

**Syllabus**

**Landforms of the Earth:** Mountains, plateaus, plains (definition, types and their formation):

- Mountains - fold, residual and block.
- Plateaus - intermontane and volcanic.
- Plains - structural and depositional.

Examples from the world and India.

The earth is made up of a series of concentric rock layers namely crust, mantle and core. The intense heat in the earth's interior does not travel to the surface because rocks are bad conductors of heat. The internal heat of the earth therefore, melts the rocks and keeps the asthenosphere which is underneath the crust in a semi-molten state. This leads to several conditions which cause landform development

on the surface of the earth. A **landform** is a natural feature of the earth's surface.

### Causes of Landform Development

**1. Plate Tectonics:** The lithosphere is broken into several small and big plates. These plates float on the semi-molten asthenosphere. The horizontal movement of these plates is very slow. The plates push, collide or slide past each other. This results in disturbances in the sedimentary rock deposits lying in between two or more plates. The sedimentary rocks are compressed. This compression causes *folding* of the rocks. Almost all the fold mountain ranges of the world have been formed this way. The forces responsible for the formation of fold mountains are called *Orogenic* movements. The term 'orogenic' is derived from the Greek word meaning 'mountain-building'. These forces act at a tangent to the surface of the earth and are primarily involved in plate tectonics.

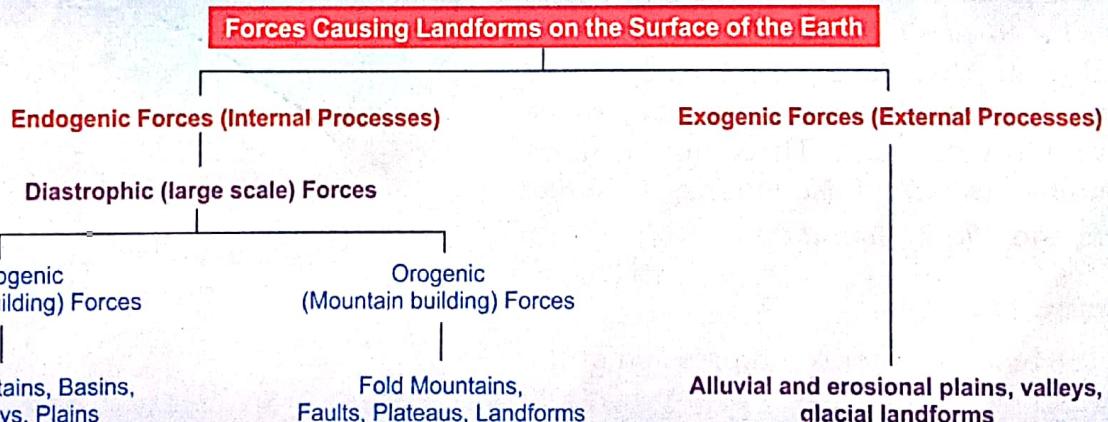


Fig. 5.1. Forces causing formation of landforms

**2. Uplift and Submergence:** Another set of forces operating inside the earth act along the radius from the earth's centre to the surface and are characterised by large-scale uplift or subsidence of land area. These vertical movements are known as *Epeirogenic* movements or *Continent building* movements. 'Epeiros' in Greek means 'continent'; 'genic' or 'genetic' means 'building'. Such movements are the result of *faulting* or cracks in the earth's surface. Block mountains, basins, rift valleys, are produced by these movements. Thus, the continent building activities occur on a very large scale.

The above two forces, namely *orogenic* and *epeirogenic*, are together called *Diastrophic Forces* (originating deep inside the earth). They act horizontally and vertically and produce relief such as mountains, plateaus, plains, lakes and big faults.

**3. Exogenic Forces:** There are forces operating on the surface of the earth, not inside the earth which cause formation of landforms. These forces are called *Exogenic Forces*. The external forces or *Exogenic forces* are described as *Destructive Forces* because they cause widespread destruction through weathering and erosion of existing landforms. They, then form new landforms through both erosion and deposition.

## LANDFORMS

There are a large number of landforms on the surface of the earth. The major landforms are: (i) Mountains; (ii) Plateaus; and (iii) Plains.

## MOUNTAINS

A mountain is described as a very steep land or hill rising to great heights above the land surrounding it. Mountains are classified into three main types depending on the forces that have formed them. Three main types of mountains are—*Fold Mountains*, *Residual Mountains* and *Block Mountains*.

### Fold Mountains

They are the result of lateral compression of the earth's crust.

*Fold mountains* are the result of large-scale earth movements caused by stresses in the

earth's crust. Such stresses may be caused by weight of the overlying rocks, movements in the mantle, the expansion or contraction of some part of the earth, etc. These stresses subject the rocks to compressive forces, producing wrinkling or folding along the lines of weakness. This is shown in Fig. 5.2. The raising of folds makes the fold mountains.

If you look at the physical map of the world you will find a number of arc shaped mountain chains. They are Andes (South America), Rockies (North America), Alps (Europe), Atlas (Africa), the Himalayas, Zagros, Elburz and Kunlun (Asia). More such mountain chains exist below the sea. Almost all the high ranges like the Himalayas and the Alps have peaks covered with snow throughout the year. Many glaciers are found on these ranges. These glaciers become the source of water for perennial rivers. Therefore, these mountains give birth to active agents of denudation and glacial erosion.

Fold mountains are the highest and the most extensive mountain ranges of the world. Their chief characteristics are:

- (i) They form irregular wave-like formations called folds. *The upfold rock strata in arch-like shape are called anticlines or crest and the down folded structures are known as synclines or troughs.* (Fig. 5.2)
- (ii) Most of these mountains are constituted of sedimentary rocks formed due to deposition and consolidation of sediments in shallow oceans like the Tethys, in the case of the Himalayas.

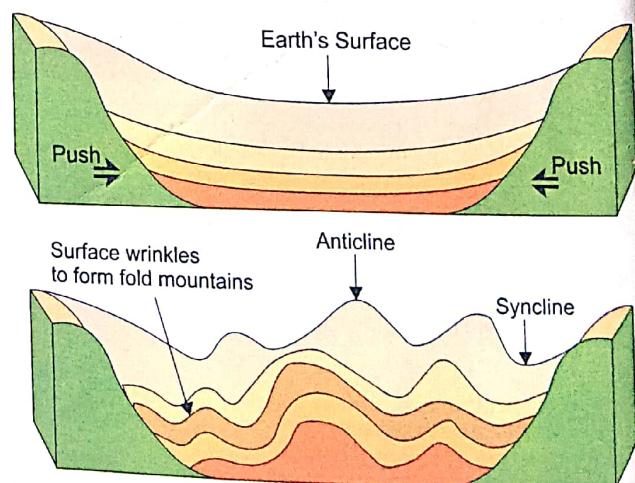


Fig. 5.2. How fold mountains are formed

- (iii) Fold mountains have greater length but are comparatively smaller in width. The Himalayas are about 2400 km in length.
- (iv) Most fold mountains except the Himalayas are found on the margins of continents. They are located in two directions. The Rockies and The Andes are in north-south direction. The Himalayas are in west-east direction. It is clear that all of them face the oceans.
- (v) Fold mountains are associated with volcanic activity and have many active volcanoes.
- (vi) They have parallel ranges. Between the parallel ranges are high plateaus known as intermontane plateaus, such as Anatolian Plateau in Turkey and the Tibetan Plateau.

The fold mountain chains that exist beneath the sea have their tops revealed as *Islands* like in the West Indies. There are also *oceanic trenches* which are the result of the same forces as fold mountains. These forces in combination with volcanic mountain systems lead to the formation of *ridges*. The Mid-Atlantic Ridge rises 3 km above the floor of the Atlantic Ocean and joins the Indian Ocean Ridge.

### Residual Mountains

*Mountains which are subjected to weathering and erosion for a long time, are lowered down and called **residual** or **relict mountains**.*

There are two types of Fold Mountains:

Young Fold Mountains	Old Fold Mountains
1. They have been formed later than the Old Fold Mountains.	1. They have been formed long ago much before the Young Fold Mountains.
2. The Himalayas, Andes, Alps and Rockies are examples of young fold mountains.	2. The Appalachians, the Urals and the Aravallis (India) are examples of old fold mountains.
3. They have steep slopes, deep valleys and sharp pointed snow covered peaks.	3. They are highly eroded by the agents of gradation. They have gentler slopes, rounded tops and sculptured domes.
4. They are much higher than the old fold mountains and have rough topography.	4. They are lower than the young fold mountains.
5. Volcanic activities are common in these mountains.	5. There are evidences of volcanic activities still in them.

- Denudation and erosion by natural agents such as winds, water, snow etc., cause the mountains to be lowered but some resistant areas may remain and form residual mountains.
- They may also be formed on plateaus that are dissected by rivers. For example the hills and valleys in the Deccan plateau.
- In Fig. 5.3 the original highland (plateau) is worn down by the down cutting action of rivers to form residual mountains.
- They are also called mountains of denudation. Most residual mountains are characterised by low elevations; however, both gentle and precipitous relief can exist, depending on the degree of recent erosion.
- Examples of Residual mountains are Nilgiri, Parasnath and Rajmahal Hills in India and the Catskill range in the USA.

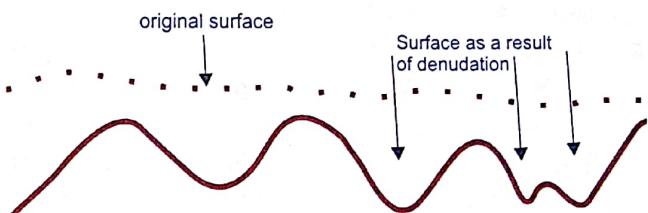


Fig. 5.3. Residual Mountain.

### Block Mountains

- The forces of faulting, also known as *epeirogenic forces*, lead to the formation of **block mountains**.

## PLATEAUS

**Plateau** is defined as an area of high ground 500 feet above the ground level. These uplands have steep slope on one side. The upper part is generally flat and is called *tableland*. Plateaus are also classified in several ways. In the case of mountains we have used the criteria of mode of formation. We will use the same criteria in the case of plateaus.

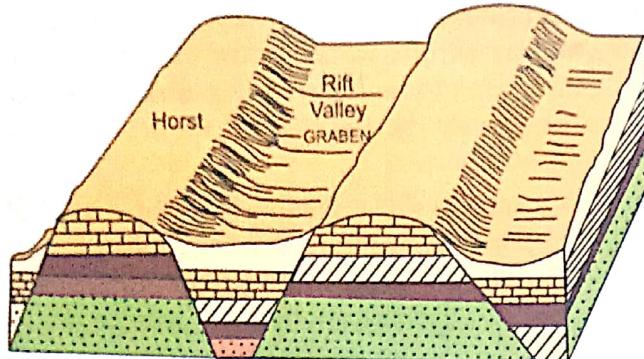


Fig. 5.4. Rift Valley.

- Due to tensional force, cracks or faults may occur on the earth's crust. If two parallel faults occur, the land in between subsides to form a rift valley. If a block rises, it forms a horst or block mountain.
- **Block mountains which have flattened summits are also called *horst mountains*.** Those which have tilted summits have one side steep, other side very gentle.
- **Block mountains are often separated by intervening basins called *graben*.**
- If there are two parallel faults, the valley floor may sink and a *rift valley* may be formed (Fig. 5.5). The most extensive system being the *African Rift Valley*.
- Examples of block mountains are the Vosges (France) and the Black Forest mountains in Europe. Salt Range of Pakistan and Sierra Nevada mountains of California, USA are other examples of block mountains.

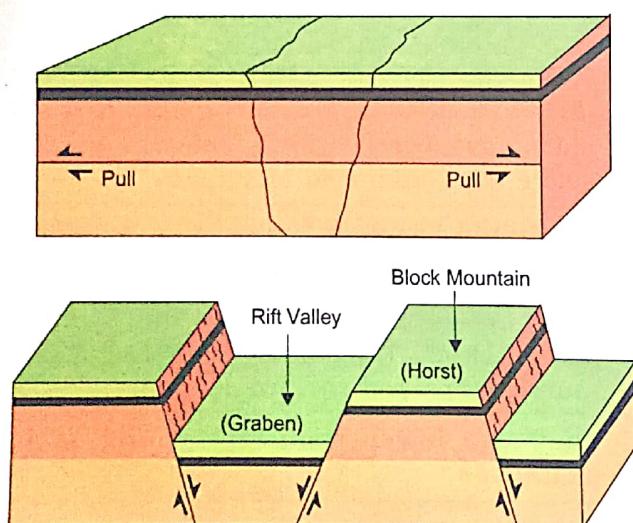


Fig. 5.5. Formation of block mountain by tension after faults develop

## Intermontane Plateaus

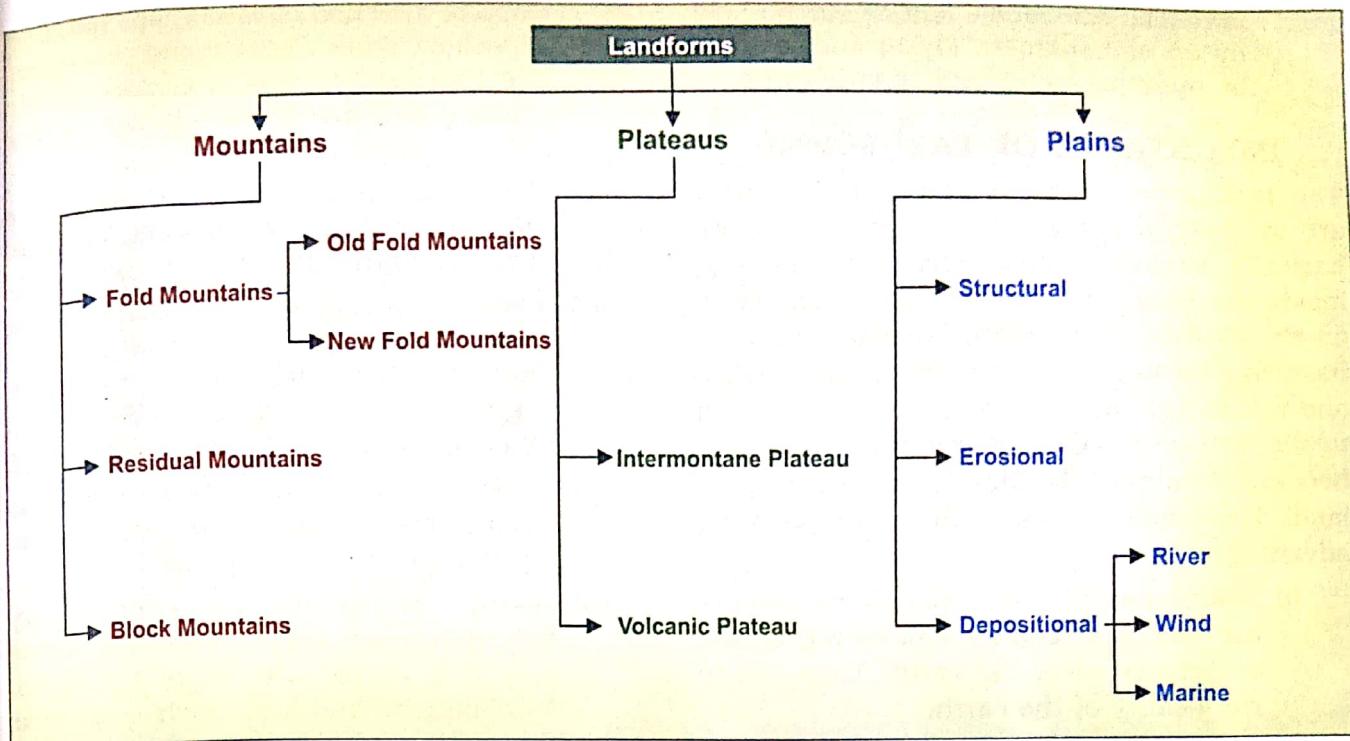
These are the highest and most extensive types on the globe. *The plateaus surrounded by hills and mountains on all sides are called Intermontane Plateaus.* They are formed along with fold mountains. The Tibetan plateau is the world's highest as well as most extensive intermontane plateau. Other examples are Columbian Plateau, North American Cordillera, Bolivian, Peruvian and Mexican plateaus.

## Volcanic Plateaus

**Volcanic plateaus** are formed by numerous volcanic eruptions that slowly build up over time, forming a plateau. The Plateau of Peninsular India, especially the north western Deccan, is an example of lava plateau. Other examples are South African plateau, Columbian Plateau and Ethiopian plateau. The Peninsular plateau of India has enormous accumulation of basaltic rock. The Columbian Plateau has about 20 layers of lava suggesting that 20 different volcanic eruptions have formed this plateau.

## PLAINS

**A Plain** is defined as an extensive area of lowland with a level or gently undulating surface. The formation of plains is one of the most intriguing landform development process on the surface of the earth. There are seemingly endless variations in plains. They are also an imprint of past and present processes. For example, a sudden heavy downpour may wash away a standing landform or fill up a depression to form a plain. A plain is seldom formed by a single process. However, three types of plains can be distinguished—*Structural Plains*, *Erosional Plains* and *Depositional Plains*.



**Fig. 5.6.** Landforms

### Structural Plains

The plains that are formed due to uplift or subsidence of land are called **Structural Plains**. Diastrophic forces may cause uplift of a portion of land beneath the ocean water or may cause submergence of coastal land under ocean water. The Great Plains of the USA were formed due to uplift of land submerged under water. The Great Plains are surrounded by Mississippi-Missouri Plains in the east and Rockies in the west. The fact that they were submerged under water is responsible for the existence of many lakes in the vast lowland. Gulf Coast is another example of an emerged coastal plain.

On the other hand, the Coromandel plains in India are the result of mild subsidence followed by sedimentation. Thus, the forces of structural development as well as deposition were active in the formation of these plains.

### Depositional Plains

The plains that are formed by the deposition of materials which have been brought by various agents of transportation are called **Depositional Plains**.

(i) **River Deposition:** The most widespread of these are alluvial plains like the

Northern Plains of India; the flood plains like the Mississippi Plains in the USA, deltaic plains in Egypt and India. At the foothills of mountains are formed **Piedmont Alluvial Plains**. The flood plains described above are also alluvial plains. They are found along the rivers like Ganga, Yang-tze, Mekong, Salween etc., and are regarded as granaries of the world. In India, flood plains are divided into *Khadar Plains* (new deposits made every year) and *Bhangar* (old deposits not renewed every year).

(ii) **Wind Deposition:** Most such plains are sandy deserts like the Sahara in Africa and the Thar desert in India. They have irregular and undulating surface made by existence of sand dunes and hollows. Loess plains in China are formed from deserts.

(iii) **Marine Deposition:** These plains are found in coastal regions. Examples are the east coast of India, the estuarine banks in the Netherlands, coast of Germany and Denmark. In Denmark we find *polders* and *dykes*. A **polder** is a piece of land reclaimed from the sea or

*lake*. The submerged land is surrounded by an embankment (dyke) and drained by pumping water into canals.

## IMPORTANCE OF LANDFORMS

The landforms on the surface of the earth are symbols of energy of the earth. They are basically a result of enormous heat generated inside the earth and climate factors operating on the surface of the earth. The earth releases its energy through tectonic activity, earthquakes and volcanoes. These internal forces in addition to the surface weathering and erosional forces become dominant factors in sculpturing of land. The landforms have, thus, the following advantages:

- (i) Mountains, plateaus, plains and valleys are beautiful sculptures of nature on the surface crust of the earth. They add to the beauty of the earth.
- (ii) Landforms represent the relief features of the earth. They have an impact on

climate, direction of winds, precipitation as well as other atmospheric processes. The Himalayas act as a climatic divide shaping the distinctive climate of the Indian subcontinent.

- (iii) The mountain ranges of the world are the abode of snow and glaciers. They are thus the source of perennial rivers.
- (iv) Many kinds of forests are found on the slopes of mountains, hills and plateaus. These are home to different species of plants and animals. Thus, biodiversity of life on earth can also be attributed to relief.
- (v) Since such relief features also exist in oceans, the island groups and coastal regions are ideal fishing sites.
- (vi) Major landforms are created by disturbances resulting from the forces operating in the interior of the earth. Most mineral and fossil fuels come near the surface of the earth due to these disturbances.

## EXERCISES

### I. Choose the correct option:

1. The forces responsible for the formation of fold mountains:
 

(a) Orogenic movements	(b) Collisional movements
(c) Diastrophic movements	(d) Exogenic movements
2. The large scale uplift or subsidence of land:
 

(a) Orogenic movements	(b) Diastrophic forces
(c) Epeirogenic movements	(d) Exogenic movements
3. The two forces, Orogenic and Epeirogenic that originate deep inside the earth:
 

(a) Exogenic forces	(b) Continent building movements
(c) Diastrophic forces	(d) Collisional movements
4. The forces operating on the surface of the earth which cause formation of landforms are called:
 

(a) Exogenic forces	(b) Orogenic forces	(c) Diastrophic forces	(d) Epeirogenic forces
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5. Upfold : Anticline :: Downfold : \_\_\_\_\_
 

(a) Synclines	(b) Archlines	(c) Anticlines	(d) Ridges
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6. Oceanic trenches in combination with volcanic mountain systems lead to the formation of:
 

(a) Troughs	(b) Ridges	(c) Fold mountains	(d) Synclines
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7. Volcanic activities are common in which of the following?
 

(a) Young fold mountains	(b) Old fold mountains
(c) Residual mountains	(d) Volcanic plateaus

- 8.** Which amongst the following highlands are highly eroded by the agents of gradation and have gentler slopes, rounded tops and sculptured domes?
- Young fold mountains
  - Old fold mountains
  - Residual mountains
  - Volcanic plateaus
- 9.** Mountains which are subjected to weathering and erosion for a long time are lowered down:
- Old fold mountains
  - Volcanic plateaus
  - Relict mountains
  - Intermontane plateaus
- 10.** Which of the following is/are correctly matched?
- Young fold mountains : Himalayas, Alps
  - Old fold mountains : Urals, Aravalli
  - Residual mountains : Nilgiri, Rajmahal Hills
  - All of the above.
- 11.** The coromandel plains along the east coast of India were formed as a result of two different activities. Name them.
- Subsidence, deposition
  - Subsidence, erosion
  - Upliftment, deposition
  - Upliftment, erosion
- 12.** The plains that are formed by the deposition of materials which have been brought by various agents of transportation:
- Structural plain
  - Depositional plain
  - Plain
  - Landform
- 13.** Depositional plains formed as a result of action of wind have irregular and undulating surface because of
- new deposits made every day.
  - existence of sand dunes and hallows.
  - existence of scrubs.
  - All of the above.
- 14.** A piece of land reclaimed from the sea or lake:
- Sealand
  - Iceland
  - Lakeland
  - Polder
- 15.** The plains that are formed due to uplift or subsidence of land are called:
- Structural plains
  - Depositional plains
  - Plains
  - Landforms
- 16.** Which of the following pairs is incorrectly matched?
- Structural Plains : Coromandel Plains
  - Wind Deposition Plains : Thar Desert
  - River Deposition Plains : Northern Plains (India)
  - Marine Deposition Plains : Western Coastal Plains (India)
- 17.** Epeirogenic forces lead to the formation of Block Mountains. In this context which of the following are true?
- Horst – block mountains with flattened summits.
  - Graben – basins separating block mountains.
  - Vosges – example of block mountains.
  - All of the above.
- 18.** Name the plateaus, formed along with fold mountains, that are surrounded by hills and mountains on all sides.
- Volcanic Plateaus
  - Structural Plateaus
  - Intermontane Plateaus
  - Depositional Plateaus

## II. Short Answer Questions

- What is meant by a landform? Give two examples.
- Why are the fold mountains called so?

3. Give two chief characteristics of the fold mountains.
4. Give one example of each:
  - (a) Young fold mountain; (b) Old fold mountain.
5. Give one example of residual mountain and an example of depositional plain.
6. Briefly describe how the Great Plains of USA were formed. They are examples of which type of Plains.
7. Draw a well labelled diagram to show the formation of a residual mountain.
8. How is a rift valley formed? Give one example of a rift valley.
9. Give a brief definition of a plateau.
10. What is an intermontane plateau? Give one example.
11. Give two points of importance of landforms.

### **III. Distinguish between each of the following:**

1. Fold Mountains and Block Mountains.
2. Intermontane plateaus and Volcanic plateaus.
3. Structural plains and Depositional plains.

### **IV. Structured Questions**

1. (a) How are various landforms formed on the surface of the earth?  
(b) Describe the formation of mountains and their types.  
(c) Give a reason for each of the following:
  - (i) Asthenosphere though underneath the crust is in a semi-molten state.
  - (ii) Exogenic forces are also called destructive forces.
  - (iii) Residual mountains are also called mountains of denudation.  
(d) Draw a well labelled diagram to show the formation of block mountain.
2. (a) Describe the characteristics of two different types of plateaus.  
(b) Describe the characteristics of structural plains.  
(c) Give a reason for each of the following:
  - (i) There are different types of plains.
  - (ii) Alluvial plains are regarded as the granaries of the world.
  - (iii) The landforms on the surface of the earth are symbols of the energy of the earth.  
(d) Explain the chief characteristics of depositional plains and their types.

### **V. Thinking Skills**

1. Find out the landforms found in your state. How were these landforms formed? How many changes have come in these landforms over the years.
2. The earth releases its energy through tectonic activity, earthquakes and volcanoes. Imagine what will be the consequences if this energy remains trapped inside the earth. State these consequences with examples.

### **VI. Practical Work**

1. Draw and colour different relief features on the surface of the earth.
2. On an outline map of the world show major fold mountains, plateaus and plains with the help of symbols.