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Shankar IAS Academy™
Door No 18, New Plot No 259 /109,
AL Block, 4th Avenue, Shanthi Colony,
Annanagar, Chennai - 600040.

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SCIENCE & TECHNOLOGY

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1. SPACE

1.1 Cloud bands on Luhman 16

Why in News?

A group of international astrophysicists have identified cloud bands on the surface of Luhman 16A, one of a pair of binary brown dwarfs in the Vela constellation.

What is Luhman 16?

- It is a Brown dwarf.
- Brown dwarfs are objects heavier than planets but lighter than stars and typically have 13 to 80 times the mass of Jupiter.
- Luhman 16A is part of a binary system containing a second brown dwarf, Luhman 16B.
- It is situated at a distance of 6.5 light-years.
- It is the third closest system to our Sun after Alpha Centauri and Barnard's Star.
- Both brown dwarfs weigh about 30 times as much as Jupiter.
- Despite the fact that Luhman 16A and 16B have similar masses and temperatures (about 1,900deg F or 1,000deg C), and presumably formed at the same time, they show markedly different weather.
- Luhman 16B shows no sign of stationary cloud bands, instead of exhibiting evidence of more irregular, patchy clouds.
- Luhman 16B, therefore, has noticeable brightness variations as a result of its cloudy features, unlike Luhman 16A.

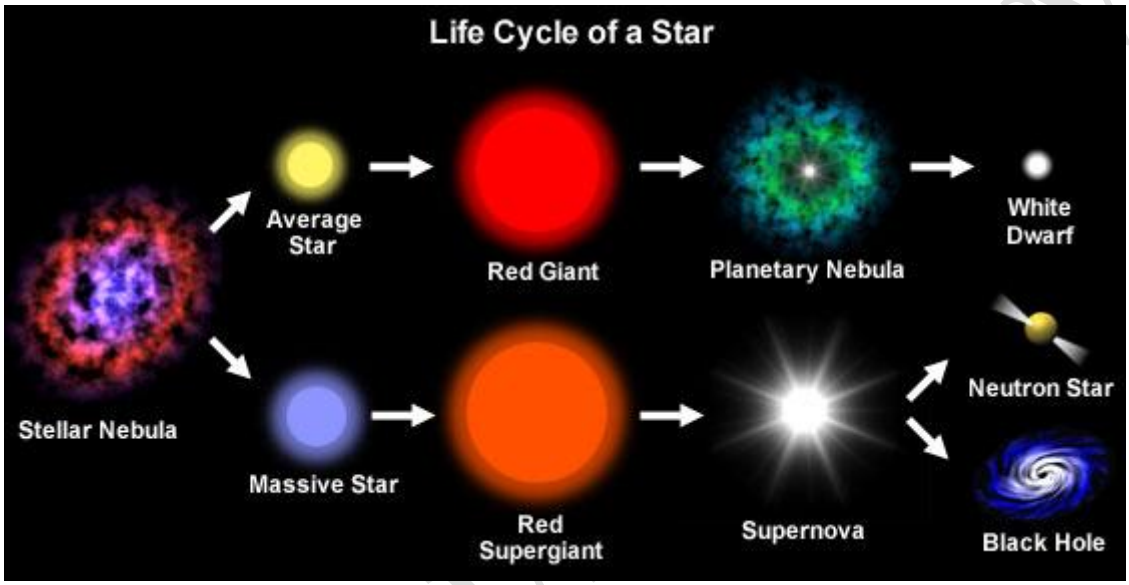
What is Polarimetry?

- Polarimetry is a sensitive, nondestructive technique for measuring the optical activity exhibited by inorganic and organic compounds.
- A compound is considered to be optically active if linearly polarized light is rotated when passing through it.
- The amount of optical rotation is determined by the molecular structure and concentration of chiral molecules in the substance.

What is a brown dwarf?

- Brown dwarfs are very dim, glowing objects that never gained enough mass to become fully fledged stars.

- In other words, the temperatures and pressures at their centres never got high enough for nuclear fusion to start.
- Brown dwarfs occupy the mass range between that of large gas giant planets and the lowest mass stars, i.e. somewhere between 12 and 75 times the mass of the planet Jupiter.
- Whilst most have been found orbiting stars, some have been found roaming alone in the cosmos.
- These sub-stellar objects will have formed in the same way as stars, but glow a cool brownish colour due to thermal energy (or heat) created by the collisions of material within them.



1.2 Gaganyaan Training Resumed

Why in News?

Four Indian astronaut candidates currently at Moscow have resumed theory classes and physical training for the maiden Indian human space mission.

What are the countries that achieved human space mission independently?

No.	Country	Name	Flight	Date (UTC)
1	**Soviet Union**	Yuri Gagarin	Vostok 1	12 April 1961
2	**United States**	Alan Shepard	MR-3	5 May 1961
3	**Russia**	Aleksandr Kaleri Aleksandr Viktorenko	Soyuz TM-14	17 March 1992
4	**China**	Yang Liwei	Shenzhou 5	15 October 2003

2. ENVIRONMENT

2.1 Degrading Sundarbans

Why in News?

The degrading health of Sundarbans' mangroves affects their resilience and recovery potential against climate change consequences.

What is Sunderbans?

- The Sundarbans is a cluster of low-lying islands in the Bay of Bengal, spread across India and Bangladesh, famous for its unique mangrove forests.
- This active delta region is among the largest in the world, measuring about 40,000 sq km.
- The Sundarbans forest is about 10,000 sq km across India and Bangladesh, of which 40% lies in India.
- It is home to many rare and globally threatened wildlife species such as the
    - Estuarine crocodile *(Crocodilus porosus),*
    - Royal Bengal tiger *(Panthera tigris)*,
    - Water monitor lizard *(Varanus salvator)*,
    - Gangetic dolphin *(Platinista gangetica)*, and
    - Olive ridley turtle *(Lepidochelys olivacea)*.

What are mangroves?

- Mangrove trees grow in areas with low-oxygen soil, where slow-moving waters allow fine sediments to accumulate.
- Mangrove forests only grow at tropical and subtropical latitudes near the equator.
- Because they cannot withstand freezing temperatures.
- Many mangrove forests can be recognized by their dense tangle of prop roots.
- This tangle of roots allows the trees to handle the daily rise and fall of tides, which means that most mangroves get flooded at least twice per day.
- The roots also slow down the movement of tidal waters, causing sediments to settle out of the water and build up the muddy bottom.
- Mangrove forests stabilize the coastline, reducing erosion from storm surges, currents, waves, and tides.
- The intricate root system of mangroves also makes these forests attractive to fish and other organisms seeking food and shelter from predators.
- The root systems of mangroves that grow in tidal mudflats are characterized by the presence of "breathing roots" known as pneumatophores.

What are the States/Union Territories in India with mangrove cover?

- West Bengal

- Orissa
- Andhra Pradesh
- Andaman & Nicobar
- Tamil Nadu
- Kerala
- Karnataka
- Goa
- Maharashtra

What the important adaptations in mangroves?

- Mangroves have leaves with glands that excrete salt
- Some species of Mangrove can also tolerate the storage of large amounts of salt in their leaves. (discarded of when the levels are too high)
- Mangroves can restrict the opening of their stomata. Allows the mangrove to preserve fresh water, vital to survive in a saline environment.
- Able to turn their leaves to reduce exposure to the sunlight (reduces water loss as a result of evaporation)
- The pneumatophores allow the plant to breath, however also change in size to stop the intake of salt from the water.

2.2 Hatching of Olive Ridley ended

Why in News?

Mass hatching of the Olive Ridley turtle eggs has ended at the Rushikulya rookery on the Odisha coast.

What are olive ridleys?

- They are also known as the **Pacific ridley sea turtle**
- They are the smallest and the most abundant of all sea turtles found in the world.
- They are found in warm and tropical waters, primarily in the Pacific and Indian Oceans.
- They can also be found in warm waters of Atlantic Ocean.
- They are best known for their unique mass nesting called Arribada, where thousands of females come together on the same beach to lay eggs.

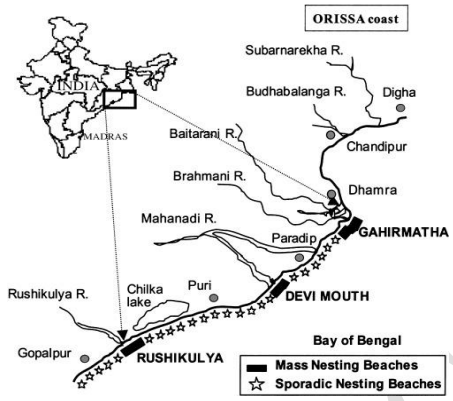
What are the important nesting sites in india?

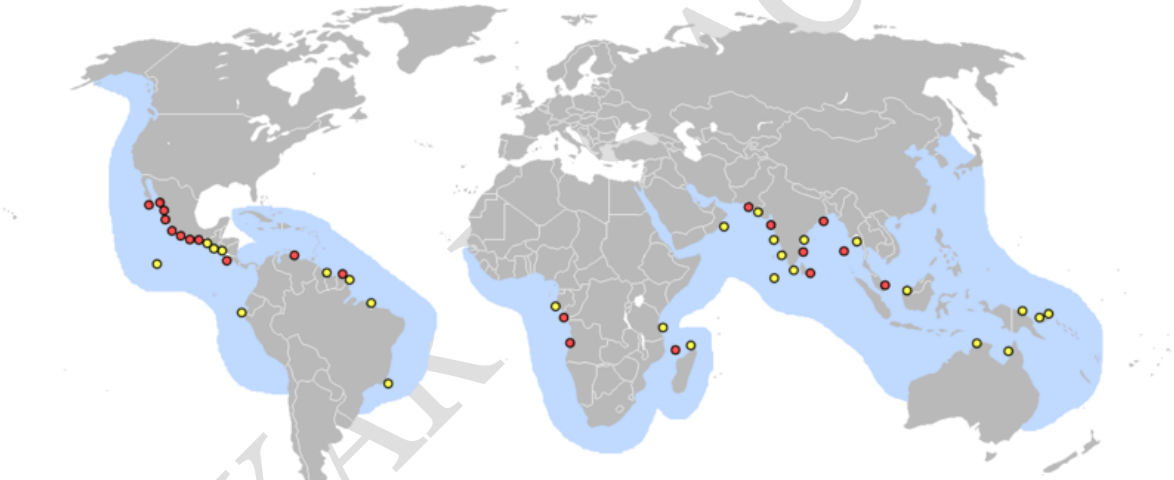
- Gahirmatha Beach, Odisha
- Rushikulya River Mouth, Odisha
- Devi River Mouth, Odisha
- Marina Beach, Chennai

- Velas Beach, Ratnagiri

What are the nesting sites in Orissa?

- The coast of Orissa in India is the largest mass nesting site for the Olive-ridley, followed by the coasts of Mexico and Costa Rica.
- Nesting also occurs along the Coromandel Coast and Sri Lanka, but in scattered locations.





2.3 Heat Wave

Why in News?

Several parts of north India have been reeling under an intense heat wave.

What is a heat wave?

- A Heat Wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the summer.
- Heat Waves typically occur between March and June (in India), and in some rare cases even extend till July.
- The extreme temperatures and resultant atmospheric conditions adversely affect people living in these regions causing physiological stress, sometimes resulting in death.

What are the criteria for declaring heat waves in India?

As per Indian Meteorological Department (IMD):

- Heat Wave need not be considered till maximum temperature of a station reaches atleast 40°C for Plains and atleast 30°C for Hilly regions
- When normal maximum temperature of a station is less than or equal to 40°C Heat Wave Departure from normal is 5°C to 6°C , Severe Heat Wave Departure from normal is 7°C or more
- When normal maximum temperature of a station is more than 40°C Heat Wave Departure from normal is 4°C to 5°C, Severe Heat Wave Departure from normal is 6°C or more
- When actual maximum temperature remains 45°C or more irrespective of normal maximum temperature, heat waves should be declared.

What are the health impacts of Heat Waves?

- The health impacts of Heat Waves typically involve dehydration, heat cramps, heat exhaustion and/or heat stroke.

The signs and symptoms are as follows:

- Heat Cramps: Ederna (swelling) and Syncope (Fainting) generally accompanied by fever below 39°C i.e.102°F.
- Heat Exhaustion: Fatigue, weakness, dizziness, headache, nausea, vomiting, muscle cramps and sweating.
- Heat Stoke: Body temperatures of 40°C i.e. 104°F or more along with delirium, seizures or coma. This is a potential fatal condition.

2.4 Inchworm Attack

Why in News?

Amid the COVID-19 lockdown, crops in Nagaland are under attack from the semilooper, a moth larva commonly known as inchworm.

What is an Inchworm?

- The larva of any member of a large, widespread group of moths is called an inchworm.
- Also called loopers, inchworms move in a characteristic “inching” or “looping” gait by extending the front part of the body and bringing the rear up to meet it.
- Resembling twigs or leaf stems, they feed on foliage and can seriously damage or even destroy trees.

What are the types of pesticides?

- **Algaecides** are used for killing and/or slowing the growth of algae.
- **Antimicrobials** control germs and microbes such as bacteria and viruses.
- **Biopesticides** are made of living things, come from living things, or they are found in nature.

- **Desiccants** are used to dry up living plant tissues.
- **Defoliants** cause plants to drop their leaves.
- **Disinfectants** control germs and microbes such as bacteria and viruses.
- **Foggers** (total release foggers) are used to kill insects that are in the open and touch the pesticides.
- **Fungicides** are used to control fungal problems like molds, mildew, and rust.
- **Herbicides** kill or inhibit the growth of unwanted plants, aka weeds.
- **Illegal and Counterfeit Pesticides** are imported or sold illegally.
- **Insecticides** are used to control insects.
- **Insect Growth Regulators** disrupt the growth and reproduction of insects.
- **Minimum Risk Pesticides** are exempt from EPA registration, but many states require them to be registered.
- **Miticides** control mites that feed on plants and animals. Mites are not insects, exactly.
- **Molluscicides** are designed to control slugs, snails and other molluscs.
- **Mothballs** are insecticides used to kill fabric pests by fumigation in sealed containers.
- **Natural and Biological Pesticides** control pests using things found in nature, or man-made versions of things found in nature.
- **Ovicides** are used to control eggs of insects and mites.
- **Pheromones** are biologically active chemicals used to attract insects or disrupt their mating behavior. The ratio of chemicals in the mixture is often species-specific.
- **Plant Growth Regulators** are used to alter the growth of plants. For example, they may induce or delay flowering.
- **Repellents** are designed to repel unwanted pests, often by taste or smell.
- **Rodenticides** are used to kills rodents like mice, rats, and gophers.
- **Synergists** make certain pesticides more effective, but they are not effective when used alone.
- **Wood Preservatives** are used to make wood resistant to insects, fungus and other pests.

2.5 Increase in Bee Population

Why in News?

Due to the coronavirus lockdown, Delhi is witnessing an increase in the population of different bees.

What are pollinators?

- Pollinators are animals that move pollen from male structures (anthers) of flowers to the female structure (stigma) of the same plant species.
- Movement of pollen (analogous to sperm) to a flower's stigma results in fertilization of the flower's eggs.

- An adequately fertilized flower will produce seeds and the fruit surrounding seeds, ensuring that a new generation of plants can be grown.
- Pollination is mutually beneficial to plants and to pollinators.
- Pollination results in the production of seeds and is necessary for many plants to reproduce.
- Meanwhile, pollinators receive nectar and/or pollen rewards from the flowers that they visit.
- Sugary nectar provides pollinators with carbohydrates while pollen offers proteins, fats, vitamins, minerals, and necessary phytochemicals.
- Examples: Honey bee, other bee species, butterflies, beetles, flies, some birds and some bats are pollinators.

Why pollinators so important?

- Not every species of plant requires animal-mediated pollination services.
- For example, wheat is wind-pollinated.
- However, the majority of crops that we like most to eat and provide most of our nutrition (fruits, vegetables, and nuts) use animal-mediated pollination.
- Without pollinators, our diets would be severely limited, and it would be more difficult to acquire the variety of vitamins and minerals that we need to stay healthy.

2.6 Pollution Dropped to 2006 level

Why in News?

Due to the COVID-19-related lockdown, global CO2 emissions in 2020 have dropped to levels last seen in 2006. Particulate matter pollution levels in select Indian cities exhibit a similar decline.

What is a particulate matter?

- **Particle pollution**, also called particulate matter or PM, is a mixture of solids and liquid droplets floating in the air.
- Particles less than or equal to 10 micrometers in diameter are so small that they can get into the lungs, potentially causing serious health problems.
- Particle pollution includes:
    - **Coarse dust particles (PM_{10})** are 2.5 to 10 micrometers in diameter.
    - **Fine particles ($PM_{2.5}$)** are 2.5 micrometers in diameter or smaller, and can only be seen with an electron microscope.

What are its sources?

- Some particles are released directly from a specific source, while others form in complicated chemical reactions in the atmosphere.
- Sources of PM10 include crushing or grinding operations and dust stirred up by vehicles on roads.

- Whereas, fine particles of PM2.5 are sourced from all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes.

What are its health effects?

- People with heart or lung diseases, older adults and children are most likely to be affected by particle pollution exposure.
- Even a healthy person may feel temporary symptoms if exposed to high levels of particle pollution.
- Numerous scientific studies connect particle pollution exposure to a variety of health issues, including:
    - irritation of the eyes, nose and throat
    - coughing, chest tightness and shortness of breath
    - reduced lung function
    - irregular heartbeat
    - asthma attacks
    - heart attacks
    - premature death in people with heart or lung disease

2.7 Locust Attack

Why in News?

India is gearing up for what could be one of its worst locust invasions in decades.

What Is a Locust?

- A locust is a grasshopper that develops gregarious characteristics.
- The environmental conditions have to be suitable to allow the grasshoppers to form into an organized group.
- These conditions can include dense vegetation growth after a drought.
- For example, during a drought, locusts are driven to small areas of vegetation.
- They abandon their solitary phase, which is common for grasshoppers, and reproduce at incredibly high rates.
- Transitioning from the solitary phase is signaled when the grasshoppers secrete serotonin
- Locusts move together as a group, making stops on any patch of green that they notice and causing extensive and devastating damage to crops, covering long distances in a short period of time.

What Is the Difference Between Grasshoppers and Locusts?

- Both grasshoppers and locusts are similar in appearance, and have similar morphological structures.
- When grasshoppers change into locusts, their wing structures change.
- As locusts, they need to be able to fly longer distances, so their wings become longer and stronger.

- A locust also has a smaller body than a grasshopper.
- Locusts also have the ability to exist in the solitary or gregarious phase, while grasshoppers can only be solitary (although, they get together to mate).
- Locusts come into being when the need for food becomes desperate, and they'll do what they can to ensure their survival.

3. BIO-TECHNOLOGY

3.1 Amid COVID fall in Co2 emissions

Why in News?

The daily levels of carbon dioxide emissions in the world have reduced by 17% during the COVID-19 pandemic – study.

What is Carbon Sequestration?

- Carbon sequestration secures carbon dioxide to prevent it from entering the Earth's atmosphere.
- The idea is to stabilize carbon in solid and dissolved forms so that it doesn't cause the atmosphere to warm.
- The process shows tremendous promise for reducing the human "carbon footprint."
- There are two main types of carbon sequestration: biological and geological.

What are the types of Sequestration?

Three main categories of sequestration are:

- **Ocean Sequestration:** Carbon stored in oceans through direct injection or fertilization.
- **Geologic Sequestration:** Natural pore spaces in geologic formations serve as reservoirs for long-term carbon dioxide storage.
- **Terrestrial Sequestration:** A large amount of carbon is stored in soils and vegetation, which are our natural carbon sinks. Increasing carbon fixation through photosynthesis, slowing down or reducing decomposition of organic matter, and changing land use practices can enhance carbon uptake in these natural sinks.

Geologic Sequestration Trapping Mechanisms

- **Hydrodynamic Trapping:** Carbon dioxide can be trapped as a gas under low-permeability cap rock (much like natural gas is stored in gas reservoirs).
- **Solubility Trapping:** Carbon dioxide can be dissolved into a liquid, such as water or oil.
- **Mineral Carbonation:** Carbon dioxide can react with the minerals, fluids, and organic matter in a geologic formation to form stable compounds/minerals; largely calcium, iron, and magnesium carbonates.

3.2 Antibody fragment-based immunotherapy

Why in News?

Antibody fragment-based immunotherapy for immediate treatment for COVID-19 pandemic is underway.

What are the Parts of immune system?

White blood cells

- White blood cells are the key players in your immune system.
- They are made in your bone marrow and are part of the lymphatic system.
- White blood cells move through blood and tissue throughout your body, looking for foreign invaders (microbes) such as bacteria, viruses, parasites and fungi.
- When they find them, they launch an immune attack.
- White blood cells include lymphocytes (such as B-cells, T-cells and natural killer cells), and many other types of immune cells.

Antibodies

- Antibodies help the body to fight microbes or the toxins (poisons) they produce.
- They do this by recognising substances called antigens on the surface of the microbe, or in the chemicals they produce, which mark the microbe or toxin as being foreign.
- The antibodies then mark these antigens for destruction.
- There are many cells, proteins and chemicals involved in this attack.

3.3 Complement System

The complement system is made up of proteins whose actions complement the work done by antibodies.

Lymphatic system

The lymphatic system is a network of delicate tubes throughout the body. The main roles of the lymphatic system are to:

- manage the fluid levels in the body
- react to bacteria
- deal with cancer cells
- deal with cell products that otherwise would result in disease or disorders
- Absorb some of the fats in our diet from the intestine.

The lymphatic system is made up of:

- lymph nodes (also called lymph glands) -- which trap microbes
- lymph vessels -- tubes that carry lymph, the colourless fluid that bathes your body's tissues and contains infection-fighting white blood cells

- white blood cells (lymphocytes).

Spleen

- The spleen is a blood-filtering organ that removes microbes and destroys old or damaged red blood cells.
- It also makes disease-fighting components of the immune system (including antibodies and lymphocytes).

Bone marrow

- Bone marrow is the spongy tissue found inside your bones.
- It produces the red blood cells our bodies need to carry oxygen, the white blood cells we use to fight infection, and the platelets we need to help our blood clot.

Thymus

- The thymus filters and monitors your blood content.
- It produces the white blood cells called T-lymphocytes.

3.4 BCG vs Coronavirus

Why in News?

A study has found that BCG vaccination during childhood does not have a protective effect against novel coronavirus infection in adulthood.

What is BCG?

- BCG is an effective immunization against tuberculosis.
- BCG stands for Bacille Calmette Guerin.
- BCG is a weakened (attenuated) version of a bacteria called Mycobacterium bovis which is closely related to Mycobacterium tuberculosis, the agent responsible for tuberculosis.
- BCG is also used as an adjuvant to stimulate the immune response and in cancer chemotherapy.
- BCG is used in many countries with a high prevalence of TB to prevent childhood tuberculous meningitis and miliary disease.

3.5 COVID transmission through Aerosols?

Why in News?

A Perspective piece published suggests that a "large proportion of the spread of COVID-19 appears to be occurring through airborne transmission of aerosols produced by asymptomatic individuals during breathing and speaking".

What are Aerosols?

- Aerosols are minute particles suspended in the atmosphere.
- When these particles are sufficiently large, we notice their presence as they scatter and absorb sunlight.
- Their scattering of sunlight can reduce visibility (haze) and redden sunrises and sunsets.
- Aerosols interact both directly and indirectly with the Earth's radiation budget and climate.

- As a direct effect, the aerosols scatter sunlight directly back into space.
- As an indirect effect, aerosols in the lower atmosphere can modify the size of cloud particles, changing how the clouds reflect and absorb sunlight, thereby affecting the Earth's energy budget
- Aerosols come from both natural and human sources—and sometimes both at once.
- Dust, for example, is scoured from deserts, the dried-out edges of rivers, dry lakebeds, and more.
- Its concentrations in the atmosphere rise and fall with climate; in cold, dry, periods in the planet's history like the last ice age, more dust filled the atmosphere than during warmer stretches of Earth's history.

3.6 CSIR Contributes to Genome Database

Why in News?

Amid concerns that the novel coronavirus may have undergone a mutation and the new strain maybe even more contagious, the CSIR has submitted as many as 53 genome sequences of the novel coronavirus to a global genome database, a move that may help in better understanding the virus and developing a vaccine.

Why study Genome?

- Sequencing the genome of novel coronavirus will help us to know where the virus came from and how the virus has spread.
- For instance, by sequencing the genome of the virus isolated from an Indian patient, it will become possible to know if the virus had come from China or any other country.

What is Genome sequencing?

- Genome sequencing is figuring out the order of DNA nucleotides, or bases, in a genome—the order of As, Cs, Gs, and Ts that make up an organism's DNA.
- The human genome is made up of over 3 billion of these genetic letters.
- The rules of base pairing (or nucleotide pairing) are:
    - A with T: the purine adenine (A) always pairs with the pyrimidine thymine (T)
    - C with G: the pyrimidine cytosine (C) always pairs with the purine guanine (G)

What are Genome, Gene and DNA?

- A gene is the basic physical and functional unit of heredity.
- Genes are made up of DNA.
- Some genes act as instructions to make molecules called proteins.
- In most living things, the genome is made of a chemical called DNA.
- The genome contains genes, which are packaged in chromosomes and affect specific characteristics of the organism.
- The genome is divided into chromosomes, chromosomes contain genes, and genes are made of DNA.

3.7 Does SARS-CoV-2 affect the liver?

Why in News?

Cases of acute liver failure for COVID-19 patients have not been reported yet from China or from other countries.

What is a liver?

- The liver is a large, meaty organ that sits on the right side of the belly.
- Weighing about 3 pounds, the liver is reddish-brown in color and feels rubbery to the touch.
- Normally you can't feel the liver, because it's protected by the rib cage.
- The liver has two large sections, called the right and the left lobes.
- The gallbladder sits under the liver, along with parts of the pancreas and intestines.
- The liver and these organs work together to digest, absorb, and process food.
- The liver's main job is to filter the blood coming from the digestive tract, before passing it to the rest of the body.
- The liver also detoxifies chemicals and metabolizes drugs.
- As it does so, the liver secretes bile that ends up back in the intestines.
- The liver also makes proteins important for blood clotting and other functions.

What are the types of liver disease?

- **Hepatitis:** Inflammation of the liver, usually caused by viruses like hepatitis A, B, and C. Hepatitis can have non-infectious causes too, including heavy drinking, drugs, allergic reactions, or obesity.
- **Cirrhosis:** Long-term damage to the liver from any cause can lead to permanent scarring, called cirrhosis. The liver then becomes unable to function well.
- **Liver cancer:** The most common type of liver cancer, hepatocellular carcinoma, almost always occurs after cirrhosis is present.
- **Liver failure:** Liver failure has many causes including infection, genetic diseases, and excessive alcohol.
- **Ascites:** As cirrhosis results, the liver leaks fluid (ascites) into the belly, which becomes distended and heavy.
- **Gallstones:** If a gallstone becomes stuck in the bile duct draining the liver, hepatitis and bile duct infection (cholangitis) can result.
- **Hemochromatosis:** Hemochromatosis allows iron to deposit in the liver, damaging it. The iron also deposits throughout the body, causing multiple other health problems.
- **Primary sclerosing cholangitis:** A rare disease with unknown causes, primary sclerosing cholangitis causes inflammation and scarring in the bile ducts in the liver.
- **Primary biliary cirrhosis:** In this rare disorder, an unclear process slowly destroys the bile ducts in the liver. Permanent liver scarring (cirrhosis) eventually develops.

3.8 ELISA

Why in News?

National Institute of Virology develops ELISA test to detect antibodies.

What is an ELISA test?

- An enzyme-linked immunosorbent assay, also called ELISA or EIA.
- It is a test that detects and measures antibodies in your blood.
- This test can be used to determine if you have antibodies related to certain infectious conditions.
- Antibodies are proteins that your body produces in response to harmful substances called antigens.
- ELISA is often used as a screening tool before more in-depth tests are ordered.

What are the diseases diagonised by ELISA test?

- HIV, which causes AIDS
- Lyme disease
- pernicious anemia
- Rocky Mountain spotted fever
- rotavirus
- squamous cell carcinoma
- syphilis
- toxoplasmosis
- varicella-zoster virus, which causes chickenpox and shingles
- Zika virus

3.9 Monoclonal Antibodies

Why in News?

Monoclonal antibody to block coronavirus infection identified

What are human monoclonal antibodies?

- An antibody is a protein produced by the body's immune system in response to antigens, which are harmful substances.
- Antigens include bacteria, fungi, parasites, viruses, chemicals, and other substances the immune system identifies as foreign.
- Sometimes the body mistakenly identifies normal tissues as foreign and produces antibodies against the tissue.
- This is the underlying cause of autoimmune conditions such as rheumatoid arthritis and multiple sclerosis or MS.

- Antibodies are naturally produced by the immune system.
- However, scientists can produce antibodies in the lab that mimic the action of the immune system.
- These man-made (synthetic) antibodies act against proteins that attack normal tissues in people with autoimmune disorders.
- Man-made antibodies are produced by introducing human genes that produce antibodies into mice or another suitable mammal.
- The mice then are vaccinated with the antigen that scientists want to produce antibodies against.
- This causes the immune cells of the mice to produce the desired human antibody.
- The term monoclonal antibody means that the man-made antibody is synthesized from cloned immune cells, and the identical monoclonal antibody produced binds to one type of antigen.
- Polyclonal antibodies are synthesized from different immune cells and the antibodies produced bind to multiple antigens.

What are the uses for monoclonal antibodies?

The use of monoclonal antibodies to treat diseases is called immunotherapy therapy because each type of monoclonal antibody will target a specific targeted antigen in the body.

Uses for monoclonal antibodies include:

- Cancer
- Rheumatoid arthritis
- Multiple sclerosis
- Cardiovascular disease
- Systemic lupus erythematosus
- Crohn's disease
- Ulcerative colitis
- Psoriasis
- Transplant rejection, and several more conditions

3.10 Neutralisation by Antibody

Why in News?

Study shows hospital staffs developed antibodies capable of neutralising SARS-CoV-2 virus.

What is virus neutralization by antibody?

- The antibody response is crucial for preventing many viral infections and may also contribute to resolution of infection.
- When a vertebrate is infected with a virus, antibodies are produced against many epitopes on multiple virus proteins.

- A subset of these antibodies can block virus infection by a process that is called *neutralization*.
- These antibodies are call neutralizing antibodies.

What is non-neutralising antibody?

- Non-neutralizing antibodies are also produced after viral infection.
- Such antibodies bind specifically to virus particles, but do not neutralize infectivity.
- They may enhance infectivity because antibodies can interact with receptors on macrophages.
- The entire virus-antibody complex is brought into the cell by endocytosis.

3.11 RT-PCR test

What is an RT-PCR test?

- The RT-PCR test is a method of testing by taking a nasal/throat swab from a patient.
- It involves extracting ribonucleic acid or RNA, which is the genetic material of the virus.
- If it shares the same genetic sequence as SARS-CoV-2 virus, then it is deemed positive.
- This form of testing can turn negative only if the actual sample does not carry the virus, or if it was not administered properly.
- The RT-PCR technology is a fairly expensive method.
- Sometimes, it can even take up to 4 hours to test for the presence of virus from one batch.
- The cost of chemicals and importing elements required for the test is also high. One test can cost a minimum of ₹4,500.
- On the other hand, anti-body tests are fast and inexpensive.
- It is portable, administered on-site and provides quick answers.
- Rapid tests changes colour when particular molecules are detected.
- It is the presence of immunoglobulin M and immunoglobulin G in a sample that determines whether the virus is present or not.
- These tests can be used to gauge the extent of infection in a certain community.

3.12 Herd immunity & Herd Masking

What is herd immunity?

- Herd immunity concept is most commonly used in the context of vaccination, herd community can also be achieved after enough people have become immune after being infected.
- Herd immunity refers to preventing an infectious disease from spreading by immunising a certain percentage of the population.
- It provides indirect protection to those who are not immune.

- Also known as herd protection, this concept can be achieved in two ways.
- A large population either gets infected or gets a protective vaccine.
- With some diseases, people sometimes expose themselves intentionally as a way of achieving immunity.
- Based on estimates, at least 70% of the population needs to be immune to have herd protection.
- The premise is that if a certain percentage of the population is immune, members of that group can no longer infect another person.
- This breaks the chain of infection through the community ("herd"), and prevents it from reaching those who are the most vulnerable.
- For less severe diseases, this approach could be achievable.
- But for COVID-19, the situation is different as the virus carries a much higher risk of severe disease and even causes death.

What is herd masking?

- This refers to the immunity against the disease that wearing masks gives a community.
- The benefit of masks in preventing the spread of infection has been a common notion across the world.
- Since the virus spreads through respiratory droplets, evidence shows that the use of masks would go a long way.

4. INNOVATION

4.1 Composite Material for Masks

Why in News?

A team from IISc Banglore has developed a three-layered antimicrobial composite material of low-cost for making masks.

What are composite materials?

- A composite material is a combination of two materials with different physical and chemical properties.
- When they are combined they create a material which is specialised to do a certain job, for instance to become stronger, lighter or resistant to electricity.
- They can also improve strength and stiffness.
- The reason for their use over traditional materials is because they improve the properties of their base materials and are applicable in many situations.

What are the Advantages of Composite Materials?

- Low costs compared to metals
- Design flexibility

- Resistance to a wide range of chemical agents
- Low weight
- Durability
- Electric insulation

4.2 Kashmir saffron gets GI tag

Why in News?

Kashmir saffron has been given the GI tag by the Geographical Indications Registry.

What is a geographical indication?

- A geographical indication (GI) is a sign used on products that have a specific geographical origin and possess qualities or a reputation that are due to that origin.
- In order to function as a GI, a sign must identify a product as originating in a given place.
- In addition, the qualities, characteristics or reputation of the product should be essentially due to the place of origin.
- Since the qualities depend on the geographical place of production, there is a clear link between the product and its original place of production.

Why GI tag?

- It supports local production and helps in mainstreaming and upliftment of the rural and the tribal communities.
- These GI tags must not be confused with IPR.
- GI is a collective right, unlike IPRs which grants protection to individual interest.

4.3 Phishing attacks in name of Aarogya Setu app

Why in News?

Phishing attacks in the name of Aarogya Setu mobile application are witnessing a “high rise”.

What is Phishing?

- Phishing is the fraudulent use of electronic communications to deceive and take advantage of users.
- Phishing attacks attempt to gain sensitive, confidential information such as usernames, passwords, credit card information, network credentials, and more.
- By posing as a legitimate individual or institution via phone or email, cyber attackers use social engineering to manipulate victims into performing specific actions—like clicking on a malicious link or attachment—or willfully divulging confidential information.
- Both individuals and organizations are at risk;

- Almost any kind of personal or organizational data can be valuable, whether it be to commit fraud or access an organization's network.
- In addition, some phishing scams can target organizational data in order to support espionage efforts or state-backed spying on opposition groups.

4.4 LG Polymers' gas leak

Why in News?

The gas leak from LG Polymers, which led to the death of at least seven people in Visakhapatnam, is suspected to have been caused by styrene gas.

What is styrene?

- Styrene is an organic compound with the formula C8H8.
- It is a derivative of benzene (C6H6).
- It is stored in factories as a liquid, but evaporates easily, and has to be kept at temperatures under 20°C.

What is styrene used for?

- Styrene is the main raw material for synthesis of polystyrene, or (C8H8)n.
- Polystyrene, in turn, is a versatile plastic that is used to make parts of various appliances
    - such as refrigerators or micro-ovens;
    - automotive parts; and
    - parts of electronics such as computers;
    - and also to manufacture disposable cups and in food packaging.
- Styrene is also used as an intermediate to produce copolymers — which are polymers derived from one or more species of monomers such as styrene.

What happens when exposed to styrene?

Short-term exposure may result in:

- Respiratory problems
- Irritation in the eyes
- Irritation in the mucous membrane, and
- Gastrointestinal issues.
- And long-term exposure could drastically affect the central nervous system and lead to other related problems like peripheral neuropathy.
- It could also lead to cancer and depression in some cases.
- However, EPA notes that there is no sufficiet evidence despite several epidemiology studies indicating there may be an association between styrene exposure and an increased risk of leukemia and lymphoma.

4.5 Smart phone with quantum security

Why in News?

Samsung's Galaxy A Quantum will be the world's first 5G smartphone with quantum random number generator (QRNG) chipset that ensures better mobile communication security.

What is a quantum state?

- A quantum state corresponds to a specific wave packet (= wave function).
- A quantum state is characterized by a set of quantum numbers, such as the energy E.
- Quantum numbers can be measured exactly.
- For example, the uncertainty ΔE is zero for a stable state, where one can take an infinite time Δt for measuring the energy.
- Quantum 'jump': During the transition from one quantum state to another, the wave packet morphs continuously.
- Superposition: One particle is in two quantum states at the same time.
- Entanglement: Two particles in two quantum states can become intertwined inseparably.
- This occurs for electrons, photons, or any quantum object.