



**INSIGHTSIAS**  
SIMPLIFYING  
IAS EXAM PREPARATION

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Science and Technology

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## Defence Technology

### NOTES

### 1. INS Kalvari

- INS Kalvari is Indian **Navy's first indigenous Scorpene-class stealth submarine.**
- It is a **diesel-electric attack submarine** which is built under the strategic **Project 75** by Mazagon Dock Limited (**MDL**) in collaboration with French naval defence and Energy Company **DCNS.**
- INS Kalvari is also known as **Tiger Shark (or S50).**
- It can undertake various operations including multifarious warfare, Anti-submarine warfare, Intelligence gathering, mine laying, area surveillance etc.
- It can launch attack on the enemy using precision guided weapons and attack can be launched from underwater or on surface.
- **Background:**
  - **Six Scorpene submarines** are being built under **Project-75** by Mazgaon Docks Limited (MDL) with technology transfer from France.
  - All the six submarines under this project will be **indigenously built** at Mumbai's Mazagaon Dockyard Ltd.
  - These attack submarines have diesel propulsion and additional air-independent propulsion.

### 2. INS Khanderi

- Khanderi is the **second Scorpene submarine under Project-75** being built at Mazgaon Docks Limited (MDL).
- Khanderi is named after the **Island fort of Maratha forces**, which played a vital role in ensuring their supremacy at sea in the late 17th century.
- The attack can be launched with torpedoes, as well as tube-launched anti-ship missiles, whilst underwater or on surface.
- The submarine is designed to **operate in all theatres, including the tropics.**
- It can undertake multifarious types of missions typically undertaken by any modern submarine like anti-surface warfare, anti-submarine warfare, intelligence gathering, mine laying and area surveillance.

### 3. INS Karanj

- The **third Scorpene-class submarine** – INS Karanj has been launched.
- Karanj is the third of the six Scorpene-class submarines being built by Mazagon Dock Shipbuilders Limited (MDL) under the Project 75 programme of Indian navy.
- It is designed to **operate in all theatres, including the tropics.**
- It is provided with all means and communications to ensure interoperability with other components of a naval task.
- It has **superior stealth features** such as advanced acoustic silencing techniques, low radiated noise levels and hydrodynamically optimized shape.
- These stealth features give it invulnerability, unmatched by most submarines.

#### 4. Prithvi-II missile

- Prithvi-II is indigenously developed **nuclear-capable surface-to-surface ballistic missile**.
- The missile is capable of carrying warheads weighing **500 kg to 1,000 kg**.
- With a **strike range of 350 km**, Prithvi-II is powered by twin-engines which use liquid propulsion.
- It also uses advanced inertial guidance system with manoeuvring trajectory to hit its target.
- Prithvi II is the **first missile to be developed by DRDO under India's IGMDP** (Integrated Guided Missile Development Programme).

#### 5. Air-independent propulsion

- The Navy is planning to install Air Independent Propulsion (AIP) modules on all six Scorpene submarines to extend their endurance.
- This will be done when the submarines go for normal refit which is six years after their induction.
- Air-independent propulsion (AIP) is any **technology which allows a non-nuclear submarine to operate without the need to access atmospheric oxygen** (by surfacing or using a snorkel).
- It can **augment or replace the diesel-electric propulsion system** of non-nuclear vessels.
- It is based on the combustion of stored oxygen and ethanol to augment battery-powered propulsion.
- AIP significantly **improves stealth** because it enables a submarine to generate electricity for services and battery charging and propulsion while completely submerged.
- They enable conventional diesel-electric submarines to remain submerged for two to three weeks at a time.
- Another advantage is that the submarines can be **virtually silent**.

#### 6. Terminal High Altitude Area Defense (THAAD)

- Terminal High Altitude Area Defense (THAAD) is a **United States Army anti-ballistic missile** system.
- It is designed **to intercept and destroy short and medium-range ballistic missiles in their final flight phase**.
- Its role, by use of **powerful radar**, is to simply track and destroy missiles before they are launched.
- US deployed THAAD to South Korea to protect South Korea from North Korea.

#### 7. Anti-Tank Guided Missile Nag

- The Anti-Tank Guided Missile Nag was successfully flight tested.
- Nag is a **third-generation, fire-and-forget, anti-tank guided missile** developed by DRDO to support both mechanised infantry and airborne forces of the Indian Army.
- Nag can be launched from **land and air-based platforms**.
- Nag missile has been equipped with the highly advanced **Imaging Infrared**



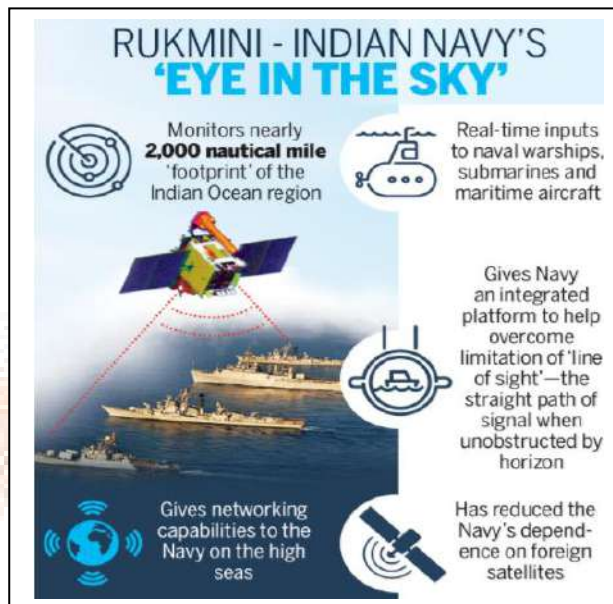
**NOTES**

**Radar (IRR)** seeker along with integrated avionics. This technology is possessed by very few nations.

- The helicopter launched version known as **helicopter-launched NAG (HELINA)**.
- The Nag missile was indigenously developed under the Indian Ministry of Defence's **integrated guided missile development programme (IGMDP)**, which also involved the development of four other missiles that are Agni, Akash, Trishul and Prithvi.

## 8. Rukmini

- **Gsat-7 also called Rukmini** is the **Navy's own dedicated military satellite** that was launched in September 2013.
- It has helped the Navy monitor the Indian Ocean Region (IOR) as it **has a nearly 2,000 nautical mile 'footprint'**.
- The **multi-band communication-cum surveillance satellite**, which is operating from the geostationary orbit, provides real-time inputs to naval warships, submarines and maritime aircraft and networking capabilities to its naval assets on the high seas.
- With the help of the shore-based operational centres, 'Rukmini' has not only helped the Navy keep an eye on both Arabian Sea and Bay of Bengal but also helped the force increase its communication and surveillance capabilities from Persian Gulf to Malacca Strait.



## 9. Naval Offshore Patrol Vessels (NOPVs)

- **Reliance Defence and Engineering Limited (RDEL)** has launched the **first two Naval Offshore Patrol Vessels (NOPVs)**.
- The ships are part of a five ship project being constructed for the Indian Navy.
- The primary role of NOPVs is to undertake **surveillance of the country's vast Exclusive Economic Zone (EEZ)** besides operational tasks such as anti-piracy patrols, fleet support operations, maritime security of offshore assets, coastal security operations, and protection of shipping lanes.

## 10. Akash missile

- The Akash missile is **indigenously developed air defence surface-to-air missile system**.
- Akash is a **supersonic surface-to-air missile** which is capable of neutralising aerial targets like cruise missiles, fighter jets, unmanned aerial vehicles (UAV)



**NOTES**

and air-to-surface missiles.

- It has been developed by Defence Research and Development Organisation (DRDO) under Integrated Guided-Missile Development Programme (IGMD).
- The range of this missile is approximately 25 kilometres and can neutralise targets at an altitude of 20 kilometres.
- It is an **all-weather area air defence weapon system** for defending vulnerable areas against medium range air targets penetrating from low, medium and high altitudes.
- It is powered by **Ramjet-rocket propulsion system (RRPS)** which renders thrust for the missile to intercept the target at supersonic speed without any retardation.

### **11. India's first unmanned tank Muntra**

- Muntra is India's first unmanned tank developed by the Defence Research and Development Organisation (DRDO).
- **Muntra has three variants:**
  - Muntra-S has been developed for unmanned surveillance missions,
  - Muntra-M is built for detecting mines,
  - Muntra-N, will be deployed in areas where nuclear radiation or bio weapon risk is high.



### **12. Quick Reaction Surface to Air Missile (QRSAM)**

- The QR-SAM weapon system has **been jointly developed by the Defence Research and Development Organisation (DRDO) and Bharat Electronics Ltd.**
- It is a **quick reaction, all-weather, network-centric missile system** capable of **search-on-the-move**.
- The missile system can also **engage multiple targets** within a range of around 30 km with two vehicle configuration for area air defence.
- It is a truck-mounted missile with a 360° rotatable, electro-mechanically operated, turret-based launch unit.

### **13. World's 1st Laser Weapon**

- The US has launched the world's first laser weapon known as the **Laser Weapons System (LaWS)**.
- **It works just like a laser pointer.** There's a chamber inside with special materials that release photons.
- The LaWS laser beam is **completely silent and invisible**. It's **also fast**: The laser travels at the speed of light, meaning it's about 50,000 times the speed of an incoming intercontinental ballistic missile.
- In addition to being able to take down threats in the air, the LaWS can hit and disable objects in the water.

### **14. Medium Range Surface to Air Missile (MRSAM)**

- The MRSAM is a **land-based version of long range surface to air missile (LRSAM) of Indian Navy**, has strike range of up 70 km.
- It is capable of shooting down enemy ballistic missiles, aircraft, helicopters,

drones, surveillance aircraft and AWACS (Airborne Warning and Control systems) aircraft.

- It is an advanced all weather, 360 degree mobile land based theatre air defence system.
- The supersonic missile system is **developed jointly by India and Israel**.

### 15. Indian Coast Guard ship 'Shaurya'

- **Indian Coast Guard ship "Shaurya"**, the fifth in the series of six 105-metre offshore patrol vessels (OPVs), was commissioned in Goa.
- The OPV, which draws 2,350 tonne and is propelled by 9100 kilowatt diesel engine, has been designed and built indigenously by **Goa Shipyard Ltd** and is fitted with state-of-the-art navigation and communication equipment, sensors and machineries.

### 16. Astra Missile

- It is a **Beyond-Visual Range, air-to-air indigenously developed missile**.
- The all-weather, radar homing missile has **high manoeuvrability** and capability to engage and destroy aerial targets at **supersonic speeds**.
- The **60-km plus range** missile possesses **Shot Kill Probability (SSKP)** making it one of the most reliable in its class of weapon systems.
- The missile could be launched at different altitudes from sea level to 20 km for engaging aerial targets at various ranges.
- Apart from integrating the missile with Su-30, it is planned to be mounted on other fighter aircraft including Tejas Light Combat Aircraft, Mirage-2000 and MIG-29.
- It is developed by missile complex at Hyderabad and several DRDO laboratories in partnership with the Hindustan Aeronautics Limited and the Indian Air Force.

### 17. INS Tarasa

- **INS Tarasa**, a **Water Jet Fast Attack Craft** was recently commissioned into the Indian Navy.
- INS Tarasa is the fourth and last of the follow-on Water Jet FAC's built by the **Garden Reach Shipbuilders and Engineers (GRSE), Kolkata**.
- The first two ships of the class i.e. **INS Tarmugli and Tihayu** were commissioned in 2016 and the third ship **INS Tillanchang** was commissioned in early 2017.
- The ship is an ideal platform for missions like **coastal and off-shore surveillance**, EEZ Patrol, law enforcement as well as non-military missions such as Search and Rescue, Humanitarian Assistance and Disaster Relief.

### 18. INS Kiltan

- INS Kiltan (P30), third **Anti-Submarine Warfare (ASW)** stealth corvettes built under **Project 28 (Kamorta Class)** was recently commissioned into the Indian Navy.
- The ship gets her name from old INS Kiltan (P79), a Petya class ASW ship that served the nation for 18 years before being decommissioned in June 1987.

**NOTES**

### NOTES

- It is named after the coral island belonging to the Lakshadweep group of islands.
- More than 80 % of the ship is indigenous with state of the art equipment & systems to fight in Nuclear, Biological and Chemical (NBC) warfare conditions.
- INS Kiltan is the first major warship with superstructure entirely of composite material.
- The very low under water acoustic signature makes it a '**silent killer on the prowl**'.
- The ship's advanced stealth features make her less susceptible to detection by the enemy and help in effective employment of soft kill measure like the Chaff.

### 19. 'NIRBHAY' Sub-Sonic Cruise Missile

- **NIRBHAY is India's first indigenously designed and developed Long Range Sub-Sonic Cruise Missile.**
- It is an **all-weather** low-cost missile with stealth and high accuracy.
- The missile has a range of more than 1000 km.
- The missile has the capability to loiter and cruise at 0.7 Mach, at altitudes as low as 100 m.
- Its relatively slow flight speed allows it to navigate its way precisely to the target.
- The Nirbhay cruise missile is an **Indian version of the American Tomahawk.**
- The missile is capable of being launched from **multiple platforms** on land, sea and air.

### 20. BrahMos Missile

- India has successfully test-fired the **Brahmos supersonic cruise missile.**
- Brahmos has been developed as part of a **joint venture between India and Russia.**
- The name Brahmos has been taken from **two rivers – Brahmaputra and Moskva.**
- It is **two-stage missile**, the first one being solid and the second one ramjet liquid propellant.
- It operates on '**fire and forget principal**'.
- It is capable of being launched from land, sea, sub-sea and air against sea and land targets.
- It is capable of carrying warhead of 300 kilogram (both conventional as well as nuclear) and has top **supersonic speed** of Mach 2.8 to 3.
- It is hailed as the **world's fastest anti-ship cruise missile** in operation.
- It has been already inducted in Army and Navy. The air-launched version of missile was test-fired recently for the first time from modified Su-30MKI aircraft.

### 21. "PRATAP" helicopters

- The **Soviet-era MI-8, also known as 'Pratap'**, the backbone of the Indian Air Force helicopter operations, was recently phased out, bringing an end to its glorious service career spanning 45 years.

- Formally inducted in 1972 and rechristened as “Pratap”, MI-8 took part in several major IAF operations, including **Operation Meghdoot in the Siachen Glacier** and the Indian Peace Keeping Force operation in Sri Lanka.
- The helicopter, inducted in 10 operational helicopter units, was also extensively used in Humanitarian and Disaster Relief operations, besides being associated with VIP/VVIP flying.

## 22. World’s largest amphibious aircraft takes off in China

- China has launched homegrown **AG600, the world’s largest amphibious aircraft**. The plane is codenamed Kunlong.
- It is intended for fighting forest fires and performing marine rescues.
- Built for **marine take-off and landing**.

## 23. Agni-V Missile

- Agni-5, India’s nuclear capable missile, was recently successfully test fired.
- Agni- 5 is the **intercontinental surface-to-surface nuclear capable ballistic missile**.
- Agni-5 has a range of over 5,000 km and can carry about a 1,000-kg warhead.
- It can target almost all of Asia including Pakistan and China and Europe.
- The 17-metre long Agni-5 Missile weighs about 50 tonnes and is a very agile and modern weapon system.
- The surface-to-surface missile is a **fire-and-forget system** that cannot be easily detected as it follows a ballistic trajectory.
- India describes the Agni – 5 missile system as a **‘weapon of peace’**.
- India has already joined an **elite club of nations that possess the ICBM launch capability** when the maiden test-firing of Agni-V was successfully conducted in April, 2012.
- Only the five permanent members of the United Nations Security Council – China, France, Russia, the United States and Britain, along with Israel, have so far possessed such long-range missiles.

### AGNI MISSILE FAMILY

- Agni-I Medium range ballistic missile, 700 – 1200 km range.
- Agni-II intermediate range ballistic missile, 2,000-2,500 km range.
- Agni-III intermediate range ballistic missile, 3,000 - 5,500 km range.
- Agni-IV intermediate range ballistic missile, 3,200-3,700 km range.
- Agni-V intercontinental ballistic missile, 5,000 km range
- Agni-VI intercontinental ballistic missile, 10,000 km range (under development)

## Space Technology

### NOTES

### 1. GSLV-Mk III

- ISRO has successfully launched the **country's heaviest rocket – Geosynchronous Satellite Launch Vehicle-Mark III (GSLV-Mk III)** – along with a **communications satellite GSAT- 19**.
- GSLV Mk III is conceived and designed to make **ISRO fully self reliant in launching heavier communication satellites** of INSAT-4 class, which weigh 4500 to 5000 kg.
- The vehicle envisages **multi-mission launch capability** for Geosynchronous Transfer Orbit (GTO), Low Earth Orbit (LEO), Polar and intermediate circular orbits.
- It can carry a manned module and launch people into space.
- **GSAT-19 will help to improve telecommunication and broadcasting** areas.
- **Cryogenic engines** are used in the upper stage of a rocket launch as they provide the maximum thrust to a launcher vehicle.
- This is **India's first fully functional rocket to be tested with a cryogenic engine**.
- **Cryogenics:**
  - Cryogenics is the study of **substances at very low temperature** – at minus 150 degrees Celsius and less, in which gases like **oxygen, hydrogen and nitrogen turn liquid**.
  - Cryogenic engines are called so because they use **liquid oxygen and liquid hydrogen as fuel**.

### 2. LISA Pathfinder

- LISA Pathfinder, a mission led by the **European Space Agency (ESA)** with **contributions from NASA**, is a **space-based observatory for detecting gravitational waves**.
- LISA Pathfinder spacecraft has positioned itself in gravitational stasis at the first Lagrangian Point (L1) that lets its instruments hang in freefall.
- This is expected to filter out extraneous cosmic noise so the spacecraft can achieve its mission: measuring gravitational waves.

### 3. Brown dwarfs

- Brown dwarfs are objects which have a **size between that of a giant planet like Jupiter and that of a small star**.
- Most astronomers would classify any object with between 15 times the mass of Jupiter and 75 times the mass of Jupiter to be a brown dwarf.
- Given that range of masses, the object would not have been able to sustain the fusion of hydrogen like a regular star; thus, many scientists have dubbed **brown dwarfs as “failed stars”**.
- Scientists study their atmospheres in order to look at what weather on other worlds might look like.

### 4. ‘Hottest’ planet in universe discovered

- Scientists have discovered the **hottest known planet located 650 light years**

**from Earth**, which is warmer than most stars in the universe and sports a giant, glowing gas tail like a comet.

- The Jupiter-like planet, named **KELT-9b**, orbits a massive star KELT-9 every day and a half.
- With a day-side temperature peaking at 4,326 degree Celsius, the newly discovered exoplanet is hotter than most stars and only 926 degree Celsius cooler than our Sun.

## 5. NASA's Orion Spacecraft

- NASA's **Orion spacecraft** – designed to **take astronauts to deep space destinations** such as the Moon and Mars – has **successfully completed a series of tests** for its critical safety systems.
- Researchers tested **the abort motor** for Orion's launch abort system.
- Orion will serve as the **exploration vehicle** that will carry the crew to space, provide emergency abort capability, sustain the crew during the space travel, and provide safe re-entry from deep space return velocities.
- Orion will launch on NASA's new heavy-lift rocket, the **Space Launch System**.
- **Abort system:**
  - The launch abort system is an important part of making sure crew members stay safe on the launch pad and on their way to space.
  - The **launch abort system is positioned on top of the Orion crew module** and will play a critical role protecting future crews travelling to deep space destinations in Orion.



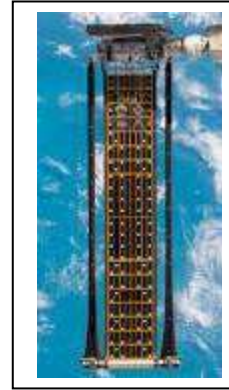
## 6. Exoplanets

- NASA's Kepler mission team has released a survey of **219 potential exoplanets**.
- An exoplanet is a **planet outside our solar system, usually orbiting another star**.
- They are also sometimes called "**extrasolar planets**", "extra-" implying that they are **outside of our solar system**.
- **Habitable zone:**
  - If a planet is too close to the star it orbits, any water on the surface quickly boils off, forming a steam atmosphere. If the planet is too far from the star, any water on the surface freezes.
  - The **habitable zone (or "Goldilocks zone")** is the range of orbital distances from a star at which **liquid water can exist on the surface of a planet**.
  - This range of distances changes depending on the size and temperature of the star.
  - **Earth is in the habitable zone of the sun** – one of the reasons our planet has liquid water like oceans and lakes.

## 7. Flexible Roll-Out Solar Array (ROSA)



- NASA’s new compact high-power solar array—the **Roll Out Solar Array (ROSA)**— has made its debut on the International Space Station.
- The Roll Out Solar Array (ROSA) **could power an advanced solar electric propulsion spacecraft.**
- Tapping into ROSA technology allows the conversion of sunlight into electrical power.
- ROSA has the potential to replace solar arrays on future satellites, making them more **compact and lighter weight.**



## **8. Imaging X-ray Polarimetry Explorer (IXPE)**

- NASA has signed an agreement with Italian Space Agency for the launch of **the Imaging X-ray Polarimetry Explorer (IXPE) mission.**
- The mission will provide important **clues about the origins of cosmic X-rays,** their interactions with matter and gravity as they travel through space.
- Slated to launch in 2020, the IXPE **mission will help explore some of the most turbulent and extreme environments in our universe.**
- The IXPE mission will fly three telescope systems capable of measuring the polarisation of X-rays emitted by cosmic sources.

## **9. Cartosat-2 series satellite**

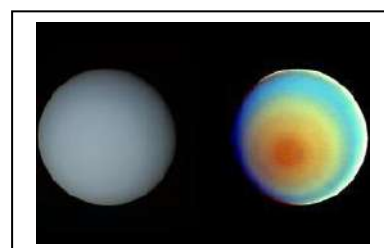
- India’s Polar Satellite Launch Vehicle has launched the Cartosat-2 series satellite—a dedicated satellite for defence forces.
- Cartosat-2 is a **remote sensing satellite** and it is similar in configuration to earlier satellites in the series with the objective of providing **high-resolution scene specific spot imagery.**
- Cartosat-2 series satellite imagery would be useful for **cartographic applications,** urban and rural applications, coastal land use and regulation, and utility management like road networking.

## **10. NASA’s CHESS**

- NASA is launching a sounding rocket **CHESS to study vast interstellar clouds and know about the earliest stages of star formation.**
- The **Colorado High-resolution Echelle Stellar Spectrograph** will measure light filtering through the interstellar medium, which provides crucial information for understanding the lifecycle of stars.

## **11. Uranus’ Unusual Rotation Creates Light Switch Effect**

- **NASA’s Voyager 2 spacecraft** has discovered that **Uranus’ magnetosphere** gets flipped on and off like a light switch every day as it rotates along with the planet.
- The finding showed that magnetosphere is ‘open’ in one orientation, allowing solar wind to flow into it. It is later “closed”, forming a shield against the solar wind and deflecting it away from the planet.
- **Is it a unique phenomenon?**





- Reconnection of magnetic fields is a **phenomenon throughout the solar system**. It is one reason for the **Earth's auroras**.

### 12.ASTROSAT

- ASTROSAT is **India's first dedicated multi wavelength space observatory**.
- This scientific satellite mission endeavours for a more **detailed understanding of our universe**.
- ASTROSAT is designed to observe the universe in the **Visible, Ultraviolet, low and high energy X-ray regions** of the electromagnetic spectrum simultaneously with the help of its five payloads.
- Astrosat aims at understanding the **high energy processes in neutron stars and black holes**, to estimate magnetic fields of neutron stars, to study star birth regions and high energy processes in star systems lying beyond the Milky Way galaxy.
- This mission has put ISRO in a very **exclusive club of nations** that have space-based observatories, that is United States, European Space Agency, Japan and Russia have such observatories in space.

### 13.Double Asteroid Redirection Test (DART)

- NASA is developing the first-ever mission - **Double Asteroid Redirection Test (DART)**, that will **deflect a near-Earth asteroid**.
- The mission will help to test the systems that will allow mankind to **protect the planet from potential cosmic body impacts** in the future.
- DART would be NASA's first mission to demonstrate what's known as the **kinetic impactor technique** – striking the asteroid to shift its orbit – to defend against a potential future asteroid impact.
- The target for DART is an **asteroid called Didymos** that will have a distant approach to Earth in October 2022 and again in 2024.

### 14.Saraswati

- A team of Indian scientists have discovered a previously unknown **'supercluster' of galaxies**, some four billion light years away from Earth, and **named it Saraswati**.
- This is one of the largest known structures in the neighbourhood of the universe roughly more than 10 billion years old.
- **Superclusters, a group of clusters of galaxies, are the largest structures of stars, planets and other heavenly bodies in the universe, and very few of them are known.**
- A cluster could roughly have galaxies ranging from 1000 to 10,000. A supercluster could have clusters ranging from 40 to 43.

### 15.Israel launches first environmental research satellite Venus

- Israel has launched the country's first environmental research satellite in a joint venture between the Israel Space Agency (ISA) and its French counterpart CNES.
- The **Venus satellite (Vegetation and Environment Monitoring New Micro-Satellite)** is an earth-observation micro-satellite.

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- The satellite's goal is **to obtain high-resolution photographs of specific sites to track environmental issues** such as desertification, erosion, pollution, natural disasters, and other phenomena linked to climate change.
- The satellite will be able to take repeated photos of the same spot in the same light conditions (accounting for the position of the sun), allowing for more accurate tracking of changing environmental issues.
- This is called "**heliosynchronis orbit**" because it requires taking a photo of the same coordinates while the sun is in the same position.

### 16. NASA-ISRO Synthetic Aperture Radar (NISAR)

- ISRO and NASA are working towards realisation of NASA-ISRO Synthetic Aperture Radar (NISAR) mission by 2021.
- ISRO and NASA have a framework agreement for cooperation in the exploration and use of outer space for peaceful purposes signed in 2008.
- NISAR mission is to co-develop and launch a dual frequency synthetic aperture radar satellite.
- The satellite will be the **first radar imaging satellite to use dual frequency** and it is planned to be used for **remote sensing to observe and understand natural processes of the Earth.**
- NISAR would provide information about a place more frequently than older satellites orbiting the Earth at present.
- Among the objectives of NISAR is **estimation of soil moisture, agriculture and forest biomass.**
- It is also designed to observe and take measurements of some of the planet's most complex processes, including ecosystem disturbances, ice-sheet collapse, and natural hazards such as earthquakes, tsunamis, volcanoes and landslides.

### 17. ISRO and CSIR-NPL sign MoU to make desi GPS a reality

- The **ISRO Telemetry Tracking and Command Network (ISTRAC) and CSIR-National Physical Laboratory (NPL)** has signed MoU to make indigenous regional positioning system-NavIC (Navigation with Indian Constellation) independent from the US clock system.
- Until now, the satellites on NavIC relied on the US GPS.
- The MoU will help the **NAVIC to get formally synchronized with the Indian Standard Time (IST)** which is being maintained by the Delhi-based NPL – the timekeeper of India.
- It will also help in making NAVIC to **get fully operational in the market for commercial purposes** as time synchronisation is essential for all kinds of services such as financial transactions, digital archiving, stock handling, time stamping, national security or prevention of cyber-crimes etc.

### 18. Launch of IRNSS-1H unsuccessful

- The launch of **IRSO's eight navigation satellite IRNSS-1H** onbaord of PSLV-C39 was unsuccessful.
- The IRNSS-1H was being sent to space to back up and replace the functions of **IRNSS-1A (launched in July 2013) as its three rubidium atomic clocks on**

**board had stopped functioning.**

- The Indian Regional Navigation Satellite System (IRNSS) also known as NAVIC is an independent regional system developed by India.
- IRNSS is similar to the GPS (Global Positioning System) of the US, Glonass of Russia and Galileo of Europe as well as China's Beidou.
- IRNSS is said to be the "Indian GPS" that will give **accurate real-time positioning** and timing services over India and the region around it **extending to 1,500km.**
- The **applications of IRNSS** are: terrestrial, aerial and marine navigation, vehicle tracking and fleet management, terrestrial navigation for hikers and travellers, disaster management etc.
- IRNSS will provide **two types of services**:
  - **Standard Positioning Services (SPS)**, which will be provided to all users.
  - **Restricted Services – (RS)**, which will grant access only to authorised users.

### **19. ISRO to develop full-fledged Earth observation satellite**

- The Indian Space Research Organisation (ISRO) is planning to launch a full-fledged niche Earth observation (EO) satellite — called the **Hyperspectral Imaging Satellite or HySIS.**
- The HySIS satellite has critical chip called an "**optical imaging detector array**" indigenously developed by ISRO.
- It will allow ISRO to enter the domain of operational hyperspectral imaging from earth orbit.
- With this satellite, it can see in 55 spectral or colour bands from 630 km above ground.
- **Hypex imaging**:
  - Hyperspectral imaging or hypex imaging combines the power of digital imaging and spectroscopy.
  - It collects and processes information from across the electromagnetic spectrum.
  - Hypex' imaging is said to enable **distinct identification of objects, materials or processes** on Earth by reading the spectrum for each pixel of a scene from space.
  - It can be used for a range of activities from monitoring the environment, crops, looking for oil and minerals and military surveillance.

### **20. Scientists map lunar water with data from Chandrayaan-1**

- Scientists, using data from an instrument which flew aboard India's Chandrayaan-1 spacecraft, have created **the first map of water trapped in the uppermost layer of the moon's soil.**
- The study found that **water is present nearly everywhere on the lunar surface**, not limited to the Polar Regions as previously reported.
- **Chandrayaan 1**:
  - The Chandrayaan-1 mission performed **high-resolution remote**

**sensing of the moon** in visible, near infrared (NIR), low energy X-rays and high-energy X-ray regions.

- One of the objectives was to **prepare a three-dimensional atlas** (with high spatial and altitude resolution) of both near and far side of the moon.
- It aimed at conducting **chemical and mineralogical mapping** of the entire lunar surface for distribution of mineral and chemical elements such as Magnesium, Aluminium, Silicon, Calcium, Iron and Titanium as well as high atomic number elements such as Radon, Uranium and Thorium with high spatial resolution.

### **21. India's Mars Orbiter Mission completes 3 years in orbit**

- The spacecraft was **indigenously designed, built and launched by ISRO** in record period of less than two years with Rs.450 crore budget, making it cheapest inter-planetary mission till date to reach Mars.
- MOM mission *aims at studying the Martian surface and mineral composition as well as scan its atmosphere for methane (an indicator of life on Mars)*.
- The Mars Orbiter has **five scientific instruments**—Lyman Alpha Photometer (LAP), Methane Sensor for Mars (MSM), Mars Exospheric Neutral Composition Analyser (MENCA), Mars Colour Camera (MCC) and Thermal Infrared Imaging Spectrometer (TIS).
- This mission **made India to become one of the four nations in the world to send space mission to Planet Mars**.
- India became the **first country in the world to insert a spacecraft into the Martian orbit in its very first attempt**.

### **22. Breakthrough Listen project**

- Breakthrough Listen project has detected **15 fast radio bursts (FRBs)** coming from a dwarf galaxy about 3 million light years away from earth.
- **What is a fast radio burst?**
  - In radio astronomy, a fast radio burst (FRB) is a **high-energy astrophysical phenomenon of unknown origin** manifested as a transient radio pulse lasting only a few milliseconds.
  - Fast radio bursts are bright, unresolved (pointsource-like), broadband (spanning a large range of radio frequencies), millisecond flashes found in parts of the sky outside the Milky Way.
  - Unlike many radio sources the signal from a burst is **detected in a short period of time** with enough strength to stand out from the noise floor.
- **Breakthrough Listen Project:**
  - Breakthrough Listen is a program to **search for intelligent extraterrestrial communications in the Universe**.
  - It is the most comprehensive search for alien communications to date.
  - The project **uses radio wave observations from the Green Bank Observatory and the Parkes Observatory, and visible light observations from the Automated Planet Finder**.
  - Targets for the project include one million nearby stars and the

centers of 100 galaxies.

**NOTES****23. Pluto mountains named after Tenzing Norgay, Edmund Hillary**

- **Two mountain ranges on Pluto have been named after Tenzing Norgay and Edmund Hillary** respectively by the **International Astronomical Union**, which for the first time, has officially approved the naming of 14 features on the icy dwarf planet.
- Who are Tenzing Montes and Hillary Montes?
  - Tenzing Norgay (1914-1986) and Sir Edmund Hillary (1919-2008), the Indian/Nepali Sherpa and New Zealand mountaineer were the **first to reach the summit of Mount Everest and return safely.**
- **IAU:**
  - The International Astronomical Union (IAU) was founded in 1919.
  - Its mission is **to promote and safeguard the science of astronomy in all its aspects through international cooperation.**
  - Its members are professional astronomers from all over the world, at the Ph.D. level and beyond, who are active in professional research and education in astronomy.
  - The IAU has 12625 members.
  - It acts as the **internationally recognized authority for assigning designations to celestial bodies** (stars, planets, asteroids, etc.) and any surface features on them.

**24. Cassini Mission**

- **Cassini–Huygens** is an **unmanned spacecraft sent to the planet Saturn.**
- Cassini is the fourth space probe to visit Saturn and the first to enter orbit.
- Its design includes a **Saturn orbiter and a lander** for the moon Titan.
- The lander, called Huygens, landed on Titan in 2005. The spacecraft was launched on October 15, 1997.
- This was the **first landing ever accomplished in the outer Solar System.**
- NASA's Cassini has completed a final, distant flyby of Saturn's giant moon Titan.
- **Objectives:**
  - Study the dynamic behavior of the rings of Saturn.
  - Determine the composition of the satellite surfaces.
  - Study the dynamic behavior of Saturn's atmosphere at cloud level.

**25. OSIRIS-Rex**

- **The Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer (OSIRIS-REx)** is a **NASA asteroid study** and sample return mission.
- Its mission is to study **asteroid Bennu**, a carbonaceous asteroid, and return a sample to Earth in 2023 for detailed analysis.
- The material returned is expected to enable scientists to **learn more about the formation and evolution of the Solar System** and the source of organic compounds that led to the formation of life on Earth.
- **Asteroids:**
  - Asteroids are **small, airless rocky worlds** revolving around the sun that

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are too small to be called planets.

- They are also known as **planetoids or minor planets**.
- In total, the mass of all the asteroids is less than that of Earth's moon.
- Many have hit Earth in the past, and more will crash into our planet in the future.
- Most asteroids lie in a vast ring between the **orbits of Mars and Jupiter**.
- **The Differences between an Asteroid, Comet, Meteoroid, Meteor and Meteorite?**
  - **Asteroid:** A relatively small, inactive, rocky body orbiting the Sun.
  - **Comet:** A relatively small object whose **ices can vaporize in sunlight** forming an atmosphere (coma) of dust and gas and, sometimes, a tail of dust and/or gas.
  - **Meteoroid:** A small particle from a comet or asteroid orbiting the Sun.
  - **Meteor:** The light phenomena which results when a meteoroid enters the Earth's atmosphere and vaporizes; a shooting star.
  - **Meteorite:** A meteoroid that survives its passage through the Earth's atmosphere and **lands upon the Earth's surface**.

## 26. Dawn Mission Extended at Ceres

- **NASA has authorized a second extension of the Dawn mission at Ceres, the largest object in the asteroid belt between Mars and Jupiter.**
- During this extension, the spacecraft will descend to lower altitudes than ever before at the dwarf planet, which it has been orbiting since March 2015.
- The spacecraft will continue at Ceres for the remainder of its science investigation and will remain in a stable orbit indefinitely after its hydrazine fuel runs out.
- Dawn mission:
  - It was launched by NASA in 2007 to study the two massive protoplanets of the asteroid belt: Vesta and the dwarf planet Ceres, celestial bodies believed to have accreted early in the history of the solar system.
  - Dawn is the only mission ever to orbit two extraterrestrial targets. It orbited giant asteroid Vesta for 14 months from 2011 to 2012, then continued on to Ceres, where it has been in orbit since March 2015.

## 27. Proxima Centauri may host planetary system

- Scientists have detected **dust belts around Proxima Centauri**, a finding that indicates the presence of an elaborate planetary system hosted by the closest star to the solar system.
- These new observations were made by the **Atacama Large Millimeter Array (ALMA) observatory** in Chile.
- Proxima Centauri is the closest star to the Sun.
- It is a faint red dwarf lying just four light years away in the southern constellation of Centaurus.
- It is orbited by the Earth-sized temperate world Proxima b, discovered in 2016 and the closest exoplanet to the solar system.



- **ALMA telescope:**
  - What is it?
    - ALMA -the **largest astronomical project in existence**- is a single telescope of revolutionary design, composed of 66 high precision antennas located on the Chajnantor plateau, 5000 meters altitude in northern Chile.
  - Who has built it?
    - The Atacama Large Millimeter/submillimeter Array (ALMA) is an **international partnership** of the European Southern Observatory (ESO), the U.S. National Science Foundation (NSF) and the National Institutes of Natural Sciences (NINS) of Japan, together with NRC (Canada), NSC and ASIAA (Taiwan), and KASI (Republic of Korea), in cooperation with the Republic of Chile.
  - What is it for?
    - ALMA allows scientists to unravel longstanding and important astronomical mysteries, in search of our Cosmic Origins.

### 28. NOAA's JPSS-1 satellite

- The **Joint Polar Satellite System-1**, an advanced U.S. weather satellite designed to improve the accuracy of extended forecasts has been launched into polar orbit from California.
- The satellite is the first of four next-generation spacecraft for NASA and the National Oceanic and Atmospheric Administration.
- JPSS-1 carries a suite of five instruments intended to make **global observations that will improve forecasts of severe weather events** three to seven days beforehand.
- The satellite also will contribute to near-term weather forecasts, climate and ocean dynamics research, among many other uses.
- JPSS-1 data will also improve **recognition of climate patterns** that influence the weather, such as El Nino and La Nina.

### 29. Aditya-L1

- ISRO is planning to launch **Aditya-L1, India's maiden mission to the Sun, in 2019.**
- It is **India's first solar mission**. It will **study the sun's outer most layers**, the corona and the chromospheres and collect **data about coronal mass ejection**, which will also yield information for space weather prediction.
- The data from Aditya mission will be helpful in discriminating between different models for the origin of solar storms and also for constraining how the storms evolve and what path they take through the interplanetary space from the Sun to the Earth.
- Aditya- L1 satellite will be **placed in the halo orbit around the Lagrangian point 1 (L1)** of the sun-earth system.
- The mission is a joint venture between ISRO and physicists from various institutes including Indian Institute of Astrophysics (Bengaluru), Tata Institute of Fundamental Research (Mumbai) and Inter University Centre for Astronomy and Astrophysics (Pune).



- Aditya L1 satellite will be launched by using **PSLV XL**.
- The satellite will **image sun's magnetic field** from space.

### 30.Sentinel satellite

- **Sentinel- 5P, a European satellite tracking the levels air pollutants around the world** has beamed back new views of the Earth's atmosphere, including images of pollution drifting away from power plants in India.
- The worst of this pollution runs from north of Patna in Bihar to south of Raipur in Chhattisgarh.
- The Sentinel-5P satellite is designed to **make daily global maps of the gases and particles that pollute the air**.
- **About the Sentinel- 5P satellite:**
  - Sentinel-5P is the latest spacecraft in a fleet of Earth observers being commissioned by the European Union and the European Space Agency.
  - It carries an instrument called **Tropomi – a spectrometer that observes the reflected sunlight coming up off the Earth**, analysing its many different colours.
  - This helps detect the presence of trace gases such as nitrogen dioxide, ozone, sulphur dioxide, methane, and carbon monoxide in the atmosphere.

### 31.Deep learning neural networks

- Scientists have announced the discovery of two new exoplanets, **Kepler-90i and Kepler-80g**.
- With this discovery, it is now clear that there is another star besides the Sun that has eight planets orbiting it.
- The new exoplanets have been **discovered using a deep learning neural network** – an artificial intelligence tool that mimics the workings of a human brain.
- **What is Deep Learning?**
  - Deep learning is a **machine learning technique** that teaches computers to do what comes naturally to humans: learn by example.
  - In deep learning, a computer model learns to perform classification tasks directly from images, text, or sound.
  - Deep learning models can achieve state-of-the-art accuracy, sometimes exceeding human-level performance.
  - Models are trained by using a large set of labeled data and neural network architectures that contain many layers.
- **Applications:**
  - Deep learning is a key technology behind driverless cars, enabling them to recognize a stop sign, or to distinguish a pedestrian from a lamppost.
  - It is the key to voice control in consumer devices like phones, tablets, TVs, and hands-free speakers.

### 32. SOFIA - NASA's flying telescope

- NASA's flying observatory Sofia is preparing for its 2018 campaign, which will include **observations of celestial magnetic fields, star-forming regions, comets and Saturn's giant moon Titan.**
- This will be the fourth year of full operations for Sofia, short for **Stratospheric Observatory for Infrared Astronomy.**
- **Significance of the observations:**
  - The observatory's investigations will help **understand how magnetic fields affect the rate at which interstellar clouds condense to form new stars.**
  - These observations could also help them learn whether the luminosity of these active black holes is driven by star formation or accretion of material onto the central black hole.
  - Sofia will also conduct observations to better understand how methane levels change with seasons on Mars.
- **About Sofia:**
  - Sofia is a Boeing 747SP jetliner modified to carry a 100-inch diameter telescope.
  - It is a **joint project of NASA and the German Aerospace Centre, DLR.**
  - SOFIA is designed to observe the infrared universe.



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### 33. Parker solar probe

- **NASA's Parker Solar Probe** is scheduled for launch in 2018 **to explore the Sun's outer atmosphere.**
- NASA's Parker Solar Probe mission will revolutionize our understanding of the sun, where changing conditions can propagate out into the solar system, affecting Earth and other worlds.
- Parker Solar Probe will travel through the sun's atmosphere, closer to the surface than any spacecraft before it, facing brutal heat and radiation conditions.
- In order to unlock the mysteries of the sun's atmosphere, **Parker Solar Probe will use Venus' gravity** during seven flybys over nearly seven years to gradually bring its orbit closer to the sun.
- The primary science goals for the mission are to **trace how energy and heat move through the solar corona** and to explore what accelerates the solar wind as well as solar energetic particles.
- This will be **NASA's first mission to the sun** and its outermost atmosphere corona.
- **Benefits:**
  - The mission can help scientists to **better understand solar flares** – brief eruptions of intense high-energy radiation from the sun's surface that can knock out communications on Earth.
  - These events have impacts on Earth as well as the satellites and astronauts in space.
- **Why study the corona?**

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- The corona is the sun's outer atmosphere.
- It is unstable and produces solar wind and flares.
- Millions of tons of highly magnetised material can erupt from the sun at speeds of several million miles an hour.
- Therefore, we need to get closer to it in order to understand how it works.

**34. International Space Station (ISS)**

- The International Space Station (ISS) is a space station, or a **habitable artificial satellite, in low Earth orbit**.
- The ISS is now the **largest artificial body in orbit**.
- The ISS serves as a microgravity and **space environment research laboratory** in which crew members conduct experiments in biology, human biology, physics, astronomy, meteorology and other fields.
- The station is suited for the **testing of spacecraft systems and equipment** required for missions to the Moon and Mars.
- ISS is the **ninth space station to be inhabited by crews**, following the Soviet and later Russian Salyut, Almaz, and Mir stations as well as Skylab from the US.
- The ISS programme is a **joint project** among **five participating space agencies**: NASA (US), Roscosmos (Russia), JAXA (Japan), ESA (Europe), and CSA (Canada).
- The ownership and use of the space station is established by **intergovernmental treaties and agreements**.
- The station is divided into two sections, the **Russian Orbital Segment (ROS)** and the **United States Orbital Segment (USOS)**, which is shared by many nations.

**35. China to be world's first country to launch a lunar probe on far side of moon**

- China announced its plans to launch a lunar probe in 2018 to achieve the **world's first soft landing on the far side of the moon** to showcase its ambitious space programme.
- The mission is called **Chang'e 4 project**.
- Chang'e 4 is the fourth mission in the country's lunar mission series which is being named after the Chinese moon goddess.
- Landing on the far side of the moon is undoubtedly one of the most challenging missions ever launched by any of the world's superpowers.
- The far side of the moon known as '**South Pole-Aitken Basin**' still remains a mystery among space scientists and by sending a probe there, China will outdo the historical achievements of the US and USSR.

**36. NASA's missions to explore nearest space**

- U.S. space agency National Aeronautics and Space Administration (NASA) - to **explore a little-understood area 60 miles (96 KM) above Earth's surface**. The missions are named **GOLD and ICON**.
- The **Global-scale Observations of the Limb and Disk (GOLD)** mission was

launched recently, and the designed spacecraft **Ionospheric Connection Explorer (ICON)** will be launched later.

- GOLD and ICON will team up to **explore the ionosphere.**
- These layers of near-Earth space are increasingly becoming a part of human domain as it is home to radio signals used to guide airplanes, ships and Global Positioning System satellites.
- The missions' goals is to measure how upper atmosphere changes in response to hurricanes and geomagnetic storms.
- GOLD will also explore how the upper atmosphere reacts to geomagnetic storms, which are temporary disturbances of Earth's magnetic field set off by solar activity.
- The agency is hoping to find evidences for a theoretical model about El Nino's repercussions on the ionosphere.

### **37. SPARCS**

- Scientists are planning to launch a **small telescope into the Earth's orbit** that will **monitor the flares and sunspots of small stars** to assess how habitable the environment is for planets orbiting them.
- The spacecraft is known as the **Star-Planet Activity Research CubeSat, or SPARCS.**
- SPARCS is a new **NASA-funded space telescope** and will be launched in 2021.
- The mission, including spacecraft design, integration and resulting science, is led by Arizona State University's School of Earth and Space Exploration (SESE).
- The stars that SPARCS will focus on are small, dim, and cool by comparison to the Sun.

### **38. James Webb Space Telescope**

- NASA's James Webb Space Telescope the world's premier **infrared space observatory** of the next decade — has successfully completed critical testing, enabling it to function properly in the extremely cold and airless environment in space in 2019.
- The James Webb Space Telescope (JWST) is the **largest space telescope ever built.**
- It is an international collaboration between of about 17 countries including NASA, European Space Agency (ESA) and the Canadian Space Agency (CSA).
- **When it is launched in 2019, it will be the world's biggest and most powerful telescope.**



- The telescope is 100 times more potent than its predecessor, Hubble, and three times larger.
- The telescope will be used to look back to the first galaxies born in the early

universe more than 13.5 billion years ago, and observe the sources of stars, exoplanets, and even the moons and planets of our solar system.

### 39. Chandrayaan-2

- The Indian Space and Research Organisation (ISRO) has postponed launch of India's second lunar mission 'Chandrayaan-2'.
- Chandrayaan 2 is India's second mission to Moon and is **advanced version of previous Chandrayaan-1 mission** which was launched in 2008.
- It has been developed indigenously by ISRO.
- Chandrayaan-2 includes **soft-landing on Moon** and **moving a rover on its surface**.
- It consists of an orbiter, lander and rover configuration.
- The Orbiter spacecraft when launched will travel to the Moon and release the Lander, which will in turn deploy a tiny Rover to roam the lunar surface — all three sending data and pictures to Earth.
- **Soft-landing on the lunar surface is the most challenging part of the mission.** Till now, **only the US, Russia and China have been able to soft-land** spacecraft on the lunar surface.

### 40. Kilopower

- NASA has announced new tests are underway for the **Kilopower project**, a program designed to **create small nuclear power sources to fuel further space exploration**.
- The principal goal of the project is to sufficiently develop and test nuclear power system technologies by 2018 so that fission power can be a viable option.
- Kilopower tackles a few different problems in spacecraft design: existing nuclear power systems rely on a fuel we've essentially run out of, solar power becomes increasingly feeble the further from the sun the spacecraft goes, and more complicated space activities—like those involving humans—would require significantly stronger power supplies than current projects.

### NOTES

## Technologies / New Discoveries

### NOTES

### 1. Gravitational Waves merger

- The **Laser Interferometer Gravitational-wave Observatory (LIGO)** detectors in the U.S. have detected yet another merger of two black holes.
- The observation also supports **Einstein's General Theory of Relativity**.
- According to this theory, **gravitational waves, unlike light waves, will not disperse as they travel through space.**
- Gravitational waves are the **ripples in the pond of spacetime**.
- These waves will be particularly useful for **studying black holes** (the existence of which was first implied by Einstein's theory) and other dark objects.
- Since they pass through matter without interacting with it, gravitational waves would come to Earth **carrying undistorted information** about their origin.
- They could also improve methods for **estimating the distances to other galaxies**.
- The reason that gravitational waves have been so difficult to detect is that their effects are tinier than tiny.
- Gravitational waves are also detected with the help from **Italy-based equipment called Virgo detector**.
- **About LIGO:**
  - LIGO operates three gravitational wave detectors-One is at Livingston in Louisiana and other two are at Hanford in Washington and the detectors are located about 3,000 km apart in L shape.
  - They were built and operated with funding from the National Science Foundation.
  - The project is led by scientists from the California Institute of Technology and the Massachusetts Institute of Technology, and is supported by an international consortium of scientists and institutions.
- **Virgo detector:**
  - The Virgo collaboration includes more than 280 physicists and engineers belonging to 20 different European research groups.
  - The Virgo detector — an **underground L-shaped instrument** that tracks gravitational waves using the **physics of laser light and space** is less sensitive than its U.S. counterparts.
  - Known as **interferometers**, these high-tech underground stations do not rely on light in the sky like a telescope does, but instead **sense vibrations in space** and can pick up the "chirp" created by a gravitational wave.
- **LIGO India project:**
  - The formation of **LIGO-India observatory** was announced soon after the confirmation of first gravitational waves in 2016 and is expected to be commissioned by 2025.
  - The project will be jointly funded by the **Department of Atomic Energy (DAE)** and the **Department of Science & Technology (DST)**.
  - LIGO-India project aims to move one Advanced LIGO detector from



Hanford (US) to India.

- LIGO India will be set up as a **joint scientific collaboration** between:
  - LIGO laboratories of the California Institute of Technology (Caltech),
  - Massachusetts Institute of Technology (MIT), the US, and
  - Three lead Indian institutions, namely,
    - Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune,
    - Institute for Plasma Research (IPR), Gandhinagar, and
    - Raja Ramanna Centre for Advanced Technology (RRCAT), Indore.
- **Nobel prize for gravitational wave detection:**
  - Three American scientists were awarded the Nobel prize “**for decisive contributions to the LIGO detector and the observation of gravitational waves**”.

## 2. First train that runs on virtual tracks

- China has unveiled **the world’s first train that runs on virtual tracks**.
- The new train is part of China’s attempts to develop “**intelligent rail express system**”.
- Instead of railway tracks, the **train runs on rubber tyres**. The train can move at a maximum speed of 70 km/hour.
- The **Autonomous Rail Transit (ART) system** is fitted with sensors that detect the dimensions of the road. This enables the vehicle to follow routes without the need for metal rails.



## 3. GeneXpert

- It is a device released by the **WHO** which can be used to **diagnose TB and HIV infections**, and quantitatively **measure HIV and hepatitis C viral loads**.
- The WHO is recommending use of these state-of-the-art portable machines the size of a microwave oven, which can run **molecular tests**.
- **How does the Genexpert test work?**
  - The test is a molecular test which **detects the DNA in TB bacteria**.
  - It uses a sputum sample and can give a result in less than 2 hours.
  - It can also **detect the genetic mutations associated with resistance to the drug Rifampicin**.



## 4. Quantum Communication

- **China** has launched a 712-km **quantum communication line**, stated to be the **world’s longest secure telecommunications network**.
- Quantum communication lines boast **ultra-high security as a quantum photon can neither be separated nor duplicated**.
- It is **impossible to wiretap, intercept** or crack the information transmitted



through them.

- Quantum communications technology is nearly impossible to hack because **any interference to transmission of information destroys it.**
- **Quantum computing:**
  - Quantum computer is computer design which uses principles of **quantum physics** to increase computational power beyond attainable limits of traditional computer.
  - In a traditional computer, information is stored using binary units, or bits. A bit is either a 0 or 1.
  - A quantum computer process information using **quantum bits, or qubits.**
  - A qubit can be both 0 or 1 at the same time, or any range of numbers between 0 and 1.
  - Qubit allows for greater flexibility than the binary system.
  - Quantum Computing help in solving complex computing physics problems, which were earlier not possible on traditional computers.

### 5. Scientists develop world's sharpest laser

- Scientists have developed the **world's sharpest laser** with **record-breaking precision** that can help **make optical atomic clocks more precise** as well as **test Einsteins theory of relativity.**
- This precision can also be useful for radioastronomy, precision spectroscopy and carry out new precision measurements on ultracold atoms.
- **What is Laser?**
  - A **laser (light amplification by stimulated emission of radiation)** is a device that emits light through a process of **optical amplification** based on the stimulated emission of electromagnetic radiation.
  - It is quite different from a light bulb or a flash light. Lasers produce a **narrow beam of light** in which all of the light waves have very similar wavelengths.
  - Laser light is used in numerous applications in industry, medicine and information technologies.

### 6. Google's machine-raised mosquitoes to shrink vector's numbers

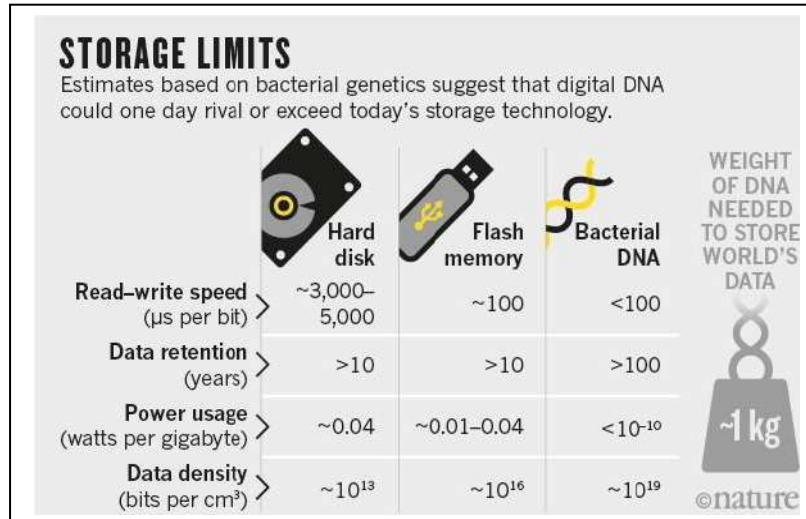
- Google's parent company Alphabet and scientists in the US have teamed up to release 20 million machine-raised mosquitoes to shrink the numbers of the disease-carrying ones.
- The project, called **Debug Fresno**, is being undertaken by Verily, a subsidiary of Alphabet.
- The **goal is to cut the numbers of Aedes aegypti mosquitoes** — the species responsible for spreading zika, dengue and chikungunya.
- For 20 weeks, the company plans to release a million of the sterile, non-biting male mosquitoes in two neighbourhoods in Fresno County.
- The male mosquitoes are bred and infected with **Wolbachia, a bacterium that is naturally found in at least 40% of all insect species.** The bacterium used to sterilise mosquitoes "is not known" to infect humans.
- In a phenomenon called **cytoplasmic incompatibility**, matings between

Wolbachia-infected males and uninfected females result in embryo lethality or low hatch rates.

## NOTES

### 7. When DNA is the new hard drive

- **Scientists have successfully encoded a movie in the DNA of a living cell,** where it can be retrieved at will and multiplied indefinitely as the host divides and grows.



- It is the latest and perhaps most astonishing example of the **genome's potential as a vast storage device.**
- The geneticists ended up with a **sequence of DNA molecules** that represented the entirety of the film. Then they used a powerful **new gene editing technique, Crispr, to slip this sequence into the genome of common gut bacteria, E. coli.**
- **CRISPR:**
  - CRISPR, short for **clustered regularly interspaced short palindromic repeats**, was named "2015 Breakthrough of the Year" by the U.S. journal Science.
  - It allows scientists to selectively **edit genome parts** and replace them with new DNA stretches.
  - **Cas9 is an enzyme that can edit DNA**, allowing the alteration of genetic patterns by genome modification.

### 8. Gelator to remove oil from spills

- Scientists have developed a simple, cheap and environment-friendly system that can effectively remove crude oil from sea that can pollute and even destroy marine ecosystems.
- The scientists have developed **gelator that can suck up oil and congeal it.**
- The gelator is hydrophobic material that has property of **oleophilic (oil-loving)** and takes up oil when it comes in contact with it.
- **Gelation turns the liquid oil into semi-solid** and this allows congealed oil to be simply scooped out using a scoop or a sieve.
- It can be used to **recover marine oil spills** with a simple, efficient and cost-effective method.
- The gelator can be easily applied over oil-water mixture and no solvent is needed for spraying it thus making it environment friendly.

## 9. Sohum

- The Union Ministry of Science and Technology has launched a **low-cost indigenously developed hearing screening device for newborns called Sohum**.
- This device, which allows screening without requiring babies to be sedated, once available across the country can **help minimise hearing impairment** or even reverse the damage.
- The battery-operated noninvasive Sohum uses **brainstem auditory evoked response technology**.

## 10. Food Irradiation

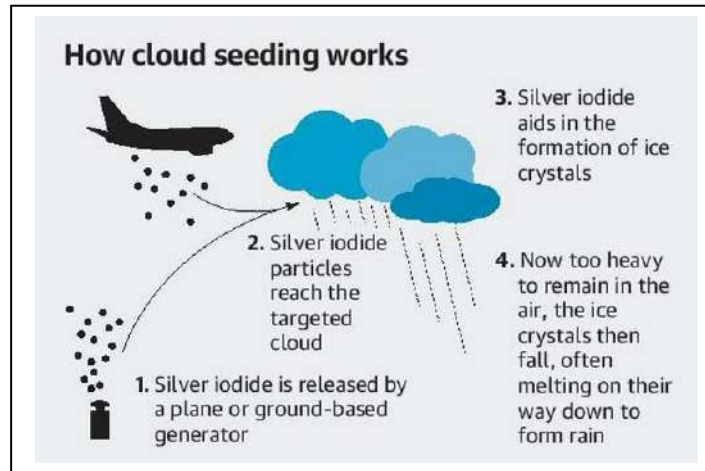
- **Bhabha Atomic Research Centre (BARC)** – Department of Atomic Energy (DAE) has been actively engaged in R&D work on the technology of preservation and hygienization of food and agri-products by radiation.
- In irradiation, **food products are subjected to a low dosage of radiation** to treat them for germs and insects, increasing their longevity and shelf life.
- Radiation treatment is carried out in dosage recommended by the **International Atomic Energy Agency (IAEA)** and it neither reduces the nutritional value of food nor spoils their taste and appearance.
- **Advantages of radiation processing:**
  - Significant **increase in shelf life** for many products including fruits, vegetables, cereals, pulses, spices, sea foods and meat products.
  - Effective **elimination of harmful bacteria, viruses and insects/pests**.
  - Cold & clean process (No temperature raise or residue); and treatment done after final packaging (no repacking necessary).
- **Government efforts in this regard:**
  - BARC-DAE has set up **two technology demonstration units**, one commissioned in the year 2000 for high dose irradiation at Vashi, Navi Mumbai, and another in 2002, for low dose irradiation, KRUSHAK (Krushi Utpadan Sanrakshan Kendra) facility at Lasalgaon, near Nashik.
  - **Harmonization of food irradiation rules with the international regulation** through adaptation of class wise clearance of irradiated food items by the Food Safety and Standards Authority of India (FSSAI) has taken place.
  - **India and Russia have also signed a pact to set up 25 integrated infrastructure centers for irradiation treatment** of perishable food items.

## 11. Cloud Seeding

- Cloud seeding is a form of **weather modification**, a way of changing the amount or type of precipitation that falls from clouds.

## NOTES

- The most common chemicals used for cloud seeding include **silver iodide, potassium iodide and dry ice (solid carbon dioxide)**.
- **Liquid propane**, which expands into a gas, will also be used.
- Experts say precipitation in clouds has been affected recently due to increase in particulate matter in the atmosphere, among other factors.



### 12. World's smallest surgical robot created

- Scientists in the UK have developed the world's smallest surgical robot with low-cost technology used in mobile phones and space industries.
- **The robot is called Versius**. The robot is controlled by a surgeon at a console guided by a 3D screen in the operating theatre.
- It **mimics the human arm** and can be used to carry out a wide range of procedures in which a series of small incisions are made to circumvent the need for traditional open surgery.

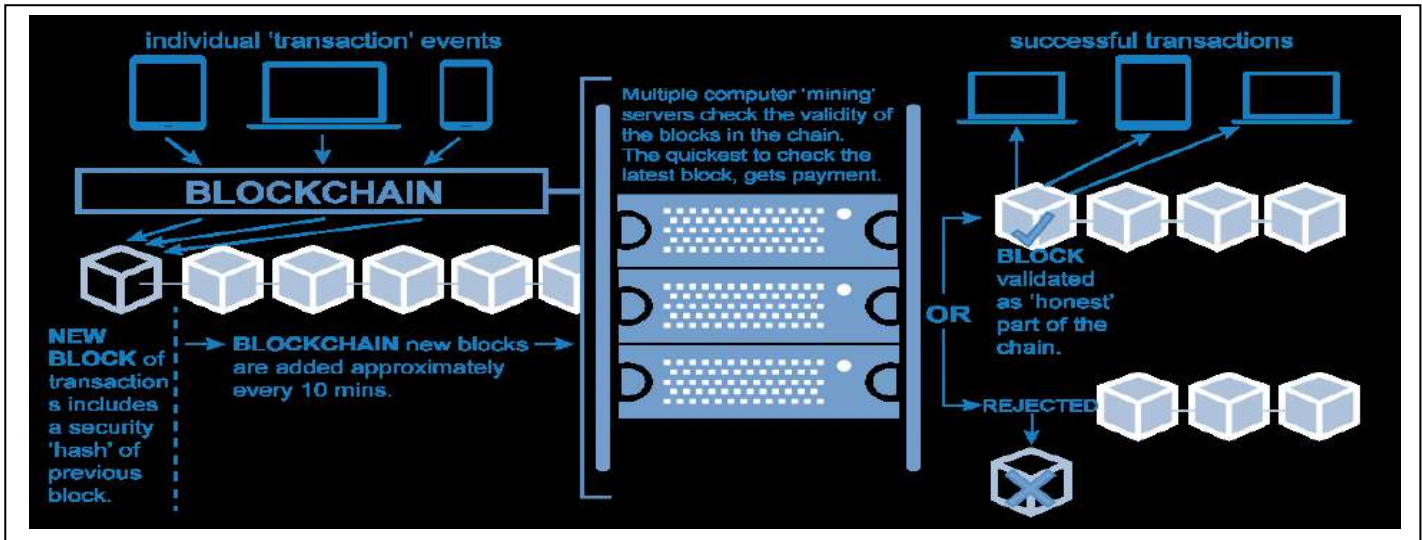
### 13. Project Brainwave

- Microsoft has announced its **Project Brainwave**, a deep learning acceleration platform for real-time artificial intelligence (AI).
- **Real-time AI is becoming increasingly important** as cloud infrastructures process live data streams, whether they be search queries, videos, sensor streams, or interactions with users.
- The 'Project Brainwave' uses the massive **field-programmable gate array (FPGA) infrastructure** that Microsoft has been deploying over the past few years.
- With the help of ultra-low latency, the system processes requests as fast as it receives them.
- **Artificial Intelligence (AI):**
  - Artificial intelligence is branch of computer science concerned with making computers behave like humans.
  - In contrast to normal hardware and software, AI enables a machine to perceive and respond to its changing environment.

### 14. Blockchain Technology

- Blockchain is the **technology behind crypto-currency** such as Bitcoin, which is a purely electronic currency that can be traded on exchanges.
- **A blockchain is an anonymous online ledger that uses data structure to simplify the way we transact.**

- Blockchain allows users to manipulate the ledger in a secure way without the help of a third party.
- **How it works?**
  - Blockchain enables two entities that do not know each other to agree that something is true without the need of a third party.
  - A **blockchain is a distributed database** that takes a number of inputs and places them into a block.
  - Each block is then 'chained' to the next block using a cryptographic signature.
  - This allows blockchains to be used as a ledger which is accessible by anyone with permission to do so.



- **Benefits of blockchain technology:**
  - A blockchain is **anonymous**, protecting the identities of the users.
  - This makes blockchain a **more secure way to carry out transactions**.
  - The algorithm used in blockchain reduces **the dependence on people to verify the transactions**.
  - Use of blockchain technology is **not limited to the financial sector**. It is being used in many other areas.

### NOTES

### 15. World's biggest X-ray laser gun

- The world's largest and powerful **X-ray laser-European X-ray Free Electron Laser (XFEL)** was unveiled in Hamburg, Germany.
- It will help scientists **penetrate the inner workings of atoms, viruses and chemical reactions**.
- It boasts a list of superlatives: the light's brilliance is a billion times higher than that of the best conventional X-ray sources.
- This ultrafast strobe light will allow researchers for the first time to look deep inside matter and take snapshots and films at the nano-level.
- It has capacity to **generate extremely intense laser flashes**, at rate of 27,000 per second generated by **Self-Amplified Spontaneous Emission (SASE)**.
- **Applications:**
  - It will help to reveal and capture in **images at the sub-atomic level**,





promising breakthroughs and revealing secrets in medicine, biology, energy, information technology and chemistry.

- The images of biomolecules may help understand and treat illnesses, while a peek inside a building material might explain why it tears or cracks.
- The light beams can also be bundled to create extreme pressure and temperatures to study process like those at the Earth's core.

### **16. Cobots**

- **Small, collaborative robots, or cobots,** are gaining currency across the world, as also in India.
- A cobot is intended to work hand-in-hand with humans in a shared workspace.
- This is in contrast with full-fledged robots that are designed to operate autonomously or with limited guidance.
- They support and relieve the human operator of his excess work.
- Cobots are easy to use, flexible and safe.
- Unlike industrial robots, cobots don't need fencing for the protection of workers in the shop floor.



### **17. New Graphene-based battery**

- Samsung Electronics has developed core battery technology using graphene to make lithium-ion batteries last longer and charge more quickly.
- Graphene has been touted in the global electronics industry as a “miracle material” given its **strength, electrical conductivity and elasticity**.
- It is a form of carbon that can be used to develop smaller, slimmer batteries but with higher capacity.
- **Graphene:**
  - Graphene is a **carbon material** that is **one atom thick**.
  - Its **thin composition** and **high conductivity** means it is used in applications ranging from miniaturised electronics to biomedical devices.
  - These properties also enable thinner wire connections; providing extensive benefits for computers, solar panels, batteries, sensors and other devices.
  - The potential applications of graphene include **water filtration and purification**, renewable energy, sensors, personalised healthcare and medicine, to name a few.
  - Graphene has excellent electronic, mechanical, thermal and optical properties as well.

### **18. VoLTE services**

- VoLTE stands for **voice over Long Term Evolution**.
- VoLTE is an **Internet Protocol Multimedia Subsystem (IMS)** specification which enables a variety of services to operate seamlessly on the network rather than having to switch to different applications for voice or video.

**NOTES**

- **How it works?**
  - VoLTE is a technology **update to the LTE protocol** used by mobile phone networks.
  - Under LTE, the infrastructure of telecom players only allows transmission of data while voice calls are routed to their older 2G or 3G networks.
  - This is why, under LTE, one cannot access 4G data services while on a call. This leads to problems such as slow internet speeds and poor voice clarity.
  - VoLTE allows voice calls to be 'packaged' and carried through LTE networks. This would mean 4G data accessibility even during calls.
- **Benefits of VoLTE:**
  - VoLTE provides a **more efficient use of spectrum** than traditional voice and increases handset battery life.
  - VoLTE ensures that video services are fully interoperable across the operator community, just as voice services are.

**19.FSOC technology**

- X, a division owned by Google's parent company Alphabet, has signed a MoU with Andhra Pradesh government to setup developmental centre in Visakhapatnam and to create a **high speed internet network that doesn't require special cabling**.
- **About the project:**
  - No cables will be used. Instead of cables, "**Free Space Optical Communications (FSOC) technology**" will be used.
  - This network will power internet in 13 districts through 2 thousand FSOC links.
  - The X centre in Visakhapatnam will be its first development centre outside the US.
- **What is FSOC technology?**
  - FSOC is an **optical communication technology** that **uses light to wirelessly transmit data** to telecommunication and internet applications.
  - The technology remained outside the commercial applications for long owing to distance, speed, and efficiency related problems.
- **How FSOC technology works?**
  - FSOC links use beams of light to deliver high-speed, high-capacity connectivity over long distances, just like fiber optic cable, but without the cable.
  - FSOC boxes can simply be placed kilometres apart on roofs or towers, with the signal beamed directly between the boxes to easily traverse common obstacles like rivers, roads and railways.

**20.Bharatiya Nirdeshak Dravya (BND-4201)**

- It is **India's first home-grown high purity gold reference standard**. It was launched recently.
- It is the reference material for gold of '9999' fineness (gold that is 99.99%



### NOTES

pure). It will be beneficial to the consumers and public at large to ensure purity of gold.

- This means that Indian jewellers will no longer need to import gold bars to check the purity of ornaments.
- The **earlier method was conventional fire assay methods for testing**, which are not only time consuming but also not environment friendly as poisonous gases were released.
- Goldsmiths in the country were depended on imported reference gold bars (mostly imported from Canada and Switzerland) to check purity.
- It has been developed through collaboration between India Government Mint (IGM), Bhabha Atomic Research Centre -- National Centre for Compositional Characterisation of Materials (Hyderabad), and Council of Scientific & Industrial Research-National Physical Laboratory (New Delhi).

### 21. Pratyush and Mihir

- India has unveiled **Pratyush - India's fastest supercomputer and 'Mihir' - high performance computer system (HPC)**.
- **Ministry of Earth Science (MoES)** has acquired HPC facility total of 6.8 Peta Flops (PF) which has been installed at two of its constituent units:
  - **4.0 PF HPC facility named 'Pratyush'** at Indian Institute of Tropical Meteorology (IITM), Pune.
  - **2.8 PF HPC facility named 'Mihir'** at National Centre for Medium Range Weather Forecast (NCMRWF), Noida.
- One petaflop is a million billion floating point operations per second and is a reflection of the computing capacity of a system.
- **India will now occupy the fourth position, next only to United Kingdom, Japan and USA** in terms of dedicated capacity for HPC resources for weather and climate proposes.
- The UK leads with a capacity of 20.4 Petaflop, followed by Japan with 20 Petaflop and USA with 10.7 Petaflop.
- It will also move an Indian supercomputer from the 300s to the 30s in the Top500 list, a respected international tracker of the world's fastest supercomputers.
- India had till now occupied the eighth position with a capacity of 1 Petaflop. With the new system, it has now jumped over Korea (4.8 Petaflop), France (4.4 Petaflop) and China (2.6 Petaflop).
- **Applications:**
  - Weather forecasts at block level over India which can predict extreme weather events.
  - High resolution seasonal/extended range forecasts of active/break spells of Monsoon.
  - Very high resolution coupled models for prediction of cyclones with more accuracy and lead time.
  - Ocean state forecasts including marine water quality forecasts at very high resolution.
  - Tsunami forecasts with greater lead time.
  - Air quality forecasts for various cities.

- Climate projections at very high resolution.

## 22. World's first 'speed breeding' technique to boost production of wheat

- Australian scientists have developed the world's first '**speed breeding**' **technique** that can boost the production of the crop by up to three times.
- **Significance of the technique:**
  - By using speed breeding techniques in **specially modified glasshouses** scientists could grow six generations of wheat, chickpea and barley plants, and four generations of canola plants in a single year.
  - The quality and yield of the plants grown under controlled climate and extended daylight conditions was as good, or sometimes better than those grown in regular glasshouses.
- **How it works?**
  - This technique uses **fully controlled growth environments** and can also be scaled up to work in a standard glass house.
  - It uses **LED lights optimised to aid photosynthesis** in intensive regimes of up to 22 hours per day.
- **Why LED?**
  - LED lights significantly reduce the cost compared to sodium vapour lamps which have long been in widespread use but are ineffective because they generate much heat and emit poor quality light.

### NOTES

## Diseases / Infections

### NOTES

### 1. Keratitis

- Keratitis is **the inflammation of the eye**, which starts with redness and itching and might eventually lead to blindness.
- Keratitis can be caused by both **bacteria and fungi**.
- Fungi attach themselves to the cornea and release enzymes that break down the corneal proteins for their nutritional requirements.
- In the process the cornea also gets inflamed.
- **Corneal damage** causes wound and scar formation leading to severe visual impairment.
- It is estimated that about 30% of keratitis cases in India lead to blindness.

### 2. Drug resistant TB

- A joint study conducted by Foundation for Innovative New Diagnostics (FIND) find the **higher prevalence of MDR-TB in Children**.
- A person with active TB disease has drug resistant TB if the TB bacteria is resistant to, at least one of the main TB drugs.
- There are **two main types of drug resistant TB - MDR-TB and XDR-TB**.
  - MDR (multi drug resistant) TB is the name given to TB when the bacteria is resistant to at least **isoniazid and rifampicin**, two of the most effective TB drugs.
  - XDR-TB (extensively drug resistant TB) is defined as strains resistant to at least rifampicin and isoniazid. This is in addition to strains being resistant to one of the fluoroquinolones, as well as resistant to at least one of the second line TB drugs amikacin, kanamycin or capreomycin.
  - **A third type of drug resistant TB, referred to as totally drug resistant TB (TDR-TB or XXDR-TB)** is resistant to all the first and second line TB drugs.

### 3. Threefold rise in domestic budget for fight against tuberculosis

- According to a report from the World Health Organisation (WHO), India's domestic budget for fighting tuberculosis showed a dramatic jump from about ₹700 crore in 2015 to ₹2,500 in 2016.
- **Key facts of WHO report 2017 on India's TB burden:**
  - With 1.7 million new cases in 2016, **India still continues to be the largest contributor to the global burden** with up to a quarter of the 6.3 million new cases of TB (up from 6.1 million in 2015).
  - Funding Source: 74% domestic funding and 26% international funding.
  - **More men above the age of 15 suffer from TB than women.**
- **Government's intervention:**
  - The government has committed to achieve a **'90-90-90 target' by 2035** (90% reductions in incidence, mortality and catastrophic health expenditures due to TB).

### 4. Moscow declaration

- Health ministers, NGOs, and private sector representatives from 120

countries adopted the Moscow Declaration at the recently held first **WHO Global Ministerial Conference**.

- The declaration calls for **eliminating additional deaths from HIV co-infection by 2030** and **achieving synergy in coordinated action against Tuberculosis**.
- India is among signatories to the declaration.
- A co-infection is when a person suffers from two infections at same time.
- **Moscow declaration:**
  - Moscow declaration emphasis need for fixing multi-sectoral responsibility towards ending TB by 2035.
  - Multi-drug resistant TB will be tackled as national public health crisis.
  - National inter-ministerial commission will be set up by 2018 to achieve fast-tracking universal access to health care.

## 5. Gonorrhoea

- Antibiotic resistance is making gonorrhoea harder and sometimes even impossible to treat, according to a new warning from the World Health Organization (WHO).
- Gonorrhoea, also called “**the clap**”, is a disease caused by bacteria. It spreads by unprotected sex.
- Untreated, it can cause **painful pelvic inflammation in women, and infertility in both genders**.
- In extreme cases, the bacteria can spread in the blood to cause life-threatening infections in other parts of the body.
- Symptoms of infection include painful urination and abnormal discharge, but many will experience no symptoms at all.

## 6. Avian Influenza

- India has declared itself free from highly pathogenic **Avian Influenza – H5N1 and H5N8** and notified it to the **World Organisation for Animal Health**.
- The move will help it resume export of poultry products to the countries which had banned trade in such items.
- Avian influenza, commonly called bird flu, is an infectious viral disease of birds with a tendency of causing large-scale outbreaks of serious disease.
- Although most influenza viruses do not infect humans, A(H5N1) and A(H7N9) have caused **serious infections in people**.
- However, infections in humans have been associated **with direct or indirect contact with infected live or dead poultry**.
- There is no evidence that the disease can be spread to people through properly cooked food.
- **World Organization for Animal Health:**
  - The World Organisation for Animal Health is recognised as a **reference body by the World Trade Organization**.
  - This global body **keeps tab on animal health issues** and advises countries on best practices to be followed during such outbreaks.

## 7. Swine Flu (H1N1)

- Swine flu is a respiratory disease of pigs caused by type A influenza viruses


**NOTES**

that causes regular outbreaks in pigs.

- When it was first detected in 2009, it was called “swine flu” because the virus was similar to those found in pigs.
- **Transmission from Pigs to Humans:** The H1N1 virus is currently a seasonal flu virus found in humans. Although it also circulates in pigs, one cannot get it by eating properly handled and cooked pork or pork products.
- **Pandemic:** In 2009, H1N1 was spreading fast around the world, so the World Health Organization called it a pandemic.
- **Spread:** Swine flu is contagious, and it spreads in the same way as the seasonal flu.
- Pregnant women who contract the H1N1 infection are at a greater risk of developing complications because of hormonal changes, physical changes and changes to their immune system to accommodate the growing foetus.

## 8. Kala-azar

- Kala-azar also called **black fever or dum dum fever** is a fatal parasitic disease of viscera (the internal organs particularly the bones, liver, spleen etc.) caused by the infection due to the **parasitic agent called Leishmania Donovanii**.

WHAT IS KALA-AZAR	
<ul style="list-style-type: none"> <li>▪ A slow progressing indigenous disease</li> <li>▪ Caused by protozoan parasite of genus <i>Leishmania</i></li> <li>▪ In India, <i>Leishmania donovani</i> is the only parasite causing the disease</li> <li>▪ The parasite primarily infects reticuloendothelial system</li> </ul>	<p style="color: red; font-weight: bold; margin: 0;">Signs &amp; Symptoms</p> <ul style="list-style-type: none"> <li>➔ Recurrent fever</li> <li>➔ Loss of appetite</li> <li>➔ Weakness</li> <li>➔ Spleen enlargement</li> <li>➔ Anaemia</li> </ul>
Transmission	
<ul style="list-style-type: none"> <li>▪ Sandfly of genus <i>Phlebotomus argentipes</i> only known vector of kala-azar in India</li> </ul>	
 <ul style="list-style-type: none"> <li>▪ Indian kala-azar has a unique epidemiological feature of being anthroponotic</li> </ul>	<ul style="list-style-type: none"> <li>▪ Female sandflies pick up parasite while feeding on infected human host</li> </ul>
<ul style="list-style-type: none"> <li>▪ Parasite undergoes morphological change to become flagellate</li> </ul>	<ul style="list-style-type: none"> <li>▪ Healthy human hosts get infection when an infective sandfly vector bites them</li> </ul>

- It is transmitted by **Sand Fly bites**. Hence it is common in families living in close proximity to livestock or in humid condition.
- WHO has categorised it as **NTD (Neglected Tropical Disease)** which affects

poorest populations in tropical and subtropical regions especially in developing countries of the world.

- The South bank of Ganga River is the global epicentre for Kala-Azar.
- **Kala-azar is endemic to the Indian subcontinent** in 119 districts in four countries (Bangladesh, Bhutan, India and Nepal).
- This disease is the **second-largest parasitic killer in the world**.
- Elimination is defined as reducing the annual incidence of Kala Azar (KA) to less than 1 case per 10,000 people at the sub-district level

## 9. Measles-Rubella

- Aiming to eliminate measles and curb instances of rubella by 2020, the Centre has rolled out the **second phase of its measles-rubella (MR) vaccination campaign** in the country.

**NOTES**

- Under the measles-rubella (MR) vaccination campaign, **all children in the age group of 9 months to less than 15 years will be vaccinated** in a phased manner across the nation.
- Following the campaign, **MR vaccine will become a part of routine immunization** and will replace measles vaccine, currently given at 9-12 months and 16-24 months of age of child.
- **Measles:**
  - Measles is a deadly disease and one of the **important causes of death in children**.
  - It is **highly contagious** and spreads through coughing and sneezing of an infected person.
  - Measles can make a child vulnerable to life threatening complications such as pneumonia, diarrhoea and brain infection.
- **Rubella:**
  - **Rubella** is generally a mild infection, but has serious consequences if infection occurs in pregnant women, causing **congenital rubella syndrome (CRS)**, which is a cause of public health concern.
  - CRS is characterized by congenital anomalies in the foetus and newborns affecting the eyes (glaucoma, cataract), ears (hearing loss), brain (microcephaly, mental retardation) and heart defects.

### 10. Monkey Fever

- Scientists have traced the source of a re-emerging disease, **Kyasanur Forest Disease (KFD) or “monkey fever”**, to cashew plantations in Goa.
- Monkey fever is tick-borne viral diseases caused by **Kyasanur forest disease virus (KFDV)**, a member of the virus family **Flaviviridae**, which also causes dengue and yellow fever.
- It is endemic to South Asia and was first detected in 1957 in **Kyasanur Forest of Karnataka**.
- Monkey fever is so named because it **primarily affects black-faced langurs and red-faced bonnet monkeys** and result in their death.
- Even when the monkey dies still the KFD virus gets transmitted through ticks thriving on monkeys.
- **Symptoms:**
  - High fever with headache, followed by haemorrhagic symptoms such as bleeding from nose, throat and gums.
  - It also causes gastrointestinal bleeding, muscle stiffness, tremors, absent reflexes and mental disturbances.

### 11. Zoonotic TB

- The first-ever road map to combat **animal tuberculosis (bovine TB)** and its transmission to humans, referred to as **zoonotic TB**, was recently launched at the 48th Union World Conference on Lung Health in Guadalajara, Mexico.
- The roadmap has been built on a **‘One Health Approach’**, addressing health risks across sectors for the animal tuberculosis and its transmission to humans.
- **Zoonotic TB:**

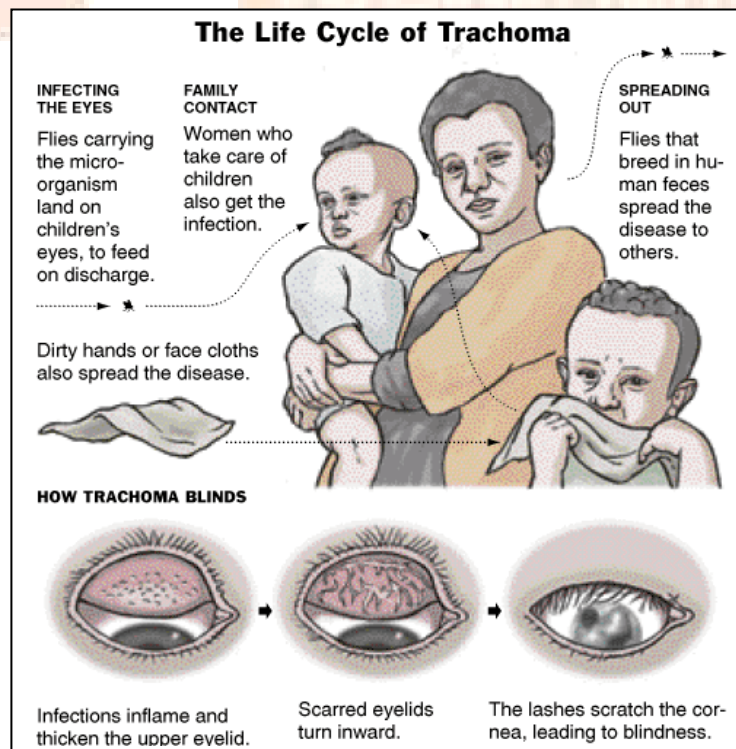


**NOTES**

- It is a type of TB in people caused by *mycobacterium bovis*.
- The disease can affect many other species surrounding cattle and become established in wildlife reservoirs.
- **Spread:** Bovine TB is most often communicated to humans through **food consumption**, usually non-heat-treated dairy products or raw, or improperly cooked meat from diseased animals.
- **Direct transmission** from infected animals or animal products to people can also occur.
- There is **no cure** for bovine TB and it threatens animal welfare and those with livelihoods based on livestock.

## 12. Trachoma

- The **National Trachoma Survey Report (2014-17)** has been released. **India is now declared free from 'infective trachoma'**.
- The survey findings indicate that the **active trachoma infection has been eliminated among children in all the survey districts** with overall prevalence of only 0.7%.
- This is much below the elimination criteria of infective trachoma as defined by the WHO- **active trachoma is considered eliminated if the prevalence of active infection among children below 10 years is less than 5%.**
- The Survey results indicate that active trachoma is **no longer a public health problem** in India.
- India has now met the goal of trachoma elimination as specified by the **WHO** under its **GET2020 programme**.
- This has been possible due to decades of **inter-sectoral interventions** and efforts that included provision of antibiotic eye drops, personal hygiene, availability of safe water, improved environmental sanitation, availability of surgical facilities for chronic trachoma, and a general improvement in the socio economic status in the country.
- **Trachoma:**
  - Trachoma is a **chronic infective disease of the eye** and is the leading cause of infective blindness globally.



**NOTES**

- Trachoma is a disease of **poor environmental and personal hygiene** and inadequate access to water and sanitation.
- It affects the conjunctiva under the eyelids.
- Repeated infections cause scarring leading to in-turning of the eyelashes and eyelids.
- This further causes damage to the cornea and blindness.

**13. Typbar TCV**

- It is a **Typhoid conjugate vaccine** developed by Bharat Biotech Ltd (BBL).
- Typbar TCV is reportedly the **world's first typhoid vaccine clinically proven** for use on recipients who can be as young as six months.
- The World Health Organisation (WHO) has pre-qualified the typhoid conjugate vaccine.
- The **pre-qualification by WHO allows for the sale of the vaccines to UN agencies such as UNICEF and GAVI.**
- The new vaccine was found to have given a **longer immunity** from typhoid than older vaccines and it required fewer doses for childhood immunisation.
- **Typhoid:**
  - Typhoid fever is caused by **food and water contaminated by Salmonella Typhi** (S. Typhi) bacteria.
  - It infects humans due to **contaminated food and beverages** from sewage and other infected humans.
  - The symptoms of the disease include fever, headache, nausea, loss of appetite, constipation and sometimes diarrhoea.
- **GAVI:**
  - Created in 2000, **Gavi is an international organisation – a global Vaccine Alliance**, bringing together public and private sectors with the shared goal of creating equal access to new and underused vaccines for children living in the world's poorest countries.
  - Gavi brings together developing country and donor governments, the World Health Organization, UNICEF, the World Bank, the vaccine industry in both industrialised and developing countries, research and technical agencies, civil society, the Bill & Melinda Gates Foundation and other private philanthropists.

**14. Tourette Syndrome**

- **Context:** For patients with Tourette syndrome, deep brain stimulation (DBS) is associated with symptomatic improvement, according to a study.
- **Tourette's syndrome is a neuropsychiatric disorder** that causes people to make sudden repetitive movements or sounds which aren't controlled (known as tics).
- **Causes:**
  - Though the exact cause of the Tourette's syndrome is unknown, it is believed to be caused both by **genetic and environmental factors.**
  - Studies suggest that it is inherited most of the time, though the mode of inheritance and the carrier gene is not yet identified.
  - This syndrome has been linked to a **dysfunction in an area in the**

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**brain**, which could be basal ganglia, thalamus and frontal cortex, which controls the body movements.

- A disruption in the working of neurotransmitters is also believed to cause tics.

- **Symptoms:**

- Tourette's syndrome causes sudden repetitive movements called the tics.
- These can be so mild as to go unnoticed and can be severe enough to seek medical assistance as well.
- These tics can be of two types, motor tics and vocal tics.
- Motor tics concentrate on the sudden, involuntary muscle movement in the body. These include: Head jerking, Rapid blinking, Mouth, or face twitching, Shrugging and Arms jerking.
- Vocal tics concentrate on the involuntary vocal sounds made by an individual. For example: Throat clearing, Coughing, Repeating what someone else says, Swearing, Shouting and Sniffing.

## 15. Seasonal affective disorder (SAD)

- According to a recent study, in India, more than 10 million people suffer from a self-diagnosable ailment called Seasonal affective disorder (SAD).
- **SAD occurs in climates where there is less sunlight at certain times of the year.**
- Sometimes, it is mistaken to be a "lighter" version of depression, which is untrue.
- Symptoms include fatigue, depression, a feeling of hopelessness and social withdrawal.
- **Vulnerable group:**
  - Statistics released by the Indian Medical Association (IMA) show that SAD occurs four times more often in women than in men.
  - The age of onset is estimated to be between 18 and 30 years but can affect anyone irrespective of age.
  - SAD generally starts in late fall and early winter and goes away during spring and summer.
  - Depressive episodes linked to summer can occur, but are much rarer than winter episodes.
- **Prevention:**
  - A few ways in which people can prevent winter depression include ensuring a healthy and balanced diet.
  - Staying well hydrated is key during the winter months since it gives you more energy, mental clarity and an enhanced digestive function.
  - Getting enough sunlight and engaging in regular outdoor physical exercise are also important.
- Treatment for SAD involves enough light exposure, artificial light exposure, sun therapy and drugs, if needed.

## 16. Polio

- Polio is a highly infectious **viral disease**, which mainly affects young children.

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- The virus is **transmitted by person-to-person** spread mainly through the **faecal-oral route** or, less frequently, by a common vehicle (e.g. **contaminated water or food**) and multiplies in the **intestine**, from where it can invade the **nervous system** and can cause paralysis.
- **Injectable inactivated polio vaccine (IPV):**
  - IPV is produced from **wild-type poliovirus strains** of each serotype that have been **inactivated (killed)** with formalin.
  - As an injectable vaccine, it can be administered alone or in combination with other vaccines.
  - IPV provides serum immunity to all three types of poliovirus, resulting in **protection against paralytic poliomyelitis**.
  - Studies have confirmed that **two fractional doses** (one fractional dose is one-fifth of a full dose) of IPV, given twice to infants — first at the age of six weeks and then at 14 weeks — provide the **same protection against all polio viruses as does one full dose of IPV**.
  - **India became the first country globally to introduce fractional doses of IPV** in childhood immunisation programme in eight states and Union territories in early 2016.
- **Difference between IPV and OPV:**
  - There are two types of vaccine that protect against polio: inactivated poliovirus vaccine (IPV) and oral poliovirus vaccine (OPV).
  - **IPV contains live killed virus and OPV contains live weakened virus.**
  - **OPV** is made up of attenuated or weakened poliovirus and there is a **risk of vaccine derived polio**.
  - **IPV** is made up of inactivated (killed) polio virus and will provide **immunity from all three strains of polio**.

## Government Programmes / Departments

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### 1. Council for Scientific and Industrial Research (CSIR)

- It was established as an autonomous body that has emerged as the **largest research and development organisation in India**.
- It runs several laboratories and field stations or extension centres throughout the nation.
- Although it is **mainly funded by the Ministry of Science and Technology**, it operates as an **autonomous body** through the **Societies Registration Act, 1860**.
- The **research and development activities** of CSIR include aerospace engineering, structural engineering, ocean sciences, life sciences, metallurgy, chemicals, mining, food, petroleum, leather, and environmental science.
- It provides significant **technological intervention** in many areas with regard to **societal efforts**, which include environment, health, drinking water, food, housing, energy, and farm and non-farm sectors.

### 2. VAJRA scheme

- The **Department of Science and Technology (DST)** has launched a scheme named '**Visiting Advanced Joint Research Faculty (VAJRA)**'.
- The scheme enables **NRIs and overseas scientific community to participate and contribute to research and development in India**.
- It was announced during the 14th Pravasi Bharatiya Divas Convention.
- The **Science and Engineering Research Board (SERB)**, a statutory body of the Department of Science and Technology will implement the Scheme.
- Scientists or senior researchers abroad – of Indian origin or otherwise – can collaborate with faculties here.
- Foreign researchers would receive endowments at par with those in their own countries.
- **Public funded academic institutions and national laboratories** will be eligible for hosting the VAJRA Faculty.
- The idea of the scheme is to bring the best of the world to India and conduct research here.
- The broad areas of research like energy, health, advance material and others would be promoted under the scheme.

### 3. CERT-In (the Indian Computer Emergency Response Team)

- CERT-In is a **government-mandated information technology (IT) security organization**.
- CERT-In was created by the Indian **Department of Information Technology** in 2004 and operates under the auspices of that department.
- Purpose:
  - The purpose of CERT-In is to **respond to computer security incidents, report on vulnerabilities and promote effective IT security practices** throughout the country.
  - According to the provisions of the **Information Technology Amendment Act 2008**, CERT-In is responsible for overseeing

administration of the Act.

- It Issue guidelines, advisories, vulnerability notes and whitepapers relating to information security practices, procedures, prevention, response and reporting of cyber incidents.
- The first CERT group was formed in the United States at Carnegie Mellon University.

#### 4. NIC CERT

- The Centre has unveiled the NIC-CERT centre that would monitor and help in **early detection and mitigation of cyber attacks on government networks**.
- It is a dedicated body to detect, prevent and mitigate the impact of cyber attacks on the National Informatics Centre (NIC).
- NIC-CERT monitors data across the NIC platform, including communication between all the levels of government and between governments to citizens.
- NIC-CERT will operate in close **coordination and collaboration with sectoral CERTs** and more so with CERT-IN.
- NIC, which comes under the IT ministry, has a key role in e-governance at the national, state and district levels.
- Almost all Indian-government websites are developed and managed by NIC.

#### 5. Central Drugs Standard Control Organization (CDSCO)

- The **Central Drugs Standard Control Organization (CDSCO)** is the **national regulatory body for Indian pharmaceuticals and medical devices**.
- It functions parallel to the European Medicines Agency of the European Union, the PMDA of Japan, and the Food and Drug Administration of the United States.
- Within the CDSCO, the **Drug Controller General of India (DCGI)** regulates pharmaceutical and medical devices, under Ministry of Health and Family Welfare.
- The DCGI is advised by the Drug Technical Advisory Board (DTAB) and the Drug Consultative Committee (DCC).
- **Functions:**
  - Regulatory control over the import of drugs,
  - Approval of new drugs and clinical trials,
  - Meetings of Drugs Consultative Committee (DCC) and Drugs Technical Advisory Board (DTAB),
  - Approval of certain licences as Central Licence.

#### 6. Sagar Vani

- The **Union Ministry of Earth Science** has launched Sagar Vani, an **integrated information dissemination system** that will serve the **coastal community, especially the fishermen community** with the **advisories and alerts** towards their livelihood as well as their safety at Sea.
- Sagar Vani has been developed by ESSO-Indian National Centre for Ocean Information Services (INCOIS).
- It is a software platform where various dissemination modes will be integrated on a single central server.

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- It includes Multi Lingual SMS, Voice Call/Audio Advisory, Social Media, Mobile Apps, email, Fax, GTS, Digital Display Boards, IVRS, Radio/Television broadcast units, Cloud Channels, etc.
- The system also has facility to provide access to various stakeholders (State Fishery Departments, Disaster Management Authorities, NGOs etc.) so that they will be able to further disseminate these ocean information and alerts to the user community.
- It can also disseminate **services in local languages**.

### 7. JIGYASA – Student-Scientist connect Programme

- Jigyasa, a **student- scientist connect programme** has been launched by the government.
- The programme is implemented by the **Council of Scientific and Industrial Research (CSIR) in collaboration with Kendriya Vidyalaya Sangathan (KVS)**.
- The main focus of the programme is to connect school students and scientists as well as to extend student’s classroom learning to research laboratory based learning.
- “JIGYASA” programme is one of the major initiatives of the CSIR at the national level during its Platinum Jubilee Celebration Year.

### 8. National Cyber Coordination Centre

- The first phase of **National Cyber Coordination Centre**, set up to **scan the country’s web traffic** to detect cyber security threats, has been made operational.
- NCCC, a multi-stakeholder body, will be **implemented by Indian Computer Emergency Response Team (CERT-In)** at Ministry of Electronics and Information Technology.
- NCCC scans internet traffic coming into the country to detect real-time cyber threat and alert various organisations as well as internet service providers for timely action.
- The Centre derives necessary powers as per provisions of section 69B of the Information Technology Act, 2000 and the Rules notified thereunder.

### 9. Directorate General of Quality Assurance

- Directorate General of Quality Assurance (DGQA) has completed 60 years of its existence.
- The Directorate General of Quality Assurance (DGQA) is **under Department Of Defence Production, Ministry of Defence**.
- It provides Quality Assurance (QA) cover for the entire range of Arms, Ammunitions, Equipments and Stores supplied to Armed Forces.
- Apart from QA activities, the organisation is responsible for **import substitution** and associates with Defence Research and Development Organisation (DRDO) in the development projects.
- The other services rendered are **promotion of small scale industries, Post procurement services**, Defect Investigations and Technical Consultancy to the users, Ministry and the Production Agencies.

### 10. India Hypertension Management Initiative (IHMI)

- India Hypertension Management Initiative (IHMI) was recently launched.
- The India Hypertension Management Initiative (IHMI) is a collaborative project of Indian Council of Medical Research (ICMR), Ministry of Health and Family Welfare (MoHFW), State Governments, World Health Organization (WHO), and Resolve to Save Lives initiative of Vital Strategies.
- **The IHMI aims to reduce disability and death related to cardiovascular disease (CVD)**, the leading cause of death in India, by improving the control of high blood pressure (hypertension), reducing salt consumption and eliminating artificial trans-fats, leading risk factors for CVD.
- **The IHMI is focused on five essential components** of scalable treatment of hypertension.
- It will support the adoption of standardized simplified treatment plans for managing high blood pressure, ensure the regular and uninterrupted supply of quality-assured medications, task sharing so health workers who are accessible to patients can distribute medications already prescribed by the medical officer, and patient-centered services that reduce the barriers to treatment adherence.

### 11. Bio-toilets

- Bio-toilets are small-scale sewage-treatment systems beneath the toilet seat.
- These toilets incorporate **microbes with an anaerobic digestion process** to digest human waste.
- A colony of anaerobic bacteria acts upon the collected waste and **converts the waste into water and biogases (mainly methane and carbon dioxide)**.
- While the gases escape into the atmosphere, the wastewater is discharged after disinfection onto the track, thus putting an end to the crisis of railway tracks strewn with excreta.
- Each bio-toilet requires 60 litres — or three large bucketfuls — of **inoculum**, a mix of cow dung and water.
- This inoculum begins the process of breaking down 3,980 tons of human excreta. Anaerobic bacteria are abundantly available in cow dung.

### 12. 'IPrism'

- It is one of its kind **Intellectual Property (IP) Competition** for college and university students.
- The Cell for IPR Promotion and Management (CIPAM), Department of Industrial Policy and Promotion (DIPP), in collaboration with ASSOCHAM and ERICSSON India, has launched this competition.
- The competition aims to **foster a culture of innovation** and creativity in the younger generation.
- It will provide young creators a unique opportunity to see their creations recognized on a national platform.
- This competition invites students to submit films on piracy & counterfeiting under two categories of 30 and 60 seconds. Another category in the competition is for a mobile gaming app on IP.

### **13. iCreate**

- Prime Minister Modi and his Israeli counterpart Benjamin Netanyahu recently dedicated to the nation the iCreate facility located on the outskirts of Ahmedabad.
- iCreate is an **independent centre created with the objective of facilitating entrepreneurship** through a blend of creativity, innovation, engineering, product design and leveraging emerging technologies to deal with major issues such as food security, water, connectivity, cybersecurity, IT and electronics, energy, bio-medical equipment and devices etc.
- iCreate aims to develop an ecosystem in India to generate quality entrepreneurs.

## **Biotechnology**

### **1. Stem Cells**

- Stem cell is an **undifferentiated cell** of a multicellular organism which is capable of **giving rise to indefinitely more cells of the same type** and from which certain other kinds of cell may be formed by the **cellular differentiation**.
- They are found in multicellular organisms.
- In mammals, there are two broad types of stem cells: **embryonic stem cells** and **adult stem cells**.
- Both are generally characterized by their potential to **differentiate into different cell types**. For eg: Pluripotent stem cells have the ability to differentiate into almost all cell types.
- In the stem cell treatments new adult cells are introduced into the damaged tissue to treat the disease.
- Stem cells offer new potentials for treating diseases such as diabetes, and heart disease.

### **2. GM Crop**

- A **GM or transgenic crop** is a plant that has a novel **combination of genetic material** obtained through the use of modern **biotechnology**.
- For example, a GM crop can contain a **gene(s) that has been artificially inserted** instead of the plant acquiring it through pollination.
- The resulting plant is said to be “genetically modified” although in reality all crops have been “genetically modified” from their original wild state by domestication, selection, and controlled breeding over long periods of time.
- Currently, **only Bt Cotton** – a non-food GM crop – is **commercially cultivated in the country**.

### **3. China plans to build gigantic DNA database platform**

- China plans to build a \$1 billion **super-sized DNA sequencing platform**.
- Aim:
  - **Store genetic information** of millions of its ethnic Chinese population
- Use:

- Researchers will use big data created in the database to **study genetic mutations related to major diseases**,
- look for the impact of interaction between genes and environmental concerns on human health,
- Provide statistical support for **diagnosis and treatment** of major diseases.

## Events / Celebrations

### 1. 2017 BIO International Convention

- The 2017 BIO International Convention was held in San Diego, California hosted by the **Biotechnology Innovation Organization (BIO)**.
- It is the **largest global event for the biotechnology industry** that offers key networking and partnering opportunities and provides insights and inspiration on the major trends affecting the industry.
- The BIO International Convention helps BIO fulfil its mission to help grow the global biotech industry.
- The first BIO International Convention was held in 1993.
- **Biotechnology Innovation Organization (BIO):**
  - BIO represents more than 1,100 biotechnology companies, academic institutions, state biotechnology centres and related organizations across the United States and in more than 30 other nations.
  - BIO members are involved in the **research and development** of innovative healthcare, agricultural, industrial and environmental biotechnology products.

### 2. World Diabetes Day 2017

- World Diabetes Day is observed on **November 14** every year.
- **The theme for World Diabetes Day 2017 is Women and Diabetes.**
- The main objective of this year's campaign is to promote the importance of affordable and equitable access to medical care for all women.
- Diabetes is a chronic disease or condition that is caused when the pancreas is no longer able to make insulin, or when the body cannot make good use of the insulin it produces.

### 3. World AIDS Day 2017

- World AIDS Day takes place on the **1st December** each year.
- It's an opportunity for people worldwide to **unite in the fight against HIV**, to show support for people living with HIV, and to commemorate those who have died from an AIDS-related illness.
- **Founded in 1988**, World AIDS Day was the **first ever global health day**.
- The theme selected by World Health Organization (WHO) for year 2017 is **'Right to health'**.
- WHO under slogan **"Everybody counts"** will advocate for access to safe, effective, quality and affordable medicines, including diagnostics and other health commodities.
- **What is the difference between HIV and AIDS?**
  - HIV stands for **human immunodeficiency virus**.

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- This virus leads to infection and it **attacks the immune system**.
- While HIV can be transmitted between people, **AIDS is a condition that is acquired only after a person has contracted the HIV infection**.
- AIDS is the final stage of the HIV infection.
- **Reasons for getting infected with AIDS:**
  - Unprotected sex with an infected person.
  - During pregnancy from mother to child or even breastfeeding.
  - Through transfusion of blood.
  - Using of hypodermic needles of infected person to other person.
- **How can HIV be diagnosed?**
  - **Serological tests**, such as RDTs or enzyme immunoassays (EIAs), detect the presence or absence of antibodies to HIV-1/2 and/or HIV p24 antigen.
  - No single HIV test can provide an HIV-positive diagnosis.
  - It is important that these tests are used in combination and in a specific order.



## Miscellaneous

### NOTES

### 1. Oxytocin

- Oxytocin has also been dubbed the love hormone, hug hormone, cuddle chemical, moral molecule, and the bliss hormone due to its **effects on behavior**, including its role in love and in **female reproductive biological functions** in reproduction.
- Oxytocin is a hormone that is **made in the brain, in the hypothalamus**.
- It is transported to, and secreted by, the pituitary gland, which is located at the base of the brain.
- It acts both as a hormone and as a **brain neurotransmitter**.
- The release of oxytocin by the pituitary gland acts to regulate two female reproductive functions: Childbirth and Breast-feeding.
- **Why its sale is being limited?**
  - The drug is used by dairy owners and farmers to boost milk production and make vegetables look bigger and fresher.
  - But, it was found that indiscriminate use of Oxytocin in milch animals and by farmers was causing irreversible hormone damage.
  - Implications to human health are humongous, from reproductive complications to hormonal imbalances.

### 2. Petrwrap or Petya

- Petrwrap or Petya is the latest in a series of powerful **ransomware attacks** which deny access to a computer system and then demands money from users to regain access.

### 3. WHO revises Protocol for Antibiotics

- With an aim **to curb antibiotic resistance**, the World Health Organization (WHO) has revised the protocol for antibiotics.
- This is the **biggest revision of the antibiotics** section in the **essential medicines list (EML)**.
- WHO has divided the drugs into **three categories — access, watch and reserve**.
- The antibiotics in 'access category' will be made available at all times as a treatment for a wide range of common infections.
- Second line of antibiotics which are slightly potent will be placed under 'watch' category. The drugs coming under this category must be prescribed less to avoid further development of resistance.
- The highly potent drugs which should be used only as a last resort will be placed under the 'reserve' category.
- **Antibiotic resistance:**
  - Antibiotics are medicines used to prevent and treat bacterial infections.
  - Antibiotic resistance occurs when bacteria change in response to the use of these medicines.
  - Antibiotic resistance can affect anyone, of any age.
  - Antibiotic resistance occurs naturally, but misuse of antibiotics in



humans and animals is accelerating the process.

- **WHO Model List of Essential Medicines:**

- The WHO Model Lists of Essential Medicines has been **updated every two years since 1977**.
- It serves as a **guide for the development of national and institutional essential medicine**.
- These are the medications to which **people should have access at all times** in sufficient amounts.
- They satisfy the **priority health care needs** of the population.

#### 4. IMD to release Malaria and Chikungunya Alerts

- The India Meteorological Department (IMD) is working on a forecasting system that will give **15-day warnings on the likelihood of a malaria or chikungunya outbreak** across different regions.
- It is aimed at providing custom, weather-related information to cope with challenges of a global warming and its associated impact of weather.
- IMD will release five-day and 15-day forecasts of heat-waves, cold waves and disease outbreaks.
- The **IMD's National Climate Centre in Pune** will be reorganised to offer such climate services.
- **India Meteorological Department (IMD):**
  - IMD is the principal agency responsible for meteorological observations, weather forecasting and seismology in India.
  - It functions under the **Union Ministry of Earth Sciences**.
  - It headquartered in New Delhi and operates hundreds of observation stations across India.

#### 5. Atomic Clock

- An **atomic clock** is a clock device that **uses an electron transition frequency of the electromagnetic spectrum** of atoms as a frequency standard for its timekeeping element.
- Atomic clocks are the **most accurate time and frequency standards known**, and are used as primary standards **for international time distribution services**, to control the wave frequency of television broadcasts, and in global navigation satellite systems such as GPS.

#### 6. NASA's Quieter Supersonic Jet

- NASA has developed a quieter supersonic passenger jet.
- NASA has completed the preliminary design review of its **Quiet Supersonic Transport (QueSST)** aircraft design.
- QueSST design will produce a soft "thump" instead of creating the disruptive sonic boom associated with supersonic flights of the present day.

#### 7. Flammable ice

- China has successfully produced **natural gas from methane hydrate**, also known as "**flammable ice**", in South China Sea.
- Flammable ice **consists of methane trapped within water crystals**, and has

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been identified as a potential new gas source for China.

- Officially known as **methane clathrates or hydrates**, they are formed at very low temperatures and under high pressure.
- They can be **found in sediments under the ocean floor** as well as underneath permafrost on land. Despite **the low temperature, these hydrates are flammable**.
- By lowering the pressure or raising the temperature, the hydrates break down into water and methane – a lot of methane.
- Many countries including the US and Japan are working on how to tap those reserves, but **mining and extracting are extremely difficult**.
- Vast deposits exist basically underneath all oceans around the globe, especially on the edge of continental shelves.
- **Challenges:**
  - These reserves are often distributed over a large area rather than concentrated in one spot as oil or natural gas reserves often are.
  - Methane hydrates are **unstable and potentially explosive**.
  - Drilling into the seafloor could destabilize the methane ice crystals and cause explosions.

## 8. lithium-ion battery

- Indian Space Research Organization (ISRO) has approved commercial use of lithium-ion battery technology.
- At present Lithium-ion batteries are imported from abroad which makes them very expensive.
- Lithium ion batteries have the advantage of being less weight, having high power, and less volume in comparison to conventional batteries.
- Lithium-ion batteries are nearly 100% efficient in both charge and discharge while the lead batteries have the 70% efficiency.
- Rechargeable lithium-ion batteries cycle 5000 times or more compared to just 400-500 cycles in lead acid.
- Lithium-ion batteries are a much cleaner technology and are safer for the environment.

## 9. Generic Drugs

- A generic drug is **identical** — or **bioequivalent** — to a **brand name drug** in dosage form, safety, strength, route of

### Branded Drugs V/S Generic Drugs

The most important thing to note down between branded drugs and the generic drugs is



**Branded Drugs**



**Generic Drugs**

- 1.) Both contain the similar active ingredients and generic drugs are equally effective and safe as the branded ones. So it can be said that there is no major difference between the two drug types.
- 2.) However generic drugs are available at a lower price and thus it makes it affordable for most of the people.
- 3.) There is a difference in the color of a generic drug and the brand name drug.

administration, quality, performance characteristics and intended use.

- Although generic drugs are chemically identical to their branded counterparts, they are typically sold at substantial discounts from the branded price.

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### 10. Chemicals banned in firecrackers

- The Supreme Court has prohibited the use of five chemicals, labelled as toxic by the Central Pollution Control Board (CPCB), in the manufacture of firecrackers.
- The banned chemicals include **antimony, lithium, mercury, arsenic and lead** in any form whatsoever.
- The responsibility to ensure compliance particularly in Sivakasi is given to the **Petroleum and Explosive Safety Organisation (PESO)**.
- The sound and light show is produced by chemicals such as **sulphur, aluminium powder and charcoal** (used as fuel), besides **potassium nitrate** and **barium nitrate** (as oxidising agents).
- **PESO:**
  - Petroleum And Explosives Safety Organisation (PESO) was formed to **control and administer the usage of explosives, petrol stations in India.**
  - The agency issues licenses for Operation of Petrol Stations, Licenses to operate Petroleum Product Transportation vehicles, Licenses for Refineries, Petrochemical Complexes, etc.
  - The Department is headed by **Chief Controller of Explosives** and is headquartered at Nagpur.
  - It functions under DIPP.

### 11. CARB-X, or Combating Antibiotic Resistant Bacteria

#### Biopharmaceutical Accelerator

- A Bengaluru firm has become **India's first to receive the international CARB-X grant to develop antibiotics to treat hospital-acquired infections.**
- CARB-X, or Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator, is a **public-private international partnership**, which was set up in 2016 to focus on innovations to **improve diagnosis and treatment of drug-resistant infections.**
- It grew out of President Barack Obama's 2015 Combating Antibiotic Resistant Bacteria (CARB) initiative.
- The purpose of CARB X is to provide a new, collaborative approach to speed R&D and delivery of new antibiotics, vaccines, diagnostics, and other innovative products to address global problem of drug-resistant bacterial infections.

### 12. Sahara Forest Project

- A new project named "**Sahara Forest Project**" has been launched in Jordan.
- It aims to **turn Jordan's sand dunes into farming land** to produce food using sun and



sea water.

- In the first stage, the project aims to produce up to 130 tonnes of organic vegetables per year from an area the size of four football pitches. It also produces fresh water.
- It will use solar panels to provide power and include outdoor planting space, two saltwater-cooled greenhouses, a water desalination unit and salt ponds for salt production.
- The project funded by Norway and the European Union, is to be expanded from three hectares to around 200 hectares of desert.

### 13. Nobel Prize in medicine

- Three US scientists have won the Nobel Prize in Physiology or Medicine “**for their discoveries of molecular mechanisms controlling the circadian rhythm,**” known as our biological clock.
- Jeffrey C. Hall, Michael Rosbash and Michael W. Young were awarded the prize for their research on **how plants, humans and animals adapt their biological rhythm** to synchronize with our planet’s day and night cycle, in order to control their daily life.
- **Background:**
  - **All living organisms on Earth have an internal clock, known as the circadian rhythm,** which in humans underlies why we are awake during the day and sleep at night.
  - But our **biological clock also helps regulate eating habits, hormone release, blood pressure and body temperature.**
  - A person’s well-being is affected when there is a “temporary mismatch between our external environment and this internal biological clock.”
  - For example, disruption to our clocks when someone travels across a number of time zones results in jet lag.
  - An **imbalance** between lifestyle and rhythm could lead to increased risk for a number of diseases including **metabolic diseases**, such as diabetes and cancer, and neurodegenerative diseases, such as Alzheimer’s disease.
- **Significance of research in this field:**
  - Research on the body clock has helped scientists **improve health.**
  - Many drugs now on the market work best when taken at the right time.
  - The cholesterol-cutting drug Mevacor, for example, is taken at night because levels of the enzyme it targets are highest then. The same is true for low-dose aspirin used to reduce blood pressure.

### 14.2017 Nobel Prize in Chemistry

- The 2017 Nobel prize in Chemistry has been awarded to Jacques Dubochet, Joachim Frank and Richard Henderson “**for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution**”.
- **What is cryo-electron microscopy?**

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- “Cryo”, short for cryogenic refers to very low temperatures.
- Though the actual temperature is not well defined, it is **below minus 150°C**.
- In the context of electron microscopy, it refers to the fact that the **object to be imaged is frozen to such low temperatures** to facilitate being studied under the beam of the electron microscope.
- This method is so effective that even in recent times it has been used to image the elusive Zika virus.

### 15. Urinary Tract Infection (UTI) test

- UTI second most common infectious disease that affects millions of people globally each year.
- These resistant bacteria not only cause long lasting infection but also **reduce effectiveness of the available antibiotics**.
- **Problems with present testing method:**
  - Has 48-hour wait for urine test report
  - It delays treatment
  - Leads to inappropriate use of antibiotics
  - Gives rise to multidrug-resistant pathogens
- The **new test strip contains 15 common antibiotics and helps in identifying the antibiotic sensitivity of the bacteria** and deciding the most appropriate medicine to be used for the patient.
- **Advantages:**
  - The test does not require any other specialised equipment, dedicated space/lab or trained personnel.
  - As the strip already has the panel of antibiotics, it is easier, faster and cheaper.
  - Minimises the irrational use of antibiotics.

### 16. E-cigarettes

- The government is examining the legal implications and health effects of e-cigarettes.
- An electronic cigarette (or e-cig) is a **battery-powered vaporizer that mimics tobacco smoking**.
- It works by heating up a nicotine liquid, called “juice.”
- **e-liquid is composed of:**
  - **Vegetable glycerin** (a material used in all types of food and personal care products, like toothpaste) and **propylene glycol** (a solvent most commonly used in fog machines.)
  - Propylene glycol is the ingredient that produces thicker clouds of vapor.
- **Harmful effects of e cigarettes:**
  - Although they are generally thought to be less harmful than smoking real cigarettes, because they contain no tobacco, **they do still contain the addictive chemical nicotine**.
  - Scientists have confirmed that e-cigarette vapours to contain the same potentially dangerous chemicals.



**NOTES**

- Research has also confirmed that **e-cigarette vapours contain free radical chemicals** previously thought only to be found in tobacco cigarettes and air pollutants.
- **Free radicals are highly reactive agents that can damage DNA or other molecules within cells, resulting in cell death.**
- Cigarette smoke contains 1014 free radicals per puff.
- Though e-cigarette vapour contains far fewer free radicals than cigarette smoke – one percent as much – their presence in e-cigarettes still suggests potential health risks.

**17.WHO to recognize gaming disorder as mental health condition**

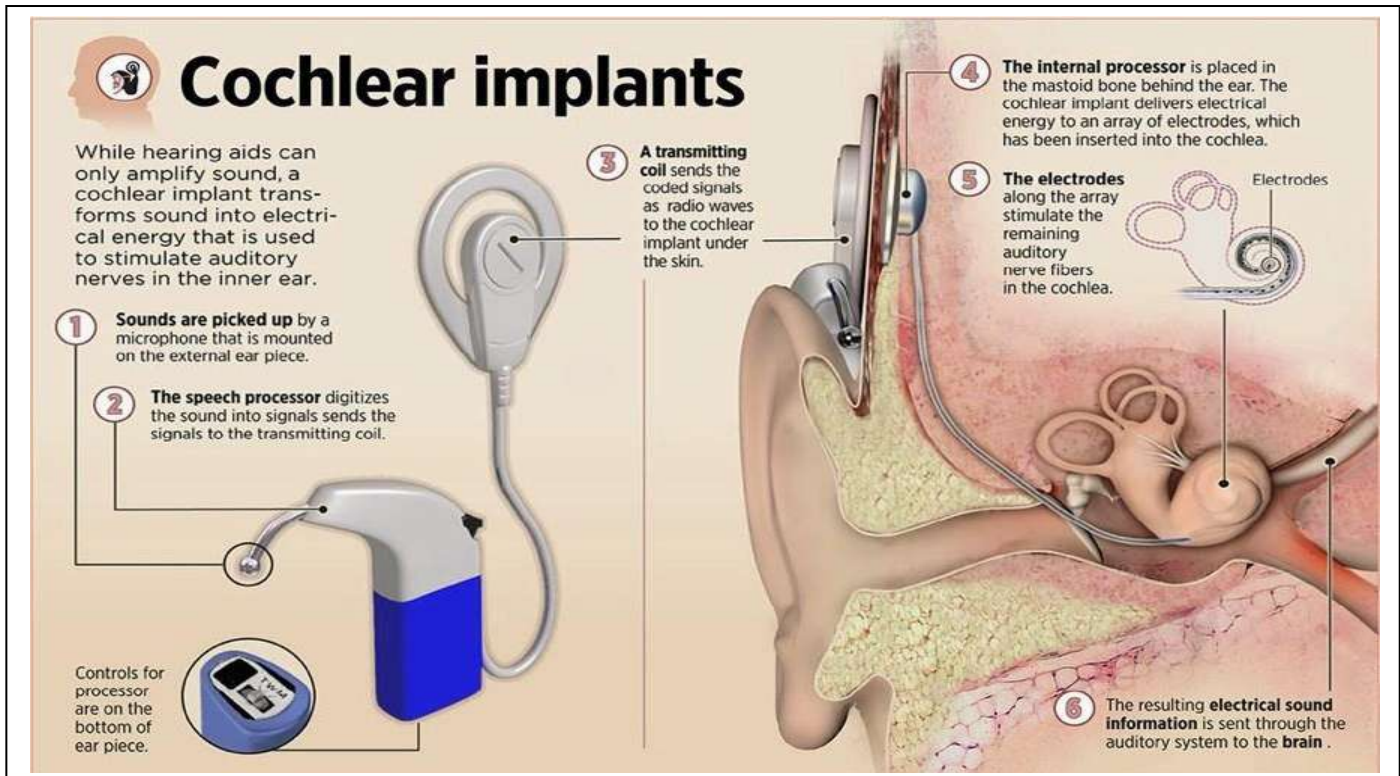
- The World Health Organisation (WHO) is set to classify gaming disorder as a mental health condition in its forthcoming **11th International Classification of Diseases (ICD)**.
- Mental health experts and psychiatrists believe **that internet and gaming addiction has become emerging psychological malady** and it is likely to be major mental health problem in the coming years.
- The new ICD-11 entry on gaming disorder “includes only a clinical description and not prevention and treatment options.”
- **What is gaming disorder?**
  - The WHO defines the disorder as a “persistent or recurrent” behavior pattern of “sufficient severity to result in significant impairment in personal, family, social, educational, occupational or other important areas of functioning.”
  - The disorder is characterized by “**impaired control**” with **increasing priority given to gaming** and “escalation,” despite “negative consequences.”
- **About International Classification of Diseases:**
  - ICD is the basis for **identification of health trends and statistics globally** and the international standard for reporting diseases and health conditions.
  - It is used by medical practitioners around the world to diagnose conditions and by researchers to categorize conditions.
  - The WHO’s ICD lists both **mental and physical disorders**.
  - This comprehensive list is intended to make it easier for scientists to share and compare health information between hospitals, regions and countries.
  - Additionally, public health experts use the ICD to track the number of deaths and diseases.

**18.Cochlear Implant Surgery**

- CSR Summit for Pioneering Cochlear Implant Surgery under CSR initiative of Airport Authority of India (AAI) through Artificial Limbs Manufacturing Corporation of India (ALIMCO) was recently inaugurated.
- **Cochlear Implant is an electronic device** having two parts (External and Internal).
- Internal part is surgically implanted in the skull (Cochlear) by ENT surgeons.



- Post-operative rehabilitation is undertaken by Audiologist and speech language pathologist and special educator of Hearing Impaired.
- Parent have very important role in stimulating child to learn speech and language at home and maintain the external part (Processor).
- **The cochlear implant technology may help children who:**
  - Have severe to profound hearing loss in both ears.
  - Receive little or no benefit from hearing aids.
  - No Development Delay or Mental Retardation.



### 19. China's First Solar Highway

- China has constructed the country's first solar highway, in which **solar panels are placed underneath transparent concrete.**
- The expressway can handle 10 times more pressure than the normal asphalt variety and in a year generate 1 million kWh of electricity.
- China has become the second country to construct a photovoltaic highway. France introduced the world's first photovoltaic road fitted with solar panels in late 2016.