alluvial deposits from rivers and coastal processes. o **Island Territories:** Sedimentary rocks, coral reefs, & volcanic formations, Eg, Andaman & Nicobar Islands & Lakshadweep.
Metamorphic	o **Aravalli Range:** In NW India, containing Precambrian gneisses, schists, and quartzites. o **Himalayan Region:** Extensive gneiss and schist formed under intense pressure and temperature.



Restoring Mountain Ecosystems from Development and Tourism Impacts

Mountain ecosystems are fragile and vulnerable to the negative impacts of development initiatives and tourism. These impacts can include:

- Habitat destruction
- Pollution
- Overcrowding
- Climate change

To restore mountain ecosystems from these impacts, a variety of measures can be taken, including:

- **Protecting and restoring habitat:** This can be done by establishing protected areas, reforesting degraded areas, and controlling invasive species.
- **Reducing pollution:** This can be done by improving waste management, reducing energy consumption, and promoting sustainable transportation.
- **Managing tourism:** This can be done by limiting the number of visitors, educating tourists about the importance of protecting the environment, and providing alternative sources of income for local communities.
  - The Aravalli and Vindhyan ranges are being promoted for geotourism, with new geoparks proposed in 2024.
- **Addressing climate change:** This can be done by reducing greenhouse gas emissions, investing in renewable energy, and promoting energy efficiency.

Previous Years Questions	
• How are the fjords formed? Why do they constitute some of the most picturesque areas of the world.	2023
• Discuss the geophysical characteristics of Circum- Pacific Zone.	2020
• Describe the characteristics and types of primary rocks.	2022
• Mention the global occurrence of volcanic eruptions in 2021 and their impact on regional environment.	2021
• Discuss the geophysical characteristics of the Circum-Pacific zone.	2020
• The process of desertification does not have climate boundaries. Justify with examples.	2020
• How can the mountain ecosystem be restored from the negative impact of development initiatives and tourism?	2019
• Define mantle plume and explain its role in plate tectonics.	2018
• How does the Juno Mission of NASA help to understand the origin and evolution of the Earth?	2017
• 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	2014
• Explain the formation of thousands of islands in the Indonesian and Philippines archipelagos.	2014
• What do you understand by the theory of continental drift? Discuss the prominent evidence in its support.	2013

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