

**SCIENCE AND TECHNOLOGY**

❖ **The NASA spacecraft-asteroid collision**

❖ **CONTEXT: On September 27, at 4:44 am IST, the DART (Double Asteroid Redirection Test) spacecraft collided with the space rock Dimorphos (just 160 metres wide).**

- NASA has confirmed that the collision of the auto-rickshaw sized 600 kilogram weighing DART, on the football stadium-sized Dimorphos, about five billion kilogram in mass (orbiting around the 780 metres wide primary asteroid Didymos), has deflected the trajectory of the pair of space rocks.
- This kinetic impact technique, which appears as the climax of Hollywood sci-fi movies like Deep Impact and Armageddon, is also known as the 'kick' method. It could one day save humanity from a potential cataclysmic collision by safely deflecting a killer asteroid on its course towards earth. It could also fuel space mining technologies and unleash the space economy in decades to come.

❖ **What are asteroids?**

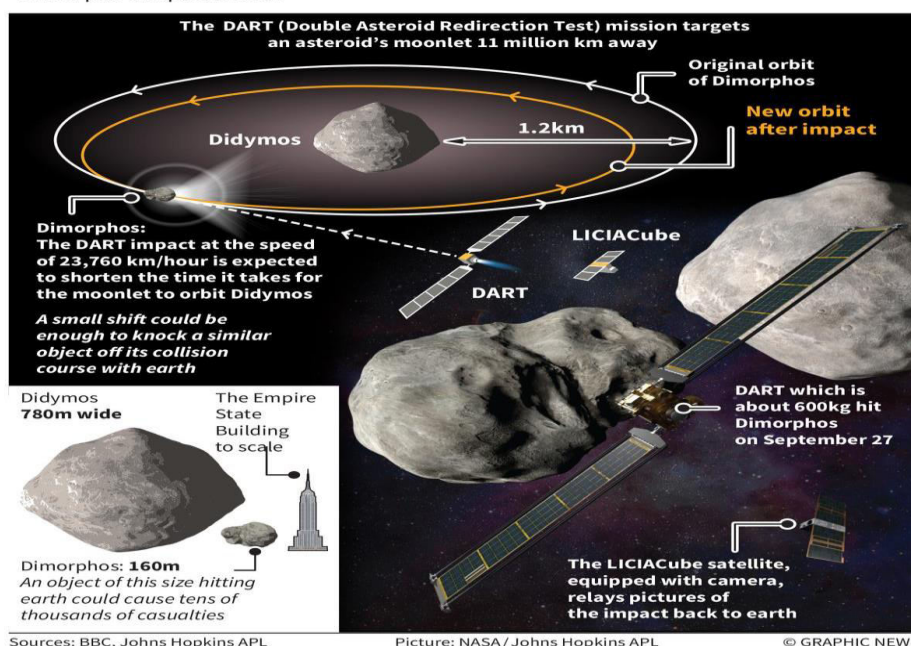
- Around a construction site, bits and pieces of leftover bricks, unused steel rods, and emptied paint canisters are usually strewn.
- Likewise, leftover materials from the formation of the sun, earth and planets, through the accretion and agglomeration of giant gas and rocks, are scattered as comets, asteroids and meteoroids in the solar system.
- Some of these cross their path and collide with earth from time to time, resulting in a spectacular meteor shower.
- Most rocks are so small that they burn up completely in the atmosphere due to frictional heating. If they are large enough, the charred piece falls through as a meteorite. The falling piece from a meteoroid 140 metres wide or more will be capable of completely wiping out a city like Chennai. The impact would be devastating if it was one or more kilometres wide.
- About 66 million years ago, an asteroid about 10-15 kms struck earth. The tsunamis, volcanic eruptions and thick dust clouds ensuing from the blow decimated dinosaurs and nearly 75% of all species.
- What happened in the past can occur in the future. The chances of a giant asteroid striking earth are small; however, if it did occur, the devastation would be cataclysmic, wiping out the entire human civilisation.
- While dinosaurs were mute spectators, humans can prepare themselves to face the imminent threat. NASA tracks and keeps a close watch on the nearly 26,115 asteroids whose orbits are dangerously close to earth.

❖ **What was NASA's mission?**

- NASA, undertook the 'kick' technique.
  - Compared to the massive Dimorphos, DART is a tiny Goliath. Yet crashing at a breakneck speed of 23,760 kilometres per hour, the momentum is adequate to slash the angular momentum of Dimorphos, making it speed up and move closer to Didymos.
  - All of these reduce the orbital period and the time taken for the moonlet to go around the primary asteroid. The pair's trajectory is thus deflected as the net result of these dynamics.
  - Consider it like this: a fast-moving moped slamming into a truck is sure to undergo a massive crash and burn, yet will veer the massive truck a bit. This is the essence of the 'kick' technique.

**Ready, set, crash!**

NASA's DART spacecraft collided with the space rock Dimorphos (which orbits around Didymos, the primary asteroid) and has therefore, deflected the trajectory of the pair of space rocks



- The extent of the trajectory change depends on the context. Compare throwing a ball against a solid wall and a sand pit.
- If the Dimorphos were solid, the crashing craft would make a dent on its surface and skim a tiny bit of its angular momentum, reducing the orbital time by about 75 seconds.
- However, close-up images transmitted by the DART moments before the fatal collision indicate that Dimorphos is more like a pile of rubble loosely held by gravity.
- If true, the impact will eject a cascade of debris, each piece carrying away a bit of momentum and energy.
- And as a net result, the asteroid will suffer a considerable loss. It will speed up more, and the orbit will become nearer to Didymos. The orbital period will then reduce by as much as 10 minutes.
- ❖ **What has been the impact assessment?**
  - The DART craft carried a high-resolution DRACO (Didymos Reconnaissance and Asteroid Camera for Optical navigation) camera to observe the collision and its consequences. The close-up images until its fatal crash are being analysed.
  - In addition, like a kangaroo with a baby in its pouch, a tiny toaster-sized Italian Space Agency-built Light Italian CubeSat for Imaging of Asteroids (LICIACube) took a piggyback ride with the DART.
  - The CubeSat was released and deployed two weeks before the impact. Hovering 50 kilometres from the asteroid, the two cameras aboard the CubeSat have captured the plume of the debris ejected by the collision.
  - At 11 million kilometres, the asteroids appear like a blip of dot even through the best of telescopes. As they waltz around each other, once in 11 hours and 55 minutes, Dimorphos and Didymos line up, eclipsing one another.
  - The total brightness of the pair darkens when Dimorphos passes in front of and behind Didymos.
  - Astronomers will now spend weeks and months observing the periodic change in the brightness using the telescopes to tease out the altered orbital period.
  - All this data is still in process and will help fine-tune the technology.
- ❖ **What are the other possibilities of this technique?**
  - At the heels of NASA, China is set to deflect a 40m diameter earth-crossing asteroid called 2020 PN1 sometime in 2026.
  - While ostensibly the drive comes from the desire to protect earth from killer asteroids, perhaps the lure of space mining lurks behind. Mining rare earth elements comes with a high environmental cost.
  - In the coming years, the penalty for polluting could make space mining economically viable. If one can tug a mineral-rich asteroid near the Moon or establish a space mining factory between the orbits of earth and Mars, precious mineral resources needed for decades could be easily sourced.
  - The 'kick' technique that deflects asteroids can then be used to move a small asteroid into a convenient position for space mining.
  - NASA's Asteroid Redirect Mission (ARM) aimed at precisely this by bringing a 20-tonne space rock near earth to study and mine. In a way, the DART mission is also part of it.
  - For developing green energy technologies — electric vehicles, solar panels, wind turbines, and energy storage devices — and ushering in the low carbon economy of the future, rare earth elements such as yttrium, niobium, rhodium, palladium, osmium, iridium and scandium are critical. They are short in supply, and asteroid mining, it is believed, could solve the rare earth supply problem.
  - From the robotic Soviet Luna 16 in the 1970s to U.S. Apollo missions and China's first lunar sample-return mission, Chang'e 5 — all have brought back lunar soil.
  - NASA's Stardust spacecraft returned a canister full of dust from comet Wild-2 captured by an aerogel-based sample collector in 2004.
  - Japan Aerospace Exploration Agency (JAXA)'s Hayabusa 1 to 25143 Itokawa, the Hayabusa 2 to 162173 Ryugu, and NASA's OSIRIS-Rex to near-earth asteroid Bennu are missions to extract and return samples from asteroids.

### PRELIMS

1. **PM-POSHAN Scheme(Pradhan Mantri Poshan Shakti Nirman' scheme )**
- ❖ **CONTEXT:** Under POSHAN Abhiyan 2022 various activities such as T3 camps (test, treat, talk), IFA distribution, seminars, Ayush for anemia, webinars, quiz being conducted throughout the country
  - In September 2021, the Union Cabinet approved the Pradhan Mantri Poshan Shakti Nirman or PM-POSHAN for providing one hot cooked meal in Government and Government-aided schools with the financial outlay of Rs 1.31 trillion.
  - The scheme replaced the national programme for mid-day meal in schools or Mid-day Meal Scheme.
  - It has been launched for an initial period of five years (2021-22 to 2025-26).

- Coverage: Primary (1-5) and upper primary (6-8) schoolchildren are currently entitled to 100 grams and 150 grams of food grains per working day each, to ensure a minimum of 700 calories.
- It also covers students of balvatikas (children in the 3-5 year age group) from pre-primary classes.
- Nutritional Gardens: Use of locally-grown nutritional food items will be encouraged from "school nutrition gardens" for boosting the local economic growth, and will also include involvement of Farmers Producer Organizations (FPO) and Women Self Help Groups in the implementation of the scheme.
- Supplementary Nutrition: The scheme has a provision for supplementary nutrition for children in aspirational districts and those with high prevalence of anaemia.
- It does away with the restriction on the part of the Centre to provide funds only for wheat, rice, pulses and vegetables.
- Currently, if a state decides to add any component like milk or eggs to the menu, the Centre does not bear the additional cost. Now that restriction has been lifted.
- Tithi Bhojan Concept: TithiBhojan is a community participation programme in which people provide special food to children on special occasions/festivals.
- Direct Benefit Transfer (DBT): The Centre has directed the states and the UTs to switch to Direct Benefit Transfer (DBT) system for providing compensation to the cooks and helpers working under the scheme.
- This is to ensure no leakages at the level of district administration and other authorities.
- Nutrition Expert: A nutrition expert is to be appointed in each school whose responsibility is to ensure that health aspects such as Body Mass Index (BMI), weight and haemoglobin levels are addressed.
- Social Audit of the Scheme: A social audit of the scheme has also been mandated for each school in each state to study the implementation of the scheme, which was so far not being done by all states.

## 2. Sugamya Bharat Abhiyan

- ❖ **CONTEXT:** As a part of 'Sugamya Bharat Abhiyan', to provide ease of movement for Divyangjans, aged and children on railway platforms, Indian Railways is installing lifts and escalators at railway stations across the country. So far, there are 497 stations where either lifts or escalators have been provided.

- Accessible India Campaign or Sugamya Bharat Abhiyan is a program that is launched to serve the differently-able community of the country.
- The flagship program has been launched on 3 December 2015, the International Day of People with Disabilities.
- The program comes with an index to measure the design of disabled-friendly buildings and human resource policies.
- The initiative also in line with Article 9 of the (UN Convention on the Rights of Persons with Disabilities) which India is a signatory since 2007.
- The scheme also comes under the Persons with Disabilities Act, 1995 for equal Opportunities and protection of rights which provides non-discrimination in Transport to Persons with Disabilities.
- The Central Public Works Department (CPWD) released the Harmonised Guidelines and Standards for Universal Accessibility in India 2021.
- Drafted by a team of the IIT-Roorkee and the National Institute of Urban Affairs of the MoHUA, the revised guidelines aim to give a holistic approach.
- Earlier, the guidelines were for creating a barrier-free environment, but now they are focusing on universal accessibility.

### ❖ **Key highlights**

- Ramps: The guidelines provide the gradient and length of ramps — for example, for a length of six metres, the gradient should be 1:12. The minimum clear width of a ramp should be 1,200 mm.
- Beyond PwDs: While making public buildings and transport fully accessible for wheelchair users is covered in the guidelines, other users who may experience temporary problems have also been considered. For instance, a parent pushing a child's pram while carrying groceries or other bags, and women wearing saris.
- Women friendly: Built environment needs for accessibility for women should consider diverse age groups, diverse cultural contexts and diverse life situations in which women operate. Diverse forms of clothing (saris, salwar-kameez, etc.) and footwear (heels, kolhapuri chappals, etc.) require a certain orientations.
- Accessibility symbols: The guidelines call for accessibility symbols for PwD, family-friendly facilities and transgender to be inclusively incorporated among the symbols for other user groups.
- Targeted authorities: The guidelines are meant for State governments, government departments and the private sector, as well as for reference by architecture and planning institutes.
- India is a signatory to the UN Convention the Right of Persons with Disabilities, which came into force in 2007.



- The Union Minister for Social justice and Empowerment has also launched the “Sugamya Bharat App” to complain for ease accessibility for PwDs.
- India has its dedicated the Rights of Persons with Disabilities Act, 2016, which is the principal and comprehensive legislation concerning persons with disabilities.
- 3. **Kaziranga after dark**
  - ❖ **CONTEXT: Facing flak for driving inside Kaziranga National Park with Sadhguru Jaggi Vasudev after sunset, Assam Chief Minister Himanta Biswa Sarma said that night safari in wildlife sanctuaries was in fashion around the world, and that no law in the country, including those for the protection of wildlife, prohibits it.**
  - ❖ **Is the chief minister right?**
    - In India, entry into forests is governed by two laws — The Indian Forest Act, 1927, and The Wildlife Protection Act, 1972. The first applies to all reserve forests and bars trespassing. Everyone other than people who live in villages inside reserve forests, needs permission from the divisional forest officer concerned for entering these forests for any purpose.
    - The Wildlife Protection Act empowers the Chief Wildlife Warden of a state to frame laws for tourists entering Protected Areas — sanctuaries and national parks. Under the same Act, the National Tiger Conservation Authority (NTCA) has the powers to set rules for tiger reserves. Kaziranga National Park is also a tiger reserve.
    - While a chief wildlife warden must act “with the previous approval of the State Government” concerned, no rule once set by the warden can be violated by anyone, including superior officers or executives, such as the chief minister.
    - A chief minister can direct the chief wildlife warden of the state to modify or make certain rules. But any violation of a standing rule will be a violation of — and invite penalty under — The Wildlife Protection Act.
  - ❖ **What is the law currently in Kaziranga?**
    - Like most national parks and tiger reserves of India, Kaziranga does not allow entry after sunset, barring forest staff. It remains unclear if that rule has been modified, or the chief minister’s entourage was given prior permission by the chief wildlife warden.
    - In July 2022, the NTCA asked Madhya Pradesh to stop night safaris that were started in 2021 in the buffer zones of the Kanha, Bandhavgarh, and Pench tiger reserves on the ground that such activities disturbed the wildlife in the park. The state has requested the NTCA to reconsider, and allow night safaris to continue in the three reserves.
    - In 2010, the Karnataka High Court allowed the state government to conduct night safari in an area of 50 hectares of Bannerghatta National Park after it was assured that the forest department would take adequate security and safety measures for both wildlife and tourists.
  - ❖ **What is the policy in wildlife parks around the world?**
    - While the scope for legally permitted night safaris inside sanctuaries and national parks is limited in India, night game drives are routine across Africa in the private concessions of Botswana, South Africa, Tanzania, Kenya, Zimbabwe, Namibia, and Zambia etc.
    - Night boat safaris to spot caimans — or their eyes reflecting roving spotlights — are popular across the Amazon river system from Peru to Brazil.
    - Closer home, Singapore offers a more curated, if somewhat artificial, experience — Mandai is advertised as the “world’s first nocturnal wildlife park”.
  - ❖ **So why are night safaris generally not encouraged in India?**
    - India does not have private forests where tour promoters can do as they like. But the practical reason why night safaris are not encouraged in the country has to do with the topography.
    - In the African savanna, lack of vegetation reduces the chances of surprise encounters with wild animals, and tourists generally get a good 360-degree view to put hand spotlights and cameras to good use at night. In India by contrast, most forests present dense tropical vegetation where sighting wildlife is not easy even during the day.
    - Anyone who has driven along dark roads would know how our pupils adjust to the light ahead of the vehicle, coming from its headlamps. While driving on a forest track overhung by vegetation, this makes spotting animals extremely difficult on both sides of the track even when they are very close. This can cause accidents and put both tourists and animals at risk.
    - Worse, a wild animal that is momentarily blinded by direct light from an approaching vehicle can react unpredictably. It is one thing to marvel at a hare or two caught in the glare, quite another to negotiate a bigger animal that is either stunned in the middle of a dirt track or is making a blind dash.

- Foresters, who travel almost daily through forests at night, say they take extra care to spot animals approaching laterally or to avoid bumping into ones waiting by the wayside. While foresters have a job to do, such risks are not worth taking for tourism revenues, or a few prize photos.

**ANSWER WRITTING**

**Q. What is Cryptocurrency? How does it affect global society? Has it been affecting Indian society also?**

A cryptocurrency is a digital currency designed to work as a medium of exchange through a computer network that is not reliant on any central authority, such as a government or bank, to uphold or maintain it. It is a digital or virtual currency that is secured by cryptography, which makes it nearly impossible to counterfeit or double-spend.

Cryptocurrency affects society in following ways:

- Bringing the next level of globalisation as the cryptocurrency is digital currency and easily available across the international borders.
- Emergence of one currency for the countries of the world which are decentralised and not related to any country. This may make fiat money redundant in the future.
- Cryptocurrencies are way cheaper to use to execute international transactions making transactions faster and accurate, there are less chances of fraud. It has made it easier for entrepreneurs to reach international markets.
- However, it takes away the sovereign power of issuing currency. Thus, making economic policy of the government ineffective. It also makes capital more volatile posing risk to macroeconomic stability.
- Use of cryptocurrency by terrorist organisations, drug cartels etc. negatively impacts the global society and the anonymity of its use has potential to increase crime.

India is the largest receiver of remittances. However, people lose money on conversion, processing charges, and switching to crypto will help people to get rid of these expenses. But in the era of digital currency, those who are not able to afford technology are devoid of such digital currency. In 2018, The RBI issued a circular preventing all banks from dealing in cryptocurrencies. This circular was declared unconstitutional by the Supreme Court in May 2020. Recently, the government has announced to introduce a bill to create a sovereign digital currency and simultaneously ban all private cryptocurrencies.

Blockchain and crypto assets will be an integral part of the Fourth Industrial Revolution, Indians should not be made to simply bypass it. The framework on cryptocurrencies should be developed which will require global partnerships and collective strategies.

**MCQs**

1. With reference to Indian laws about wildlife protection, consider the following statements:
  1. Wild animals are the sole property of the government.
  2. When a wild animal is declared protected, such animal is entitled for equal protection whether it is found in protected areas or outside.
  3. Apprehension of a protected wild animal becoming a danger to human life is sufficient ground for its capture or killing.

Which of the statements given above is/are correct?

- a) 1 and 2
  - b) 2 only
  - c) 1 and 3
  - d) 3 only
2. With reference to the Wildlife (Protection) Act 1972, consider the following statements:
    1. It was formed in order to fulfil India's international obligation under the Convention on Biological Diversity.
    2. As per the law only a part of the wild animal is considered as a wildlife trophy.

Which of the statements given above is/are correct?

- a) 1 only
  - b) 2 only
  - c) Both 1 and 2
  - d) Neither 1 nor 2
3. Which of the following are the objectives of 'National Nutrition Mission'?
    1. To create awareness relating to malnutrition among pregnant women and lactating mothers.
    2. To reduce the incidence of anaemia among young children, adolescent girls, and women.
    3. To promote the consumption of millets, coarse cereals, and unpolished rice.
    4. To promote the consumption of poultry eggs.

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) 3 and 4 only
4. With reference to Person with Disability (PwD), consider the following statements
1. Right of Persons with Disabilities Act 2016 defines Person with a disability means a person with long term physical, mental, intellectual or sensory impairments.
  2. International Day of Persons with Disabilities is celebrated worldwide on 3rd December
  3. Accessible India Campaign envisages for achieving universal accessibility to help PwD.
- Select the correct statement.
- a) 1 and 2 only
  - b) 2 and 3 only
  - c) 1 and 3 only
  - d) All of the above**
5. With reference to celestial bodies, consider the following statements.
1. A Satellite is a celestial body that moves around the planets in the same way as the planets move around the sun.
  2. Apart from the stars, planets and satellites, there are numerous tiny bodies that also move around the sun. These bodies are called meteoroids.
  3. The small pieces of rocks which move around the sun are called asteroids.
- Which of the following statements is/are correct?
- a) 1, 2 and 3
  - b) 1 and 2 only
  - c) 2 and 3 only
  - d) 1 only**
6. Consider the following pairs
1. Hayabusa 1 - Itokawa
  2. Hayabusa 2 - Ryugu
  3. OSIRIS-Rex - Bennu
- Which of the above pair/s is/are correctly matched?
- a) 1 and 2 only
  - b) 1 and 3 only
  - c) 2 and 3 only
  - d) All of the above**
7. With respect to Asteroid Impact Deflection Assessment (AIDA), consider the following statements
1. It is an ambitious double-spacecraft mission to deflect an asteroid in space.
  2. The mission includes NASA and the European Space Agency (ESA).
- Which of the statement/s given above is/are correct?
- a) 1 only
  - b) 2 only
  - c) Both 1 and 2**
  - d) Neither 1 nor 2
8. 65803 Didymos sometimes seen in the news recently is a/an?
- a) Exo-planet
  - b) Asteroid**
  - c) Planet Hunter
  - d) Exo-comet
9. Exercise KAKADU 2022 is a Multinational Maritime Exercise hosted by which country?
- a) Oman
  - b) Japan
  - c) Australia**
  - d) Sri Lanka
10. The term 'Nord Stream 2' often mentioned in news is related to which of the following?
- a) A natural gas pipeline through the Baltic Sea.**
  - b) Newly discovered Ocean current near Peru coast responsible for El-Nino.
  - c) Recently discovered near earth asteroid.
  - d) Anti Tank guided missile