



CURRENT AFFAIRS



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CRITICAL MINERALS

This article covers "Daily Current Affairs" and the topic details "Critical Minerals". This topic has relevance in the "Economy" section of the UPSC CSE exam.

For Prelims:

What are critical minerals?

For Mains:

GS3: Economy

What is the significance of Critical Minerals?

Why in the news?

The Union Cabinet has approved changes to the MMDR Act 1957 to set competitive royalty rates for mining critical minerals such as lithium, niobium, and rare earth elements (REEs).

What are Critical Minerals?

- A mineral is considered critical when the **potential risk of supply shortage could substantially impact the economy more than other raw materials.**

Risk of Supply Shortage + Impact on Economy= Critical Mineral

- These minerals play a vital role in both economic development and national security. Thus, their scarcity or concentration in specific geographic regions can create vulnerabilities in the supply chain.
- Minerals like lithium, graphite, cobalt, titanium, and rare earth elements are crucial for advancing various sectors, including high-tech electronics, telecommunications, transportation, and defence.
- They are integral components in strategic value chains, including clean technologies like zero-emission vehicles and renewable energy technologies, information and communication technologies, and advanced manufacturing materials used in defence applications, permanent magnets, and ceramics.

Identification of Critical Minerals by the Indian Government:

• Why the Identification Matters?

- The Indian government's recognition of 30 minerals as critical is driven by international commitments to reduce carbon emissions and transition to a net-zero energy landscape.

- An expert team appointed by the Ministry of Mines prepared a report on critical minerals to establish this identification, which will undergo periodic reviews.

- **The Three-Stage Identification Process:**

- The identification process involved three stages.
 - **Examination of the strategies of countries** like Australia, the USA, Canada, the UK, Japan, and South Korea resulted in a list of 69 critical elements and minerals.
 - **Consultations** with various ministries to identify minerals critical to their respective sectors.
 - **Creating an empirical formula** to evaluate mineral criticality, considering economic importance and supply risk.
- Following this process, 30 minerals were identified as most critical for India.

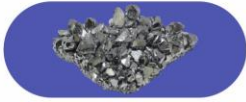
Significance of the Critical Minerals:

- **Economic Development:**
 - Critical minerals are crucial for various industries, including clean energy, defence, and electronics.
 - Developing these resources boosts India's domestic economy and reduces import dependence.
- **National Security:**
 - Critical minerals, like cobalt for lithium-ion batteries, impact national security.
 - A secure supply reduces vulnerability to supply disruptions and protects India's interests.
- **Sustainable Development:**
 - Critical minerals, such as lithium in electric vehicle batteries, promote sustainable development by curbing emissions.
 - Utilising these resources accelerates India's shift to a cleaner energy economy.

About the Recent Amendment:

- Under the MMDR Act, the Second Schedule sets royalty rates for various minerals.
- Currently, Item No. 55 in this schedule specifies a 12% royalty rate based on the average sale price (ASP) for minerals not explicitly listed. This rate significantly exceeds international standards.
- The new royalty rates are as follows:
 - **Lithium:** 3% of the London Metal Exchange price,
 - **Niobium:** 3% of the Average Sale Price (both primary and secondary sources),
 - **REE:** 1% of the Average Sale Price of Rare Earth Oxide, the most common source of REE.

Niobium



- It is commonly found in jet engines, buildings' structural components, and oil/gas pipelines.
- A corrosion-resistant metal used to strengthen alloys, including stainless steel.
- Used in superconducting magnets for MRI scanners and particle accelerators.
- Primary source: Columbite mineral in Canada, Brazil, Australia, and Nigeria.

Rare Earth Metals



- A group of 17 elements with unique properties, including fluorescence, conductivity, and magnetism.
- It is valuable when mixed with common metals like iron. Silvery-white heavy metals.
- China leads global production (90%), followed by Australia, the USA, Russia, Malaysia, and Vietnam.

Lithium



- Major reserves located in the 'Lithium Triangle' (Argentina, Bolivia, Chile) hold 54% of global reserves.
- A key component in rechargeable batteries.
- Major reserves located in the 'Lithium Triangle' (Argentina, Bolivia, Chile) hold 54% of global reserves.

Sources:

pib.gov.in/PressReleaseframePage.aspx?PRID=1966595

Q1. With reference to Critical Minerals, consider the following statements:

1. They are critical for economic development and energy security.
2. They are primarily used for thermal power generation, fertilisers, and agriculture.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) None

Answer: (a)

Q2. Consider the following :

1. Niobium is used to strengthen alloys such as stainless steel.
2. China leads the global production of the rare earth metals.
3. Major reserves of Niobium are located in the Niobium Triangle – Argentina, Bolivia, and Chile.

How many of the abovementioned statements are correct?

- (a) Only one
- (b) Only two
- (c) All three
- (d) None

Answer: (b)

Q3. Discuss the significance of critical minerals. What steps is the Indian government taking to develop its domestic mineral resources?

CAR-T CELL THERAPY

This article covers “Daily Current Affairs” and the topic details “CAR-T Cell Therapy”. This topic has relevance in the “Science and Technology” section of the UPSC CSE exam.

For Prelims:

What is CAR-T cell therapy?

For Mains:

GS3: Science and Technology: Indigenization of Technology
Significance of CAR-T Cell Therapy

Why in the news?

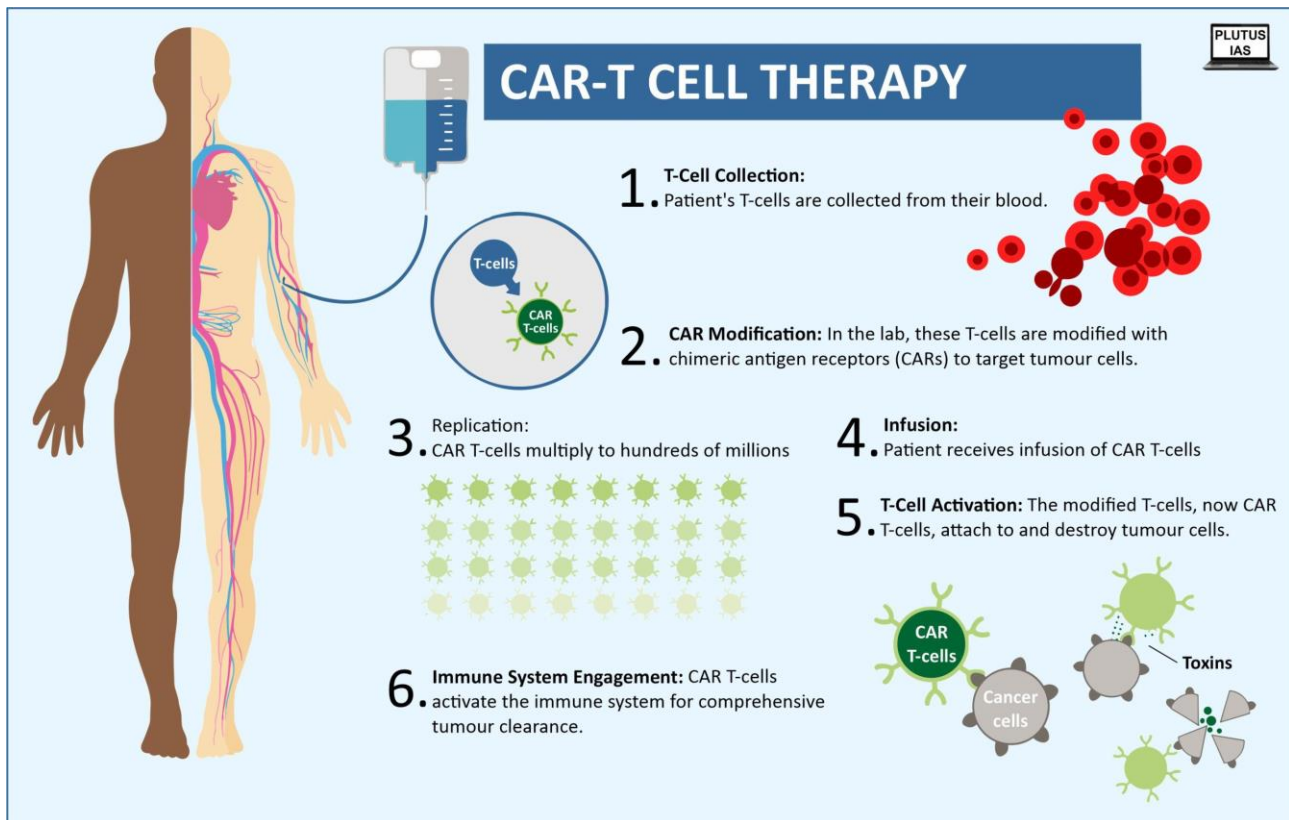
Recently, **NexCAR9** received approval from the **Central Drugs Standard Control Organization (CDSCO)** for the first chimeric antigen receptor (CAR) T-cell therapy to treat cancer, marking the first time in India.

Background Information:

- Cancer is a condition characterised by the uncontrolled growth and spreading of specific cells within the body. Cancer treatment primarily involves three primary modalities:
 - **Surgery** for the removal of the cancerous tissue;
 - **Radiotherapy** utilising ionising radiation to target the tumour;
 - **Systemic Therapy** which entails the administration of drugs that act on the tumour.
- While surgery and radiotherapy have undergone significant refinements over time, advancements in systemic therapy have been remarkable.
- CAR T-cell therapy is a noteworthy development in this systemic therapy, currently capturing researchers’ attention worldwide.

What is CAR-T Cell Therapy?

- CAR T-cell therapy is a highly advanced form of cancer treatment. Unlike chemotherapy or immunotherapy, which involve mass-produced medications, **CAR T-cell therapy utilises a patient’s cells.**
- These cells are modified in a lab to activate T-cells, a type of immune cell, to target and attack tumours.
- These modified cells are reintroduced into the patient’s bloodstream after being prepared to multiply more effectively.
- These cells are even more precise than targeted agents and directly stimulate the patient’s immune system to fight cancer, making the treatment exceptionally effective. They are frequently called “**living drugs.**”



Steps of CAR-T Cell Therapy

1. **T-Cell Collection:** Patient's T-cells are collected from their blood.
2. **CAR Modification:** In the lab, these T-cells are modified with chimeric antigen receptors (CARs) to target tumour cells.
3. **T-Cell Activation:** The modified T-cells, now CAR T-cells, attach to and destroy tumour cells.
4. **Immune System Engagement:** CAR T-cells activate the immune system for comprehensive tumour clearance.

Usage of CAR- T Cell Therapy

- **Leukaemias and Lymphomas:**
 - CAR T-cell therapy has been approved for treating **leukaemias** (cancers originating from white blood cell-producing cells) and **lymphomas** (from the lymphatic system).
 - These cancers result from the **uncontrolled growth of a single cell type**, making the target for CAR T-cells **consistent and dependable**.
- **Relapse:**
 - CAR T-cell therapy is also used for patients whose cancers have returned after initial successful treatment or haven't responded to previous combinations of chemotherapy or immunotherapy.
- **Success Rate:**
 - In some types of leukaemias and lymphomas, the therapy can be highly effective, with success rates as high as 90%, while in other cancer types, it is less effective.
- **Potential Side Effects:**
 - **Cytokine release syndrome** – a widespread activation of the immune system with collateral damage to normal cells

- **Neurological symptoms** – severe confusion, seizures, and speech impairment.

About NexCAR19:

- Mumbai's Immunoadoptive Cell Therapy (**ImmunoACT**) gained approval for India's first CAR T-cell therapy from the **Central Drugs Standard Control Organization (CDSCO)**.
- The treatment, called **NexCAR19**, focuses on **CD19**, a **biomarker for B lymphocytes**, making it a target for leukaemia immunotherapies.
- Previously, the cost of CAR-T cell therapy was exorbitant, reaching approximately \$400,000 or over Rs 3.3 crore, and it was predominantly available in the United States.
- However, this breakthrough will bring the therapy within reach of patients in India. It will be offered at 20 government and private hospitals in major cities, with an estimated cost of approximately Rs 30-35 lakh per patient.
- This milestone not only offers accessible life-saving treatment in India but also extends its availability to other resource-constrained countries.
- India has joined the ranks of elite nations with access to CAR-T therapy.

Sources:

[Cancer treatment breakthrough: India's homegrown CAR-T cell therapy, a form of immunotherapy, gets market authorisation](#)

Q1. With reference to CAR- T Cell Therapy, consider the following statements:

1. CAR – T Cell therapy is a type of systemic therapy that involves the surgical removal of the cancerous tissue.
2. CAR T-cell therapy utilises a patient's cells to produce medications.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Answer: (b)

Q2. Consider the following:

1. T-Cell Activation
2. Immune System Engagement
3. T-Cell Collection
4. CAR Modification

Arrange the above steps in the sequence of CAR- T cell therapy:

- (a) 1-2-3-4
- (b) 4-3-2-1
- (c) 3-4-1-2
- (d) 4-3-1-2

Answer: (c)

Q3. What is CAR-T cell therapy? Discuss the significance and challenges of CAR-T cell therapy in the context of cancer treatment.