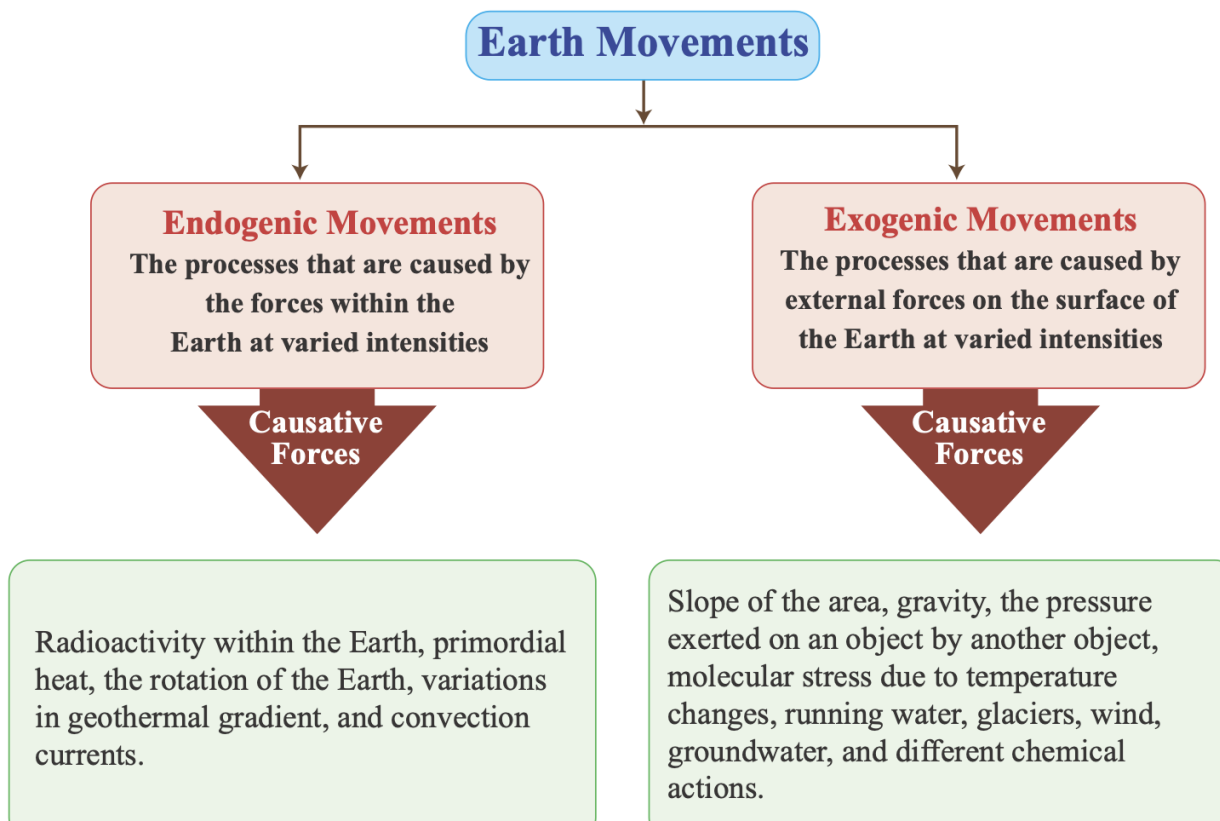


6. THE CHANGING EARTH

EARTH MOVEMENTS

The movements that cause the ups and downs on the surface of the Earth are called the Earth movements.

- Earth movements can be classified into two



- **Endogenic movements again divided in to two**

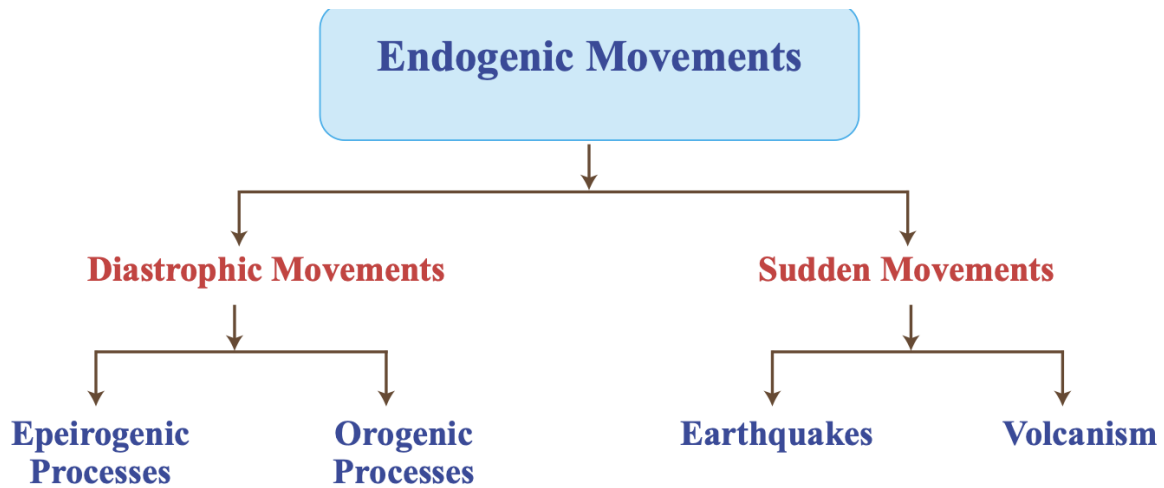


Fig 6.3

Diastrophism

- Refers to **endogenic processes** that move, elevate, or build up parts of the Earth's crust.
 - Includes all **crustal deformation movements** such as folding, faulting, and uplift.
-

Epeirogenic Movements

- Cause **uplift or subsidence** of large portions of the Earth's crust.
 - Produce **broad, gentle warping** of the crust.
 - Result in **minimal surface deformation**.
-

Orogenic Movements

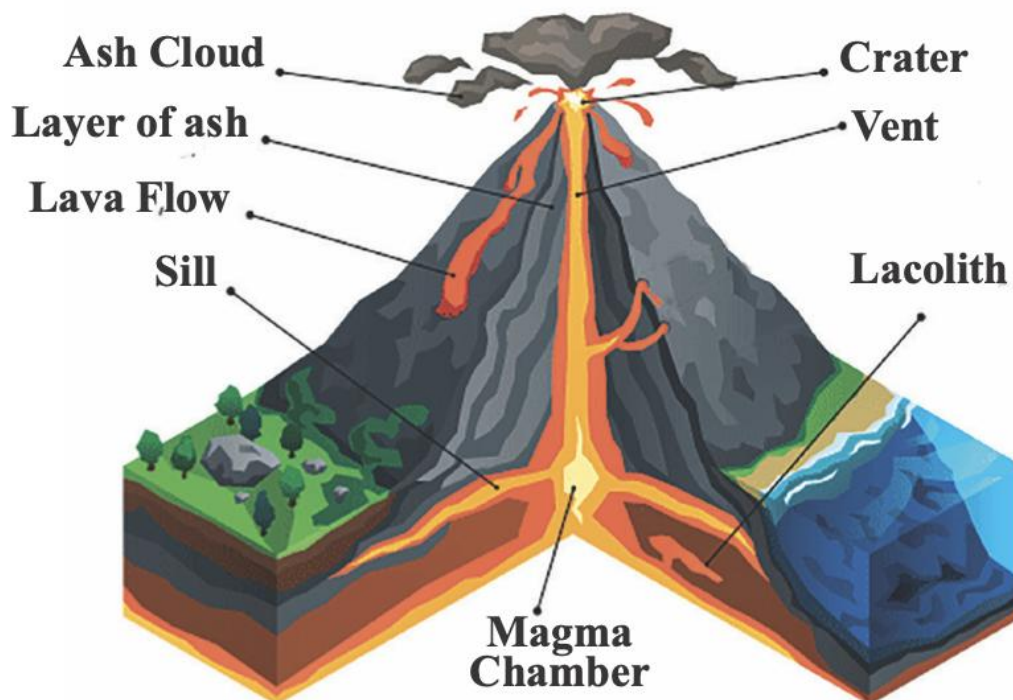
- Responsible for the **formation of mountains**.
- Involve **intense deformation** of the Earth's crust (folding, faulting).

- Occur over **narrow and elongated regions**.

VOLCANO

- The openings in the lithosphere through which molten rock material, gases, ash, pyroclastic materials (rock fragments), dust, and water vapour erupt to the surface of the Earth are called volcanoes.
- The materials that erupt in this way are known as **volcanic materials**.
- The molten rock material present in the upper mantle is called **magma**
- Once it starts moving towards the crust or reaches the surface, it is referred to as **lava**.

Structure of volcano



Structure of a volcano

Effects of Volcanic Explosions on Human

- Loss of Lives and Property: Volcanic explosions near settlements cause deaths and widespread destruction of property.
- Disruption of Economic Activities: Eruptions halt industries, agriculture, and other economic operations.
- Adverse Impact of Lava Flow: Flowing lava damages both the natural environment and human structures.
- Homelessness and Unemployment: The destruction of houses and land leaves many people without homes or livelihoods.

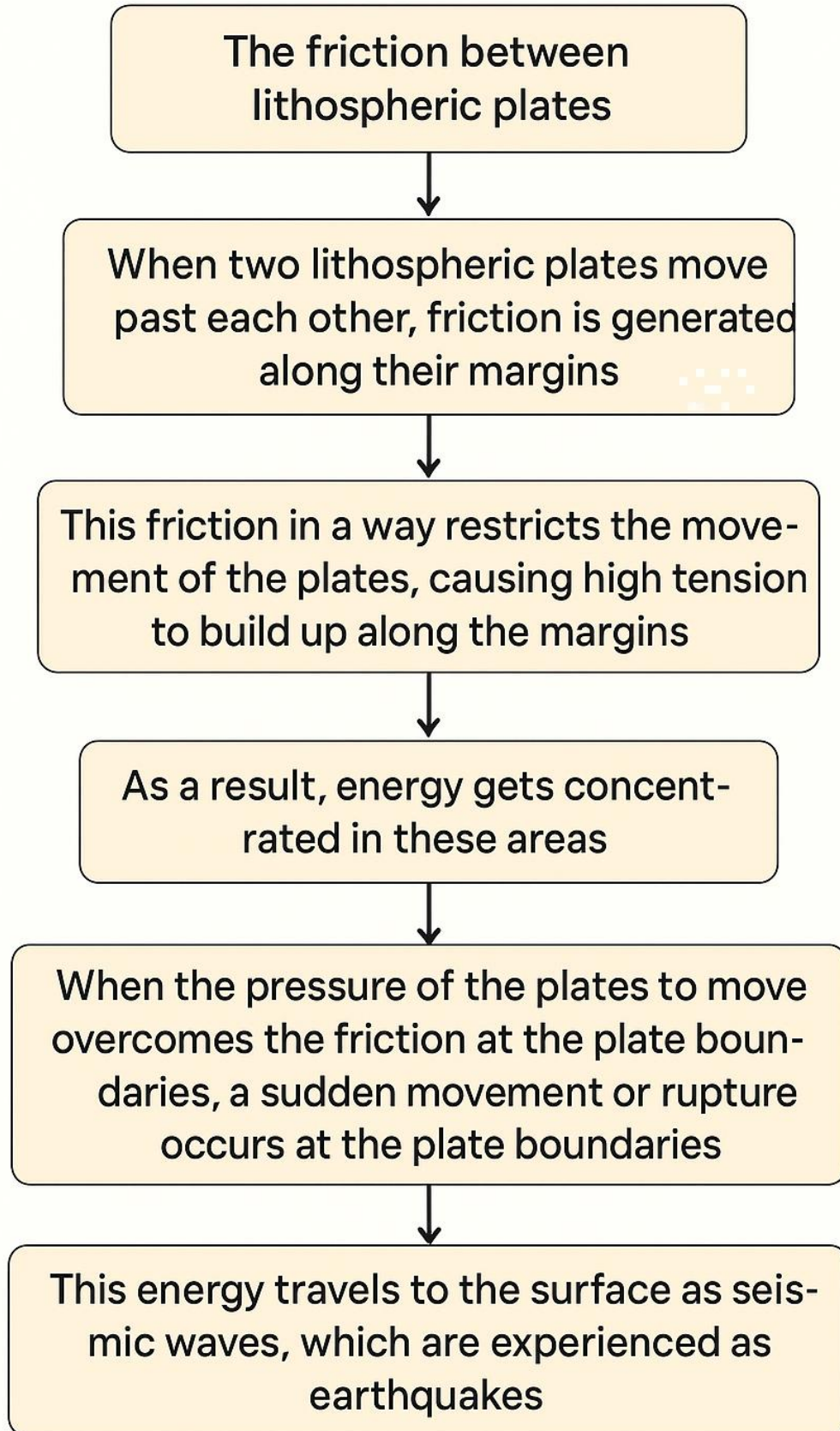
Positive Effects of Volcanic Activity

- **Source of Energy**: Geothermal energy from volcanic regions is used to generate electricity.
- **Mineral Resources**: Lava brings valuable minerals to the Earth's surface.
- **Tourism Attraction**: Volcanic areas often draw many tourists.

EARTHQUAKE

? How it happens

The cause of earthquakes



- The point inside the Earth from which the energy is released is called the **focus or hypocentre**
- The point on the Earth's surface directly above the focus is called the **epicentre**

Other Causes of Earthquakes

- Volcanic eruptions
- Collapse of mine roofs in mining areas
- Explosions
- Faults in bedrock caused by the pressure of large reservoirs

HOW TO FACE EARTHQUAKE

Before	During	After
<ul style="list-style-type: none"> • Plan and practice evacuation routes • Bolt and brace heavy furniture • Keep a flashlight and first-aid kit handy 	<ul style="list-style-type: none"> • Drop, cover, and hold on • Stay indoors until shaking stops • Avoid windows and heavy furniture 	<p>Check for injuries and damage</p> <p>Listen to emergency broadcasts</p> <p>Beware of aftershocks</p>

TSUNAMI

- Severe earthquakes that occur on the ocean floor cause giant waves, which can rise up to several metres. These giant waves are called tsunamis.

Ways to Safeguard from Tsunamis

- Move to higher ground immediately after strong tremors
- Stay away from beaches and low-lying areas
- Listen to official warnings and alerts
- Do not return until authorities declare it safe
- Keep an emergency kit ready
- Learn and follow local evacuation routes

EXOGENIC MOVEMENTS

- The forces are responsible for various processes that operate on the surface of the Earth, such as weathering, erosion, transportation, deposition, and mass wasting. These processes are collectively known as **exogenic movements**.

Examples of Exogenic Forces

- Weathering
- Erosion
- Deposition
- Mass wasting (like landslides)
- Wind action
- River action

- Glacial movement
- Wave action

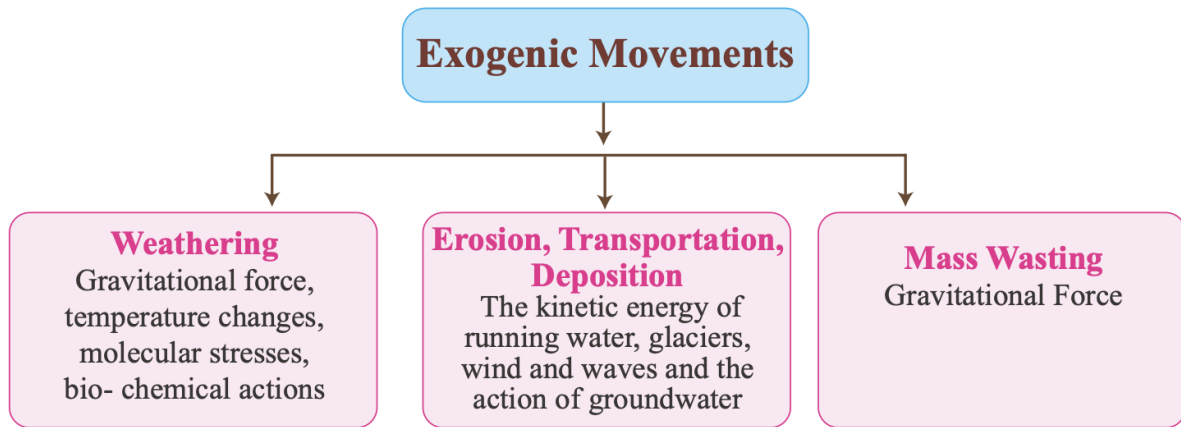
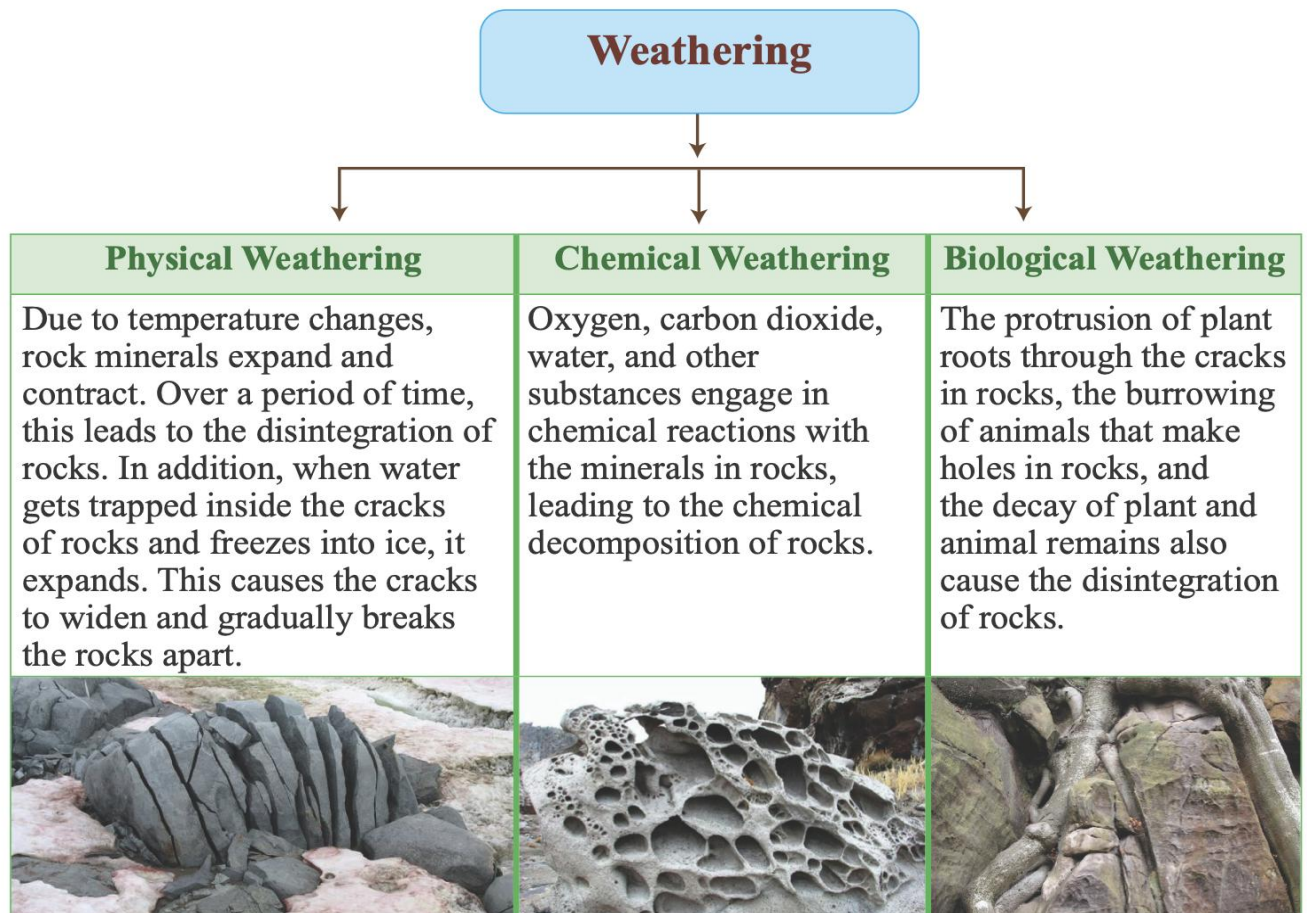


Fig 6.12

WEATHERING

- The breaking down of rocks by external forces through mechanical or chemical actions.

TYPES OF WEATHERING



? How can weathering be useful to us?

- Weathering leads to the formation of soil
- It helps to separate minerals from rocks
- It causes mineral enrichment
- It makes mining easier

Erosion

Erosion happens when natural forces like wind, water, or ice slowly wear away rocks and soil from the Earth's surface. These materials are removed from one place.

Transportation

Transportation is the process of moving the eroded materials (like sand, soil, or rocks) from one place to another by agents such as rivers, wind, or glaciers.

Deposition

Deposition occurs when the carried materials are dropped or settled in a new place — for example, sand getting deposited on riverbanks or sea floors

Mass Wasting

- Caused by external (exogenic) forces.
- It is the movement of rocks or soil down a slope.
- Happens because of gravity.
- Can be slow or very fast.
- Includes small soil slides or large landslides.
- The movement of rocks or topsoil from higher to lower areas due to gravity is called **mass wasting**.
- It includes **landfalls, rockfalls, landslides, debris flows, and land subsidence**.
- A **debris flow** is the sudden movement of rock debris and soil mixed with water down a steep slope.
- A **landslide** is the sliding of a portion of a mountain slope under gravity.

- In Kerala’s hilly regions, **heavy rain** often triggers landslides or debris flows.
- This phenomenon is locally known as ‘**Urulpottal**’, which is often **highly destructive**.

Factors Causing ‘Urulpottal’ (Landslide/Debris Flow)

- **Natural factors:** Slope of land, soil depth and structure, land use, and stream distribution.
- **Triggering factors:** Heavy rainfall, cloudbursts, and earthquakes.
- **Human factors:** Unscientific rock quarrying and construction, especially during monsoon.
- **Risk zone:** Areas with slopes above **22°** are more prone to landslides and debris flows.

HOW TO FACE URULPOTTAL

During	After
Remain calm, act quickly	Avoid disaster areas
Evacuate immediately	Check for injuries
Avoid areas prone to landslides	Report damage
Listen to official warnings	Avoid damaged areas

7. INDIAN ECONOMY:GROWTH AND TRANSFORMATION

Objectives of Individuals, Institutions, and Government Engaging in Economic Activities

- ❖ Increase in infrastructure
- ❖ Better employment opportunities
- ❖ Increased income and purchasing power
- ❖ Higher quality of life

ECONOMIC GROWTH

Economic growth is the increase in a country's Gross Domestic Product compared to the previous year.

→ Economic growth increases a country's ability to meet people's needs by improving production, employment, and income.

ECONOMIC GROWTH RATE

- The economic growth rate is the rate of increase in GDP in the current year compared to the previous year.

- The growth rate is measured in percentage.

$$\text{Economic growth rate} = \frac{\text{Current year's GDP} - \text{Previous year's GDP}}{\text{Previous year's GDP}} \times 100$$


-
- Per capita income is an important indicator used to measure and evaluate economic growth.

PER CAPITA INCOME (PCI)

- PCI is calculated by considering the national income and population.
- **PCI = National Income/ Population**
- The World Development Report published by the World Bank classifies economies into four categories based on per capita income.

No	Category	PCI in US Dollars (\$)	Example (Countries)
1	Low income	Less than 1145	Afghanistan, Ethiopia, Chad
2	Lower middle income	1146 To 4515	India , Bangladesh , Kenya
3	Upper middle income	4516 To 14005	China , Brazil , South Africa
4	High income	Above 14006	USA , Germany , Japan

-
- The per capita income of countries with different levels of development, Afghanistan, India, China and the USA, over different periods are given below.

Country	1991	2001	2011	2021 
India	364	442	1,569	2,116
China	318	949	5,425	12,554
USA	26,741	35,892	48,303	69,287
Afghanistan	317	169	606	369

LIMITATIONS OF PCI

1. Per capita income shows only the average income of people.
2. It does not show how wealth is distributed among rich and poor.
3. It depends on national income, so any mistake in that affects it.
4. It does not include other things that improve people's quality of life

ECONOMIC DEVELOPMENT

- Economic growth alone cannot solve poverty, unemployment, and inequality.
- Real development improves people's quality of life.
- **Better education, nutrition, and transportation** are essential for this.
- When everyone benefits from growth, the standard of living increases.
- True economic development happens when both income and living conditions improve.

Economic development is the process of improving the standard of living and economic well-being of people through growth in income, education, and infrastructure.

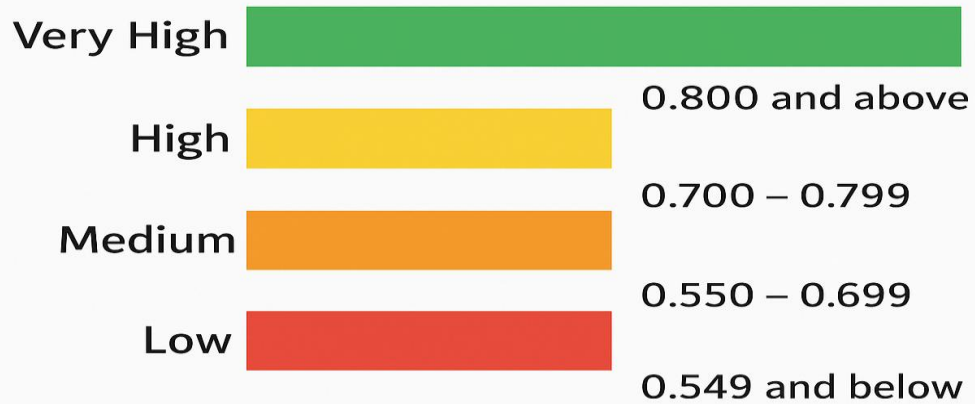
Todaro & Smith

ECONOMIC DEVELOPMENT INDICES

1. Human development index

- ❖ Developed by the United Nations
- ❖ The Human Development Index is calculated based on three factors:
 - Life expectancy
 - Literacy and gross school enrollment rate
 - Per capita income
- ❖ Based on the value of this index, the countries of the world are divided into four groups
- ❖ The Human Development Index is found by averaging the values of its parts, which range between 0 and 1.

HUMAN DEVELOPMENT INDEX VALUE MARGINS



Year	HDI Value
1990	0.446
1995	0.469
2000	0.497
2005	0.547
2010	0.590
2015	0.633
2020	0.652
2023	0.685

Findings

- India's HDI has shown steady growth from **0.446 in 1990** to **0.685 in 2023**.
- The HDI value has **increased in every five-year period**, showing continuous progress.
- The most significant improvement occurred between **2000 and 2010**.
- Overall, the data indicates **consistent improvement in education, health, and income levels** over the years.

2. Physical quality of Life Index

- Developed by a renowned economist, Morris David Morris, in 1979.
- Based on 3 indices
 - ❖ Basic Literacy Index (BLI)
 - ❖ Infant Mortality Index (IMI)
 - ❖ Life Expectancy Index (LEI)
- **Basic literacy** is the percentage of the population that can read and write.
- **Infant mortality** rate refers to the number of deaths of infants under the age of one per 1,000 live births.
- **Life expectancy** is calculated based on the average number of years a person lives.

$$PQLI = \frac{(LEI+IMI+BLI)}{3}$$

- **The drawback** of this index is that it does not include people's annual income.

Sustainable Development Goals Index (SDGI)



Sustainable Development Goals (SDGs)

- Set by the United Nations in 2015
- Aim to achieve balanced growth — economic, social, and environmental

SDG Index

- Measures how well countries are achieving the SDGs
- A comprehensive development index

SDG India Index

- Prepared by NITI Aayog with the United Nations
- Tracks progress of states and union territories
- Launched in 2018
- Assesses India's performance on all 17 Sustainable Development Goals

Economic goals	Social goals	Environmental goals
<ul style="list-style-type: none"> • Affordable and Clean Energy (SDG 7) • Decent Work and Economic Growth (SDG 8) • Industry, Innovation, and Infrastructure (SDG 9) • Responsible Consumption and Production (SDG 12) 	<ul style="list-style-type: none"> • No Poverty (SDG 1) • Zero Hunger (SDG 2) • Good Health and Well-being (SDG 3) • Quality Education (SDG 4) • Gender Equality (SDG 5) • Clean Water and Sanitation (SDG 6) • Reduced Inequalities (SDG 10) • Sustainable Cities and Communities (SDG 11) • Peace, Justice and Strong Institutions (SDG 16) • Partnerships for the Goals (SDG 17) 	<ul style="list-style-type: none"> • Climate Action (SDG 13) • Life Below Water Life (SDG 14) • Life on Land (SDG 15)

SDG India Index Score

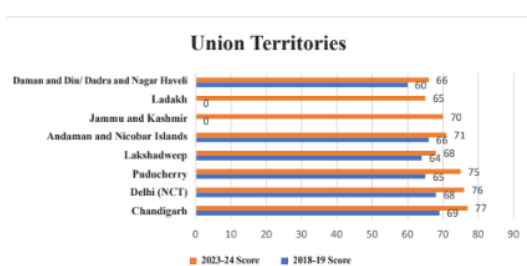
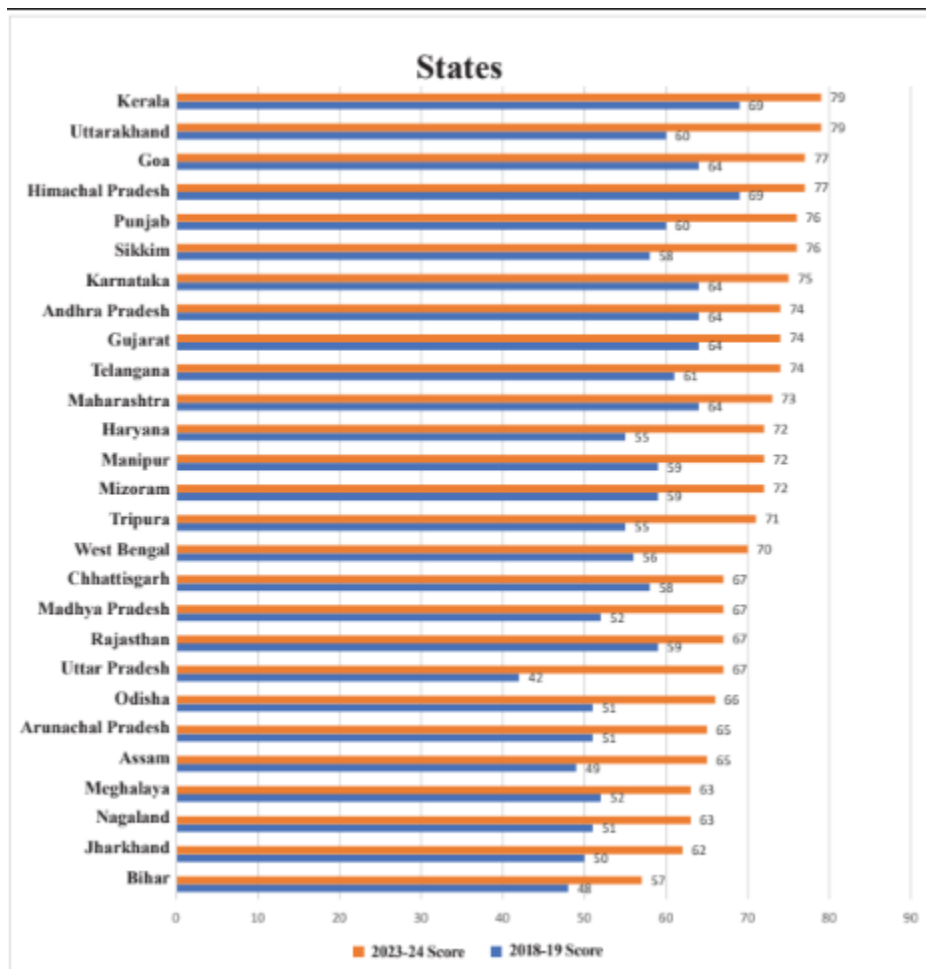
- Calculated by averaging the scores of all 17 SDGs
- Each goal is scored on a scale from 0 to 100
- Higher score = better progress toward Sustainable Development Goals

SDG India Index – Score Categories

Score Range	Category
0 – 49	Aspirant
50 – 64	Performer
65 – 99	Front Runner
100	Achiever

SDG Index (2018–19 vs 2023–24)

- The SDG India Index compares progress of all states and union territories.
- Scores show improvement in most regions between 2018–19 and 2023–24.
- Kerala consistently ranks among the top-performing states.



Top 5 States (2023–24)

1. Kerala
2. Uttarakhand
3. Goa
4. Himachal Pradesh
5. Punjab

Bottom 5 States (2023–24)

1. Bihar
2. Jharkhand
3. Nagaland
4. Meghalaya
5. Assam

2018–19 Rankings

- Top State: Kerala
- Bottom States: Bihar, Jharkhand, Assam, Meghalaya, Arunachal Pradesh
- Category Distribution (2018–19):
 - Aspirants (0–49): Bihar, Jharkhand
 - Performers (50–64): Assam, Odisha, Uttar Pradesh
 - Front Runners (65–99): Kerala, Himachal Pradesh, Sikkim
 - Achievers (100): None

Kerala – Why Ranked High?

- Strong healthcare and education systems
- High literacy rate and low infant mortality
- Effective local governance
- Focus on gender equality and social welfare
- Better environmental management and renewable energy use

Kerala model of development

Kerala has made great strides in the areas of education, health and social justice. High literacy rates, low infant mortality rates and improved life expectancy are its key features. Kerala was able to achieve this feat through land reforms, universal public health and education systems, public distribution systems, social security schemes and public participation.

Nava Kerala Mission

The Nava Kerala Mission is an action plan launched in 2016 with a holistic development vision for Kerala. It includes four main missions: Aardram Mission in the health sector, Life Mission to ensure adequate housing, Vidhyakiranam to improve the education sector, and Haritha Keralam Mission to improve water conservation, waste management, and organic farming. The main objective of the mission is to improve the lives of the people by solving fundamental problems in these four areas.

In addition to strengthening the activities of the existing four missions, Nava Kerala Mission has also included the Rebuild Kerala Initiative, and is being implemented from 2021. The objective of Nava Kerala Mission - 2 is to lead Kerala towards economic and social progress by embracing the benefits of development and embracing all sections of the people, while facing new challenges and second-generation problems.

Economic Planning



Jawaharlal Nehru

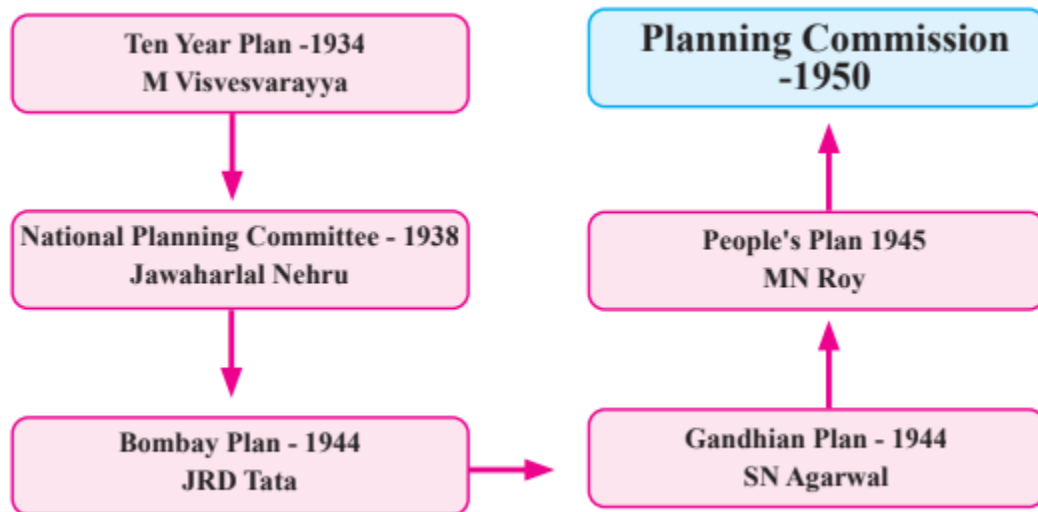
- After independence, India adopted a Mixed Economy to rebuild the nation's economy.
- The economy was fragmented during British rule.
- Economic planning was introduced to decide how to use the country's resources efficiently.
- These plans set common national goals for development.
- Economic planning means using available resources to achieve economic and social objectives.

Planning is a scientific method for utilizing the diverse resources, human potential and skills of the country in the best and most comprehensive manner.

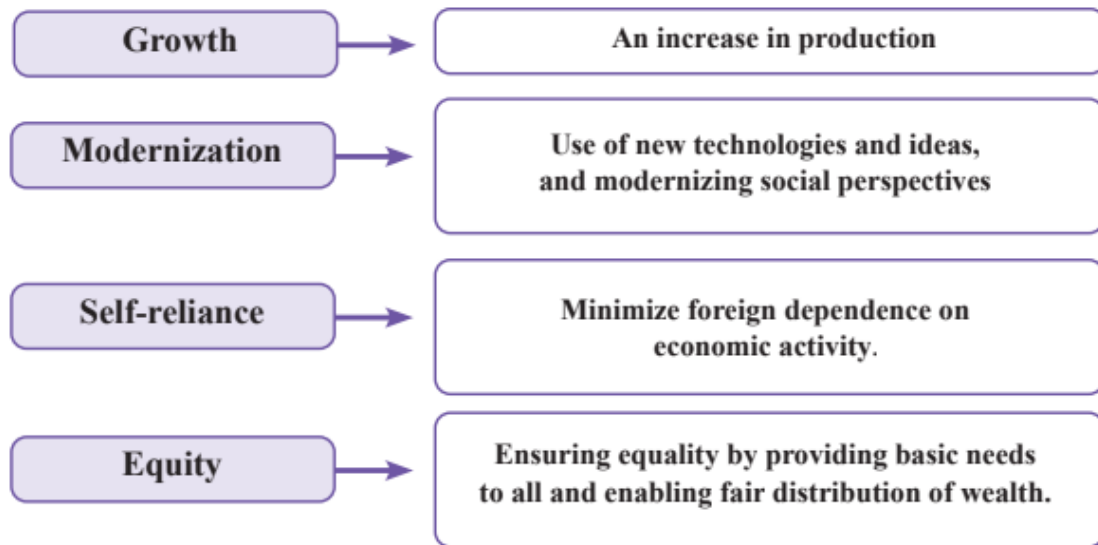
Jawaharlal Nehru

History of Planning

- Planning activities began even before Independence.
- Early plans focused on economic reconstruction and development goals.
- These efforts laid the foundation for national planning after 1947.
- The Planning Commission was later set up to organize and monitor plans.
- The chart shows the growth and progress of planning in India over time.
- M Visvesvaraya is considered as the Father of Indian economic planning.



Objectives of Planning



Planning Commission (1950–2014)

- Set up in 1950 to guide India's economic development
- Responsible for framing Five-Year Plans (from 1951 onward)

Structure of the Planning Commission

- Chairman: Prime Minister
- Vice Chairman
- Nominated Members from the Central Cabinet

Role and Timeline

- Implemented the Five-Year Planning process starting in 1951

- Functioned at the national level until 2014
- From 2015 onward, its role is replaced by NITI Aayog



PC Mahalanobis is the
architect of the Five-Year
Plan in India

NITI Aayog

(National Institution for Transforming India)

- NITI Aayog (National Institution for Transforming India)
- Established on 1 January 2015
- Replaced the Planning Commission
- Aims to transform India through:
- Economic growth
- Social welfare
- Infrastructure development

Structure of NITI Aayog

- Chairman: Prime Minister

- Vice Chairman: Nominated by Prime Minister
- Members:
 - All Chief Ministers
 - Lieutenant Governors of Union Territories
- Other Members:
 - 2 part-time members
 - 4 non-official members
 - Chief Executive Officer (CEO)
 - 4 Central Ministers (as nominated by PM)

Objectives of NITI Aayog

- Create a vision and strategy for India's development
- Promote sustainable and inclusive growth
- Encourage innovation, entrepreneurship, and job creation
- Collaborate with international organizations
- Develop and implement long-term policies and programmes

Role of Planning in India (1950–1990)

- Planning played a major role in economic growth
- Government had strong control over the private sector
- Private sector regulated by
 - Licenses
 - Permits
 - Quotas (LPQ)
- Economic reforms began in 1991, reducing these restrictions

Economic Reforms of 1991 – Causes

- High fiscal deficit
- Decline in foreign exchange reserves
- Inefficiency in public sector enterprises
- Changes in the world market, favouring free markets
- 1990 Gulf War, causing global economic crisis
- Growth in East Asian economies through liberalization
- Conditions imposed by World Bank & IMF

Goals of the 1991 Reforms

- Liberalize the Indian economy
- Deregulate the private sector
- Reduce government control
- Remove trade restrictions with foreign countries
- Marked shift from LPQ → LPG (Liberalization, Privatization, Globalization)

Liberalization

Meaning:

Policy that gives more freedom to the economy by relaxing government controls.

Major Areas of Liberalization:

- Industrial sector reforms
- Financial sector reforms

- Tax reforms
- Foreign exchange reforms
- Foreign trade sector reforms

Privatization

Meaning:

Reducing government control and giving more space to the private sector.

Disinvestment

Government sells its investment or capital in public sector enterprises.

Types of Disinvestments:

- Wholesale: Entire unit sold
- Share Sale: Only some shares sold
- Capital Sale: Govt. exits sectors where it need not intervene
- Strategic Sale: Shares sold to a chosen partner

Globalization

- Integration of India's economy with the global economy
- Reduces import duties
- Encourages foreign investment
- Increases global movement of trade, capital, technology, and people
- Result of economic policies like liberalization & privatization
- "Globalization is not a policy; it is a phenomenon." — Amartya Sen



World Trade Organization (WTO)

- Ensures rules for global trade
- Provides a platform for trade negotiations
- Reduces tariffs and promotes fair competition
- Established in 1995
- Headquartered in Geneva, Switzerland
- 166 member countries, including India

Multinational Corporations (MNCs)

- Companies operating in multiple countries
- Engage in international trade & production
- Have decentralized management
- Use local resources, skills, and markets

Impact of Globalization

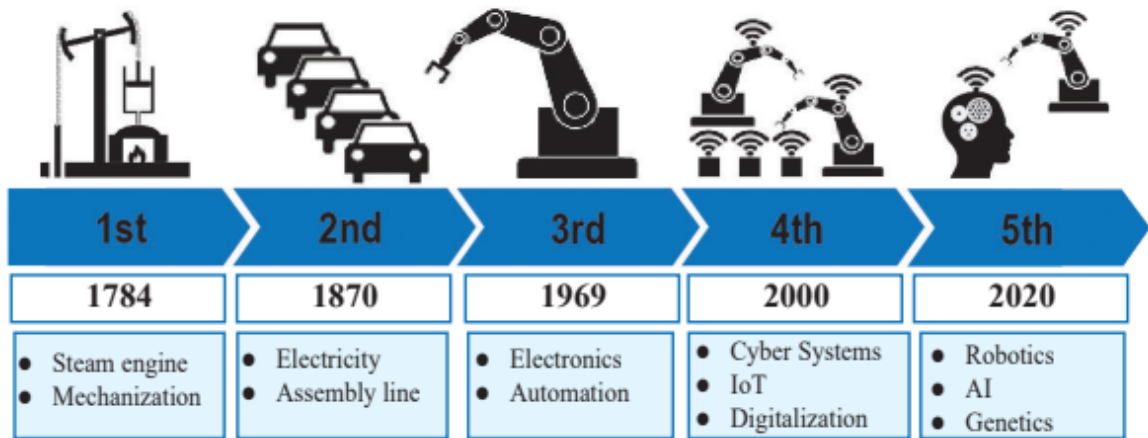
- Increased worldwide exchange of goods, services, and capital
- Inflow of foreign investment
- MNCs promoted research and innovation

- Accelerated technological progress

Driving forces of economic growth

- Inventions and mechanization
- Spread of technology
- Modernization of industries
- These factors have significantly accelerated economic growth

Industrial Revolution	Features
1. Invention of the steam engine:	<ul style="list-style-type: none"> • Emergence of the factory system • Changes in production and transportation
2. Electricity	<ul style="list-style-type: none"> • Use of electricity in the place of steam. • Expansion into new areas of production and distribution
3. Electronics & Automation	<ul style="list-style-type: none"> • Use of robotics and automation in factories
4. The era of advanced technologies	<ul style="list-style-type: none"> • The beginning of Internet of Things (IoT) sensors and Big Data Analytics, Cloud Computing, Nanotechnology
5. Human-centric approach to digital technologies including AI	<ul style="list-style-type: none"> • Sustainable productivity growth and expansion of smart factories through technologies like AI, IoT and Robotics.



Industrial Revolutions

- The Industrial Revolution began with the invention of the steam engine
- Since then, the world has passed through multiple stages of industrial revolutions
- Today, we are on the verge of a Fifth Industrial Revolution

How Technology Transformed the Economy

- Technology has expanded and diversified economic activities
- A knowledge economy has emerged
- In this economy, knowledge, skills, and technology play a key role in driving:
 - Economic growth
 - Productivity
 - Innovation
 - Development

Knowledge Economy

- An economic system driven by knowledge, ideas, and innovation
- Focuses on the creation, distribution, and use of information
- Knowledge becomes the key resource, not just land, labour, or capital

Features of a Knowledge Economy

- Importance of new ideas, research, and inventions
- Relies on skilled human resources who can use knowledge and technology effectively
- Emphasis on:
 - Research & Development (R&D)
 - Innovation
 - Skill development
- Continuous creation of new products and services
- High dependence on technology and digital tools

Knowledge Economy in India

- India is witnessing major changes due to the growth of the knowledge sector
- Knowledge-based activities are expanding across various fields such as:
 - IT & Software
 - Biotechnology
 - Education & Research
 - Healthcare innovations
 - Digital services and startups

Sector: Agriculture

Agri Tech

- Modern technology is transforming traditional farming
- Use of sensors, drones, mobile apps
- Smart farming decides when to water, fertilize, spray, etc.
- Benefits:
- Reduced costs
- Higher yields
- Direct online sales → higher farmer income



Sector: Industry

Industry 4.0

- Modern manufacturing using:
- Computers
- Automation

- AI & IoT
- Factories become smart and connected
- Results:
 - Higher production
 - Better quality
 - Less wastage
 - More diversified jobs
- Supported by Make in India for faster economic growth



Tech Advancements in the Service Sector

Edu Tech

- Innovative use of technology in education
- Robotics, Artificial Intelligence (AI), Internet of Things (IoT)
- Smart classrooms, online learning, digital labs

Health Tech

- Telemedicine
- Digital health platforms

- Remote diagnosis & healthcare apps

Green Tech

- Renewable energy (solar, wind)
- Electric vehicles (EVs)
- Environment-friendly technologies

AVGC-XR Sector

(Animation, Visual Effects, Gaming, Comics & Extended Reality)

- 3D animation
- Virtual Reality (VR) & Augmented Reality (AR)
- Game development and digital entertainment

Kerala Towards a Knowledge Society

Major Institutions Leading the Transformation

- Kerala Startup Mission (KSUM)
- Kerala Development and Innovation Strategy Council (K-DISC)
- Digital University of Kerala

These institutions build digital skills, promote innovation, and support startups.

Digital University of Kerala

- Established in **2020**
- Aims to make Kerala a **global digital education hub**

- Focus areas:
 - Artificial Intelligence
 - Data Science
 - Cyber Security
 - Blockchain
- Develops highly skilled digital professionals

Kerala Development & Innovation Strategy Council (K-DISC)

- Formed in 2018
- Goal: Transform Kerala into a knowledge economy
- Promotes R&D in new technologies
- Conducts skill development programmes
- Major initiatives:
 - Young Innovators Program (YIP) – supports student innovation
 - Kerala Knowledge Economy Mission (KKEM) – creates digital jobs for the educated





Kerala Startup Mission (KSUM)

- Launched in **2006**
- Builds a strong startup ecosystem in Kerala
- Supports innovators through:
 - Incubation centres
 - Innovation hubs
 - Funding support
 - Mentorship
 - International exchange programmes



8. Towards Sustainability

- The Aral Sea was once the 4th largest lake in the world.
- Over four decades, it shrunk and turned into the Aralkum Desert.
- Rivers feeding the lake were diverted for agriculture (mainly cotton).
- Excessive use of pesticides and chemicals damaged the ecosystem.
- This became a major environmental disaster.
- The Aral Sea tragedy shows the impact of overusing and mismanaging natural resources.
- It reminds us of the need for sustainable resource management to protect Earth.

Classification of Resources

- Resources can be grouped based on origin, renewability, ownership, and stage of development.
- Based on Origin, resources are of two main types:
 - Biotic Resources – Living resources such as plants, animals, and humans.
 - Abiotic Resources – Non-living resources such as water, minerals, air, and soil.

Biotic Resources and Abiotic Resources

Biotic Resources

- Part of the biosphere and living in nature
- Can be used by humans

- Examples: Humans, plants, animals

Abiotic Resources

- Made of non-living components
- Examples: Water, air, minerals, soil

Renewability Classification

- Renewable Resources – Can replenish naturally over time
- Non-renewable Resources – Exist in limited quantity; once exhausted, cannot be quickly replaced

Renewable & Non-Renewable Resources

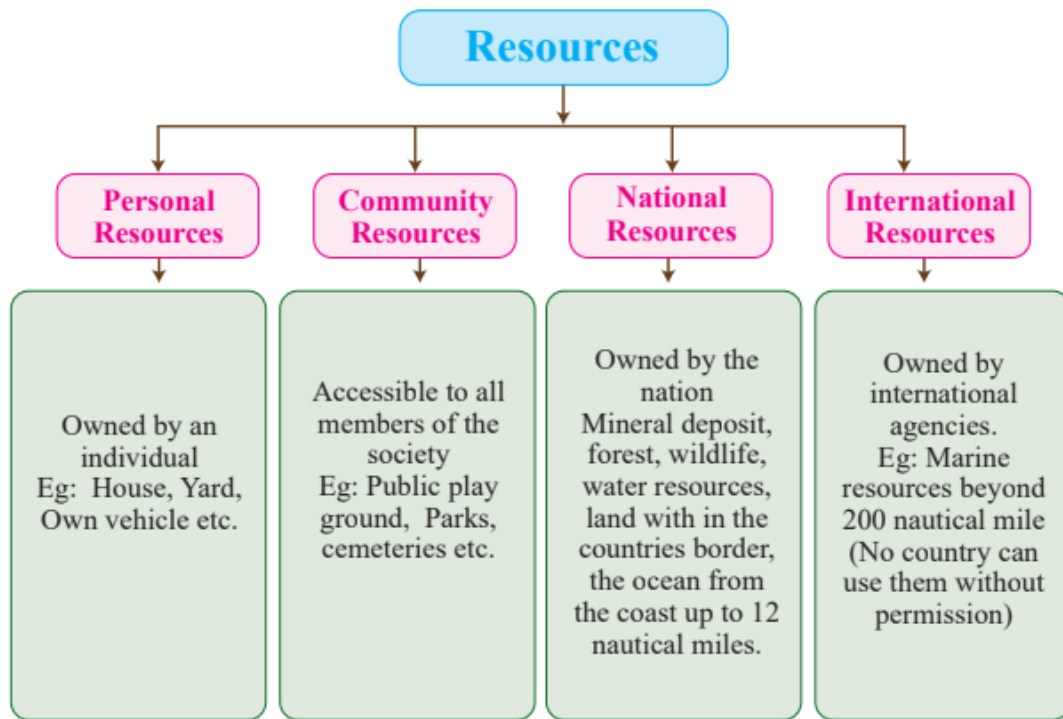
Renewable Resources

- Continuously replenished by natural processes
- Do not diminish after use; many can be reused
- Sustainable if not overused
- Examples: Air, sunlight, wind, water, forests

Non-Renewable Resources

- Formed over millions of years
- Reserves decrease with use

- Some (like metals) can be reused; others (like fossil fuels) cannot be replaced
- Examples: Coal, petroleum, natural gas, minerals



Potential & Developed Resources (Pointwise)

- Not all resources on Earth are fully accessible due to technological limitations.
- Many materials become resources only when suitable technology is developed.
- Potential Resources
 - Found in a region but not fully utilized yet.
 - Example: Wind & solar energy in Rajasthan and Gujarat (largely untapped).

- Developed Resources
 - Their quantity and quality are surveyed and assessed.
 - Technology exists to use them efficiently.
- Protecting resources is a shared responsibility—individuals, communities, and the nation.

Natural Resources

- Natural resources are materials and energy obtained directly from nature.
- They include air, water, soil, plants, animals, minerals, and fossil fuels.
- These resources support domestic, agricultural, industrial, and energy needs.
- Natural resources greatly influence our daily life and overall development.
- Minerals are naturally occurring substances with definite chemical & physical properties.
- They are usually formed by the combination of two or more elements.
- Minerals are vital for technology, economic growth, and human welfare.
- Minerals are broadly classified into metallic and non-metallic minerals.





Importance of Natural Resources & Minerals

- Natural resources greatly influence our daily life and support all human activities.
- Mineral and energy resources are essential for survival and development.
- Minerals are naturally occurring substances with definite chemical and physical properties.
- Atoms in minerals are arranged in a specific structural pattern.
- Most minerals are compounds of two or more elements; only a few occur in pure elemental form.
- Minerals support people's welfare, scientific progress, and economic growth.
- Minerals are broadly classified into metals and non-metals.

Types of Minerals (with Examples)

1. Ferrous Minerals

- Contain iron.
- Strong, durable, used in construction & industry.
- Examples: Iron ore, Manganese, Chromite.

2. Non-Ferrous Minerals

- Do not contain iron.
- Resistant to corrosion, lightweight, highly valuable.
- Examples: Copper, Bauxite, Lead, Zinc.

3. Inorganic Minerals (Non-metallic Minerals)

- Do not contain metals; may be organic/inorganic.
- Used in industry, agriculture, and manufacturing.
- Examples: Limestone, Mica, Gypsum, Salt.

Ores and Metallic Minerals

- The Earth is rich in rocks containing minerals with valuable metallic elements.
- Ores are rocks/minerals from which metals can be extracted profitably.
- Metallic elements are extracted at a relatively low cost when present in ore form.
- One metal can be extracted from different ores.
- *Example:* Iron → extracted from Hematite and Magnetite.
- One ore deposit can contain more than one metal.
- Ores play a vital role in industrial development, technology, and economic growth.



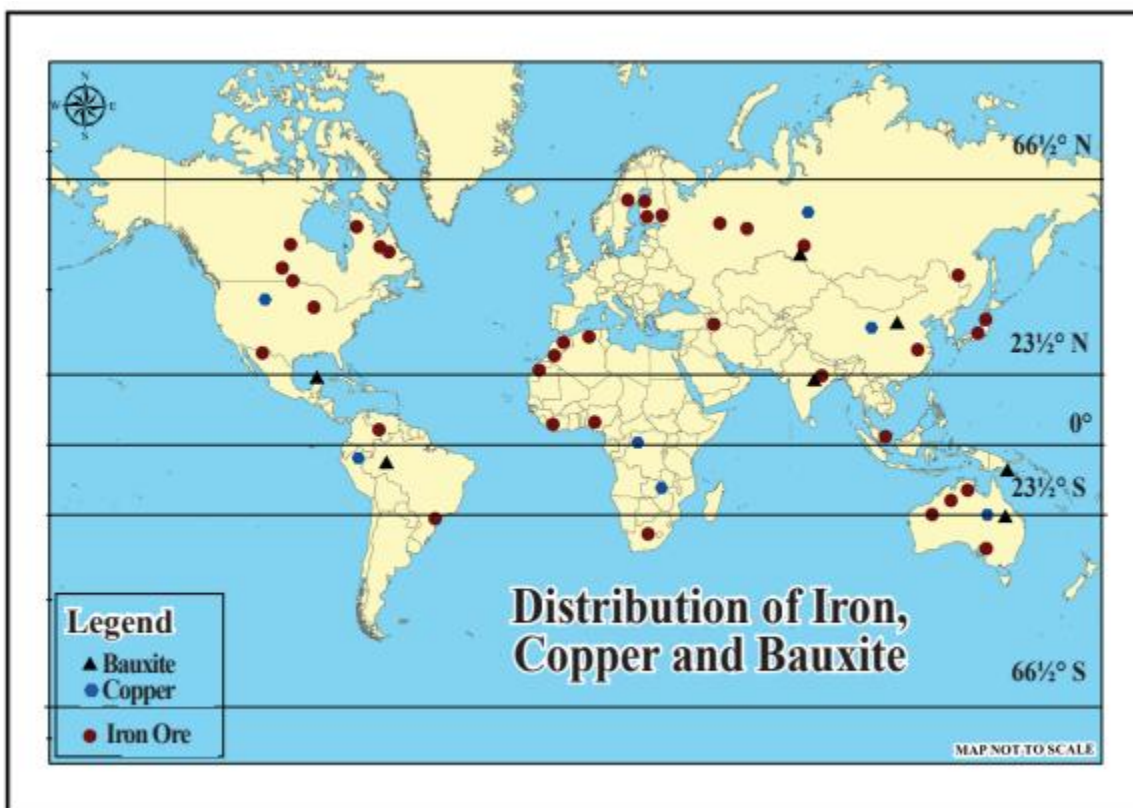
Different Ores

Importance of Minerals & Iron Ore

- Earth contains a wide variety of metals, each found in specific important ores.
- Mineral deposits = minerals occurring in high concentrations naturally.
- Minerals differ in availability; they are not evenly distributed across Earth.
- Continuous exploitation leads to depletion and possible exhaustion.
- Students must understand the need to conserve valuable mineral wealth.

Iron

- Carajás Mine in Brazil → world's largest iron ore mine.
- Iron is essential in daily life and has shaped human progress (Iron Age).
- Major iron ore reserves: Australia, Brazil, Russia, India.
- 98% of global iron ore is used to make steel.
- Around 50 countries mine iron ore; steel is a backbone of industrial growth.



Copper



- Found in pure form, easy for early humans to extract.
- Discovery marked the Copper Age.
- Used for tools, weapons, and ornaments in ancient times.
- Essential today in the electrical industry:
- Wires
- Motors
- Transformers
- Generators
- Chile → world's largest copper producer (Escondida & Collahuasi mines).



Escondida



Collahuasi

Other Important Metals

- Aluminium → wires, vehicles, aircraft, cans, buildings.
- Manganese → crucial for steel and metal processing.
- Lead → batteries, ceramics.
- Chromium → stainless steel production.

Non-Metallic Minerals

- Do not have metallic luster.
- Used in natural form or after purification.
- Examples: Gypsum, Limestone, Kaolin, Graphite.

What are energy resources?

- Any substance that can produce heat, generate electricity, or move objects.
- Substances that release energy through chemical processes are called fuels.
- Essential for daily life—electricity powers lights, fans, appliances, and devices.
- Energy also runs motor vehicles, industries, hospitals, transportation, and agriculture.

Importance of Energy Resources

- Vital for economic development and modern living.
- Needed for food production, communication, healthcare, and transport.

Types of Energy Resources (by Renewability)

- Renewable energy resources
- Non-renewable energy resources

Fossil Fuels – Non-Renewable Resources

- Formed from the remains of ancient plants and animals.
- Major fossil fuels include coal and petroleum.

Coal



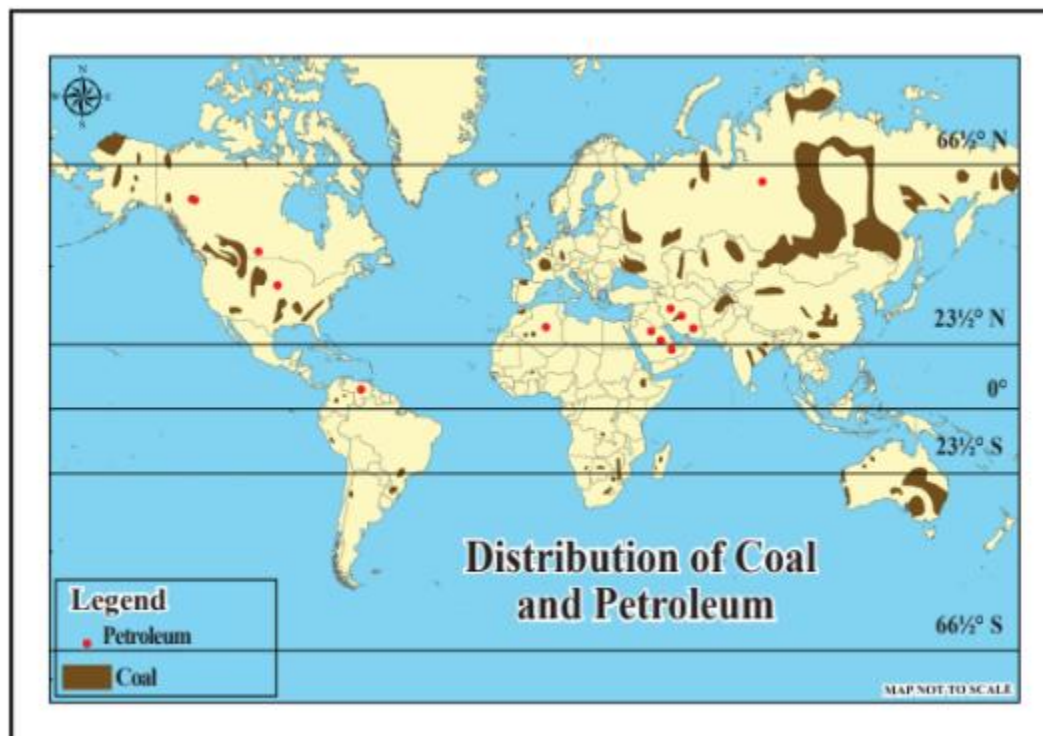
The largest coal mine in the world is the North Antelope Rochelle Mine, located in the United States of America.

What is Coal?

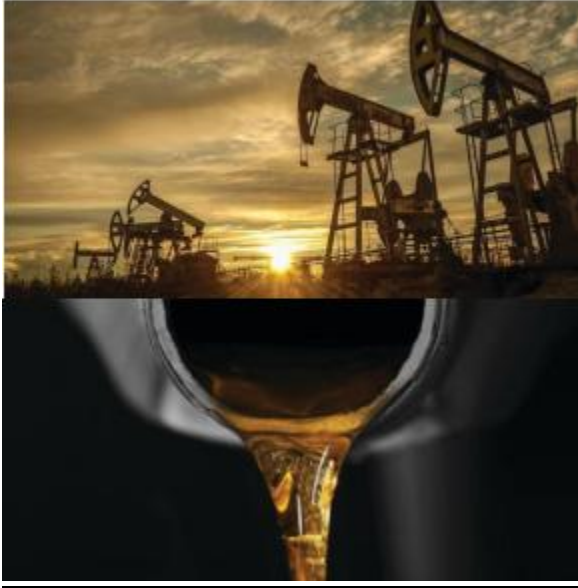
- A carbon-rich sedimentary rock formed from ancient plant remains.
- Found in black or brown coloured deposits.
- Contains high carbon content, making it a powerful fuel.

Uses of Coal

- Metallurgy: Used for extracting and refining metals from ores.
- Thermal Power: Major source of fuel for electricity generation in thermal power plants.
- Chemical Industry: Used to manufacture waxes, ointments, medicines, pesticides, dyes.
- Important for various industrial processes due to its high energy output.



Petroleum



What is Petroleum?

- A naturally occurring liquid mixture found in rocks → called ‘rock oil’.
- Also known as ‘black gold’ due to its high economic value.

Historical Uses

- Ancient people worshipped natural gas flames from underground seepages.
- Asphalt used for waterproofing boats & regulating indoor temperature.
- In ancient Egypt, used in pyramid construction and preserving mummies.

Importance in Modern Times

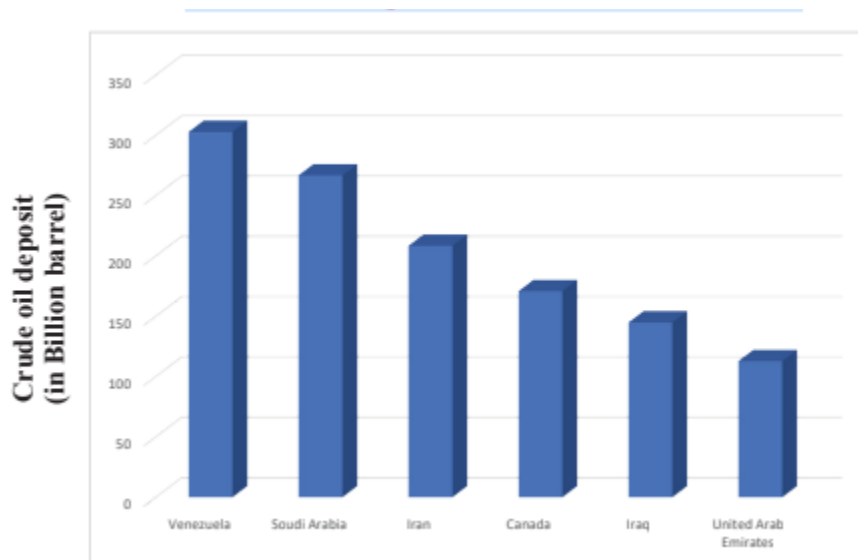
- Became a key fuel during the Industrial Revolution, replacing coal.
- Middle East petroleum availability at low cost transformed global industries.
- Today, it is the primary global energy resource influencing daily life and economy.

Economic Impact

- Countries like Saudi Arabia became developed within decades due to oil wealth.

Crude Oil Deposit

The Leading Countries in the World



Energy Resources – Fossil Fuels & Alternatives

Petroleum & Fossil Fuels

- USA is the top petroleum producer (USGS 2024).
- Crude petroleum varies in colour: black, brown, green, or yellow.
- Crude oil is refined to produce petrol, jet fuel, lubricants, asphalt, and thousands of products (paints, medicines, fibres, fertilizers, cosmetics).
- Maracaibo Basin (Venezuela) → major oil & gas region; faces oil spills & environmental issues.



An oil refinery in West Asia

Fossil Fuels – Growing Concerns

- Coal was the first fossil fuel commonly used (steam engines, furnaces).
- Petroleum use increased rapidly after the 19th century.
- Natural gas widely used today, especially in homes.

- Fossil fuels are non-renewable → depletion may cause future energy crisis.

Need for Alternative Energy

- Overuse of resources → environmental damage + energy scarcity.
- Shift towards sustainable, renewable, non-conventional energy sources.

Non-Conventional Energy Sources

- Solar Energy → Photovoltaic & solar thermal methods convert sunlight to electricity.
- Wind Energy → Wind turns turbines to generate power.
- Geothermal Energy → Heat from magma, hot water, and geysers used for electricity & heating.
- Tidal Energy → Energy from tidal movement drives turbines.
- Bioenergy → Produced from organic waste; reduces pollution and supports rural development.

Solar Energy



We know that the Sun is the primary source of energy. Many techniques are currently in use to convert solar rays into energy. Photovoltaic and solar thermal capture methods are used to harness energy from the Sun. The energy obtained by converting solar rays is stored in photovoltaic cells and used for various purposes.



The kinetic energy of the wind is converted into electricity. The force of the wind is used to spin a windmill, which in turn drives a generator connected to it, producing electricity.

Geothermal Energy



The heat released when magma erupts from the Earth's interior to the surface is efficiently stored and converted into electrical energy. In addition, it is possible to generate thermal energy from the hot water and vapour that emerge from the Earth through geysers. It has significant importance as an alternative energy source.

Tidal Energy



The movement of ocean tides is used to spin turbines and generate electricity.

Bioenergy



Bioenergy is energy produced from organic matter and organic waste. It helps improve the quality of life for rural populations in developing countries and reduces environmental pollution. Today, projects to produce energy from urban waste are also being implemented.

Energy from Hydrogen

Hydrogen, a chemical element, is used to produce energy, which can serve as a clean fuel. When hydrogen is burned in a fuel cell, only water vapor is released. The main peculiarity of this energy source is that it does not release pollutants like fossil fuels when they are burned. This energy is useful in areas ranging from transportation to various economic activities. Hydrogen may play an important role in meeting the energy needs of the future.

Energy conservation

Energy Conservation Day – December 14

Energy Conservation

- Energy Conservation Day: December 14 → reminds us to protect Earth.
- Rising population + high resource demand → rapid depletion of natural resources.
- Conservation means careful use of resources so Earth retains its self-regenerative capacity.

Why Conservation is Needed

- Natural resources are limited and may run out for future generations.

- Must balance development with resource protection.
- Use energy sources that do not harm the ecosystem or global climate.

Sustainable Development

- “Development that meets present needs without compromising the ability of future generations to meet their own needs.”
- Involves protecting the Earth, conserving resources, and ensuring a better tomorrow

Steps Toward Sustainability

- Promote renewable energy: solar, wind, hydroelectric, geothermal.
- Reduce dependence on fossil fuels (scarce, polluting, non-renewable).
- Engage in activities that support environment protection and resource conservation.