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Part 2

ENVIRONMENT and S&T

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RAPID REVISION (RaRe) SERIES - UPSC 2021

RaRe Notes

DAY 61 - ENVIRONMENT and S&T

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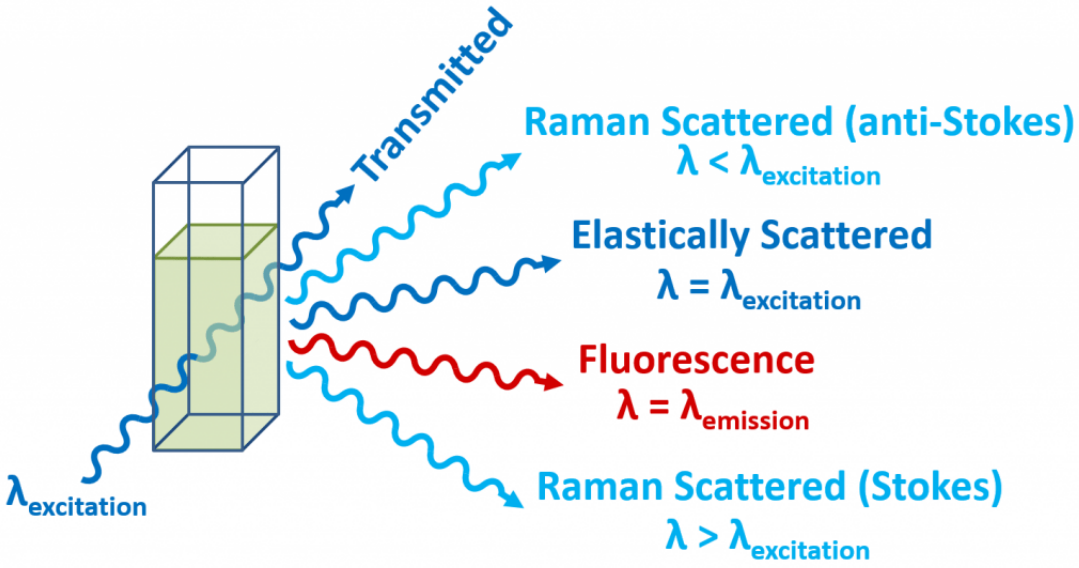
441. Raman Scattering

- **In News:** Researchers at IIT Madras have demonstrated that by using **Raman thermometry** on **fiber optic cables**, they can achieve monitoring of power transmission cables



About Raman Scattering

- It is a light scattering technique, whereby **a molecule scatters incident light from a high intensity laser light source.**
- Most of the scattered light is at the same wavelength (or color) as the laser source and does not provide useful information – this is called **Rayleigh Scatter**.
- However a small amount of light (typically 0.0000001%) is scattered at different wavelengths (or colors), which depend on the chemical structure of the analyte – this is called **Raman Scatter.**

Applications

- Raman spectroscopy is used in many varied fields – in fact, any application where non-destructive, microscopic, chemical analysis and imaging is required.
- Whether the goal is qualitative or quantitative data, Raman analysis can provide key information easily and quickly.
- It can be used to rapidly characterize the chemical composition and structure of a sample, whether solid, liquid, gas, gel, slurry or powder.

Raman thermometry:

- The lower frequency component of Raman scattering is strongly dependent on the **temperature that the material is subjected to.**
- Thus, by measuring the intensity of the lower frequency scattered light we can **estimate the temperature.** This is Raman thermometry.

442. Optical Tweezers

- **Optical tweezers** are originally called **single-beam gradient force trap.**
- They use a highly focused laser beam to hold and move microscopic and sub-microscopic objects like atoms, nanoparticles and droplets, in a manner similar to tweezers.
- Optical tweezers are a better technique for catching and organizing atoms.

- The 2018 Nobel prize was awarded "for ground breaking inventions in the field of laser physics" with one half to Arthur Ashkin "for the optical tweezers and their application to biological systems", the other half jointly to Gérard Mourou and Donna Strickland "for their method of generating high-intensity, ultrashort optical pulses."

The basic principle behind optical tweezers is the momentum transfer.

- Light carries momentum that is proportional to its energy and in the direction of propagation.
- Any change in the direction of light, by reflection or refraction, will result in a change of the momentum of the light.
- If an object bends the light, changing its momentum, conservation of momentum requires that the object must undergo an equal and opposite momentum change.
- This gives rise to a force acting on the object.

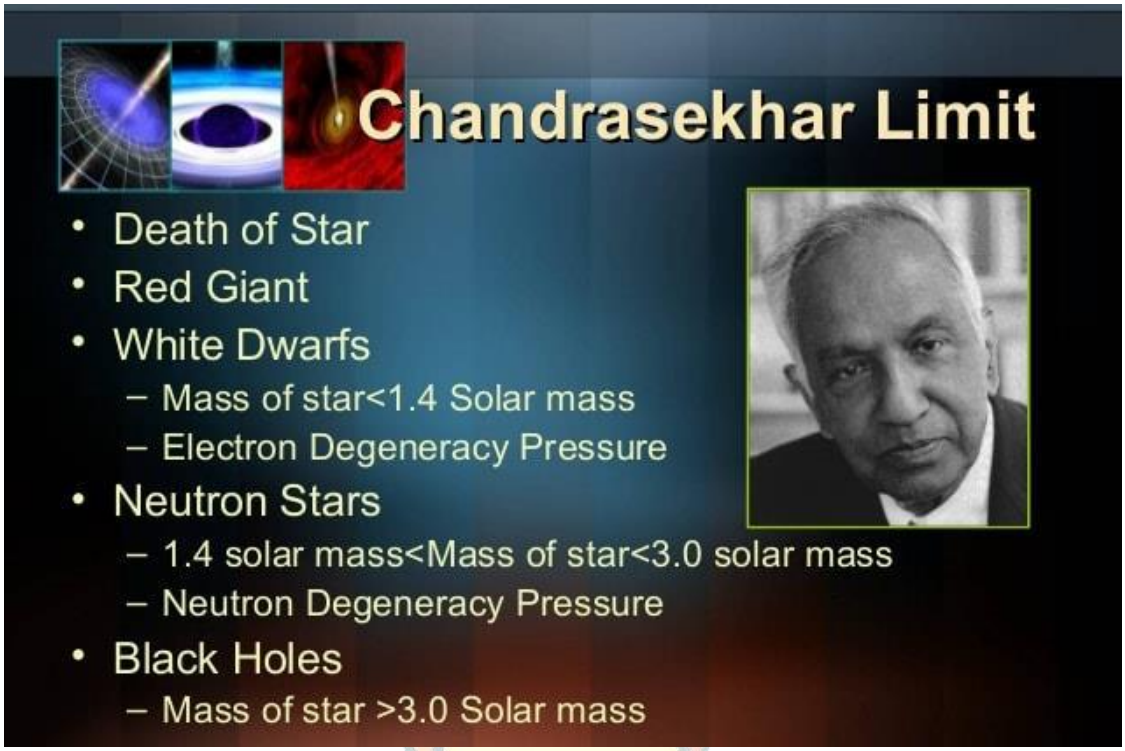
Applications of Optical Tweezers

- Optical tweezers have been used to trap dielectric spheres, viruses, bacteria, living cells, organelles, small metal particles, and even strands of DNA, without damaging them.
- Other Applications include:
  - Confinement and organization (e.g. For cell sorting).
  - Tracking of movement (e.g. Of bacteria).
  - Application and measurement of small forces.
  - Altering of larger structures (such as cell membranes).
- Two of the main uses for optical traps have been the study of molecular motors and the physical properties of DNA.
- However, optical tweezers are only able to manipulate very small objects and only at very short distances.

Optical Levitation

- If the object is held in air or vacuum without additional support, it can be called **optical levitation**.
- Levitation is possible if the **force of the light counters the force of gravity.**
- The laser light provides an attractive or repulsive force.

443. Chandrashekar Limit



- Chandrasekhar limit is established at a point when the mass at which the **pressure from the degeneration of electrons** is not able to balance the self-attraction of the gravitational field.
- The **Chandrasekhar limit** is the maximum mass of a stable white dwarf star.
  - Or equivalently, the limit is the minimum mass that must be exceeded for a star to collapse into a neutron star or black hole (following a supernova)
- The currently accepted value of the Chandrasekhar limit is about 1.4 times the mass of Sun. [Chandrasekhar limit is 2.765×10^{30} kg]
- The limit is named after the **Nobel laureate Subrahmanyan Chandrasekhar,** who first proposed the idea in 1931. He was awarded the **Nobel Prize in Physics in 1983 for his work on the physical processes involved in the structure and evolution of stars.**

444. Dark Matter & Dark Energy

- **Dark matter** is a hypothetical form of matter thought to account for approximately 85% of the matter in the universe
- The Dark matter is called dark because it does not appear to interact with the electromagnetic field,
- Which means it does not absorb, reflect or emit electromagnetic radiation, and is therefore difficult to detect.
- Primary evidence for it is the fact that many galaxies would fly apart, or that they would not have formed or would not move as they do**, if they did not contain a large amount of unseen matter.**
- Other lines of evidence include observations in **gravitational lensing.**

About Dark Energy

- In physical cosmology and astronomy, **dark energy** is an unknown form of energy that affects the universe on the largest scales.

- The first observational evidence for its existence came from the fact that the universe does not expand at a constant rate; rather, the **expansion of the universe is accelerating.**
- The best current measurements indicate that dark energy **contributes 68% of the total** energy in the present-day observable universe.

445. Anti-Matter

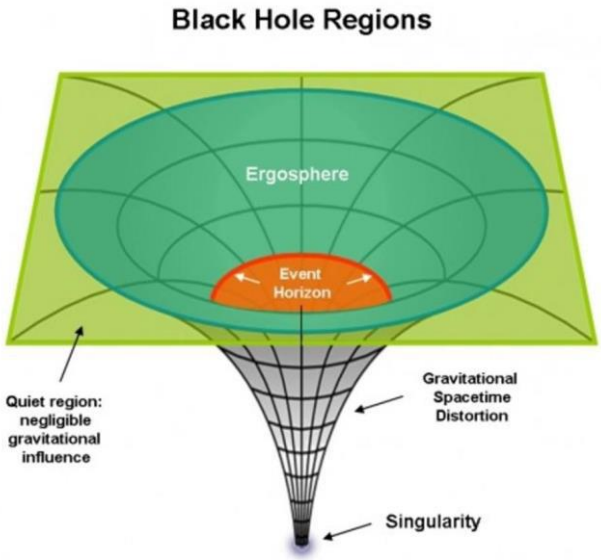
Anti-Matter

- **Antimatter** is defined as matter that is composed of the antiparticles of the "ordinary" matter.
- For example, a **positron** (the antiparticle of the electron) and an **antiproton** (the antiparticle of the proton) can form an antihydrogen atom.
- **Minuscule numbers of antiparticles** are generated daily at cosmic ray collisions and some types of radioactive decay
- But only a tiny fraction of these have successfully been bound together in experiments to form anti-atoms.
- **No macroscopic amount** of antimatter has ever been assembled due to the extreme cost and difficulty of production and handling it.
- A collision between any particle and its anti-particle partner **leads to their mutual annihilation**, giving rise to various proportions of intense photons (gamma rays), neutrinos, and sometimes less-massive particle–antiparticle pairs.

446. Black Holes and Theory of Relativity

Black Holes

- It refers to a point in space where the **matter is so compressed as to create a gravity field from which even light cannot escape.**
- The concept was **theorized by Albert Einstein in 1915** and the term 'black hole' was coined in the mid-1960s by American physicist John Archibald Wheeler.
- Usually, the black holes **belong to two categories:**
    - One category **ranges between a few solar masses and tens of solar masses.** These are thought to form when massive stars die.
    - The other category is of **supermassive black holes.** These range from **hundreds of thousands to billions of times that of the sun** from the Solar system to which Earth belongs.
- In April 2019, the scientists at the Event Horizon Telescope Project released the first-ever image of a Black Hole (more precisely, of its shadow).
    - The Event Horizon Telescope is a group of 8 radio telescopes (used to detect radio waves from space) located in different parts of the world.
- Gravitational waves are created when two black holes orbit each other and merge.



Theory of Relativity

- According to **Einstein's Theory of Relativity,** space-time is like a trampoline.
- Suppose, a large body of mass stays at the center of it. The large mass causes the **matter to press down.** As a result, it causes a dimple.
- So, if you roll a marble towards it, the marble gets sucked inside.
- Stephen Hawking later stated that light can probably pass through what he once defined as a **point-of-no-return void** and that black holes can leak **"information" in the form of matter.**

447. India-based Neutrino Observatory

- **In News:** An India based Neutrino Observatory (INO) is going to be set up in Bodi West Hills, in Theni district, Tamil Nadu.

About

- INO Project is aimed at building a **world-class underground laboratory** with a rock cover to conduct basic research on neutrino.
- The Tata Institute of Fundamental Research is the nodal institution. The observatory is to be built jointly with the **Department of Atomic Energy** and **the Department of Science and Technology.**
- The observatory will be located underground so as to provide adequate **shielding to the neutrino detector from cosmic background radiation**.
- The operation of INO will have **no release of radioactive or toxic substances**. It is not a weapons laboratory and will have no strategic or defence applications.

Applications

- Neutrinos, which travel close to the speed of light, are produced in the core of the sun. Studying these neutrinos can help us understand what goes on in the interior of the sun.
- Light coming from distant stars can be studied by astronomers, for example, to detect new planets. Likewise, if the properties of neutrinos are understood better, they can be used in astronomy to discover what the universe is made up of
- Neutrinos interact very little with the matter around them, so they travel long distances uninterrupted. These undamaged messengers can give us a clue about the origin of the universe and the early stages of the infant universe, soon after the Big Bang.

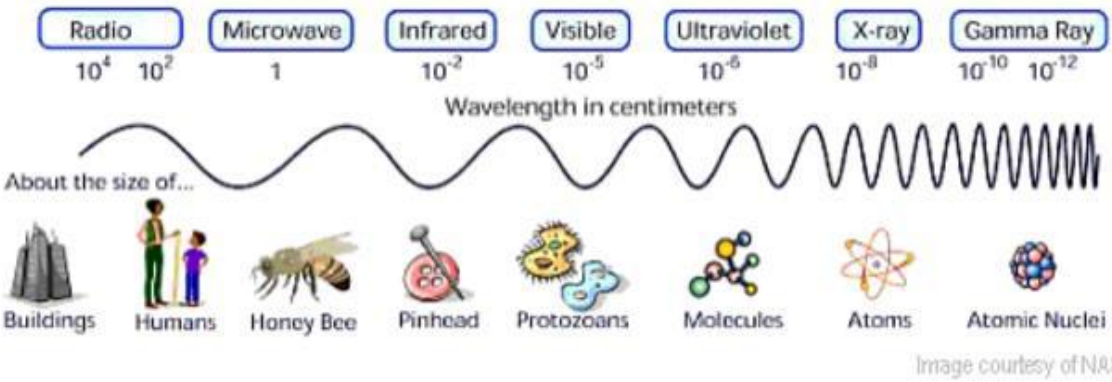
- X-ray machines, MRI scans, etc., all came out of research into particle detectors. Hence the INO detectors may have applications in medical imaging.

About Neutrinos

- Neutrinos are **subatomic fundamental particles,** with **no charge and little or zero mass** that interacts only via the weak subatomic force and gravity.
- Detected for the first time in 1959, neutrinos are the **second most abundant particles** in the world (about a billion of them pass through a cubic centimeter of space every second), after photons, or the light particle.
- Neutrinos are created by various radioactive decays; during a supernova, by cosmic rays striking atoms etc.
- They belong to **the lepton family**
- They are not affected by the electromagnetic forces which act on electrons.
- Three Types of Neutrinos
  1. "Electron neutrino"
  2. "Muon neutrino"
  3. "Tau neutrino"
- In 2015, the Nobel prize in physics was awarded to Takaaki Kajita and Arthur B. Mcdonald for discovering neutrino oscillations demonstrating that **neutrinos have mass.**
- Neutrinos are the least harmful of all elementary particles, as they almost never react with solid bodies.
- A neutrino is about **17 billion times lighter than a neutron**. The two are incomparable.

448. UV-C technology

In News: Ultraviolet-C or UV-C Disinfection Technology will soon be installed in Parliament for the "mitigation of airborne transmission of SARS-COV-2''.



About UV radiation

- UV radiation is the portion of the Electromagnetic spectrum between X-rays and visible light.
- The most common form of UV radiation is sunlight, which produces three main types of UV rays: UVA, UVB and UVC.
- UVA rays have the longest wavelengths, followed by UVB, and UVC rays which have the shortest wavelengths.
- While UVA and UVB rays are transmitted through the atmosphere, all UVC and some UVB rays are absorbed by the Earth's ozone layer.
- So, most of the UV rays you come in contact with are UVA with a small amount of UVB.

How is it being used?

- UV radiations are normally used to **kill microorganisms.**
- Particularly, UV-C, also known as Ultraviolet germicidal irradiation (UVGI) is a disinfection method that uses short-wavelength ultraviolet light to kill or inactivate microorganisms by **destroying their nucleic acids and disrupting their DNA**, leaving them unable to perform vital cellular functions and stops their replication.
- UVGI is **used in a variety of applications**, such as food, air, and water disinfection.
- UVC lamps used for disinfection purposes may pose **potential health and safety risks** depending on the UVC wavelength, dose, and duration of radiation exposure.
    - Direct exposure of skin and eyes to UVC radiation from some UVC lamps may cause painful eye injury and burn-like skin reactions.
    - Some **UVC lamps generate ozone.** Ozone inhalation can be irritating to the airway.
    - However, studies have shown that **far-UVC light (207–222 nm) does not harm** mammalian skin as they have a very limited range and cannot penetrate through the outer dead-cell layer of human skin

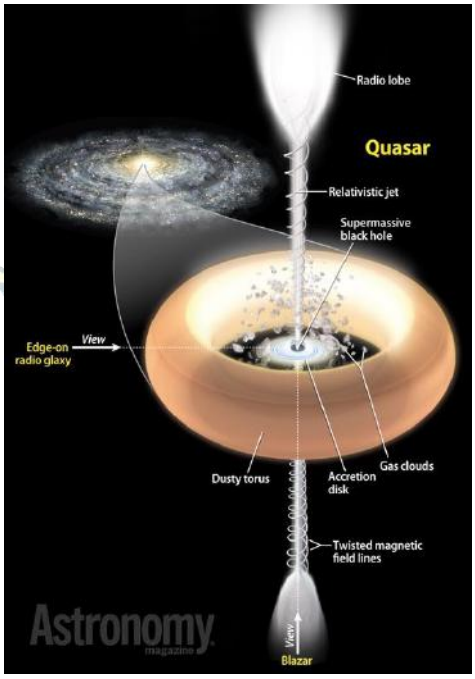
About the UV-C air duct disinfection system

- Developed by CSIR-CSIO (Central Scientific Instruments Organisation).
- The system is designed to fit into any existing air-ducts and the UV-C intensity can be calibrated according to the existing space.
- The virus will get deactivated in any aerosol particles by the calibrated levels of UV-C light.
- It can be used in auditoriums, malls, educational Institutions, AC buses, and in railways.

449. Quasars & Pulsars

About Quasars:

- The word *quasar* stands for *quasi-stellar radio source*.
- Quasars got that name because they looked starlike when astronomers first began to notice them in the late 1950s and early 60s. But quasars aren't stars.
- Quasars are an astronomical object of very high luminosity **found in the centres of some galaxies** and powered by gas spiraling at high velocity into an extremely large black hole.
    - They're now known as young galaxies, **located at vast distances from us**, with their numbers increasing towards the edge of the visible universe.



How can they be so far away and yet still visible?

- The answer is that quasars are extremely bright, up to **1,000 times brighter than our Milky Way galaxy.** They are highly active, emitting staggering amounts of radiation across the entire electromagnetic spectrum
- The intense radiation released by Quasar is thought to be powered by a **supermassive black hole at its center.**
- The radiation is emitted when material in the accretion disk surrounding the black hole is superheated to millions of degrees by the intense friction generated by the particles of dust, gas and other matter in the disk colliding countless times with each other.

- As matter in a quasar/black hole's accretion disk heats up, it generates radio waves, X-rays, ultraviolet and visible light. The quasar becomes so bright that it's able to outshine entire galaxies.
- Quasars are so far from us that we only observe the active nucleus, or core, of the galaxy in which they reside. We see nothing of the galaxy apart from its bright center. It's like seeing a distant car headlight at night: you have no idea of which type of car you are looking at, as everything apart from the headlight is in darkness.
    - On the other hand, there are galaxies which are *not* classed as quasars but that still have bright, active centers where we *can* see the rest of the galaxy.

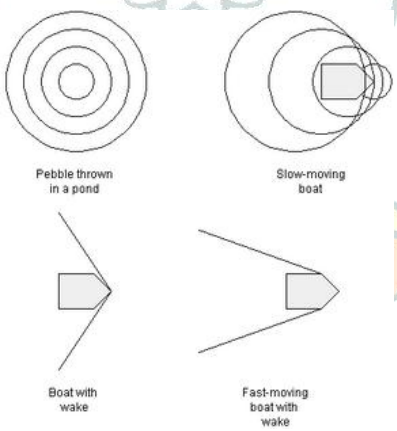
Pulsars

- A **pulsar** or **Pulsa**ting **R**adio Sources is a highly magnetized rotating compact star that emits beams of electromagnetic radiation out of its magnetic poles.
- They are usually **neutron stars** but may also be white dwarfs.
- This radiation can be observed only when a beam of emission is pointing toward Earth and is responsible for the **pulsed appearance of emission.**
- This produces a very precise interval between pulses that ranges from **milliseconds to seconds** for an individual pulsar.

450. Sonic Boom

About Supersonic:

- Supersonic speed is the rate of travel which exceeds the speed of sound, also referred to as **Mach 1 speed (1234.8km/hour or 343 m/s)**
- Since the speed of sound depends on temperature and composition of air, supersonic speed also **varies with changing altitudes.**



Sonic Boom

- Sound travels in the form of waves which are emitted outwards from its source
- From a stationary source, such as a television set, sound waves travel outwards in concentric spheres of growing radii.
- When the source of sound is moving – e.g, a truck, plane– the successive waves in front of the truck get closer together, and the ones behind it spread out (see above figure)
- As long as the source of the sound keeps moving slower than the speed of sound itself, this source– say a truck or a plane – remains nested within the sound waves that are travelling in all directions.
- When an aircraft travels at supersonic speed – meaning faster than sound (>1225 kmph at sea level) – the field of sound waves moves to the rear of the craft

- A stationary observer thus hears no sound when a supersonic flight approaches, since the sound waves are at the rear of the latter.
- At such speeds, both newly created as well as old waves, are forced into a region at the aircraft's rear called a 'Mach cone', which extends from the craft and intercepts the Earth in a hyperbola-shaped curve and leaves a trail called the 'boom carpet'. The loud sound that is heard on the Earth when this happens is called a 'sonic boom'.
- Sonic booms generate enormous amounts of sound energy, sounding similar to an explosion or a thunderclap to the human ear
- When such aircraft fly at a low altitude, the sonic boom can become intense enough to cause glass to crack or cause health hazards.
- The crack of a supersonic bullet passing overhead or the crack of a bullwhip are examples of a sonic boom in miniature

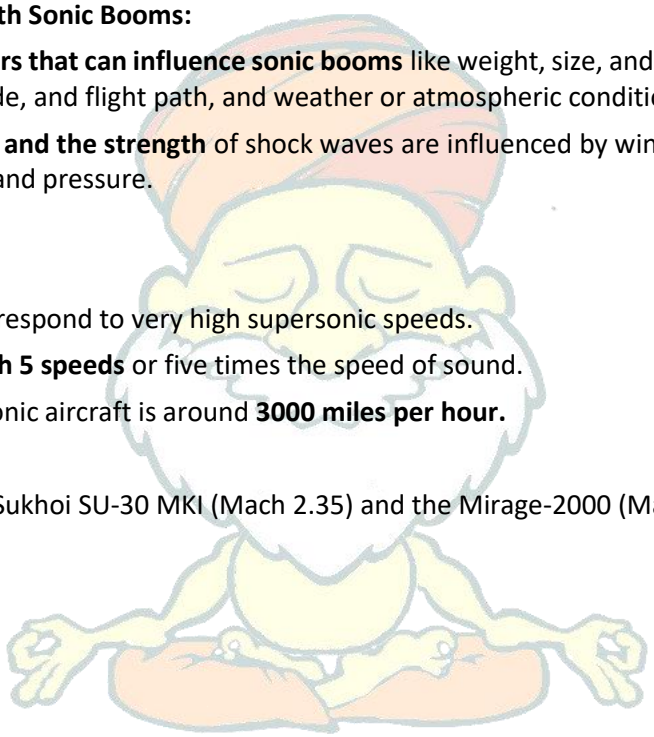
General Factors Associated with Sonic Booms:

- There are several **factors that can influence sonic booms** like weight, size, and shape of the aircraft or vehicle, plus its altitude, attitude, and flight path, and weather or atmospheric conditions.
- The **direction of travel and the strength** of shock waves are influenced by wind, speed, and direction, as well as by air temperature and pressure.

Hypersonic speed

- Hypersonic speeds correspond to very high supersonic speeds.
- They are basically **Mach 5 speeds** or five times the speed of sound.
- The speed of a hypersonic aircraft is around **3000 miles per hour.**

India's fastest jets include the Sukhoi SU-30 MKI (Mach 2.35) and the Mirage-2000 (Mach 2.3).



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DAY 68 - ENVIRONMENT and S&T

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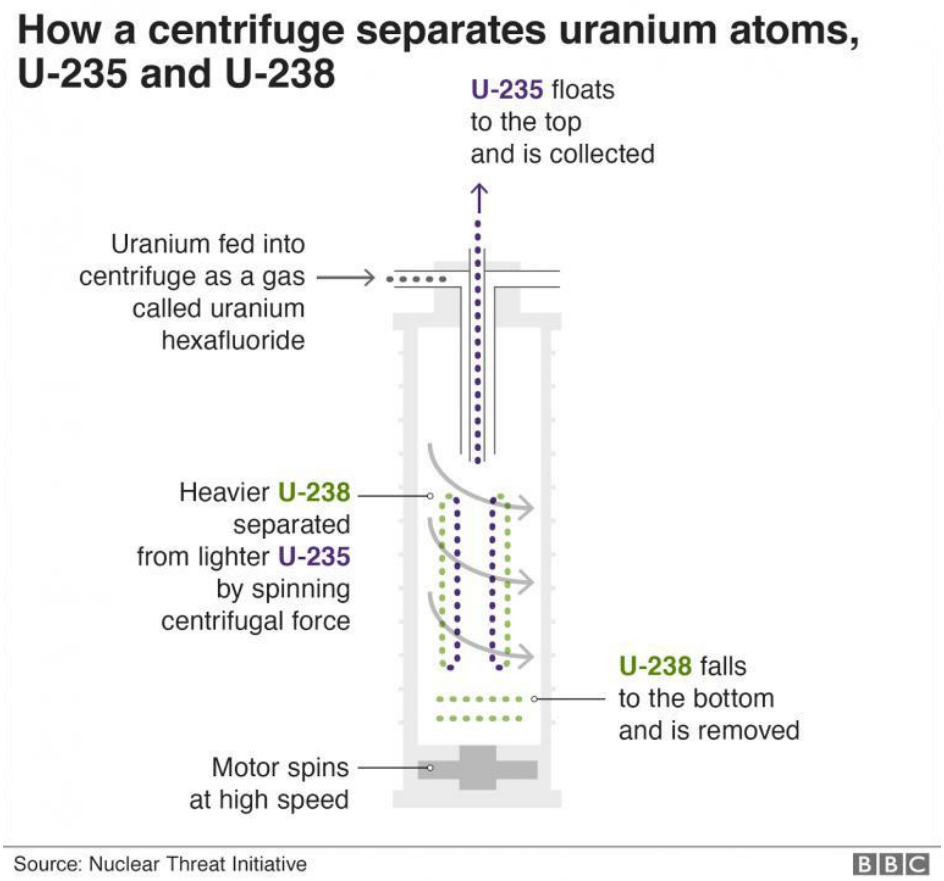
491. Nuclear Enrichment

- **In New:** Recently, Iran has **resumed enriching uranium up to 20%** in **violation of the 2015 nuclear deal**

Uranium Enrichment:

- Natural uranium consists of two different isotopes –
  - nearly 99% U-238
  - only around 0.7% of U-235.
- U-235 is a fissile material that can sustain a chain reaction in a nuclear reactor.
- Enrichment process increases the proportion of U-235 through the process of isotope separation (U-238 is separated from U-235).
- For nuclear weapons, enrichment is required upto 90% or more which is known as Highly Enriched Uranium/**weapons-grade uranium.**
- For nuclear reactors, enrichment is required upto 3-4% which is known as Low Enriched Uranium/**reactor-grade uranium.**
- Enrichment is often done through the use of centrifuges — machines that spin a form of unrefined uranium at high speeds.



492. Polymetallic nodules

- Polymetallic nodules, also commonly known as manganese nodules
- They are potato-shaped, largely porous nodules found in the sea floor.
- Besides manganese and iron, they contain nickel, copper, cobalt, lead etc

Significance of Polymetallic Nodules:

- They contain Rare Earth Elements and metals.
- The amount of copper contained in the nodules is estimated to be about 20% of that held in global land-based reserves.
- These are the great source of valuable minerals such as gold, silver and zinc.

India and Polymetallic Nodules:

- India is the first country to have received the UN permission for exploration and utilization of nodules in Central Indian Ocean Basin (CIOB).
- India had signed a 15-year contract for exploration of Polymetallic Nodules in CIOB with the International Seabed Authority in 2002.
- In 2016, India got extension of this contract up to 2022.

United Nations Convention on the Law of the Sea (UNCLOS)

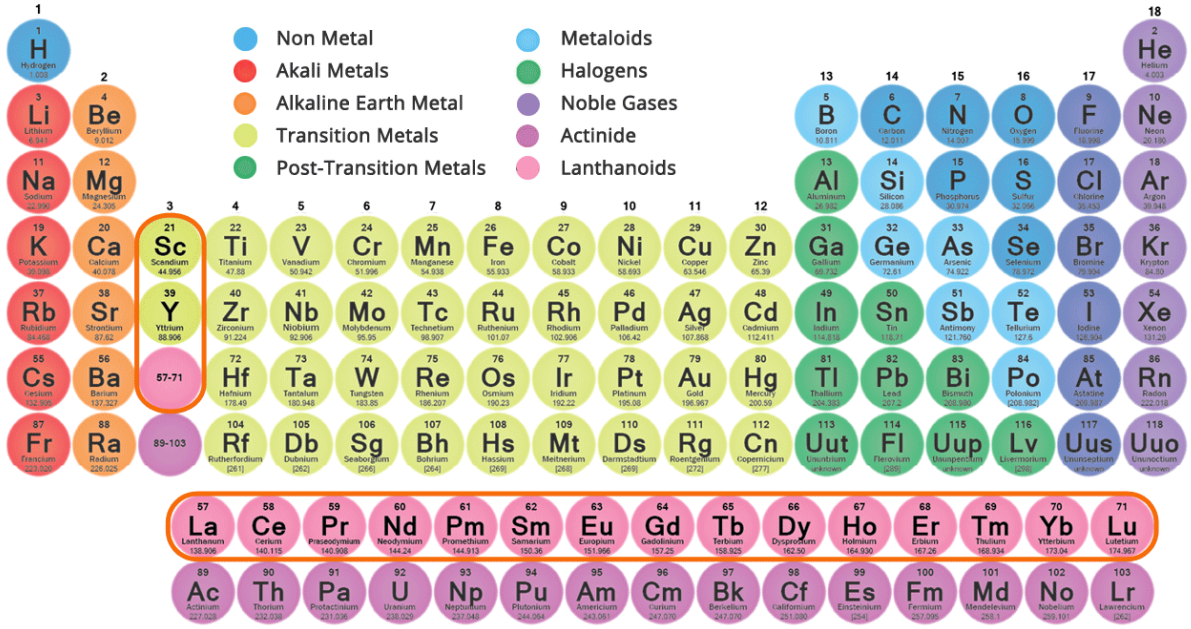
- The 'Law of the Sea Treaty', formally known as United Nations Convention on the Laws of the Sea (UNCLOS) was adopted in 1982 to establish jurisdictional limits over the ocean areas.
- The convention defines distance of 12 nautical miles from the baseline as Territorial Sea limit and a distance of 200 nautical miles distance as Exclusive Economic Zone limit.
- It provides for technology and wealth transfer from developed to underdeveloped nations and requires parties to implement regulations and laws to control marine pollution.
- India became a signatory to the UNCLOS in 1982.

UNCLOS created **three new** institutions:

- **International Tribunal for the Law of the Sea**- It is an independent judicial body established by UNCLOS to adjudicate disputes arising out of the convention.
- **International Seabed Authority**- It is a UN body set up to regulate the exploration and exploitation of marine non-living resources of oceans in international waters.
- **Commission on the Limits of the Continental Shelf-** It facilitates the implementation of the United Nations Convention on the Law of the Sea (the Convention) in respect of the establishment of the outer limits of the continental shelf beyond 200 nautical miles.

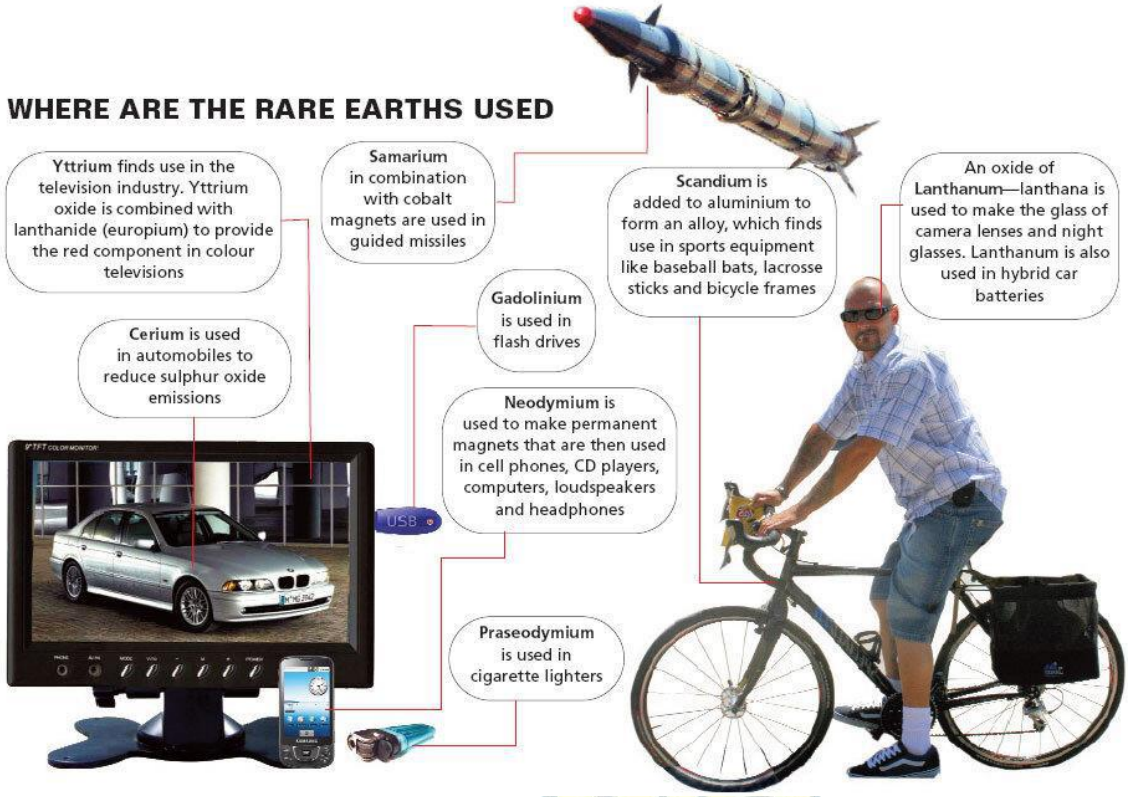
493. Rare Earth Metals

- As defined by IUPAC, rare earth minerals are a set of seventeen chemical elements in the periodic table, specifically the fifteen lanthanides, as well as scandium and yttrium.
    - International Union of Pure and Applied Chemistry (IUPAC) is a member of the International Council for Science. It is an international federation of National Adhering Organizations that represents chemists in individual countries.



About rare earth elements:

- The **rare-earth elements**, or the **lanthanides** are a set of 17 nearly-indistinguishable lustrous silvery-white soft heavy metals.
- Despite their name, rare-earth elements are **relatively plentiful in Earth's crust.**
    - These metals are called rare because of the difficulties involved in extracting metals from the ore. The rare earth metals rarely occur in pure form. The costs involved in mining the rare earth metals is very high.
- **Scandium and yttrium** are considered rare-earth elements because they tend to occur in the same ore deposits as the lanthanides and exhibit similar chemical properties.
- In pure form, these metals **tarnish slowly** in air at room temperature.
- They **react slowly with cold water** to form hydroxides, liberating hydrogen.
- They **react with steam to form oxides**, and at elevated temperature ignite spontaneously and burn with a fierce colorful flame.
- The water-soluble compounds are **mildly to moderately toxic**, but the insoluble ones are not.
- Because of their **unique magnetic, luminescent, and electrochemical properties,** these elements help make many technologies perform with reduced weight, reduced emissions, and energy consumption; or give them greater efficiency, performance, miniaturization, speed, durability, and thermal stability.
- The rare earths have diverse applications in electrical and electronic components, lasers, glass, magnetic materials, and industrial processes
- China has the rarest Earth Minerals at 44 million Metric Tons (MT). Brazil and Vietnam have the next highest reserves of Rare Earth Minerals at 22 million MT. Russian has 12 million MT, India has 6.9 million MT of Rare Earth Minerals. The other leading nations with high Rare Earth Mineral reserves are Australia (3.4 million MT) and the United States (1.4 million MT).



494. Acute encephalitis syndrome (AES)

- **Acute encephalitis syndrome** (AES) is a serious public health problem in India that is characterized as acute-onset of fever and a change in mental status (mental confusion, disorientation, delirium, or coma) and/or new-onset of seizures in a person of any age at any time of the year.
- The disease most commonly affects children and young adults and can lead to considerable morbidity and mortality.
- Viruses are the main causative agents in AES cases, although other sources such as bacteria, fungus, parasites, spirochetes, chemicals, toxins and non-infectious agents have also been reported over the past few decades.
- Japanese encephalitis virus (JEV) is the major cause of AES in India (ranging from 5%-35%).Herpes simplex virus, Influenza A virus, West Nile virus, Chandipura virus, mumps, measles, dengue, Parvovirus B4, enteroviruses, Epstein-Barr virus and scrub typhus, S.pneumoniae are the other causes of AES in sporadic and outbreak form in India. Nipah virus, Zika virus are also found as causative agents for AES. The etiology in a large number of AES cases still remains unidentified.
- **Symptoms:** include confusion, disorientation, coma, or inability to talk, high fever, vomiting, nausea, and unconsciousness.
- **Diagnosis: The National Vector Borne Disease Control Programme** in India has set up countrywide surveillance for AES through sentinel sites with a focus on detecting Japanese encephalitis (JEV).
    - In the sentinel surveillance network, AES/JE is diagnosed by **IgM Capture ELISA,** and **virus isolation** is done in the National Reference Laboratory.

495. Glyphosate

- The Glyphosate is a controversial **herbicide** usually use to kill weeds in cotton farms.
    - Glyphosate is absorbed through foliage (plant leaves). It is minimally absorbed by roots.
- The usage of Glyphosate is banned because it is **carcinogenic**.

  - In 2015, World Health Organisation classified Glyphosate under Category 2A, that is, a "Probably Carcinogenic in Humans".
- Also, it is being banned to **control the illegal cultivation of HTBt cotton.**
  - Reports suggest that about 8-10 lakh acres are under HTBt cotton that has not got the permission for commercial use.
  - The ban on herbicide Glyphosate is seen as a move to indirectly stop cultivation of HTBt cotton.

Why do farmers prefer HTBt cotton:?

- A normal cotton grower spends 20% to 25% of expenditure in removing weeds.
- The HTBt cotton will help growers avoid expenditure on removing weeds as spraying of **glyphosate will help kill the weeds even as the HTBt cotton plant remains unaffected**.
- Farmers began planting HTBt cotton in 2019 and it gained momentum last year. This year, at least 50 per cent of the area under cotton could be under the illegal variety.

Reason for ban of HTBt Cotton:

- The **Genetic Appraisal Engineering Committee (GEAC)** has not yet approved HTBt cotton.
  - In India, the only genetically-modified (GM) crop approved for cultivation is cotton (Bt Cotton). Since 2006, no new GM variety, including cotton, has been approved by the GEAC the nodal agency to clear GM crops in the country.
- The Glyphosate leaches into food and water and causes chronic **kidney diseases** in humans.
- The Glyphosate is also used as **Crop Desiccant**. The crop desiccants kill out leaves/plants allowing the plants to dry.

496. Dicofol and Perfluorooctanoic acid(PFOA)

Dicofol

- **Dicofol** is an **organochlorine pesticide** that is chemically related to DDT.
- WHO classifies dicofol as a Level II, **"moderately hazardous" pesticide**.
- It is used as Foliar spray on agricultural crops and ornamentals, and in and domestic buildings for mite control.
- Dicofol is a **nerve poison**. It causes hyper stimulation of nerve transmission along nerve axons. This effect is thought to be related to the inhibition of certain enzymes in the central nervous system.
- Symptoms of ingestion and/or respiratory exposure include **nausea, dizziness, weakness and vomiting.**
- Dermal exposure may cause **skin irritation** or a rash; and eye contact may cause **conjunctivitis.**
- Poisoning may affect the liver, kidneys or the central nervous system.
- Dicofol can be **stored in fatty tissue.** Intense activity or starvation may mobilize the chemical, resulting in the reappearance of toxic symptoms long after actual exposure.

Perfluorooctanoic Acid (PFOA)

- PFOA also known colloquially as C8 — is a perfluorinated carboxylic acid produced and used worldwide as an industrial surfactant in chemical processes.
- It is a **water and oil repellent** in fabrics and leather and in the production of floor waxes and waxed papers;
- The compound is also used in "**insulators for electric wires, planar etching of fused silica**", fire-fighting foam, and outdoor clothing.
- PFOA has been detected in the blood of more than **98% of the general US population.**
- PFOA has been detected in industrial waste, stain-resistant carpets, carpet-cleaning liquids, house dust, microwave popcorn bags, water, food, and Teflon (PTFE) products.
- **Effects on health:** Kidney cancer, testicular cancer, ulcerative colitis, thyroid disease, hypercholesterolemia (high cholesterol), and pregnancy-induced hypertension.

497. CFC, HFC, PFC - Kigali Agreement

Kigali Agreement

- In the 28th meeting of the Parties to the Montreal Protocol, negotiators from 197 nations have signed a historic agreement to amend the Montreal Protocol in Kigali, a capital city of a tiny African country, Rwanda on 15th October 2016.
- Kigali agreement is an **amendment to Montreal Protocol.**
    - Montreal Protocol, came into force in 1989, to phase out the Ozone Depleting Substances (ODSs) like **Chlorofluorocarbons (CFC)** from the atmosphere.
    - **CFCs** are released by solvents, spray aerosols, refrigerators, air-conditioners, etc. The molecules of chlorofluorocarbons in the stratosphere are broken down by the ultraviolet radiations and release chlorine atoms. These atoms react with ozone and destroy it
    - Montreal Protocol has successfully curbed the 98% production of chlorofluorocarbons and other ODSs and significantly contributed to the **repair of the ozone hole.**
- As per Kigali agreement, these countries are expected to reduce the manufacture and use of **Hydrofluorocarbons (HFCs)** by roughly 80-85% from their respective baselines, till 2045.
- Kigali Agreement is a **legally binding agreement** between the signatory parties with non-compliance measures.
- It has divided the signatory parties into three groups-
    - **The first group** consists of rich and developed economies like USA, UK and EU countries who will start to phase down HFCs by 2019 and reduce it to 15% of 2012 levels by 2036.
    - **The second group** consists of emerging economies like China, Brazil as well as some African countries who will start phase down by 2024 and reduce it to 20% of 2021 levels by 2045.
    - **The third group** consists of developing economies and some of the hottest climatic countries like India, Pakistan, Iran, Saudi Arabia who will start phasing down HFCs by 2028 and reduce it to 15% of 2024-2026 levels till 2047.
- This phase down is expected to arrest the global average temperature rise up to 0.5° C by 2100.

What are Hydrofluorocarbons (HFCs)?

- Hydrofluorocarbons are organic compounds containing hydrogen, Carbon, and fluorine.
- They are commonly used as **substitutes for** Ozone depleting substances like Chlorofluorocarbons (CFCs) and are used in refrigerators and air-conditioners.
- **Under normal conditions, HCFCs are gases or liquids** which evaporate easily. They are generally fairly stable and unreactive.
- HCFCs **do not usually dissolve in water, but do dissolve in organic (carbon-containing) solvents.**
- They are similar to **Hydrobromofluorocarbons** (HBFCs), **Chlorofluorocarbons** (CFCs) and **Halons** and therefore display some similar properties, though they are much less stable and persistent.
- HCFCs are also part of a group of chemicals known as **the volatile organic compounds (VOCs).**
- As VOCs, they may be slightly involved in reactions to produce ozone, which can cause damage to plants and materials on a local scale.
- At a global level however, releases of HCFCs have serious environmental consequences. Although not as stable and therefore not so persistent in the atmosphere as CFCs, HBFCs or Halons, they can still end up in the higher atmosphere (stratosphere) where they can **destroy the ozone layer**, thus reducing the protection it offers the earth from the sun's harmful UV rays.
- HCFCs also contribute to **Global Warming** (through "the Greenhouse Effect"). Although the amounts emitted are relatively small, they have a powerful warming effect (a very high "Global Warming Potential").

Perfluorocarbon, the breathable fluid

- Fluorocarbons, sometimes referred to as perfluorocarbons or PFCs, are organofluorine compounds with the formula CxFy, i.e., they contain only carbon and fluorine.
- Fluorocarbons and their derivatives (perfluorinated compounds) are used as fluoropolymers, refrigerants, solvents, and anesthetics.
- Perfluoroalkanes are very stable because of the strength of the carbon–fluorine bond, one of the strongest in organic chemistry.
- Fluorocarbons are colorless and have high density, up to over twice that of water.
- They are not miscible with most organic solvents (e.g., ethanol, acetone, ethyl acetate, and chloroform), but are miscible with some hydrocarbons (e.g., hexane in some cases).
- They have very low solubility in water, and water has a very low solubility in them (on the order of 10 ppm).

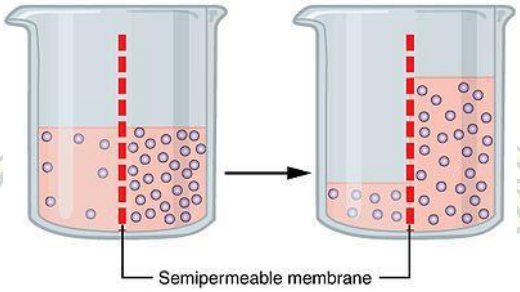
Ill effects:

- **Potential to Global warming.**
- **They do not a bioaccumulate unlike Flourosurfactants.**
- Reduced female fertility and sperm quality, reduced birth weight, attention deficit hyperactivity disorder (ADHD), prostate and bladder cancer, etc.

498. Osmosis & Reverse Osmosis

Osmosis:

- It is a process by which molecules of a solvent tend to pass through a semipermeable membrane from a less concentrated solution into a more concentrated one.
- It is a movement of molecules from a region of high water potential (region of lower solute concentration) to a region of low water potential (region of higher solute concentration), in the direction that tends to equalize the solute concentrations on the two sides.



OSMOSIS	REVERSE OSMOSIS
A process by which water molecules of a solvent tend to pass through a semipermeable membrane from a less concentrated solution into a more concentrated one	A process by which water molecules of a solvent passes through a semipermeable membrane in the direction opposite to that of natural osmosis when subjected to a hydrostatic pressure greater than osmotic pressure
Occurs through a potential gradient	Occurs against the potential gradient
A natural process	An artificial process
Occurs during absorption of water from the soil by roots and opening the stomata	Used in the water purification systems

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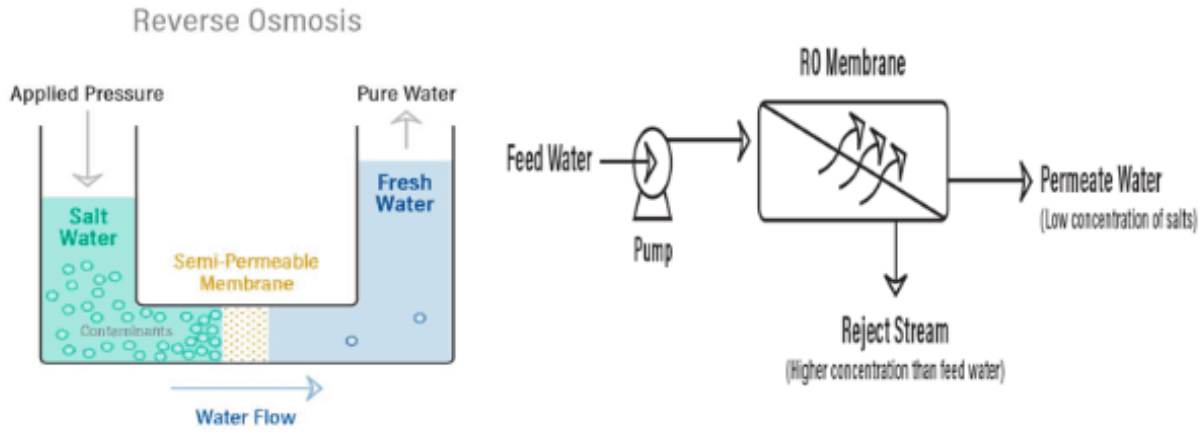
About Reverse Osmosis

- Reverse Osmosis is a technology that is used to remove a large majority of contaminants from water by pushing the water under pressure through a semi-permeable membrane.



- It works by using a high-pressure pump to increase the pressure on the salt side of the RO and force the water across the semi-permeable RO membrane, leaving around 95% to 99% of dissolved salts behind in the reject stream.
- The amount of pressure required depends on the salt concentration of the feed water. Higher the concentration of salt, higher is the pressure required.

- An RO membrane rejects contaminants based on their size and charge
- Reverse Osmosis is also used to produce water that is suitable for many industrial applications that require demineralized or deionized water

Issues with RO System

- **Wastage**: RO systems now recover only 20 per cent of water while 80 per cent go waste
- **Can remove beneficial mineral:** The process can cut the levels of calcium and magnesium, which are vital nutrients.
- **Membranes get clogged easily** which happens when materials build up on the membrane and slow down the flow of water. Thus it requires constant replacement which increases operational costs
- **Not 100% purification capability:** BIS standards clearly state that RO system is not recommended for treatment of raw water having Arsenic level above 0.1 mg/l and Fluoride level above 8.0 mg/l.

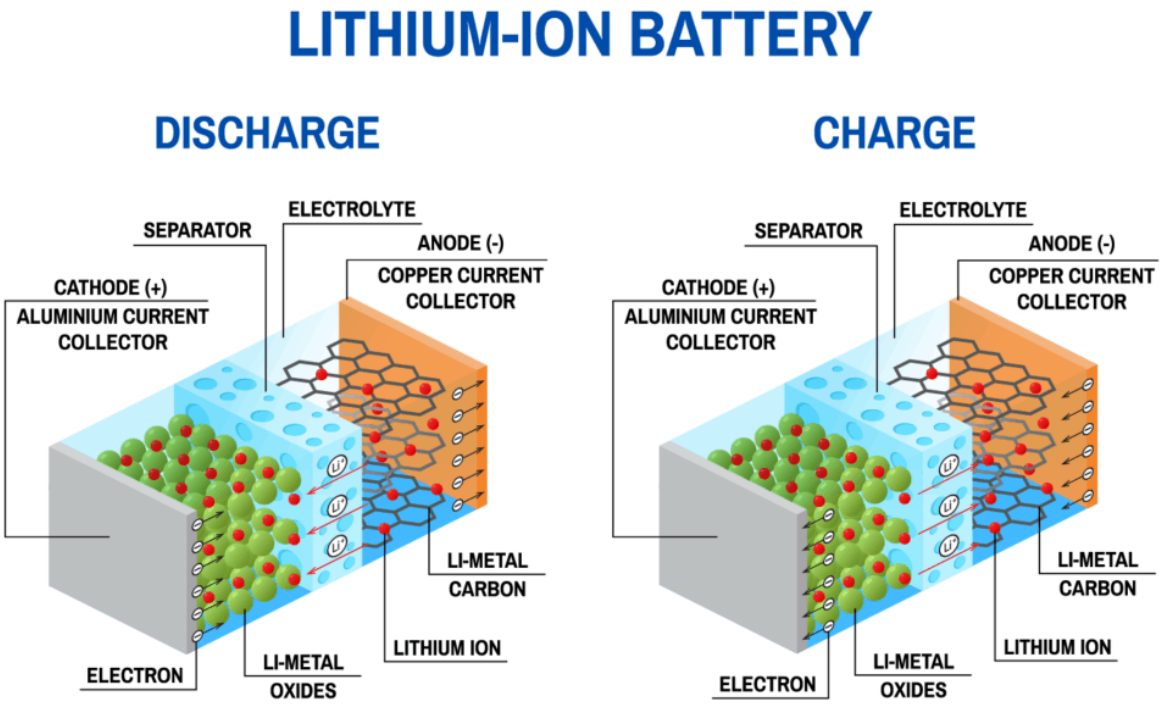
499. Li-Ion Battery

In Newss: India, through a newly-floated state-owned company **Khanij Bidesh India Ltd,** has inked a pact with **an Argentine firm** to jointly **prospect lithium in Argentina,** a country that has the **one of the largest reserves** of Lithium in the world.

- Khanij Bidesh India Ltd was incorporated in August 2019 by three state-owned companies, NALCO, Hindustan Copper and Mineral Exploration Ltd, with a specific mandate to acquire strategic mineral assets such as lithium and cobalt abroad.
    - It is also learnt to be exploring options in **Chile and Bolivia,** two other top lithium-producing countries.
- Lithium is a crucial building block of the lithium-ion rechargeable batteries that power electric vehicles (EVs), laptops and mobile phones.
- Currently, India is heavily dependent on import of these cells and the move to ink sourcing pacts for lithium is also seen as a move to reduce its dependency on China which is a key source of both the raw material and cells**.**

Lithium-ion Battery

- A lithium-ion battery or Li-ion battery is a type of **rechargeable battery.**
- Li-ion batteries use an **intercalated** (Intercalation is the reversible inclusion or insertion of a molecule into materials with layered structures) lithium compound as one electrode material, compared to the metallic lithium used in a non-rechargeable lithium battery.
- The battery consists of electrolyte, which allows for **ionic movement,** and the two electrodes are the constituent components of a lithium-ion battery cell.
- Lithium ions move from the **negative electrode** to the **positive electrode during discharge and back when charging.**



Lithium-ion Battery Applications:

- Electronic gadgets, Tele-communication, Aerospace, Industrial applications.
- Lithium-ion battery technology has made it the favourite power source for electric and hybrid electric vehicles.

Disadvantages of Li-ion Batteries:

- Long charging times.
- Safety issues as instances of batteries catching fires have been there.
- Expensive to manufacture.
- While the Li-ion batteries are seen as sufficiently efficient for applications such as phones and laptops, in case of EVs, these cells still lack the range that would make them a viable alternative to internal combustion engines.

500. Zeolites

- **Zeolites** are **microporous, aluminosilicate minerals** commonly used as commercial adsorbents and catalysts.
- Ten grams of Zeolites can have an internal surface area the size of a **soccer field.**
- Their cavities make them useful in **catalyzing chemical reactions** and thus saving energy.
- One important application is the **conversion of biomass into biofuel.**
- Zeolites contain oxygen atoms in their crystal structure which already carry a proton.
- They form hydronium ions through the **interactions with water.**

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541. Memory Cells

In New: According to a study by scientists at the Indian Council of Medical Research, antibodies produced in response to Covaxin were reduced when tested against the Delta variant; but continued to be high enough to remain protective.

Adaptive response:

- When infected by a virus, non-specific immune response in the form of **macrophages, neutrophils and other cells** tend to prevent the virus from causing symptoms.
- Soon after, the body makes **antibodies specific to the virus** called the immunoglobulins, called the **adaptive response.**
- In addition, **cellular immunity** kicks in when the **body makes T cells** that destroy cells that have been infected by the virus.
- The combination of **adaptive response and cellular immunity** may prevent progression to severe.
- Besides T cells, body also makes **memory B cells**, which rapidly produce antibodies when required. If they find the virus again, they **remember and start to make** antibodies quickly.
- Also, pre-existing memory T cells may only reduce COVID-19 severity, do not prevent infection.

How the memory T cells may help reduce the severity of the disease?

- The cross-reactive **memory T cells** on activation would help in the development of killer T cells that would kill virus infected cells.
- Cross-reactivity refers to **a situation in which an antibody reacts to a substance other than its corresponding antigen**.
- This would most likely reduce disease severity.

Why do antibodies reduce over time?

- Antibodies are proteins, and like any other protein will be **naturally broken down** and removed from the body within a few months.
- Once the infection or vaccine has been completely removed, **memory B cells** no longer replenish the plasma cell population, which then declines.

542. GM Soya Bean

In New: Poultry industry seeks extension of loans, import of GM soybean

- After facing crushing losses for the past 18 months due to the pandemic, the poultry industry is demanding that the Central government permit the **import of crushed genetically modified (GM) soy seeds** for captive consumption of poultry farmers.
- **Soybean constitutes 25% of poultry feed** and maize constitutes 60%.
- Rise in soybean process in domestic Indian market had led to the skyrocketing of input costs which led to increase in prices of chicken products in the retail market. Therefore the demand for import of GM Soya seeds.

Key Points

- India allows the import of Genetically Modified soybean. However, the main fear is that import of GM soya bean will **affect the Indian soya bean industry by contaminating non-GM varieties.**
    - A **GM or transgenic crop** is a plant that has a novel combination of genetic material obtained through the use of modern biotechnology.
- The only GM crop approved for cultivation in India is BT cotton. Talks are on to allow Htbt Cotton.

  - Bt Cotton has alien genes from the soil bacterium Bacillus thuringiensis (Bt) that allows the crop to develop a protein toxic to the common pest pink bollworm.
- **Roundup Ready Soybeans (RR soybeans)** are genetically engineered soybeans that have had their DNA altered to allow them to withstand the herbicide glyphosate (the active ingredient in Monsanto's herbicide Roundup).
  - They are also known as "glyphosate tolerant" soybeans

- Glyphosate kills unwanted plants by interfering with the synthesis of the **essential amino acids phenylalanine, tyrosine and tryptophan.**
- Some microorganisms make these amino acids with an enzyme called **5-enol-pyruvyl-shikimate-3-phosphate synthase (EPSPS).**
- Roundup Ready Soybeans express a version of EPSPS from the CP4 strain of the bacteria **Agrobacterium tumefaciens.**
- The plasmid with **EPSPS and a genetic promoter** was inserted into soybean germplasm.
- The promoter called E35S was derived from **Cauliflower Mosaic Virus.**

Do You Know the approval Process for GM crops in India?

- In India, the **Genetic Engineering Appraisal Committee (GEAC),** under Environment Ministry, is the apex body that allows for commercial release of GM crops.
- Use of the unapproved GM variant can attract a jail term of 5 years and fine of Rs. 1 lakh under the Environment Protection Act, 1986.
- **Food Safety and Standards Authority of India (FSSAI**) is the authorised body to regulate the imported crops in India.

543. Avicennia Marina and Hypnea Indica

- **In New:** Scientists at the **Department of Biotechnology (DBT)** have reported the genome sequence of a highly salt-tolerant and salt-secreting true-mangrove species Avicennia Marina.

About Avicennia marina

- Avicennia marina is found in all mangrove formations in India.
- It grows optimally in **75% seawater and tolerates >250% seawater.**
- It can excrete **40% of the salt through the** salt glands in the leaves
- It can exclude salt entry to the roots.

Its significance

- **Salinity is prevalent** in ~900 million hectares globally (with an estimated 6.73 million ha in India), and it is estimated to cause an annual loss of 27 billion USD.
- The genomic resources will help developing drought and **salinity tolerant varieties of important crop species.**

Hypnea Indica

Two new species of seaweed have been discovered in Central University of Punjab, Bathinda.

- Named **Hypnea indica and Hypnea bullata**, they are part of the genus Hypnea or red seaweeds.
- They grow in the intertidal regions of the coast.

Details of the genus

- The genus Hypnea consists of calcareous, erect, branched red seaweeds.
- Hypnea indica was discovered **Kanyakumari in Tamil Nadu, and Somnath Pathan** and Sivrajpur in Gujarat,
- Hypnea bullata was discovered from **Kanyakumari and Diu island of Daman and Diu.**
- **Significance for the food industry**
    - Species of Hypnea contain the **biomolecule carrageenan**, which is widely used in the food industry.
    - The **extensive calcareous deposit** on the body can also be beneficial.

544. Chemotaxis by E.coli

In New: Recently, scientists tracked the behaviour of Intestinal Bacteria-E-coli.

- **The new finding will help track behavior of E-Coli bacteria** in response to chemical signals. The response of E-Coli to chemicals in the intestine bacteria plays a crucial role in the functioning of the human intestine

About Chemotaxis

- It is the **movement of an organism or entity in response to a chemical stimulus.**
- Somatic cells, bacteria, and other single-cell or multicellular organisms direct their movements according to certain chemicals in their environment.
- This is important for bacteria to find food (e.g., glucose) by swimming toward the highest concentration of food molecules, or to flee from poisons (e.g., phenol).
- Many organisms in nature respond to the chemical signal received from their environment by showing bodily motion or as chemotaxis.
- White blood cells that are needed for healing injuries find the site of injury or inflammation by chemotaxis.
- Butterflies also track flowers, and male insects reach their targets by using chemotaxis.
- In multicellular organisms, chemotaxis is critical to early development (e.g., movement of sperm towards the egg during fertilization) and subsequent phases of development as well as in normal function and health (e.g., migration of leukocytes during injury or infection).

Escherichia coli (E.coli)-

- E. coli is a Gram-negative, facultative anaerobic, rod-shaped, coliform bacteria of the genus Escherichia that is commonly found in the lower intestine of warm-blooded organisms.
- It is transmitted to humans primarily through consumption of contaminated foods, such as raw or undercooked ground meat products, raw milk, and contaminated raw vegetables and sprouts.
- **Most E.coli strains are harmless**, but some can cause serious food poisoning.
- Shiga toxin-producing E. coli (STEC) is a bacterium that can cause severe foodborne disease**.**
- Primary sources of STEC outbreaks are raw or undercooked ground meat products, raw milk, and faecal contamination of vegetables.
- In most cases, the illness is self-limiting, but in some cases it may lead to a life-threatening disease especially in young children and the elderly.
- E.coli bacteria show chemotaxis in response to different chemicals present in the human gastrointestinal tract.
- **E. coli cells swim toward amino acids** (serine and aspartic acid), sugars (maltose, ribose, galactose, glucose), dipeptides, pyrimidines and electron acceptors (oxygen, nitrate, fumarate).

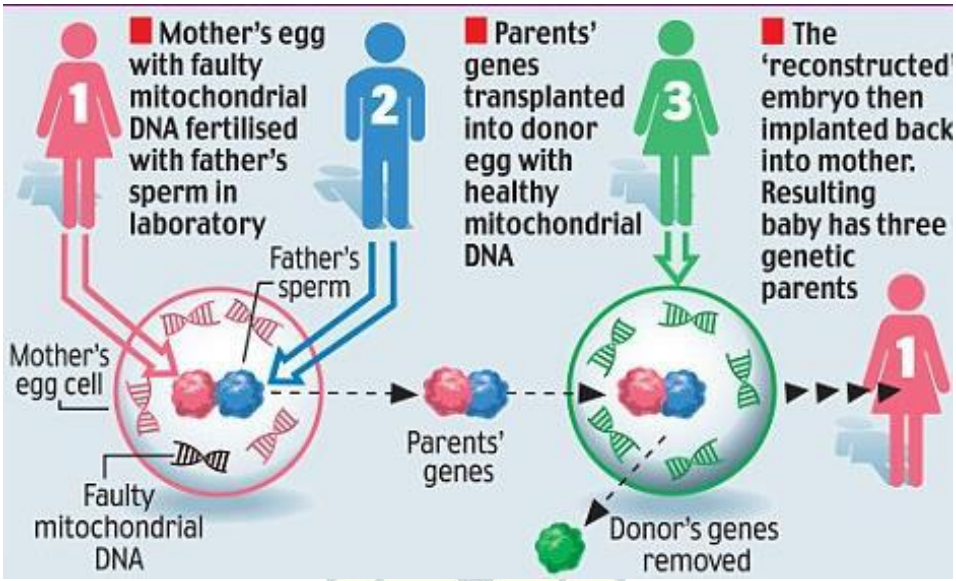
545. Three Parent Baby

In New: Greece also entered the group of countries which produce three parent babies.

- Three-parent baby, **human offspring produced from the genetic material of one man and two women** through the use of assisted reproductive technologies, specifically mitochondrial manipulation (or replacement) technologies
- In general, the reproductive technologies used to produce three-parent babies focus on replacing or otherwise reducing the effects of mutations that occur in the **DNA of mitochondria,** a cellular organelle which reside in the cell cytoplasm.
- The various approaches could help women to overcome infertility and could prevent the transmission to their offspring of potentially debilitating mitochondrial diseases.

About Mitochondrial disorders

- Mitochondria are found in every cell of the human body except red blood cells.
- They convert the energy of food molecules into the ATP that powers most cell functions.
- A group of Mitochondrial diseases renders them dysfunctional, these might be genetic disorders as well.
- Also, in Leigh Syndrome, mother acts as carriers she passes the disease to the offspring.



Working:

- The Mitochondrial Gene Therapy involves transplantation of healthy DNA in human eggs from a women with mitochondrial disease into the eggs of women donors who don't have the disease.
- There are two methods of MGT**:** First involving the early stage embryo and second manipulating the egg before it is fertilized.

546. Induced Pluripotent Stem Cells

- Special human cells that have the capability to develop into wide-ranging types of cells in the human body, from muscle cells to brain cells, are called stem cells.
- Induced pluripotent stem cells (iPSCs) are **adult cells that have been genetically reprogrammed to an embryonic stem cell–like state** by being forced to express genes and factors important for maintaining the defining properties of embryonic stem cells.
- iPSCs are not found in the body but made in the laboratory from cells of the body.
- Although additional research is needed, iPSCs are already useful tools for drug development and modeling of diseases, and scientists hope to use them in transplantation medicine.

Why stem cells are important?

- Stem cells have the remarkable potential to develop into many different cell types in the body during early life and growth.
- In addition, in many tissues they serve as a sort of internal repair system, dividing essentially without limit to replenish other cells as long as the person or animal is still alive.
- When a stem cell divides, each new cell has the potential either to remain a stem cell or become another type of cell with a more specialized function, such as a muscle cell, a red blood cell, or a brain cell.

Stem cells are distinguished from other cell types by two important characteristics:

- First, **they are unspecialized cells** capable of renewing themselves through cell division, sometimes after long periods of inactivity.
- Second, **under certain physiologic or experimental conditions, they can be induced to become tissue- or organ-specific cells with special functions**.
    - In some organs, such as the gut and bone marrow, stem cells regularly divide to repair and replace worn out or damaged tissues. In other organs, however, such as the pancreas and the heart, stem cells only divide under special conditions.

Difference between Embryonic and Adult Stem Cells

- One major difference between adult and embryonic stem cells is their different abilities in the number and type of differentiated cell types they can become.
- Embryonic stem cells can become all cell types of the body because they are pluripotent. Adult stem cells are thought to be limited to differentiating into different cell types of their tissue of origin.
- Embryonic stem cells can be grown relatively easily in culture. Adult stem cells are rare in mature tissues, so isolating these cells from an adult tissue is challenging, and methods to expand their numbers in cell culture have not yet been worked out.

547. Bioremediation

Bioremediation: It can be defined as any process that uses microorganisms or their enzymes to remove and or**neutralize contaminants within the environment to their original condition.**

1. In-situ bioremediation

In situ treatment is limited by the nature of the soil. In most of soils, effective rate for oxygen diffusion of bioremediation extend to only a few centimeters to about 30 cm into the soil.

- **Bio-venting** is the most common in situ treatment and involves **supplying of air** to contaminated soil to stimulate the growth of microorganisms.
- **Bio-sparging** It involves the pressurized injection of **air below the water table** to increase the content of groundwater oxygen concentration.
- **Bioaugmentation** involves the **continuous addition of microorganisms** (indigenous or exogenous) to the contaminated sites.

2. Ex-situ bioremediation

This technique involves the **excavation, removal and transportation** of contaminated soil from ground to a different site.

- **Land farming** is a simple technique in which **contaminated soil is excavated and then spread** over an already prepared bed and at regular intervals tilled until pollutants are degraded.

- **Composting** involves **mixing contaminated soil with non-hazardous organic materials** such as manure or agricultural wastes.
- **Bio piles** They are a mixture of **land farming and composting**. Characteristically used for treatment of surface contamination with petroleum hydrocarbons.
- **Bioreactors** - **Bioremediation in reactors** includes the processing of polluted and infected solid material through an engineered containment system.

- **Pseudomonas putida** is involved in the bioremediation of **toluene,** a component of paint thinner. It is also capable of **degrading naphthalene**, a product of petroleum refining.
- **Dechloromonas aromatica** can oxidize aromatics including **benzoate, chlorobenzoate, and toluene**. It is the only organism able to oxidize **benzene anaerobically.**
- **Nitrifiers and Denitrifiers:** During nitrification, ammonium is oxidized to nitrite by organisms like **Nitrosomonas europaea.** Then, nitrite is further oxidized to nitrate by microbes like **Nitrobacter hamburgensis.**
- **Deinococcus radiodurans** is genetically engineered to degrade ionic mercury and toluene in radioactive mixed waste environments.
- **Methylibium Petroleiphilum** capable of **methyl tert-butyl ether (MTBE)** bioremediation.
- **Alcanivorax borkumensis** had been used in cleaning the oil from the **Deepwater Horizon oil spill in the Gulf of Mexico.**

548. African Swine Fever

In New: Pigs in Mon, Kiphire and Phek districts of Nagaland were affected by African Swine Fever, recently.

African Swine Fever(ASF)

- It is a **highly contagious and fatal animal disease** that infects and leads to an acute form of hemorrhagic fever in domestic and wild pigs.
- It is **caused by a large double strained DNA virus of the Asfarviridae family**, which also infects ticks of the genus Ornithodoros.
- **Other manifestations of the disease include** high fever, depression, anorexia, loss of appetite, hemorrhages in the skin, vomiting and diarrhoea among others.
- It was **first detected in Africa in the 1920s.**
    - Historically, outbreaks have been reported in Africa and parts of Europe, South America, and the Caribbean.
    - However, more recently (since 2007), the disease has been reported in multiple countries across Africa, Asia and Europe, in both domestic and wild pigs**.**
- The **mortality is close to 100%** and since the **fever has no cure,** the only way to stop its spread is by culling the animals.
- ASF is **not a threat to human beings** since it only spreads from animals to other animals.
- ASF is a **disease listed in the World Organisation for Animal Health's Terrestrial Animal Health Code** and must be reported to it.

Classical Swine Fever:

- **CSF**, also known as **hog cholera,** is an important disease of pigs.
- It is one of the most economically-damaging pandemic viral diseases of pigs in the world.
- It is **caused by a virus of the genus Pestivirus of the family Flaviviridae,** which is closely related to the viruses that cause bovine viral diarrhoea in cattle and border disease in sheep.
- Mortality is 100%.

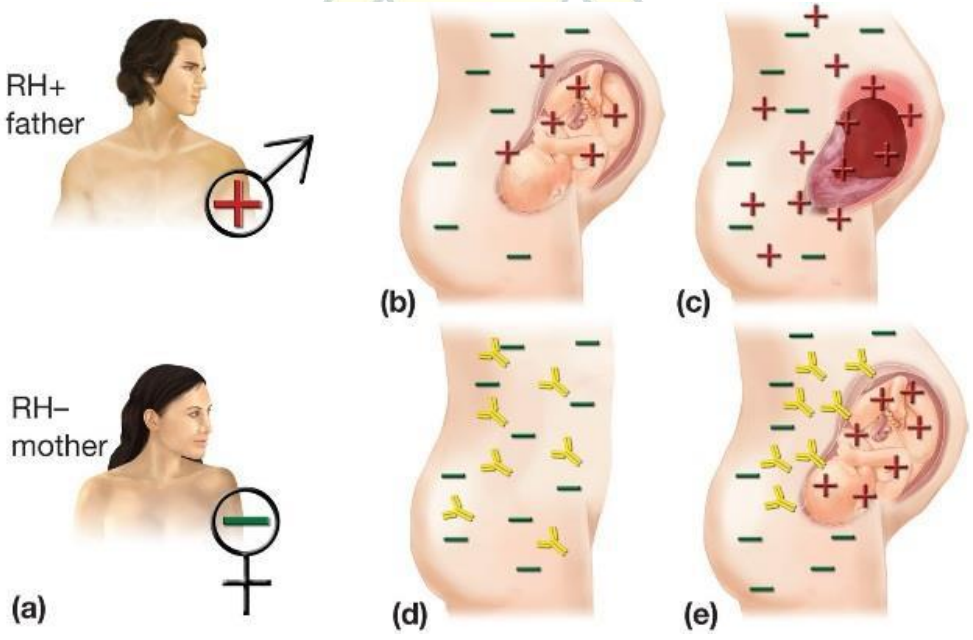
World Organisation for Animal Health

- Formerly the Office International des Epizooties, WOAH is an intergovernmental organization coordinating, supporting and promoting animal disease control.
- It was founded in 1924 (HQ: Paris) with the main objective to control epizootic diseases and thus to prevent their spread.
- Other objectives consist of: transparency, scientific information, international solidarity, sanitary safety, the promotion of Veterinary Services, food safety and animal welfare
- The recent innovation of the World Animal Health Information System (OIE-WAHIS) system is a testimony to the OIE's progressive evolution of its digital services.
- The platform provides Members with a new tool for animal disease surveillance for strengthened risk analysis and the monitoring during disease emergencies.
- OIE develops normative documents relating to rules that Member Countries can use to protect themselves from the introduction of diseases and pathogens. One of them is the Terrestrial Animal Health Code.
- OIE standards are recognised by the World Trade Organization as reference international sanitary rules.
- India is also a member country.

549. Erythroblastosis Fetalis

In New: Neanderthal and Denisovan blood groups deciphered

- It was long thought that Neanderthals all had type **O Blood Groups.**
- Just as chimpanzees are all **type A and gorillas all type B.**
- The researchers demonstrated that these ancient hominins already displayed the full range of ABO variability observed in modern humans.
- Also it was discovered that Neanderthals harbored **a unique Rh allele** absent in modern humans.
- **Cause of disappearance:**
    - Discovery also reports that these ancient hominins exhibited very little **genetic diversity**, and that they may have been susceptible to **haemolytic disease of** the fetus and newborn **(erythroblastosis fetalis).**
    - These clues strengthen the hypothesis that low genetic diversity together with low reproductive success **contributed to the disappearance of Neanderthals.**



Erythroblastosis fetalis

- Erythroblastosis fetalis, also called hemolytic disease of the newborn, type of anemia in which the **red blood cells (erythrocytes) of a fetus are destroyed** in a maternal immune reaction resulting from a **blood group incompatibility between the fetus and its mother.**
- This incompatibility arises when the fetus inherits a certain blood factor from the father that is absent in the mother.
- Symptoms of erythroblastosis fetalis range from mild to severe; death of the fetus or newborn sometimes results.

How it is caused?

- Erythroblastosis fetalis can occur when different Rh factor blood types mix during pregnancy.
    - Rh factor is an inherited protein, found on the surface of red blood cells. Not everyone has this protein. If a person has the protein, they are Rh positive. Those who do not have the Rh protein are Rh negative.
- If a woman is Rh negative and the foetus is Rh positive, it can lead to Rh incompatibility.
- Although it is rare for blood between the woman and the foetus to mix during pregnancy, it could happen as a result of several factors like bleeding, miscarriage, abortion etc.
- If Rh-negative blood (of mother) mixes with Rh-positive blood (of foetus), an immune response known as Rh sensitization may occur. This means that the **person with Rh-negative blood will produce antibodies** to fight any future exposure to Rh-positive blood.
    - The body can also produce antibodies after contamination with a Rh-positive blood from a needle or a blood transfusion.
- Once sensitized, the mother's immune system **will recognize any future Rh-positive cells** in foetus as foreign and attack them.
- Destruction of the red blood cells (hemolysis) can be rapid in a foetus. As a result, the foetus will not receive enough oxygen, which may lead to anaemia, other illnesses, or even death.

550. Zebrafish and Glowing Mushrooms

- **In New:** Indian scientists have used the **Zebrafish model** and identified its genes that can promote heart regeneration.

About Zebrafish

- Itis a small (2-3 cm long) freshwater fish found in the tropical and subtropical regions.
- The fish is native **to Indo-Gangetic plains**, where they are mostly found in the paddy fields and even in stagnant water and streams.

Ability to heal their heart

- The ability of Zebrafish to **heal their heart after injury makes** them an attractive model to investigate mechanisms governing the regenerative process.
- Years of efforts have helped researches identify the **cellular communication network factor 2a (ccn2a)**, a gene that can promote heart regeneration by enhancing cardiomyocyte proliferation.

Glowing Mushrooms

- **Why in news:** A mushroom documentation project in the forests of Northeast India has discovered a bioluminescent — or light-emitting — variety of mushroom.

Roridomyces phyllostachydis

- The new species was first sighted near a stream in **Meghalaya's Mawlynnong in East Khasi Hills** district.
- It is now one among the 97 known species of bioluminescent fungi in the world.

Bioluminescence in fungi

- Bioluminescent organisms are found in **both ocean and terrestrial environments.**
- The color of the light emitted by the organism depends on its chemical properties.
- In the case of fungi, the luminescence comes from the enzyme**, luciferase.**
- The green light emits when **luciferin is catalyzed** by the enzyme luciferase, in the presence of oxygen.

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591. Hope, Mangalyaan and Perseverance Rover

- Humankind is curious about Mars because of the possibility that the planet was once warm enough to allow water to flow through it, which means life could have existed there too.
- Despite being starkly different in many ways, the Red Planet has several **Earth-like features–** such as clouds, polar ice caps, volcanoes, and seasonal weather patterns.
- However, no human has set foot on Mars yet because the atmosphere on Mars is very thin, consisting of mostly carbon dioxide with no breathable oxygen, making it difficult for astronauts to survive there.

UAE's Hope Mars Mission	• The UAE's Mars Mission called 'Hope' was announced in 2015 with the aim of creating mankind's first integrated model of the Red planet's (Mars) atmosphere. • 'Hope' was developed by UAE scientists in the USA and was launched in July 2020 from the Tanegashima Space Centre in Japan. It entered into Mars orbit successfully in Feb 2021. • **Scientific Instruments:** The Probe carries three scientific instruments: ✓ **Emirates eXploration Imager (EXI):** A high-resolution camera. ✓ **Emirates Mars Ultraviolet Spectrometer (EMUS):** A far-UV imaging spectrograph. ✓ **Emirates Mars InfraRed Spectrometer (EMIRS):** It will examine temperature profiles, ice, water vapor and dust in the atmosphere of Mars. • This mission help to trace the mechanisms that **leached oxygen and hydrogen** out of the Marian atmosphere, which was previously warmer and wetter with plenty of oxygen. • It is expected to complete one orbit around the planet every 55 hours.The overall life of UAE's Mars mission is around **one Martian year, which is about 687 days on Earth** • With the successful Mars orbit insertion, the **UAE becomes the fifth entity to reach the Red Planet, joining NASA,** the Soviet Union, the European Space Agency and India.
Mangalyaan by ISRO	Mars Orbiter Mission was launched with the help of the Polar Satellite Launch Vehicle (PSLV) C-25 of **ISRO** **The specific objectives of the Mars Orbiter Mission:** • Develop and design **the interplanetary mission.** • Orbit maneuvers from **Earth orbit into Mars orbit.** • Maintain the spacecraft in all phases of the Mission. • Study **climate, geology, origin and evolution of Mars** • To study **sustainability of life** on the planet. **Payloads:** • **Mars Color Camera (MCC):** It is an electro-optical sensor imaging surface of Mars in three colours • **Methane Sensor for Mars (MSM):** It is a differential radiometer to measure columnar methane (CH_4) in the Martian atmosphere at several parts per billion (ppb) levels • **Lyman Alpha Photometer (LAP**): It is a compact far-ultraviolet photometer capable of providing deuterium to hydrogen (D/H) abundance ratio of Martian exosphere from spacecraft observations. • **Thermal Infrared Imaging Spectrometer (TIS):** It is aimed to observe thermal emission from Mars surface to detect its temperature and hot spot regions or hydrothermal vents on Martian surface.

<table>
<tr><td></td><td>• Mars Exospheric Neutral Composition Analyzer (MENCA): It is meant for in situ study of the composition of the Martian neutral exosphere.</td></tr>
<tr><td>Mars 2020 Mission by NASA</td><td>NASA's Mars mission includes
✓ A six-wheeled self-driving rover – Perseverance
✓ A twin-rotor helicopter – Ingenuity : To test powered, controlled flight on another world for first time.
✓ An orbiter - NAVEN

• The target of this mission is to study Jezero Crater, a site of an ancient river delta.
• Perseverance was developed to address the faults of NASA's current Curiosity rover.
The Perseverance rover has four science objectives that support the Mars Exploration Program's science goals:

<table>
<tr><td>Looking for Habitability:</td><td>Identify past environments capable of supporting microbial life.</td></tr>
<tr><td>Seeking Biosignatures:</td><td>Seek signs of possible past microbial life in those habitable environments, particularly in special rocks known to preserve signs of life over time.</td></tr>
<tr><td>Caching Samples:</td><td>Collect core rock and "soil" samples and store them on the Martian surface.</td></tr>
<tr><td>Preparing for Humans:</td><td>Test oxygen production from the Martian atmosphere.</td></tr>
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592. Tianwen and ExoMars

- China's first-ever independent mission to Mars, Tianwen-1 (formerly Huoxing 1), which means **"questions to heaven",** was launched.
- The launch craft consists of an orbiter, a lander and a 240 kg rover.
- The orbiter carries radar and a camera to measure and map the **Mars' morphology, electromagnetic and gravitational** fields and the ionosphere.
- The rover will operate for 90 Mars days. It will map soil characteristics and **water-ice distribution**, and also study climate and environment.
- The orbiter will use a high-resolution camera to search for a suitable landing site somewhere in the **Utopia Panitia region.**

About ExoMars:
It is a joint endeavor between **ESA and the Russian space agency, Ros cosmos.**

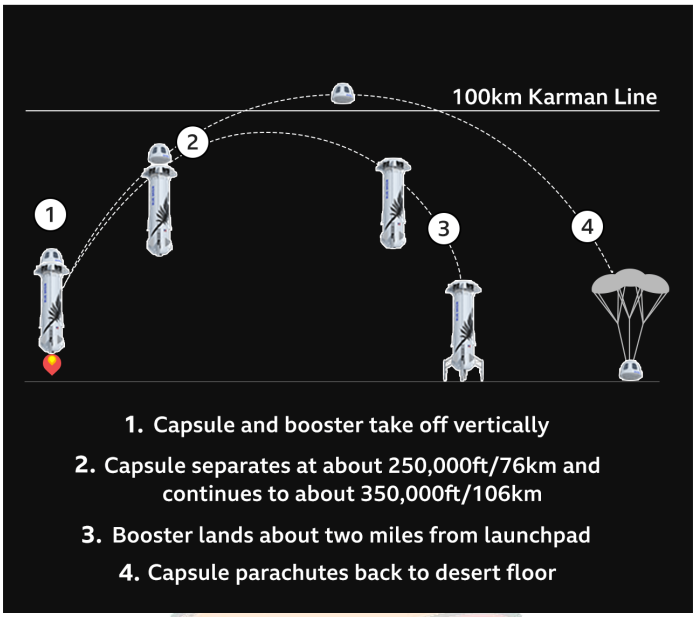
Components of the mission:
The **program** consists of the **Trace Gas Orbiter (TGO)** and **Schiaparelli**, an entry, descent and landing demonstrator module.

- **TGO** searches for evidence of **methane and other trace atmospheric gases**.
- The **Schiaparelli** probe crashed during its attempt to land on Mars.
- The second mission, **comprising a rover and surface platform,** is planned for 2022. Together they will address the question of whether life has ever existed on Mars.

593. New Shepard Rocket

In News: Blue Origin launched its first crewed mission aboard the New Shepard rocket.

Flight profile of the New Shepard

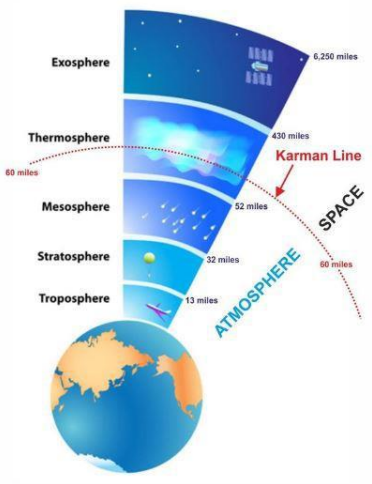


About New Shepard Rocket

- It is a vertical-takeoff, vertical-landing (VTVL), crew-rated suborbital launch vehicle that is being developed by Blue Origin (US based Private Space company founded by Jeff Bezos, founder of Amazon Company)
- New Shephard has been named after **astronaut Alan Shephard – the first American to go to space**
- **It offers flights to space over 100 km above the Earth** and accommodation for payloads.
- It is a rocket system that has been designed to take astronauts and research payloads past the **Karman line.**
- The idea is to provide **easier and more cost-effective access to space** meant for purposes such as academic research, corporate technology development and entrepreneurial ventures among others.
- It will also allow **space tourists to experience microgravity by taking them 100 km above the Earth.**
- There will be **no pilot as the capsule is fully autonomous.**
- The system is a **fully reusable**.
    - After its separation from the booster, the **capsule free falls in space and lands back with the help of parachutes**,
    - While the **booster performs an autonomously controlled vertical landing back to Earth.**

Karman Line

- The Karman line is the **internationally recognized boundary of space.**
- The line is named after **Theodore von Kármán (1881–1963),** a Hungarian American engineer and physicist, who was active primarily in aeronautics and astronautics.
    - He was the first person to calculate the altitude at which the atmosphere becomes too thin to support aeronautical flight and arrived at 83.6 km himself.
- The **Fédération Aéronautique Internationale (FAI) defines Karman Line as the altitude of 100 kilometres** above Earth's mean sea level.
    - FAI is the world **governing body for air sports, and also stewards definitions regarding human spaceflight.**
- However, other organizations do not use this definition. **There is no international law defining the edge of space, and therefore the limit of national airspace.**



594. Lucy Mission and CAPSTONE

Lucy Mission (by NASA)

- The swarms of **Trojan asteroids** associated with Jupiter are thought to be remnants of the primordial material that formed the outer planets.
- The **Trojans orbit the Sun** in two loose groups, with one group leading ahead of Jupiter in its path, the other trailing behind.
- Lucy will be the **first space mission to study the Trojans.**
- Lucy will launch in October 2021 and, with boosts from Earth's gravity, will complete a **12-year journey to eight different asteroids** — a Main Belt asteroid and seven Trojans.
- Lucy will give us our first close-up view of all three major types of asteroids(so-called C-, P- and D-types).
- Trojans are thought to be abundant in **dark carbon** compounds. They are probably rich in water and other volatile substances.

About CAPSTONE (by NASA)

- CAPSTONE is expected to be the **first CubeSat to fly in cislunar space** – the orbital space near and around the Moon.
- A microwave oven–sized CubeSat will test a unique, elliptical lunar orbit as part of the **Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment (CAPSTONE).**
- It is a precursor for **Gateway**, a Moon-orbiting outpost that is part of NASA's Artemis program.
- The orbit, formally known as a near rectilinear halo orbit (NRHO), is significantly elongated.
- It is located at a precise balance point in the gravities of Earth and the Moon,
- It offers stability for long-term missions like Gateway and requires minimal energy to maintain.

595. Artemis Program

- NASA's Artemis programme **aims to return humans to the Moon by 2024.**
- NASA Announces **Eight-Nation Space Coalition** Under Artemis Accords.

About Artemis

- ARTEMIS stands for **Acceleration, Reconnection, Turbulence and Electrodynamics of Moon's Interaction with Sun.**
- Is an upcoming crewed mission to the Moon.
- It is a collaborative project of NASA, European Space Agency (ESA), Japanese Aerospace Exploration Agency (JAXA) and the Canadian Space Agency (CSA).
- The preparations for the mission started in 2017 and is expected to be launched in 2024.

Artemis program Concept

- With the Artemis program, NASA wishes to demonstrate new technologies, capabilities and business approaches that will ultimately be needed for the future exploration of Mars.
- The program is divided into three parts,
  - **Artemis I** is most likely to be launched in 2022 and involves an uncrewed flight to test the Space Launch System (SLS) and Orion spacecraft.
  - **Artemis II** will be the first crewed flight test and is targeted for 2023.
  - **Artemis III** will land astronauts on the Moon's South Pole in 2024.
- For NASA, going to the moon involves various elements – such as the
  - Exploration ground systems (the structures on the ground that are required to support the launch),
  - Space Launch System (SLS)
  - Orion (the spacecraft for lunar missions)
  - Gateway (the lunar outpost around the Moon)
  - Lunar landers (modern human landing systems)
  - Artemis generation spacesuits.

- NASA's new rocket called SLS will send astronauts aboard the Orion spacecraft a quarter of a million miles away from Earth to lunar orbit.
- Once the astronauts dock Orion at the Gateway which is a small spaceship in orbit around the moon they will be able to live and work around the Moon, and from the spaceship, will take expeditions to the surface of the Moon

About Artemis Accord

- The **Artemis Accords** are an international agreement between governments of participating nations in the **Artemis program** on the principles for cooperation in the civil exploration and use of the Moon, Mars, comets, and asteroids for peaceful purposes, and is grounded in the **Outer Space Treaty of 1967.**
- The Accords were signed on October 13, 2020 by the directors of eight national space agencies: United States, Australia, Canada, Japan, Luxembourg, Italy, the United Kingdom, and the United Arab Emirates.
  - Ukraine and Brazil signed it later in 2020.
  - The Artemis Accords **exclude China, a rising space rival to the US.**

596. Space Telescope - Hubble & James Webb

About the Hubble Space Telescope

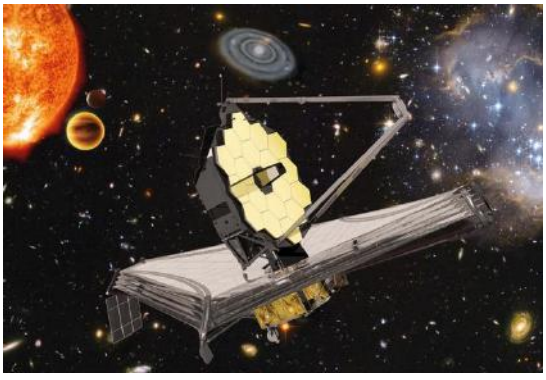
- The Hubble Space Telescope is named after the astronomer **Edwin Hubble.**
- It was launched in 1990 and is still operational. It is expected to decay by 2030-2040
- Hubble features a 2.4-meter mirror, and its four main instruments include ultraviolet, visible, and near-infrared regions of the electromagnetic spectrum.
- It is one of the largest space telescopes which can perform versatile missions.
- With the ongoing construction of the **Thirty Meter Telescope (TMT)**, HST will no longer with the largest light-vision telescope in the world

Thirty Meter Telescope

- TMT project is an international partnership between the **USA, Canada, Japan, China, and India.**
- TMT project is expected to create one of the largest visible-light telescopes in the world, which would have a 30 m prime mirror diameter, three times wider and with nine times more area than the current largest telescope
- The telescope will open a wider range of opportunities for people studying and researching on astrophysics
- A non-profit organisation, TMT International Observatory LLC (TIO) was established to manage the construction, maintenance, and operation of the telescope
- It will produce 12 times sharper images than the **Hubble Space Telescope**, which is the largest and most versatile telescope in the world till date

About James Webb Space Telescope (JWST)

- It is an **orbiting observatory** that will complement the discoveries of the Hubble Space Telescope.
- It is an international collaboration between **NASA, the European Space Agency (ESA)**, and **the Canadian Space Agency (CSA).**



Comparison between Webb and Hubble Telescopes

- Webb will observe **primarily in the infrared**.
- **Hubble's capabilities are in the ultra-violet and visible parts** of the spectrum.

- Webb will have an **approximately 6.5 meter diameter primary mirror**, Hubble's mirror is a **much smaller 2.4 meters in diameter**.
- The Hubble Space Telescope **orbits around the Earth.**
- Webb will **not actually orbit the Earth**, instead it will **sit at the Earth-Sun L2 Lagrange point**, 1.5 million km away.

Other Global Projects with Indian Collaboration:

- ✓ **The Laser Interferometer Gravitational-Wave Observatory (LIGO) Project:** for analysis of signals from gravitational waves, estimating energy and power radiated from black holes etc.
- ✓ **CERN Project:** It is a kind of atom smasher machine. It is the world's largest and most powerful particle accelerator.
- ✓ **Facility for Antiproton and Ion Research (FAIR):** It is a sophisticated accelerator complex that will use the high energy and ion beams to mimic the condition inside the core of the stars and early phase of the universe. FAIR is coming up at **Darmstadt, Germany.** The role of Indian scientists would be to build NUSTAR (Nuclear Structure, Astrophysics and Reactions), CBM(Compressed Baryonic Matter) and PANDA (Antiproton Annihilation at Darmstadt).
- ✓ **Square Kilometre Array (SKA):** India has joined nine other countries to build the **world's largest and most sophisticated radio telescope**. The core of the telescope will be based in Karoo desert in South Africa. Since the total detection area of the receiver dishes would exceed 1 square kilometer, it is called SKA.
- ✓ **International-Thermonuclear-Experimental-Reactor** (ITER) is focused around creating an environment mimicking the Sun in laboratory conditions using nuclear fusion.

597. Parker Solar Probe

Context: Parker Solar Probe Marks Seventh Successful Swing around the Sun.

About the mission:

- The Parker Solar Probe is a **robotic spacecraft** the size of a small car and is named after American solar astrophysicist Eugene Newman Parker.
- It is set to fly into the sun's corona within 3.8 million miles from the solar surface, seven times closer than any other spacecraft.
- The probe is capable to endure wicked heat while zooming through the solar corona to study this outermost part of the stellar atmosphere that gives rise to the solar wind.
    - The probe has been outfitted with a heat shield designed to keep its instruments at a tolerable 29 degrees Celsius even as the spacecraft faces temperatures reaching nearly 21,370 degrees Celsius at its closest pass.

Parker Solar Probe has three detailed science objectives:

- Trace the **flow of energy that heats and accelerates** the solar corona and solar wind.
- Determine the structure and dynamics of the **plasma and magnetic fields** at the sources of the solar wind.
- Explore mechanisms that accelerate and transport **energetic particles.**

Importance of the Study

- The Sun is a dynamic and magnetically active star.
- The Sun's atmosphere constantly sends magnetised material outward, enveloping the Solar System far beyond the orbit of Pluto and influencing every world along the way.
- The corona gives rise to the **solar wind,** a continuous flow of charged particles that permeates the solar system.
- Unpredictable solar winds cause **disturbances in our planet's magnetic field and** can play havoc with communications technology on the earth.
- The findings of the probe will enable scientists to **forecast changes in the earth's space environment.**

598. EOS-03 Satellite

In News: Recently, the Indian Space Research Organisation (ISRO) has suffered the **loss of an important earth observation satellite "EOS-03"** when the GSLV rocket carrying it malfunctioned.

Key Highlights

- The launch was supposed to **place EOS-03**, an earth observation satellite, into a **geostationary orbit**.
- The mission could not be accomplished as intended because the **Cryogenic Upper Stage ignition did not happen** due to technical anomaly.

About Geo-imaging satellite "EOS-03"

- It is a **geo-imaging satellite** for Earth Observation from Geostationary Orbit.
- It consists of capabilities including:
- Imaging the whole country 4-5 times daily
- In addition to natural disasters, **EOS-03** would also enable monitoring of water bodies, crops, vegetation condition, forest cover changes etc.
- It would enable **near-real time monitoring of natural disasters** like floods & cyclones.

About GSLV Mark III

- It is capable of **launching four-tonne satellites** in the **Geosynchronous Transfer Orbit (GTO).**
- Up to **eight tonnes in a Low Earth Orbit (LEO)**, enough to carry a manned module.
- It is **India's first fully functional rocket** to be tested with a cryogenic engine.
- The 640-tonne rocket, **equal to the weight of 200 fully-grown Asian elephants**, is the country's heaviest but shortest rocket with a height of 43 metre.
- It is a three-stage vehicle with **two solid motor strap-ons (S200)**, **a liquid propellant core stage (L110)** and **a cryogenic stage (C-25).**

599. Gaia and Bepi Columbo

About Gaia:

- Gaia, the **Global Astrometric Interferometer for Astrophysics.**
- It is a **European Space Agency** astronomical observatory mission.

- Its goal is to create the largest, most precise three-dimensional map of the **Milky Way** by surveying about 1% of the galaxy's 100 billion stars.
- Gaia will detect and very accurately measure the motion of each star in its orbit around the center of the galaxy.
- Each of the **1 billion stars that Gaia** studies will be observed an average of 70 times over five years to create a record of the brightness and the position of each star over time.

About Bepi Colombo

- The mission **Bepi Colombo** consists of two satellites launched together. The **Mercury Planetary Orbiter and Mercury Magnetospheric Orbiter.**
- The spacecraft Bepi Colombo was launched on Ariane 5 rocket.
- It will arrive **Mercury in 2025.**
- The Mission is a part of the **Horizon 2000+ Program of European Space Agency** and was the last mission of the program.
- **Objectives of the Mission**
    - To study the origin and evolution of Mercury
    - To investigate the exosphere of Mercury, its composition, dynamics
    - To study the magnetosphere of mercury
    - To verify Relativity Theory of Einstein
- **Horizon 2000+**
    - The missions under the Horizon 2000 program were Huygens, Rosetta and Gala. The mission launched under Horizon 2000+ were **Gaia, LISA Pathfinder and Bepi colombo.**

600. Rosetto and Cheops

Rosetta

- **Rosetta spacecraft** is a project of ESA (European Space Agency), launched in 2004.
- **It has two main elements viz:**
    - Rosetta space probe orbiter.
    - Philae robotic lander.
- **Objectives**
    - To document **how the comet changes and reacts to a close encounter** with the sun.
    - The output data will help the scientists to learn more about the **origin and evolution of our solar system.**
    - And the role comets may have played in seeding **Earth with water, and perhaps even life.**
- After 10 years of its journey Rosetta dropped its lander **Philae onto 67P/** Churyumov-Gerasimenko, a comet.
- With this Rosetta is poised to became world's **first mission to both** orbit and land on a comet.

CHEOPS

- CHEOPS – **CHaracterizing ExOplanet Satellite** is a new telescope going to be launched by European Space Agency.
- It is a mission for the study of exoplanets rather than a discovery machine.
- It will lift-off as a secondary passenger on a **Soyuz-Fregat rocket.**
- It is the first mission dedicated to searching for exoplanetary transits by performing **ultra-high precision photometry** on bright stars already known to host planets.
- **The Mission objectives:**
    - To measure accurate sizes of **Earth to Neptune sized planets.**
    - To measure light curves of hot Jupiters to see how energy is transported in planetary atmospheres.
    - To search for key molecules in the planets' atmospheres.

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641. & 642. MCQs

Q. 1) A Parliamentary System of Government is one in which
(a) All political parties in the Parliament are represented in the Government
(b) The Government is responsible to the Parliament and can be removed by it
(c) The Government is elected by the people and can be removed by them
(d) The Government is chosen by the Parliament but cannot be removed by it before completion of a fixed term

Answer: (b)

By definition, a parliamentary system of government is one in which the executive is responsible to the legislature. This responsibility means that executive stays in power as long as it enjoys the confidence of the house. The moment, the confidence is lost, it can be removed by Parliament by passing the no-confidence motion. This is is the same feature which hampers the stability of the parliamentary system. Therefore, option (b) is correct answer.

Q.2) Which part of the Constitution of India declares the ideal of Welfare State?
(a) Directive Principles of State Policy
(b) Fundamental Rights
(c) Preamble
(d) Seventh Schedule

Answer: (a)

A welfare state is a concept of government where the state plays a key role in the protection and promotion of the economic and social well-being of its citizens.

It is based on the principles of equality of opportunity, equitable distribution of wealth, and public responsibility for those unable to avail themselves of the minimal provisions for a good life. The Directive Principles of State Policy embody the concept of a 'welfare state'.

Q.3) Consider the following statements:
1. The Constitution of India defines its 'basic structure' in terms of federalism, secularism, fundamental rights and democracy.
2. The Constitution of India provides for 'Judicial review' to safeguard the citizens' liberties and to preserve the ideals on which the Constitution is based.

Which of the statements given above is are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Answer: (b)

The doctrine of basic features is neither defined nor mentioned anywhere in the Constitution. This doctrine was laid down by the Supreme Court in the landmark Keshavnand Bharati case. And even the Supreme Court is yet to define or clarify what all constitutes basic features, and the doctrine therefore, remains open ended. **Hence, statement 1 is not correct.**

The doctrine of judicial review originated and developed in the USA. It was propounded for the first time in the famous case of Marbury versus Madison (1803) by John Marshall, the then chief justice of the American Supreme Court. In India, on the other hand, the Constitution itself confers the power of judicial review on the judiciary (both the Supreme Court as well as High Courts). Judicial review is needed for the following reasons:
(a) To uphold the principle of the supremacy of the Constitution.
(b) To maintain federal equilibrium (balance between the Centre and the states)
(c) To protect the Fundamental Rights of the citizens.

Therefore, statement 2 is correct.

Q.4) One common agreement between Gandhism and Marxism is
(a) The final goal of a stateless society
(b) Class struggle
(c) Abolition of private property
(d) Economic determinism

Answer: (a)

Classless society, in Marxism, the ultimate condition of social organization, expected to occur when true communism is achieved. According to Karl Marx (1818–83), the primary function of the state is to repress the lower classes of society in the interests of the rulingclass. However, after the class struggle has resulted in the victory of the proletariat and the establishment of a socialist society, there will be no further need for such a repressive institution; with the disappearance of classes, the state is expected to wither away.

According to Gandhiji, ideal society is a Stateless democracy, the state of enlightened anarchy where social life has become so perfect that it is self-regulated. "In the ideal state, there is no political power because there is no State." Hence, stateless society is the common point in the two thinkers.

Q.5) In the context of India, which one of the following is the characteristic appropriate for bureaucracy?
(a) An agency for widening the scope of parliamentary democracy
(b) An agency for strengthening the structure of federalism
(c) An agency for facilitating political stability and economic growth
(d) An Agency for the implementation of public policy

Answer: (d)

Bureaucracy or the permanent executive is body of appointed officials which primarily responsible for two functions

1. Providing policy inputs to the elected representatives who form the popular executive
2. Implementation of the public policy approved by the popular executive

643. Pradhan Mantri Fasal Bima Yojana

Why in news: Maharashtra government has urged for state-wide implementation of the **'Beed model'** of the crop insurance scheme Pradhan Mantri Fasal Bima Yogna (PMFBY).

About PMFBY

- PMFBY was launched on **13th January 2016.**
- It provides **a comprehensive insurance cover** against failure of the crop thus helping in stabilising the income of the farmers.
- **Scope:** All food & oilseed crops and annual commercial/horticultural crops for which past yield data is available.
- **Premium:** The prescribed premium is **2%** to be paid by farmers for all Kharif crops and **1.5%** for all rabi crops. In the case of annual commercial and horticultural crops, the premium is **5%.**
    - Premium cost over and above the farmer share was **equally subsidized** by States and GoI.
    - However, GoI shared **90% of the premium subsidy for North Eastern States** to promote the uptake in the region.
- The scheme was **compulsory for loanee farmers** availing Crop Loan/**Kisan Credit Card** (KCC) account for notified crops and voluntary for others.
- To assess crop losses, **satellite imagery, remote-sensing technology, drones, artificial intelligence** and machine learning are used.
- PMFBY Portal has been established for integration of land records.

- **Aadhar seeding** (linking Aadhaar through Internet banking portals) has helped in speedy claim settlement directly into the farmer accounts.
- In order to ensure more efficient and effective implementation of the scheme, the central government **had revamped PMFBY in the 2020 Kharif season.**
- This overhauled PMFBY is often called **PMFBY 2.0** it has the following features:
    - **Completely Voluntary:** Enrolment 100% voluntary for all farmers from 2020 Kharif.
    - **Limit to Central Subsidy:** The Cabinet has decided to cap the Centre's premium subsidy under the scheme for premium rates up to 30% for unirrigated areas/crops and 25% for irrigated areas/crops.
    - **More Flexibility to States:** The government has given the flexibility to states/UTs to implement PMFBY and given them the option to select any number of additional risk covers/features.
    - **Investing in ICE Activities:** Insurance companies have to now spend 0.5% of the total premium collected on information, education and communication (IEC) activities.

The Beed model

- The state-run **Indian Agricultural Insurance Company** implemented the scheme.
- Under the new guidelines, the **insurance company provided a cover of 110% of the premium collected**.
- If the **compensation exceeded** the cover provided, the **state government would pay** the bridge amount.
- If the compensation was less than the premium collected, the insurance company would **keep 20%** of the **amount as handling charges** and reimburse the rest to the state government.
- In a normal season where farmers report minimal losses, the state government is expected **to get back money** that can form a corpus to fund the scheme for the following year.
- Hence in this model, the **profit of the company is expected to reduce and the state government would access another source of funds.**

644. National Edible Oil Mission- Oil Palm

In News: Recently, the Prime Minister announced a National Edible Oil Mission-Oil Palm (NMEO-OP) to make the country self-sufficient in cooking oils.

- The scheme involves investment of over Rs. 11,000 crore (over **a five year period**).
- Aim
    - To **raise the domestic production of palm oil** by three times to 11 lakh MT by 2025-26.
    - This will involve **raising the area under oil palm cultivation** to 10 lakh hectares by 2025-26 and 16.7 lakh hectares by 2029-30.
- The special emphasis of the scheme will be in **India's north-eastern states and the Andaman and Nicobar Islands** due to the conducive weather conditions in the regions.
- Under the scheme, oil palm farmers will be provided financial assistance and will get remuneration under a price and viability formula.
- It is expected to incentivise production of palm oil to reduce dependence on imports and help farmers cash in on the huge market.

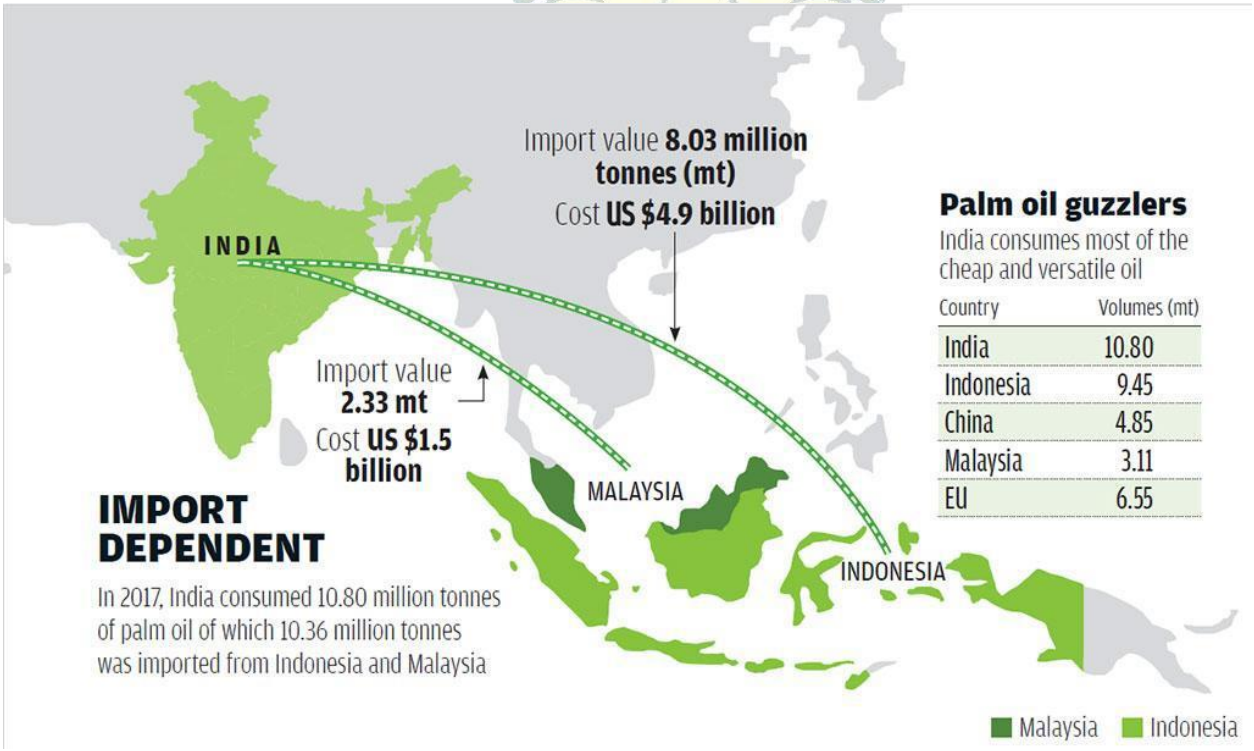
About Palm Oil

- Palm oil is currently the **world's most consumed vegetable oil.**
- It is used extensively in the production of detergents, plastics, cosmetics, and biofuels.
- **Top consumers** of the commodity are India, China, and the **European Union (EU).**

Edible Oil Economy

- Technology Mission on Oilseeds was set up in 1986 which was converted into a National Mission on Oilseeds and Oil Palm (NMOOP) in 2014.

- This gave a thrust to Government's efforts for augmenting the production of oilseeds. This is evident by the very impressive **increase in the production of oilseeds from about 11.3 million tons in 1986-87 to 33.22 million tons in 2019-20.**
- The other dominant feature which has had significant impact on the present status of edible oilseeds/oil industry has been the **program of liberalization** under which the Government's economic policy allows greater freedom to the open market and encourages healthy competition and self regulation rather than protection and control.
- The **Yellow Revolution** is one of the colour revolutions that was launched to increase the production of Edible oilseeds in the country to meet domestic demand.
- **Oils Commonly Used in India:** Groundnut, mustard, rapeseed, sesame, safflower, linseed, niger seed, castor are the major traditionally cultivated oilseeds.
    - Soybean and sunflower have also assumed importance in recent years.
    - Coconut is most important amongst the plantation crops.
- India produces less than half of the roughly 2.4 crore tonnes of edible oil that it consumes annually.
- The country has 3 lakh hectares of land under oil palm cultivation, producing around 2.80 lakh tonnes of crude palm oil (CPO) a year. There is a potential to bring 1.9 million hectares of land.
- It imports the rest, buying palm oil from Indonesia and Malaysia, soyoil from Brazil and Argentina, and sunflower oil, mainly from Russia and Ukraine.
- India is the world's biggest vegetable oil importer.
- India's vegetable oil imports have surged to 1.5 crore tonnes from 40 lakh only two decades ago and imports could reach 20 million by 2030.



645. Soil Health Card

- Soil Health Card (SHC) is a Government of India's scheme promoted by the **Department of Agriculture & Cooperation.**

- It is being **implemented through the Department of Agriculture of all the State and Union Territory Governments**.
- A Soil Health Card is used to assess the current status of soil health and changes in soil health that are affected by land management.

Soil Health Card

- SHC will contain 12 parameters, namely
- **N,P,K (Macronutrients);**
- **S (Secondary- nutrient);**
- **Zn, Fe, Cu, Mn, Bo (Micronutrients);**
- **pH, EC, OC (Physical parameters).**

Objectives of the Soil Health Card Scheme

- To issue **soil health cards every 3 years**.
- To **strengthen functioning of Soil Testing Laboratories (STLs)** and linkage with **ICAR/ State Agricultural Universities.**
- To **diagnose soil fertility related constraints** and design taluqa/ block level **fertilizer recommendations** in targeted districts.
- To develop and promote **soil test based nutrient management** in the districts for enhancing nutrient use efficiency.
- To **build capacities of district and state level staff** and of progressive farmers for promotion of nutrient management practices.

646. M-Kisan

About mKisan Portal – Mobile Based Services for Farmers

- mKisan is an SMS Portal for farmers which enables the Central and all State Government organizations to provide quick and useful information to the farmers.
- The m-KiSAN is used to provide information/services and important advisories to the farmers in the language of their *own choice and as per their agricultural practices & location*
- The project **is developed by the Department of Agriculture & Cooperation.**
- These messages are specific to farmers' needs & relevance at a particular point of time.
- Every Government Office from the **Ministry Headquarters down to the level of Block** to use this Portal to provide information to farmers.
- Farming in India is unsustainable in its present form. It requires a careful guiding hand from the Government for providing technical, weather and crop-specific information to all farmers. m-KISAN is the simplest way to provide government-sanctioned advisory and improvements to all farmers, at least those with a phone.

Objectives of the Portal include:

- To make SMS and other mobile based services
- Answer specific queries through SMS.
- Making use of mobile telephony to cover every farm household in the country.
- Integration of database of farmers from the State Governments, Universities, KVKs, Kisan Call Centres etc.

647. Matera declaration

Why in news: It was adopted at the **'G-20 Foreign and Development Ministers' Meeting** in Matera, Italy.

About the declaration-

- It calls upon the international community to step up efforts to contain the effects of the COVID-19 pandemic on lives and livelihoods, and build inclusive and resilient food chains and ensure adequate nutrition for all, in line with the **"Zero Hunger" goal** set for 2030.
- In the Matera Declaration, the G20 ministers recognised that **poverty alleviation, food security and sustainable food systems**, are key to ending hunger, encouraging social cohesion and community development, reducing socio-economic inequalities, and promoting overall inclusive economic growth and sustainable development.
- They also called for implementing effective actions for the empowerment of **women and youth** in the rural-urban continuum.
- The ministers also stressed on enhancing **social-protection measures and programmes,** with a focus on people living in vulnerable situations, of whom large shares depend on the agriculture and food sector for their livelihoods.
- It stressed on accelerating the adaptation of agriculture and food systems to climate change, as increased climate variability and extreme weather events impact agriculture output
- The declaration emphasised on keeping **international food trade open** and strengthening global, regional and local diversified value chains for safe, fresh and nutritious food, as well as promoting a science-based holistic One Health approach.

- The G20 is an influential bloc that brings together the world's major economies.
- The G20 member countries are Argentina, Australia, Brazil, Canada, China, France, Germany, Japan, India, Indonesia, Italy, Mexico, Russia, South Africa, Saudi Arabia, South Korea, Turkey, the United Kingdom, the United States and the European Union.

648. CSIR Aroma Mission

Why in news : On February 2021, CSIR-IIIM-Jammu announced Aroma Mission phase 2 after the success of the first phase.

About CSIR Aroma Mission:

The objectives of the Mission have been divided into eight verticals. These include:

1. Development of **superior varieties and agro-technologies** for aroma crops.
2. Assessment of their suitability for **specific agro-climatic regions.**
3. Enhancing area under selected aromatic crops.
4. Setting up of **distillation units** and **cooperatives** for marketing of the produce.
5. **Value-addition** of aromatic crops (High-end aroma chemicals and products).
6. Skill development activities.
7. Intellectual property generation, valuation and management.
8. **Entrepreneurship** development/Spin-offs.

CSIR-Central Institute of Medicinal and Aromatic Plants (CSIR-CIMAP), Lucknow is the nodal laboratory of the mission.

This Mission aims to achieve following outcomes:

- Bring about **5500 ha** of additional area under captive cultivation of aromatic cash crops
- Targeting **rain-fed /degraded land**.
- Enabling effective **buy-back mechanisms** to assure **remunerative prices** to the farmers/growers.
- Integration of domestic aroma products with global trade and economy.

649. Rashtriya Gokul Mission

Why in News:

PM recently inaugurated the following under **Rastriya Gokul Mission:**

- **Semen Station** with state of the art facilities in Purnea, Bihar.
- **IVF lab** established at Animal Sciences University, Patna.
- **Sex sorted semen** in artificial insemination by Baroni Milk Union in Begusarai district of Bihar.

About Rashtriya Gokul Mission:

Rashtriya Gokul Mission comprises of two components namely:

- The national program for bovine breeding
- National mission for bovine productivity.

Underlying objectives of the Mission:

- **Development and conservation** of indigenous breeds in a focused and scientific manner.
- Undertake **breed improvement** program for indigenous cattle breeds so as to improve the genetic makeup and increase the stock.
- Enhance **milk production and productivity**.
- Distribute **disease free** high genetic merit bulls for natural service.
- Upgrade nondescript cattle using elite indigenous breeds like Gir, Sahiwal, Rathi, Deoni, Tharparkar, Red Sindhi.

Implementing Agency

- Rashtriya Gokul Mission will be **implemented through the "State Implementing Agency (SIA viz Livestock Development Boards).**
- State Gauseva Ayogs will be given the mandate to sponsor proposals to the SIA's (LDB's) and monitor implementation of the sponsored proposal.
- All Agencies having a role in indigenous cattle development will be the "Participating Agencies" like ICAR, Universities, Colleges, NGO's, Cooperative Societies and Gaushalas.

Significant initiatives under Rashtriya Gokul Mission:

- Awards for encouraging farmers/breeder societies to rear Indigenous breeds of bovines:
  - **Gopal Ratna awards:** for farmers maintaining the best herd of Indigenous Breed and practicing best management practices.
  - **Kamdhenu awards:** for best managed Indigenous herd by Institutions/Trusts/ NGOs/ Gaushalas or best-managed Breeders' societies.
- **Gokul Gram:** The Rashtriya Gokul Mission envisages the establishment of **integrated cattle development centers** known as 'Gokul Grams' which will be established in: i) the native breeding tracts and ii) near metropolitan cities for housing the urban cattle. Roles and responsibilities of Gokul Grams are"

- Act as Centers for development of Indigenous Breeds and a dependable source for supply of high genetic breeding stock.
- They will generate economic resources from sale of **A2 milk**, organic manure, vermin-composting, urine distillates, and production of electricity from bio gas for in house consumption and sale of animal products.
- They will also function as **state of the art in situ training center** for Farmers and breeders.
- The Gokul Gram will **maintain milch and unproductive animals in the ratio of 60:40** and will have **the capacity to maintain about 1000 animals.**
- Nutritional requirements of the animals will be provided in the Gokul Gram through in house fodder production.
- **Metropolitan Gokul Gram will focus on genetic upgradation** of urban cattle.

- **National Kamdhenu Breeding Centre:** (NKBC) is being established as a Centre of Excellence to develop and conserve Indigenous Breeds in a holistic and scientific manner.
- **"E-Pashu Haat"- Nakul Prajnan Bazaar:** An e-market portal connecting breeders and farmers, for quality-disease-free bovine germplasm.
- **Pashu Sanjivni:** An animal wellness program encompassing the provision of animal health cards ('Nakul Swasthya Patra') along with UID identification and uploading data on National DataBase.
- **Advanced Reproductive Technology:** Including Assisted Reproductive Technique- In-vitro Fertilization (IVF) and sex-sorted semen technique to improve the availability of disease-free female bovines.
- **National Bovine Genomic Center** for Indigenous Breeds (NBGC-IB) will be established for selection of breeding bulls of high genetic merit at a young age using highly precise gene-based technology.

650. Gramin Krishi Mausam Sewa (GKMS) scheme

Why in news : I India Meteorological Department (IMD) has undertaken installation of Agro-AWS (**Agro automatic weather station)** at District Agromet Units (DAMUs) located in the KVKs under ICAR network.

About the Gramin Krishi Mausam Sewa (GKMS)

- Parent Body: Ministry of Earth Science
- Under GKMS project, IMD of Ministry of Earth Science in collaboration with State Agricultural Universities /ICAR etc. is **issuing crop and location specific weather based agro advisories.**
- Under this d**istrict level 5 day advanced weather forecast in respect of Rainfall, maximum temperature, minimum temperature, wind speed,** wind direction and Crop specific advisories are provided to farmers.
- Advisories are provided through different print/visual/Radio/ IT based media including **short message service** (SMS) and **Interactive Voice Response Service (IVRS).**
- The GKMS of IMD has been successful in providing the crop specific agro meteorological advisories in **vernacular languages** to about 22 million farmers in the country.

IASBABA'S

RAPID REVISION (RaRe) SERIES - UPSC 2021

RaRe Notes

DAY 96 - ENVIRONMENT and S&T

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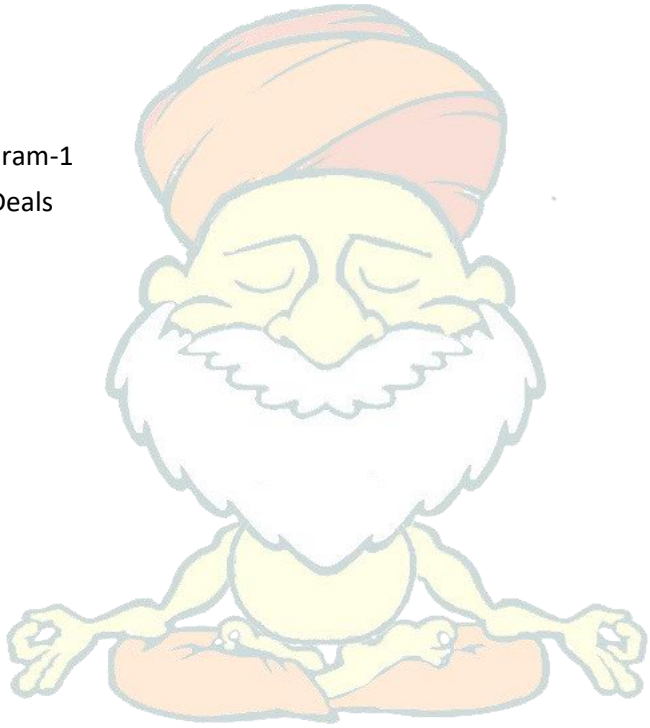

691. & 692. MCQs

Q.1) Who among the following rulers advised his subjects through this inscription? "Whosoever praises his religious sect or blames other sects out of excessive devotion to his own sect, with the view of glorifying his own sect, he rather injures his own sect very severely."
(a) Ashoka
(b) Samudragupta
(c) Harshavardhana
(d) Krishnadeva Ray

Answer: (a)

- Using common sense, this question can be answered. In whole of Ancient History that you must have read, inscriptions related to ASHOKA should have dominated your coverage.
- Through Dhamma, Ashoka wanted to establish a peaceful and coherent society in which every sect should respect and honour the other sect.
- If you knew this Dhamma of Ashoka, can easily guess the answer.

Major Rock Edict 12

English translation (Kalsi version)

King Devanampriya Priyadarsin is honouring all sects: ascetics or house holders, with gifts and with honours of various kinds.

But Devanampriya does not value either gifts or honours so (highly) as (this), (viz.) that a promotion of the essentials of all sects should take place. This promotion of the essentials (is possible) in many ways. But its root is this, viz. guarding (one's) speech, (i.e.) that neither praising one's own sect nor blaming other sects should take place on improper occasions, or (that) it should be moderate in every case. But other sects ought to be honoured in every way.

If one is acting thus, he is promoting his own sect considerably and is benefiting other sects as well.

If one is acting otherwise than thus, he is both hurting his own sect and wronging other sects as well.

For whosoever praises his own sect or blames other sects, — all (this) out of pure devotion to his own sect, (i.e.) with the view of glorifying his own sect, — if he is acting thus, he rather injures his own sect very severely.

But concord is meritorious, (i.e.) that they should both hear and obey each other's morals.

For this is the desire of Devanampriya, (viz.) that all sects should be both full of learning and pure in doctrine.

And those who are attached to their respective (sects), ought to be spoken to (as follows). Devanampriya does not value either gifts or honours so (highly) as (this), (viz.) that a promotion of the essentials of all sects should take place.

And many (officers) are occupied for this purpose, (viz.) the Mahamatras of morality, the Mahamatras controlling women, the inspectors of cowpens, or other classes (of officials).

And this is the fruit of it, (viz,) that both the promotion of one's own sect takes place, and the glorification of morality.

— 12th Major Rock Edict. Translation by E. Hultzsch (1857-1927). Published in India in 1925. Inscriptions of Asoka p.34. Public Domain.

Q.2) What are the advantages of fertigation in agriculture?
1. Controlling the alkalinity of irrigation water is possible.
2. Efficient application of Rock Phosphate and all other phosphatic fertilizers is possible.
3. Increased availability of nutrients to plants is possible.
4. Reduction in the leaching of chemical nutrients is possible.

Select the correct answer using the code given below:
(a) 1, 2 and 3 only
(b) 1, 2 and 4 only
(c) 1,3 and 4 only
(d) 2, 3 and 4 only

Answer: (c)

Fertigation is a process in which fertilizer is dissolved and distributed along with water in your drip or spray irrigation system. There is abundant research available that supports the superiority of fertigation as compared to traditional fertilizing techniques.

Advantageous of fertigation:

- Improves efficiency of fertilizer use
- Increases nutrient availability ((**Hence, statement 3 is correct**))
- Saves 20-40% fertilizer without affecting growth and yield
- Saves labour and energy in application of fertilizer
- Reduce environmental contamination through fertilizer run-offs
- Reduces leaching of nutrients (**Hence, statement 4 is correct**)
- Allows to alter the pH of the irrigation water (**Hence, statement 1 is correct**)

Disadvantages of fertigation

- Uneven nutrient distribution occurs when the irrigation system is faulty. It leads to over fertilization or leaching of nutrients when excess water is applied to crops.
- Chemical reactions of fertilizer with calcium and magnesium, bicarbonates in water, which can lead to chemical clogging.
- Suitable for readily soluble or liquid fertilizers. Phosphatic fertilizer and some micronutrients may precipitate in micro-irrigation system. **Hence, statement 2 is not correct.**
- Corrosion resistant fertigation equipments are needed.
- Potential chemical backflow into the water supply source.

Q.3) Consider the following minerals:

1. Bentonite
2. Chromite
3. Kyanite
4. Sillimanite In India,

Which of the above is/are officially designated as major minerals?

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

Answer: (d)

Major minerals are those specified in the first schedule appended in the MMDR Act. There is no official definition for "major minerals" in the MMDR Act. Hence, whatever is not declared as a "minor mineral" may be treated as the major mineral.

The central government has the power to notify "minor minerals" under section 3 (e) of the MMDR Act, 1957. On the other hand, as per Section 15 of the MMDR Act, 1957 State Governments have complete powers for making Rules for grant of concessions in respect of extraction of minor minerals and levy and collection of royalty on minor minerals.

Thus, "Minor Minerals" are building stones, gravel, ordinary clay, ordinary sand other than sand used for prescribed purposes etc. Therefore, Chromite, Kyanite and Sillimanite are major minerals, whereas Bentonite is a minor mineral.

Therefore, the correct answer is (d).

Q.4) With reference to Ocean Mean Temperature (OMT), which of the following statements is/are correct?

1. OMT is measured up to a depth of 26°C isotherm which is 129 meters in the south -western Indian Ocean during January –March.
2. OMT collected during January –March can be used in assessing whether the amount of rainfall in monsoon will be less or more than a certain long -term mean.

Select the correct using the code given below:
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Solution (b)

OMT, which is measured up to a depth of 26 degree C isotherm, is more stable and consistent, and the spatial spread is also less. The 26 degree C isotherm is seen at depths varying from 50–100 metres. During January–March, the mean 26 degree C isotherm depth in the Southwestern Indian Ocean is 59 metres.

Scientists from Pune's Indian Institute of Tropical Meteorology (IITM) find that ocean mean temperature (OMT) that has better ability to predict this than the sea surface temperature. Compared with SST which has 60% success rate of predicting the Indian summer monsoon, OMT has 80% success rate.

Reference: https://www.thehindu.com/sci-tech/science/ocean-mean-temperature-can-better-predict-indian-summer-monsoon/article24842963.ece

Q.5) With reference to chemical fertilizers in India, consider the following statements:
1. At present, the retail price of chemical fertilizers is market -driven and not administered by the Government.
2. Ammonia, which is an input of urea, is produced from natural gas.
3. Sulphur, which is a raw material for phosphoric acid fertilizer, is a by -product of oil refineries.
Which of the statements given above is/are correct?
(a) 1 only
(b) 2 and 3 only
(c) 2 only
(d) 1, 2 and 3

Answer: (b)

Statement 1is incorrect– The prices of fertilizers are administered through MRP, subsidies by the government. It is not market driven in India.

Statement 2 is correct– Natural gas is the primary raw material used to produce ammonia. Urea is made from ammonia and carbon dioxide. The ammonia and carbon dioxide are. fed into the reactor at high pressure and temperature, and the urea is formed in a two step.

Statement 3 is correct – Sulfur is a by-product of processing natural gas and refining high-sulfur crude oils. Some fertilizers, such as two-component fertilizers Monoammonium Phosphate (MAP) and Diammonium Phosphate (DAP), offer farmers an effective means of delivering both nitrogen and phosphorus to soils. Sulfuric acid is used as a key first step in the production of both MAP and DAP, after which it is mixed with phosphate rock to produce phosphoric acid.

693. Patent to an AI system

In news: In a world first, South Africa grants patent to an artificial intelligence system

About

- At first glance, a recently granted South African patent relating to a "food container based on fractal geometry" seems fairly mundane.
- The innovation in question involves interlocking food containers that are easy for robots to grasp and stack.
- On closer inspection, we notice that the **inventor is not a human being** — it is an artificial intelligence (AI) system called DABUS. The invention was entirely devised by the DABUS.
- The patent application listing DABUS as the inventor was filed in patent offices around the world, including the U.S., Europe, Australia, and South Africa. But only South Africa granted the patent (Australia followed suit a few days later after a court judgment gave the go-ahead).
- The United States Patent and Trademark Office and the European Patent Office rejected these applications in the formal examination phase.

What is the DABUS?

- DABUS stands for "device for the autonomous bootstrapping of unified sentience".
- It is an AI system created by Stephen Thaler, a pioneer in the field of AI and programming.
- The system simulates human brainstorming and creates new inventions.
- DABUS is a particular type of AI, often referred to as "creativity machines" because they are capable of independent and complex functioning.

What are the 'Creativity machines'?

- Creativity machines can process and critically analyse data, learning from it. This process is known as machine learning.
- Once the machine learning phase has occurred, the machine is able to "autonomously" create without human intervention.
- Prior to DABUS, Thaler built another AI which created novel sheet music, and which he credited with inventing the cross-bristle toothbrush design.

Why are some experts opposing this move?

- First, their respective patent laws only provide for human inventors — not AI — as indicated by the use of pronouns such as "him" and "her" in their text.
- Second, ideas, for the purposes of patents, require the element of "mental conception" — something of which only a human mind is capable.
- Finally, inventorship comes with rights, which AI is not legally capable of possessing.
- The critics argued that it was the incorrect decision in law, as AI lacks the necessary legal standing to qualify as an inventor.
- Critics feel that if South Africa instead had a substantive search and examination system in place, the DABUS patent application would have been rejected.

694. AL-Mohed AL-Hind and Talisman Sabre

AL-Mohed AL-Hind

- In 2021, India and Saudi Arabia started their first-ever Naval joint exercise called the Al-Mohed Al-Hindi Exercise.
    - The decision on this exercise was taken in the Riyadh Summit held in 2019.
- **Aim:** To carry out tactical manoeuvres, search and rescue operations, and an electronic warfare drill **to enhance interoperability**.
- Indian Naval Ship (INS) Kochi is participating in the exercise. The exercise comprises several coastal and sea-based exercises between the two navies.

- **Significance:**
  - It reflects the growing defense ties between the two countries in the midst of rapidly changing developments in the Gulf region.
  - It will enhance bilateral cooperation and security in the Indian Ocean Region.

Talisman Sabre

In news: Australia is keen that India join its biggest war games 'Exercise Talisman Sabre' in 2023.

About

- Exercise Talisman Sabre is a biennial, multinational military exercise led by Australia and the United States.
- Leadership of the exercise switches between Australia and the US every 2 years.
- The exercise focuses on crisis-action planning and contingency response, enhancing both nations' military capabilities to deal with regional contingencies and the War on Terrorism.
- The exercise is historically held in odd-numbered years starting from 2005, with the ninth iteration taking place in 2021.
- Talisman Sabre 2021 was the largest bilateral combined training activity between the Australian and the USA and saw the participation of approximately 17,000 military personnel from seven nations on land, air and sea. The other countries include Canada, Japan, New Zealand, South Korea and U.K.

695. Paramilitary Forces or Central Armed Police Forces

- Under the Indian Constitution, police and public order are state subjects. However, the **Ministry of Home Affairs (MHA)** assists state governments by providing them support of the Central Armed Police Forces.

Major Functions of Central Armed Police Forces

- Safeguard the security of borders of India and promote a sense of security among the people living in border areas.
- Prevent trans-border crimes, smuggling, unauthorized entry into or exit from the territory of India and to prevent any other illegal activity.
- Provide security to sensitive installations, persons at security risk.
- Restore and preserve order in any area in the event of disturbance therein.
- **Other Functions:** Counter Insurgency Operations, Anti Naxal Operations, Internal Security Duties, VIP Protection, Lead Intelligence Agency, Security To Diplomatic Missions Abroad, UN Peacekeeping Operations, Disaster Management, Civic Action Nodal agency for UN Police Missions, etc.

Assam Rifles (AR):	• The Assam Rifles came into being in 1835, as a militia called the **'Cachar Levy'.** • It is considered the oldest of all paramilitary forces • This force plays a crucial role in North East India, handling counterinsurgency and border security operations. • They are also guarding the 1,643 km long Indo-Myanmar border since 2002. • It is often referred to as the"Friends of the Hill People", "Friends of the North East People" and the "Sentinels of the North East". • It is headed by an Army officer of the rank of Lieutenant General. • The administrative control of Assam Rifles is with MHA while the operational control is with the Ministry of Defence.

	• It remains the most awarded paramilitary force in both pre-and post-independent India – Since independence, it has been awarded 120 Shaurya Chakras, 31 Kirti Chakras, five Vir Chakras and four Ashok Chakras, apart from 188 Sena Medals.
Border Security Force (BSF)	• The BSF is the border guards of the country and is called the 'India's First Line of Defence. • It came into being in the wake of the 1965 Indo-Pakistan war. It was established on 1st December 1965. • It also undertakes defensive actions during wartime to free up Indian Army troops for offensive operations. • Of late, the BSF has also been tasked with assisting the CRPF and army in counter-insurgency operations.
Central Reserve Police Force (CRPF)	• It was established by the enactment of the CRPF Act in 1949. • Initially, it came into existence as Crown Representative's Police in 1939 for internal security. • The primary mission of the Central Reserve Police Force is counter-insurgency operations. • It also assists the State and Union Territories in police operations to maintain law and order. • Apart from this, the force participates as a police force in the UN peace-keeping missions. • The CRPF maintains a special operation unit known as Commando Battalion for Resolute Action(COBRA) to combat Maoist insurgents.
Central Industrial Security Force (CISF)	• was established in 1969, under an Act of Parliament, "Central Industrial Security Force Act, 1968." • It provides integrated security cover to the Public Sector Undertakings, airports and SEZs on a case to case basis. • It is currently providing security cover to nuclear installations, space establishments, airports, seaports, power plants, sensitive Government buildings, heritage monuments and large special economic zones. • CISF is also responsible to provide protection to the persons classified as Z Plus, Z, X, Y. • CISF is the only force with a customized and dedicated fire wing.
Indo-Tibetan Border Police (ITBP)	• The Indo-Tibetan Border Police was established on 24th October 1962 after the 1962 Sino-Indian conflict. • It was created under the CRPF Act. • It guards the **Indo-Tibetan border** and the mountainous regions of the **India-China border** and monitors the northern borders. • The force also keeps a check on illegal immigration and trans-border smuggling. • It has been deployed in UN peacekeeping missions in Kosovo, Sierra Leone, Haiti, Western Sahara, Bosnia, Herzegovina, Afghanistan and Sudan. • ITBP replaced Assam Rifles in Sikkim and Arunachal Pradesh in 2004. The Indi-China border covering the following state is guarded by the ITBP (From the Karakoram pass in Jammu & Kashmir to Jechap La in Arunachal Pradesh):

	○ Jammu & Kashmir ○ Himachal Pradesh ○ Uttarakhand ○ Sikkim ○ Arunachal Pradesh
Sashastra Seema Bal (SSB)	• The Sashastra Seema Bal was set up in March 1963. • They guard **Indo-Nepal and Indo-Bhutan Borders.** • They are also deployed during elections as polling booth security. • Its area of coverage included 15 states • Previously, it was known as the Special Service Bureau and they are deployed to control anti-national activities and inculcate feelings of national belonging in the border population among others. It also acts against smuggling and other illegal activities.
National Security Guards (NSG)	• It is a counter terrorism unit which was raised in 1984, following Operation Blue Star. • It has a highly trained force which deals with exceptional situations when local police and special forces need assistance. • It was raised to combat terrorist activities and to guarantee the states do not experience any internal disturbances. • They played a crucial role in countering the 26/11 Mumbai terrorist attack

696. CoBRA and SFF

Why in news: Recently a CoBRA commando was killed in IED blast in Chhattisgarh's Sukma

History of Commando Battalion for Resolute Action(CoBRA)

- In the year 2009, the Ministry of Home affairs had accorded approval for setting up the Commando Battalion for Resolute Action (CoBRA)
- It is trained **for guerrilla/jungle warfare type operations for dealing with extremists and insurgents, etc.**
- It is raises as **unattached battalions in Central Reserve Police Force(CRPF)**.
- Originally established to counter the Naxalite problem,
- CoBRA is also deployed to address insurgent groups engaging in asymmetrical warfare.

Special Frontier Force(SFF) of India

- SFF is an Indian special operations unit **created in 1962.**
- It mainly comprised **Tibetan refugees** living in India.
- Its primary goal originally was to conduct covert operations behind Chinese lines in the event of another Sino-Indian War.
- SFF has fought in India's major external wars including the **Bangladesh Liberation War and the Kargil War.**
- Based in **Chakrata, Uttarakhand**.
- The force was put under the direct supervision of the IB, and later RAW, India's external intelligence agency
- It is not part of the Indian Army.
- **It falls under the authority of the Directorate General on Security in the Cabinet Secretariat**.

697. Indrajaal

Why in news: Grene Robotics, a Hyderabad-based technology R&D firm has designed and developed India's first **indigenous drone defense dome** called "Indrajaal".

About Indrajaal

- It has the capability to **protect an area of 1000-2000 sq km** against the aerial threats
- It can act on aerial threats such as Unmanned Aerial Vehicles (UAVs), loitering munitions, and **Low- Radar Cross Section (RCS) targets.**
- It has gained significance as Jammu Air Base on June 27th was attacked by UAVs to drop explosives next to the Mi-17.
- The ANTI-UAV systems will not only provide **protection to defense bases** but it will be beneficial for linear infrastructures like **international borders.**
- The path-breaking development is imperative because manual weapons and point-based defence systems can't defend modern warfares, which are operated by Artificial Intelligence (AI) and robotics.
- The design principles of Indrajaal are based on **delivering autonomy to the armed forces.**
- Capable of real-time situational awareness, Indrajaal comprises all current weapons suite and infrastructure along with a honeycombed cell structure to provide a seamlessly built over a combination of 9-10 technologies for 24×7 persistent monitoring, tracking and action.

Salient features of Indrajaal

- Real-time situational awareness
- Integrated and Intelligent meshed network
- Integrated all current weapons suite and infrastructure
- Honeycombed cell structure for seamlessly built
- Synergic combination of 9-10 technologies
- 24×7 persistent and autonomous monitoring, action and tracking

698. Mimang cheton

Why in news: China is raising new militia units named Mimang Cheton comprising **local Tibetan youth for high-altitude warfare near Eastern Ladakh.**

Key updates

- The intelligence intercepts have revealed that **China is raising these units to counter India.**
- The n**ew units named Mimang Cheton** are presently undergoing training, and are to be deployed mostly in the eastern and western sectors of the India-China border.
- They have been deployed along **various locations in the Chumbi valley**.
- Units are also to be deployed at Rutog in Tibet, near the Pangong Tso (lake) in eastern Ladakh.
- The deployment of the new Mimang Cheton **units mirrors India's Special Frontier Force(SFF)** consisting of persons of Tibetan origin.

699. Anti Radiation Missile Rudram-1

Why in news: India's **first indigenous anti-radiation missile, Rudram**, developed for the Indian Air Force, was successfully flight-tested from a Sukhoi-30 MKI jet.

Features of the Anti Radiation Missile

- Rudram is an **air-to-surface missile**, designed and developed by the **Defense Research and Development Organization (DRDO).**
- The integration with fighter jets has been a collaborative effort of DRDO, IAF and Hindustan Aeronautics Ltd.
- While the system has been **tested from a Sukhoi-30 MKI**, it can be adapted for launch from other fighter jets too.
- Rudram has been developed to enhance **Suppression of Enemy Air Defense (SEAD) capability.**
- They are used mainly in the **initial part of air conflict to strike at the air defense assets of the enemy, and also in later parts, leading to higher survivability of a country's own aircraft.**
- **Also for Neutralising or disrupting** the operations of the adversary's early warning radars.
- Once the Rudram missile locks on the target, it is **capable of striking accurately even if the radiation source switches off in between.**
- It can **hit radiation emitting targets within a range of 250 km.**

700. Offset Clause in Defence Deals

Why in News: The government has decided **not to have an offset clause** in procurement of defense equipment if the deal is done through **inter-government agreement (IGA), or an ab initio single vendor**.

Features of Offset Clause

- Under defense offset, a foreign supplier (Ex: France) of equipment agrees to manufacture a given percent of his product in the buying country (India).
- The defense offset policy is a part of **Defense Procurement and Procedure (DPP).**
- **Valuation for Offset**: Under the DPP 2006, the offset value was fixed at 30% of defence deals above ₹300 crore, which was revised to ₹2,000 crore in DPP 2016 for full-import deals.
- The 2016 offset policy **increased the threshold of defense offset to Rs 2000 crore** from the previous level of Rs 300 crores under "buy" and 'buy and make" categories.
    - Only for those purchases of above Rs 2000 crore, the foreign company has to **ensure 30% domestic value addition in India.**

Offset obligations may be discharged by any one or a combination of the following methods:

- **Direct purchase of** products manufactured by Indian enterprises.

- Foreign Direct Investment in **joint ventures** with Indian enterprises.
- Investment in 'kind' in terms of **transfer of technology** (TOT) to Indian enterprises.
- Investment in 'kind' in Indian enterprises in terms of **provision of equipment.**
- Provision of equipment or TOT to **Government institutions and establishments** like DRDO.

Offsets as a "mechanism generally established with the triple objectives of:

a) partially compensating for a significant outflow of a buyer country's resources in a large purchase of foreign goods
b) facilitating induction of technology and
c) adding capacities and capabilities of domestic industry

What has been the working of Offset Clause?

- Auditing the offset deals till March 2018, the Comptroller and Auditor General (CAG) said 46 offset contracts were signed for ₹66,427 crores.
- **Target**: Till December 2018, ₹19,223 crore worth of offsets should have been discharged.
- **Actual Implementation:** The vendors have claimed discharge of only ₹11,396 crore, 59%, of the offsets. But the Defence Ministry has accepted only ₹5,457 crore of these offset claims, while the rest were pending or rejected due to various deficiencies
- **Pending:** The remaining offset commitments of about ₹55,000 crore would be due for completion by 2024, but the rate of the offset discharge has been about ₹1,300 crore per year.
- **Ineffective:** At other times, international vendors reportedly discharged offsets that didn't necessarily contribute to India's defence manufacturing prowess, thereby defeating the very purpose of these deals.

Will no defence contracts have offset clauses now?

- Only government-to-government agreements (G2G), ab initio single vendor contracts or inter-governmental agreements (IGA) will not have offset clauses anymore.
    - For example, the deal to buy 36 Rafale fighter jets, signed between the Indian and French governments in 2016, was an IGA.
    - Ab initio single vendor means that when you start the process you have only one vendor
- According to DAP 2020, all other international deals that are competitive, and have multiple vendors vying for it, will continue to have a 30% offset clause.

Why was the clause removed?

- **To reduce procurement cost**: Generally, vendors would "load" extra cost in the contract to balance the costs of offsets, and doing away with the offsets can bring down the costs in such contracts.
- **To reduce Administrative Costs**: There are "administrative costs" involved in discharging offset obligations, which the vendors pay.
- **Criticism by CAG about Offsets**: CAG audit report "found that the foreign vendors made various offset commitments to qualify for the main supply contract but later, were not earnest about fulfilling these commitments"
- The CAG had also not found "a single case where the foreign vendor had transferred high technology to the Indian industry".

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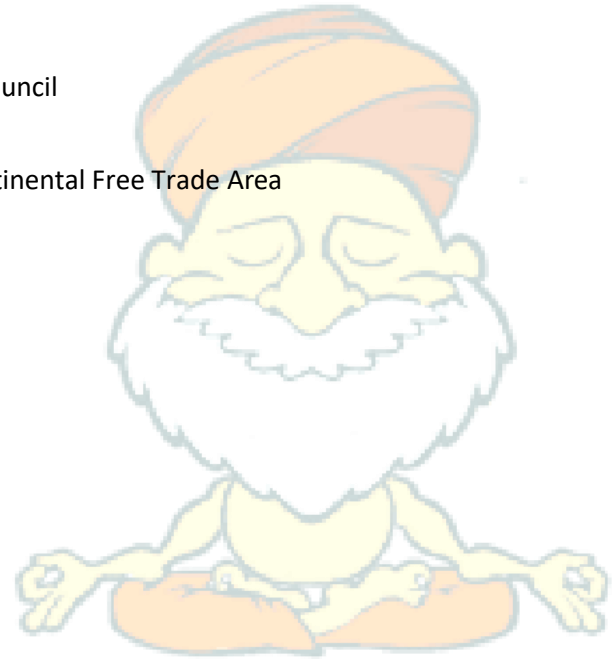


741. & 742. MCQs

Q.1) In India, which of the following can be considered as public investment in agriculture?

1. Fixing Minimum Support Price for agricultural produce of all crops.
2. Computerization of Primary Agricultural Credit Societies.
3. Social Capital Development.
4. Free Electricity supply to farmers.
5. Waiver of agricultural loans by the banking system.
6. Setting up of cold storage facilities by the government.

Select the correct answer using the code given below:

(a) 1,2 and 5 only

(b) 1,3,4 and 5 only

(c)2,3 and 6 only

(d) 1,2,3,4,5 and 6

Solution (c)

EXPLANATION:

- Fixing Minimum Support Price for agriculture produce of all crops, Free electricity supply of farmers, Waiver of agriculture loans by the banking system do not qualify to be public investment, rather they come under the category of subsidies.

Q.2) What is the importance of the term "Interest Coverage Ratio" of a firm in India?

1. It helps in understanding the present risk of a firm that a bank is going to give loan to.
2. It helps in evaluating the emerging risk of a firm that a bank is going to give loan to.
3. The higher a borrowing firm's level of Interest Coverage Ratio, the worse is its ability to service its debt.

Select the correct answer using the code given below:

(a) 1 and 2 only

(b) 2 only

(c)1 and 3 only

(d) 1,2 and 3

Solution: (a)

One of the significant and most crucial liquidity ratios is the **Interest Coverage Ratio**, which indicates the level of a company's ability to afford the interest that is to be paid by the company for raising debt. It does not measure the ability to make principal payments on the debt; instead it depicts how much the company can afford to pay the interests on the debt promptly.

- The interest coverage ratio is used to see how well a firm can pay the interest on outstanding debt. **So, statement 1 is correct.**
- Also called the times-interest-earned ratio, this ratio is used by creditors and prospective lenders to assess the risk of lending capital to a firm. **So, statement 2 is correct.**
- A higher coverage ratio is better, although the ideal ratio may vary by industry. **So, statement 3 is not correct.**

Q.3) Which of the following factors/policies were affecting the price of rice in India in the recent past?

1. Minimum Support Price

2. Government's trading

3. Government's stockpiling

4. Consumer subsidies

Select the correct answer using the code given below:

(a) 1,2 and 4 only

(b) 1,3 and 4 only

(c) 2 and 3 only

(d) 1,2,3 and 4

Answer: (d)

Explanation:

By the following ways the price of rice in India gets affected:

- MSP increases the overall price of rice in market as the traders have to buy near MSP value otherwise farmers have the option to sell to government appointed agency at MSP.
- Government also carries out auction of the excess stockpile or intervenes when market prices soar to stabilize them.
- Similarly stockpiling is done to offload the stock when market prices soar providing cheap rice to consumers and stocking when prices fall ensuring remunerative prices to farmers.
- Government also provides subsidised food to poor at Fair price Shops. This reduces the overall demand in the open market and prices are affected.

Q.4) Consider the following statements:

1. The value of Indo-Sri Lanka trade has consistently increased in the last decade.
2. "Textile and Textile articles" constitute an important item of trade between India and Bangladesh.
3. In the last five years, Nepal has been the largest trading partner of India in South Asia.

Which of the statements given above is/are correct ?

(a) 1 and 2 only

(b) 2 only

(c) 3 only

(d) 1,2 and 3

Solution (b)

EXPLANATION:

The value of Indo-Sri Lanka trade has no consistent trend in the last decade. **Hence Statement 1 is incorrect**

There are significant value chain linkages between India and Bangladesh, particularly in the textile and apparel sector. India specializes in the upstream segment, supplying such intermediate inputs as silk, cotton, yarn, and fabrics to Bangladesh. Bangladesh specializes in the downstream final apparel segment, exporting worldwide as well as to India. **Hence Statement 2 is correct.**

Bangladesh is India's biggest trade partner in South Asia.**Hence Statement 3 is incorrect.**

Q75. In which one of the following groups are all the four countries members of G20?

(a) Argentina, Mexico, South Africa and Turkey

(b) Australia, Canada, Malaysia and New Zealand

(c) Brazil, Iran, Saudi Arabia and Vietnam

(d) Indonesia, Japan, Singapore and South Korea

Solution (a)

EXPLANATION:

The Group of Twenty (G20) is the premier international forum for global economic cooperation. **Its members are:**

Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, United Kingdom, United States, and the European Union.

Therefore, the correct answer is (a)

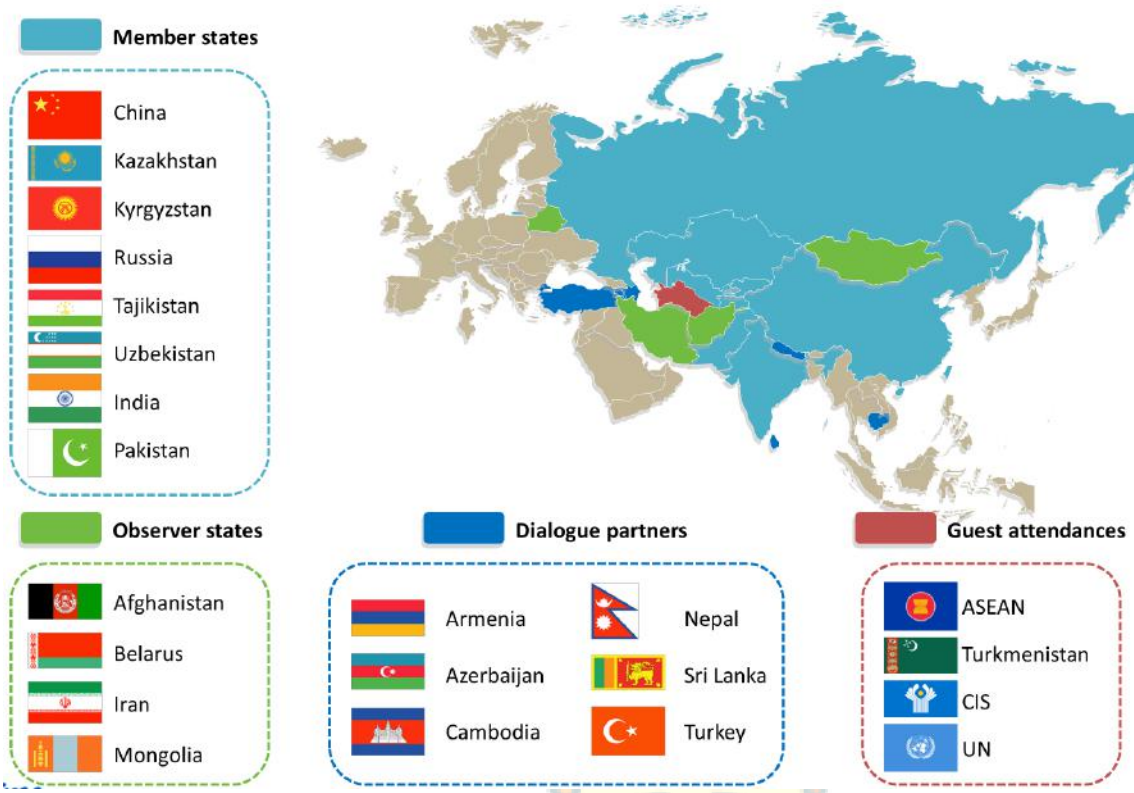
743. SCO & E9 Countries

Shanghai Cooperation Organisation (SCO)

Why in news: SCO Heads of Government Summit was hosted by India. It is the first time India has hosted the SCO Summit since it became a member of the group in 2017.

What was SCO founded and what is its historical background?

- **Built on Shanghai Five:** Russia, China, Kazakhstan, Kyrgyzstan (Kyrgyz Republic) and Tajikistan popularly known as Shanghai Five had come together in the post-Soviet era in 1996, in order to work on regional security, reduction of border troops, and terrorism.
- **Initial Success in resolving Boundary Disputes:** The 1996 meeting of the Shanghai Five resulted in an 'Agreement on Confidence-Building in the Military Field Along the Border Areas' between China, Russia, Kazakhstan, Kyrgyzstan and Tajikistan, which led to an agreement on the mutual reduction of military forces on their common borders in 1997.
- **Inclusion of Uzbekistan:** Subsequently, Shanghai Five helped resolve disputes between Kyrgyzstan, Tajikistan and Uzbekistan on border issues and the Ferghana Valley enclaves.
- **Institutionalisation**: Subsequently a permanent intergovernmental international organisation called SCO was founded in June 2001. It is Eurasian political, economic, and security alliance of China, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, and Uzbekistan.
- **Expansion**: Its membership was expanded to include India and Pakistan in 2017.
- **Observer States**: The SCO also has four observer states — Afghanistan, Iran, Belarus and Mongolia — which may be inducted at a later date.



What is the Organisational Structure of SCO?

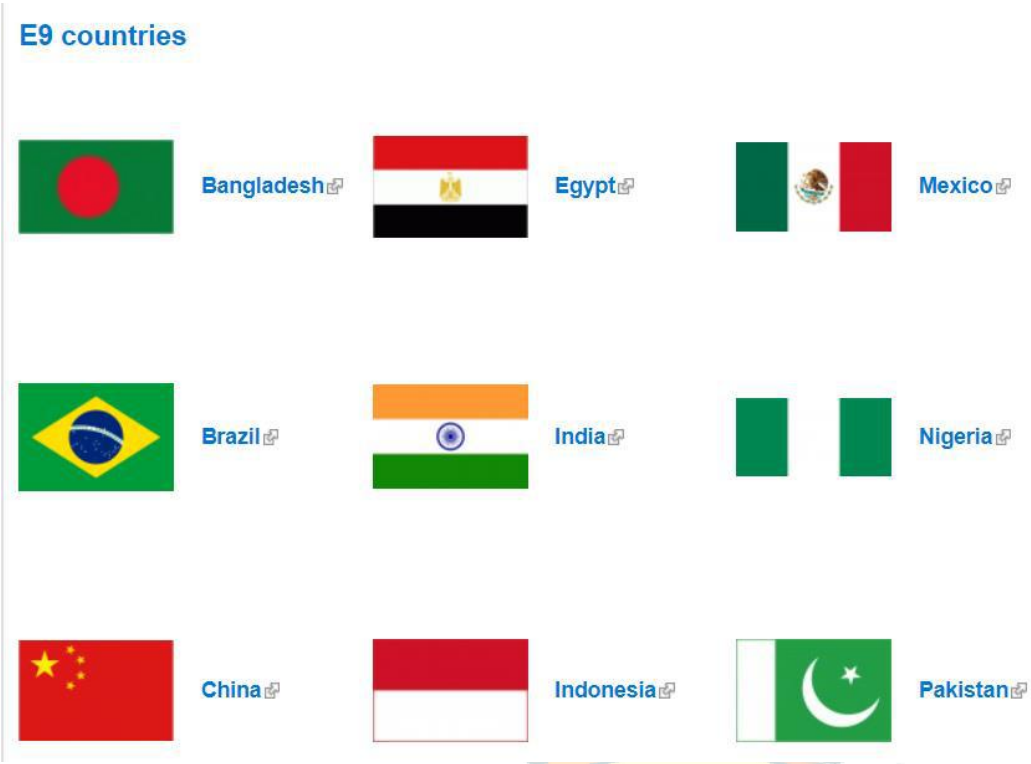
- The organisation has two permanent bodies — the SCO Secretariat based in Beijing and the Executive Committee of the Regional Anti-Terrorist Structure (RATS) based in Tashkent.
- The SCO Secretary-General and the Director of the Executive Committee of the SCO RATS are appointed by the Council of Heads of State for a term of three years.
- However, the venue of the SCO council meetings moves between the eight members

E9 Countries

Why in news: E9 countries recently decided explore possibility of scaling up digital learning to achieve **UN sustainable goal on quality education.**

About

- The E9 is a forum of nine countries, which was formed to achieve the goals of UNESCO's Education For All (EFA) initiative.
- E-9 Initiative was launched in 1993 at the EFA Summit in New Delhi, India.
- The "E" stands for education and the "9" represents the following nine countries: These countries represent over half of the world's population and 70% of the world's illiterate adults.



744. East Asian Summit & Boao Forum for Asia (BFA)

East Asian Summit

Context: The latest edition of **the East Asia Summit (EAS)** is being held in **Bangkok**.

About East Asia Summit:

- The East Asia Summit (EAS) is the Indo-Pacific's premier forum for strategic dialogue. It is the only leader-led forum at which all key partners meet to discuss political, security and economic challenges facing the Indo-Pacific, and has an important role to play in advancing closer regional cooperation.
- The inaugural EAS held in Kuala Lumpur on 14 December 2005.
- The EAS has 18 members - the ten ASEAN countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam) along with Australia, China, **India**, Japan, New Zealand, the Republic of Korea, Russia and the United States.
- ASEAN leads the forum, and the chair position rotates between ASEAN Member States annually.
- In 2020 EAS members represented 54 per cent of the world's population and accounted for 62 per cent of global GDP worth an estimated US$52.3 trillion

Boao Forum for Asia

Why in news: The opening ceremony of **the Boao Forum for Asia** Annual Conference 2021 was held in **Boao, south China's Hainan Province.**

- **Theme:** "A World in Change: Join Hands to Strengthen Global Governance and Advance Belt and Road Cooperation."

About the Bao Forum for Asia (BFA):

- It is an **international not for profit organization** which was jointly initiated by 26 member states in 2001, the members have now increased to 29. India is also a member of the BFA.
- Its **annual conference** is held in **Boao, Hainan province of China**.

- The establishment of BFA is modelled on the lines of the **World Economic Forum** which bases its annual meeting in **Davos-Klosters, Switzerland.** Thus earning the name of **'Davos of the East'.**
- The founding purpose of BFA was to **promote economic integration in Asia.** Its mission now is to **pool positive energy for the development of Asia and the world.**
- Its five focal areas include technology innovation, health, education, culture and media in response to the new economy.

745. Eurasian Economic Council & 17+1 Initiative

Eurasian Economic Council

Why in news: India has skipped a meeting of the **Eurasian Economic Union (EAEU)**, which was organised by the **Shanghai Cooperation Organisation (SCO)** at Xi'an in China.

About Eurasian economic union:

- It is an international organization for regional economic integration that came into existence on **1st January 2015.**
- The EAEU provides for **free movement** of goods, services, capital, and labor within its borders.
- It pursues, coordinates, & harmonizes the policies in the sectors determined by the Treaty and international agreements within the Union.
- The **member states** of the Eurasian Economic Union are,
    - The Republic of **Armenia,**
    - The Republic of **Belarus,**
    - The Republic of **Kazakhstan,**
    - The **Kyrgyz** Republic, and
    - The **Russian** Federation.

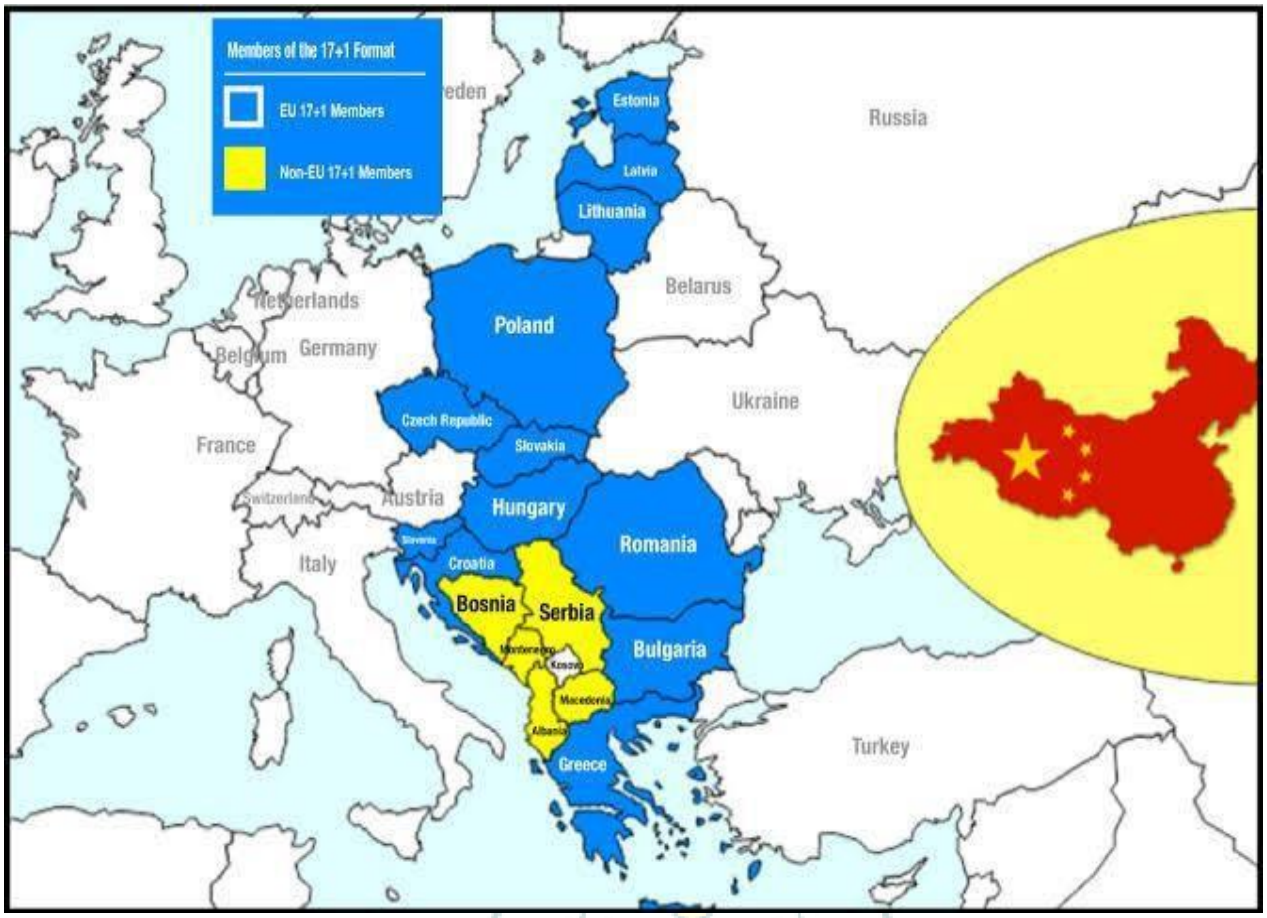
17+1 Initiative

Context: Lithuania has quit China's 17+1 cooperation forum with central and eastern European states, calling it "divisive".

- **Reason:** Lithuania's new ties with Taiwan, its Parliament's resolution on Uighurs, and then Chinese sanctions on Lithuanian and EU politicians.

About

- The 17+1 initiative is a China-led format founded in 2012 in Budapest with an aim to expand cooperation between Beijing and the Central and Eastern European (CEE) member countries.
- **Objective:** To promote business and investment relations between China and 16 countries of Central and Eastern Europe Countries (CEEC)
- It will now be known as 16+1 after Lithuanias' exit.
- **Composition:** The initiative includes twelve EU member states and five Balkan states.



746. G7 & G20

Context: At the invitation of UK Prime Minister Boris Johnson, Prime Minister Narendra Modi participated in the Outreach Sessions of the G7 Summit on June 12 and June 13, 2021 in virtual format.

The UK currently holds the presidency of the G7 and has invited India, along with Australia, Republic of Korea and South Africa, as guest countries for the Summit.

About G-7

- The G7 comprises the US, UK, France, Germany, Italy, Canada and Japan.
- It is an intergovernmental organisation that was formed in **1975.**
- The bloc meets annually to discuss issues of common interest like global economic governance, international security and energy policy.
- The G-7 does not have a formal constitution or a fixed headquarters. The decisions taken by leaders during annual summits are non-binding.
- The G7 was known as the 'G8' for several years after the original seven were joined by Russia in 1997. The Group returned to being called G7 after Russia was expelled as a member in 2014 following the latter's annexation of the Crimea region of Ukraine
- The G7 or the Group of Seven is a group of the seven most advanced economies as per the **International Monetary Fund (IMF).**
- These countries represent 58% of the global net wealth ($317 trillion).
- The G7 countries also represent more than 46% of the global gross domestic product (GDP) based on nominal values, and more than 32% of the global GDP based on purchasing power parity.

- The requirements to be a member of the G7 are a high net national wealth and a high HDI (Human Development Index).

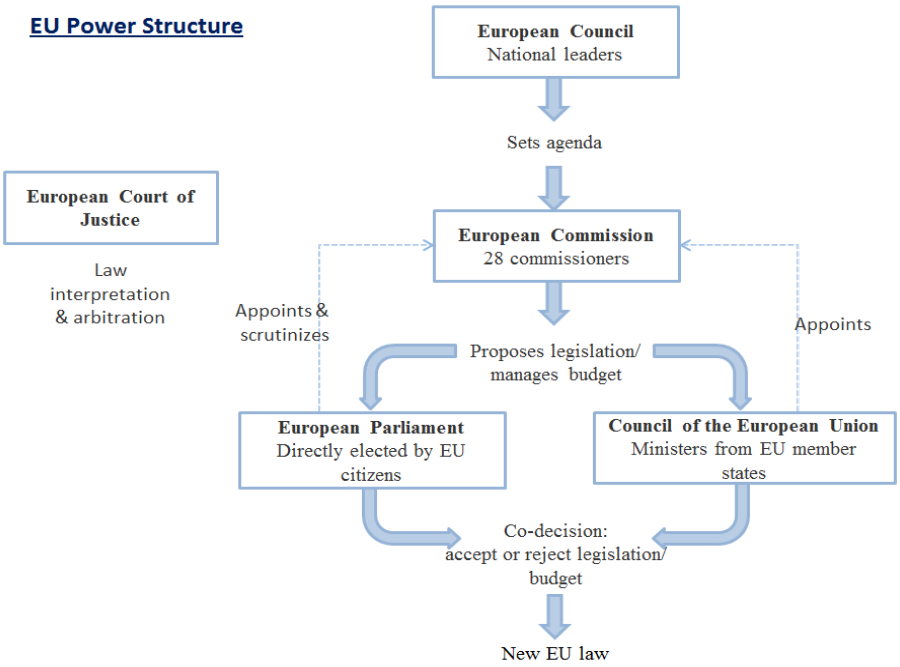
G20

- The G20 (or Group of Twenty) is an **international forum** for the governments and central bank governors from 19 countries and the European Union (EU).
- It was **founded** in 1999.
- Its **aim** is to discuss policy pertaining to the promotion of **international financial stability.**
- The **G20 members** are Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, Republic of Korea, Turkey, the United Kingdom, the United States and the European Union (EU).
- Its members account for 85% of the world's GDP, and two-thirds of its population.

747. EU & Euro Zone & OECD

European Union (EU), international organization comprising 27 European countries and governing common economic, social, and security policies.

- Formed in 1993 and headquarters Brussels, Belgium
- It came into force after the signing of the Maastricht Treaty by 28 countries.
- The Maastricht Treaty was amended thrice. The amendments are listed below.
    - Treaty of Amsterdam (1997)
    - Treaty of Nice (2001)
    - Treaty of Lisbon (2007)
- 19 of these countries use **EURO** as their official currency this grouping is called the eurozone.
- **9 EU members** (Bulgaria, Croatia, Czech Republic, Denmark, Hungary, Poland, Romania, Sweden, and the United Kingdom) **do not use the euro**.



- **European Union – Decision-Making Bodies**
  - The 7 important decision-making bodies of the European Union are listed below.
  - European Parliament
  - European Council
  - European Commission
  - Court of Justice of the European Union
  - European Central Bank
  - European Court of Auditors.

Organization for Economic Cooperation and Development

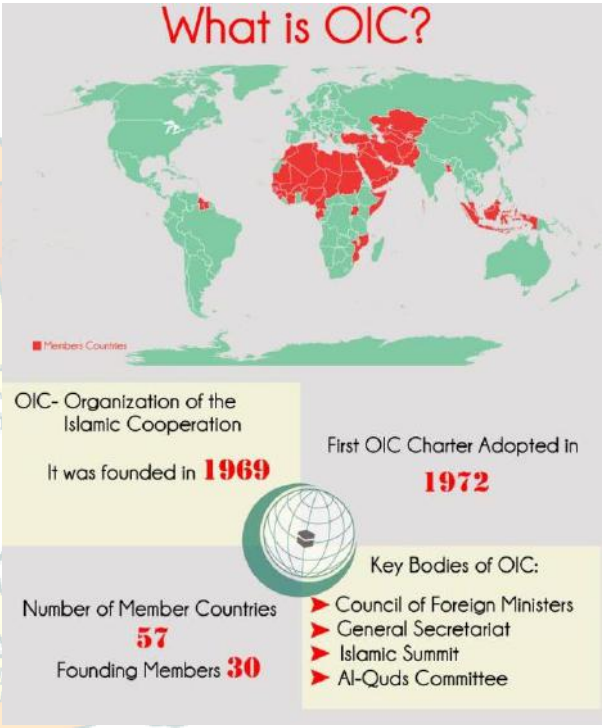
- The OECD is an intergovernmental economic organisation, founded to stimulate economic progress and world trade.
- Most OECD members are high-income economies with a very high Human Development Index (HDI) and are regarded as developed countries.

- Founded: 1961.
- Headquarters: Paris, France.
- Total Members: 36.
- India is not a member, but a key economic partner.
- Reports and Indices by OECD
    - Government at a Glance 2017 report.
    - International Migration Outlook.
    - OECD Better Life Index.

748. OIC & Gulf Cooperation Council

Context: The 14th summit of the Organisation of Islamic Cooperation (OIC) was held in Mecca, Saudi Arabia.

About the OIC:



- It is an international organization **founded in 1969, consisting of 57 member states**.
- It is **the second largest inter-governmental organization after the United Nations**.
- The organization states that it is **"the collective voice of the Muslim world"**.
- The OIC has **permanent delegations to the United Nations and the European Union**.
- Permanent Secretariat is in Jeddah, Saudi Arabia.

Gulf Cooperation Council (GCC)

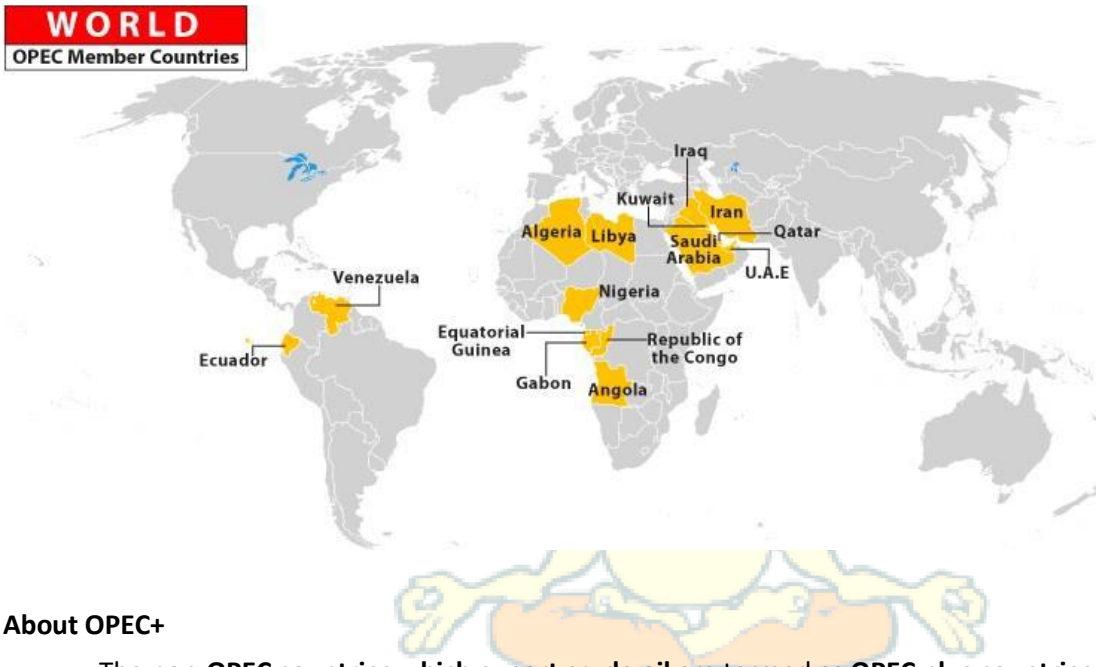
- Its current official name is Cooperation Council for the Arab States of the Gulf.
- GCC was **established by an agreement** concluded in 1981 among **Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE** in view of their special relations, geographic proximity, similar political systems based on Islamic beliefs, joint destiny and common objectives.
- The **structure** of the GCC consists of the Supreme Council (the highest authority), the Ministerial Council and the Secretariat General.
- The **Secretariat** is located in **Riyadh,** Saudi Arabia.
- It is an economic and political union comprising of all the Arab countries of the Persian Gulf **except Iraq.**
- There are also discussions for possible future memberships for Yemen, Jordan and Morocco.

749. OPEC & OPEC+

About Organization of the Petroleum Exporting Countries (OPEC)

(Mindmap: https://iasbaba.com/wp-content/uploads/2017/11/OPEC-IASbaba.jpg)

- It is an intergovernmental organization of **13 nations** as of February 2021.
- It was founded in 1960 in Baghdad by the first five members Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela.
- And it is headquartered since 1965 in Vienna, Austria.
- Its **mission** is to ensure the stabilization of oil markets.
    - It aims **to manage the supply of oil in an effort to set the price of oil in the world market,** in order to avoid fluctuations that might affect the economies of both producing and purchasing countries.
- The organization is also a significant provider of information about the international oil market.
- OPEC **membership** is **open to any country** that is a **substantial exporter of oil** and which shares the **ideals of the organization.**
- Gabon terminated its membership in January 1995. However, it rejoined the Organization in July 2016.



About OPEC+

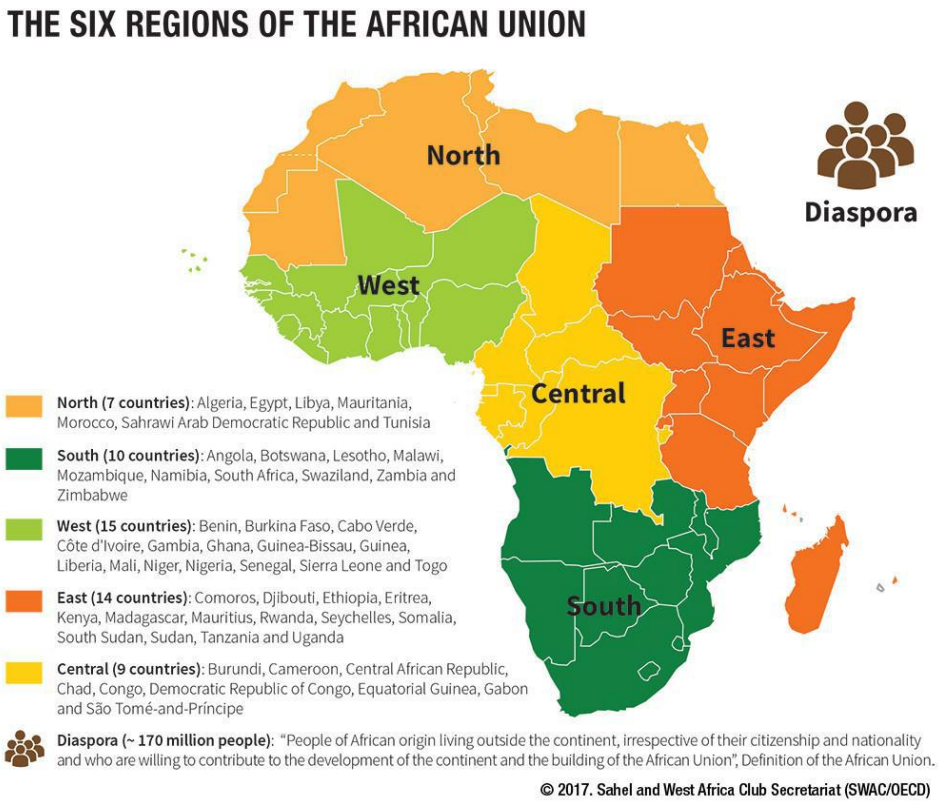
- The **non-OPEC countries which export crude oil** are termed as **OPEC plus countries.**
- OPEC plus countries include Azerbaijan, Bahrain, Brunei, Kazakhstan, Malaysia, Mexico, Oman, Russia, South Sudan and Sudan.
- OPEC+ is an agreement between OPEC and 10 Non-OPEC nations in order to protect oil prices from a global slowdown.
- OPEC's 13 members control 35 percent of global oil supplies and 82 percent of proven reserves.
- With the addition of the 10 Non-OPEC nations, those shares had increased to 55 percent and 90 percent respectively.

750. MERCOSUR & African Union

MERCOSUR

- Mercosur is a sub-regional bloc of South American Countries.
- Its purpose is to promote free trade and the fluid movement of goods, people, and currency
- Its full members are Argentina, Brazil, Paraguay, Uruguay and Venezuela.
- Its associate countries are Bolivia, Chile, Peru, Colombia, Ecuador and Suriname
- The Mercusor trading bloc was established in 1991
- **Headquarter** : Montevideo (Uruguay)

AFRICAN UNION



- The African Union (AU) **is a continental union consisting of 55 countries of Africa, with exception of various territories of European possessions located in Africa**.
- The bloc was founded in 2001 in Addis Ababa, Ethiopia.
- It is intended to replace the Organization of African Unity (OAU).
- 54 of 55 of its member states of African Union signed the African Continental Free Trade Agreement (AfCFTA) for goods and services.
- The AfCFTA would create an African Common Market of 1.2 billion people and a GDP of over $3.4 billion.
- This come with the elimination of customs duties up to 90% of the tariff-lines.

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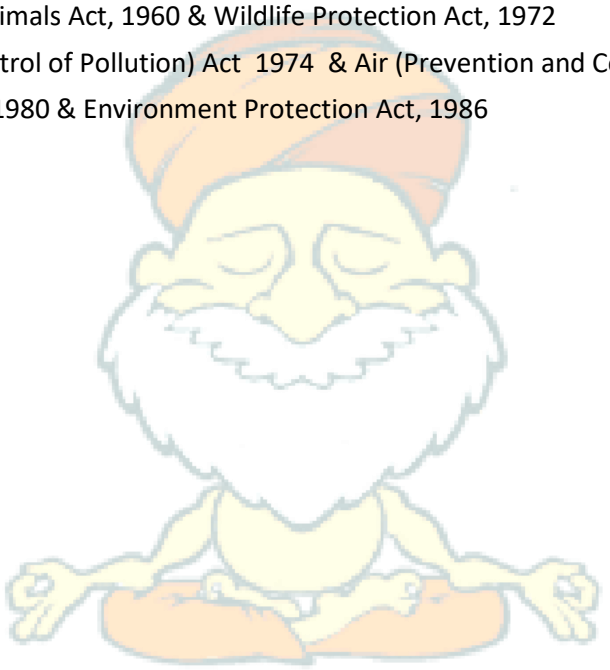

791. & 792. MCQs

Q.1) Steel slag can be the material for which of the following?

1. Construction of base road
2. Improvement of agricultural soil
3. Production of cement

Select the correct answer using the code given below:

a. 1 and 2 only
b. 2 and 3 only
c. 1 and 3 only
d. **1,2, and 3**

Solution (d)

EXPLANATION:

The use of steel slag as an aggregate is considered a standard practice in many jurisdictions, with applications that include its use in granular base, embankments, engineered fill, highway shoulders, and hot mix asphalt pavement.

Q.2) Which of the following are the most likely places to find the musk deer in its natural habitat?

1. Askot Wildlife Sanctuary
2. Gangotri National Park
3. Kishanpur Wildlife Sanctuary
4. Manas National Park

Select the correct answer using the code given below

a. **1 and 2 only**
b. 2 and 3 only
c. 3 and 4 only
d. 1 and 4 only

Solution (a)

EXPLANATION:

Himalayan Musk deer is found in the areas between Ladakh to Sikkim i.e. Askot wildlife Sanctuary and Gangotri National Park.

REFERENCE:

https://www.downtoearth.org.in/news/wildlife-biodiversity/fading-scent-of-musk-deer-55664

Q.3) In rural road construction, the use of which of the following is preferred for ensuring environmental sustainability or to reduce carbon footprint?

1. Copper slag
2. Cold mix asphalt technology
3. Geotextiles
4. Hot mix asphalt technology
5. Portland cement

Select the correct answer using the code given below:

a. **1, 2 and 3 only**
b. 2, 3 and 4 only
c. 4 and 5 only
d. 1 and 5 only

Solution (a)

EXPLANATION:

- The usage of Copper slag reduces the usage of primary materials as well as reduces the construction depth which in turn reduces energy demand in building. **So, (1) is correct.**
- Cold asphalt mix is produced by mixing unheated mineral aggregate with either emulsified bitumen or foamed bitumen. Unlike hot mix asphalt (HMA), cold asphalt mix does not require any heating of aggregate which makes it economical and relatively pollution-free (no objectionable fumes or odours). **So, (2) is correct and (4) is not correct.**
- Geotextiles reinforces the soil by adding tensile strength to it. It is used as a rapid de watering layer in the roadbed. **So, (3) is correct.**
- Portland cement production needs energy and can impact the environment. **So, (5) is not correct.**

Q.4) Consider the following statements:

1. Coal ash contains arsenic, lead and mercury.
2. Coal-fired power plants release sulphur dioxide and oxides of nitrogen into the environment.
3. High ash content is observed in Indian coal.

Which of the statements given above is/are correct?

a. 1 only
b. 2 and 3 only
c. 3 only
d. **1, 2 and 3**

Solution (d)

EXPLANATION:

Statement 1: Coal ash contains contaminants like mercury, cadmium and arsenic. Without proper management, these contaminants can pollute waterways, ground water, drinking water, and the air.

Statement 2: Coal-fired power plants release large amount of smoke in air which contains compounds of sulphur dioxide and oxides of nitrogen into the environment.

Statement 3: India's domestic coal reserves have high ash content—up to 40 to 45 percent.

Q.5) What is the use of biochar in farming?

1. Biochar can be used as a part of the growing medium in vertical farming.
2. When biochar is a part of the growing medium, it promotes the growth of nitrogen-fixing microorganisms.
3. When biochar is a part of the growing medium, it enables the growing medium to retain water for longer time.

Which of the statements given above is/are correct?

a. 1 and 2 only

b. 2 only
c. 1 and 3 only
d. **1, 2 and 3**

Solution (d)

EXPLANATION:

Uses of Biochar:

- Evidence shows that bioavailability and plant uptake of key nutrients increases in response to biochar application
- Decontamination/removal of organic pollutants from soil and water
- Oil carbon sequestration and mitigate GHGs emission
- A system converting biomass into energy (hydrogen-rich gas) and producing biochar as a by-product might offer an opportunity to address many problems

793. Gulf of Munnar & Sundarbans Biosphere Reserve

Gulf of Munnar Biosphere Reserve

- The Gulf of Mannar endowed with three distinct Coastal ecosystems namely coral reef, seagrass bed and mangroves is considered one of the world's richest region from a marine biodiversity perspective.
- It is the first Marine Biosphere Reserve in the South and South East Asia.
- In India, the Gulf of Mannar region in Tamil Nadu is one of the four major coral reef areas and the others are Gulf of Kutch in Gujarat, Lakhsadweep and Andaman and Nicobar islands.
- The Gulf of Mannar Biosphere Reserve supports several globally important species such as the critically endangered Dugong dugon (sea cow), all protected sharks (IWPA, 1972) including whale shark, sea horses, green and hawksbill sea turtles, dolphins and sea cucumbers and several endemic species of Balanoglossus, sea grass, crabs and mangroves.
- **Threats**: Habitat destruction (coral reefs, seagrass, and mangroves) is the most serious threat to the long-term viability of the Park's globally significant resources.
    - Coral mining, though it is illegal, has stopped from 2005.
    - Seagrass beds are damaged by inappropriate bottom trawling practices.
    - Localized pollution outside of the southern tip of the buffer zone represents a potential threat to the Reserve's biological diversity.

Sundarbans Biosphere Reserve

- Sundarbans are a vast contiguous mangrove forest ecosystem in the coastal region of Bay of Bengal spread over India and Bangladesh on the delta (world's largest) of the Ganges, Brahmaputra and Meghna rivers.
    - It **contains the world's largest mangrove forests.**
- As part of the Man and Biosphere Programme (MAB), accepted in the general conference of the UNESCO in 1970, the Ministry of Environment & Forests, Govt. of India adopted the National MAB programme and declared the entire 9630 sq. km. Of Sundarban as the Sundarban Biosphere Reserve in 1989.
- The Sundarbans, due to its unique ecosystem, has also been declared as a World Heritage site in 1989.
- Administrative boundary of the Sundarban is spread over two districts of West Bengal i.e. North 24-Parganas and South 24-Parganas
- **Sundarban Tiger Reserve** was created by a Govt Order dated 23.12.1973, under the "Project Tiger" scheme of MOEF, GOI. It is part of the Sundarban Biosphere Reserve and has a total Reserve Forest area of 2585 sq km.
    - Within the Reserve Forests, 1330 sq km has been notified **as Sundarban National Par**k which also forms the Core area of the Reserve.
    - Balance area forms the Buffer Zone and **Sajnekhali Wildlife Sanctuary** is part of this zone.
- Sundarban Wetland, India was recognised as the 'Wetland of International Importance' under the Ramsar Convention in January 2019.
- The Sunderbans Delta is the only mangrove forest in the world inhabited by tigers.
- Sunderban National Park is known for its wide range of fauna, including 260 bird species and is home to many rare and globally threatened wildlife species such as the Estuarine Crocodile, Royal Bengal Tiger, Water Monitor Lizard, Gangetic Dolphin and Olive Ridley Turtles.

794. Nanda Devi & Nokrek Biosphere Reserve

Nanda Devi Biosphere Reserve

- Nanda Devi Biosphere Reserve, located in the Himalayan Mountains in the northern part of the country, includes as core areas the Nanda Devi and Valley of Flowers National Parks, which are one World Heritage site.

- Nanda Devi National Park has remained more or less intact because of its inaccessibility. The Valley of Flowers National Park is renowned for its meadows of endemic alpine flowers and outstanding natural beauty. Together they encompass a **unique transition zone between the mountain ranges of the Zanskar and Great Himalaya.**
- The Biosphere Reserve includes reserve forests, evam soyam (civil) forests, panchayat (community) forests, agricultural land, grassy slopes, alpine meadows (bugiyals) and snow-covered areas.
- The area has a large altitudinal range (1,800 to 7,817 m) and is dominated by the peak of Nanda Devi.
- Some 1,000-plant species including lichens, fungi, bryophytes and pteridophytes have been recorded. The percentage of native and endemic species is high compared to non-native species. Over 55% of the species are native to Himalaya, over 10 are endemic and 225 are near endemic.
- Seven endangered mammal species find refuge in the area such as the snow leopard (Panthera unica), Himalayan black bear (Selenarctos thibetanus), brown bear (Ursus arctos), musk deer (Moschus chrysogaster) and bharal/blue sheep (Pseudois nayaur).
- The snow clad peaks, presence of over 30 glaciers, occurrence of charismatic animals and birds, deep and vast valleys, meadows and rivers, and a unique culture of the native communities make the Biosphere Reserve ideal for ecotourism

Nokrek Biosphere Reserve

- The Nokrek Biosphere Reserve is located in the northeast of India on the Tura Range, which forms part of the **Meghalaya Plateau** (average altitude: 600 metres). The entire area is mountainous and Nokrek is the highest peak of the **Garo hills** (located in Meghalaya state), rising up 1,412 metres.
- The biosphere reserve contains major rivers and streams that form a perennial catchment system. Examples include the Ganol, Dareng and Simsang rivers, of which the latter is the longest and largest.
    - The Simsang originates in the north of the Biosphere Reserve
    - the Dareng from the southern peaks
    - the Ganol flows westward into the Brahamputra River
- Ecological Characteristics
    - The tropical climate is characterized by high humidity, monsoon rains (April–October) and high temperatures, which presents ideal circumstances for the growth of rich vegetation, and consequently for the development of a unique and varied biodiversity.
    - Evergreen and semi-evergreen deciduous forests dominate the landscape: 90% of the Nokrek Biosphere Reserve is covered by evergreen forest.
    - Some patches of bamboo forest can also be found in the lower altitudes, and a remarkable variety of endemic *Citrus sp*ecies can also be found in the reserve, especially *Citrus indica* (Indian wild orange)
    - Highly vulnerable and threatened fauna species in Nokrek include the Slow Loris, *Petaurista philippensis* (Giant flying squirrel) and *Macaca leonina* (Pig-tailed macaque).
    - In addition, the reserve is home to other unique and endangered animals, such as tigers, leopards, elephants and Hoolock gibbons.
- Socio-Economic Characteristics
    - Today, Garo tribes dominate the area. However, other tribes, such as the Banias or Hajjons, also exist in the area.
    - The Garo refer to themselves as *Achik mande* (man of hills). While practising Christians, they believe in reincarnation and pray to several gods.
    - The most worshipped deity is Saljong to whom the Garo offer sacrifices, such as chicken and monkeys, in return for protection of their cultivated farms.

795. Khangchendzonga and Pachmarhi Biosphere Reserve

Khangchendzonga Biosphere Reserve

In news: In a recent publication by the Botanical Survey of India (BSI), it was reported that Sikkim, the smallest State

with less than 1% of India's landmass, is home to 27% of all flowering plants found in the country.

- Sikkim is a part of the Kanchenjunga biosphere landscape

About Kanchenjunga Biosphere

- Khangchendzonga Biosphere Reserve which is located in Sikkim is one of the highest ecosystems in the world, reaching elevations of 1, 220 metres above sea-level.
- The biosphere has different altitudinal ecosystems, varying from sub-tropic to Arctic, as well as natural forests in different biomes, that support an immensely rich diversity of forest types and habitats.
- World's third highest peak, **Mt. Khangchendzonga,** is situated within the Park.
- Numerous lakes and glaciers, including the 26 km long **Zemu Glacier** are a part of the Biosphere reserve.
- Khangchendzonga National Park (KNP) was designated **a World Heritage Site in 2016 under the 'mixed' category** (Mixed heritage sites contain elements of both natural and cultural significance).
- The Khangchendzonga Biosphere Reserve in Sikkim, surrounding the world's third highest peak Mount Khangchendzonga, has been added to **UNESCO's World Network of Biosphere Reserves**, making it the 11th biosphere in India to be included in the network.
- Its location – bordering Nepal, Tibet (China) and in close proximity of Bhutan – offers unique opportunities for joint collaboration and conservation of biodiversity with neighbouring countries.
- Increasing unregulated tourism, lack of awareness about the landscape and shortage of staff are some of the key challenges in maintaining the reserve's sanctity

Pachmarhi Biosphere Reserve

- Location: Madhya Pradesh
- The Pachmarhi Biosphere Reserve is located in the biogeographical region of the Deccan Peninsula and the Biotic Province of Central India.
- The **highest peak is the Dhoopgarh**, which reaches 1,352 metres above sea level, while the Pachmarhi hills are characterized by steep slopes in the northern regions.
- The eastern boundary of the biosphere reserve lies along a road with cultivation farms, close to the **Dudhi River**, while the southern boundary borders the **Tawa plateau.**
- Ecological Characteristics
    - Pachmarhi comprises three protection sites:
        - Bori Sanctuar
        - Satpura National Park
        - Pachmarhi Sanctuary – otherwise known as the Satpura Tiger Reserve.
    - The Pachmarhi Plateau is also known as the 'Queen of Satpura', because it contains valleys, marshes, streams and waterfalls, all of which have led to the development of a unique and varied biodiversity.
    - Forests represent approximately 63% of the biosphere reserve's area, while agricultural lands (30%), waste lands (2.18%), water bodies (5%) and human settlement areas (0.54%) account for the remainder.
    - *Tectona grandis* (Teak) and *Shorea robusta* (Sal) are the most common and unique flora species found in the forests.
    - Tropical moist deciduous forests, tropical dry deciduous and central Indian sub-tropical hill forests are the major ecosystem types within Pachmarhi.

- The largest wild herbivores found in the reserve are *Gaura*, which together with bears, tigers and leopards, *Ratufa indica* (Giant Squirrel) and *Spilornis cheela*(Crested serpent eagle) are rare and endangered.
- Lastly, over 50 mammal species, 254 bird species, 30 reptile species and 50 butterfly species live in the Pachmarhi Biosphere Reserve.

- **Socio-Economic Characteristics**
  - The Pachmarhi Biosphere Reserve is characterized by high population growth, with Gond tribes accounting for 50% to 90% of the tribal population. They live in the forests and therefore have a special connection to the reserve.
  - Korkus tribes introduced the cultivation of potatoes and made use of honeycombs to produce honey in significant quantities for commercial use.
  - Captain J. Forsyth discovered the area in 1862 and remarked upon **the extensive cave network.** These caves are of great archaeological interest, containing rock paintings up to 2,500 years old. Today, many Hindus festivals are celebrated near the reserve.
  - Conservation tactics were first introduced in 1865 with the banning of **slash-and-burn agriculture.**

796. Prevention of Cruelty to Animals Act, 1960 & Wildlife Protection Act, 1972

Prevention of Cruelty to Animals Act, 1960

- The **Animal Welfare Board of India (AWBI) was established in 1962 under Section 4 of the Act.**
- This Act **provides for punishment for causing unnecessary cruelty and suffering to animals.**
- The Act **defines animals and different forms of animals.**
- **Discusses different forms of cruelty, exceptions, and killing of a suffering animal**.
- Provides the **guidelines relating to experimentation on animals** for scientific purposes.
- The Act enshrines the provisions relating to the **exhibition of the performing animals**.
- This Act provides for the **limitation period of 3 months** beyond which no prosecution shall lie for any offences under this Act.

The **Prevention of Cruelty to Animals (Care and Maintenance of Case Property Animals) Rules, 2017** have been framed under the **Prevention of Cruelty to Animals Act, 1960.**

- The Rules **allow a Magistrate to forfeit the cattle of an owner facing trial under the Act.**
  - The animals are then **sent to infirmaries, animal shelters,** etc.
  - The authorities **can further give such animals for "adoption".**

Salient Features of Wildlife Protection Act

- The Act provides for the formation of wildlife advisory boards, wildlife wardens, specifies their powers and duties, etc.
- It helped India become a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (**CITES**).
- For the first time, a comprehensive list of the endangered wildlife of the country was prepared.
- The Act **prohibited the hunting of endangered species**.
- Scheduled animals are prohibited from being traded as per the Act's provisions.

- The Act provides for licenses for the sale, transfer, and possession of some wildlife species.
- Its provisions paved the way for the formation of the **Central Zoo Authority**.
- The **National Board for Wildlife** was constituted under the Act. And, it is chaired by the Prime Minister.
- The Act also provided for the establishment of the **National Tiger Conservation Authority.**
- **Protected Areas under the Wildlife Protection Act**: Sanctuaries, National Parks, Conservation Reserves, Community Reserves and Tiger Reserves

Schedules of the Wildlife Protection Act	
Schedule I • This Schedule covers **endangered species**. • Absolute protection is accorded to species on this list. • The Trade of these animals is prohibited. • Examples: tiger, blackbuck, etc.	**Schedule II** • Animals under this list are also accorded high protection. • Their trade is prohibited. • They cannot be hunted except under threat to human life. • Examples: Kohinoor (insect), Assamese Macaque, Bengal Hanuman langur, etc.
Schedule III & IV • This list is for species that are not endangered. • This includes protected species but the penalty for any violation is less compared to the first two schedules. • Examples: hyena, Himalayan rat, porcupine, flying fox, Malabar tree toad, etc.	**Schedule V** • This schedule contains animals that can be hunted. • Examples: mice, rat, common crow, fruit bats, etc.
Schedule VI • This list contains plants that are forbidden from cultivation. • Examples: pitcher plant, blue vanda, red vanda, kuth, etc.	

797. Water (Prevention and Control of Pollution) Act 1974 & Air (Prevention and Control of Pollution) Act 1981

Water (Prevention and Control of Pollution) Act of 1974

- Aims **to provide for the prevention and control of water pollution, and for the maintaining or restoring of wholesomeness of water** in the country.
- The **Water (Prevention and Control of Pollution) Cess Act was enacted in 1977, to provide for the levy and collection of a cess** on water consumed by certain types of industrial activities.
- The Act vests regulatory authority in **State Pollution Control Boards** to establish and enforce effluent standards for factories.
- A **Central Pollution Control Board** performs the same functions for Union Territories and coordinates activities of different State Boards.
- The **Act grants power to SPCB and CPCB to test equipment and to take the sample for the purpose of analysis.**
- Prior to its amendment in 1988, enforcement under the Act was achieved through criminal prosecutions initiated by the Boards.
- The **1988 amendment act empowered SPCB and CPCB to close a defaulting industrial plant**.

Air (Prevention and Control of Pollution) Act of 1981

- To implement the decisions taken at the **United Nations Conference at Stockholm in June 1972.**
- **Section 2(a)** defines an '**air pollutants**'.

- A **1987 amendment to the act also added 'noise' to the list of harmful substances.**
- The air act defines '**air pollution'.**
    - **Section 2 (g)** of the Act also set up the **Central Pollution Control Board (CPCB)** and State Pollution Control Board (SPCB) for the individual states of India.
- The **states are required to prescribe emission standards for industry and automobiles after consulting the central board and noting its ambient air quality standards.**
- Notably, **the 1987 amendment introduced a citizen's suit provision into the Air Act.**
- **Penalties and Procedure under the Air Act**
    - The failure to comply with the Central Pollution Control Board directives would result in **imprisonment of 1 year**.

798. Forest (Conservation) Act, 1980 & Environment Protection Act, 1986

In the wake of the **Bhopal tragedy**, the Government of India enacted the **Environment Protection Act of 1986.**

Important Provisions of the Environment Protection Act 1986

1. The **act defines the environment, pollution, pollutants, and hazardous substances in a comprehensive way.**
2. The **act is based on the polluter pays principle.**
3. The **Act explicitly prohibits discharges of environmental pollutants** in excess of **prescribed regulatory standards.**
4. The **act provides provisions for the proper handling of hazardous substances.**
5. The act has a **relaxed provision for locus stands**. Now **any common citizen can approach the court**.
6. **The act enjoys supremacy over other environment-related legislation.**

Rules under this Act

1. **Rules 1989 for regulating GM Crops**
2. **EIA rules,** 2006
3. **Eco-Sensitive Area(Zone)** rules, 1988
4. **CRZ rules,** 2018 based on **Shailesh Nayak Committee**
5. **CGWA**
6. **Ozone Depletion rules**
7. **National Ganga River Basin Authority**

Forest Conservation Act 1980

- It was **enacted to consolidate the law related to forest.**
- **Forest officers** and their staff **administer the Forest Act.**
- The **Forest Conservation Act, 1980** stipulated that **central permission is necessary to practice sustainable agro-forestry in forest areas.**
- An **Advisory Committee constituted under the Act advises the Centre on these approvals.**
- The **Act deals with the four categories of forests, namely reserved forests, village forests, protected forests, and private forests.**

- A **state may declare forestlands or waste lands as reserved forests** and may sell the produce from these forests.
- Reserved forests **assigned to a village community** are called village forests.
- The **state governments are empowered to designate protected forests** and **may prohibit the felling of trees, quarrying, and the removal of forest produce** from these forests.

- There is also a provision of **compensatory afforestation**. **NPV (Net Present Value) has to be paid for 50 years.** NPV is an **ecological cost of forests**.

799. Havana syndrome

In news: Recently US Vice-President Kamala Harris' trip from Singapore to Vietnam was delayed due to Havana syndrome.

About the syndrome:

- Havana syndrome was **first detected in 2016 among spies and diplomats working at the American embassy in Havana.**
- These "unexplained health ailments" have been reported by Americans serving in other countries, including Germany, Austria, Russia and China.
- A person suffering from Havana syndrome exhibits a **range of symptoms including nausea, hearing loss, memory loss, dizziness and tinnitus.**
- Some of those have also reported hearing a loud piercing sound and feeling intense pressure in the face.
- When the brains of some affected people were scanned, the **diagnosis revealed tissue damage similar to the one caused by a car accident or a bomb blast.**
- The real cause for Havana syndrome has not been ascertained yet.
- In December 2020, a report revealed that **directed and pulsed radio frequency energy as the most "plausible" cause for this syndrome.**
- Some researchers have also considered microwave weapons to be "a main suspect" for the syndrome.

800. Chandrayaan-3

In news: India is likely to launch its third mission to the moon, Chandrayaan-3, in the third quarter of 2022.

Key updates:

- The Chandrayaan-3 mission has been planned as **only a lander-rover mission** to demonstrate India's capability of soft landing on a celestial body.
- It will communicate with Earth via the existing orbiter from Chandrayaan-2 whose lifespan has been estimated to be seven years.
- The mission was announced just a few months after the Vikram lander aboard Chandrayaan-2 mission crash-landed on the lunar surface.

Chandrayaan-1

- The mission included a **lunar orbiter and an impactor.**

Goals:

- High-resolution mineralogical
- Searching for surface or subsurface water-ice.
- Chemical stratigraphy of crust and South Pole Aitken Region (SPAR)

Chandrayan-2:

- Chandrayaan-2 is **India's first lander mission.**
- It consists of an **Orbiter, Lander and Rover**, all equipped with scientific instruments to study the moon.