# Indian Express News Analysis (IENA)

# English PDF Notes – 01 July 2023

## Centre identifies 30 critical minerals

*#CriticalMinerals #RareEarthElements #PeriodicTable #Minerals #StrategicMinerals #Economy #GS3*

In a strategic move, the Centre has identified **30 critical minerals**, including lithium, cobalt, nickel, graphite, tin and copper, which are essential for the country's economic development and national security.

The identification of these minerals — which form part of multiple strategic value chains, including **clean technologies initiatives such as zero-emission vehicles, wind turbines, solar panels; information and communication technologies, including semiconductors; and advanced manufacturing inputs and materials such as defence applications, permanent magnets, ceramics** — was done on the basis of a report on critical minerals prepared by an expert team constituted by the **Ministry of Mines** last November. The ministry will revisit the list periodically.

While elements such as cobalt, nickel and lithium are required for batteries used in electric vehicles or cellphones, rare earth minerals are critical, in trace amounts, in the semiconductors and high-end electronics manufacturing. Most countries of the world have identified critical minerals as per their national priorities and future requirements.

In India too, some efforts have been made in the past to identify the minerals that are critical for the country, including an initiative in 2011 by the Planning Commission of India (now NITI Aayog) that highlighted the need for the "assured availability of mineral resources for the country's industrial growth", with a clear focus on the well-planned exploration and management of already discovered resources. That report analysed 11 groups of minerals under categories such as metallic, non-metallic, precious stones and metals, and strategic minerals. From 2017 to 2020, a big thrust was accorded to the study of exploration and development of rare earth elements in the country.

The specific trigger for the latest exercise are India's **international commitments towards reducing carbon emissions**, which require the country to urgently relook at its mineral requirements for energy transition and net-zero commitments. In November 2022, the Ministry of Mines had constituted a seven-member Committee under the chairmanship of Joint Secretary (Policy), Ministry of Mines to identify a list of minerals critical to our country and the panel decided to have a three-stage assessment to arrive at a list of critical minerals.

### Critical minerals

These are minerals that are essential for **economic development** and **national security**, and the lack of availability of these minerals or the concentration of extraction or processing in a few geographical locations could potentially lead to "supply chain vulnerabilities and even disruption of supplies". This is true for minerals such as lithium, graphite, cobalt, titanium, and rare earth elements, which are essential for the advancement of many sectors, including hightech electronics, telecommunications, transport, and defence.

One of the definitions cited in the report characterises a mineral as critical when the risk of supply shortage and associated impact on the economy is (relatively) higher than other raw materials. This definition of a critical mineral was first adopted in the US and the subsequent legislation that resulted from the analysis, the report said. The European Union also carried out a similar exercise and categorised critical minerals on the basis of two prerequisites: supply risk and economic importance.

Australia refers to critical minerals as: "metals, non-metals and minerals that are considered vital for the economic well-being of the world's major and emerging economies, yet whose supply may be at risk due to geological scarcity, geopolitical issues, trade policy or other factors".

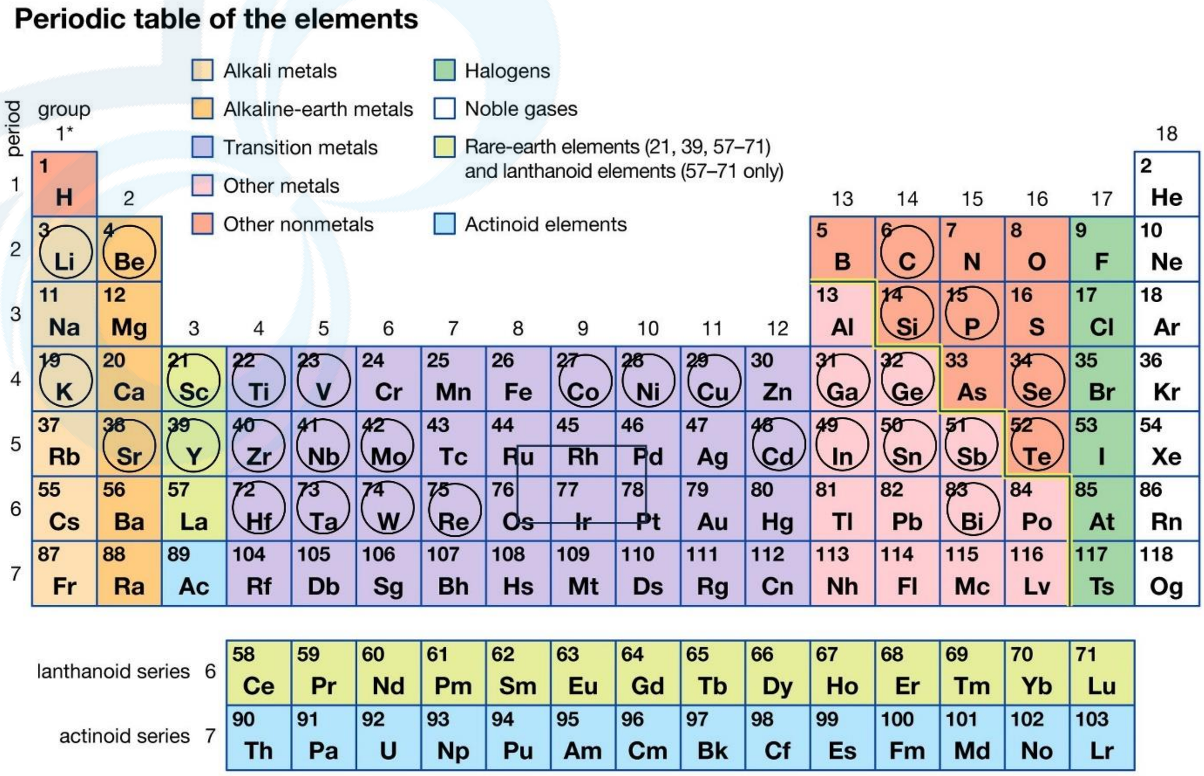
**Three-stage process**

In its three-stage assessment for identifying the minerals critical to India, the panel, in the **first stage, looked at the strategies of various countries such as Australia, USA, Canada, UK, Japan and South Korea**. Accordingly, a total of **69 elements/ minerals** that were considered critical by major global economies were identified for further examination, the report said, adding that due importance was given to domestic initiatives as well.

In the **second stage of assessment, an inter-ministerial consultation was carried out with different ministries to identify minerals critical to their sectors.** Comments and suggestions were received from the Ministry of Power, Department of Atomic Energy, Ministry of New and Renewable Energy, Department of Fertilisers, Department of Science and Technology, Department of Pharmaceuticals, NITI Aayog, etc.

The **third stage assessment was to derive an empirical formula for evaluating minerals criticality**, taking cognizance of the EU methodology that considers two major factors — economic importance and supply risk.

Based on this process, a total of **30 minerals** were found to be most critical for India, out of which two are critical as fertiliser minerals: **Antimony, Beryllium, Bismuth, Cobalt, Copper, Gallium, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Niobium, Nickel, PGE, Phosphorous, Potash, REE, Rhenium, Silicon, Strontium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zirconium, Selenium and Cadmium.**



## Total 30 Critical Minerals

**28 Minerals** (shown by circle) + **Platinum Group Elements** (6 elements with atomic no.s 44, 45, 46, 76, 77, 78) + **Rare Earth Elements** [17 elements (15 lanthanoid elements + Scandium (at. no. 21) + Yttrium (at. no. 39)]

## Specialised agency

Alongside this list, the committee also called for a need for establishing a **National Institute or Centre of Excellence on critical minerals** on the lines of Australia's CSIRO, which is the largest minerals research and development organisation in Australia and one of the largest in the world. **A wing in the Ministry of Mines can be established as a Centre of Excellence for Critical Minerals**, the report said, adding that this proposed Centre will periodically update the list of critical minerals for India and notify the critical mineral strategy from time to time and will execute a range of functions for the development of an effective value chain of critical minerals in the country.

## Global practices

The **US**, according to the report, adopted a two-stage screening methodology to arrive at the list of critical minerals. An early warning screening tool assesses a mineral's potential criticality using three fundamental indicators: supply risk, production growth, and market dynamics.

In the **UK**, the criticality to the British economy was determined in terms of their global supply risks and the economic vulnerability to such a disruption. Three indicators were used to estimate the production concentration, companion metal fraction and recycling rate. A total of **18 minerals** were identified as critical to the UK economy.

The **European Commission** has been issuing a list of critical raw minerals since 2011 that is updated every three years. The main parameters used to determine the criticality of the mineral for the EU are the economic importance, in terms of end-use applications and the value added of corresponding EU manufacturing sectors. Supply risk is the other parameter. A total of **34 raw materials** are identified as Critical Raw Materials for 2023.

**Japan's** first list of critical minerals was prepared by the country's Advisory Committee on Mining Industry in 1984, under the direction of the Ministry of International Trade and Industry (current METI). In March 2020, Japan released its latest perspective on how to secure its supply chains for critical minerals and materials as part of the New International Resource Strategy. Japan has identified a set of **31 minerals** as critical for their economy.

The **Australian** Government, in 2019, released its inaugural Critical Minerals List and associated national strategy and a list of **24 critical minerals** was first identified. Two more elements were added in the latest critical mineral strategy.

## Domestic and global outreach

The Geological Survey of India, an attached office of Ministry of Mines, has carried out a G3 stage mineral exploration (fairly advanced) during Field Season 2020-21 and 2021-22 in **Salal-Haimna areas of Reasi district, Jammu & Kashmir**, and estimated an inferred resource of **5.9 million tonnes of lithium** ore.

In addition, a joint venture company namely **Khanij Bidesh India Ltd. (KABIL)** has been incorporated with equity contribution from three Central Public Sector Enterprises. It is mandated to identify and acquire overseas mineral assets of critical and strategic nature such as lithium, cobalt and others so as to ensure supply side assurance. KABIL has initiated engagement with several state owned-organisations of the shortlisted source countries through the Ministry of External Affairs and the Indian

Embassies in countries like Argentina and Australia to acquire mineral assets, including lithium, cobalt and rare earth elements.

In a fresh boost, India has recently been inducted into the **Mineral Security Partnership (MSP)**, a US-led collaboration of 14 countries that aims to catalyse public and private investment in critical mineral supply chains globally.

India is seen as a late mover in attempts to enter the lithium value chain, coming at a time when EVs are predicted to be a sector ripe for disruption. The year 2023 could be an inflection point for battery technology – with several potential improvements to the Li-ion technology, and alternatives to this combination in various stages of commercialisation.

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## Groundwater extraction shifted the Earth's axis

***#PolarMotion #ShiftingOfEarthAxis #GroundwaterExtraction #ScienceandTechnology #GS3***

The excessive extraction of groundwater for drinking and irrigation has shifted the Earth's axis of rotation, according to a new study. Noting that humans pumped out around 2,150 gigatons of groundwater between 1993 and 2010, the study says that the planet's axis has drifted at the rate of 4.36 cm per year towards the east.

Although the shift isn't significant enough to have real-life consequences, the study shows that humans have extracted so much water from the ground that it has impacted the planet's axis and contributed to global sea level rise.

### Earth's axis keeps shifting

Earth spins around an imaginary axis which passes through the north pole, its centre of mass and the south pole — just like a top spins around its spindle. Scientists for years have known that the poles and the axis keep shifting naturally as the mass distribution in and on the planet changes. This phenomenon is known as **"polar motion".**

For instance, rocks slowly circulating inside Earth's mantle causes the planet's mass to shift, leading to a change in the position of the rotational axis.

There are several other reasons responsible for polar motion like **ocean currents** and even **hurricanes**. But this phenomenon is also impacted by human activities. In 2016, a team of researchers demonstrated that climate-driven changes in water mass distribution, led by the **melting of glaciers and ice in Greenland, can cause Earth's axis to drift.** Five years later, another study said climate change was causing the rotational axis to shift more than usual since the 1990s.

### Findings of the new study

To carry out the study, team of researchers took observational data spanning 17 years and a computer model to find out which factors affected the Earth's rotation of axis the most. Initially, the team wasn't able to match their prediction with the level of shift that scientists have observed in previous years.

**Variations of the spin axis using many kinds of data including atmospheric pressure, ocean bottom pressure, artificial reservoirs behind dams, polar ice, mountain glacier, wind, current and finally groundwater were calculated.** The estimated spin axis variations didn't agree with the observation when excluding the groundwater effect. After including it, estimation agreed really well with observation.

The study also noted that the groundwater extraction from **North America and northwestern India**, both located at the Earth's midlatitudes, had an outsized impact on the polar motion in comparison to the extraction taking place in poles or equators.

The water sucked out from the ground for irrigation and meeting the world's freshwater demands, eventually, goes into the oceans. Groundwater extraction is one of the major contributors to the global sea level rise. The calculations matched with previous research, which estimated that **groundwater extraction raised global sea levels** by 6.24mm between 1993 and 2010.

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## What is aspartame, the additive in your diet cola, which the WHO may declare as 'possibly carcinogenic'?

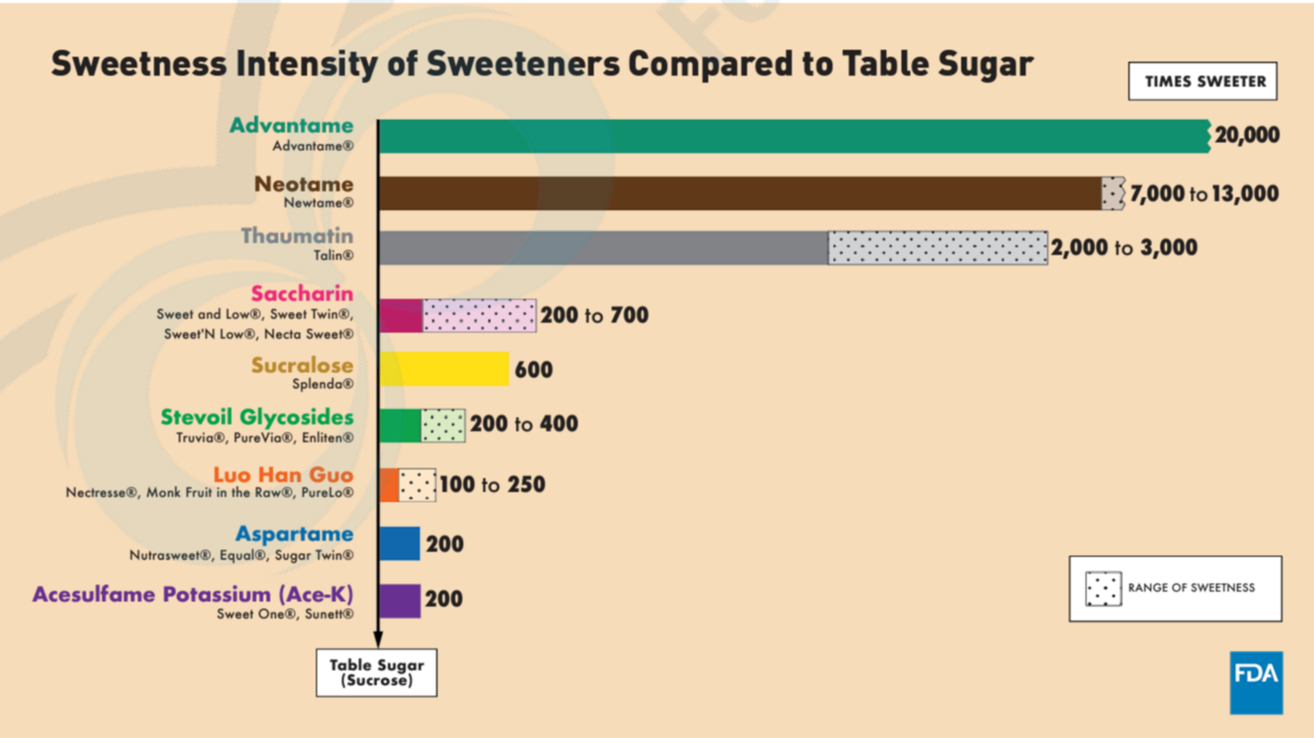
***#Aspartame #ArtificialSweetener #DietCoke #LowCalorie #ScienceandTechnology #GS3***

Aspartame is one of the world's most common **artificial sweeteners** and is used in a wide range of diet soft drinks, sugar-free chewing gum, sugar-free ice cream, sugar-free breakfast cereals, etc.

### And what exactly is aspartame?

Chemically, aspartame is a **methyl ester of the dipeptide of two natural amino acids, L-aspartic acid and L-phenylalanine.** It was discovered by James M Schlatter, a chemist at the American pharmaceutical company G D Searle & Co. (which is now a subsidiary of Pfizer) in 1965, apparently by accident, when, while researching an anti-ulcer drug, he happened to lick his finger and detected a sweet taste.

According to the US Food and Drug Administration (FDA), aspartame is about **200 times sweeter than table sugar** — which makes aspartame far less sweet than other artificial sweeteners like advantame and neotame, but even then, **1 gram of aspartame has the sweetness intensity of roughly 2 teaspoons (about 8 g) of sugar.**




Aspartame is preferred by people trying to cut calories or lose weight, or by diabetics, because while 2 teaspoons (8 g) of sugar provides about 32 kcals of energy, 1 g of aspartame is only 4 kcals.

## So is aspartame dangerous?

Over more than 40 years, aspartame has been one of the most widely studied and rigorously tested chemical additives in food, including for its possible links with cancer. More than 100 studies have found no evidence of harm caused by aspartame.

While doubts and concerns have continued to be raised by some critics and a few studies, there is a broad scientific consensus on the safety of aspartame for all groups of people except one — those suffering from phenylketonuria (PKU), a rare inherited disorder in which the patient does not have the enzyme that is needed to break down phenylalanine, one of the two amino acids in aspartame. Foods containing aspartame carry the warning **"Not for phenylketonurics".**

The USFDA permitted the use of aspartame in food in 1981, and has reviewed the science of its safety five times since then, The Washington Post report said. Aspartame is also certified as safe for human consumption by the European Food Safety Authority (EFSA), national regulators in Japan, Australia, New Zealand, and Australia, and even the WHO's JECFA. **Around 100 countries around the world, including India, permit the use of aspartame.**

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