

Chapter-6

Geomorphic Processes

1. Multiple choice questions

Question 1(i).

Which one of the following processes is a gradational process?

- (a) Deposition**
- (b) Diastrophism**
- (c) Volcanism**
- (d) Erosion.**

Answer:

- (d) Erosion**

Question 1(ii).

Which one of the following materials is affected by hydration process?

- (a) Granite**
- (b) Clay**
- (c) Quartz**
- (d) Salts.**

Answer:

- (d) Salts**

Question 1(iii).

Debris avalanche can be included in the category of:

- (a) Landslides**
- (b) Slow flow mass movements'**
- (c) Rapid flow mass movements**
- (d) Subsidence.**

Answer:

(c) Rapid flow mass movements.

2. Answer the following questions in about 30 words.

Question 2(i)

It is weathering that is responsible for bio-diversity on the earth. How?

Answer:

Weathering processes lead to breaking down the rocks into smaller fragments and preparing the way for formation of not only regolith and soils, but also erosion and mass movements. Bio-diversity is basically a result of forests and vegetation. Forests and vegetation depend upon the depth of weathering mantles. Erosion cannot be significant if the rocks are not weathered. It implies that weathering aids mass wasting, erosion and reduction of relief and changes in landforms are a consequence of erosion.

Question 2(ii)

What are mass movements that are real rapid and perceptible? List

Answer:

These movements transfer the mass of rock debris down the slopes under the direct influence of gravity. That means, air, water or ice do not carry debris with them from place to place but on the other hand the debris may carry with it air, water or ice.

Mass movements can be slow or rapid. Rapid movements are mostly prevalent in humid climatic regions and occur over gentle to steep slopes. When slopes are steeper, even the bedrock especially of soft sedimentary rocks like shale or deeply weathered igneous rock may slide downslope.

Question 2(iii)

What are the various mobile and mighty exogenic geomorphic agents and what is the prime job they perform?

Answer:

The exogenic processes derive their energy from atmosphere determined by the ultimate energy from the sun and also the gradients created by tectonic factors. All the exogenic geomorphic processes are covered under a general term, denudation. The word 'denude' means to strip off or to uncover. As there are different climatic regions on the earth's surface, the exogenic geomorphic processes vary from region to region. Temperature and precipitation are the two important climatic elements that control various processes.

Their prime job includes weathering, mass wasting/movements, erosion and transportation.

Question 2(iv)

Is weathering essential as a pre-requisite in the formation of soils? Why?

Answer:

Yes, weathering is an essential pre-requisite in the formation of soils. Weathering is action of elements of weather and climate over earth materials. There are a number of processes within weathering which act either individually or together to affect the earth materials in order to reduce them to fragmental state. Weathering is mechanical disintegration and chemical decomposition of rocks through the actions of various elements of weather and climate.

Weathering is an important process in the formation of soils. When rocks undergo weathering, rocks start to break up and take form of soil gradually.

3. Answer the following questions in about 150 words.

Question 3(i).

**“Our earth is a playfield for two opposing groups of geomorphic processes.”
Discuss.**

Answer:

It is absolutely right to say that our earth is playfield for two opposing groups of forces. These forces are exogenic and endogenic. The external forces are known as exogenic forces and the internal forces are known as endogenic forces. The differences in the internal forces operating from within the earth which built up the crust have been responsible for the variations in the outer surface of the crust. The earth's surface is being continuously subjected to external forces induced basically by energy (sunlight). Of course, the internal forces are still active though with different intensities. That means, the earth's surface is being continuously subjected to by external forces originating within the earth's atmosphere and by internal forces from within the earth.

The actions of exogenic forces result in wearing down (degradation) of relief/elevations and filling up (aggradation) of basins/ depressions, on the earth's surface. The endogenic forces continuously elevate or build up parts of the earth's surface and hence the exogenic processes fail to even out the relief variations of the surface of the earth. So, variations remain as long as the opposing actions of exogenic and endogenic forces continue. In general terms, the endogenic forces are mainly land building forces and the exogenic processes are mainly land wearing forces.

Question 3(ii).

Exogenic geomorphic processes derive their ultimate energy from the sun's heat. Explain.

Answer:

The exogenic processes derive their energy from atmosphere determined by the ultimate energy from the sun and also the gradients created by tectonic factors. Various minerals in rocks possess their own limits of expansion and contraction. With rise in temperature, every mineral expands and pushes against its neighbour and as temperature falls, a corresponding contraction takes place. Because of diurnal changes is the cause of splitting of individual grains within rocks, which eventually fall off. This process of falling off of individual grains may result in granular disintegration or granular foliation. Salt crystallisation is most effective of all salt-weathering processes. In areas with alternating wetting and drying conditions salt crystal growth is favoured and the neighbouring grains are pushed aside. Sodium chloride and gypsum crystals in desert areas heave up overlying layers of materials and with the result polygonal cracks develop all over the heaved surface. With salt crystal growth, chalk breaks down most readily, followed by limestone, sandstone, shale, gneiss and granite, etc.

Question 3(iii).

Are physical and chemical weathering processes independent of each other? If not, why? Explain with examples.

Answer:

No, physical and chemical weathering are not independent of each other. They are different but still interdependent. Physical or mechanical weathering processes depend on some applied forces. The applied forces could be: (a) gravitational forces such as overburden pressure, load and shearing stress; (b) expansion forces due to temperature changes, crystal growth or animal activity; (c) water pressures controlled by wetting and drying cycles. Chemical weathering depends on a group of weathering processes viz; solution, carbonation, hydration, oxidation and reduction act on the rocks to decompose, dissolve or reduce them to a fine clastic state through chemical reactions by oxygen, surface and/or soil water and other acids. Water and air (oxygen and carbon dioxide) along with heat must be present to speed up all chemical reactions. Over and above the carbon dioxide present in the air, decomposition of plants and animals increases the quantity of carbon dioxide underground. These chemical reactions on various minerals are very much similar to the chemical reactions in a laboratory.

These forces are interdependent. For example availability of water and heat depends on physical factors while chemical reactions depend on availability of water and heat.

Question 3(iv).

How do you distinguish between the process of soil formation and soil- forming factors? What is the role of climate and biological activity as two important control factors in the formation of soils?

Answer:

Process refers to step by step procedure or methodical ways in which soil comes into existence while factors causing this formation are called soil forming factors. Soil formation process: Soil formation is called pedogenesis. It depends on weathering the most. It is this weathering mantle which is the basic input for soil to form. The weathered material or transported deposits are colonised by bacteria and other inferior plant bodies like mosses and lichens. Several minor organisms may take shelter within the mantle and deposits. The dead remains of organisms and plants help in humus accumulation. Minor grasses and ferns may grow; later, bushes and trees will start growing through seeds brought in by birds and wind. Plant roots penetrate down, burrowing animals bring up particles, mass of material becomes porous and sponge- like with a capacity to retain water and to permit the passage of air and finally a mature soil, a complex mixture of mineral and organic products forms.

Soil-forming factors: Five basic factors control the formation of soils:

1. Parent material
2. Topography
3. Climate
4. Biological activity
5. Time.

In fact, soil forming factors act in union and affect the action of one another. Climate: Climate is an important active factor in soil formation. The climatic elements involved in soil development are :

1. moisture and
2. temperature.

Precipitation gives soil its moisture content which makes the chemical and biological activities possible. Excess of water helps in the downward transportation of soil components through the soil (eluviation) and deposits the same down below (illuviation). Temperature acts in two ways – increasing or reducing chemical and biological activity. Chemical activity is increased in higher temperatures, reduced in cooler temperatures (with an exception of carbonation) and stops in freezing conditions. That is why, tropical soils with higher temperatures show deeper profiles and in the frozen tundra regions soils contain largely mechanically broken materials.

Biological Activity: The vegetative cover and organisms that occupy the parent materials from the beginning and also at later stages help in adding organic matter, moisture retention, nitrogen, etc. Dead plants provide humus. Some organic acids which form during humification aid in decomposing the minerals of the soil parent materials. Intensity of bacterial activity shows up differences between soils of cold and warm climates. Humus accumulates in cold climates as bacterial growth is slow.

With undecomposed organic matter because of low bacterial activity, layers of peat develop in sub-arctic and tundra climates. Rhizobium, a type of bacteria, lives in the root nodules of leguminous plants and fixes nitrogen beneficial to the host plant. The

influence of large animals like ants, termites, earthworms, rodents etc., is mechanical, but, it is nevertheless important in soil formation as they rework the soil up and down. In case of earthworms, as they feed on soil, the texture and chemistry of the soil that comes out of their body changes.