

Mains PYQs - GS-I (2026) (Q. 4 - 6)

4. What is the Fujiwhara effect? Explain its impact on the movement and intensity of tropical cyclones. (150 words, 10 marks)

Direction: Intro----- impact on the movement and intensity-----Conclusion.

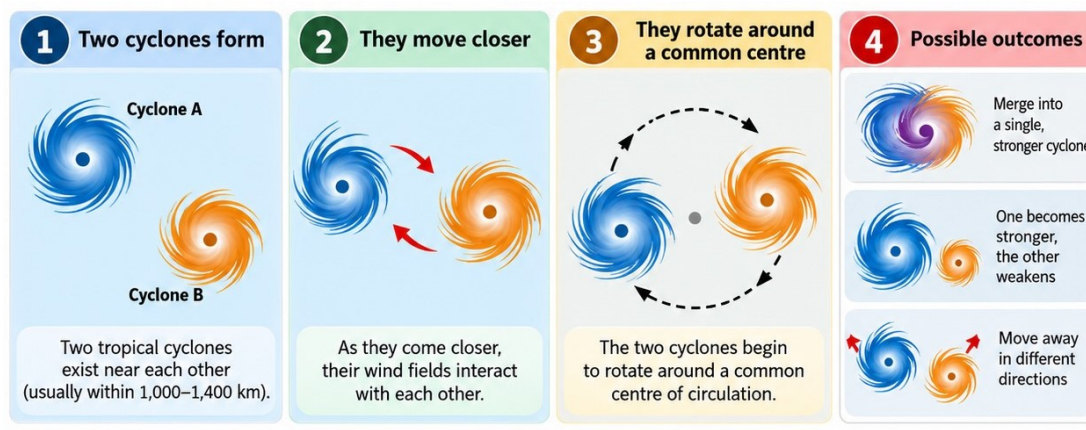
Introduction:

Describe the Fujiwhara effect.

Meteorological phenomenon - two nearby tropical cyclones come relatively close to each other, interact and rotate around a common centre of circulation.

Named after Japanese meteorologist Sakuhei Fujiwhara.

Does not always strengthen cyclones - depends on the relative size, intensity and structure of the systems.



Main Body

Impact on the movement of tropical cyclones

- Change in direction - Cyclones may deviate from their original tracks - curve toward, away from, or orbit around each other.
- Cyclonic rotation around a common centre - Northern Hemisphere rotate counter-clockwise & Southern Hemisphere; the rotation is clockwise.
- Unpredictable landfall - Interaction can significantly alter the rainfall.
- Difficult to forecast - causes more damage.

Impact on intensity of tropical cyclone

- Weak interaction - Cyclones may simply alter their trajectories, affecting the direction and speed of the cyclone.
- Strong interaction - One cyclone may weaken while the other becomes dominant.
- Partial merger - Two systems can combine into a larger circulation, producing a stronger system, which may transform into a mega cyclone.
- Shear and disrupted circulation - Interaction can also weaken both systems.

Conclusion:

Give a positive conclusion.

Though the effects are more, it is a rare phenomenon - not a regular one; it occurred last in 2023.

5. Tundra regions are ecologically fragile but economically important." Examine this statement critically. (150 words, 10 marks)

Directions: Intro----- ecologically fragile + economically important-----Conclusion.

Introduction:

Define the tundra region.

Found in arctic, Antarctic and high-altitude areas with extremely low temperatures, permafrost, short growing seasons and sparse vegetation.

Main Body

Ecologically fragile

- Slow regeneration of vegetation - Low temperatures and short growing seasons.
- Permafrost vulnerability - Permafrost thaw leads to releasing stored carbon and methane.
- Specialised biodiversity - Reindeer, Arctic foxes and polar bears are highly adaptable to these harsh conditions.
- Effects of Climate change - Loss of snow and ice reduces albedo, accelerating regional warming.
- Disturbance to sensitive region - Roads, mining and oil extraction can damage vegetation and destabilise permafrost for decades.

Economically important

- Mineral and energy resources - Significant reserves of oil, natural gas and minerals such as nickel, copper and rare earth elements.
- Emerging shipping routes - Arctic maritime routes have more potential due to the decline of sea ice.

- Pastoralism and livelihoods - Indigenous communities depend on reindeer/caribou herding, hunting and fishing.
- Tourism and scientific research provide additional economic opportunities.

Critical examine

- However, economic exploitation itself can undermine the ecological foundations and the livelihood of this region.
- Therefore, development should prioritise a sustainable and inclusive approach for low-impact extraction, indigenous participation, strict environmental assessment, permafrost-sensitive infrastructure and climate-resilient planning.

Conclusion:

Give a balanced conclusion.

Tundra regions: development-conservation dilemma - economic potential must be harnessed without crossing ecological thresholds.

6. Discuss the role of aeolian processes in desertification and land degradation. (150 words, 10 marks)

Direction: Intro-----Role in desertification and land degradation-----Conclusion.

Introduction:

Describe aeolian processes.

Refers to the erosion, transportation and deposition of soil and sediment by wind, particularly in arid and semi-arid regions.

Main Body

Role of aeolian processes in desertification and land degradation

- Removal of fertile topsoil reduces soil fertility and agricultural productivity
- Wind erosion and soil degradation - Repeated wind erosion causes damage to rocks and vegetation & degrade soil structure.
- Formation and movement of sand dunes
- Encroachment of sand dunes in agricultural fields, roads, settlements and grazing lands.
- Vegetation loss led damage - Overgrazing, deforestation and excessive cultivation reduce vegetation cover; exposed soil becomes more susceptible to wind erosion, accelerating desertification.
- Nutrient redistribution - Wind can transport nutrient-rich dust away from degraded areas.

- Interaction with climate change - Increasing temperatures, droughts and changing rainfall patterns intensify wind erosion - more vulnerable to degradation.

Conclusion:

Give a neutral conclusion and suggest some measures.

Aeolian process is a natural processes - combating desertification requires not only controlling wind erosion but also restoring vegetation, soil moisture and sustainable land-use practices. SDG 15.3 - Land Degradation Neutrality.

