DAILY CURRENT AFFAIRS 27-09-2025

GS-1

1. **Varkala Cliff**

GS-2

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4. **Perovskite Solar Cells (PSC)**
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Varkala Cliff

Syllabus: GS-1&3; geo-heritage, ecological and cultural importance

Context

- **UNESCO has placed the Varkala Cliff on its tentative list of World Heritage Sites (2025).**

About Varkala Cliff

- **Location:** Varkala, Thiruvananthapuram district, Kerala.
- **Geological Significance:**
  - Exposes the **Warkalli Formation** of the **Mio-Pliocene age** (≈ 2.5 crore – 13 lakh years old).
  - Recognised as India's **27th National Geological Monument** (2nd in Kerala after Angadipuram Laterite).
- **Unique Features:**
  - Locally known as **Sivagiri Thuruthu**.
  - Formed of **laterite and sedimentary layers** that contain fossils and records of ancient climates.
  - **Erosional landforms** and **natural springs** add scientific and tourism value.
  - **Papanasam Beach** at its base:
    - Hosts natural mineral springs.
    - Considered sacred; waters believed to have **therapeutic properties**.
- **Ecological & Community Value:**

- Acts as a **natural aquifer and water-harvesting system** for local communities.
- Microhabitat supports **unique biodiversity**.
- Adjacent **underwater reefs** sustain local fishing livelihoods.

Sixth Schedule

Syllabus: GS-2; Polity- The Constitution of India

Context

- Ladakh has witnessed one of its worst episodes of violence in decades due to demands for **statehood and inclusion under the Sixth Schedule**.

Why the Demand?

- To safeguard tribal rights, land, and culture through autonomous governance.

Key Facts:

- Sixth Schedule applies to **Assam, Meghalaya, Tripura, and Mizoram** (Art. 244(2) & 275(1)).
- Provides for **Autonomous District & Regional Councils** with legislative, judicial, and financial powers.
- Councils legislate on land, forests, inheritance, customary laws, money-lending by outsiders (subject to Governor's assent).
- They can levy taxes, regulate minerals, and manage local administration (schools, dispensaries, markets, roads, transport, etc.).
- Councils can establish courts for tribal disputes, excluding serious crimes.
- Parliament/State laws apply with **exceptions/modifications**.
- Governor can reorganise districts, review administration, and nominate members.

Significance Now:

- Extending the Sixth Schedule to **Ladakh** is being debated as a constitutional safeguard for its tribal communities, similar to Northeastern states.

China's K Visa

Syllabus: GS-2; International Relations

Context

- China has launched a new **"K Visa"** aimed at attracting foreign science and technology talent.

Legal Basis

- Created by revising the *Regulations on the Administration of the Entry and Exit of Foreigners*.

Effective Date

- Comes into force on **October 1, 2025**.

Target Group:

- Foreign youth and professionals in **STEM (Science, Technology, Engineering, Mathematics)**.
- Graduates from reputed universities/research institutions (Bachelor's degree or higher).
- Professionals engaged in STEM-related teaching and research.

Key Features (vs. existing visas):

- **Greater flexibility** in entry frequency and visa validity.

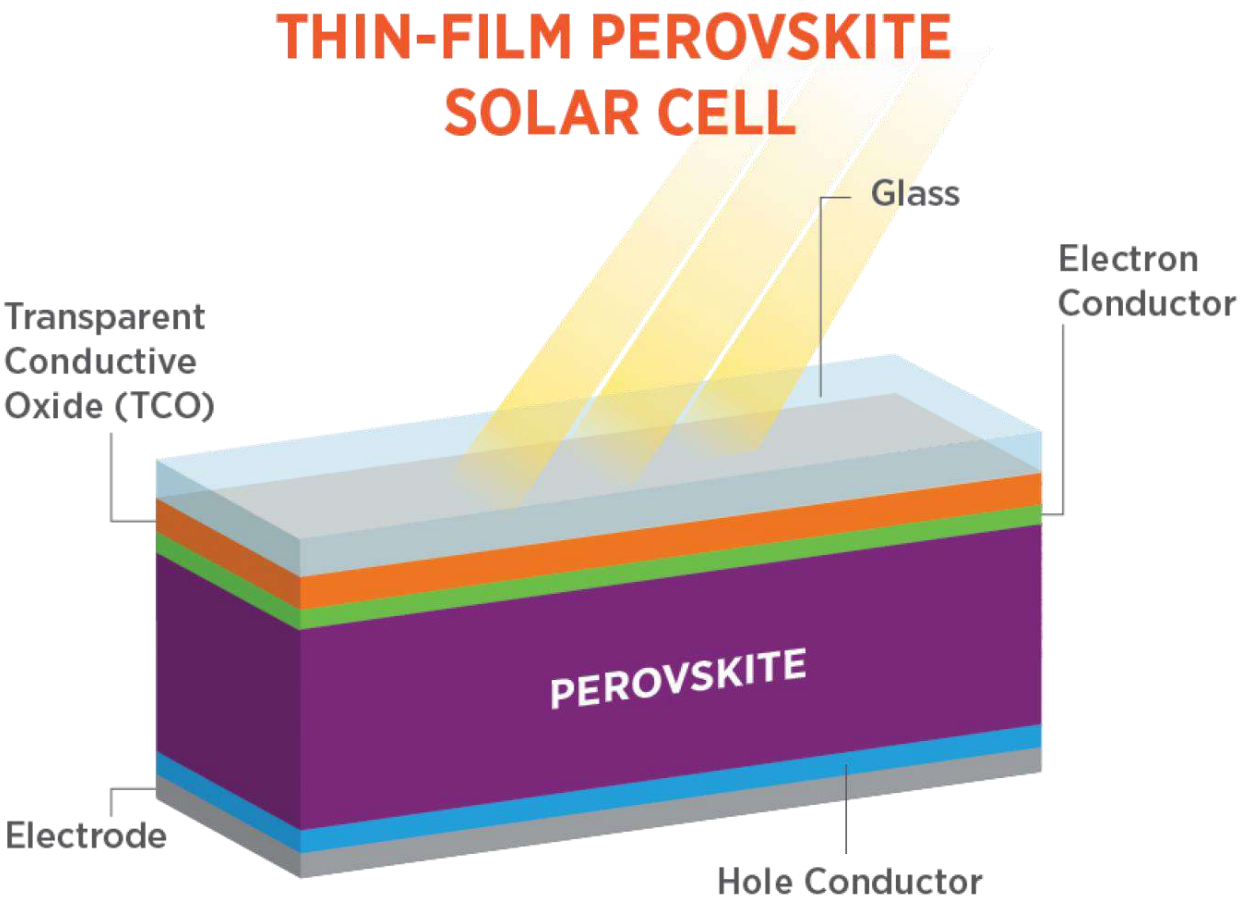
- **Wider scope of permitted activities** – education, science, technology, culture, entrepreneurship, and business.
- **No requirement of local enterprise sponsorship** (a major relaxation).

Perovskite Solar Cells (PSC)

Syllabus: GS-3; Science & Technology

Context

- **Swedish scientists at Chalmers University of Technology** (Sep 2025) used **AI-enhanced simulations** to address the long-standing problem of **halide perovskite instability**, a major bottleneck in commercializing perovskite solar cells.



About Perovskite Material

- **Discovered:** 1839, named after the mineral **Calcium Titanate ($CaTiO_3$)**.
- **Structure:** General chemical formula **ABX_3**

- **A:** Large cation (organic/inorganic) → e.g., methylammonium (MA), formamidinium (FA), cesium (Cs^+)
- **B:** Smaller metal cation → e.g., lead (Pb^{2+}), tin (Sn^{2+})
- **X:** Halide anion → iodide (I^-), bromide (Br^-), chloride (Cl^-)

- **Type used in solar cells:** Metal halide perovskites (organic–inorganic hybrids).

Features of Perovskite Solar Cells

1. **High Power Conversion Efficiency (PCE):**
   a. Lab record efficiency: **>25%**, comparable to silicon.
2. **Lightweight & Flexible:**
   a. Can be integrated into **windows, vehicles, smartphones, buildings**.
3. **Low-Cost Fabrication:**
   a. Solution-processed at low temperature vs. energy-intensive silicon.
4. **Bandgap Tunability:**
   a. Adjusted for tandem solar cells with silicon → efficiency potential **>30%**.
5. **Superior Optoelectronic Properties:**
   a. Strong light absorption, long carrier diffusion length, good charge transport.

Challenges

- **Stability Issues:**
  - Sensitive to **moisture, oxygen, heat, UV radiation** → degrades quickly.
- **Toxicity Concerns:**
  - Use of **lead (Pb^{2+})** poses environmental and health risks.
- **Scalability Issues:**
  - Transitioning from lab-scale to **large-area commercial modules** is still under research.

Recent Advances

- AI-driven materials design is helping identify more **stable halide compositions**.
- Development of **lead-free perovskites** (e.g., tin-based) to reduce toxicity.
- Research on **encapsulation techniques** to improve moisture resistance.

Significance for India

- Supports **National Solar Mission** target of **500 GW renewable capacity by 2030**.
- Can complement silicon-based panels, lowering costs and enhancing efficiency.
- Potential for **integration into urban infrastructure (BIPV – Building Integrated Photovoltaics)**.

Apterichtus kanniyakumari

Syllabus: GS-3; Biodiversity

Context

- Researchers from the **National Bureau of Fish Genetic Resources (NBFGR)** have discovered a **new species of finless snake eel** off the Colachel coast, Tamil Nadu.
- The species has been named **Apterichtus kanniyakumari** after Kanniyakumari.

Features

- Belongs to the **genus Apterichtus**.
- **Distinct traits**:
  - Golden-yellow body colouration.
  - Ventral side of head pale white with yellow lines along lower jaw.
  - Three black blotches – one behind the eyes, one at the rictus, and another behind origin of rictus.
- **Molecular analysis** (mitochondrial CO1 gene): shows distinct clade formation, but related to *Apterichtus nanjilnaduensis* (a sympatric species).

Snake Eels – Key Facts

- Family: **Ophichthidae**.
- **Appearance**: Snake-like elongated bodies.
- **Distribution**: Found worldwide in tropical & temperate waters.
- **Habitat**: Sandy shallow seas; some species live up to **800m depth**.
- **Behavior**: Use tail to burrow backward into seabed, creating a protective burrow.