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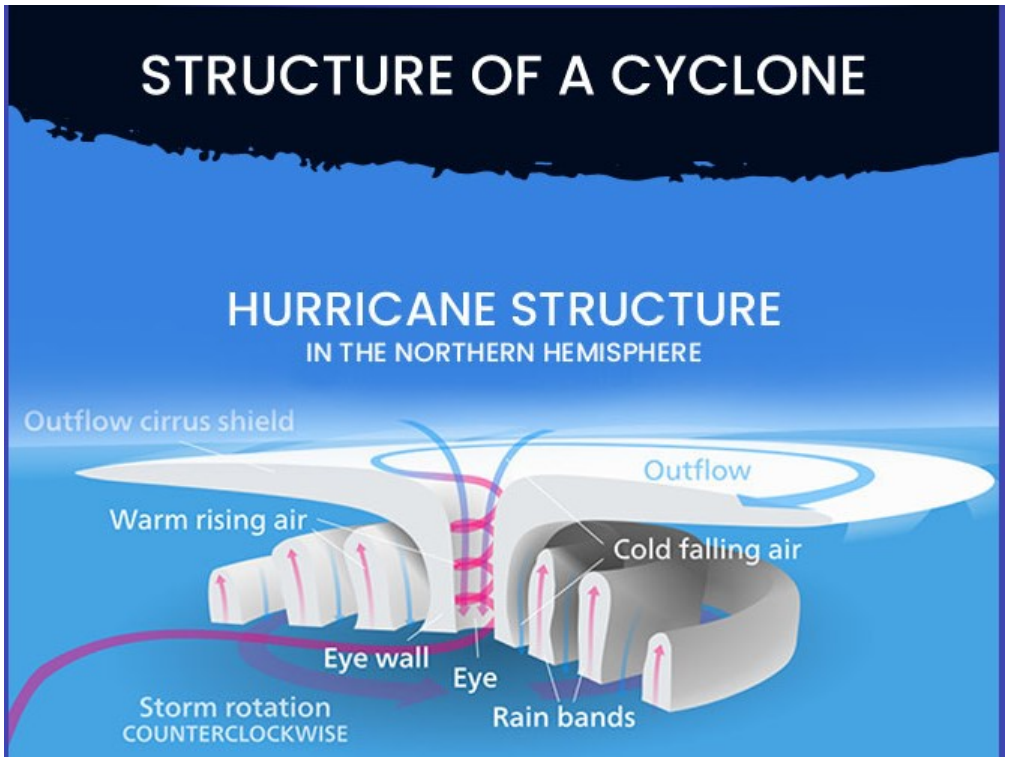
Landfall of a cyclone

The India Meteorological Department (IMD) recently reported that Cyclone Fengal, tropical cyclone made landfall over Puducherry.

- **Formation of a cyclone -** Cyclones are large storms that form when water evaporates from the surface of a sea into the air.
- As it rises, the air cools and becomes saturated with vapor, eventually forming clouds.
- These clouds and the air circulation around them eventually start to rotate.
- The warmer the sea, the more powerful the cyclone will be. There are many requires for a cyclone to form.
- Once it is fully formed, all tropical cyclones (in the northern hemisphere) have a complex 3D structure.



- At this point it has 2 important features, among others - the eye and the eyewall.
- **Eye of a cyclone -** The eye is the small centre around which the cyclone rotates. It consists of cold air descending from the cyclone's top with warm air rising in a spiral around it.
- **Eyewall of a cyclone -** The eyewall consists of high thunderstorms that bring rain, lightning, and powerful winds.
- These storms may also have large cloud tops called a central dense overcast that obscure a view of the eye as seen from above.

- As long as the cyclone moves over water, it can draw more moisture from below to produce new clouds and rain events around it.
- But when the storm crosses over onto land, its ***moisture supply declines drastically*** and the cyclone weakens.
- **Landfall -** Landfall is the event of a ***tropical cyclone coming onto land*** after being over water.
- A tropical cyclone is said to have made landfall when the ***centre of the storm or its eye moves*** over the coast.

A 'direct hit', refers to a situation where the core of high winds (or eyewall) comes ashore but the centre of the storm may remain offshore.

- Landfalls can last for a few hours, with their exact duration ***depending on the speed of the winds and the size of the storm*** system.
- As because the strongest winds in a tropical cyclone are not located precisely at the centre, it is possible for a cyclone's strongest winds to be experienced over land even if landfall does not occur.

References

1. The Indian Express | Landfall of a cyclone
2. The Hindu | What is landfall?

One Nation One Subscription (ONOS) initiative

The Union Cabinet recently approved the One Nation One Subscription (ONOS) initiative.

- ONOS is a ***central sector scheme*** to ***consolidate researchers' subscriptions*** to prominent academic journals and other similar publications.
- **Ministry -** Ministry of Education.
- It gives centralized access to research articles and journal publication for ***government higher education institutions and research and development (R&D) laboratories*** of the central and state government.
- It is designed to help students and academicians access the latest research articles and journals, including those in Tier 2 and 3 cities.
- The initiative originates from the ***National Education Policy (NEP) 2020.***
- **Payment -** It will provide access to journal articles to all individuals in India for one "centrally negotiated payment", replaces individual institutional journal subscriptions.
- It offers a fully digital platform coordinated by the ***Information and Library Network (INFLIBNET)***, an autonomous inter-university centre of the UGC.

India spent around Rs. 1,500 crore on subscription for electronic and print journals in 2018 and Rs. 995 crore on journal subscriptions in 2022.

- **Accessibility -** It provides access to nearly 13,000 e-journals from 30 renowned international publishers.
- The funds will be available for ***3 calendar years***, starting from next year and going on till the end of 2027.
- The ONOS initiative is also expected to include concessions on fees that authors have to pay to have their work published in open access journals.

References

1. The Hindu | What is the 'One Nation One Subscription' initiative?
2. Hindustan Times | One Nation One Subscription

Twisted bilayer tungsten diselenide ($tWSe_2$)

The researchers recently explored superconductivity in twisted bilayer tungsten diselenide ($tWSe_2$).

- **Moire Pattern -** Even though the 2 layers of a moire material have the same arrangement of atoms, the misalignment caused by small twist produces a completely different pattern when seen from the top.
- This is called the moire pattern.
- **Super conductivity in moire material** - In moire materials, the moire pattern gives rise to new behaviours that are not present in the individual 2D materials alone.
- This is because the twist ***leads to the formation of flat bands*** in the electronic structure of the material.
- The electronic structure of a material describes how electrons in the material behave. The energy bands are a way to visualize the energy the electrons possess and how fast they move within the material.
- In moire materials, because the ***bands are flat***, the electrons experience very little variation in energy. As a result, the electrons move slowly and are said to be heavy.
- These slower-moving electrons are more likely to interact with each other, creating strong electron-electron interactions that aren't seen in typical materials.
- These interactions can lead to the ***formation of Cooper pairs***, where two electrons pair up across a short distance and move around as a single unit.
- This pairing is central to the phenomenon of superconductivity.
- Their coordinated movement helps them avoid scattering, a process where electrons collide with atoms or impurities in the material and deviate from their path, causing electrical resistance.
- On the other hand, Cooper pairs can travel through the material without scattering, leading to ***zero resistance and energy loss***, and thus superconductivity.

Recent Findings

- The superconductivity is explored in a moire material created by stacking 2 layers of tungsten diselenide, a semiconductor, and rotating one layer by a small angle.
- The researchers used $tWSe_2$ with a twist angle of 3.65º to form a moire material.

- Then they examined how the electrons behaved when the material's electronic states were half-filled, a configuration strongly associated with superconductivity in moire materials.
- They also examined the behaviour of the electrons when the energy gap between the sublattices within the material is small, since this influences the superconducting properties.

Sublattices are smaller grids of groups of atoms within the material.

- **Features - Temperature -** The researchers found that tWSe2 was a robust conductor with a transition temperature of around –272.93º C.

The transition temperature is the critical value below which a material enters the superconducting state, exhibiting zero electrical resistance. Conventional superconductors transition at around –250º C.

- **Insulating property -** The superconductivity in tWSe2 occurs precisely when the electronic states are half-filled.
- The team also found that the moire material could transition to ***an insulating (non-conducting)*** state by altering the electronic properties of the material.
- **Coherence Length -** The material had a coherence length ***about 10-times longer than other moire materials***, meaning that its superconducting state is not fragile.
- For tWSe2, superconductivity is driven by electron-electron interactions and half-band filling, while graphene-based systems depend on flat bands and electron-lattice interactions.
- As a result, while graphene-based systems become superconducting at higher temperatures, tWSe2 is more stable.

Reference

The Hindu | New moire superconductor

Girnar Wildlife Sanctuary

As per the Centre for Environmental Planning and Technology (CEPT) data the vegetation of Girnar Wildlife Sanctuary had declined from 2000 to 2020.

- Girnar National Park and wildlife sanctuary is located in ***Junagadh, Gujarat.***
- It is also known as *Sasan Gir*.
- **Established in** –1965.
- The sanctuary was established to conserve the endangered Asiatic lion, which was once wiped out from other parts of Asia due to indiscriminate hunting.
- The Gujarat government declared 180 square km of the sacred Girnar forests as a Wildlife Sanctuary in 2008.

- It spans the rugged terrain of the ***Girnar hills,*** which are a part of the Saurashtra region and also a part of the Khathiar-Gir dry deciduous forests ecoregion.
- It is home to ***Asiatic Lions*** and the only place in the world after Africa where these species live in the hilly and forested area of the park.
- **Vegetation -** Mostly consists of
    - **Deciduous** – It sheds their leaves seasonally, usually in the dry season.
    - **Thorny scrubland** – It is found in areas with low water availability and these plants have fewer leaves.
- These vegetation are classified ***under open forest.***
- **Flora** – Includes variety of plant species, avian species, insect species, animal species and reptile species.
- It also filled with several trees, climbers, twiners, creepers, parasite and many other varieties of flower plants.
- **Fauna –** Includes Asiatic lions, spotted deer, Sambar, Chousinghas, Chinkaras, leopards, and Indian golden jackals.
- 179 Birds Species, 33 Reptiles species, 30 Mammals species are available.

Recent Findings

- The study revealed that 94% vegetation of the total area in 2000, has dipped to 83% in 2020 over 2 decades.
- It revealed that settlements were increased from 2000 to 2020 near the dense forest which was converted to open forest during the same period of time.

Asiatic Lions

• **Scientific name -** Panthera leo persica.
• **Habitat -** Gir National Park and Wildlife Sanctuary is the only abode of the Asiatic lion.
• **Distribution** - State of West Bengal in east and Rewa in Madhya Pradesh, in central India.
• **Conservation status**
- Wildlife (Protection) Act 1972 - Schedule I.
- CITES - Appendix I.
- IUCN – Endangered.
• ***World Wide Fund for Nature India (WWF)*** strengthen the efforts of Gir towards managing the conflict and poaching.

References

1. The Indian Express| Grinar Wildlife Sanctuary
2. GNP| Girnar Wildlife Sanctuary
3. WWF| Girnar Wildlife Sanctuary

Moinuddin Chishti

Recently, an Ajmer court has admitted a petition that a Shiva temple lie under the Sharif dargah shrine of Khwaja Moinuddin Chishti in Rajasthan.

- Moinuddin Chishti is the ***Persian-origin*** Sunni Muslim philosopher and religious scholar.
- **Born in –** 1st February 1141 CE, in Sistan, a province in Persia (Iran).
- He is said to have been a ***descendent of Prophet Muhmmad.***
- He is known as Muinuddin, Muiniiddin, and Mu'in al-din.
- He is also known as ***'Gharib Nawaaz'*** and 'Benefactor of the poor'.
- In his spiritual journey Harooni became a mentor to Moinuddin and he led him to rigorous spiritual discipline.
- He was initiated into the *Chishti silsila (chain of spiritual descent).*

The Chishti order was founded in the 10th century by Abu Ishaq Shami in the town of Chisht near Herat.

- He came to the Indian subcontinent in the 13th century and settled in Ajmer, Rajasthan.
- He founded and spread the ***Chishti Order of Sunni Islam*** in the Indian subcontinent.
- The Chishti Order emphasised the doctrine of the unity of being with God and members of the order were also pacifists.
- His famous dictum was ***"Sulh-i-Kul"*** (Peace with all).
- His disciples spread the Chishti order in the Indian Subcontinent.

Disciples	Year	Contributions
Qutbuddin Bakhtiyar Kaki	1173-1235	Established the Chishti order base in Delhi.
Baba Fariduddin	1173-1265	Spread the Chishti order's teachings in Punjab.
Hamiduddin Nagauri	1192-1274	Served as a spiritual leader in Nagaur.
Nizamuddin Auliya	1238-1325	His teachings and shrine in Delhi.
Chirag Dehalvi	1274-1356	He spread Moinuddin teachings after his death.

- **Died on –** 15th March 1236 in Ajmer.
- The shrine was built by ***Mughal King Humayun*** in honour of this saint.

The Urs festival is an annual festival held at Ajmer in Rajasthan which

commemorates the death anniversary of Sufi saint Moinuddin Chishti.

References

1. The Indian Express| Moinuddin Chishti
2. KMCLU| Moinuddin Chishti