OPSC STUDY

Name: Plaben Subject: Geography

Time: Maximum Marks: 180

		TO BE FILLED BY EVALUATOR
Question No:	Marks allotted	Comments
Q: 1 (a)	46	If the question demands
Q: 1 (b)		then it needs elaboration
Q: 1 (c)		(ex → Q-4/2nd part)
Q: 1 (d)		
Q: 2	48	
Q: 3	50	
Q: 4		
Q: 5 (a)		→ 2-3 facts are mis-represented
Q: 5 (b)		
Q: 5 (c)	144/180	
Q: 5 (d)		
Q: 6		→ maps → more geographical
Q: 7		significance
Q: 8		

Total Marks (Obtained):

Feedback/Comment/Suggestion:

Structure → 8/10

Presentation → 10/10

context → 9/10

content → 8/10

Handwriting/language skills → 10/10

intro - conclusion → 9/10

overall excellent writing

⇓

Keep it up

Optional Test Series: [redacted]

Syllabus: *Origin of the earth, Physical conditions of the earth's interior; continental drift; isostasy; plate tectonics; mountain building; volcanism and earthquakes; weathering and erosion, Concepts of geomorphic cycles (Davis and Penck), Landforms associated with fluvial, arid, glacial, coastal and karst region, Polycyclic landforms.*

Candidates Should attempt Question No: 1 (compulsory) and attempt two questions out of three. (Q. No: 2, 3& 4)

1. Mark the location of any Ten of the following on the Map of World or Map of India. Also write in your answer script the most significant aspect of each of them in not more than 20 words: (6 x 10 = 60 marks)

a) Dead Sea
b) Death Valley
c) Mt Elbrus
d) K2
e) Gobi Desert
f) Great Dividing Range
g) Toronto
h) Alaska
i) Jalandhar
j) Zawar
k) Kandla
l) Kudremukh

2. Explain "Plate Tectonic Theory". Give a detailed account of Indian Plate movement and Himalaya formation. (60 marks)
3. Write an essay on geomorphic cycles with reference to the theories explained by Davis and Penck. Discuss cycle of erosion by fluvial process (rivers) and landforms associated. (60 marks)
4. Discuss Big Bang Theory on earth' origin. Also elaborate the formation of Earth's Atmosphere. (60 marks)


The World
Death Valley
Toronto
Mt Elbrus
Dead Sea
K2
Jalandhar
Gobi Desert
Great Dividing Range
excellent map marking

1 (a)	Dead Sea	Location: Between Jordan (East) and Israel (West). Geographical Significance: Earth's lowest elevation on land (392 to 45 m) World's saltiest (34.2%) bodies of water.
(b)	Death Valley	Location: SE California, US. Geographical Significance: Lowest, hottest and driest portion of North America. It is a graben
(c)	Mt. Elbrus	Location: Caucasus mountain chain Geographical Significance: Highest Peak ([illegible]) in Russia
(d)	K_2	Location: NW Karakoram Range. Geographical Significance: 2^{nd} highest mountain ([illegible]) in the world
(e)	Gobi Desert	Location: Parts of China and Mongolia. Geographical Significance: A cold desert with extreme weather conditions. It is a Rain-shadow desert
(f)	Great Dividing Range	Location: Eastern Australia Geographical Significance: A series of plateaus and low mountain ranges. South Eastern
(g)	Toronto	Location: SE side of Canada Geographical Significance: Largest major inland port of Canada.
(h)	Alaska	Location: NW part of Canada Geographical Significance: Largest state (area-wise) of Canada
(i)	Jalandhar	Location: A district of Punjab. Geographical Significance: Famous for sports industry, surgical goods and leather industry in the region.
(j)	Zawar	Location: A city in Udaipur district, Rajasthan. Geographical Significance: famous for Zinc mines
(k)	Kandla	Location: Kutch district, Gujarat Geographical Significance: Kandla harbour is a natural seaport
(l)	Kudremukh	Location: A city in Karnataka Geographical Significance: Longest deposit of iron-ore in the World

Not counted

2. In late 1960s, the consolidation of works and evidences of different geomorphologists like McKenzie, Parker, Wilson, A Holmes, Harry Hess, Wegener, etc led to the development of the "Plate Tectonics Theory." It gave a more comprehensive understanding about the movement related to the different parts of the Earth's crust (both Oceanic and Continental).

48/60

PLATE TECTONICS THEORY (PTT)

- Postulates of PTT
  - Main layers of Earth
  - Tectonic Plate
  - Convective magma current
  - Relative movement magnitude
  - Cause of Plate movement
- Evidences in support of PTT.
  - The Forces
  - Tectonic Plates
    - Major Plates
    - Minor Plates
  - Plate Movement
    - Divergent
      - Continental - Continental
      - Oceanic - Oceanic
      - Continental - Oceanic
    - Convergent
      - Oceanic - Oceanic
      - Oceanic - Continental
      - Continental - Continental
    - Transform
- Evaluation
  - Positives
  - Limitations
- PTT Vs CDT
  - Explained by
  - Theory
  - Forces for movement
  - Evidences
  - Drawbacks
  - Acceptance
  - Usefulness
- Indian Plate Movement and Himalayan formation
- Present condition
- Figures
  - Plate movement. (Fig 1)
  - Tectonic Plates (Fig 2)
  - Plate boundaries (Fig 3)
  - Indian Plate Movement and Himalayan Formation (Fig 4)

good diagram.

Postulates of PTT

1. The Earth is made up of 3 main layers (Core, Mantle and Crust).
   On the surface of Earth are Tectonic Plates that slowly move around the Globe.
2. A Tectonic Plate (Lithospheric Plate) is a massive, irregularly shaped slab of plate of solid rock. It is composed of both continental and oceanic Lithosphere.
3. Under the effect of Convective Magma Current (Convection Current Hypothesis by A. Holmes), the Lithosphere Plate floats over the fluid-like (visco-elastic solid) Asthenosphere.
   That leads to plate movement.
4. The relative movement of the plates typically ranges from Zero to 100 mm Annually.
5. The cumulative effect of 3 phenomena like ridge push, slab pull and frictional drag led to plate movement (fig)
6. The forces for Plate movement are generated due to internal heat of the Earth that includes Radioactivity, Residual heat and Gravitational heat.
7. The Earth's Lithosphere is composed of 7 Major Plates and Many Minor Plates. (Fig 2)
   The Lithosphere is a rigid outermost shell of Earth and is broken up into Tectonic Plates.
   7.1 Major Tectonic Plates
      7.1.1 Antarctica and the surrounding Oceanic plate.
      7.1.2 North American Plate
      7.1.3 South American Plate
      7.1.4 Pacific Plate
      7.1.5 India - Australia - New Zealand Plate.
      7.1.6 Africa with the Eastern Atlantic floor Plate
      7.1.7 Eurasia and the adjacent oceanic Plate.
   7.2 Minor Tectonic Plates

7.2.1 Arabian Plate
7.2.2 Bismark Plate
7.2.3 Caribbean Plate
7.2.4 Carolina Plate
7.2.5 Cocos Plate
7.2.6 Juan de Fuca Plate
7.2.7 Nazca Plate
7.2.8 Philippine Plate
7.2.9 Persian Plate
7.2.10 Anatolian Plate
7.2.11 China Plate
7.2.12 Fiji Plate

Map depiction is needed.

8. Types of Plate Movements (Fig 3)

8.1 Divergent Movement

The boundary between 2 Plates that are moving apart or Rifting.
Rifting causes Seafloor Spreading.

8.1.1 Continental - Continental Divergence

When Divergent convection flows between 2 Continental Plates due to tensional force, Plates crack down and create faults and move away, forming Block Mountains and Rift Valley. Eg: East African Great Rift Valley

8.1.2 Oceanic - Oceanic Divergence

The Magma comes out of the Asthenosphere as it rises due to its denser and hot nature. it spreads in horizontal direction and cools down gradually.
Magma is Basaltic and forms elongated sea between rifts and later forming the ocean floor. Eg: Red Sea.

8.1.3 Continental - Oceanic Divergence

Basaltic Magma will always come from Oceanic floor only and it is not possible that Magma comes out and forms continent on one side and ocean on the other side.
Hence Continental - Oceanic Divergence is not possible

8.2 Convergent Movement

At a Convergent boundary, Plates collide and as such are sometimes called "Destructive boundaries" because they result in removal or compression of the Earth's crust. Convergent Plate boundaries are responsible for some of the most massive and spectacular of earthly landforms: major Mountain Ranges, Volcanoes and Oceanic Trenches.

8.2.1 Oceanic - Oceanic Convergence

8.2.1.1 If the Convergent Boundary is between 2 Oceanic Plates, subduction also takes place. As one of the Oceanic Plates subducts beneath the other, an Oceanic Trench is formed, shallow and deep-focus Earthquakes occur and volcanic activity is initiated with volcanoes forming on the Ocean floor.

8.2.1.2 With time, a volcanic Island Arc (Eg: Aleutian Islands and Mariana Islands) develops; such an Arc may eventually become a more mature Island Arc system (such as Japan and the Islands of Sumatra and Java in Indonesia are today).

Add map/diagram besides the each paragraph.

8.2.2 Oceanic - Continental Convergence

8.2.2.1 Because the oceanic lithosphere includes dense Basaltic crust, it is denser than the continental lithosphere and so the oceanic lithosphere always under-rides the continental lithosphere when the 2 collide.

8.2.2.2 The dense oceanic plate slowly and inexorably sinks into the Asthenosphere in the process of subduction. The subducting slab pulls on the rest of the plate - such "slab pull" is the main cause of most plate movement, pulling the rest of the plate in after itself.

8.2.3 Continental - Continental Convergence

When there is a convergent boundary between 2 continental plates, no subduction takes place because

because the continental crust is too buoyant to subduct. Instead huge mountain ranges, such as Alps, are built up. The most dramatic present day example of the continental collision has resulted in the formation of the Himalayas.

8.3 Transform or Slide past movement

A Transform fault or Transform boundary (Strike slip boundary), is a fault along a plate boundary where the motion is predominantly horizontal.

Transform Plate boundaries are locations where 2 Plates are sliding past each other, and there is no creation or destruction of landform but only deformation of the existing landform.

In oceans, transform faults are the planes of separation generally perpendicular to the mid-oceanic ridges.

North Anatolian fault and San Andreas Fault (along the Western coast of USA) is the best example for a Transcurrent edge on continents.

rate of plate movement?

Evidences in support of PTT

1. Ocean deep drilling - Glomar challenger
2. Joint Oceanographic Institutions for Deep Earth Sampling (JOIDE
3. Hot spots
4. Palaeomagnetism
5. Magnetic reversal
6. Seafloor spreading.

Evaluation

1. Positives
   1.1 Most widely accepted theory.
   1.2 Explains all endogenetic process and all physical features of Earth.
2. Limitation
   2.1 It couldn't explain the processes like Hotspot, Mantle convection cell creation, etc.
   2.2 It remains a largely descriptive and kinematics

theory albeit a remarkably predictive one.
In real world Plate Tectonics, Triple junctions and boundary conditions evolve, and Plates interact and reform when conditions change.

2.3 It doesn't clearly explain the 2nd Order Features such as Fracture zones, Accreted terranes, Transform faults, Diffuse boundaries, Swells, Sutures and Microplates may hold the key to global tectonics and volcanism.

PTT Vs CDT

Not needed

Feature	Plate Tectonics Theory	Continental Drift Theory
1. Explained by	In 1967, McKenzie and Parker suggested the Theory of Plate Tectonics. Morgan later outlined the theory in 1968.	Put forward by Alfred Wegener in the 1920s
2. Theory	Explains the movement of Lithospheric plates that include both continents and oceans.	Explains the movement of continents only
3. Forces for movement	Convection currents in the mantle drag crustal plates.	Buoyancy, gravity, pole-fleeing force, tidal currents, tides.
4. Evidence	Ocean bottom relief, Palaeomagnetic rocks, distribution of Earthquakes and volcanoes, gravitational anomalies at trenches, etc.	Apparent affinity of physical features, botanical evidence, fossil evidence, tillite deposits, placer deposits, rocks of same age across different continents etc.
5. Drawbacks	Nil significant	Too general with silly and sometimes illogical evidence
6. Acceptance	Most widely accepted	Discarded

7. Usefulness	Helped us understand the various geographical features	Helped in the evolution of convection current theory and seafloor spreading theory

Indian Plate Movement and Himalayan formation

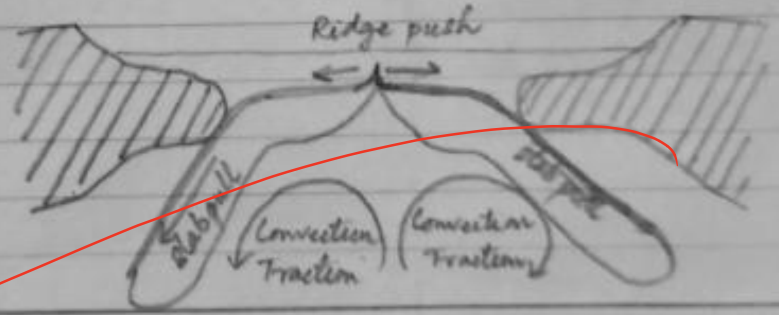
1. The Himalayas are the youngest mountain chain in the World
2. Himalayan mountains have come out of a great geosyncline called the Tethys Sea and the uplift has taken place in different phases.
3. During Permian Period (250 Million Years Ago), there was a supercontinent known as Pangea.
4. Its Northern part consisted of the present day North America and Eurasia (Europe and Asia) which is called as Laurasia or Angaraland
5. The Southern part consisted of the present day South America, Africa, South India, Australia and Antarctica which is called as Gondwanaland.
6. In between Laurasia and Gondwanaland, there was a long narrow and shallow sea known as the Tethys sea.
7. There were many rivers which were flowing into the Tethys Sea
8. Sediments were brought by these rivers and were deposited on the floor of the Tethys Sea.
9. These sediments were subjected to powerful compression due to the Northward movement of the Indian Plate. This resulted in the folding of the sediments and so the summit of Mt. Everest is made of marine limestone.
10. Once the Indian Plate started plunging below the Eurasian plate, these sediments were further folded and raised. This process is still continuing (India is moving Northwards at the rate of about 5cm per year and crashing into the rest of Asia).
11. The folded sediments, after a lot of erosional activity, appear as the present day Himalayas. (Fig 4)

12. Tibetan plateau was formed due to upthrusting of Southern block of the Eurasian Plate.

Present condition

At present, the movement of India continues to put enormous pressure on the Asian continent, and Tibet in turn presses on the landmass to the North that is hemming it in.
The net effect of Plate Tectonic forces acting on this geologically complicated region is to squeeze parts of Asia Eastward towards the Pacific Ocean.
One serious consequence of these processes is a deadly "domino effect": tremendous stresses build up within the Earth's crust, which are relieved periodically by Earthquakes along with the numerous faults that scar the landscape.

Plate Movement (Fig 1)



Tectonic Plates (Fig 2)

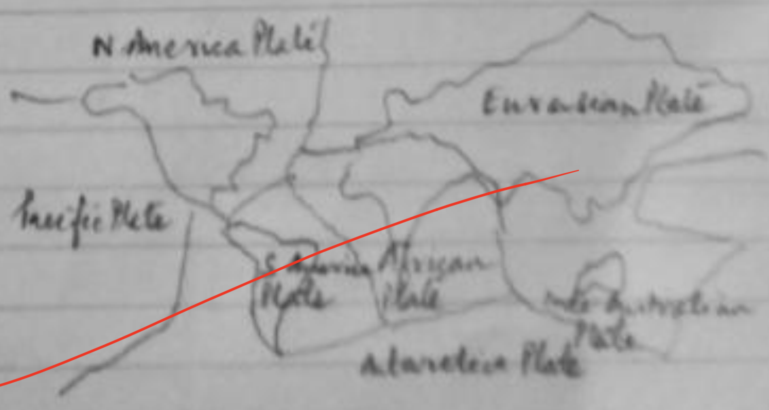
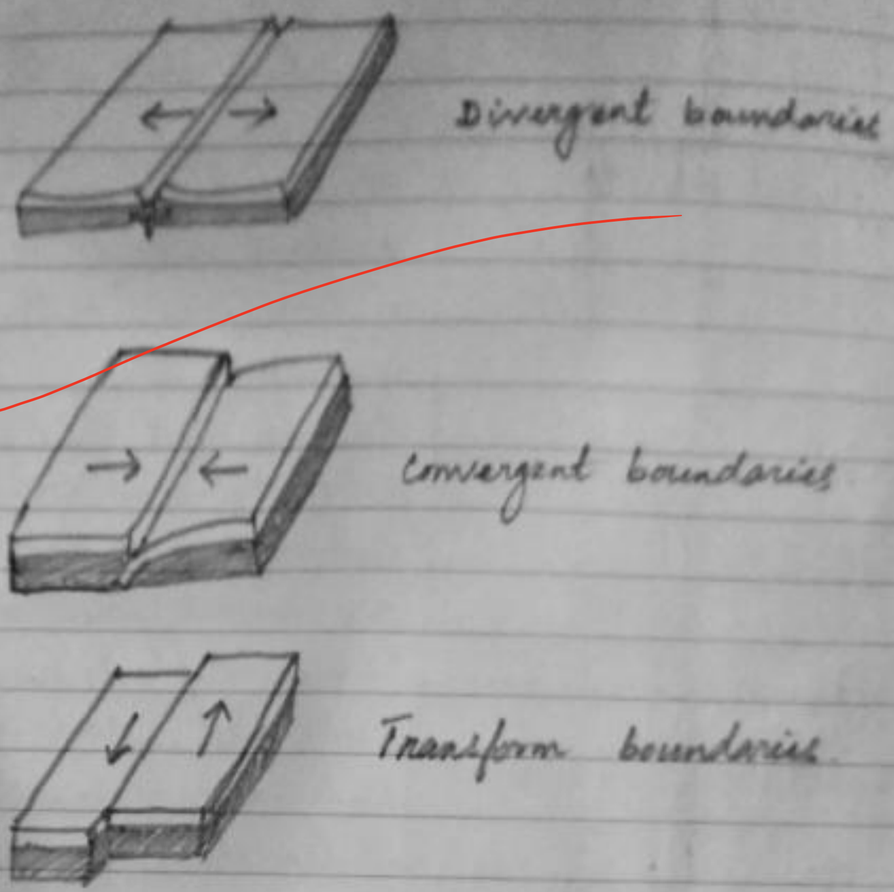
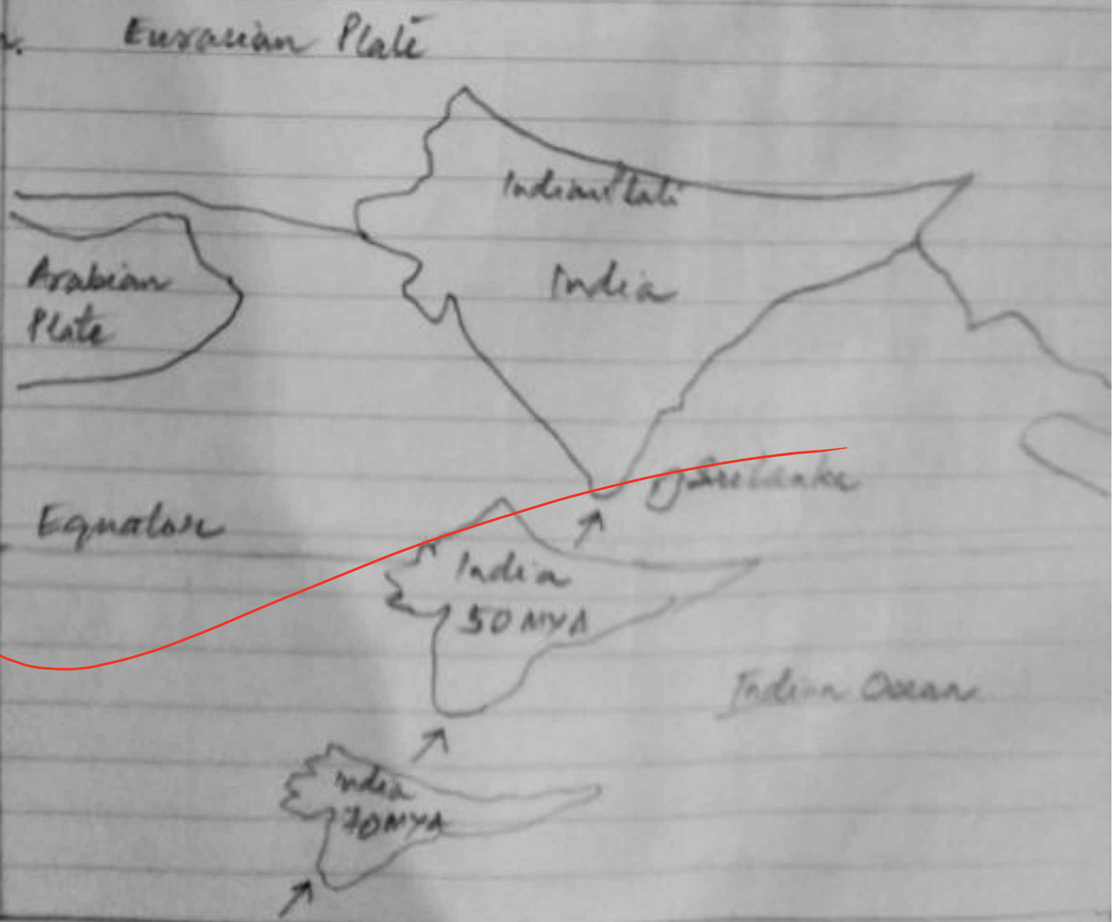


Plate Boundaries (Fig 3)



Indian Plate movement and Himalayan formation. (Fig 4)



Thus, the Plate Tectonics Theory is the grand unifying theory of Earth Sciences, combining the concepts of Continental Drift and Sea-floor spreading into one holistic theory that explains many of the major structural features of the Earth's surface.

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3 · Broadly speaking Geomorphology is the study of Landforms which is a composite result of different Exogenetic activities operated on that land or on that region. But Exogenetic activities try their best to make a balance with that of Endogenetic and their ultimate level of balance is the sea level below which that cannot perform their respective work. So, the balance between the 2 activities in a cyclic process is known as the Cycle of Erosion.

The concept of geographical cycle of erosion recognises the possibility of obliteration of relief (height difference), or plantation, during the life history of a landscape, by a process of erosion, occurring in a sequence of orderly changes, finally reducing the landscape relief to a minimum.

50/60

CYCLE OF EROSION (CoE)

- Geomorphic Cycle
- Theories
  - Davis CoE
    - Landscape ∝ S, P and T
    - Stages & Features
      - Youth Stage
      - Maturity Stage
      - Old Stage
    - Interruptions to the CoE
    - Evaluation
      - Positives
      - Drawbacks
  - Penck CoE
    - Deviations from Davis views
    - Valley slopes
      - Straight
      - Convex
      - Concave
    - Stages & Features
      - Stage 1
      - Stage 2
      - Stage 3
      - Stage 4
      - Stage 5
      - Stage 6
    - Evaluation
      - Positives
      - Drawbacks
- Davis CoE Vs Penck CoE
  - Description
  - Stages
  - Upliftment
  - Period of Uplift
  - Rate of Upliftment
  - Slope development
  - End product
  - Nature
  - Cause
  - Time dependancy
  - Applicability
  - Landform development
- Fluvial CoE
  - Youth Stage
  - Maturity Stage
  - Old Stage
- Fluvial Landforms
  - Erosional Landforms
    - River Valleys
    - Waterfalls
    - Pot Holes
    - Terraces
    - Gullies
    - Meanders
    - Ox-bow lakes
    - Peneplains
  - Depositional landforms
    - Alluvial Fans & Cones
    - Natural Levees
    - Deltas
- Figures
  - Geomorphic Cycle (Fig 1)
  - Davis CoE (Fig 2)
  - Graphical Rep. of Davis CoE (Fig 3)
  - Graphical Rep. of Penck CoE (Fig 4)
  - Fluvial Landforms (Fig 5)

Geomorphic Cycle

It is a theory that talks about the evolution of landforms, where a cycle is usually regarded as constituting the sequence of changes from an Initial stage via a series of stages to an ultimate state.
Erosion is a process in which various erosive agents (running water, wind, glacier, sea waves and underground water) obtain and remove rock debris from the Earth's crust and transport them for long distance.

Theories of Cycle of Erosion

1. Daviscian Cycle of Erosion
William Morris Davis advanced the idea of "Geomorphic cycle of Erosion" in 1899. His major objective was to describe and explain the distinctive characteristics possessed by Landforms. He described that all landscapes have definite life history after its emergence. Through different stages and after a long time the elevated landmass becomes a featureless and flat plain known as "Peneplain".

1.1 Accordingly, Davis has described the landscape as the function of Structure, Process and Time.
Landscape $\propto$ (Structure, Process and Time).
Where,
Structure - Includes nature (hardness, permeability) and attitude (folds, faults, joints, slopes) of rocks.
Process - Implies the factors or agents responsible for Weathering and Erosion.
Time - Implies the stage at which the cycle is - Youth, Maturity or Old age.

For the purpose of demonstrating his cycle concept in the simplest and persuasive way, Davis imagined as an initial form a mass of land uplifted from beneath the sea by Earth movements. (Fig 2)

1.2 Stages and Features

1.2.1 Youth Stage

Davis assumed that the uplift of the land took place very rapidly, so that the processes of denudation were able to act almost from the start on what was in effect a stable mass.

The uplift is complete and stopped now. Immediately erosion of the uplifted block sets in. The streams follow initial irregularities available without adjusting to the structure. These are Consequent streams. The floors of the valley suffer down cutting while the summits remain almost unaffected. Increased relief heralds the beginning of mature age, indicated by widening of the gap between lines 'A' and 'B'.

~~1.2.1.1~~ Features

→ Few Consequent Streams with few Large Tributaries

→ Headward Erosion by Small Tributaries and Gullies.

→ Development of V-shaped Valleys

→ Lack of Floodplain development

→ Interstream Tracts – wide and poorly drained; development of Lakes and Swamps.

→ Waterfalls and Rapids exist where stream crosses resistant Rockbeds.

→ Stream Meandering may exist on flat, undissected initial surface but are closely confined.

→ Maximum Altitude → Maximum Potential energy

1.2.2 Maturity Stage

At this stage the vertical erosion slows down and the horizontal action increases. A characteristic feature is the erosion of mountain tops at a faster rate than lowering of the valley floor. The coming closer of lines 'A' and 'B' indicates emergence of a gentle slope. The subsequent streams gain importance now.

~~1.2.2.1~~ Features

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~~1.2.2.1~~ Features

→ Valleys extends → Well-integrated Drainage system
→ Adjustment of streams with lithology and Structure → Existence of Longitudinal Tributaries along belts of weak rock
→ Stream divides Sharp and ridge-like → Minimum interstream uplands → Maximum Relief at early Maturity.
→ Attainment of Profile of Equilibrium by master streams.
→ Elimination of Lakes and Waterfalls
→ Wide Floodplains at Valley floor
→ Conspicuous Meanders – Free to shift positions over floodplain
→ Width of the Valley floors don't exceed the width of the Meander belts.
→ Maximum possible Relief
→ Topography consists much of slopes of Hillsides and Valley sides

1.2.3 Old Age Stage

A gentle gradient, accentuated by horizontal action & deposition, reduces the erosion intensity. A thick layer of sediment represents the earlier erosion activity. The land gets mellowed lines 'A' and 'B' run parallel to each other. Relicts of mountains or Monadnocks are dotting the water divides and a featureless plain – Peneplain is produced.

~~1.2.3.1~~ Features

→ Tributaries – Less numerous than in Maturity but more in Youth.
→ Valleys – Extremely broad & gently sloping laterally & longitudinally.
→ Extensive Floodplains with broadly Meandering Streams
→ Valley widths – Greater than those of the Meander belts
→ Stream divides reduce in heights, gently sloping → Residual hills (Monadnocks).
→ Lakes, Swamps, Marshes on floodplains, not on interstream
→ Mass Wasting – Dominant over Fluvial processes.
→ Extensive areas are near Base level of Erosion

1.3 Interruptions to the Cycle of Erosion

1.3.1 Some change causes stream to speed up and cut deeper
→ Uplift of land
→ Lowering of Sea Level
→ Greater Stream flow

1.3.2 Stream Valley takes on youthful characteristics but retains features of older stages aswell.

1.3.3 Can happen at any point in the cycle

1.3.4 Leads to development of Polycyclic or Multicyclic Landscapes.

1.4 Evaluation

1.4.1 Positives

→ The Davisian cycle affords a genetic classification and nomenclature of landscape as compared to a morphological one

→ It provides the means of expressing texture and the build of a landscape.

→ The consideration by Davis of change in base level as indication of the initiation of a new cycle has certain advantages:

⇒ The base level change can be considered a unit of time compared to the geologists stratigraphical time unit

⇒ The base level changes during glaciations are accomodated.

1.4.2 Drawbacks

→ The geographical cycle proposed by Davis is backward looking as it considers complete suspension of uplift after the erosion has set in

→ There are no logical grounds for the assumption that flat slopes are old and steep slopes are young.

→ The Davisian cycle doesn't take into account the Earth movements.

→ Too much of generalisation in the Davisian cycle presents an inadequate framework for landform interpretation.

→ There is little evidence to prove that landforms actually evolve to an end product or Peneplain.
→ It was not practical and was later objected by Penck.

2. Penck's Cycle of Erosion

Penck propounded the theory of erosion in 1953. Though Penck has accepted the concept of cycle of erosion but not like the concept given by Davis. Penck was the main critic of the Davisian cycle. Penck has also told wrong the concept of Structure, Process and Time in the peneplaination of any landmass and he said that landforms are the result of phase, rate of upliftment and degradation. Penck has given some different terminology at the place of Davisian stages. He has also accepted the 3 stages but that are not showing the time factor but the rate of upliftment.

2.1 Deviations from the views of Davis.

Penck made certain deviations from the views of Davis:

2.1.1 Erosion doesn't remain suspended till the uplift is complete.

In fact, interaction between the 2 factors, uplift and degradation is continuous.

2.1.2 The rate of uplift keeps changing.

2.2 Types of Valley slopes

Penck proposed 3 types of Valley slopes on the basis of erosional intensity acting on crustal movements:

2.2.1 Straight slope

Indicates uniform erosion intensity and a uniform development of landforms or "Gleichformige Entwickelung" in German.

2.2.1 Convex slope

Indicates waxing erosion intensity and a waxing development of landforms or "Aufsteigende Entwickelung" in German.

2.2.2 Concave slope

indicates waning erosion intensity and a waning development of landforms or "Absteigende Entwickelung" in German.

2.3 Stages and Features

2.3.1 Stage 1

With uplift, the interfluves, as well as the lower parts, rise. There is a lack of brisk undercutting. Penck used the term "Primarumpf" to represent the characteristic feature before upliftment. Primarumpf is, in fact, initial surface or primary peneplain representing either newly emerged surface from below sea level or a "Fastenbene" or "Peneplain" type of land surface converted into featureless landmass by uplift.

2.3.2 Stage 2

Here, the rate of downcutting is less than the rate of uplift. There is not much change in relief.

2.3.3 Stage 3

Rate of downcutting becomes equal to the rate of uplift. Again there is not much change in relief.

2.3.4 Stage 4

Uplift comes to an end and the downcutting further intensifies. The height of interfluves decreases. Deepening of valleys accelerates. A convex slope results. This is the stage of waning erosion or Aufsteigende Entwickelung.

2.3.5 Stage 5

The downcutting and the deepening of valleys slows down. The interfluves are rounded and further lowered. A concave slope results. This is the stage of waning erosion or Absteigende Entwickelung.

2.3.6 Stage 6

Uniform erosion or Gleichformige Entwickelung characterises the end product – "Endrumpf" or "Endplain".

2.4 Evaluation

2.4.1 Positives

→ Penck followed a deductive approach and didnot restrict himself to any particular condition.

→ Compared to the Davisian cycle, Penck's approach was forward looking.

→ Penck emphasised the mutual relation between uplift and the deepening of valleys. This indicates Penck's respect for geological evidence. Penck's 3rd stage is evident in the Middle Alps.

2.4.2 Drawbacks

→ Penck gave too much importance to the role of Endogenetic forces.

→ The orderliness in Landform changes, as assumed by Penck, may be difficult to achieve.

→ Inadequate knowledge about the ~~initial~~ pristine landscape doesn't allow much verification.

→ The concept of geographical cycle of Erosion itself has been criticised by many, since many of the cyclic generalisations are based on untested assumptions.

→ An overemphasis on historical and evolutionary studies in landforms results in the reconstruction of stages of evolution becoming the focus of study.

Davis CoE Vs Penck CoE

Feature	Davis CoE	Penck CoE
1. Description	Davis suggested landform evolution as a function of Structure, Process and Time (Stage). Davis limited his idea upto Exogenic forces and almost ignored Endogenic forces.	Penck suggested that landform was resultant of competition between Endogenic and Exogenic forces. Penck paid equal attention to both the forces.
2. Stages	Davis cycle of Erosion has 3 Stages - Youth, Mature	Penck Cycle of Erosion has stages as mention

	and Old Age.	5 conditions - Prima, Aufsteigende, Gleich, Absteigende and Endrumpf
3. Upliftment	According to Davis, upliftment finished before degradation starts.	According to Penck, upliftment and degradation starts together as soon as the landmass comes above the sea level.
4. Period of Upliftment	According to Davis the period of upliftment is small.	According to Penck, the period of upliftment is a long process.
5. Rate of Upliftment	The rate of upliftment is very rapid, according to Davis.	The rate of upliftment is sometimes slower and sometimes higher.
6. Slope Development	Davis didn't back his theory by a concrete slope development idea.	Penck's Cycle of Erosion contained the idea regarding slope replacement.
7. End Product	The end product of Davis Cycle of Erosion was Peneplain (A flat extensive featureless plain)	The end product of the Penck Cycle was Endrumpf or Peneplain (Not entirely featureless).
8. Nature	Davis Cycle of Erosion is a monocycle, that means cycle complete after the old stage of landforms.	Penck's Cycle of Erosion is polycyclic, that means a never-ending process; the cycle starts again by the rejuvenation of landforms.
9. Cause	In Davis cycle, landforms are the result of Davis Trios - Structure, Process and Time.	Penck's landforms are the result of the ratio between the intensity of Endogenic and Exogenic forces
10. Time-dependency	Davis cycle of landform development is time-dependent.	The Penck cycle of erosion is not time-dependent.

	and old Age	5 conditions- Primar[illegible] Aufsteigende, Gleich[illegible] Absteigende and Endrum[illegible]
3 Upliftment	According to Davis upliftment finished before degradation starts.	According to Penck, upliftment and degradation starts together as soon as the landmass comes above the sea level
4 Period of Upliftment	According to Davis the period of upliftment is small	According to Penck, the period of upliftment is a long process
5. Rate of Upliftment	The rate of upliftment is very rapid, according to Davis.	The rate of upliftment is sometimes slower and sometimes higher.
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10. Time-dependency	Davis Cycle of Landform development is time-dependent.	The Penck cycle of erosion is not time-dependent.

11. Applicability	Davis limited his idea upto the humid and subhumid areas	Penck original idea of Cycle of Erosion was applicable to arid, semi-arid and tropical regions
12. Landform development	Landform development is in form of "Slope decline". For example V-shaped valley get converted to U-shaped valley and then featureless peneplain in Davisian Cycle of Erosion	Landform development in the Penck Cycle of erosion is in the form of "Slope replacement" where a free face slope and concave slopes get replaced to rectilinear slopes.

Fluvial Cycle of Erosion

The cycle of erosion by fluvial process (running waters or rivers) is called normal cycle of erosion as fluvial processes are most widespread (covering most parts of the globe) and most significant geomorphic agent. Even water also plays important roles in glacial and arid regions.

1. 3 stages can be identified during the lifetime of a stream
   1.1 Youth stage
   A few consequent streams exist and a few subsequent streams are trying to develop valleys by random headward erosion. These valleys may be V-shaped. The depth of these valleys depends on the height above sea level. The inter-stream divides are broad, extensive, irregular and may have lakes. Rapids, waterfalls, gorges, river capture are characteristic features. Floodplain is generally absent but may exist along the trunk stream. Overall a highly uneven relief exists.
   1.2 Mature stage
   This stage is marked by well integrated drainage system with a few streams trying to adjust through softer beds. Broad valleys result from continuous horizontal erosion. Meanders are a characteristic feature and valley floor which is more than the meander belt width. The inter-stream

divides are sharp and the upland is reduced. Rapids, waterfalls are absent. Floodplain development is a prom feature. Maximum relief exists overall.

1.3 Old Age stage

The streams are more numerous than in the youth but less as compared to maturity. With increasing deposition valley broadening dominates. Meanders are highly developed with Ox-bow lakes and floor width is more than the meander belt width. The interstream divides are highly reduced. Lakes and marshes may be present. The successive floodplains join to form a peneplain. Delta formation is characteristic of Old Age at the mouth of the river. Mass wasting is dominant and overall minimum relief is evident.

Fluvial Landforms

The landforms created as a result of degradational action (erosion) or aggradation work (deposition) of running water is called Fluvial landforms. These landforms result from the action of surface flow / run-off or stream flow. The creative work of Fluvial processes may be divided into 3 physical phases - Erosion, Transportation and Deposition. The landforms created by a stream can be divided into Erosional and Depositional landforms.

1. Erosional landforms

1.1 River Valleys

The extended depression on ground through which a stream flows throughout its course is called a River Valley. In Youth stage it is V-shaped but in Maturity stage it becomes U-shaped.

1.2 Waterfall

It is simply the fall of an enormous volume of water from a great height, because of a variety of factors such as variation in the relative resistance of rocks relative difference in topographic relief. fall in the sea level and related rejuvenation, earth movements, etc. Eg: Jog falls on Sharavati has a fall of 260 mtr.

1.3 Pot Holes

The kettle like small depressions in the rocky beds of the river valleys are called Pot Holes which are usually cylindrical in shape. The Pot Holes goes on increasing in both diameter and depth.

1.4 Terraces

Stepped benches along the river course in a flood plain are called Terraces.

1.5 Gullies / Rills

Gully is an incised water-worn channel, which is particularly common in semi-arid areas. Eg: Ravines of Chambal Valley in Central India and Chos of Hoshiarpur in Punjab.

1.6 Meanders

A meander is defined as a pronounced curve or loop in the course of a river channel. Morphologically, the meanders may be wavy, horse-shoe type or ox-bow / bracelet type.

1.7 Ox-Bow Lake

Sometimes, because of intensive erosion action, the outer curve of a meander gets accentuated to such an extent that the inner ends of the loop come close enough to get disconnected from the main channel and exist as independent water bodies.

1.8 Peneplane (Peneplain)

These refers to the undulating featureless plain punctuated with low-lying residual hills of resistant rocks according to WM Davis. It is the end product of an erosional cycle.

2. Depositional Landforms

2.1 Alluvial Fans and Cones

When a stream leaves the mountains and comes down to the plains, its velocity decreases due to a lower gradient. As a result it sheds a lot of material it had been carrying from the mountains, at the foot. This deposited material acquires a conical shape and appears as a series of continuous fans. These are called Alluvial fans. Such fans appear throughout the Himalayan foothills in the North Indian plains.

2.2 Natural levees

These are narrow ridges of low height on both sides of a river, formed due to deposition action of the stream, appearing as natural embankments. It appears in Hwang Ho river in China.

2.3 Delta

A delta is a tract of alluvium usually fan-shaped at the mouth of a river where it deposits more material than can be carried away. Depending on the conditions under which they are formed, deltas can be of many types:

2.3.1 Arcuate or Fan-shaped

It results when light depositions give rise to shallow, shifting distributaries and a general fan-shaped profile. Eg: Nile, Ganga, Indus etc.

2.3.2 Bird's Foot Delta

This type of delta emerges when limestone sediment deposits do not allow downward seepage of water. Eg: Mississippi river

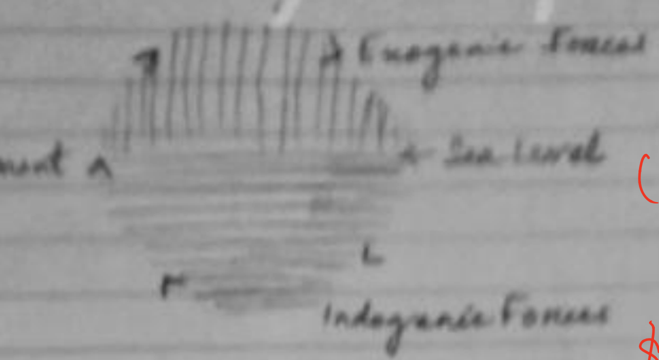
2.3.4 Estuaries

Sometimes the mouth of a river appears to be submerged. This may be due to a downward valley because of a rise in sea level. Here the fresh water and the saline water gets mixed. These are ideal sites for fisheries, ports and industries. Eg: Hudson

2.3.5 Cuspate Delta

This is a pointed Delta formed generally along the strong coasts and is subjected to strong wave action.

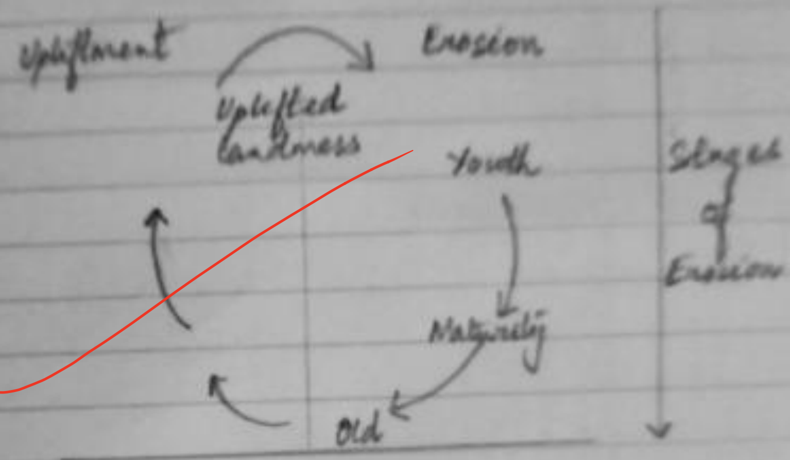
Geomorphic Cycle (Fig 1)



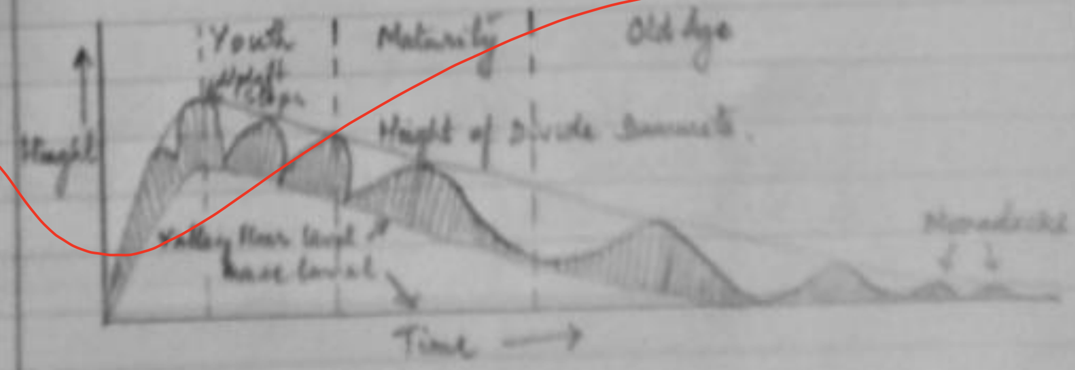
Maps needs to be added besides each relevant paragraph.

(Add this neat geomorphic cycle

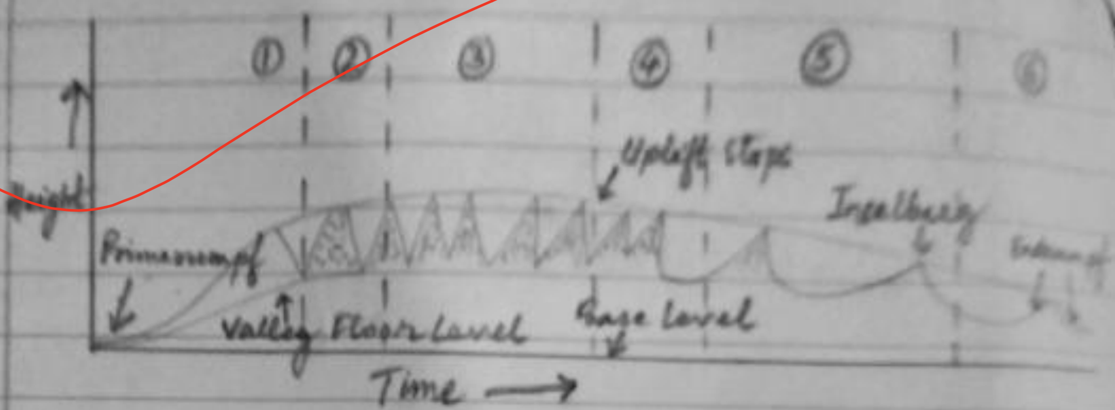
Davis CoE (Fig 2)



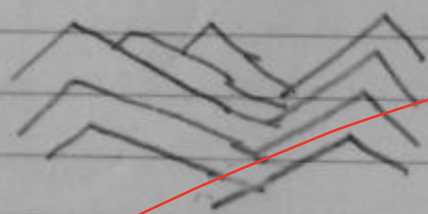
Graphical Representation of Davis CoE (Fig 3)



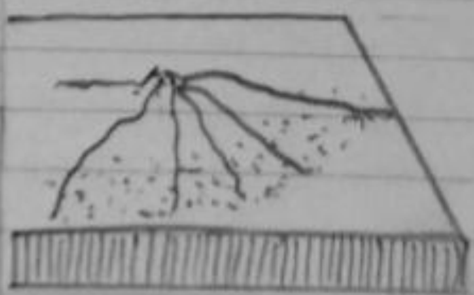
Graphical Representation of Penck CoE (Fig 4)



Fluvial Landforms (Fig 5)



River Valleys



Alluvial Fans and Cones

Thus, the concept of geographical Cycle of Erosion recognises the probability of obliteration of relief on plantation, during the life history of a landscape by process of erosion, occurring in a sequence of orderly changes, finally reducing the landscape relief to a minimum.

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4. Scientists in Modern period (early 20th century) took up the problem of origin of universe than that of just the earth or the planets. The most popular argument regarding the origin of the universe is the Big Bang Theory. It is also called expanding universe hypothesis.

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EARTH'S ORIGIN

- Big Bang Theory
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    - 1st
    - 2nd
    - 3rd
  - Evidences
    - Universal Expansion & Hubble's law
    - Background Radiation
    - Quasars
    - Radioactive Decay
    - Stellar formation & evolution
    - Speed of light & stellar distances
  - Contraindications
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    - Too complex, too early
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  - The Big Bang Theory (Fig 2)
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Big Bang Theory

1. Postulates

Edwin Hubble in 1924, provided evidence that the Universe is expanding. As time passes, galaxies move further and further apart. In 1927, a Belgian astrologer Georges Lemaitre proposed the Big Bang theory. In 1931, he took his further, suggesting that the current expansion of the Universe meant the father back in time one went, the smaller the Universe would be. At some point in the past, the entire mass of the universe would have been concentrated into a single point from which the very fabric of space and time originated.

The Big Bang hypothesis states that all of the current and past matter in the Universe came into existence at the same time, roughly 13.8 Billion Years Ago. At this time, all matter was compacted into a very small ball with infinite density and intense heat called a singularity.

1.1 Stages

The Big Bang theory considers the following stages in the development of the Universe.

1.1.1 1st Stage

In the beginning, all matter forming the Universe existed in one place in the form of a "tiny ball" (singular atom) with an unimaginably small volume, infinite temperature and infinite density.

1.1.2 2nd Stage

At the Big Bang the "tiny ball" exploded violently. This led to a huge expansion. It is now generally accepted the event of Big Bang took place 13.7 billion years before the present. The expansion continues even to the present day. As it grew, some energy was converted into matter. There was particularly rapid expansion within fractions of a second after the bang. Thereafter, the expansion has slowed down. Within first three minutes from the Big Bang event, the first atom began to form.

1.3 3rd stage

Within 300,000 years from the Big Bang, temperature dropped to 4,500 K and gave rise to atomic matter. The Universe became transparent.

The expansion of Universe means increase in space between the galaxies.

2. Evidences

2.1 Universal expansion and Hubble's law

Edwin Hubble discovered that galaxies appeared to be moving away from us at speeds proportional to their distance. This is called Hubble's law.

2.2 Background radiation

The Big Bang Theory predicts that the early Universe was a very hot place and that as it expands, the gas within it cools. Thus, the Universe should be filled with radiation that is literally the remnant heat left over from the Big Bang, called the "Cosmic Microwave Background".

2.3 Quasars An extremely luminous active galactic nucleus where a super-massive Black Hole with mass ranging from millions to billions of times the mass of the Sun is surrounded by a gaseous accretion disk.

2.4 Radioactive decay

Scientists discovered that Earth receives Microwave radiation from all directions. These are the evidences in the support of Big Bang Theory.

2.5 Stellar formation and evolution

2.6 Speed of light and stellar distances

3. Contraindications

3.1 Steady-state Universe

In 1920s and 1930s almost every major cosmologist preferred an endless Steady-state Universe. During the 1930s other ideas were proposed as non-standard cosmologies to explain Hubble's observations, including the oscillatory Universe originally suggested by Friedmann, but advocated by Albert Einstein and Richard

However, it was then criticized by supporters of the Steady state theory that if the Universe was really initially very hot as the big bang suggests, we should be able to find some remnant of that heat.

3.2 Too much energy

Most of the Universe is empty space: a vacuum which is defined as a volume containing no particles, force fields, nor waves. By definition a vacuum has no energy. However, the Big Bang theory requires both in its early phases and its later phases that the vacuum must have some energy. The law of conservation demands that energy can't be created nor destroyed.

3.3 Too complex, too early

The Universe has too many large structures to be created in 10-20 billion years. Considering the rate of expansion, we can get a rough estimate on how long it would take for them to form, probably about 100 billion years.

Formation of Earth's Atmosphere

When Earth formed 4.6 billion years ago from a hot mix of gases and solids, it had almost no atmosphere. The surface was molten. As the Earth cooled, an atmosphere started evolving.

1. Stages in the evolution of the present atmosphere

1.1 1st Stage (Loss of primordial atmosphere)

The early atmosphere with Hydrogen and Helium, is supposed to have been stripped off as a result of the Solar winds. This happened not only in the case of the Earth, but also in all the Terrestrial Planets, which were supposed to have lost their primordial atmosphere through the impact of Solar winds.

1.2 2nd Stage (Degassing)

During the cooling of the earth, gases and water vapour were released from the interior solid Earth. This started the evolution of the present atmosphere. The early atmosphere largely contained water vapour, Nitrogen, Carbon Dioxide, Methane, Ammonia and very little of free Oxygen. The process through which the gases were outpoured from the interior is called degassing.

1.3 3rd Stage (Photosynthesis)

Continuous volcanic eruptions contributed water vapour and gases to the atmosphere. As the Earth cooled, the watervapour released started getting condensed. The CO_2 in the atmosphere got dissolved in rainwater and the temperature further decreased causing more condensation and rains. The rainwater falling into the surface got collected into the depressions to give rise to oceans. The Earth's oceans were formed within 500 Million years from the formation of the Earth. Thus oceans are as old as 4,000 Million years. Sometime around 3,800 Million years ago, life began to evolve. However, around 2,500 - 3,000 Million years before the present, the process of photosynthesis got evolved. Life was confined to the oceans for a long time. Oceans began to have the contribution of Oxygen through the process of Photosynthesis. Eventually, oceans were saturated with Oxygen, and 200 Million years ago, Oxygen began to flood the atmosphere.

The Big Bang (Fig 1)

The Big Bang Theory (Fig 2)	Time begins 1 Inflation 2 Post-Inflation 3 Rapidly Cooling Cosmos 4 Superhot fog 5 Light Quarks Protons formed 6 Galaxies & Stars 7 Stars die
Atmosphere Formation (Fig 3)	Earth traps gases for protoplanetary disk → Volcanic gases accumulate → Origin of life in Oceans → Origin of Cyanobacteria → Origin of Eukaryotes Green Algae → Origin of Multicellular life → Phanerozoic organisms → Atmospheric Evolution.

elaborate the atmosphere formation more.

Thus, the Big Bang Theory is crucial to understand the origin of the Earth. After that gradually lithosphere, hydrosphere and atmosphere evolved which combined to produce habitable environment for life to generate and make Earth a liveable planet.

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