Chapter 5: Geomorphic Processes

Exercises — Exercises

Q1 1(i). Which one of the following processes is a gradational process?
(a) Deposition
(b) Diastrophism
(c) Volcanism
(d) Erosion

(d) Erosion. Gradation is the wearing down of relief variations through erosion, and erosion is the main degradational process. Diastrophism and volcanism are endogenic, land-building processes.

Q2 1(ii). Which one of the following materials is affected by hydration process?
(a) Granite
(b) Clay
(c) Quartz
(d) Salts

(b) Clay. Hydration is a chemical weathering process in which minerals take up water and swell. Clay minerals are the material that responds to it, while quartz and granite resist chemical change.

Q3 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

(c) Rapid flow mass movements. The chapter lists debris avalanches alongside landslides as frequent Himalayan events. An avalanche is a fast, flowing mass of debris on steep slopes, so it counts as a rapid flow movement.

Q4 2(i). It is weathering that is responsible for bio-diversity on the earth. How?

Weathering breaks rocks down and builds the weathering mantle. Forests depend on the depth of this mantle, and biomes and bio-diversity are largely the result of forests and vegetation. Weathering also forms regolith and soil, which support plant growth, so it indirectly sustains bio-diversity.

Q5 2(ii). What are mass movements that are real rapid and perceptible? List.

Landslides are the relatively rapid, perceptible movements of mostly dry material. Their types are slump (backward-rotating slip of debris), debris slide, debris fall, rockslide and rock fall. Heave, flow and slide are the three broad forms of mass movement.

Q6 2(iii). What are the various mobile and mighty exogenic geomorphic agents and what is the prime job they perform?

The agents are running water, groundwater, glaciers, wind, waves and currents. Each is a mobile medium that removes (erodes), transports and deposits earth materials, so wearing down relief and filling depressions is their prime job.

Q7 2(iv). Is weathering essential as a pre-requisite in the formation of soils? Why?

Yes. Soil formation depends first on weathering. The weathering mantle, the depth of weathered material, is the basic input from which soil forms. Without weathered debris there is nothing for organisms to colonise and no parent material for soil to develop from.

Q8 3(i). "Our earth is a playfield for two opposing groups of geomorphic processes." Discuss.

The two groups are endogenic and exogenic processes. Endogenic forces, driven by heat from within the earth (radioactivity, rotational and tidal friction, primordial heat), act through diastrophism and volcanism. They elevate and build up parts of the surface and are mainly land-building forces. Exogenic forces derive energy from the atmosphere, ultimately from the sun, and act through weathering, mass wasting, erosion and deposition. They wear down relief (degradation) and fill basins (aggradation), and are mainly land-wearing forces. Because the endogenic forces keep raising parts of the surface, the exogenic processes cannot even out the relief. Variations in the surface therefore persist as long as the two sets of opposing forces continue to operate.

Q9 3(ii). Exogenic geomorphic processes derive their ultimate energy from the sun's heat. Explain.

Exogenic processes get their energy from the atmosphere, whose ultimate energy comes from the sun, along with gradients created by tectonic factors. Solar heating creates thermal gradients between latitudes, seasons and land and water, and these produce different climatic regions. Temperature and precipitation, the two key climatic elements, control the processes of weathering, mass movement and erosion. Climate also decides the density and type of vegetation, which influences these processes indirectly. Wind, running water and glaciers, the climate-controlled agents, work through the atmosphere's energy. Thus the sun's heat ultimately drives exogenic processes, which vary from region to region as climate varies.

Q10 3(iii). Are physical and chemical weathering processes independent of each other? If not, why? Explain with examples.

No. Weathering processes very rarely operate completely alone; usually one dominates, but they act together. Physical weathering, through thermal expansion, pressure release or crystal growth, fractures rocks and exposes fresh surfaces. This lets water and air penetrate and speeds up chemical actions such as solution, carbonation, hydration and oxidation. Biological activity links both: burrowing organisms and plant roots break rocks apart mechanically, while decaying plant and animal matter produces humic and carbonic acids that enhance chemical decay. Chemical weathering in turn loosens bonds between grains and weakens rocks, making them easier to break mechanically. Hence the two are interdependent.

Q11 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?

Soil formation (pedogenesis) is the process: weathering produces a mantle of debris, which bacteria, mosses and lichens colonise, humus accumulates, plants and burrowing animals make it porous, and finally a mature soil forms. Soil-forming factors are the controls on this process: parent material, topography, climate, biological activity and time. Climate is an active factor. Moisture (precipitation, evaporation, humidity) enables chemical and biological activity and drives eluviation, illuviation and desilication in wet areas and hardpans in dry ones. Temperature raises or lowers chemical and biological activity, so tropical soils have deeper profiles. Biological activity adds organic matter, humus, moisture retention and nitrogen, through nitrogen fixation by bacteria like Rhizobium. Bacterial intensity differs between cold and warm climates, and animals such as earthworms and termites rework the soil.