Daily News Juice 7th May,2024

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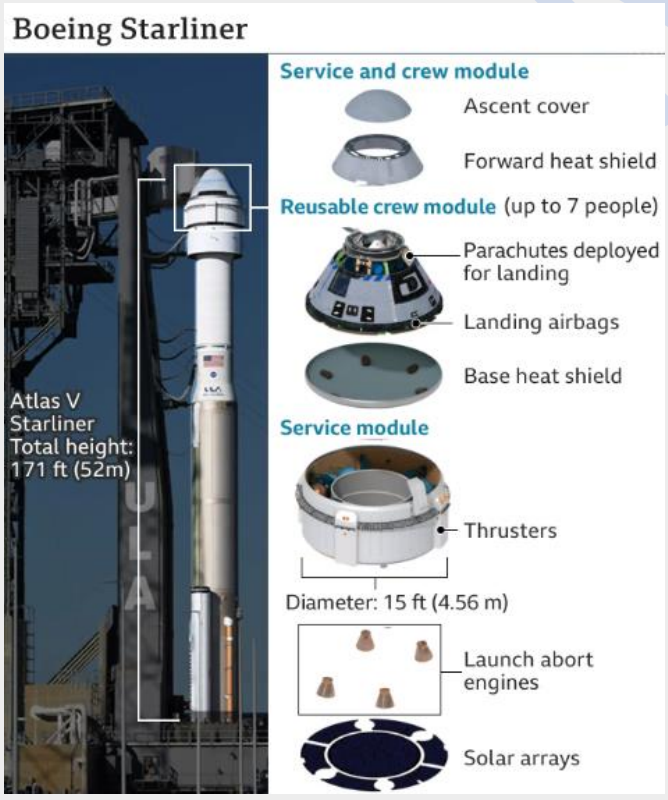
1. Why is the launch of Boeing's Starliner significant?

Why in News?

Boeing's Starliner spacecraft, carrying two NASA astronauts, will be launched by an Atlas V rocket from the Kennedy Space Center in Cape Canaveral, Florida, to the International Space Station (ISS) on May 7.

This will be Starliner's first crewed test flight. If the mission is successful, Boeing will become the second private firm to be able to provide NASA crew transport to and from the ISS, alongside Elon Musk's SpaceX.

The stakes are high, especially for Boeing. The image of its airline business has been tarnished by a recent series of safety and regulation issues. The company's space sector is also under pressure as the launch of Starliner's crewed test flight has been delayed for several years due to technical setbacks.



But first, what is Boeing's Starliner?

Starliner is a partially reusable crew capsule, officially known as CST-100 (crew space transportation). The capsule, which is 5 m tall and 4.6 m wide, consists of two modules. One is the crew module, which can accommodate seven astronauts — although, for trips to the ISS, it will be modified for four astronauts and cargo. The crew module can be reused up to 10 times, with a six-month turnaround.

The other is the service module — the powerhouse of the spacecraft — which supplies electricity, propulsion, thermal control, air, and water in space. This module is expandable.

What is the mission?

The main objective of the mission is to see how Starliner performs in space with a crew onboard. It is supposed to dock with the ISS — a day after the launch — for around 10 days before it returns to the Earth.

But before Starliner automatically docks with the space station, the crew members, who are NASA astronauts Barry "Butch" Wilmore and Sunita Williams, will test flying it manually. The crew will also "test seats, assess onboard life-support and navigation systems, as well as evaluating the system that moves cargo into the ISS. The space suits worn by Wilmore and Williams will also be tested — these blue suits are around 40% lighter than their predecessors and have touchscreen-sensitive gloves.

During the return journey, NASA and Boeing will be keeping an eye on the spacecraft's heat shield and parachutes. They will slow the descent before airbags open to soften the moment of impact with the ground — unlike other crew capsules, Starliner will land on the ground and not in the sea.

What caused the delay?
After NASA retired its space shuttle fleet in 2011, it invited commercial space companies to help it transport astronauts and cargo to the ISS. Two companies got the contracts: SpaceX and Boeing. While SpaceX has been ferrying astronauts to and from the ISS since 2020, Boeing is yet to successfully launch its first crewed flight, something which may change soon.

Starliner's first uncrewed flight itself came after four years of delay. Although it was set to take off in 2015, the company postponed it to 2019. When it did finally happen, a series of software and hardware failures thwarted the spacecraft from getting into its planned orbit and docking with the ISS. As a result, Boeing delayed the launch of Starliner's first crewed flight.

Why is the mission significant?
The mission's success is crucial for both NASA and Boeing. Currently, NASA has only one private company, SpaceX, which can take its astronauts and cargo to the ISS. Starliner getting approval for conducting routine flights to and from the ISS would give NASA a backup and option to not depend on one company or vehicle for space launches.

If Starliner completes its objectives, it will also help Boeing challenge SpaceX's dominance in the commercial space industry.

Relevance: GS Prelims; Science & Technology
Source: Indian Express

2. Why are cancer cases soaring in India?

Cancer capital of the world?
In fact, a report released by the Indian multinational health care group, Apollo Hospitals, last month labeled the South Asian nation as "the cancer capital of the world."

The study revealed an alarming picture of declining overall health across the country, pointing to soaring cases of cancer and other non-communicable diseases nationwide.

The report found that at present, one in three Indians is pre-diabetic, two in three are pre-hypertensive, and 1 in 10 struggles with depression. Chronic conditions like cancer, diabetes,

hypertension, cardiovascular diseases, and mental health disorders are now so prevalent that they have reached "critical levels".

The study projected the number of annual cancer cases to rise from almost 1.4 million in 2020 to 1.57 million by 2025. Breast, cervix, and ovarian cancer are the most common forms of cancer affecting women. And among men, they are lung cancer, mouth cancer, and prostate cancer.

Contributory factors to rising incidence are advancing age, unhealthy diets with ultra-processed foods stoking inflammation, exposure to air pollution laden with carcinogens and climate change with increased exposure to ultraviolet radiation.

Children increasingly affected by cancer

The Apollo Hospitals report also details how certain cancers are affecting younger people sooner than in countries like the US and the UK. The median age for lung cancer is 59 in India, for instance, but 70 in the US, 75 in the UK and 68 in China.

Around a million new cases of cancer are diagnosed in India every year, of which about 4% are in children.

Doctors and other health professionals say there is a shortage of pediatric oncology facilities in the country, particularly in government-run hospitals.

Regular screenings needed

Experts said low health screening rates in the country pose a significant challenge for the fight against cancer, and stressed the importance of preventive health care measures.

India has a screening program in place for oral, breast, and cervical cancer, but screening rates are less than 1%, according to national data, despite the WHO's recommendation that at least 70% of women should get tested.

Relevance: GS Prelims & Mains Paper I; Indian Society
Source: Indian Express

3. GOLDENE: A sheet of gold that is only one atom thick

Why in News?

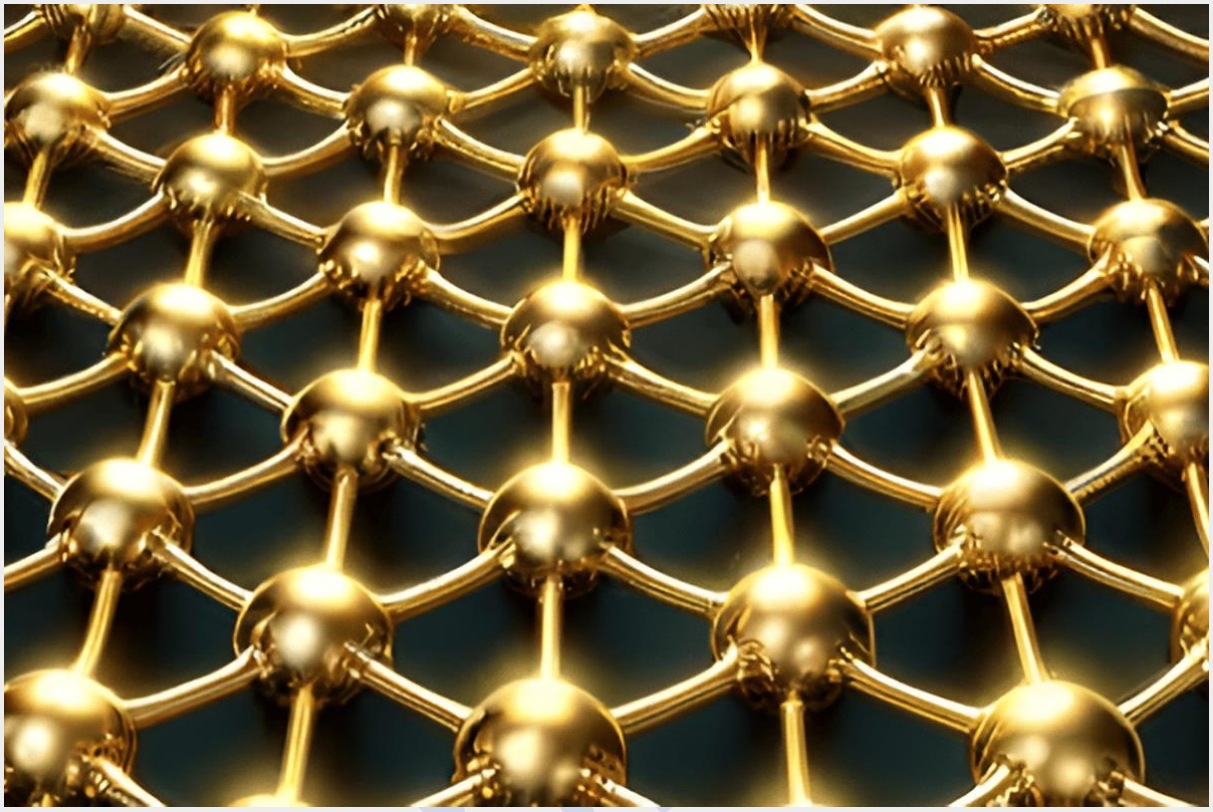
For the first time, researchers have created a free-standing sheet of gold that is only one atom thick. This makes gold the first metal to be formulated into (freestanding) 2D sheets — opening up a host of exciting possibilities for the future.

Developing goldene

Creating 'goldene', as the one-atom thick material has been named, was not easy for the scientists. It is not that such 2D materials have not been created before.

Since the 2004 development of graphene, the atom-thin material made of carbon, scientists have identified hundreds of 2D materials.

However, coming up with atom-thin metallic sheets has been a challenge, due to metals' tendency to cluster together to make nanoparticles instead. While scientists have previously produced gold sheets sandwiched between other materials, "goldene is the first free-standing 2D metal.



Method of Creation

To create goldene, researchers first sandwiched an atomic monolayer of silicon between layers of titanium carbide. When they deposited gold on top of this sandwich structure, the gold atoms diffused into the material and replaced the silicon atoms, forming a trapped monolayer of gold atoms.

Subsequently, scientists etched away the titanium carbide layers to create a free-standing, one atom thick layer of gold. This was done with the help of an age-old Japanese technique used to forge katanas and high-quality knives, using a chemical popularly known as Murakami's reagent.

These sheets of goldene are roughly 100 nanometres thick (a nanometre is a billionth of a metre), approximately 400 times thinner than the thinnest commercially available gold leaf.

Many potential applications

Scientists believe that the super thin, super light material can potentially revolutionise the electronics industry. Goldene holds promise because it's much more economically viable than thicker, three-dimensional gold. This means that electronics, which use gold due to its electrical conductivity, can potentially use lesser amounts for the same purpose.

Moreover, the technique used by the scientists to create goldene can, in theory, also be applicable to other metallic objects. Scientists are already working to make 2D sheets of iridium and platinum.

Lastly, goldene possibly also has some special properties, like other previously developed 2D materials. This is due to the fact that each gold atom, in this case, has only six neighbouring atoms, compared to 12 in a three-dimensional crystal. Scientists say that future applications could include carbon dioxide conversion, hydrogen-generating catalysis, selective production of value-added chemicals, hydrogen production, water purification, etc.

Relevance: GS Prelims & Mains Paper III; Science & Technology
Source: Indian Express