MODEL QUESTION FOR NEW CBCS SYSTEM

GROUP - A

Answer any TWO. **2X10 =20**

1. Discuss the various seismic waves that help in understanding the earth's interior. 10

2. Define fold. Classify fold with suitable diagram. 2+8.

3. Explain the concept of cycle of erosion as proposed by W. M DAVIS with suitable diagram. 10

4. Explain the processes of Aeolian erosion of arid region. 10

Group - B

Answer any THREE. **3X5 =15**

5. What are the conditions essential for the development of karst land form.

6. Explain the concept of Airy.

7. What are the geometrical elements of a fault?

8. Describe the slope elements?

9. Explain about different types of volcanic materials.

Group - C

Answer any FIVE. **5X1 =5**

10. Answer the following question.

    Which period is called period of dinosaurs?

11. Choose the correct answer.

    The book entitled 'Theory of the Earth, with Proofs and Illustrations' was written by Davis/Hutton/Playfair.

12. Fill in the blanks with appropriate words.

    The term 'Plate' was first used by _____ in the year _____ .

13. Mention whether the following statements are true or false.

    Esker is a Glacio- fluvial deposit.

14. Select the appropriate name:

The term panplain was proposed by Crickmay/ Penck.

15. Match the items under Group ‘A’ to those under Group ‘B’

Group A	Group B
a) The Unstable Earth	a) Wooldridge and Morgan
b) An outline of Geomorphology	b) Dune
c) Seif	c) Steers

16. Answer the following question.

Which is known as Scoriae?

17. Fill in the blanks with appropriate words.

Regolith grades down into solid unaltered rock known as _____.

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SAMPLE ANSWER

GROUP - A

Ans. of Q.No.1 >>

Introduction:

Seismology is the science which studies various aspects of seismic waves generated during the occurrence of earthquakes. Seismic waves are recorded with the help of an instrument known as **seismograph.** It may be pointed out that seismology is the only source which provides us authenticated information about the composition of the earth’s interior. The place of an occurrence of an earthquake is called ‘Focus’ and the place which experiences the seismic event first is called ‘epicentre’, which is located on the earth’s surface and is always perpendicular to the ‘focus’. On the other hand, the focus or the place of the origin of an earthquake is always inside the earth.

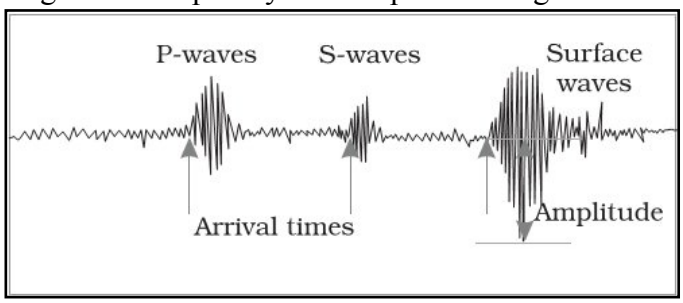
Seismic waves:

The different types of tremors and waves generated during the occurrence of an earthquake are called seismic waves which are generally divided in 3 broad categories e.g. primary waves, secondary waves and surface waves.

1. **Primary waves.** These are also called P. Waves, push and pull waves compression- rarefaction waves or longitudinal waves (like those of sound waves) in which each particle vibrates to and front in the direction of propagation of the wave. These are the fastest waves and travel at an average speed of 8 km. per second. But their speed varies according to the density of the medium through which they are travelling. Their speed increases to as much as 14 km. per second

in medium of very high density. Because of their high speed they each the recording station first .That is why they are designated by the letter 'P' (Latin prima, first). As a general rule P waves travel about 1.7 times the speed of S waves. It has been observed that P waves take about 21 minutes for travelling from epicentre to antipodal point 9 point diametrically opposite to epicentre).Like sound waves, P was pass through gasses, liquids and solids alike.

2. **Secondary waves.** These are also called S waves or transverse waves or distortional waves shake waves or shear waves. These are analogous to light waves or water ripples in which particles move at right angles to the direction of propagation of the wave like the loops in a lout rope shaken at one end. S waves are slower than P waves and travel at an average speed of 4 km. per second. Consequently S waves reach the recording station after the P waves have arrived .That is why they are designated by the letter S (Latin secunda, second).S waves can travel only through solids and are lost in liquids and gasses.
3. **Surface waves.** These are also called Long waves or simply L waves. There are two types of L Waves. One type was discovered by Lord Rayleigh in 1887 and these waves are called Rayleigh waves. The other type was discovered by A.E.H. Love and waves of this type are called Love waves. Both Rayleigh and Love waves fade out at various depths according to their periods and give invaluable information for distinguishing between continental and oceanic types of crust.
Evidently, they affect only the surface of the earth and die out at smaller depth. L Waves arrive later than P and S waves because of their slow speed (about 3 km. per second) and greater complexity of their paths through crucial layers.



Seismic waves

Seismology and Constitution of the Earth's Interior:

When an earthquake occurs the seismic waves are recorded at the epicentre with the help of seismograph. In the beginning a few small and weak swings are recorded .Such tremors are called 'first preliminary tremors'. After a brief interval the 'second preliminary tremors' are recorded and finally the 'main tremors' of strong waves are recorded.

The nature and properties of the composition of the interior of the earth may be successfully obtained on the basis of the study of various aspects of seismic waves mainly the velocity and travel paths of these waves while passing through a homogeneous solid body but these waves are reflected and refracted while passing through a body having heterogeneous composition and varying density zones. If the earth would have been composed of homogenous solid materials the seismic waves should have reached the core of the earth in a straight path but this is not the case in reality. In fact, the recorded seismic waves denote the fact that these

waves seldom follow straight paths rather they adopt curved and refracted paths. Thus, it becomes obvious that the earth is not composed of homogenous materials rather there are variations of density inside the earth. The seismic waves are refracted at the places of density changes. A regular change of density inside the earth causes a curved path to be followed by the seismic waves. Thus, the seismic waves become concave towards the earth's surface.

The nature, characteristics and velocity of seismic waves, we may find the presence of several density zones inside the earth. Detailed studies of seismic waves of different epicentres all over the world have revealed the fact that there are extra sets of seismic waves which are similar to P and S waves but with slower rate of velocity. It is known fact that the velocity seismic waves changes only when there are changes in the density of rocks.

On the basis of velocity seismic waves are divided in three sets of waves e.g.

(i) First set of P-S waves of maximum velocity
(ii) Second set of Pg-Sg waves of minimum velocity
(iii) Third sets of P*- S* waves of medium velocity falling between the first and the second sets of waves.

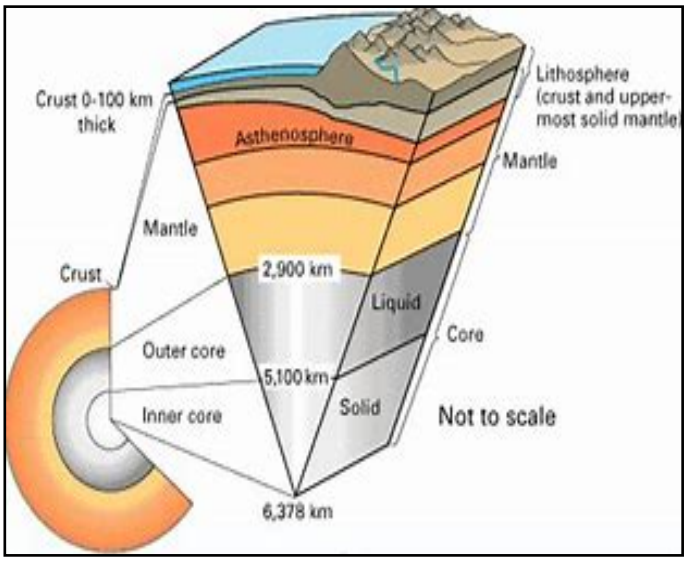
Thus, on the basis of changes of velocity of seismic waves it is proved that there are major changes in the velocity of waves at three places inside the earth and hence it can be safely inferred that there are three distinct zones or layers of varying densities inside the earth below the outer thin layer of sedimentary rocks.

The scientific study and analysis of various aspects of seismic waves (mainly velocity and travel paths) of natural and man- induced earth quakes have enabled the scientists to unravel the mystery of the earth's interior based on authentic information. Three zones of varying properties have been identified in the earth on the basis of changes in the velocity of seismic waves while waves passing through the earth e.g. crust, mantle and core.

(i) **Crust.** The average density of the outer and lower crust is 2.8 and 3.0 respectively. It may be pointed out that in the beginning vast difference between the structure and composition of upper and lower crust was reported by the scientists but now the evidences of seismology have revealed almost identical structure and composition of these two sub-zones of the crust. The difference of density between the upper and lower crust is because of the pressure of supper incumbent load. The formation of the minerals of the upper crust was accomplished at relatively lower pressure than the minerals of the lower crust. The continents are composed of lighter silicates called **'sial'** while the oceans have the heavier silicates called **'sima'.**

(ii) **Mantle.** It lies between 100 to 2900 km. below the earth's surface and forms 16 percent of the earth's volume. The outer layer of the mantle is partly simatic and behaves like a plastic mass while the inner layer is composed of wholly simatic ultra basic rocks. The boundary between the crust and the mantle is a surface of discontinuity which was discovered by A. Mohorovicic and is, therefore, named after him.

(iii) **Core.** It lies between 2900 km to 6400 km. below the earth's surface and accounts for 83 percent of the earth's volume. The central core has the heaviest material of highest density. It is composed of nickel and iron and is therefore called **'nife'**, while a zone of mixed heavy metals+silicates separates the core from outer layers.



Ans. of Q. No. 3 >>

Introduction:
William Morris Davis (1850-1934 A.D.) was an American geomorphologist who presented his 'Geographical Cycle of Erosion' in 1899. He was perhaps the first geomorphologist in the world to elaborate the cyclic development of landscape. The concepts inherent in the geographical cycle, Davis model of landscape development, provided all his geomorphological publications subsequent to his initial presentation in 1884.
Initially Davis's geographical cycle was basically concerned with the evolution of landforms in humid temperature areas were river is the most dominant agent of landforms evolution .However, this concept was applied to almost all the geomorphic process such as arid of erosion 91905),glacial cycle of erosion (1900,1906) and marine cycle of erosion (1912).

Assumptions:
The basic premises of Davisian model of 'Geographical cycle"' included the following assumptions made by Davis.

1) Landforms are the evolved products of the interactions of endogenetic forces originating from within the earth and the external or exogenetic forces originating from the atmosphere.

2) The evolution of landforms takes place in an orderly manner in such a way that a systematic sequence of landforms is developed through time in response to an environmental change.
3) Streams erode their valleys rapidly downward until the graded condition is achieved.
4) There is a short period rapid rate of upliftment in land mass. It may be pointed out that Davis also described slower rates of upliftment if so described.
5) Erosion does not start until the upliftment in complete. In other words, upliftment and erosion do not go hand in hand. This assumption of Davis became the focal point of severe attacks by the critics of the cyclic concept.

Based on the above assumptions Davis expressed the opinion that the development of landforms of a place primarily depends upon 3 main factors. These factors are,

(i) Structure
(ii) Process and
(iii) Time (stage)

These factors are known as Trio of Davis. According to Davis, 'Landscape is a function of structure, process and stage'.

(i) Structure. The word 'structure' has been used by Davis in a wider sense than is normally used in geomorphology. Structure, according to Davis, do not include only the regional geological structure which includes folds and faults but also the nature of rocks and their characteristics, their physical and chemical properties, their relative hardness and softness, their permeability, and solubility ,the nature of joints, bedding and cleavage, etc. Thus on a permeable rock, most of the rain water percolate in the rock and there will be minimum runoff and consequently erosion by running water will be lesser than adjacent impermeable rock. Sedimentary rocks are layered and have several joints and faults. The process of erosion is accelerated on such rocks. On the contrary, igneous rocks are massive and crystallined and are more resistant to erosion as compared to sedimentary rocks. Rocks with steeper slope are more susceptible to erosion than rocks with gentler slope. Hardness and permeability of rocks influence the process of erosion in their own way. For example, Granite is harder and less eroded than Gabro. So, structure as a rule is older than landscape and provides the base for the operation of the various gradational processes which give rise to new sequential landforms.

(ii) Process. The term process applies to many physical and chemical ways by which the earth's surface undergoes modification. Some processes, such as diastrophism and volcanism originate from forces within the earth's crust and have been designated as endogenetic process. Some process operates on the surface of the earth and is termed

as exogenetic process. Weathering, mass-wasting, and erosion are the main examples of exogenetic process. Endogenetic forces produce irregularities on the earth's surface by building and uplifting mountains, plateaus, hills etc. While exogenetic forces tend to level down the irregularities the earth's surface. The main agents of exogenetic process are running water, ground water, glacier, and wind and sea waves. Flood plains, alluvial fans and deltas are produced by stream action, sink holes and caverns are the products of ground water and moraines and drumlins point to the depositional work of glaciers. This process results in lowering and levelling down the earth's surface. As the agents of process operate on an uplifted area for a sufficiently long time, this uplifted area is gradually reduced in height and its irregularities are removed. In the end, the area is reduced to a flat and featureless plain to which Davis gave the name 'peneplain'.

(iii) Time. Time was regarded by Davis as the pre-eminent factor among the three. Stage indicates the length of time during which various agents of processes have been active in lowering and levelling down the earth's surface. In this context time is not expressed in terms of years but the duration in which the 'geographical cycle' is completed.

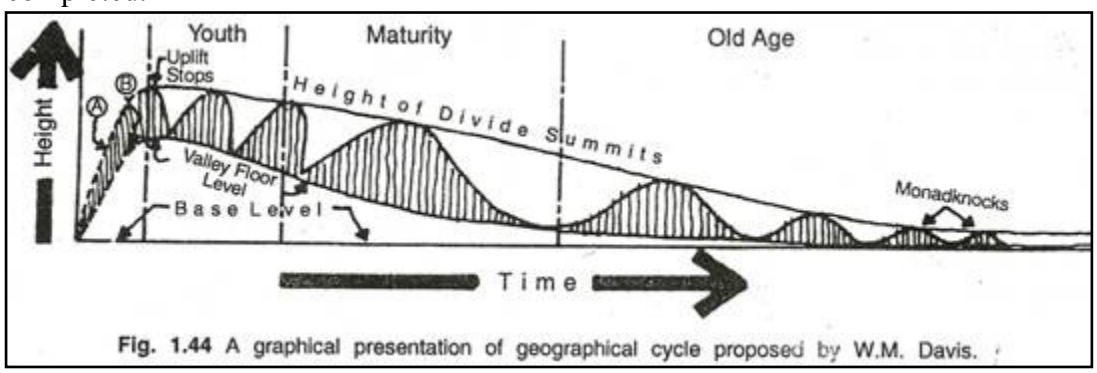


Fig. 1.44 A graphical presentation of geographical cycle proposed by W.M. Davis.

Davis cycle of erosion

Davis recognised three stages of cycle of erosion which are termed as

- **Youth**
- **Mature and**
- **Old**

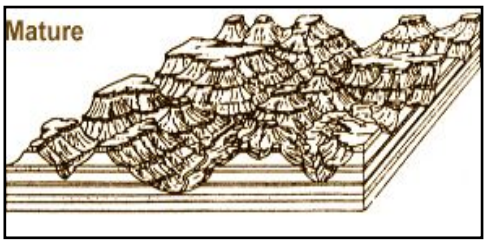
A. Youthful Stage. Youthful Stage commences when the process of erosion starts after rapid and lived upliftment is complete. Following are the main characteristics of this stage.

- ✓ In the beginning the rivers are small and widely spaced. There may be a few consequent trunk streams but few large tributaries.
- ✓ Erosion starts in the river valley but there is eroson on the top surface or summits of water divides.
- ✓ Due to steep slope and steep channel gradient, the rivers are actively involved in vertical erosion as a result of which the depth of valleys increases. This is known as 'valley deepening'.
- ✓ The overall valley form is gorge or canyon.

- ✓ The relative relief continues to increase and is at its maximum at the end of youthful stage.
- ✓ As the rivers carry their load, their capacity to erode is reduced due to transfer of energy in transporting the load, and consequently deposition starts.
- ✓ By the end of the youthful stage, a balance is reached between erosion and deposition and velocity of water is just enough to transport sediment load supplied from the drainage basin and neither erosion nor deposition takes place.
- ✓ The duration of youth stage is short.

B. Mature Stage. This stage commences after the river has crossed its youthful stage and is characterised by the following features.

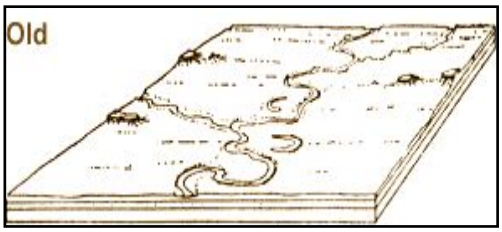
- ✓ The mature stage is marked by maximum level of relief as the distance between lower and upper curve is maximum.
- ✓ Vertical cutting has decreased whereas lateral erosion has increased.
- ✓ The area is covered with well integrated drainage network which has developed maximum relationship with the bedrock geological structure.
- ✓ Flood plains, river meanders, incised meanders, oxbow lakes, etc are the dominant geomorphological features.
- ✓ The duration of mature stage is longer than that of youthful stage but shorter than that of old stage.



C. Old Stage. This is the last and longest stage of cycle of erosion proposed by W.M. Davis. Following are its main characteristics.

- ✓ Vertical erosion and valley deepening almost come to end but lateral erosion and valley widening still continue as active processes.
- ✓ The number of tributaries to trunk stream is lesser tan that in mature stage but more than that in youthful stage.
- ✓ Braiding of the river, flood plains, levees, well developed river meanders, residual convexo-concave monad nocks and undulating plain of extremely low relief are typical features of this stage.

- ✓ The whole surface approaches closer to the base level and the area are transformed into peneplain.



Conclusion:
It may be concluded in the words of Charles Higgins (1975) that "If the desire for a cyclic, time dependent model stems from an unacknowledged fundamental postulate that the history of the earth is itself cyclic, then no non cyclic theory of landscape development can win with general acceptance until this postulate is unearthed, examined and possibly rejected."

Group - B

Ans. of Q. No. 5 >>

Essential Conditions for the Development of Karst Topography:

The following conditions alone favour the development of true karstictopography :

1) The limestones must be massive, thickly bedded, hard and tenaceous, well cemented and well jointed (high density of joints).
2) Limestones should not be porous wherein permeability is largely controlled by joints and not by the mass of rocks because if limestones are porous, the water may pass through the rock mass and thus whole rock mass will become weak and will collapse.
   On the other hand, if limestones are non-porous and thickly bedded, water will infiltrate through joints resulting into effective corrosion of limestones along the joints and solution holes would be formed.
3) The position of limestones should be above the ground water table so that surface drainage may disappear through sinks. Blind valleys and sinking creeks to have subterranean (subsurface) drainage so that cave, passages and galleries and associated features may be formed.
4) The limestones should be widely distributed in both areal and vertical dimensions.
5) The carbonate rocks should be very close to the ground surface so that rain water may easily and quickly infiltrate into the beds of limestones and may corrode the rocks to form solutional landforms.
6) The limestones should be highly folded, fractured or faulted.
7) There should be enough rainfall so that required amount of water is available to dissolve carbonate rocks.

Ans. of Q.No. 6>>

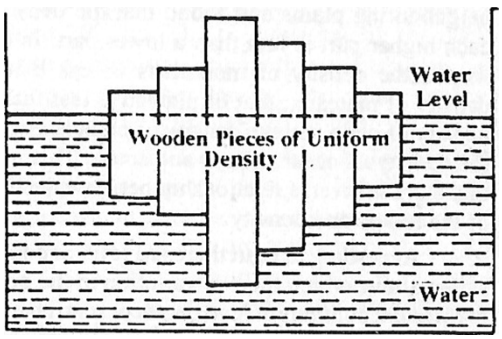
AIRY'S CONCEPT:

Sir George Airy, the astronomer Royal of Britain expressed his views about isostasy in 1859. He followed the 'law of floatation' and opined that the lighter upper crust of the earth floats on the heavier substratum. He told that Himalayan Mountains are not just a landform but has its root deep into the substratum.

According to Archimedes principle, a floating body displaces liquid equal to the volume of the submerged part of the floating body. The greater the part of the body about the liquid in which it is floating, the greater the part of the body inside the liquid. For example, if ice (density = 0.9) floats over water (density = 1) we find that for one part of the ice above water level, there are nine parts beneath. In the same way, if the Himalayas (density = 2.67) float in a liquid (density = 3.0), the relation between their densities is 2.67 : 3.0 or 8.89 : 1. It means that for every one part of the Himalayas above liquid, there should be nearly parts below it. Thus, we come to the conclusion that those blocks which are not much raised above the liquid are also not much submerged below.

Airy explained his hypothesis by an experiment. He took a number of wooden blocks of different height and put them in a pot containing water (FIG. 1). It was observed that the larger blocks rose higher and had deep roots in the water. On the other hand, the blocks which were not much raised above the water level were also not much submerged below it.

Airy believes that the position of mountains, plateaus, plains and sea beds is somewhat similar to that of wooden blocks. All the landforms have the same density of 2.67 and they float on the substratum of higher density varying from 3 to 3.3 hence, the areas which rise high have deep roots. The hypothesis of Airy is considered to be more acceptable than that of Pratt. Deep mining has revealed that the density of rocks remains almost the same. Hayford and Bowie have also supposed Airy's views.



Ans. of Q.No. 7>>

Introduction:

According to Worcester, “A fault is a fracture or fissure in the earth along which one side has moved with reference to the other side.”

In general fault is a crack or fracture in the rocks of earth’s crust with an associated movement of strata on either side. Faulting is caused by plate tectonics, when movements in the earth’s crust create stress and tension in the rocks, causing them to stretch and crack.

Geometrical elements of a fault:

i) Footwall and hanging-wall:

Of the two blocks lying on either side of the fault-plane, one appears to rest on the other. The former is known as hanging-wall side whiles the latter which supports the hanging-wall is known as the footwall side.

(ii) Fault scrap:

The relative displacement on either side of the fault line results in an upstanding structure with a steep side which is called 'fault scrap'.

Fault-line scrap:

It owes its relief due to differential erosion along a fault-line.

(iii) Down thrown side and up-thrown side:

In case of a fault, one of the dislocated blocks appears to have been shifted downwards in comparison with the adjoining block lying on the other side of the fault-plane. The former, therefore is known as the down-thrown side while the latter is described as the up-thrown side.

Terminologies associated with faults:

1. Strike:

Strike of the fault is the trend of a horizontal line in the plane of the fault.

2. Dip:

Dip is the angle between a horizontal surface and the plane of the fault and is measured in a vertical plane that strikes at right angles to the fault.

3. Hade:

It is the complement angle of dip, i.e., the angle which the fault plane makes with the vertical plane or (90°-Dip -Hade).

4. Throw and heave:

The throw of a fault is the vertical component of the apparent displacement of abed, measured along direction of dip of the fault.

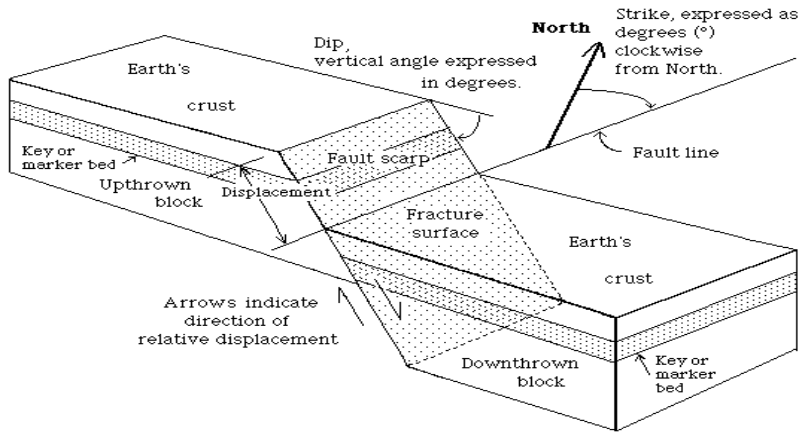
The heave of a fault, in a like manner, is the horizontal component of the apparent displacement. It is also known as gape.

5. Stratigraphic throw:

If the same bed occurs twice because of faulting, the perpendicular distance between them measured along a vertical section at right angles to the strike of the fault, is known, as stratigraphic throw.

6. Net-slip:

The total displacement due to a fault is described as its net-slip.



Group - C

Ans. of Q.No. 10>>

The Jurassic Period is called period of Dinosaurs. The land reptiles of this time included gigantic dinosaurs some of which were up to 20 metres long and about 5 metres high, weighing as much as 35-40 metric tonnes.

Ans. of Q.No. 12 >>

The term 'Plate' was first used by _____J.Tuzo_____ in the year _____1965___.

Ans. of Q.No. 13 >>

Esker is a Glacio- fluvial deposit. (True)

Ans. of Q.No. 16 >>

The vesicular fragments of lava crust sponge-like in texture are known as Scoriae. This Causes cracks in the crust and parts thus broken are carried down.

Ans. of Q.No. 17>>

Regolith grades down into solid unaltered rock known as _bedrock__.
