

**GS Advanced Program 2023****Generic Booklet**Test Name/Code/No. : **35 (Batch 2)**

Name			
Email ID.			
Roll No.			
Mobile No.		Date	6/1/23

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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Q.1)

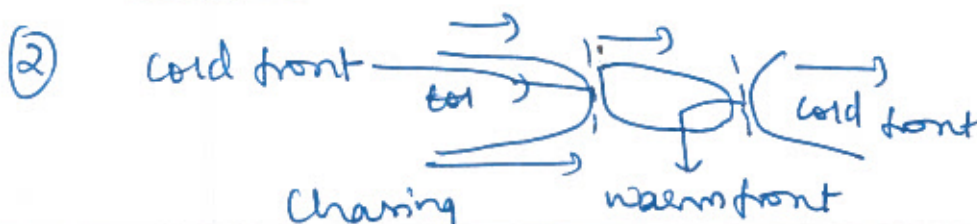
Airmass refers to large parcel of air both in horizontal and vertical distribution having similar parameters of Temperature and pressure.

Concept of airmass

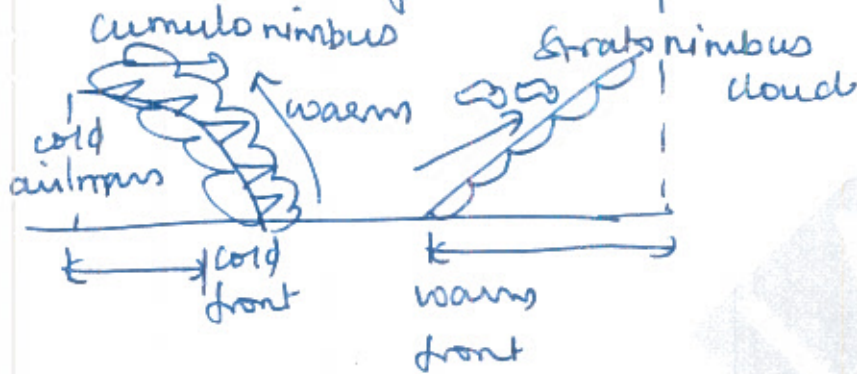
- ① ~~has~~ occupies regional characteristics from various source regions either land & sea
- ② forming of fronts and frontogenesis
(eg) warm front, occluded front.
- ③ moves comparatively slower over regions.
- ④ moves from west to east

Role in macro-climatic changes

- ① Result in Temperate / extra-tropical Cyclones



- (3) when warm front is lifted by cold fronts $\Rightarrow$ result is occluded front $\Rightarrow$ cyclone dissipates.



cold front tries to uplift warm air mass by wedging into it



formation of occluded front



uplifting of warm air mass



Frontolysis occurs

Cyclone dissipates

Thus, phenomenon of air masses helps to understand frontogenesis, frontolysis in Temperate latitudes

Overall Grading (✓)

Poor			Average			Good		
1	2	3	4	5	6	7	8	9

Q.2)

Urban Heat Islands occur when urban areas experience greater warmer temperatures than surrounding rural habitats due to human activities.

Causes for formation of heat islands

(1) Lithosphere → Increase in concrete surfaces, use of ~~atp~~ asphalt reduces albedo ⇒ Increases terrestrial temperature

(2) Atmosphere

vehicular emissions
Industrial emissions ⇒ Increase of pollutants
SO_x, NO_x, CO₂ in atmosphere.

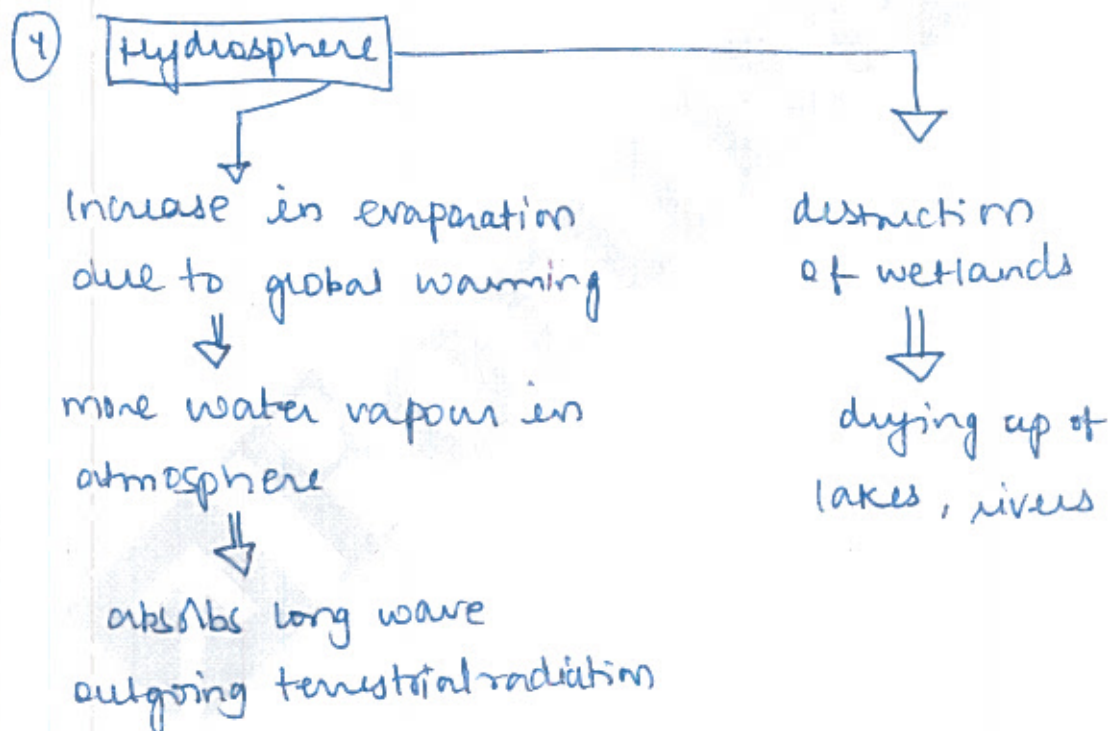
↓
non-transparent to outgoing
long wave terrestrial radiation

(3) Biosphere

⇒ man made activities → urban sprawl



- urbanisation leads to deforestation
- area loses the ability to moderate the climate (because of less forests)



Thus, urban areas with heat islands increases the vulnerability of people to heatwaves and increase in forest cover is imperative to address it.

Overall Grading (✓)

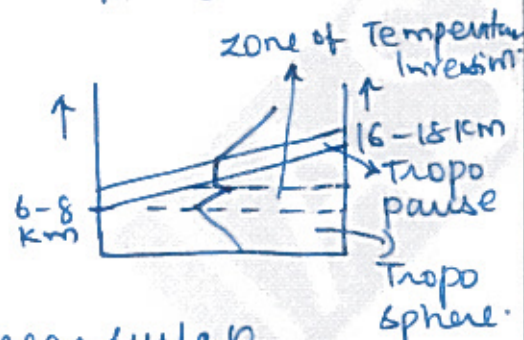
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Q.3)

Temperature Inversion refers to Increase of temperature as one rises / with Increase in height / altitude [opposite to Normal lapse rate of $6.5^{\circ}\text{C}/\text{km}$]

Suitable conditions

- ① long winter nights
- ② Cloudless
- ③ presence of dry air near surface
- ④ slow movement of air



Affect on weather and habitats

- ① Precipitation - Due to Inversion of temperature, convective clouds cannot rise above to precipitate.

↳ Affects winter rainfall which is important for Rabi crops (eg) wheat.

② Formation of Fog

① Results in dense fog in mornings.

(ii) Favourable for coffee plantations in

Yemen hills - helps crops from sunlight and gives shade.

(iii) Reduces visibility - delay in travel
- rise of accidents

(iv) Increases smog conditions $\Rightarrow$ smoke + fog where pollutants are more (eg cities).

③ Pollution

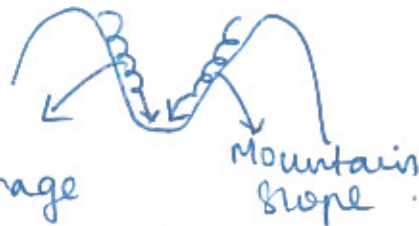
(i) Due to slow movement of air $\Rightarrow$ leads to stagnation / atmospheric stability.

No movement of pollutants (CO_2 , SO_x , NO_x).

(ii) causes respiratory problems in population.

④ Frost damage

dense cold air $\Rightarrow$ air sinks into valley drainage



$\Rightarrow$ Apple growers avoid planting along slopes to avoid it.

Appropriate measures are to be taken to counter the ill-effects of Temperature Inversion.

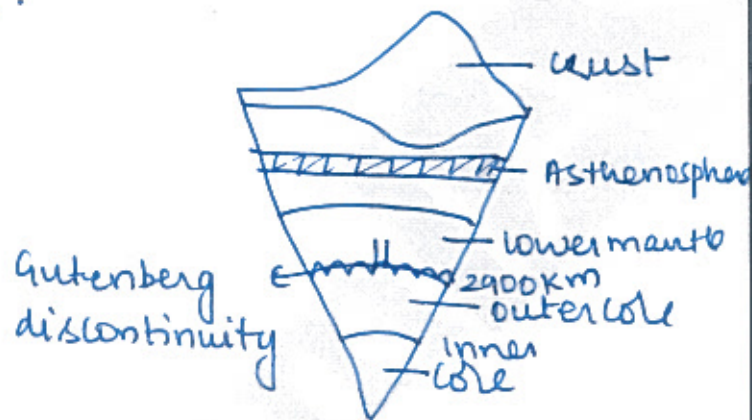
Overall Grading (✓)

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Q.4)

Mantle plume refers to magma arising from core-mantle boundary through pipe-like structure called plume and spreads either on the surface or within interior.

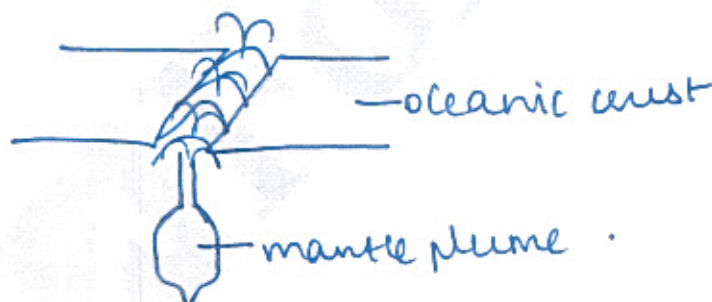
Role in plate tectonics



(a) Volcanism

(1) at Mid-oceanic ridges.

(Fig) - Earth's Interior depicting mantle plume location



olivine of mantle plume converts to basalt and occupies openings of cracks forming oceanic crust.

(2) Continent-continent divergence

African Rift valley



mantle plume active
breaks & pull away
crust on either sides



olivine - Basalt $\Rightarrow$ formation of oceanic crust



nascent sea (eg. Red Sea forms)



Ocean.

(b) Hotspot volcanoes

Hawaiian volcanoes

(c) Mauna Loa

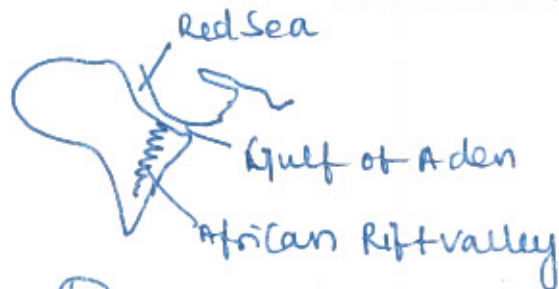
← direction of plate.



olivine of mantle plume $\Rightarrow$ Basaltic flows

It occurs on land $\Rightarrow$ ocean traps

Mantle plume occupies a significant
role in explaining formation of volcanoes,
rift valleys and other landforms.



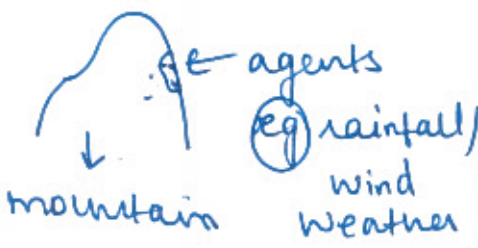
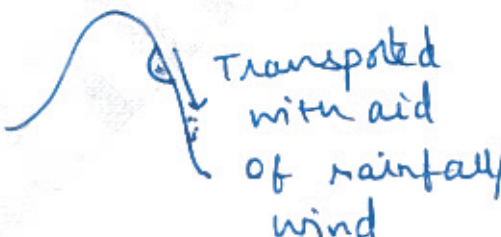
(fig) Rift valley / Nascent
Sea - C-C divergence
in Africa.

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Q.5)

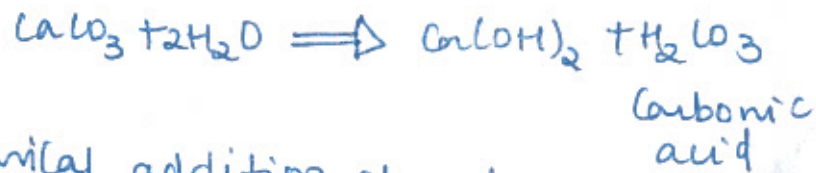
weathering refers to disintegration and breakdown of rocks in situ whereas erosion refers to movement of weathered surface through agents like water, running and ground, glaciers, wind, waves and ocean currents.

weathering	erosion
 mountain rock exposed to climate eg rainfall, wind, weather	 Transported with aid of rainfall, wind eg Joshimath is situated on ancient <u>landslides</u> rock material
exogenous <u>Types of weathering</u>	exogenous process.

① Chemical

a) Solution $\Rightarrow$ Rocks which are soluble in water form solution

(eg) calcium carbonate, magnesium bicarbonate of limestone dissolve in water.



b) chemical addition of water to mineral grains.

c) carbonation

d) oxidation and reduction

Iron exposed to air oxidises in presence of oxygen to form rust

Similarly ~~reduced~~ oxidised iron in absence of oxygen undergoes reduction.

② Mechanical

a) unloading and expansion

↪ pressure released after removal of external domes ⇒ cause

expansion of newly exposed surfaces



further weathering



fig - exfoliated domes

- b) Freezing & thawing - expansion & melting of ice crystals in water cause weathering
- c) Salt crystals - frequent expansion & melting
- d) Temperature changes - diurnal variations cause differences in expansion of internal & external surfaces cause unequal $\Rightarrow$ weathering takes place.

(3) Biological $\rightarrow$ Roots of vegetation trap the rocks and disintegrate causing weathering

movement of organisms like earthworms, rats exposes to atmosphere.

Significance

- $\rightarrow$ transformation of soil layers
- $\rightarrow$ growth of vegetation.
- $\rightarrow$ landforms like Karst topography.

weathering along with endogenous process explains the formation of landforms.

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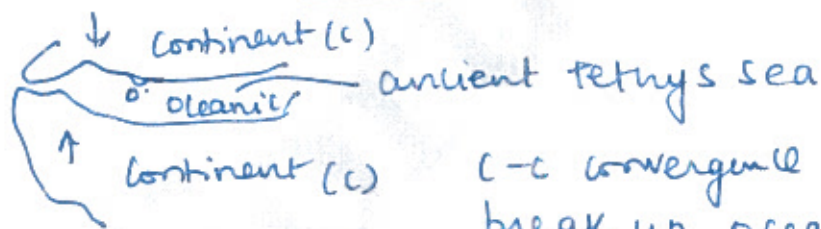
Q.6)

Volcanic eruption occurs after formation of magma and movement and spreading above earth's surface.

(eg) Recent volcanic eruption of Hungo-Tonga-Hunga-Hapei volcano in Tonga Islands.

Global occurrence

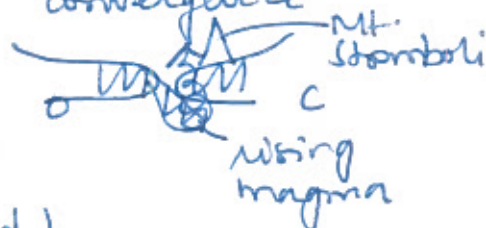
① Mount Stromboli - recently erupted located in Mediterranean region



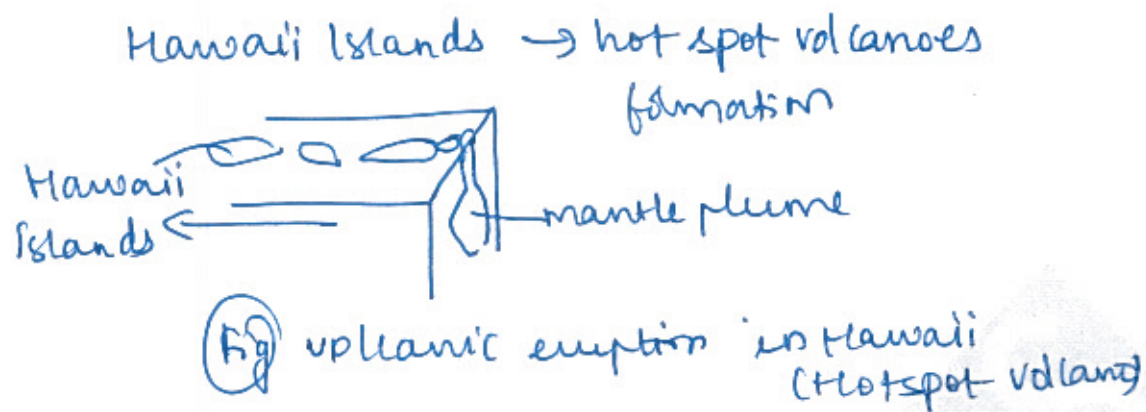
② Nyiragongo in Democratic republic of Congo.

oceanic-oceanic convergence

③ Mt. Merapi in Indonesia



④ Hawaii volcano (shield) erupted recently



Impact on local environment

- ① volcanic eruption spreads ashes across thousands of miles
 - ⇒ fertile ⇒ increases fertility of soil ⇒ improved agricultural productivity.
- ② eruption gases, ashes stay afloat in atmosphere for long period of time
 - ⇒ decreases the incoming solar radiation to reach the earth
 - ⇒ decrease of temperature
 - ⇒ further, it reduces visibility in atmosphere restricting the movement of vehicles.

⇒ Air pollution causes and affects the health causing breathing difficulties.

- ③ may trigger Tsunami over long ranges
(eg) Hunga Tonga Hunga Haapei triggered a Tsunami

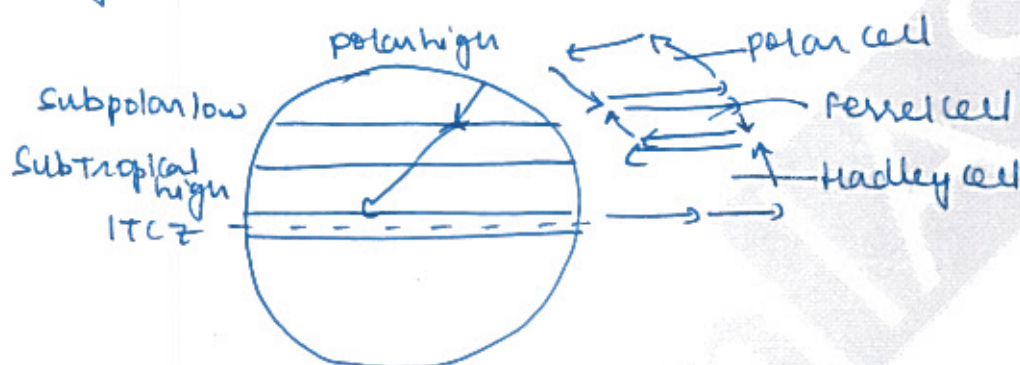
Thus, Volcanic eruptions due to their both local and large scale impact needs wider cooperation amongst countries in a line with Sendai Framework of 2015.

Overall Grading (✓)

Poor			Average			Good		
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Q.7)

Tricellular model of global atmospheric circulation refers to presence of Hadley, Ferrel and polar cells with aid of large scale movement of air.



(fig) Tricellular model

Hadley cell

- ① Rise of convective clouds at Inter-Tropical convergence zone due to insolation
- ② 10-30° latitudes
- ③ Thermally induced cell
- ④ movement of air toward poles in upper atmosphere and towards equator in form of Trade winds (easterlies)

Ferrel cell

- ① 35-60° latitudes

- (2) dynamically induced cell
- (3) Descending zone at subtropical high
- (4) movement of winds
 - └ surface - westerlies toward poles
 - └ upper atmosphere - Towards equator.

Polar cell

- (1) Thermally induced + 65° - 90° latitudes
- (2) movement of winds
 - └ surface └ converging winds rise
 - └ move towards equator
 - └ upper atmosphere - movements towards poles.

Significance in explaining climatic patterns

- (1) formation of pressure belts in Northern and southern hemisphere
 - └ Trade winds
 - └ westerlies.
 - └ polar easterlies.

- (2) Presence and formation of deserts at

subtropical high region due to descending air and lack of rainfall.

③ cells have influence on monsoon of Indian subcontinent and frequent shifting of ITCZ and pressure belts.

④ explain the path and travel of Jetstreams in upper air circulation.

Thus, global atmospheric circulation with tri-cellular model helps in understanding climatic ~~an~~ phenomena at affecting globe.

Overall Grading (✓)

Poor			Average			Good		
1	2	3	4	5	6	7	8	9

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