

UNIT – 1: GEOMORPHOLOGY

SYLLABUS

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2	1.1.2 Structure of the Earth:
3	1.1.3 Volcano and eruption types Lahar
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Section – 1: Unit at a Glance

Sub Unit – 1: Earth Movement

Immanuel Kant, a geographer argued that gaseous clouds (nebulae) slowly rotate, gradually collapse and flatten due to gravity, eventually forming stars and planets.

In our solar system the Earth is third planet from the Sun. The earth crust (Lithosphere) is harder; the inner part of the earth is semi liquid to liquid. Earth has atmosphere and hydrosphere. It sustains life (biosphere). The living beings are present on Lithosphere and hydrosphere; and a little amount in atmosphere.

Endogenetic and Exogenetic forces:

Endogenous processes such as volcanoes, earthquakes, and plate tectonics uplift and expose continental crust to the exogenous processes of weathering, of erosion, of deposition and of mass wasting.

Example and explanation: The **Peninsular plateau** is a tableland. It is composed of the old crystalline, igneous and metamorphic rocks. The **Peninsular plateau** is considered the oldest land mass as it was **formed** due to the drifting of the Gondwana land.

Structure of the Earth:

Layers: The five layers are the lithosphere, asthenospheric, mesospheric mantle, outer core, and the inner core.

Discontinuities:

1. Conrad Discontinuity- Upper Crust and Lower Crust.
2. Moho Discontinuity – Crust and Mantle.
3. Repetti Discontinuity – Upper Mantle and lower Mantle.
4. Gutenberg Discontinuity – Mantle and Core
5. Lehmann Discontinuity – Outer Core and Inner Core

Volcano and eruption types Lahar

Volcano is a weak place, where liquid or semi liquid magma (asthanospheric material) can come out (i.e. lava) and make a cone shaped landform in crust.

Some volcanoes are covered with snow and ice. If they erupt, melted snow and ice mixes with mud and volcanic ash and flows down through mountain. This type of volcanic flow is called **Lahar**.

Earthquake, Richter's scale and Tsunami

An earthquake is shaking of earth, resulting of sudden release of energy stored in Lithosphere. It releases seismic waves(P,S,L waves).

Focus is the location where the earthquake originates.

Epicenter is a point on the Earth's surface just above the focus.

A series of waves in a water body caused by the displacement of a large volume of water, generally in an ocean caused by Earthquakes, volcanic eruptions and other underwater explosions is called Tsunami.

Isostasy :

The general term 'isostasy' was introduced in 1882 by the American geologist C Dutton.

The principal models of isostasy are :

1. Airy's model – where different topographic heights are accommodated by changes in crustal thickness, in which the crust has a constant density.
2. The Pratt's model – where different topographic heights are accommodated by lateral changes in rock density. He introduces line of compensation concept.

Fold and Fault:

The strike line of a [bed](#), fault, or other planar feature, is a line representing the intersection of that feature with a horizontal plane. The dip gives the steepest angle of descent of a tilted bed or feature relative to a horizontal plane.

Types of fold: Anticline, Syncline, Antiform ,Synform etc.

Types of Faults:strike-slip, dip-slip, oblique-slip,normal fault, reverse fault, thrust fault etc.

Theories of Mountain Building: The concept of the geosyncline was introduced by the American geologist James Hall in 1859.

1. Thermal contraction theory by Jeffrey:

2. Geosynclinal theory of Kober:

3. Hypothesis of Sliding Continent by Daly:

4. Thermal Convection Current Theory by A. Holmes

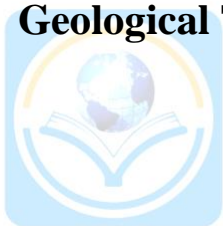
5. Radio- activity and Surface History of Earth:

Types of rocks and minerals:

The outer part of earth is formed by solid components are called rocks. There are three types of rocks - i) igneous ii) Sedimentary and iii) metamorphic rocks.

Rocks are formed by the components are called **minerals**.

Geological Time Scale:



Geological Time Scale deals with the chronological order of evolution of life and landforms.

There have been at least five major ice ages in the Earth's history (the Huronian, Cryogenian, Andean-Saharan, late Paleozoic, and the latest Quaternary Ice Age).

World detail topography has seen in Cenozoic era.

Sub Unit – 2:Origin of Continents and ocean basins

Continental Drift Theory:

In 1914 A. Wegner introduces the theory. He believes one united landmass (Pangia) was present. Pangia split into different continents. Those are floated over oceans by tidal force. At last those continents and oceans make the present form of the planet.

Sea Floor Spreading:

In 1960, Professor Harry Hess and Robert W. Ditz introduce the concept. Seafloor spreading is a process that occurs at mid-ocean ridges, where new oceanic crust is formed through volcanic activity and then gradually moves away from the ridge.

Plate Tectonic

The 'Plate' first time used by J. T. Wilson in 1965. In 1967 Makenzie and Parker discuss elaborately about plate. W. J. Morgan and Le Pichon discussed about plate tectonic in 1968. Lithosphere is formed by seven large and many medium to small plates. Plate Tectonic is a scientific concept. Plate can float on asthenosphere. Asthenosphere is in semi liquid to liquid state.

Sub Unit – 3: Cycles of Erosions and Landforms

Some Fundamental concepts:

1. The same physical processes and laws that operate today operated throughout geologic time, although not necessarily with the same intensity as now (in 1785 Hutton's write principle of uniformitarianism in his book “Theory of the Earth”. In 1802, Play Fair believes “Present is the key to past”)
2. Geologic structure is a dominant control factor in the evolution of land forms and is reflected in them.
3. To a large degree the earth's surface possesses relief because the geomorphic processes operate at differential rates.
4. Geomorphic processes leave their distinctive imprint upon land forms and each geomorphic process develops its own characteristic assemblage of land forms.

Denudation and erosion:

Denudation involves the processes that cause the wearing away of the Earth's surface by moving water, by ice, by wind and by waves, leading to a reduction in elevation and in relief of landforms and of landscapes.

Rainfall, and the surface runoff which may result from rainfall, produces four main **types** of soil **erosion**: splash **erosion**, sheet **erosion**, **rill erosion**, and gully **erosion**.

Weathering:

The process of deformation of rocks by atmospheric agents (temperature, Rainfall, humidity, chemical reaction etc.) is called Weathering. Physical weathering depends upon temperature, pressure etc. Chemical weathering depends upon low temperature, rainfall, humidity etc.

Mass wasting:

Mass wasting, also known as slope movement or mass movement, is the geomorphic process by which soil, sand, regolith, and rock move down slope typically as a solid, continuous or discontinuous mass, largely under the force of gravity, frequently with characteristics of a flow as in debris flows and mudflows.

Landslide and avalanches:

A **landslide** is defined as the movement of a mass of rock, debris, or earth down a slope under the direct influence of gravity.

Avalanches occur when the snow-pack starts to weaken and allows the buildup of snow to be released. Small avalanches are generally made up of ice, snow and air. The larger ones comprise of rocks, trees, debris and even mud that is resting on the lower slopes.

Landforms and evolutions:

River:

Types of Streams:

1. **Consequent** streams are streams whose course is a direct consequence of the original slope of the surface
2. **Subsequent** streams are streams whose course has been determined by selective headward erosion along weak strata.
3. **Resequent** streams are streams whose course follows the original relief, but at a lower level than the original slope (e.g., flows down a course determined by the underlying strata in the same direction). These streams develop later and are generally a tributary to a subsequent stream.
4. **Obsequent** streams are streams flowing in the opposite direction of the consequent drainage.

5. **Insequent** streams have an almost random drainage often forming dendritic patterns. These are typically tributaries and have developed by a headward erosion on a horizontally stratified belt or on homogeneous rocks. These streams follow courses that apparently were not controlled by the original slope of the surface, its structure or the type of rock.

Drainage Patterns:

1. Dendritic, 2. Parellel, 3. Trellis, 4. Rectangular, 5. Redial, 6. Annular

Deposition on different position of River channels: Point bar, Terrace deposits

Landform evolution:

Cycle of Erosion by W.M.Davis:

William Morris Davis was an American Geomorphologist. In geology and geomorphology a **base level** is the lower limit for an erosion process. The modern term was introduced by John Wesley Powell in 1875. The term was subsequently appropriated by William Morris Davis who used it in his cycle of erosion theory.

Concept: According to Davis “Landscape is the function of structure, process and time”. These three factors are also called “Trio of Davis”.

Morphological Analysis by Penck:

Penck provided his theory in his work ‘Morphological analysis and its perspective’. This theory was a reaction to Davies theory on cycle of erosion. Contrary, to Davies he emphasized on role of endogenetic forces in landform development and also, replaced stage with a time-independent concept of Phase.

Parallel Retreat theory by LC King:

His theory on geomorphic cycle is based on landscapes of semiarid and arid. He has criticized many elements of Davies theory, though there are some similarities too.

Davies considered fluvial cycle as normal cycle which was severely criticized by King. According to him $\frac{2}{3}$ of landscapes in world are either arid, semi-arid or savanna type. Thus, arid cycle should be the normal cycle.

Glacier and peri glacier:

Landform evolution in periglacial:

In 1950, Peltier proposed periglacial cycle of erosion. The periglacial cycle of erosion begins with a non-periglacialized landscape. Once-periglacialized mass wasting of regolith exposes bedrock in the upper slopes. These outcrops are then subject to frost weathering that makes slopes retreat forming extensive blockfields at the base of the bedrock areas. At a later stage [solifluction](#) wears down summits and fills in topographic lows.

Landform evolution in glacial:

In 1900 W.M. Davis proposed the theory of Glacial erosion cycle. The glacial cycle of erosion deals with mountainous regions and lacks an old stage since Davis argues that nothing more developed than mature glacial landscapes exists at present. A glacial cycle of erosion begins with a pre-glacial landscape. Over time valley glaciers erode the underlying rock at different rates, creating valleys and glaciers that are more entrenched than others. As time passes the less-entrenched glaciers reach the same levels of entrenchment as the more entrenched ones, since the deeper a glacier erodes, its erosive power diminishes. In a mature stage, valleys form smooth-sided troughs.

Aeoline Landforms:

Landform evolution:

Cycle by Davis: In 1905, W.M.Davis propound arid cycle of erosion. At the beginning of the cycle of erosion in arid climate there are numerous small basins to where material is washed during the scarce rainfall events. In the next stage (*youthful stage*) valleys are developed and highlands dissected by these. Gentle slopes and basins accumulated material derived from the highlands. In the *mature stage* drainage basins coalesce. At the end a stage is reached where the terrain has lost much of its relief and deflation hollows interfere with the drainage systems, breaking it up into local systems. During all stages sand and dust might be *exported* by wind to other landscapes.

Cycle by L.C.King:

Gilbert believed the origin of pediments in the Henry Mountains are due to stream planation and active erosion of deserts.

The role of lateral planation by stream in the formation of pediments:

Mc Gee, Paige, Johnson etc.

Coastal:**Wave cut platform:**

A **wave-cut platform**, shore **platform**, coastal bench, or **wave-cut** cliff is the narrow flat area often found at the base of a sea cliff or along the shoreline of a lake, bay, or sea that was created by erosion.

Landform evolution:

In 1919 Johnson proposed the cycle of coastal erosion. Alternate models are proposed for shore profiles: one for shore profiles of emergence and another for shore profiles of submergence. A complementary model can be applied to shore lines where different parts might have undergone submergence and emergence.

Karst:**Landform evolution:**

In 1918, Cvijic propounded karst cycle of erosion. The cycle of erosion in karst regions has three phases. At first the upper parts of fractures are dissolved, enlarged and filled with water. Normal fluvial valleys develop on the surface, small poljes might exist. Subsequently, re-routing of water by the growth of a karst system disorganizes the fluvial drainage pattern, with valley bottoms developing large dolines and uvalas. Ridges between uvalas gradually disappear as these landforms coalesce. If the bedrock is underlain by insoluble rock, normal fluvial valleys will slowly re-appear once the underground river systems reach the insoluble rock. In the end soluble rocks appear only as isolated hills. Contrary to Davis' original cycle of erosion the karst one does not end in the formation of a peneplain.

Theories and Process of Slope Development:

Types of slope: seepage slope, Fall face etc.

Theories:

Slope decline

Slope decline was proposed by William Morris Davis in his cycle of erosion theory. It consists of a gradual decrease in slope angle as stream incision slows down.

Slope replacement

Slope replacement first proposed by Walther Penck challenging Davis' ideas on slope development. Slope replacement describes an evolution of slopes that is associated with decreasing rates of over-all erosion (denudation).

Parallel slope retreat

King considered scarp retreat and the coalescence of pediments into pediplains a dominant processes across the globe. Further he claimed that slope decline was a special case of slope development seen only in very weak rocks that could not maintain a scarp. Slopes that are convex upslope and concave downslope and have no free face were held by King to be a form that became common in the late Tertiary. King argued that this was the result of more slowly acting surface wash caused by carpets of grass which in turn would have resulted in relatively more soil creep.

Section – 2: Key Statements

Every candidates appearing for NET/SET examination should follow these key (main) points those can help them a better understanding regarding this unit very quickly.

Basic Key Statements: Lithosphere(3.1), Hydrosphere(3.1), Atmosphere(3.1), Biosphere(3.1), lithosphere (1.1.2), asthanospheric (1.1.2), mesospheric mantle (1.1.2), outer core (1.1.2), inner core (1.1.2), Lehmann Discontinuity (1.1.2), Moho Discontinuity (1.1.2), Repetti Discontinuity (1.1.2), Gutenberg Discontinuity (1.1.2), Conrad Discontinuity (1.1.2), Volcano (1.1.3), magma (1.1.3), lava (1.1.3), earthquake(1.1.4), Richter (1.1.4), Tsunami(1.1.4), Isostacy (1.1.5), Dip (1.1.6), Strike (1.1.6), fold (1.1.6.1), Faults (1.1.6.2), Rift Valley (1.1.6.2), Horst (1.1.6.2), Grabon (1.1.6.2), geosynclines (1.1.7), minerals (1.1.8), rocks (1.1.8), igneous (1.1.8), Sedimentary (1.1.8), metamorphic (1.1.8), Continental Drift (1.2.1), Pangia (1.2.1), Sea Floor Spreading (1.2.1), mid-ocean ridges (1.2.1), Paleomagnetic (1.2.1), Plate Tectonic (1.2.3), asthenosphere (1.2.3), Denudation (1.3.2), erosion (1.3.2), Mechanical Weathering (1.3.3.1), Chemical Weathering (1.3.3.2), Mass wasting (1.3.4), Landslide (1.3.4.1), avalanches (1.3.4.1), Consequent (1.3.5.1), Subsequent (1.3.5.1), Resequent (1.3.5.1), Insequent (1.3.5.1), Obsequent (1.3.5.1), base level(1.3.5.1), Trio of Davis (1.3.5.1), peneplain (1.3.5.1), Monadnocks (1.3.5.1), rejuvenation (1.3.5.1), Primarumf(1.3.5.1), Endrumf(1.3.5.1), Waxing phase(1.3.5.1), Waning Phase(1.3.5.1), Parallel Retreat (1.3.5.1), Inselbergs(1.3.5.1), pediments(1.3.5.1), Bajada(1.3.5.1), playa(1.3.5.1), periglacial (1.3.5.2), glacial (1.3.5.2), [solifluction](#) (1.3.5.2), Ria coast (1.3.5.4), Fjord Coast (1.3.5.4), polje (1.3.5.5), fall face (1.3.6), seepage slope (1.3.6), Slope decline (1.3.6), Slope replacement (1.3.6), Parallel slope retreat (1.3.6).

Standard Key Statements: Endogenetic forces(1.1.1), Endogenetic forces(1.1.1), Basaltic magma (1.1.3), Rhyolitic Magma (1.1.3), Andesitic magma (1.1.3), Focus (1.1.4), Epicenter (1.1.4), Sismograph (1.1.4), line of compensation(1.1.5), Horizontal plane (1.1.6), Anticline (1.1.6.1), Syncline (1.1.6.1), Synform (1.1.6.1), Antiform (1.1.6.1), Monocline (1.1.6.1), Chevron (1.1.6.1), Recumbent (1.1.6.1), Nappe (1.1.6.1), Disharmonic (1.1.6.1), strike-slip (1.1.6.2), thrust fault (1.1.6.2), oblique-slip (1.1.6.2), normal fault (1.1.6.2), reverse fault (1.1.6.2), dip-slip (1.1.6.2), Thermal contraction (1.1.7), Lithogenesis (1.1.7), Orogenesis (1.1.7), Gliptogenesis (1.1.7), Sliding Continent (1.1.7), Thermal Convection Current (1.1.7), Radio- activity and Surface History (1.1.7), Subduction (1.2.3), splash erosion (1.3.2), sheet erosion (1.3.2), rill erosion (1.3.2), gully erosion (1.3.2), Wet Snow Avalanches (1.3.4.1), Slab Avalanches (1.3.4.1), Powder Snow Avalanches (1.3.4.1), Loose Snow Avalanches (1.3.4.1),

Advanced Key Statements: Nebulae (3.1), peninsular Plateau (1.1.1), Gondana Land (1.1.1), Table land (1.1.1), Quaternary (1.1.9), late Paleozoic (1.1.9), Andean-Saharan (1.1.9), Cryogenian (1.1.9), Huronian (1.1.9), Sinistral motion (1.2.3), dextral motion (1.2.3),

[N.B. – Values in parenthesis are the reference number]

Section – 3: Key Facts and Figures

Sub Unit – 1:

Earth Movement

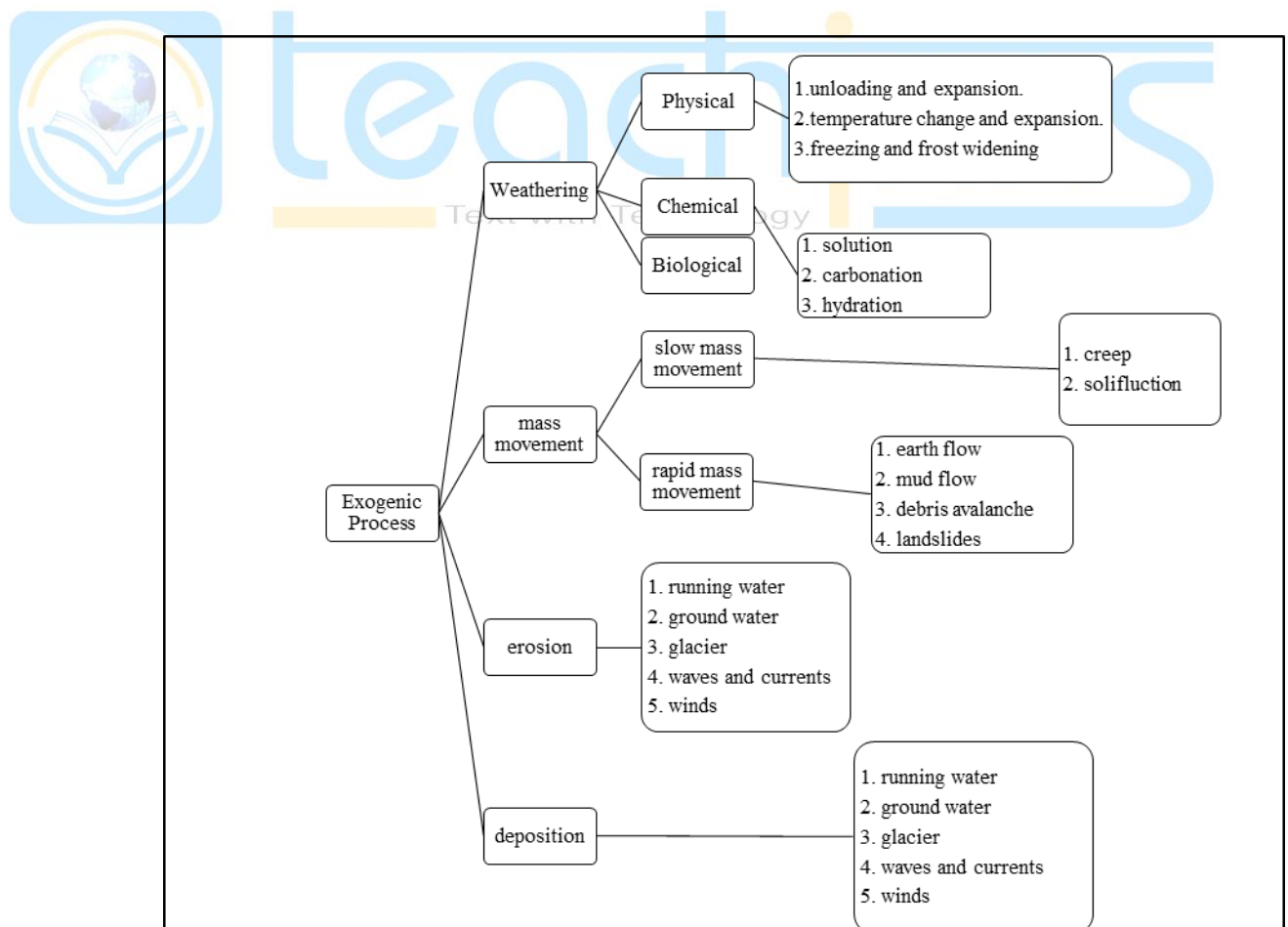
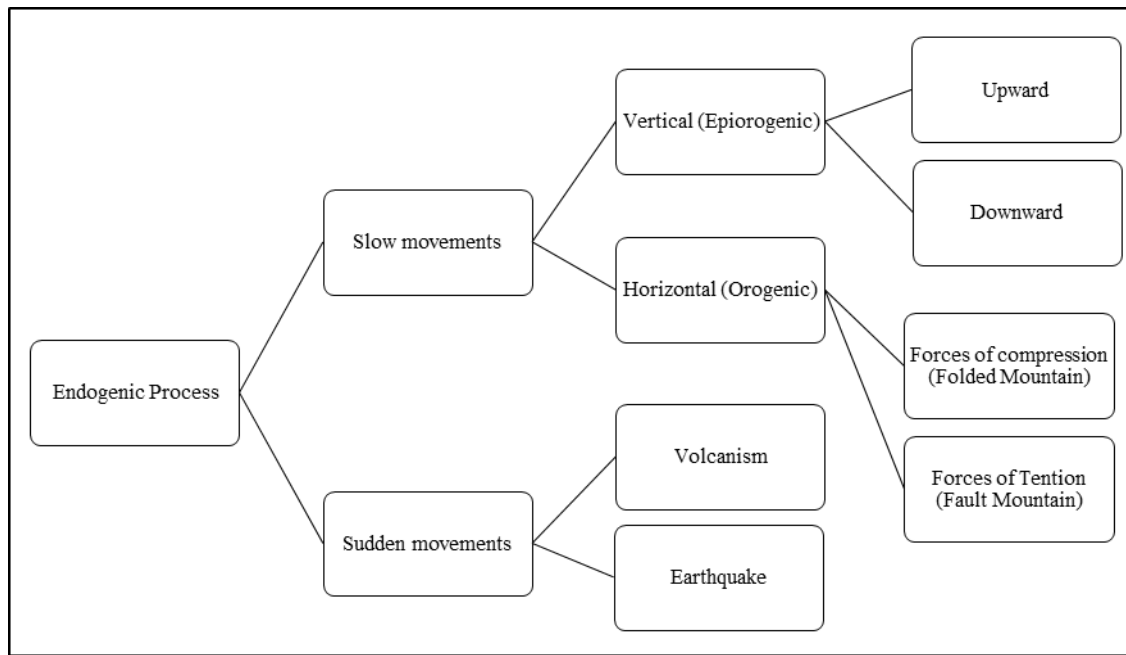
Immanuel Kant, a geographer argued that gaseous clouds (nebulae) slowly rotate, gradually collapse and flatten due to gravity, eventually forming stars and planets.

In our solar system the Earth is third planet from the Sun. The earth crust (Lithosphere) is harder; the inner part of the earth is semi liquid to liquid. Earth has atmosphere and hydrosphere. It sustains life (biosphere). The living beings are present on Lithosphere and hydrosphere; and a little amount in atmosphere.

Surface to Upper Mantle, the solid outer part of the earth is called Lithosphere. Plates are also present in this sphere. Lithosphere is divided into two groups – i) Oceanic lithosphere and ii) Continental lithosphere

1.1.1 Endogenetic and Exogenetic forces:

Endogenous processes such as volcanoes, earthquakes, and plate tectonics uplift and expose continental crust to the exogenous processes of weathering, of erosion, of deposition and of mass wasting.



Example and explanation: The **Peninsular plateau** is a tableland. It is composed of the old crystalline, igneous and metamorphic rocks. The **Peninsular plateau** is considered the oldest land mass as it was **formed** due to the drifting of the Gondwana land.

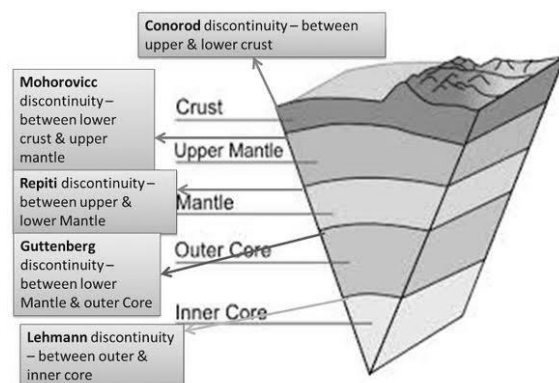
1.1.2 Structure of the Earth:

Layers: The five layers are the lithosphere, asthenospheric, mesospheric mantle, outer core, and the inner core.

Depth from Surface in Kms.	Layer
0–60	Lithosphere (locally varies between 5 and 200 km)
0–35	... Crust (locally varies between 5 and 70 km)
60–210	Asthenosphere
35–60	... Uppermost part of mantle
35–2,890	Mantle
210–270	... Upper mesosphere (upper mantle)
660–2,890	... Lower mesosphere (lower mantle)
2,890–5,150	Outer core
5,150–6,360	Inner core

Discontinuities:

6. Conrad Discontinuity- Upper Crust and Lower Crust.
7. Moho Discontinuity – Crust and Mantle.
8. Repetti Discontinuity – Upper Mantle and lower Mantle.



9. Gutenberg Discontinuity – Mantle Layers and discontinuities and Core
10. Lehmann Discontinuity – Outer Core and Inner Core

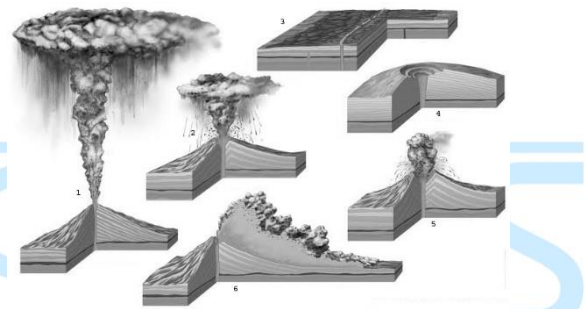
1.1.3 Volcano and eruption types Lahar

Volcano is a weak place, where liquid or semi liquid magma (asthenospheric material) can come out (i.e. lava) and make a cone shaped landform in crust.

Volcanic eruption can damage all three spheres (Lithosphere, Hydrosphere and Atmosphere) of the earth.

Types of Magmatic eruptions :

1. Plinian
2. Vulcanian
3. Icelandic
4. Hawaiian (Hawaii, Mauna Loa)
5. Strombolian
6. Peléan



Types of Magmatic eruptions

Types of eruption by their sound:

1. Effusive
2. Explosive

Types according to the property of magma:

1. Basaltic magma (less viscous-Iceland, Deccan trap of India)
2. Andesitic magma (medium viscous- Indonesian Krakatoa)
3. Rhyolitic Magma (highly viscous- Yellowstone national park of USA)

Some volcanoes are covered with snow and ice. If they erupt, melted snow and ice mixes with mud and volcanic ash and flows down through mountain. This type of volcanic flow is called **Lahar**.

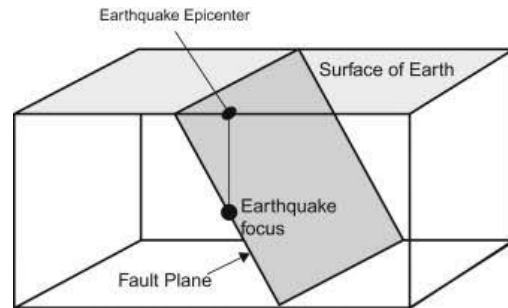
1.1.4 Earthquake, Richter's scale and Tsunami

An earthquake is shaking of earth, resulting of sudden release of energy stored in Lithosphere. It releases seismic waves(P,S,L waves).

Focus is the location where the earthquake originates.

Epicenter is a point on the Earth's surface just above the focus.

The Richter magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismometer. In seismograph reading difference between 5 and 4, it gives 10 times greater reading from 4. At the same time it releases 31.6 times larger energy from 4.



Focus and Epicenter

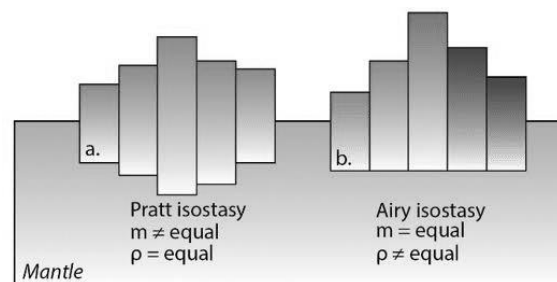
A series of waves in a water body caused by the displacement of a large volume of water, generally in an ocean caused by Earthquakes, volcanic eruptions and other underwater explosions is called Tsunami.

1.1.5 Isostasy :

The general term 'isostasy' was introduced in 1882 by the American geologist C Dutton.

The principal models of isostasy are :

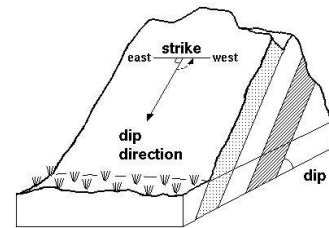
1. Airy's model – where different topographic heights are accommodated by changes in crustal thickness, in which the crust has a constant density.
2. The Pratt's model – where different topographic heights are accommodated by lateral changes in rock density. He introduces line of compensation concept.



Isostasy : Models of Pratt and Airy

1.1.6 Fold and Fault:

Dip and strike: The strike line of a bed, fault, or other planar feature, is a line representing the intersection of that feature with a horizontal plane. The dip gives the steepest angle of descent of a tilted bed or feature relative to a horizontal plane.



Dip and Strike

1.1.6.1 Types of fold:

Anticline: linear, strata normally dip away from axial center, oldest strata in center irrespective of orientation.

Syncline: linear, strata normally dip toward axial center, youngest strata in center irrespective of orientation.

Antiform: linear, strata dip away from axial center, age unknown, or inverted.

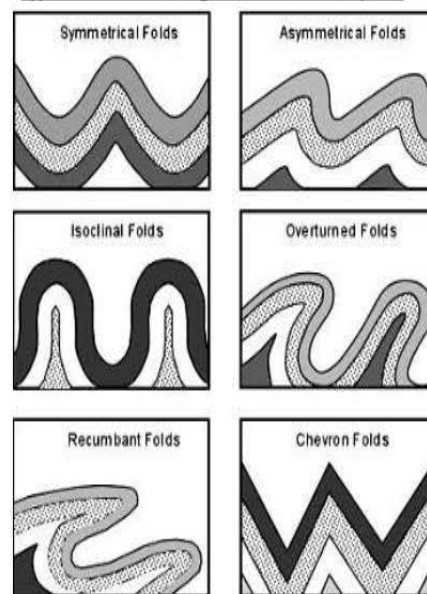
Synform: linear, strata dip toward axial center, age unknown, or inverted.

Monocline: linear, strata dip in one direction between horizontal layers on each side.

Chevron: angular fold with straight limbs and small hinges

Recumbent: linear, fold axial plane oriented at low angle resulting in overturned strata in one limb of the fold.

Types of folds according to attitude of axial plane



Types of folds

Nappe: Nappes form when a mass of rock is forced (or "thrust") over another rock mass, typically on a low angle fault plane.

Disharmonic: Folds in adjacent layers with different wavelengths and shapes.

1.1.6.2 Types of Faults:

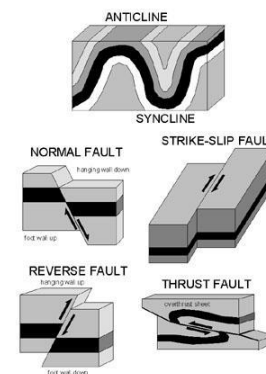
Based on the direction of slip, faults can be categorized as:

1. strike-slip, where the offset is predominantly horizontal, parallel to the fault trace;

2. dip-slip, offset is predominantly vertical and/or perpendicular to the fault trace; or

3. oblique-slip, combining strike and dip slip.

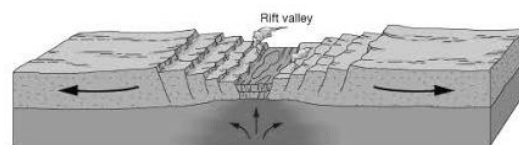
The several types are also- a) normal fault, b) reverse fault, c) thrust fault etc.



Types of faults

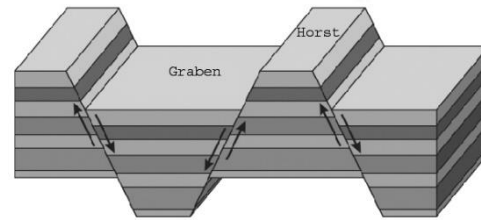
Fault forming landforms:

1. Rift Valley: A **rift valley** is a linear shaped lowland between several highlands or mountain ranges created by the action of a geologic **rift** or fault. A **rift valley** is formed on a divergent plate boundary, a crustal extension or spreading apart of the surface, which is subsequently further deepened by the forces of erosion. Very frequently sevier earthquake is happen by this process.



Rift valley

2. **Horst and Graben:** A horst is a raised block of the Earth's crust that has lifted, or has remained stationary, while the land on either side (graben) has subsided.



Horst and Graben

1.1.7 Theories of Mountain Building:

The concept of the geosyncline was introduced by the American geologist James Hall in 1859.

1. Thermal contraction theory by Jeffrey:

In his opinion folded mountains are formed by following causes-

- i) thermal radiation of outer part of the earth makes itself shrinking
- ii) reduction of rotational speed of earth also reduced.

2. Geosynclinal theory of Kober:

As per his opinion folded mountain is formed in geosyncline. Geosyncline deposits in between rigid masses. By the lateral movement of rigid masses following stages are happened:

- i) Lithogenesis, ii) Orogenesis, iii) Gliptogenesis

3. Hypothesis of Sliding Continent by Daly:

In his opinion-

- i) Geosyncline is deposited on the continental mass.
- ii) Continued deposition on geosyncline makes itself heavier.
- iii) Underneath continental land mass cannot take stress of the geosyncline.
- iv) A part of continental mass slides under the asthenosphere.
- v) At the same time lateral stress on geosyncline stress makes folded mountain.

4. Thermal Convection Current Theory by A. Holmes

In his opinion-

- i) the surface of the earth and ocean floor is solid.
- ii) inner part of the earth is liquid and hot ie asthenosphere.
- iii) due to presence of hot and liquid state of the asthenosphere it has some rotational currents.
- iv) by this current the solid surfaces are moving slowly.

5. Radio- activity and Surface History of Earth:

Jolly believes -

- i) magma is less denser than magma.
- ii) magma increases volume after melting, and get less denser.

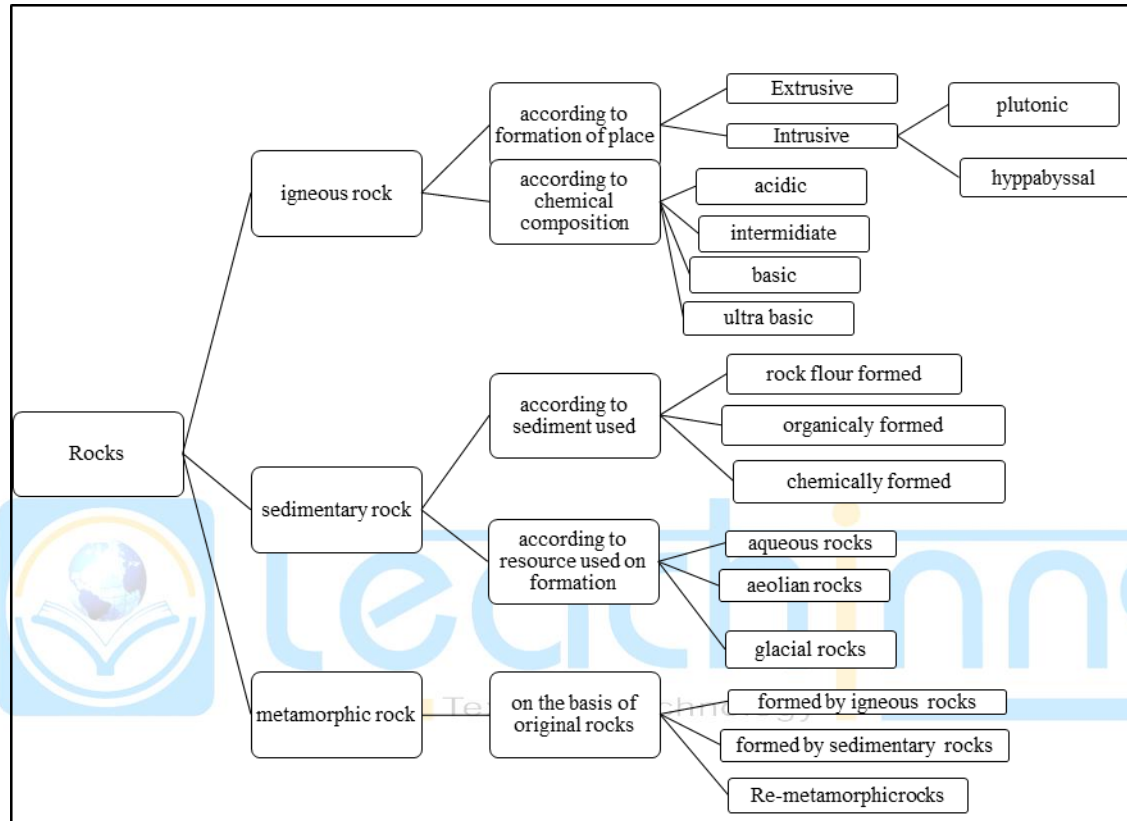


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1.1.8 Types of rocks and minerals:

The outer part of earth is formed by solid components are called rocks. There are three types of rocks - i) igneous ii) Sedimentary and iii) metamorphic rocks.

Rocks are formed by the components are called **minerals**.



1.1.8.1 Igneous Rock:

Rocks formed by the cooling and solidifying of molten materials.

Examples: Granite, Basalt

1.1.8.2 Sedimentary Rock:

Rock that has formed through the deposition and solidification of sediment, especially sediment transported by water (rivers, lakes, and oceans), ice (glaciers), and wind.

Examples: Mudstone, Sandstone

1.1.8.3 Metamorphic Rock:

A **metamorphic rock** is a type of **rock** which has been changed by extreme heat and pressure

Examples:

Basalt → Amphibolites

Granite → Gneiss

Sandstone → Quartzite

Shale → Slate

1.1.9 Geological Time Scale:

Geological Time Scale deals with the chronological order of evolution of life and landforms.

Era	Period	Epoch	Plant and Animal Development
Cenozoic	Quaternary	Holocene (.01)	1000 years before sea level become 130 meters lower than today because of latest ice age. Humans develop
		Pleistocene (1.8)	
	Tertiary	Pliocene (5.3)	"Age of mammals"
		Miocene (23.8)	
		Oligocene (33.7)	
		Eocene (54.8)	
Mesozoic	Cretaceous (144)	"Age of Reptiles"	First flowering plants
			First birds
	Triassic (248)		Dinosaurs dominant.

Paleozoic	Permian (290)	"Age of Amphibians"	Extinction of trilobites and many other marine animals
	Carboniferous: Pennsylvanian (323)		First reptiles
	Carboniferous: Mississippian (354)		Large coal swamps Large Amphibians abundant.
	Devonian (417)	"Age of Fishes"	First insect fossils
	Silurian (443)		Fishes dominant First land plants
	Ordovician (490)		First fishes
	Cambrian (540)	"Age of Invertebrates"	Trilobites dominant First organisms with shells
Precambrian - comprises about 88% of geologic time (4500)			First multicelled organisms First one-celled organisms Origin of Earth

The numbers are in millions of years.

*There have been at least five major ice ages in the Earth's history (the Huronian, Cryogenian, Andean-Saharan, late Paleozoic, and the latest Quaternary Ice Age).

**World detail topography has seen in Cenozoic era.



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Previous Year Question**June - 14**

1. Which of the following is strongly presumptive fault line scarps?

- (A) Superimposed drainage across a fault
- (B) Poor correlation between rock resistance and topographic forms
- (C) Frequent severe earthquakes
- (D) Actual Fault Plane identified along a scarp



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Answer & Reference Table

SL. NO.	QUESTION SL. NO.	ANSWER	REFERENCES
1.	3	B	1.3.5.1



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June - 15

1. Which of the following is formed due to tectonic forces?

- (A) Rift valley
- (B) Hanging valley
- (C) Super imposed valley
- (D) Antecedent valle

2. Match **List - I** with **List - II** and select the correct answer from the codes given:



- List - I**
- (a) Basalt
 - (b) Granite
 - (c) Sandstone
 - (d) Shale

List - II

- (i) Gneiss
- (ii) Quartzite
- (iii) Schist
- (iv) Slate

Codes:

- | | (a) | (b) | (c) | (d) |
|-----|-------|------|-------|-------|
| (1) | (ii) | (i) | (iv) | (iii) |
| (2) | (i) | (ii) | (iii) | (iv) |
| (3) | (iv) | (ii) | (i) | (iii) |
| (4) | (iii) | (i) | (ii) | (iv) |

3. Consider the following statements regarding kants view on the origin of the earth:

- (a) Kant introduced the Newtonian law of gravitation in his theory.
- (b) Kant developed his theory accepting the principle of conservation of angular momentum.
- (c) Though Laplace put forward the nebular hypothesis of origin of the earth, Kant is regarded by many as the real propounder of the nebular hypothesis.

Which of the statements are correct?

- (A) (a) and (b)
- (B) (b) and (c)
- (C) (a) and (c)
- (D) (a), (b) and (c)

4. Excessive folding results in:

- (A) Reverse fault
- (B) Geosyncline
- (C) Nappe formation
- (D) Block disintegration

5. Guttenberg discontinuity is found between the:

- (A) Upper core and lower core
- (B) Mantle and the core
- (C) Crust and the mantle
- (D) Upper mantle and lower mantle

6. Mauna Loa, in Hawaii is famous for:

- (A) Botanical garden
- (B) Monitoring sea level rise since 1950
- (C) Monitoring rainfall
- (D) Continuous monitoring of atmospheric CO₂ since 1957



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Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO.
1.	1	A	1.1.6.2
2.	3	D	1.1.8
3.	4	D	Introduction
4.	5	C	1.1.6.1
5.	7	B	1.1.2
6.	9	D	1.1.3



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December - 15

1. Consider the following rock characteristics:

- (a) These are layered (b) These contain fossils
(c) These are transported rocks (d) These are formed in water bodies

Which of the above characteristics is true of sedimentary rocks?

Codes:

- (A) (a), (b) and (c)
(B) (a), (b) and (d)
(C) (a) and (d)
(D) (a), (b), (c) and (d)



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Text with Technology

Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO.
1.	6	D	1.1.8



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July - 16

1. Which of the following is strongly presumptive of fault line scarp ?

- (A) Superimposed drainage
- (B) Frequent severe earthquakes
- (C) Actual fault plane identified along the scarp
- (D) Poor correlation between rock resistance and topographic form

2. Which one of the following arrangements of Pleistocene Ice age is in a correct chronological order ?

- (A) Mindel – Würm – Gunz – Riss
- (B) Gunz – Mindel – Riss – Würm
- (C) Würm – Mindel – Rim – Gunz
- (D) Rim – Mindel – Würm – Gunz

3. Most of the details of the World's topography belongs to

- (A) Paleozoic Era
- (B) Mesozoic Era
- (C) Cenozoic Era
- (D) Protozoic Era

4. Guttenberg discontinuity is found between the

- (A) Mantle and Core
- (B) Crust and Mantle
- (C) Upper mantle and lower mantle
- (D) Upper core and lower core

5. Given below are two statements, one is labelled as **Assertion (A)** and other labelled as **Reason (R)**. Select your answer from the codes given below.

Assertion (A) : In the Pacific Islands Volcanic eruptions are effusive type.

Reason (R) : Less viscous lava erupts quietly.

Codes :

- (A) Both (A) and (R) are true, (R) is the correct explanation of (A).
- (B) Both (A) and (R) are true, (R) is not the correct explanation of (A).
- (C) (A) is true, but (R) is false.
- (D) (A) is false, but (R) is true



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Answer & Reference Table

SL. NO.	QUESTION SL. NO.	ANSWER	REFERENCES
1.	3	D	1.1.6.2
2.	7	B	1.1.9
3.	2	C	1.3.5.2
4.	6	A	1.3.5.2
5.	5	A	1.1.3



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January - 17

1.The Indian plateau owes its existence due to

- (A) compressional forces
- (B) tensional forces
- (C) emergence
- (D) subsidence

2.The comprehensive theory of geosyncline was put forward by

- (A) Hall and Dana
- (B) E. Haug
- (C) J.A. Steers
- (D) J.W. Evans

3.Given below are two statements, one labelled as **Assertion (A)** and the other labelled as **Reason (R)**. Select your answer from the codes given below:

Assertion (A): Hawaii Island is a region of volcanic activity.

Reason (R): Convergent plate margins are sites of volcanic eruptions.

Codes:

- (A) Both (A) and (R) are correct and (R) is the correct explanation of (A).
- (B) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
- (C) (A) is correct, but (R) is false.
- (D) (A) is false, but (R) is correct.

Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO
1.	2	C	1.1.1
2.	3	B	1.1.7
3.	7	B	1.1.3



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November - 17

1. 'Mohorovicic discontinuity' marks the boundary between:

- (A) Continental shelf and Ocean crust
- (B) Asthenosphere and lithosphere
- (C) Crust and the upper mantle
- (D) Core and the mantle

2. The direction of a horizontal line on an inclined rock strata is known as:

- (A) Anticline
- (B) Dip
- (C) Syncline
- (D) Strike

3. Which one of the following periods when the sea level around the world, was as much as 130 meters lower than today?

- (A) Holocene
- (B) Pleistocene
- (C) Miocene
- (D) Cambrian

Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO.
1.	1	C	1.1.2
2.	2	D	1.1.6
3.	19	B	1.1.9



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July - 18

1. Gutenberg discontinuity is found between the:

- (A) Crust and mantle
- (B) Mantle and Core
- (C) Upper Core and Lower Core
- (D) Upper mantle and lower mantle

2. The direction of a horizontal line on an inclined rock strata is termed as:

- (A) Strike
- (B) Dip
- (C) Anticline
- (D) Free face

3. The concept of geosyncline was propounded by :

- (A) Holmes
- (B) James Hutton
- (C) Hall and Dana
- (D) J.W. Powell

4. Which one of the following phenomena plays a vital role in the dispersion of majestic dinosaurs?

- (A) Volcanic eruption
- (B) Zonal faulting
- (C) Global cooling
- (D) Continental drift

Answer & Reference Table

SL. NO	QUESTION NO.	ANSWER	REFERENCE NO.
1.	5	B	1.1.2
2.	7	A	1.1.6
3.	1	C	1.1.7
4.	29	D	1.1.9



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Sub Unit – 2:

Origin of Continents and ocean basins

1.2.1 Continental Drift Theory:

In 1914 A. Wegner introduces the theory. He believes one united landmass (Pangia) was present. Pangia split into different continents. Those are floated over oceans by tidal force. At last those continents and oceans make the present form of the planet.

Evidences:

1. Jig-saw-fit
2. location of Glacier of Post Carboniferous
3. Fossil study
4. Evidence of formation of mountains
5. Pole Wandering
6. Presence of Island Arc

1.2.2 Sea Floor Spreading:

In 1960, Professor Harry Hess and Robert W. Ditz introduce the concept. Seafloor spreading is a process that occurs at mid-ocean ridges, where new oceanic crust is formed through volcanic activity and then gradually moves away from the ridge.

Evidences:

1. Ocean floor sampling by Glomar Challenger.
2. Study of the deposited materials in ocean floor. Oceanic crust is more denser than continental crust. Density of Basaltic oceanic crust is 2.9 g/cm^3
3. Higher proportion of Radioactive elements are present in Continents than ocean floor.
4. Presence of earthquake centres in ocean floor.
5. Paleomagnetic evidence by F. J. Vine and D. H. Mathews.

1.2.3 Plate Tectonic

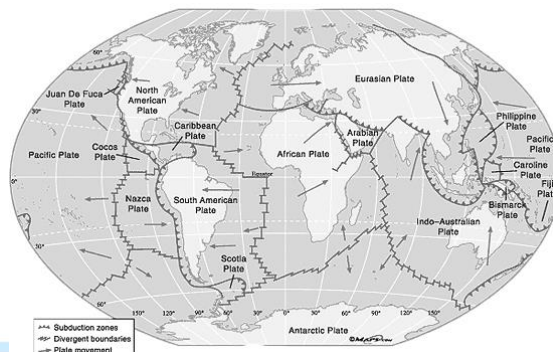
The 'Plate' first time used by J. T. Wilson in 1965. In 1967 Makenzie and Parker discuss elaborately about plate. W. J. Morgan and Le Pichon discussed about plate tectonic in 1968. Lithosphere is formed by seven large and many medium to small plates. Plate Tectonic is a scientific concept. Plate can float on asthenosphere. Asthenosphere is in semi liquid to liquid state.

1. Types of plates:

- A) Continental plates
- B) Oceanic plates

2. Types of plate boundaries:

- A) Destructive plate boundaries - Himalaya
- B) Constructive plate boundaries- Mid-oceanic ridge of Atlantic Ocean
- C) Transverse plate boundaries – San Andean fault(dextral motion)



Subduction zone, Divergent Boundaries and plate movement direction

Subduction: it is a geological process that takes place at destructive plate boundary.

Sinistral motion-leftside towards to the observer

dextral motion-rightside towards to the observer

Previous Year Question**July - 15**

1. Who postulated the concept of Sea floor spreading?

- (A) W. J. Morgan
- (B) T. J. Wilson
- (C) Le Pichon
- (D) Harry Hess



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Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO.
1.	8	D	1.2.2



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December - 15

1. Which of the following are evidences in favour of the continental drift theory?

- (1) Zig – saw fit (2) Trans – current faults
(3) Fossils in different areas (4) Convection in mantle

Codes :

- (A) (1) and (3)
(B) (1) and (4)
(C) (1) and (2)
(D) (1) , (3) and (4)

2. Which of the following authors is associated with the concept of Geosyncline?

- (A) Penck and Davis
(B) Wooldridge and Morgan
(C) Hall and Dana
(D) Wooldridge and Lapichon

3. Which one of the following plateau can be considered as intermontane?

- (A) Brazilian
(B) Indian
(C) Tibatian
(D) Arabian

Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO.
1.	4	A	1.2.1
2.	1	C	1.1.7
3.	3	C	1.2.3



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July - 16

1. Given below are two statements, one labelled as **Assertion (A)** and other labelled as **Reason (R)**. Select your answer from the codes given below :

Assertion (A) : The islands along the Mid-Atlantic Ridge are highly prone to volcanic activity

Reason (R) : The sea-floor spreading is the main cause of earthquakes in the Atlantic Ocean

Codes :

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
- (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
- (C) (A) is true, but (R) is false.
- (D) (A) is false, but (R) is true.

2. Given below are two statements, one labelled as **Assertion (A)** and other labelled as **Reason (R)**. Select your answer from the codes given below :

Assertion (A) : Divergent plate margin cause sea floor spreading

Reason (R) : Construction plate margins result in the formation of faults

Codes :

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
- (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
- (C) (A) is true, but (R) is false.
- (D) (A) is false, but (R) is true.

Answer & Reference Table

SL. NO.	QUESTION SL. NO.	ANSWER	REFERENCES
1.	5	A	1.2.2, 1.2.3
2.	8	C	1.2.3



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January - 17

1. Which one of the following mountains is formed due to convergence of one oceanic and one continental plate?

- (A) Urals
- (B) Alps
- (C) Andes
- (D) Appalachians



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Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO
1.	1	C	1.2.3



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November - 17

1. The process in which one plate slides beneath another is known as:

- (A) Advection
- (B) Subduction
- (C) Convergence
- (D) Convection

2. San Andrean fault is a:

- (A) Transform fault
- (B) Converging fault
- (C) Spreading fault
- (D) Submergent fault

3. Match **List - I** with the **List - II** and select the correct answer from the code given below:

List - I**List - II****(Scholar)****(Theory)**

- (a) Hall and Dana
- (b) Hutton
- (c) Harry Hess
- (d) Jeffrey

- (i) Sea floor Spreading
- (ii) Thermal Contraction Theory
- (iii) Theory of Geosyncline
- (iv) Doctrine of Uniformitarianism

Code:

- | | (a) | (b) | (c) | (d) |
|------------|------------|------------|------------|------------|
| (A) | (i) | (ii) | (iv) | (iii) |
| (B) | (ii) | (i) | (iii) | (iv) |
| (C) | (iv) | (ii) | (i) | (iii) |
| (D) | (iii) | (iv) | (i) | (ii) |

4. Given below are two statements, one labelled as **Assertion (A)** and the other labelled as **Reason (R)**. Select your answer from the code given below:

Assertion (A): There is close relationship between volcanic activities and plate margins.

Reason (R): A vast majority of the world's volcanoes are associated with the convergent plate margins.

Code:

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
- (B) Both (A) and (R) are true, but (R) is not a correct explanation of (A).
- (C) (A) is true, but (R) is false.
- (D) (A) is false, but (R) is true.

5. Match **List - I** with the **List - II** and select the correct answer from the code given below:

List - I

(Plate name)

- (a) Indo-Australian plate
- (b) Cocos plate
- (c) Pacific plate
- (d) Nazca plate

List - II

(Direction of movement)

- (i) East
- (ii) West
- (iii) North
- (iv) North-West

Code :

- | | | | | |
|-----|-------|------|-------|------|
| (a) | (b) | (c) | (d) | |
| (A) | (iii) | (iv) | (i) | (ii) |
| (B) | (iii) | (iv) | (ii) | (i) |
| (C) | (iii) | (ii) | (i) | (iv) |
| (D) | (i) | (ii) | (iii) | (iv) |

Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO.
1.	2	B	1.2.3
2.	3	A	1.2.3
3.	5	D	1.2.2, 1.1.7, 1.3.1
4.	6	A	1.2.3
5.	18	B	1.2.3



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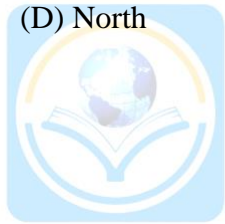
July - 18

1. Which one of the following types of plate boundaries and motions are exemplified by the San Andreas fault of California ?

- (A) Transform boundary with Sinistral motion
- (B) Transform boundary with dextral motion
- (C) Divergent boundary with sinistral motion
- (D) Convergent boundary with dextral motion

2. In which of the following direction the Nazca Plate is moving?

- (A) East
- (B) West
- (C) South
- (D) North



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Answer & Reference Table

SL. NO	QUESTION NO.	ANSWER	REFERENCE NO.
1.	13	B	1.2.3
2.	23	A	1.2.3



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Sub Unit – 3:

Cycles of Erosions and Landforms

--

1.3.1 Some Fundamental concepts:

1. The same physical processes and laws that operate today operated throughout geologic time, although not necessarily with the same intensity as now (in 1785 Hutton's write principle of uniformitarianism in his book "Theory of the Earth". In 1802, Play Fair believes "Present is the key to past")

2. Geologic structure is a dominant control factor in the evolution of land forms and is reflected in them.

3. To a large degree the earth's surface possesses relief because the geomorphic processes operate at differential rates.

4. Geomorphic processes leave their distinctive imprint upon land forms and each geomorphic process develops its own characteristic assemblage of land forms.

5. As the differential erosional agents act upon the earth's surface there is produced an orderly sequence of land forms.

6. Complexity of geomorphic evolution is more common than simplicity.

7. Little of the earth's topography is older than Tertiary and most of it is no older than Pleistocene.

8. Proper interpretation of present-day landscapes is impossible without a full appreciation of the manifold influences of the geologic and climatic changes during the Pleistocene.

9. An appreciation of world climates is necessary to a proper understanding of the varying importance of the different geomorphic processes.

10. Geomorphology, although concerned primarily with present day landscapes attains its maximum usefulness by historic extension.

1.3.1.1 Some Popular books and the authors:

Books	Authors
Principles of Geomorphology	W.D. Thornbury
The study of Landforms	R.J.Small
Unstable Earth	J.A. Steers
Morphology of the Earth	L.C.King
Spirit and Purpose of Geography	Von Richthofen
Principles of Geomorphology	Woolridge and Morgan

1.3.2 Denudation and erosion:

Denudation involves the processes that cause the wearing away of the Earth's surface by moving water, by ice, by wind and by waves, leading to a reduction in elevation and in relief of landforms and of landscapes.

Rainfall, and the surface runoff which may result from rainfall, produces four main **types** of soil **erosion**: splash **erosion**, sheet **erosion**, **rill erosion**, and gully **erosion**.

1.3.3 Weathering:

The process of deformation of rocks by atmospheric agents (temperature, Rainfall, humidity, chemical reaction etc.) is called Weathering. Physical weathering depends upon temperature, pressure etc. Chemical weathering depends upon low temperature, rainfall, humidity etc.

1.3.3.1 Process of Mechanical Weathering :

- a) Insolation weathering
- b) Unloading weathering
- c) Crystal weathering
- e) Moisture weathering

1.3.3.2. Process of Chemical Weathering:

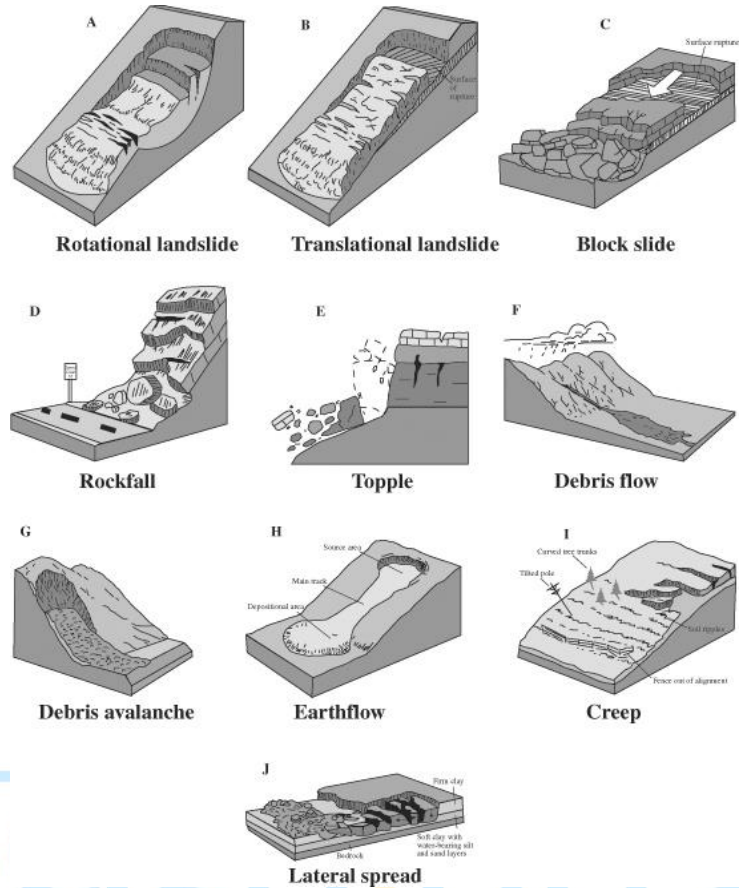
- a) Solution-
- b) Carbontion-
- c) Hydrolysis-
- d) Hydration-
- e) Oxydation-
- f) Reduction-
- g) Chelation-

1.3.4 Mass wasting:

Mass wasting, also known as slope movement or mass movement, is the geomorphic process by which soil, sand, regolith, and rock move down slope typically as a solid, continuous or discontinuous mass, largely under the force of gravity, frequently with characteristics of a flow as in debris flows and mudflows.

Types:

1. Fall
2. Topple
3. Subsidence
4. Collapse
5. Settlement
6. Block glide
7. Spreading
8. Cambering
9. Sacking
10. Creep
 - a) soil creep
 - b) rock creep
 - c) talus creep
 - d) rock-glacier creep
 - e) solifluction
11. Landslide
12. Slump
13. Flow

**1.3.4.1 Landslide and avalanches:**

A **landslide** is defined as the movement of a mass of rock, debris, or earth down a slope under the direct influence of gravity.

Causes of landslide:

1. Earthquake
2. Rainfall
3. Human activity

Avalanches occur when the snow-pack starts to weaken and allows the buildup of snow to be released. Small avalanches are generally made up of ice, snow and air. The larger ones comprise of rocks, trees, debris and even mud that is resting on the lower slopes.

Types of Avalanches

1. Loose Snow Avalanches: They are common on steep slopes and are seen after a fresh snowfall.
2. Slab Avalanches: Loose Snow Avalanches in turn could cause a Slab Avalanche, which are characterized by the fall of a large block of ice down the slopes.
3. Powder Snow Avalanches: The bottom half of this avalanche consists of a slab or a dense concentration of snow, ice and air. Above this is a cloud of powdered snow, which can snowball into a larger avalanche as it progresses down the slope.
4. Wet Snow Avalanches: They travel slowly due to friction, which collects debris from the path fairly easily. The avalanche comprises of water and snow at the beginning.

Causes of Avalanches

1. Snowstorm and Wind Direction:
2. Heavy snowfall:
3. Human Activity:
4. Vibration or Movement:
5. Layers of Snow: There are conditions where snow is already on the mountains and has turned into ice. Then, fresh snow falls on top which can easily slide down.
6. Steep Slopes:
7. Warming Temperature

Effects of Avalanches:

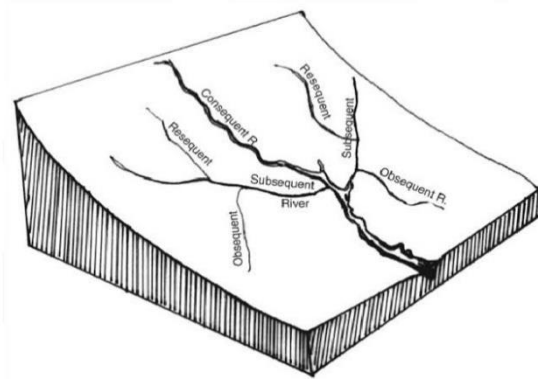
1. Damage to Life and Property
2. Flash floods
3. Economic Impact

1.3.5 Landforms and evolutions:

1. 3. 5. 1 River:

A) Types of Streams:

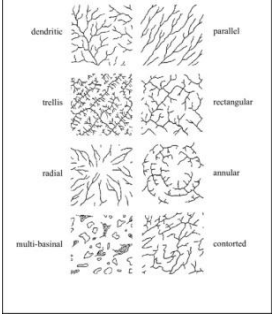
6. **Consequent** streams are streams whose course is a direct consequence of the original slope of the surface
7. **Subsequent** streams are streams whose course has been determined by selective headward erosion along weak strata.
8. **Resequent** streams are streams whose course follows the original relief, but at a lower level than the original slope (e.g., flows down a course determined by the underlying strata in the same direction). These streams develop later and are generally a tributary to a subsequent stream.



Types of streams

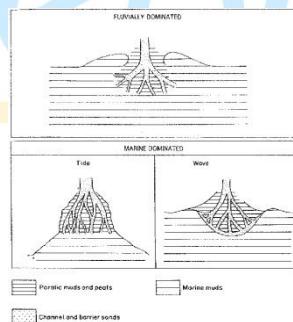
9. **Obsequent** streams are streams flowing in the opposite direction of the consequent drainage.
10. **Insequent** streams have an almost random drainage often forming dendritic patterns. These are typically tributaries and have developed by a headward erosion on a horizontally stratified belt or on homogeneous rocks. These streams follow courses that apparently were not controlled by the original slope of the surface, its structure or the type of rock.

B) Drainage Patterns:

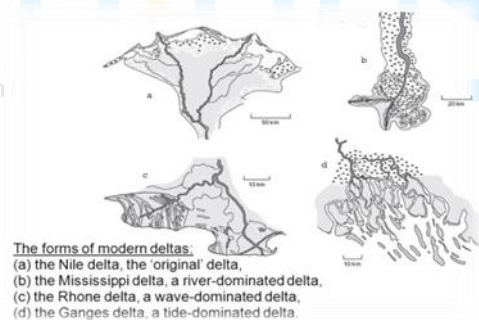
1. Dendritic	7. Contorted	 <p>Types of drainage patterns</p>
2. Parellel	8. Centrifugal	
3. Trellis	9. Braided	
4. Rectangular	10. Anastomosing	
5. Redial	11. Anabranching	
6. Annular		

Depositional landforms:**Classification of Delta by domination:**

1. Web dominated
2. Tide dominated
3. Fluvial dominated



Delta by dominating factors



Delta by dominating factors

Classification of Delta by Shape:

1. Caspete
2. Birdfoot
3. Esturine delta
4. Aquate etc.

Deposition on different position of River channels: Point bar, Terrace deposits

E) Landform evolution:

1. Cycle of Erosion by W.M.Davis:

William Morris Davis was an American Geomorphologist. In geology and geomorphology a **base level** is the lower limit for an erosion process. The modern term was introduced by John Wesley Powell in 1875. The term was subsequently appropriated by William Morris Davis who used it in his cycle of erosion theory.

Concept: According to Davis "Landscape is the function of structure, process and time". These three factors are also called "Trio of Davis".

Basic premises of Davisian Model: 1) There is vertical upliftment of landmass. 2) There is rapid rate of upliftment of landmass. 3) During upliftment no erosion will be started. 4) Streams erode their valley rapidly downward until the graded condition is achieved.

Stages of cycle of erosion and their characteristics

- a) Youth stage: Very steep and narrow valley. Valley form is gorge and canyon. Absolute height remain constant because of very less amount of lateral erosion. Relative height is continuously increasing, because of rapid down ward erosion. Valleys are of V shape characterized by convex valley side slope. Long profile of rivers are characterized by rapids and waterfall.
- b) Mature stage: In this stage steep valley slope turns into wide valley due to lateral erosion. The graded conditions spread over larger area and most of the tributaries are graded to base level of erosion.
- c) Old stage: This stage is characterised by almost total absence of downward erosion but lateral erosion is still active. Thus height of water divide decreases rapidly. The entire valley became almost flat with concave valley side slopes. This type of landscape is called as peneplain. Sometimes hard rocks are stand over the peneplain, which resistant to erosion, known as Monadnocks.

After end of old stage **rejuvenation** may require to start youth stage again.

CRITICISM

1. Upliftment instead of sudden, is a very long process
2. Endogenetic and exogenetic forces don't act in isolation.
3. Too much emphasis on stage, role of structure and process less discussed.
4. L.C.King objected that fluvial cycle is normal cycle as $\frac{2}{3}$ of landscape is either arid, semi arid or Savanna type.
5. Cyclicity criticised by J.T.Hack and Strahler in there non-cyclic models.
6. Landform development is polycyclic.i.e before a cycle completes another cycle starts and gets superimposed.
7. Role Isostatic adjustments ignored.
8. Crickmay has also been a bitter critic of Davis' concept of peneplanation. He firmly believes that plantation by lateral erosion which begins in the stage of maturity of a river, and which continues long after valley deepening has stopped, must play a significant part in the late stages of the cycle of erosion.

2. Morphological Analysis by Penck:

Penck provided his theory in his work 'Morphological analysis and its perspective'. This theory was a reaction to Davies theory on cycle of erosion. Contrary, to Davies he emphasized on role of endogenetic forces in landform development and also, replaced stage with a time-independent concept of Phase.

BASIC POSTULATES

1. Upliftment starts on a featureless plain dotted with residual hardrocks, similar to peneplain of Davies. Penck called it Primarumf.
2. Upliftment is very long process and too protracted in time.
3. Endogenetic and exogenetic works in tandem. Thus, upliftment and erosion goes side by side.
4. Landforms are the expression of ratio of work done by both endogenetic and exogenetic forces.

5. Landform development takes place in Phases rather stages.
6. End product of landform development is called Endrumf.

GRAPHICAL MODEL

1. Waxing phase

Upliftment is greater than summit erosion. Thus, absolute relief increases. Valley deepening is faster than upliftment of valley. Thus, relative relief increases. Mountain slopes are undergoing parallel retreat at various section forming treppen. Various channels are developed due to channel lengthening by headward erosion.

2. Phase of uniform development

Summit erosion and valley deepening rate almost similar. Thus, absolute relief almost constant. Valley deepening and valley upliftment also almost similar. Thus, valley height and relative relief almost similar.

3. Waning Phase

Upliftment stops completely. Summit erosion is fast. Absolute relief decline rapidly. Relative relief also decline rapidly as valley deepening has stopped. Lateral erosion results in valley widening.

4 Endrumf

Landscape development ends with a featureless low plain dotted by inselberg. It is called endrumf.

3. Parallel Retreat theory by LC King:

His theory on geomorphic cycle is based on landscapes of semiarid and arid. He has criticised many elements of Davies theory, though there are some similarities too.

Davies considered fluvial cycle as normal cycle which was severely criticized by King. According to him $\frac{2}{3}$ of landscapes in world are either arid, semi-arid or savanna type. Thus, arid cycle should be the normal cycle.

BASIC POSTULATES

- Upliftment of mountains are sudden process.
- Erosion process starts once upliftment stops.
- Landforms are in equilibrium with climate and thus it does not affect its cyclicity.
- Slopes of mountains are constantly retreating or apparently shifting which is called parallel retreat.
- Mountain slope can be divided into broadly 4 sections. Slope in each sections are changing through different mechanism as explained in the figure.

1. Youth Stage:

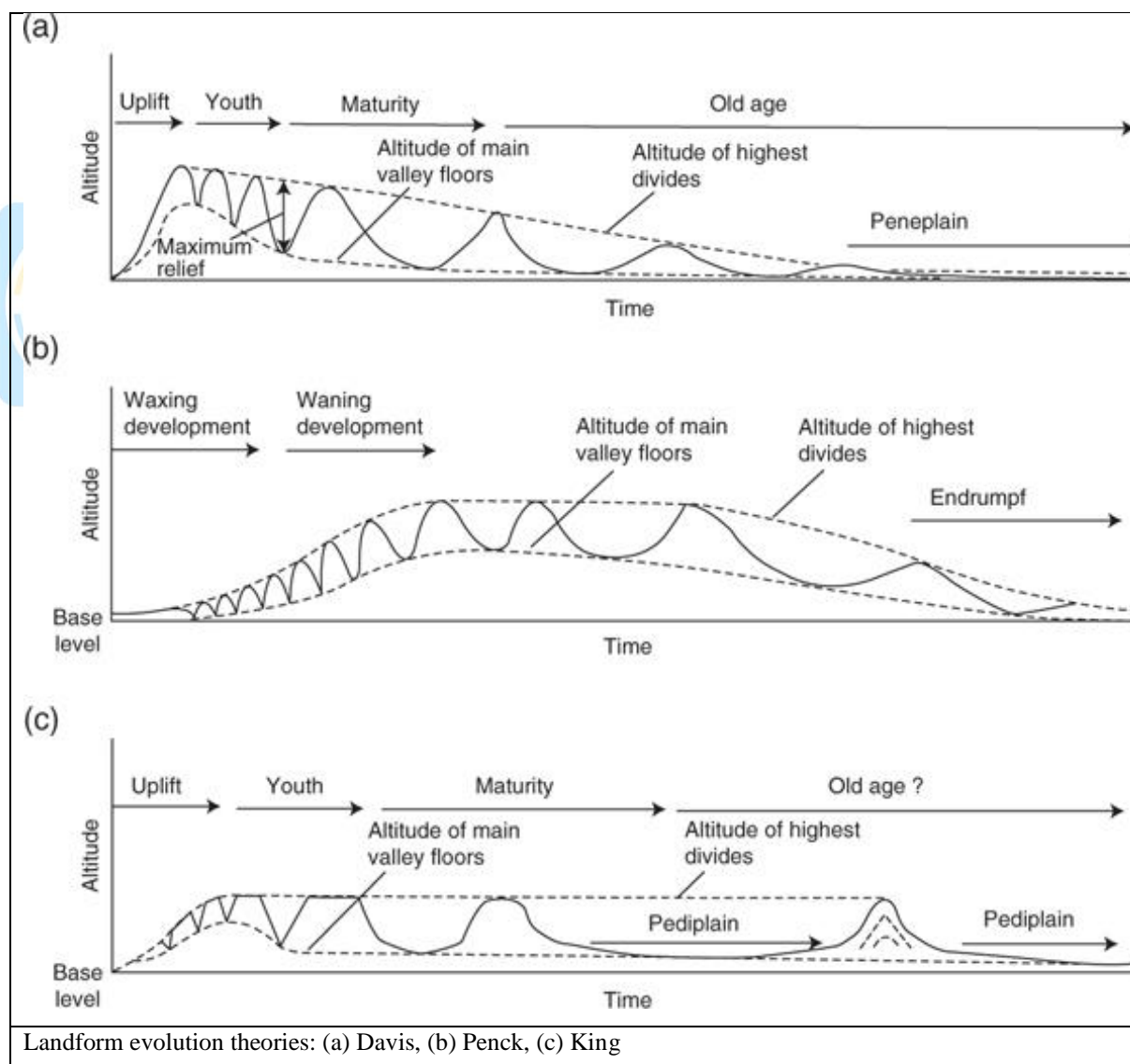
- Inselbergs rounded summit erodes through soil creep mechanism.
- Parallel face or scarp face below the summit section goes parallel retreat.
- At the end of this stage, inselbergs are transformed into rounded hillocks called Koppes.
- Pedimentation does not occur in this stage.
- Only valley deepening occurs and no lateral erosion takes place.

2. Mature Stage:

- Valley deepening stops. Lateral erosions results in valley widening.
- Pedimentation starts where rectilinear slope below parallel scarp section develops.
- Pedimentation include cavitation at the foot and sheet erosion by seasonal streams.
- Parallel retreat continues and they are combinedly called pediplanation.
- At the end of this stage, Koppes are transformed in debris rocks.

3. Old Stage

- Pedimentation continues at large scale and valley sides develop vast pediments.
- Extensive pediments of valley sides starts to coalesce together to form extensive area of pediments.
- Sediments in valley are deposited in fan shape known as Bajada.
- In the mid valley, salty marshes or lakes are formed which are known as playa.
- Thus, in the end of cycle the landscape formed is referred as pedepain characterized by rock debris, extensive pediments, bajada and playa.



1.3.5.2 Glacier and periglacier:

A) Landform evolution in periglacial:

In 1950, Peltier proposed periglacial cycle of erosion. The periglacial cycle of erosion begins with a non-periglacialized landscape. Once-periglacialized mass wasting of [regolith](#) exposes bedrock in the upper slopes. These outcrops are then subject to [frost weathering](#) that makes [slopes retreat](#) forming extensive [blockfields](#) at the base of the bedrock areas. At a later stage [solifluction](#) wears down summits and fills in topographic lows.

B) Landform evolution in glacial:

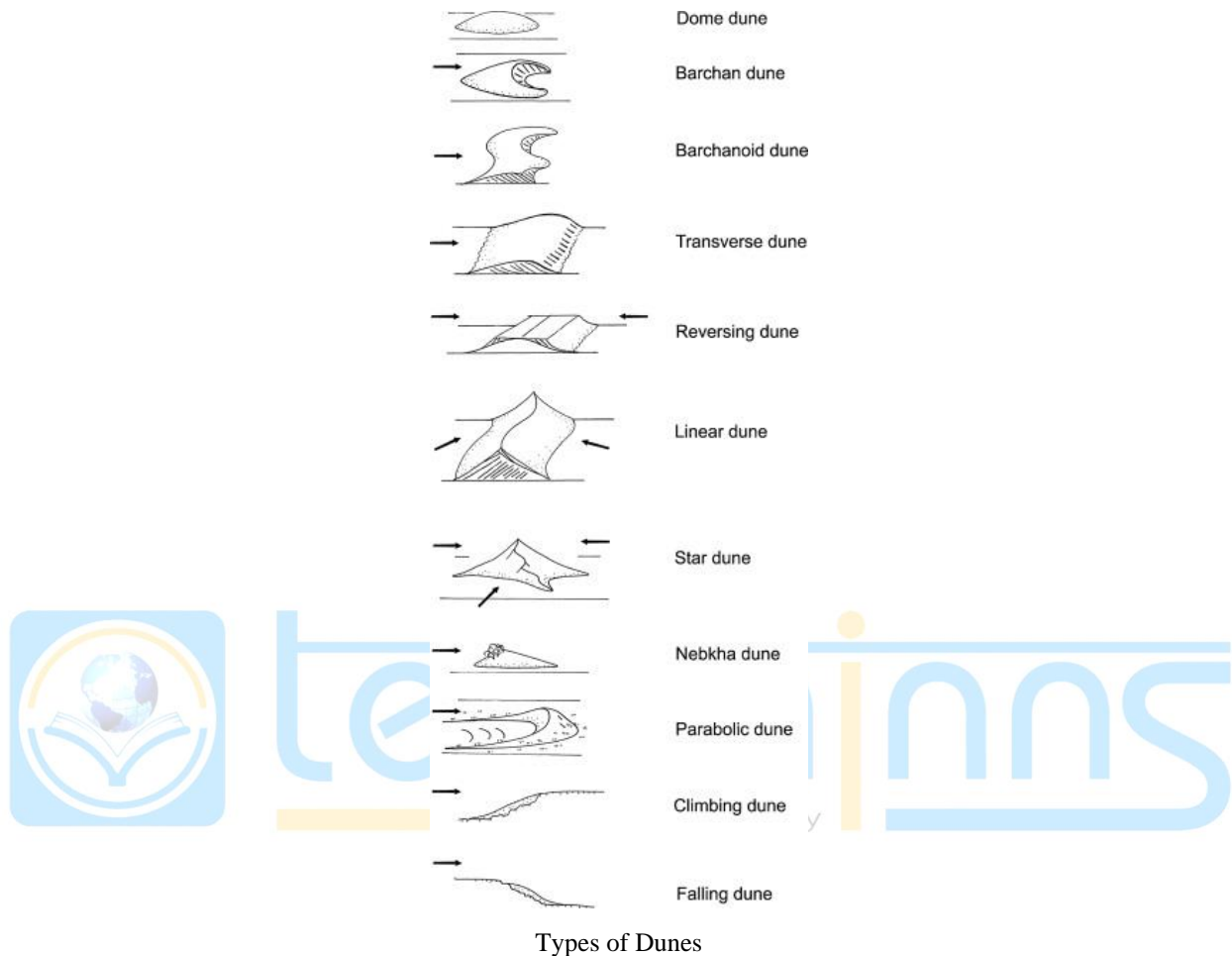
In 1900 W.M. Davis proposed the theory of Glacial erosion cycle. The glacial cycle of erosion deals with mountainous regions and lacks an old stage since Davis argues that nothing more developed than mature glacial landscapes exists at present. A glacial cycle of erosion begins with a pre-glacial landscape. Over time valley glaciers erode the underlying rock at different rates, creating valleys and glaciers that are more entrenched than others. As time passes the less-entrenched glaciers reach the same levels of entrenchment as the more entrenched ones, since the deeper a glacier erodes, its erosive power diminishes. In a mature stage, valleys form smooth-sided troughs.

C) Some Landforms:

Esker, Paternoster lake, Kem etc.

1.3.5.3 Aeoline Landforms:

A. Classification of sand dunes



B) Landform evolution:

1.Cycle by Davis: In 1905, W.M.Davis propounded arid cycle of erosion. At the beginning of the cycle of erosion in arid climate there are numerous small basins to where material is washed during the scarce rainfall events. In the next stage (*youthful stage*) valleys are developed and highlands dissected by these. Gentle slopes and basins accumulated material derived from the highlands. In the *mature stage* drainage basins coalesce. At the end a stage is reached where the terrain has lost much of its relief and deflation hollows interfere with the drainage systems, breaking it up into local systems. During all stages sand and dust might be *exported* by wind to other landscapes.

2. Cycleby L.C.King: see 1.3.5.1.E.3

3. Gilbert believed the origin of pediments in the Henry Mountains are due to stream planation and active erosion of deserts.

C)The role of lateral planation by stream in the formation of pediments:

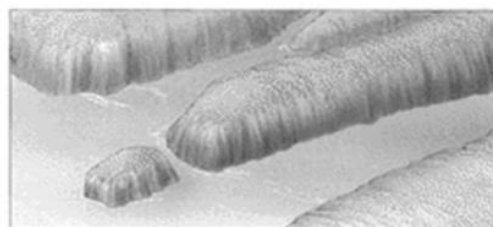
Mc Gee, Paige, Johnson etc.

1.3.5.4 Coastal:

A) Types of coasts:



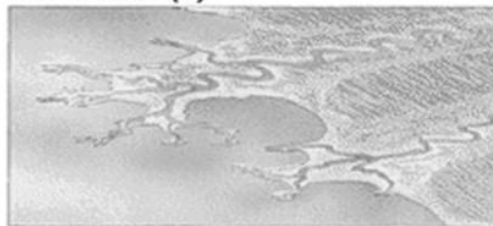
Ria coast (a)



Fiord coast (b)



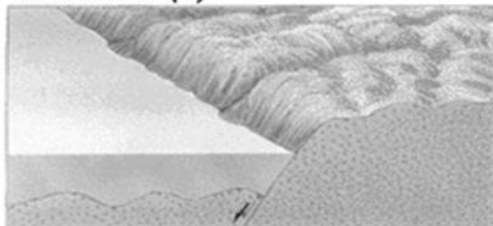
Barrier-island coast (c)



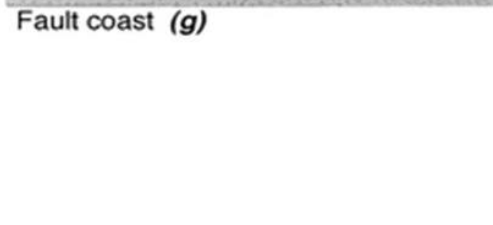
Delta coast (d)



Volcano coast (left) (e)

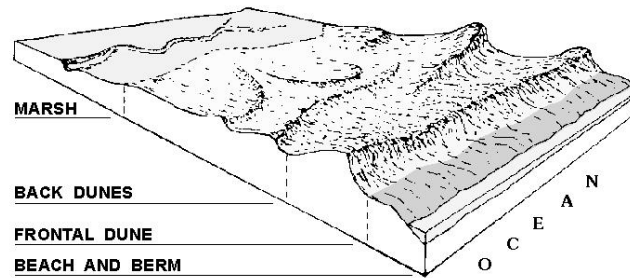


(f) Coral-reef coast (right)



Fault coast (g)

T

B.Coastal Dunes:**C)Web cut platform:**

A **wave-cut platform**, shore **platform**, coastal bench, or **wave-cut** cliff is the narrow flat area often found at the base of a sea cliff or along the shoreline of a lake, bay, or sea that was created by erosion.

D) Landform evolution:

In 1919 Johson proposed the the cycle of coastal erosion. Alternate models are proposed for shore profiles: one for shore profiles of emergence and another for shore profiles of submergence. A complementary model can be applied to shore lines where different parts might have undergone submergence and emergence.

1.3.5.5 Karst:**A) Landform evolution:**

In 1918, Cvijic propound karst cycle of erosion. The cycle of erosion in karst regions has three phases. At first the upper parts of fractures are dissolved, enlarged and filled with water. Normal fluvial valleys develop on the surface, small poljes might exist. Subsequently, re-routing of water by the growth of a karst system disorganizes the fluvial drainage pattern, with valley bottoms developing large do lines and uvalas. Ridges between uvalas gradually disappear as these landforms coalesce. If the bedrock is underlain by insoluble rock, normal fluvial valleys will slowly re-appear once the underground river systems reach the insoluble rock. In the end soluble rocks appear only as isolated hills. Contrary to Davis' original cycle of erosion the karst one does not end in the formation of a peneplain

Gardner- Static Water Zone Theory

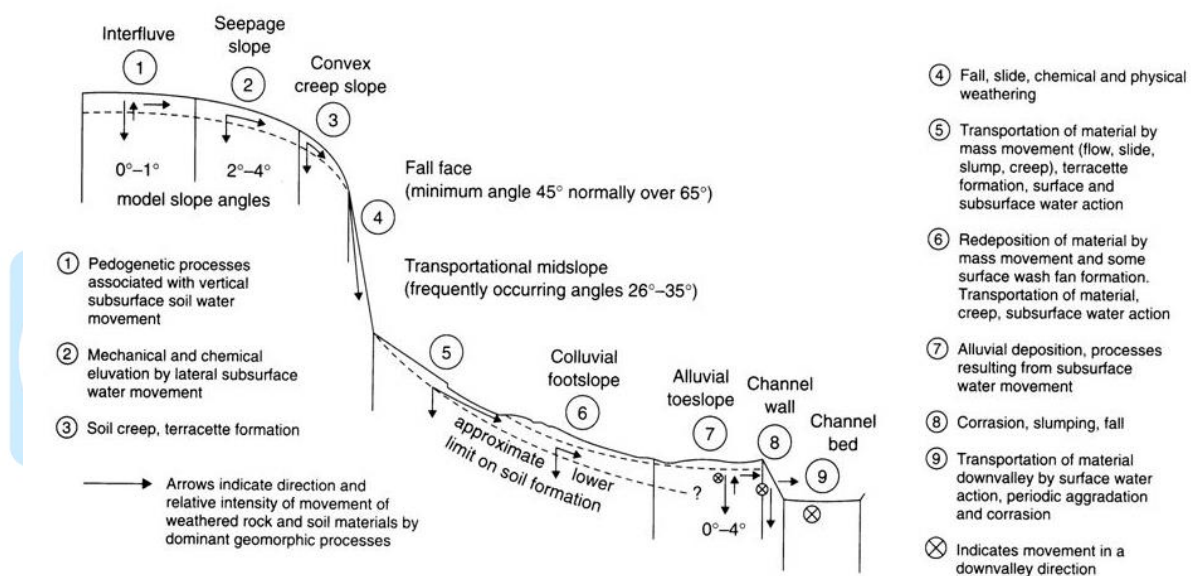
Malot- Vadose Zone Theory

Swinerton- Water table theory

Davis- Two cycle theory(Formation of karst cave)

1.3.6 Theories and Process of Slope Development:

A) Types of slope:



B) Theories:

a) Slope decline

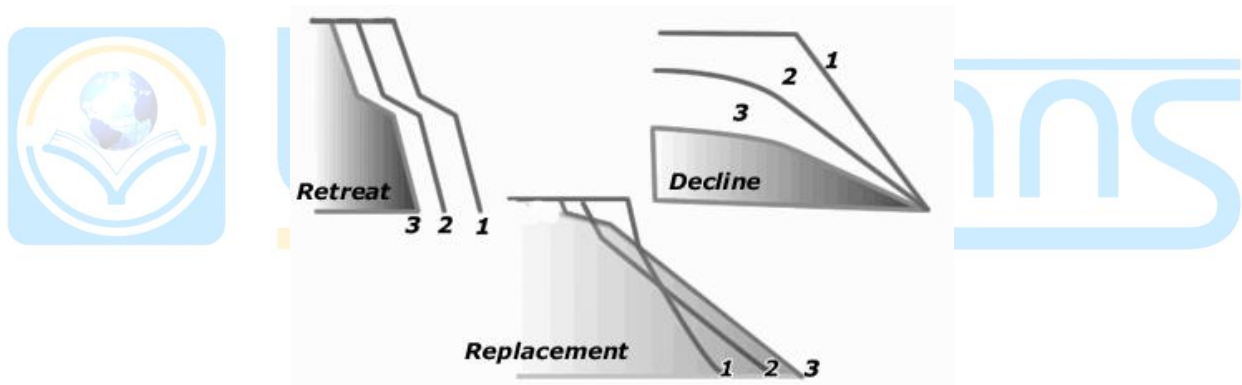
Slope decline was proposed by William Morris Davis in his cycle of erosion theory. It consists of a gradual decrease in slope angle as stream incision slows down.

b) Slope replacement

Slope replacement first proposed by Walther Penck challenging Davis' ideas on slope development. Slope replacement describes an evolution of slopes that is associated with decreasing rates of over-all erosion (denudation).

c) Parallel slope retreat

King considered scarp retreat and the coalescence of pediments into pediplains a dominant processes across the globe. Further he claimed that slope decline was a special case of slope development seen only in very weak rocks that could not maintain a scarp. Slopes that are convex upslope and concave downslope and have no free face were held by King to be a form that became common in the late Tertiary. King argued that this was the result of more slowly acting surface wash caused by carpets of grass which in turn would have resulted in relatively more soil creep.



Slope: retreat, decline and replacement

Previous Year Question**July - 14**

1. The landscapes produced by a single dominant geomorphic process called as

- (A) Simple Landscapes
- (B) Compound Landscapes
- (C) Monocyclic Landscapes
- (D) Multicyclic Landscapes

2. Flat topped sandridges with long dimensions extending parallel to the Prevailing winds but locking collapsing fronts are known as

- (A) Whalebacks
- (B) Seifs
- (C) Barchans
- (D) Sand drifts



3. The river valleys whose courses are controlled by factors which are determinable are termed as

- (A) Consequent
- (B) Subsequent
- (C) Insequent
- (D) Resequent

4. Match **List – I** with **List – II** select the correct answer from codes given below :

List – I

(Books)

- a. Principles of Geomorphology
- b. The study of Landforms
- c. Unstable Earth
- d. Morphology of the Earth

List – II

(Authors)

- i. L.C. King
- ii. W.D. Thornbury
- iii. R.J. Small
- iv. J.A. Steers

Codes :

a	b	c	d	
(A)	ii	iii	iv	i
(B)	i	ii	iii	iv
(C)	iv	iii	ii	i
(D)	iii	i	iv	ii

5. The slope replacement model was propounded by

- (A) Wood
- (B) Davis
- (C) Penck
- (D) Strahler

6. Lateral Planation Theory of pediment formation was proposed by

- (A) Lawson
- (B) Davis
- (C) Gilbert
- (D) McGee

7. Match **List – I** with **List – II** and select the correct answer from the codes given below:

List – I	List – II
(Books)	(Authors)
a. Geomorphology	i. Wooldridge and Morgen
b. Essays in	ii. Strahler Geomorphology
c. Physical	iii. Lobeck Geography
d. An outline of	iv. Dury Geomorphology

Codes :

	a	b	c	d
(A)	iii	iv	ii	i
(B)	i	iv	ii	iii
(C)	iii	ii	iv	i
(D)	iv	iii	i	ii

8. Paternoster lakes are features typical of :

- (A) Lava Plains
- (B) Piedmonts
- (C) Deserts
- (D) Glacial Troughs

9. Match **List – I** with **List – II** and select the correct answer from the codes given below:

List – I
(Theories of Cavern formation)

- a. Two cycle theory
- b. Water table theory
- c. Static waterzone
- d. Invasion Theory

List– II
(Scholar)

- i. Davis
- ii. Garner
- iii. Malot theory
- iv. Swinnerton

Codes :

- | | a | b | c | d |
|-----|----|-----|-----|-----|
| (A) | i | iv | ii | iii |
| (B) | i | ii | iii | iv |
| (C) | iv | iii | i | ii |
| (D) | ii | i | iv | iii |

10. Which one of the following process typical to glacial erosion ?

- (A) Plucking
- (B) Hydrolic action
- (C) Deflation
- (D) Corrosion

11. Given below are two statements, one labelled as **assertion (A)** and the other labelled as **Reason(R)**. Select your answer from the codes given below :

Assertion (A): Deep chemical decay of rocks is one of the out standing features of humid tropical regions.

Reason (R): Intensity of chemical weathering depends to a large degree upon an abundance of water and high air temperatures.

Codes :

(A) Both (A) and (R) are true and (R) is correct explanation of (A).

(B) Both (A) and (R) are true, but (R) is not correct explanation of (A).

(C) (A) is true but (R) is false.

(D) (R) is true but (A) is false.



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12. Crickmay, while disagreeing with Davis, supplanted peneplain with the term :

(A) Pediplain

(B) Panplane

(C) Etch plain

(D) Structural plain

Answer & Reference Table

SL. NO.	QUESTION SL. NO.	ANSWER	REFERENCES
1.	1	A	1.3.5.1
2.	2	A	1.3.5.3
3.	3	C	1.3.5.1
4.	4	A	1.3.1.1
5.	5	C	1.3.6.2
6.	1	C	1.3.5.3
7.	2	A	1.3.1.1
8.	4	D	1.3.5.2
9.	5	A	1.3.5.5
10.	6	A	1.3.5.2
11.	7	A	1.3.3
12.	8	B	1.5.1C

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December - 14

1. The most fundamental principle of Earth Science “Uniformitarianism” for the first time presented in the book entitled

- (A) Principles of Geology
- (B) Geomorphology from the Earth
- (C) Unstable Earth
- (D) Theory of the Earth

2. Which of the following phrased the concept “Landscape is function of process, structure and stage” ?

- (A) W.M. Davis
- (B) L.C. King
- (C) A.N. Strahler
- (D) Thornbury

3. Match the **List – I** with **List – II** and select the correct answer from the codes given below:

List – I**(Agents of Erosion)**

- a. Running water
- b. Moving ice
- c. Blowing wind
- d. Dashing wave

List – II**(Erosional Features)**

- i. Hanging valley
- ii. Incised meander
- iii. Head and Bay
- iv. Barchan

Codes :

- | | a | b | c | d |
|-----|----|----|-----|-----|
| (A) | i | ii | iii | iv |
| (B) | ii | i | iv | iii |
| (C) | i | ii | iv | iii |
| (D) | ii | i | iii | iv |

4. Which of the following condition is not essential for a limestone landscape to develop into karst topography ?

- (A) The limestone formation must contain 100% calcium carbonate for solution processes.
- (B) Complex patterns of joints in the otherwise impermeable limestone.
- (C) There must be an aerated zone between the ground surface and the water table
- (D) Good vegetation cover

5. Identify the correct sequence of terminology used for denoting different parts along a sloping ground from top to bottom :

- i. Debris slope ii. Waning slope
- iii. Waxing slope iv. Free face

- (A) ii, iii, i, iv
- (B) iii, ii, iv, i
- (C) iii, iv, ii, i
- (D) iii, iv, i, ii



6. The term 'active layer' is associated with

- (A) Fluvial deposition
- (B) Plate tectonic
- (C) Periglacial processes
- (D) Processes of soil formation

7. Match **List – I** with **List – II** and select the correct answer from the codes given below :

List – I

(Concept/Theory)

- a. Base level
- b. Parallel retreat
- c. Cycle of erosion
- d. Stream competency and capacity

List – II

(Put forwarded by)

- i. G.K. Gilbert
- ii. W. Penck
- iii. J.W. Powell
- iv. W.M. Davis

Codes :

- | | a | b | c | d |
|-----|----------|----------|----------|----------|
| (A) | iii | ii | iv | i |
| (B) | ii | i | iii | iv |
| (C) | iii | ii | i | iv |
| (D) | ii | iv | i | iii |

8. Hydration process belongs to

- (A) Physical and Biological processes
- (B) Chemical processes
- (C) Biological and Chemical processes
- (D) Physical and Chemical processes

9. Match List – I with List – II and select the correct answer from the codes given below :

List – I

- a. Gour
- b. Graben
- c. Gabro
- d. Groin

List – II

- i. Lithosphere
- ii. Littoral zone
- iii. Aeolian area
- iv. Orogenic belt

Codes :

- | | a | b | c | d |
|-----|----------|----------|----------|----------|
| (A) | iii | iv | i | ii |
| (B) | iii | iv | ii | i |
| (C) | ii | iv | iii | i |
| (D) | iii | ii | i | iv |

10. The “wave-cut platform” is found in

- (A) **California coast**
- (B) Hokkaido coast
- (C) Madagascar coast
- (D) Malabar coast

Answer & Reference Table

SL. NO.	QUESTION SL. NO.	ANSWER	REFERENCES
1.	1	D	1.3.1
2.	2	A	1.3.5.1.C
3.	5	B	1.3.5.1,1.3.5.2,1.3.5.3,1.3.5.4
4.	7	D	1.3.5.5
5.	8	D	1.3.6.1
6.	1	B	1.3.5.2
7.	2	A	1.3.1, 1.3.6.2
8.	3	D	1.3.3.2
9.	12	A	1.3.5.3,1.3.5.4
10.	13	A	1.3.5.4



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July - 15

1. Match the **List-I** with **List-II** and select the correct answer from the given codes:

List-I (Concept)	List-II (Proposer)
(a) Peneplain	(i) Holmes
(b) Uniformitarianism	(ii) W.M. Davis
(c) Tetrakedral kypotkesis	(iii) Hutton
(d) Convectional Current Tkeory	(iv) Lotkian Green

Codes:

	(a)	(b)	(c)	(d)
(A)	(ii)	(iii)	(iv)	(i)
(B)	(iii)	(i)	(ii)	(iv)
(C)	(i)	(ii)	(iv)	(iii)
(D)	(iv)	(ii)	(iii)	(i)

2. Who postulated the concept of Base level?

- (A) Walther Penck
- (B) W.M. Davis
- (C) J.W. Powell
- (D) James Hutton

3. Ria is an example of:

- (A) Deposited land features
- (B) Emerged upland skorelines
- (C) Submerged upland skorelines
- (D) Eroded land forms

4. Who wrote the book “Illustration of the Huttonian Theory of the earth”?

- (A) James Hutton
- (B) John Playfair
- (C) Vidal de la Blache
- (D) W.M. Davis



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5. For coastal sand dune formation, the ideal grain size diameter is:

- (A) 0.15 mm
- (B) 0.50 mm
- (C) 0.25 mm
- (D) 0.75 mm

6. Drowned glaciated valleys in high latitudes regions are known as:

- (A) Ocean trenches
- (B) Submarine ridges
- (C) Fiords
- (D) Submarine canyons



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Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO.
1.	1	A	1.3.1, 1.3.5.1,c, 1.1.7.4
2.	5	C	1.3.5.1
3.	2	B	1.3.5.4
4.	4	B	1.3.1
5.	12	C	1.3.5.4
6.	2	C	1.3.5.4



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December - 15

1. Which one of the following is unrelated to the denudational action of mass movement?

- (A) Basal sapping
- (B) Exfoliation
- (C) Landslide
- (D) Mud flow

2. Which one of the following features are unrelated with mountain glaciation ?

Choose the correct answer from the codes given below.

- (1) Cirques (2) Tarn (3) Aretes (4) Fiords

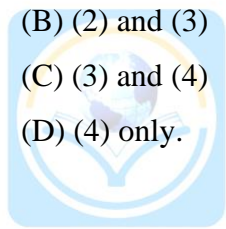
Codes :

(A) (1) and (2)

(B) (2) and (3)

(C) (3) and (4)

(D) (4) only.



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3. Match **List – I** with **List – II** and select the correct answer from the codes given below:

List – I**List – II****(Book title)****(Author)**

- | | |
|------------------------------------|----------------------|
| (a) Morphology of the Earth | (i) A. Holmes |
| (b) Principles of Physical Geology | (ii) Sparks |
| (c) Geomorphology | (iii) W.D. Thornbury |
| (d) Principles of Geomorphology | (iv) L.C. King |

Codes :

- | | | | |
|------------|------------|------------|------------|
| (a) | (b) | (c) | (d) |
| (A) (iv) | (i) | (iii) | (ii) |
| (B) (iv) | (i) | (ii) | (iii) |
| (C) (iv) | (ii) | (i) | (iii) |
| (D) (i) | (iv) | (ii) | (iii) |

4. Match **List - I** with **List - II** and select the correct answer from the codes given below:

List - I**List - II****(Author)****(Book)**

- | | |
|------------------------|------------------------------------|
| (a) K.W. Butxer | (i) Process in Geomorpology |
| (b) W.M. Davis | (ii) Geomorpology and Time |
| (c) C. Embleton, et al | (iii) Geomorphology from tke Earth |
| (d) J. Thornes, et al | (iv) The Geomorphic Cycle |

Codes :

- | | | | |
|------------|------------|------------|------------|
| (a) | (b) | (c) | (d) |
| (1) (iii) | (iv) | (ii) | (i) |
| (2) (iv) | (iii) | (ii) | (i) |
| (3) (iii) | (i) | (iv) | (ii) |
| (4) (iii) | (iv) | (i) | (ii) |

5. Given below are two statements, one labelled as **Assertion (A)** and other labelled as **Reason (R)**. Select your answer from the codes given below:

Assertion (A): Eskers are the features formed due to the depositional action of wind.

Reason (R): Eskers are the outcome of Fluvio-glacial deposition.

Codes:

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A)
- (C) (A) is true, but (R) is false
- (D) (A) is false, but (R) is true

6. Negative movements of baselevel produce:

- (A) Rejuvenation
- (B) Stabilisation
- (C) Attrition
- (D) Saltation

7. Match List - I with List - II and select the correct answer from the codes given below:

List - I

List - II

(Place of deposition)

(Name of deposition)

- | | |
|--------------------------|---------------------------------|
| (a) Channel | (i) Vertical accretion deposits |
| (b) Channel margin | (ii) Lag deposits |
| (c) Overbank flood plain | (iii) Colluvium |
| (d) Valley margin | (iv) Lateral accretion deposits |

Codes:

- | | | | | |
|-----|------|------|-------|-------|
| | (a) | (b) | (c) | (d) |
| (1) | (ii) | (i) | (iii) | (iv) |
| (2) | (iv) | (ii) | (i) | (iii) |
| (3) | (ii) | (iv) | (i) | (iii) |
| (4) | (ii) | (iv) | (iii) | (i) |

8. Which one of the following features is formed when the roof of a limestone cavern collapses?

- (A) Tarn
- (B) Polje
- (C) Swallow hole
- (D) Doline



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Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO.
1.	1	B	1.3.4
2.	2	D	1.3.5.2
3.	3	B	1.3.1.1
4.	2	A	1.3.5.1
5.	4	D	1.3.5.2
6.	5	A	1.3.5.1
7.	7	C	1.3.5.1
8.	8	B	1.3. 5.5



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July - 16

1. Normal Cycle of Erosion is associated with

- (A) Glacial Erosion
- (B) Fluvial Erosion
- (C) Marine Erosion
- (D) Wind Erosion

2. Crickmay while disagreeing with Davis supplemented peneplain with the terms

- (A) Pediplain
- (B) Panplane
- (C) Etchplain
- (D) Structural plain

3. Lateral planation theory of Pediment formation was proposed by

- (A) Lawson
- (B) Gilbert
- (C) Mc Gee
- (D) Davis

4. The concept of Base level of Erosion was proposed by

- (A) Malolt
- (B) Powell
- (C) Davis
- (D) Johnson

5. Which of the following groups of scholars stressed the role of lateral planation by stream in the formation of pediments ?

- (A) Paige, Blackwelder, Mc Gee
- (B) Blackwelder, Johnson, Paige
- (C) Mc Gee, Paige, Johnson
- (D) Paige, Johnson, Lawson

6. Match **List-I** with **List-II** and select the correct answer using codes given below.

List – I

(Theory of Cavern formation)

- I. Two Cycle Theory
- II. Water Table Theory
- III. Static Water Zone Theory
- IV. Invasion Theory

List – II

(Scholars)

- A. Davis
- B. Gardner
- C. Malot
- D. Swinnerton

Codes :

- | | I | II | III | IV |
|-----|---|----|-----|----|
| (A) | C | B | D | A |
| (B) | A | D | B | C |
| (C) | D | B | C | A |
| (D) | B | C | A | D |

7. Slope replacement model was propounded by

- (A) Wood
- (B) Davis
- (C) Penck
- (D) Strahler

8. The drainage pattern which is not controlled by the parent structure on which it flows is termed as

- (A) Consequent
- (B) Subsequent
- (C) Insequent
- (D) Resequent

9. The term “Swash” refers to

- (A) Backward movement of sea water at the beach after the breaking of a wave.
- (B) Oblique movement of sea water at the beach after the breaking of a wave.
- (C) Forward movement of sea water up the beach after the breaking of a wave.
- (D) Sideward movement of sea water up the beach after the breaking of a wave.

10. Which one of the followings is not a glacio-fluvial depositional feature ?

- (A) Drumlin
- (B) Esker
- (C) Horn
- (D) Kame

11. The unconsolidated rock material deposited by surface wash at the base of a cliff is called

- (A) Alluvium
- (B) Colluvium
- (C) Moraines
- (D) Silt

12. Given below are two statements, one is labeled as **Assertion (A)** and other labelled as **Reason (R)**. Select your answer from the codes given below.

Assertion (A) : The velocity of moving ice increases with steepness of slope of the area and thickness of glacial ice.

Reason (R) : The velocity decreases to the sides owing to lesser depth of ice and friction against the valley walls and the bottom floor.

Codes :

- (A) Both (A) and (R) are true, (R) is the correct explanation of (A).
- (B) Both (A) and (R) are true, (R) is not the correct explanation of (A).
- (C) (A) is true, but (R) is false.
- (D) (A) is false, but (R) is true.

13. Paternoster lakes are features of

- (A) Lava Plains
- (B) Piedmonts
- (C) Deserts
- (D) Glacial troughs



14. Match **List-I** with **List-II** and select the correct answer using codes given below.

List – I		List – II	
(Deposits)		(Processes)	
I.	Loess	A.	Fluvial
II.	Moraines	B.	Glacial
III.	Gravels	C.	Aeolian
IV.	Silt	D.	Marine

Codes :

	I	II	III	IV
(A)	A	B	D	C
(B)	C	B	D	A
(C)	D	A	C	B
(D)	C	D	A	B

15. "The present is the key to the past." This statement was made by

- (A) John Playfair
- (B) W.M. Davis
- (C) Walther Penk
- (D) James Hutton

16. A drainage pattern which is not related to the structure of the region is known as

- (A) Radial drainage
- (B) Trellis drainage
- (C) Dendritic drainage
- (D) Superimposed drainage

17. Given below are two statements, one labelled as **Assertion (A)** and other labelled as **Reason (R)**. Select your answer from the codes given below :

Assertion (A) : Deep chemical decay of rocks is one of the outstanding features of humid tropical regions

Reason (R) : Intensity of chemical weathering depends to a large extent on abundance of water and higher air temperature

Codes :

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
- (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
- (C) (A) is true, but (R) is false.
- (D) (A) is false, but (R) is true.

18. Match **List – I** with **List – II** and select the correct answer using the codes given below :

List – I		List – II	
(Authors)		(Title of the Book)	
I.	Woolridge and Morgan	A.	Principles of Geomorphology
II.	Thornbury	B.	Geomorphology
III.	Von Richthofen	C.	-Spirit and Purpose of Geography
IV.	Steers	D.	Unstable Earth

Codes :

	I	II	III	IV
(A)	A	B	C	D
(B)	B	C	A	D
(C)	C	A	B	D
(D)	D	B	A	C

Answer & Reference Table

SL. NO.	QUESTION SL. NO.	ANSWER	REFERENCES
1.	1	B	1.3.5.1.C
2.	2	B	1.3.5.1.C
3.	1	B	1.3.5.3B
4.	3	B	1.3.1
5.	7	B	1.3.5.3B
6.	8	B	1.3.5.5
7.	4	C	1.3.6
8.	2	C	1.3.5.1.B
9.	3	C	1.3.5.4.A
10.	4	C	1.3.5.1, 1.3.5.2
11.	5	B	1.3.6
12.	4	B	1.1.9
13.	1	D	1.1.2
14.	3	B	1.3.5.1, 1.3.5.2, 1.3.5.3, 1.3.5.4
15.	5	D	1.3.1
16.	1	C	1.3.5.1.B
17.	4	A	1.3.3.2
18.	6	C	1.3.1.1

January - 17

1. The term panplane refers to

- (A) A level surface formed by wind erosion.
- (B) A plane formed by joining of flood-plains.
- (C) A level surface formed by the fluvial cycle at the old age.
- (D) A level plain formed by human intervention.

2. Match **List-I** with **List-II** and select the correct answer from the codes given below:

List-I

(Theories of Cavern formation)

I. Two cycle theory A. Swinnerton

II. Water table theory B. Gardner

III. Static water zone theory C. Marott

IV. Invasion theory D. Davis

List-II

(Scholars)

Codes:

I	II	III	IV	
(A)	C	B	A	D
(B)	D	A	B	C
(C)	B	C	A	D
(D)	D	B	C	A

3. Lateral planation theory of pediment formation was proposed by

- (1) McGee
- (B) Gilbert
- (3) Lawson
- (D) Davis

4. Which one of the following processes is responsible for the weathering of rocks in a Karst region?

- (A) Hydrolysis
- (B) Carbonation
- (C) Oxidation
- (D) Scree formation

5. Match **List – I** with **List – II** and select the correct answer from the codes given below:

List – I

(River)

- I. Nile
- II. Mississippi
- III. Ganga
- IV. Tiber

List – II

(Type of Delta)

- A. Estuarine
- B. Arcuate
- C. Bird foot
- D. Cuspate

Codes:

- | | I | II | III | IV |
|-----|----------|-----------|------------|-----------|
| (A) | (B) | (D) | (C) | (A) |
| (B) | (D) | (B) | (A) | (C) |
| (C) | (A) | (D) | (B) | (C) |
| (D) | (B) | (C) | (A) | (D) |

6. The statement “The present is the key to the past” was made by

- (A) Walther Penck
- (B) W.M. Davis
- (C) Huntington
- (D) James Hutton

7. Ria is an example of –

- (A) Neutral shore
- (B) Compound shore
- (C) Emerged upland shore
- (D) Submerged upland shore

8. Match **List-I** with **List-II** and select the correct answer from the codes given below:

List-I List-II

(Shape and Alignment Dunes)

(Specific names of Dunes)

- | | |
|-----------------|--------------|
| I. Longitudinal | A. Reversing |
| II. Transverse | B. Coastal |
| III. Parabolic | C. Seif |
| IV. Complex | D. Barchan |

Codes:

- | I | II | III | IV |
|-------|----|-----|----|
| (A) C | D | B | A |
| (B) A | B | C | D |
| (C) B | A | D | C |
| (D) D | C | A | B |

9. Match **List-I** with **List-II** and select the correct answer from the codes given below:

List-I

(Nature of the change)

- I. Desertification in the semi-arid area
- II. Gully development in a valley bottom
- III. Increasing coast erosion
- IV. Greater river-flood intensity

List-II

(Possible anthropogenic causes)

- A. Effect of groynes up the coast
- B. Overgrazing
- C. Runoff from a new road
- D. Urbanisation

Codes:

I	II	III	IV	
(A)	B	C	D	A
(B)	B	C	A	D
(C)	C	B	A	D
(D)	D	C	B	A



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Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO
1.	4	B	1.3.5.3
2.	5	B	1.3.5.5
3.	6	B	1.3.5.3
4.	2	B	1.3.3.2
5.	3	D	1.3.5.1
6.	5	D	1.3.1
7.	1	D	1.3.5.4
8.	4	A	1.3.5.3.2
9.	16	B	1.3.5.1, 1.3.5.3, 1.3.5.4



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November - 17

1. The concept of Padiplain is associated with:

- (A) W.M. Davis
- (B) L.C. King
- (C) W. Penk
- (D) C.A. Cotton

2. Who stated that the slope profiles are convex, plane or concave according to the circumstances of the uplifting action?

- (A) Penck
- (B) Davis
- (C) Johnson
- (D) Wood

3. Which one of the following is a fluvio-glacial deposit?

- (A) Pediplain
- (B) Kame terrace
- (C) Floodplain
- (D) Loess plain

4. The premise that the present-day processes have been operating throughout geological time is the principle of :

- (A) Isostasy
- (B) Diastrophism
- (C) Uniformitarianism
- (D) Catastrophism

5. Match **List - I** with the **List - II** and select the correct answer from the code given below:

List - I

(Topography)

- (a) Glacial
- (b) Marine
- (c) Fluvial
- (d) Aeolian

List - II

(Landforms)

- (i) Alluvian fan
- (ii) Yardangs
- (iii) Arate
- (iv) Tombolo

Code:

- | | | | | |
|-----|------------|------------|------------|------------|
| | (a) | (b) | (c) | (d) |
| (A) | (ii) | (iii) | (iv) | (i) |
| (B) | (i) | (iv) | (ii) | (iii) |
| (C) | (iv) | (ii) | (i) | (iii) |
| (D) | (iii) | (iv) | (i) | (ii) |

6. Match **List - I** with the **List - II** and select the correct answer from the code given below:

List - I

(Author)

- (a) J.A. Steers
- (b) S.W. Wooldridge
- (c) Walther Penck
- (d) Thornbury

List - II

(Book)

- (i) Morphological Analysis of Landforms
- (ii) Principles of Geomorphology
- (iii) Unstable earth
- (iv) Spirit and purpose of Geography

Code:

- | | | | | |
|-----|------------|------------|------------|------------|
| | (a) | (b) | (c) | (d) |
| (A) | (ii) | (iii) | (iv) | (i) |
| (B) | (i) | (iv) | (ii) | (iii) |
| (C) | (iv) | (ii) | (i) | (iii) |
| (D) | (iii) | (iv) | (i) | (ii) |

Answer & Reference Table

SL. NO.	QUESTION NO.	ANSWER	REFERENCE NO.
1.	1	B	1.3.5.3
2.	3	A	1.3.6
3.	4	B	1.3.5.2
4.	4	C	1.3.1
5.	7	D	1.3.5.1, 1.3.5.2, 1.3.5.3, 1.3.5.4
6.	8	D	1.3.1.1



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July - 18

1. The concept of panplain was propagated by:

- (A) C.A. Cotton
- (B) Von Rithofen
- (C) Crickmay
- (D) Alfred Von Wegener

2. “The present in the key to the past.” This phrase is related to the concept of:

- (A) Isostasy
- (B) Diastrophism
- (C) Plate tectonics
- (D) Uniformitarianism

3. The Hydraulic Slope Theory was propounded by:

- (A) R. E. Horton
- (B) Darwin
- (C) Penck
- (D) Mallot

4. Paternoster lakes are:

- (A) Lakes formed on glacial stairways
- (B) Lakes having volcanic origin
- (C) Lakes formed by a shallow stretch of water caused by sea erosion
- (D) Crescent shaped lakes formed due to cut-off of a river meander

Answer & Reference Table

SL. NO	QUESTION NO.	ANSWER	REFERENCE NO.
1.	6	C	1.3.5.1.C
2.	10	D	1.3.1
3.	34	A	1.3.6.2
4.	9	A	1.3.5.2



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