

CLASS 10 CHAPTER 6

THE CHANGING EARTH

Hazard:

- Refers to a situation that poses a threat to life, health, property, services, socio-economic stability, or the environment.
- A physical event that has the potential to trigger a disaster, though it does not necessarily result in one on its own.

Disaster:

1. A serious disruption in the functioning of a community or society that causes widespread material, economic, social, or environmental losses and exceeds the ability of the affected society to cope using its own resources.

Risk:

2. The measure of expected losses caused by a hazard event occurring in a specific area over a given time period.

Vulnerability:

3. The extent to which a community, structure, service, or geographic area is likely to be damaged or disrupted by the impact of a particular hazard.

Capacity:

4. Refers to the resources, means, and strengths within a community that enable it to cope with, withstand, prepare for, prevent, mitigate, or quickly recover from a disaster.

Earth Movements

5. All geological features—such as mountains, plateaus, valleys, and rivers—are created as a result of Earth movements and processes.
6. The physical movements that cause variations and changes in elevation across the Earth's surface are known as Earth movements.



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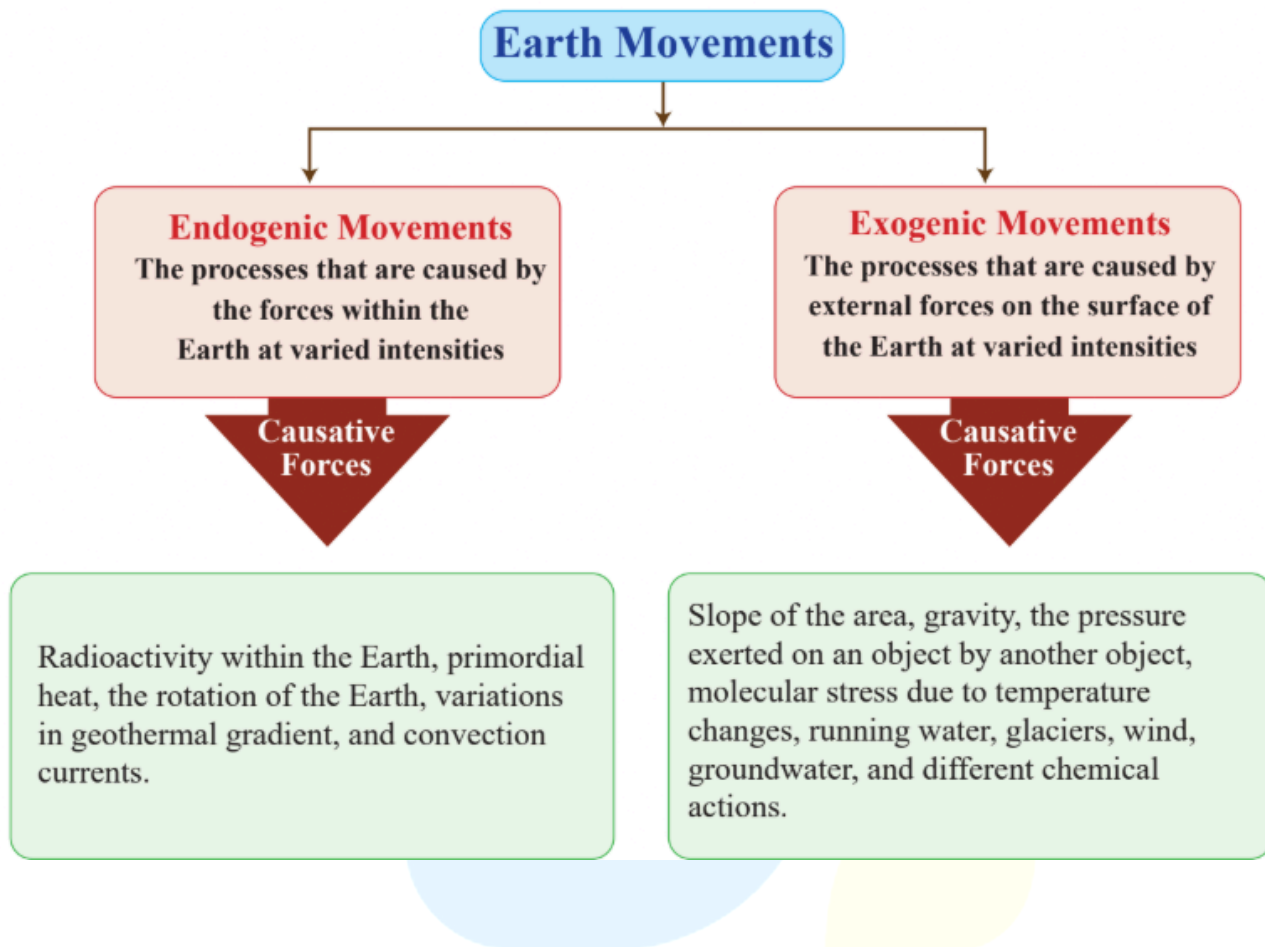


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Earth movements can be categorized into two types based on the forces that cause them.



Convection Currents

- Heat increases with depth inside the Earth. The presence of radioactive elements causes temperature variations within the mantle. Due to thermal variations, magma in the mantle heats up and rises upward toward the crust. As it approaches the crust, it cools down and sinks back toward the deeper mantle. The continuous cyclic movement of magma in the mantle, driven by thermal variations, is called a convection current.

Classification of Endogenic Movements

- Earthquakes, volcanic activities, mountain building (orogenic movements), continent building (epeirogenic movements), and plate tectonics are all results of endogenic movements.
- Endogenic movements can be divided into two based on speed:



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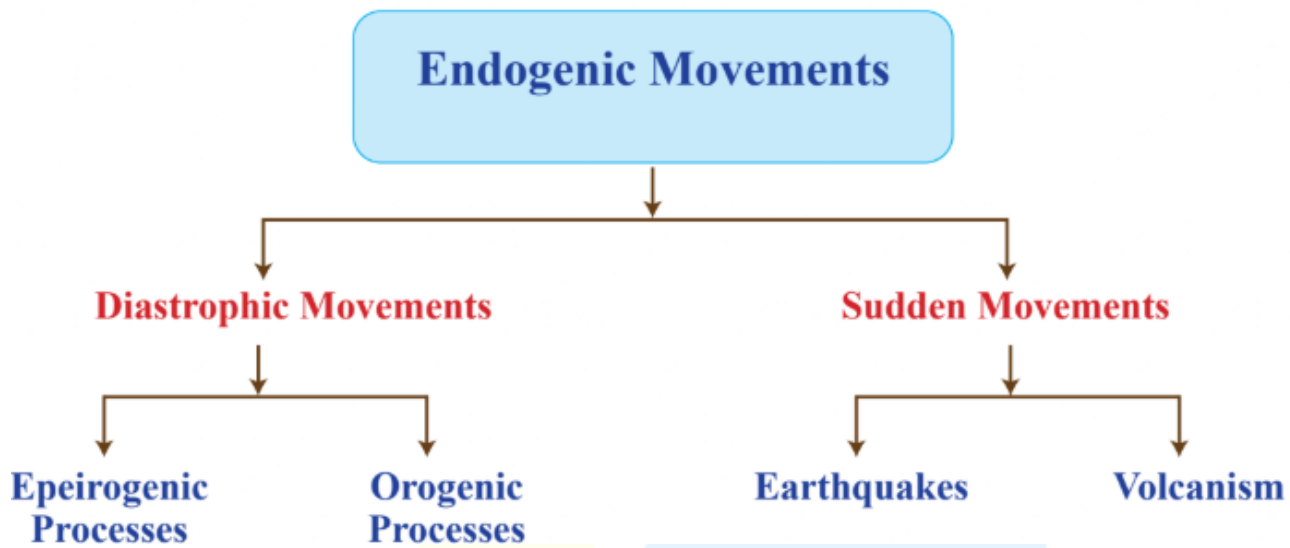
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Diastrophic Movements

- Endogenic processes and movements that move, elevate, or build up portions of the Earth's crust are known as diastrophic movements (or diastrophism).

Epeirogenic Movements:

- Processes that cause the upliftment of large portions of the Earth's crust are called epeirogenic movements.
- These movements cause only minimal deformation on the Earth's surface.

Orogenic Movements:

- Processes that lead to the formation of mountains are called orogenic movements.
- Unlike epeirogenic movements, orogenic movements severely deform the Earth's surface.

Fold Mountains:

- Formed through the folding of crustal portions (e.g., the Himalaya mountains).

Horst(Block Mountain) and Graben

- The uplifted block of the Earth's crust formed due to faulting.



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Graben:

- The corresponding down-dropped block of the Earth's crust.

Lithosphere:

- Formed by the outermost layer of the Earth (the crust) together with the uppermost portion of the mantle.
- It has an average thickness of 100 kilometres.

Asthenosphere:

- A zone lying directly beneath the solid lithosphere. Rocks in this zone exist in a partially molten (semi-liquid) state. Serves as the source from which molten rock material rises toward the Earth's surface through cracks, holes, and weaker sections of the lithosphere.

Volcanism**Definition of Volcanism:**

- Includes the formation of magma, its upward movement towards the Earth's surface, and its expulsion through cracks or pores in the lithosphere.
- Encompasses all related processes such as explosions, lava flow, solidification of magma, and the formation of various igneous landforms.

Volcanoes and Volcanic Materials**Volcanoes:**

- Defined as openings in the lithosphere through which molten rock material, gases, ash, pyroclastic materials (rock fragments), dust, and water vapour erupt to the Earth's surface.

Volcanic Materials:

- The collective term for the substances (gases, ash, rock fragments, etc.) that erupt through volcanic vents onto the surface.

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Magma vs. Lava

- Magma: The molten rock material present in the upper mantle/asthenosphere.
- Lava: The name given to magma once it begins moving towards the crust or reaches the Earth's surface.

Based on the nature of the eruption and the structures they form, volcanoes are classified into:

- **Shield Volcanoes**
- **Composite Volcanoes**
- **Calderas**

Basalt Plains & Examples:

- Lava spreading across vast areas can form massive basalt flood plains.
- The Deccan Plateau in India is an example of a region formed this way.
- The vast region in India formed by the weathering and breakdown of lava rocks into fertile black soil is the Deccan Plateau (also known as the Deccan Traps).
- This region is famous for its black soil (or Regur soil), which is rich in minerals and ideal for growing cotton.
- India's only active volcano is Barren Island. It is located in the Andaman and Nicobar Islands in the Andaman Sea.

Benefits of Volcanic Activities

- **Geothermal Energy:**

Geothermal energy released from volcanic regions is converted into electricity in some places to meet local needs.

- **Mineral Wealth:**

Lava is rich in minerals. Many valuable minerals reach the Earth's surface through the flow of lava.

- **Tourism:**

Volcanic regions attract a large number of tourists.

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Earthquakes

- As tectonic plates move over the asthenosphere, friction accumulates energy between them. When the plates can no longer withstand the immense pressure, this accumulated energy is suddenly released. This released energy travels to the surface in the form of waves, causing an earthquake.

Tectonic Earthquakes:

- Earthquakes caused by the movement of tectonic plates are known as tectonic earthquakes.

Focus (Hypocentre):

- The point within the Earth's crust where energy is released during an earthquake is called the focus (or hypocentre).

Epicentre:

- The point on the Earth's surface directly above the focus is called the epicentre.
- Earthquake waves reach this surface point first, making it the closest point on the surface to the focus.

Seismic Waves

- **Primary Waves (P-waves)**
- **Secondary Waves (S-waves)**
- **Surface Waves (L-waves)**

Surface waves are the most destructive seismic waves.

Measuring Earthquakes

Richter Scale:

- Developed by Charles F. Richter in 1935 to measure the magnitude (intensity) of earthquakes.
- Generally used to calculate smaller, local earthquakes.

Seismograph:

- The instrument used to record seismic (earthquake) waves.



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- Magnitude is calculated based on the amplitude of the waves recorded by the seismograph.

Moment Magnitude Scale:

- Used to record larger earthquakes with greater accuracy compared to the Richter scale.

Shadow Zones

- Following an earthquake, seismic waves travel in all directions from the focus. However, there are certain areas at a specific distance from the focus where these seismic waves do not reach. These regions are known as shadow zones of the earthquake.

Tsunami

- Caused by severe earthquakes that occur on the ocean floor. These underwater earthquakes generate giant sea waves that can rise to heights of several metres. These massive ocean waves triggered by seismic activity are called tsunamis.
- A severe earthquake with a magnitude of 9.1 occurred on 26 December 2004, Located in the Indian Ocean, southwest of Sumatra's Aceh Province. The earthquake triggered a massive tsunami that caused widespread destruction across many coastal regions, including the coast of Kerala.

Tsunami Warning Systems

- **DART System:**

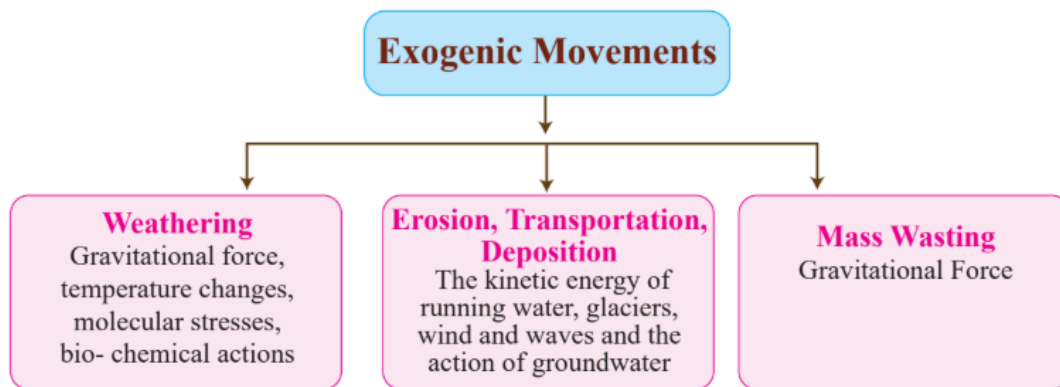
The National Oceanic and Atmospheric Administration (NOAA) has set up a tsunami warning system called DART (Deep Ocean Assessment and Reporting of Tsunami) in various oceanic regions.

- **Satellite Communication:**

The DART system leverages satellite communication technology to transmit real-time ocean data and provide early tsunami alerts.

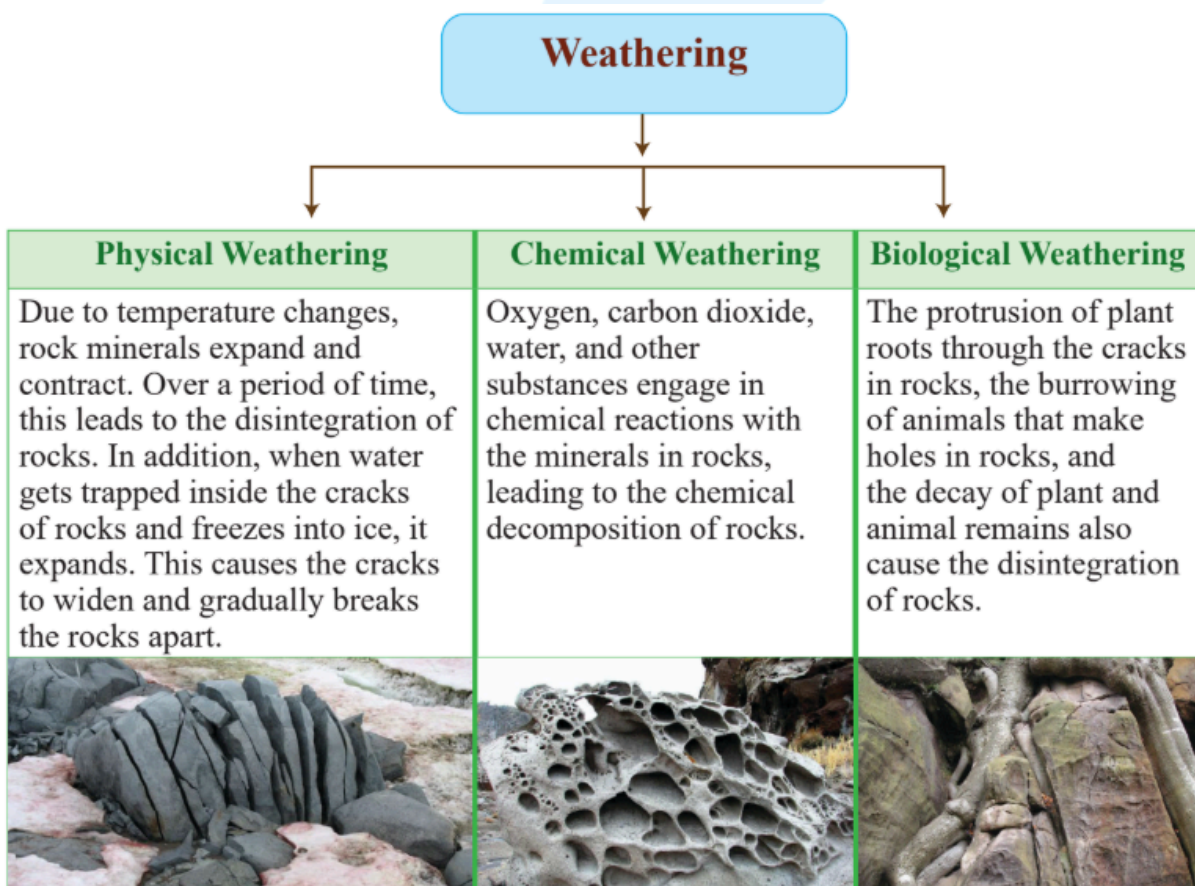
Exogenic processes and their Forces

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Weathering

- The physical breaking down or chemical decomposition of rocks at or near the Earth's surface caused by exogenic (external) forces.



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Mass Wasting

- Mass wasting is an earth movement that occurs on the surface of the Earth due to exogenic (external) forces, distinct from weathering and erosion.
- It occurs under the direct influence of gravitational pull.
- Rock fragments or earth materials move or fall down a sloped terrain.
- Speed Range: Varies from very slow movements to rapid movements.

Types of Mass Wasting

- **Landfall**
- **Rockfall**
- **Landslide**
- **Debris Flow**
- **Land Subsidence**

Debris Flow

- The rapid downward flow of rocks, soil, and debris along with a stream of water down a steep mountain slope, driven by the Earth's gravity.

Landslide

- A form of mass wasting where portions of a hill or mountain slide downward along a slope under the direct influence of gravity.

Soil Piping (Tunnel Erosion)

- Soil piping is a subsurface erosion process where water removes soil particles beneath the ground, forming hollow, pipe-like channels or tunnels underground.
- The physical removal of weak subsurface soil layers by flowing underground water.
- During heavy rainfall, water seeps through the natural pores of the hard top layer (laterite cap).
- As water reaches the clayey subsurface, it disrupts the weak cohesive bonds (cohesion force) holding the clay and silt particles together.
- The flowing water washes away the clay-silt mixture, creating underground pipe-like channels or tunnels.
- Once the underground support is completely washed away, the surface above collapses, creating deep, well-shaped depressions.



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- Frequently observed in hilly areas with laterite topsoil and clayey subsoil.
- Deep, well-like circular pits formed in Idukki and Kannur districts have been identified as results of soil piping.

Technologies for Identifying Hazard Zones

- Studies using Remote Sensing and Geographic Information System (GIS) help identify regions with a high risk of hazards, such as landslides.

Landslide Hazard Zonation Maps

Key Organizations:

- Geological Survey of India (GSI)
- National Centre for Earth Science Studies (NCESS)



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