Chapter 6: Landforms and Their Evolution

Exercises — Exercises

Q1 Multiple choice questions. (i) In which of the following stages of landform development, downward cutting is dominated? (a) Youth stage (b) Late mature stage (c) Early mature stage (d) Old stage

(a) Youth stage. In the early (youthful) stage of a river's development, streams flow over steep slopes and down-cutting dominates, removing irregularities such as waterfalls and cascades. Later, as the bed grows gentler, lateral erosion takes over.

Q2 (ii) A deep valley characterised by steep step-like side slopes is known as (a) U-shaped valley (b) Gorge (c) Blind valley (d) Canyon

(d) Canyon. A canyon has steep, step-like side slopes and is wider at the top than at the bottom, whereas a gorge has very steep, straight sides and is nearly equally wide at top and bottom. Canyons commonly form in horizontally bedded sedimentary rocks.

Q3 (iii) In which one of the following regions the chemical weathering process is more dominant than the mechanical process? (a) Humid region (b) Limestone region (c) Arid region (d) Glacier region

(a) Humid region. Abundant moisture and rainfall in humid regions favour chemical processes such as solution and carbonation, so chemical weathering outweighs mechanical weathering there. Arid and glacier regions are dominated by mechanical weathering.

Q4 (iv) Which one of the following sentences best defines the term 'Lapies'? (a) A small to medium sized shallow depression (b) A landform whose opening is more or less circular at the top and funnel shaped towards bottom (c) A landform formed due to dripping water from surface (d) An irregular surface with sharp pinnacles, grooves and ridges

(d) An irregular surface with sharp pinnacles, grooves and ridges. When pits and trenches eat away most of a limestone surface, a maze of points, grooves and ridges is left, formed by differential solution along joints. Option (a) describes swallow holes, (b) sinkholes and (c) stalagmites.

Q5 (v) A deep, long and wide trough or basin with very steep concave high walls at its head as well as in sides is known as: (a) Cirque (b) Glacial valley (c) Lateral Moraine (d) Esker

(a) Cirque. Cirques are cut by accumulated ice at the heads of glacial valleys and have steep, concave walls at the head and sides. A lake, called a cirque or tarn lake, often remains in them after the glacier melts.

Q6 Answer the following questions in about 30 words. (i) What do incised meanders in rocks and meanders in plains of alluvium indicate?

Meanders in alluvial plains show gentle gradients where rivers erode laterally into loose deposits. Incised or entrenched meanders, cut deep into hard rock, show that a river once meandered on a gentle surface and was later rejuvenated, cutting downward.

Q7 (ii) Explain the evolution of valley sinks or uvalas.

Solution action creates swallow holes and sinkholes in limestone. When sinkholes and dolines join through slumping of their margins or roof collapse of caves, long, narrow to wide trenches form. These are called valley sinks or uvalas.

Q8 (iii) Underground flow of water is more common than surface run-off in limestone areas. Why?

Limestone is permeable, thinly bedded, jointed and cracked, and calcium carbonate dissolves in water. Surface water therefore sinks quickly through swallow holes and sinkholes, then flows underground along bedding planes and joints as cave streams, re-emerging at some distance downstream.

Q9 (iv) Glacial valleys show up many linear depositional forms. Give their locations and names.

Moraines are linear ridges of glacial till: terminal moraines lie at the glacier's toe; lateral moraines along the valley sides; medial moraines in the valley centre between laterals; ground moraines as irregular sheets on the valley floor. Eskers, sinuous ridges, lie under the melted glacier's ice channel.

Q10 (v) How does wind perform its task in desert areas? Is it the only agent responsible for the erosional features in the deserts?

Wind works through deflation (lifting and removing fine particles), abrasion (sand and silt wearing surfaces) and impact (sand blasting rock). It is not the only agent: torrential rain, sheet floods and sheet wash, along with weathering and mass wasting, also shape desert landforms such as pediments and plains.

Q11 Answer the following questions in about 150 words. (i) Running water is by far the most dominating geomorphic agent in shaping the earth's surface in humid as well as in arid climates. Explain.

In humid regions with heavy rainfall, running water is the most important agent of land degradation. It acts as overland sheet flow and as linear flow in streams and rivers. Overland flow forms rills, which grow into gullies and then valley networks. In early stages down-cutting removes waterfalls and cascades; later lateral erosion lowers valley sides and divides, eventually leaving a peneplain with monadnocks. Rivers also create depositional landforms such as alluvial fans, deltas, floodplains, levees, point bars and meanders. In arid regions rainfall is scarce but falls torrentially in a short period. Bare, weathered desert rock is easily removed by sheet floods and sheet wash, which accomplish most mass erosion. Wind moves only fine material. Broad, indefinite stream channels flow briefly after rains, and pediments and playas owe their formation to running water. Thus water dominates in both climates.

Q12 (ii) Limestones behave differently in humid and arid climates. Why? What is the dominant and almost exclusive geomorphic process in limestone areas and what are its results?

Limestone is rich in calcium carbonate, which dissolves in carbonated rainwater. In humid regions, plentiful rain drives solution and precipitation, so karst landforms develop abundantly. In arid regions there is little water, so these chemical processes are weak and limestone behaves like any other resistant rock. The dominant, almost exclusive process in limestone areas is chemical solution (and precipitation); physical removal by groundwater is insignificant. Erosional results include swallow holes, sinkholes, dolines, uvalas, lapies, limestone pavements and caves, and tunnels where caves open at both ends. Depositional results arise when calcium carbonate is redeposited as the water evaporates or loses carbon dioxide: stalactites hanging from cave roofs, stalagmites rising from floors, and columns or pillars where the two fuse.

Q13 (iii) How do glaciers accomplish the work of reducing high mountains into low hills and plains?

Glaciers are masses of ice that move slowly under gravity, from a few centimetres to a few metres a day. Their sheer weight causes tremendous friction. Large angular blocks and rock fragments plucked from the land are dragged along valley floors and sides, causing great damage through abrasion and plucking, even to unweathered rocks. Cirques are cut at valley heads; headward erosion of cirque walls produces horns and serrated ridges (arêtes), and valleys are deepened into U-shaped troughs. As glaciers continue moving, debris is removed, divides are lowered and slopes are reduced until the glaciers stop moving. What remains is a mass of low hills and vast outwash plains, along with depositional features such as moraines, eskers and drumlins.