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SOLUTIONS BOOK

# CLASS 9

## Social Science · Understanding Society

CHAPTER 2

## Shaping of the Earth’s Surface

Complete Questions and Activities Solutions

In-text Questions

Questions and Activities

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Every question is followed by its answer. Question numbers above are clickable and the PDF bookmarks panel lets you jump to any exercise set or question. Figures are reproduced from the NCERT textbook (© NCERT) for educational use.

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2.1

CLASS 9 SOCIAL SCIENCE · CHAPTER 2

# In-text Questions

Solutions · 15 questions

**Directions (Questions 1–15):** These are the questions that appear inside the chapter (The Big Questions, Let’s Map, Let’s Explore and Think About It), numbered in the order in which they appear. Many are open-ended; model answers based on the chapter are given, and you may add examples from your own surroundings.

QUESTION 1 *The Big Questions · p. 13*

## What shapes the Earth’s surface?

ANSWER

The Earth’s surface is shaped by two sets of forces that work together: internal forces acting from within the planet and external forces acting on its surface.

### a Internal (interior) forces

- **Earthquakes, volcanic eruptions, folding and faulting** are the internal forces that move the crust.
- They arise from the movement of **tectonic plates**, which is driven by convection currents in the mantle.
- Their work is **constructive**: they create mountains, valleys and ocean basins.

### b External forces

- **Weathering** breaks rocks into smaller pieces without moving them; **erosion** carries the broken material away; **deposition** lays it down elsewhere.
- The agents of gradation are **running water, glaciers, wind, waves and groundwater**.
- Their work is mostly **wearing down and reshaping**: they carve valleys, form plains and create caves, cliffs and river deltas.

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### c Summary of the two sets of forces

| Force | Examples | Effect on the surface |
|---|---|---|
| **Internal** | Plate movement, earthquakes, volcanic eruptions, folding, faulting | Build up mountains, valleys and ocean basins |
| **External** | Weathering, erosion and deposition by water, ice, wind and waves | Wear down high areas, fill low areas and reshape landforms |

**Therefore, internal forces build the Earth's surface and external forces wear it down and reshape it.**

QUESTION 2 *The Big Questions · p. 13*

## What is plate tectonics? What are the effects of plate movement?

ANSWER

Plate tectonics is a theory in earth science (attributed in the chapter to W.J. Morgan) which explains the movement of the Earth's crust: the outermost layer is broken into large and small pieces called tectonic plates that move slowly over the semi-molten layer beneath them.

### a What is plate tectonics?

- The Earth has three layers: **crust, mantle and core**. The crust and the upper part of the mantle form the **lithosphere**, which is broken into tectonic plates.
- Beneath the lithosphere lies the semi-molten **asthenosphere**, which allows the plates to move.
- Plates are massive slabs of solid rock moving a few centimetres per year. They are of three types: **continental, oceanic and mixed** plates.
- Plates move because of **convection currents** in the mantle: heat from the core makes molten material rise while cooler material sinks, pushing and pulling the plates.

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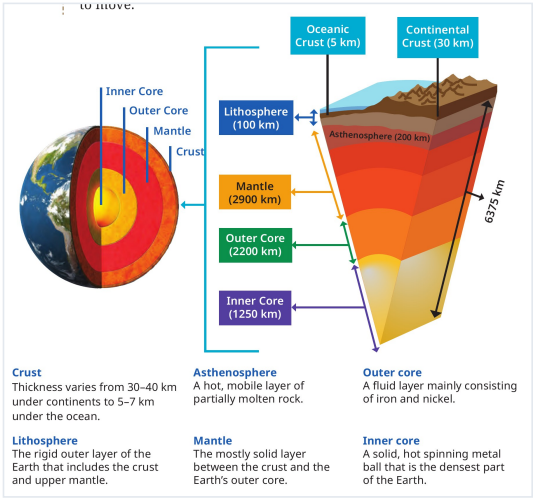



*Fig. 2.1. The Earth's interior (Given values are approximate)*

## b Plate boundaries and their effects

| Boundary | Plate movement | Effect | Example |
|---|---|---|---|
| **Convergent** | Two plates move towards each other | Continental plates colliding form fold mountains; an oceanic plate sinking under a continental plate causes volcanic activity and earthquakes | Himalaya |
| **Divergent** | Plates move away from each other | Magma rises and forms new crust, creating mid-ocean ridges | Mid-Atlantic Ridge |
| **Transform** | Plates slide past each other | Crust is neither created nor destroyed; mainly earthquakes | San Andreas Fault, USA |

## c Overall effects of plate movement

- Formation of **mountains, valleys, ocean basins, volcanoes and earthquakes**.
- It explains the **distribution of continents and oceans** across the Earth.
- Most earthquakes and volcanoes occur along plate boundaries, especially around the Pacific Ocean (the **Ring of Fire**).
- It helps in identifying earthquake- and volcano-prone regions and in managing disasters arising from them.

**Therefore, plate tectonics explains how the crust moves, and plate movement builds mountains and ocean basins and causes earthquakes and volcanoes.**

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QUESTION 3 *The Big Questions · p. 13*

## How are landforms formed and how are they classified?

ANSWER

A landform is a natural feature on the Earth's surface formed by weathering, erosion, deposition and the movement of the Earth's crust. Examples are mountains, valleys, plateaus, plains, deserts and coastal features.

### a How landforms are formed

- **Internal forces** (plate movement, folding, faulting, volcanic eruptions) raise mountains, form volcanoes and create ocean basins.
- **Weathering** (physical, chemical and biological) breaks down rocks; **erosion** removes and transports the broken material; **deposition** builds new features where the material is dropped.
- Over long periods these processes work together to wear down mountains, carve valleys, form plains and create caves, cliffs and deltas.

### b Classification by the agent of gradation

| Agent | Landforms formed (examples from the chapter) |
|---|---|
| **Running water** | V-shaped valleys, waterfalls, rapids (upper course); meanders, oxbow lakes, floodplains (middle course); deltas, levees, alluvial fans (lower course) |
| **Waves and currents** | Beaches, sand bars; cliffs, wave-cut platforms, caves, arches and stacks |
| **Glaciers** | U-shaped valleys, cirques, aretes, hanging valleys, fjords; moraines (by deposition) |
| **Wind** | Yardangs, ventifacts, deflation hollows (blowouts), desert pavements; dunes (barchan, longitudinal, star, parabolic) |
| **Underground water** | Caves, stalactites, stalagmites, sinkholes (dolines) and underground rivers (Karst topography) |

**Therefore, landforms are built by internal forces and shaped by external agents, and they are classified mainly by the agent that forms them.**

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QUESTION 4 *The Big Questions · p. 13*

## How are humans and other living beings connected to these landforms?

ANSWER

Landforms decide where people settle, how they earn a living and how history unfolds; they also provide soil, water and habitats for living beings.

### a Connection with different landforms

| Landform | How humans and living beings are connected |
|---|---|
| **Rivers, meanders, deltas** | Fertile alluvial soil supports agriculture (rice and jute in deltas); fishing, irrigation, navigation, trade and dense settlements. Rivers such as the Ganga, Nile, Brahmaputra and Indus gave rise to early cities |
| **Waterfalls** | Tourism, hydroelectric power, trekking and photography; often culturally or religiously important |
| **Beaches and coasts** | Tourism, fishing, harbours and trade; beaches act as natural barriers against strong waves |
| **Mountains and glaciers** | Trekking, skiing and mountaineering; glaciers are sources of fresh water for rivers; fjords serve as harbours; the Himalayas shielded India yet allowed exchange through passes like the Khyber |
| **Deserts and dunes** | Influence settlements and farming in arid regions; dunes check desertification; deserts like the Thar encouraged trade routes such as the Silk Route |
| **Caves and underground rivers** | Fresh water, tourism, study by geologists, cultural and religious importance |

### b Effect on occupations and traditional knowledge

- Erosion removes fertile topsoil from farms, damages land, houses and roads near rivers and coasts, and affects mining, construction, tourism and fishing.
- People have also learnt to **work with the land**: the Sindhu-Sarasvatī civilisation used contouring, bunding, terracing, dams and canals, and the Zabo system of Nagaland conserves soil and water on hillslopes.

**Therefore, landforms provide soil, water, shelter and livelihoods, and humans have learnt to use and conserve them wisely.**

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QUESTION 5 *The Big Questions · p. 13*

## How do disasters associated with different landforms impact human lives?

ANSWER

Disasters such as landslides, avalanches, Glacial Lake Outburst Floods (GLOFs) and dust storms are linked to particular landforms and cause loss of life, property and livelihoods.

### a Disasters, their causes and their impact

| Disaster | Main causes | Impact on human life |
|---|---|---|
| **Landslide** | Heavy rain, earthquakes, steep slopes, loose rocks; deforestation, mining, road and unplanned construction | Damage to buildings and roads, blocked routes, loss of lives and property |
| **Avalanche** | Heavy snowfall, sudden rise in temperature, strong winds, vibrations, skiing, trekking or construction | People, camps and routes in mountains get buried; rescue is difficult |
| **GLOF** | Rapid glacier melting, heavy rain or snowfall; earthquake, avalanche or landslide breaks the natural dam | Sudden destructive floods in downstream areas |
| **Dust storm** | Strong winds, drought, loose dry soil, sparse vegetation, climate change | Poor visibility, damage to crops and health, disruption of daily life |

### b General effects

- Loss of human and animal lives, as in the Chamoli flood (February 2021), in which many people and livestock died.
- Severe damage to buildings, roads, bridges and hydel projects, and loss of connectivity to villages.
- Loss of farmland and livelihoods; the 2001 Gujarat earthquake caused extensive damage to life and environment.

**Therefore, landform-linked disasters threaten lives, property and livelihoods, so preparedness is essential.**

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QUESTION 6 *Let's Map · p. 16*

**Pick any two plates from the map above and complete the table given below.**

ANSWER

Fig. 2.3 shows each plate in a different colour. The continents and the ocean lying on a plate are read from the map; two plates are completed below, with two more for practice.

## a Completed table

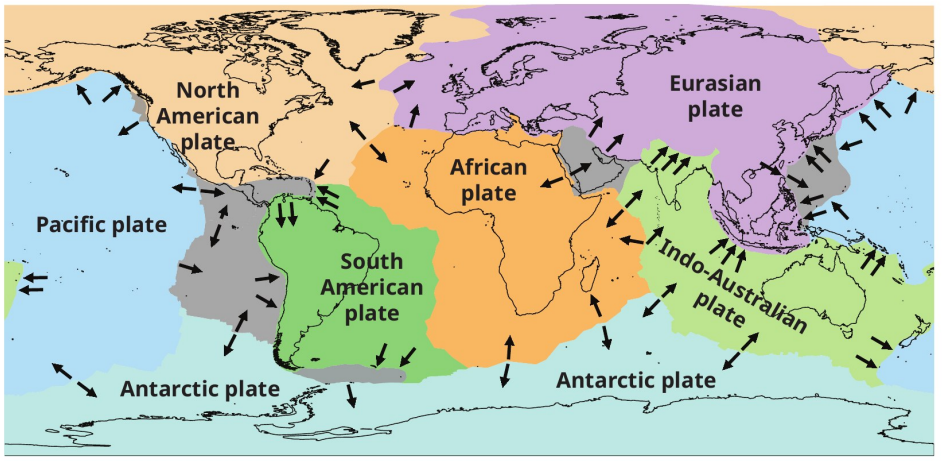



*Fig. 2.3. World map showing major plates and their direction of movement*

| Name of the plate | Continents | Ocean |
|---|---|---|
| **Indo-Australian plate** | Australia and the Indian subcontinent (southern Asia) | Indian Ocean |
| **African plate** | Africa | Parts of the Atlantic and Indian Oceans |
| **South American plate** | South America | Western part of the Atlantic Ocean |
| **Pacific plate** | No continent lies wholly on it; it is mainly an oceanic plate | Pacific Ocean |

## b How to fill the table

- Find the plate by its name and colour on the map.
- Note which continents lie on the coloured area.

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- Note the ocean that forms the rest of the plate.

**Therefore, a plate may carry continents, an ocean floor or both (a mixed plate).**

QUESTION 7 *Let's Explore · p. 16*

**Examine the plate map (Fig. 2.3) with the earthquake and volcano map (Fig. 2.4). What correlation do you observe?**

ANSWER

Earthquakes and volcanoes are not spread evenly: most of them lie along the edges of the plates and very few in the middle of plates.

### a The two maps side by side

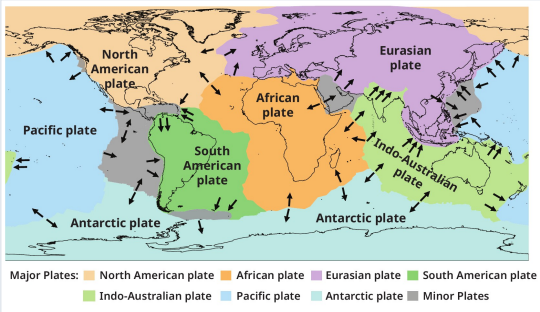



*Fig. 2.3. Major plates*

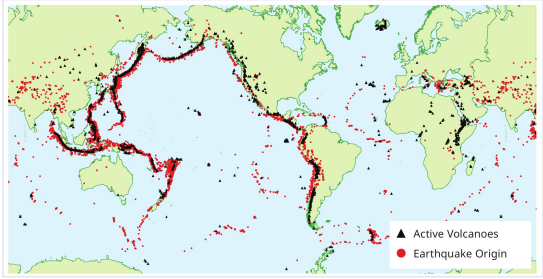



*Fig. 2.4. Earthquakes and volcanoes*

### b Observations

- A dense belt of earthquake origins (red dots) and active volcanoes (black triangles) runs around the **Pacific Ocean**, along the edges of the Pacific plate. This is the Ring of Fire.
- Another belt follows the southern edge of the Eurasian plate, where it meets the African and Indo-Australian plates (Mediterranean region, West Asia and the Himalaya).
- A line of dots follows the **mid-ocean ridge** in the Atlantic Ocean, where plates move apart.
- The interiors of large plates show few dots.

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### c Correlation

Where plates collide, separate or slide past one another, stress builds up in the rocks and magma finds a way to the surface. So the pattern of earthquakes and volcanoes closely matches the plate boundaries.

**Therefore, there is a strong correlation between plate boundaries and the distribution of earthquakes and volcanoes.**

**QUESTION 8** *Let's Explore · p. 17*

**Observe the map showing the distribution of earthquakes and volcanoes (Fig. 2.4). Can you identify which continents and countries are located around the Ring of Fire with the help of an atlas or a globe?**

**ANSWER**

The Ring of Fire is the horseshoe-shaped belt around the Pacific Ocean where most earthquakes and volcanoes occur. Locating this belt in an atlas gives the following continents and countries.

### a Continents and countries around the Ring of Fire

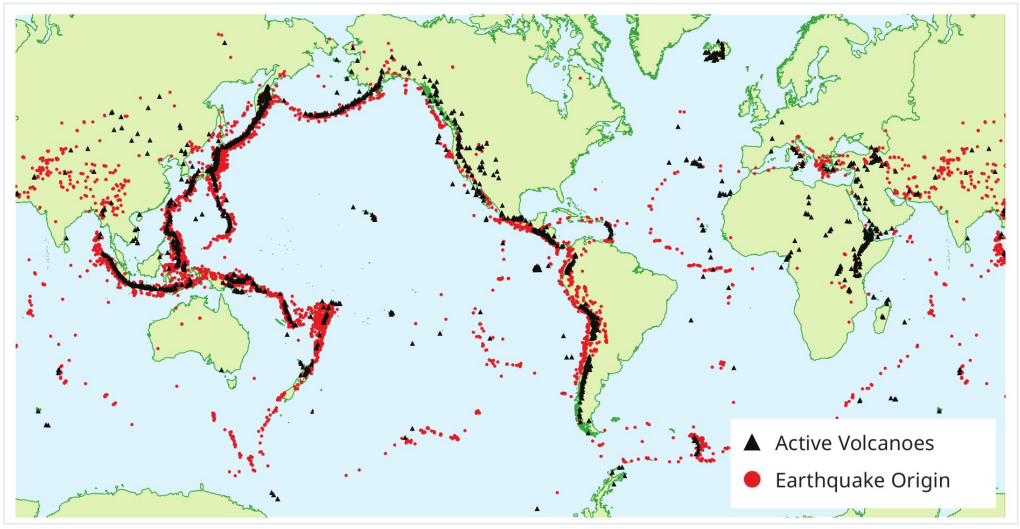



*Fig. 2.4. Map showing the distribution of earthquakes and volcanoes*

| Continent | Countries along the Ring of Fire |
|---|---|
| **Asia** | Russia (Kamchatka and the Kuril Islands), Japan, Philippines, Indonesia |
| **Oceania** | Papua New Guinea, Solomon Islands, New Zealand |

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| Continent | Countries along the Ring of Fire |
|---|---|
| **North America** | Canada (west coast), United States (Alaska and the west coast), Mexico and the countries of Central America |
| **South America** | Colombia, Ecuador, Peru, Chile (along the Andes) |

**Therefore, the Ring of Fire runs along the Pacific coasts of the Americas and Asia and through the island countries of the western Pacific.**

QUESTION 9 *Let's Explore · p. 17*

**Does India have a risk of earthquakes?**
**Can you find out which region is more vulnerable to earthquakes?**
**Why do you think human lives are at risk?**

ANSWER

Yes. India has experienced major earthquakes in the past that caused thousands of deaths, and some regions are far more vulnerable than others.

### a Why India has an earthquake risk



*Fig. 2.5. The extensive damage caused by the major earthquake in Gujarat in 2001*

- The Indo-Australian plate carrying India moves northwards and collides with the Eurasian plate. This convergent boundary built the Himalaya and keeps building up stress in the rocks.
- When the stored stress is suddenly released, an earthquake occurs.

### b Regions more vulnerable

- The **Himalayan belt** (Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh) and the **north-eastern states**.

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- The **Kachchh region of Gujarat**, which suffered the 2001 earthquake, and the Andaman and Nicobar Islands.

### c Why human lives are at risk

- India is **densely populated**, so a large earthquake affects very many people.
- Weak and unplanned buildings collapse, causing most deaths and injuries.
- Earthquakes strike suddenly and cannot be predicted, so people get no time to move to safety.
- Roads, water supply, electricity and hospitals are damaged, which makes rescue and relief harder.

**Therefore, India has a real earthquake risk, highest in the Himalayan and north-eastern regions, and dense populations are at great risk.**

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QUESTION 10 *Let's Explore · p. 18*

**Look carefully at this photograph and answer the following questions:**
**→ What do you think caused this situation?**
**→ What could that grey powder be?**
**→ What does it tell us about the Earth's internal forces?**

ANSWER

Fig. 2.6 shows a hill settlement whose houses, trees and slopes are covered with grey powder deposited by a volcanic eruption.

### a Answers



*Fig. 2.6. Photograph showing the deposition by volcanic eruption*

| Question | Answer |
|---|---|
| **What caused this situation?** | A **volcanic eruption**. The volcano threw out ash and other material, which fell over the village and its surroundings and settled as a thick layer. |
| **What could the grey powder be?** | **Volcanic ash**: very fine fragments of rock, minerals and volcanic glass blasted out during the eruption. |
| **What does it tell us about the Earth's internal forces?** | Powerful forces and heat inside the Earth push magma, gases and ash up through the crust. They can change a landscape and affect human life within a short time. |

**Therefore, the grey powder is volcanic ash, and it shows the great power of the Earth's internal forces.**

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QUESTION 11 *Let's Explore · p. 21*

**Observe the photographs (Fig. 2.9) and also note the types of erosion. How are farmers affected by erosion due to water and wind?**

ANSWER

Fig. 2.9(a) shows erosion by water and Fig. 2.9(b) shows erosion by wind. Both remove the surface of the land.

## a Types of erosion




*Fig. 2.9. Erosion caused by (a) water and (b) wind*

| Photograph | Type of erosion | What is seen |
|---|---|---|
| **Fig. 2.9(a)** | Water erosion (by rivers, rain or waves) | Running water has cut a deep gully into the soil |
| **Fig. 2.9(b)** | Wind erosion (common in dry, sandy areas) | Strong wind lifting dust and sand across dry ground |

The chapter also names **glacial erosion** (moving ice) and **coastal erosion** (sea waves).

## b How farmers are affected

- Erosion by water and wind removes the **fertile topsoil** needed for crop growth, which lowers yields.
- Water cuts gullies across fields and washes away land near rivers; wind blows away loose soil and may bury or damage crops.
- Land becomes poorer, farmers spend more on inputs, and their income and livelihood suffer.

**Therefore, water and wind erosion strip farmland of fertile soil, reducing crop yields and farmers' income.**

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QUESTION 12 *Let's Explore · p. 25*

**Have you heard about the Sundarbans delta? Try and explore its uniqueness and find out why it is popular with tourists.**

ANSWER

The Sundarbans is the vast delta formed where the Ganga, Brahmaputra and Meghna rivers flow into the Bay of Bengal, shared by India (West Bengal) and Bangladesh.

### a Its uniqueness



*Fig. 2.13. Sundarbans delta*

- It is a **delta**: the river splits into many channels (distributaries) and deposits sediment to form islands and bars.
- It has the world's largest **mangrove forest**, which grows in the mix of fresh river water and salty sea water.
- The mix of fresh and salt water supports rich **aquatic life** and fishing.
- It is the home of the **Royal Bengal tiger**, a tiger that swims in the creeks. Its mangrove forests have been declared UNESCO World Heritage Sites.

### b Why tourists like it

- Boat trips through the creeks and mangroves, and the chance to see wildlife such as tigers, crocodiles, dolphins and many birds.
- Its unusual scenery of tidal channels and islands, and the village life of the delta.

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- Like other deltas, it is fertile, but also prone to flooding, so visitors should travel responsibly.

**Therefore, the Sundarbans is unique for its mangrove delta and wildlife, and this attracts tourists.**

QUESTION 13 *Think About It · p. 29*

**A devastating flood struck the Chamoli district in Uttarakhand in February 2021 in which many people and livestock lost their lives. There was severe damage to buildings, roads, bridges, and hydel projects, and connectivity to villages was adversely affected. Can you find out the reasons that led to the sudden and unexpected flood?**

ANSWER

The Chamoli flood of 7 February 2021 was sudden because it was not caused by rain falling at the place. A mass of rock and glacier ice collapsed from a steep mountain slope and turned into a fast flood of water and debris.

### a Reasons for the flood



*Fig. 2.20*

- **Collapse of rock and ice:** scientific studies found that a large block of rock and glacier ice broke away from a high slope above the Raunthi Gad stream (Ronti peak area).
- **Debris flood:** the falling mass melted and mixed with water, rock and mud and rushed down the Rishiganga and Dhauliganga valleys without any warning.

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- **Steep, glaciated, fragile mountain terrain:** steep slopes and weathered rocks in a warming Himalaya make such collapses possible.
- **Human presence in the valley:** hydel projects, roads, bridges and villages lay in the path, so the damage and loss of life were severe.

### b Link with the chapter

The causes resemble those of a GLOF: rapid melting of ice, instability of slopes and the sudden release of water downstream. Landslides and avalanches in the mountains can trigger floods far away.

**Therefore, a sudden collapse of rock and ice on a steep, glaciated slope sent a debris-laden flood down the valley without warning.**

QUESTION 14 *Let's Explore · p. 32*

## Observe the landforms around your school or residence and try to identify which agent may have created them.

ANSWER

This is an observation activity. Landforms differ from place to place, so the table below shows how to match each landform with the agent that created it.

### a Matching landforms with agents

| Landform you may see | Agent | Clue |
|---|---|---|
| **Gully, riverbank, river valley, flat farmland with silt** | Running water | Cut channels; fertile alluvial soil |
| **Sand ridges and mounds in dry areas** | Wind | Rippled sand; dust in the air |
| **Beach, sand bar, sea cliff** | Waves and currents | Seashore with sand or rock |
| **Valley with ice, moraine, lake in a mountain bowl** | Glaciers | High mountains with snow |
| **Cave, sinkhole, spring in limestone areas** | Underground water | Soluble rock like limestone |
| **Hill, ridge or mountain** | Internal forces, then weathering | Folded or lifted rock, worn down by rain |

### b Steps for the activity

- Walk around your school or home and **list** the landforms you can see (slopes, mounds, ponds, riverbanks, gullies).

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- **Observe** their shape and the material they are made of.
- **Decide** which agent (water, wind, ice, waves, groundwater or internal forces) shaped each and confirm with an atlas.

**Therefore, every landform is the work of internal forces or of an agent of gradation, which can be identified from its shape and setting.**

QUESTION 15 *Let's Explore · p. 32*

**Complete the exercises given at the end of each type of disaster with the help of newspapers, atlases, and books. Make a list of disaster-prone areas from India and the world and enlist mitigation measures quoting recent examples.**

ANSWER

The exercise at the end of each of the four disasters (landslides, avalanches, GLOFs and dust storms) asks for prone areas, mitigation measures and recent examples. All four are completed below.

### a Landslides



*Fig. 2.27. A landslide*

| Exercise | Answer |
|---|---|
| **Prone areas** | **India:** Himalayan states (Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh), the north-eastern hills, the Western Ghats (Kerala, Karnataka, Maharashtra, Goa) and the Nilgiris. **World:** Andes, Nepal, Japan, Philippines. |

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| Exercise | Answer |
|---|---|
| **Mitigation measures** | • Plant trees and grass; stop deforestation on slopes.<br>• Build retaining walls and stabilise slopes; keep drains clean and open.<br>• Avoid construction, mining and road cutting on steep slopes; prepare landslide hazard maps.<br>• Monitor rainfall, issue early warnings and evacuate in time. |
| **Recent examples** | • Wayanad, Kerala (July 2024): landslides in Mundakkai and Chooralmala after very heavy rain caused heavy loss of life.<br>• Joshimath, Uttarakhand (January 2023): sinking of land and cracks in houses forced families to leave.<br>• Irshalwadi, Maharashtra (July 2023): a village was buried by a landslide. |

## b Avalanches



*Fig. 2.28. An avalanche*

| Exercise | Answer |
|---|---|
| **Prone areas** | **India:** Jammu and Kashmir (Kashmir valley, Kargil, Ladakh, Siachen), Lahaul-Spiti and Kinnaur in Himachal Pradesh, upper Uttarakhand and Sikkim.<br>**World:** Alps, Rockies, Andes, Norway. |
| **Mitigation measures** | • Forecast avalanches and warn people (for example by the Snow and Avalanche Study Establishment).<br>• Build snow fences and supporting structures; plant trees on slopes.<br>• Avoid risky slopes after fresh snowfall or sudden warming; control skiing and trekking.<br>• Carry beacons and rescue gear; keep trained rescue teams ready. |
| **Recent examples** | • Draupadi ka Danda II, Uttarkashi (October 2022): an avalanche hit a group of mountaineering trainees.<br>• Mana village, Chamoli, Uttarakhand (February 2025): an avalanche trapped workers of a road-building camp; the Army and other agencies carried out rescue. |

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## c GLOFs



*Fig. 2.29. A GLOF*

| Exercise | Answer |
|---|---|
| **Prone areas** | **India:** Sikkim (Teesta basin), Himachal Pradesh, Uttarakhand, Arunachal Pradesh and Ladakh. **World:** Nepal, Bhutan, Pakistan (Gilgit-Baltistan), the Peruvian Andes. |
| **Mitigation measures** | • Map and monitor glacial lakes by satellite and sensors; set up early warning systems.<br>• Lower the water level of dangerous lakes and strengthen their natural dams.<br>• Avoid settlements and projects in flood paths; hold evacuation drills.<br>• Reduce warming that melts glaciers. |
| **Recent examples** | • South Lhonak Lake, Sikkim (October 2023): the lake burst and a flood down the Teesta river damaged the Chungthang dam and bridges and caused deaths.<br>• Kedarnath, Uttarakhand (June 2013): heavy rain and the breach of a glacial lake caused devastating floods. |

## d Dust Storms



*Fig. 2.30. A dust storm*

| Exercise | Answer |
|---|---|
| **Prone areas** | **India:** Rajasthan (Thar desert), Punjab, Haryana, Delhi region, western Uttar Pradesh and Gujarat, mainly in April-June. **World:** Sahara and the Sahel, Arabian Peninsula and Iraq, Gobi desert and northern China, interior Australia. |

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| Exercise | Answer |
|---|---|
| **Mitigation measures** | • Plant shelterbelts and windbreaks; restore grass and tree cover.<br>• Stop overgrazing and follow good farming practices such as mulching and crop cover.<br>• Conserve water to reduce drought; issue weather warnings.<br>• During a storm stay indoors, cover nose and mouth, protect eyes. |
| **Recent examples** | • India (April-May 2018): severe dust storms in Rajasthan and Uttar Pradesh killed over 100 people.<br>• Beijing and northern China (March 2021): one of the worst dust storms in years.<br>• Iraq (spring 2022): repeated storms sent thousands to hospital with breathing problems. |

**Therefore, each landform-linked disaster has known prone areas, and monitoring, planning and awareness reduce its impact.**

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2.2

CLASS 9 SOCIAL SCIENCE · CHAPTER 2

# Questions and Activities

Solutions · 15 questions

**Directions (Questions 1–15):** These are the Questions and activities at the end of the chapter (pages 37–38). Answer each in your own words using the points given.

QUESTION 1

**What are the sources of energy that are required to cause movements associated with the internal forces of the Earth?**

ANSWER

The internal forces of the Earth are powered by heat energy generated inside the Earth.

### a Sources of energy

| Source | How it supplies energy |
|---|---|
| **Radioactivity** | Radioactive elements in the interior break down slowly and release heat |
| **Primordial heat** | Heat left over from the origin of the Earth, still flowing outwards from the hot core |
| **Rotational and tidal friction** | Friction caused by the Earth’s rotation and by tides adds some energy |

### b How this energy causes movement

- Heat from the core makes molten material in the mantle **rise**, while cooler material **sinks**.
- This creates **convection currents** that push and pull the tectonic plates in different directions.
- Plate movement then produces **earthquakes, volcanic eruptions, folding and faulting**.

**Therefore, heat from within the Earth drives convection currents in the mantle, which move the plates and produce the internal forces.**

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QUESTION 2

**Relate various physiographic divisions you have studied in the earlier grades with various endogenic forces responsible for their origin.**

ANSWER

Endogenic forces are the internal forces such as plate movement, folding, faulting and volcanic activity. The table links each physiographic division of India with the forces that created it.

### a Physiographic divisions and endogenic forces

| Physiographic division | Endogenic force responsible |
|---|---|
| **Northern Mountains (Himalaya)** | **Folding** caused by the collision of the Indian and Eurasian plates (convergent boundary); they are fold mountains |
| **Northern Plains** | Formed by deposits of the Indus, Ganga and Brahmaputra in the trough at the foot of the Himalaya, which was created by the plate collision |
| **Peninsular Plateau** | An old, stable block. **Volcanic activity** produced the Deccan lava; **faulting** formed rift valleys such as those of the Narmada and Tapi. The Aravallis are old fold mountains |
| **Indian Desert** | Mostly shaped by wind (an external agent); the Aravallis on its edge are fold mountains |
| **Coastal Plains** | Built by river deposition along coasts; rising and sinking of land has shaped their form |
| **Islands** | The Andaman and Nicobar Islands lie in a zone of plate movement and have volcanic activity (Barren Island volcano); Lakshadweep islands are built by corals |

**Therefore, the Himalaya, the plateau and the island groups owe their origin mainly to endogenic forces like folding, faulting and volcanic activity.**

NCERT ARCHIVE

QUESTION 3

## Why and where do earthquakes occur frequently? Is it possible to predict earthquakes?

ANSWER

An earthquake is a shaking of the Earth that occurs when energy stored in rocks is suddenly released as plates move.

### a Why earthquakes occur

- Plates move slowly because of convection currents and press, pull or slide past one another.
- Rocks along the boundaries get strained until they suddenly break or slip, releasing energy as shaking.

### b Where earthquakes occur frequently

| Region | Reason |
|---|---|
| **Around the Pacific Ocean (Ring of Fire)** | Many plate boundaries, including convergent ones where oceanic plates sink beneath continental plates |
| **Southern edge of the Eurasian plate, including the Himalaya** | Convergence of the Eurasian plate with the African and Indo-Australian plates |
| **Mid-ocean ridges (such as the Mid-Atlantic Ridge)** | Plates move apart (divergent boundary) |
| **Transform faults such as the San Andreas Fault, USA** | Plates slide past each other |

### c Can earthquakes be predicted?

- **No.** It is not possible at present to predict exactly when and where an earthquake will strike.
- Scientists can **identify earthquake-prone regions** from plate boundaries, which is important for managing disasters.
- Being prepared (earthquake-resistant buildings, awareness and drills) is the best protection.

**Therefore, earthquakes occur mostly along plate boundaries, and although prone regions can be identified, earthquakes cannot be exactly predicted.**

NCERT ARCHIVE

QUESTION 4

**“Plate movements are responsible for the distribution of earthquakes and volcanoes.” Explain.**

ANSWER

Most earthquakes and volcanoes occur along plate boundaries, so the movement of plates decides where they are found.

## a Link between plate boundaries and these events

| Boundary | Earthquakes | Volcanoes |
|---|---|---|
| **Convergent** | Plates pushing together cause strong earthquakes (for example in the Himalaya) | An oceanic plate sinking beneath a continental plate causes volcanic activity |
| **Divergent** | Earthquakes occur as plates pull apart | Magma rises and forms new crust, creating mid-ocean ridges |
| **Transform** | Mainly earthquakes, as along the San Andreas Fault | Few or none |

## b Evidence from the maps

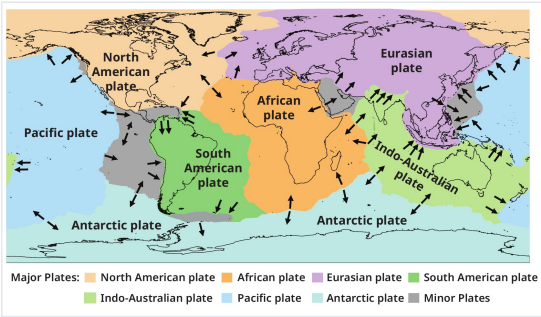



*Fig. 2.3. Major plates*

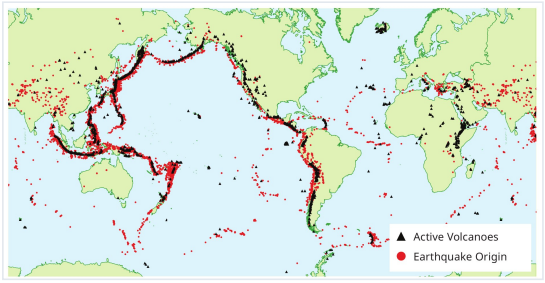



*Fig. 2.4. Earthquakes and volcanoes*

- The belt of dots around the Pacific Ocean (**Ring of Fire**) follows the edges of the Pacific plate.
- Other clusters follow the plate boundaries across southern Eurasia and along the Atlantic ridge.
- The middle parts of plates have few earthquakes and volcanoes.

**Therefore, earthquakes and volcanoes are concentrated along plate boundaries, where plate movement releases energy and magma.**

NCERT ARCHIVE

QUESTION 5

## Draw and label a diagram of a meander and a delta.

ANSWER

The labelled diagrams below are those given in the chapter (Fig. 2.11 and Fig. 2.12). Redraw them in your notebook with the same labels.

### a Meander




*Fig. 2.11. Meander*

| No. | Label | Meaning |
|---|---|---|
| 1 | Oxbow lake | A loop cut off from the river when a meander bend is closed off |
| 2 | Steep bank | Outer bank of the bend, eroded by the river |
| 3 | River | The winding river channel |
| 4 | Bar | Sediment deposited on the inner bank of the bend |

A meander is a winding curve in the middle or lower course of a river. The river erodes the outer banks of bends and deposits sediment on the inner banks.

NCERT ARCHIVE

## b Delta




*Fig. 2.12. Delta*

| No. | Label | Meaning |
|---|---|---|
| 1 | River | The river that carries sediment to its mouth |
| 2 | Distributary | A branch into which the river splits near the sea |
| 3 | Islands / Bars | Land built from deposited sediment |
| 4 | Sea | Where the river ends; the sediment settles here |

A delta forms at the mouth of a river, where it flows into a sea, ocean or lake and deposits the sediments it carried. The deposits form a fan-shaped or triangular area of land.

## c Tips for drawing

- Draw the meander as an S-shaped river and mark the outer (steep) and inner (bar) banks.
- Draw the delta as a fan of branching channels (distributaries) ending in the sea.
- Label every part with a neat arrow.

**Therefore, a meander is a river bend with erosion on the outer bank and deposition on the inner bank, and a delta is a fan of deposits at the river mouth.**

NCERT ARCHIVE

QUESTION 6

**How are deforestation and erosion associated with each other? Explain.**

ANSWER

Deforestation (the removal of trees and forests) makes erosion much faster, and erosion in turn makes it harder for forests to grow back.

### a How deforestation leads to erosion

- Tree **roots hold the soil together**; without them the soil becomes loose.
- Leaves and branches **break the force of rain**; bare ground is hit directly and washed away.
- Forest cover slows running water and lets it soak in; on bare slopes the **run-off** is faster and carries away topsoil.
- Bare, dry land is also easily blown away by wind.

### b Effects of the resulting erosion

- The fertile **topsoil is lost**, farm yields fall and land is degraded.
- Rivers get filled with silt, which may cause floods; slopes become unstable and landslides are more likely.
- Poor soil cannot support new plants, so the land stays bare and erosion continues.

### c Relationship

| Deforestation | Erosion |
|---|---|
| Removes plant cover and roots | Washes or blows away loose soil |
| Leaves soil exposed | Leaves poor land where trees cannot grow |

**Therefore, deforestation exposes the soil to erosion, and erosion prevents recovery of vegetation, so the two form a harmful cycle.**

NCERT ARCHIVE

QUESTION 7

## Develop a plan to protect the land in your local area from erosion.

ANSWER

This is a project. A model plan is given using methods named in the chapter; fit it to the landscape of your own area.

### a Model plan

| Step | Action | Why it helps |
|---|---|---|
| **1. Survey** | Walk around the area and mark bare slopes, gullies and riverbanks | Shows where erosion is worst |
| **2. Plant cover** | Plant trees and grass; stop felling trees and overgrazing | Roots bind soil; leaves break rainfall |
| **3. Slow water on slopes** | Dig continuous contour trenches, build bunds and terraces along the contour | Slows run-off, retains water and prevents soil loss |
| **4. Check dams** | Build small check dams across streams and gullies | Slows water and lets sediment settle |
| **5. Protect from wind** | Plant rows of trees as windbreaks; keep soil covered | Reduces wind erosion |
| **6. Involve people** | Make a community group to care for the plantation | Keeps the work going |

### b Follow-up

- Check after each rainy season and repair damaged bunds and trenches.
- Record changes using photographs.

**Therefore, a good erosion plan keeps the land covered, slows running water and involves the local community.**

NCERT ARCHIVE

QUESTION 8

**Which disasters do you think you might experience in your region? Discuss a mitigation plan in your classroom.**

ANSWER

The disasters depend on the landform of the region. This is a classroom discussion; a model table and plan are given.

## a Likely disasters by region

| Region | Likely disasters | Mitigation ideas |
|---|---|---|
| **Mountain and hill areas** | Landslides, avalanches, GLOFs, earthquakes | Plant trees, avoid steep-slope construction, monitor lakes, earthquake-safe buildings |
| **Plains and river valleys** | Floods, earthquakes | Embankments, early warning, safe buildings |
| **Deserts and dry areas** | Dust storms, drought | Shelterbelts, water conservation, vegetation cover |
| **Coasts** | Cyclones, coastal erosion | Protective belts of trees, warnings, safe shelters |

## b Steps of the classroom plan

- **List** the disasters your area may face, using newspapers, atlases and books.
- **Mark** the prone places in your locality.
- **Before:** prepare an emergency kit and a family plan; **during:** follow safety rules; **after:** help the injured and avoid damaged structures.
- **Share** the plan with your family and neighbours.

**Therefore, a mitigation plan names the likely disasters, plans what to do before, during and after, and is shared with everyone.**

NCERT ARCHIVE

QUESTION 9

## Prepare a model of landforms created by underground water.

ANSWER

This is a model-making activity. Underground water dissolves soluble rocks like limestone and creates Karst landforms such as caves, stalactites, stalagmites and sinkholes.

### a What the model should show




*Fig. 2.24. Cave*

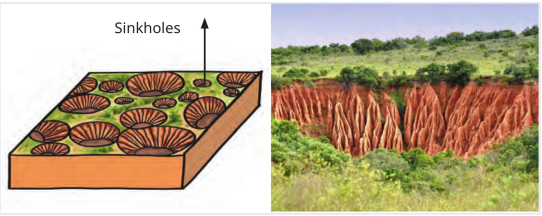



*Fig. 2.25. Sinkholes*

| Landform | Description for labelling |
|---|---|
| **Cave** | Hollow space formed as acidic water dissolves rock |
| **Stalactite** | Icicle-shaped formation hanging from the cave ceiling |
| **Stalagmite** | Formation rising from the floor of the cave |
| **Sinkhole (doline)** | Depression formed when ground collapses into an underground cavity |
| **Underground river** | River flowing through a cave system |

### b Steps to make the model

- Make a **base board** and build a hill with clay, paper pulp or thermocol.
- Cut the hill open to show a **cave**; paint the rock layers.
- Attach hanging cones as **stalactites** and standing cones as **stalagmites**.
- Make a **sinkhole** by pressing a round hollow in the surface.
- Show an **underground river** with blue paper or paint and **label** every part.

**Therefore, a good model shows the cave, its stalactites and stalagmites, the sinkhole and the underground river, all labelled.**

NCERT ARCHIVE

QUESTION 10

**What precautionary measures will you take if you are staying in an earthquake-prone region?**

ANSWER

Earthquakes cannot be predicted, so we must prepare in advance and know what to do before, during and after the shaking.

### a Before an earthquake

- Build or choose **earthquake-resistant buildings**; repair weak walls and avoid unplanned construction.
- Fix heavy furniture and shelves to walls; keep heavy objects low.
- Prepare an **emergency kit** (water, food, torch, first-aid, radio) and a family plan with a meeting place.
- Learn safe spots in each room and take part in mock drills.

### b During an earthquake

- **Drop, cover and hold on** under a strong table; protect your head.
- Stay away from windows, glass and heavy objects; do not use lifts.
- If outdoors, move to an open space away from buildings, trees and electric wires.
- Stay calm and do not run.

### c After an earthquake

- Expect **aftershocks**; leave damaged buildings by the stairs.
- Switch off gas and electricity; help the injured and listen to the radio for instructions.
- Do not enter damaged buildings.

**Therefore, preparing buildings and families in advance and following drop, cover and hold on can save lives.**

NCERT ARCHIVE

QUESTION 11

**Prepare a map showing landform-associated disasters that happened in the current calendar year.**

ANSWER

This is a map-making project that uses news of the current year. The method and a format to use are given below.

### a Steps

- Take an **outline map** of India (or the world) and use newspapers and websites to list disasters of the current year.
- Choose a **symbol** for each disaster and mark its location.
- Add a **legend** and a title, and note the date and cause.

### b Suggested legend and table

| Disaster | Symbol | Details to note |
|---|---|---|
| **Landslide** | Brown triangle | Place, date, cause, damage |
| **Avalanche** | White star | Place, date, people affected |
| **GLOF / flood** | Blue wave | River, lake, damage |
| **Dust storm** | Yellow circle | Region, date, effect |
| **Earthquake / volcano** | Red dot / black triangle | Place, magnitude or eruption, damage |

**Therefore, a good map has a title, a legend and each disaster marked at its correct place with date and cause.**

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QUESTION 12

**Create a poster showing landforms that are considered to be sacred or important in your region, and add the folk stories associated with them.**

ANSWER

This is a poster activity. Gather local landforms and their stories from elders, books and the internet. Examples are given as models.

### a Model examples

| Landform | Why it is important | Story or belief |
|---|---|---|
| **Mount Kailash** | Holy to Hindus, Buddhists and Jains | Believed to be the abode of Lord Shiva |
| **Gaumukh (Gangotri glacier)** | Source of the Bhagirathi, a headstream of the Ganga | River Ganga is believed to have descended on earth through Bhagiratha's prayers |
| **Govardhan hill** | Sacred hill in Braj region | Krishna lifted it on his finger to shelter villagers from heavy rain |
| **Kanchenjunga** | Mountain sacred to the people of Sikkim | Regarded as a protective deity |

### b How to make the poster

- Choose **three or four landforms** of your region and write the local names.
- Add a **picture or sketch** and a short **folk story** for each.
- Write a short note on **why** the landform is valued and how it is protected.
- Use a bold title, neat labels and bright colours.

**Therefore, a poster should show the landform, its folk story and the reason it is valued.**

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QUESTION 13

**Document a case of a disaster that hit your region in the past, highlighting its effects on various human activities.**

ANSWER

This is a case-study project. Use a format with the headings below. The Chamoli flood from the chapter is used as a model.

### a Format for the case study

| Heading | Model entry (Chamoli flood, Uttarakhand) |
|---|---|
| **Disaster and date** | Flood in Chamoli district, February 2021 |
| **Landform involved** | High glaciated Himalayan slopes and river valleys |
| **Cause** | Collapse of rock and glacier ice that turned into a debris flood |
| **Effect on lives** | Many people and livestock lost their lives |
| **Effect on buildings, transport and power** | Severe damage to buildings, roads, bridges and hydel projects |
| **Effect on daily life** | Connectivity to villages was affected |
| **Relief and lessons** | Rescue, relief and need for early warning and planning |

### b How to collect information

- Ask elders, read old newspapers and visit local offices.
- Write about effects on **farming, trade, transport, schools and health**.
- Add photographs, a map and a short note on what was learnt.

**Therefore, a case study states the disaster, its cause, its effects on human activities and the lessons learnt.**

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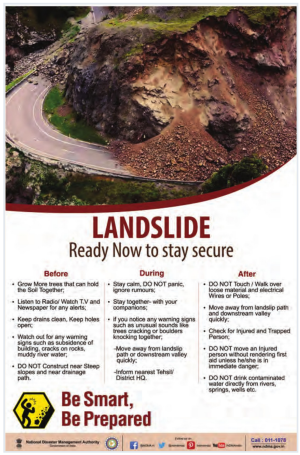
QUESTION 14

**Translate the given poster on landslide into your native language and display it in your home.**

ANSWER

The poster is from the National Disaster Management Authority. Its message is written out below, stage by stage, so that it can be translated line by line into your native language.

## a Message of the poster




*Landslide poster given in the chapter*

| Stage | Message to translate |
|---|---|
| **Before** | Grow more trees that can hold the soil together. Listen to the radio / watch TV and read the newspaper for alerts. Keep drains clean and holes open. Watch for warning signs such as sinking of buildings, cracks on rocks and muddy river water. Do not construct near steep slopes and drainage paths. |
| **During** | Stay calm, do not panic and ignore rumours. Stay together with your companions. If you notice warning signs such as unusual sounds like trees cracking or boulders knocking together, move away quickly from the landslip path or downstream valley and inform the nearest Tehsil / District HQ. |
| **After** | Do not touch or walk over loose material and electrical wires or poles. Move away from the landslip path and downstream valley. Check for injured and trapped persons. Do not move an injured person without first aid unless in immediate danger. Do not drink contaminated water directly from rivers, springs or wells. |
| **Slogan, helpline** | Be Smart, Be Prepared. Helpline: 011-1078 (NDMA) |

## b Steps

- Translate **each line** into your native language in simple words.

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- Write it on a chart with the title and the three headings, and decorate it.
- **Display** it at home and explain it to your family.

**Therefore, translating the poster spreads the safety message to people who read your language.**

QUESTION 15

**Divide the class into three groups. Each group will work on one project (water, wind, and glacier). The project should highlight the causes, impact on human life and the environment, and mitigation measures.**

ANSWER

This is a group project. A model outline is given for each group; every group adds local examples, pictures and recent news.

### a Model outlines

| Group | Causes | Impact | Mitigation |
|---|---|---|---|
| **Water (running water)** | Heavy rain, steep slopes, loss of vegetation, human settlement near rivers | Loss of topsoil and land, floods, damage to houses and roads; benefits like fertile deltas | Plant trees, bunds, terraces, check dams, embankments, early warning |
| **Wind** | Strong winds, dry loose soil, drought, sparse vegetation | Dust storms, loss of soil, damage to crops and health, shifting dunes | Windbreaks, tree and grass cover, mulching, good farming practices |
| **Glacier** | Rising temperature, melting of glaciers, heavy rain, earthquakes | Glacial lake outburst floods, damage to villages, bridges and hydel projects; effect on river water | Monitor lakes, early warning, lower lake levels, keep away from hazard zones, reduce warming |

### b Presentation

- Each group presents its project with **maps, photographs and charts**.
- Include **recent examples** and ask the class for suggestions.

**Therefore, each project explains causes, impact and mitigation for water, wind or glacier, supported by local examples.**

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