

**GS Advanced Program 2023****Generic Booklet**Test Name/Code/No. : **691043**

Name			
Email ID.			
Roll No.			
Mobile No.		Date	

**Allotted Time : 60 Minutes****Instructions to Candidates -**

- There are 7 Questions in this Question paper.
- All Questions are Compulsory.
- For all updates, please visit the noticeboard -  
<https://noticeboard.forumias.com/gsap-2023/>

**Important -**

- Answers must be attempted in the QCA Booklet only.
- To upload the Answer Copies please visit to "My Course" section on -  
<https://academy.forumias.com/>
- Only those copies will be evaluated which will be submitted before the next class.

Q. No.	Grade/Score
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Overall Grade/Score	

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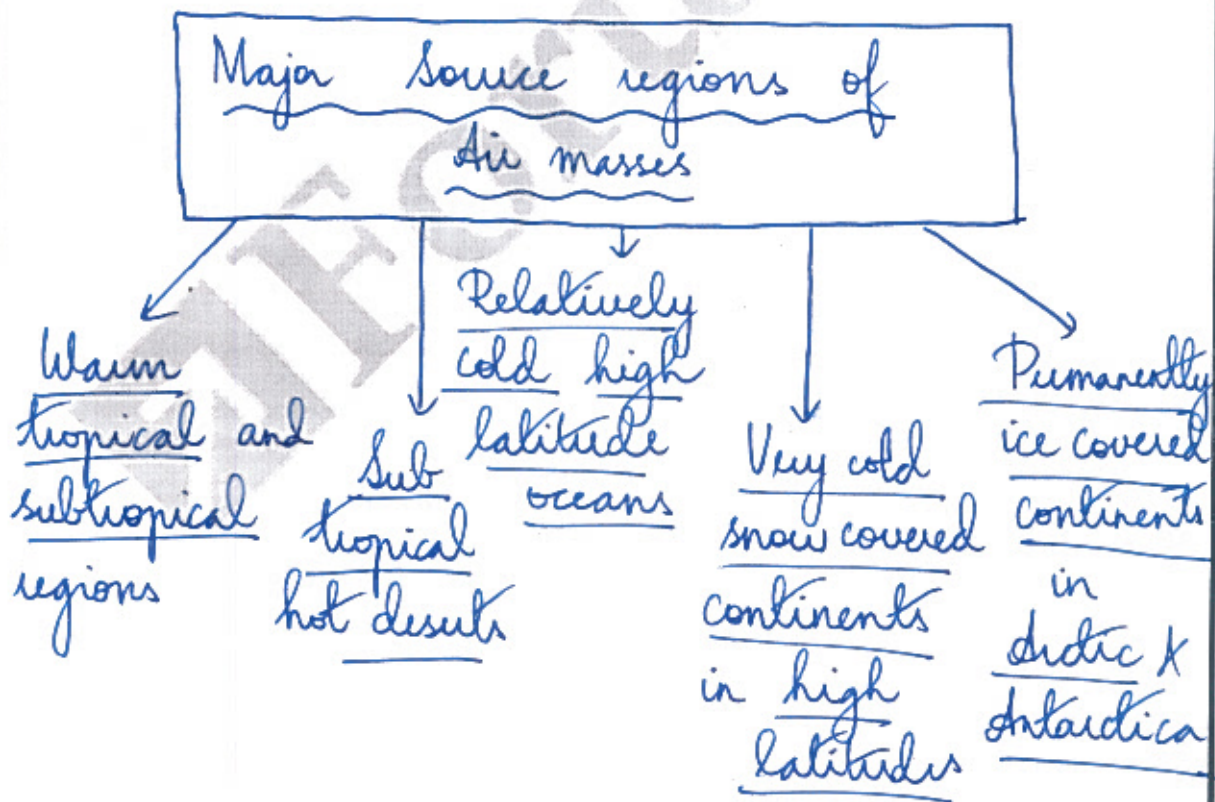
**Start Writing Here**

Q.1)

discuss the concept of air mass and explain its role in macro-climatic changes.

Air mass refers to a homogenous body of air in which there is little horizontal variation in temperature and humidity.

When the air remains over a homogenous area for a very long period of time, it acquires the characteristics of that area (source region).





## Role in macro climatic changes

### (i) Precipitation

Maritime air masses over Atlantic ocean causes persistent humidity in North America in summer

### (ii) Cyclones

Mixing of 2 air masses → cyclonic storms

### (iii) Desertification

Dry air mass → arid conditions in Sahel region of Africa

### (iv) Droughts

Dry air mass → droughts and wildfires  
e.g. California

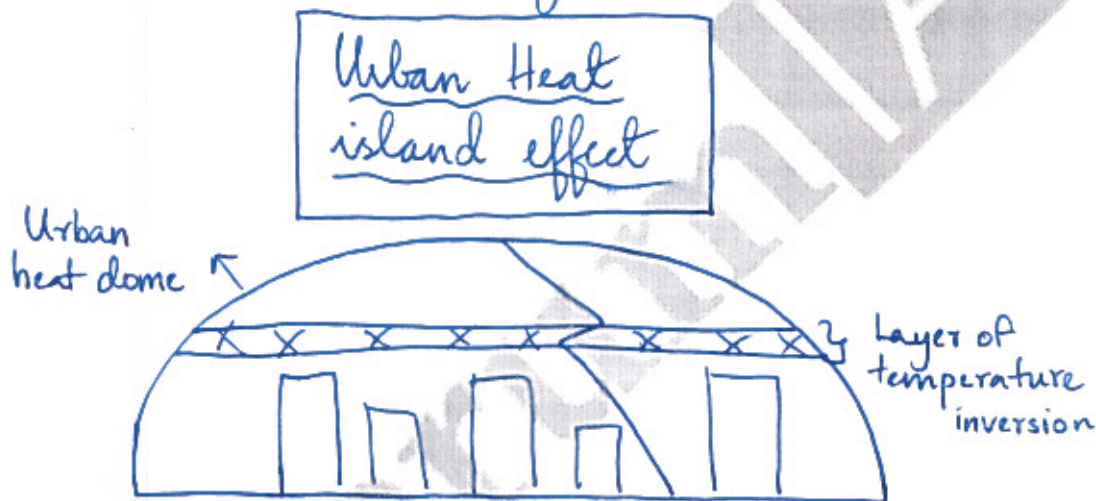
Thus air masses play an important role in macro climate changes

#### Overall Grading (✓)

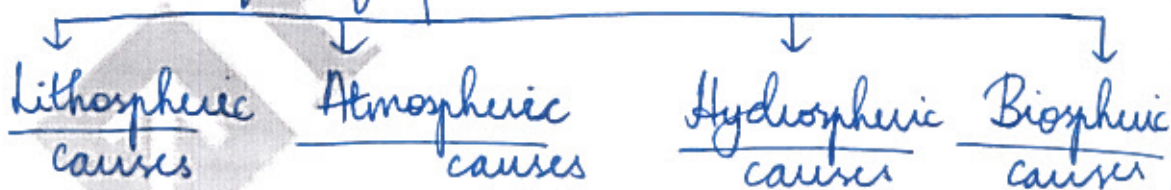
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Q.2) Bring out the causes for the formation of heat islands in urban habitat of the world.

Urban heat islands are a local weather phenomenon where certain pockets within the city experience higher heat than the surrounding area.



Causes for formation



Lithosphere

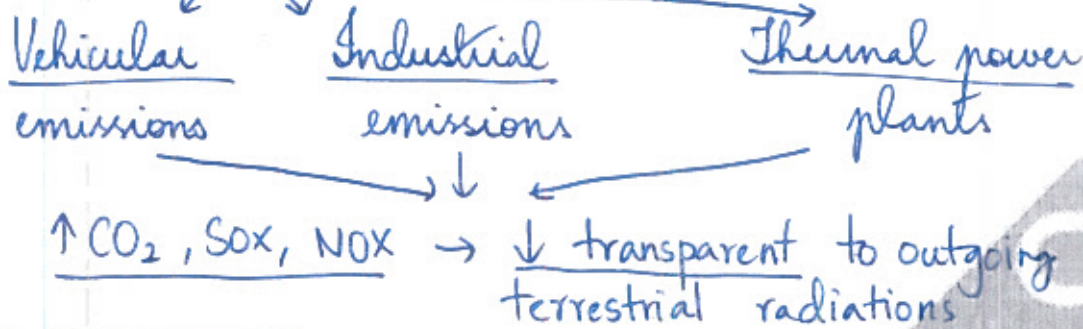
Road construction

Asphalt usage

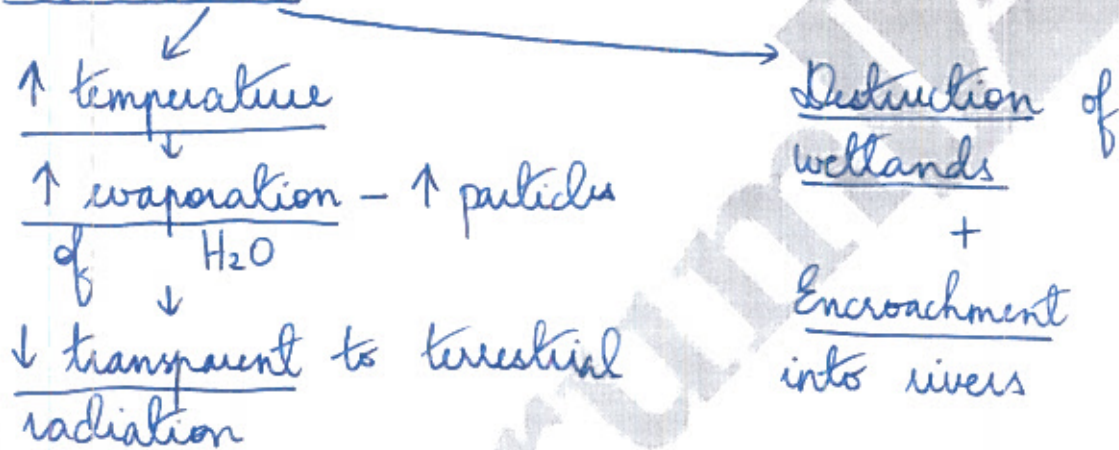
↓ albedo → ↑ heat absorbed



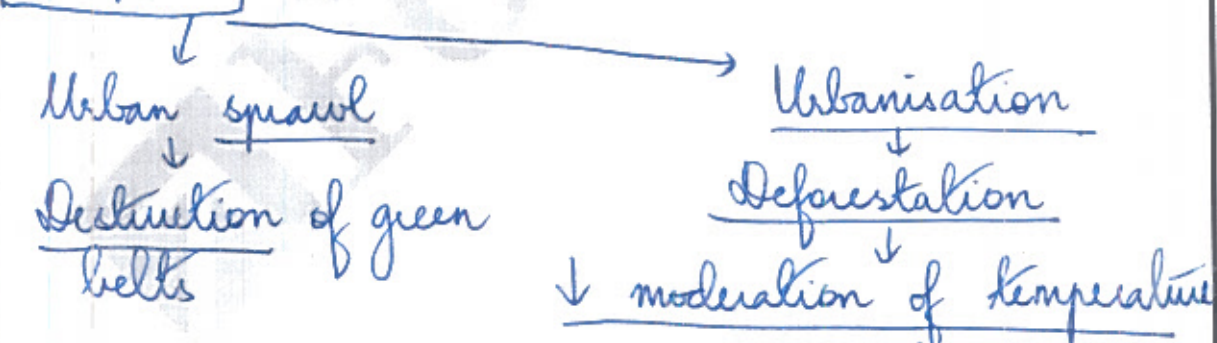
## Atmosphere



## Hydrosphere



## Biosphere



To reduce heat islands, area under green cover must be increased and appropriate construction materials must be used

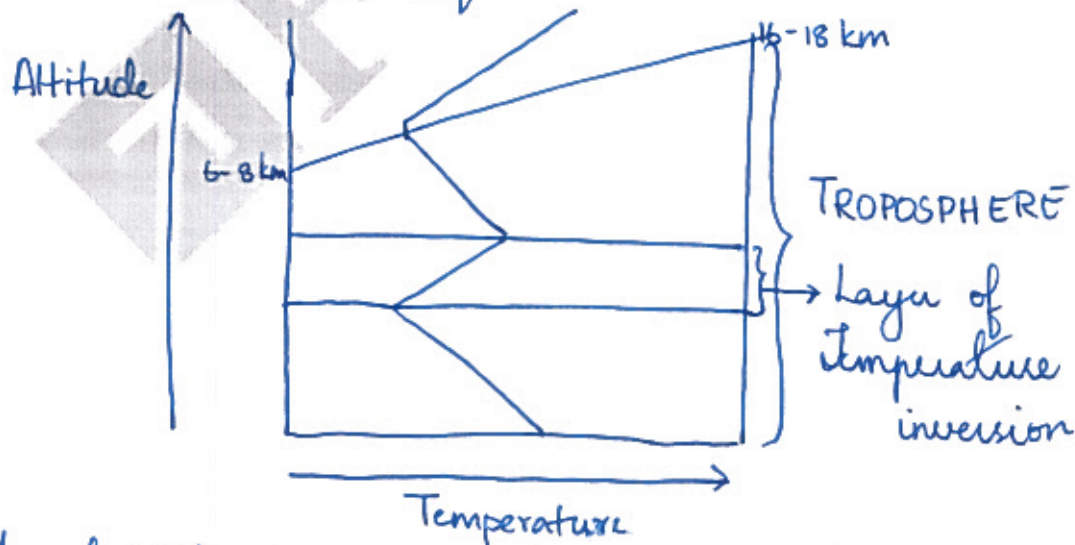
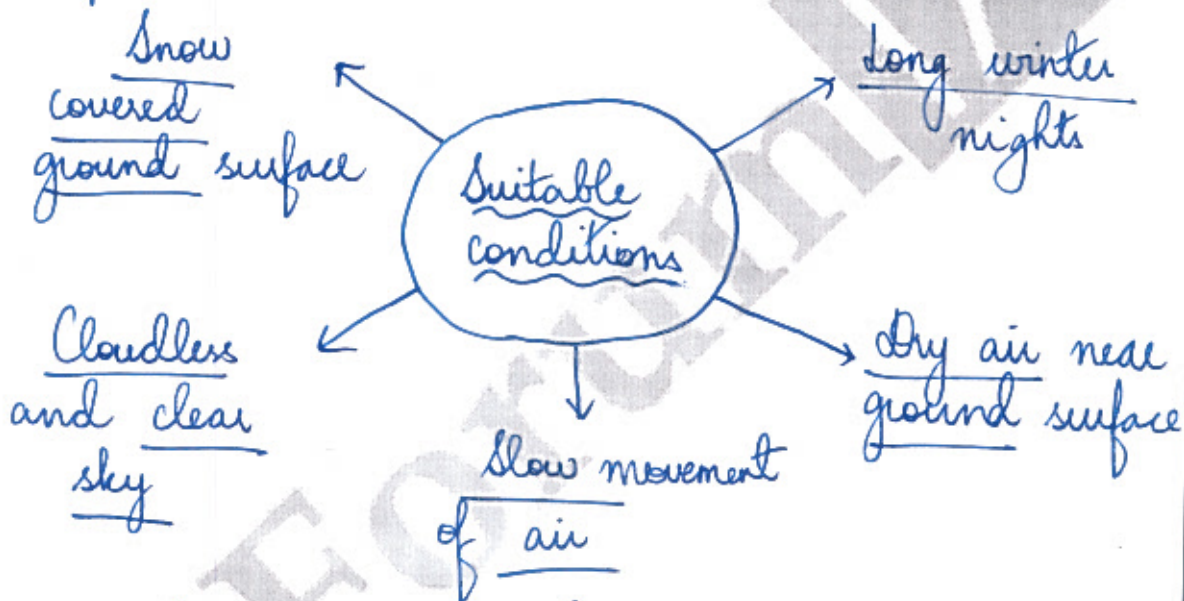
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Q.3)

What do you understand by phenomenon of temperature inversion in metuology? How does it affect the weather and habitants of the place?

Temperature inversion refers to the phenomenon wherein with an increase in height, there is a reversal of air temperature



As height increases, temperature also increases



Impact

Weather

Habitat

(i) Precipitation

Convective clouds cannot rise high

Restricts winter rainfall  
(Important for Rabi crops)

Creates desert ecosystems in western margins of continents e.g. Sahara

(ii) Fog formation

Surface inversion

Dense fog in morning

Benefits coffee plantations of Yemen Smog in urban areas

Temperature inversion thus has a multidimensional impact on weather and habitat

(i) air pollution

slow movement of air

Non dispersal of air pollutants

Winter pollution in Delhi

Respiratory problems

Accidents

(ii) Frost damage

Air drainage

Frost damage - important for apple cultivation

(iii) Telecommunication

Refraction above cold air

Disturbs radio signals

Overall Grading (✓)

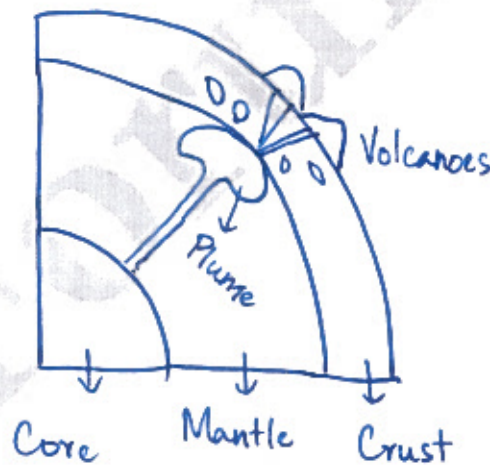
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Q.4) Define mantle plume and explain its role in plate tectonics

Mantle plume refers to the upwelling of hot materials from the Earth's mantle which reaches the base of the lithosphere

Heat transferred from the plume raises the temperature in lower lithosphere and forms magma chambers that raise volcanoes at the surface.



Role of mantle plume in plate tectonics

(i) Plates rifting

Plumes creates pressure that stretches the crust and break up continents

(ii) Hotspots

Mantle plumes cause volcanic centres called hotspots. eg. Formation of Hawaii

(iii) Flood basalts

Plume head encounters base of lithosphere

↓  
Melting → Large volumes of basalt magma  
eg. Deccan trap

(iv) Continent breakup

Eruption of flood basalts

↓  
Continental rifting  
↓  
Breakup

Thus mantle plumes have a role to play in the study of plate tectonics

Overall Grading (✓)

Poor			Average			Good		
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Q.5) Distinguish between weathering and erosion along with suitable illustrations. Also discuss various types of weathering and significance of weathering.

Weathering refers to the in situ disintegration of rocks into smaller sediments. Factors controlling weathering are



### Weathering vs. Erosion

#### WEATHERING



- Weathering causes the rock to break down
- Weathered materials are not displaced
- Types
  - Physical
  - Chemical
  - Biological

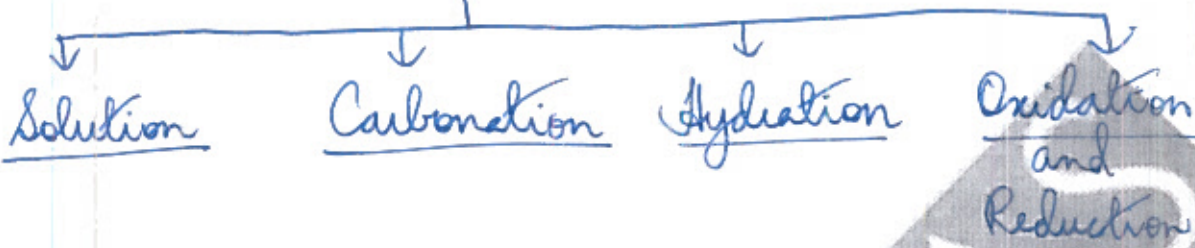
#### EROSION



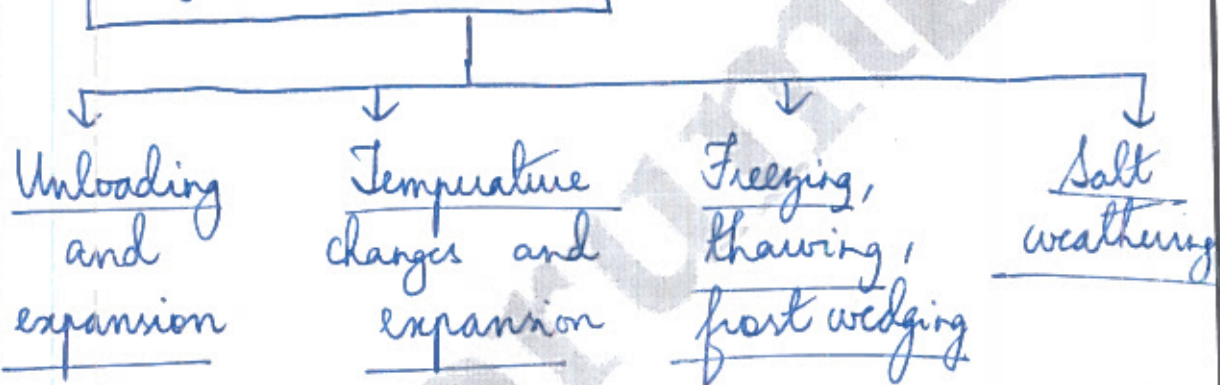
- Erosion displaces the rocks to another place
- Eroded materials are displaced
- Types
  - Water
  - Ice
  - Wind
  - Gravity
  - Thermal

## Types of weathering

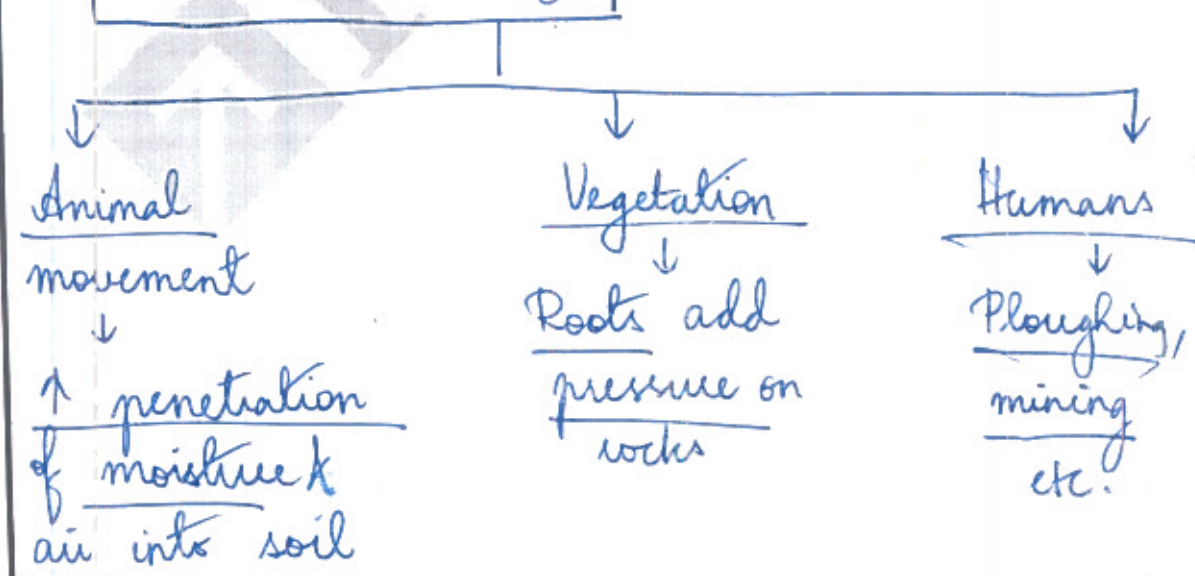
### ① Chemical Weathering



### ② Physical weathering



### ③ Biological weathering





Forest depends on depth of weathered materials

Enrichment and concentration of valuable ores  
eg. Iron



Helps in erosion  
↓  
Changes in landforms

Formation of regolith  
↓  
Soil formation

Thus Weathering plays an important role in building an ecosystem and also determines the formation of soil and as a result, formation of landforms.

Overall Grading ( ✓ )

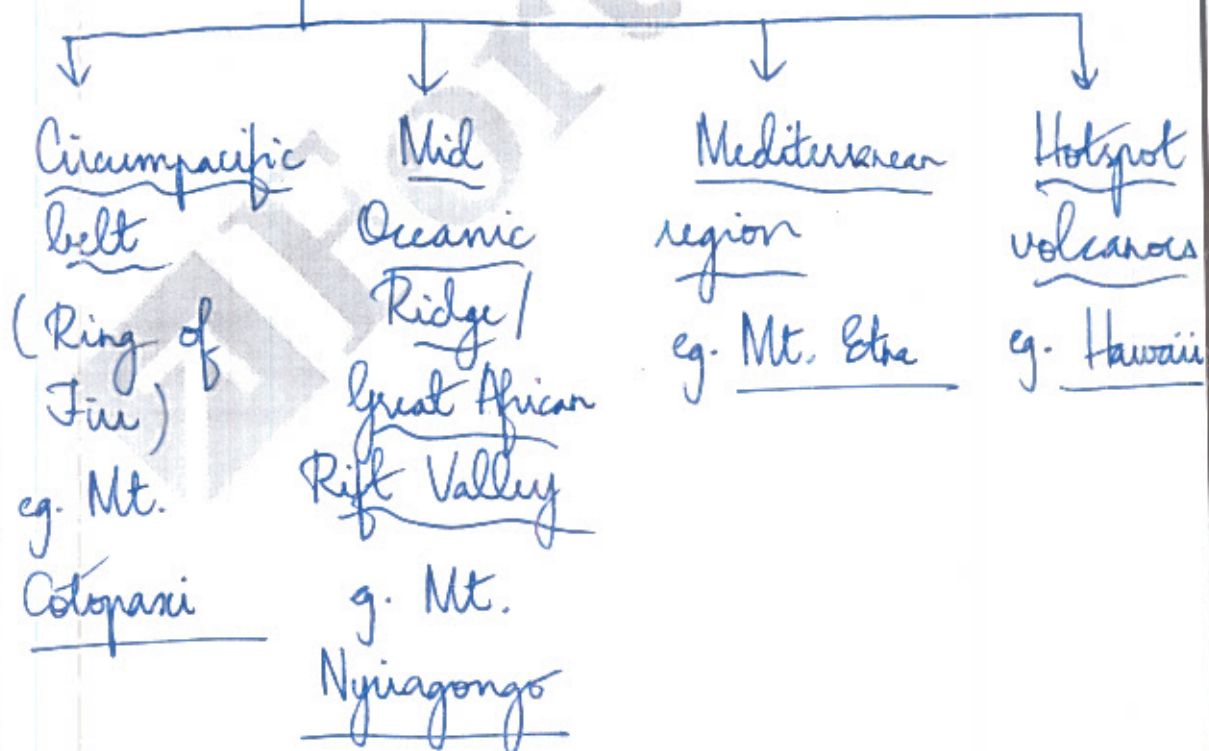
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Q.6)

Mention the global occurrence of volcanic eruptions in recent times and their impact on local environment.

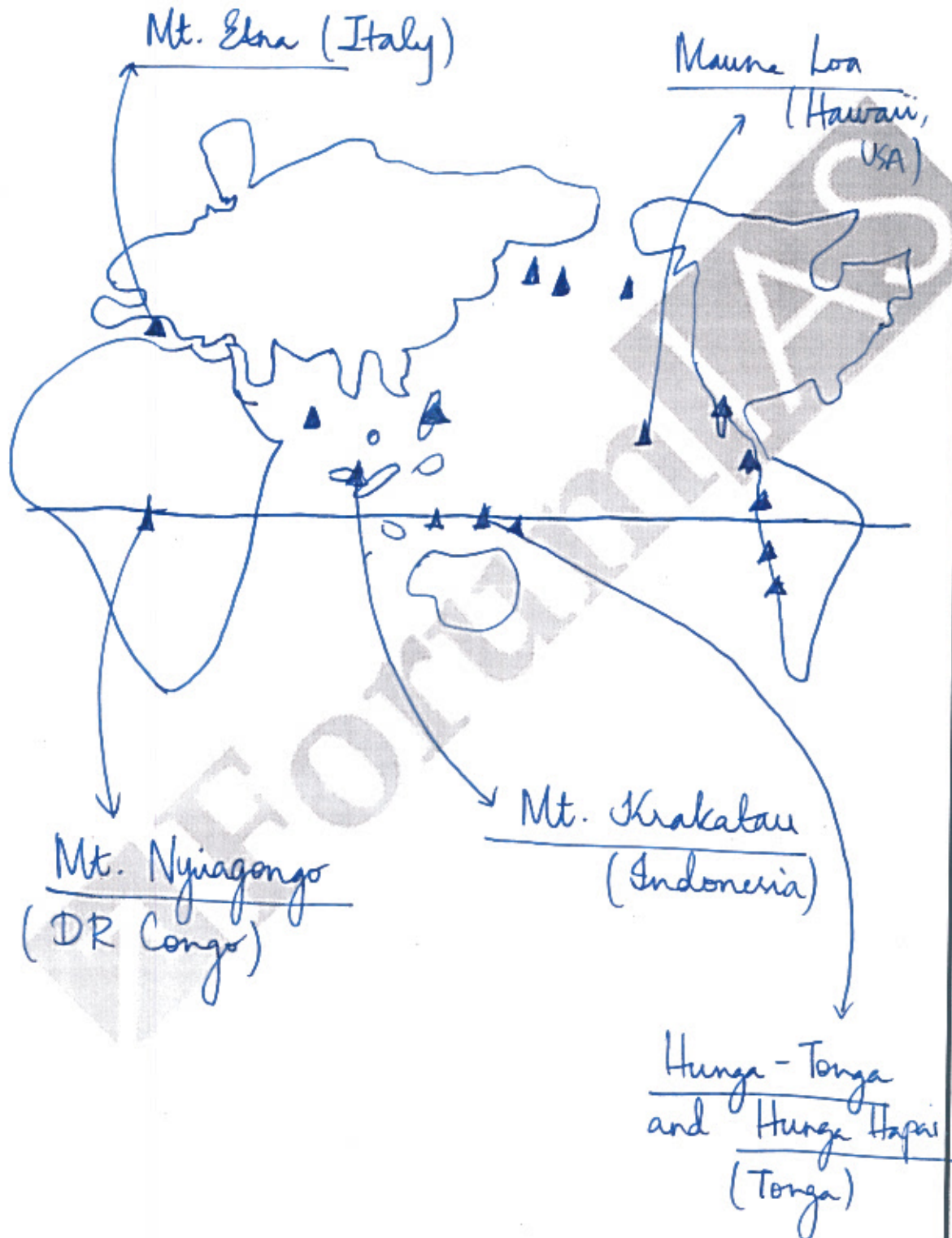
Volcanism includes the processes like generation of magma, its rise towards the earth's surface and its emplacement on the surface or under it.

Recent occurrences of volcanic eruptions have mostly been located along 4 regions.

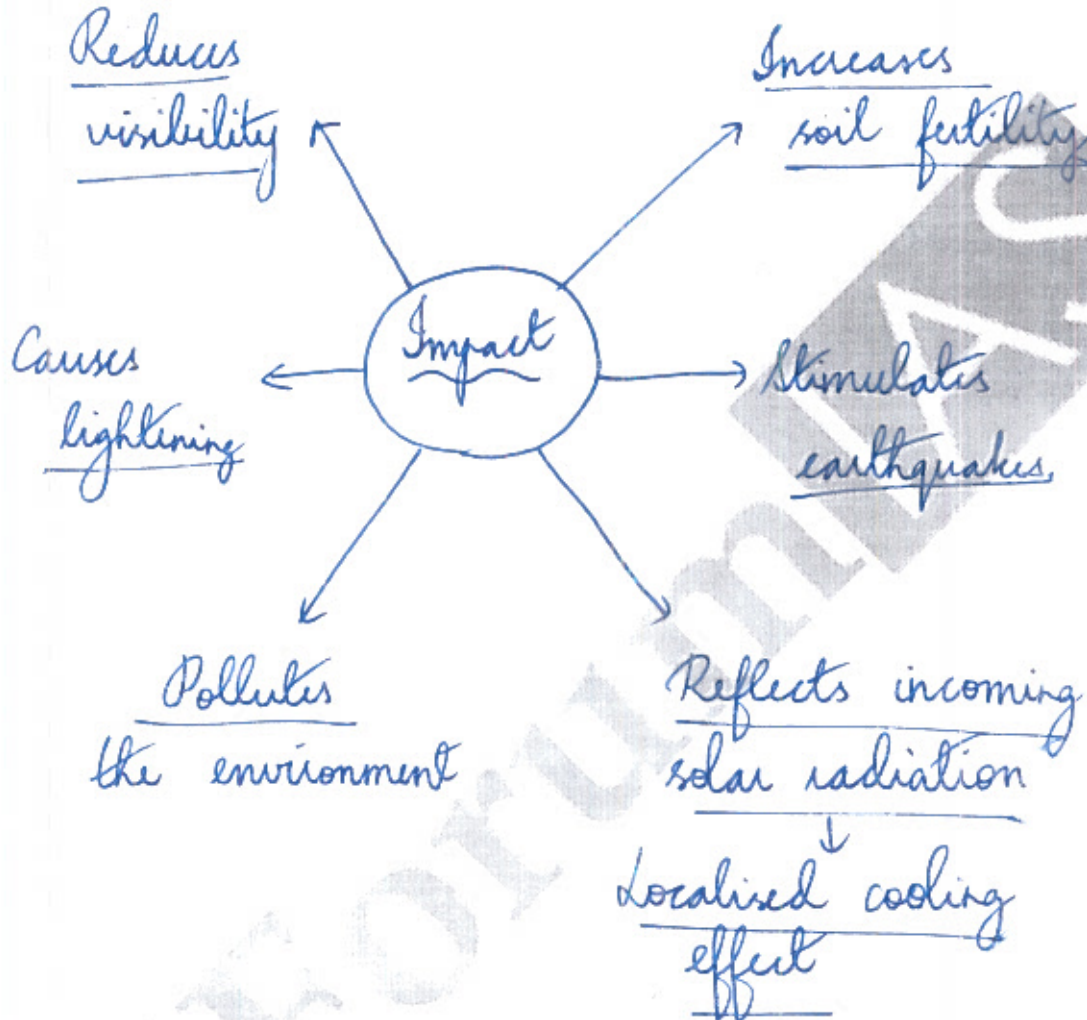




Global occurrences in recent times



## Impact on local environment



Thus volcanic eruptions produce significant impact on the environment. Sufficient steps may be taken to mitigate a disaster.

### Overall Grading (✓)

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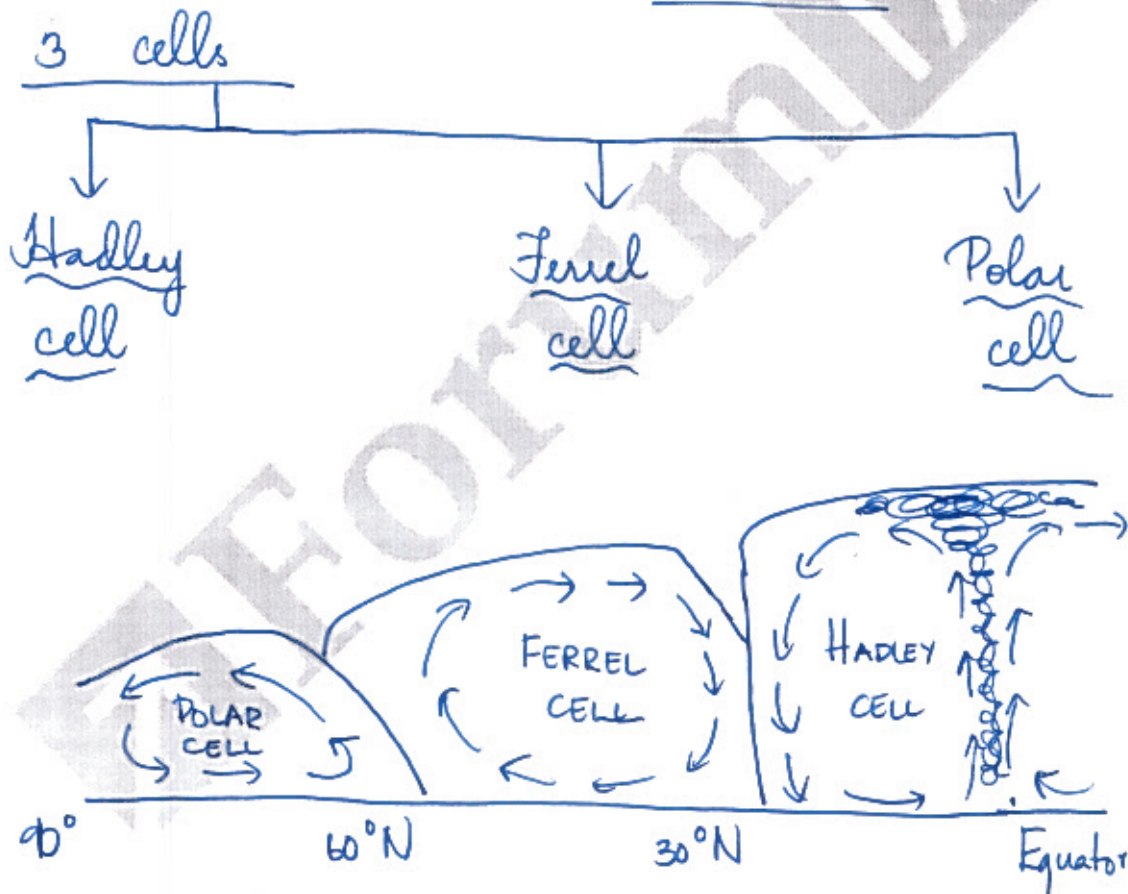


Q.7)

Describe the tricellular model of global atmospheric circulation. Examine its significance in explaining the world's climatic patterns.

The tricellular model of global atmospheric circulation explains surface wind distribution in the atmosphere.

It can be divided into



① Hadley cell

→ Circulates between 10° - 30° latitudes

- Due to solar insolation
- Creates Low Pressure at ITCZ → air rises
- Trade winds from Sub-tropical High Pressure zone flows to Equator and completes the cell

## ② Ferrel Cell

- Between 35 to 60° latitudes
- air flows
  - ↙ ↘
  - Near the surface      Higher altitude
  - ↙      ↘      ↙      ↘
  - Poleward      Eastward      Equator      Westward

## ③ Polar cell

- Between 65 to 90° latitudes
- sinking of air from upper layers of atmosphere to surface
  - ↓
  - Subpolar low - Easterly winds
  - ↓
  - Circular loop - air travels to poles



### Significance - Climate patterns

- (i) Explains location of deserts eg. Kalahari and aridity along sub-tropical high pressure belts
- (ii) Hadley cell - responsible for heavy rainfall along equator  
eg. Amazon rainforest
- (iii) Influence precipitation and climate patterns eg. Indian monsoon
- (iv) Formation of jet streams - due to shifting of pressure belts
- (v) Development of tropical cyclones, temperate cyclones and anticyclones  
eg. Hadley Cell  $\Rightarrow$  Western disturbances

Atmospheric circulations make the parts of earth habitable. Therefore the detailed study of tricellular model stays relevant

#### Overall Grading (✓)

Poor			Average			Good		
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