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OSIRIS-REx

- Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer (OSIRIS-REx) spacecraft will depart asteroid Bennu, and start its two-year long journey back to Earth.
- OSIRIS-REx is NASA's first mission to visit a near-Earth asteroid, survey its surface and collect a sample from it.
- The seven-year-long mission was launched in 2016, reached its target in 2018. In October 2020, the spacecraft touched asteroid Bennu.
- When the spacecraft finally returns in September 2023, it will bring back the largest sample of dust and pebbles collected by a NASA mission since the Apollo astronauts collected samples of Moon rock.
- Bennu is considered to be an ancient asteroid that has not gone through a lot of composition-altering change through billions of years.
- This means that below its surface lie chemicals and rocks from the birth of the solar system. Studying Bennu might give clues about the origins of the solar system, the sun, the Earth and the other planets.

Asteroid Bennu

- Named after an Egyptian deity, Bennu is located about 200 million miles away from the Earth. It was discovered by a NASA-funded Lincoln Near-Earth Asteroid Research team in 1999.
- It is a **B-type asteroid**, implying that it contains significant amounts of carbon and various other minerals.
- Because of its high carbon content, Bennu reflects about 4% of the light that hits it, which is very low. (Earth reflects 30% of the light that hits it.)
- Around 20-40% of Bennu's interior is empty space and it was formed in the first 10 million years of the solar system's creation, implying that it is roughly 4.5 billion years old.
- There is a slight chance that Bennu, a Near Earth Object (NEO), might strike the Earth in the next century, between 2175 and 2199.
- [NEOs are comets and asteroids nudged by the gravitational attraction of nearby planets into orbits which allow them to enter the Earth's neighbourhood.]

The Unicorn

- It is the name of the smallest-known black hole in the Milky Way galaxy and the closest to our solar system.
- A luminous star called a red giant orbits with the black hole in a binary star system named V723 Mon in the Monoceros constellation.
- The black hole ‘Unicorn’ is roughly three times the mass of our sun, testing the lower limits of size for these extraordinarily dense objects that possess gravitational pulls so strong not even light can escape.
- It is located about 1,500 light years - the distance light travels in a year, 9.5 trillion km - from Earth.
- 'The Unicorn' falls into "mass gap" between the largest-known neutron stars (2.2 times the mass of our sun) and what previously had been considered the smallest black holes at around five times the sun's mass.
- Its strong gravity alters the shape of its companion star in a phenomenon known as **tidal distortion**, making it elongated rather than spherical and causing its light to change as it moves along its orbital path.
- Unlike some other black holes orbiting with a star, this one was not observed to be drawing material from its companion, which is 173 times more luminous than our sun.

Three Categories of Black Holes

- Black holes form when massive stars die and their cores collapse. They are electromagnetically dark, and so they are difficult to find.
- Their effects on the companion star are what indicate their presence.
- **Stellar mass black holes** - They are the smallest black holes formed by the gravitational collapse of a single star.
- **Gargantuan supermassive black holes** - They are black holes at our galaxy's center, 26,000 light years from Earth, which is four million times the sun's mass.
- **Intermediate-mass black holes** - They have masses somewhere in between the above two.

Shuvuuia deserti

- Shuvuuia was a pheasant-sized, two-legged Cretaceous Period dinosaur weighing about as much as a small house cat.
- Lacking the strong jaws and sharp teeth of many carnivorous dinosaurs, it had a remarkably bird-like and lightly built skull and many tiny teeth.
- It lived in desert habitats about 70 million years ago, in what is today Mongolia and northern China.
- It employed excellent night vision and superb hearing to thrive as a menacing pint-sized nocturnal predator.
- Shuvuuia is unique among predatory dinosaurs with a **hyper-elongated**

lagena, almost identical in relative size to a barn owl's.
- [The barn owl, a proficient nocturnal predator even in pitch-black conditions, has the proportionally longest lagena of any living bird.]
- Shuvuuia had a **very wide scleral ring**, indicating an extra-large pupil size that made its eye a specialized light-capture device.
- Nocturnality was uncommon among dinosaurs, aside from a group called alvarezsaurs to which Shuvuuia belonged.
- Alvarezsaurs had nocturnal vision very early in their lineage, but super-hearing took more time to evolve.

Global Methane Assessment Report

- The "Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions" report was released by the Climate and Clean Air Coalition and the United Nations Environment Programme (UNEP).
- The report has said that human-caused methane emissions must be cut by 45% to avoid the worst effects of climate change. Such a cut would,
    1. Prevent a rise in global warming by up to 0.3 degrees Celsius by 2045.
    2. Prevent 260,000 premature deaths, 775,000 asthma-related hospital visits annually, as well as 25 million tonnes of crop losses.
- Human-caused methane emissions are increasing faster currently than at any other time since record keeping began in the 1980s. Methane in the atmosphere reached record levels in 2020.
- The report noted that the most human-caused methane emissions came from three sectors - Fossil fuels, waste and agriculture.

Actions to be taken

- **Fossil fuels Sector** - Oil and gas extraction, processing and distribution accounted for 23% of methane emissions in the fossil fuel sector. Coal mining accounted for 12% of emissions.
- Up to 80% of measures in the oil and gas industry could be implemented at negative or low cost. About 60% of methane cuts in this sector could make money as reducing leaks would make more gas available for sale.
- **Waste Sector** - Landfills and wastewater made up about 20% of emissions in the waste sector.
- This sector could cut its methane emissions by improving the disposal of sewage around the world.
- **Agricultural Sector** - Livestock emissions from manure and enteric fermentation constituted for 32% and rice cultivation 8% of emissions.
- The mitigation potential varied between countries and regions.
    1. Europe had the greatest potential to curb methane emissions from

farming, fossil fuel operations and waste management.
2. India had the greatest potential to reduce methane emissions in the waste sector.
3. China's mitigation potential was best in coal production and livestock, while Africa's was in livestock, followed by oil and gas.

- The report said that three behavioural changes could reduce methane emissions by 65-80 million tonnes per year over the next few decades,
  1. Reducing food waste and loss,
  2. Improving livestock management and
  3. Adopting healthy diets (vegetarian or with a lower meat and dairy content).

Post Devolution Revenue Deficit

- The Department of Expenditure, Ministry of Finance released the second monthly instalment of Post Devolution Revenue Deficit (PDRD) Grant of ₹9,871 crore for the financial year 2021-22 to 17 States.
- The Centre provides the Post Devolution Revenue Deficit Grant to the States under **Article 275** of the Constitution.
- PDRD is charged on the **Consolidated Fund of India** in each year as grants in aid of the revenues of such States as Parliament may determine to be in need of assistance.
- As per the recommendations of the **Finance Commission,** the grants are released in **12 monthly instalments** to meet the gap in revenue accounts of the States post-devolution.
- The Finance Commission provides PDRD grants as a mechanism for compensation of any loss incurred by states.
- The 15th Finance Commission has recommended PDRD grants over the five-year period ending FY26 to the States based on the gap between the assessment of revenue and expenditure of the State.

Finance Commission Grants

- The Finance Commission Grants, in the Union Budget, provides funds to local bodies, state disaster relief funds and compensates any revenue loss to states after devolution of taxes. The grants include,
- **Grants for rural local bodies**- Nearly half of the Finance Commission Grants in Union Budget goes to village local bodies.
- **Grants for urban local bodies** - Urban local bodies like municipal councils receive the largest chunk of Finance Commission Grants after Rural Local Bodies and Post Devolution Deficit Grants to states.
- **Assistance to SDRF** - Based on the recommendations of the Finance

Commission, the central government provides funds to State Disaster Relief Funds.
- **Post devolution revenue deficit grants** - This forms the second largest chunk of Finance Commission transfers after the assistance to local rural bodies.

Covid-19 Line on Everest

- To prevent coronavirus transmission at the summit of Mount Everest, China is planning to erect a “line of separation” at the top.
- This line would prevent any contact between mountaineers from both sides of the peak i.e. Nepal and China.
- In Nepal, a wave of the pandemic is currently surging. But in China, the pandemic is largely suppressed.
- Nepal has so far not cancelled the spring climbing season, which lasts from April to June before the monsoon rains begin.

Source: PIB, The Hindu, The Indian Express, Down To Earth, Financial Express

