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SUNDAY, 16th NOVEMBER 2025

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1. Saranda Forest Area

- **Prelims -** Saranda Forest Area
- **Mains -** GS 3 - Environment

Why in the news?

- The Supreme Court has directed the Jharkhand government to declare 31468.25 hectares of Saranda forest area as a wildlife sanctuary.

Saranda Forest Area

- **Location:** Jharkhand's West Singhbhum District- Southern part of Jharkhand bordering Odisha
- **Geography:**
  - ➔ Part of the Singhbhum Craton- One of the world's oldest geological formations.
  - ➔ Undulating hills, Deep valleys and High plateaus are found in the region.
- **Key Features:**
  - ➔ Moist deciduous forests dominated with Sal trees
  - ➔ One of the world's pristine Sal Forests
  - ➔ Home to endemic Sal forest tortoise as well as Four horned antelope
  - ➔ Accounts for 26% of the Iron ore reserves in India.
- **Tribal Population:** Home to Ho, Munda, Oraon, and other tribal communities.

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2. Vanadium Flow Battery

- **Prelims -** Vanadium Flow Battery
- **Mains -** GS 3 - Science and Technology

Why in the news?

- India's first MWh-scale Vanadium redox flow battery was inaugurated by the Union Minister for Power.

Vanadium Flow Battery

- **What is it?:** A Vanadium Flow Battery (VFB) is an electrochemical energy storage system where vanadium ions in liquid electrolytes store and release energy.
- **Working Principle:**
  - ➔ Utilizes vanadium ions in four oxidation states (V^{2+}, V^{3+}, V^{4+}, V^{5+}) in two separate electrolyte tanks.
  - ➔ During charging, electrons move through an external circuit where ions change oxidation state and energy gets stored in the liquid.
  - ➔ During discharge, the reverse process releases energy.
  - ➔ The electrolytes circulate through a cell stack separated by an ion-exchange membrane.
- **Advantages:**
  - ➔ Long cycle life (up to 20,000–25,000 cycles, 20+ years).
  - ➔ No cross-contamination since the same vanadium element is used in both tanks.
  - ➔ High safety: Non-flammable, no thermal runaway.
  - ➔ Scalability: Energy capacity depends on tank size
  - ➔ Deep discharge capability (up to 100% DoD).
  - ➔ Excellent for long-duration storage (4–10 hours).
- **Applications:**
  - ➔ Grid-level renewable energy storage (solar/wind).
  - ➔ **Peak shaving** (Reducing consumption peak during periods of high demand) and **load shifting** (Moving the electricity consumption from peak time to off-peak hours).
  - ➔ Microgrids and remote power systems.

- ➔ Backup power for industrial facilities.
- ➔ Integration with green hydrogen and long-duration storage systems.

- **Limitations:**
  - ➔ **High upfront cost** due to vanadium prices.
  - ➔ Lower energy density compared to lithium-ion.
  - ➔ Requires pumps and tanks, increasing space and maintenance needs.
  - ➔ **Efficiency is lower** than Li-ion battery- 70-80% as compared to the 90-95% efficiency of Li-ion.
- **Indian Context:**
  - ➔ Interest rising due to energy transition and RE expansion (500 GW target by 2030).
  - ➔ India has significant vanadium deposits in Arunachal Pradesh, Odisha, and Karnataka.
  - ➔ MNRE promotes advanced battery technologies including flow batteries under R&D programs.
  - ➔ Used in pilot projects under Smart Grid Mission and Renewable Energy Storage missions.

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3. Rheumatoid Arthritis

- **Prelims** - Rheumatoid Arthritis
- **Mains** - GS 3 - Science and Technology

Why in the news?

- A recent study has traced the covert molecular progression of rheumatoid arthritis during its preclinical phase.

Rheumatoid Arthritis

- **What is it?:**
  - ➔ Rheumatoid Arthritis (RA) is a chronic, systemic, autoimmune inflammatory disorder that primarily affects synovial joints.
  - ➔ The immune system mistakenly attacks the body's own tissues causing persistent inflammation which later leads to joint damage and disability.
- **Key Features:**
  - ➔ Symmetrical joint involvement- both sides of the body.
  - ➔ Affects small joints (hands, wrists, feet) early; larger joints later.
  - ➔ Can involve extra-articular organs- lungs, heart, eyes, skin, blood vessels.
  - ➔ More common in women.
- **Causes:**
  - ➔ **Autoimmune reaction** causing production of autoantibodies.
  - ➔ Obesity and stress can worsen risk.
- **Symptoms:**
  - ➔ Persistent joint pain & swelling.
  - ➔ Morning stiffness > 1 hour.
  - ➔ Fatigue, fever, weight loss.
  - ➔ Deformities: swan-neck, boutonnière, ulnar deviation.
- **Treatments:**
  - ➔ DMARDs (Disease-Modifying Anti-Rheumatic Drugs)
  - ➔ NSAIDs & Steroids: To reduce pain and inflammation.
  - ➔ Biologics like TNF inhibitors, IL-6 inhibitors and JAK Inhibitors.

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4. ESCAPADE Mission

- **Prelims** - ESCAPADE Mission
- **Mains** - GS 3 - Science and Technology

Why in the news?

- NASA launched its latest Mars mission- The ESCAPADE Mission.

ESCAPADE Mission

- **What is it?:**
  - ➔ ESCAPADE stands for Escape and Plasma Acceleration and Dynamics Explorers.
  - ➔ It comprises two identical spacecraft, nicknamed *Blue* and *Gold*, that will travel to Mars and carry out a dual-spacecraft orbital science mission.
- **Launched By:** NASA under its SIMPLEx (Small Innovative Missions for Planetary Exploration) programme.
- **Mission Objectives:**
  - ➔ To understand how energy and momentum from the solar wind are transported into and through Mars' magnetosphere and upper atmosphere.
  - ➔ To investigate how and why Mars lost much of its atmosphere, transitioning from a warmer, wetter planet to the cold arid planet we see today.
  - ➔ To study the structure and dynamics of Mars' hybrid magnetosphere, including flows of ions and electrons, plasma behaviour, and coupling between solar wind, magnetosphere and atmosphere.
- **Key Features:**
  - ➔ After launch, the spacecraft will first enter an Earth–Sun libration point orbit (L2) (a "loiter" phase) before beginning transit to Mars.
  - ➔ Arrival at Mars is expected around 2027.
  - ➔ Once in Mars orbit, the twin spacecraft will operate in complementary orbits, enabling multi-point measurements of Mars' magnetosphere, solar wind interactions and atmospheric escape processes.
- **Significance:**
  - ➔ This is the first time NASA is sending two coordinated spacecraft into orbit around another planet (Mars) for simultaneous multi-point science.

- ➔ Provides critical information for future human missions: understanding Mars' radiation and plasma environment, atmospheric escape mechanisms, and space-weather impacts.
- ➔ Demonstrates a lower-cost approach to planetary exploration (via SIMPLEx), showing how smaller/cheaper missions can still yield high-value science.

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5. Venezuela

- **Prelims -** Location of Venezuela
- **Mains** - GS 2 - International Relations

Venezuela

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Why in the news?

- Venezuela has expressed keen interest in enhancing cooperation with India in critical minerals sector and attract investments, the commerce ministry said.

Venezuela

- **Location**: It is a South American country.
- **Capital:** Caracas
- **Bordering Countries**: Guyana, Brazil, and Colombia.
- **Bordering Waterbodies**: Caribbean Sea and the Atlantic Ocean.
- **Rivers:** Orinoco River
- **Grasslands:** Llanos
- **Waterfall:** Angel Falls, the world's highest waterfall.

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6. Strait of Hormuz

- **Prelims -** Strait of Hormuz
- **Mains -** GS 1 - Geography

Why in the news?

- Iranian forces recently seized a Marshall Islands flagged oil tanker as it passed through the Strait of Hormuz, the world's most sensitive energy chokepoint.

Strait of Hormuz

- **Location**: Narrow waterway between Iran (north) and UAE & Musandam (Oman) (south).
- **Connectivity**: Connects the Persian Gulf (west) to the Gulf of Oman (east).
- **Geostrategic Importance:**
  - ➔ It is one of the world's most critical maritime choke points.
  - ➔ Around 25% of global oil and 30% of liquefied natural gas (LNG) pass through this strait.
- **Major Islands in the Strait**: Hengam, Hormuz, Qishm.

7. Colombo Security Conclave

- **Prelims** - Colombo Security Conclave
- **Mains** - GS 2 - International Relations

Why in the news?

- The Colombo Security Conclave (CSC) officially welcomed Bangladesh as its fifth member state during the 8th Deputy National Security Adviser (DNSA) level meeting.

Colombo Security Conclave

- **Overview**: The Colombo Security Conclave was established in 2020, when India, Sri Lanka and the Maldives agreed to expand the scope of their trilateral meeting on maritime cooperation.
- **Objective**: To promote regional security by jointly addressing transnational threats and challenges of common concern.
- **Pillars of Cooperation**: Maritime security, counterterrorism, combating transnational organised crime, cyber security & humanitarian assistance and disaster relief.
- **Members:**
  - ➔ India, Sri Lanka, Maldives, Mauritius & Bangladesh
  - ➔ Seychelles is an observer nation.

8. Stem Cell Therapy

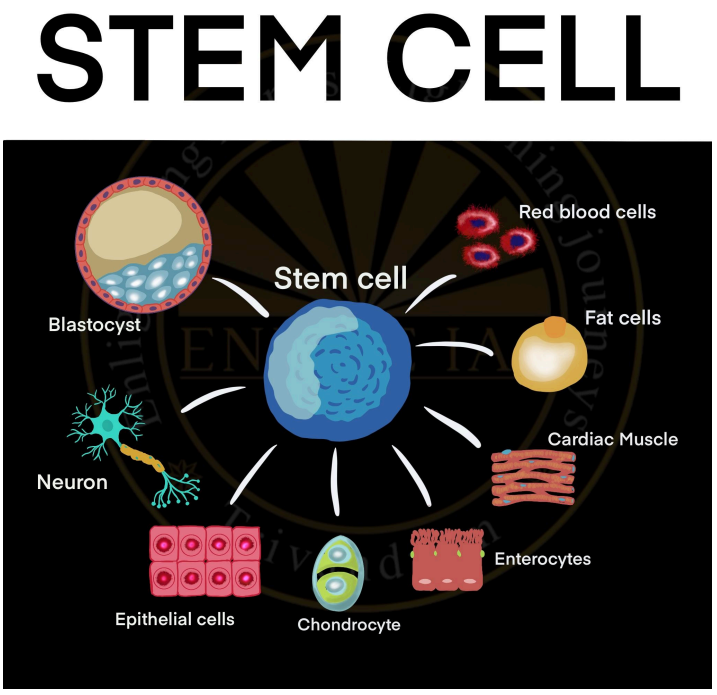
- **Prelims -** Stem Cell Therapy
- **Mains -** GS 3 - Science and Technology

Why in the news?

- Researchers at Osaka Metropolitan University have developed a new technique to heal spinal fractures using adipose-derived stem cells (ADSCs).

Stem Cells

- The smallest functional unit of life is called the Cell.
- Bone marrow, Umbilical cord blood, Adipose tissue, Allografts, Amniotic fluid etc are the source of stem cells.



Stem Cell Therapy

- **Types**
  - ➔ **Regenerative therapy**: Using stem cells to regenerate damaged tissues or organs.
  - ➔ **Transplantation**: Replacing damaged or diseased stem cells (e.g., in bone marrow transplants).
  - ➔ **Autologous stem cell therapy**: Using the patient's own stem cells.

- ➔ **Allogeneic stem cell therapy**: Using donor stem cells.

- **Applications of Stem Cell Therapy:**
  - ➔ **Blood and immune system disorders**: Conditions like leukemia, lymphoma, and multiple myeloma can be treated through stem cell transplants.
  - ➔ **Bone and cartilage repair**: Stem cells are used to heal damaged bones or regenerate cartilage, especially in cases of severe injury or arthritis.
  - ➔ **Neurological conditions**: Emerging therapies focus on repairing neurons in conditions like Parkinson's disease, Alzheimer's disease, and spinal cord injuries.
  - ➔ **Cardiovascular diseases**: Experimental treatments aim to regenerate heart tissue after heart attacks or in chronic heart diseases.
  - ➔ **Diabetes**: Research is ongoing to use stem cells to generate insulin-producing cells for the treatment of Type 1 diabetes.
  - ➔ **Eye disorders**: Stem cell therapy is being studied to restore vision in patients with retinal diseases.
  - ➔ **Skin regeneration**: Burn victims or patients with skin diseases benefit from stem cell-based skin regeneration treatments.
- **Benefits of Stem Cell Therapy:**
  - ➔ **Personalized treatment:** Autologous stem cell therapy reduces the risk of immune rejection.
  - ➔ **Repair and regeneration**: Stem cells can aid in the repair of tissues and organs that do not naturally regenerate well.
- **Challenges and Ethical Concerns**
  - ➔ **Ethical concerns**: Particularly with the use of embryonic stem cells, as it involves the destruction of embryos.
  - ➔ **Immune rejection**: In allogeneic therapies, the patient's immune system may reject donor stem cells.
  - ➔ **Tumor formation**: There is a risk that transplanted stem cells might form tumors (teratomas) if not properly controlled.
  - ➔ **High cost**: Stem cell treatments can be expensive and are not always covered by insurance.