

The Hindu Important News Articles For UPSC CSE

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The Indian Space Research Organisation (ISRO) has successfully tested three major Crew Module Systems under its ambitious Gaganyaan Mission. This test is an extremely important milestone towards ensuring the safety and technical self-reliance of India's first manned space mission.

Key Tests and Their Significance

The three tests conducted by ISRO were mainly focused on astronaut safety, safe re-entry to Earth, and landing phases:

Crew Module Uprighting System (CMUS) Test:

- **Objective:** To keep the Crew Module (the capsule in which astronauts reside) upright in the water after landing in the sea (Splashdown).
- **Mechanism:** A cold-gas-based flotation (floating) system has been developed for this purpose. During the test, the balloons/floats were successfully inflated from a high-pressure gas bottle by operating the control valves.
- **Significance:** If the module capsizes (turns upside down) after falling into the sea, it could endanger the lives of the astronauts and disrupt communication. This system ensures that the module always remains upright and safe.

Service Module Connect-Disconnect System (CSU) Test:

- **Objective:** To check the safe separation of the 'Umbilical Mechanism' that connects the Crew Module (CM) and the Service Module (SM). (The Service Module provides power and propulsion during the mission).
- **Mechanism:** This system consists of two parts - CSU-1 (on the Crew Module side) and CSU-2 (on the Service Module side). Before re-entering the Earth's atmosphere, these two parts separate in a sequential manner. In this test, the clean separation of CSU-2 was successfully demonstrated.
- **Significance:** If this part does not separate at the right time, the Crew Module will not be able to enter the Earth's atmosphere safely.

Apex Cover Separation Test:

ISRO successfully carries out tests of Gaganyaan systems

One of the tests involved separation of the 'umbilical mechanism' that serves as a link between the crew module, where astronauts live, and the service module that provides propulsion, agency says

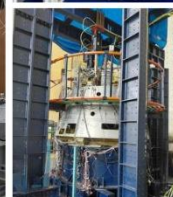
Press Trust of India
NEW DELHI

The Indian Space Research Organisation on Sunday said it had successfully carried out three major tests of the Gaganyaan crew module systems.

The first test pertained to ensuring an upright position of the crew module after splashdown in the sea, considered one of the most important crew safety requirements. To do this, a stored cold-gas-based uprighting system was developed and tested.

"A system-level qualification test set-up consisting of all the elements of CMUS (crew module uprighting system) was realised," the ISRO said, adding it successfully conducted inflation tests "for the primary inflation module wherein stored gas in the high-pressure gas bottle was made to inflate the floatation by operating the control valves."

The second test involved examining the separation of the umbilical mechanism that serves as a link between the crew module, where astronauts live, and the service module, which provides power and propulsion. The mechanism consists of two parts, each located at the crew module side, called CSU-1, and the service module side, called CSU-2.



Step-by-step: (Clockwise from left) The crew module uprighting system, the service module connect-disconnect system, and the apex cover that underwent testing, ISRO

Clean separation
During the crew module's earth re-entry stage, the service module first separates from the crew module after the CSU-1 disconnects. Subsequently, just before re-entry, the CSU-2 is also separated.

"Separation test of CSU-2 from simulated crew module was carried out. The test demonstrated the clean separation of CSU-2 as well as structural stability of the crew module panel and their interfaces,"

the space agency said. The third test validated the structural integrity of the crew module during the apex cover separation event. The apex cover protects the parachutes and associated subsystems during the mission. It is separated before parachutes are deployed to decelerate the crew module.

Daily News Analysis

- **Objective:** To check the structural stability during the separation of the 'Apex Cover' located at the top of the Crew Module.
- **Mechanism:** The Apex Cover protects the parachutes and other systems present inside the module during the mission. It is necessary to remove this cover just before deploying the parachutes to slow down the speed of the module.
- **Significance:** This test ensures that there is no structural damage to the module when the cover separates and that the parachutes can open without any hindrance.

Strategic & Scientific Significance

- **Self-reliance in Human Spaceflight:** The success of this test brings India closer to joining the league of select nations (USA, Russia, and China) that have the capability to independently send humans into space.
- **Crew Safety:** In missions like Gaganyaan, there must be zero scope for technical failure. These tests guarantee the safety of astronauts during the most risky phases like 'Re-entry' and 'Splashdown'.
- **Foundation for Future Missions:** The success of Gaganyaan will lay the technical foundation for the construction of India's own 'Bharatiya Antariksha Station' (BAS) and future lunar missions (manned moon landing).
- **Indigenization:** The development of these complex systems (such as the cold-gas uprighting system) has been done entirely at an indigenous level, which promotes 'Make in India' and self-reliance in the defense/space sector.

Conclusion

The recent successful testing of Gaganyaan systems by ISRO demonstrates that India is moving rapidly towards mastering complex and risky space technologies. In space missions, it is not only important to go into space, but bringing astronauts safely back to Earth is the biggest challenge. These successful tests related to keeping the crew module upright, the breaking of the umbilical mechanism, and the removal of the apex cover underline the maturity of India's human space programme and its commitment to safety. This success will not only establish India's scientific prowess on the global stage but will also inspire the country's younger generation to move forward in the field of science and research.

UPSC Prelims Exam Study Questions

Question: What is the primary objective of the Crew Module Uprighting System (CMUS) used in the Gaganyaan mission?

- (a) To provide thermal protection during re-entry
- (b) To control orientation in space
- (c) To keep the crew module in an upright position after landing in the sea
- (d) To deploy the parachute

Ans: c)

UPSC Mains Practice Questions

Question: "In human space missions, bringing astronauts back to Earth safely is just as important as sending them into space." Explain this statement in the context of the recent tests of the Gaganyaan mission. (10Marks, 150Words)

Kerala has always prided itself on its high literacy, scientific temper, and environmental consciousness. Being a hub of rich biodiversity like the Western Ghats and centuries-old traditional knowledge, Kerala should have led India in biological research and the bio-economy. However, currently, due to a shift in policy priorities and the neglect of basic research, the state's leading scientific institutions are heading towards decline, which is a major obstacle to its long-term economic and technological progress.

Fading research hubs are stalling Kerala's leap into the bio-economy

Kerala's approach to science has changed, with basic research losing its place among public policy priorities; the State is attracted to projects that deliver visible and immediate outcomes, but that does not mean abdicating fundamental scientific research is okay; only such research can lead to long-term value creation

Biju Dharmapalan

Kerala has long taken pride in its literacy, scientific temper, and environmental consciousness. Home to the biodiverse Western Ghats and centuries of traditional knowledge, it should have emerged as India's leading hub for biological research and the bioeconomy. But instead, many of its premier biological research institutions are today on the decline.

The reasons are clear: policy support for basic scientific research has eroded and institutions that were once internationally respected centres of excellence have become increasingly politicised.

The prime example is the Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI) in Palode, in Thiruvananthapuram district. Established following the United Nations Conference on the Human Environment in 1972,

JNTBGRI transformed nearly 300 acres of forest into one of Asia's finest centres for tropical plant research and conservation. It has housed more than 50,000 plant accessions representing over 5,000 species, and was for most of its life a living repository of India's botanical wealth. Its achievements ranged from documenting biodiversity and conserving endangered plants to pioneering research on medicinal plants and sustainable utilisation of biological resources.

The institute also demonstrated how scientific research could benefit society. Its researchers' development of 'Jeevani', an anti-fatigue herbal formulation, based on the traditional knowledge of the Kani tribe became an internationally acclaimed model of access and benefit-sharing. In 2024, JNTBGRI also received the Botanic Gardens Conservation International's Global Genome Initiative for Gardens Award.

These accomplishments were only possible because successive generations of scientists enjoyed the freedom, leadership, and institutional stability that long-term research demands. Today, however, a large fraction of experienced scientists have retired and JNTBGRI has not adequately recruited their successors. The number of research scholars has also dwindled. Together, the technical expertise the institute built over decades is at risk of disappearing.

This crisis at JNTBGRI is actually symptomatic of a larger change in Kerala's approach to science. Basic research has slowly but surely lost its place among the State's public policy priorities. State and local governments are understandably



The Jawaharlal Nehru Tropical Botanic Garden and Research Institute in Palode, Kerala, has demonstrated how scientific research can benefit society. JNTBGRI

attracted to projects that deliver visible and immediate outcomes – but that does not mean abdicating fundamental scientific research is okay. Only such research can lead to long-term innovation and value creation.

For example, discoveries in taxonomy, ecology, genetics, and plant biology usually take decades to turn into medicines, climate-resilient crops, and commercial technologies – but once they do, their effects become transformative. Short-term investments cannot achieve this.

Sadly, this retreat from basic research also comes at a time when the global bioeconomy is expanding at an unprecedented scale. Countries are investing heavily in biotechnology, natural products, synthetic biology, nutraceuticals, and biodiversity-based industries.

Kerala has the raw material to participate in this revolution, including biodiversity and trained scientists and institutions with decades of expertise; what it crucially lacks at this time is a coherent long-term vision.

Conditions for success

Equally concerning is the gradual politicisation of scientific institutions. Research organisations thrive when scientific excellence determines leadership, recruitment, and institutional priorities. But when political considerations influence these decisions, the scientific culture inevitably suffers. Administrators replace academic leaders and long-term research planning gives way to a fondness for routine

management. Thus scientific autonomy gradually erodes and institutions become less attractive to talented young researchers.

Many of Kerala's leading scientific institutions were built by visionary scientists who enjoyed considerable administrative autonomy, including because their credibility stemmed from academic excellence rather than political affiliation. That culture now appears to be declining, with the consequences going beyond laboratories. Scientific institutions are repositories of specialised knowledge that cannot be recreated overnight.

The State's scientific ecosystem also suffers from a tendency to create new institutions while existing ones struggle with vacancies, ageing infrastructure, and declining manpower.

New centres certainly have their place but scientific excellence cannot be built merely by inaugurating new buildings or announcing ambitious missions. Institutions mature through sustained investment in people, infrastructure, and the research culture.

So instead, the State should focus on revitalising its established centres of excellence. Institutions such as JNTBGRI, the Kerala Forest Research Institute, and the Malabar Botanical Garden already possess internationally recognised collections, infrastructure, and scientific credibility. Strengthening these institutions will yield greater dividends than continuously expanding the institutional landscape without adequately supporting existing facilities.

Kerala also needs to rethink how it views biodiversity. Its forests, medicinal

plants, endemic species, and traditional knowledge systems are ecological assets, yes, but they also present significant economic opportunities. With appropriate safeguards for conservation and equitable benefit-sharing, biological research can support biotechnology, pharmaceuticals, natural cosmetics, and climate-resilient agriculture. Around the world, scientists and policymakers are increasingly recognising biodiversity as the foundation of future bioeconomies. Kerala should be leading this transformation.

Reversing the decline will also require a renewed commitment to basic science, transparent and merit-based institutional leadership, timely recruitment of young scientists, greater research autonomy, and stronger partnerships with universities and responsible industries.

The trajectory of JNTBGRI reflects Kerala's changing relationship with science. The State once demonstrated that patient investment in scientific institutions could produce global recognition, conservation success and innovations that benefited society.

The forests of the Western Ghats continue to hold countless scientific discoveries waiting to be made. Whether Kerala remains at the forefront of that exploration or becomes a spectator to opportunities seized elsewhere will depend on the choices policymakers make today.

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THE GIST

Policy support for basic scientific research has eroded and institutions that were once internationally respected centres of excellence have become increasingly politicised

The State's scientific ecosystem suffers from a tendency to create new institutions while existing ones struggle with vacancies, ageing infrastructure, and declining manpower

Reversing the decline will require a renewed commitment to basic science, transparent and merit-based institutional leadership, timely recruitment of young scientists, greater research autonomy, and stronger partnerships with universities and responsible industries

Key Points: Major Causes and Effects of Kerala's Research Crisis

1. Basic vs. Immediate Outcomes

Daily News Analysis

- **Shift in Policy Priorities:** The inclination of the state government and local administration has now shifted towards projects that yield immediate and visible outcomes.
- **Neglect of Basic Science:** Investment in fundamental fields like taxonomy (classification science), ecology, genetics, and plant biology has decreased.
- **Long-Term Loss:** Translating basic discoveries into a medicine, climate-resilient crop, or commercial technology takes decades, but this very research lays the foundation for future major innovations.

2. Politicization of Institutions and Erosion of Autonomy

- **Interference in Leadership and Appointments:** Previously, these institutions were built by visionary scientists who enjoyed administrative autonomy. Now, political considerations have begun to dominate appointments and priorities.
- **Damage to Academic Culture:** The erosion of scientific culture and autonomy in institutions is happening because bureaucratic or political affiliation is being prioritized over scientific excellence.
- **Disinterest Among Young Talent:** Due to this political environment, the country's talented young researchers are not attracted to these institutions.

3. Human Resource Crisis and Lack of Infrastructure

- **Vacant Positions:** Over the past few years, many senior and experienced scientists have retired, but new appointments have not been made in a timely manner.
- **Declining Number of Researchers:** Due to the continuous decrease in the number of research scholars, there is a threat of losing the technical expertise accumulated over decades.
- **Rush for New Institutions:** Instead of strengthening established centers, the government is focusing more on inaugurating new buildings and announcing new institutions, while older institutions struggle with a shortage of budget and manpower.

Case Study: JNTBGRI and 'Jeevani'

- **A Glorious History:** Located in Palode, Thiruvananthapuram, the 'Jawaharlal Nehru Tropical Botanic Garden and Research Institute' (JNTBGRI) has been one of Asia's finest tropical plant research and conservation centers.
- **A Repository of Biodiversity:** It is spread across 300 acres and houses a collection of over 50,000 plants belonging to more than 5,000 species. It also received the 'Global Genome Initiative for Gardens Award' in 2024.
- **Successful Social Model (Jeevani):** JNTBGRI scientists developed an anti-fatigue herbal drug named 'Jeevani' by utilizing the traditional knowledge of the 'Kani Tribe'. This project became an internationally acclaimed model for 'Access and Benefit-Sharing' (equitable sharing of benefits).
- **Current Status:** Today, this institution is also passing through a phase of crisis due to a shortage of scientists and policy apathy.

Global Scenario and Bio-economy

- **Growing Global Investment:** Countries worldwide are currently investing heavily in biotechnology, natural products, synthetic biology, and nutraceuticals.
- **Kerala's Untapped Potential:** Kerala possesses the rich biodiversity, trained scientists, and established institutions required to be part of this global revolution, but it lacks a clear long-term vision.

Way Forward

- **Commitment to Basic Science:** Moving beyond projects with immediate political benefits, the state must make patient and long-term investments in basic scientific research.
- **Restoration of Institutional Autonomy:** Scientific leadership and appointments should be completely transparent, merit-based, and free from political influence.
- **Revival of Established Centers:** Instead of opening new institutions, existing centers like JNTBGRI, Kerala Forest Research Institute (KFRI), and Malabar Botanical Garden should be strengthened by providing modern infrastructure and funds.
- **Timely Appointments:** Quick and transparent recruitment of young scientists should be done to replace retiring scientists so that there is no gap in knowledge and expertise.
- **Promoting Partnerships:** The tripartite partnership (Triple-Helix Model) among research institutions, universities, and responsible industries should be strengthened to take laboratory research to the market.

Conclusion

Biodiversity is not just an ecological asset but also the largest economic foundation for the future bio-economy. The current crisis at JNTBGRI reflects a shift in Kerala's scientific approach. If Kerala is to lead the global bio-economic revolution, it must abandon its obsession with immediate outcomes and re-nourish the roots of its basic research. Countless scientific discoveries are still hidden within the forests of the Western Ghats; whether Kerala will reap their benefits or remain a mere spectator depends on the decisions of today's policymakers.

Daily News Analysis

UPSC Prelims Practice Questions

Question: Consider the following statements regarding 'Jeevani':

1. It is an herbal medicine developed based on traditional tribal knowledge.
2. It was developed with the collaboration of the Kani tribe, utilizing their traditional knowledge.
3. It is recognized as a successful international model of 'Access and Benefit Sharing (ABS)'.

Select the correct answer using the code given below.

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Ans:c)

UPSC Mains Practice Questions

Question: Examine the role of biodiversity-based research institutions in the development of the bioeconomy in India. **(10 Marks, 150 Words)**



In recent years, the Government of India has aggressively pushed the Ethanol Blending Programme (EBP) to reduce dependence on crude oil imports, cut carbon emissions, and boost the rural economy. Currently, the government aims to blend 20% ethanol into petrol (E20 petrol).

However, this policy has courted controversy as the government continues to emphasize the production and blending of expensive ethanol under the guise of compensating farmers, even when crude oil prices in the international market have fallen below \$70 per barrel. This analysis reviews the economic, environmental, and agro-scientific aspects of this policy and its economic justification.

Key Points: Challenges of the Ethanol Blending Policy

- **Unfair Economic Burden on Consumers:** When global crude oil prices fall below \$70 per barrel, the cost of pure petrol is lower than that of ethanol-blended petrol (E20). Despite this, administered prices set by the government force consumers to pay more at the pump. This is unfair to poor consumers whose income brackets are even lower than those of sugarcane farmers.
- **The Problem of Low Mileage:** The energy density of ethanol is lower than that of pure petrol. Consequently, consumers not only have to pay a higher price for the fuel but also experience a reduction in their vehicle's mileage.
- **Over-exploitation of Resources (Water and Fertilizer Crisis):** In India, the primary feedstock for ethanol is sugarcane. Sugarcane is a crop that requires an excessive amount of water and chemical fertilizers. The concern is that its production is mainly carried out in water-stressed regions like Maharashtra and Karnataka, further deepening the groundwater crisis.
- **Inefficient Value Chain:** This process of delivering direct benefits to sugarcane farmers is highly complex and inefficient. The money moves from the consumer to Oil Marketing Companies (OMCs), then to distilleries, and through sugar mills before finally reaching the farmers. Due to this long chain, the actual benefit of the policy does not fully reach the farmers.
- **Ignoring the Root Problems:** Fixing high input prices (high feedstock prices) does not solve the fundamental problems of farmers. The primary reasons for low farmer incomes are post-harvest losses and limited market access, which this policy fails to address.
- **Food vs Fuel Debate:** The government has also permitted ethanol production from maize and surplus or damaged rice from the Food Corporation of India (FCI). Using maize and coarse grains poses a threat to food security. Although millets require less water, their starch yield per hectare is very low.

Way Forward: Measures to Reform the Policy

Insular incentive

Ethanol-blended fuel should not be forced on consumers irrationally

The Indian government's policy to continue producing E20 petrol at a cost higher than that of pure petrol when oil prices dip under \$70 a barrel to "compensate farmers adequately" is a deceptively well-formulated proposition. Most feedstock for the fuel-blending programme is from sugarcane, one of India's most water- and fertilizer-intensive crops, mainly grown in water-stressed Maharashtra and Karnataka. Whether the policy's net economic benefit remains positive will depend on the gains from lower crude imports, environmental improvements, and higher rural incomes outweighing these additional costs. Efficiency also remains a concern. Consumers – including people who are poorer than sugarcane farmers – pay more at the pump, oil marketing companies procure ethanol at the administered price, distilleries buy feedstock, and only then do farmers receive higher prices. Higher feedstock prices also do not address most reasons farmers have lower incomes, such as post-harvest losses and limited market access. Crucially, if the government rewards every unit of ethanol irrespective of feedstock, the policy will favour whichever feedstock has the largest installed base: sugarcane. Instead, the objectives should include resource efficiency and food security. The state could invest in irrigation and logistics and institute revenue-sharing arrangements with ethanol producers and cooperatives.

India has encouraged maize and grain-based distillation capacity has expanded rapidly, periodically allowed ethanol to be produced from the Food Corporation's surplus or damaged rice holdings, and has supported commercial plants using agricultural residues such as rice straw under Ministry of Petroleum and Natural Gas schemes. Maize and millets are less thirsty but maize still demands significant fertilizer inputs while millets produce less fermentable starch per hectare. Sweet sorghum is less water-intensive and has a shorter growing season than sugarcane. Lignocellulosic biomass such as rice and wheat straw, maize stover and groundnut shells can also support second-generation (2G) ethanol. 2G ethanol from agricultural residues can avoid using cropland for fuel, reducing competition with food crops and addressing stubble burning. It is more expensive and technologically demanding but that is a better problem to solve, with proactive policymaking. The government could pay a premium for ethanol produced from residues, subsidise equipment and infrastructure to collect and store crop residue, facilitate contracts between aggregators and distilleries, and provide viability-gap funding and offtake agreements. Ultimately, ethanol policy should not be independent of agricultural policy. And import substitution is no excuse for consumers being forced to pay more for lower-mileage fuel than pure petrol.

Daily News Analysis

- **Promoting Resource-Efficient Crops:** Instead of sugarcane, water-efficient crops like sweet sorghum should be promoted, which also have a shorter growth cycle.
- **Focusing on Second-Generation (2G) Ethanol:** Priority should be given to technologies that produce ethanol from agricultural residues (lignocellulosic biomass) such as rice/wheat straw, maize stalks, and groundnut shells.
- **Solving the Stubble and Environmental Crisis:** If 2G ethanol is produced from agricultural residues, it will not only reduce land competition for food crops but also solve the severe problem of stubble burning in Northern India.
- **Financial and Infrastructure Support:** 2G ethanol technology is expensive and complex. The government should provide Viability Gap Funding (VGF), subsidies for crop residue collection infrastructure, and assured offtake agreements with distilleries.
- **Integrated Agricultural Policy:** Instead of viewing the ethanol policy in isolation, it should be integrated with the country's broader agricultural policy. Rather than merely providing subsidies, the state should invest in developing irrigation systems, cold chain logistics, and revenue-sharing models between ethanol producers and cooperative societies.

Conclusion

There are no two opinions that import substitution and forex savings are vital for India, but consumers should not be forced into using low-mileage and expensive fuel in its name. The success of the Ethanol Blending Programme will depend on whether its economic benefits (savings from reduced crude oil imports) outweigh its environmental damages (over-exploitation of water) and the financial burden placed on consumers. India needs a rational and balanced policy that strikes the right chord between resource efficiency, food security, and energy security.

Daily News Analysis

UPSC Prelims Exam Study Questions

Question: Which of the following are used as feedstock for ethanol production in India?

1. Sugarcane
2. Maize
3. Surplus or damaged rice from FCI
4. Rice and wheat straw

Select the correct answer using the code given below.

- (a) 1 and 2 only
- (b) 1, 2 and 3 only
- (c) 1, 2 and 4 only
- (d) 1, 2, 3 and 4

Ans: b)

UPSC Mains Exam Study Questions

Question: Briefly describe the key objectives of India's Ethanol Blending Programme (EBP) and the challenges associated with it. **(10 Marks, 150 Words)**



Page 10 : GS II & III : International Relations and Economy

Recently (on July 10, 2026), China's Ministry of Commerce and the General Administration of Customs imposed an immediate and temporary ban on helium exports from the country. Although China is a small producer of helium globally (merely 1.6%), amid current global geopolitical tensions, fears of US sanctions, and disruptions in the global supply chain, this move by China establishes helium as a strategic resource. This analysis highlights the strategic importance of helium, its applications, and global vulnerability.

Why has China banned helium exports?

Why is helium emerging as a strategic resource? How vulnerable is the world to a helium supply shock? Why is it considered a critical input for future technologies? Why is storing and transporting helium so expensive? What makes it so hard to replace?

EXPLAINER

Vasudevan Mukunth

The story so far:
On July 10, the Ministry of Commerce and General Administration of Customs, China, has temporarily but immediately banned helium exports from the country. As of 4.30 pm IST on July 10, Beijing had not published any other information as to why it took this step now or its scope.

Is China a major helium producer?
China imports more than 80% of its helium needs but produces only around 1.6% of the world's helium. The export ban follows an extended period of supply strained by Russia's export restrictions — where the Prime Minister needs to sign off on shipments through 2027 — and supply risks tied to heightened tensions in West Asia.

The world's major helium producers are the U.S. (meeting 43% of total supply), followed by Qatar, Russia, Canada, and Algeria. In 2024, the U.S. privatised its Federal Helium Reserve and, selling its assets to the Messer Group and no longer buffering shocks such as those due to the U.S.-Iran conflict.

The next year, the U.S. House Committee on Oversight and Government Reform launched an investigation into Messer's Chinese interests, stoking the risk of tit-for-tat measures. Which China's latest export ban could be.

After the U.S., Qatar has been meeting 33% of the demand, especially in Asia. After the conflict with Iran escalated, as medical chemist and *Science* columnist Derek Lowe put it, "one-third of global helium production is now literally bottled up behind the Strait of Hormuz, a much higher percentage than world oil production [where the situation is bad enough already]."

In this light, China's new export restriction could preserve the country's helium supply for its domestic chip



Helium can only be transported in vacuum-jacketed stainless steel vessels that are manufactured only by a few companies worldwide. GETTY IMAGES

manufacturers and its medical sector.

How is helium obtained?
Helium is the second-lightest element, after hydrogen, and is not manufactured. It is a non-renewable resource generated deep in the earth's crust, where the radioactive decay of uranium and thorium atoms emits alpha particles, which capture electrons to form helium atoms.

Over millions of years, this helium migrates into the same reservoirs of natural gas, and they are extracted together. This said, natural gas is not processed to isolate the helium from it until the latter makes up at least 0.3% by volume.

But once it does, the gas is isolated using the fact that it has a different boiling point.

Some operators also recover helium from LNG plants and from the air but these quantities are too low to matter to the global demand. Helium for commercial use is usually at least 99.997% pure.

What is helium used for?

Helium has an extremely low boiling point — negative 269°C — and does not participate easily in chemical reactions. These are good properties for a coolant that needs to cool the magnets in MRI machines, the silicon wafers in the semiconductor fabricating industry, and increasingly, some of the devices used in quantum computers. Its small atoms mean the gas escapes easily through gaps that might be too small for oxygen or nitrogen atoms — so engineers use helium as a leak-detector.

Helium is also used in the process of drawing optical fibres to rapidly and uniformly cool molten glass and to displace oxygen or nitrogen from forming bubbles inside the material. Spaceflight organisations like ISRO, NASA, and SpaceX use helium to pressurise fuel tanks in rockets. Research and the tourism sector in many parts of the world also use helium to inflate balloons and airships.

According to the U.S. Geological Survey, laboratory use-cases account for

22% of the demand for helium, followed by controlled atmospheres and semiconductors (17%), lifting gas (17%), MRI scanners (15%), aerospace (9%), and detecting leaks (5%).

How much does helium cost?

In June 2026, the spot price for highly pure helium in Northeast Asia had reportedly spiked to \$150-205 per thousand cubic feet, almost double what it was in late 2025. At least one major supplier, the U.S.-based industrial supplier Airgas, has invoked force majeure and tacked on surcharges of \$13.50 per hundred cubic feet to existing contracts. Liquid helium is by default expensive to store and transport because helium only liquefies at -269°C.

In fact, the helium supply chain as a whole is cost-intensive because purification, storage, and transport are each expensive and technically sophisticated. A mid- to large-scale purification and liquefaction facility will require more than \$100 million while smaller ones can cost around \$10 million, thanks to the need for corrosion-resistant alloys that can withstand ultra-low temperatures.

The gas can be stored in underground salt caverns, which reduce leaks significantly — but these formations are rare and developing a new one can cost more than \$200 million. It can also be stored as compressed gas or cryogenic liquid. The former typically costs up to \$10 million to build while bulk cryogenic liquid storage systems generally need between \$0.5 million and \$20 million depending on capacity. Then there are the operational expenses.

Finally, helium can only be transported in vacuum-jacketed stainless steel vessels — which are manufactured by relatively few companies worldwide, including several Chinese ones.

Finally, the contractor transporting the containers must also ensure they are delivered before the holding time expires, after which the helium will start boiling off into the atmosphere.

THE GIST

The export ban follows an extended period of supply strained by Russia's export restrictions — where the Prime Minister needs to sign off on shipments through 2027 — and supply risks tied to heightened tensions in West Asia.

Helium is an important coolant in the semiconductor fabricating industry, where it removes heat from silicon wafers.

The helium supply chain as a whole is cost-intensive because purification, storage, and transport are each expensive and technically sophisticated.

Key Points: Detailed Analysis

1. Why did China ban helium exports?

- **Protection of Domestic Industries:** China imports more than 80% of its helium requirements. Given the uncertainty in supply, China wants to secure helium for its domestic chip manufacturers (Semiconductor) and medical sector.

Daily News Analysis

- **Tensions and Anticipation of Retaliation:** In the year 2024, the US privatized its 'Federal Helium Reserve', reducing the capacity to withstand global shocks. Following this, the US Congress launched an investigation into the Chinese interests of the Messer Group. This ban by China could be a 'tit-for-tat' strategy in response to this.
- **Control over Transportation:** Helium can only be transported in special 'vacuum-jacketed stainless steel containers', the world's leading manufacturers of which are located in China. By stopping exports, China is strengthening its control over these logistics resources.

2. Why is helium emerging as a strategic resource?

- **Limited and Non-renewable Source:** Helium cannot be made artificially. It is formed by the radioactive decay of uranium and thorium in the Earth's crust and accumulates along with natural gas.
- **Geopolitical Concentration:** Most of the world's helium supply is concentrated in the hands of only a few countries—the US (43%), Qatar (33%), Russia, Canada, and Algeria.
- **Strait of Hormuz Crisis:** Due to the escalating conflict with Iran, one-third of the world's helium supply (especially coming from Qatar) has trapped behind the Strait of Hormuz, making it a resource even more sensitive than oil.

3. Why is helium essential for future technologies?

- **Ultra-low Boiling Point:** The boiling point of helium is -269°C , making it the coldest liquid in the universe. Without it, the following technologies cannot function:
 - **Semiconductor Industry:** For cooling silicon wafers.
 - **Medical (MRI Machines):** To keep superconducting magnets cool (15% of total demand).
 - **Quantum Computing:** Quantum processors require extremely low temperatures to remain stable.
 - **Space and Defense:** Agencies like ISRO, NASA, and SpaceX use helium to pressurize fuel tanks in rockets.
 - **Leak Detection:** Its atoms are so small that it escapes through even the most microscopic pores compared to air or nitrogen, leading scientists to use it for finding leaks.

4. Why is the storage and transportation of helium so expensive?

- **Requirement of Extremely Low Temperatures:** To keep helium in liquid form, a continuous temperature of -269°C must be maintained, which requires expensive infrastructure made of corrosion-resistant alloys.
- **High Cost of Infrastructure:** A medium-scale liquefaction plant costs over \$100 million. Developing underground salt caverns to prevent leakage costs upwards of \$200 million.
- **Boil-off Risk:** During transportation, if containers do not arrive on time, the helium boils off and escapes into the atmosphere, destroying the entire stock.

5. Why is it difficult to find an alternative to helium?

- **Chemically Inert:** It does not react with any other element, making it completely safe for processes where there is a risk of fire or explosion (such as rocket or wafer manufacturing).
- **No Alternative to Physical Properties:** Hydrogen is lighter than helium, but it is highly flammable. Nitrogen or other gases cannot provide temperatures as low as helium (-269°C). Therefore, no exact alternative is available in cutting-edge science.

Conclusion

China's helium export ban is not merely a commercial decision, but is part of the emerging 'resource nationalism' and tech-war. As the world moves towards semiconductors, quantum computing, and space exploration, the dependence on helium is increasing. Given this extreme vulnerability of the global supply chain, it is essential for countries like India to prioritize helium recycling, its extraction from domestic natural gas fields, and strategic storage in their national strategies, so that domestic technological development can be protected from any future 'helium supply shock'.

UPSC Prelims Exam Study Questions

Ques: Consider the following statements regarding helium:

1. It is a chemically inert gas.
2. It has the lowest boiling point of all elements.
3. It can be produced artificially on a large scale through industrial production.

Select the correct answer using the code given below.

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Answer: (a)

UPSC Mains Exam Study Questions

Ques: Why is helium being considered a strategic resource? Explain its scientific and economic significance. **(10 Marks, 150 Words)**

The formation of District Development Councils (DDCs) has been a major shift in the political and administrative structure of Jammu and Kashmir. Formed in the year 2021, the 5-year tenure of these councils ended on February 24, 2026. Since new elections have not been held yet and the local bodies are largely dysfunctional, the debate over the relevance of the DDC model has intensified again.

How DDCs changed local governance in J&K?

What is at stake in the debate over local democracy in Jammu and Kashmir?

Tikender Singh Panwar

The story so far:

The restructuring of Jammu and Kashmir's political and administrative framework through the constitution of District Development Councils (DDCs) has remained the subject of legal and constitutional debate. Formed in 2021, the DDCs completed their five-year term on February 24, 2026. With no fresh elections held and local government institutions remaining largely inactive in recent years, questions have resurfaced about the relevance of the DDC model. Introduced as a mechanism for direct local democracy, the DDCs are viewed by supporters as a step towards grassroots governance, while critics argue they have impeded rather than strengthened democratic decentralisation in the region.

What do the 73rd and 74th Amendments provide for?

One of the core arguments presented for

the abrogation of Article 370 was the need to fully integrate J&K with the constitutional framework applicable to the rest of India.

A central element of this argument was the introduction of the 73rd and 74th Constitutional Amendment Acts, which provide for elected rural and urban bodies. This integration was intended to ensure regular, mandatory elections and empower grassroots democracy.

How is local governance structured?

The standard constitutional framework operates on a clearly defined multi-tier electoral system where citizens directly elect their local representatives:

Urban areas: Municipal Corporations, Municipal Councils, and Nagar Panchayats.

Rural areas: A three-tier structure comprising Gram Panchayats (Village Pradhans), Block Development Councils (BDCs), and District-level bodies (Zila Parishads).

Mandated under Article 243ZD of the

Constitution, the District Planning Committee (DPC) is envisaged as a coordinating body that brings together development plans prepared by panchayats and municipalities and integrates them into a comprehensive district-level plan.

Unlike an independent executive authority, the DPC is intended to function as an institutional mechanism that reflects priorities generated by elected local bodies and facilitates bottom-up planning. In this sense, it is designed to strengthen democratic decentralisation by aggregating local mandates rather than exercising authority over them.

However, while the constitutional framework assigns a key role to DPCs in district-level planning, their functioning has been uneven across the country, with many remaining largely inactive, barring a few exceptions such as Kerala.

How do DDCs differ from DPCs?

The DDCs were established in J&K through an executive order rather than a

legislative process. While the government presents DDCs as directly elected bodies that strengthen grassroots democracy, it is contended that the model contains major contradictions within the governance framework.

Critics argue that the DDC structure bypasses existing institutions such as Zila Panchayats and urban local bodies. Unlike the DPC, which is intended to aggregate development priorities emerging from lower tiers of government, the DDC functions as a parallel administrative authority with executive and developmental powers. This blurs the relationship between the electorate and the actual exercise of power.

The key distinction is that the DPC seeks to strengthen local democracy by consolidating mandates generated from the ground up, whereas the DDC operates from above, competing with lower tiers of governance and functioning as an instrument of centralised bureaucratic control rather than democratic decentralisation.

The DDC structure raises concerns about unequal representation. The allocation of seats across districts does not adequately reflect variations in population, thereby diluting the principle of uniform political weight.

For instance, Srinagar, with a population of roughly 12 lakh, and Kishtwar, with around 2.5 lakh residents, are allocated the same number of DDC members. This creates an imbalance where the political voice per capita is drastically skewed.

The DDCs are being compared to the "special purpose vehicles" used in Smart City projects. They create an illusion of decentralisation, but act as capital-driven, bureaucratically managed structures. Since DDCs can easily jettison legislatively approved local initiatives, they function as a governance substitute rather than a governance supplement.

The creation of 280 DDC members across J&K has established a form of parallel 'parliament' in disguise. Historically, in politically fragile regions, central authorities have often sought to weaken provincial or State-level assemblies by backing district-level entities.

With the J&K State Assembly absent or weakened for years, the DDC framework has allowed key functions and financial powers that would ordinarily rest with elected legislators and local panchayats to remain concentrated under Union administration control.

What is the way forward for local democracy in J&K?

Genuine local democracy cannot be reduced to an administrative or legal exercise; it is fundamentally a political question. True decentralisation requires the restoration of the DPC model envisaged under the 73rd and 74th Constitutional Amendments, ensuring financially empowered and grounded local governments accountable to the State's electorate, rather than an administrative architecture serving centralised union control.

Key Analysis Points

1. Constitutional Framework and the 73rd-74th Amendment

- **Argument for Integration:** A major argument behind the removal of Article 370 was to fully bring Jammu and Kashmir under the 73rd and 74th Amendments of the Indian Constitution, which grant the right of mandatory and regular elections to rural and urban local bodies respectively.
- **Three-Tier Rural System:** In the standard Indian system, there are three tiers at the rural level—Gram Panchayat (lower level), Block Development Council (BDC - middle level), and Zila Parishad at the district level.
- **Role of DPC:** Under Article 243ZD of the Constitution, there is a provision for the 'District Planning Committee' (DPC). Its job is to consolidate plans coming from the lower panchayats and municipalities to create a holistic district plan. It is a coordinating body, not an independent executive authority.

2. Main Differences and Contradictions Between DDC and DPC

- **Executive Order vs Legislative Process:** Unlike traditional Zila Parishads, DDCs in Jammu and Kashmir were established through an Executive Order rather than an Act of the Legislative Assembly.

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- **Ignoring Lower-Level Bodies:** The job of the DPC is to formulate plans from the bottom up, but the DDC functions as a parallel administrative authority. It bypasses (overrules) the rights of the lower-level panchayats and urban bodies.
- **Administrative Control:** According to critics, instead of strengthening local democracy, the DDC works from top to bottom and serves as a tool for direct bureaucratic control by the Central Government.

3. Problem of Unequal Representation

- **Imbalance of Population and Seats:** In the DDC model, the allocation of seats has been made uniform rather than being in proportion to the population of the districts, which goes against the principle of political equality.
- **Example:** Srinagar district, with a population of about 12 lakhs, and Kishtwar district, with a population of only 2.5 lakhs, have both been allocated an equal number of DDC members. This skews the significance of the political voice per capita.

4. Comparison with "Special Purpose Vehicle"

- **Facade of Decentralization:** DDCs are being compared to 'Special Purpose Vehicles' (SPVs) used in 'Smart City' projects. These institutions appear to be elected, but in reality, they are capital-driven and managed by bureaucrats.
- **Alternative to the Legislative Assembly:** When an elected state legislative assembly was absent or weak in Jammu and Kashmir, the DDC structure took over those financial and legislative powers that should normally belong to MLAs and local panchayats.

5. What is at Stake for Local Democracy?

- **Creation of a Parallel 'Parliament':** By creating 280 DDC members in Jammu and Kashmir, a kind of hidden parallel parliament has been set up. In politically sensitive areas, the Centre often tries to weaken state-level assemblies by promoting district-level bodies.
- **Lack of Accountability:** Due to this system, local development policies seem to lean more towards the administration of the Central Government instead of being accountable to the local public.

Way Forward

- **Genuine Political Will:** Local democracy should not be treated merely as an administrative or legal exercise, but as a serious political right. For this, genuine democratic decentralization is required.
- **Restoration of the DPC Model:** 'District Planning Committees' (DPCs) should be restored in Jammu and Kashmir in line with the original spirit of the 73rd and 74th Amendments of the Constitution, which formulate plans from the bottom up.
- **Financial Empowerment:** Local bodies should be made self-reliant not only in terms of administrative powers but also financially, so that they do not depend on the Centre or bureaucracy for funds.

Daily News Analysis

- **Ensuring Regular Elections:** After the tenure of DDCs ended in 2026, transparent and regular local elections should be conducted without any delay so that public faith in democratic institutions is maintained.

Conclusion

The experiment of District Development Councils (DDCs) in Jammu and Kashmir has proven to be a double-edged sword. While on one hand, it brought the electoral process to the remote areas of Kashmir in the initial phase, on the other hand, it has weakened the original structure of the traditional three-tier Panchayati Raj system and District Planning Committees. For a genuine and vibrant democracy, it is essential that administrative control is reduced and power is devolved directly into the hands of the people of Jammu and Kashmir and their elected lower-level representatives.

UPSC Mains Exam Study Questions

Ques: Explain the key differences between the District Planning Committee and the District Development Council. **(10 Marks, 150 Words)**



Five crore Indians wait when the courts take a break

The Supreme Court of India and the major High Courts are on a summer holiday break, i.e., shut down with some vacation Benches functioning to hear urgent matters. However, shops, markets, eating places, government and private offices, hospitals and police stations do not cease to work even though their staff enjoy personal leave. On the other hand, somewhere in an Indian jail tonight, a man who has been convicted of nothing is finishing another year behind bars, his trial still ongoing and perhaps years away from ending. He is one of the roughly three in four prisoners in this country who are undertrials: unconvicted, presumed innocent, yet serving time anyway – often longer than the sentence they would have received had they pleaded guilty. And as you read this, the courts, the public institutions that hold the fate of the poor in their hands, are functioning at only a fraction of their strength.

A three-century backlog

From June 1 to July 12, the Supreme Court is on its summer break, sitting with three or four Benches a week instead of a full court and resuming in earnest on July 13. The doors are not bolted; urgent pleas are still heard. But for six weeks, the most powerful court in the world's most populous democracy idles.

Now hold that against the number it is meant to be fighting. As of the last day of 2025, more than 5.39 crore cases were pending in Indian courts: over 4.76 crore in the district courts, 63.6 lakh in the High Courts, and more than 92,000 in the Supreme Court itself, its heaviest load in over 30 years. A government study once calculated that, at the present pace, clearing the pile could take three centuries.

Three centuries. And the Court takes the summer and winter vacations off.

To be fair, the judges deserve it. The recess is when reserved judgments finally get written, when the brutal daily cause-list eases enough to think



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When courts
rest together
for vacations,
crores of
litigants across
the country
wait longer
for justice

Last year the Chief Justice of India and his four senior-most colleagues worked clean through the first week of the break. Indian judges are among the most overworked in the world. This is not an accusation of laziness; no one who has seen a judge's docket could make one.

Because that is precisely the point. When the people doing the work are exhausted and the backlog is biblical, what conceivable logic shuts the whole shop at once? Not that judges rest – which they should – but that almost all of them rest together, so the institution goes quiet for six-plus weeks every year. And the habit is a colonial hand-me-down: the calendar was built for English judges who could not stand the Indian heat and retreated to cooler climes each summer, then enjoyed long Christmas holidays in the winter.

In 2024, the Court announced a fix: it renamed the “summer vacation” as “partial court working days”. That was it. The number of days it actually sits – about 190 days in a year – did not change. You cannot rebrand your way out of a backlog; a litigant whose case is stuck does not care what the recess is called, only whether his matter is heard and disposed of.

Justice needs court continuity

So what would actually help? The first answer is one the judiciary's own watchdogs have urged for years: do not abolish judicial rest; stagger it. A parliamentary standing committee in 2023 objected to “the entire court going on vacation en masse”, and proposed the obvious: rotate the leave, keep the Benches full, and never let the court run thin. A hospital does not empty its wards because its doctors are owed time off; it builds a roster. The Law Commission and the Justice Malimath Committee said the same, long ago. They were not enemies of the courts; they were trying to save them from themselves.

The standard objection is that all this is a sideshow: the real disease is vacancies, not vacations. It is true that courts are starved of judges, with up to a third of High Court seats

lying empty. But the objection boomerangs. If the Bench is already running at half strength, thinning it further for six weeks every summer is not a defence of the recess; it is the strongest case against it. And while filling those seats depends on the government and the collegium and will drag on for years, the calendar is the judiciary's to fix. One reform needs permission; the other needs only will.

Beyond courts, towards solutions

Staggering the leave, though, only treats the symptom. The deeper fix is to keep disputes out of the courtroom in the first place; it was never meant to be the first stop for every quarrel, but the last. India already has the tools. Lok Adalats settled more than 2.59 crore cases in a single national sitting last December, and over 23.5 crore in three years. The Mediation Act of 2023 now nudges parties to attempt settlement before going to court, and arbitration can take commercial disputes entirely out of judges' hands; yet these routes remain badly underused. But none of this happens on its own.

The country has a reservoir of experience it scarcely draws on: its retired judges, who spent their careers mastering this very machinery and step down, still in full command of it, at 62 or 65. Their expertise need not retire with them. Albeit many of them do function as heads of quasi-judicial bodies and tribunals. Freed from any daily docket, a dedicated corps of former judges could be invited to take up a single targeted charge: identify where cases pile up, set public targets for their disposal, and account for progress openly. Reform that belongs to everyone belongs to no one.

The judges will keep working through the heat, as they always do. The honest demand is not that they stop resting, but that the courts stop closing ranks and falling silent at the same moment, because justice, for five crore Indians, is not on vacation. It is overdue.

With contributions from Anushka Kewlani of CUTS

GS Paper II: Indian Polity

UPSC Mains Exam Practice Questions: Outline the major reasons for the pendency of cases in the Indian judiciary and suggest measures to resolve this issue. (10Marks, 150 Words)

Context : The Indian judiciary is one of the largest and most powerful judicial systems in the world, but currently, it is struggling with a heavy workload and a crisis of pending cases. By the end of December 2025, more than 5.39 crore cases were pending in various courts of India. Amidst this severe crisis, the closure of regular work during summer and winter vacations in

Daily News Analysis

the Supreme Court and High Courts has become a major policy and administrative issue. This analysis highlights court vacations, the impact of pending cases, and measures for reform.

Current Status of Pending Cases (Key Data)

- **Total Pending Cases:** More than 5.39 crore cases are pending in the courts of the country.
- **Subordinate/District Courts:** The highest burden is on the lower courts, where about 4.76 crore cases are pending.
- **High Courts:** About 63.6 lakh cases are stuck in the High Courts.
- **Supreme Court:** More than 92,000 cases are pending in the apex court of the country, which is its heaviest burden in the last 30 years.
- **Speed of Resolution:** According to a government study, if the current speed of justice delivery continues, it may take about 3 centuries (300 years) to completely eliminate this backlog (pending cases).

Main Issues and Challenges Related to Court Vacations

- **Impact on Undertrials:** Three out of every four prisoners (about 75%) confined in India's jails are 'undertrials'. They have spent a long time in jail despite no crime being proven, which is often longer than the sentence they would have received if found guilty. The closure of courts further prolongs their hope for justice.
- **Colonial Legacy:** This system of collective vacations is a legacy of the British era. The British judges of that time could not tolerate the Indian summer and used to move to colder places during summers. Questions are being raised on the relevance of this system in today's time.
- **Change in Name Only (Rebranding):** In the year 2024, the Supreme Court changed the name of "Summer Vacation" to "Partial Court Working Days", but this did not cause any change in the actual working days of the court (about 190 days in a year).

Judges' Perspective and Arguments

- **Overworked Judges:** Indian judges are among the busiest and most stressed judges in the world. They have a very long daily list of cases (Cause-list).
- **Time for Writing Judgments:** Judges use long vacations not for rest, but for writing pending judgments (Reserved Judgments) and deeply considering complex legal matters.

Key Suggestions for Reform (Way Forward)

- **Staggering of Leave / Vacation Rotation:** The Parliamentary Standing Committee (2023), Law Commission, and Justice Malimath Committee have suggested that instead of closing the entire court at once, the vacations of judges should be fixed alternately (Staggered). Just as hospitals run 24/7 with the rotation of doctors, courts should also remain open throughout the year.

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- **Filling Vacant Posts of Judges:** Currently, about one-third of the posts in High Courts are vacant. The Government and the Collegium together will have to fill these posts as soon as possible.
- **Promoting Alternative Dispute Resolution (ADR):** Lok Adalats, Mediation (Mediation Act 2023), and Arbitration should be used maximum to resolve cases outside courts. Lok Adalats have proven their capability by disposing of more than 23.5 crore cases in three years.
- **Utilizing the Experience of Retired Judges:** Judges retiring at the age of 62 or 65 have extensive experience. They can be included as a dedicated corps, who solely identify the areas where cases get stuck the most and set public targets for their disposal.

Conclusion

Justice delayed is justice denied. For the poor and underprivileged sections of India, courts are the last resort. Judges certainly need rest to remain mentally and physically healthy, but the entire justice system cannot be stalled at once for this. The need of the hour is for the judiciary to reform its administrative system, implement vacations on a rotation basis, and use modern technologies and alternative mechanisms. When more than 5 crore Indians are waiting for justice, the institutions delivering justice cannot go on collective leave. The judiciary, while utilizing its autonomy, should implement this calendar reform with strong willpower.